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IMPOTENCE AND STERILITY

with

Aberrations of the Sexual Function

and

SEX-GLAND IMPLANTATION

By

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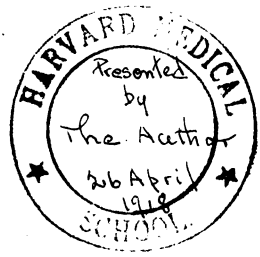

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TO

THE MEMBERS

OF

THE AMERICAN UROLOGICAL ASSOCIATION

AS A SLIGHT EXPRESSION OF APPRECIATION OF THE

EARNEST AND CONSCIENTIOUS WORK OF

THE

GREATEST ASSOCIATION OF ITS KIND IN THE WORLD, WHICH

HAS ACHIEVED GREAT CREDIT FOR ITSELF AND HAS

EMPHASIZED THE DIGNITY AND IMPORTANCE

OF GENITO-URINARY SURGERY,

THIS VOLUME IS RESPECTFULLY INSCRIBED

BY

THE AUTHOR

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FOREWORD

MY belief that there is room for still another monograph on diseases and aberrations of the sex function is sufficient explanation for this volume. The advisability of presenting in permanent form my hormone theory of aberrations of sex development and function and my researches and observations in the field of sex-gland implantation, will be sufficiently obvious to those laborers in the vineyard of science who have learned to their cost that the medical press alone cannot be relied upon to perpetuate, protect and give lasting credit for original work. It is hoped that the legal profession may find in the chapters on Sterility, Sex Aberrations and Sterilization, material of forensic value.

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CHAPTER I.

Aberrant and Imperfect Differentiation of Sex.

Hermaphroditism.

The relation of physical deformities of congenital origin involving the sexual organs to abnormalities and imperfections of the sexual function is most important. The subjects of physically aberrant sexual differentiation are more numerous than is generally believed; fortunately, however, the majority of cases are either slightly marked or of but little practical importance as regards their physiologic and social status.

Certain marked cases of physical aberration of sexual structure always have been of vital importance to medical jurists. Hermaphroditism, so-called, has received considerable attention from authorities on medical jurisprudence. In England, where the law of primogeniture prevails, the male is relatively so important a factor in the body social that the legal traditions upon the subject of hermaphroditism have been much more enduring and important than elsewhere.

As our knowledge of physiology and morphology has advanced, however, the so-called hermaphrodite not only has decreased in frequency in all social systems, but is a much less important factor in jurisprudence. The most important features of such cases at the present time are the questions of: 1. Impotence and sterility in both sexes. 2. Sexual perversion and inversion, or other psychopathies of a sexual type.

That the evils resulting from aberrations of structure of the sexual organs produce mechanic and functional obstacles to procreation is not at all remarkable and is sufficiently well understood.

The psychosexual aspect of the question is not, however, so fully and intelligently comprehended as it should be. The term

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hermaphroditism has been applied in a loose and unscientific fashion, the physical conformation of the subjects being accepted as the chief factor in diagnosis. Hermaphroditism literally implies a mingling of the physical and functional qualities of both sexes. The crucial test as now accepted is the existence of a more or less perfectly formed testicle and ovary in the same individual. Even from this stand-point, the existence of true hermaphroditism is open to serious question. If hermaphroditism be accepted as implying the performance of the male or female function at will, such a condition cannot possibly exist in view of the fact that the sexual function does not begin and end with the act of sexual congress, procreation being necessary to its complete fulfillment. The so-called hermaphrodite is sterile—fortunately for society—and, so far as procreation is concerned, cannot functionate as either male or female. The author is of opinion that, while pseudohermaphroditism is by no means rare, true hermaphroditism does not, and from biologic reasoning, cannot exist.

Although in most cases of pseudohermaphroditism it is possible to classify the subject as either male or female with greater or less ease, it must, nevertheless, be acknowledged that cases occasionally occur in which the differential diagnosis demands the highest degree of diagnostic skill. A case coming under the observation successively of Guyon and Fournier pointedly illustrates this. These distinguished gentlemen rendered lengthy and diametrically-opposed opinions as to the sex of the subject.

Cases occasionally occur in which a differential diagnosis is impossible until the age of puberty, when certain sexual attributes —menstruation, the growth of beard, changing voice, etc., as the case may be—decide the question of sex. In very rare instances the sex cannot be decided during life.

In some of the cases of alleged hermaphroditism the subject not only does not present what can justly be termed an admixture of male and female organs, but is practically a neuter, being without desire or capacity to perform the functions of either sex. When, however, the subject of general and local malformation also is the subject of sexual perversion, observation of the case may indicate an apparent commingling of the functional capacity. A case coming under the author's observation aptly illustrates this. The subject was a mulatto cook to whose case the author's attention was

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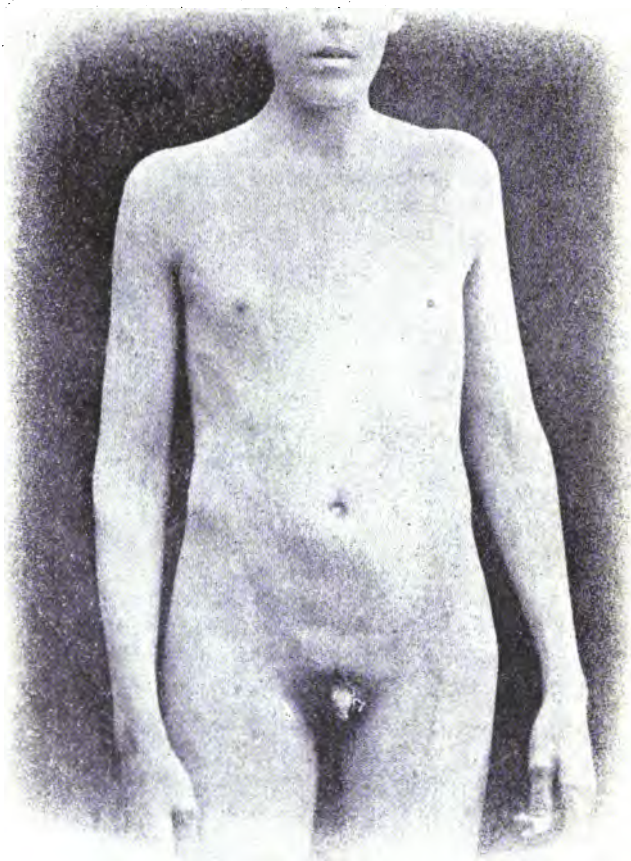

Aberrant psychosexual differentiation with imperfect physical differentiation. Sexual organs of normal form, but undeveloped.

called by some of the lads of the neighborhood, who came for relief from typic gonorrhea, which they claimed they had contracted from him. Investigation proved the truth of the boys' story. This hypospadiac male had contracted the disease in the normal manner from a female and, subsequently, performing the passive rôle in the sexual act, had given the disease to the lads.

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A case illustrating the difficulties of diagnosis in so-called hermaphroditism is reported by Dr. G. R. Green:

CASE.—A housemaid, aged 24, had symptoms which seemed to point to retained menses. She was five feet seven inches in height, of dark complexion, and anemic in appearance. For several years she had been in domestic service, and was well known to the doctor personally. On examination, the external genitals appeared to be those of a woman; in keeping with this was the arrangement of the pubic hair, while there was in addition considerable mammary development. There was an oval body, freely movable, in the right labium and a similar one in the left. On separating the labia a clitoris was found, rather larger than usual. Below this was a small opening, which apparently led to a narrow and contracted vagina. Subsequent examination, however, under ether, revealed a very different state of things. The "swellings" in the labia proved to be testes; the labia were formed by a splitting of the scrotum into two halves. At the bottom of the "split" the "clitoris" was clearly the penis, with its glans only developed, and without the corpus spongiosum. Upon its under surface there was a groove which led backward to a urethral orifice, into which a silver female catheter easily passed into the bladder. The sex of this "housemaid" was evidently, therefore, male, and the question arose what was to be done under the circumstances. The patient was anxious to continue being a woman, but the law does not allow a man to masquerade in woman's clothes. Dr. Green determined that the difficulty would be met if he were to remove the testicles from the "labia." This was accordingly successfully done, and now, in his unsexed condition, the man has resumed his ordinary occupation of that of a "housemaid."

Aberrant sexual differentiation may not involve any physical defects of the sexual organs; it may be purely psychic, and dependent upon imperfection differentiation of sexual affinity. That there is an essential defect in the psychosexual centers of the cerebral cortex is probable; but, if such defect exists, it is too occult for detection by any known method of research. Cases of psychically defective sexual differentiation present themselves under three forms: 1. Cases with normal development of physical sexual type, both general and local. These constitute the class of cases in which sexual perversion is least likely to be suspected. 2. Cases of normal general physique, but defective or aberrant development of the genitals. 3. Cases in the male in which the genitals are imperfectly developed and the general physique effeminate.

The same classification applies to both male and female. The author has, however, observed homosexuality oftener among neuropathic females of an ultrafeminine type than in those of mas-

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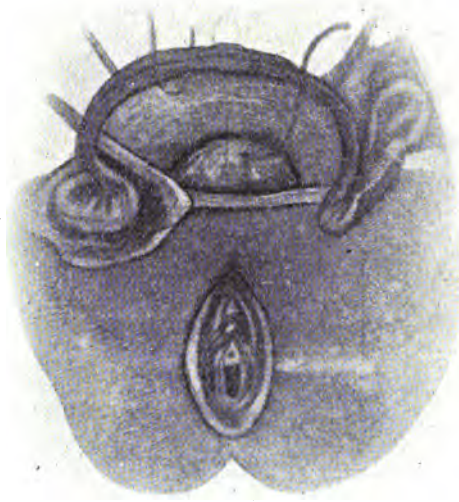
culine attributes. It is admitted that this probably is an exceptional experience.

Sexual affinity has been held to be a form of hunger which, traced to its source, is merely chemic—or at least, bio-chemic—affinity. If this be true, as the author believes it to be, imperfect differentiation of sexuality should be expected to lead to reversional peculiarities manifested by sexual perversions of various



Pseudohermaphroditism (aberrant genitosexual differentiation), showing testes, which were retained within the pelvis. Subject was a male.

forms. This point will be more fully discussed in the next chapter. The point that the author desires to make here is that pederasts, urnings,—a term applied by Caspar to individuals having "the body of a man and the soul of a woman,"—and some other sexual perverts (inverts especially) are closely akin to hypospadiacs and epispadiacs—so-called hermaphrodites. Psychic hermaphroditism or pseudohermaphroditism may be quite as readily accepted as a possibility as may the physical type. The subjects of imperfect

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or aberrant sexual differentiation may be specially classified as follows:—

1. Imperfect differentiation of sexual type (affinity) without physical defect, either general or local.
   - Pederasts, urnings, subjects of bestiality and inverts; *i. e.*, individuals with a sexual affinity for their own sex—homosexuality. The latter is called in the female gynandry, and, in the male, androgyny. This class is not numerous.

2. Defective—*i. e.*, imperfect or aberrant—differentiation of structure.
   - (*a*) The simplest variety. Genital defects partaking of more or less of the attributes of the opposite sex, with normal sexual appetite.
   - (*b*) Genital defects of similarly atypic conformation, associated with perverted sexual appetite.
   - (*c*) Aberrations of general physique only—*i. e.*, a physique approximating that of the opposite sex—associated with perversion of sexual appetite. Most cases of homosexuality belong to this class.
   - (*d*) Aberrations of general physique with associated genital defects and perverted sexual appetite.

In class 2—*a, b, d*—are embraced epispadias and hypospadias and rudimentary development or absence of uterus, ovary, testicle, and penis.

Much of the rubbish that has been popularly accepted on the question of hermaphroditism has been promulgated by men about town and physicians who are ignorant of sexual morphology. On several occasions the author has been invited by physicians to inspect a wonderful hermaphrodite, which, on examination, proved to be a male of by no means extraordinarily-defective type. These cases on investigation proved to be *attachés* of disreputable houses in which the alleged femininity of the subject was being devoted to profitable mercantile designs. In one case—which was claimed to be a male pervert—the subject afterward confessed that his perversion was for revenue only, his sexual appetite being gratified only in the normal manner. This was borne out by the testimony of some of his intimate associates.

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Guy, one of the older writers on medical jurisprudence, classified cases of genital malformation as follows:—

1. Male individuals with such unusual formations of the generative organs as in many respects to resemble the female.
2. Female individuals with such unusual formations of the same organs as to resemble the male.
3. Where a mixture of the sexual organs of both sexes is exhibited without either being entire.



Aberrant genitosexual differentiation (hypospadiac). Male type, psychosexually; general physique of female type.

It is obvious that there are certain acquired conditions which would fall under the above classification, yet would not be true cases of aberrant sexual differentiation: *e. g.*, a prolapsed and hypertrophied uterus has been mistaken for a rudimentary penis, and females thus affected have been known to copulate with other females. An hypertrophied clitoris may be mistaken for a rudimentary penis and may perform the male part in copulation. The importance of caution in deciding the sex in cases of genital malformation is aptly illustrated by a celebrated case occurring in Chicago. In this case society was electrified by the discovery that

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a supposed young lady who had been visiting about and sleeping with *bona fide* young lady friends was a boy. The first intimation of the truth was the development of a pronounced beard with a bass vocal accompaniment.

The assertion that certain cases of sexual perversion are akin to epispadias and hypospadias and the result of imperfect differentiation, may seem a trifle far-fetched, but the author nevertheless holds the opinion that, even when the differentiation of sex is complete from a gross physical standpoint it still is possible that the receptive and generative centers of sexual sensibility may fail to become perfectly differentiated. The result, under such circumstances, might be, on the one hand, sexual apathy, and, upon the other, an approximation to the male or female type according to the circumstances of the case. Such a failure of development and imperfect differentiation of structure necessarily would be too occult for detection from physical character by any means of investigation at our command. It is, however, only too well recognized by its results and is often responsible for disgusting cases of sexual perversion that society is prone to attribute to moral depravity. This point, and the relation of reversion of type to sexual perversion, will be more fully discussed in the next chapter. That failure of differentiation and development is equally responsible for certain cases of sexual perversion and instances of hypospadias and epispadias is the principal point to be remembered at this juncture.

Cases of gross physical aberration of genital structure are not difficult to account for, so far as the *modus operandi* of their formation is concerned; but their cause is not so readily explicable.

There evidently is an exhaustion of formative energy before the occurrence of complete fusion of the two lateral segments, of which the embryo is practically composed. Defective genital formation bears the same relation to this exhaustion of formative energy as do *crania bifida, spina bifida,* etc. It is obvious that the degree of deformity depends entirely upon the period at which developmental progression ceases. So far as appearances go, one would naturally conclude that differentiation does not cease at a very early period in the life-history of the fetus, else what is ordinarily accepted as true hermaphroditism would not only occur in reality, but would be frequent.

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Geoffroy St. Hiliare, one of the older writers, mapped out a very elaborate plan in explanation of hermaphroditism in a work especially devoted to that subject. He divided the generative apparatus into a series of portions or segments, three in each lateral division. The upper set comprised the testes and ovaries; the middle the womb, prostate, and seminal vesicles; the lower the penis,



Pseudohermaphroditism (aberrant genitosexual differentiation), showing vulva, pseudovagina, and absence of uterus. Subject was a male.

scrotum, clitoris, and vulva. According to him, therefore, there might occur any number of varieties of hermaphroditism, according to the combination of faulty structures. This scheme was defective because of the fact that, in spite of all appearances to the contrary, differentiation practically never falls quite short of determining one or the other sex.

The simplest plan for the explanation of genital deformities and anomalies is to remember that the fetus practically develops in two lateral segments and that any failure of union at the genital furrow will result in a greater or less degree of aberration of genital

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conformation. The view that hypospadias and epispadias are the result of atresia and rupture of the fetal urethra apparently is untenable in view of the generally-defective physique found in most cases of the kind.

The relation of aberrations of genital formation to sterility and impotence is very important. Impotence does not exist in the female unless there be atresia or complete absence of the vagina. Almost any aberration of the structure of the ovary, tubes or uterus may, however, produce sterility. In the male impotence is more likely to result than sterility, as serious deformity may prevent either erection or sufficient development of the organ to permit intromission. No matter how great the deformity, however, the individual may be fruitful if circumstances be favorable, so long as the testicles are functionally perfect.

The author is of opinion that perversion of the quality or lessening of the quantity of the sex hormone formed in the glands that produced the parental germ cell or sperm cell—or both—is the biologic foundation of both psychic and physical aberrations of sex differentiation. As to what causes the defective or vicious hormone supply in the parent, this also must be theoretic. It possibly is a defect in the suprarenals or in the anterior lobe of the pituitary body with defective sex gland development. The author believes that any general or local condition which impairs the integrity of the bioplasm of the hormone-producing cells in the sex glands may be responsible for physio-sexual and psycho-sexual aberrations. Sexual excesses, syphilis—or other general infections—might reasonably be considered as possible general causes.

Physical or psychic maternal shock probably may bring about hormone disturbance and consequent maldevelopment. This may explain certain so-called "maternal impressions."

It certainly is true that vitiated blood is poor material for the elaboration of normal hormone by the sex glands and, without healthy and proper hormone supply, it is reasonable to suppose that the ovule and spermatozoa will lack the nutritive "punch" necessary to complete and perfect development. *If the author's view be correct, sexual perversion and inversion—with or without physical aberrations—are purely biochemic in origin, and, if taken early, susceptible of cure by implantation of sex glands, thereby adding to the economy during the period of sex develop-*

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ment, a certain quantity of a new and better quality of sex-hormone. The author is convinced, moreover, that there is great advantage in the fact that the added hormone usually is an alien strain. So logical does the foregoing seem to the author, that he believes that a certain proportion of cases of perversion and inversion, if treated prior to adult age, are hopeful cases for the procedure.

What could be more logical than the treatment of masculinity in the female and of femininity in the male, by large and constant doses of sex hormone of the corresponding sex through the medium of implanted glands during the period of sex-development and differentiation? That the acquired type of aberrant physio-sexual differentiation frequently is susceptible of cure by implantation seems probable. Later on, the author will relate a case that is decidedly in point. (Case 6, Chapter XI.)

Incompatibility of the sex hormones due to biologically unfit mating may have much to do with teratologic sex aberrations. This is occult, it is true, but possibly is an important factor in eugenics.

That a primary defect in the quantity and quality of the sex hormone is essentially the cause of certain aberrant types of physio-sexual development—and incidentally of their attendant pschyo-sexual aberrations—is fairly conclusively proven by the facts that: 1st., Loss of the ovaries in previously normal young females is followed by the development of masculine secondary sex characteristics. 2nd., The same principle holds good in the loss of the testes in the male, secondary female sex characteristics developing. 3rd., Successful administration of the appropriate sex hormone is followed in greater or less degree by a return to the normal secondary sex characteristics.*

The author believes that the sex hormone aberration theory of sex maldevelopment is not incompatible with the theory of the influence of pituitary and adrenal cortex hormone on the primary development of the sexual organs. Normal sex hormone probably is primarily essential to the development of the ovum, the other hormones coming into play only after the embryonic development of the pituitary body and adrenals is completed, after which the endocrine nutritive cycle is established and the hormones work in harmony for the purposes of nutrition, differentiation and development.

*As will be seen later, this has been proved by the author's work in sex gland implantation.

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Curiously enough, the sex hormone theory suggested by the author is not inharmonious with certain theories of the Neo-Darwinian school of biologists, notably Weismann's. According to the latter, the theory of germinal selection can be applied to the degeneration of organs.

The germ (or the chromatic matter in the nucleus of the germ) is composed of tiny particles called determinants, each of which has its cell, or group of cells, to form in the growing organism. These determinants themselves feed and grow in the ovary and are subject to a kind of struggle for food. Some obtain more than their normal share of nourishment, and this leads to increased size or efficiency of the parts of the organism which they construct. But others obtain less than their normal quantity, and the parts of the organism which they build are of diminished strength.

If we accept as the underlying determinant principle of nutrition 1. the parental individual sex hormone—modifying the ovule and spermatozoa—2. the combined hormones in the fructified ovule —*i. e.,* the ovum, 3. the maternal hormones furnished by the ovary and especially by the *corpus luteum* of pregnancy, the possible relation of perversions of the sex hormone to aberrations of sex development and differentiation would seem to have excellent biologic support.

In determining the sex of alleged hermaphrodites the following points require consideration:—

1. The character of the voice.
2. The development of the mammæ.
3. The growth or absence of beard.
4. The form of the shoulders, hips, and waist.
5. The presence or otherwise of the menses or vicarious discharges.
6. The character of sexual desire. In respect to this point the occasional co-existence of sexual perversion with genital deformity should be given its due meed of consideration. Thus, in a case in which difficulty of diagnosis existed, a perverted sexual affinity for the same sex might mislead the physician.
7. The presence or absence of rudimentary (or perfect) testes or ovaries.
8. The form of the supposed clitoris or penis, the method of attachment of its prepuce, and the absence or presence of perforation in its glans.
9. The presence or absence of the hymen (rudimentary),

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nymphæ, labia majora, or bifid scrotum, as the case may be. *In cases of doubt it is safest to regard the individual as a female until time and pubescence have settled the question.*

The cases of imperfect or aberrant sexual differentiation included under the head of sexual perversion obviously are more difficult to study than those in which the aberration is of a purely physical character. This is especially true regarding sapphic love, or sexual affinity of female for female. That such cases are frequent is certain, but they are extremely difficult to trace. The confessional of the family physician doubtless might offer evidence of a clinical character, but he is very chary of airing the shortcomings of his patients in this particular direction.

The existence of this abnormal sexuality can be explained only by aberrant psychosexual differentiation. In the case of the male, instances are so common that the subject is decidedly trite. *It is not only charity, but a sense of justice and a desire to lessen the stigma upon human nature, that impels the author to include typic cases of sexual perversion under the head of aberrant sexual differentiation, and to attribute the condition to perverted or imperfect evolutionary development, on the one hand, and a reversion of type, on the other. To understand such problems it is necessary to consider the sex life of the primordial cell and the prehuman ancestral hermaphroditic type of all animal life. Sex differentiation came relatively late in the operations of biogenic law. Until the male principle appeared there was no sex, but merely sexually undifferentiated bioplasm which multiplied after its kind.*

CONGENITAL DEFORMITIES OF THE URETHRA.

Hypospadias and Epispadias.

These comprise practically all of the congenital deformities of the urethra, save the rare cases in which diverticula or duplicate channels exist. These conditions quite generally have been attributed to a failure of development in intrauterine life. The embryo being practically laid down primarily in two longitudinal sections—which subsequently became fused together in a perfect anatomic entity—it is obvious that failure of fusion at any particular point may produce congenital deformity. The deformity necessarily varies in kind according to the location of developmental failure,

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and its degree is, of course, modified by the extent of such defect in fusion. It seems logical to infer that the deformities under consideration are the results of failure of fusion of the genital furrow. It is the normal fusion of this furrow which eventually differentiates the sexes. A failure of development results in an approximation to the male or female according to the degree of perfection to which embryonic development has arrived at the time it is interfered with. The various forms of failure of differentiation have led in many instances to confusion in the determination of sex. The subjects of hypospadias and epispadias—especially the former—therefore, are very closely associated with so-called hermaphroditism in its various phases. Failure of fusion of the scrotum, associated with cryptorchidism, rudimentary development of the penis, and hypospadias, represents the most frequent type of pseudo-hermaphroditism—the type that most often masquerades as true hermaphroditism. As will be seen later on, the subject of sexual perversion is very intimately blended with urethral deformities.

Failure of embryonic development as the cause of urethral deformities recently has been disputed. Thiersch, for example, and others have claimed that these deformities are due, not to imperfect embryonic development, but to atresia of the urethra, with subsequent rupture behind the point of obstruction. Numerous arguments have been advanced in support of this view by various investigators; dilation of the ureter and pelvis of the kidney, such as is often found in hydronephrosis, and the presence of cicatricial tissue being the chief points.

The author cannot accept the foregoing theory; there are too many analogous conditions that almost necessarily must develop along the same lines as urethral deformities and which cannot be explained upon a simple mechanic basis. The principal argument against the theory is the general defective development associated with urethral deformities, there being not only a failure of physical, but also of psychosexual differentiation in a large proportion of cases. It is not necessary to resort to a mechanic explanation of the intimate association of congenital diseases of the kidney and ureter found coincidentaly with all urethral deformities. The same aberration and failure of embryonic development are sufficiently explanatory in both.

HYPOSPADIAS.—In this condition the deficiency of development

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is situated along the floor of the urethra, and is associated with a defective penile development proportionate to the degree of the hypospadias. The urethra may open at any point from the *frenum preputii* to the perineum; the farther back the opening, the greater the failure of physical differentiation of sex. In the majority of instances the deformity is slight, the urethra opening just behind or at the side of the frenum. Cases in which the opening is located posterior to the peno-scrotal angle are relatively rare. In the simpler variety there is, as a rule, no great inconvenience resulting from the condition, soiling of the clothing with urine and sterility being the principal features of annoyance. These disagreeable results increase in degree proportionate to the extent of the deformity.

EPISPADIAS.—Epispadias is rarer than hypospadias, is most often found in the female, and generally is associated with exstrophy of the bladder. It sometimes is associated with congenital absence of the symphysis pubis, and so often is combined with *ectopia vesicæ* that its consideration properly falls under the head of congenital deformities of the bladder. There are some rare cases in which there is a simple epispadias without exstrophy.

The operative management of urethral deformities does not come within the scope of this work. It is obvious, however, that in so far as a given deformity interferes with potency or fertility, operation is indicated. The author has had the good fortune to successfully operate on a number of cases of this kind.

ACQUIRED DEFORMITIES.

Acquired urethral deformities and traumatic accidents to the penis and urethra, or to the urethra alone, are occasional causes of impotence. Cases of mutilation of the penis by jeaalous women are more frequent than generally is supposed. The author has met with several cases of complete amputation. Quite recently also, a case of mutilation of the testes produced through a similar agency came under his observation.

The psychology of cases of genital injury by criminal assaults varies. As originally formulated by the author,* they are:

1.—Simple jealousy. Women sometimes injure, not only the offending mate, but also the female rival, making the genitals the

* New York Med. Jour., Feb. 3, 1912.

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object of assault. The male often makes the genital organs the objective point of assault upon a rival. The dominant idea in most cases simply is revenge.

2.—The desire to deprive a rival of what seems to the jealous person the chief point of interest to the rival.

3.—A desire to punish the one at whose hands the assailant has suffered injury.



Case of amputation of penis by a jealous wife.

4.—A "dog in the manger" sentiment. Both women and men have been known to commit sex mutilation on persons in whom they no longer were interested.

5.—The desire to protect oneself from future encroachment on one's sexual rights. A comparatively recent famous Western case is in point.

6.—Insane impulse.

7.—Reversionary instinct, resulting in sadism. Apropos of this point, the attack of the female spider and of the female *Mantis religiosa* upon the male after copulation are illustrations.

CASE.—X, referred to the author by the late Dr. H. F. Steere, of Chicago. An honest, hard working, decent Bohemian incurred the jealousy of his wife,

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through what she chose to believe was indifference due to attentions to other women. So far as the author was able to determine, the woman was abnormally developed sexually and the "indifference" of the unfortunate victim of her jealousy and vindictiveness was due merely to the physical fatigue incidental to his occupation, which was that of a laborer.

About 3 o'clock on the night of October 15, 1911, while X was sleeping soundly, Mrs. X procured a razor and completely amputated his penis, about an inch from the pubic cymphysis. The hemorrhage was very profuse, and as Dr. Steere, who was called to attend the case, did not arrive on the scene for about forty minutes, he found the patient in semi-syncope and almost exsanguinated. The amputated organ was found hanging by a narrow strip of integument.

After severing the skin and removing the injured member, the doctor trimmed the stump, leaving the urethra longer than the stump. He then split the "cuff" of the urethra and stitched it partly over the stump to form a pseudo-meatus. A small, soft rubber catheter No. 17 F. was left in the bladder.* Healing was prompt, and the author was privileged to exhibit the case at his clinic three weeks later.

Deformity of the penis due to chronic inflammation of the corpora cavernosa not infrequently produces impotence. The author so often has observed this condition in conjunction with arteriosclerosis, that he has come to believe that this condition of the blood vessels frequently is of etiologic importance.

Precocious Sexuality.

In rare instances young children exhibit sexual precocity—both as to physical-sexual and psycho-sexual development. These cases are easy of recognition but difficult to explain. The sex syndrome consists of prematurely enlarged sexual organs and development of pubic hair and, in the male, excessive general hair growth with corresponding voice change, precocious sexual desire in both sexes, notably in the male, and abnormally early menstruation in the female. Associated with these sex manifestations are precociously mature thought and speech habit, and general bodily overgrowth, a child of five or six years of age presenting the physical appearance of one of eleven or twelve.

The cause of sexual precocity is obscure, but has been asserted to be an impairment of the functions of the pineal gland, the hormone of which, it is claimed, normally inhibits sexual growth until

* The retained catheter slipped into the bladder. The author found it with the cystoscope six weeks later and removed it with a lithotrite per urethram.

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puberty. This theory is based upon cases of tumor of the pineal gland in which the syndrome described existed. Inasmuch, however, as feeding pineal gland to young animals produces a similar syndrome, the only explanation of the phenomena seems to the author to be a derangement of the equilibrium of the endocrine nutritive cycle, which may be produced by, 1st, increase, 2nd, diminution, 3rd, vitiation of the pineal endocrine secretion. In any event, the administration of pineal substance at present must stand on purely tentative and empirical ground.

That a pernicious heredity—involving especially syphilis and neuro-degeneracy—possibly may underlie sexual precocity hardly will be disputed.

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CHAPTER II.

Diseases of the Sexual Function and Instinct.

GENERAL CONSIDERATIONS.—The sexual function is animated by the most vital of all animal instincts. When made to subserve its real purpose—procreation—sexual desire fundamentally is the most disinterested of the purely animal appetites. Granting that it is a mere differentiation of its ancestral instinct, hunger, its ultimate object is higher than that of the parent appetite. The ultimate object of hunger is the preservation of the life of the individual, while that of the sexual passion is the preservation of the species. The fact that the individual derives pleasure from the sexual act detracts not at all from the unselfishness of its object, so far as its relation to the grand scheme of Nature is concerned. The sexual passion is no more open to impeachment on the ground of selfishness than is the fundamental instinct of hunger. Both are alike productive of pleasure in their gratification; both are alike subject to abuse by those who pursue the pleasure of gratification of the animal appetites with a total disregard of their natural objects. There are relatively few who "eat to live;" those who live to eat are legion. The proportion of human beings who copulate for procreative purposes is very small as compared with those for whom the sexual act is the axis upon which the world revolves.

As regards his sexual ethics, man probably has retrograded from the primal stock from which he descended—or ascended, according to the point of view. Those of the lower animals that modern human society pretends to imitate—the monogamous types—are vastly superior to man from the sexual stand-point. The pairing of animals, even though it be for a limited period only, means something. The unwritten law is unbroken. With human beings, the contract involved in the pairing system legitimatized in monogamous social organizations, means much or little, according to the moral bent and sexual capacity of the individual.

The sexual immorality and perverted sexual physiology of the human race generally is discussed from the stand-point of morals,

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with a total disregard for common sense, to say nothing of natural law. It does not seem to occur to the moralist and would-be social reformer that there is an organic basis for sexual infractions of moral and physiologic law—still less is it understood that the moral code is a relative matter, devised to subserve some selfish motive or other, with a total disregard for natural law.

The question of the relative social value and safety of monogamy and polygamy is too broad for discussion here. That monogamy, from a sociologic stand-point, irrespective of arbitrary moral codes, is best adapted to our own social necessities, is admitted. That it is in conformity with natural law so far as the human race is concerned, the author does not believe. Man, by nature, instinct, and physiologic demand—and incidentally, as a cog in the machinery of biologic "economics"—is a polygamous animal. Monogamy, like many other social customs, is a sacrifice of natural law to personal and social selfishness and expediency. The sexual immorality and perverted sexual physiology of man—taking our own moral code as the standard—are the result of the battle of social with natural man.

If man basically is a monogamous animal, nature builds poorly and is an unreliable physiologic conservator. It is evident that, inasmuch as the object of the sexual function is the preservation of the species, the act of copulation should be performed only at such times and under such circumstances as subserve that object. In the lower monogamous animals copulation and desire apparently both cease with impregnation. This does not hold good with the human species. Even with polygamous animals the beginning of breeding heralds the cessation of copulation. The domestic fowl—whose polygamy, by the way, originally was acquired through forced adaptation to the commercial demands of its human proprietors—presents a shining example of the relative decency of polygamy so far as the female is concerned.

To even hint that the female of the human species was originally designed for a monogamous animal perhaps is dangerous, after expressing the opinion that the male is polygamous by nature, yet the author unhesitatingly affirms that view. A certain proportion of females experience sexual desire even during gestation, but the fact remains that desire is relatively feeble in women, as a rule, and normally coitus should be repugnant to the female during gesta-

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tion. Where it is not, there simply is hereditarily perverted sexual physiology due to the unphysiologic approaches of the male practiced from time immemorial, or local irritation from disease. Socially it is not well that there should be "one law for the man and another for the woman," but such, apparently, was Nature's original intention, however much it has been subverted to social demands and individual selfishness. That nature designed the sexual function of the human male to lie latent during the pregnancy and parturition of a given mate is a reflection on the efficiency of biologic law.

While in no sense desiring to apologize for the sexual immorality and perverted sexual physiology of the human race, the author firmly believes that much of it is explicable upon the foregoing grounds. And, the sooner we face the issue the more intelligently will we be able to meet sex problems. This view is especially pertinent with respect to the etiology of sexual excess. Man and woman alike have suffered from abrogation of natural law. It is, of course, admitted that polygamy as practiced in the harems of the Orient is likewise productive of perverted sexual physiology; but the basic sexual instinct of the human male is not at all responsible for his abuse of the sexual function.

Ignorance of sexual physiology is one of the fundamental causes of disease of the sexual function, and especially of those produced by masturbation. Society imposes certain sexual restrictions upon the human race, while at the same time discountenancing the acquirement of knowledge of the sexual function and its object. Society also furnishes the worst possible environment for its own moral ends. The natural desires, especially of the male, are excited by various impressions to which he is exposed until sexual irritability inevitably results. The individual is then asked to be chaste and virtuous, notwithstanding the fact that society furnishes him with an environment that would lead one to infer that virtue is an unknown quantity. Society has not changed its moral law—written or unwritten—*pari passu* with its advancing wickedness. It is not so many years since such books, pictures, and plays as are tolerated to-day were tabooed. The movies are "censored" by long haired men and short haired women, whilst the uncensored burlesque show presents "attractions" that would shock the sensibilities of a tenderloin parrot. Latter-day art, literature, and stage furnish an atmosphere of sexual immorality to which, sooner or later, every

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youth—male or female—is inevitably exposed. Tabooed books and pictures are not very dangerous; the person who indulges in them knows full well that such things are evil. Trilby, the fad, did more damage to the sexual *morale* of society than all the tabooed obscene books ever written. Clandestine vice, known to be under the ban, is honest enough, to say the least. Vice thinly veiled, or gilded over by the mawkish sentiment engendered by Trilby pink teas and yellow breakfasts and apologized for by social faddists, is insidious and deadly. A Magdalen repentant has ever been a lesson in morality, but the naïve admission of Trilby that she had had a certain limited number of lovers hardly can be admitted to Magdalenic literature.

The example often set by celebrities in their private (sic) lives, tolerated as it is by society, is a very dangerous factor in the promulgation of sexual immorality. Society proclaims from the housetops: "Thou shalt not," and then whispers softly in the ear of the favored ones: "Of course, I don't mean geniuses like you." And the favored and talented few go on and on, even exploiting their sexual derelictions for advertising purposes.

The public press must come in for its share of blame in the promulgation of pernicious sexual impulses among the young. Sexual immorality is either condoned or discussed in a tone of flippancy that amounts to condonation. To the minds of the young and inexperienced, sexual license would seem to be the unwritten code of modern society.

Is it fair that society should demand that the young should remain in ignorance of the physiologic side of sexual matters, while its vicious aspects are paraded in all their nakedness? How difficult the task of the mother who endeavors to inculcate purity in the minds of her daughters! And how much more difficult the task of the father who endeavors to keep his son off the rocks and shoals, not by teaching—often not by example—but by discipline!

The sum-total of results is that the growing lad comes to regard sexual purity as something to be ashamed of, and female virtue as extremely out of fashion. Young girls, too, are likely to regard with tolerant eyes those moral lapses which are common to social, literary, and stage lions. The resultant evils are sufficiently obvious.

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Inasmuch as society practically has thrown down all but the traditional theoretic barriers between sexual purity and impurity, it would seem that abuses of sexual physiology can be combated only upon purely physical grounds. In a certain sense, too, the selfishness of the individual must be appealed to. Young lads should be taught that masturbation is dangerous to their physical well-being—that they never can become as perfect men, morally, physically, or intellectually, if they indulge prematurely in any sort of exercise of the sexual function as they will if they remain continent. The young lad's instinct of self-preservation will accomplish much more than lessons in morality that momentarily are being contradicted by scenes, persons, and incidents about him. A most profound impression may often be made by stating that early indulgence blunts sexual sensibility, and thus to a certain degree deprives the individual of the legitimate pleasures of his later matrimonial life. And this statement is by no means exaggerated. It is probable that no man who has indulged in sexual congress or masturbation to any degree prior to full maturity is ever possessed of normal sexual sensibility in later life.

The psychic effect of early sexual indulgence and masturbation is even more deleterious than the purely physical. Youth is imaginative, as well as hyperesthetic, and its pleasures are consequently relatively keen. The sexual experiences of youth so mold the psychosexual centers that a standard is set for all future sexual experiences. The adult life of the individual is often devoted to the pursuit of a sexual ideal that exists only in his brain—an ideal that is but a memory of his younger and more impressionable days. This ideal is the will-o'-the-wisp that leads many men into sexual immorality and excess.

In brief, while preaching morality to youth, it were well to give it "a reason." Wise counsel and intelligent instruction of young lads in sexual matters might do more for the morals of society than any amount of preaching.

Much has been said of the evils of quack literature in polluting the minds of the young, still more has been said of the harpy-like proclivities of the quack. There is, however, something to be said on the other side of the question. There is a "soul of good in things evil." Many lads would go on in their evil ways indefinitely did they not stumble upon quack literature, which, while exaggerat-

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ing the evils of masturbation and sexual excess, none the less sounds the first note of warning they ever have received. The profession largely is responsible for this, by crying down any attempt on the part of scientific men to impart knowledge of sexual matters to the laity. Why the profession should join the ignorant public in tabooing sexual knowledge is a mystery, quite as much so as a great deal of other cant and hypocrisy that has pervaded the medical profession from time immemorial. So-called medical ethics has done more to foster quackery than to prevent it. And the public smiles derisively at a profession which, after years of travail, will tolerate "practice limited to diseases of women" on professional cards; yet would roll up its eyes like a dying rabbit should it perchance run across a card inscribed, "diseases of men only." Precisely what phase of sentiment elevates a woman with a leucorrhea to a higher plane than that which a man with spermatorrhea occupies is one of the things which, as Dundreary says, "no fellow can find out." Irrespective of cause, it is a deplorable fact that the regular profession is woefully ignorant and culpably negligent regarding the sexual ailments of its clientele.

The respectable physician still is laughing at the complaints of men who consider themselves impotent, on the one hand, and prescribing virgins for broken-down *roués* and sexual wrecks, on the other. The fact that the virgins are to be sacrificed on Hymen's altar satisfies the medical imbecile who, like the ostrich, has his head in the sand, and the sacrifice at the same time conforms with social demand. The impotent man should receive intelligent advice from the general practitioner. The man who is unable to copulate is face to face with a grim reality. Whether psychic or not, his impotence is a material fact of which he is only too keenly conscious. As for the virgins who daily are prescribed as placebos or panaceas, it is high time they were represented at court. The remedy lies with the profession. The sexual organs and functions are the noblest attributes of man, and their diseases are quite as worthy of intelligent study and considerate treatment as affections of other organs. False modesty and mawkish sentiment have no place in scientific medicine. At present, the ignorance and mock prudery of a large proportion of the profession is absolutely sickening. But matters are improving. One can write upon sex hygiene nowadays, without running the risk of professional ostracism.

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CHAPTER III.

Sexual Perversion and Inversion.

THE subject of sexual perversion.—*Conträre Sexuale Empfindung,*—although a disagreeable one for discussion, demands the attention of the scientific physician, and is of great importance in its social, medical, and legal relations. J. G. Kiernan, in discussing the hypothetic dependence of the Whitechapel murders upon perversions, says:—

The subject may seem to trench on the "prurient," which in medicine does not exist, since "science, like fire, purifies everything," and what Macaulay calls "the mightiest of human instincts" is too intimately related to the physical basis of human weal and woe for any physician prudishly to ignore any of its phases.

Until a comparatively recent date the subject has been studied solely from the standpoint of the moralist, and, from the indisposition of the scientific physician to study them, the unfortunate class of individuals who are characterized by perverted sexuality have been viewed in the light of their moral responsibility rather than as victims of a physical, and incidentally of a psychic, defect. It certainly is much less humiliating to us as atoms of the social fabric to be able to attribute the degradation of these poor unfortunates to a physical cause than to a willful viciousness over which they have, or ought to have, volitional control. Even to the moralist, there should be much satisfaction in the thought that a large class of sexual perverts are physically abnormal rather than morally leprous. It often is difficult to draw the line of demarkation between physical and moral perversion. Indeed, the one so often is dependent upon the other that it is doubtful whether it were wise to attempt the distinction in many instances. But this does not affect the cogency of the argument that the sexual pervert is generally a physical aberration—*a lusus naturæ.*

Krafft-Ebing expresses himself upon this point as follows:—

In former years I considered *conträre Sexuale Empfindung* as a result of neuropsychic degeneration, and I believe that this view is warranted by more

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recent investigations. As we study into the abnormal and diseased conditions from which this malady results, the ideas of horror and criminality connected with it disappear, and there arises in our minds the sense of duty to investigate what at first sight seems so repulsive, and to distinguish, if may be, between a perversion of natural instincts which is the result of disease and the criminal offences of a perverted mind against the laws of morality and social decency. By so doing the investigations of science will become the means of rescuing the honor and re-establishing the social position (sic) of many an unfortunate whom unthinking prejudice and ignorance would class among depraved criminals. It would not be the first time that science has rendered a service to justice and to society by teaching that what seem to be immoral conditions and actions are but the results of disease.

In every community of any size there is a colony of male sexual perverts; they are usually known to each other, and are likely to congregate together. At times they operate in accordance with some definite and concerted plan in quest of subjects wherewith to gratify their obnormal sexual impulses. Often they are characterized by effeminacy of voice, dress, and manner. In a general way, their physique is likely to be inferior—a defective physical make-up being quite general among them, although exceptions to this rule are numerous.

Sexual perversion is more frequent in the male; women usually fall into perverted sexual habits for the purpose of pandering to the depraved tastes of their patrons rather than from instinctive impulse. Exceptions to this rule occasionally are seen. For example, the instance of a woman of perfect physique, who is not a professional prostitute, but moves in good society, who has a fondness for women, never being attracted to men for the purpose of ordinary sexual indulgence, but for perverted methods. The physician rarely has his attention called to these things and, when evidence of their existence is placed before him, he is likely to receive it with skepticism. He regards the subject as something verging on Münchausenism, or, if the matter seem at all credible, he sets it aside as something unholy with which he is not or should not be concerned. It is, indeed, not to be wondered at that the physician, who so often views with pessimistic eyes the human animal, should be reluctant to add to his store of contempt. The man about town very often is *au fait* in these matters and can give very valuable information. Indeed, witnesses enough can be found to convince the most skeptical.

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SEXUAL PERVERSION AND INVERSION

Sexual perversion may best be defined, in a general way, as the possession of impulses to sexual gratification in an abnormal manner, with a partial or complete apathy toward the normal method.

The affection presents itself in several forms, which may be tabulated as follows:—

I. Congenital and perhaps hereditary sexual perversion.
- (*a*) Sexual perversion, *i. e.*, imperfect psychosexual differentiation, without defect of structure of sexual organs.
- (*b*) Sexual perversion with defect of genital structure: *e. g.*, hermaphroditism.
- (*c*) Sexual perversion with obvious defect of cerebral development: *e. g.*, idiocy.

II. Acquired sexual perversion.
- (*a*) Sexual perversion from pregnancy, the menopause, ovarian disease, hysteria, etc.
- (*b*) Sexual perversion from acquired cerebral disease, with or without recognized insanity.
- (*c*) Sexual perversion (?) from vice.
- (*d*) Sexual perversion from overstimulation of the nerves of sexual sensibility and the receptive sexual centers incidental to sexual excesses and masturbation.

When the author's classification as above presented first appeared, it was by no means cordially received, its practicality being overlooked. Its adoption by Havelock Ellis, who asserts its superiority to Krafft-Ebing's classification, was extremely gratifying.

As regards the clinical manifestations of the disease, sexual perverts may be classified as: (*a*) those having a predilection (affinity) for their own sex—homosexuality; (*b*) those having a predilection for abnormal methods of gratification with the opposite sex; (*c*) those affected with bestiality. Instances of all these different varieties have been observed.

It hardly is necessary to say that the sexual pervert is by no means a modern institution. Sexually-perverted conduct evidently characterized some of the ancient orgies. It is certain that sexual perversion was prevalent in the time of Nero. The author is not aware that attention has hitherto been called to the Scriptural evidence of its ancient existence. If, however, Scriptural chronology

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be correct, it was recognized at least as early as A. D. 60. Positive proof of this is seen in the Epistle of Paul to the Romans: Chapter I; 24, 26, 27, and 28 verses. The text reads:—

Wherefore God also gave them up to uncleanness through the lusts of their own hearts, to dishonor their own bodies between themselves.

Who changed the truth of God into a lie, and worshiped and served the creature more than the Creator, who is blessed forever. Amen.

For this cause God gave them up unto vile affections; for even their women did change the natural use into that which is against nature; and likewise also the men leaving the natural use of the women, burned in their lust one toward another; men and men working that which is unseemly, and receiving in themselves that recompense of their error which was meet.

And even as they did not like to retain God in their knowledge, God gave them over to a reprobate mind, to do those things which are not convenient.

The Scriptural authority thus quoted may not add any particular scientific weight to the subject of sexual perversion, but it certainly is of interest as showing the early lay recognition of this peculiar morbid state.

The precise causes of sexual perversion are obscure.* Abnormal conditions of the anterior lobe of the pituitary body perhaps may be a causal factor. The explanation of the phenomenon is, in a general way, much more definite. Just as we may have variations of physical form and of mental attributes in general, so we may have variations and perversion of that intangible entity, sexual affinity. In some cases, perhaps, sexual differentiation has been psychically imperfect, and there is a reversion of type; as Kiernan remarks:—

The original bisexuality of the ancestors of the race, shown in the rudimentary organs of the male, could not fail to occasion functional, if not organic, reversions when mental or physical manifestations were interfered with by disease or congenital defect. The inhibitions on excessive action to accomplish a given purpose, which the race has acquired through centuries of evolution, being removed, the animal in man springs to the surface. Removal of these inhibitions produces, among other results, sexual perversion.

It has been asserted by the type of observers who wear leather goggles, that sexual perversion cannot be reversionary, because the lower animals are free from it. Any one who has intelligently studied the habits of dogs, cattle, horses, fowls and other domesti-

* The possible relation of defective hormone supply to sexual perversion already has been expatiated upon.

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cated animals well knows that certain manifestations of perversion are, to use a paradox, normal among them. The author has noted typic examples of perversion among fowls. In two instances of a normal laying and breeding hen—who possessed masculine secondary characteristics, such as well developed spurs and the crowing habit—the female bird immediately took charge of the walk whenever the male bird was removed, and devoted herself most assiduously to treading the other hens.*

Reasoning back to cell-life, we see many variations in sexual affinity and the function of reproduction between the primal fusion and subsequent segmentation of cells—the lowest type of procreative action—and that complete and perfect differentiation of the sexes which requires a definite act of sexual congress as a manifestation of the acme of sexual affinity and for the purpose of reproduction. The variations in the methods of sexual gratification—or, to attribute it to instinct, of perpetuating the species—which are presented to the student of natural history are numerous and striking. It is not the author's intention, however, to give this matter more than passing notice. The method of sexual gratification—*i. e.*, procreation—of fishes is a curious phenomenon. It is difficult to appreciate the sexual gratification involved in the deposition of the milt of the male fish upon the spawn of the female, yet that the so-called instinctive act of the male is unattended by gratification is improbable. Indeed, it is an argument as applicable to the lower animals as to man, that, were the act of procreation divested of its pleasurable features, the species speedily would become extinct; for the act of procreation *per se* is possessed of no features of attractiveness, but of many that are repulsive and in themselves productive of discomfort.

It is puzzling to the healthy man and woman to understand how the practices of the sexual pervert can afford gratification. If considered in the light of reversion of type, however, the subject is much less perplexing. That maldevelopment, or arrested development, of the sexual organs should be associated with sexual perversion is not at all surprising; and the more nearly the individual approximates the type of fetal development which exists prior to

* The author elaborated the theory of reversion as explanatory of sexual perversion in the Philadelphia Medical & Surgical Reporter, Sept. 7, 1889.

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the commencement of sexual differentiation, the more marked is the aberrance of sexuality, of which more anon.

There is one element in the study of sexual perversion that deserves especial attention. It is probable that few bodily attributes are more readily transmitted to posterity than peculiarities of sexual physiology. The offspring of the abnormally-carnal individual is likely to be possessed of the same inordinate sexual appetite that characterizes the parent. The child of vice has within it in many instances, the germ of vicious impulse, and no purifying influence can save it from following its own inherent inclinations. Men and women who seek, from mere satiety, variations of the normal method of sexual gratification, stamp their nervous systems with a malign influence which in the next generation may present itself as true sexual perversion. Acquired sexual perversion in one generation may be a true constitutional and irradicable vice in the next, and this independently of gross physical aberrations. Carelessness on the part of parents is responsible for some cases of acquired sexual perversion. Boys who are allowed to associate intimately are likely to turn their inventive genius to account by inventing novel means of sexual stimulation, with the result of ever after diminishing the natural sexual appetite. Any powerful impression made upon the sexual system at or near puberty, when the sexual apparatus is just maturing and very active, although as yet weak and impressionable, may leave an imprint in the form of sexual peculiarities that will haunt the patient throughout his after-life. Sexual congress at an early period often leaves its impression in a similar manner. Many an individual has had reason to regret the indulgences of his youth because of its moral effect upon his after-life. The impression made upon him in the height of his youthful sensibility never is eradicated, but remains in his memory as his ideal of sexual matters, for there is a physical as well as a psychic memory. Variations of early impressions may determine sexual perversion rather than abormally-powerful desire. Let the physician who has the confidence of his patients inquire into this matter, and he will be surprised at the result. Only a short time since, one of the author's patients, a man of exceptional intellect, volunteered a similar explanation for his own excesses. Satiety may bring in its train a deterioration of normal sexual sensibility, with an increase, if anything, in the sexual appetite. As a result,

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the deluded and unfortunate being seeks for new and varied means of gratification, often degrading in the extreme. Add to this condition intemperance or disease, and the individual may become the lowest type of sexual pervert. As Hammond concisely puts it, regarding one of the most disgusting forms of sexual perversion:—

Pederasty is generally a vice resorted to by debauchees who exhaust the resources of the normal stimulus of the sexual act, and who for awhile find in this new procedure the pleasure which they can no longer obtain from intercourse with women.

As shown in the preceding chapter, even when the differentiation of sex is complete from a gross physical stand-point, the receptive and generative centers of sexual sensibility may fail to become perfectly differentiated. The result under such circumstances might be, upon the one hand, sexual apathy, and, upon the other, an approximation to the female or male type, as the case may be. Such a failure of development and imperfect differentiation of structure necessarily would be too occult for discovery by any physical means at our command. It is, however, only too readily recognizable by its results.

There exists in every great city so large a number of sexual perverts that seemingly their depraved tastes have been commercially appreciated by the *demi-monde*. This has resulted in the formation of establishments whose principal business it is to cater to the perverted sexual tastes of a numerous class of patrons. Were the names and social positions of these patrons made public in the case of most of our large cities, society would be regaled with something fully as disgusting, and coming much nearer home, than the old time *Pall Mall Gazette* exposures.

The individuals alluded to undoubtedly would resent the appellation of "sexual pervert;" but, nevertheless, in many instances they present the disease in its most inexcusable form: that from vicious impulse. Personally, the author cannot appreciate any difference, from a moral stand-point, between the individual who is gratified sexually only by perverted manipulations performed by the opposite sex and those unfortunate mortals whose passions can be gratified only by performing the active rôle in the same disgusting performance. One is to be pitied for his constitutional fault; the other to be despised for his deliberately-acquired debasement. The professional prostitute who panders to the depraved sexual

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tastes of certain male specimens of the *genus homo* has, at least, the questionable excuse of commercial instinct, and in some cases the more valid one of essential sexual perversion. These excuses the majority of her patrons certainly do not have.

An interesting theory, bearing upon the question of sexual perversion in its relations to evolutionary reversion, is advanced by Clevenger:—

A paper on "Researches into the Life-history of the Monads," by W. H. Dallinger, F.R.M.S., and J. Drysdale, M.D., was read before the Royal Microscopical Society, on December 3, 1873, wherein fission of the monad was described as being preceded by the absorption of one form by another. One monad would fix on the sarcode of another, and the substance of the lesser or under one would pass into the upper one. In about two hours the merest trace of the lower one was left, and in four hours fission and multiplication of the larger monad began. Professor Leidy has asserted that the ameba is a cannibal. Michels calls attention to Dallinger and Drysdale's contribution, and draws therefrom the inference that each cannibalistic act of the ameba is a reproductive or copulative one, if the term is admissible.

At first glance such a suggestion seems ludicrous enough; but a little consideration will show that, in thus fusing two desires, we still have to get at the meaning and derivation of the primary one—desire for food. The cannibalistic ameba may, as Dallinger's monad certainly does, impregnate itself by eating one of its own kind, and we have innumerable instances, among algæ and protozoa, of this sexual fusion's appearing very much like ingestion. Crabs have been seen to confuse the two desires by actually eating portions of each other while copulating; and, in a recent number of the *Scientific American,* a writer details the *Mantis religiosa* female eating off the head of the male mantis during conjugation. Some of the female *arachnide* find it necessary to finish the marital repast by devouring the male, who tries to scamper away from his fate. The bitings and even the embrace of the higher animals appears to have reference to this derivation. It is a physiologic fact that association often transfers an instinct in an apparently outrageous manner. With quadrupeds it is most clearly olfaction that is most related to sexual desire and its reflexes; but not so in man. Ferrier diligently and vainly searched the region of the temporal lobe near its connection with the olfactory nerve for the seat of sexuality; but, with the diminished importance of the smelling sense in man, the faculty of sight has grown to vicariate olfaction; certainly the "lust of the eyes" is greater than that of other special sense-organs among bimana.*

In all animal life multiplication proceeds from growth, and until a certain stage of growth, puberty, is reached, reproduction does not occur. The complementary nature of growth and reproduction is observable in the

*The "lust" of olfaction is stronger than Clevenger seems to think. Often it is dominant.

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large size attained by some animals after castration. Could we stop the division of an ameba, a comparable increase in size would be effected. The grotesqueness of these views is due to their novelty, not to their being unjustifiable. While it must thus seem apparent that a primeval origin for both ingestive and sexual desire existed, and that each is a true hunger, the one being repressible and in higher animal life being subjected to more control than the other, the question then presents itself: What is hunger? It requires but little reflection to convince us of its potency in determining the destiny of nations and individuals and what a stimulus it is in animated creation. It seems likely that it has its origin in the atomic affinities of inanimate nature, a view monistic enough to please Haeckel and Tyndall.

Spitzka, in commenting on the foregoing, says:—

There are some observations made by alienists which strongly tend to confirm Clevenger's theory. It is well known that, under pathologic circumstances, relations, obliterated in higher development and absent in health, return and simulate conditions found in lower, and even in primitive, forms. An instance of this is the pica, or morbid appetite of pregnant women and hysteric girls for chalk, slate-pencils, and other articles of an earthy nature. To some extent this has been claimed to constitute a sort of reversion to the oviparous ancestry, which, like the birds of our day, sought the calcareous material required for the shell-structure in their food. There are forms of mental perversion properly classed under the head of the degenerative mental states in which a close relation between the hunger appetite and sexual appetite becomes manifest.

Under the heading *"Wollust, Mordlust, Anthropophagie,"* Krafft-Ebing describes a form of sexual perversion where the sufferer fails to find gratification unless he or she can bite, eat, murder, or mutilate the mate—sadism. He refers to the old Hindoo myth, Civa and Durga, as showing that such observations in the sexual sphere were not unknown to the ancient races. He gives an instance where, after the act, the ravisher butchered his victim and would have eaten a piece of the viscera; another where the criminal drank the blood and ate the heart; still another, where certain parts of the body were cooked and eaten. *Nature* (London), commenting on Kiernan's article, quotes Ovid: *"Mulieres in coitu nonnemque genas cervicemque maris mordunt."*

Illustrations of the varying types of sexual perversion are, of late years, finding their way into literature. A very interesting series of cases of inverted sexuality is reported by Krafft-Ebing, which vividly demonstrate the psychic peculiarities of their class. The following is a fair type, save in the fact that the condition was

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in no way betrayed by femininity of physique. This is not usual, but by no means rare:—

CASE 1.—Mr. X., merchant, residing at the time in America, 38 years old, said to be of a family sound in mind and body, affected since youth with neurasthenic complaints, otherwise sound, wrote me in the fall of 1882 a long letter, the most important parts of which are here transcribed:—

"I have read your article in the *Zeitschrift für Psychiatrie.* By it I and thousands of others are rehabilitated in the eyes of every thinking and half-way-fairminded man, and I give you my heartiest thanks. I well understand that science has taken hold of this matter so recently that, in the eyes of one whose mind is sound and who is unversed in the nature of this disease, it appears as a horrible and unnatural crime. Ulrich has not overestimated the prevalence of this disease. In my own city (13,000 inhabitants) I personally know of fourteen cases, and in a city of 60,000 people I know of eighty.

"I will take the liberty of encroaching on your time by giving a short sketch of my life, and shall do so with all frankness. It will perhaps furnish you with data for your critical studies of this malady. You may make such use of these statements as you see fit so long as my name is suppressed.

"Music and literature were always my hobbies. My whole disposition is feminine. I hate all noise, disturbance, and obscenity. As a child, I associated constantly with girls and played with their dolls and toy-kitchens. I liked to dress in girls' clothes and so earned the nickname of 'girl-lover' (*'mädchen-schmecker'*). Afterward, when I became a student and took part in turning and gymnastics, it was still my delight to help my mother in her household duties. At the age of thirteen I arrived at puberty,—that is, I acquired a fondness for another being; but it was for one of my own sex. At school I always had my lover and was horribly jealous of any young girl or school-mate toward whom he showed any preference. My delight was to kiss him, while my sense of propriety overcame my sexual desires, though to gratify them was the very goal of my wishes. You will be surprised to learn that until I was twenty-eight years of age I never had a seminal emission, either through involuntary emissions, onanism, or by performing a perverted sexual act.

"While still a young man I had a serious love-affair with a sophomore. He returned my love in a way, but only with the enthusiastic friendship of a boy. Once, when we happened to be sleeping together he naïvely asked me if I took him for a girl. In the manner of youths we raved over poetry and literature. Our parting was for me almost heart-breaking. The young ladies in the house of my master where I lived had no effect upon me. I associated with them in a friendly, but entirely dispassionate, manner.

"New, but entirely Platonic, love-affairs with young men followed; but although the outward appearances were most agreeable, there often came over me the depressing thought—you are not like other men—and this troubled me most when I was in a circle of laughing, joking comrades who were full of animal spirits and sometimes indulged in licentious pleasures.

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I did not know whether I should laugh or cry. It was an almost unbearable condition, and I was forced constantly to throw sand in the eyes of others and to act contrary to my inclinations. I was out of this dilemma only when in the society of those like myself; it was therefore necessary for me to seek the society of those whom it would have been more advisable for me to have avoided. I never found in the society of beautiful women that invigoration of the mental powers which is commonly the case, but did find it among fascinating young men. I prefer to associate with married women or entirely innocent and ingenuous young ladies. Every attempt to draw me into the matrimonial net disgusts me, and on the question of marriage I am sensitive to a ridiculous degree.

"Until I was twenty-eight years old I had no suspicion that there were others constituted like myself. One evening in the castle-garden at X——, where, as I subsequently found, those constituted like myself were accustomed to seek and find each other. With that I lost my better manhood and came often to the park and sought similar places in other cities.

"You will readily conceive that with the knowledge thus acquired there came a sort of comfort—the satisfaction of association and the sense of no longer being alone and singular. The oppressive thought, that I was not as others were, left me. The love-affairs which now followed gave my life a certain zest which I had never known before. But I was only hurrying to my fate. I had formed an intimate acquaintance with a young man. He was eccentric, romantic, and frivolous in the extreme and without means. He obtained complete control over me and held me as if I were his legal wife. I was obliged to take him into business. Scenes of jealousy which are scarcely conceivable took place in my house. He repeatedly made attempts at suicide with poison and it was with difficulty that I saved his life. I suffered terribly by reason of his jealousy, tyranny, obstinacy, and brutality. When jealous he would beat me and threaten to betray my secret to the authorities. I was kept in constant suspense lest he should do so. Again and again I was obliged to rid my house of this openly insane lover by making large pecuniary sacrifices. His passion for me and his shameless avarice drove him back to me. I was often in utter despair and yet could confide my troubles to no one. After he had cost me 10,000 francs, and a new attempt at extortion had failed, he denounced me to the police. I was arrested and was promptly condemned to imprisonment. My social position was totally destroyed, my family brought to sorrow and shame, and the friends who had heretofore held me in high esteem now abandoned me with horror and disgust. That was a terrible time! And yet I had to say to myself: 'You have sinned—yes, grievously sinned—against the common ideas of morality, but not against Nature.' A thousand times no! A part of the blame at least should fall upon the antiquated law which would confound with depraved criminals those who are forced by nature to follow the inclinations of a diseased and perverted instinct.

"You may get an idea of how natural and spontaneous our actions are from the following incident:—

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"About two years ago I was with a friend in a company of jovial acquaintances. A bright, fun-loving young lady whom I might well have a passion for, but who, as a woman, made no impression whatever upon me, dressed herself in the uniform of an officer with moustache, etc. From the minute when she entered the room in this metamorphosis I felt sexual passion toward her.

"A friend once advised me to marry and dress my wife in male attire. I know of a case in Geneva where an admirable attachment between two men like myself has existed for seven years. If it were possible to have a pledge of such a love they might well make pretensions to marriage, but in the absence of that the proposal of Ulrich seems laughable indeed. One thing is true. Our loves bear as fair and noble flowers, incite to as praiseworthy efforts as does the love of any man for the woman of his affections. There are the same sacrifices, the same joy in abnegation even to the laying down of life, the same pain, the same joy, sorrow, happiness, as with men of ordinary natures.

"I will add that, so far as I can judge, I am of perfect physical build, and that there is nothing remarkable as regards my sexual organs. My walk and voice are masculine, and one would never suspect me to be what I have described, while many of my class betray themselves by their expression, downcast eyes, gait, posture, bending of the body, manner of sitting, or dress.

"In consequence of the disgrace that came upon me in my fatherland I am obliged to reside in America. Even now I am in constant anxiety lest what befell me at home should be discovered here and thus deprive me of the respect of my fellow-men.

"May the time soon come when science shall educate the people so that they shall rightly judge our unfortunate class; but before that time can come there will be many victims."

A case of quite similar type came under the author's observation:

A man thirty-five years of age sought a cure for sexual inversion. The subject was a college and technical graduate, and filled the position of chief chemist of a pharmaceutical manufacturing concern. He had noticed at about the age of puberty that he was homosexually inclined. He never had indulged in perverted practices. Seeking an explanation of his condition he had read widely on the subject of psychopathia sexualis and had all the literature almost at his command. He recognized the psychic element in his case and, endeavoring to cure himself, had become engaged to an estimable young woman. The engagement lasted for a year, during which time he never experienced the slightest normal sexual attraction save on one occasion, when the young woman in a frolicsome mood dressed herself in her brother's clothes. Subsequently the patient deliberately became intoxicated and while in that condition succeeded in sustaining sexual relations with a prostitute. The engagement finally was broken off and the patient practically had given up all hope of cure until the idea that

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hypnotism might succeed suggested itself to him and he consulted the author. This case passed from under observation, and the subsequent history is unknown to the author. A remarkable feature of the patient's case was the statement that he was going to will his brain to the author for study. Said he: "I don't believe you will find any pathology, but it will do no harm to investigate."

The deplorable case of Oscar Wilde was a pertinent example of the association of perversion with the highest culture and a most artistic temperament.

The following case of Krafft-Ebing's is an excellent illustration of inverted sexuality in the female. It is a type that is quite familiar to all students of the psychology of sex:—

CASE 2.—Miss X, 38 years old, consulted me in the fall of 1881 regarding severe spinal irritation and chronic insomnia, for which she had extensively used chloral and morphine.

Her mother was of a nervous organization; the rest of the family apparently healthy. Her sufferings dated from a fall upon the back received in 1872, which caused the patient a severe shock. In connection therewith there developed neurasthenic and hysteric symptoms with severe spinal irritation and insomnia. Episodically there was hysteric paraplegia of eight months' duration and instances of hysteric hallucinatory delirium with convulsions. In addition there were symptoms of morphinism. A stay of several months in the clinic removed these and also materially alleviated the neurasthenic condition. These gratifying results were in great part accomplished by general faradism.

At her first appearance the patient attracted attention by her clothing, features, man's hat, short hair, spectacles, gentleman's cravat and a sort of coat of male cut covering her woman's dress. She had coarse male features, a rough and rather deep voice, and with the exception of the bosom and female contour of the pelvis, looked more like a man in woman's clothing than like a woman. During all the time I had her under observation there were no signs of eroticism. When I spoke about her clothing she said she wore it because it was convenient.

I incidentally discovered that as a child she had a fondness for horses and masculine pastimes, but never took any interest in feminine occupations. She later developed a taste for literature and sought to fit herself for a teacher. She never enjoyed dancing, and the ballet had no interest for her. Her highest enjoyment was to go to the circus. Up to the time of her sickness in 1872 she had no particular fondness for persons of either sex. After this there developed in her an attachment toward women, especially young women. She was never passionately aroused in her intimacy with them, but her friendship and self-sacrifices toward those she loved were boundless, while from that time on she had abhorrence for men and male society. Her relatives informed me that the patient had an offer of marriage in 1872, but refused it. She took a trip to a watering-place and re-

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turned entirely changed sexually, and made use of expressions which implied that she did not consider herself to be a woman. Since then she would only associate with women, had love-affairs with them, and let fall insinuations that she was a man. Her passion for women showed itself in tears, fits, jealousy, etc. While she was at the baths in 1874 a young woman fell in love with her, thinking she was a man in woman's clothing. When this young lady afterward married, Miss X became very melancholy and complained of faithlessness. Her friends noticed that after her sickness she evinced a decided preference for male clothing and a masculine appearance, while before her illness she had been in nowise other than a womanly character, at least as regarded her sexual feelings.

Further investigations showed that the patient was carrying on a purely Platonic love-affair with a young woman and wrote her tender love-letters.

The foregoing case is a type that is very frequently met with in women. It is by no means necessary that the female should be masculine in physique, however. In such relatively-mild cases she often is not. Nor is it necessary that physical indulgence of a perverted character should occur; it often does not go beyond the psychic phase. Favoring circumstances will inevitably produce the extreme result, however. Parents, sociologic students, physicians, and educators should understand this.

The medico-legal importance of a recognition of such cases was shown by the Mitchell-Ward murder at Memphis some years since.

Tardieu chronicles the following interesting points with regard to one form of sexual perversion:—

I do not pretend to explain that which is incomprehensible, and thus to penetrate into the causes of pederasty. We can nevertheless ask if there is not something else in this vice than a moral perversion, than one of the forms of *psychopathia sexualis,* of which Kaan has traced the history. Unbridled debauchery, exhausted sensuality, can alone account for pederastic habits as they exist in married men and fathers of families, and reconcile with the desire for women the existence of these impulses to unnatural acts. We can form some idea on the subject from a perusal of the writings of pederasts containing the expression of their depraved passions. Casper had in his possession a journal in which a man, member of an old family, had recorded, day by day, and for several years, his adventures, his passions, and his feelings. In this diary he had, with unexampled cynicism, avowed his shameful habits, which had extended through more than thirty years, and which had succeeded to an ardent love for the other sex. He had been initiated into these new pleasures by a procuress, and the description which he gives of his feelings is startling in its intensity. The pen refuses to write of the orgies depicted in this journal, or to repeat the names which he gave to the objects of his love.

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I have had frequent occasion to read the correspondence of known pederasts and have found them applying to each other under the forms of the most passionate language, idealistic names which legitimately belong to the diction of the truest and most ardent love. But it is difficult not to admit the existence in some cases of a real pathologic alteration of the moral faculties. When we witness the profound degradation, the revolting salacity of the individuals who seek for and admit to their disgusting favors men who are gifted with education and fortune, we might well be tempted to think that their sensations and reason are altered; but we can entertain no doubt on the subject when we call to mind facts such as those I have had related to me by a magistrate, who has displayed both ability and energy in the pursuit of pederasts. One of these men, who had fallen from a high position to one of the lowest depravity, gathered about him the dirty children of the streets, knelt before them and kissed their feet with passionate submission before asking them to yield themselves to his infamous propositions. Another experienced singularly voluptuous sensations by having a vile wretch inflict violent kicks on his gluteal region. What other idea can we entertain of such horrors than that those guilty of them are actuated by the most pitiable and shameful insanity?

Some of the manifestations of sexual perversion, quoted by various authorities, are very extraordinary, and it is difficult to associate them with titillations of sexual sensibility. Perhaps the most familiar of these cases is that of Sprague, who was committed in Brooklyn many years ago for highway robbery. It is unnecessary to present this case in detail, but an outline of it may prove interesting. Sprague was arrested immediately after having assaulted a young lady by throwing her down, violently removing one of her shoes and running away with it. He made no attempt to steal anything else, although she wore valuable jewelry. When the trial came on, insanity was alleged as a defence. Numerous witnesses, the principal of whom was the father of the defendant, a clergyman of the highest respectability, testified to the erratic conduct of the prisoner. A family history was elicited which bore most pertinently upon Sprague's case, his grandfather, grandmother, great-grandmother, three great-aunts, and a cousin having been insane. He had himself in his youth received numerous blows and falls upon the head, and within a year from the last head-injury he had developed severe headaches, associated with which his friends noted a bulging of the eyes. About this time the prisoner developed a fondness for stealing and hiding the shoes of females about the house, and it was found necessary by his relatives and the female domestics to carefully conceal or lock up their shoes to prevent his

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abstracting them. Upon investigation it was discovered that the act of stealing or handling the shoes produced in him sexual gratification.

The so-called "Jack the Clipper" psychopaths, who assault women apparently for the purpose of stealing their hair, in most instances are sexual perverts of the Sprague type.

Wharton some years ago chronicled a most peculiar case of sexual perversion. In this instance, the morbid sexual desire impelled the individual to assault young girls upon the streets of Leipzig by grasping them and plunging a small lancet into their arms above the elbow. The fact was developed after his arrest that these peculiar acts of assault were accompanied by seminal emissions. This authenic case gives a vivid coloring to the rational hypothesis that the notorious Whitechapel assassin was a sexual pervert.

Many cases of sexual perversion manifest themselves only under the influence of disease or drunkenness. Ovarian irritation and those obscure cases of hysteria in women which we are unable to trace to a definite physical cause frequently are associated with sexual perversion. The physiologic (?) disturbance incidental to pregnancy is, in certain neurotic patients, productive of similar aberration. Whether the influence of liquor obtunds the moral faculties or develops an inherent defect of sexual physiology in any given case is, of course, difficult to determine. The author knows of an individual who conducts himself with perfect propriety when sober, and who is a man of exceptional intellect, but who, when under the influence of alcohol, is too low for consort with the human species.

Some of the cases of sexual perversion that have come under the author's observation have been as unique as that of Sprague's or the case related by Wharton. In one instance a man who frequented houses of ill fame found it impossible to qualify sexually until a chicken had been decapitated. The sight of the struggling, bleeding fowl was eminently aphrodisiac in his case. Under no other circumstances was it possible for him to secure an erection. In another case the pervert was in the habit of renting a full set of regal robes, crown and all. These he would put upon the object of his attention. Having seated the woman upon an improvised throne, he would besiege (?) his ready-made queen until his object was attained. Egomania evidently was a dominant phase of the sexual psychopathy of this particular case.

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Heredity, on the one hand, and acquired disease or injury, on the other, sometimes bear a very important relation to sexual psychopathy. A very interesting case bearing on both these etiologic factors was reported by Urquhart:—

CASE.—Young man, 26 years of age, of medium height and weight and fairly robust development, was sentenced to one year's imprisonment at hard labor as a punishment for immoral practices. The judge in passing sentence remarked that while it might not be the logical course of treatment, it was the only thing to do, for he was not legally insane, and if set at liberty would only go on with his vicious practices. The heredity in this case was exceptionally bad. The father was a drunkard and *roué*. He was syphilitic and died young. The mother was also syphilitic—infected by the father during her pregnancy. Subject's only sister was a prostitute, but his only brother was decent and respectable. When a small boy, subject fell over a staircase, striking on his head and injuring his skull. He became unconscious, with bleeding at the ears. His mother noticed thereafter a great change in his conduct. At school he soon became a confirmed masturbator, and showed a marked amorous preference for male children. It was finally discovered that it was unsafe to permit other boys to be in his company. His sexuality toward the opposite sex was perverted, and women in general disgusted him. His habits toward his own sex finally attracted the attention of the police, because of which he attempted to kill himself. He was finally apprehended, tried, and sentenced to prison.

A peculiar case was reported to the Chicago Medical Society by A. R. Reynolds, of a man who had a love-affair with a woman whose right lower extremity had been amputated at the thigh, and became so much attached to her that he afterward was impotent with perfectly-formed women, it being necessary for him to secure females who had undergone mutilation similar to that of his former attachment in order that he might be sexually gratified.

A peculiar phase of sexual perversion is occasionally seen among masturbators, male and female. The individuals suffering from this have a peculiar predilection for titillating the sexual organs in various outlandish fashions. Such patients in many instances are particularly fond of introducing foreign bodies of various kinds into the urethra and thus gratifying their sexual desires. Such cases occur even among persons who have opportunities for normal gratification. Thus, an interesting case is reported by Poulet of a married woman, the mother of three children, who failed to receive gratification from ordinary intercourse, and practiced masturbation with a blunt piece of wood fastened to a wire.

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Her unfortunate failing was exposed through the slipping of the foreign body from her grasp into the bladder. Kiernan reports a somewhat similar case of an insane girl who was admitted into his service at the Cook County Insane Asylum. In this instance the physical appearance of the sexual organs and anus led to a suspicion of pederasty, which was confirmed upon investigation.

A case of the author's was quite remarkable:

A married man, 40 years of age, was wont to insert a wire ten-penny nail into the urethra for masturbatory purposes. The nail slipped from his fingers one day, and disappeared in the urethra. After some hours of fruitless attempts to extract the foreign body, the family physician brought the patient to the author. The nail was found with the point embedded in the membranous urethra and the head lying just within the vesical orifice. The author removed it by perineal section.

There are several types of sexual perverts that infest the streets, alleys and public buildings of our large cities and should receive the attention of the police—who are well aware of the existence of such defectives, but nevertheless maintain an apathetic attitude toward them. Certain male perverts are wont to mingle with street throngs and under the cover of the crowd offer women physical indignities of one kind or another. Crowded elevators and street cars are favorite haunts for such depraved persons. Another class, "exhibitionists," is quite numerous. These degraded specimens of humanity stealthily expose their persons, whenever the conditions of opportunity and apparent safety from punishment present themselves. The police are thoroughly cognizant of the existence of such psychopathics, but do not trouble themselves with efforts to capture them.

Masochism,—the opposite of sadism—is one of the most peculiar manifestations of sexual perversion. In this psychopathy, the subject derives sexual gratification through submission to the infliction of pain, usually by one of the opposite sex. In some cases the sex by which the pain is inflicted is a matter of indifference, as witness the "flagellants," who titillated their genito-spinal centers by flogging each other.

Necrophilism, or perverted sexual manipulation of the dead body, is so clearly a manifestation of insanity that it requires only mere mention here.

Pornography—obscene writing and drawing, as seen on fences and the walls of public buildings and public conveniences—is a

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manifestation of perverted psycho-sexuality. Young lads who are given to this practice do not come under this classification, but adult offenders invariably do. The attention of the police authorities is herewith called to this point as suggesting that adult pornographists are more dangerous to the community than the mere fact of their obscene writings and pictures would imply.

In passing, it is worthy of note that while young lads of well bred families often are given to pornography in the belief that it indicates "smartness," manliness and worldly wisdom, the adult pornographer usually is a degenerate of low type.

The physician—or jurist—should not fall into the error of believing that the victims of sexual psychopathy usually belong to the uneducated and unrefined classes. In the author's experience, the reverse is true. Sex degeneracy is one of the penalties exacted by nature for the refinements of civilization. When races begin to degenerate they begin at "the top" and neuro-psychic degeneracies of all kinds—and especially those of a sexual type—increasingly develop. There is a question in the author's mind as to whether the present frightful European war may not act as a social alterative in this direction. War involves a reversion of humanity toward the primitive animal, who is free from the degenerative effects of "higher civilization."

The most shining recent example of the combination of artistic and literary genius with inversion was Oscar Wilde. His Ballad of Reading Gaol is one of the finest productions of modern English literature. Wilde was the product of a bad heredity plus the evil influence of certain English educational institutions. His sex view-point is well illustrated by the following quotation from his "confessions":—

"Don't talk to me of the other sex. First of all, in beauty there is no comparison between a boy and a girl. Think of the enormous, fat hips which every sculptor has to tone down, and make lighter, and the great udder breasts which the artist has to make small and round and firm, and then picture the exquisite slim lines of a boy's figure. No one who loves beauty can hesitate for a moment. The Greeks knew that; they had the sense of plastic beauty, and they understood that there is no comparison. The boy is far more beautiful. It is the sex-instinct, the sinful sex-instinct which prevents worshipping the higher form of beauty. Height

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and length of limb give distinction; slightness gives grace; women are squat. The boy's figure is more beautiful; the appeal it makes far higher, more spiritual."

The association of sexual perversion with malformations of the sexual organs with or without associated close approximation to the general physique of the opposite sex, male or female, as the case may be, certainly is not surprising. The author has met with some most peculiar instances of this form of sexual perversion. The relation of both physical and psychic defects of sexual differentiation to sexual perversion has been expatiated upon in the preceding chapter.

TREATMENT.—The treatment of sexual perversion has in the past been highly unsatisfactory, largely from the fact that the abnormality of sexual instinct is due to defective sexual differentiation—psychic or organic, or both. To the average pervert, his or her condition seems normal. The victim recognizes the fact that he differs from the usual standard of sexual normality, but he is absolutely incapable of reasoning out his defect from any other stand-point. He often desires to be cured of his abnormal sexuality —only, however, by the substitution of the instinct which seems common to those about him. There is no innate repugnance to his own condition, which is as normal to his own mind as is a confusion of colors to the color-blind. He knows his abnormal sexuality only from study and comparison of normal individuals. He regrets his social ostracism, while really seeing nothing wrong in the condition that has brought it about. Taking into consideration the congenital character of most cases, the difficulty of cure is self-evident. Where there is physically imperfect differentiation of sex, the case is absolutely hopeless. Perversion from impressions of an abnormal psychosexual character made while the sexual function is, so to speak, in its plastic, formative stage, perversions due to functional neuropathic disturbances, and perversions from vice, are often susceptible of cure. Therapeutic suggestion is of paramount importance in most cases. Psychotherapy often is the keynote of treatment. As Kiernan so tersely says:—

> Insistence on the morbidity of the pervert ideas, and prohibition of sexual literature as in the sexual neurasthenic, together with allied psychic therapy and anaphrodisiac methods cannot but benefit. These patients, like the hysteric, will not "will" to be cured while they are subjects of sympathy.

The author already has expressed his belief that in his own

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method of sex-gland implantation we have a therapeutic resource—sex hormone therapy—which, under favorable conditions, may offer hope of cure of sexual perversions and inversion.

It has long been the author's belief that a large proportion of both boys and girls may be easily converted into sexual perverts by unnatural sexual impressions at or about the age of puberty, when the centers of sexual receptivity and impulse are in a plastic state. It is strange that physicians did not discover this earlier. The sexual dangers of boarding-schools long ago were pointed out by a French novelist, Adolph Belot. (Mdlle. Giraud, Ma Femme). A word of warning, therefore, may not be out of place.*

To emphasize the necessity of school supervision in the matter of exposure of children to evil sex influences, the author will cite three cases of young girls who became *enceinte* while attending a fashionable boarding school for girls, and two cases of gonorrhea occurring in girl pupils of a similar institution. Cases of boys corrupted and infected in boarding schools are too numerous to mention. In passing, the author desires to express his advocacy of the establishment by law of an age of consent for boys. As matters now stand, the debauchery of young girls is a crime, whilst that of boys is taken for granted and carries with it no responsibility. The extent to which young lads are inculcated into sexual immorality by lewd women is far greater than some of our "lop-sided" reformers suspect.†

A most striking illustration of the sex dangers to which school children are exposed came under the author's observation. A self-confessed sexual pervert asked for advice in the matter of accepting the superintendency of a certain school for delinquent boys which had been tendered him. *He had been for four years principal of a high school.* The tenor of the author's advice to this particular psychopath may be imagined. Suffice it to say that, at last accounts, the teacher of youth had left the country for parts unknown.

For the insane pervert the asylum is the only recourse. In rare instances of perversion, castration, oöphorectomy, and clitoridectomy are worth consideration. *Sterilization should be practiced in all cases. No sexual pervert should be allowed to procreate.*

* The terrible arraignment of the English schools by Frank Harris in his Life of Oscar Wilde should be suggestive to educators.

† The author thus far has vainly endeavored to interest legislators in this subject.

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CHAPTER IV.

Satyriasis, Sexual Erethism and Nymphomania.

SATYRIASIS is a disease that occurs in the male, with or without insanity, the principal manifestation of which is an abnormally excessive and unreasonable, and uncontrollable sexual desire. It is not a frequent disease as brought to the attention of the physician, probably because the opportunities for gratification of the male are relatively numerous. The disease consists of constant desire, attended with vigorous, often painful, erections, which in some instances no amount of sexual intercourse will relieve. It has been termed "erotic delirium," and it may or may not be due to coarse disease of the brain. In the worst cases the unfortunate individual may be the subject of mania and delirium of a violent form. Acton relates the case of an old man, suffering from satyriasis, whose desire was so extreme that he would masturbate whenever he was brought into the presence of women. After his death a small tumor was found in the pons Varolii. Shock and injuries involving the cerebellum are peculiarly likely to be followed by persistent erections. This phenomenon has been noticed in subjects killed by hanging. Injuries of the spinal cord, although in the majority of instances inhibiting the sexual function by producing complete paralysis of that portion of the cord which seems to bear an intimate relation to sexual sensibility—the genito-spinal center—produce in some instances, from irritation of the same nervous structure, persistent erection. Cases of this kind are related by Lallemand. The following case is one that has been very frequently quoted:—

CASE.—The subject was a soldier, who, climbing over the walls of the garrison, fell upon his sacrum. Following this injury he became paraplegic and suffered with persistent priapism. This lasted for some time, and could not be relieved by intercourse. All pleasurable sensations and the power of ejaculation were destroyel, although sexual desire was very ardent. During

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sleep, however, the unfortunate subject had lascivious dreams, accompanied by slight sensation and ejaculation.

The causes of satyriasis, as enumerated by different authorities, are: masturbation; disease of the brain, particularly those affecting the cerebellum; injuries and diseases of the spinal cord, sexual excesses, and the administration of poisonous doses of cantharides. Prolonged continence is another rare and dubious cause to which satyriasis has been ascribed. Blandet describes a case of this kind:—

CASE.—The patient was an earnest, hard-working, and zealous missionary. He was unfortunate in the possession of an intensely passionate nature, although he had not gratified himself in a vicious manner. So intense was his excitement in the presence of women that it became necessary to seclude himself from them so far as possible. This plan proved a failure, for he became so much worse that he suffered from satyriasis in an extreme degree. A cure was finally accomplished by the normal indulgence of his passion.

The mild form of excessive sexual activity called priapism may be due to local irritation. In some instances irritation will produce severe priapism without sexual desire. The author once had under treatment a gentleman who was suffering in this manner:—

CASE.—The patient was 50 years of age, had been somewhat dissipated and a high liver, as a consequence of which he had gout in an extreme degree. He had suffered for several years from vesical irritation, attributed by him to stricture of long standing. The urethra on examination presented no abnormality; the urine was highly concentrated and strongly acid. As soon as the patient retired for the night he began to be troubled with severe erections that were so vigorous as to be quite painful and which persisted during the entire night. Sexual intercourse gave no relief.

Such cases can be attributed only to sexual hyperesthesia incidental to long-continued gout and irritation of the genito-urinary tract. This does not manifest itself during the day-time, but during the night, when, as is well known, the spinal cord is relatively hyperemic and in a condition of increased functional activity. The same explanation holds good here as in nocturnal emissions, which will be discussed later.

In another case of the author's, no cause save a slight deep linear stricture could be found. Vasectomy, perineal section and cerebro-spinal sedatives failed to more than temporarily relieve this case.

Satyriasis of greater or less severity not infrequently is met

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with in elderly men suffering from prostatic disease. Such cases usually are relieved by prostatectomy. Annoying and perhaps persistent priapism often is noted in patients afflicted with vesical calculus, especially in young children. Children sometimes suffer from frequent and obstinate priapism due to irritations beneath the prepuce. Obviously, operation for stone in the one class and circumcision in the other is indicated. The author is a persistent and strenuous advocate of routine circumcision in male children.

Tumors of the brain—notably of the spinal cord, and traumatisms of the brain and cord—especially those involving the genito-spinal center, may cause priapism or satyriasis. Death by hanging often is accompanied by priapism and emission.

Priapism sometimes is severe and associated with perversions. Dr. Wm. H. Dukeman reports a highly interesting case of priapism in which there was no desire for the normal sexual act, but an almost maniacal desire for unnatural indulgence:*

CASE.—A tall muscular Englishman, thirty-four years of age. Appearance suggested mental depression. His features looked haggard, and anemic. Penis was found in a rigid state of erection, which had persisted for four months. This had occurred at frequent intervals for years, lasting for two or three months at a time. The organ measured eight inches in length on the dorsum, twelve inches from the bulb, and seven inches in circumference; and was tattooed in various designs such as serpents' heads, coats of arms, anchors, etc.

No history could be elicited suggesting the cause of the trouble. He would not permit any surgical treatment. Antispasmodics and anaphrodisiacs were prescribed. The next day his father, an officer in the English army, related the following history: While stationed at the Solomon Islands in the South Sea, his son at seven years of age was stolen by the natives and was not recovered until he was eleven. The natives used the boy as an idol, and practiced on him sexual perversion. The young man developed abnormal desire, with frequent and continuous priapism with intense pain lasting several days. His only relief from this miserable condition was passive perversion.

He was married at sixteen and had four children. During his married life he enjoyed good health and was comparatively free from the attacks. After death of his wife, about nine years ago, his malady returned with more violence than ever and for nine years he has been growing worse. The old perverted passion returned with overwhelming acuteness, and during these times he would develop priapism and fall into a hysterical or trance-like state which would last several hours. He is called a spiritual medium of unusual attainments, and has given séances in various places

* Pacific Med. Jour., Aug., 1889.

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along the coast. It was found that he could be hypnotized by placing one hand on the nape of his neck and the other over his eyes. Hypnosis was induced and he remained in this condition for one hour, during which time the penis was as rigid as before. While in this state he would talk of the natives of the islands where he was taken captive and of their peculiar habits.

He was under observation for six weeks. Various remedies were tried with no benefit. His trance-like attacks grew more frequent, and he refused further treatment. He stated that sexual intercourse only aggravated his trouble, his only relief from pain being his old perverted habit. The priapism remained as persistent as ever. No spinal lesion was discoverable. He was able to work. In conversation he used intelligent language but there was some aberration of the mental faculties.

This patient died of pulmonary tuberculosis some months later. This may explain the obstinate priapism.

Excessive Libidinousness—Sexual Erethism.

Excessive sexual desire bordering on satyriasis not infrequently is met with at all adult ages. Cases observed before puberty are, of course, classed as precocious sexuality. The phenomenon is noted very frequently in elderly men, in whom the sexual impulse naturally should be expected to have decreased—and continually to decrease. Prostatic irritation—with or without a gouty foundation—or prostatic enlargement perhaps is the most frequent obvious cause. R. W. Taylor reported a case in an adult due to vesical calculus. Possibly the prostatic congestion and irritation result in aberration of both prostatic and testicular hormones, which in turn produces irritation of the psycho-sexual and genito-spinal sex centers. The element of reflex irritation is obvious.

Elderly and middle age *roués* frequently present a characteristic psychic predilection for very young females. This is due to: 1st. Pursuit of youthful memories, 2nd. To the increasing development of the paternal instinct and its confusion with the sexual instinct, with advancing age. The only saving grace on the part of nature often is the waning of sexual capacity as age progresses. The youth often begins by falling in love with a woman old enough to be his mother, she with him because the instinct of the female is to "mother" the male. "Mothering" a poodle or a cat merely is vicarious sexuality. There is an element of pathos in it all and, in a general way, it perhaps serves to aid in the maintenance of sex psychology equilibrium.

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The element of novelty is a most powerful psycho-sexual stimulant and explains much unethical and immoral sex conduct. In the author's opinion it is normal and a much more powerful factor in sexual phenomena than Darwin's so-called sexual selection, if, indeed, it does not controvert it and tend rather to support Wallace's idea of hypernutrition of the male as an all-sufficient explanation in certain species. The author has proved by experiments with fowls that, in them, at least, brilliant secondary male sex characteristics have no bearing on the attraction of the male for the female. A number of hens were confined in a yard in company with a cock of brilliant plumage. At the end of four weeks the author selected the most outlandish looking young mongrel cockerel he could find, denuded him of all feathers save those of the wings and tail, so that he resembled the fowls hanging in a meat market, and put him in with the thoroughbreds. The hens immediately deserted the splendid lord of the harem and flocked to the weird looking stranger, who kept the master of the harem exceedingly busy in protecting his rights until, several days later, the doughty old warrior succeeded in cornering and killing the interloper.

NYMPHOMANIA.

Nymphomania (erotomania, *furor uterinus*) is a disease, analogous to satyriasis, in the male, occurring in the female. It is characterized by excessive and inordinate sexual desire, and very often by most pronounced lewdness and vulgarity of speech and action. In the severe forms it is likely to be associated with, and dependent upon, other forms of insanity, with or without gross brain disease. The delusions of the female insane frequently are sexualized. In some instances the disease is a reflex manifestation of irritative affections of the sexual apparatus. Thus, ovarian and uterine diseases are likely to be associated with it. Any irritation of the external genital organs in females of hysteric temperament may produce the affection, all that is necessary being a nervous and excitable state of the nervous system, a passionate temperament, and local irritation of the sensitive sexual apparatus. Some of the recorded cases of nymphomania are very pitiful. It has been known to be associated with the cerebral disturbance incidental to pulmonary consumption. Thus, a case has been recorded of a woman

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in the last stages of this disease who exhibited the most inordinate sexual desire, and a short time before her death importuned her husband to have intercourse with her. The association of hysteria with this unfortunate psychosexual condition is one with which nearly every gynecologist of experience is perfectly familiar.

Nymphomania also is known to occur as a result of masturbation and sexual excess. In women of a highly erethistic temperament it has developed as a consequence of sudden cessation of the normal method of sexual indulgence.

Knowledge or experience in sexual matters is by no means necessary to the development of nymphomania, for it has been known to occur in individuals who had neither masturbated nor indulged in sexual intercourse. Some of the most painful cases of the disease have occurred during pregnancy. The principal astonishing feature of such unfortunate cases is the acquirement of lewd actions and expressions on the part of women previously and naturally pure-minded and refined. Such women may use expressions and indulge in actions that lead the physician to wonder where they possibly could have acquired a knowledge of them.

The author recently removed the clitoris and labia from a young girl masturbator fifteen years of age who as early as seven or eight years of age showed such lasciviousness that she was excluded from every school in which she was placed. There was a sexually bad heredity on the maternal side. In this case it is too early as yet to determine the result.

The gynecologist is compelled to be on his guard with reference to a not-infrequent form of nymphomania, but one which is little suspected by those surrounding the patient, in which the woman develops a fondness for gynecologic manipulations. The subterfuges and devices of such patients to induce handling of the sexual organs by the physician often are remarkable. One of the most frequent forms of this malingering is the pretense of retention of urine, although every disease that they ever heard of may be complained of by such patients in their insane endeavors to obtain manipulations at the hands of the physician.

Howe relates an interesting case of this kind occurring under his observation at Bellevue Hospital:—

Case.—A girl, aged 18, was admitted, supposed to be suffering from retention of urine. She was thin; her eyes were deep-set, but bright and

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staring, and were found filled with tears. Her statement was that she had passed no water for three days; that she was subject to these attacks and was treated by having her water drawn off. I introduced the catheter, and found only a few ounces of urine in her bladder, not enough, indeed, to corroborate her history. The next morning, as she had not urinated during the night, I drew off the urine again. While doing so I noticed by a peculiar convulsive movement that she was under the influence of strong excitement. Further examination showed that the labia minora, clitoris, and adjacent parts were red and swelled and bathed in a profuse mucous secretion. I then remembered that on the previous evening she had shown a somewhat similar state of excitement, and gave the nurse orders to watch her closely all day. In the evening the nurse informed me that the patient kept up a constant friction of the genitals when she supposed no one was watching, and even when eyes were on her she endeavored by uneasy movements in the bed to continue the titillation. Knowing then what I had to deal with, the patient was given a sedative and told that she must empty her bladder without assistance. For thirty-six hours subsequently she obstinately insisted on her inability to urinate. When she was told no catheter would be employed again there was no further retention. Soon after she left the hospital I learned that a physician friend of mine was treating her for uterine disorder, but, he, too, soon found out the true nature of the case, and advised her to get married.*

An appalling number of cases of a similar nature come under the physician's observation, both in hospital experience and private practice.

It is the author's belief that both satyriasis and nymphomania primarily are due to a defective structure or disturbed function—or both—of the special hormone-producing cells of the testis and ovary. The secretion may be lessened in quantity or vitiated in quality. This aberration of the hormone may be disastrous in several ways, viz: 1st. Defective general development (congenital), 2. Defective physio-sexual development and differentiation (congenital), 3rd. Defective psycho-sexual development and differentiation (congenital), 4th. Excessive psycho-sexual development and activity (congenital), 5th. Hyperesthesia of previously normal psycho-sexual and genito-spinal centers (acquired). It is readily understood that with a loss of equilibrium between general and psycho-sexual differentiation and development would be associated a faulty development of the brain, resulting in defective will and perversion of the moral faculties.

* Reversing the abominable custom of prescribing virgins for the cure of disease in the male.

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Treatment of satyriasis and nymphomania consists chiefly in the removal of irritation of the sexual apparatus, the administration of anaphrodisiac remedies, to be hereafter considered, and attempts to restrain sexual excesses, or to break the habit of masturbation, as the case may be. Where there is actual organic disease the case is likely to be found to be incurable in the majority of instances, particularly if the structural disease involves the nervous centers. In women, extirpation of the ovaries or the procedure of Mr. Baker Brown—clitoridectomy—sometimes with excision of the nymphæ, may be performed. Howe recommends the application of the actual cautery to the back of the neck. Basing this treatment upon the theory that the disease takes its origin in oversexcitation of the nerve-fibres of the cerebellum or some of the ganglia in the neighborhood, he also suggests blisters and setons as answering the same purpose. Dry cupping to the nucha also is serviceable. Means to restore the general health always are indicated. In the severe cases of the maniacal form of excessive sexual desire the asylum usually is our only recourse, though castration occasionally is effective. Castration, however, is a remedy to be suggested with the greatest caution. There recently has been a tendency to recommend this operation in various conditions without duly weighing the responsibility involved.

The obvious query at once suggests itself; "Why does not castration or oöphorectomy always cure cases of nymphomania and satyriasis due to perverted hormone supply?" The answer is: Simply because: a, In the congenital cases, the defective or vitiated hormone supply has resulted in nutritive disturbance with resultant vicious development of neurons. b, In the acquired cases vicious nerve and brain habit have been established.

It may be remarked that, in other nervous disturbances primarily due to reflex irritation—*e. g.*, neuralgias of reflex origin—removal of the cause does not necessarily result in cure. Nutritional changes in the reflexly irritated nerve may cause a persistence of symptoms.

Satyriasis and nymphomania sometimes may be relieved by removal of sources of the reflex sexual irritation which has caused a perversion of hormone production, this being, in the author's opinion, the chief determining factor in such cases.

In all intractable cases of sexual psychosis in both sexes sterilization should be practiced. It also should be practiced on the milder

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types where physical degeneracy is determined as an underlying cause. Even in cases in the male in which the protection of posterity is not in question, sterilization is the logical indication and vasectomy may prove effective by lessening hyperemia and hyperesthesia of the seat of sexual desire in the prostatic urethra—the *colliculus seminalis*—and, secondarily, of the genito-spinal center.

If the author's theory of the causation of satyriasis and nymphomania is correct, the application of hormone therapy seems logical. The administration of normal sex hormone may act beneficially by, 1st. improving the nutrition of, and stimulating normal hormone production by, the patient's own glands, 2nd. by improving the nutrition of the psycho-sexual centers and thereby correcting the evil effects of vitiated hormone action, 3rd. by improving general nutrition and as a corollary the general health, 4th. by improving the nutrition of the brain and thereby improving the will power and the receptive capacity for moral and ethical impressions.

Attempts at hormone medication by the internal administration of various sex gland extracts are not as promising as some would have us believe. The testicular substances in particular are disappointing. In the treatment of the female, the corpus luteum substance apparently is more reliable than the testicular preparations are in the sexual disturbances of the male. It is to be hoped that experimental organo-therapy eventually will produce more reliable preparations than many of those at present in vogue. The author's method of sex gland implantation seemingly at present is the only reliable method of administering the hormone. This later will receive extended discussion.

It is claimed by Von der Kolk, that the sexual excitement which sometimes complicates mania is due to changes in the medulla. Here, sedation alone offers a prospect of relief.

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Although the indications for this procedure are given in the appropriate portion of the text of this work, they here demand brief tabulation:

1. Surgical injuries or traumatisms of the vas.
2. Stricture of the vas.
3. Benign neoplasm involving the vas.
4. Incipient prostatic enlargement and occasionally where prostatectomy is refused.
5. Obstinate cases of irritability of the vesical neck.
6. Intractable chronic prostatitis.
7. Intractable seminal vesiculitis.
8. Doubtful tumors of the testes in which we desire to protect the urinary way from possible infection.
9. Suspected tuberculosis of the testes, in which operation on the testicle itself is refused.
10. Cases of true spermatorrhea.
11. Cases of spermatophobia, in which the mental condition practically is a psychopathy.
12. Certain rare cases in which involuntary seminal emissions are frequent and intractable. (The author has met with a number of cases of married men afflicted in this way.)
13. Obstinate cases of prostatorrhea.
14. Prevention of propagation of the socially unfit and inefficient from any and all causes.
15. In confirmed masturbators.

In some cases the occlusion of the vas should be permanent, e. g., in a large class of syphilitics, subjects of tuberculosis, insane, epileptics, habitual criminals, imbeciles, perverts, etc., and also in some local pathologic conditions. Where the objective is permanent sterilization, the entire available portion of the duct should be removed to prevent a possible restoration of continuity by operation.

Laying aside all theoretic speculation as to the effects of resection of the *vasa deferentia,* this much is certain, viz., that the operation affords rest to the seminal vesicles and prostate and lessens their blood supply. The effect upon congestive and inflammatory conditions is obvious. In certain psychopathic subjects — notably those with prostatorrhea — the cessation of visible

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discharge often secured by the operation has a profound beneficial effect. One of the favorable points of double anastomosis of the *vasa deferentia* is that the continuity of only one duct is sufficient for fertility, and this doubles the chances of success from the operation. The length of time that should be allowed to elapse after resection before anastomosis is performed, of necessity varies with the case.

Technique: After careful shaving and asepsis of the scrotum, the vas is isolated sub-scrotally with needle pointed forceps* above and below the point of election and exposed by an incision one-half an inch to two inches in length. Where temporary sterilization is desired, the shorter incision should be employed. The sheath of the cord next is carefully incised and the edges of the sheath wound caught with snap forceps. The vas now is separated carefully from its fascial envelopments and divided and the requisite portion excised. In the author's resections, where anastomosis at some future time is anticipated, the vas merely is severed, ligated, and joined, so that the ends overlap. This prevents re-establishment of continuity — granting this to be possible, — and enables the surgeon readily to find the two ends when he desires later to make a true anastomosis. Care should be taken in such cases, not to strip the vas more than is necessary to resect it. Its sheath really should be preserved, so far as possible, to prevent atrophy of the distal portion. The operation is concluded by stitching with horse hair — interrupted — or with fine catgut — continuous —and covering the wound with bismuth sub-iodide, gauze and collodion.

Anastomosis of the vasa deferentia: This is demanded under three conditions, viz.:

1. Accidental severing of the duct, either from traumatism or during the performance of surgical operations.
2. After resection for the relief of stricture of the vas or for the removal of new growths.
3. Where the vas has been resected on one or both sides for therapeutic purposes and, the object of the resection having been accomplished, restoration of the continuity of the duct is desired.

The vas is exposed as in resection, using a longer incision than in temporary sterilization. Where previous resection has been performed according to the author's method, a small nodule is

*Suggested by Dr. W. T. Belfield.

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found and excised at the junction of the severed ends of the vas. Both ends of the vas now are probed with a fine filiform bougie, or a bit of silkworm gut, — the latter suggested by Dr. Emil Ries — to determine whether the lumen of the vas is patent. The duct is now bent at about a right angle and a sharp-pointed probe or smooth broach, or a long, round, fine needle passed through the wall of the vas about 1¼ inches from the cut proximal end. A straight strand of the largest sized silkworm gut now is passed into the lumen of the proximal end of the vas and made to emerge at the opening made by the broach or needle. A hypodermic needle may be used and the gut passed through it. The gut is drawn through the puncture in the wall of the vas until about three inches of it portrudes. The other end of the strand of gut is threaded into the distal portion of the vas and the two ends of the severed duct brought together over the "coupling" thereby formed.

A fine catgut stitch now is inserted in the vas at the line of the anastomosis and tied securely. A second stitch is placed directly opposite the first. In the author's opinion these stitches really are made unnecessary by the next step of the operation, although they make assurance doubly sure in maintaining apposition of ends of the duct. The edge of the fascia of the cord next is stitched upon itself so as to enwrap the vas in a distinct sheath. The opposite edge of the fascia finally is stitched over the cord to the sheath just made for the vas. The vas for about an inch or more beyond the line of union of the duct is thus enveloped in a snugly fitting sheath of fascia that securely holds the ends of the tube and prevents them from slipping apart, protecting, in addition, the line of junction.

The free strand of silkworm gut is passed through a small puncture in the skin just above the upper angle of the wound. It is not wise to use a needle for this purpose, lest the portion of the silkworm gut that occupies the lumen of the vas be disturbed. If desired, the strand of gut also may be made to emerge from the distal portion of the duct wall and the corresponding portion of the scrotum.

The skin wound now is sutured in the usual manner, with fine catgut or horse-hair, and the ordinary dressings applied. On the tenth day the strand of silkworm gut is withdrawn. A very fine

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whalebone filiform bougie may be used instead of silkworm gut for coupling the vas. The author also has used silver wire.

The advantages claimed for the foregoing briefly are: 1, Accurate anastomosis, not to be secured in any other way; 2, immobility of the anastomosed vas, so necessary to union; 3, maintenance of patency of the vas, which is not insured by any other method; 4, simplicity, ease and rapidity of performance.

The earlier anastomosis is performed after resection of the vas, the better, for, despite careful manipulation during resection, atrophy of the distal portion possibly may follow resection and make subsequent anastomosis impossible.

In the female, the correlative of vasectomy is resection of the Fallopian tubes. This is a more logical method of preventing procreation than is sterilization of the husband. For example, sterilization of the husband for the purpose of preventing conception by a wife who is permanently unfit to bear children, is as unfair as it is illogical, presupposing, as it does: a, that a perfectly normal male should be put out of the running sexually because his present mate is inherently and permanently unfit for maternity; b, that operation for restoration of the fertility in the male is infallible.

Conditions may be such that both parents should be sterilized, for either may marry again.

From reading most of the dissertations hitherto published on sterilization as a remedy for social ills, one might conclude that criminals are monosexual. It must be remembered, however, that the sterilization of the male criminal does not complete the task of social defense via sex mutilations. The female criminal also should be sterilized by removal of the Fallopian tubes. The ovaries should be preserved. Care should be taken to make the resection of the tubes complete, lest regeneration occur. The uterine tubal stump should be cauterized with pure carbolic acid to insure its obliteration. In many instances in married life, the female, not the male, should be sterilized to prevent conception. *The healthy husband never should be sterilized to save a degenerate or diseased wife from child-bearing, for, while subsequent anastomosis of the vas is likely to be successful, it cannot be guaranteed, and the capacity for fatherhood under more favorable circumstances possibly might be lost.*

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CHAPTER VII.

Sterility and Impotence.

GENERAL CONSIDERATIONS.—As a result of certain organic or functional disturbances of the sexual organs the procreative function may fail of its object. To the sexual perturbations that are responsible for inability to propagate the species the terms impotence and sterility are applied. These conditions may be found in both male and female.

As a preliminary to the consideration of the diseases affecting the mechanics of the procreative act some consideration of its physiologic phenomena is essential.

Erection: During normal erection the penis becomes firm and erect, from engorgement with blood — active hyperemia. The erectile tissue of the *corpora cavernosa* and the *corpus spongiosum* is peculiarly adapted to this transformation of the organ, being composed of relatively large spaces inclosed in trabeculæ of connective and plain muscle tissue which support an abundance of arterioles — the so-called erectile tissue. It is generally agreed that the work of Eckhard demonstrated the essential facts in the mechanics of erection.* He showed by experiment on the dog, that stimulation of the *nervi erigentes* causes erection. These nerves are composed of autonomic fibers arising from the sacral portion of the spinal cord. They arise from the first to the third sacral nerves on each side and help to form the pelvic plexus. They contain vasodilator fibers to the penis, as well as to the rectum and anus. When these fibers are stimulated there is a large dilatation of the arterioles in the erectile tissue of the penis and a greatly augmented blood-flow to the organ. If the erectile tissue is cut or the dorsal vein opened, the blood-flow under usual conditions is a slow stream,

* Howell, Text Book of Physiology.

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but when the *nervus erigens* is stimulated the outflow is very greatly increased, eight to fifteen times more blood flowing out of the organ. Erection therefore is due essentially to a vascular dilatation of the small arteries whereby the cavernous spaces become filled with blood under considerable pressure, the cavernous tissue being distended to the limits permitted by their tough, fibrous walls. It seems probable that the turgidity or rigidity of the congested organ is completed by a partial obstruction of the venous outflow, which is effected by a compression of the efferent vein by means of the intrinsic muscles (ischio- and bulbocavernosus) and possibly by the intrinsic musculature as well. This compression does not occlude the blood flow completely, but greatly increases the venous pressure. Commenting on the foregoing, Howell says: "This explanation of the act of erection, while no doubt correct, so far as it goes, leaves undetermined the means by which the dilation of the small arteries is produced. Vasodilator nerve fibers in general are assumed to produce a dilation by inhibiting the peripheral tonicity of the arterial walls. If this explanation is applied to the case under consideration it forces us to believe that, throughout life, except for the very occasional acts of erection, the arteries of the penis are kept in a constant condition of active tone. Moreover, on this view we should expect that section of the vaso-constrictor fibers to the penis, by abolishing the tone of the arteries, also would cause erection. These constrictor fibers arise from the second to the fifth lumbar spinal nerves, and reach the organ by way of the hypogastric nerve and plexus and the pudic nerve. No such result of their section is reported, and it seems that, in the matter of erection, the actual mechanism of the great dilatation caused by the *nervi erigentes* still contains some points that need investigation."

The Reflex Apparatus of Erection and Ejaculation: The dilation of the arteries of the penis during erection normally is a reflex act, effected through a center in the lumbar cord. This center may be acted upon by impulses arising in some part of the genital tract — from the testes themselves. Mechanic stimulation of the glans leads to erection, and Eckhard showed in dogs that section of the pudic nerve prevents this reflex from occurring, proving, therefore, that the sensory fibers concerned run in the pudic nerve. Stimulation of these latter fibers leads also to erotic sensations and

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eventually to the completion of the sexual orgasm. This latter act brings about the forcible ejection of the sperm through the urethra. It is initiated by contraction of the musculature of the *vasa deferentia,* ejaculatory duct, the seminal vesicles, and the prostatic gland, which force the spermatozoa, together with the secretions of the vesicles and prostate gland, into the urethra, whence they are expelled in the culminating stage of the orgasm by the rhythmical contractions of the *ischiocavernosus* and *bulbocavernosus* muscles, together with the constrictor urethra. The immediate center for this complex reflex is assumed to lie in the lumbar cord, since, according to the experiments of Goltz, mechanic stimulation of the glans in dogs causes erection and seminal emission after the lumbar cord is severed from the rest of the central nervous system. Under ordinary conditions the act is accompanied by strong psychical reactions which indicate that the cortical region of the cerebrum is involved. It is interesting in this connection to find that electrical stimulation of a definite region in the cortex of dogs may cause erection and ejaculation. It is evident from the foregoing that either mechanic or psychic causes, or both, may interfere with erection, as indeed is clearly shown by the varying clinical conditions met with in the study of impotence. It further is evident that any condition, mechanic or psychic, that disturbs the equilibrium of the circulation of the erectile tissue may cause impotence. It seems logical to infer that either interference with the penile blood intake or excessive outflow may impair the erectile power.

Impotence implies inability to consummate the sexual act. This inability may be due to organic or psychic causes, or, as it is usually expressed, may be real or imaginary in either sex. Irrespective of the underlying cause, the material result so far as copulation is concerned is of a purely mechanic nature. The male fails to penetrate the vagina of the female because of failure, imperfection, or transitory nature of erection, or penile deformities — congenital or acquired — that make intromission impossible. The condition is rare in the female, for the reason that, so long as she presents a more or less suitable receptacle for the male organ, she does not usually consider herself impotent. Impotence in the female usually implies either some deformity or disease that produces atresia of the vagina or some local inflammatory affection — acute or chronic — that

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gives rise to vaginismus; *i. e.,* pain and spasm during attempts at copulation. In neurotic or hysteric subjects this condition may occur independently of local inflammation or atresia.

Sterility practically implies incapacity for fecundation. Copulation and even orgasm may be perfect, yet fecundation cannot occur because of organic defect in one or both parties to the sexual act. These defects are several, and, broadly speaking, are of two kinds: (*a*) mechanic and (*b*) nutritive. In the first category are (1) conditions in which, although copulation is normal, and both ovule and sperm-cell are healthy, certain local conditions prevent them from meeting at the proper time; (2) the germ-cell and sperm-cell having met, their blending is prevented; or (3) the ovule having been fecundated, certain local conditions prevent the development of the ovum.

In the second category are various more or less obscure conditions that affect the vitality of the ovule and the vitality and activity of the spermatozoa. Independently of constitutional weakness of either ovule or spermatozoön, or both, there probably is a lack of affinity between them in some cases that either prevents them from blending or, if blending occurs, makes the union unproductive. This lack of affinity heretofore has been regarded as "mysterious." The author believes that his application of the hormone theory in great measure solves the problem. That certain vitiated conditions of ovule or spermatozoa may make the one deadly to the other is probable in the light of the hormone theory.

The author's theory of hormone incompatibility reduces the problem of infertility to a purely bio-chemical basis in many otherwise inexplicable cases. This later will be fully expatiated upon. Suffice it to say here that this lack of affinity may be primary or secondary;* *i. e.,* inherent to the cell determinants, or acquired by certain extraneous conditions, *e. g.:*

Inherent conditions	Consanguinity	
	Individual incompatability	Physical
	Extreme youth	Psychic
	Senility	

* In the matter of sex affinities in general, Goethe's novel, "Elective Affinities," will be recalled.

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Acquired conditions
- a. Psychic
  - Fear of consequences, notably of pregnancy or of contracting disease.
  - Aversion for the sexual act
  - Disgust for the partner in the act
  - Painful conjugation (in the female)
  - Anger
  - Jealousy
  - Psychic shock, before, during or soon after conjugation
- b. Toxic
  - Anemias and Cachexias
  - Narcotics
  - Alcohol
  - Toxemia from disease

In breeding domestic animals, notably fowls, the author has noted the greatest variation in fertility in crossing different strains, as well as a lack of uniformity in the results shown in the progeny of different strains of the same pure-blooded variety. Prior to the discovery of internal secretions, the author was wont to explain such phenomena by the inharmonious blending of some subtle bio-chemical blood principle, by virtue of which the blood of certain strains when mingled "precipitated," so to speak, various qualities — good or bad — which do not appear when these strains are crossed with others of the same variety. Sports and type reversions perhaps may thus be explained.

One of the experiences related by certain breeders of blooded stock, for which no logical explanation hitherto has been offered, is the apparent permanent "tainting" of the female — for breeding purposes — that has been claimed to result from a mongrel cross. Some extensive and careful breeders are so convinced of this that they no longer use for breeding purposes a thoroughbred female that ever has been impregnated by a mongrel, because of the alleged fact that, even when subsequently bred constantly to thoroughbred males, a "throw back" of the progeny to the characteristics of the ill bred previous sire at any time may occur. Instances have been reported of human females who have procreated children presenting the characteristics of the male parent of children born in a previous marriage.

Granting that these incidents — in both the lower animals and human beings — are authentic, may they not be explained by a

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more or less enduring effect of the combined sex hormones of the previous mating upon the ovary of the female?

The theory of a psychic impression cause hardly would do in the case of the lower animals, and in the case of the human being would act, if at all, by modifying for a time the hormone production of the female sex glands. This would be more logical than the popular maternal impression theory.

There are, to be sure, several possible sources of error in the alleged clinical observations — such as accidental new sources of undesirable paternity in the case of the lower animals, and both auto- and hetero-suggestion in the case of the human female.

The author is free to say that he has had no opportunity of verifying the alleged facts involved in the foregoing, and that, in extensively breeding pure bred fowls where accidental contaminations have occurred, he never has observed such phenomena. Another point worthy of consideration is the ever present possibility that the sire, or dam, or both, may have an inherited "cold" strain which crops out under the combined sex hormone influences of certain matings, and results in what the author unconventionally has termed a "precipitation" of the objectionable ancestral characteristics.

A moment's reflection will show that both male and female may be potentially fertile, although practically sterile. It also may be seen that, although sterile with one person of the opposite sex, either male or female may be fertile with others. Incompatibility of otherwise normal hormones is the author's explanation of this.

Sterility and impotence may or may not be combined. Thus, as a consequence of removal of the testes the male may be entirely shorn of sexual desire, and is necessarily at the same time made incapable of producing the germinal material necessary for fecundating the ovule. On the other hand, the testes may be removed in some cases, and yet for a greater or less length of time the potency of the individual remains unimpaired. Stallions that are gelded late are likely to retain their sexual desire and power; if, however, castration be performed when they are young, they are rendered both impotent and sterile. It is nothing unusual for owners of stock to keep on hand a horse that has been gelded late in life, for the

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purpose of gratifying the mares during the period of horsing. In horses of this kind emissions occur of a character somewhat resembling normal semen, although spermatozoa are necessarily absent. The secretion emitted under such circumstances is furnished by the mucous glands of the urethra, the prostatic follicles, and Cowper's glands. The possibility of retention of the power of copulation after castration is so well recognized in the harems of the East that eunuchs from whom both testes and penis have been removed bring a much higher price in the market than those who have been merely castrated. Individuals who are absolutely incapable of emitting true semen may be perfectly potent. Such cases are an illustration of potency combined with sterility.

The explanation of the continuance of mechanic sex capacity after castration or loss of the testes, probably is the fact of perfect development of the genito-spinal and cerebral sex centers and sympathic nerve supply, which continue to act for a greater or less length of time after loss of the secreting organs. Possible vicarious action of other hormones in the endocrine cycle is worthy of consideration. The author would suggest that there is a prostatic hormone which is more or less essential to sexual activity and which acts vicariously until such time as the prostate atrophies — as the normal prostate is likely to do — after castration. Much depends on the continuance of the sexual habit — disuse is detrimental — and on the psychic effect of loss of the testes.

A very important source of error in the case of the oriental eunuch and castrated animals, and of human males who have lost the testes as a result of accident or disease, is that a certain amount of testicular tissue may escape removal or destruction, a very small amount being effective in perpetuating virility. A peculiar case has been related of an oriental chief eunuch, who proved to be the father of a number of infants presented to a certain polygamous patriarch by the ladies of the harem. It transpired that, when the eunuch was "castrated" as a young lad, the scrotum only was removed, the testes being temporarily retained — cryptorchidism — only to descend later, with embarrassing results. The person of the chief eunuch being sacred, he was exiled — in an iron box by sea. The box "accidentally" was lost overboard in a convenient gale.

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When either animal or man is completely castrated prior to the completion of sex development, impotence invariably results. That sterility always follows castration in either sex at any age is self-evident.

Sterility sometimes is due to disparity of development of the sexual organs in husband and wife. The author has met with several cases of such physio-sexual "misfits."

Individuals in whom the testes are intact, the penis having been removed, necessarily are impotent, although under favorable circumstances they hardly could be said to be sterile. They might be termed potentially fertile and dynamically sterile. If it were practicable to bring the semen of such individuals in contact with the healthy ovule, fecundation would be as likely to occur as in individuals possessing perfect virile power. The same holds true of men whose epididymes, *vasa deferentia,* or ejaculatory ducts have been occluded by injury or disease. In time the testes may fail to elaborate fertile semen, but at first it certainly is formed. Individuals who from various causes are unable to secure or maintain an erection, nevertheless may be capable of impregnating the female, for such persons are likely to have emissions and the ejaculated fluid may be capable of fecundating the ovule. It is not even necessary that the semen thus ejaculated should be thrown into the vagina, as has been shown in instances in which contact and emissions without penetration have been permitted by the female, with resulting pregnancy. It appears to be possible for pregnancy to occur when the semen is deposited only upon the external female genitals, although in some instances the recorded evidence is somewhat dubious.

Sterility in the Male.

Sterility in the male has been sadly neglected by the profession. When consulted with reference to unfruitfulness in married life, the medical man, as a matter of routine, usually attributes the difficulty to some inherent incapacity or acquired morbid condition of the female. It is probable that much of the effort that is directed to the cure of sterility in women is misapplied, the husband and not the wife being at fault. If the direct and remote results of gonorrheal infection in both male and female be given due consideration, the

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responsibility of the male sex in the matter of sterility will at once be seen to be considerable. It has been stated by eminent gynecologists — with reason and great moderation — that at least one-sixth of the cases of sterility that are brought to the attention of the physician, are due, not to difficulties in the female, but to morbid conditions in the male.*

ETIOLOGY.—Sterility in the male is due to: 1. Some morbid condition that perverts the vitality of the seminal fluid and renders it incapable of fecundating the ovum. 2. Conditions obstructing the escape of the semen from the ejaculatory ducts. 3. Conditions preventing the proper deposition of the semen in the vagina. 4. Defective development of the testes is likely to give rise to sterility on account of the functional inactivity of the imperfect organs. 5. Cryptorchidism. 6. Defective or perverted quality or insufficient supply of sex hormone due to conditions 4 and 5 or to acquired local general conditions which disturb sex hormone production.

According to Kehrer, the cause of childless marriages is to be sought much oftener on the side of the man than heretofore has been the custom. This statement is based upon investigations of the semen. Kehrer investigated ninety-six cases:

In 3.12 per cent. there existed inability to copulate; in all such cases there had been preceding masturbation.† The men suffered from frequent pollutions, or the ejaculations were premature and the penis could not be inserted into the vagina. In these cases Kehrer claims, impregnation may result, if before the attempt at coitus a speculum be introduced into the vagina. In several cases conception was obtained by this maneuver. In 31.21 per cent. azoöspermia—absence of spermatozoa—existed. In most of these cases gonorrhea, with unilateral or bilateral orchitis, had preceded. The author lays particular stress upon occlusion of the ejaculatory ducts through gonorrheal prostatitis. But azoöspermia was also found where no disease of the sexual organs had occurred, and where nothing abnormal in the genital organs could be demonstrated. Oligospermia—deficient quantity of semen —was demonstrated in 11.45 per cent. Several times masturbation was confessed, or else gonorrhea with orchitis, or syphilis, had preceded. But, in addition, Kehrer thinks that the diseases of the female sexual apparatus that may cause sterility are considered too lightly.

*The gynecologic estimate above quoted is, in the author's opinion, far short of the mark.

†Considering the prevalence of masturbation, this observation is of no special value.

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Utero-vaginal catarrh under certain circumstances leads to sterility, and Kehrer also thinks that bacteria may exert a destructive influence upon the ovule. It is questionable whether these bacteria produce inflammation of the mucous membrane or only find in the latter suitable conditions for further development. Nöeggerath found eight sterile marriages in a series of fourteen to be the fault of the male. Gross, in a table comprising one hundred and ninety-two cases, shows that the male was deficient in one out of every six.

Sterility in the male may be due to any of the following conditions:

(*a*) Non-secretion of semen—*aspermia* (defective or diseased testes).

(*b*) The semen may not contain spermatozoa — *azoöspermia.*

(*c*) The spermatozoa may be few in number, motionless, or their movements ephemeral — *oligospermia.* This may be due to aberration of the male sex hormone.

(*d*) Obstruction to the passage of active spermatozoa to the deep urethra and seminal vesicles.

(*e*) Obstruction to the escape of semen from the meatus — as in stricture.

(*f*) Escape of the semen at some point between the deep urethra and meatus, thus preventing its proper deposition in the vagina — as seen in hypospadias and extensive urethral fistula. The Australian aborigines had an ingenious custom of slitting the floor of the urethra down to the penoscrotal angle in a certain proportion of males, thus forming an artificial hypospadias, to prevent conception.

(*g*) The vitiation of hormone production already mentioned.

Cryptorchids, in whom the testes are not only retained, but also are in an embryonal and imperfectly-developed condition, are usually, if not invariably, sterile. This does not apply to monorchids. Cryptorchids are, however, often potent to a high degree. A cryptorchid gonorrheic under the author's care is sexually extremely vigorous. Individuals from whom both testicles have been removed necessarily are sterile. When both organs have sustained serious injuries, sterility may result, either from destruction of the

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secreting structure of the organs or from traumatic occlusion of the efferent ducts. The semen may be secreted in proper quantity and of a healthy quality, yet it may be prevented in some manner from reaching the mouths of the ejaculatory ducts. This condition is more frequent than generally is supposed, it being difficult of detection on account of the fact that impotence is not necessarily associated with it, the sexual orgasm being attended by the ejaculation of secretions from various portions of the sexual tract that collectively resemble semen, and which under normal circumstances form an important and considerable component part of that fluid.

As already stated, the relation of gonorrhea or urethritis to sterility is a very important one. Epididymitis is attended by the exudation of inflammatory lymph in and about the epididymis. This may be speedily absorbed, or may become organized into connective tissue that subsequently contracts and completely obliterates the tubes of the epididymis — a condition which most effectually prevents the escape of semen from the testis into the *vas deferens*. When consulted regarding matrimonial unfruitfulness the physician should carefully inquire of the husband as to a gonorrheal history, and especially as to the occurrence at some previous time of double epididymitis. The explanation of the apparent sterility of the wife may not be satisfactorily determined until after a microscopic examination of the semen of the husband has been made.

A low grade of chronic inflammation of one or both epididymes may occur without sufficient pain or swelling to especially attract the patient's attention, hence examination may reveal thickened and indurated epididymes in the absence of a history of epididymitis. It should be remembered also, that the ejaculatory ducts, *vasa deferentia,* or vesicles, may be infected, with resultant occlusion, without either history or objective symptoms of epididymal involvement.

Inflammation — orchitis — and infection with subsequent atrophy of the testes proper may occur from various causes and produce sterility or impotence — or both. Orchitis secondary to parotiditis is a frequent cause. Any systemic infection may result similarly. Thus the author has met with a case in which one testicle was lost from trauma and the other some years later from

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some unknown infection. In another case, one testis was atrophied from infection secondary to vaccination, and the other from no apparent cause some time later. This and the preceding rare case are oddly suggestive of a similarity to the so-called sympathetic ophthalmia in which one eye is destroyed by one cause or another—notably by foreign bodies—and the remaining eye subsequently is lost without immediate exciting cause, after an interval, perhaps, of some months or even years. The author recently had under observation an operative case of his own in which unilateral orchitis with loss of the testicle followed a few weeks after supra-pubic section for removal of vesical carcinoma.

The imminent danger of atrophy and loss of function of the testis from true orchitis, suggests the imperative duty of operative relief of tension in all cases, even of the traumatic variety. The old idea that a hematoma of the testis or cord should not be operated, is, in the author's opinion, responsible for numerous cases of testicle destruction.

Injuries to the prostatic urethra incident to operations upon urethral stricture or stone in the bladder may produce occlusion of the mouths of the ejaculatory ducts and consequent sterility. Cauterization of the prostatic sinus may result in a similar condition. A well-known French writer observed, regarding the use of the *porte-caustique* by Lallemand, that by its use many men had been unsexed, causing "more eunuchs than had all the harems of the east." It is to be remembered that sterility in the male may be attended by absolutely no symptoms that will lead to a satisfactory diagnosis without resort to the microscope. Both seminal ducts may be occluded, so that the semen cannot by any possibility pass through the ejaculatory ducts, yet, if the testes are well developed and firm and in a perfectly normal condition, sexual desire, power of erection and pleasurable sensations are normal. When these phenomena are normal, yet spermatozoa are not emitted, it usually is safe to infer that there is mechanic obstruction to the escape of semen from the testes, rather than a secretory perturbation, even though these organs and their ducts present no evidences of disease.

The gross appearance of the fluid ejaculated during the sexual orgasm in azoöspermia may be almost precisely similar in appearance to normal semen, the absence of spermatozoa alone constituting

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its principal clinical feature. As a rule, however, the fluid is thin and watery.

Men who are suffering from pronounced stricture of the urethra are likely to be sterile, as a consequence of interference with ejaculation of the semen. In cases of stricture of long duration, sterility may persist for some time after the urethral obstruction has been removed. This is due to the fact that the obstruction to ejaculation has resulted in the semen being habitually forced backward into the bladder past the *veru montanum,* or *colliculus seminalis,* the function of which is to prevent such backward passage under ordinary pressure and to facilitate the extrusion of the spermatic fluid from the urethra. It is said that there exists in Paris a certain class of prostitutes who prevent conception by passing the index finger into the rectum of the male during intercourse, and pressing upon the membranous urethra just in front of the prostate at the moment of ejaculation. This ingenious and disgusting practice causes the semen to be forced back into the male bladder by overcoming the resistance of the *colliculus.* If this performance be indulged in frequently, the function of this erectile structure may be permanently destroyed, the individual ever after ejaculating his semen into his own bladder. In most cases of pronounced stricture the semen is retained in the urethra until erection subsides, when it slowly dribbles away. In hypospadias and epispadias the deformity of the urethra may be such as to prevent the extrusion of the semen far enough into the vagina to accomplish impregnation. Individuals thus affected practically are sterile.

A further and excellent illustration of potency conjoined with sterility is a case that the author elsewhere has described as illustrative of the effects of pathologic changes in the epididymis. A tuberculous testicle was removed from this patient, and in a few months chronic inflammation and induration occurred in the remaining organ. As a consequence, while the patient found that his sexual desire and power were very much stronger than prior to the operation, he stated that after the appearance of disease in the remaining organ he no longer had emissions, the orgasm being apparently perfectly normal with the exception of the absence of seminal discharge.

It sometimes is very difficult accurately to determine the causes of a lack of fecundating power in the semen. Thus, the sperma-

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tozoa may be absent from the seminal fluid in cases in which there is no history of inflammatory trouble with the testicle or other causes that would prevent its formation or discharge.

In some instances, probably from constitutional depression or cachexia, the elaborated semen is perverted in quality and deficient in quantity, the vitalizing element being either absent entirely or of such degenerate constitution that it is incapable of impregnating the ovule. Spermatozoa may be present at one time, and absent at another in certain instances, according to the constitutional condition of the patient at the time. In one case of a professional man of the author's acquaintance, sterility had existed for a number of years; the semen, being examined at various times, was found to contain no spermatozoa, yet they finally appeared in the seminal discharge and the patient succeeded in impregnating his wife.

In connection with the subject of sterility the varying vitality of both ovule and spermatozoa must be taken into consideration. As is well known, there is no constant relation between the performance of the sexual act and the discharge of the ovule. It therefore is necessary, in order that impregnation may be facilitated, that both the male and the female elements be capable of retaining their vitality for a certain length of time. Obviously, if this were not the case, it would be necessary for copulation and ovulation to occur simultaneously. By a wise provision of nature, however, both ovule and spermatozoa retain their vitality for a considerable time. It has been claimed by some physiologists that their vitality is preserved for a week or ten days, or even longer. If, during the persistence of this vitality, the male and female elements are brought in contact, impregnation is likely to occur. Anything that lessens the period during which the elements necessary to conception retain their vitality tends to produce sterility. In some females it is necessary for copulation to take place either just before or shortly after menstruation, in order that conception may occur. The mid-period necessarily is least favorable to conception, for at this time the ovule has reached its minimum degree of vitality, if, indeed, it has not already become disintegrated. Between this period and the next ovulation a sufficient time will have elapsed to impair, or perhaps destroy, the vitality of the spermatozoa. The sources of fallacy in taking this fact as a basis for precautions against pregnancy are the varying vitality of the ovule and spermatozoa and the fact that

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ovulation probably is not necessarily coincident with menstruation. Indeed, ovulation probably may occur at the time of the sexual act as a result of extreme sexual excitement. These physiologic facts are worthy of consideration in the management of some cases of sterility. For example, if copulation be permitted only just before and after menstruation, the sexual energies of both parties to the act are conserved and made more active. The sexual passion is stronger in the female at this time, and, if the male is abstinent at other times, he, too, is likely to be more passionate and vigorous. By taking this precaution the ovum and spermatozoa will be brought in contact at the time when the vitality of both is at its maximum.

Leaving the question of impotence out of consideration, it is a well-known fact that sterile marriages occasionally are observed where both husband and wife are perfectly capable of procreation, yet for some peculiar reason the elements necessary for conception apparently have no affinity for each other, and this independently of the question of sexual passion. The truth of this assertion is shown by the fact that in many instances individuals who have been childless in a first marriage have married again, and have reared large families. The physiologic question involved under these circumstances is well recognized by stock-breeders, who find, for example, that certain mares cannot be fecundated by a stallion that perhaps is distinguished by the multiplicity of his progeny, but are readily impregnated when covered by another and even inferior stallion.

It is conceivable that varying states of vitality of the spermatozoa may result from morbid conditions affecting the general health. Perfection of elaboration of the various secretions of the body depends greatly on the condition of the individual. It is well known that the secretions of the salivary, mammary, and gastro-intestinal glands are greatly modified by mental emotions, and by various pathologic conditions affecting the system at large, and why may not this be equally true as regards the semen? It is probable that the condition of the emotional faculties at the time of copulation have much to do with fertility in the human subject. This is one of the possible explanations of the infrequency of conceptions in prostitutes, in whom, however, the results of infection usually sooner or later are an all-sufficient explanation.

Abuse of the sexual apparatus, either through masturbation or

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sexual excess, next to inflammatory troubles of the testicle is probably the most frequent cause of sterility. Prolonged overstimulation of the secreting structures of the testes finally results in exhaustion and relaxation of the organs, the semen being imperfectly elaborated, even though its quantity and consistency may be apparently the same. Again, the frequent shocks to the nervous system involved in the oft-recurring orgasm, in combination with the drain afforded by the excessive loss of seminal secretion, results in constitutional debility; and this again, reacting upon the semen, devitalizes it. The important relation that the bodily condition bears to the number and constitution of the spermatozoids can hardly be overestimated. Other things being equal, the activity and potency of the spermatic cells is in direct proportion to the strength and vigor of the general system.

The author's theory of the physiologic relation of the supply and constitution of the sex hormone to the procreative act, and therefore to both sterility and impotence, will receive special attention later on.

DIAGNOSIS.—The diagnosis of sterility in the male can be made only by examination of the ejaculated discharge. When the spermatozoids are found to be absent, feeble, imperfectly formed, or few in number, the source of the infecundity of the individual is at once apparent. Defective hormone supply may in part explain such conditions. Careful physical examination of the testicles and spermatic cords, with exploration of the urethra, may demonstrate the fact that the trouble is not defective elaboration of semen, but obstructive, the semen being prevented from escaping into or from the urethra. This is the only logical inference if the testes are firm and hard and of the proper size, the spermatic cords being also apparently healthy. Relative sterility, due to hormone perversion or incompatibility, with numerous and active spermatozoa, necessarily is too occult for detection.

Prophylaxis of sterility in both sexes largely consists in careful treatment of gonorrhea and its complications. It is obvious that successful treatment in the male in a large measure protects both sexes from sterility. Competence and thoroughness on the part of the genito-urinary surgeon stands between the public and much sterility. Not the least of his functions is to prevent, if possible, uncured gonorrheics from marrying. The management of epididymitis is especially important in its bearing on possible sterility

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in the male. After critical observation and experience extending over a period of some nine years—following Hagner's work in epididymotomy in 1906—the author has arrived at the conclusion that epididymitis invariably should be treated by radical operative measures. Although the surgery of acute inflammation of the epididymis is not new, the disease almost universally has been "mollycoddled." Physician and patient alike have failed to comprehend the seriousness of the condition as regards its menace to the comfort, efficiency and especially the fertility of the affected individual.

Following epididymitis in the large majority of cases the testis of the affected side is "put out of business," *i. e.*, while still potentially fertile, it is dynamically sterile by virtue of permanent occlusion of the infected and inflamed epididymis or vas, or both. In that rare condition, simultaneously double epididymitis, or that frequent accident, an epididymitis subsequently occurring upon the opposite side. Sixty-five per cent. of the subjects are made sterile.

Aside from the danger of sterility, recurrent epididymitis and reinfection of the posterior urethra from an infective focus remaining in the epididymis often are a source of serious crippling. Then, too, the probability of certain obscure cases of rheumatism being due to latent infection in the epididymis is worthy of consideration. It also will be noted that the analogy between pus tubes and the infected epididymis is by no means far fetched.

In considering the surgical aspects of epididymitis the character of the infection is of no moment — excluding, of course, the tubercular form. Gonococcus, colon bacillus and staphylococcus are alike, so far as the surgical management of the inflamed epididymis is concerned. The benefits of epididymotomy are due to

1st. Relief of tension.
2nd. Depletion.
3rd. Drainage.

It is the author's opinion that the tension of the epididymal walls is accountable in a measure for permanent occlusion of the tubuli. The acute tension due to the thickening of the epididymis and more or less internal exudate, impairs the integrity of the tubular structures as well as occludes them. When closely pressed together the tubuli are more likely to become distorted, kinked and

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glued shut, than when there is no abnormal pressure from within and without the epididymis. Here, then, is the cue for prevention of a large number of cases of sterility in the male: *Relieve tension in the epididymitis by multiple incisions or punctures of the dense walls of the affected part.*

TREATMENT.—The treatment of sterility in the male unfortunately is unsuccessful in a large proportion of cases. Chronic inflammatory conditions of the epididymis sometimes may be removed by measures that will be suggested later in the consideration of diseases of the testicle. Electricity is perhaps the most reliable remedy at our command for these conditions. Tonics, proper food, and attention to sexual hygiene occasionally may accomplish the desired result. It must be confessed that there are many cases in which, however faithfully we may seek for the cause of sterility, it escapes observation, and the case consequently is absolutely incurable. Some of the conditions that obstruct the passage of the semen from the urethra may be removed, stricture being the morbid state that is especially amenable to treatment.

Obstructions in the vas sometimes are removable by resection followed by the author's method of anastomosis. When they are close to the epididymis and both *vasa deferentia* are involved, the vas may be anastomosed with the epididymis as suggested by Edward Martin. This operation as described by its originator is as follows:

"The vas lies behind the spermatic artery, which sends its main branches forward to the inner side of the epididymis, anastomosing freely at this point with the artery of the vas. The epididymis is approached from its outer side. A portion of the head is picked up in toothed forceps and excised. If the excision is made on the testicular side of the obstruction there will ooze from the wound semen which contains motile spermatozoa. The lumen of the vas is opened by a longitudinal cut one-quarter of an inch long. Into the wound of the epididymis the vas is implanted by means of four fine silver-wire sutures, carried on small face needles from the outer surface of the vas into its lumen; thence from the cut surface of the opening made into the epididymis through its fibrous tunic. Because of the smallness of the structures involved, the operation is tedious rather than difficult. Aside from the ordinary

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surgical instruments, there will be needed a sharp-pointed pair of scissors, a slender bistoury and a grooved director, such as are used by ophthalmologists."

Lespinasse has ingeniously suggested the formation of an artificial sac or reservoir for the semen in connection with the epididymis in obseructive sterility in the male.* The semen is to be withdrawn by aspiration from the husband as required and injected into the uterus of the wife.

Although not potentially sterile, hypospadiacs and subjects with urethral fistula may be dynamically sterile because the semen is not discharged so that it reaches the vicinity of the cervix. These cases may be curable by operation. Disproportionate size of the penis sometimes is a cause of sterility. This condition is hopeless. Artificial fecundation is the only recourse.

Sterility is sometimes due to syphilis which may produce chronic inflammation, although gross lesions are not perceptible.

Sterility due to syphilis sometimes is curable by the ordinary therapeutic routine.

Conformably with his views of the intimate relation of the proper formation of sex hormone to fertility, the author believes that his method of sex gland implantation may have a considerable range of usefulness in both sexes as a remedy for sterility. This subject later will be more fully discussed.

Impotence in the Male.

In the majority of cases of impotence there apparently is a normal, or, at most, merely a debilitated and flaccid condition of the generative apparatus, yet the patient is unable to obtain an erection. The lack of power varies in degree from a condition in which there is absolutely no manifestation of the physiologic function of erection to cases in which the erection is partial, but insufficient for copulation. In some instances erection is perfect, but of a transitory character, ejaculation occurring prematurely. Care should be taken to differentiate the cases, else treatment is not likely to be successful. Clinically it will be found that cases of impotence may be divided into:—

1. Those in which virility is impaired by general constitutional

* Trans. American Urological Assoc., 1914.

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debility or exhaustion of nervous force — impairment of hormone supply being one element — the lack of sexual vigor being functional and secondary to the general disturbance. These cases may depend upon: *a.* sexual excess or masturbation, which produce both local and general debility, or *b.* general diseases of an exhausting character. *c.* Profound psychic impressions. *d.* Shock from trauma. They may or may not be associated with spermatorrhea, nocturnal emissions, etc.

2. Cases in which the lack of power is entirely due to adverse psychic impressions.

3. Those in which the patient is strong and vigorous, his testes secreting actively, and his *vesiculæ seminales* being overdistended as a consequence of infrequent indulgence. In these cases premature ejaculation and a transitory character of erection are the principal features.

4. Those in which, as a consequence of masturbation or sexual excess, there is hyperesthesia of the floor of the prostatic urethra, or colliculitis. Imperfect secretion and premature ejaculation characterize these cases.

5. Cases in which there is some pathologic condition of the sexual apparatus that acts by disturbing innervation and producing mental depression, chiefly from the moral effect of the condition.

6. Those in which deformity or acquired disease interferes with erection, completely or partially preventing it.

7. Those in which congenital malformations, injury, disease, or surgical operation have impaired or destroyed the structure of the sexual apparatus to an extent sufficient to prevent copulation.

8. Cases due to toxemia—from disease or from alcoholics or other drugs.

Some of these conditions are amenable to treatment, while others, unfortunately, are beyond the reach of medical art.

Impotence is divided for description into the false and true varieties.

PSEUDO-IMPOTENCE.—False impotence is the form that is most frequently seen, and usually is dependent upon causes of a purely mental or moral character, the sexual organs, so far as can be determined by examination, being perfectly healthy. Individuals suffering from this form of impotence usually are of a highly impressionable nervous temperament primarily, or have become so

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as a consequence of masturbation or sexual excesses. Some men who apparently are perfectly healthy find themselves unable to perform the act of copulation as a consequence of a lack of confidence due to a recollection of early indiscretions and an exaggerated estimate of their effects. Ignorance of sexual physiology often is the foundation for this form of impotence. Failure to accomplish the act of sexual intercourse sometimes is due — paradoxic as it may seem — to extraordinary vigor and secretory activity of the sexual apparatus. Individuals who have masturbated but little, or perhaps not at all, and who never have attempted sexual intercourse until they have attained their majority, frequently are troubled in this manner. The author recalls several cases of this kind:—

CASE.—A young professional man 30 years of age, a fine healthy-appearing subject as could be imagined. He had masturbated but little as a boy, and after attaining adult age became very fond of the society of women and acquired the reputation of being something of a *roué*, yet he assured the author that he never had been able to accomplish the act of copulation, premature ejaculation having attended every attempt—such attempts having been made at very infrequent intervals. He seemed to think that there was some organic disease, either of the sexual organs or "of the blood," that inhibited his sexual powers. Examination showed that the sexual organs were perfectly healthy. On careful interrogation he said that he never had attempted intercourse twice consecutively, but had become thoroughly disgusted by his first failure on each occasion. It seemed that intercourse always had been attempted under circumstances involving not only extreme sexual excitement, but more or less uneasiness as regards the possibility of detection. All possible means were tried to convince this patient that he was perfectly sound and sexually potent, but without result. He still entertains the opinion that he is impotent, and nothing but success in copulation, which certainly will be achieved if the act is ever attempted under proper circumstances, ever will convince him to the contrary. Overdistension of the seminal vesicles, in combination with overexcitement and consequent hyperesthesia of the prostatic sinus existing at the time of attempted copulation, is the explanation of the pseudo-impotence of this individual.

CASE.—A similar case that came under our observation was much more tractable. This patient stated that he never had masturbated and never had attempted intercourse until past the age of 25. He was of an exceedingly passionate temperament, and has found that he never had been able to accomplish the act at a first or even a second attempt, but that if he attempted the act repeatedly with a person with whom he had the opportunity of associating for several days at a time, he finally succeeded, and thereafter was in a perfectly normal condition. He finally happily married and has several

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children. The persistency of this individual is all that saved him from the same despairing frame of mind as that which exists in the previous case.

The form of impotence born of excessive and uncontrolled desire has been familiar from time immemorial. Three centuries ago Montaigne dilated upon it in his philosophic essays as follows:—

Neither is it in the height and greatest fury of the fit that we are in a condition . . . to sally into courtship, the soul being at that time overburthened and laboring with profound thoughts, and the body dejected and languishing with desire; and hence it is that sometimes proceed those accidental impotencies that so unreasonably surprise the willing lover, and that frigidity which by the force of an immoderate ardor so unhappily seizes him in the very lap of fruition; for all passions that suffer themselves to be relished and digested are but moderate.

The surgeon not infrequently is called upon for relief for just such impotencies as Montaigne so clearly describes. That the remedy is better psychic control goes without saying.

Continence as a cause of true impotence has been admitted by some writers. Howe relates two interesting cases that apparently were due to this cause:—

Case 1.—In the winter of 1876 an undertaker of this city was admitted to St. Francis Hospital, suffering from prolapse of the rectum. He was 45 years old and his general health was good. After recovering from the prolapse he informed me that he was impotent, and likewise was subject to nocturnal emissions. During the whole course of his life he had refrained from any gratification of his passions, and had never attempted sexual intercourse until within the past year. Twelve months previous to his admission he had married, and without expecting anything of the kind found himself impotent and unable to consummate the marriage. Every attempt at intromission failed, through weak erections and rapid emissions. He denied masturbation, and the condition of the genitals seemed to confirm his statement. From the age of 25 he had emissions once a fortnight and frequent erections, but the erections were feeble, and lasted only a few moments. Since his marriage the emissions had increased in frequency, and there seemed to be much relaxation and apparent elongation of the penis. The patient did not seem to be depressed by the fact of his impotence. He attributed it all to total abstinence, and hoped that, in the course of time, Nature would effect a cure.

The author does not believe that continence *per se* ever causes true impotence. The cases in which it apparently does so usually are either masturbators or congenitally weak, or both.

A few cases are recorded by Lallemand and others where rectal disease caused temporary impotence, but the patients were not con-

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tinent, and they recovered from the spermatorrhea and impotence when the prolapse was cured. In the patient whose history has just been given the prolapse of the rectum may have added to the genital weakness, but it probably was not the cause of it.

Howe records a second interesting case of impotence from continence, unaccompanied by spermatorrhea:—

CASE 2.—The patient was 38 years old, and a broker by occupation. His general health was excellent, and he was constantly and actively employed in a flourishing business. He commenced to masturbate a little when a boy of 12, and occasionally was guilty of the habit until he reached the age of 16, at which time he discontinued it altogether. At twenty he had intercourse in a natural way, and without any difficulty whatever. For six months subsequently he cohabited at intervals of two weeks, and never at any time indulged to excess. A period of eight years then elapsed without any opportunity for sexual congress. At the termination of that period he again attempted to renew his sexual relations with his former partner, but, to his great annoyance, failed. Though he subsequently made frequent trials, the result was the same. He finally gave up all hope, firmly believing that his impotence was beyond the reach of therapeutic agents. He attributed his loss of virility to continence, and not to any dissipation or bad habits in early life. A period of ten years elapsed, during which interval he tried sexual congress but once, and was unsuccessful. He had few emissions, and few erections. For twelve months previous to calling at my office he had had only three emissions, and no erections of any degree of permanence. He thought his desire for sexual pleasures had not diminished, but, the knowledge of his impotence being ever present, would prevent him from attempting it again. This mental state necessarily complicated his case, and added to the difficulty of a cure. On making an examination of his genital organs I found the penis and testicles somewhat smaller than natural. The left testicle was smaller than the right, and more than ordinarily sensitive to pressure. Otherwise the parts were unchanged. Knowing that the patient's habits were excellent, and that his general health was good, I made a favorable prognosis, and put him under treatment. He continued under treatment for three months, improving slowly. His erections were more frequent and natural, and his hopes of final recovery revived. He suddenly, without any notification, ceased his visits at the office. The summer following he consulted me for gonorrhea, and informed me that a few days after he had ceased calling he renewed his attempt at intercourse, and succeeded, and had kept well in that respect ever since.

The author has seen so many cases similar to those reported by Howe, that he feels warranted in the belief that prolonged continence in exceptional cases bears a definite etiologic relation to impotence. As already stated, however, he does not believe that continence alone ever causes true impotence. Oftentimes the impotence is

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purely psychic, resulting from the fear of non-success. The patient's confidence sometimes is shaken by the popular notion that prolonged continence necessarily results disastrously. In some cases the patient's statements regarding masturbation should be discounted. It is nothing unusual for patients to assert that they have practiced the vice "but a few times," etc., when, as a matter of fact, they not only have practiced it very frequently, but are not yet rid of the habit. In a general way, however, men who abstain from sexual intercourse up to thirty years of age often are impaired in their sexual power — pseudo-impotence — even though they have not masturbated. Disuse is detrimental to the vigor of all organs, and it is not surprising that a certain degree of inhibition of sexual activity should result in such cases. Where they have masturbated, especially if the habit has not been broken, impotence is common. When men of thirty or over deny both masturbation and normal sexual indulgence, a primary lack of sexual activity may be suspected. On the other hand, sexual repression continued for years may seriously inhibit primarily active sexual impulses.

It should be remembered, in considering the subject of pseudo-impotence, that the sexual passion varies in intensity in different individuals. Many persons are of frigid temperament and are likely to exhibit more or less sexual indifference. This usually is associated with a relative sluggishness of the sexual apparatus, which, however, is perfectly natural to the particular individual.

Very slight mental disturbances at the time of attempted intercourse may result in temporary impotence. Anxiety or mental worry of any kind may cause it. Individuals who have labored mentally or physically to the extent of producing exhaustion are likely to experience temporary inhibition of sexual activity and desire. This physiologic phenomenon may be, as already has been suggested, taken advantage of in the treatment of sexual disorders. Emotional influences that are capable of making a powerful impression upon the nervous system especially tend to inhibit sexual desire, the more particularly as they tend to check the secretion of semen. The influences that tend to produce activity of secretion of the testes are chiefly emotional, and, conversely, diverse mental influences may check the secretion. Carter outlined this fact as follows:—

The glands liable to emotional congestion are those which, by forming

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their products in larger quantity, subserve to the gratification of the excited feeling. Thus, blood is directed to the mammæ by the maternal emotions, to the testes by the sexual and to the salivary glands by the influence of appetizing odors; while in either case the sudden demand may produce an exsanguine condition of other organs, and may check some function which was being actively performed, as, for instance, the digestive.

Lack of secretion has a mechanic bearing on sexual desire and impotence. When the secretions of the testes and seminal vesicles are abundant, the vesicles become distended and directly and reflexly excite desire by mere pressure. The individual whose vesicles quickly refill after emptying, soon experiences another erection with accompanying sexual desire. Activity of secretion, therefore, is an important factor in analyzing the causes and treatment of impotence. This explains the service sometimes rendered by pilocarpin. It must be remembered, however, that there is interaction between sexual passion and the distention of the seminal vesicles. While the vesicles become more or less rapidly distended even where no sexual desire exists, they fill under the influence of sexual passion with a rapidity that is in direct ratio to the degree and duration of the stimulation. It is obvious that exhausting diseases act in several ways, viz.: 1. by diminishing secretion, 2. by disturbing sexual innervation, 3. by diminution and perturbation of hormone formation, 4. by toxemia, 5. by reducing general bodily vigor.

The emotion of fright or the condition of mind produced by the fear of detection or of the results of copulation invariably will inhibit the sexual power. Disgust, indifference, or antipathy for the party of the second part often has a similar effect.

The practical physician does not usually put much faith in the theory of affinity as existing between the sexes, but the author is of opinion that in many instances failure to consummate the marital act is due to a lack of harmony between the contracting parties. An apparent instance of this is the following:—

CASE.—A man 31 years of age, perfectly healthy, the sexual organs being perfectly formed and apparently in a normal condition, came to the author for relief of impotence. He was a man of very highly-wrought nervous organization, and had never been anything of a *roué*. The only possible exception that could be taken to his physical condition was the fact that he was somewhat inclined to corpulence. He stated that he had not experienced an erection for some months. During this time, however, he had been working very hard, and had not allowed his mind to dwell on sexual matters, and he himself was inclined to attribute the absence of erections to

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this fact. As he contemplated matrimony, however, he desired a course of treatment. On inquiry he stated that he had on several occasions failed in accomplishing intercourse, but that he had found that with certain females he was perfectly potent, while with others he was absolutely impotent. He was assured that there was no physical impediment to matrimony, and a course of local faradization was advised. He improved very rapidly, and in a few months the sexual function became so active that the bougie electrode could not be passed because the slightest contact with the urethra produced vigorous erection. He stated that when he took a Turkish bath, as per advice, he was considerably embarrassed by the occurrence of erections so soon as the attendant attempted to rub him. Under these circumstances the author felt perfectly justified in advising matrimony. The result was unfortunately not what had been expected, for a year after marriage he had not yet succeeded in accomplishing intercourse. There was evidently in this case some inhibitory cause of a mental character, as shown by the fact that after marriage he still had vigorous erections and nocturnal emissions with dreams. As soon as the idea of attempting intercourse entered his mind he found it absolutely impossible to secure an erection. The author finally succeeded in curing this case by the exercise of a little ingenuity. The wife was sent away for three months, the husband being meanwhile treated with electricity. On the day of the wife's home-coming the patient was provided with a rectal suppository containing a little belladonna, opium, and camphor. He was instructed to insert this on going to bed and was assured that the wonderful suppository never failed. The treatment was a brilliant success and there was no future trouble, the wife becoming pregnant within a few weeks.

A sensitive sexual organization is part of the price man has paid for civilization. The more refined the organization of the human rule, the more likely he is to suffer from impotence due to psychic impressions. Laying aside organic causes, the savage and the lower animals do not experience impotence. The human male who can perform the sexual act under any and all environmental conditions probably is an example of atavism, where — exceptionally — it does not prove neuro-psychic degeneracy. The commission of rape, in the author's opinion, is sure evidence of atavism.

The male sex is not alone in paying the price of civilization. The female also has been sexually penalized for her upward progress from the social-primitive to the civilized type. Among the penalties are, frigidity in many, frequent sexual neuro-degeneracy — as evidenced by nymphomania — relative or complete infertility, and an artificially created, so-called normal desire persisting during utero-gestation in a certain proportion of women. Repression of sexual desire, through religious and other social inhibitions, has had a very

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powerful influence on civilized woman. With many, sexual passion develops only in response to the demands of the male. It is probable that the sex habits of our pre-human ancestors, the female of which experienced sexual desire — the breeding instinct — only at certain stated periods, would have persisted in their human descendants if social environmental influences had not been brought to bear. It is probable that any sexual desire on the part of the female manifested at any time other than shortly before, during and after the menstrual period, has been acquired in response to the sex demands of the male. Certain it is, also, that nature never intended that the female of any species should either cohabit during pregnancy, or experience sexual desire at such a time. Once pregnancy has occurred, the function for which the sexual act was intended has been subserved so far as the female is concerned.

Society's attitude towards the matrimonial question is based largely upon mawkish sentiment, ignorance of biologic law, and the impracticability of its application in every-day life. The average moralist, accepting marriage as a divine institution instead of what it really is — a conventionalized regulation of sex love via a civil, business and social contract — sees nothing in the problem save conformity or non-conformity to divine law. Quite naturally he cannot conceive of such a thing as divine error and consequently is dominated entirely by the "Tied you are, and tied you must stay" dogma. From this point of view there can be no such thing as marital mistakes to be rectified. In certain quarters, therefore, infallibility of matrimonial selection primarily is taken for granted and invariably demanded. It is noteworthy that marriage is the only human act in which anybody ever expects infallibility of judgment.

Unfortunately, however, marriage in real life is a strictly human institution in which the contracting parties are not demigods, but fallible human beings, fundamentally possessed of certain animal traits which are a rather heavy handicap to the intellectual attributes that are distinctively human. Marriage necessarily is experimental. As a rule, neither of the contracting parties has any means of knowing the true character of the other. The young man who goes courting dons his best behavior with his best clothes. The young woman courted, not to be outdone at woman's own game, lays even greater stress upon externals. She puts on her prettiest

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gown and "company manners" and does her best to conceal, not only her physical defects, but her mental and moral flaws. Her mission in life is to catch a husband — honestly if she can, but to catch him. If either one is inexperienced, the game is an easy going one, and the end assured; propinquity assists the fraud. Rarely is there a critical study of character on either side. When love dominates, the loved one is beyond criticism and there is no incentive to character study.

After marriage both parties to the arrangement sooner or later become more critical. Marriage is a steady and intimate association which only compatibles can face without disaster. The rose tints of the pre-marital ideal become rather murky when incompatibility once becomes manifest.

Compatibility involves several elements that only intimate association can discover. Broadly speaking, these may be either physical or psychic, the qualities that attract or repel being sometimes blended so that it is difficult to determine where the one terminates and the other begins. Psychic impressions modify the physical and *vice versa*. The resulting complex, modified by the couple's imaginations, may or may not correspond to their pre-marital ideals. That such ideals should be so often shattered is not astonishing. Ideals based entirely upon externals, and the superstructure of which is built up from an imagination dominated by psycho-sexual erethism, are greatly handicapped in their contest with the psychic and physical realities of life.

Under natural conditions, the physical is far more important than the psychic in the question of mating. Sex attraction is a purely animal attribute which, invest it as we may with a halo of sentiment and romance, is none the less a primitive biologic instinct that is common to all species. Civilization and its attendant refinements have added the psycho-sexual to the purely animal, but as yet the former by no means dominates matrimonial selection, nor would the best interests of the race be conserved by its domination. The unlike attracts and the like repels, here as elsewhere. If the large, powerful man usually selected a woman built upon similar lines, and the small man the small woman, we in time would have two races side by side — one of dwarfs and the other of giants. Should intellectual persons always gravitate together, procreation finally would cease and the race would run out, dying at the top,

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after passing through all the degrees of physical and mental degeneration. As a matter of fact, the natural tendency of human beings to select mates of opposite characteristics has been conservative, and has tended to maintain a certain racially healthful physical and mental average.

It is true that the tendency to rise superior to the purely physical in matrimonial selection is increasing, *pari passu* with the progress of civilization and the increasing complexity of human life — but so is the business of the divorce courts, and so, also, is degeneracy. Men and women are growing more and more selfish and exacting. The family is coming to be less their concern, hence the qualifications of the given member of the opposite sex for parenthood are of diminishing importance. The demand for congenial companionship is greater and, as the test can be made only after marriage, mental incompatibility necessarily has become more prominent in matrimony. The psychic element primarily is purely artificial, and therefore less stable than the purely physical. The savage does not prate of incompatibility. With him the question is altogether a physical one. The physical element, however much modified by civilization, still being dominant in matrimony, the proportion of marital disharmonies is as yet relatively small, although it is steadily growing.

Purely physical incompatibility probably is the exception, yet, as all physicians know, is more frequent than is generally supposed. It is not manifest in frigidity alone, for in many instances there is an instinctive repugnance to physical contact, yet there really is no frigidity, and psychic conditions apparently are ideal.

Reduced to its biologic ultimate, sex attraction requires no more psychic explanation than does chemical affinity, and yet the fact remains that many human beings go through life without meeting their sex "complement." Some know what they have missed; the majority, fortunately, do not. "Ignorance is bliss."

The author is well aware that ideals of all kinds usually are assigned to the realm of spiritual things, and is willing to acknowledge that the hyperesthetic psycho-sexuality of civilized races has much to do with the construction of sex ideals, but he nevertheless is convinced that the question of physical affinity is to be given serious consideration. It is here that the author would take issue with the purely spiritual conception of the ideal. The instance of childless couples who have been divorced and remarried, each

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taking the partner of the other, with resultant fruitfulness, certainly has a biologic explanation that is well worth consideration. When a beautiful, refined, and intellectual woman, surrounded by every luxury, runs away with a coarse, unattractive stable-hand, the spiritual ideal is a dubious explanation.

Where the physical conditions of married persons are absolutely harmonious, mental incompatibility is unusual. Where one or the other is a high-strung, neurotic individual, however, the psychic element is likely to be discordant. Should both be neurotic, compatibility is almost impossible. Sentiment gradually is submerged until there is left a physical reality that contains no suggestion of the ideal.

In most cases of marital infelicity, it is safe to say that the husband is at fault. There is a very cogent reason for this. He usually has in mind a physical standard based upon previous experiences. While the glamour of early married life lasts, he is satisfied with the situation. The inexperience of the wife primarily is a decided novelty. When, however, satiety arrives, as it usually does sooner or later, he recalls memories of past experiences in the light of which the physical charms of the wife begin to pale. He soon discovers physical incompatibility, and resumes the pursuit of elusive past sexual impressions that his marriage temporarily interrupted. His relations with his wife perhaps began practically with legalized rape, that served to make permanent and incurable any qualities of frigidity which she primarily may have possessed. For her, the marital relation is only a painful and disgusting memory inspiring her with abhorrence.

In many cases moral degeneracy on one or both sides is the cause of infelicity. The anti-social instincts of the degenerate are as manifest in the matrimonial relation as they are elsewhere.

The undue familiarity usually existing between husband and wife is a feeder of psycho-sexual aberrations. Once the halo of sex mystery is dispelled, romance often fades completely. The author is firmly convinced that a less intimate association of husband and wife would be better for both health and morals. The less knowledge they have of each other's physiology, the better for sentiment. Privacy is an individual right, in or out of matrimony. Familiarity breeds satiety. Satiety is the parent of sexual discontent. The satiated, discontented man often browses in queer pastures

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in search of new thrills for his exhausted psycho-sexual centers Often he is unable to find them save in debasement that would astonish his intimates, but is not at all remarkable to the student of sex psychology. Granting that the foregoing premises are sound, they should go far in showing that, in many cases of impotence and sterility, the divorce court and a matrimonial "rearrangement" must be the final recourse. Every man and woman of experience and, above all, every physician, knows this, but nobody apparently has had the courage to openly state the facts. Meanwhile, the divorce mills grind merrily on and students of social questions continue to use only economic and moral explanations for certain biologic phenomena of matrimony, whilst physicians daily are asked to perform impossible therapeutic feats.

That certain individuals of highly-sensitive nervous organization are impotent respecting some women, while with others they are perfectly potent, is a well-known fact. Individuals of this sort very often are convinced that they are impotent, by failure in experimenting with prostitutes for the purpose of determining whether or not they are justified in assuming the matrimonial state. The fact that they are impotent under such circumstances is highly complimentary to their moral tone. The environment that surrounds the average prostitute, in conjunction with the purely mercantile character of the transaction, is not likely to inspire with sexual passion an individual possessed of the average amount of decency and self-respect. It is not unusual for individuals to state that, excepting when under the influence of liquor, they are absolutely impotent with prostitutes. Considerable and forcible argument may be necessary to convince patients who have applied what they consider the crucial test of attempting intercourse with prostitutes, and have failed, that they are not impotent.

Roubaud records a case which, although it has become so extensively quoted by writers upon the subject that it has been worn almost threadbare, is nevertheless very pertinent as applied to patients who are psychically impotent with some women, while perfectly potent with others:—

CASE.—M. X., son of a general of the First Empire, was brought up at his father's country-seat, which he did not leave until he was eighteen years of age, when he went to the military school. During his long period of isolation in the country he had been initiated, at the age of fourteen, into an

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experience of the pleasures of love, by a young lady, a friend of the family. This lady, then twenty-one years old, was a blonde; wore her hair in the English style, that is to say, in corkscrew curls; and in order to lessen the liability of detection in her amorous intrigue, she never had intercourse with her young lover except when clothed in her day attire,—that is to say, wearing gaiter-boots, corsets, and a silk gown.

All these details I mention purposely, for they had great influence, not only over the degree of excitability of the genital function, but over its very existence in the case of M. X.

The young lady was of strong passions, and, as it appeared, exhausted the strength of the young neophyte, and the severe regimen of the military school was no more than sufficient to restore to the genital organs the energy which had been seriously affected by too early and too frequent indulgence.

But when, the period of his study having passed, he was sent to a garrison, and was disposed to enjoy the rights which nature had restored, he perceived that sexual desire was only provoked by certain women and with the concurrence of certain circumstances. Thus, a brunette did not produce in him the slightest emotion, and a woman in her night-dress was sufficient to extinguish and freeze every amorous transport.

In order that he might experience the venereal desire, it was necessary that the woman should be blonde, should wear gaiter-boots, should be laced in a corset, wear a silk gown, and, in a word fulfill all the requirements of the lady who had first caused M. X. to experience the sexual orgasm.

And this was not by reason of any sentimental love, the magic power of which lasts through a life-time. In his early sexual relations M. X. had only been actuated by animal desire. His heart had never been touched, and after twenty-five years, in consulting me for his singular infirmity, he declared that he had loved with his heart but one woman, and to her he had never been able to render homage, for, by a perverse coincidence, she was a brunette.

His fortune, his name, his social position, made it the duty of M. X. to marry, but he had always resisted the solicitations of his family and friends, knowing that he would be incapable of availing himself of his marital rights, with a wife arrayed in the costume of the nuptial bed. Yet he was in good health, was of the sanguino-choleric temperament, was above the medium height, and was of so strong a constitution that for fifteen years he had been an officer in a regiment of heavy cavalry.

Evidently his impotence was relative only, for, when the woman was blonde and when the other conditions specified existed, he accomplished the sexual act with all the ardor of a healthy man of amorous disposition.

Roubaud finally cured this patient by suggestion, in conjunction with the use of alcoholic stimulants to the point of mild intoxication. The spell once broken, there was no further trouble.

Such psycho-sexual inhibitions as the case related by Roubaud

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are more frequent than is generally supposed. Prolonged sexual relations with an individual of a certain type not infrequently makes such a profound psychic impression that other types of women are unattractive. Especially is this true of men of fine nervous organization who happen to consort with women of decided blonde or brunette type. Prolonged association with one type by no means rarely makes the other unattractive, sometimes even repellent. This, of course, is not always a matter merely of physique. Certain intellectual attributes in the woman may have much to do with the psycho-sexual impression she produces.

Cases have been noted in which pseudo-impotence was relieved by the affected individual's picturing in his imagination the person of some woman other than the one with whom he was attempting to cohabit. In certain impressionable individuals impotence may result from a lack of affinity between the parties to the act, actual antipathy on the part of either being unnecessary to its causation. Goethe took advantage of this physiologic fact in his "Elective Affinities." In this tale is described the mutual enjoyment obtained by an estranged couple through the medium of their imaginations, each party to the act imagining the other to be the individual for whom an affinity was felt. Goethe carries the theory of affinity still further, and describes the child that was born as the fruit of this particular conjugal act as in no way resembling its parents, but presenting a strong resemblance to both individuals for whom the parents respectively felt an affinity, and who were present in imagination at the time of conception.

Hammond relates a case that is aptly illustrative of the manner in which certain mental conditions will produce temporary impotence:—

Case.—A married gentleman, who before entering into the matrimonial state, had been excessively given to sexual intercourse, but who had no reason to think that his powers were exhausted, or even materially weakened, found himself on his wedding-night and for some days thereafter absolutely incapable of consummating the marriage. His wife was a highly-educated, intelligent, refined, and beautiful woman; he was devotedly attached to her, and on marrying at once and for all gave up the evil associations of his younger days. His passions were strong, but as soon as he attempted intercourse the desire he had previously entertained vanished at the thought that it was a profanation for a man like him to subject so beautiful and pure a woman to such an animal relation as sexual intercourse. "She is too good

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for me," he would say to himself; "I ought to have married a woman used to this sort of thing, or, better still, have remained single and gone on in the old way." This happened several times, and then, in disgust with himself, he paid a visit to one of his former female associates, and soon satisfied himself that his powers were as good as ever. Again he essayed the act with his wife, and again he met with disappointment.

He had now been married a week, and the marriage was still unconsummated.

A case like this presented very little difficulty: I reminded him of the fact that in all probability, however pure and noble his wife might be, there was no profanation in sexual intercourse, chastely undertaken; that she had sexual organs which were intended for the performance of certain function; that these functions were all connected with the propagation of the human species; that there was but one way that I knew of by which the species could be propagated; that she had selected him as the man who was to put her in the way of fulfilling her office in the grand scheme of Nature, and that my advice to him was to lower his estimate of her angelic character, and to look upon her in the not less worthy light of a woman to be treated as other women are treated under like circumstances. He left, promised to be less exalted in appreciation, but the next morning returned with the information that it was no use; he had tried his best, his erections were strong and repeated, but as soon as he went further toward the object he had in view his desire became utterly extinguished. She was "too good, too delicate, for a mere animal like him; he could not desecrate her beautiful body by any such vile act," etc.

With the sensible co-operation of the wife, Hammond had no difficulty in curing this case by suggestion.

Sexual perversion may cause impotence. It is obvious that individuals for whom the natural method of performance of the sexual act has no attraction are likely to fail should they attempt it. Impotence of a transitory character may be due to the psychic effect of satiety as well as to the debilitating influence of sexual excess. This is the form of impotence most frequently seen in married men. Through resulting psychic perturbation, a lack of responsiveness on the part of the female is an occasional cause of pseudo-impotence in the male. This is especially likely to arise in married men and probably in the majority of instances is primarily their own fault.

The proper functioning of the sex glands, probably is more dependent on environmental conditions than are the secretions of any of the other important organs of the body. The functions of the digestive organs, salivary glands, liver and mammary glands are perturbed—through disturbances of the nervous and sympathetic

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centers — by such emotions as jealousy, worry, anger, disgust or fright. The perversion or suppression of the lacteal secretion through adverse — and their increased activity from favorable — psychic influences is especially suggestive. The disastrous effect upon the child produced by toxins developed in the mother's milk by fright, anger, jealousy and grief are familiar to every practitioner of experience. Even the cow — which certainly cannot be accused of a highly refined psycho-emotional organization — suffers from diminution or perversion — or both — of milk supply from disturbing influences. In this connection the important physiologic relation of the mammary glands and sexual organs is very suggestive.

Why, then, should we expect the sexual organs, which are still more actively dominated by emotional influences viâ the sympathetic than are other organs, to be less sensitive to such impressions than they?

In direct ratio to the degree to which potency and fertility are determined by the proper performance of the function of the testis and ovary, and upon the innervation and vascular supply of erectile tissue, will be the evil effect of adverse psychic influences. The shrew, the termagant, the virago and the indifferent female will please take notice.

With respect to the sexual act *per se,* adverse psychic conditions are not so serious in their effects upon the female as upon the male, merely because they do not throw any mechanical obstacles in the way of coitus. The indifferent female can conceal her aversion to the sexual act. Not so the male, for with aversion or frigidity on his part comes the impossibility of its performance. The same may be said of such influences as fear, worry, etc. On the other hand, in the matter of fertility and sexual passion, adverse psychic influences have an important bearing on the sexual function of the female.

In searching for the causes of impotence and sterility in married life, the physician should carefully seek for possible psycho-sexual disharmony of various kinds and degree. No method of treatment of impotence can succeed where pronounced marital disharmony exists and cannot be removed. To be sure, domestic quarrels may be followed by exaltation of sexual desire, but these instances are the exception — and besides, there really may be no sexual dis-

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harmony or aversion in such cases. Then, too, the easily aroused temper is likely to be associated with an ardent sex temperament, to the fire of which "making up" domestic quarrels merely adds fuel.

When the wife ridicules her husband's sexual disability, expresses disgust or dissatisfaction with the sexual act, accuses the husband of infidelity as an explanation of his marital sexual inefficiency, exhibits indifference to the act, or complains of pain in coitus, relative impotence in the husband develops sooner or later and, so long as the adverse psychic conditions prevail, the condition is irremediable.

The man or woman whose attitude is that of the man who, having caught the street car, ceases to "run after it," is on dangerous ground. Couples who, after marriage, take everything for granted and cease to exert themselves to perpetuate mutual sex attraction, always are on thin ice.

The thinking physician, knowing the inside history of matrimonial *mésalliances,* is likely to be astonished, not at the frequency of marital-sexual disharmony, but that there is not even more of it.

The author recalls a number of very interesting cases bearing on the problem of the relation of marital disharmony to impotence. One of the most typic was the following:

CASE:—A professional man, thirty-five years of age, had been gradually developing impotence for four or five years until now it was complete. He had been married for ten years and had had no extra-marital experiences. Beginning after a prolonged period of overwork and business worries, the trouble finally had impelled him to seek medical counsel. He showed no organic disease and physically was more powerful than the average man of his age. He stated that he had moderately vigorous erections but little desire, and that erection always failed him. He denied domestic infelicity, but in such wise that the author was suspicious that his denial savored more strongly of gallantry than truthfulness. After some months of treatment, without success, resection of the *vena dorsalis penis* was suggested and performed, with excellent results, so far as frequency and vigor of erections was concerned. He still, however, was impotent. Several months later the wife called upon the author and interrogated him regarding her husband's condition. The author found that the patient's failure to recover his potency was easily explained. The wife was an exacting, shrewish person and suspicious of her husband's fidelity. By her unfounded accusations, fault finding and ridicule — begun at the time the husband's virility was impaired by sheer physical exhaustion — she finally succeeded in permanently inhibiting both his power and desire. The author bluntly stated the facts to both parties and did his best to harmonize their widely divergent psychic attitudes. but

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without result. A divorce was the sequence, about a year later. Two years subsequently, the patient married again and since has been perfectly normal.

Certain phases of the matrimonial problem are of vital interest to the physician who is interested in problems involving the sexual function. Society bungles the matrimonial question, and if there ever is to be any progress, it necessarily will be largely through the educational efforts of the physician-sociologist.

The author is of opinion that production of impotence by psychic influences is in a measure explicable by the hormone theory. Worry, aversion and other adverse sex psychic elements may, by disturbing the nutrition of the glands, pervert or inhibit sex hormone supply. Absolutely normal sexual relations demand certain favorable conditions. Love, with normal environment, and a normal ovary and testis, are great stimulants to the proper formation of the sex hormones.

TRUE IMPOTENCE.—True impotence is rare in both male and female; extremely so in the latter. The function of the male in the act of copulation is an active one, and erection of the sexual member is necessary; whereas in the case of the female no preparation is necessary for the sexual act, her function being comparatively passive. The necessary element in the case of the male is a sufficient degree of firmness of erection to permit the introduction of the penis into the vagina, and any individual who is possessed of this amount of capacity cannot justly be said to be afflicted with true impotence. It is unnecessary to potency that the individual should experience either desire for, or pleasure in the performance of, the act of copulation. In certain conditions perfect erection and even ejaculation are possible, although the individual does not experience either desire or pleasure. Some of the diseases affecting the spinal medulla produce this phenomenon. In certain cases of aspermatism a similar state of affairs is noted. Severe priapism due to cantharidal poisoning is not usually attended by sexual desire, and intercourse under such circumstances may be absolutely devoid of pleasure.

The term impotence in the case of the male should be restricted to those cases in which there exists some actual physical impediment to the performance of the act of copulation. Such impediment may, however, be temporary or permanent.

ETIOLOGY.—The causes of true impotence may be classified as (*a*) congenital; (*b*) acquired.

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(*a*) *Congenital Causes.*—1. Marked hypospadias or epispadias. In some cases of the former the penis is curved or otherwise deformed. In the latter condition exstrophy of the bladder may coexist. The author has met with one case of impotence due to a congenital lateral curvature of the penis.

2. Imperfect development of the penis and testes, the former being too small and too flaccid for copulation. Oftentimes the penis seems overlarge, yet the erectile tissue is not well developed, and erection is consequently imperfect.

3. Congenitally-excessive development of the penis (?). This form of impotence may be only a relative affair, the real cause being a disproportionate smallness of the vagina of the individual with whom intercourse is attempted. In the absence of tumors it is probable that the cases in which the penis is too large to permit of copulation are extremely rare, if, indeed, they ever occur.

4. Cryptorchidism or monorchidism, with imperfect development of the penis.

5. Excessive redundancy of the prepuce, with phimosis.

6. Congenital tumors of the organ.

(*b*) *Acquired Causes.*—1. Tumors of the penis, prepuce, or glans.

2. Inflammatory thickening of the prepuce, with phimosis, incidental to balanitis, gonorrhea, or chancroid.

3. Large venereal vegetations.

4. Excessive obesity. This cause is frequent, but is sometimes overcome by the ingenuity of the patient in reversing the relative positions of the male and female during copulation; an expedient as old as the Decameron. Obesity also lessens desire.

5. Ankylosis of both hips may prevent copulation in the normal manner, although by appropriate posturing the act may be accomplished, at least by the male.

6. Tumors of the scrotum or testes, such as hydrocele, sarcocele, hematocele, cancer, and elephantiasis. The two latter conditions may involve the penis.

7. Chancre or chancroid of the penis of sufficient size and irritability to interfere with copulation by the pain the act produces.

8. Gonorrheal or simple urethritis.

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9. Acute or chronic chordee. The former condition occurs in gonorrhea; the latter may result from frequent and severe attacks of urethritis, or from stricture, and may occasionally arise as a consequence of urethrotomy.

10. Inflammation of the deep urethra, prostate, and seminal vesicles.

11. Circumscribed inflammation of the corpora cavernosa. In these cases calcareous plates sometimes form.

12. Cicatrices from wounds of the penis or urethra, interfering with erection.

13. Removal of the penis and testes. If the operation be performed early in life removal of the latter only is necessary.

14. The habit of masturbation, spermatorrhea from whatever cause, nervous shock, and in some instances organic disease of the brain and spinal cord may produce a complete and permanent loss of power of erection by exhaustion or inhibition of the nervous stimulus to the parts.

15. Temporary and symptomatic impotence sometimes is the result of constitutional diseases, such as fevers. Debilitating and prostrating acute or chronic disease, and neurasthenia from overwork or worry, may produce it.

For several years the author's attention from time to time has been directed to a form of *impotentia coeundi* which, so far as its etiology and pathology are concerned, hitherto has escaped observation. Cavernositis chronica — sclerosing inflammation of the corpora cavernosa — is sufficiently familiar to the genito-urinary surgeon, at least, but the dependence of the affection on a general systemic condition apparently is not recognized. The patient, usually above middle age, presents himself complaining of curvature of the penis during erection, which in effect is a chronic chordee. This often has progressed until coitus is impossible before the surgeon is consulted. Syphilis, alcohol, rheumatism and gout are the chief etiologic factors to which the condition is attributed. The possible causal relation of these etiologic factors to the local condition is logical enough, but it is not easy to explain why the pathologic process should localize itself in the erectile tissue of the penis, especially where the process is more or less diffuse. Where the condition is quite circumscribed, what the author has to say regarding a general arterial disturbance is not so pertinent. Old-time

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injury, perhaps long forgotten, and infections of various kinds, gonorrhea, especially, may have been the determining cause, especially in the last mentioned class of cases. In the diffuse variety, and probably also in many cases of the circumscribed, the author is confident that something more than a local disease exists. In brief, whatever the primary etiologic factors, local and general, may be, the penile process is merely the local expression of general arterial disease.

This in no wise lessens the importance of the etiologic factors usually assigned to chronic cavernositis for, as is well known, they bear a most important relation to the general condition. Experience has taught the author to look for evidences of general arteriosclerosis in such cases. So often is it found that its existence may be suspected even when the accessible arteries are but little, if at all, involved. In gouty "high livers," who are not far advanced in life, incipient arteriosclerosis may exist, yet no cardiac or superficial changes be evident as yet. Errors in diagnosis by internists are frequent because of this fact.

In "type" cases of the condition under consideration, cardiovascular changes are found. *Arcus senilis* may be present. Time levels symptomatic distinctions between the man of forty-five or fifty years of age, in whom there is perhaps nothing but slight hyper-vascular tension; and the man of sixty or above, with pipestem radials and temporals, cardiac changes and *arcus senilis*.

The prognosis of cavernositis is in general unfavorable so far as disappearance of the deformity is concerned. The condition fortunately is painless and not dangerous to life. Occasional cases are met with, usually of the circumscribed variety, in which the sclerotic plaques disappear, whether despite or because of treatment, the author does not venture to say. Radium is promising but little that is definite can as yet be said about it. In the form associated with general arteriosclerosis thiosinamin sometimes seems to be useful.

Certain local conditions occasionally are attended by symptomatic impotence. Thus, inflammation of the testicles, varicocele, and tumors of the testes or scrotum, other than those that are capable of interfering mechanically with the act of copulation, may produce complete impotence. In some instances this is due to reflex inhibition of the sexual power, while in others the condition is a purely

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mental one, resulting from the moral effect of the knowledge of the existence of pathologic conditions of the sexual apparatus. In varicocele, particularly, both elements in the causation of impotence deserve consideration. There is a lack of tone — in fact, a marked debility of the generative apparatus in many instances — and associated with this enervation there is profound mental disturbance, resulting from the consciousness that the sexual organs are not healthy. Syphilitic orchitis in a similar manner may produce impotence, and, as already seen, sterility. If this condition be not speedily relieved, permanent impotence and sterility may result as a consequence of changes in the secretory structure of the testes incidental to the pressure of the syphilitic neoplasm.

Indulgence in alcohol may cause impotence. Various other drugs have been said to have a special action in producing impotence; but a certain amount of skepticism is pardonable in this connection. It certainly must require large doses of the various sedative and alterative drugs to bring about this condition. Arsenic, antimony, lead, iodin, camphor, and hasheesh are among the drugs that are said to produce impotence. Iodin has been accredited with the power of producing atrophy of the testes. The author does not believe, however, that a single authentic case can be produced in which such atrophy is justly attributable to the use of this drug. One explanation for the popular idea that the potassium iodid is capable of producing atrophy of the testes is that certain cases of syphilitic orchitis have been insufficiently treated with the drug, or treated too late. Atrophy of the testicle has resulted, not from the drug, but from pressure-innutrition produced by syphilitic neoplasm that large and long-continued doses of iodid might have removed in time to save the testis. The carbonated waters taken in excess are said to produce impotence. The author regards this as a pleasing delusion on the part of "men about town." In general, the truth probably is that: 1st, narcotics may inhibit sexual power; 2d, any powerful drug which is given freely enough to injure the general health may produce impotence.

Vecki claims that a severe cold produces impotence by inhibiting olfaction. The author admits the clinical fact, but believes the temporary impotence to be due to the constitutional effect — toxemia — of the cold. It occurs where the naso-pharynx is not involved and the sense of smell is perfect.

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There probably is, however, some association between the olfactory and sexual function. That perfumes and personal odors may attract or repel is well known. Where olfactory impressions have a powerful influence over sexual desire, atavism probably is a sufficient explanation.

In many cases of impotence it is impossible to attribute the condition to any particular cause.

Since the advent of the X Ray, a special cause of impotence has been noted in the disastrous effect of the ray upon the structure and function of the testes. Careless operators have produced impotence in both their patients and themselves. A peculiar effect of the X Ray occasionally met with in persons exposed to its action frequently and for prolonged periods is profound anemia. This may be a factor in producing impotence, but the directly destructive atrophy-producing action of the ray upon the secretory cells of the sex glands is the logical explanation. Sterility may result without impotence. Similarly, the female may be sterilized by the X Ray. Obviously, the interstitial or hormone producing cells — cells of Leydig — share with the spermatic secretory epithelium the deleterious results of the ray. This is an important factor in both the sterility and impotence that result. Proper screening of the sexual organs and filtering of the ray will prevent injury from the X Ray. If the action has not been too severe and prolonged and further exposure is avoided, the structure and function of the testes possibly may be restored to a greater or less degree. It has been asserted that radium will restore the integrity of gland tissue impaired by the X Ray. The method certainly is worth a trial. Sex gland implantation quite likely would be of service.

TREATMENT. — The treatment of impotence may be divided into (*a*) moral, (*b*) medicinal and surgical. The latter may be subdivided into: (1) general, (2) local.

The mainstay of treatment in false or nervous impotence consists of psychotherapy. In fact, there is no form of impotence in which a psychic element that requires correction cannot be found. The principal requirement is the restoration of the patient's self-confidence. The greatest delicacy and judgment are necessary in the management of these cases. The patient should feel that his physician sympathizes with him in his apparent affliction. It will not do to laugh at his ailment, or to treat it lightly, even though

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assured that his impotence is imaginary rather than real. The patient usually is comparatively strong and healthy, but has masturbated to a certain extent and has experienced nocturnal emissions with greater or less frequency. Morning erections often are strong and vigorous, and apparently perfectly normal. Sexual desire is felt and may be present in an exaggerated form. When such a patient attempts intercourse, erection either does not occur at all or takes place in a spiritless way that is not at all encouraging to his mind. When he reflects that he has masturbated, and that he has experienced an occasional nocturnal emission, with perhaps other little symptoms that coincide with the description of spermatorrhea outlined in some quack treatise or other, he becomes completely demoralized. So careful do these patients study quack literature, and so firmly convinced of their impotence do they become, that it often is absolutely impossible to gain their confidence or to benefit them in any way whatever. A symptom that greatly depresses the patient's mind is the escape of prostatic fluid and urethral mucus during prolonged and vigorous erection.

An effort should be made to obtain the fullest confidence of such individuals, and they should be given instruction in the rudiments of sexual physiology. In the majority of cases they may be reasoned out of their perverted and pernicious notions regarding their physical condition. Many times we are compelled to be somewhat disingenuous in our management of the case, for, the patient's confidence once gained, some comparatively trivial local or general measure may cure the case, providing the patient himself believes in the potency of the treatment. Above all, the patient should be assured that his sexual apparatus is in an exceptionally strong and healthy condition. Marriage should be recommended where practicable. Regarding this point, however, marriage should never be advised unless the occurrence of strong and vigorous erections proves copulation to be possible. Even under these circumstances, an occasional unfavorable result will ensue, because of persistent psychic inhibition of erectile power at the time copulation is essayed. In cases dependent upon moral or mental causes prevailing when copulation is attempted, removal of the circumstances that produce mental depression is, of course, necessary. The elements of sexual indifference due to mental worry, nervous shock,

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fear and excessive passion may be amenable to correction. Disgust with the partner in the sexual act causes impotence which is irremediable when the unfavorable conditions are continued. It may prevail even when intercourse with a new partner is attempted. Sooner or later, however, the case usually recovers if a satisfactory sexual "rearrangement" is consummated.

In those cases of married men in which lack of affinity is the principal cause of impotence, medical measures are likely to be unsuccessful, although some form of local stimulation of the sexual organs possibly may be efficacious. The divorce-court, however, is a better and more logical remedy if the circumstances imperatively demand a cure.

In many instances of purely nervous impotence, irritability of the prostatic urethra exists. This may be removed in the majority of instances by the occasional passage of a cold steel sound. If the case be obstinate, astringent applications may be made by means of the cupped sound or deep urethral syringe. The prostate or seminal vesicles sometimes are congested or chronically inflamed. Massage of these parts relieves this condition. The psychrophor or cooling sound sometimes is serviceable.

In cases of premature ejaculation success often may be attained by a second attempt at copulation. The patient should be advised to avoid excitement during intercourse. Very often he may succeed in delaying orgasm by thinking of something else beside sexual intercourse at the time of its performance. Patients who are apprehensive of failure should be advised to refrain from intercourse during the night, and to attempt it only in the early hours of the morning.

It is well for newly married men affected with nervous impotence to confide in their wives and explain their temporary debility. The patient should be informed that, sooner or later, he will have a vigorous erection — as soon, at least, as the novelty of the situation has worn off and his timidity has been allayed. He should be instructed to immediately take advantage of the situation, when an erection does occur, and perform the marital act.

Measures of a general and hygienic character are requisite, especially in the management of cases in which actual structural disease does not exist. These general measures involve proper exercise, diet, baths, proper hours of sleep, temperance, or, better,

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total abstinence in the matter of alcoholics and tobacco, and freedom from care and worry so far as possible. Such measures apply also to the treatment of spermatorrhea, a condition with which impotence very often is associated.

Cases in which impotence is due to an exhausted condition of the sexual apparatus and incidentally of the general nervous system, with in some instances impairment of nutrition, primarily require complete sexual rest. Occasional or so-called moderate indulgence is not to be thought of in these cases. Perfect continence must be insisted upon for the time being, the length of time varying with the gravity of the case. It is unfortunate that the majority of patients, and particularly voluptuaries, are loath to accept such advice, believing, as they do, that by means of aphrodisiacs their virile powers should be restored without interfering with the indulgences that are responsible for their condition.

Hammond's remarks upon this point certainly are judicious. He says:

> I have generally found that in those cases in which an erection sufficient for intromission does not take place, sexual repose for about a year is necessary. Again, the age of the patient and the length of time during which the condition has existed are factors to be considered in determining the question. In persons over forty, and in whom the condition has lasted six months, no attempt should be made for even a longer period than a year. With every unsuccessful effort, even though no emission occurs, the nervous excitability is still further lessened, and the *morale* materially lowered. Generally in these extreme cases there is no difficulty in securing the requisite quiescence. The patient is fully aware of his inability, and is in no mood to undertake what he knows will result in failure. It sometimes happens, however, that masturbation, with the erection almost *nil* and the orgasm imperfect, is practiced, when the individual finds that intercourse is impossible. It is in this respect that the requirement of rest must be strictly enjoined.

Cases in which the principal trouble consists of premature ejaculation and feeble erection unquestionably require rest for a time; but the patient is likely to disregard the instruction of his medical adviser because still retaining a certain degree of potency and able to copulate after a fashion — sufficiently well, at least, to make the indulgence pleasurable. In cases of this kind the patient should be informed that it is absolutely impossible to benefit his condition unless he will consent to at least six months' continence.

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The moral tone and mental condition of the patient deserve special consideration. The remarks that have been made in connection with the subject of masturbation and sexual excess are pertinent in these cases. Exercise, intellectual occupation, and avoidance of all sources of sexual stimulation must be insisted upon. Where practicable, the patient should be advised to take a change of scene; in short, to cease associations that tend to excite his sexual passion. Traveling — and particularly a sea-voyage — is excellent for these cases.

Cold shower-baths or plunge-baths are excellent adjuvants to the general treatment. Delicate patients should begin by a course of sponge-bathing. Cold sitz-baths or hot and cold water in alternation are useful. Whatever form of bath be selected, it should be followed by brisk rubbing with a towel or flesh-brush. Local douches with hot and cold water alternately are very stimulating to the parts. The Turkish bath taken in moderation and followed by the cold plunge constitutes one of the best of general tonics.

The diet requires some attention. It should consist of an abundance of easily digestible and nutritious food, a preponderance of nitrogenous elements being essential. The various preparations of malt and codliver oil are excellent means of improving nutrition. An abundance of good rich milk and cream is demanded. Meats should be eaten rare and should contain considerable fat. A moderate amount of stimulants is often useful. Claret, port, sherry of good quality, or Dublin stout may be taken with the meals. The patient should be advised to sleep upon a hard mattress with light covering, this measure being particularly essential if nocturnal emissions are a feature of the case.

Certain internal remedies are useful. Contrary to the general belief, however, not only are there no specifics for impotence — *i. e.*, no drugs that can be depended upon to so stimulate the sexual apparatus as to immediately render copulation possible — but there is no drug known to science that can be relied upon for the restoration of the abused and maltreated procreative organs. All drugs and systems of treatment advertised are arrant humbugs and swindles. Treatment of impotence by mail is a delusion and a snare set for the credulous and ignorant by quacks. Nearly if not quite all of the aphrodisiac remedies that are likely to be useful in impotence, with the possible exception of cantharides, act rather

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as general restorers of nervous energy than by a special predilection for, and stimulation of, the sexual apparatus. Much of the reputation of various drugs depends upon the moral effect of their administration in cases of pseudo-impotence. Nearly all the celebrated nostrums and quack remedies recommended as specifics for impotence have become celebrated through their influence upon the minds of the patients. An individual who is impotent because of lack of confidence in his virility, is likely to be relieved by a trituration of milk-sugar, providing he has confidence in the efficacy of the placebo. If some alleged aphrodisiac be given, it is likely to acquire an undeserved reputation for efficacy. The best remedy for a lack of tone in the generative apparatus probably is iron. The tincture of the chlorid may be given in doses of from 15 to 20 drops in water, three times daily, after meals. The pyrophosphate of iron perhaps is a more eligible preparation and equally efficacious. It should be administered in doses of from 5 to 10 grains thrice daily. It may be advantageously combined with strychnia.

The following is a favorite prescription of the author's:

℞ Ferri pyrophos.....gr. v.
Strychniæ sulph. .....gr. $^1/_{60}$
Sodii arsenit .....gr. $^1/_{60}$
M Ft. Caps.
Sig. Three times a day after meals.

Nux vomica, or its alkaloid, strychnia, has an excellent reputation in the condition under consideration. Phosphid of zinc and nux vomica may be given in combination. The following is an excellent formula:

℞ Zinci phosphidi ..... gr. v.
Ext. nucis vomicæ..... gr. xx.

M Ft. pil. No. xl.
Sig.: One three times a day, after meals.

Phosphorus is the most reliable remedy in these cases. It may be given in solution, as a tincture, in combination with zinc as in the formula just given, or in its pure state.

A pill composed of $^1/_{50}$ grain of phosphorus and $^1/_4$ grain of nux vomica is an excellent combination. The principal objection to the use of phosphorus is the offensive eructations and gastric disturbance it sometimes produces. The mineral acids — such as

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dilute phosphoric, muriatic, and nitric — are all of service. Hypodermic injections of strychnia often are useful, a single daily injection of $^1/_{64}$ grain of the sulphate of strychnia being more efficacious than much larger and more frequent doses taken *per orem*.

Opium, the bromids, ergot, digitalis, gelsemium, and alcoholics all have their uses in nervous impotence.

Cantharides exhibits a more marked and direct immediate action upon the generative apparatus than any other aphrodisiac. It should be given cautiously, however, for in large doses it may produce inflammation of the bladder and, coincidently, severe strangury. So severe are its effects in some cases that obstinate priapism and insatiable sexual desire may occur, perhaps with inflammation and sloughing of the penis and vesical mucosa. Deaths from the drug have been frequently observed. In impotence the tonic effect of the drug should be aimed at. It may be given in from 10 to 15 drops three times daily. In occasional cases a gradual and cautious increase of the dose is warrantable. Thus, 10 to 15 drops three times a day may be given to commence with, the dose being increased 1 drop each day until slight strangury is produced, when it should be discontinued. If there has been no benefit to the impotence by this time, further administration of the drug is useless. Damiana is a much-vaunted remedy for impotence that is useful to a certain degree as a tonic. The dose is 1 or 2 drams of the fluid extract three or four times daily. Both damiana and cantharides will be reverted to in a subsequent chapter.

Ergot often is a valuable remedy in impotence, particularly in those cases in which there seems to be a lack of tone in the vascular supply of the penis. It may be given in doses of 10 to 20 drops, three or four times daily. Certain cases of impotence have been attributed to a lack of tone in the dorsal vein of the penis, this condition resulting in too rapid removal of the blood from the part during erection. Injections of ergotin in the course of the vein have been recommended for this condition. Ligation or resection of the vein may be of great service. According to Bartholow, jaborandi, or its alkaloid, pilocarpin, is an active aphrodisiac, being indicated in cases characterized by debility. He claims that it is more efficacious than any other agent. The dose should be 30 minims of the fluid extract, night and morning, or from $^1/_5$ to $^1/_8$

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grain of the muriate of pilocarpin thrice daily. The author believes that pilocarpin is of some value. It probably acts by increasing testicular, prostatic and seminal vesicle secretion. Cimicifuga also is recommended by the same authority, particularly in those cases of impotence accompanied by spermatorrhea of long standing, with excessive nervousness and anxiety and diminished sexual desire.

In cases in which premature ejaculation from sexual hyperesthesia and active secretion of semen are noted, regular intercourse, with moderate frequency, and the administration of such remedies as potassium bromid, chloral-hydrate, gelsemium, and ergot often will relieve the condition. Potassium bromid is the most popular sedative for sexual hyperesthesia or excessive desire, so often attended by partial impotence. Its efficacy has, however, been disputed by some authors. In explaining the sources of fallacy of those who dispute the anaphrodisiac effects of the bromids Bartholow speaks as follows:

1. The physiologic effects of potassium bromid are not very decided, and are readily modified by any local disturbance.

2. Its therapeutic action is still more decidedly influenced by local morbid processes.

3. It is indicated where a sedative to the nervous system is required: *e. g.*, in insomnia, too great reflex excitability, nervous and spasmodic affections of the larynx and bronchi, sexual excitement, and irritable states of the sexual organs.

4. It will be effectual in the foregoing conditions, in proportion to the degree in which structural lesions are absent, or, in other words, in proportion to the degree in which these morbid states are functional rather than organic.

5. These conclusions, the result of observation and experiment, afford us a satisfactory solution of the cause of failure in the use of the bromid of potassium. Sexual excitement in mania is due, as shown by Schroeder von der Kolk, to structural alteration in the medulla oblongata, the center, according to this author, of the sexual impulse. The bromid of potassium can have no influence over these structural alterations, and hence cannot control manifestations of sexual excitement depending upon them.

With increasing experience in endoscopy, we have come to assign more and more importance to morbid conditions of the colliculus seminalis as the underlying cause of perturbations of the sexual function.

Where the colliculus is inflamed, endoscopic application of nitrate of silver is essential.

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The local and general application of electricity in its various forms is very useful in impotence. It is especially useful in the form of the general faradic bath, the current being applied while the patient is in a tub of hot water. Its application should be followed by a cold shower- or sponge-bath, and the application of static electricity or the high frequency current to the spine, particularly over the lumbo-sacral region. It sometimes is beneficial to apply the latter form of electricity to the perineum, penis, and testes. Hammond claimed that he had succeeded by means of the static apparatus in restoring sensibility to the glans penis and adjacent tissues when galvanism and faradism had failed. While inclined to take some of this gentleman's clinical observations *cum grano salis,* the application of the static or high frequency current in this manner seems rational enough. The stimulating effect of static electricity upon the nervous system often is remarkable; some patients say that it acts like a glass of champagne.

The faradic current in moderate strength is a powerful stimulant to the sexual organs. The ordinary sponge electrodes may be used, the positive pole being applied to the lower part of the spine and the negative to the penis and testes. More benefit, however, sometimes is to be derived by applying the negative electrode to the genitals and the positive to the inner aspect of the thighs. A wire brush electrode may be used instead of a sponge, this being attached to the negative pole and passed up and down the spinal column. The positive pole may be placed first upon the nucha and afterward upon the lower portion of the spine, the wire brush being passed over the genitals. More or less pain is caused if the current be at all strong, but considerable benefit will be derived from its use. The circulation and nutrition of the spinal medulla is greatly improved, and the vigor of the sexual nerves is necessarily increased. The application of the wire brush to the genitalia is especially serviceable in cases of impotence that appear to depend chiefly upon anesthesia of the nervous supply of the glans penis. The galvanic current often is useful, either alone or in combination with the faradic current on alternate days.

The high frequency current has proved very useful in the author's hands. It may be applied with a glass electrode directly to the prostatic urethra.

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One of the best stimulants for the sexual organs is the faradic current applied directly to the prostate. An insulated sound or bougie is attached to the negative pole of the faradic battery and passed down to the prostatic urethra. The positive electrode may be applied to the spine, thighs, hypogastrium, or genitals. It is best applied by means of a large flat sponge electrode to the lumbar region. The prostate may be faradized by a rectal electrode attached to the negative pole. The galvanic current may be used in a similar manner. In cases in which the trouble appears to depend chiefly upon hyperesthesia of the prostatic sinus much benefit often may be derived from the application of the positive pole of the galvanic battery to the prostatic urethra. A local electric bath may be given by suspending the penis and testicles in a receptacle of warm water, the negative electrode being placed therein, and the positive held in the patient's hand. In applying electricity directly to the prostate care should be taken to avoid too powerful currents and too long continuance of their application. Inflammation of the neck of the bladder, and even prostatitis, are possible sequences of carelessness in this regard.

In the milder types of impotence the local application of electricity by the insulated sound in combination with psychotherapy and the general measures that have been suggested rarely will fail to restore the vigor of the sexual apparatus, providing the patient is faithful in his treatment and devotes sufficient time to it. It is not well to make promises regarding the length of time necessary, and the patient should be told that the period necessary for treatment can be determined only by the progress of the case, some cases yielding in a short time, while others require a protracted course of treatment.

Prostatic and vesicular massage are very frequently necessary in the treatment of impotence, especially in post-infective cases.

It should be remembered that, to achieve permanency of result, it is necessary for the patient to continue treatment, and to abstain from sexual indulgence for some little time after his capacity apparently has been restored.

In cases of premature ejaculation and failure of erection due to extreme sensitiveness of the glans penis, circumcision usually is necessary, as most of these cases are affected with redundancy and

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phimosis. The daily application of cold water to the glans is an excellent adjuvant to circumcision. The application of electricity by the galvanic brush or the high frequency current, is a very valuable recourse. Daily applications of a solution of tannic acid in alcohol, or of aluminum acetate, are serviceable in allaying hyperesthesia.

The application of stimulating embrocations to the penis has been recommended for impotence. As a general rule, they are worse than useless. Sinapisms, however, as recommended by Roubaud, may be of temporary service in some instances, by temporarily exciting erectile power and affording a permanent cure by the psychic effect of the erection. The irritation produced by mustard is sufficient to reflexly excite an erection in the majority of instances. Care should be taken not to prolong the application, lest serious inflammation result. Cases of impotence secondary to cerebral or spinal disease should not be subjected to much special treatment. All therapeutic efforts should be directed to the cure or improvement of the primary condition. As improvement of the condition of the brain and cord occurs, a corresponding improvement in sexual vigor is noted. Some remedies for impotence are injurious in cases dependent upon spinal disease. For example, spinal excitants, such as phosphorus and strychnia, should not be given in locomotor ataxia, as they are likely to aggravate the organic disease, and will in no way benefit the impotence. In some extreme cases of sexual hyperesthesia, the application of silver nitrate to the deep urethra by means of the deep urethral syringe is of benefit.

As a temporary expedient and in psychic impotence, the application of very hot water to the penis and testes just prior to copulation often is efficacious.

Most of the deformities of the sexual apparatus that produce impotence are not amenable to treatment. Diagonal section of the roof of the contracted urethra may benefit some cases of curvature of the penis. Epispadias, hypospadias, and certain tumors of the penis, scrotum, and testicles are amenable to treatment by the knife.

The author has had some very interesting cases showing what sometimes can be done for impotence due to hypospadias. The following is of especial interest:

CASE.—A youth of seventeen with hypospadias and marked curvature of the penis. Erections deformed and intromission a physical impossibility.

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Subject otherwise normal. The pseudo-meatus was located at about the middle of the penis—antero-posteriorly.

Operation: 1st stage. The urethra (*corpus spongiosum*) was dissected away from the body of the penis and implanted posteriorly, the new location of the meatus being the penoscrotal angle. All connective tissue bands and fibrous contractures were divided and the penis straightened. After healing was complete, several months later, a new penile urethra was made from a flap taken from the scrotum. A practically perfect result was secured. The author assured the father of the boy that there was one especially favorable element in the boy's condition, viz., that he could not contract gonorrhea, because of the fact that his entire penile urethra was composed of skin, which was not susceptible to gonococcal infection. To the astonishment of all parties concerned, the boy did contract a severe gonorrhea within a year after the operation. Several years later he married and had a normal child. He still is sexually normal.

Resection of the Vena Dorsalis Penis: Like all other surgical innovations, ligation and resection of the dorsal vein of the penis for the cure of impotence became a fad. The "commercial" surgeon hailed the new operation with delight, and the conservative and conscientious surgeon, who was ready to grasp at any straw which offered hope of relief for the most annoying class of cases that come under our observation, welcomed the operation as a friend in need. As is usual with new methods of treatment, the surgical fraternity speedily divided into two camps, viz.: those who proclaimed from the house-tops the infallibility of the method, and those who proclaimed quite as vociferously its utter worthlessness. The gap between a certain prominent American surgeon, whose patients had a vigorous priapism, coming on before they left the operating table, and demanding ice-packs for its relief, and those who condemned the operation as worthless, was a wide one. There was, however, something so seductive about the reports of the surgeon with the priapism patients, especially in view of the fact that the procedure was extremely simple, requiring only a few minutes under local anesthesia, that one was loth to give ear to the adverse critics. Still more entrancing was the simpler "improved" operation of "subcutaneous ligation of the dorsal vein."

The first point which the author's experience has settled to his own satisfaction is that the wide variation in results of the method obtained by different operators largely is explicable by a wide difference of technique. As the object aimed at is purely mechanic

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and psychic, the average of results should be the same, provided the contemplated mechanic obstruction in the vein is accomplished by it.

The operation is not so simple nor so easily performed as its more sanguine adherents have claimed. The rapid operation and the subcutaneous ligation consist in most cases of anything *but* ligation or resection of the *vena dorsalis penis*.

The dorsal vein proper lies beneath the *fascia propria* — Buck's fascia — and cannot be accurately or safely ligated or resected without careful and painstaking dissection. Subcutaneous ligation of the vein is a conception of anatomic ignorance. Ligation of the superficial penile veins, however large and prominent they may be, and essential though it often is to a thorough operation, is not ligation of the *vena dorsalis penis*. Granting that this vessel can be ligated without an open operation, it can be accomplished only by wounding or including in the loop of the ligature other important vascular and nerve structures.

The relatively prompt effect of properly performed resection of the *vena dorsalis penis* in demonstrating dynamic sexual capacity, through purely mechanic circulatory agencies, necessarily must be a powerful factor in the result. Add to this the fact that the mechanic conditions secured by the operation practically are permanent in quite a proportion of cases, and we have excellent reasons for faith in the efficacy of the operation. Admitting, for the sake of argument, that its effect upon the circulation of the penis is merely transitory, this would not count against the operation in purely psychic cases, still less in those with a lesser degree of psychic aberration. The suggestion of dynamic capacity has done its work long before the effect of the operation disappears.

If the argument that the effect of the operation is purely psychic, and that it consequently is not warrantable in the treatment of impotence, is permitted to have much weight, the majority of patients would be discriminated against. Cases of impotence in which true organic etiologic factors dominate are relatively infrequent, and in many of those of an organic type, there are certain factors which minimize the importance of impotence *per se* — e. g., in certain cases of hypospadias, epispadias, etc.

In presenting the claims of the operation to patients, a full and frank statement of possibilities and probabilities of a successful

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result should be made, with due and thorough consideration of the individual merits of the given case. With the psychic element in mind, the patient should be encouraged as much as is consistent.

A careful and exhaustive inquiry always should be made into the circumstances under which the erectile power is wanting, with especial reference to the psychic influences dominating at the time of failure.

As to whether the results of the operation substantiate the claim that defective erection is due in a large proportion of instances to the too rapid emptying of the blood from the dorsal vein of the penis, the author is unable to say. This appears, however, to be a by no means inconsiderable factor in the etiology of impotence, and consequently in the results obtained by resection of the *vena dorsalis penis*. It must be remembered, however, that, in its mechanic results, a sluggishness of arterial supply would in effect be precisely the same as a too rapid return of the venous blood from the part. Defective arterial supply probably is a logical explanation of quite a proportion of cases of impotence, and consequently of the benefits derived from operation.

From the author's experience his conclusions in brief are:

1. Resection of the *vena dorsalis penis* in the treatment of impotence is an operation requiring accurate anatomic knowledge. It cannot be done subcutaneously without serious injury to important parts or total failure of the operation.

2. The operation, while not essentially dangerous, is neither so simple nor so easily performed as some have claimed.

3. The ligation of the superficial penile veins often has been performed by those who claimed that they had ligated the dorsal vein proper. This operation upon the superficial veins often is essential to a complete operation, but when performed alone is futile.

4. The location of the dorsal vein is such that careful and painstaking dissection is necessary for its ligation or resection.

5. The operation is beneficial in very many cases on strictly psychic grounds, but this does not militate against the advisability of its performance. The important thing for the patient is a restoration of function.

6. In some cases of impotence of organic origin the operation

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is not to be thought of, but in quite a wide range of cases of the kind the operation is successful, firstly, because of its mechanic effect; secondly, because of its psychic effect.

7. One of the most important elements in the cure of impotence by a properly performed resection of the *vena dorsalis penis* is the demonstration to the patient of dynamic sexual capacity through purely mechanic circulatory agencies.

8. Normal erection largely revolves around the maintenance of equilibrium between the efferent and the afferent blood flow in the erectible tissue. Inefficient intake, or excessive outflow, is equally detrimental to erection. Resection of the dorsal vein of the penis aids in restoration of the equilibrium.

9. The mechanic conditions secured by the operation are permanent in quite a large proportion of cases.

10. In cases of complete impotence which are not dependent upon irremediable local causes of functional disturbances of innervation, the operation apparently is successful in about 50 per cent of the cases, and beneficial in probably one-half of the remainder.

11. In by far the majority of cases of impotence that come under the observation of the surgeon, a trial of this operation is justifiable.

The cases of impotence that are most trying to the physician are those met with in individuals at about middle age who have for many years indulged excessively in sexual intercourse. Patients of this sort consult the physician in the hope of receiving a remedy that will enable them to go on with their excesses, and, as a rule, they do not attribute their condition to its true cause. It is hard to convince such patients that they are paying for their early indulgence, and that they ought not to expect to perform the sexual act so often and so indiscriminately as when they were young. Such an opinion seldom satisfies them. The physician is consulted by many middle-aged *roués* who complain of real or imaginary sexual exhaustion, spermatorrhea, premature old age, etc., and these cases certainly are difficult to manage. If the patient cannot be made to understand the physiologic conditions involved in his case, and the importance of resting sexually in order that the organs involved may recuperate their exhausted vitality, very little success can be obtained by treatment. There is a vulgar notion among the laity to the effect that a man is capable of just so many acts of sexual indulgence

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during his life-time, and that he may either distribute these acts at proper intervals throughout a great number of years or may perform them within a few years early in life. There is much of truth in this, for it is a cardinal rule that overexcitement of any function will cause loss of power. The man that copulates with moderation is the one best fitted for procreation, because he is, from a sexual point of view, the most energetic. It is a well-known fact that the male population of the Orient become impotent at a very early age, earlier than any other race of men, on account of free indulgence of their sexual appetites. For that matter, among all nations men and women alike suffer from premature old age when excessive sexual indulgence is conjoined with a life of indolence and ease. The man who indulges in sexual intercourse most frequently in his youth is the one who is most likely to become impotent or sterile when he reaches middle age. It is said that quite a proportion of Oriental males become impotent at the age of from 30 to 40 years.

Moderation in sexual intercourse is not only conducive to prolonged virility, but to longevity. It is certain that many cases of neurasthenia in both male and female are due to sexual excess.

The treatment of the class of cases under consideration depends for its success mainly upon careful instruction of the patient in sexual physiology. The cause of his disability should be explained to him, and he should be assured that the only hope of restoration of virility and of its perpetuation lies in complete rest of the sexual function for a prolonged period, with moderate indulgence for the rest of his life, after his capacity has returned. In conjunction with these moral means for restoration, the remedies and local measures already recommended may be employed as the case demands. Care should be exercised in advising prolonged rest of the sexual function in old men. Obstinence sometimes is followed by permanent sexual disability.

Where impotence depends upon one or more of the organic conditions enumerated in connection with etiology, the cause should be dealt with upon its surgical merits.

Aspermia.

The term "aspermism," or aspermia, has been applied to some cases in which, although erections are normal and copulation is

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performed with facility, there is no ejaculation of semen. There may or may not be sexual desire. A peculiar feature of these cases is that the patient, although unable to have an emission during normal intercourse, invariably acknowledges the occurrence of voluptuous dreams attended by pleasurable sensations and emission of semen. On examination the urethra will be found to possess the usual amount of sensitiveness in all parts, excepting the prostatic sinus, where there apparently is complete anesthesia.

The author has observed several cases in which aspermism was the foundation of sterility. Two of these are of particular interest:

CASE 1.—A healthy man, 35 years of age, who had never had any ailment or injury, sought advice regarding failure of emission. The patient stated that he had been sexually normal until within a year, since which time he had found it impossible to have either orgasm or emission. Sexual desire still was normal and erection perfect, but no amount of duration of effort in copulation was sufficient to bring about an orgasm. Sexual intercourse never had been indulged in to any great extent, even before any abnormality was noticeable. Erotic dreams and nocturnal emissions were quite troublesome. This case finally yielded to faradism of the prostatic urethra. The treatment was directed to the relief of the evident anesthesia of this part, which apparently was the cause of the aspermia.

Another very interesting case recently came under the author's observation:

CASE 2.—A young man, 30 years of age, with the following history: He had masturbated for some years, beginning at the age of fifteen. For the last ten or twelve years he had had intercourse at frequent intervals, latterly two or three times weekly. He never had been able, either by masturbation or during sexual intercourse, to have an ejaculation of semen. The act, he said, was pleasurable, but absolutely unattended by anything like orgasm or seminal emission. On inquiry he stated that he had tired himself out in the attempt repeatedly, but without success. He was aware that it was not the fault of secretion, as he stated that he frequently after intercourse had lascivious dreams with copious emissions.

On examination the sexual organs were found to be normal, with the exception that there was absolute anesthesia of the prostatic sinus, in which nothing was found on endoscopy. Sounds produced no sensation whatever, nor was a strong faradic current more successful. The patient in all other respects was perfectly normal—indeed, he was an exceptionally robust man. He stated that during strong sexual excitement there escaped from the meatus a small quantity of fluid, which, from his description, unquestionably was prostatic secretion.

Sexual desire was marked, which made his condition particularly distressing. He stated, however, that copulation was not entirely unattended with gratification, else he would not have had intercourse so frequently.

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Under prostatic massage and faradism of the prostatic urethra, this case improved so that scanty emissions occurred during copulation, but he never fully recovered.

Ultzmann related some very typic illustrations of aspermia.

Roubaud advanced the theory that aspermia depends upon spasmodic contraction of the muscular fibers about the mouths of the ejaculatory ducts, preventing the escape of the semen into the prostatic sinus. This view hardly is in accordance with the physiology of the part. Keyes says, anent this point:

> Were there desire and pleasure, prostatic mucus would be secreted in excess and would be thrown out by ejaculation, while the semen proper would collect and distend the seminal vesicles and ducts below the ejaculatory orifices, and would escape and flow away from the meatus with the relaxation of spasm brought about by the fatigue following prolonged sexual intercourse, but this is not the case; the fault is evidently in the nerves. There is no pleasurable sensation, no call for secretion of prostatic mucus, nor for a supply of spermatic fluid. There is anesthesia of the prostatic sinus, and although the power of having an orgasm and ejaculation remains, as proved by dreams, yet there is some connecting link missing in the chain which transforms friction of the glans into pleasure at the prostate, and finally into secretion in the testicle.

There probably is not only anesthesia of the floor of the prostatic urethra, but a lack of the special sensibility of the nerves of the glans penis that normally is acquired during erection. It is possible, too, that, although the nerves of the prostatic sinus are normally sensitive, the nerves of the glans fail to appreciate and transmit pleasurable sensations. The function of the latter nerves perhaps is inhibited by the consciousness of the patient of the lack of sensibility in the glans. During sleep inhibition does not occur, and the subconscious memory of normal copulation, of which the patient once was capable, is sufficient to impart a pleasurable sensation and reflexly produce an orgasm.

Defective secretion is, in the author's opinion, an important factor in some cases. Perturbation of hormone supply may be an element in these cases. With increasing faith in the physiologic importance of the sex hormone, the author inclines to the belief that in many cases both of primary and secondary impotence, defective hormone is an important factor. In some cases, it alone may be the cause of the condition. Variation in sex hormone quality probably is the explanation of the wide variation in primary sexual capacity.

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TREATMENT.—The treatment of this condition generally is regarded as very unsatisfactory. Roubaud reports a case in which blistering the perineum, with subsequent application of powdered morphin, produced a cure. He recommends antispasmodics, in accordance with his theory of the pathology of the disease. Electricity in the form of the static and faradic currents applied to the spine and genitalia—especially to the prostatic urethra—would appear to be the most rational form of treatment, and has been moderately successful in the author's hands.

Faradism is to be recommended for both its moral and physical effects. A strong faradic current applied to the prostate sinus, daily if possible, thrice weekly at least — in combination with mildly irritant injections into the prostate from time to time, appears to be the rational indication. Prostatic massage also seems to be a logical measure.

It seems to the author that in some of these cases there may exist at the time of copulation some peculiar inhibitory mental influence that prevents culmination of the sexual act. Mental influences sometimes have this effect in perfectly healthy individuals. Once let the sexual act be naturally performed in these cases of aspermism and the "spell" is likely to be broken. When once the sexual act is co-ordinated with the mental elements necessary to the proper performance of the sexual function, not only will ejaculation occur, but the impression is likely to be a permanent one, the necessary sensibility being subsequently called forth in a normal manner on all proper occasions. The prognosis in these cases usually is not promising.

The question of matrimony is important in cases of aspermia. As the matter of sterility so far as the male is concerned is of relatively little importance, provided he be capable of performing the sexual act, the author can see no reason why the patient should not marry, particularly as marriage is likely to afford the mental condition and the environment necessary to awaken the more or less dormant sexual sensibility. A frank statement of conditions of course should be made to the prospective wife.

Roubaud's suggestion of the use of antispasmodics, on the theory of the dependence of the disease upon muscular contraction, seems a little fanciful. Inasmuch, however, as antispasmodics usu-

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ally are sedative, success might be obtained by their administration through their effect upon the brain, and incidentally the production of mental calm where unfavorable circumstances of disquietude exist at the time of copulation.

It generally is supposed that it is necessary for the semen to distend the prostatic sinus in order that orgasm may occur. This may be true of individuals who never have had an emission of semen, but that it is not true in general is shown by the fact that aspermics — *i. e.*, individuals who expel no semen whatever — sometimes have an orgasm as keenly pleasurable as that of a healthy individual. Thus, in one of the author's cases in which he removed a tuberculous testicle, the remaining epididymis subsequently became occluded from epididymitis and chronic thickening. There was, however, a restoration of previously impaired power, the patient having intercourse regularly and experiencing the normal amount of pleasure therein. Never since the involvement of the remaining epididymis, however, has he had an emission, even of prostatic fluid.

Duration of the Procreative Power.

The period of endurance of procreative vigor varies with the individual. It sometimes is preserved to very old age. It begins at puberty, growing more and more vigorous as time goes on, until maturity, when, if the subject has not indulged in vicious habits, the procreative power is at its height. It remains more or less stationary until middle life, when a gradual decline is noticed. From this time on, under physiologic conditions, the activity of the procreative power gradually wanes along with that of all the other bodily functions. Fertility probably wanes faster than physical capacity.

In normal women, physical capacity is coeval with life. Fertility begins with menstruation and ceases with the menopause.

The author recalls a very peculiar case occurring in the New York Charity Hospital showing that sexual congress may sometimes be carried on by the female under extreme difficulties:

Case.—A woman, 20 years of age, with complete atresia vaginæ, who, strange to say, nevertheless led the life of a public prostitute. The external parts were perfectly developed, but there was no opening whatever corresponding to the normal situation of the vagina. The case differed, too, from

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ordinary atresia, inasmuch as there was no thickened fibrous cord between the bladder and rectum such as is ordinarily met with in occlusion of the vagina, and which represents the walls of the canal that have become fused together. When the index finger of each hand was introduced into the bladder and rectum respectively nothing could be felt between them but the walls of these viscera. Neither uterus nor ovaries could be detected. How this woman copulated is a mystery. There was no evidence of pederasty. Whatever the circumstances may have been, the woman certainly was not aware of her condition, but supposed that she had been performing the act of copulation like other women. The urethra was very commodious, and it is possible that it had been utilized as a sexual way. Such cases have been reported.

It is safe to formulate the following cardinal principles for the laity, viz.:

1. Conservation of bodily vigor conserves procreative vigor. The better the care of the body, the better the likelihood of the procreative capacity being carried into the later years of life and the better the quality of children born.
2. Certain persons primarily are more virile than others. The standard must be individual.
3. Men of middle age or over, who expect as much of their procreative function as in early manhood, merely display their ignorance of physiology.
4. Men who have abused or excessively used their procreative function in youth and early manhood may expect to "pay the fiddler" at middle life. One cannot "eat his cake and have it."
5. The man who indulges to excess in alcoholics also may expect to "pay the price" sooner or later.
6. Persons who have had deep-seated gonorrhea or severe syphilis may expect early waning or absolute destruction of the procreative power.

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CHAPTER VIII.

Sterility and Impotence in the Female.

FERTILIZATION.—For the purposes of this volume the process of fertilization may be reduced to very simple terms. The conditions necessary are: 1st. The production of spermatozoa by the male and of an ovule by the female. 2nd. The discharge of the one from the testis and of the other from the ovary. 3rd. The contact in the female sexual tract of a single spermatozoön with an ovule; this probably usually occurs in the uterine end of the Fallopian tube. 4th. The chromosomes of both ovum and spermatozoön must be healthy. 5th. There must be no essential primary incompatibility of the ovule and the spermatozoön. 6th. The tubal and uterine mucosa must be normal, meaning that there must be no secretion of the membrane that is deleterious to the vitality of either ovum or spermatozoa, and no condition of the mucosa that will prevent lodgment and growth of the ovum.

It is evident that there are numerous conditions which may: 1st. Impair the primary vitality of the ovule and spermatozoön. 2nd. Prevent the meeting of the two elements at the proper time and place. 3rd. Impair the fitness of the soil in which the two elements meet.

It is obvious that nutritive perversion of the parental chromosomes and obstacles to their meeting may occur in either party to the sexual act.

Statistics show that about one in eight marriages are unproductive. As already seen, a portion of the responsibility for sterility must be borne by the male. Most of it, however, justly or unjustly,—unjustly, of course, where the fault is due to gonorrhea contracted from the husband—falls upon the female.

ETIOLOGY.—The causes of sterility in the female are very numerous. In general, they are as follows:

1. Inability to receive the semen. (Impotence from various causes.)

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2. Destruction of spermatozoa by morbid secretions of the female sexual tract.

3. Inherent or acquired resistancy to impregnation.

4. Failure to ovulate.

5. Inability to develop the ovum after fecundation.

Sterility in the female may be classified as:

1. Intrinsic or "facultative."
2. Relative, *e. g.*, one child sterility.
3. Artificial, *i. e.*, incidental to
   a. Surgical operation.
   b. Religious ceremony.
   c. Removal for social protection.
4. Accidental, *i. e.*, from disease or accident.

Etiology in detail:

Impotence, *i. e.*, mechanic obstruction to coitus.
Idiopathic vaginismus.
Inflammation of the sexual tract.
Uterine myoma; uterine prolapse, flexions and versions; lacerations, indurations and new growths and strictures of the cervix; congenital or acquired atresia and new growths of the vagina; imperforate hymen; infantile uterus, and undeveloped ovaries; dysmenorrhea; ovarian and pelvic tumors; stenosis of the Fallopian tubes; vulvar tumors and traumatisms; anchylosis of the hip joints.

These are the principal mechanic causes of sterility in women. Parotiditis with secondary infective inflammation and atrophy of the ovaries is an occasional cause inhibiting the production of the ovule.

Gonorrhea acts in the production of sterility in numerous ways, viz.: 1. Producing an unhealthy state of the mucosa of the vagina, uterus and tubes, which renders the soil unfit for the growth of the ovum. 2. Producing a toxic secretion which impairs the vitality of the ovule and spermatozoa or kills them completely. 3. Producing mechanic obstacles to coitus. 4. Producing mechanic obstruction within the utero-vaginal-tubal tract, thus preventing the downward passage of the ovum and the upward passage of the spermatozoa. 5. Producing pelvic peritonitis with adhesions which displace the ovary, tube or uterus—one or all—or constrict the tube. 6. Infecting and damaging the ovary.

The vitality of the ovule is impaired (*i. e.*, the quality and quantity of sex hormone produced in the ovary and supplied to the

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ovule are injuriously altered) by numerous constitutional conditions, such as primary lack of vitality on the part of the female, anemia and debility from any cause, and various toxemias, such as those produced by malaria, lead poisoning, mixed infection from tuberculosis, fevers, alcoholism and, most important of all, syphilis. Obesity produces debility as well as a mechanic obstacle to fertilization. Cross breeding, as of negro and white, lessens fertility and produces relative sterility. Consanguineous marriage is likely to have a similar effect, merely because of the fact that selective mating is not practiced. It is obvious that perverted hormone production may be secondary to any local disease of the sexual organs.

In some women the cause of sterility probably is a primary inherent incapacity for fertilization. It is to be remembered, however, that sterility in such cases may be only apparent, not real. Proper mating might correct it. That sterility may be hereditary seems at first sight to be something of an "Irish bull." Relative sterility, however, may be transmitted and eventually end in complete sterility.

The female most often fails to receive the semen from default upon her own part. Various local conditions may prevent her from having coitus. These conditions comprise such congenital or acquired malformations or imperfections of development as prevent penile intromission. In these rare cases the female is impotent as well as sterile. Impotence in the female may be due to incapacity for the complete performance of the sexual act. She may, however, nevertheless be capable both of insemination and impregnation.

Frigidity—*i. e.,* absence of sexual desire or aversion to its performance—and absence of orgasm constitute one variety of female "impotence." Many women never experience the slightest degree of voluptuous excitement during cohabitation, yet they are fruitful and bear children. It has been held that the erectile structures of the genital organs become turgid even in this class of cases, just as it occurs in the male, without orgasm; but this is doubtful. Orgasm is necessary to the normal performance of the sexual act in the female as well as in the male, and, while conception may occur without it, it is the exception rather than the rule, be the orgasm ever so slight. The orgasm in the female must subserve some physiologic purpose, which purpose must be the correlative of the orgasm in the male. The male orgasm being of an expulsive character, it follows

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that the female orgasm must be for the purpose of furthering the reception of the semen—possibly by favoring the formation and expulsion onto the surface of the cervical mucosa, of a secretion which favors vitality and activity of the spermatozoa.

Certain observers have described the peculiar behavior of the uterus during orgasm. The organ appears to assume a more perpendicular position, and sinks lower in the pelvis; the *os uteri* becomes softer; the "labia" of the uterus alternately project and retract in such a manner as to produce a "suction" effect. These phenomena are accompanied by the emission of a clear, sticky mucus. Granting the occurrence of these phenomena in the cases observed, they should occur in all cases where there is a normal orgasm and also to a greater or less degree in all females to whom sexual congress is in any degree pleasurable.

That more or less softening of the cervix and a flow of mucus occurs the author believes, beyond this he is skeptical.

Acton states that it is his belief that the majority of women do not experience sexual desire. He expresses his opinion as follows:

I should say that the majority of women (happily for society) are not very much troubled with sexual feeling of any kind. What men are habitually, women are only exceptionally. It is too true, I admit, as the divorce-courts show, that there are some few women who have sexual desires so strong that they surpass those of men, and shock public feeling by their consequences. I admit, of course, the existence of sexual excitement terminating even in nymphomania, a form of insanity that those accustomed to visit lunatic acylums are fully conversant with; but, with these sad exceptions, there can be no doubt that sexual feeling in the female is, in the majority of cases, in abeyance, and that it requires positive and considerable excitement to arouse it at all; and even if aroused (which in many instances it can never be) it is very moderate compared with that of the male. Many persons, and particularly young men, form their ideas of women's sensual feelings from what they notice early in life among loose, or, at least, low and vulgar women. There is always a certain number of females who, though not obtensibly in the ranks of prostitutes, make a kind of trade of a pretty face. They are fond of admiration, they like to attract the attention of those immediately above them. Any susceptible boy is easily lead to believe, whether he is altogether overcome by the siren or not, that she, and therefore all women, must have at least as strong passions as himself. Such women, however, give a very false idea of the condition of female sexual feeling in general. Association with the loose women of the London streets in casinos and other immoral haunts (who, if they have not sexual feeling, counterfeit it so well that the novice does not suspect but that it is genuine) seems to corroborate such an impression, and, as I have stated, it is from

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these erroneous notions that so many unmarried men think that the marital duties they will have to undertake are beyond their exhausted strength, and for this reason dread and avoid marriage.

Married men, medical men, or married women themselves would, if appealed to, tell a very different tale, and vindicate female nature from the vile aspersions cast on it by the abandoned conduct and ungoverned lusts of a few of its worst examples.

One would infer from Acton's opinion that frigidity is the normal and physiologic condition of the woman. While ready to accept the statement that a large proportion of married women do not experience sexual desire, the author does not believe that their frigidity is natural, but holds that it usually is due to mistreatment on the part of the husband. The average man when entering upon the matrimonial state gives very little consideration to the question of reciprocal pleasure. A virtuous woman primarily entertains an aversion for sexual intercourse, which is both unesthetic and painful in the beginning, and shrinks from it with becoming modesty and physical fear. This condition of mind usually is by no means improved by the conduct of the husband, whose sole idea is to obtain gratification, irrespective of the feelings of his wife. For a time he is perfectly satisfied with his matrimonial relations because of their novelty. As soon as this wears off, however, he begins to recall past experiences, and finds fault with his wife for her lack of reciprocity. By this time, unfortunately, the disgust and dread of the marital act that have been inspired by the brutality of the husband have become a part of the woman's very existence, and she usually is ever afterward absolutely frigid. Having become satiated and disgusted with the marriage-relation the husband is likely to seek elsewhere for that of which he has been deprived through his own mismanagement. It is the author's opinion that in most instances of frigidity in married women the difficulty would have been obviated and the woman would have become, after a time, perfectly natural in respect to the sexual function if the husband had been more intelligent and considerate. It is by no means the ex-*roué* alone who is open to impeachment. The inexperienced man often is more at fault, through ignorance, than the man of the world who, perhaps, has done more than his share in educating women in sexual love.

The old adage that "familiarity breeds contempt" is an excellent one as applied to matrimonial infelicity. The divorce-courts speak

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volumes with respect to inharmonious sexual relations of married persons. Ignorance on the part of the woman, brutality or ignorance on the part of the husband, and perhaps in some instances excessive indulgence on the part of both — this latter bringing satiety and physical ills in its train — are responsible for many of the cases that are brought all too prominently before the gaze of a patient and long-suffering public.

The prevalent custom of married people occupying the same bed is the cause of more instances of lack of harmony in sexual matters, and incidentally of more cases of sexual excess, than anything that could be mentioned. It certainly tends in many instances to lessen the mutual respect of married couples, and to pall the attractiveness of the matrimonial state. If married persons occupied separate apartments the novelty of matrimony would not be likely to wear away, and our divorce-courts would be shorn of a large proportion of their cases.

As already indicated, certain mental conditions modify the sexual passion in women. It certainly would be too much to expect a refined woman to be possessed of sufficient animal propensities to be able to display a genuine passion for one for whom she has an aversion. Once let a woman — however passionate naturally — experience a feeling of disgust or hatred for her husband, and it is probable that she could not exhibit genuine sexual passion if she would. It certainly is true that some women are extraordinarily passionate with certain individuals, while absolutely frigid with others. This is well illustrated in the case of the average prostitute, whose passion in her strictly-business relations is more often assumed than real, but who nevertheless usually has a favorite lover who certainly has no cause for complaint.

Apropos of inharmonious conjugal relations there is another circumstance that often explains the frigidity exhibited by married women. Many women are allowed to become mere household drudges, and become so exhausted physically that it is hardly fair for their husbands to expect any reciprocity upon their part. That the tendency of hard labor is to divert the nervous energies from the sexual apparatus is as true of the female as of the male.

Many women are restrained from the exhibition of sexual passion by the fear of conception, their apprehensions being aug-

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mented by the popular and to a certain extent justifiable notion that the danger of impregnation is proportionate to the amount of passion exhibited by the woman.

We have seen that, in order that impregnation may occur, it is necessary that living spermatozoa should come in contact with a mature healthy ovule at some point above the uterine cervico-corporeal junction, and further that there are many local conditions that prevent this meeting, even though the sexual act be normal. It must be understood that, while women under such circumstances are dynamically sterile, they are not potentially so.

The conditions that interfere with the normal development of the ovule are a *terra incognita* to science. It is probable that many immature ovules escape prematurely from healthy Graafian follicles from one cause or another. On the other hand, they may be devitalized by disease. In either event they are incapable of impregnation.

Defective or vitiated hormone supply may have much to do with primarily imperfect development of the ovule.

It is not necessary that the ovaries should be healthy, however, in order that conception may occur. Women with extensively diseased ovaries sometimes conceive and bear healthy children. If a single Graafian follicle be healthy and there is nothing to prevent the ovule and spermatozoa coming together, conception may occur. On the other hand, a healthy mature ovule may be formed, and many healthy ovules be discharged from the ovary from time to time, but fail to reach the uterine cavity. Inflammatory affections of the ovary involving thickening of the walls of the Graafian follicles may prevent healthy ovules from leaving. A healthy ovary may be so bound down by surrounding inflammation that the ovules cannot escape. Other conditions that are especially fatal to the physiologic purpose of the ovule are diseases of the Fallopian tubes, adhesions of the fimbriæ to the ovary, and uterine disease producing closure of the uterine extremities of the tubes.

Granting that conception has occurred, the uterus may be so diseased that it can not furnish a suitable *nidus* for the reception, attachment, and subsequent development of the ovum. The corporeal endometrium is a highly organized structure and often the seat of pathologic conditions. Gestation demands that it be healthy. Intra-uterine disease is so frequent, however, that good authorities consider it to be the cause of sterility. Women thus

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diseased are perfectly capable of conception; but, the uterine mucous membrane being unfitted for the attachment and development of the ovum, they practically are sterile.

Endometritis, the most common of intra-uterine diseases, bears a very important relation to sterility. It not only interferes with gestation, but the dense, glairy discharge it produces may, by plugging the cervical canal, not only obstruct the entrance of spermatozoa, but by its toxicity destroy or inhibit their vitality. Catarrhal states of the Fallopian tube often result from endometritis. The mucus it produces may so coat the ovule in its downward passage that the permatozoa either cannot penetrate it or else they are killed by its toxic properties.

There are numerous other etiologic conditions, some of which are symptomatically associated with those already mentioned. In 408 cases of sterility studied by Kammerer dysmenorrhea was observed in 69; menorrhagia and metrorrhagia in 57, scanty menstruation in 41, amenorrhea in 2, delayed menstruation in 8, hysteria in 16, nervous headache in 3, intercostal neuralgia in 1. Some of these derangements probably had no causal relation to the sterility, but depended on the same conditions as the latter.

A profuse uterine discharge, of whatever kind, may wash away the ovule before or after impregnation. Dysmenorrhea undoubtedly is a frequent cause of sterility. In the membranous form sterility is a matter of course. Dysmenorrhea is due to uterine or ovarian disease or to some obstruction to the free escape of the menses. It is attended, moreover, by spasmodic uterine contractions that may persist as a matter of habit, and cause the expulsion of the fecundated ovum. The same conditions that produce dysmenorrhea also prevent the spermatozoa from entering the uterus or destroy them after they have entered.

As already repeatedly indicated in this volume, the author believes that sterility in both sexes and impotence in the male are largely dependent upon aberrations of sex hormone secretion. This is important in the consideration of treatment.

This will be again referred to later.

Following Marion Sims, the profession in general, until comparatively recently, held that sterility in the female was almost entirely due to some cause of a mechanic nature intrinsic to the individual case, such as is induced by uterine displacement. Out of

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this fallacy grew two methods of treatment, viz., first, the Sims method of artificial fertilization — which never became popular, but recently has been revived in certain quarters, and, second, indiscriminate surgical tinkering with the uterus and its adnexa.

Increasing knowledge of the effects of gonorrhea have greatly modified our views of sterility. Especially have we found that morbidity of utero-vaginal secretions often is deadly to the healthiest spermatozoön. Acidity and, in general, toxicity of the secretions of the female sexual tract is very important in this regard.

In an excellent presentation of his method of diagnosis of sterility, Hühner says:

Treatment: It of course is pre-supposed that, in seeking the causes of sterility, the possible responsibility of the husband also has been investigated thoroughly. The treatment of sterility in the female demands: 1st. The surgical correction of any mechanical obstacles to fecundation. 2d. Attention to such constitutional conditions as apparently are contributory to the sterility. 3d. Such local measures as may be demanded for the cure of infections and the inflammatory conditions produced by infections. 4th. The removal or neutralization of any utero-vaginal discharges that may toxically impair the vitality of the spermatozoa or mechanically obstruct their upward passage. 5th. Attention to the time — relative to the menstrual period — at which coitus takes place. 6th. Correction of any untoward conditions that might impair fertility. 7th. Last, but not the least, the questions of: (*a*) Inherent incapacity for fecundation. (*b*) Marital physical incompatibility, must receive due attention.

Briefly, obstructions to intercourse or to the upward passage of the spermatozoa must be corrected. Infections — notably gonorrhea — should receive careful attention. Here, vaccines — and especially auto-vaccines —often are of great service.

The consideration of the various surgical measures of correcting pathologic conditions of the female genitalia is not within the province of this volume. So, too, with the treatment of gonorrhea and its results. Hühner's suggestion of coitus after modification of the utero-vaginal secretions has been accomplished by an alkaline douche is an excellent one, and has the merit of simplicity and safety.

Limitation of intercourse to the periods immediately preceding and following menstruation often overcomes apparent sterility.

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Uterine stimulation by simple dilation of the cervix sometimes is effective.

Intercourse after prolonged marital separation not infrequently results in impregnation.

Where sterility apparently is due to inherent incapacity for fertilization, or to sources of constitutional depravity and exhaustion, the sex gland hormone may be of value. *Corpus luteum* substance logically is indicated and possibly may be of service, especially if combined in debilitated conditions with tonics, such as arsenic, iron, quinine, strychnia and phosphorus. Where anemia is evident, arsenic and iron especially are indicated. The primary condition which lies behind the debility or cachexia, of course requires correction.

In conformity with his view that sterility revolves largely around aberrations of sex hormone supply, the author believes that, in the inherent form and that due to constitutional debility from non-malignant disease, or due to causes which are not incurable *per se*, sex gland implantation possibly may have a very important field. It is unnecessary to repeat here what already has been said of the relation of the sex hormone to fertility, or to forestall much that will be exhaustively considered in the next chapter.

Physical abuse — especially physical sexual abuse — may cause a permanent inhibition of sex hormone formation in women, with resultant permanent frigidity and perhaps sterility. It is true that such women may conceive, merely because there still may be enough hormone and its quality may be good enough to maintain the nutrition of the ovule and make conception possible. Here would be a direct indication for the administration of sex hormone, in the form of *corpus luteum* at least, if not by implantation of sex glands.

After conception, the psychic and circulatory stimulus afforded to maternal sex hormone supply, by the ovule itself, may be sufficient to insure the nutrition of the fetus. In many instances, however, hormone secretion might be so perverted that abortion would occur, or a defective child be born.

In connection with what seems to the author to be a very interesting field for speculation as to the importance of the nutritive rôle of the sex hormone, some important questions suggest themselves, viz.: 1. Is it not possible that the sex hormone of one sex may by

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implantation determine the sex of the progeny, if successfully administered before conception or, perhaps, even later? 2. Might not fertility be induced in the infertile by sex gland implantation? The birth of an heir may be of vital importance. 3. Might not alien hormone, administered via implantation early in pregnancy, possibly determine the development and birth of a normal instead of a still-born, or of a degenerate child? 4. Might not an implantation in one or both parents, by the action of the alien sex hormone, correct the evils of consanguineous marriage? 5. Might not derangement of a hereditary neuro-degenerate type be corrected during early life by implantation of alien sex glands? 6. Apropos of query No. 5, might not the influence of alien sex glands be even greater from a racial "cross," *e. g.*, of Aryan sex glands upon Semitic stock, or of Anglo-Saxon upon the Latin? That the principle might be too radically applied — *e. g.*, by cross implantation between negro and Caucasian — is suggested by the known deleterious results of cross breeding of white and black, and yet the sex hormone of the very fertile black, might add just the right element to the blood of the relatively infertile white, when administered by implantation.

The interest of the profession in the method of artificial impregnation first suggested by Marion Sims, recently has been revived in certain quarters. Sims was almost ostracized by the profession for suggesting the collection of the semen from the vagina of the wife immediately after intercourse and its injection into the uterus, thus overcoming the obstruction which, in Sims' day, was supposed to underlie most cases of sterility. Latterly it has been suggested that, where the husband's semen is infertile, a fresh condom specimen from extra-domestic sources should be used, where there are urgent reasons for child bearing. Needless to say that esthetic objections to the method often would be entertained to this, although it might be overruled in certain instances. It is obvious that the person donating the semen should be perfectly healthy. A series of Wassermann examinations and tests of the prostato-urethral secretions for gonococci are very essential. It is important, also, that the vitality of the spermatozoa should not be impaired when the specimen is delivered. Keeping the condom of semen in a water bath at blood temperature will protect the spermatozoa from impairment for some hours.

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CHAPTER IX.

Spermatorrhea.

FEW subjects in medical literature have been treated in so confusing a manner as has spermatorrhea by the few authors who have deigned to give it attention. The special treatises upon the subject by American writers have been limited in number, and authors in general have well-nigh ignored it. The subject formerly was so obnoxious, because of the treatises of quacks and impostors, that reputable physicians showed a somewhat excusable, but illogical, tendency to ignore it altogether. It is a remarkable fact that, until recent years, nearly all of our knowledge of the subject had been handed down from the classic, yet overdrawn, treatise of Lallemand: a work that has been extensively quoted — both the original and the English translation. Excellent monographs have, however, been written by Milton, Acton, Howe, Hammond, and Bartholow, the latter being devoted to spermatorrhea alone. More recently have appeared works by Taylor, Ultzmann, Vecki, Cooper and others, and numerous articles in text books and the medical press.

It is unfortunate that the reputable general practitioner knows so little of the pathology and treatment of the various phases of aberration of the sexual function included under the term spermatorrhea. As a rule, the physician takes little interest in the subject, probably because of the disrepute into which it has been brought by impostors and quacks; and, as a consequence, cases of this kind either consult the charlatan primarily or are driven to him by the indifference and repugnance exhibited by most reputable physicians. This course is not only unjust to the patient, but unworthy of the physician. No function of the body is more intimately associated with the welfare and happiness of the human race than that of the sexual organs, and the physician is no more justified in ignoring its

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disturbances or refusing to treat patients suffering from them than in the case of aberrations of structure and function of the stomach, liver, or kidneys. It is not at all remarkable that "spermatopathic" quacks flourish and wax fat, when the reputable physician by his neglect of a plain duty to humanity actually drives patients into their toils. It is unfortunately true, moreover, that a course of quackery usually produces a psychopathic condition that makes the patient insusceptible to either moral persuasion or medical treatment, should he finally fall into the hands of a scientific physician who is competent and willing to advise him.

The definition of spermatorrhea has given rise to considerable discussion. The majority of scientific authorities are not inclined to accept as spermatorrhea any case in which the loss of semen is attended by erection and ejaculation. Spermatorrhea as a steady flow of semen probably does not occur, as was formerly supposed. The seminal loss occurs only at intervals and under special conditions, largely mechanic in character.

It is evident that spermatorrhea was recognized by the ancients. Thus, under the name of *tabes dorsalis,* Hippocrates describes a condition that evidently is spermatorrhea, as follows:

> This disease proceeds from the spinal cord. It is frequently met with among newly-married people and libertines. There is no fever, the appetite is preserved, but the body falls away. If you interrogate the patients, they will tell you that they feel as if ants were crawling down along the spine. In making water or going to stool they pass semen. If they have connection the congress is fruitless. They lose semen in bed, whether they are troubled with lascivious dreams or not—they lose it on horseback or in walking. To epitomize, they find their breathing difficult; they fall into a state of feebleness, and suffer from weight in the head and a singing in the ears. If, in this condition, they become attacked with a strong fever, they die, with cold extremities.

Acton defines the disease as follows:

> The condition or ailment which we characterize as spermatorrhea is a state of enervation produced, at least primarily, by the loss of semen. This term, I admit, has many objections, but its general acceptance would render it inconvenient to alter it or to employ any other.

According to Bartholow, the term spermatorrhea should be restricted to that condition in which involuntary seminal losses occur with sufficient frequency to produce a definite morbid state.

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Many surgeons regard spermatorrhea as a loss of semen independently of intercourse or masturbation: *i. e.,* involuntary losses of all kinds. This interpretation of the term is objectionable because of its comprehensiveness. It necessarily embraces certain conditions in which involuntary emission of semen occurs as a perfectly physiologic phenomenon. Some authorities will not accept as spermatorrhea any case in which the discharge from the urethra does not contain spermatozoa, as demonstrated by microscopic examination. This is too sweeping, for in severe cases the formation of the seminal elements may finally cease, the other ingredients of the seminal secretion being normal or nearly so. According to the author's views, the term spermatorrhea should be applied to all involuntary seminal discharges that occur without orgasm.

Seminal losses with orgasm are most conveniently styled pseudospermatorrhea. The frequency of involuntary losses is no diagnostic criterion, for, while robust individuals might not be injured by two or three discharges weekly, delicate patients might be powerfully affected by a single weekly emission. In estimating the importance of involuntary emissions due consideration should be given to their effect upon the mind of the patient. For example, a patient who is ignorant of sexual physiology and has read quack literature extensively may be greatly depressed and worried by an emission occurring once in three or four weeks, while another less impressionable individual, who knows something of sexual physiology and has not had his mind poisoned by fallacious treatises, will bear several emissions weekly without apparent ill effects. The assertion has been made that nocturnal emissions are no more injurious in their effects upon the nervous system than similarly frequent acts of normal intercourse. The author does not believe this to be true. Whether or not the depression resulting in many patients from an occasional emission is altogether due to the moral impression produced by it is open to question, but certain it is that intelligent individuals with a knowledge of sexual physiology claim that such emissions are much more enervating than normal intercourse. They confessedly lack the physiologic stimulation and mental satisfaction of normal coitus. The lack of normal sex hormone production in the absence of proper psycho-sexual stimulus may be a factor in this.

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ETIOLOGY. — Lallemand's theory of the pathology of spermatorrhea implies the existence of irritation of the prostatic urethra and seminal ducts produced by various influences. He admits as causes of the disease gouty and rheumatic conditions of the sexual apparatus, gonorrhea and stricture, phimosis and accumulation of *smegma preputii,* masturbation and sexual excess, the excessive use of such drugs as cantharides, ergot and various diuretics, intemperance, excessive drinking of coffee and tea, constipation, irritation of the rectum from ascarides, hemorrhoids, fistula, *prolapsus ani,* etc. He claimed that in severe cases he had demonstrated upon autopsy inflammation and thickening, with sometimes ulceration of the vesiculæ seminales, ejaculatory ducts, and prostatic urethra. Recent investigations in the pathology of the seminal vesicles — and especially of the *colliculus seminalis* — vindicate Lallemand to a certain degree.

The author regards the essential condition in spermatorrhea as hyperesthesia and exhaustion — "irritable weakness" — of the general nervous supply of the genitalia, the special areas of sexual sensibility in the genitalia, the afferent nerves of sexual sensibility, the genito-spinal center, and the psycho-sexual centers in the brain. Hyperesthesia of the *caput gallinaginis* is a most important element, both in true and false spermatorrhea. There certainly is exhaustion and irritability of the nervous system, probably occurring in the following order: 1. Of the nerve-supply of the area of special sexual sensibility on the floor of the prostatic urethra. 2. Of the afferent nerves of sexual sensibility. 3. Of the transmitting fibers of the spinal cord. 4. Of the receiving centers of the brain. The final result is a greater or less loss of general nerve-tone; *i. e.,* neurasthenia. The author does not wish to imply that these effects are not more or less simultaneous, but that the serious results are likely to be manifested in the order named. Inasmuch as spermatorrhea in the majority of instances is the result of sexual excess or masturbation, and, moreover, the effects of the venereal orgasm being expended upon the nervous system, it is rational to infer that the disease when fully developed essentially is a neurosis. Bartholow expresses a similar view, which is in direct opposition to Lallemand. According to Bartholow, spermatorrhea is always a neurosis, and any structural alterations that may be found are coincidental, not

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causative. He asserts, moreover, that Lallemand's cases in which organic changes in the sexual organs were claimed as the essence of the disease, were selected for the purpose of justifying his theory and practice.

Sir Henry Thompson claims that sexual indulgence cannot have the effect of producing prostatitis — considered to be so important in the etiology of spermatorrhea by Lallemand — unless gonorrhea already exists. This *dictum,* however, the author cannot accept.

Peyer says:

> Spermatorrhea in itself is not a disease, as little as is fluor albus in the female sex, but is only a symptom of various pathologico-anatomic conditions, affecting either locally the seminal vesicles, their ducts, their muscles, and surrounding mucous membrane, or else resulting from general disturbances of the body, especially in the nervous system. The several nervous disorders that accompany spermatorrhea are mostly not its consequences, but co-ordinate symptoms of a pathologico-anatomic condition: the original cause of this loss of semen.

Granted that spermatorrhea is symptomatic in many cases, it is not necessarily symptomatic of the existing perceptible organic local conditions of the sexual organs. These conditions may exist coincidentally, often secondarily, and sometimes are produced by the same causes as are responsible for the spermatorrhea, the essential condition underlying the spermatorrhea being in the nervous system. It is a striking fact that spermatorrhea is very rare among the host of patients who consult the surgeon for prostatic and deep-urethral disease.

The most important local condition associated with spermatorrhea and pseudospermatorrhea is dilation and relaxation of the orifices of the ejaculatory ducts as a consequence of frequent overdistension. The *vesiculæ seminales* in the first instance become so hyperesthetic that they are intolerant of their contents. This intolerance, in combination with hyperesthesia and irritability of the *veru montanum,* results in frequent reflex expulsion of the semen. The orifices of the ejaculatory ducts finally become so dilated that the semen dribbles away at will. Such cases, however, are extremely rare. It is not the loss of fluid that produces debility at first, but the frequency of the discharge of nervous force — with perturbation of sex hormone production — which, as already indicated in connection with the subject of masturbation, is quite similar to that

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produced by an epileptic attack. As a consequence of frequently-recurring orgasm produced in sexual intercourse or by masturbation, the organs become so weak that the jolting produced by horseback-riding, or the strain incidental to gymnastic exercise, causes an emission. The author had under his observation a case of a young man who could not ride a trotting horse because of emissions occurring in rapid succession. So hyperesthetic are the sexual centers in many instances that the mere thought of sexual indulgence produces an emission, often without erection or sensation.

Prolonged sexual excitement without gratification is one of the frequent causes of the simpler forms of spermatorrhea. Undue familiarity with women, in combination with the fostering influences of immoral literature and associations, keeps up a constant irritation of the sexual organs that increases their sensibility and stimulates the secretion of semen. If the patient is not vicious or ignorant and does not masturbate, Nature is quite likely to relieve the condition of turgescence of the sexual organs by an emission during sleep. If the cause be not removed, the seat of sexual sensibility becomes very irritable, the organs meanwhile growing weaker until finally involuntary losses become extremely frequent. It will be observed that pseudospermatorrhea may merge into the true variety.

Lallemand divided seminal losses into nocturnal and diurnal, the nocturnal losses being frequent, physiologic, and due to sexual excitement, but becoming pathologic after a time in some instances because of their abnormal frequency. Some patients, he claimed, were subject to both diurnal and nocturnal escape of semen. Diurnal emissions, according to this authority, are much less frequent than those occurring at night, although they are more serious and more rebellious to treatment. They occur mostly without erection or ejaculation, during or just following the acts of defecation and micturition. The results, after the disease is well established, were described by Lallemand, as follows:

The penis becomes relaxed, the erection feeble. The corpora cavernosa either atrophy or their vessels lose tonicity; the corpus spongiosum and the glans penis also shrink. The testes undergo a certain degree of atrophy; the superficial veins of the penis become dilated and tortuous. The nervous system very often manifests sympathetic disturbances in the form of vertigo, pains along the course of the principal nerves, etc. The subjective symptoms, after a variable longer or shorter period, become very marked; there are pains in the lumbar region, aching in the arms and testes; capricious appetite

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and feeble digestion; the bowels become deranged, constipation alternating with diarrhea.

The evil habit of masturbation, if continued, produces great irritation of the procreative organs — especially of the seat of sexual sensibility in the prostatic urethra. Sensations originating in the seat of sexual sensibility are transferred to the psycho-sexual brain centers, producing erotic thoughts. Conversely, erotic thoughts are reflected to the seat of sexual sensibility in the form of voluptuous sensation. Under such conditions neither physical-sexual nor mental-sexual rest is possible, day or night. Erotic dreams result, with losses of seminal secretion. This may merge into true spermatorrhea, the morbid condition finally becoming so pronounced that with little or no provocation, losses occur in the day-time. In severe cases the seminal secretion sometimes escapes with the urine.

In the milder cases of erotic dreams and nocturnal losses the condition is absolutely physiologic. Such losses constitute Nature's method of disposing of excessive secretion. In subjects who previously have lived a regular sexual life in the matrimonial state, sexual deprivation produces the same result.

The specious advertisements of the charlatan concerning nocturnal losses are cunningly devised to impress the layman with the belief that all cases are alarming and lead to "lost manhood." The credulity and ignorance of the public in such matters have fattened generation after generation of those human wolves, the advertising quacks.

Etiology: The causes of erotic dreams and nocturnal losses are of two classes, viz.:

1. Those which produce erotic thoughts.
2. Those which produce irritability of the sexual organs, especially of the deep urethra and inflammation of the *colliculus seminalis.*

The first class comprises all environmental influences, both psychic and physical, which tend to produce hyperemia and hyperesthesia of (*a*) the seat of sexual sensibility in the prostatic urethra, (*b*) hyperactivity of the genito-spinal and cerebro-sexual centers.

The second class comprises masturbation, sexual excesses and infections; in brief, all conditions which directly produce hyperemia or inflammation of the generative organs or of the lower urinary tract. Obviously, gonorrhea is an important factor.

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It is obvious that the psychic and physical causes overlap or intermingle, in varying degree in all cases; *e. g.*, psycho-sexual stimulation gives rise to stimulation of the sexual organ centers, and vice versa.

Spermatorrhea sometimes is a symptom of nervous disease, particularly of the spinal cord. Thus, it is occasionally seen in locomotor ataxia. In conditions of this kind spermatorrhea is a secondary consideration and should be regarded as such with respect to treatment. In the majority of instances the disease is associated with complete or partial impotence. The milder types of pseudospermatorrhea are quite likely to be associated with pseudo-impotence because of the effect of the nocturnal emissions upon the mind, rather than upon the virility of the patient *per se*.

Numerous local diseases of the urino-sexual organs have been mistaken for spermatorrhea, affording abundant material upon which the patient's mental distemper is fed by the quacks.

Besides nocturnal emissions, the organic affections and functional perturbations that are most often erroneously termed spermatorrhea are: chronic urethral catarrh, stricture with accompanying gleet, prostatorrhea, premature ejaculation of semen, vesical catarrh, and phosphaturia. Phosphaturia and prostatorrhea have been a veritable gold mine for the charlatan.

VARIETIES OF TRUE SPERMATORRHEA. — 1. Diurnal emissions without erections or sexual stimulation of any kind.

2. Frequent nocturnal emissions without sensation or power: *i. e.*, escape of semen with neither pleasurable sensations, dreams, nor erections.

3. Escape of semen on slight provocation without erection, or, at most, with imperfect erection.

These varieties, in a measure, may be associated. Usually where there are diurnal losses there also are unconscious losses at night. All varieties usually are associated with complete or partial impotence. Prostatorrhea may co-exist.

VARIETIES OF PSEUDOSPERMATORRHEA. — 1. Occasional nocturnal emissions, with orgasm, usually with dreams, and almost always accompanied by erections. There usually are no injurious effects except, perhaps, those of a mental character. In some cases, however, the various disturbances outlined in the symptomatology of true and false spermatorrhea result.

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2. Premature ejaculation in coitus, associated with pseudo-impotence ("spermatospasmos").



Microscopic appearance of normal human semen. *a*, Spermatozoids. *b*, Columnar epithelium. *c*, Bodies inclosing lecithin-granules. *d*, Squamous epithelium from the urethra. *d*, Testicle-cells. *e*, Amyloid corpuscles. *f*, Spermatic crystals. *g*, Hyaline globules.

3. Prostatorrhea { (*a*) From prostatic hyperemia and hypersecretion. (*b*) From follicular prostatitis.

4. Hypersecretion of the urethral and prostatic glands during erection.

5. The appearance of spermatozoids in the urine after erections, coitus, etc.

6. Discharge of semen during a very difficult stool.

7. Discharge from chronic urethral catarrh.

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TABULATED ETIOLOGY OF SPERMATORRHEA AND PSEUDOSPERMATORRHEA.

Predisposing causes

General

(*a*) Defective will-power and unstable nervous equilibrium.
(*b*) Effeminate and defective physique.
(*c*) Hereditary inordinate sexual desire.
(*d*) Mental influences exciting sexual desire; *e.g.*, erotic novels, pictures, and stories.
(*e*) Evil associations and example.
(*f*) Freedom from restraint in associating with the opposite sex.
(*g*) Excesses in eating and drinking.

Local

(*a*) Precocious development of the sexual organs and function.
(*b*) Maldevelopment of sexual organs, such as hypospadias and phimosis. Imperfectly developed and weak testes.
(*c*) Acquired conditions of disease, such as phimosis, stricture, urethritis, prostatic congestion and inflammation, cystitis, stone in the bladder, colliculitis, seminal vesiculitis, balanitis, herpes, and constipation.
(*d*) Reflex irritation from hemorrhoids, ascarides, fistula, etc.
(*e*) Varicocele.

Exciting causes

(*a*) Masturbation.
(*b*) Sexual excesses.
(*c*) Cerebro-spinal disease and injuries.
(*d*) Infection (gonorrhea, etc.).

SYMPTOMS OF SPERMATORRHEA AND PSEUDOSPERMATORRHEA. — The line of demarkation between true and false spermatorrhea is determined by the occurrence or absence of erection and orgasm at the time the emissions of semen occur. Aside from this difference the symptoms of the true and false varieties are the same, differing in degree only. It of course is understood that an exception is made of those rare cases in which seminal losses are the result of cerebro-spinal disease — as sometimes seen in locomotor ataxia.

Local Symptoms. — A sense of weight and dragging in the testes and spermatic cords; sensitiveness and perhaps neuralgia of the testes, urethra, and cords; relative smallness and softness of the testes, pendulous scrotum, congestion of the pampiniform plexus, —

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often amounting to varicocele, — dilation of the superficial veins of the penis and relative diminution in size of the organ, the veins of which are distinctly enlarged, coldness and loss of sensibility of the penis, and, most important of all, the escape of semen at stool or with the urine, or as a result of erotic dreams or sexual excitement. On examination the entire urethra, prostate, and especially the prostatic urethra, almost uniformly are very sensitive. Partial or complete impotence is usual. It is to be remembered that none of the foregoing symptoms are characteristic; neither are they of importance, so far as spermatorrhea is concerned, unless involuntary seminal discharges without orgasm co-exist. The semen is abnormally constituted, being thin, and more or less watery. It often is scanty in amount. The spermatozoa are relatively few in number, inactive, and poorly developed (oligospermia). In extreme cases spermatozoa may be absent — azoöspermia.

General Symptoms. — There is more or less disturbance of the sympathetic nervous system, as evidenced by capricious appetite, impaired digestion, constipation, or diarrhea. Pain in the back, headache, and neuralgias in various situations, gastralgia, and abdominal pain are not unusual. The headache usually is occipitofrontal, and sometimes associated with more or less marked vertigo or a sense of cerebral fullness. The skin usually is sallow and pale, or muddy. Acne is plentiful in young subjects. The facial expression is one of care and anxiety, or of deep melancholy. The subject is morbidly self-conscious and inclined to shun companionship. Profound mental depression with failure of memory and loss of the power of concentration usually are prominent symptoms. The patient acquires the habit of introspection and becomes extremely hypochondriac. His genius for the invention of symptoms, fostered as it usually is by reading quack literature, becomes phenomenal. Insanity perhaps is rare, but suicidal mania occasionally is seen. Thoughts of suicide are a choice intellectual morsel with a large proportion of these patients, but the real suicidal intent is generally lacking. Many such patients come to regard thoughts of suicide as a mild sort of dissipation which, perhaps, makes their melancholy more tolerable. The knowledge that there is a final way out of their troubles — although they are not in the least inclined to take advantage of it — is in the highest degree comforting to some spermatorrheic or spermatophobiac patients.

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The circulation generally is feeble in spermatorrhea. Coldness of the feet and hands often is complained of, and the pulse is likely to be irritable and either quick and feeble or irregular. Lithemia is a frequent concomitant of the disease. Phosphaturia and oxaluria very frequently are met with in spermatorrhea, oxaluria being especially frequent. The lumbar pain so often met with is not uncommonly due to oxaluria, rather than to the sexual derangement *per se*.

Many spermatorrheics complain of disturbed or failing vision. Blurring or spots before the eyes — *muscæ volitantes* — are the most frequent sources of complaint.

The most important varieties of pseudospermatorrhea, so far as their liability to be mistaken for true spermatorrhea is concerned, are characterized by the escape of semen-like fluid from the urethra (*a*) at stool (*b*) with the last straining effort of micturition, or (*c*) during or after sexual excitement, either with or without erection. Bartholow remarks upon this point as follows:

> After every erection without ejaculation there is a mucous flow from the urethra. A mixture of this with the semen produces the so-called watery semen. The same discharge is often observed after urination and defecation. It alarms the patient because he believes that it is seminal. These are the cases to which M. Lallemand applies the term "diurnal pollution." If a proper examination of this fluid be made, it will be found not to contain spermatozoa. It is a thick, transparent albuminous fluid, alkaline in reaction. The presence of spermatozoa is essential to prove the existence of semen. No other test is applicable than the microscopic. It cannot be denied that spermatozoa may be found in the urine or mucous secretion from the urethra, if a nocturnal emission, or an emission produced by natural or unnatural means, has recently occurred; but these fluids should be examined, when this source of error may be eliminated.

This accords with the views of Flint, who long ago said:

> In most of these cases the fluid is either the liquor prostaticus or a secretion from the vesiculæ seminales. The microscope affords the only mode of determining that the fluid is seminal. Were this mode of examination generally adopted, cases of spermatorrhea would be extremely rare.

Hassell, in one of the early editions of his work on the urine, says:

> Care must be taken not to confound the discharge of urethral gleet with seminal fluid; the distinction is easy, since the former is distinguished by the presence of infusoria, by the presence of scaly epithelium, and by the escape's being, in general, continuous. Sometimes the gleety discharge occurs only after sexual excitement and lasts but for a short time, when, of course,

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its character is more likely to be mistaken. The prostatic fluid also might be mistaken for semen; in this the spermatozoa also would be absent, and, in addition, the microscope would reveal in it the presence of the prostatic cylinders, and perhaps, also, of the peculiar lamellated concretions of phosphate of lime, which are found in the prostate in such numbers. Like the mucus from ordinary gleet, that from the prostate may also be continuous, but more frequently it appears only after violent efforts of defecation, when



Spermuria. Last drop of urine expelled in a case of spermatorrhea.

a small quantity of matter may be expressed, forming only a drop or two, of a thick, stringy, and transparent fluid, which appears at the orifice of the urethra.

It is easy to mistake the discharge of chronic urethral cartarrh for semen. This mistake does not often occur, however, for the experienced man with past gonorrheal troubles usually does not attribute his discharge to any but the real cause. A moment's reflection is sufficient to show that there is abundant room for mistakes in the microscopic diagnosis of urethral discharges. The prostatic, urethral, and Cowper's glands are prodigal in secretion, and slight stimuli or mechanic pressure often are sufficient to cause the secre-

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tion to appear at the meatus. Bladder-mucus or muco-pus, and phosphatic deposit in the urine, also are sources of error. It must be remembered, however, that in genuine spermatorrhea sexual excitement and mechanic pressure may cause true seminal discharge, which may at once appear at the meatus, or pass backward to appear later in the urine. Whenever true semen appears at the meatus without orgasm, the author believes that the function of the muscular urethra temporarily is inhibited, or overcome by prostatic pressure, or else orgasm occurs, but is too feeble to be perceptible to the patient's weakened sensorium.

Symptomatic spermatorrhea in central nervous disease requires brief special consideration. As might be inferred from the fact that sexual excesses and masturbation bear an important etiologic relation to locomotor ataxia, spermatorrhea is associated with that form of nervous disease more often than with any other. In passing, the author desires to express the opinion that, notwithstanding the fact that sexual abuses often are a very important factor in tabetic etiology, it is very doubtful if such influences alone ever cause tabes. Primary predisposition, — often involving heredity, — syphilis, alcoholism, and nervous overstrain, one or all, are likely to co-operate with faulty sexual hygiene, which becomes, therefore, merely a contributory cause, albeit an important one. The author believes, with most syphilographers, that tabes primarily always is due to syphilis— hereditary or acquired, usually the latter.

Sexual phenomena in tabes usually develop in the early stage of the disease. Meryon, Trousseau, Duchenne, Topinard, and, later, Bartholow are a few of the prominent writers who have called attention to these symptoms. Topinard speaks as follows:

> Four symptoms present themselves: spermatorrhea, satyriasis, anaphrodisia, and impotence. The first occurs among the most remote antecedents of the first period of tabes, throughout which it continues. The nocturnal pollutions, at first accompanied by erections and a sensation of pleasure, at last become passive. After the spermatorrhea, or without having been preceded by it, there occur, after some months or years, progressive diminution of desire, difficulty in procuring satisfaction, and at last absolute impotence.

Topinard mentions a case of ataxia in which the patient for thirty years was tortured by priapism so obstinate as to yield only to large and increasing doses of opium. This is rare; sexual atony is the rule.

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Among other neuropathic disorders in which spermatorrhea often occurs as a symptom may be mentioned neurasthenia from various causes; tumors and other diseases of the pons, medulla, and especially of the cerebellum; inflammation, tumors, and syphilis of the spinal cord; epilepsy, certain phases of insanity, and diabetes mellitus.

With reference to the diagnosis and relative importance of symptomatic spermatorrhea, Bartholow says:

> In all cases in which the involuntary loss is a symptom it is of little consequence from the therapeutic point of view: the centric lesion, of which it is a sign, is the point of importance to which our attention should be directed.
>
> That the spermatorrhea is a symptom merely should be easily determined by reference to the accompanying lesions. There will be present evidences of degenerative changes in the great vessels, in the fundus oculi, in the organs of special sense, and in cerebro-spinal centers. As a rule, spermatorrhea as a substantive affection occurs in the young, in men at the most vigorous period of life, and is a result of the abuse of the sexual organs. On the other hand, spermatorrhea as a symptom appears after the middle period of life, during the decline of sexual activity, and coincidently with symptoms indicating lesions of the cerebro-spinal apparatus. When spermatorrhea is a symptom, the important centric lesions on which it depends soon manifest themselves by other and more characteristic signs, whereas when spermatorrhea is a disease the case remains in very much the same state for months or even years. Attention to these points hardly can fail to conduct the examination to a correct conclusion.

Because of its relative frequency, pseudospermatorrhea, while really of slight pathologic importance, is of greater clinical moment than the genuine form. The psychic effects of spermatophobia are so numerous and varied, and so magnified by the imagination of its victims, that the ingenuity and breadth of mind of the physician often are sorely taxed in the management of such cases. While inexcusable, it is, in a way, hardly remarkable that most physicians are content with a *laissez faire* policy in dealing with spermatophobiacs. Conscious that the patient is suffering with ailments which, from an organic standpoint, are *maladies imaginaires,* the medical man feels justified in "pooh-poohing" his patient's tale of woe which, baseless though it is, is yet sufficiently unutterable to the sufferer. The lack of an organic foundation renders the symptoms none the less prominent. Pseudo-impotency is often regarded as a fitting subject for jest on the physician's part, but, to the patient,

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the absence of erection, or the presence of other conditions that render successful copulation impossible, is terribly real. Each and every symptom, therefore, merits consideration — as a beginning of suggestive therapy, if nothing more.

The spermatophobiac invariably becomes extremely hypochondriac and practices introspection with a zeal that is worthy of a better cause. The slightest sensation of a subjective character, which, by persons of a normal psychic condition, would either be ignored or attributed to some rational cause, is attributed by the sufferer from pseudospermatorrhea to seminal losses. Should he perchance discover in addition to an occasional emission a little cloudiness of the urine, or a slight discharge at the meatus, during sexual excitement, after micturition or during a difficult stool, his worst fears are confirmed and he believes himself a victim of the worst imaginable type of spermatorrhea. Should he have any remaining doubts as to the diagnosis they are dispelled by the first chance bit of quack literature that he peruses. And peruse quack literature he will, as the only possible source of enlightenment upon sexual matters. Reliable information — indeed, the simplest physiologic truth — often is denied him because of the hide-bound condition of an ultra-ethical and, if the truth were known, often essentially hypocritic profession. The author is aware that the foregoing statement has a decidedly radical flavor, but he has, nevertheless, no hesitancy in expressing the view that some phases of so-called medical ethics are positively sickening.

The symptomatology constructed by spermatophobiacs is best appreciated by perusal of their correspondence. It is as historians of their own cases that these patients especially distinguish themselves. All experienced neurologists and urologists will at once recognize the type shown in the following letter received by the author:

My Dear Doctor:

You will doubtless be surprised to receive a letter from me so soon after the consultation of yesterday; but, on reflection, I fear that I gave you a very meager account of a case which seems to me much more serious than you realize, judging from the advice you gave me to "stop studying my symptoms and cultivate a spirit of indifference toward my numerous sensations." I therefore take the liberty of writing my symptoms more in detail:—

The state of my mind is, perhaps, more important than anything else. As I told you, I dread getting among people, no matter how congenial they

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may be; but I did not tell you the chief reason for my aversion to society. I am sure that my appearance betrays my condition, and many times I know from the queer way in which people look at me while talking with each other that they are discussing my ailment. Imagine my feelings, if you can. Of course, my confusion settles all possible doubt in their minds as to the correctness of their conclusions. I am positive, also, that the horrible odor of which I spoke to you really does come from the affected parts, and is so plain that he who runs may read. At the times when I detect the odor, the parts seem bathed in a cold, clammy sweat, though the skin does not feel wet. I have frequent spells of ringing in the ears, and sometimes snapping sounds with some pain that must be in my ear-drums. Just before meals I am dizzy, and this cames on just from hearing dinner announced. I notice that the spots before my eyes come only in daylight and are plainer on cloudy days. I am sure my hair is getting very thin and it seems very oily at times, and at such times the scalp is hot and tingling. Almost always, after meals, there is a full feeling in my stomach and bowels, and my breath seems like the odor of tobacco, though I do not use it. I get very much depressed at times and feel like suicide. I did not tell you this, but it is a fact. If I did not hope that medical science has some cure for my terrible disease I doubtless would make away with myself ere long. I wish that at my next visit to you you would examine my rectum. I am sure there is something wrong there, for just before and after my bowels move I feel a peculiar crawling sensation that starts just at the opening of the bowel and passes along the stride into the testicles. I notice, too, that these organs—the testicles—are sometimes drawn up tightly and at other times hang quite low, the left one actually dragging at times. I have frequent palpitations, as I told you, but perhaps I did not tell you that at such times there is a strange tickling and fluttering feeling at my heart which has a tendency to cause a sense of suffocation. I think that I have given you the most important symptoms that have occurred to me as being necessary to give you besides those I told you of yesterday, but, if you do not mind, I will bring a full written list of all of them the next time I come, which will assist you a great deal in the treatment of the case.

Very truly yours,

This patient did indeed present a complete list of his symptoms. It covered eight pages of foolscap.

TREATMENT. — *General Considerations.* — In considering the therapeutics of spermatorrhea a knowledge of the relations of the involuntary seminal discharges to various organic and functional disturbances of the sexual organs or nervous system — or both — is of paramount importance. A knowledge of the pathologic conditions underlying seminal losses is especially valuable in assigning to spermatorrhea its proper rôle — that of a symptom. Understanding the symptomatic character of involuntary seminal losses, the physician

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is not likely to overrate the importance of certain very common cases in which the involuntary discharges constitute but little, if any, departure from the strictly physiologic. If, however, he labors under the erroneous impression that the disease-entity consists merely in involuntary discharges of semen, he is likely to be unnecessarily alarmed, and, what is worse, he is likely to seriously alarm his patient. In true spermatorrhea it is to be remembered that, while the disease essentially is a neurosis — according to the author's view — there often are associated with the neurosis pathologic conditions of the genito-urinary system that demand attention. These pathologic changes may have arisen coincidently with the neurosis — being produced by the same causes — or they may either precede or follow the neurosis — being due to causes absolutely independent of those producing the latter. No matter what relation pathologic changes in the genito-urinary system may bear to spermatorrhea, no form of treatment is likely to be successful that does not aim not only at the correction of the essential neuropathic condition, but also at the removal of co-existing local derangements. Thus, while, in the author's opinion, deep-seated gonorrheal infection does not often cause true spermatorrhea, it may co-exist with, and constitute a very important and obstinate factor in the perpetuation of that disease. An intelligent therapy of spermatorrhea necessarily must comprehend proper treatment for the conditions produced by the deep infection, whatever such conditions may be.

The majority of cases of pseudospermatorrhea are due to conditions that essentially, if not absolutely, are physiologic. This has come to be generally accepted by reputable physicians. Unfortunately, however, it too often has been taken for granted that the patient is quite as well balanced mentally, or should be quite as well balanced mentally, and should be quite as well versed in the principles of physiology, as his medical adviser. When a youth, perhaps barely past puberty, immature of mental development, and unstable of nervous system — to say nothing of the melancholy and hypochondriasis produced by ungratified sexual desire and brooding over an imaginary spermatorrhea — presents himself to the average reputable practioner, he is either laughed at for his ignorance or informed that his case is not worthy of serious consideration. He rarely is convinced, however, that his case is deserving of ridicule, still less

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that his symptoms are "trifles light as air." On the contrary, he becomes convinced that his case is either more serious or offensive than his physician cares to undertake, or else that the derision aroused by his tale of woe is merely a subterfuge to conceal medical ignorance. Should he chance to consult with a lay friend, more experienced than himself, he is informed that, from esthetic motives, ordinary physicians object to treating, or even studying, such important and serious cases as his own. The quack, that court of last resort for the ignorant and incurable, is suggested and finally appealed to.

The author has no hesitancy in asserting that the reputable profession itself is largely responsible for the opulence and indisputable power of the quack. Would it not be better to employ the same psychic instability that is utilized by the quack for the purpose of alarming the patient and preying upon his fears, in an honest endeavor to correct his psychopathic state? Therapeutic suggestion, honestly — which means scientifically — used will relieve most cases of pseudospermatorrhea, both psychically and physically, and keep them out of the hands of the vultures that find in such patients their most lucrative victims. The patient should be given to understand primarily that, while his case demands attention, it is by no means so serious as he supposes and readily will yield to treatment. He should be instructed in sexual physiology, but not expected to become an adept in one lesson. Such organic or functional disturbances as may have a bearing upon his symptoms demand careful attention. Oftentimes regulation of the diet, attention to the bowels, and the passage of the cold sound a few times will lessen the frequency of emissions which the practitioner pronounces off-hand, physiologic. If, in the meantime, the patient's confidence has been gained and proper psychic control attained, the result is likely to be all that could be desired. There are very few spermatophobiacs who do not demand careful attention, for, no matter how trivial the sexual derangement *per se,* the patient's psychic state is such as to make his ailments terribly real to him. The author takes this opportunity of saying that in his opinion the neglect of the profession to do its full duty in such cases is responsible for much suffering — both mental and physical. It is, of course, understood that there are occasional cases in which a perfectly healthy subject consults the

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physician regarding infrequent emissions the significance of which the patient does not understand and whom it is perfectly safe to dismiss with a few words of instruction in sexual physiology. It is to be remembered, however, that the practitioner is not often consulted until the patient has developed a psychopathic state that demands the most judicious management.

Prophylaxis. — Subservience to the rules of sexual hygiene is preventive of both pseudospermatorrhea and real spermatorrhea, save in exceptional instances where the seminal losses are symptomatic of, or secondary to, debilitating general diseases or lesions of the nervous system. Even in the case of locomotor ataxia, however, it is to be remarked that proper sexual habits may be prophylactic, for it is probable that sexual excesses bear a very important etiologic relation to that disease. The various features of genito-urinary and sexual hygiene have received special attention in the chapters upon impotence, sterility, and masturbation. The cure of local organic disturbances of the sexual organs obviously is prophylactic of spermatorrhea.

Special Treatment. — In considering the treatment of pseudospermatorrhea it is well to remember that in the form characterized by more or less frequent involuntary emissions the frequency of their occurrence is not the sole criterion of their importance. The important point is the degree of tolerance of the emissions. Just as some individuals may copulate very frequently without apparent harm, certain plethoric subjects may apparently tolerate involuntary emissions that would produce most disastrous results in feebler subjects. It is to be remarked, however, that frequent emissions in themselves are usually a sign of disturbed innervation both of the sexual organs and general nervous system, or of some local source of reflex irritation. Before deciding the question of the necessity of treatment, even in apparently slight cases, it is wise to ascertain the condition of the sexual organs. The emissions may be a symptom of local disturbance of a congestive or inflammatory character that later on may cause serious trouble, but which may be readily relieved by proper early attention.

By far the most important measure of general treatment in the class of subjects seeking advice in pseudospermatorrhea is physical training. With careful development of the muscular system will

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come improvement in nervous tone, both general and local. Exercise should, so far as possible, be taken in the open air, although field-sports should be aided by proper gymnastic training to secure general and symmetric muscular development. Exercises involving pressure or strain upon the perineum should be avoided, as a rule. Climbing, bicycling, and horseback-riding are especially pernicious. The cold bath or cold shower — very cautiously used at first — constitutes an auxiliary measure of great value. The baths should not be prolonged — stimulation, not sedation or refrigeration, is desired — and should be followed by brisk toweling, or rubbing, either with the hands of an attendant or by means of a flesh-brush wielded by the patient himself. The functions of the kidney and bowel, and especially of the stomach, demand attention in all cases of sexual disturbance. Constipation and excesses or indiscretions in eating and drinking are particularly to be avoided. Sexual rest — both psychic and physical — is indispensable, save in certain cases where matrimony is advisable, either primarily, or after a suitable course of treatment.

It is not, as a rule, difficult to elicit a history of the usual cause of spermatorrhea — masturbation — in most cases. The patient's frankness, however, often has a limit. He alludes to the habit of masturbation in the past tense, and forgets to inform the physician that he has not yet discontinued the practice. If the inquiry be pressed closely, he usually lies outright. It has been the author's experience, however, that a large proportion of such patients eventually can be induced to betray themselves. A popular method of deceiving the physician is to inform him that masturbation is performed unconsciously during sleep. This is a possible, but unquestionably rare, occurrence.

A very valuable method of diminishing the frequency of seminal emissions is sleeping upon a hard and uncomfortable bed. Patients occasionally discover this for themselves. Several patients of the author's have derived excellent results from sleeping upon the floor. A hard mattress is often effective. Physical discomfort and erotism are somewhat incompatible, and the patient whose bones and muscles are aching from a vain effort to find comfortable and luxurious repose is not very likely to be disturbed by lascivious dreams. A few weeks of this practice will often break up the emission-habit. Light

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and relatively cool covering is advantageous. In a general way, the tendency to nocturnal emissions is directly proportionate to the luxuriousness and warmth of the bed.

Certain mechanic appliances have been used to break up the emission-habit. The most effective of these is the so-called "spermatorrhea-ring." Although originally a quack device, this appliance often is successful. It consists of a double ring adapted to the circumference of the penis when flaccid. The inner or elastic ring holds the appliance *in situ* after it has been slipped upon the penis, while the outer ring, which is provided with moderately sharp metallic serrations, inflicts punishment upon the member whenever it chances to become erect. The ring is to be applied at night and, as a rule, if an erection occurs the patient is immediately awakened—before an emission can take place. In some cases erection and emission occur despite the appliance. In true spermatorrhea such devices are ineffective. A very ingenious device is a similar appliance connected with a small battery placed beneath the patient's pillow. An erection completes the circuit and causes a small alarm bell to ring, awakening the patient and thus forestalling emission.

Any plan that will serve to interrupt the emission-habit is likely to be successful. It has been noted that the dorsal decubitus favors emissions, theoretically because in this position there is a determination of blood to the genito-spinal center—relative hyperemia—with consequent heightening of reflex sensibility.

In many cases the patient rarely, if ever, has an emission while lying upon his side. Under such circumstances a towel tied about the body in such a manner that the knot rests in the middle of the back, often serves to awaken the patient or make him so uncomfortable that he instinctively and unconsciously avoids the dorsal decubitus. In some cases the patient has emissions only while lying upon one or the other side. Changing to the opposite side is often effectual under such circumstances.

In cases in which the patient fosters emissions by handling the genitals during sleep, the author has advised the patient to wear a pair of ordinary boxing-gloves at night. This simple device renders manual manipulation of the genitalia quite difficult.

In all forms of spermatorrhea complicated by chronic congestion or inflammation of the prostate or — as is frequently the case — by chronic inflammation of the *vesiculae seminales,* the most impor-

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tant measure of treatment is massage, performed by the finger of the surgeon *via* the rectum. Instruments have been devised for the performance of prostatic and vesicular massage, but digital massage is the only safe, intelligent and reliable method. Considerable experience is, moreover, necessary to the proper performance of the massage. The surgeon with short stubby fingers often merely wastes his time in attempting to perform this manipulation, which is in itself sufficiently simple.

Aphrodisiac remedies, like those of an opposite character, are used far too recklessly in the impotence accompanying spermatorrhea. This is natural enough, considering (1) that the profession in general overrates the potency of this class of remedies, and (2) the imperative demand of the patient to be relieved of the sexual incapacity that often exists in pseudospermatorrhea and almost always in true spermatorrhea.

In the author's opinion there is no class of remedies so fallacious as the aphrodisiacs. Erections produced to meet emergencies by large doses of aphrodisiac drugs are pathologic, and inevitably followed by a reactionary depression which makes the patient's sexual powers more unreliable than ever, to say nothing of the local irritation produced by the action of such drugs upon the genito-urinary mucosa. In moderate doses, however, with a clear understanding of their tonic rather than their aphrodisiac properties, there are a number of drugs that have a markedly beneficial effect in all forms of sexual debility, whether characterized by spermatorrhea or not. Of these drugs, phosphorus is the most reliable, where tolerated by the stomach. It is best given in the pure state in pill form, but the dilute phosphoric acid, the phosphid of zinc, and the hypophosphites are quite serviceable. Nux vomica or strychnia and its preparations come next in order, and may be advantageously combined with phosphorus. Ergot also is useful as tending to restore muscular and vascular tone to the genital apparatus. It also tends to the correction of nervous hyperactivity of all kinds, and is too seldom employed with this object in view.

The most overrated remedy for diseases of the sexual apparatus is damiana. That this drug has a tonic effect in spermatorrhea and sexual debility in general is true, but as an aphrodisiac it is an arrant fraud. In general, it is inferior to strychnia. The drug should be

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given in liberal doses—2 to 5 grains of its solid or 1 to 2 drams of the fluid extract three or four times daily.

Cantharides is the most popular of all remedies of the aphrodisiac class. It has been the basis of "love-philters" from time immemorial. Its true worth, however, can be summed up in very few words. As an aphrodisiac it is not only unreliable, but such results as may be obtained by large doses are pathologic, and therefore dangerous. Given in rational doses as a tonic, it is serviceable to a moderate degree. It seemingly has a general tonic effect, and in addition a somewhat stimulating action upon the nerves of sexual sensibility and the genito-spinal center. A marked degree of sexual stimulation never is to be obtained save by dangerously large doses. Nor is the drug always reliable in producing in rational doses even a mild degree of stimulation of the sexual apparatus. It has been claimed—and it must be confessed with some reason—that cantharide acts locally only by virtue of its directly irritant action upon the genito-urinary mucosa *via* the urine. If this be true, any stimulating effect upon the genito-spinal center must be produced reflexly. The possibility of the drug's acting by virtue of an irritant effect upon the mucous surfaces of the genito-urinary tract should impose additional caution in its administration where inflammatory or congestive conditions of the sexual organs exist. A dose of more than 20 minims of the tincture rarely should be exceeded, although by increasing one minim daily, as suggested in the preceding chapter, this dose sometimes may be exceeded.

When malformations of the sexual organs exist they should be corrected by surgical measures so far as possible. Phimosis and meatal stenosis demand attention with especial frequency. The various other conditions already enumerated under the head of predisposing causes should be sought for, and if found should receive appropriate surgical treatment. Disturbances located in the rectum and anus quite frequently are overlooked. These conditions are important sources of exaggeration of the genital reflexes, and require most careful consideration.

Varicocele, if large, always demands operation. Even in the milder forms the patient's psychopathic state is such that an operation often is not only justifiable, but positively indicated.

Such conditions as prostatorrhea from prostatic hyperemia or follicular prostatitis have received attention elsewhere in this vol-

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ume. Seminal discharges during a difficult stool should be explained to the patient, and his constipation relieved. In many such cases the prostate is the seat of hyperemia or inflammation demanding especial attention. Hypersecretion during erection and the appearance of spermatozoids in the urine after sexual intercourse or excitement should be explained to the patient upon a physiologic basis.

Anaphrodisiac measures constitute the most popular routine treatment for spermatorrhea. In the author's opinion, however, remedies of this class are much abused. In cases of what may be termed the sthenic type, characterized by a greater or less degree of constitutional vigor associated with marked sexual irritability, anaphrodisiac measures are a distinct advantage. The bromids in free doses, gelsemium, camphor and lupulin are types of this class of remedies. In many cases remedies directed to the alleviation of irritation of the mucous membrane are distinctly anaphrodisiac. Alkalies—the salts of lithia especially, if the subject be gouty,—and such remedies as pichi, buchu, ustilago maidis, triticum repens, and the balsams are of service under such circumstances.

In a large proportion of cases of pseudospermatorrhea, and in a majority of, if not all, cases of true spermatorrhea, a tonic rather than a sedative line of therapy is demanded. The use of remedies of the aphrodisiac class as tonics already has been dwelt upon. Proper exercise and bathing for improving nervous tone have also received attention. Quinin, arsenic, manganese, and iron—the latter two especially if anemia exists—often are of distinct service. The fluid extract of salix nigra has seemed serviceable as a sexual tonic. It is well to remember that in the class of affections under consideration tonics should generally be combined with suitable mild laxatives. Constipation is nowhere more pernicious in its effects than in diseases involving the sexual function. One of the best ferruginous preparations is ferratin in tablet form. Pyrophosphate of iron, perhaps, is best of all. One of the most valuable tonics at our command is static electricity. The general tonic effect of the static current is not so generally appreciated by the profession as it deserves. That the moral effect of the spark is valuable in pseudospermatorrhea is obvious. The high frequency current is very useful.

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A simple yet often effective tonic treatment is the free ingestion of raw eggs. The popular notion of the efficacy of eggs as an aphrodisiac is, of course, a fallacy, yet their effects as a tonic must be admitted and, moreover, they seem to have a special tonic effect upon the sexual apparatus. In several cases of very frequent nocturnal emissions in sickly, delicate lads, the author has obtained excellent results from the free use of raw eggs. Whether the beneficial effect of egg is to a certain extent due to the small amount of contained phosphorus is open to question; its efficacy may well be attributed simply to its highly nutritive properties.

Psychotherapy has a wide and important field of usefulness in the various forms of spermatorrhea. Suggestion necessarily enters into all methods of treatment to a certain degree. Cases occur, however, in which positive efforts in this special direction are warrantable. The services of the specialist in psychotherapy — or suggestion-therapy—sometimes may be enlisted to good advantage.

Vibratory massage of the spine and genitalia sometimes appears to be of service in disorders of the sexual function. It acts both psychically and as a circulatory stimulant.

The treatment of spermatorrhea secondary to organic cerebrospinal disease necessarily resolves itself into the treatment of the primary nervous disorder. In many cases, however, appropriate local treatment is of distinct service in diminishing what is obviously not only a serious drain upon the patient's vitality, but also a source of most profound psychic depression.

Cold sitz-baths and the prolonged local application of cold water to the genitalia—especially the testes—are of great value as a sexual sedative primarily, and more remotely in improving the tone of the sexual organs. Galvanism applied to the external surface of the genitals or, in selected cases, directly to the prostate *via* the rectal or deep urethral electrode, often is very serviceable. The faradic current, however, often acts better when the condition is largely psychopathic, because of the moral effect of the sound of the rheotome. Cold-water enemata often are of service, especially where congestive or inflammatory conditions of the seminal vesicles exist. The psychrophor of Winternitz—which consists essentially of a double-current metallic catheter—is a valuable adjunct to the treatment of cases characterized by urethro-prostatic hyperesthesia. The psychrophor is introduced into the bladder and a current of cold

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water—ice-water if necessary—made to pass through it for some minutes—the time varying with the degree of tolerance. This is to be repeated daily or every second day.

In general, the urethral sound is the most useful instrument for the local treatment of all forms of spermatorrhea. If introduced cold and allowed to remain in the urethra for from five to ten minutes it combines the effects of mild refrigeration with the blunting of nervous sensibility by its mechanic action. There is also an improvement in the circulation of the prostate produced by the pressure of the instrument and the reactionary hyperemia incidental to its withdrawal. The milder forms of pseudospermatorrhea usually yield readily to the occasional use of the sound. In some cases the sound is painful, though the psychrophor is well tolerated. Sounding usually should be performed twice or thrice weekly.

Direct medication of the prostatic urethra—and incidentally of the mouths of the ejaculatory ducts—is a very popular method of treatment of spermatorrhea. When judiciously and aseptically applied, various astringents act well in these cases. The most useful astringents are silver nitrate, copper sulphate, tannin, thallin, protargol and ichthyol. These may be used in the form of suppository, ointment or solution. The most useful astringent is silver-nitrate solution in a strength of 2½ to 30 grains to the ounce. In the author's experience a relatively mild solution in considerable quantity is usually best. Where strong solutions are used, only a few drops should be injected. If the instillations are followed by prostatic massage, their beneficial effects are enhanced. Applications of strong solutions of silver nitrate to the colliculus sometimes give wonderful results. Vasostomy and the injection of silver salts into the seminal vesicles is sometimes of great service in spermatorrhea.

The introduction of animal extracts into medicine was seized upon with avidity as a possible solution of all problems in the therapy of diseases involving the sexual function. The experiments of Brown-Séquard were used as a justification of all sorts of quackery, "regular" and otherwise. The "fake" solutions of spermin and its congeners, fathered by a noted neurologic specialist of this country, will be remembered in this connection. In view of the nitroglycerin upon which such action as these preparations possessed depended, it is not surprising that their false pretensions were exposed. Legitimate solutions of spermin have been indorsed as of limited value.

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The dessicated substance of the sex glands—testicle and ovary—of late have been very popular in the treatment of disorders of the sexual system, notably impotence in the male. The author's experience with these preparations has not harmonized with that reported by a number of other surgeons who have extolled their action. The usefulness of the orchic preparation appears to be limited. Indeed, so far as the author is able to judge, its action in impotence is not noticeable unless the patient knows what he is taking. The knowledge that he is taking testicle substance sometimes appeals very strongly to the patient's imagination. Its action in this regard is like that of the lamb's fries and Spanish fries diet of the man about town, who implicitly believes in their efficacy as a sexual stimulant. Inasmuch, however, as there is a more or less marked psychic element in all cases of impotence, the preparation under consideration has a prominent place in the therapy of that disease.

Corpus luteum substance, on the other hand, apparently is useful *per se* in the treatment of certain conditions in the female, and apparently is a much more potent preparation than any thus far made from the testicle substance. Pituitary substance and adrenal cortex substance both have been suggested for impotence. The author has employed these preparations in a limited number of cases, but, thus far, has had no reason to be enthusiastic about them. More reliable preparations of organic products eventually may greatly increase their usefulness. Fresh, vital hormone-carrying secretion can be successfully employed only through the author's method of sex gland implantation, which will be discussed in the next chapter.

The author has experimented extensively with emulsions of various human organs, notably of the brain, testicle, spleen, pancreas, liver and kidney, has shown that their use is practicable, and is encouraged to believe that future observations may show that they are of distinct value in various conditions. Emulsions of the brain and testicle may prove of special value in certain conditions, such as sexual neurasthenia and impotence.*

One of the most popular methods of treatment of spermator-

*Vide author's paper, "Experiments with Emulsions of Organs from the Dead Human Body, and Sex-glands of the Lower Animals."—American Medicine, 1914.

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rhea among surgeons of a past generation was cauterization of the prostatic urethra with pure silver nitrate *viâ* the *porte-caustique* of Lallemand, an instrument which the great Ricord said was "responsible for more eunuchs than all the harems of the East." Cauterization of the prostatic urethra is occasionally justifiable, but only in the hands of the expert, and never by any method other than *viâ* the endoscope under illumination and ocular control. The caustic application should generally be limited to the *colliculus seminalis,* being made with a view of lessening hyperesthesia and curing chronic inflammation of that structure. As formerly used, complete obliteration of the mouths of the ejaculatory and prostatic ducts was a frequent result of the method. Sterility is a necessary consequence of such rough treatment.

It is noteworthy that, while he carried his theory and practice to extremes, Lallemand builded wiser than he knew, as is shown by the stress laid by the modern urologist upon morbid conditions of the *colliculus* in the consideration of the pathology and treatment of sexual ailments.

Marriage often is advised in spermatorrhea and its congeners. This "prescription" involves very serious responsibility. In some cases of pseudospermatorrhea the physician may safely advise matrimony, but he should use great care in determining the patient's potency. Even psychic impotence may be a bar to marriage. In true spermatorrhea marriage never is justifiable. The author has commented elsewhere on the heinous practice of prescribing healthy and presumably innocent women in the treatment of masculine degenerates who cannot be other than wrecks of humanity. Oftentimes the game is not worth the candle, even though an apparent success be obtained. There is rarely an instance in which the woman prescribed does not get the worst of it. Such offerings upon the altar of Hymen—to say nothing of the still broader question of infection—are responsible for quite a proportion of the sum-total of human misery, both physic and psychic. Both the profession and the public may one day awake to a sense of their duties in this matter, and the time may come when proposals of marriage, or, at least, applications for a license to marry, will be unorthodox unless accompanied by a clean bill of health from a reputable physician. Half the misery of the human race comes from a lack of supervision at the marriage-license window. Marriage is too easy, divorce too diffi-

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cult, for the physical and moral welfare of mankind. Marriage should at least be as difficult to enter as it is to escape from.

There are certain cases of spermatorrhea, pseudospermatorrhea, prostatorrhea and nocturnal pollutions in which the resulting physical, moral and psychic degeneracy demands the most radical measures. The author herewith records the opinion that in such cases vasectomy is justifiable. We have performed it in many instances, with the best results, and shall continue to perform it with perfect confidence in its harmony with the highest altruism in the relief of human suffering. The technique of the operation of vasectomy already has been discussed.

The author would suggest that, before performing it, its results, so far as sterility is concerned, should be explained by the surgeon in the presence of witnesses.

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CHAPTER X.

Sexual Neurasthenia.

Sexual neurasthenia requires special consideration, even at the cost of repetition of much that already has been said. It implies ordinary neurasthenia with a sexual element, either psychic or physical in character. Organic sexual disturbances hardly can exist without a strong incidental psychic element. A purely psychic sexual element in sexual neurasthenia is rare. There almost always is some functional derangement of the sexual apparatus, behind which lies a varying degree of organic disorder.

The author's experience leads him to the conclusion that neurasthenia in the male is associated with prostatic hyperemia and hyperesthesia, and with inflammation of the prostatic urethra, more often than with any other condition.

Considering the abundant sensory and sympathetic nerve supply of the prostate and its intimate relation to the sympathetic system in general, the frequency with which nervous symptoms develop in patients suffering from prostatic disease is not remarkable. Add to the purely organic factors the profound psychic impression made upon the patient by the knowledge of sexual disability, and we have a very satisfactory explanation of the frequency of "sexual neurasthenia."

It is the author's belief that the prostate secretes a hormone the perversion of which, conjoined with the absorption of infection toxins, often has much to do with the etiology of sexual neurasthenia.

Disturbed digestion, irregular bowel action, headache, depression, lassitude, melancholy and brooding, hypochondriasis and introspection, unstable emotions and "hysteria"—for there is a condition in the male analogous to hysteria which we logically might call

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"prostateria"—are among the results of a sensitive, congested prostate and deep urethra.*

It is the custom of the reputable profession to regard the sexual neurasthenics who are the prey of the quacks, as sufferers from purely imaginative ailments. As practically all of these subjects have been masturbators, many of them have indulged in sexual excesses, and not a few have had gonorrhea, the verdict of the profession is not sound as regards the quack's victim, however just it may be as to the quack himself.

Reputable medical men are wont to wave the sexual neurasthenic away with a bluff and hearty, "My good friend, forget it. There is nothing the matter with you." The patient seeks for some one who will sympathize with him, and goes to the quack. The quack doesn't diagnose the real condition, but, to the patient's cost, he does find a lot of things that do not exist, and all because the reputable physician flouted as imaginary, conditions which, to the patient's sensitive and morbid mood, always are terribly real. The layman who feels, however mistakenly, that the regular profession is both ignorant and unsympathetic, is fine material for the charlatan.

It hardly is possible for one to indulge in either masturbation or sexual excess for any great length of time without producing disturbance of prostatic circulation and innervation. The physician is likely to advise such patients to stop their evil habits, but he ignores the sensitive prostate and hyperesthetic *veru montanum,* which continually are sending sexual stimuli to the psycho-sexual centers, where they are at once transformed into erotic ideas. These erotic pictures of the imagination reverse the nerve current, so to speak, and increase the prostatic irritation. The patient's sexual emotions are used as a shuttlecock by the seat of sexual sensibility in the prostate on the one hand, and the psycho-sexual centers on the other. More important still is the attendant sex-hormone perversion with its disastrous effects upon all the organic functions and upon cell metabolism. The result essentially is a toxemia, the effects of which, especially upon the nervous system, are most profound.

Advising the patient to "keep his mind off the sexual organs," is a pseudo-Christian science prescription which usually works satisfactorily only when conjoined with the instillation of a little nitrate

* The author dealt in extenso with the subject of Sexual Neurasthenia and the Prostate in the N. Y. Medical Record, Feb. 3, 1912.

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of silver solution into the prostatic urethra, supplemented by prostatic massage and the cold sound.

Practically every masturbator who has practiced the habit for any length of time may be considered a neurasthenic with a more or less tender and swollen prostate. Experience shows that this condition underlies many of the cases of nocturnal emissions with which we meet.

The analogy between the prostate and seminal vesicles and the uterus and tubes is nowhere better shown than by pathologic conditions of these organs. The infected subinvoluted uterus and tubes, with the surrounding pelvic infiltration, producing pressure symptoms and neurasthenia, have their counterpart in the enlarged infected prostate, infected seminal vesicles, and periprostatic infiltration, producing the same local disturbances and general nervous symptoms. The two conditions are alike also in the matter of the stubbornness and lasting quality of the infection.

The management of sexual neurasthenia, while largely directed to the relief of local conditions, requires even more care and judgment than that of cases of neurasthenia in which there is no sexual element. Regulation of sleep, diet and work always is in order. Hydrotherapy, tonics, general massage, and static electricity, or the high frequency current, all have their uses, in conjunction with prostatic massage, instillation of silver and, in infected cases, irrigations. Urethral dilations and endoscopic applications of silver should supplement the other local treatment.

We occasionally meet with cases in which, while the local conditions improve and the neurasthenia is more or less benefited, the patient remains unfit for the active duties of life and becomes a confirmed hypochondriac. For cases such as these, complete change of scene and climate is required. A sea voyage sometimes accomplishes wonders. In a series of cases of the author's in which a sea voyage was practicable, the results were all that could be desired. In one case the patient's will was so unstable that it was necessary to keep someone with him constantly until the steamer started, lest he should fail in his determination to take the voyage. He was so emotional that, when his frequent fits of self-pity came over him, he would cry like a child. This meant much in a man like him, for he was an ex-soldier of tried mettle and courage. He first went to the Philippines, then to Japan. He returned perfectly well in five or six months and,

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as he expressed it, "snapping his fingers at the doctors." This case is typic of a number in the author's experience.

Sexual neurasthenia associated with real or imaginary spermatorrhea, obstinate prostatorrhea, or seminal emissions occurring frequently and resistant to treatment, sometimes is very difficult of management. In such cases benefit sometimes is obtained from temporary resection of the *vasa deferentia.* Aside from the moral effect—which is profound—the relative rest secured for the sexual apparatus, and the lessened activity of the circulation of the prostate are extremely beneficial. As the author has shown in this work and elsewhere (Journal A. M. A., July 21, 1906), and has demonstrated in his own practice, subsequent anastomosis is perfectly practicable, by his method of "coupling" the vas.

Cases of sexual neurasthenia—with or without prostatic derangement—associated with impotence are the most trying of all. If unrelieved, these cases go from one doctor to another, and finally land in the arms of the quacks. Many of them are purely psychic at the beginning, but a few recurrences of their inability to copulate puts a large proportion of them into the permanent class. In such cases the nomenclature "psychic" is not at all comforting to the patient, which is not astonishing, inasmuch as potency really consists of ability to secure and sustain an erection. Our nomenclature has driven a host of patients to the quacks. The cause of impotence may be psychic, but the lack of erectile power *per se* is a purely mechanic and obvious proposition.

In many cases of impotence the failure of erectile power obviously is not due to general or local organic conditions. Once the accident of failure of erection has occurred, however, the patient's memory of the first time is sufficient to cause another and another, until failure is the rule of his sexual life. Even the removal of determinable organic etiologic conditions is likely to fail to cure sexual neurasthenia, once the habit of sexual failure has been established.

Morbid prostatic conditions, involving especially the floor of the prostatic urethra, often underlie neurasthenia. In such cases prostatic massage, silver instillations, or endoscopic applications of silver to the *colliculus seminalis,* often do excellent work.

Not infrequently all measures of treatment fail completely. If impotence exists and the sexual disability is unrelieved, cure of the

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neurasthenia is impossible, hence any measure that holds out even a faint hope of relief should be adopted. As already noted, it has been the author's experience that a very respectable proportion of cases of sexual neurasthenia associated with impotence are remediable by resection of the *vena dorsalis penis*. As to how far the psychic effect of the operation explains its benefits one need not argue in the face of mechanic effects, which constitute the only means of physically impressing the patient. If the patient notices an increase in the functional activity of the penis, he certainly is justified in having some psychic impressions from the operation, and, as these impressions run counter to those which have been a prominent feature of his sexual disability, the operation would seem logical enough. Even a small proportion of cures would justify the operation, and as the proportion really is encouraging, the procedure should be generally employed in suitable cases.

In otherwise irremediable cases of sexual neurasthenia the author believes that treatment with sex-hormone viâ gland implantation is a rational indication, where the method is practicable. The relation of the sex-hormone to sexual aberrations of the organs and functions, and to neurasthenia, already has been touched upon. The subject of gland implantation will be fully presented in the next chapter.

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CHAPTER XI.

Sex Gland Implantation.

SUCCESSFUL AUTO-IMPLANTATION OF A TESTIS FROM A SUBJECT DEAD TWENTY-FOUR HOURS — OTHER SUCCESSFUL IMPLANTATIONS OF TESTES AND OVARIES FROM DEAD SUBJECTS — EXPERIMENTAL IMPLANTATIONS IN VARIOUS CONDITIONS, AND CROSS IMPLANTATIONS OF TESTES AND OVARIES TAKEN FROM DEAD SUBJECTS.

SINCE long before the days of the oöphorectomy craze—the darkest blot upon the history of the surgery of the last quarter of the nineteenth century—the attention of the profession has been more or less insistently directed to the possible relation of various derangements of the sex glands to certain morbid phenomena of a general or special character, notably affecting the nervous system. The interest aroused finally led to the widespread adoption of the Battey operation, which once was so disastrously fashionable as a remedy for "neuroses" in women.

The period at which the author himself first began to suspect that in many cases we were on the wrong track, is fairly well fixed in his mind by two personal cases that occurred during the then prevalent epidemic of ovarian mutilation into which the masters of surgery had led us. These cases were respectively one that now probably would be termed dementia præcox, in a girl of twenty years, and another of "hystero-epilepsy" in a girl of eighteen. In the former the author set about removal of the ovaries to relieve the "reflex irritation" which, according to the then fallacious popular theory, presumptively underlay the nerve and brain symptoms, and was astonished to find "atrophied" — or more probably, undeveloped — ovaries and uterus. In the other case, operation was refused and, several years later, the author had the opportunity of making an autopsy, the young woman having died peacefully without

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surgical interference. "Atrophied" — undeveloped — ovaries and an undersized uterus again were found. Both subjects had menstruated, although tardily and irregularly from the beginning, but finally menstruation had entirely ceased.

Even at that early period of the author's professional career, these cases suggested to his mind the possibility that an aberration of function of the ovary, rather than reflex irritation from diseased ovarian structure, bore an etiologic relation to some of the manifold nervous phenomena in women, for which bushels of ovaries were being sacrificed. In the light of recent researches in the field of internal secretions, it would seem that possibly the profession builded wiser than it knew in attributing to ovarian disease a host of nervous disorders in women.

It was a great misfortune that we then had no knowledge of the internal secretions, and no blood researches to show us that the trouble often lay, so to speak, not in too much ovary, but in what was, in effect, too little, the internal sex gland secretion being either insufficient in quantity or perverted in quality, from disease or congenital structural defect.

It is remarkable that the nervous and other phenomena following castration in females who previously were normal in respect to the nervous system, did not make matters clearer to the profession, but possibly our attention was distracted and our reasoning powers were inhibited by the grave discussions with which we were regaled on the wisdom of "leaving the ovarian nerves intact" when we removed the ovaries. Even this point in technic was regarded as important chiefly because of the consideration of the influence of the ovarian tissue and the ovarian nerve upon menstruation, this function being regarded as the main factor in the preservation of a normal nervous system after extensive pelvic mutilations.

Since the inception of the pelvic mutilation fad, the profession has had the opportunity of observing the nervous effects of the Ramm-White operation of castration for enlarged prostate — now reposing so peacefully in the surgical dead lumber room by the side of the long defunct epidemic oöphorectomy mania, the ghost of which, unhappily, still perverts the minds of a few of the surgically obscure and, what is worse, inspires the malpractice of certain commercially depraved members of the profession.

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It is noteworthy that Brown-Séquard's self experimentation with the extract of the testes of lambs really signified more than either he himself or the profession comprehended. Had we grasped the great principle involved, the much ridiculed "elixir of life" probably would have been more of an epoch maker than a joke. Believing that a most important principle was involved in Brown-Séquard's self experimentation, the author for many years has been especially interested in the problem of the normal equilibrium between sexual activity and age, and that between general bodily vigor and sex gland structural and functional integrity. The most fascinating, although, perhaps, the least practical phase of the problem, has been the question of the interrelation of senility and sex gland activity.

The association of remarkable sex vigor with notable longevity is a matter of common observation, even among laymen, but which is the *propter* and which the *post?* Do we age because the sex glands deteriorate or do they deteriorate because we age? As shown by his report of his experiments upon himself with the juices of sex glands of the lower animals, Brown-Séquard evidently had certain ideas of his own upon the subject. Is there merely a normal, very delicate equilibrium between age and sex gland activity, the maintenance of which determines whether or not the individual will live and preserve the vital functions, notably the sex powers, in active condition to the normal extreme age average? Finally, while assuming as skeptical an attitude as we please toward the possibility of the discovery of the "elixir of life," may we not — granting the acceptance of the "equilibrium" theory just suggested — logically search for a method of restoring or preserving that equilibrium, thus prolonging life to its rare, normal conclusion of extreme old age? May we not even hope to go beyond the limit of what we now regard as "extreme"? Obviously, the collateral problems suggested are very numerous.

At first sight the logical answer seems to be that sex gland activity is entirely dependent upon age and general nutrition, becoming impaired *pari passu* with advancing age, to be finally extinguished by the degenerescence of senility. In the light of our present knowledge of the internal secretions, however, are we not justified in suspecting that rejuvenation of the supply of internal sex gland secretion may have a marked effect in retarding age, the disturbance

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of equilibrium being in favor of the individual supplied with the gland elements necessary to the formation of young internal secretion? Admitting the cogency of this theory, who could foretell how far longevity might be prolonged by successive supplies of young internal secretion? We, of course, must admit that anatomic and physiologic machinery is predestined to wear out, and whatever one may think of the future prospects of spiritual man, we must recognize his mortal limitations.

Following the widely heralded alleged discovery of the "elixir of life" by Brown-Séquard, came a host of imitators. These were of two classes: First, ethical workers in therapeutic fields; second, quacks who pretended to employ animal extracts. Among the latter was a distinguished American neurologist, since dead, who prostituted to commercialism a once enviable reputation. His testine and cerebrine will be recalled by many of the older members of the profession. Samples submitted to the author direct by the neurologist aforesaid proved to be merely solutions of glonoin.

Since the publication of Brown-Séquard's experiments, and more particularly since the discovery of the internal secretions, the profession has been deluged with animal extracts of many kinds, manifold pretensions, and varying degrees of harmfulness and therapeutic efficiency. Naturally, much attention has been paid to sex gland extracts. These we will give scant courtesy. In the author's opinion, most of them, up to date, have been wrong in principle, toxic in action and, aside from their psychic effects, absolutely valueless, save as sordidly commercial propositions. Recently, however, some really scientific preparations have appeared and in some instances apparently have given brilliant results.

One of the unfortunate features of organotherapy is the toxicity of animal extracts in general; this with due deference to the brilliant results achieved by some of them. It is logical to assume, also, that the therapeutic potency of the best of them is not to be compared to that of the hormones produced *in vivo* and normally discharged into the circulation. Some of the various extracts of internal secretory glands probably bear the same relation to the internal secretions that old-fashioned beef tea does to wholesome beef. The nutritive properties of the beef do not appear in the beef tea, but the toxic elements do. As to whether emulsions of fresh

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material will prove more satisfactory than "extracts" have done remains to be shown. The author is optimistic in this regard.

Since the attention of the profession has been so pertinently directed to the internal secretions, the author has given considerable thought to the probable relation of sex gland secretory aberrations, first, to nutrition in general; second, to brain and nerve integrity; third, to sex power and activity; fourth, to senile pathology and physiology. The impression that the well being of all animals hinged upon the integrity of the sex organs, and especially of the testis and ovary, prevailed in very ancient times. The mechanism by which the sexual apparatus operates was enveloped in mystery until we began to comprehend that the procreative function of the sex glands was not their only biologic mission. The phenomena which for centuries were known to take place after suppression of the secretion of the sexual glands by castration, and by the physiologic change incidental to the climacteric, were formerly supposed to be due to "reflex nervous action." It was noted that the sexes were much alike in this respect, and it has long been suspected that the male has a climacteric, analogous to that of the opposite sex, which occurs later in life than in the female, and is attended by varying peculiarities of nerve action. As this is likely to occur in the male long before fertility ceases — if, indeed, we accept such a climacteric at all, as the author is inclined to do — the only rational explanation in the light of modern research seems to be a diminution or change, or both, in the internal secretion of the sexual glands, with, of course, due appreciation of arterial changes, which themselves may be merely secondary. Still more logically will this theory explain the nervous phenomena of the menopause.

In the latter part of the eighteenth century, Bordieu asserted that the nervous and other morbid phenomena which followed removal of the sex organs, and in diseased conditions affecting them, were due to either a deficiency or superfluity of the procreative glandular secretions. Bordieu, however, had no conception of internal secretions. Johannes Müller recognized certain "ductless" glands. He even designated the placenta as a ductless gland. These glands, he believed, modified the blood which circulated through them, and thereby gave what he called a "plastic influence" to the generative circulation.

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The testicle long has been known to have a double function, but until recently none knew that both functions were secretory. That it acts as a duct gland has been accepted as long as its physiology has been known. In 1849, Berthold, of Göttingen, transplanted the testes of cocks to their abdominal cavities and showed that the masculine sex qualities were preserved, through, he averred, an effect upon the blood. Thus, without precise scientific knowledge, and with no accuracy of nomenclature, Berthold first proved the existence and significance of what we now recognize as an internal secretion. Many years later, Forel asserted that "the implantation of a sex gland in any part of the body is sufficient to arrest the production of the special peculiarities of the eunuch," and he might nervous phenomena of the menopause.

Since Berthold's day, and especially of recent years, considerable experimental work has been done in sex gland implantation, some of which had in view merely transplantation *per se* and some the matter of internal secretion in mind. A number of the contributions are worthy of special mention. Herlitzka, in 1899, reported successful experimental transplantations of testes of frogs into the peritoneal cavity of the same individual. Later, Meyns successfully transplanted portions of frog's testes into the dorsal lymph vessels. Hammond and Sutton reported a case of testicle transplantation. A testicle was removed from a subject who had just died of traumatic hemorrhage, due to a rupture of the liver, and placed in sterile salt solution in cold storage. A sarcomatous testicle was removed from a patient, twenty-nine and a half hours later, and the testis from the dead body systematically anastomosed upon the cord stump. Healing was perfect. One month later, only a small nodule remained on the end of the cord. Some time later this was observed to have enlarged a little, whether or not from return of the sarcoma has not yet appeared. The object of the transplantation was a purely psychic effect, and no observations regarding sex hormone therapy were made. This case obviously was a severe test of implantation on account of the possible, or even probable, malignant involvement of the cord and the anastomosis.

Foà, after extensive experiments on animals, concluded that testicle grafts fail, merely because of the impracticability of reëstablishing, by any technic then known, blood and nerve supply.

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Guthrie, however, found that a testicle removed from a fowl and planted in the shoulder of the same bird, was growing, had considerably enlarged, and had acquired a liberal blood supply after four months. He also concludes from his experiments that "ovarian tissue" from fowls engrafted into fowls may develop and preserve its functional powers to a high degree." Cevolotto found that, after forty-five days, small pieces of testicle tissue implanted under the skin of rabbits showed changes which proved that the highly differentiated cells of such tissues tend to retrograde to ordinary connective tissue cells. He notes an increase of Sertoli cells as an evidence of degenerescence of the gland tissue proper. In this far, Cevolotto is pessimistic regarding the success of sex gland transplantation.

Lode, following Berthold, believed he had proved by experiment that testes of fowls transplanted beneath the skin retain their vitality and functional activity, continuing to secrete semen. He also concludes that, in fowls at least, a special secretory nerve supply for the testes does not exist. Foges, from his experiments on fowls, concluded that, while the semen producing power of transplanted testes was preserved, their influence on the secondary sex characteristics was not. This latter observation does not accord with the results of certain recent experiments on fowls by the author, although, as to the end results, it is too early to arrive at definite conclusions. In human beings the author has proved the reverse to be true.

The gross results of caponizing fowls are familiar, even to the laity. In a series of recent experiments on fowls, the author made some interesting observations of the effects of glands from non-related birds, implanted in the capon. The nutritive stimulant effect was remarkable.

Ribbert holds that he has shown by animal experimentation the feasibility of transplantation of various living tissues, the terminal results not being uniform for different tissues, and resorption finally taking place in all tissues save the epithelial structures of the skin and conjunctiva.

Guthrie reports an experiment in which removal of the ovaries resulted in the development of secondary male characteristics, the subject when grown being spurred, plumaged like the male, pugnacious to cocks, and treading hens as would a cock. The author

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has observed a number of supposedly normal hens — never experimented upon — which were spurred, given to crowing, pugnacious to strange cocks, and who would assume charge of the flock of hens and tread them systematically, as soon as the cock was removed from the run. Despite their "inversion" symptoms, these hens were good layers and their progeny was normal. Such hens are familiar to most breeders of domestic fowl.*

Claude Bernard, in 1855, called attention to the glycosuric function of the liver as dependent on a special internal secretory action under control of the nervous system. Brown-Séquard, in 1869, first expressed the idea that all glands, whether with or without ducts, supplied to the blood a substance a deficiency of which produced pathologic disturbances. It was not, however, till the publication of his celebrated experiments on himself that attention was given to the question of internal secretions. In 1889, at the age of seventy-two years, he injected himself with testicular extract from the lower animals. According to his reports, he experienced a marked improvement in mental activity, physical strength, and bowel action, and an increased appetite.

Poehl states that "injections of spermine have been given to enfeebled old men who had lost appetite and sleep, and produced improvement lasting for months. From the instances given, I have selected that of an old lady of ninety-five years, afflicted with severe sclerosis of the arteries, with no appetite, a bad digestion, and constipation. This patient had complained for several years of sacral pains, and, moreover, was nearly quite deaf and suffered from

* Apropos of plumage as a criterion of secondary sex characteristics in fowls, the author takes the opportunity of observing that it is not so important as might be supposed. The hencock, or "hennie," is familiar to all game fowl fanciers. The plumage of the male practically is the same as that of the female. These fowls are vicious fighters, some strains are heavy weights, and all are excellent layers and breeders. The hencock often crops out either as a sport or a throwback (atavism). An observation of my own may be of interest. For ten years the author had bred a certain strain of brilliant colored, rich plumaged, black red game bantams. The originator of the strain had bred them for twenty-five years. Neither of us ever had made an outcross, but carefully preserved the type by inbreeding and line breeding. Desiring to increase the vigor of the stock by a change of environment, the author placed some of these bantams — a full brother and several sisters — in the hands of a very careful country breeder. In the second year thereafter, four fine specimens of hencock appeared in the progeny. These the author succeeded in perpetuating fairly well by careful selection — a difficult task because the female hennie could not be distinguished from her "regulation" sisters.

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periodical attacks of malarial fever. The injections of spermine, given for a period of fifteen months, restored the old lady to such an extent that she recovered her power of hearing and felt the sacral pains only slightly and after a long walk. Her general condition was highly satisfactory."

Brown-Séquard's self experimentation is generally recognized as the pioneer work in organotherapy. The suggestion of the old humoral pathology, fathered by Bichat, and of the once derided alleged vagaries of Hahnemann, which lingers about the physiology and pathology of the internal secretions and vaccinoserotherapy, is striking, and should appeal to the modesty of modern science. It shows how close the great thinkers of past generations came to the solution of problems which a better knowledge of chemistry, biology, and bacteriology would have made clear.

Bayliss and Starling proposed the name *hormone,* meaning to awake or excite, for the substances contained in those internal secretions that affect the functions of other organs. It appears that continuous doses of some hormones are necessary to maintain physiologic activity at par. Presumptive evidence of this is shown by the physiologic hypertrophy of the remaining gland when one of a pair is removed or destroyed. In the case of duct glands, this, of course, bears upon the ordinary secretory function, as well as upon that of internal secretion.

That the internal secretions are therapeutically powerful is shown by the brilliant results obtained from the administration of thyroid extract and implanted thyroid fragments in cretinism and allied conditions due to pathologic disturbances or removal of the thyroid, and by the more recent observations on pituitrin and other extracts. That the preservation of a very small portion of thyroid tissue in thyroidectomy will prevent serious after-results has been abundantly proved. This latter observation is also true, although perhaps in less measure, of the ovary and testis. Paschoud also has published some remarkable results from thyroid grafting. That even the smallest possible fragment of even approximately normal ovary should be preserved in pelvic operations, ought to be regarded as axiomatic. That the same conservatism should be exhibited toward the male has not yet dawned upon the majority of surgeons. When a testis is condemned to removal in testicular tuberculosis, and it is possible to save a small fragment of gland

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substance, this should be done. Rarely, however, when the testis is extensively involved and there is suppuration, is it wise to leave fragments of the organ in the scrotal sac on account of the almost inevitable secondary tissue infection. If, however, the fragment be implanted in another and easily accessible situation, suppuration may be avoided and the gland tissue is likely to be preserved. If tubercular infection should occur, it is easily accessible to treatment.*

According to Biedl, the hormones do not provoke the formation of antibodies. It would appear, then, that any increased resistance to infections that may result from them when used therapeutically would, of necessity, be indirectly produced through such stimulating or tonic effect as they might have upon the organism in general. The question of whether resistance to infection can be dissociated from the formation of antibodies is, of course, not under consideration here.

Schiefferdecker's hypothesis of the physiologic action of the specific internal secretions is very interesting, in that he advances a direct nervous intervention as a substitute for the old theory of reflex action. He says: "Internal secretion determines the effect which the products of metabolism, excreted by the nerve cells during the simple processes of nutrition, will exercise upon other nerve cells or upon the cells of the end organs, such activity being called 'trophic.' It also determines the effect which the products of metabolism excreted in the course of specific activity will produce, and this effect is known as 'irritation' or 'stimulus.'" We will not argue the point of whether "irritation" and physiologic "stimulus" are the same. The distinction seems too obvious — clinically, if not biologically.

The wonders of even the generative sex gland function are almost incomprehensible to all but the scientist, who has come to accept them as a matter of course. At birth the ovaries contain something like seventy thousand ovules, only 360 of which mature and discharge during a normal menstrual life of about thirty years. The real meaning of this is staggering. The intrinsic capacity of development into a new being under favorable conditions may be assumed to be theoretically possessed by each and every one of

* Dr. John F. Golden, of Chicago, in a recent conversation informed the author that, having in mind the author's work, and the conservation of the patient's nutrition, he had auto-implanted in the abdominal wall a fragment of testis from a case of testicular tuberculosis with apparently the best of results.

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these ovules, and we surely must grant creative potentialities to the 360 ovules which mature and are discharged from the ovary. Every one of these mature ovules, fertilized and transplanted to a favorable soil, would develop into a new being. And the fertilized ovum seems indifferent to its feeding ground, whether peritoneum, Fallopian tube, or endometrium. The embryo could come to maturity on each of them, were the purely mechanic conditions favorable. Living blood — if it is not alien — with the complex biochemical products that it contains, alone is necessary. The local source of the blood matters but little.

The kinetic energy of the spermatozoön is remarkable, and the movements thereby rendered possible are very active. It can traverse its own length in one second, an inch in seven and a half minutes, and the distance from the ostium vaginæ to the cervix in about three and a half hours. The zoösperm is indifferent to somatic death until long after its occurrence. Living sperm cells are found in the vagina eight days after coitus, and have been found in the Fallopian tubes three and a half weeks afterward. Three days after the execution of a murderer, living spermatozoa were found in the testes. In the female bat they live for months, and in the queen bee for three years. They have been kept alive for three days in a culture oven.

The marvelous nutritional and formative potentialities of the generative secretional products of the sex glands are proved by the results of the combination of the spermatozoid and the ovule. The combination of a cell measuring only $^1/_{500}$ inch in length with another cell measuring $^1/_{125}$ of an inch in diameter produces a germ which requires only a proper environment for its development into a new being. Comprehension of this wonderful biologic fact alone should be sufficient to enable us to appreciate the possibilities of sex gland secretion in therapeutics.

Both the spermatozoid and the ovule seemingly must depend inevitably upon the internal secretory function of the glands which produced them for the remarkable results following their combination. The internal secretory function of the testis and ovary possibly may in no wise be dependent upon the generative glandular mechanism but it is hardly conceivable that either spermatozoa or ovules of normal constitution can be formed independently of the local and general nutritional stimulus produced by the hormone.

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What is it that imparts the formative energy to spermatozoid and ovule if it is not the internal secretion acting through the medium of the blood, or directly upon the procreative glandular tissue — or both? The union of sperm cell and ovule merely serves to make dynamic the potential cell energy of each. The combination surely develops a powerful nutritional stimulus. It is by no means improbable that the quality of progeny depends on the quantity and quality of the internal secretion, both before conception in both sexes and after conception in the female. Why may we not hope to improve heredity, or even determine sex, by the employment of internal secretion through the medium of sex gland implantation or other methods of administration? What may we not accomplish therapeutically with the vital energy of glandular organs which produce such powerful biologic elements as the ovule and spermatozoön and in such large quantity throughout life, if only we can make that energy do our bidding, as seemingly we can?

While the double secretory function of the generative glands has for some years been conceded, the existence of specially differentiated histologic secretory elements in these important glands has not been so generally accepted. Certain investigators, notably Nussbaum, have held that the generative elements of the glands produce the hormone. Others, again, have contended that there is a double set of secretory elements, one of which elaborates the internal secretion and the other the generative secretion proper. The problem appears much simpler in the case of the ovary than in that of the testis.

Prénant, Born, and Fraenkel showed that the corpus luteum is epithelial in structure and possesses an internal secretory function that is independent of the generative function of the gland. Bouin held that he had demonstrated that the testis contained, not only the obviously important seminiferous tubules, but also other morphologically differentiated elements of great biological importance from a secretory view-point. Nussbaum, after a series of experiments on frogs, concludes that the influence of the testes on sexual desire and function is biochemical and acts, not only with the glands normally attached, but also when the testes are isolated by cutting off their nerve attachments.

Lespinasse, before the genito-urinary section of the American Medical Association in June, 1913, reported a case of impotence

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cured by "slices" of testis, one mm. in thickness, taken from a living subject and immediately transferred to the scrotum and rectus muscle of a subject who had been castrated. On the fourth day desire and power of erection returned, and had persisted for two years when the patient was last seen. The same author reports a second case of impotence treated by implantation in the scrotal sac of a portion of testis from a living body. Lespinasse's interesting experiments in the already familiar field of transplantation of fragments of sex glands from the living to the living, bore no reference to the broad general subject of hormone therapy — save as regards virility — or of transplantation of sex glands from dead subjects. He notes, however, the probable preservation of the interstitial internal secreting tissue as the explanation of his results.*

Loisel showed by experiment that the testes and ovaries of both warm and cold blooded animals contained toxic substances which produced serious symptoms and even death, when injected into frogs and rabbits. This, however, merely proves the existence of toxic materials in extracts made from the generative glands, and, so far as it goes, in general explains the frequent disappointments and occasional harm of therapeutically using extracts from these tissues. In the author's opinion, Loisel's observations have no bearing on the action of the physiologic internal secretions of a successfully implanted sex gland.

That the mere passage of the spermatozoa is not necessary to secondary sex characteristics has been amply proved by experimental, accidental and pathologic-mechanic sterilization, *i. e.*, sterilization which does not destroy the spermatozoa-producing function of the testis, but merely prevents their exit from the gland. Obviously, however, and without questioning the fact that there is a double secretory function of the testis, this alone does not prove that the spermatic secretory tissue proper is not wholly or partially responsible for secondary sex characteristics, for spermatic secretion and resorption still continue after mechanic sterilization. Still less does it prove, when taken alone, that the internal secretion is not elaborated and eliminated with the semen by the *tubuli seminiferi,*

* The implantation of slices of testis practically is a repetition of Leo Loeb's culture of tissues within the living body, reported in Johns Hopkins Hospital Bulletin, 1898, and Proceedings of the Society of Experimental Biology and Medicine, viii, 1911, and Anatomical Record, viii, 1912.

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or that the tubuli are not necessary to perfect sex development. Neither does absence or nonformation of spermatozoids mean that the remaining elements of the semen are physiologically worthless. It has been shown that a very small amount of testicular or ovarian tissue is sufficient to preserve the secondary sex characteristics. This also does not prove the relative unimportance in this regard of the true generative tissue.*

In brief, histologic secretory differentiation having positively been demonstrated — and disregarding the spermatozoids — we still cannot by it alone exclude the secretory function of the true generative gland tissue from what we will term the sex cycle. The histologic structure on which internal testicular secretion depends was termed by Leydig, "between cells." Four years later, Kölliker described them. In 1903 they were termed by Bouin and Ancel, in an exhaustive treatise, *glande interstitielle du testicule.* These cells are situated in the interstitial tissue between the tubuli seminiferi and are of mesodermic origin. Hanes says that the Sertoli and spermatogenic cells play no part in the internal secretion, the Sertoli cells supplying fat to the sperm cells, the internal secretion, in all probability being supplied by the cells of Leydig.

The physiologic characteristics of these cells, and experimental work on animals by various investigators, suggest the possibility that, even where the spermatic tubules are "strangled out" of implanted testicular structure by subsequent destruction and replacement of generative glandular tissue by true connective tissue, the internal secretory function of the implanted gland tissue — and hence such therapeutic efficacy as it may possess — possibly may continue indefinitely.

The author's experiments show that the cells of Leydig actually proliferate, so that the remnants of successfully implanted glands contain relatively more interstitial cells than does the normal gland.

The facts that, first, the semen is not perfectly elaborated and the spermatozoa consequently are not perfectly formed until the seminal elements are acted upon by the epididymis; second, that destruction or removal of the epididymis does not affect the secon-

* The relative unimportance of the spermatogenic cells in the formation of secondary sex characters is suggested by the author's experiments. The seminiferous elements atrophy after implantation, yet there is a marked action of the remaining elements of the gland upon the secondary sex characters. (Note Cases 1 and 6, Chapter XIII.

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dary sex characteristics, and, third, that secondary sex characteristics manifest themselves before either spermatozoa are formed or ovules matured, in a measure prove that the latter are not dependent upon the generative elements, but upon some special property of the glandular tissue of the sex glands. Moll says: "If it be assumed that the testicles can secrete substances upon the influence of which the development of the secondary sexual characters depends, it is obvious that these substances have nothing to do with the spermatozoa, inasmuch as the testicles exert the influence under consideration at an age at which the formation of spermatozoa has not yet begun. The substances that act in this way must be of a different kind."

Marshall and Hammond, in experiments on sheep, conclude that castration checks horn growth (a secondary sex characteristic). Unilateral castration inhibits, but does not check horn growth. Removal of the testes without removal of the epididymes checks horn growth. The authors accept the hormone theory of development of secondary sex characteristics. They believe, however, that the rôle of the epididymis in hormone production is of little or no importance. This is not in harmony with the observations of veterinarians, who have held that preservation of the secondary sex characteristics and of potency after castration is due to failure to include the epididymes in the exsection. Cryptorchidism is, of course, another and a satisfactory explanation in some cases of inexpert castration. The author has seen a supposed gelding repeatedly cover mares. This animal was said to have retained his sexual power because he was "castrated late."

The author's observations tend to show that the epididymis plays at least a minor rôle in hormone production.

It has been shown that the X ray destroys the spermatozoa producing function of the testis without affecting the secondary sex characteristics. The further observation that the X ray primarily destroys the spermatic glandular tissue, but does not affect the interstitial tissue, is held to show conclusively that the latter is the source of the all important internal secretion. A few tubuli escape the action of the ray, and regeneration of the testis has been shown to occur. The question arises, however, as to whether inhibition of the production of the delicate spermatic cells — spermatozoids —

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necessarily means that the generative gland tissue proper really is destroyed. Does not the so-called "regeneration" mean a restoration of function? The author does not believe that a regeneration of killed tubuli seminiferi is possible. We may profitably note what occurs in the orchitis of parotiditis, and reflect on how easily the gland is destroyed. It also should be noted, however, that when one testis is atrophied by parotiditic infection and the remaining organ subsequently is lost, the secondary sex characteristics are preserved. This the author has observed in one case. It is quite as pertinent to the subject in hand as are the results of X ray experiments and accidents. Prolonged and repeated exposure to the ray will, of course, destroy the entire structure of the gland and produce effects similar to complete castration.

Summarizing all that is known regarding the internal secretory tissue of the testis, Biedl says: "We are led to the inevitable conclusion that the hormone which gives to the organism its male characteristics is elaborated in the cells of Leydig, in the interstitial tissue. Despite their mesodermal origin, these cells are able actively to produce certain specific substances and to transfer these substances to the blood stream. Such being the case, we are justified in describing them as an 'interstitial gland.'"

As already hinted, the author is not quite sure that Biedl's conclusion is "inevitable." It is by no means impossible that the procreative elements of the testis themselves have a double secreting action, the internal secretion being elaborated by the true secretory glandular tissue, and mainly taken up and distributed by the blood vessels of the organ, the excess escaping with the spermatozoa.* Consistently with this hypothesis, the internal secretion probably is constant, while the spermatozoa producing function is easily in-

* In reference to this point, Waldstein and Ekler's experiments (Der Nachweis resorbirten Spermas im weiblichen Organismus; abstract in Deutsche medizinische Wochenschrift, October 9, 1913) are very interesting. They found that within two and one half to sixteen hours after coitus, the blood of the human female contained a ferment which peptonized the albumin of testicular extract. Comparing this with Fauser's observations in dementia præcox, we are justified in suspecting that the internal secretion of the testis is in part eliminated by the semen. The marked improvement so often noted in the nutrition of sterilized—not castrated—males, and resulting from continence, thus may be scientifically explained. It is possible, however, that there is a change in the ovarian hormone itself, under the stimulus of coitus. The author believes that the sense of well being experienced after normal coitus by both sexes probably is due to a large dose of hormone entering the circulation on the one hand from the testis and on the other from the ovary.

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hibited or destroyed, and the spermatozoa doubtless are more or less intermittently produced, varying with sex stimuli and demand. In brief, the author is not inclined to the belief that the destruction of the spermatozoa producing function necessarily means complete destruction of the true generative gland tissue.

Biedl further says: "It is highly probable that, by the agency of its secretory products, this gland is responsible for the development of the male sexual gland from the differential genital tract. That it has a determining influence on the normal development and maturity of the generative portion of the sexual gland, the formation of the secondary genital organs, and the existence and persistence of those morphological and biological characteristics which are the property of the male sex, is undoubted."

The immediately foregoing positive assertion of Biedl's being accepted as in the main true, how can we reject as improbable the view that a successful testicular implantation should, other things being equal, increase virility — either by the direct action of its internal secretion upon the generative gland tissue, or (a) by entering the blood, improving general nutrition, and (b) returning to and acting as a stimulant, tonic, and nutrient reconstructive upon the generative gland cells? If the internal secretory tissue is the self elaborated "meat" upon which the generative tissue proper of the testis "feeds," aged and weakened glands should profit even by an increased supply alone; this, granting that an oversupply is impracticable — as probably it is. In connection herewith, it is noteworthy that advancing age and castration alike tend to the production of obesity. It should be noted also that obesity, even in relatively young subjects, is likely to be attended by comparative inactivity of sexuality.*

From the viewpoint of its internal secretory function, the ovary is very similar to the testicle. The correlation of the physiologic function of the Graafian follicles and of the corpus luteum has long been well known. The function of the stromal gland cells, however,

* Apropos of the nutritive stimulant action of the hormone, one of the author's own experiments is interesting. Implantation of testes from a year old cock upon a nonrelated capon of the same age resulted in an improvement in carriage, increased glossiness of plumage, a better appearance of the face, comb, and wattles, increased liveliness, and a disposition to combativeness, with a slight development of sex activity, which last phenomenon was of short duration.

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has attracted attention only in recent years, Regaud and Policard being the first to suggest that these glandular cells might be secretory. Bouin, in 1902, described these cells as *glandes interstitielles de l'ovaire.*

Biedl says, "that the secondary female sex characteristics, especially those of the genital tract, are dependent upon the interstitial cells of the ovary is at present not proved." He further directs attention to the fact that the X ray destroys the Graafian follicles alone. The interstitial tissue is not only preserved, but it hypertrophies.

While the observations thus far made upon the ovary and its secretions are not as conclusive as in the case of the male gland, Biedl states, "that the tissue which performs the function of external secretion is also the site of production of the ovarian nonsexual hormone, which exercises an alterative influence upon a large number of tissues and functions, is suggested by analogy with the male sexual gland."

This is distinctly contradictory to Biedl's attitude regarding the testis, and his reasoning by analogy seems obscure. In any event, differences of opinion as to the precise histophysiologic source of the internal secretion of either the ovary or the testis have little bearing upon the experimental or therapeutic value of implantation of the sex gland tissues in their totality.

The real, probable, or possible results of implantation of the ovary depend — so far as the properties of the gland *per se* are concerned — upon, first, the existence, effects, and continued production of an internal secretion; second, the existence, effects and continued production of the ordinary generative sexual secretion; third, successful implantation of a normal gland, in whole or in part, with its structure entire; fourth, the duration of the life of the implanted gland.*

Granting that the Graafian follicle, the corpus luteum, and the ovarian interstitial tissue are equally important, or that only one of these tissues really is important from the internal secretory stand-

* Stich, Deutsche medizinische Wochenschrift, September 25, 1913, in a résumé of the present status of organ transplanting, sums up the subject of ovarian transplantation by stating that it occasionally succeeds in animals which are blood kin. Stich altogether ignores testicular transplantation, apparently as a subject on which no data are available.

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point, the procedures and results should be the same, unless it is held that a complexity of origin impairs the effects of the gland secretion, which obviously it cannot. The first work of any importance in ovarian transplantation from the living was done by Robert T. Morris, of New York.

From Leo Loeb's pioneer experiments in cultivating tissues *in vivo* and *in vitro,* some years prior to Carrel's recent remarkable experiments, the author had suspected that more or less successful grafting of the human testis from one living subject to another was possible. Aside from the recorded experiments on animals, this was suggested by observation of the effects of division of the spermatic cord, exclusive of the *vas deferens,* in a large number of varicocele operations, and experimental severance of the cord, including the vas, in numerous hernia operations on old men in a certain public institution. In these cases the author closed the hernial opening over the "tucked up" proximal end of the cord, and sutured the distal end of the cord across the ring. In respect to division of the cord, the procedure was similar to the operation for hernia later suggested by Bloodgood. Early in his surgical experience the author found in operating for varicocele that, unless infection occurred, complete division of the cord was not followed by atrophy of the testis, even when the operation involved complete extrusion of the gland via the operation incision. Apparently the circulation of the cord could not be restored at the point of junction of the ends of the divided portion before the testis died of innutrition, if the salvation of the gland depended upon the spermatic artery and the artery of the vas.

The vascular supply of the *tunica vaginalis* alone apparently being of no magnitude, the notion obtruded itself upon the author that possibly comparatively little blood was really necessary to the life of the testis, and, further, that the juices of the surrounding tissues might be sufficient to preserve the life of the organ or at least a portion of it. Reasoning by analogy, the implantations of ovarian tissue subsequently performed by various operators, in which gland tissue from the living was replanted in the living, seemed quite conclusive evidence of the possibility of successful testicle grafts under similar conditions.

With the publication of Carrel's remarkable experiments, and having in mind not only numerous experiments with tissue from the

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living published in the literature and recent developments in the study of internal secretions, but certain preconceived ideas of his own, the author became convinced that implantation upon living subjects of sex glands from the dead body was both practicable and likely to be therapeutically successful. He felt, also, that if successful, the procedure possibly might open up avenues of medical and surgical therapy which would be somewhat staggering, even to those of us who are not easy to astonish.*

As long ago as 1913, the author from time to time endeavored to secure opportunities for experimentation with material from the dead body in sex gland implantation in both sexes. That the difficulty of obtaining proper material was great, should be obvious to any one who knows the prevailing sentiment in America against using the dead for scientific purposes — especially the recently dead. These difficulties were greatly enhanced by the fact that it seemed desirable to secure glands from special subjects, of a certain age, dead of violence, in fresh condition, and as certainly free from syphilis as it was practicable to determine. The Wassermann test might, or might not be practicable. Having secured the proper cadaveric material for experimentation, it still remained to secure a living subject who would permit the experiment.

With the triple object of experimental sex gland implantation, to determine whether it was practicable, for the purpose of studying the action of the sex hormone and of testing the procedure in the treatment of dementia præcox, the author attempted to secure a favorable subject afflicted with this disease, and endeavored to enlist the coöperation of several medical friends whose opportunities for securing material were better than his, but without success. The double problem of securing human sex glands under proper conditions and of having a complaisant subject ready and waiting for the experiment seemed insoluble, until the plan of combining surgeon and subject suggested itself and the author resolved to perform the experiment upon his own person.

January 16, 1914, there were placed at the author's disposal two supposedly appropriate male subjects from which to select the material necessary for gland implantation. One of these was re-

* Carrel himself concluded from his observations that glands could not be successfully transplanted save where donor and recipient were kin.

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jected. The other, a suicide by gunshot, and a relatively inferior but apparently healthy subject, eighteen years of age, was selected. The subject had been dead seventeen hours, having lain at the undertaker's under the ordinary conditions and temperature since shortly after death. The weather at the time was very mild. In the author's haste to secure the necessary material, the appliances necessary to secure blood for the Wassermann test were forgotten, hence it was necessary to rely upon such history of the subject as was obtainable and a careful examination of the body, especially of the genitals, including incision and macroscopic examination of the lymphatics. The danger of syphilis obviously could not be entirely eliminated, but was not sufficient to weigh heavily in the balance of opportunity to secure the long sought material.

Both testes were removed as aseptically as practicable, the instruments and gloves being sterile, and iodine being freely employed in lieu of the customary scrubbing. The testes immediately were placed in a jar of sterile normal salt solution.

CASE I. *Autoimplantation of the testis; subject fifty-six years of age.* Seven hours after securing the necessary material, and twenty-four hours after the death of the subject from which it was removed, the author implanted in his own scrotal sac one of the experimental testes. The operation was performed in his office, with the assistance of his former associate, Dr. Carl Michel, whose loyalty and intelligent co-operation throughout our experiments cannot be too highly commended. The conditions, so far as asepsis was concerned, obviously were not those of an up-to-date operating room, with the usual corps of nurses, but were as satisfactory as was possible under the circumstances.

Technic: Local anesthesia was employed—a ten per cent. solution of novocaine in one per cent. urea and quinine hydrochloride. Of this about a dram and a half was injected. The anesthesia was satisfactory so far as the skin was concerned, but by no means so as regards the deeper tissues, merely because especial care was taken not to puncture the veins of the cord and also to avoid infiltration of the tissues about the cord at the site selected for the implantation.

The author made an incision two inches in length, in the mid-scrotal region, about an inch external to the right of the scrotal rhaphé, and dissected down to the cord. The awkward position necessary to the work and the distance of the field from the operator's eye were such that the *tunica vaginalis* inadvertently was cut. The escape of vaginal fluid and the appearance of the testicle at the bottom of the wound gave the first intimation of the accident. The opening in the *tunical vaginalis* was closed with fine catgut and the operation proceeded with.

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The author next made beneath the deep fascia a pocket about two inches in depth, at the bottom of which was the cord. Into this pocket, directly upon the cord, was implanted the testis, already prepared by removal of the epididymis and decortication to the extent of about half its surface. The fascia was closed with a pursestring suture of fine catgut, following which, bismuth subiodide and the usual gauze dressing were applied and a suspensory was adjusted.

Postoperative course: Probably because of undue movement, the exigencies of practice at the time making it impracticable to rest physically, there was a little superficial hemorrhage, forming a small clot immediately beneath the skin incision. Saprophytic infection occurred, with considerable edema of the penis and scrotum, extending well up toward the inguinal ring. On the fourth day the author opened the superficial portion of the wound, drained, and aseptized it. There was not then nor subsequently any pus infection during the progress of healing. There was a little over 1° F. rise in temperature, lasting four or five days.

There was considerable pain, following undue motion, on the eighth day after the operation, and a small quantity of seminiferous tubules protruded from the wound, the pursestring fascial suture evidently having given way. Although there was no rise in temperature and, as already stated, no pus infection, the author now concluded that the experiment was a failure, and decided to remove what apparently was a somewhat dangerous foreign body. He therefore requested Dr. Michel to remove the implanted gland, and as there was a little resistance when traction was made on the protruding gland tissue at the bottom of the skin (*i. e.*, the extrafascial wound), the attempt was made to remove it entire by forcible traction. The resistance to traction and the pain attending this procedure demonstrated pretty conclusively that it would have been wiser to let the gland remain.

The gland splitting longitudinally, only half of it, and, strange to say, the more solid portion, covered by the *tunica albuginea,* came away. This, on examination, showed well formed and abundant vascular adhesions, which apparently conclusively showed that the implantation was a success. We therefore decided to leave the decorticated remaining half of the gland *in situ.* At the time of the implantation the semi-decorticated gland was so soft and so readily became extruded, that it was with difficulty retained in the implantation cavity while the pursestring suture was being inserted and tied. Had this circumstance been remembered, the mere fact that a moderate amount of traction, or even slight pressure, was not sufficient to dislodge the implanted tissue from its bed and extrude it, would have suggested the wisdom of allowing the gland to remain.

After the removal of the portion of gland there was some increase in the local inflammatory symptoms, due to simple trauma. This, however, subsided within forty-eight hours. Immediately following the removal of the gland tissue, there was a moderate discharge of a mucosanious looking secretion, which continued in gradually diminishing quantity for five weeks, at which time the sinus was completely healed. The tardiness of healing in

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a noninfected wound is worthy of note, suggesting the characteristic of fistulæ of glands in other regions, notably the parotid.

Numerous microscopic examinations by Dr. Michel of the fluid from the fistula showed blood corpuscles, leucocytes, and immature spermatozoids, such as normally are found in the testis prior to their complete elaboration in the epididymis. There was no evidence of pus infection, the fluid being free from pus cocci.

After the extraction of the portion of the gland, there was no further appearance of seminiferous tubuli in the wound, neither was there any débris nor broken down gland tissue in the secretion from the "fistula." After the inflammation in the surrounding tissues had completely subsided, a distinctly circumscribed, ovoid, insensitive body adherent to the spermatic cord could be distinctly felt. This mass measured approximately 4.5 by 3 cm. by 2 cm., and was evidently composed of the remaining portion of the testicular gland structure, with a certain amount of new connective tissue investment.

The size of the mass gradually decreased. June 1, 1914, it was a smooth, fairly movable, ovoid, insensitive, circumscribed, typically glandular body, about the size of a small almond, still loosely attached to the spermatic cord. August 1, 1914, the mass was nearly round, about the size of a hazel nut and, strange to say, slightly sensitive. It had not diminished much, if any, in size for several weeks, although still further shrinkage was expected. It was noted that the tumor varied considerably in size at different times. This was very suggestive of actual function. The "nodule" gradually decreased in size until, at the end of eighteen months, it could barely be felt. That during this time the mass was composed largely of proliferated active hormone-producing cells the author is firmly convinced.

Apparent Local Results of the Experimental Auto-Implantation.

That the implanted mass was for many months composed of living, functioning testicular tissue is, to the author's mind, not an open question. Dead tissue of such loose structure and soft consistence as are the *tubuli seminiferi,* devoid of the normal fibrous envelopment—the *tunica albuginea*—and connected by an open wound with the surface of the skin, could not logically be expected to remain *in situ,* much less to become encysted by connective tissue, but would have broken down and come away, either in mass or as débris. Nor would the sinus have healed so long as necrotic tissue was present at its tissue terminus. If the mass was purely inflammatory, it should not have become circumscribed, freely movable on its cord attachment, and relatively lasting, but should have disappeared *pari passu* with the absorption of exudate in the surrounding inflammatory area. The persistence of the tissue mass at the site of im-

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plantation, together with the continuance of the apparent physiologic results, appear to be conclusive, an opinion which was held by all who noted the progress of the case.

As to whether the implanted tissue eventually would be entirely destroyed and replaced by connective tissue, the author ventured the opinion that it would not, holding that, if the implanted tissue finally disappeared, the temporary nature of the implantation result logically might be explained by faulty technic, embracing too free decortication, which, as elsewhere stated, in future can be avoided. He further believed that the testis and ovary, if not completely decorticated, would be more likely to endure permanently after implantation, even though considerable atrophy occurred, in this respect probably differing from the thyroid and other glandular tissues.

Since the original experiment it has become evident that, in most cases, complete atrophy of the implanted tissue eventually occurs, the time at which it occurs being variable, but in all cases being delayed sufficiently to secure the benefits of the sex hormone for a prolonged period. Experience has shown, also, that decortication really does hasten atrophy.

If trophic nerve supply is essential to structural integrity, then more or less atrophy of implanted gland tissue should be expected, whatever technic is employed, unless it is conceded that regeneration of such nerve supply may occur.

The author believes that he has proved that apparently complete destruction of the generative portion of gland tissue does not nullify the physiologic effects of the implantation. With hardly perceptible tumor, the Leydig cells apparently still remain and function, producing the all important hormone. They seemingly proliferate and may increase, in amount and activity, the production of internal secretion. On the other hand, they might eventually be so changed by blood, tissue, and trophic influences as to become inert, as regards their internal secretory activity, some time before the mass entirely disappears.

In brief, whether or not there is eventually apparent disappearance of the gland tissue after a successful implantation, the method theoretically should be therapeutically useful and its benefits permanent: First, because the interstitial gland tissue may remain and function, producing hormone; second, because the hormone may

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have done its work of regeneration, the conditions for which we operated having been so profoundly modified by nutritional changes that they do not recur, with consequently no indication for continuing the remedy.

Although complete atrophy should be the fate of implanted alien testes and ovaries, irrespective of whether the entire gland or pieces are used, and sufficient benefit has not resulted, we still may have recourse to successive implantations of fragments of glands, repeating the "treatment" as often as may seem necessary.*

Suggestions for Improvements in Technic.

The difficulties under which the author labored in his auto-experiment require no further comment. That not only the sex gland implantation, but also the technic of the process necessarily was experimental is self-evident. In his subsequent work the procedure was modified by either leaving intact all the *tunica propria* of the testis, or decorticating from two to four narrow, longitudinal surfaces, about two or three mm. in breadth, running the entire length of the gland. These narrow bands of decortication are an extra, but probably unnecessary, provision for nutrition by the tissue juices of the implantation bed during the formation of vascular adhesions and new blood supply. Vascular adhesions naturally may be expected to form at the points of decortication. The limited area of decortication will not subsequently permit of an invasion of connective tissue from the surrounding structures sufficient to endanger the delicate glandular elements of the implanted organ. The portion of the *tunica albuginea* still remaining affords ample protection for the gland tissues beneath it,

* Fresh triturations of gland tissue even may be used in the form of an emulsion, injecting the fluid almost anywhere beneath the skin. Excepting implantation, this would seem to be the most rational method of administering hormone.

The danger of the phenomena characteristic of anaphylaxis naturally suggests itself in connection with successive implantations and testicular emulsion treatment. The author has implanted the testes of cocks repeatedly in the same subject, and even in female fowls without evil results. Implantation in fowls is a severe test of protein dosing. If the testis of the human being were as large in proportion to the body as that of a lusty cock, the gland would weigh several pounds; this aside from the relatively greater activity of the glands of the fowl. The author also has experimented upon guinea pigs, upon himself and upon a number of other human subjects with large doses of human brain emulsion, given beneath the skin and intramuscularly, without injury.

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and probably soon regenerates and covers such portions of the decorticated area as are not occupied by new blood vessels.

Under favorable conditions, local anesthesia is sufficient for implantation operations. In the insane, general anesthesia is likely to be required, and the author thus far has employed it. Asepsis should be most rigid both in securing the glands and their implantation. The author now removes them from the dead body without permitting his hands to come in contact with them. The glands should be removed from the body as soon as possible after death. The slightest degree of decomposition will insure failure. Obviously, haste in removing the glands is not so urgently necessary in cold as in warm weather, nor is it so necessary immediately to implant the glands.

The glands should be placed in sterile normal salt solution, or, preferably, in Ringer's solution, immediately on removal from the body, and under favorable conditions implanted within twenty-four hours. As Carrel has shown, tissues may be kept frozen for several weeks and still retain their vitality. This fact perhaps in future can be taken advantage of in preserving sex glands for implantation. In one of the author's cases the ovary was kept in a refrigerator for a week. In a series of cases which followed it, refrigeration was employed for from two to five days, but the results were not encouraging.

An aseptically prepared gland, when frozen, can undergo no change save a certain degree of "autolysis" which will prevent its functioning. Even complete autolysis would not make dangerous the implantation of an aseptic gland. The autolyzed tissue would be likely to be merely appropriated as nutriment by the living tissues of the implantation bed. It is worthy of note in connection herewith that the author's former associate, Dr. Carl Michel, has experimentally demonstrated that gland tissue kept at a temperature of 37° C. for about twelve hours, loses its functional activities—"functional autolysis." This, he states, is due to relative overfunctioning in the absence of nutriment. Other forms of autolysis he terms: (a) physical; (b) putrefactive.

The loss of activity of the gland in "functional" autolysis is probably due, not so much to a lack of nutriment as to biochemic products of the gland tissue itself, these products (both internal

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and external secretion) being inhibitory to the vitality of the tissues which produce them. This involves a familiar principle in biology, particularly in pathogenic germ biology.

Excreted into and modified by the blood after implantation, before autolysis has occurred, the gland products (secretion) returning to the gland, are stimulant to its function and nutritive to its cells.

Dr. Michel suggested that tissues designed for implantation should be kept in Ringer's solution at a temperature not below o° C., and not longer than two weeks, the object being merely to inhibit the biochemic function of the cell enzymes without destroying either them or the cells that produce the ferment.

Dr. Michel probably is correct in his conclusions, although he has overlooked a most important point in his reasoning, viz., freezing possibly may destroy the delicate cells of Leydig and the ovarian interstitial cells of Bouin, without necessarily destroying the rest of the gland. Thus it is not improbable that glands which have been frozen may sometimes apparently survive implantation and yet not function, especially from the internal secretory standpoint. The aim of implantation is not to insert what inevitably must become a functionless mass of connective tissue and useless generative gland cells into the body of the recipient.

The author originally was inclined to believe that the epididymis should be removed, where the object is merely gland implantation for experimental or for therapeutic purposes to secure the benefits of internal secretion. He said, in his first paper: "While the epididymis probably produces hormone, it is here of no particular service, and by its mere bulk and the mechanic irritation it produces, greatly enhances the danger of failure of the implantation. Again, the removal of the epididymis affords a surface favorable to adhesion and nutrition, without extensive decortication and exposure of the delicate *tubuli seminiferi.*" Subsequent experience showed that in many instances it is better to preserve the epididymis.

The results of anastomosis of the implanted testicle thus far have not been very encouraging. Very little work, however, has been done in this direction on the human subject, and it seems to be a legitimate field for experimentation. Anastomosis of testes

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from closely related subjects—especially from the living to the living—at least is hopeful, despite the great difficulties attending anastomosis of the spermatic vessels.

When, for any reason, it is desirable to attempt to preserve the generative sex function of the implanted gland, the epididymis and a portion of the vas should be preserved for anastomosis, a procedure which, mechanically at least, is perfectly feasible—and successful in simple anastomosis of the duct in the living subject—by the method devised by the author, described in a previous chapter. This method of anastomosis can be applied without disturbing the cord or testis of the recipient of the implanted gland, further than to expose and divide the vas deferens for anastomosis, as shown by several experimental cases of the author's.

The obstacles to anastomosis of the small vessels of the cord appear at present to be insuperable. That more or less successful anastomosis of a testicle immediately after its removal from the living body is practicable in a certain proportion of cases, is probable. The importance of this is easy of comprehension. There are countries where there are no legal obstacles to persons disposing of portions of their bodies as they see fit. Possibly our own laws may one day be amended so as to enable us safely to use gland material from the living that is voluntarily submitted to us by its possessor. Meanwhile, if, as is possible, anastomosis of testes taken from dead bodies ever should prove to be even moderately successful, some wonderful work is likely to be accomplished.*

That the chances of failure of implantation are greater where anastomosis is performed goes without the saying, as experiments have not been encouraging and relatively free incision and exposure of the site of operation is necessary, and more tissue of a lesser degree of vitality is implanted than where our object is merely to secure the benefits of internal secretion. If, however, the gland itself should survive, the anastomosis is not likely to fail. Here again arises the question whether Carrel's results in kidney transplantation in the lower animals are equally important as bearing upon sex

* It should be remembered that "considerable atrophy" of the testis may occur, without either the generative or the hormone producing function of the gland remnant being necessarily destroyed.

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gland transplantation in human beings.* Obviously, rest in bed for some days should be enjoined in implantations, and for a more prolonged period when anastomosis is performed.

The site selected for implantation is an important consideration, and should be decided on the merits of the individual case. It may be that the sex glands will finally be shown to be quite as successfully implanted in one part of the body as another, but at present writing the author ventures to suggest that there are points of election. In the male, the site should preferably be the neighborhood of the testis and spermatic cord. The *tunica vaginalis* will invest the implanted gland on one side, and thereby give it in part a natural covering. The gland tissue probably will adhere to the *tunica vaginalis* more readily than to the other tissues, and there will be very little connective tissue at the point of adhesion, subsequently by its contraction to menace the integrity of the implanted gland. Future experience may show the advisability of folding and stitching the tunica over the gland. This possibly would be wise where only a portion of testis is implanted. The author would suggest, also, that where only a portion of the gland—this also applies to the ovary —is implanted, the cut edges of the *tunica albuginea* should be sutured together to protect the delicate gland tissue from connective tissue invasion. Whether or not there is a special "selective" trophic or blood nutritive element in the environment afforded the implanted tissue by the proximity of its bed to the testicle, is an open question.

Future experience may change our view, but at present it seems doubtful if it would be wise to implant the gland into the cavity of the *tunica vaginalis*. The resulting mechanic irritation, conjoined

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* The author feels that he cannot too often insist that failure in transplantation of an excretory organ has little bearing on that of a double secretory organ like the testicle or ovary. Carrel seems to believe that the results of his experiments should estop organ transplantation altogether, judging by his recent paper before the American Surgical Association. He apparently loses sight of the hormone therapy angle of organ transplantation. It is to be regretted that he did not discuss this, more especially as he knew of the author's own experiments, several weeks before. To have mentioned these experiments perhaps would have been only fair to the general scientific bearings of organ transplantation. The author further insists that, while the preservation of the generative function of the transplanted ovary is not to be expected—save possibly in testicle anastomosis under the most favorable conditions—and that of the testis possibly not at all, sex gland implantation still offers great therapeutic possibilities. As to the local possibilities, note in this connection the remarkable results obtained in several of the author's cases.

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with trauma of the sac, might produce so much exudation and swelling as to cause severe pain and even endanger the recipient's own testicle. Hydrocele probably would result, although this possibly might be avoided by cutting "windows" in the sac, for drainage. Aseptic extravaginal implantation in no way endangers the subject's testicle.

The second best implantation site doubtless is the pelvic properitoneal space, as later will be suggested for the ovary.

As third choice of location the author would suggest the *mons veneris,* the pubis being shaved and the incision made transversely just below the upper margin of the pubic hair. The length of incision, of course, will vary with the amount of fat, an incision one inch in length being ample in spare subjects. By the downward insertion and opening of a pair of forceps or blunt scissors, a pocket may by dry dissection easily be made for the gland. This pocket should extend downward to just above the pubic symphysis. In this location, after the hair again has covered the part, neither the scar nor the small tumor which will result—if the implantation is successful—will cause comment by others. The cavity of Retzius also is safe and accessible. The gland should be implanted high up, or well over to one side to insure peritoneal contact. The axilla appears to be another eligible location, the incision being made well away from the centre of the axilla and the bottom of the pocket made to correspond with about the centre.

One important difference between male and female here must be noted. The former normally is dominated by the psychic influence of a testis that can be seen and felt. He always is conscious of its presence. The reverse is true of the female and the ovary. The psychic benefit of the consciousness of a demonstrable testis, especially in the scrotum, must not be forgotten in the case of the male. It will be by no means a negligible quantity in external ovarian implantations in the female. As to what extent exposure to traumatism may militate against the success of implantations in exposed sites is a matter for future determination. It is, however, worthy of consideration.

In ovarian implantation of glands from the dead subject, which is quite as practicable as similar testicular implantation, and for which the necessary glands of proper quality are much easier to

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secure, the order of choice of sites for operation at present writing appears to be as follows:

1. The properitoneal space.
2. The cul-de-sac of Douglas (extraperitoneally).
3. The *labium majus,* the incision being made high up and the part "pocketed" downward, as in the case of the scrotum.
4. Beneath the mammary gland.
5. The pubic region, as in testicular implantation in the male, better, perhaps, the cavity of Retzius, where observation of the implanted tissue is not desired.
6. The rectus muscle.

The peritoneum forms the normal environment for the ovary, and if half or more of the surface of the implanted organ is made to rest permanently on the peritoneum — which by adhesion in successful cases will form a protective and nutritive investment for the gland—the chances for success will be greatly increased.

An eligible point is the ilioinguinal region, well out toward the anterior superior spine of the ilium. After exposure of the peritoneum, a pocket should be made anteriorly to it, downward into the pelvis.

The cul-de-sac of Douglas is an available and logical site for implantation. A small vaginal incision should be made posterior to the uterus, the peritoneum being carefully pushed up with the finger, thus making a pocket for the reception of the implantation gland.

The *labium majus* is a particularly eligible site, because of the proximity of the canal of Nuck, which is a peritoneal derivative and the analogue of the tunica vaginalis in the male.

The author will reiterate that a point in favor of "exposed" sites of implantation in some cases is the psychic effect of objective evidences of success on the mind of the patient, which sometimes is so desirable. Incidentally, the surgeon can more easily determine whether or not the implantation is successful.

The methods of Tuffier and of Martin of implantation within the pelvis and rectus muscle of ovarian tissue from living donors, is a procedure entirely different from that under discussion. Heterointraperitoneal implantation within the pelvis is unnecessary and has an element of danger. For experimental purposes especially, it

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is usually best to implant the gland in a part accessible to observation, and from which, if desired, it can be subsequently removed. To imitate the natural environment as closely as possible, the author would suggest the experiment of partially wrapping the testis in a graft from the tunica vaginalis or peritoneum, and the ovary in "appendage" peritoneum, whenever the implantation site is more or less remote from the normal ovarian or testicular environment; in brief, where the environment would otherwise be alien, or possibly even hostile, it possibly can be made temporarily akin, or at least friendly. Should the membranous lining of the implantation pocket be absorbed, as is probable, it will have served its purpose of a matrix for the growth of a thin protective layer of connective tissue. A similar technic might be advisable in thyroid implantations. It is probable that implantation in the normal habitat of the thyroid is more logical than elsewhere. Where the tissue has no capsule, or the capsule is insufficient, fascia may be used as a protective "capsule." Theoretically, a piece of peritoneum should be ideal.

Ordinary connective tissue is a deadly foe of glandular, brain, and nerve tissue, as shown by its effects in cirrhosis of the liver, interstitial nephritis, and various diseases of the cerebrospinal axis. So far as possible, therefore, we should protect the implanted gland from invasion by it. It is well to remember that the environment of the ovary is such that it should be removed from the dead body relatively earlier than the testicle. The close proximity of the bowel is favorable to early decomposition of pelvic fluids.

In implantation in either sex, care should be taken: *First,* to make as limited an incision as is compatible with the insertion of the gland. As the gland is soft, and the skin and fascia elastic, a very small incision will suffice. *Second,* to insure that the dissection of the pocket shall be as dry as practicable and to traumatize the tissues as little as possible. *Third,* to avoid injuring the delicate gland tissue during its preparation and implantation. It should not be regarded as dead insensitive tissue that may be recklessly mauled, but as living tissue to be carefully handled. *Fourth,* to use the finest chromic gut—or better, perhaps, iodinized gut—and insert no more sutures than are actually necessary to a perfect closure. The purse-string suture for the fascia is ideal. *Fifth,* at all times to avoid rough manipulation of the implanted gland during healing, and

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especially to manipulate it as infrequently and as gently as possible, while adhesions and vascular supply are forming.

The problem of the quantity of gland necessary for implantation is a most important one. If the major premises herein outlined—or suggested—are correct, this problem practically involves the question of the proper dose of internal sex gland secretion in various conditions and in individual cases. In his first paper the author said: "If a fair average of successes should prove to be practicable, an entire testicle body is preferable. In general, however, probably one-half of a testis is sufficient to give definite physiologic results, and is surer to be preserved than a whole gland. In the case of the ovary, however, the author is inclined to believe it better to implant an entire ovary, even though a small portion of the gland is seemingly sufficient to preserve the secondary sex characteristics and often even to prevent the nervous wreckage incidental to oöphorectomy." Further experience has led to the conclusion that, in the case of the testis the quantity of gland implanted may be varied according to the material used, small glands being implanted entire.

If the implantation is successful, the dose of internal secretion, however large or small it may be, probably is continuous as long as any of the implanted tissue remains. It is for this reason that a relatively small portion of implanted sex gland tissue is likely to be efficacious. Even though implantation should prove successful, definite results probably should not be hoped for before six or eight weeks after the implantation, at which time complete establishment of circulation in the gland—if it survives—may reasonably be expected.* In general, it is probable that such results as may occur will be noted earlier in testis than in ovary implantation, and in the case of the testis, earlier where the gland has been decorticated, although complete decortication possibly endangers permanent success. The establishment of a sufficient vascular supply is essential, not only to the life of the gland, but to the necessary supply of materials from the blood for the elaboration of internal secretion, and to the entrance of the latter into the blood.

* In the author's experimental and therapeutic work, marked results have occurred much earlier. The initial dose of hormone shows effects for the first twenty-four to thirty-six hours. The secondary or systematic constitutional effects begin within ten days to three weeks. New blood vessels are found by the eighth day.

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Rationale of Sex Gland Implantation.

The story of sex gland internal secretion therapy can be simply told. *The hormone is a cell stimulant, nutrient, and regenerator.* The application of the principle is, of physiologic necessity, far reaching. It may in a measure serve to reconcile Bichat's humoral pathology and the cellular pathology of Virchow and prove them to be equally logical, but only half truths. A more highly developed neuropathology probably will be the connecting link between them. The germ, however, will not grow less important in etiology, but, as time goes on, undoubtedly will be aggrandized as a causal factor of disease. In brief, the micro-organism will be more clearly understood as merely the agency through which most pathologic machinery is set in motion.

Should implantation ever become an established therapeutic procedure, as it seems logical to predict that it will be, it doubtless will be found that the required dose of internal sex gland secretion will be governed by: 1. The age and general bodily vigor of the recipient of the gland. 2. The age and presumed general and sexual vigor of the dead subject from which the gland was taken. 3. The disease and the stage of disease for the cure of which implantation is done. The quantity of tissue implanted.

The cause of death of the donor is of vital importance. The safest subject is one dead of violence. Subsequent experience may show the safety of using glands removed from subjects dead of various diseases, notably nephritis and disease of the heart. Let us hope for this, as selection restricted to subjects dead of violence greatly limits the possible supply of eligible material. Subjects dead of infectious diseases, or affected by malignant disease, whether or not it is the cause of death, and those of a known cancerous heredity especially, are to be avoided. Aside from their dangerous character, testes removed from subjects dead of general infection undergo softening and decomposition with astonishing rapidity. In general, subjects dead of either acute or chronic infectious disease are not promising sources of sex gland supply, for two reasons: 1. The possible danger to the recipient; 2. the lack of vitality of and the rapidity with which autolysis occurs in the glands from the donor.

It should be borne in mind, however, that the conditions in which gland implantation is indicated often are such that even con-

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siderable risk might be justified. On the average, the dangers of infection cannot equal in gravity those of the formidable surgical operations that we daily perform, and implantation *per se* is not dangerous to life. Perfectly normal and entire testes and ovaries are not absolutely essential. Fragments of normal portions of gland tissue taken from sex organs may be utilized, where neither the subject nor the gland is affected by malignant disease, tuberculosis, acute or chronic infection—purulent or other. When the recipient of the gland is known to be syphilitic, syphilis in the donor may be disregarded. It possibly may even add to the value of the gland. The uninfected glands of patients dead of tuberculosis are likely to be especially valuable, if the applicability of the method to the treatment of tuberculosis should be proved. Theoretically, tuberculosis should be found to be an inviting field for sex gland therapy. The only theory of treatment of the disease that has stood the test of time is that of nutrition, first, last, and all the time. The inference regarding the indications for sex gland implantation is obvious.

In any general bacterial infection of chronic type there is systemic reaction of ordinary glandular, internal, and lymphatic secretion. The lymphatics, in the attempt to filter the toxic substances and the internal secretory glands, stimulated to hyperactivity, act in combination with the other defensive factors to overcome the infection. Sex glands taken from an individual who has developed a relative immunity to the infection by means of his natural physiologic resistance, and thereby decreased the relative virulence of the infecting organism, theoretically should possess, *cæteris paribus*, special therapeutic potency. Transplanted to an individual suffering from the same disease, the hormone of such glands should increase cell resistance and stimulate to greater activity the physiologic nutritive-defensive cycle, thereby aiding in overcoming the infection.

In treating experimentally tuberculosis by sex gland implantation, we therefore may use glands taken from subjects dead of that disease. There probably is little or no danger of local infection if the glands are macroscopically sound. The ovary, especially, should be safe, for it rarely is affected by tuberculosis, and even in the testis primary tuberculosis is rare. The hormone from the internal secretion of the implanted gland might be less in quantity and in-

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ferior in quality to one from a normal subject, yet potent enough to restore the balance of nutritive defense against the tubercle bacillus.

The excessive sexual activity noted in many victims of tuberculosis is here worthy of consideration. Is there a relative excess of gland activity with excess hormone thrown out as a defense, with coincidental sexual excitation, or is the tubercle toxin itself a psychosexual stimulant? The author would suggest that the Fauser-Abderhalden test might show some interesting results in this field.

In cases of complete castration in either sex, a double implantation is likely to secure the best results. Obviously, even admitting that a single gland is therapeutically sufficient, double implantation gives one hundred per cent. better chances of success. In impotence and sterility in the male, it would seem rational to implant an entire gland, not only from the viewpoint of the dose of internal secretion, but also because of the more profound psychic effect thereby attained. A successful anastomosis possibly might restore the procreative glandular secretory function. In certain cases of sterility in the female, where the secondary sex characteristics are not marked, or the general vitality is low and there are no mechanic pelvic impediments from malformation or disease, a large dose of ovarian internal secretion possibly may stimulate the recipient's ovaries and induce fertility. This also applies to certain males in whom spermatozoa are formed, but in whom they are small in number and feeble in vitality.

The age of the subject from which the sex glands are taken for implantation is of great importance. Subjects from about the age of puberty to twenty-five, or perhaps even thirty years of age, are best, as at this time sex gland function is very active. The younger the subject—below eighteen or twenty years—the less the danger of encountering syphilis, and the more active the propensity for growth after implantation. Obviously, the danger of syphilis is relatively less at a given age in the female than in the male. Glands from subjects much younger than pubescents eventually may be found to be of especial value in meeting particular indications, more especially as pubescence is not really necessary for the production of hormone. The author's best results have been from glands of subjects at about the age of puberty.

Again, we possibly may secure good results from the implan-

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tation of glands taken from subjects of relatively advanced age. Testes from donors of even the recipient's own age at least may prove effective. Advanced age is associated, not only with a senile quality of internal secretion, but also with a relatively deficient quantity. The successful implantation of a single generative gland logically would increase the supply of internal secretion by one-third, with proportionate benefit to the recipient. The foregoing remarks apply especially to the male, in whom the procreative period—and probably also the internal sex gland secretory period—lasts much longer than in the female. In dementia præcox and allied conditions, a healthy gland taken from a subject at any age below middle life possibly may be effective, if, indeed, sex gland implantation should hereafter prove to be effective at all in such cases.

Racial distinctions possibly need not be drawn in procuring implantation material, unless anastomosis is proposed. Theoretically, sex gland activity is likely to be greater in certain donors than in others, merely because of racial qualities. There is even a serious question, also, as to whether the tissue and blood elements of the recipient of the anastomosed gland would not eventually overcome any racial potentialities that might exist in the implanted gland. This the author found experimentally to be true of skin epithelium in cross grafting skin in negro and white, in 1880, a result verified by other experimenters.

Tuffier asserts that transplantation of the ovary from white to black and vice versa fails of success. The author's experience in this regard is limited to a single case. On March 18, 1914, he implanted in the axilla of a white woman aged sixty-seven years, afflicted with senile dementia, an ovary from a mulatto woman of forty years, dead eight hours of disease of the heart. Although greatly shrunken, the implanted gland apparently was still living three months later. Presumably, while the local results might be of briefer duration than in homotransplantation, we still would obtain adequate hormone results.

That the Wassermann test should be employed where practicable goes without the saying. It must be remembered, however, that no more than a single test can be made on a dead body, and the test alone cannot be relied upon to eliminate the danger of infection. If it is shown later that freezing of the sex glands does not seriously

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impair the chances of success in implantation, there will be no necessity for urgent haste in implanting the gland, the work can be done with deliberation and a Wassermann test always will be practicable.

The danger of syphilis is minimized by the probability that Treponema pallidum lives but a few hours after the death of the host. Freezing probably kills the protozoön within an hour or two. If, therefore, frozen, or even refrigerated, glands should be shown to be satisfactory for implantation, the danger of syphilis would be practically *nil.* That refrigerated glands are available the author's work has conclusively demonstrated.

In passing, the author would suggest that, from the hormone therapy standpoint, it would be interesting to study the results of cross implantation of the sex glands of male and female. The experiment, at least, is practicable. The author reports herewith (Case VI), a case in which he implanted a testicle in a senile female dement.*

As to any essential difference between the male and female sex gland hormones in their influence on sex development, the author has this to say: The primary sex characteristics are probably laid down in the initial combination of the male and female generative gland secretions—*i. e.,* ovule and spermatozoon—and are inevitable phenomena in embryologic development. The hormone, apparently, merely determines by its activities the secondary sex characteristics. Once these have developed, it may be a matter of indifference whether the body cells, even those of the sex glands themselves, are fed with male or female hormone. Accepting this hypothesis, the ovarian hormone should be therapeutically effective in the adult male, and vice versa. Possibly the male hormone is more powerful and likely to be more effective than even the ovarian, in the sex gland therapy of the adult female.

The persistence of typic sex characteristics, sexual power and desire in animals castrated late, after the internal secretion has done its work — *e. g.,* geldings — is here again worthy of note.

*** Since this foregoing experiment was made the author's attention has been called to Steinach's unsuccessful experiments of ovarian implantation in castrated male animals. Steinach makes no comments on the hormone therapy usages of such experiments. (Jahrbuch 6 für sexuelle Zwischenstufen, January, 1914.)**

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Apparent Physiologic Effects of Testicular Gland Implantation.

With due regard to the difficulty of excluding the psychic element in therapeutic experiments, particularly as regards subjective phenomena, whether the experiments are of the auto variety or the hetero variety, the author will present the apparent results of his own auto-experimentation. Apropos of the possible "psychic" element in his observations, several facts should be remembered: First, the experiment primarily was designed merely to decide the question of the feasibility of successful implantation of sex glands from a dead subject; second, the local discomfort, a certain degree of apprehension, and the inconvenience resulting from the operation were such as tended, during the early postoperative period, to offset undue optimism based upon subjective sensations; third, the apparent results were such as are logically compatible with our knowledge of internal secretions, particularly of the sex glands; fourth, the implantation *per se* practically was a success, even though the gland proper from biologic handicaps did not permanently endure; fifth, subsequent observations of numerous cases have verified the conclusions to which the auto-experiment led, so far as the effects of the sex hormone on nutrition are concerned.

The phenomena here recorded were, so to speak, "by results." Originally presented for what they were worth, more comprehensive observations of subsequent work have more than confirmed them.

The transient exhilaration usually experienced from cocaine did not follow the use of the mixture of novocaine, quinine, and urea hydrochloride. Despite considerable pain and some natural apprehension as to local results, there began at the end of twenty-four hours a marked exhilaration and buoyancy of spirits, lasting for about twenty-four hours, at which time considerable swelling of the operation field and adjacent parts had developed. Possibly the stimulation experienced was merely delayed action of the local anesthesia. Later experience, however, apparently has shown that it was due to the absorption of secretions from the semidecorticated gland, which absorption temporarily ceased synchronously with the development of inflammatory exudate about the implanted tissue, or because of temporary exhaustion of the supply, the gland not having

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as yet begun to function. This is termed by the author the "initial dose" of hormone.

On the seventh day after the operation the author again became conscious of stimulation and buoyancy so marked that he took an undue amount of exercise, also attending the theatre in the evening. It was on the day following that increase of local discomfort led to an attempt to remove the implanted gland. Following the traumatism incidental to removing half the gland, the sense of stimulation disappeared, to return on or about the tenth day, suggesting that the second period of stimulation was synchronous with the beginning of the establishment of vascular adhesions and consequent functioning of the gland, with absorption of internal secretion, *i. e.*, what may be termed the "secondary or physiologic dose" of hormone. This was checked by the traumatic reaction induced in the implantation bed, but recurred as soon as this began to subside, and was marked for several weeks, being gradually replaced by what might be termed a normal consciousness of unusual physical and mental vigor.

While the sense of stimulation was at its height, ability to endure physical and mental labor with much less than the usual amount of rest and sleep was noted. This gradually lessened, *pari passu* with shrinkage of the implanted tissue, but both physical and mental efficiency still remained far greater than before the implantation.

Blood pressure seems to have been greatly modified. As recorded by different observers on two varieties of instrument it gradually fell from 140 — systolic — to an average of 125, at which it persisted for some months. At present writing it is 125.

The foregoing record is presented without comment, save to remark that the reduced blood pressure has been associated with continuation of increased mental and physical vigor, and was taken in each instance when the author was working under "a full head of steam."

There was a distinctly perceptible change in the bloodvessels. A moderately varicosed condition of the veins of the legs and arms markedly improved. The temporal arteries, which had been decidedly and disquietingly prominent, became indubitably smaller, and their walls softer. *Pari passu* with shrinkage of the implanted tissue and diminution of hormone dose, the vessels have become more

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prominent, but by no means so prominent as before the experiment. There has been no change for some months past.

A decided change in the heart action has been noted in a certain direction. For some years frequent attacks of cardiac irritability — probably due to overindulgence in smoking, combined with mental overwork and the worry incidental to the exigencies of practice — had been experienced. Often palpitation on retiring prevented sleep for several hours. This symptom entirely disappeared and has not recurred, save as rarely induced by digestive disturbance or colds.

While the dose of internal secretion was at its height, a very peculiar symptom was noted: Glasses which had been comfortably worn for some years seemed to be a "misfit." Little attention was paid to this, however, there being no suspicion that the ocular disturbance bore any relation to the results of the experiment. As the same interesting phenomenon occurred in the case of ovarian transplantation shortly to be presented, the author concluded to record it here. The explanation of the symptom would seem to be a stimulation of the muscles of accommodation. The condition is still slightly noticeable. A test of accommodation by Dr. J. E. Colburn, May 14, 1914, showed it to be practically the same as at his last examination, nearly four years before. There had been, if anything, a slight increase in the range of accommodation.

There was an increase of ten pounds in weight within about eight weeks. This may or may not have been significant.

There was an improvement in the circulation of the skin, so marked as to excite comment by persons who had no knowledge of the experiment. Incidentally, resistance to cold appeared to be increased. The hemoglobin record which had ranged from ninety to ninety-five for some years, since the implantation has been 100 plus. As no test had been made for some time prior to the experiment, this deserves no special emphasis, yet it might not be amiss to call attention to Case VII.

The effect of the implantation on the sexual function was merely what might have been expected from local irritation of the genitalia in any normal individual at the same period of life. As to what might result in cases of impaired sex function, no deductions could be drawn from this particular experiment, save that

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the psychic effect of reflex stimulation and the increase of tone should be markedly beneficial. Case III is more to the point.

As to what might result from a dose of internal secretion larger than that afforded by the portion of gland finally remaining *in situ,* in a person whose mental faculties are not under stress and preoccupation, a definite opinion would be premature, but a decidedly stimulating or perhaps permanently tonic effect should logically be expected, judging by the report of other cases of testicular implantation shortly to be recorded, and judging by our knowledge of the relation of general well-being to sex vigor, and the marked improvement in physical and mental efficiency resulting from a moderate dose in my own experimental case.

Supplemented — where indicated by the mechanic vascular conditions — by resection of the vena dorsalis penis, as modified by the author, successful sex gland transplantation should not often fail to relieve impotence where the sexual organs are properly developed and serious brain or cord disease does not exist.

Brown-Séquard noted a pronounced stimulation of the function of the bowel following the self-administration of his animal extract. As a victim of a rather constipated habit the author regrets that his own experiment was not attended by a similar result.

The author had been annoyed for fifteen years or more by marked keratosis of the soles of the feet, which, combined with an eczementous condition of the flexures of the toes, gave much discomfort. Nothing seemed to benefit the condition. The idea of curing it eventually was abandoned, the occasional application of palliative ointments being the final recourse. About four weeks after the implantation experiment, the skin of the feet had become normal, with an unusually healthy color. By February 27, 1914, the skin was as soft and flexible as that of a young person. No remedial applications of any kind had been made for several months. Possibly it may be contended that the improvement in the condition described was nothing but a coincidence, but it certainly must be admitted that it is not incompatible with the probable effects on nutrition of internal sex gland secretion. (Note also Case VII.) Granting for the sake of argument that the change in the skin really was due to the internal secretion of the implanted gland — and this the author believes to have been the true explana-

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tion — what may we not expect from the action of internal secretion on the blood vessels?

At present writing, Aug. 1st, 1917, the keratosis has not returned, and the skin is still normal, save at the borders of the soles, where in certain limited areas it is dry and slightly eczematous.

From the author's experience in his own case he is inclined to believe that psoriasis and kindred diseases are due to perversion of internal secretion. The results of sex gland implantation in Case VII have led to the firm conviction that this theory of their etiology is well grounded. As to the possibility of the cure of certain chronic diseases of the skin, the general principle is self-evident and no comment is necessary.

Carrel and Guthrie assert that transplanted exogenous glands can function only temporarily. The kidneys of the cat, transplanted in the same individual, survived. When transplanted from one living individual to another, they excreted urine for three weeks, at the end of which time they ceased secreting and the animal died. This has little bearing on the exogenous transplantation — at least for therapeutic purposes — of the sex glands in the human being. (See author's Case VI.) The sex gland, by virtue of its internal and external secretory structures, is a more highly specialized organ than the kidney. It is also a doubly functioned organ. The kidney is distinctly an excretory organ, while the testis and the ovary are not, in the true sense of the word. The true generative secretion in either sex is not thrown out for elimination as useless or toxic matter, but, on the contrary, its physiologic function does not begin until after the discharge and organic union of the secretions of the two sexes. The organs which produce the generative secretion are more active, more highly organized, and more energetic than the kidney. So highly specialized are their functions that no other organ can act vicariously for them, as can the skin and bowel for the kidney. When the generative secretion ceases or is prevented from escaping from the sex glands, the organs still function importantly — producing hormone.*

Again, as already stated, even though the implanted gland finally should perish, its work of general cell regeneration has

* E. Ullmann, Annals of Surgery, August, 1914, reports a case of functionally successful anastomotic transplantation of the kidney from one dog to another.

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been to a greater or less extent accomplished, with beneficial results which may be permanent. Then, too, apparent atrophy does not necessarily mean that the interstitial cells (Leydig) are destroyed. Considerable diminution in bulk even may occur from various causes without the generative function itself being destroyed.

That the conditions are different in the two varieties of gland is shown by comparing the results of Carrel's and Guthrie's lower animal kidney transplantation experiments with the author's own autohuman and heterohuman sex gland implantations. Theory aside, the experiments related in this volume have conclusively proved that, as regards formation of new blood supply and survival of the hormone producing cells and internal secretion therapy, transplantation of sex glands, even from the dead body, is both practicable and successful.

As to Carrel's belief that practically the only hope of success in gland transplantation in general is in a close blood relationship of donor and recipient, the author believes that, while such relationship is highly desirable, he has proved that it is not essential to either sex gland hormone therapy via implantation, or to prolonged survival of the essential elements of the gland. The author has further confirmed this view by experiments on fowls. It is noteworthy that Carrel and Guthrie's conclusions from their experiments on the kidney of the cat, if accepted as final in their bearing upon gland implantation in general, would reduce to a minimum the practicality of Carrel's own discovery of the persistence of tissue vitality after somatic death, so far as its application to the hormone treatment of disease is concerned. Apropos of implantation of testis from distinctly alien sources Guthrie* reports a case of transplantation of a testis of a guinea fowl to the shoulder of an ordinary domestic cock. The implanted tissue disappeared. In passing, it might be interesting to Dr. Guthrie, if he has not already made the observation, that it is possible to crossbreed the guinea fowl and the American game fowl, hence they are not as alien to each other as might be supposed. The author saw, a little over a year ago, a bird — apparently a male — so bred on the farm of Mr. H. B. Gleezen, the well-known game fowl breeder, of Georgetown, Mass.

* Journal of Experimental Medicine, xii, 1910.

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The exogenous transplantations of ovaries from the living to the living in sheep and guinea-pigs, reported by Voronoff and Castle, support Carrel and Guthrie's conclusions, but there still remain the questions: 1. Whether different results may not occur in human beings; 2. the possible therapeutic value of implantations of human sex glands, with or without permanent life and function of the cells of Leydig, even though generative gland tissue atrophy inevitably should occur.

CASE II. Successful implantation of ovary from a subject twenty-three *hours after death.* Mrs. J., aged fifty-nine years, suffered from the nerve wreckage incidental to a pelvic operation performed fifteen years ago, and also from hepatic and gouty disturbances. The uterus and appendages were removed. A "piece of the ovary" was said to have been preserved. The author explained to this woman the objects and experimental nature of ovarian implantation, and she was brave enough to submit to the operation. Too much praise cannot be bestowed on her for co-operating in the experiment.

The implantation was performed March 3, 1914. Ovaries were taken from an apparently healthy girl of sixteen years, a *virgo intacta,* dead twelve hours of skull fracture. The operation was performed eleven hours after the removal of the ovaries from the subject, and twenty-three hours after death, Dr. Michel assisting. One ovary, the left, was implanted in the left labium majus, this location being selected because of the obesity of the patient, and our desire to study the local results of the implantation. There was no marked tissue reaction, only slight tenderness, very little pain, and no rise of temperature, the wound healing by primary union. The patient was up and about on the fifth day, reporting at the office on the ninth day. She might have been up sooner but for a persisting vaginal prolapse and vesicocele since the operation of many years ago, which required self-inserted tampons to permit locomotion. May 14, 1914, the implantation appeared to have been successful, the ovary was still *in situ,* and of course, "living." The case was examined by several physicians, who found that the ovary still was plainly perceptible.

It is obvious that Mrs. J.'s case was a severe test of implantation. After fifteen years of neuropathy and loss of sex function, with other disturbances alien to the latter, a great deal was not to be expected of the method. A complete failure of therapeutic results would not have disproved the efficacy of implantation in general. (The same may justly be said of Experiments IV and V.)

Apparent results in Case II. Making due allowance for psychic effects, the author will present the report of the patient and her family. Briefly, this is as follows: There was a marked exhilaration for the first few days, interrupted one morning by what the patient termed a "slight nervous chill."

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On the seventh day she complained that her glasses seemed to be no longer effective, and that she could not see with them to read or crochet. She then asserted, and appeared to demonstrate, an unwonted flexibility and comfort of action of her knees which, she said, had been "stiff and lame for several years." Her "hot flashes" disappeared. She no longer experienced an almost constant sense of exhaustion, and arose refreshed in the morning, whereas she stated, she formerly arose as tired as when she went to bed. She stated that she apparently needed less sleep. She was formerly annoyed by somnolence on inappropriate occasions. This disappeared. Having in mind the "initial dose" of hormone, the author is inclined to credit the patient's statements as to early effects. Blood pressure was not changed ten days after the operation.

After the first ten days, the patient gradually lost the primary effects. March 24th, however, she reported great increase in physical endurance, stating that she could climb three flights of stairs without discomfort or cardiac disturbance. Formerly she was compelled to aid herself by holding on to the baluster. She reported again, great increase in endurance, with improvement in the digestive functions and complete disappearance of the joint stiffness and of a feeling of numbness and coldness in the limbs associated with uncertainty of locomotion which had troubled her for some years. Blood pressure still was unchanged, registering 150, the same as before the implantation. Complete relief of constipation of many years' standing was also reported. Four weeks after the implantation, there was a marked change in blood pressure, which Dr. Michel reported to have afterward ranged from 125 to 130 (systolic). On April 27th, it was 125. May 14th, it was 125. Two different instruments were used in making the record. Dr. Harry S. Gradle, who had been making a study of Mrs. J.'s accommodation, reported that it had improved remarkably while the patient was under his observation—a period of four weeks.

The patient made a severe test of her physical condition during her spring housecleaning, and experienced only the normal degree of fatigue. She stated also that an obstinate, frequently recurring bilateral sciatica of over thirty years' standing had entirely disappeared. About July 1st, she had a moderate transient, unilateral recurrence, following mental disquiet. August 1, 1914, the improvement in the subject's condition still endured. The implanted ovary, although diminished in size, still could be distinctly felt. Blood pressure, September 10th, was 128. The condition of the bowels was not so good as at previous report, although still better than before the implantation. Following a severe nervous shock, the patient recently was in a very unsatisfactory condition. Later she improved, but now is said to be in bad health, although much better than before the implantation. Both she and her family were so gratified by the results of the implantation that they are anxious to have another performed.

CASE III. A man, aged fifty-eight years, commercial traveler, who, for a period of five years had been under the author's care from time to time for partial atonic impotence, consented to submit to testicular implantation.

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There was no local disease or abnormality. Somewhat less than half of a testis was implanted, the material used being obtained from the body of a man, aged thirty years, ten hours after death produced by contact with a live wire. The implantation was performed thirty-six hours after the death of the donor. The recipient was somewhat neurasthenic, as naturally was to have been expected, but was apparently in excellent health and well preserved for a man of his years.

The implantation was performed, March 14, 1914, Dr. Michel assisting. The portion of gland was partially decorticated and implanted in the left side of the scrotum, in contact with the cord, immediately posterior to the testis of the recipient, the technic being essentially the same as that employed in my autoexperiment. There was only moderate reaction after the implantation. This had subsided by the twelfth day, at which time a moderately firm, circumscribed, movable mass of glandular outline could be felt at the site of the implantation. During the process of healing the patient expressed himself as conscious of a remarkable stimulation of sexual activity. According to his account of the subjective symptoms, this began almost immediately —four or five days—after the implantation and continued during the progress of healing. Obviously the psychic element must be considered in connection herewith, as there was very little inflammatory reaction and the patient was not at all apprehensive of accidents. Nocturnal erections began on the second night after the operation and recurred regularly while he was under my observation. On the fourteenth day the patient left the city. A letter received from him, June 15th, was worthy of note merely as bearing upon his condition at that time. Quoting this letter, the points of interest are: ". . . The erections at night have continued regularly. They have rarely occurred before during the past four or five years. The erections are not quite as strong as in my younger days, nor so long continued, but the sexual act is natural again and is not followed by great exhaustion as was formerly the case. . . . The lump where the piece of gland was planted has shrunk somewhat, but I feel sure that the gland is alive and hearty. . . . I am still feeling fine and much more vigorous than I have felt for years." The evident improvement in this patient's sexual function cannot reasonably be entirely explained by the psychic effect of the implantation. Nocturnal erections dissociated from erotic dreams do not occur from purely psychic impressions. As to the influence of local irritation, this might explain the sexual stimulation occurring immediately after the operation, but naturally it would have subsided later.

On July 20th, this patient presented himself for examination. The implanted mass of gland tissue was still perceptible and about the size and shape of a good sized almond. He asserted that the improvement in sexual vigor still persisted. No observations were made of the physiologic effects of the implantation in this case, save to note the blood pressure—which was 165 (systolic), and has thus far had undergone no change—and to examine the semen microscopically, which was normal, July 20th.

January 15, 1915, the patient again reported. The implanted nodule

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had almost disappeared, but was still perceptible on careful palpation. Improvement had been maintained and the patient was very enthusiastic.

December 29, 1916, the patient reported himself as still doing well, and very much pleased with the results of the implantation.

In a recent letter he claims to be still satisfied with results.

February 21, 1914, the author's attention was called to a masterly paper by Dr. Bayard Holmes, of Chicago, "The Non-mental Character of Dementia Præcox." It was interesting to note that Fauser's experiments in the diagnosis of dementia præcox and allied conditions, which experiments had not previously been brought to the author's attention, were complementary to the theory on which he had been working, in endeavoring practically to administer internal sex secretion in various conditions. Following Abderhalden's theory of "dysfunction," Fauser found that the *Abwehrferment* or defensive ferment in the blood of patients with dementia præcox reduced the antigenlike material made respectively from the testicle or ovary, according to the sex of the patient. He finally established his test as a reliable diagnostic procedure. Summing up his studies of the Abderhalden test and its application to the insanities, Holmes says:

1. The evidence accumulated taken with many other factors indicates that dementia præcox is a condition or disease in which the secretions of the genital glands are greatly perverted.

2. As a part of this disturbance of the balance of the internal secretions, many other glands are coincidentally disturbed.

3. This "dysfunction" of the genital glands may be and is likely to be due to various peripheral infections, such as are found to produce dysfunction of the thyroid.

4. The Abderhalden reaction promises a method of diagnosis which can be applied early, in pedagogic and penal, if not judicial laboratories.

5. The psychogenetic theory of dementia ought to stand aside and give way to research into physical conditions and etiological factors and methods of prevention and cure.

6. Every institution that makes any pretense to psychiatry, even every reformatory for juvenile offenders, male or female, should have a laboratory fitted out for the defensive ferments reaction.

Adding to the list of causes of dysfunction imperfect or aberrant sex gland development, leading to dementia præcox and allied conditions, the etiologic picture is complete.

In the light of Fauser's observations, the conclusion is obvious that the logical indication in dementia præcox is the administration

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of internal secretion, or a combination of secretions. In implantation of sex glands we have the most logical method for the administration of probably the most important of all the internal secretions in the field of psychiatry.

If the essence of the etiology of dementia præcox really is a dysfunction of the sex glands, then the indications are especially clear and logical. It must be remembered, however, that, although it is conceded that the indications for sex gland implantation seem to be especially clear in dementia præcox, by the time the diagnosis is made, considerable organic neuron change may have occurred, with a resulting permanent aberration of function. Unlike other organs, compensatory action of brain cells probably will not occur and conserve its mental functions. A moderate impairment of the structure of the hepatic or of the renal cells may not be manifested by any apparent change in the health of the subject. In the case of the kidney, vicarious action of other eliminative areas may indefinitely keep the subject in apparently good health. The slightest impairment of the delicate, highly specialized brain neuron structure almost inevitably will be followed by a greater or less degree of mental deterioration.

The hebephrenic type of dementia præcox probably is the most promising one for hormone therapy. While diseases of the nervous system in general seem to be a promising field for sex gland secretion therapy, early administration is urgently necessary to give both the patient and the remedy a fair chance. Regeneration of structurally damaged, delicate neuron, nerve fibre, and ganglion cell is rather more than can fairly be expected of any remedy.

In the early stages of locomotor ataxia and paresis, implantation seems to be worthy of trial. The disastrous effects of the spirochete are largely due to the cell toxemia it produces, and to the pressure of vascular cell infiltration. The resulting damage is of a nutritional type, and the indications seem to be clear enough.

Chronic inebriety offers considerable inducement for sex gland therapy. The innutrition and nerve instability which cause the cell to "cry" for alcohol, quite likely can be met by the hormone of the sex gland secretion, administered in one form or another, preferably, perhaps, by implantation.

Given a remedy which really stimulates the nutrition of nerve

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tissue, and the possibilities of service in therapy are boundless. There are few chronic diseases in which the nervous system is not more or less involved, with resultant trophic, sensory, or motor perturbation.

Apropos of the possible benefit of internal sex gland secretion in arterial conditions in which syphilis is the primary etiologic factor, the analogy between senile and syphilitic vascular changes is suggestive.

In enlarged prostate, benefit possibly might occur from sex gland implantation through, 1, relief of the senile etiologic element through improved nutrition; 2, antagonism to the bacterial infection element — gonococcic or colon — which is such an important etiologic factor in prostatism; 3, resolution of the adventitious (inflammatory) tissue, more or less of which is found in the enlarged prostate.

In dementia præcox the etiologic possibility of syphilis should be seriously considered before resorting to implantation. Here the Wassermann test is of great service. Syphilis unquestionably is responsible for some cases of dementia præcox, or at least of a certain proportion of cases which fall symptomatically under that nomenclature. The author qualifies merely because the Fauser-Abderhalden test may force the adoption of a new nomenclature.

In a case of alleged dementia præcox in a boy of twenty years, seen about five years ago, in consultation with a most competent alienist, the author diagnosed syphilis. The Wassermann test proved negative. No history of syphilis had been recorded. During a fairly lucid interval, the patient finally related an escapade of intoxication and exposure to infection, a promptly and mistakenly cauterized penile sore of brief duration appearing later. Careful inspection showed a fairly typic adenopathy and a sparse, fading maculopapular syphilide. The patient recovered under specific medication and now is apparently perfectly well. As a presumptive verification of the diagnosis, a retinal or choroidal hemorrhage occurred, undoubtedly because of neglect of treatment, some months ago, destroying the vision of the affected eye.

It may be remarked that syphilis in the recipient ought not to be regarded as a contraindication for implantation. The disease may act as other infective diseases apparently do, by a toxic influ-

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ence on the internal secretory function of the sex glands. Antisyphilitic treatment is indicated, but the impression made by the infection upon the sex glands may be such that treatment is ineffective. Here gland implantation is worthy of trial.

Senile cataract and its associated conditions in their incipiency are an attractive field for experimental work with sex gland hormone via implantation.

Should sex gland implantation prove even moderately effective in checking or improving the conditions incidental to at least a moderate proportion of cases of senility, arteriosclerosis undoubtedly will be considered amenable to treatment. As to incipient senile dementia, the inference is obvious, and the author believes this to be a very promising field. Possibly certain types of prostatovesical disease and chronic rheumatoid affections of the joints also may prove amenable to treatment.

The thought occurs to the author that the sex gland hormone possibly might increase the resistance of the brain cells to toxins and improve their nutrition sufficiently to correct the underlying neuropathy of epilepsy.

Neurasthenia, in the author's opinion, more often is a purely sexual phenomenon than generally is suspected. It seemingly is due to causes which, directly or indirectly, affect the production or composition of sex gland hormone. Long continued emotions of all kinds, especially sex emotion, produce it. Worry, cerebral overstrain, sexual desire without gratification — sometimes even sexual life without desire — sexual excess, frequent child bearing — or no children at all, after the proper age — irritation of the sexual apparatus, innutrition from any cause, all are disastrous, probably through vitiating the quality or lessening the quantity of the hormone which, in the sex gland nutritive cycle, is necessary to the structure and functioning of both the internal secretory and generative secretory gland cells themselves. Chronic infectious diseases, such as syphilis, may be assumed to act upon hormone production in two ways, viz.: 1. Worry, producing nutritive depression and perverted chemism; 2. intoxication — inhibition and perversion of function of the internal secretory apparatus. The result is profound neurasthenia. The exhaustion produced by any disease is merely neurasthenia, probably produced by internal secretory dis-

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turbance affecting the production of hormone, the natural rejuvenator of nerve energy. Possibly so called physical exhaustion is due to the same cause, and not altogether to "fatigue" toxins.

May we not believe that all the vital functions really are manifestations of hormone activity, acting upon neuron, ganglion, and nerve fibre? Other hormones are essential, but is it too much to say that the sex hormone is most important of all; in brief, the most potent link of the endocrine cycle?

It is probable that a hormone complementary to the testicular hormone is produced by the prostate. The markedly beneficial results of prostatic massage in sexual neurasthenia might be explained by, *first,* reflex stimulation of sex gland activity; *second,* liberation and absorption of sex hormone by mechanical pressure; *third,* the stimulant and tonic effect of the hormone on the nervous system.

The administration of sex gland hormone viâ implantation possibly may prove serviceable in malignant disease. It certainly is worth trial. The germ theory of the etiology of carcinoma has not seemed to the author well grounded. Indeed, he is of opinion that the nearer we come to a perfect knowledge of the internal secretions, the nearer we shall be to the true etiology and rational therapeutics of carcinoma. In any event, whatever the abnormal impulse may be, the result is perverted cell growth, and we may at least regard hopefully any remedial measure that promises improvement in cell nutrition.

To put the author's view of the etiology of malignant disease concretely, he believes that there is more than a chronologic coincidence in the association of sarcoma with childhood and youth, and of carcinoma with later life. A disturbance of cell nutritive equilibrium from perverted quantity or quality — or both — of internal secretion — probably of the sex gland, the thyroid perhaps playing an important part — in my opinion underlies both varieties of malignant disease. The sex gland hormone theoretically should restore this equilibrium, making in effect the cells of the sarcoma older and stronger and those of the true carcinomata younger and stronger. In the light of the foregoing view of malignant disease, the theory of Cohnheim is especially apt in its application to malignant disease of early life, and to sarcoma and the other varieties of carcinoma at any age.

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The association of cancer with the approach or occurrence of the menopause, and with advancing age in the male, is suggestive of change in the sex gland hormone as the chief underlying factor. Epithelioma of the skin, especially, may be compared to psoriasis, in that a defect of nutrition due to perversion of internal secretion and localized by special factors of irritation is a reasonable underlying cause.

The rôle of micro-organisms in carcinoma may eventually prove to be merely that of a special determining factor of perverted cell growth through the irritation produced, and no more "specific" than traumatism, which so often appears to be the point of departure for malignant disease.

Thyroid extract has been stated to have cured psoriasis. This is not surprising. The thyroid and sex gland hormones seemingly are complementary. Thyroid defect possibly may be the more important factor in malignant diseases of early life.

Diseases due to defective quantity and quality of either, or of both hormones, perhaps may be cured by either, but possibly may require a combination of both. The one thing needful in thyroid implantation may be a simultaneous sex gland implantation. It is the author's firm conviction that the administration of sex gland hormone by implantation—with or without thyroid hormone, as events may prove—is well worthy of trial in malignant disease. As to whether beneficial results will follow organotherapy, this naturally will be determined by factors independent of the etiology of the disease.

CASE IV. *Dementia praecox, catatonic type.* Woman aged twenty-six years, family history unknown, duration of disease probably more than six years; Wassermann negative. Operation, March 8, 1914. Site of implantation, deep within the pelvis in the properitoneal space on the right side. Incision about 1.25 inch long, just internal to and slightly below the anterior superior spine of the ilium. Material used, portion of an ovary removed from woman of twenty-four years during a tumor operation, and refrigerated for thirty hours. It should be noted that a gland removed from a living subject and refrigerated is equivalent to one removed from a dead subject at a corresponding period after death—prior to beginning decomposition—save where the donor died of an infectious or an exhausting disease.

The wound healed by primary union. No rise of temperature. The case was examined on March 22, 1914. The implantation appeared to be successful. The mental status was unchanged. At the second examination, May 11, 1914, the implanted gland apparently was still *in situ*. There had

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been no improvement in the mental or physical status. The author examined the case, July 26, 1914. The implantation *per se* probably was a success, although on account of its position the gland could not be palpated. The mental status still was absolutely unchanged. Even granting the potency of the method, under favorable conditions, a negative result should not be surprising in such unpromising cases as IV and V, or in such as subsequently were experimented upon.

CASE V. *Dementia praecox*. Girl, aged seventeen years. Duration of disease, about three years. Probably a masturbatory habit. No family history. Wassermann negative. Operation, March 8, 1914. Site of implantation, right labium majus. Material used, the companion to the ovary implanted in Case II. This had been merely refrigerated, but not frozen, for a week in normal salt solution. A Graafian follicle had just ruptured at the time of death of donor, and the corpus luteum was beginning to form. Examination, March 22, 1914, showed that this implantation probably was a success. There had been a slight rise of temperature, owing probably to coincidental incision of redundant labia and slight resultant infection. The wound healed by primary union, but a small, apparently superficial abscess formed near the implantation site bed. This was opened and drained. The ovary still was *in situ*. May 11, 1914, the ovary still was *in situ*. There seemed to be a slight improvement in both the physical and mental status.

At the last examination, July 26, 1914, the implanted gland tissue was barely discernible on palpation. The mental condition was found to be remarkably improved. There appeared also to be considerable improvement in the patient's physical condition. So marked was the improvement in this case, that a reasonable number of such apparent results justly could be regarded as probably confirmatory of the theory upon which the implantation was based.

From what is known today of the internal testicular secretion and of the influence of the ovarian internal secretions upon secondary sex characteristics and the functions of the nervous system, especially in the light of Fauser's blood diagnostic observations, the internal secretion of the ovary seems to be logically indicated, not only in early cases of dementia præcox and allied conditions in the female, but especially in certain severe cases of hysteria, the nerve wreckage that often follows complete surgical removal of the ovaries, in severe and obstinate cases of neurasthenia, and the neuropathy of the menopause.

Will such beneficial effects as may be secured by a more or less continuous dose of internal secretion incidental to successful sex gland implantation be permanent, *i. e.*, will the result be merely temporary stimulation rather than what may be termed "regeneration?"

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Obviously, material from the living subject with immediate transference from donor to recipient is the most desirable method when available — as it rarely is, the effects, however, will be no better.

CASE VI. This, in a sense, is the most remarkable of all our implantation cases. Woman, aged sixty years, senile dement. At the time of the im-



Fig. 1.—Showing posterior border of implanted testis, with site of removal of epididymis, (A) and extensive vascular areas. (Case VI.)

plantation she apparently was in good health, save as to her mental condition. Wassermann negative. With the double object of the possible beneficial effect of the male sex hormone in senile dementia in the female, and determining whether sex glands could be successfully transplanted for therapeutic purposes from the one sex to the other in the human being, we made a cross implantation in this case, March 18, 1914. In this case the possible effects in general of the testicular hormone on the secondary female sex characteristics could be absolutely ignored. The gland employed was the right testis of an apparently healthy man, aged thirty years, dead from contact with a live wire The donor had been dead ten hours when the testis was removed. The gland had been refrigerated for four days.

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The gland was carefully prepared by removing the epididymis and slightly denuding the tubuli by excising four longitudinal strips of *tunica albuginea* about three mm. in width, extending for the whole length of the gland. The entire gland was used. A transverse incision about 1.25 inch in length was made, about four inches above the symphysis pubis, down to the aponeurosis of the recti. The wound was pocketed downward for approximately two inches, and the testis implanted at the bottom of the pocket. The fascial opening was closed with a pursestring suture of fine catgut, the skin wound with a catgut continuous suture, and the line of closure sealed with collodion and gauze.

Healing was prompt, aseptic, and afebrile. Considerable swelling



Fig. 2.—Anterior border of implanted testis, showing multiple vascular areas. (Case VI.)

developed at the site of the implantation and the patient complained of slight tenderness on light pressure. The skin was somewhat reddened after a few days, and the implantation seemed likely to be a failure—as had been expected. Much to the author's gratification, however, suppuration did not occur, and the case did far better, so far as the size of the mass which survived was concerned, than any other of our early testicle implantations. March 28, 1914, the implanted gland could be distinctly outlined on palpation and was fairly movable. There was no longer any tenderness at the site of implantation. May 11, 1914, the surrounding exudate seemed to have disappeared and the gland was circumscribed, freely movable, and appeared to be as large as when implanted. July 26, 1914, the mass seemed considerably smaller on palpation; it was moderately consistent to the feel,

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Fig. 3.—Lateral view of implanted testis with numerous vascular areas. (Case VI.)

still freely movable, and insensitive. There had been no change in the physical or mental status.

For purposes of study, the implanted testis in the foregoing cross implantation was removed under novocaine, July 27, 1914. The measurements of the excised mass were 4 cm. in length, 3 cm. in breadth, and 22mm. in thickness at its thickest part. The gland proper was surrounded by a pseudocapsule of connective tissue and fat. The *tunica albuginea* clearly showed, here and there, and contained numerous small blood vessels. Vascular attachments to the surrounding tissues were distinct, evidently at the points of denudation of the *tunica albuginea*. The point of severance of the epididymis was flattened and showed a broad area of vascular adhesion.



Fig. 4.—Lateral view of implanted testis with numerous vascular areas. (Case VI.)

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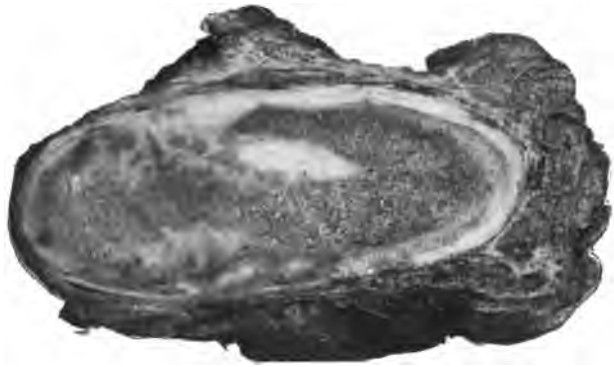

Fig. 5.—Longitudinal section of implanted testis. (Case VI.)

The mass weighed 9.5 grams. The proper capsule of the gland, the *tunica albuginea,* and the connective tissue of the mediastinum showed beautifully. The substance of the mass, within the *tunica albuginea,* was of a yellowish color, and to the naked eye, distinctly fatty. The macroscopic and microscopic findings are shown in the drawings (Figs. 1 to 12). Needless to say, the author was astonished to find living *tubuli seminiferi* and ducts in addition to a more than normally rich vascular supply and a surprising abundance of interstitial cells.

From the results in this case the author concluded that implanted human sex glands from either sex may survive in the tissues of the opposite sex, there being no greater tendency to necrosis, and perhaps less rapidity of degeneration than in homosexual transplantations. It is a striking fact that, before removal, the bulk and outline of the tumor and the conditions later shown in the specimen were more strongly indicative of a successful implantation than were the conditions in our early homosexual experiments in



Fig. 6.—Transverse section of implanted testis. (Case VI.)

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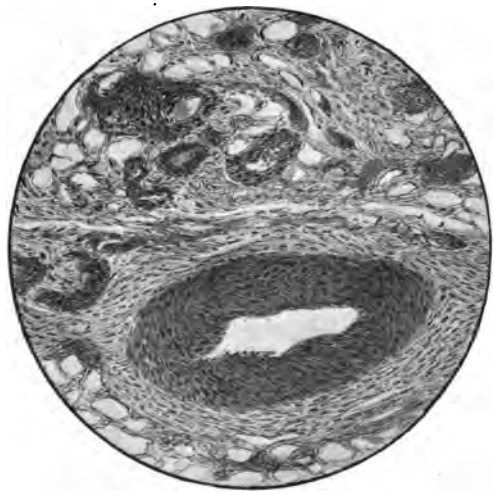

Fig. 7.—Blood vessels, connective tissue, and fat in periphery—tunica albuginea—of implanted testis. (Case VI.)



Fig. 8.—Numerous new blood vessels, fat, and connective tissue in and beneath the tunica albuginea of implanted testis. (Case VI.)

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either the male or the female.* No physiologic observations were made in this case. As already noted, no mental nor physical improvement followed the implantation of the testis, but as the subject suffered a fracture of the neck of the femur about ninety days after the implantation, it would be difficult to determine whether or not the testicle hormone was of any value.

CASE VII. Man, aged fifty-three years, musician, consulted the author June 10, 1914. Always a hard drinker and a gourmand; no history of syphilis; Wassermann negative; history of two tappings for ascites, six



Fig. 9.—Showing area of probably dead, and another of distinctly vitalized tubuli seminiferi with an abundance of living interstitial cells in implanted testis. The vitality of the glandular tissue and the quantity of interstitial cells increases from the center toward the periphery of the implanted gland. (Case VI.)

years before. A diagnosis of cirrhosis of the liver was made at that time. When the patient was first seen, his abdomen was enormously distended with fluid. Jaundice had appeared a few days previously and had become quite pronounced. No pain was complained of, nor was there any history of previous pain. On the scalp, backs of the arms and forearms, the elbows, the front of the right leg, the buttocks, and the lumbar region, were large patches of severe, typic psoriasis, from which the patient had suffered for many years. The patches on the arms were quite symmetric, each measuring about 15 cm. long and 9 cm. wide. Those on the leg, six in number, averaged

* In experiments on fowls, the most definite result the author thus far has obtained was from an implantation of a testis of a young cockerel upon a pullet four months old.

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7 cm. by 4 cm. The areas on the scalp and buttocks were of various and moderate sizes. A patch of psoriasis measuring 7 cm. by 9 cm. existed on the abdomen, involving a small portion of the skin covering an umbilical hernia. Two patches on the lumbar region measured respectively about 6 and 8 cm. The subject was very weak and markedly incommoded by the enormous bulk of his abdomen. His appetite had been excellent until a few days before, since when it had rapidly failed.

June 14th, the author removed nearly six gallons of dark bile-stained transudate from the abdominal cavity, affording the patient great relief.



Fig. 10.—Section near periphery, also showing gradual increase of vitality of gland tissue from the center toward the periphery of implanted testis. (Large amount of interstitial tissue.) (Case VI.)

The liver was now found to be greatly enlarged and indurated, showing plainly through the collapsed abdominal wall. The gall bladder was greatly distended and its walls thickened and hard. In the left iliohypochondriac region was a hard, oblong mass extending downward from the under surface of the liver for about four inches. From its location this tumor might have been either renal or omental. It could not be definitely determined that it was attached to the liver. Several hard, irregular masses were noted at the left of the median line in the umbilical region. There was a good sized umbilical hernia, evidently now containing only fluid, which freely flowed back and forth under pressure. This had been unsuccessfully operated upon some years ago. The urine contained bile in large amount and a small quantity of albumin, but no casts. The patient's heart was very weak

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following the operation and strychnine was given hypodermically for several days.

Encouraged by the observations which already had been made of the apparent effects of the sex hormone upon nutrition, and especially upon that of the skin, and with a clear understanding on the part of the patient of the experimental nature of the procedure, the author resolved to make a testicle implantation in this case. On June 19th, we planted in the patient's right scrotal sac a testicle, with the epididymis excised, removed from an apparently healthy subject about twenty-one years of age, dead about thirty hours before from contact with a live wire. Ice had been packed around



Fig. 11.—Free and attached interstitial cells with contiguous tubuli seminiferi in implanted testis. (Case VI.)

the testes for perhaps four hours. The operation was done ten hours after the removal of the testis from the dead subject, *i. e.*, forty hours after death of the donor. The local postoperative course was uneventful for two weeks. The wound apparently healed by primary union and there was very little swelling about the site of the implantation. Until the fourteenth day the implantation *pèr se* seemed to have been successful.

On the third day after the implantation improvement was noted in the skin eruption. By the eighth day after operation, the lesions were so improved that they scarcely could be recognized as psoriasis. The skin of the left arm was nearly normal. The patches upon the back and scalp had entirely disappeared. The jaundice had improved, the blood pressure, which was low on account of the patient's debilitated condition, had increased, the pulse was perceptibly stronger, appetite greatly increased, the hemoglobin, which was approximately sixty per cent., was now seventy per cent., and

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there was a distinct improvement in color of the skin, aside from the lessening of the jaundice. A considerable reaccumulation of fluid already had occurred.

The white corpuscle count showed over 13,000 at the time of operation. On the second day the white count was over 21,000, falling rapidly after the third day to about what it was originally. The obvious explanation of the rapid rise and fall in the white cell count was an ephemeral reaction to a foreign body. There was at no time any noticeable effect on the sexual function, which had been in abeyance for several years.

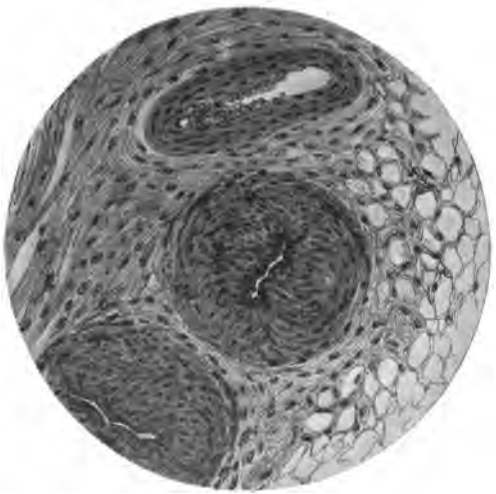

Fig. 12.—Section from area of periphery of implanted testis, corresponding with site of the epididymis, showing vein containing blood and vasa efferentia. (Case VI.)

There were no areas of softening or of fatty degeneration in the interior of the gland. The Sertoli cells could not be distinguished.

The blood and skin conditions continued to improve and the patient grew stronger—despite an extensive reaccumulation of fluid in the peritoneal cavity—until the fourteenth day. The percentage of hemoglobin had rapidly increased to 90, and the red corpuscles, which showed 2,275,000 at the time of the implantation, had increased by the tenth day to 5,600,000, varying from day to day, but at no time falling below 4,000,000 before the close of the case.

The site of the psoriasis on the left arm and buttocks now had become practically normal, and that on the right arm and leg nearly so. The patient asserted that his teeth, which had been so tender and loose that he could not chew solid food, had become so improved that he could chew with comfort.

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The scrotal wound, which apparently had united, reopened superficially for about half an inch on the ninth day after operation. This was apparently due to mechanic disturbance, the enormously pendulous abdomen giving rise to great inconvenience. The slight skin lesion, while indolent, as was to have been expected, presented no evidence of anything but the most superficial and simple pus infection. The fascial wound had not reopened and appeared to be soundly healed. The temperature was normal until the fifth day, when it rose to 100° F. It fell to normal within twenty-four hours. On the thirteenth day it again rose to 101° F., but by evening fell to normal and remained practically normal until the close of the case.

June 30th, the author again tapped the abdomen, removing fully six gallons of fluid. The testis still was *in situ* and apparently "doing well." The fluid, which at the previous tapping had been clear and about the color of moderately strong coffee, now approximated the color of normal urine and was distinctly turbid. The liver was perceptibly smaller and the abdominal tumors previously described had markedly decreased in size since the first tapping. Dr. M. M. Portis saw the case and agreed that it probably was carcinoma. Dr. Portis subsequently examined the fluid and stated that while the findings were atypic, he still thought the case probably was malignant. The report of the examination of the fluid withdrawn at the tapping was as follows:

Specific gravity, 1010; large number of lymphocytes, endothelial cells and embryonal cells; bile in moderate quantity.

The shock of the second tapping was very severe and the patient rapidly failed. On the following day he began to have involuntary bowel and bladder evacuations. The slight granulating scrotal wound became infected about the fifteenth day after the operation and on the seventeenth day pus was distinctly perceptible around the site of the implantation. This was evacuated and the implanted testis was found to have been dissected out cleanly by the pus, which was distinctly saprophytic. The gland was of normal consistence and form, and on section the tubuli apparently were not softened or in the least broken down. No evidences of adhesions were perceptible on the surface of the gland. The patient became delirious and refused alimentation; marked albuminuria developed, and death from exhaustion occurred July 12, 1914.

The autopsy showed a greatly enlarged, but otherwise typically cirrhotic liver. The omentum throughout was cirrhosed and enormously thickened. The fatty capsules of the kidneys were greatly thickened and indurated. So great was the induration and thickening of the fatty environments of the abdominal organs that they were with difficulty removed for inspection. The masses which had simulated malignant omental metastases had become so reduced in size that they were scarcely perceptible before opening the abdomen. On exposure to inspection they proved to be merely thickened and hardened portions of omentum. The spleen and pancreas were cirrhosed. The kidneys showed marked interstitial nephritis. The author does not recall ever having met with a case with such extensive alcoholic pathology. There

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was no evidence of malignancy. Histologic examination of the liver showed typic cirrhosis. The implanted testis was carelessly preserved, and when submitted for histologic study was found to be so decomposed as to be worthless for study.

The foregoing case was a severe test of sex gland implantation and the apparent results upon the blood and skin were correspondingly noteworthy. As a probable index to the physiologic effects of the sex hormone, the changes in the psoriatic skin were phenomenal. That the subject received the benefit of both the initial and the secondary physiologic effects of the hormone is probable. The author believes that the testicle elaborated hormone until the scrotal infection occurred, a period of two weeks. That any remedy whatsoever could effect such marked changes in the condition of the blood and skin in so unpromising a case as the foregoing, is remarkable. No treatment other than implantation, save attention to the bowels, was given. The changes hardly could have been spontaneous in a case in which there existed no natural tendency to improvement. The survival of the implanted testis for so long a period in a subject in which the nutrition of the tissues of the donor was so impaired is in itself phenomenal. The apparent improvement in the biliary obstruction, and the diminution in size of the liver and omental masses are merely noted as clinical phenomena, with no suggestion of any probable relation to them of the sex hormone. They obviously are susceptible of other explanations, which hardly can be true of the skin and blood phenomena.

The action and interaction of the implanted young gland and its senile, or even middle-aged environment, are worthy of serious consideration. To what extent an aged environment of nerve influence and tissue juices eventually will alter the biochemism of the implanted gland must remain an open question. Subsequent experience has seemed to show that, while the gland atrophies perhaps a little faster than in younger soil, its life is prolonged sufficiently to secure marked action of the hormone.

That the implanted gland will benefit more or less by the improved quality of the blood produced by its own internal secretion seems logical enough. To what extent and for how long a time is problematic.

The integrity of the gland tissue and the quality and quantity of its product obviously are largely dominated by the elements on which it feeds. Implanted young gland tissue possibly may not long remain young when fed only by the blood of more mature, and especially of senile life. Each sex gland is a laboratory; the gland cells are the workers. These workers select from the blood the materials for the elaboration of both the internal and procreative

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secretions. Upon the quality and quantity of these materials depend the quality and quantity of the finished product.

The end result of implantation, therefore, possibly may be merely the elaboration and absorption into the blood of a larger quantity of internal testicular or ovarian secretion than the recipient's own glands are capable of producing, this secretion eventually becoming of the same quality as the subject's own secretion. In this event the benefits derived from implantation would be only such as would result from a constant dose of a larger quantity of internal secretion, of a potency identical with that produced by the recipient's own glands. If it should prove to be true that a gland implanted in an elderly subject becomes greatly modified by its new environment — which modification should not be astonishing, for "the cell is what it eats" — then the same consideration would even more forcibly apply to a gland taken from an elderly donor and implanted in a younger recipient. The nutrition of an old, but still functioning gland probably is more likely to be improved by young blood than a young gland is to be deteriorated by old blood. This suggests more leeway in procuring material. It eventually may be shown that there are special indications for the selection of a gland from a donor of relatively advanced age as best adapted to the condition in hand.

How far the trophic influence of the relatively aged nerve supply of the implantation site may affect the permanence of implantation results would be difficult of conjecture. It is hardly possible that a community of nerve supply, sensory or trophic, or both, could be established between the implanted gland and the investing tissues.* If, however, we ever succeed in greatly impeding the wheel of time in its remorseless grind upon human life — and the author is willing to confess optimism — it is most likely to be through the agency of internal secretion therapy, via gland implantation. As to what glands, or combinations of glands, will prove most efficacious, the future alone can show. The sex

* The results of implantation in several of our cases are interesting and important in their relations to the effects of fatal electrical shock on cell vitality in general, and possibly may have a bearing upon the possibility of resuscitation after supposed death from the electric current. The author believes that cell vitality varies with the dosage of and duration of exposure to the current. Doubtless in some cases the sex glands would not be suitable material for implantation.

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gland secretion seems to be the most important of all the internal secretions so far as its possible effects in increasing efficiency and longevity are concerned. Indeed, it may be a powerful stimulant to the activity of all the other hormone producing organs. In any event, senility and its control are merely a matter of nutrition.

If a complementary hormone should be found to be necessary to the full physiologic action of the sex gland hormone, it may prove to be the thyroid, pituitary, pineal gland, or the suprarenal — or several of these in combination. The thyroid swelling incidental to menstruation and sexual excitation so frequently manifested in cases of hyperthyroidism certainly is quite suggestive. The profound nutritive effects of thyroid internal secretion are familiar enough. Possibly the effects of the sex hormone on the thyroid is in a sense "inhibitory," rather than complementary, the thyroid running riot, so to speak, with resulting hyperthyroidism when the influence of the sex hormone is removed. Granting this hypothesis, Graves' disease would be an indication for sex gland implantation. W. Blair Bell says, in reference to correlation of the internal secretions in regard to their genital functions:

When the reproductive functions cease and the ovaries atrophy at the menopause, the harmony between general and genital metabolism is temporarily deranged, and various disturbances may ensue. The basis of treatment is the administration of the necessary secretions. Some patients react to thyroid extract, some to pituitary, others, again, to combinations, so great are the individual variations.

Strictly speaking, the ovary is concerned only in the temporary function of reproduction, and, by its hormones, of bending the metabolism of the body to its purpose. As accessory to these functions the ovary has been supposed to be responsible for the beauty of the vessel by means of which its ends are to be attained. But today one is beginning to wonder how far the ovary does influence secondary sex characteristics, and whether full secondary characteristics can be obtained by the influence of the ovary alone. There is evidence that hyperplasia of the suprarenal cortex can upset any influence that the female genital gland may possess, and can produce in a female some of the secondary characteristics of the male.

Any influence the ovary has over general metabolism is, then, related to and dependent on its primary reproductive function. It probably does not influence metabolism except in so far as this special function is concerned. Removal of the ovaries may produce temporary disturbance, but this does not invalidate the view mentioned.

The rest of the ductless gland system is related to the genital functions in various ways. The thyroid, pituitary, and suprarenals influence the

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development and subsequently preserve the integrity and activity of the genitalia. Others—the thymus and possibly the pineal—appear to prevent sexual precocity. All the ductless glands control metabolism in response to the necessities of the genital functions. In addition they adapt the whole organism to the possibility of the situation, and regulate the secondary characteristics, both physical and psychical, to suit the needs of the individual. Once, however, the reproductive organs are removed or undergo atrophy, the primary genital functions of the rest of the ductless glands cease, and the rearrangement of the metabolism that follows produces what are known as symptoms of the menopause. Contrariwise, insufficiency of the thyroid or suprarenals causes the cessation of the genital functions with atrophy of the uterus.

The possibility of sex gland implantation increasing longevity requires special consideration: A successful implantation may not appreciably alter the structure of the recipient's tissues and organs, although the effect on the skin and blood pressure of the experiment outlined in this volume naturally is suggestive. The viscera in general, and especially the heart, blood vessels, and the nerve and brain tissues, may remain essentially the same, yet, even granting this, further senile changes should be retarded if, as seems probable, the internal secretions of the generative organs eventually are proved profoundly to affect nutrition. In brief, we may hope to retard senility even if we cannot "cure" it.

The question at once suggests itself, Might not the stimulating effect of the secretion defeat its own ends by exposing to overstrain organs — notably the heart — already senile? Possibly, even probably, it would do so, unless the increased efficiency was conservatively employed. Even if an increased capacity for long sustained and considerable muscular effort and increase in respiratory capacity should result, no one who is out of training should expect great tolerance of severe stress on heart, wind, and limb.

It has occurred to the author that sex gland implantation is likely to give the most satisfactory results when employed at or about middle life, with the view of retarding senility and preserving efficiency, or increasing it, if it is below par. The normal man of forty years, possibly, might at least retain the vigor of forty years until more advanced age. The man past middle age with impaired efficiency would be likely to have his efficiency restored. Successive implantations, of course, might prove to be necessary. We have shown that implantation of the reproductive glands is especially

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effective in young subjects with defective physical sexual and psychosexual development, and in subjects who have been traumatically deprived of the generative glands — recently in young subjects, or at any time in subjects past the age of puberty. In connection herewith it is well to remember that the effect should be more marked in young subjects in whom the chief secondary sex characteristics never have been normally developed, than in older subjects.

Granting that the method proves valuable in mental conditions, such as dementia præcox, the degree of benefit and permanence of results of sex gland implantation will depend upon:

1. The age of the patient.
2. The specificity and activity of such infective cause as may be determined.
3. The duration of the disease and the amount of secondary degenerative changes.
4. The degree to which perversions and defects of other internal secretory glands enter into the etiology.
5. The dose and activity of hormone.

The probable efficiency of sex gland transplantation in sexual perverts and inverts, in whom the normal psychic or physical, or both, sex characteristics are poorly developed, at once suggests itself. Paresis seems to be a suitable field for experimentation with sex gland implantation, and the author already has operated in two cases, in which, however, local failure prevented any possible therapeutic results. The third case is too recent to permit us to draw conclusions. Syphilis in the donor may here be disregarded. It is an interesting question whether many of the mental vagaries and moral perversions that so often develop after middle age are not due to a lessening or perversion, or both, of internal sex gland secretion. We are wont to attribute these conditions to structural arterial changes, but the justice of this is doubtful. Future experience with sex gland implantation seems to me likely to change our views in this regard. Indeed, even where arterial changes are proved, a defective supply or vitiated quality of hormone sometimes may be the very essence of the etiology. The mental aberrations which so frequently follow castration in either sex are suggestive in this connection.

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The possible detrimental action of the secretions of the implanted gland upon the functions of the recipient's own glands has in a way been decided by Metchnikoff's experiments. In 1898, he produced "serums" from both human and lower animal semen. He killed the spermatozoa in the serums by heat. When injected intravenously, these serums destroyed the spermatozoa through the medium of a cytotoxemia. This toxemia was temporary, the spermatozoa finally acquiring immunity. Since the experiments herein reported, examination of the seminal secretion in several cases showed the secretion to be normal in each instance. In one experimental case the wife of the subject conceived a few months after the implantation.

Obviously, if destruction of spermatozoa resulted from implantation because of toxicity of a large dose of alien secretions, the evil could be only temporary, unless the anatomic and physiologic machinery of their elaboration was destroyed, and this would involve, first, impairment of testicular structure in the recipient; second, aberration of nervous supply; third, perverted blood constitution or, fourth, a combination of two or more of these conditions.

In the author's first paper in 1914 he said:

"Should sex gland implantation prove to be as great an advantage in therapeutics as the author is inclined to believe, we soon will relegate certain gland extracts to the dead lumber room and use only the physiologic living extracts, administering them continually via implanted gland tissue. And who shall say how far the principle may be applied if tissues from dead bodies can often be successfully used? Sex glands, thyroid, liver, pancreas, brain, spleen, kidney—it is impossible to say where vito-organotherapy will end, for it is by no means certain that all tissues have not a selective action on the blood, or a special biochemic action, the fresh products of which are of therapeutic value. In brief, each tissue possibly manufactures its own special ammunition — antibodies — with which to combat disease, and even if growth of the implanted tissues should not occur, it is possible that a sufficient dose could be given and a sufficiently prolonged action secured, to accomplish valuable results.*

* In passing, it is worthy of comment as a medical curiosity that the much derided Cabanis, in the latter part of the eighteenth century, asserted that the brain was a secretory organ, "secreting thoughts just as the stomach secretes bile."

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"In the light of Abderhalden's wonderful work, it may eventually be shown that, by a special, selective, trophic action, every highly specialized tissue and organ of the body, whether glandular or not, elaborates an internal nutritive metabolic product — "secretion" — of its own. The author would suggest especially the advisability of experimental subcutaneous administration of emulsions of fresh human brain tissue in certain derangements of the brain and nervous system, splenic tissue in certain anemias, heart tissue in cardiac disease, thyroid in hypothyroidism, kidney tissue in renal diseases, lung in pulmonary disease, liver and pancreas in diabetes and of sex glands in various conditions."

The author since has experimented in this manner (in 1914) with emulsions of renal tissue from a recently dead human body, on the guinea-pig, and on one human subject. No harm resulted, save a transitory orchitis in the guinea-pig. As already stated, he also has experimented extensively with human brain emulsion.

Possibly the hormone of the internal secretion of glands, or certain metabolic products, elaborated by certain other tissues, is taken up by the blood, returns to the tissue, and stimulates its ordinary vital functions. This "secretion-nutrition-cycle" — if we may be so bold as to coin a term — perhaps may be necessary to the normal life of the tissue itself.

How far one internal secretion may supplement another, is a fascinating field for speculation that already has received attention in this volume. The author is especially inclined to believe that, in certain cases, the sex gland secretion may be a powerful adjuvant to thyroid or other hormone therapy, especially where simultaneous implantation of sex glands is performed. As for extracts of glands of the lower animals, their field of usefulness probably always will be limited, while as for implantation of such alien tissues, failure naturally should be expected. *A priori* it would seem as illogical as was the old method of transfusion of blood from the lower animals — yet such implantations possibly may have a certain range of therapeutic usefulness.

Since his first series of experiments were made and the greater part of this chapter was written, the author's attention has been called to some very interesting observations which, so far as they go, serve to strengthen the position herein recorded regarding the value of sex gland transplantation hormone therapy.

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Leopold-Levi reports a case of rheumatism and psoriasis, associated with hypo thyroidism, successfully treated with thyroid extract. In another case of psoriasis excellent results followed the administration of "testicular powders."

Garré, of Bonn, has expressed himself enthusiastically regarding the prospects of thyroid implantation. He says:

Transplantation of the thyroid will revolutionize the work of the social worker within a few years. Crime, idiocy, the lack of development in children, degeneracy will be lessened through the knowledge of this remarkable organ which is just dawning upon us.

To the thyroid have been traced thousands upon thousands of cases of stunted growth, of mental undevelopment, of idiocy, and such defects. An undeveloped thyroid means an undeveloped child.

Let us take the case of father and son. The father has a normal thyroid, and the son's is undeveloped, hence he is making no progress, mentally or physically. We can remove one-third or even two-thirds of the father's gland without injuring him in the least, and by transplanting this to the son can soon bring him to positive normal development.

Transplantation of thyroid from the dead to the living under proper conditions probably is quite as practicable as transplantation from the living to the living, unless, as Carrel has stated and Garré seems to believe, and in a measure contrary to the author's experience with the testicle, donor and recipient absolutely must be closely related.

Bandler states that he has used ovarian extract with success in dysmenorrhea, the disturbances of the climacteric, atrophy of the uterus, and amenorrhea. As he usually combines iron with the ovarian extract, comment is unnecessary.

Dubois and Boulet assert that intravenous injections of prostatic extract produce a fall of blood pressure, with an associated increase of brain volume and a lessening of renal tissue volume.

Iscovesco notes the effects of a "lipoid" extracted from the testis and ovary. Clinical trial of this lipoid in the daily dose of 0.02 gram (one-third of a grain) for thirty days in eleven patients suffering from hypochondria, or neurasthenia with sexual weakness, and in eight aged men, resulted in increased general vigor, a better mental attitude, and improved capacity for work. In four of the eight old men the blood pressure was lowered. Vesical tenesmus, due to prostatic hypertrophy, in three of the cases,

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disappeared completely and permanently after an injection of 0.16 gram (two and a half grains) of the liquid. No toxic effects were noted from the large doses, either in these patients or in the animals. The author lays stress on the erythrocytic properties of the lipoid and extols it in the treatment of severe anemia, notably chlorosis, and in severe conditions of innutrition.

In addition to the implantations already recorded herein, the author, prior to the completion of his first paper (August 1, 1914), had performed operations in both sexes, using material that had been refrigerated from three to seven days. The cases comprised two females and eight males, suffering from various conditions, three senile dements, two cases of dementia præcox, two of epilepsy, and three of general paresis. In two subjects a double implantation was made. In one an anastomosis of the vas was performed. In one case, a male, a cross implantation was made. None of the subjects was promising, and as all were institutional cases, a discriminating selection was not practicable. Fully appreciating this, as well as other unfavorable environmental conditions which are inseparable from experimental work in large public institutions, and while hoping for beneficial therapeutic results, the author feared that in all the cases the principal result would likely be the acquirement of a better knowledge of the limitations of sex gland implantations *per se,* and he was only too glad to avail himself of such material and conditions as were obtainable. The result in the majority of the operations can be very briefly recorded:

The implantations failed in all of the males and in one of the females, with varying degrees of local infection and temperature. The environmental conditions, the bad condition of the subjects, and the difficulty of preventing mentally deranged subjects from handling the implantation sites, probably had much to do with the failures, but the author is disposed to charge them chiefly to the material used. Different results possibly might have been obtained if the implanted glands had been preserved by complete freezing. This, however, remains for subsequent solution. The results probably could not fairly be ascribed to the heterologous source of the glands. In part of this series of cases the local conditions were favorable for some days.*

* Note letter in N. Y. Medical Journal, Mar. 23, 1914.

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The case of anastomosis in an old man of seventy-five years, a senile dement, was rather interesting. The implantation wound healed, the case was afebrile and looked very promising for about ten days, when the gland and the surrounding inflammatory area began to break down and slowly soften. On the fourteenth day we opened up the purulent collection and removed the *tunica albuginea,* which was all that remained of the implanted testis.* The gland had been refrigerated only four days, and as the companion organ was still *in situ,* July 26, 1914, in a female dement subject (Case VI) in whom it was implanted on the same day the anastomosis was performed, the material probably was not at fault. Anastomosis necessarily is a severe test of implantation, even under the most favorable conditions. The donor of the testis was a man of thirty years, dead ten hours from contact with a live wire.

In one of the males a double scrotal implantation was performed, using on one side an ovary taken from a mulatto woman dead eight hours of disease of the heart. The testis was from a subject dead twelve hours of a skull fracture received two days previously. The material had been refrigerated three days. The infection evidently was due to the implanted testicle, spreading to the opposite side for when the organs were removed from the infected area on the fifth day, the ovary still was normal and adhesions already were noticeable on its surface.

The other ovary taken from the mulatto was cystic. The pathologic tissue was excised and a small ovary reconstructed from the apparently normal glandular remnant, enveloped in an adherent fragment of broad ligament, and implanted, March 18, 1914, in the axilla of a female senile dement, sixty-seven years of age. The wound healed aseptically without any rise in temperature. May 11, 1914, the gland apparently still was *in situ.* On July 26, 1914, a small movable body, a little larger than a good sized pea, still could be felt at the site of the implantation. As there was very little gland tissue from which to reconstruct an ovary, and the donor was of a race alien to the recipient, the apparent local result of the foregoing experiment is at least noteworthy. There has been no change in the patient's physical or mental condition.

* Note how this differed from the condition of the implanted testis on removal in Case VII.

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No studies of the physiologic effects of the implantations were made in any of the implantation institutional cases, for reasons which should be obvious to those familiar with the unfavorable environments afforded by large hospitals for the insane, where even the most intelligent, progressive, and enthusiastic staff physicians are handicapped by overwork and scanty resources in the matter of laboratory and instrumental equipment.

All of the implantations performed were understood by the relatives of the subjects to be experimental, and were done with their full knowledge and consent.

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CHAPTER XII.

Further Experimental and Therapeutic Work in Sex Gland Implantation.

We now will consider more in detail certain features of the researches recorded in the preceding chapter and record additional observations which will serve to make the work more comprehensive and complete, and it is hoped, even more convincing. The illustrations speak for themselves. The photomicrographs are confirmatory of the evidence afforded by the illustrative drawings already presented.

Certain experiments upon fowls already have been mentioned, without presentation in detail. A number of experiments were made. Fully comprehending the improbability of securing marked results from testicular implantations upon adult subjects castrated prior to the full development of secondary sex characteristics, and having in mind merely the possible effects of the sex hormone upon nutrition, the author made the following experiment:

I. Subject, a Buff Wyandotte capon, eighteen months old, caponized at the age of four months. Weight, nine pounds. Male plumage distinct.* The almost complete absence of comb and wattles, the pallor of the face, spiritless air, massive development, clumsiness, lack of gloss of plumage, relatively inferior length and bulk of cock feathers, limited appetite, sluggish movements, lack of spurs, and asexuality of the subject were very characteristic.

April 28, 1914, the left testicle of a normal cock of the "butcher shop" mongrel variety, was implanted in the left side of the pelvis—extraperitoneally—of the capon. The wound healed promptly.

Beginning about one week after the implantation, the subject "braced up" considerably. The plumage became more glossy, the carriage of the fowl was more like that of the normal male, and the appetite and color were

* It is necessary to defer caponizing until the male plumage is fairly well shown and the testes are sufficiently large to be comparatively easily found. This accounts for the presence of the plumage factor of the secondary sex characters in the capon.

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greatly improved. By the end of the second week the improvement in condition was marked in every way, and manipulation of the vent showed a distinct sexual reflex with characteristic response on the part of the subject, less only in degree than in the normal fowl.

The improvement not only did not continue, but deterioration occurred, although at the end of three weeks after the implantation the condition still was better than prior to the experiment. The sexual reflex had almost entirely disappeared. Meanwhile several heteroimplantations of glands from nonrelated donors were done upon normal fowls, with recovery of the subjects, but, as shown by subsequent dissection, without success of any of the implantations *per se*.

II. The left testicle of a small mongrel cock, one year old, was removed and replaced by the left testicle of a recently killed Black Minorca cock, one year old. There was considerable hemorrhage, but the bird apparently recovered from the immediate effects of the operation.* Death occurred on the second day, apparently from enteritis with profuse diarrhea. Wound normal. No autopsy.

III. A testis from a large Buff Rock, fifteen months old—the largest testicle, by the way, that we ever have seen in a fowl†—was implanted extraperitoneally in the left side of the abdomen, just above the groin, of a female Buff Wyandotte, five years old. Death occurred, probably from enteritis, on the third day. Wound normal. No autopsy.

In the early period of his work the author did a double heteroimplantation upon a year-old mongrel cock, which was reported to have died six days later from exhaustion and diarrhea. As this bird had been kept under very unsanitary conditions and had been half starved and otherwise abused, and the operation had been severe, no significance had been ascribed to its death. Now, however, after the results obtained in Experiments II and III, we began to consider the toxic possibilities of implantation, and were pertinently reminded of the phenomena of anaphylaxis, said to result occasionally from various serums, and which, frankly, the author had not believed to be due to protein, but to some other serum content producing toxemia. Acute sepsis, doubtless, practically

* The author has not yet succeeded in perfecting a satisfactory technic for castrating adult birds. The ribs are firm, the testes too soft to endure much manipulation, and the vessels quite large, the arteries coming almost directly from the aorta and the veins emptying directly into the vena cava. The vessels also are very fragile. With the exception of the subject used in Experiment II, all have died of hemorrhage on the operating table. The operation is suggestive of what removal of the human kidney would be without easy access or means for controlling hemorrhage.

† Offhand, the author would say that a human testis of the same relative size would weigh between two and three pounds. This is to say nothing of the relatively greater activity of the gland in fowls.

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could be disregarded in our experiments, as fowls tolerate operations well, where severe hemorrhage can be avoided. When properly performed, caponizing in young fowls does not show over one per cent. of deaths, and this from shock and hemorrhage, or hemorrhage alone.

To determine the following points: 1, The effect of successive implantations on the same subject; 2, the effect of implantation of the male sex gland upon the female; 3, the effect of large doses of gland tissue upon the female; 4, the effect of alien protein from the fowl's testicle upon a higher animal; the following experiments next were made:

IV. May 21, 1914, the companion testis of the one used in Experiment III, was implanted in the right side of the pelvis—extraperitoneally—of the came capon used in Experiment I. The bird seemed indisposed for forty-eight hours after the implantation. He then rapidly recovered. May 29th, the color, general carriage, lustre and carriage of plumage, spirit, activity and appetite all were more than ever like the normal characteristics, although by no means up to standard. The sexual reflex reappeared in slight degree.

August 24th, a slight further improvement was noticeable in the various points mentioned, save as to the sexual reflex, which had disappeared. The bird was much more active than ever and showed signs of combativeness, fighting a little with strange males—who very promptly attacked him. This latter point is important, inasmuch as normal males at once recognize the capon as in no sense a rival and rarely annoy him. The subject, as before, showed no disposition to approach the female sexually.

About the middle of November, 1914, the capon was found fighting quite savagely with another bird through the lattice of his coop, and several times was heard to crow distinctly. The subject still showed no disposition to approach the female sexually. Shortly after this the bird was accidentally killed.

That a marked degree of physiologic regeneration occurred in this case is evident. So far as it goes, the experiment also tends to show the safety of successive implantations. Obviously the dose was much larger than in human implantations. Reimplantation in the human subject, if done at all, would be performed only after a considerable interval, and considering this point and the results of the experiment on the capon may be regarded as safe. A noteworthy point is the continuance and slowness of the process of regeneration. That there should have been in the capon any awakening whatever of dormant sex characteristics is remarkable.

There is a vast difference between implantation upon (*a*) a

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young male that has recently been castrated or one that has been castrated after full maturity, and (*b*) a male that has been castrated early and has arrived at full maturity. The difference lies in the fact that in the one instance the secondary sex characteristics may continue to grow or are already developed, while in the other the secondary sex characteristics never have developed and regeneration is very difficult of accomplishment. Once psychosexuality has developed and impressed the animal during the period of growth,



Fig. 1.—Capon used in experiments I and IV.

the results of its influence remain, even though sex power and desire completely disappear. Both sex power and desire may, however, remain for a variable period after complete castration in adults. Where they remain in young animals, the explanation usually is an incomplete operation. The author recalls an instance of a gelding that was castrated late, who served mares as normally as could any stallion. Here, the operation may or may not have been complete. Apropos of this point, the high valuation set in the Orient upon eunuchs who have suffered complete ablation of the genitalia is readily understood.

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Fig. 2.—Normal full brother of capon shown in Fig. 1.

It is probable that, in the experiment on the capon, very little of the implanted tissue survived, yet it must have been sufficient at least to set the regenerative process in motion. The application

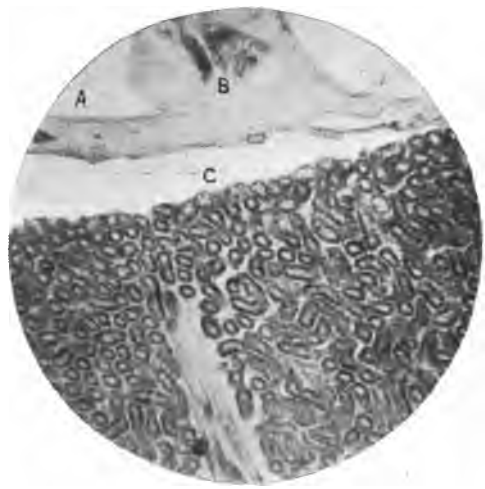

Fig. 3.—Section of normal testis of cockerel four months old, showing characteristically great abundance of generative gland tissue *(tubuli seminiferi)*. A, Rolled up—cylinder-like—segment of delicate peritoneal investment, corresponding to the visceral layer of the *tunica vaginalis* and the *tunica albuginea* of testis of higher animals. B, Mesotestis, *i. e.*, peritoneal fold at epididymal border of gland. This is almost as delicate as a cobweb. C, *Tubuli seminiferi.*

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of this to human hormone therapy is evident. The test in this case obviously was the severest possible.

Figs. 1 and 2 show the more important differences in the appearance of the head of the caponized and of the uncaponized fowl. The birds are full brothers of the same age.

V. An exceptionally large testis from a mongrel cock, one year old, and a small testis from a White Leghorn cockerel, four months old, were implanted in the right side of the pelvis—extraperitoneally—of a thoroughbred Light Brahma pullet, four months old. At the same time the companion testis of the young Leghorn was implanted in the pullet's left breast. That the dose of gland tissue was enormous is obvious.

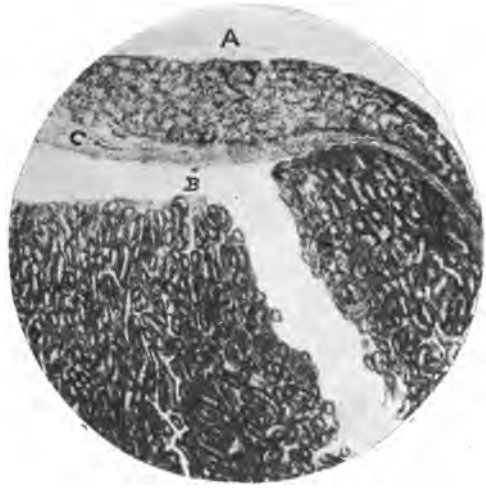

Fig. 4.—Another section of same testis shown in Fig. 3. A, Epididymis. B, *Tubuli seminiferi*. C, *Tunica propria* (peritoneal covering) of testis.

Healing was prompt and the subject was continuously normal. Seventy-five days after implantation, the pullet was killed. Autopsy: Body exceptionally plump and well nourished. Organs normal. No vestige of the gland implanted in the breast. Those implanted in the pelvis were living, and plainly recognizable as testes. Vascular supply macroscopically abundant. Vessels of attachment between the two implanted glands macroscopically visible. The larger gland was a firm lenticular body about 2 cm. long, 15 mm. wide and 1 cm. thick. Weight, 3.05 gram. The smaller testis was especially vascular in its environments and its "testicular" conformation especially plain. It measured approximately 1 cm. in length, 6 mm. in width, and 5 mm. in thickness, being about two-thirds its normal size. Weight, 0.6 gram. The microscopic characters of the implanted organs are shown in Figs. 10, 11, 12, 13 and 14.

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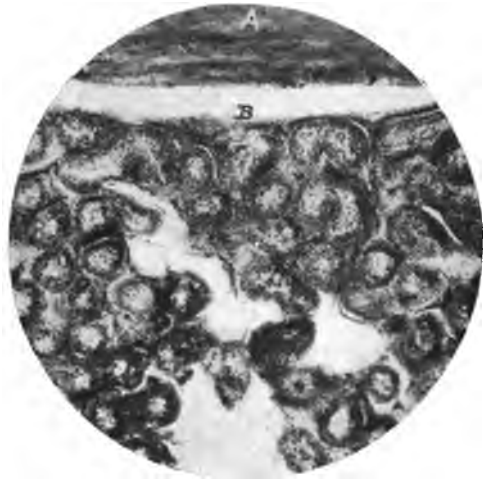

Fig. 5.— Section of normal testis of boy of fourteen years. A, *Tunica albuginea*. B, *Tubuli seminiferi*.

VI. An exceptionally large right testis from a mongrel cock, one year old, was implanted extraperitoneally in the abdomen of a Buff Wyandotte laying hen, one year old. Healing was prompt and that there were no evil results is evident from the fact that the subject went on laying as if nothing had happened. This is important, as the slightest abnormal condition of health, and even slight nervous disturbance, such as changing to a strange coop, usually checks egg laying.

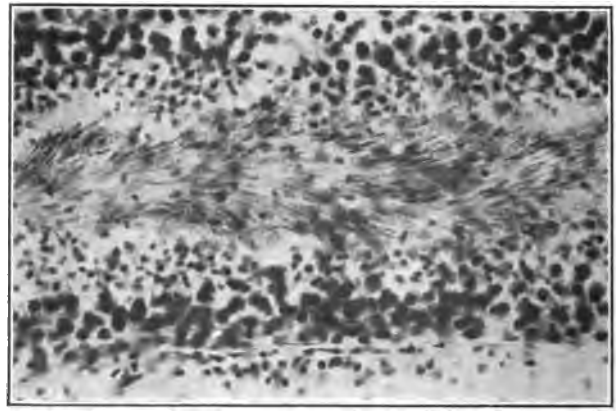

Fig. 6.—Seminiferous tubule of a young ram, showing enormous number of immature spermatozoa.

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A fowl purporting to be the same as the subject of Experiment VI was killed three months later. Autopsy showed normality throughout, but no trace of the implanted gland. As there was not even a vestige of scar or connective tissue at the recorded site of implantation, the author is in doubt as to whether or not some mistake in the identity of the subject was made.

As far as points 1, 2, and 3 are concerned, the results of the foregoing experiments seem quite conclusive. In the case of the hen used in Experiment III, old age probably had much to do with the result. The possibility that a large dose of hormone from a relatively young gland may have been the disastrous factor is freely admitted, but, granting this, no such result could occur from the



Fig. 7.—Transverse section of epididymis of a young ram, showing trabeculæ and tubuli. Masses of coagulated semen are seen within the tubuli. Some of these masses have fallen out, leaving the lumen of the tubuli clear.

relatively small dose resulting from implantation in the human subject. The other fatalities probably were due to coincidental causes, with due regard to the possibility of individual predisposition and the remote effects of shock.

Experiment V, as shown by the microscopic appearances of the removed glands nearly three months after implantation, and by subsequent histologic study, demonstrated also the success of the implantation *per se,* confirming the results obtained in our previous experiments on the human subject (Figs. 15, 16, 17, and 18). That such remarkable results should accrue from implantations of male

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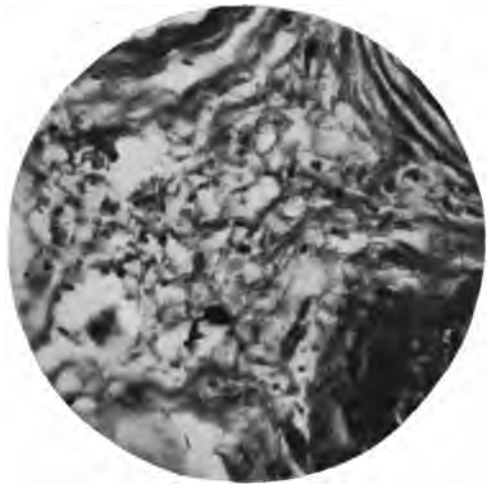

Fig. 8.—Interstitial (intertubular) connective tissue of epididymis of a young ram. Compare with Figs. 9, 12, 17 and 18.

glands upon the female is not so astonishing as it may seem at first sight. The blood of the female is excellent pabulum for every tissue in the body, as witness the development of the fetus *in utero*.

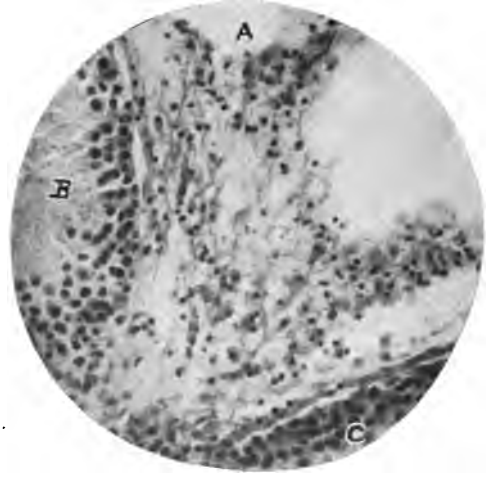

Fig. 9.—Section of the body of testis of a young ram. A, Interstitial (intertubular) connective tissue. B-C, *Tubuli seminiferi,* showing secretory epithelium. Compare with Figs. 8, 12, 17 and 18.

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VII. As to point 4: A very large left testis—companion to that used in Experiment VI—was implanted in the left groin of an Airedale terrier, three months old. Local anesthesia was employed, with more attention to asepsis than in the case of the fowls, although the technic was by no means all that could be desired. Primary union occurred, but on the fourth day sloughing of the superficial tissues of the abdomen began, and by the seventh day nearly the entire abdominal wall was denuded down to the muscular aponeurosis, necessitating the killing of the animal.

Even after making due allowance for greater facility of infection, the foregoing result was in striking contrast to that obtained in fowls. In a large number of fowl implantations we have seen



Fig. 10.—Section of testis of a cockerel four months old, implanted in an unrelated pullet, four months old, and removed at the end of seventy-five days. (Experiment V.) A, Ordinary fibroconnective tissue at the periphery of the gland, corresponding to its peritoneal tunic. B, Abundantly proliferated interstitial connective tissue, with a moderate amount of ordinary connective tissue. C, Remains of the *tubuli seminiferi*, not yet firmly organized via connective tissue proliferation. At its inferior border is seen a new capillary, showing that the degenerated mass of true secreting tissue is living. Compare with Figs. 11, 12, 14 and 16.

but two cases of infection. These were purely local and chronic, consisting of a bad smelling fungus-like growth with slight suppuration, and no deterioration of general health.

It is worthy of comment that the relative degree of traumatism in implanting adult testes in fowls — especially young ones — is immensely greater than that involved in implantations in the higher animals. In fowls the implanted gland is so large that it presses considerably on the tissues of the implantation bed, and even on the

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viscera. Fowls, moreover, are relatively insensitive to injuries. As to the "alien species protein" factor in the foregoing experiment, we confess that we were somewhat in doubt. Since, however, his recent extensive experiments with organic emulsions,* the author has felt reassured on this point.

In a number of experiments in "exchange" transplantations in both unrelated and related young cockerels, we apparently have met with but one success in preserving the secondary sex characteristics, although, in every instance, they developed much better than they

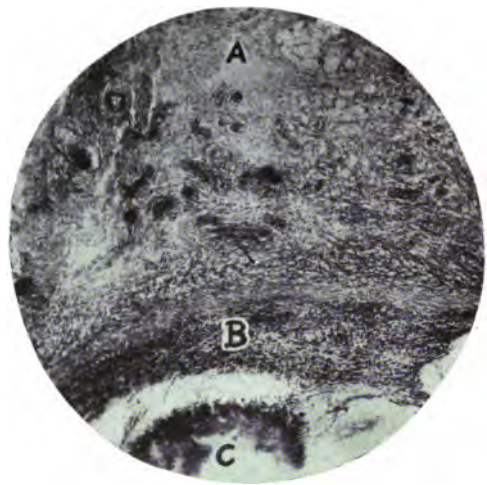

Fig. 11.—Section of testis of cock one year old, implanted in an unrelated pullet four months old, and removed at the end of seventy-five days. (Experiment V.) A-B, Subcortical area showing completely organized connective tissue, mainly of the interstitial variety, but containing ordinary fibroconnective tissue in small amount. An abundance of new vessels filled with normal blood may be seen. B shows the actively regenerating, but not yet permanently organized interstitial tissue at the border of the medullary portion of the gland. C, Degenerated tubuli. Periphery of gland not shown.

did in control capons. It is possible that different results may be obtained from implantation of unrelated adult testes on young fowls. The details of all our various experiments would here be superfluous. Two of these experiments, however, are of especial interest.

VIII. The testes of a Light Brahma cockerel, four months old, were removed and replaced by those of a White Leghorn of the same age. The

* Experiments with Emulsions of Organs Taken from the Dead Human Body and Sex Glands of the Lower Animals, American Medicine, December, 1914.

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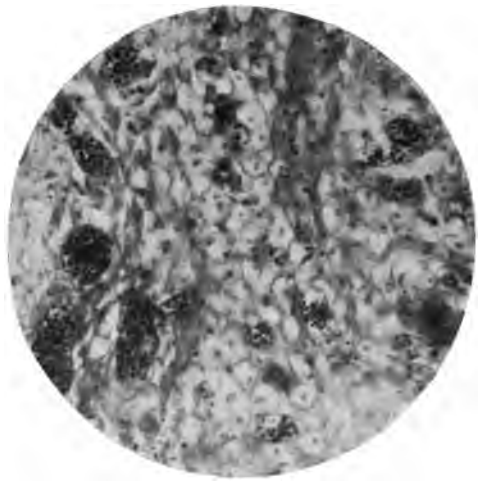

Fig. 12.—Area of section depicted in Fig. 11 under higher power, showing abundant proliferation of the characteristic interstitial cells in testis of cock one year old, implanted upon a young unrelated female and removed at the end of seventy-five days (Experiment V.) The normal blood content of the numerous vessels is plainly seen. There apparently is very little fibroconnective tissue, and this is situated chiefly in the vicinity of the vessels. Compare with Figs. 8, 9, 12, 17 and 18.



Fig. 13.—Section of testis of cock one year old, implanted on an unrelated pullet four months old, and removed at the end of seventy-five days (Experiment V.) A, Ordinary connective tissue, corresponding to the location of the peritoneal testicular investment. B, Subcortical layer of abundantly proliferating interstitial (inter-tubular) connective tissue, with a small amount of the ordinary variety. C, Permanently organized interstitial tissue, with a moderate amount of ordinary fibroconnective tissue, richly supplied with new blood vessels containing normal blood.

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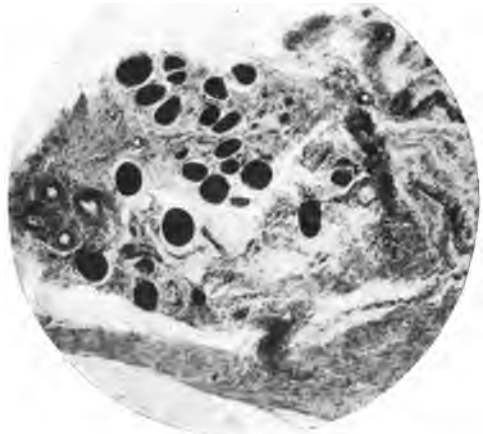

Fig. 14.—Section of testis from cock, one year old, implanted for seventy-five days in an unrelated pullet, four months old (Experiment V.), showing permanently organized interstitial (intertubular) connective tissue, an abundant supply of new blood vessels containing normal blood, and numerous large, deeply stained, round and ovoid bodies constituting degenerated, but still living, tubuli seminiferi.



Fig. 15.—Section of testis removed from man of thirty years, dead ten hours from contact with a live wire. Gland refrigerated four days in an ordinary ice box and implanted in the abdominal wall—upon the aponeurosis of the right rectus in the hypogastric region—of an unrelated female senile dement, aged sixty years. Gland removed after four months and nine days. A, *Tunica albuginea*, showing characteristic fibroconnective tissue and blood vessels (both old and new). B, Subcortical stratum of proliferated interstitial (intertubular) tissue, containing an abundance of new blood vessels. Here and there in the mass of interstitial tissue are seen the dark, distorted outlines of *tubuli seminiferi*, which have been "strangled" out and replaced by the interstitial cells, for the development of which the tubuli seemingly form an excellent matrix. The line of demarcation between the two kinds of tissue is plainly discernible.

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recipient matured with great rapidity—compared with other males of the same strain—as to color, weight, comb and wattles, plumage, carriage and what is termed by fanciers the "talking voice," which within two weeks was transformed from the "peep" of the young fowl into the hoarse notes of the adult. The bird became more spirited and combative. The testes of the Brahma were implanted in the normal position in the Leghorn, who subsequently showed all the usual characteristics of the capon.

The effects of the implantation on the Brahma gradually disappeared and he now—seven months after the removal of the testes—resembles a capon castrated rather late, markedly conforming with uncastrated males in

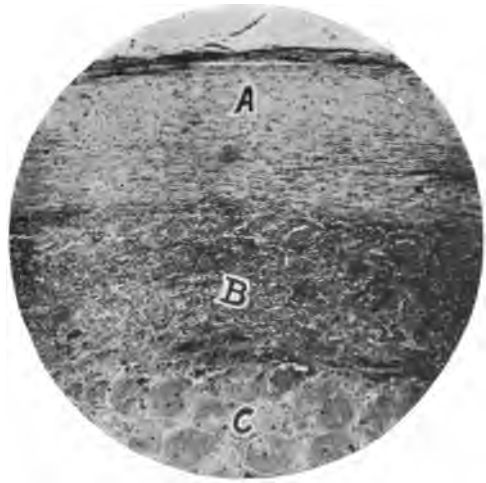

Fig. 16.—Section of testis from man of thirty years, dead ten hours from contact with a live wire, implanted upon an unrelated female. Gland refrigerated four days. Removed four months and nine days after implantation. A, *Tunica albuginea*, showing ordinary fibro-connective tissue and blood vessels. B, Stratum of characteristic interstitial (intertubular) tissue, obscurely showing distorted outlines of obsolete *tubuli seminiferi*, with abundant supply of blood vessels. C, Seminal tubuli—the secretory epithelium of which has disappeared—plainly marked and unmistakable. In this particular area the tubuli took the stain in very moderate degree, but quite as well, it will be observed, as did the unquestionably living *tunica albuginea*.

everything save crowing and sex activity. The difference in results in the two birds probably was due to the relatively early development and great activity of the sex glands taken from the Leghorn—one of our best laying breeds—compared with those taken from the Brahma, a breed which develops sex characters very slowly.*

* It is interesting to note the intimate relation of early and marked sex gland development to the great laying capacity of various fowls. What is true of the testis, also is true of the ovary. The possibility of improving the laying qualities and fertility of various strains by sex gland implantations upon normal birds at once suggests itself and may prove of interest to breeders.

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IX. May 15, 1914, we removed the testes of two White Orpington cockerels—half brothers—three months old, and implanted the testes of one subject upon the other, in the normal site of the testes, leaving one bird caponized for a control. December 11, 1914, the implantation subject was examined and found to be a splendidly developed, normal male, with all the secondary sex characteristics perfect. He is active, very pugnacious and performs his sexual function just as would any normal male fowl. The caponized subject showed fairly well developed secondary sex characters and while more active than is usual with capons, presented a marked contrast with the implanted subject.

The histologic study of sections of the implanted fowls' testes removed

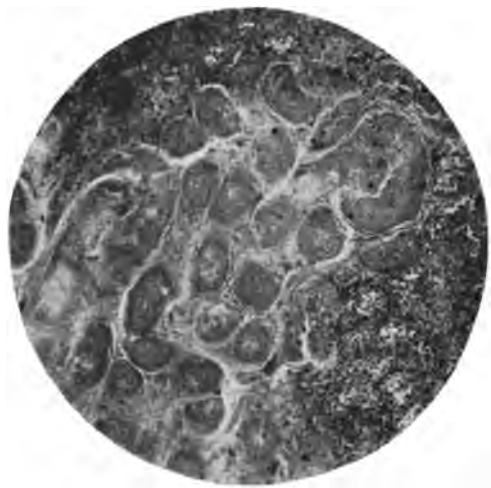

Fig. 17.—Section of another area of same testis from which Fig. 16 was taken, showing still more clearly the living but obsolete *tubuli seminiferi*, which gradually are being displaced and replaced by the interstitial (intertubular) connective tissue. The outlines of the tubuli which already have been completely engulfed in the abundant cells of the interstitial tissue still are discernible, whilst some of those at the borders of the area of the tubuli which are not yet completely enmeshed in the cell network, are more plainly visible than those which are not yet greatly encroached upon.

from experimental subject V proved very interesting and instructive. To facilitate the study of these and of other implanted glands reported in this chapter, and for the purpose of comparison will be first presented several sections of normal testes.

Fig. 4 represents a very interesting specimen as showing the perfect development of the epididymis and of the testicular structure proper in an extremely small gland from a very young subject. The epididymis was not macroscopically recognizable. Comparison of Figs. 3 and 4 with Fig. 5 demonstrates the relative great richness of

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the generative gland tissue of the fowl contrasted with that of the human subject.

In his first contribution* the author stated that, despite the statements of Marshall and Hammond, he believed that the epididymis probably played at least a minor rôle in hormone production. The photomicrograph (Fig. 8) seemingly confirms this belief.

It is interesting to note the distinct lines of demarcation between the strata of the various kinds of tissue (A, B, C) in the foregoing section and in certain of those which will follow. The interior of the gland probably was not necrotic in the true sense of the term, but was not yet organized and was so soft that it fell out of the section. This often happens in making sections of perfectly normal glands. It will be observed that the characteristic appearance of the interstitial connective tissue in stratum B is plainest just beneath the cortical layer of fibroconnective tissue and just at and above the line of demarcation separating B and C. It will be seen that this histologic feature is prominent in all similar sections—from both fowl and human being—exhibited herewith. This particular phenomenon is explicable by the greater circulatory activity and consequent better nutrition at the points mentioned. At the periphery, notably adjacent to the *pia mater testis,* or *tunica vasculosa,* conditions especially favor tissue regeneration. A certain amount of ordinary connective tissue is found in the implanted glands, apparently derived—as shown in Figs. 8, 10, 11, 12, 14, and 15—not from the *tunica propria* of the gland, but from the septa of the gland, of which the *corpus highmorianum* is the most important, and probably also from the walls of the blood vessels (Figs. 9 and 12). By far the greater part of the new tissue is composed of proliferated characteristic interstitial (intertubular) cells.

What is going on in the mass of degenerated tubuli in the interior of the gland, and its final result, is well shown in Figs. 14, 15, and 16.

The richness of the new blood supply of the implanted gland is well shown in Fig. 11, and in the next following of the series (12). Fig. 12 also demonstrates conclusively that the regenerated tissue is not composed of ordinary fibroconnective tissue—save in small

* N. Y. Med. Jour., Mar. 21, April 4, July 11, 1914.

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amount—but of what may be inferred to be the characteristic interstitial cells. This tissue plainly is present in the implanted glands in far greater amount than in the normal gland. This perhaps is the most important point. The character of the regenerated tissue is witnessed by Figs. 12 and 17.

The question of whether or not the degenerated tubuli of the testis may retain their vitality after they are functionally dead from destruction of their gland epithelium, would seem to be answered, not only by their retaining their form sufficiently to be recognizable after a long period of time, but also by the manner in

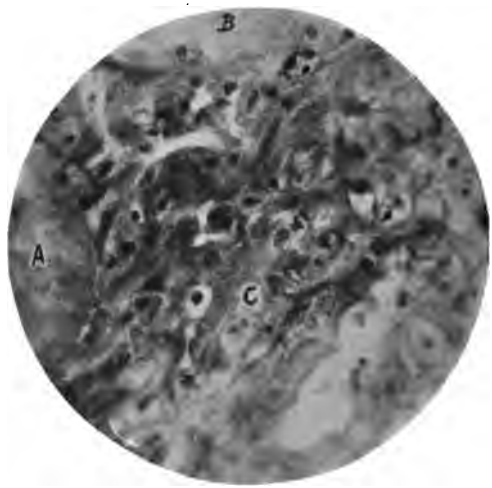

Fig. 18.—Section of testis implanted in the suprapubic region of a woman sixty years of age, and removed at the end of four months and nine days. A-B, Obsolete but still living *tubuli seminiferi.* C, Interstitial (intertubular) cell proliferation.

which they stain. (See especially, Fig. 17.) Fig. 14 is a pertinent illustration. The remnants of the tubuli took the stain so well that they had the appearance of small plums. The surface of these dark bodies showed the characteristic granular appearance that we have observed in the degenerated, though distinctly recognizable tubuli found in implanted human testes. It is hardly probable that tissues so delicate as are the *tubuli seminiferi,* would endure, if dead, and show as plainly as they do in Fig. 17 (see also Figs. 14 and 16) at the end of seventy-five days after implantation in an alien bed. To believe this, one must underrate the "digestive" or "assimilative"

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capacity of the normal tissues of the implantation bed, and overrate the resistance of those tissues to dead matter.

The foregoing results of experimental testicular implantations upon fowls are systematically corroborative of those observed in our implantations upon human subjects. To emphasize the histologic results obtained in the latter, as shown in the author's various articles, and to supplement the illustrative drawings presented therein, there are shown herewith a series of photomicrographs which show even more satisfactorily the changes occurring in implanted human glands.

The implanted and removed gland herein submitted to histologic study, is the one already recorded of a testicle implanted upon a woman of sixty years and removed over four months later.*

The illustration (Fig. 16), comprising an area of the same section of the implanted testis—a little larger than that shown in Fig. 15—beautifully shows the various strata from the periphery to the centre of the gland. It shows with especial distinctness the outlines of the obsolete *tubuli seminiferi,* which have been replaced by the interstitial connective tissue.

The foregoing illustration would seem to show pretty conclusively that, while the *tubuli seminiferi* of implanted glands undoubtedly lose their function, coincidentally with the death of their secretory epithelium—which probably inevitably occurs in implantations such as the author's—the mass proper of the tubular structure—*i. e.,* the basement membrane and its protoplasmic content—may survive for a prolonged period. Whether or not anastomosis—providing a successful technic ever is elaborated—will preserve, or, if it be not wholly destroyed, regenerate the generative gland epithelium, is very doubtful, although, perhaps, not impossible.

The resemblance of the structure shown in Fig. 18 to that shown in Fig. 8 is interesting, more especially as the latter shows a section from the epididymis of the ram. It demonstrates clearly the composition of the dark strata of connective tissue shown in the various sections.

It was the author's good fortune recently to study a specimen of a testis removed very early after an implantation. Sections prepared from this specimen show some interesting features, as also

* New York Medical Journal, October 31, 1914. Case VI of my series.

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does the history of the experiment, which later will be presented in detail in this volume.

Both testes were secured from a powerful and apparently healthy man twenty-three years old, a professional athlete, dead ten hours of narcotic poisoning. The cause of death is worthy of note, inasumch as the results of the subsequent implantation of the glands conclusively proves that death from narcotic poisoning does not impair the vitality of implantation material. Obviously, this greatly enlarges the field of available material, and consequently the usefulness of sex gland implantation as a therapeutic resource. Experi-

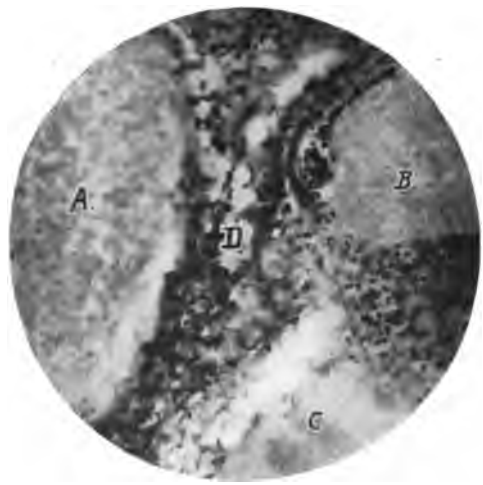

Fig. 19.—Section of implanted testis from a donor dead ten hours of narcotic poisoning removed on the ninth day. A-B-C, degenerated remains of spermatic tubuli. D, interstitial (intertubular) connective tissue cell proliferation and leucocytic infiltration.

mentation at some future time with material from bodies dead of carbolic acid, bichloride of mercury, and illuminating gas poisoning might be interesting.

Eleven hours later, both testes were implanted on a young man of twenty-two years, suffering from dementia præcox. The full details of this case will be presented later. Nutrition of the subject was only fair. One gland, the right, was implanted in the suprapubic region, beneath the deep layer of the superficial fascia upon the linea alba. The other, and the smaller, gland, was implanted in the scrotal sac, just above the recipient's left testicle.

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Healing apparently was perfect in both implantations, but on the ninth day pus appeared in the hypogastric wound, with a distinctly putrescent odor. Believing the gland to be necrotic and the implantation consequently a failure, we removed it. To our astonishment we found the tunica of the gland adherent to the tissues of the implantation bed, and covered with numerous areas of new blood vessels. The centre of the gland was necrosed, but a good portion of the periphery apparently still was living. The fate of the gland implanted in the scrotum will be presented later, it being

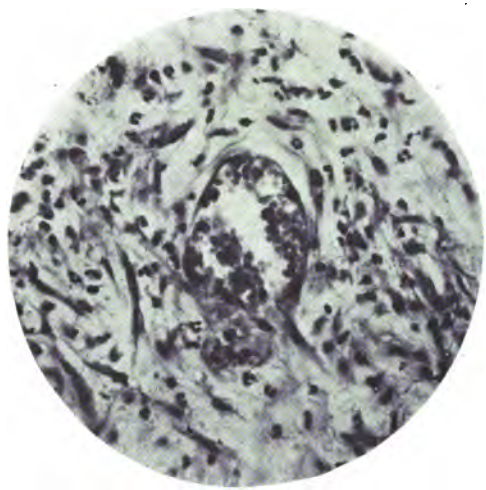

Fig. 20.—Section of tunica albuginea of implanted testis from donor dead of narcotic poisoning, removed on the ninth day after implantation. The section shown is from the inferior surface of the tunica, *i. e.*, in the zone of contact with the *tunica vasculosa*. The section shows an abundance of probably regenerating—or regenerated—connective tissue cells of a peculiar type and a moderate number of leucocytes. The nuclei in the specimen seemed in some instances to indicate a regeneration of the peculiar connective tissue cells, some of which resemble the characteristic interstitial cells of the intertubular areas shown in the preceding illustrations. In the centre of the section is a blood vessel of apparently new formation, containing normal blood.

sufficient at this point to present the histologic features of the removed companion testis (Fig. 19).

Although not so plainly marked as in the section shown in Fig. 21, the early proliferation of the intertubular tissue seemingly is quite evident in Fig. 19. The interior of the testis being necrotic and infected, it is, of course, doubtful whether in this particular instance permanent organization of this particular area would have

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occurred, although the author believes that it quite likely would have done so.

A most interesting feature of the various sections of the implanted testicle examined was the presence of a considerable proportion of normal blood still remaining in the old vessels, in connection with corpuscles which were undergoing dissolution. There also were many extravasations or infiltrations of normal blood in the tissues, interspersed with both new and old capillaries. This suggests that the vitality of the implanted gland is quite enduring, sufficiently so to give plenty of time for its nourishment from its

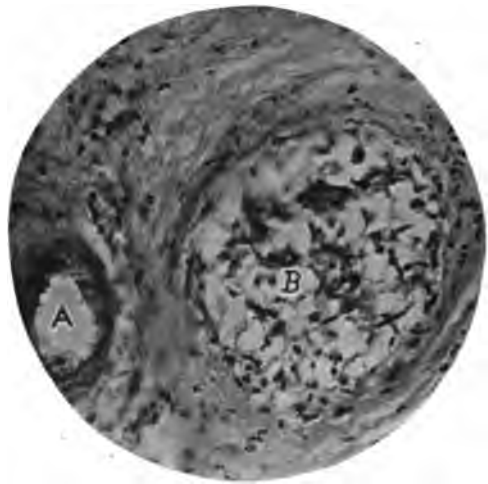

Fig. 21.—Section of inferior surface of tunica albuginea of implanted testis from donor dead of narcotic poisoning, removed on the ninth day. A, apparently new blood vessels containing normal blood. B, area of peculiar cells, probably derived from the interstitial (intertubular) tissue. This section shows the ordinary characteristics of the connective tissue of the *tunica propria* of the testis, with numerous leucocytes.

new environment to begin. Reflecting on Leo Loeb's experiments in cultivating tissue cells, both *in vivo* and *in vitro,* and the endurance of life in frozen cells, it should not be surprising that a healthy, sterile gland, bathed in nourishing blood and tissue juices at the normal temperature of the body, should survive and eventually form a new vascular supply.

The somewhat extraordinary appearance of the immediately foregoing section (Fig. 21)—which strongly resembles a neoplasmic growth—possibly may be explained as follows: In the author's

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technic of implantation small areas of the *tunica albuginea* are expected. At the point shown in the illustration, the area of the exsection did not involve quite the entire thickness of the tunica throughout, but at one point was left an extremely small aperture through which the rapidly proliferating interstitial cells extruded. The area may, of course, represent a severed blood vessel, through which the cells are extruding from beneath. We have noted in other sections an invasion of the cortex by interstitial cells at points of denudation.

In presenting the various sections illustrative of the histology of implanted testes, the author is not unmindful of possible sources of error, which subsequently may be corrected either by himself or other investigators. At present writing, however, the results seem to be conclusive. The peculiar type of connective tissue shown in the various sections must either be the interstitial cell of Leydig—or a derivative of it—or there exists in the testis a definite type of tissue hitherto undescribed. It is hardly possible that the tissue demonstrated herewith could have been overlooked by the many competent histologists who have studied the normal tissue regeneration in the testis are four: 1, The true secretory The leucocyte theory of connective tissue generation of Cohnheim and Metchnikoff having been abandoned, the possible sources of tissue regeneration in the testis are four: 1. The true secretory epithelium; 2, the Sertoli cells; 3, the ordinary fibroconnective tissue of the gland septa and the tunica albuginea; 4, the interstitial connective tissue or "between cells" of Leydig. The epithelial cells may be ruled out, offhand. The Sertoli cells are, in our opinion, of even less importance. They lie within the tubuli and have a purely nutritive function, concerning the true secretory epithelium, and die when the latter dies. The ordinary fibroconnective tissue plays but a minor part. The microscopic sections presented in this volume plainly show the strata of the histologic elements and emphasize the difference in the structure of the various strata.

The interstitial cells found in the normal ram's testicle and those shown in the section from an implanted fowl's testis are quite similar throughout. It is not to be expected that the cells in regenerated implanted glands always will appear the same. That sections of implanted glands or, for that matter, of normal glands,

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will show the "idealized" classic conformation and arrangement shown in certain works on histology also is not to be expected. The cells are thicker than normal and more or less altered in form and grouping, by contraction of the mass and resulting pressure, both by their own organization and a certain amount of ordinary fibro-connective tissue.

Like all other connective tissue, the interstitial tissue of the testis "consolidates and contracts," but it holds its own in respect of vitality, and a very small nodule of the implanted-tissue-end-result, probably contains as many, possibly more, of the Leydig cells than does the entire organ at the time of implantation. That these cells are as active, or their hormone product as abundant and physiologically as potential, as are the internal secretory cells under normal gland conditions, is open to question. Possibly the relative increase in the quantity of the highly specialized cells in the implanted gland, with a consequent relatively greater amount of hormone produced, may compensate for a difference in the quality of hormone production. That the implanted cells are therapeutically effective is no longer an open question in the author's mind. The chief problem now is: Will the implanted gland in elderly subjects eventually functionally succumb to the recipient's tissue influence and produce a quantity and quality of hormone normal to his or her age? Possibly; we have, however, two factors to consider:

1. The rejuvenation of the entire body by the alien hormone, a rejuvenation in the benefit of which the implanted tissue itself participates.

2. Even granting that the quality and quantity of the hormone produced by the implanted tissue eventually is not comparable to that produced by a similar number of cells under normal conditions, the sum total of hormone production of the implanted tissue and the subject's own glands necessarily is greater than normal to the subject's age.

It is probable that a gland from an older donor, implanted on a young subject, may be rejuvenated by the implantation. In general, such implantations are more logical than the implantation of very mature glands upon older recipients.

In all of his implantation work the author has been impressed with the fact that the *tunica albuginea* and the gland tissues just

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beneath it should be the most valuable of the testicular tissues where partial implantations are done, merely because better nourished and therefore mostly likely to survive, with resulting rapid and extensive regeneration of the interstitial tissue beneath the tunica.

CASE.* The case in which was implanted the testis from which the sections shown in Figs. 19, 20 and 21 were taken was as follows: Young man, aged twenty-two years, no occupation, heredity bad, paternal grandfather and one paternal aunt committed suicide. Another paternal aunt had seven children, five of whom developed dementia between the ages of sixteen and twenty years. This aunt was insane for twenty years after the birth of her last child and died insane. Patient was very bright at school. He suffered with a head injury of some kind four years ago, which his parents are inclined to believe had something to do with his condition, as their attention was first attracted to his mental state not long afterward. For some time he complained of headache. This injury, in our opinion, bore only a coincidental relation to the mental state that subsequently developed. Taking into consideration the family history and the typic nature of the case, and the absence of history of really severe trauma and of present evidences of previous trauma, my position regarding the possible etiologic relation of the head injury to the mental state would seem to be justified. About three years before I saw the case, a Neisserian infection was contracted. Recovery apparently was satisfactory. The contraction of this infection, according to his mother, "preyed upon his mind a good deal and may have had something to do with his mental condition."

Something over three years before the author first saw the patient, mental symptoms began to be noticeable. Dr. Archibald Church was consulted, September 13, 1914. His report in brief was as follows:

"The case impresses me as being the initial phase of a dementia præcox. I anticipate that he will develop a phase of activity, perhaps with a good deal of excitement and boisterous conduct, or he may become more and more stupid and catatonic. At any rate it will be some time before he is better and his ultimate prospects are extremely bad."

Soon after the case was brought to our attention, we referred it to Dr. Bayard Holmes for an Abderhalden test. His report was as follows:

"The hemoglobin was 80 per cent, the whites 12,400, the reds 4,800,000, the polymorphonuclear neutrophiles 57 per cent, small lymphocytes 30 per cent, large lymphocytes 8 per cent, transitionals 1 per cent, and eosinophiles 4 per cent. The form and character of the red corpuscles were normal and no parasites were to be observed.

The serum of this blood was centrifugated for two and a half hours and 1.5 c. c. of the serum was placed in each of six dialyzers, in which was also placed one gram of the following: Human organ albumins prepared according to the method of Abderhalden and each tested free from ninhydrin

* This case was reported in the N. Y. Medical Journal, April 3, 1915.

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reducing elements before being used, namely against cerebral cortex, pancreas, thyroid, ovary, testicle, and one control. They were incubated in Erlenmeyer flasks each containing 20 c. c. of sterile water for a period of sixteen hours at a temperature of 90° to 100° F. At the end of that time they were each tested against the ninhydrin solution and boiled for one minute. Every tube proved negative, being perfectly clear at the end of a half hour.

The blood serum in this case does not give any of the reactions of dementia præcox. Neither does the blood picture of the microscopical examination correspond with the blood picture in cases of dementia præcox. Although I made no considerable examination, the ocular reflexes and the mental picture did not suggest to me even the possibility of an embryonic case of that disease. I do not hesitate to state that this is not a case of dementia præcox."

Dr. Holmes' report, taken in connection with Dr. Church's diagnosis and the author's own, which corroborates that of Dr. Church, is worthy of serious reflection. That the subject was insane is beyond the possibility of doubt. With due deference to Dr. Holmes' opinion, that the case must be classed as dementia præcox is obvious. The prevailing nomenclature of psychoses is faulty, it is true, and, in the case of dementia præcox, absurd, in a way, the term having only a symptomatic-chronologic basis, with no definite pathologic foundation, but at present it is the best nomenclature available. It is possible that the Abderhalden test and hemologic observations eventually may enable us to resolve dementia præcox into several distinct pathologic types, one of which responds positively to the Abderhalden test, while the others do not. This would facilitate a more scientific nomenclature and classification. It of course is possible that our conclusion regarding the head injury in the case is incorrect, if so, this naturally might explain the negative Abderhalden. Even granting, however, that the head injury was an exciting etiologic factor, the same nomenclature would confront us.

The evidences of mental deterioration in the case in point are distinct, and of a character which lead me to classify the psychosis as hebephrenia of the paranoid type. Hallucinations have been a dominant feature. Voices whispering adverse comments and insults were daily complained of. Lack of energy, and the complaint that he was too weak to work, were salient points. The most prominent feature of the case was the patient's notion that he was a great architect and builder. His particular obsession was that

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he was in the employ of the city of Chicago, his special business being the remodelling of every large building within the loop. He spent many hours each day in writing "specifications" for such remodeling. The following are samples of his lucubrations:



Fig. 22.—Testis from a body dead ten hours from cocaine poisoning, implanted in a case of dementia præcox. Implantation eleven hours later—twenty-one hours after death. Drawing made six weeks after the implantation. Four months after the implantation, the implanted testis was a firm, characteristically shaped body about two-thirds of its original size.

1. The Mallers Building was built as large in City as neither Building contribute to Herbert at all. Fine stones on Mallers Building has stones representing the ends of earth. One on each side of door as two poles or ends of earth. Have building largest in world and fine stones as Equator higher up as students dont know. Have lights showing these stones.

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2. The Hub store built before Marshall Field & Company Building. Both sell men's suits. Buildings has no opposition on Account of neither seeing each other. Mostly for two hotels or Theatres. Blackstone and LaSalle Hotel, leaving both tops off both hotels and they will be eighteen or Blackstone Theatre and Majestic Theatre, Blackstone takes one off of Majestic leaving Eighteen. 4 Building and 4 stories make same as largest Printer Building. Both see Monadnock Bldg.

3. The LaSalle Hotel built after McCormick Bldg only a Hotel. Built same distance from Railroad and McCormick Bldg. and not hurting I. C. R. R. Have large smoke stack running up side of Hotel for no interruption of I. C. smoke stacks. Built also on account of Taft. Same height as McCormick. Top of Seats are higher in LaSalle Hotel on accounts of foreign countries and Washington and also Quaker City Church. People must not think they are Queen and Kings Seats here on that account. Little like Blackstone on Top of Build. only larger and different altogether.

4. The Franklin Bldg. is the building supposed to be finest printers building in city to honor *Benjamin Franklin* the same man discovered telephony. Same can be used as business building as close to Heisen Bldg. as Heisen Bldg. built for high telegraphy today, bringing telephony and telegraph together on account of printing paper being very precious, and two fastest ways of protecting same. Offices to be used as same making Franklin Bldg. *Finest* in city.

October 3, 1914, by request of the patient's mother and with complete understanding on her part of the experimental nature of the procedure, the author implanted two testes upon the patient, one in the suprapubic region and the other in the left side of the scrotum. The result of the suprapubic implantation already has been related. In passing, it may be stated that faulty technic probably was responsible for the loss of this testicle. The gland was very large and firm and the implantation bed was hardly ample enough, the resulting pressure being disastrous. Even as matters were, a considerable portion of the gland was living, adherent, and, had it not been removed, possibly would have survived for some months.

The scrotal implantation was perfectly successful. Fig. 22 shows the condition at the end of the sixth week (A). December 16, 1914, there had been no diminution in the size of the implantation mass that could not be explained by resolution of the defensive exudate surrounding it.

Beginning about one week after the implantation, considerable improvement in the patient's mental condition was noticeable. His "architectural" writing became a little more coherent, and he would not write unless urged to do so. He was encouraged to correspond

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with his friends. Comparison of a letter written by him soon after the implantation with another written later, showed a marked improvement. This latter missive is herewith submitted:

Miss.....,

G..... Bldg.,

Dear Miss.....,

I received your flowers and was glad to know some kind friend remembered me. The flowers were beautiful and my mother was down to see you as she said. Now you know I am here. Will want to see you next time I get a chance myself.

Your friend,

.....

Obviously, the improvement may have been of no special significance, although it was sufficient to arouse great enthusiasm on the part of his relatives and friends.

The improvement continued for several weeks, during which time the patient did not do any writing. He began reading assiduously, expressed a desire to "go to work," and showed interest in many matters to which he hitherto was indifferent. This state of affairs lasted for several weeks, during which time his response to various tests showed a marked change for the better. The aspect of the case now again changed and the mental condition was as bad as ever. He now showed some irascibility and resumed his writing. Several weeks later, he again improved and after a few weeks was distinctly better. He had ceased writing, seldom heard voices, and was working in a drug store for a portion of the day. On questioning he admitted the "foolishness" of his literary effusions and hallucinations, but if these matters were discussed at length his expressions still were unsound, although not so markedly as formerly. There was a change in the aspect of the case in that there now was a tendency to melancholy and, as a special source of worry, an imaginary defect of eyesight, which had been carefully tested and pronounced normal by Dr. Harry Gradle. There also was a new delusion. He attributed the "lump" in his scrotum to a large marble which he had swallowed when a boy.

November 3, 1914, Dr. Ralph Webster reported a blood examination as follows:

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Red cells	5,050,000 per c. mm.
White cells	16,400 per c. mm.
Polymorphonuclear neutrophiles	85%
Polymorphonuclear eosinophiles	2%
Polymorphonuclear basophiles	1%
Large mononuclears	1%
Small mononuclears	11%
Myeocytes	0%
Transitional	0%
Hemoglobin	88%
Color index	.8
Coagulation time	
Nucleated red cells	Negative
Polychromatophilia	Negative
Degenerations	Negative
Blood pressure (systolic)	120 mm.

Comparison of Dr. Webster's reports with that of Dr. Holmes is suggestive, although by no means conclusive. The improvement in hemoglobin and the number of reds is, however, consistent with what we have observed in previous implantation experiments.

February 8, 1915, the patient was surprisingly improved both as to mentality and general condition. The "melancholy" had disappeared and his mother reported that he was quite industrious and ambitious.

About December 15, 1916, the patient reported and was found to be still more improved mentally. His general health, however, seemed to be failing, without any especial reason therefor. Quite recently the author was informed that the patient had developed tuberculosis. There has been no opportunity of verifying this.

It will be evident from the foregoing account of this case that the author by no means is claiming indisputable therapeutic results from the implantation. There nevertheless is abundant encouragement for further experimental work in dementia præcox. The case may still further improve, and in any event it may later be shown that there is a form of dementia præcox which, if taken early, is susceptible of improvement, or possibly even cure, by implantation. If there is such a form, it probably will be found to be that which shows a positive Abderhalden reaction.

In an article entitled "Heteroplastic Grafting of Testicle," * Dr. Robert T. Morris relates a case as follows:

* N. Y. Med. Jour., Nov. 7, 1914.

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CASE. W. A. S., aged forty-nine years. Ten years previously, as a result of being thrown by a bucking horse upon the pommel of a Mexican saddle, both of the patient's testicles had been crushed and had been subsequently removed by operation. Shortly afterward, all characteristic masculine cenesthesia was lost and the patient, a large strong man, became extremely nervous with periods of great depression, shedding tears at slight provocation. As a man of education and intelligence he comprehended the entire situation and knew the reason for his psychic condition, although he said that it was at times unbearable.

On consultation with the patient I recalled to him our experience with ovarian grafting. After I had published the description of ovarian grafting in 1895 and had introduced the idea, a large number of authors soon furnished data of their own bearing upon the subject. There was a general conclusion along lines which biologists might have anticipated, to the effect that the tissues of one individual are antagonistic to the tissues of another individual. Therefore, heteroplastic grafts of any sort are commonly absorbed promptly by the host. The degree of antagonism between individuals varies greatly, and occasionally we may find two people (or other animals) which receive each other's tissues with good grace, if a bit of levity may be pardoned.

The patient was willing to take the chances of obtaining benefit from a grafted testicle, and entered the Post-Graduate Hospital, February 4, 1914. The first patient who offered opportunity for furnishing the graft had undescended testicle and hernia; he agreed to allow me to use a part of his testicle for grafting purposes. This patient, a young man twenty-six years of age, responded so strongly, however, to the von Pirquet test for tuberculosis that I preferred not to make use of his tissues. The next case was one of a man fifty-six years of age with a very large hernia, who made no response to the von Pirquet test for tuberculosis nor to the Wassermann test for syphilis and who gave a record of good general health.

A wedge of tissue was taken from the testicle of this patient and placed in normal saline solution until W. A. S. could be anesthetized and prepared. The segment of testicle was cut into four slices with a sharp razor, these slices averaging about three mm. in thickness, and in length approximately that of the testicle from which they had been removed. One of these segments was engrafted in the right scrotum, another one was placed beneath the fascial sheath of the right rectus abdominis, and the third segment placed beneath the sheath of the left rectus abdominis. A Wier's celluloid testicle was placed in the left side of the scrotum for the purpose of giving to the sympathetic nerves the impression of a natural mass in that vicinity. The wounds healed by primary union, and in forty-eight hours from the time when the grafting was done, the patient stated that he was distinctly conscious of the effect of the internal secretion which he was absorbing from the grafts. In fact, at that time occurred the first distention of the corpora cavernosa and corpus spongiosum that had not occurred in ten years.

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The subsequent history of this case showed considerable temporary improvement. Such benefit as was derived disappeared after a few months, as might have been expected from the fact that the "wedge" of testicle must have been small and the testicle from which it was taken necessarily degenerated — to say nothing of the advanced age of the donor.

It has been the author's aim to present the results of his experiments as fully and impartially as possible. That the results of the implantation *per se* are remarkable, probably will be admitted. The patient for a period of some months indubitably has a third testicle, which of necessity is living, and, inferentially at least, producing hormone. From his studies in implantation the author has no doubt whatever that during this time hormone production is going on. The quantity of gland tissue still present and the length of time since the implantation in all cases thus far, warrant the assumption that such an implantation is certain to secure the physiologic and therapeutic effects of the sex hormone. Whether or not these effects are what we desire in a given case depends upon its character. The same may be said of the permanency of the result. We wish to state that, although it may be proved that glands from unrelated subjects do not show such results as seen in Experiment IX of this series, we still may obtain from unrelated glands results which will prove of immense value. The author's various contributions apparently prove this point. Then, too, even though the physiologic results obtained in fowls were very discouraging—which they are not—such results by no means would settle the various questions involved in human implantations. While admitting possible sources of error, the anatomic and histologic results of the author's experiments in fowls and human beings appear to be quite conclusive. The letters of the experimental alphabet seem to be fairly complete.

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CHAPTER XIII.

Additional Clinical Cases of Sex Gland Implantation.

THE author presents herewith brief reports of six additional cases of successful implantations. He will at this time say but little further than he already has said regarding the physiologic and therapeutic effect of sex gland implantation. Suffice it to state that not only have previous observations been verified, but there also have been noted certain apparent results which still further confirm the author's belief that in the sex gland hormone we have the most powerful cell stimulant, nutrient and regenerator at present available to medical science. At present writing the additional evidence is such that the facts seemingly are established on a reasonably firm basis, free from suspicion of coincidence or intercurrent factors. Note in this connection the cases of double testicular implantations herein reported. These cases apparently are conclusive. Under proper conditions failure should be rare and the results are not likely to be disappointing.

CASE 1.—This is by far the most remarkable of the author's series of implantations, and to his mind is as conclusive evidence of the value of the work as a single case possibly could be. It is especially weighty evidence when considered in connection with the apparent results of our other implantation work.



Fig. 1.—Double implantation of testes from a dead body in a case of double complete atrophy.

A man, aged 29, sustained an injury to his testes while playing football, twelve years before he consulted the author, in July, 1915. His right testicle was enormously swollen (probably hematocele) and very painful. When the swelling subsided, the gland had entirely disappeared. The remaining testicle atrophied to a moderate degree. Virility was unimpaired, and the patient married three years later. One child was born of the union.

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About two months prior to our examination the patient, without preceding trauma or known infection, suddenly developed pain in the left iliolumbar region, left spermatic cord, and the remaining testicle. The testicle did not swell, but, the patient stated, the veins above it were swollen, The temperature record was not available. There were no urinary symptoms. At the end of three weeks the testicle had completely atrophied, and some weeks later the case was referred to me.

On examination, we found a healthy-looking subject, over-fat, with moderately feminine secondary sex characteristics. The beard was almost negligible; the mammae moderately large, and the pelvis distinctly broader than the normal masculine type. The patient stated that his physique had shown these peculiarities increasingly since his injury, twelve years before, but that his sexual power had been "satisfactory" until after the loss of the second testicle. During all these years he had not been physically as fit as before, and for about a year he had with difficulty met the physical and mental exigencies of his business, this lack of efficiency having rapidly increased since the loss of the remaining testicle. Since the loss of the second testicle there had been complete impotence.

Palpation showed scarcely a vestige of tissue at the end of the spermatic cords—nothing, indeed, that could be accepted as even a remnant of gland tissue. The penis was of only moderate development, with a long prepuce, but otherwise normal.

August 1, 1915, the author implanted on this patient both testes taken from a boy of 14, dead of a crushing injury. The subject was just approachnig puberty, and not well developed. The testes were removed six hours after death, and kept on ice in sterile salt solution until the operation, thirty-nine hours after the death of the donor. The implantation was made in the scrotal sac on each side, at the normal site of the testes. The glands were implanted entire, the epididymes not being removed. Healing was prompt; there was only 1 degree of transient febrile reaction, and very slight inflammatory swelling about the implanted glands. Five days after the implantation circumcision was performed. The patient returned home in two weeks. Vigorous and painful erections occurred after the eighth day, and required an ice bag. Successful coitus was practiced three weeks after dismissal from the hospital. Seven months after operation, the patient reported that he was perfectly normal, was taking active gymnastic exercise, and had lost nearly 20 pounds of his flabby fat. Erections vigorous and more frequent than in the average normal subject of similar age. The patient laid especial stress on his mental and physical fitness for business. The implanted testes had atrophied only moderately, and were of relatively fair size and fairly normal consistency. The epididymes were plainly distinguishable. As Dr. William T. Belfield, who courteously examined the case and questioned the patient, remarked, "The testes, while small, are as well developed and apparently as normal as in many perfectly virile men who come under our observation."

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In passing I wish to state that, for a while after the implantation, the patient experienced normal orgasm without emission. He stated to Dr. Belfield and myself that after a few weeks he began to have emissions of a considerable amount of fluid, and that these emissions were almost constant. The emitted fluid, while it has not been examined, of course is not testicular secretion—no anastomosis having been done—but comes from the urethra, Cowper's glands, the prostate, and the seminal vesicles. In brief, it probably is composed of all the usual normal elements of the normal semen, save the testicular secretion, of which the spermatozoa are the important element.

For some weeks after the implantation the patient complained of "frightful nervousness." As he described them, his symptoms were not unlike those produced by strychnine and similar spinal excitants. The "nervous" symptoms finally disappeared. The author attributed them to the unwonted dose of hormone supplied by the implanted testes, to which the nervous system gradually became accustomed.

August 15, 1916, just one year and two weeks after the implantation, the patient reported as "fit as a fiddle." He stated that he sustained intercourse often as frequently as thrice weekly, and that his health was perfect. The testes still were in evidence and, although smaller than when last examined, were well defined and of firm consistency.

This case last reported to the author July 20th, 1917. Drs. W. T. Belfield and J. J. Monahan examined the patient. The implanted testes were found not to have atrophied appreciably since the last examination a year before. The beneficial effects of the implantation still endured. It would appear that this case probably proves that permanency of result is possible, not only as to physiologic results, but also as to the endurance of the emplanted glands.

A feature of the foregoing case that is worthy of especial comment is the preservation of virility—until the loss of the remaining gland—after the accident of more than twelve years ago, despite the subsequent impairment of development of masculine secondary characteristics. It would seem that: 1. A relatively large dose of hormone is necessary to perfect development of secondary sex characteristics. 2. A very small dosage is sufficient to preserve virility. 3. Once virility is established, an extremely small dosage of sex hormone will preserve the psycho-sexual and physio-sexual sex characteristics that are so essential to potency. It has been observed that individuals possessed of exceedingly rudimentary testes often are virile. Indeed, it has been our experience that such persons sometimes are possessed of more than the average degree of virility. We recall several cases of cryptochidism coming under our observation in which there was a normal degree of virility with complete sterility.

It will be interesting to note the further progress of the case relative to atrophy of the implanted glands.

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As already noted, the glands after two years still are in fair condition and have not appreciably atrophied during the past year.

Possibly the preservation of the epididymis has something to do with this. As to how long the therapeutic results will endure, one cannot predict. Probably permanently, or at least long after the last vestige of implanted gland tissue has disappeared. The author is confident that, as long as even a small portion of the implanted tissue remains, its favorable effects will endure. Even though an occasional repetition of the implantation should prove necessary to maintain the patient's normal sex standard, the result still would be remarkable and the scientific status of the method sustained.

Case 2.—This case was purely experimental, and no exhaustive report will be made at this time. The subject was a healthy professional man, aged 58, who submitted himself to the experiment from purely scientific motives. The companion testis of that used in Case 3 was employed. The implantation was made in the left scrotal sac. The local result of the implantation was what we now feel justified in calling "typic," save that the subject got about on his feet after twenty-four hours, which resulted in considerable swelling and tenderness of the operated region. When the patient keeps to his bed, the reaction is very slight, compared to the tissue "insult."



Fig. 2.—Experimental implantation of a single testis from a dead body.

In this case there was a rise of temperature of 1 degree, which subsided in twenty-four hours. Seven months after the implantation a nodule about the size of a good-sized grape was still perceptible. Fourteen months later, the nodule was the size of a large pea.

Certain oddities of apparent physiologic effects were noted in this case, which, if sustained by future observation, will be reported.

Case 3.—A man, aged sixty, apparently normal in every respect, submitted to implantation, with a view of increasing physical vigor and endurance in general, and sexual vigor in particular. The necessary material was secured from an apparently healthy lad of seventeen years of age, dead twelve hours of crushing injury to the head. Death had occurred about four hours after the injury. The operation was performed shortly after that in Case 2.

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The testes were refrigerated for about forty-eight hours. A single gland, the right, was employed. The epididymis was removed, and numerous areas of the cortex denuded. The implantation was made in the right scrotal sac. The implantation was perfectly successful. There was practically no febrile reaction, and very little swelling at the site of the implantation. No opportunity has presented itself for a review of this case, but a little over seven months after the implantation the patient wrote that he was satisfied with results, and that there still was "quite a lump" at the site of the implantation. Twenty-two months after the implantation, the patient wrote that his "physical, sexual and mental vigor" still were greatly improved, and that his blood pressure—which was 150 at the time of the implantation—was 135.



Fig. 3.—Experimental implantation of a single testis from a dead body.

Case 4. Double testicular implantation. Subject aged sixty-nine. No organic disease. Complained of shortness of breath on comparatively slight exertion and of "unsteadiness" of lower limbs. Sexual power still fair, but "failing" as usually might be expected in a man of his age. Briefly, as the patient and his friends expressed it, he had begun to show his age. His normally ruddy complexion had paled considerably. Blood pressure, 150—systolic. Digestive function normal, despite a tendency to over-eating. Wishes to submit to implantation for its probable effect of increased efficiency and improvement of sexual power. Double scrotal implantation October 27, 1916. Material taken from healthy lad, fourteen years of age, dead about ten hours from crushing injury of the head. Material refrigerated twelve hours. Epididymes not removed and testes implanted intact without decortication. Very slight local reaction and no temperature. Patient up and about on the eighth day. Improvement in color was noticeable on the third day, and was commented on by the author's assistants and the patient's friends. Six months after the implantation, well defined nodules, insensitive and freely movable, marked the sites of implantation. Atrophy had been rather more rapid than in the average case, but both the epididymes and the bodies of the testes were plainly to be felt, the entire mass on each side being about the size of a small almond. The patient's appearance was that of a man ten years younger than his age, his face showing a healthful ruddiness. Efficiency had markedly increased, and the "insecurity" of the lower limbs had entirely disappeared. The superficial veins of the lower extremities, which were considerably enlarged and varicose, had improved to a marked degree. The sexual power had markedly increased. The patient expressed himself as

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being so well satisfied with results that he had resolved to have the implantation repeated, after a time, if necessary to sustain the admirable results.

CASE 5. Double testicular implantation. This case was purely experimental. Subject sixty years of age. Until an attack of grippe a few weeks before, was as healthy as the average man of his years. Material obtained from a powerful, athletic young man, twenty years of age, dead about three or four hours from contact with a live wire. Double scrotal implantation. Epididymes left intact, but almost the entire bodies of the testes decorticated. Considerable local reaction with marked edema. Because of faulty technique, the implantation on the right side was a failure, the disintegrated gland being removed at the end of a week, the wound healing promptly. The



Fig. 4.—Double Implantation of testes taken from a dead body, six weeks after operation.

implantation on the left side was successful, but slight infection of the upper angle of the wound occurred; the fascial pursestring gave way a few days later and seminal tubuli appeared at the aperture. Subsequently, a distinct mass of testicular tissue the size of a small pea protruded from the wound. This became vascularized and for purposes of study was removed, showing the characteristic cut surface of living testicle substance. Several weeks later, the surface again became vascularized, appearing like a small segment of cherry. Two months later, the implanted testicle was firm and hard and the size of an English walnut; the small mass of living testicular tissue still was in evidence. A small amount of puruloid secretion issued from the small surface of exposed testis and the tissues of the wound. This showed an abundance of leucocytes but no organisms were found. The patient showed increase in mental and physical efficiency and his vigor greatly improved. There was a distinct improvement in vascular tone and in the heart's action. Blood pressure had been considerably lowered and

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the heart's action became weak following the grippe toxemia, being only about 115 (systolic) at the time of the implantation. Two months later the blood pressure was 130. The patient's color markedly improved, the improvement being noticeable within ten days after the implantation.

CASE 6. Double testicular implantation. Subject, a boy nineteen years of age, with the following history: At the age of thirteen he suffered severely from a vaccination, probably with a mixed infection. Shortly after the vaccination, which, he stated, made him very ill, he developed orchitis in one testicle, probably from an infected embolus. Following the orchitis the testicle atrophied. Several weeks later the opposite testicle became similarly involved and speedily atrophied. Coincidentally the penis became distinctly smaller. Some months later the case was examined by several surgeons who diagnosed retained testis on the left side and suggested operation. The case subsequently was referred to the author. Patient now was seventeen years of age. Examination showed a tall, healthy looking subject with distinct feminine secondary sex characteristics. Pelvis, *mons veneris* and mammary glands suggestive of a female just entering upon puberty. No beard was in evidence and the complexion was distinctly of the "milk and blood" feminine type. There was a bare suggestion of hair upon the pubis. The left testicle was represented by a small, hardly perceptible nodule about as large as a small pea just below the external inguinal ring. The right testis was soft and about the size and shape of a small lima bean. The penis was no longer than that of a well developed child of five or six years of age. The voice was that of the usual boy of seventeen. Psychically, the boy fortunately was a normal, manly fellow, although there were no signs of virility.

After some six months' treatment with faradism with some slight improvement, the author suggested an implantation. Other advice was sought and several surgeons—one supposedly an authority—suggested operation for retained testis, despite the feminine sex characteristics and local conditions which plainly showed the absurdity of such an operation. The case passed from under observation and did not return to the author until two years later, when he found that an operation had been performed on the left side, with the inevitable result that the remnant of testicle on that side had completely disappeared.

At the second examination the condition in general was the same as it was two years before, save that the secondary feminine sex characteristics were more pronounced. There still had been no manifestations of virility. The pelvis was distinctly feminine and the *mons veneris* covered with a well pronounced cushion of fat and sparsely supplied with hair, the arrangement of which was distinctly that of a young girl approaching puberty. The beard still was lacking. Implantation of testes again was suggested and consented to.

Operation performed October 27, 1916. Material used was taken from a healthy boy fifteen years of age, dead twenty-four hours of carbon monoxide poisoning. Glands refrigerated 32 hours. Scrotal implantation.

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Epididymes were not removed and testes were not decorticated. There was very little reaction and practically no temperature following the operation, but the patient was kept in bed for ten days.

Six months after the implantation, the implanted testes still are well defined, the right gland being much larger than the left and as large as that of the average lad of twelve. The consistency of both glands is softer and more nearly approximates the normal than have any others thus far implanted. The patient has gained weight and strength and is virile, as demonstrated by moderately frequent erections and the fact that he has cohabited thrice in succession on four occasions, with orgasm, but no emission. Penile developmen has greatly increased and the pubic and scrotal hair also has increased and assumed a more masculine type. The lines of the patient's body have changed appreciably and become more masculine in conformation, the cushion of fat upon the *mons veneris* especially, being reduced in size. The patient's own atrophied right testicle has increased in size and firmness and the epididymis—which could not be discerned at the time of the implantation—now can be plainly outlined. The voice is distinctly more masculine; the beard is heavier and a growth of hair has appeared on the forearms.

The foregoing case alone appears to the author as conclusive a proof as could be desired of the remarkable effects of sex gland implantation.

The author had the honor of exhibiting this case to a number of the members of the American Urological Association during the recent Chicago meeting.*

At present writing the author not only feels that his heretofore published impressions of the value of the sex gland implantation—notably in the matter of increasing physical efficiency, and especially physio-sexual efficiency—have been confirmed by further experience, but also is convinced that, when technic and material are right and the recipient properly selected, continuity of hormone production by the implanted gland for at least a prolonged period is certain. That permanently beneficial physiologic and therapeutic results are equally certain seems probable. Thus far we have observed no case in which the implanted tissue had completely disappeared, or even practically so, prior to from twelve to eighteen months. In brief, the author is convinced that his method of sex gland implantation long since has been taken from the purely experimental field and that it now stands on firm ground as a valuable therapeutic resource.

The endeavor has been made fairly to present the work of others whose labors have touched, even remotely, upon the field

* While this work was going through the press the author performed four additional (being two double) implantations. These were perfectly successful, but it is too early to arrive at definite conclusions as to therapeutic results.

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covered by the author's researches, hence it may not be deemed improper to call attention to the main features of originality in the implantation work herein presented, viz.:

1—The first implantation of an entire human testis for therapeutic or experimental purposes.

2—The first successful implantation of human sex glands—ovary or testis—taken from the dead body.

3—The first study of the general physiologic effects of the hormone from implanted testes and ovaries.

4—The first demonstration of microscopic sections from implanted human or lower animal testes proving their survival.

5—The first demonstration of the acquirement of new circulation by implanted sex glands—either human or lower animal.

6—The first cross implantation of human sex glands.

7—The first experimental implantation of sex glands in dementia præcox, senility, and feminism due to aberrations of testicular structure and function.

8—The first studies of the effects of sex gland implantation upon senility, the skin, blood vessels, blood and nervous system.

9—Formulation of a practical technique for sex gland implantation.

10—Probable refutation of the belief that glands from alien sources cannot survive—at least for a considerable period—after implantation.

11—Possible — or even probable — permanency of duration of glands from alien sources in some cases.

CONCLUSIONS.

1. At least temporarily, possibly permanently—and indubitably therapeutically—successful total or partial implantation of human sex glands in both male and female is practicable.

2. Glands taken from the living subject are most desirable, though rarely obtainable. They are, however, not more viable than those taken from somatically dead subjects. The closer the blood relationship of donor and recipient the better, but such relationship is not necessary for purely therapeutic purposes.

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3. Judging by his own early autoexperiment and heteroexperiments, and with due respect to Carrel's observations, the author at first concluded that, while glands frozen before decomposition may be available, they should, if possible, be used without freezing and very promptly after removal from the body, to obtain a fair average of successes. He now believes that nothing is lost by ordinary refrigeration for twenty-four to forty-eight hours. Glands taken from the healthy dead body at any time prior to the beginning of decomposition are of therapeutic value equal to that of those taken *in vivo*. Portions of glands are to a certain degree therapeutically serviceable, according to conditions and dose.

4. While in certain cases we might be warranted in incurring some risk, the subject from which the glands are taken should be selected with extreme care.

5. The ovary and the testis probably are alike in their susceptibility to implantation, both from the living to the living and from the dead to the living. If any difference exists, it possibly is in favor of the ovary. In human beings, the gland of one sex is transplantable upon the other, and it is possible that the hormone of the one is useful to the other. The author's experiments apparently show that the tissues of the female are quite as hospitable to the implanted male sex glands as are the tissues of the male. New blood vessels are formed as early as the eighth day.

6. The benefits of implantation probably accrue irrespective of the site of the implantation, but the vicinity of the peritoneum (extra abdominal) in the female, and of the *tunica vaginalis* in the male, are the sites of selection.

7. The internal sex gland secretion is stimulant, nutrient, tonic, and reconstructive, and should increase resistance to disease. Certain chronic infections, notably tuberculosis, serious anemia, neurasthenia, and conditions of profound debility should be benefited by implantation. In brief, any chronic disease in which improvement of nutrition is a desideratum should be benefited by sex gland implantation. Blood regeneration—notably increase in hemoglobin —is here a powerful factor.

8. The development of senility apparently can be retarded to a greater or less degree, and longevity possibly increased by internal sex secretion derived from implantation. The climacteric probably

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can be postponed by it, or the disagreeable features of the climacteric relieved.

9. Used at a very early period in the disease, internal sex secretion theoretically should be the logical remedy for dementia præcox and allied conditions.

10. The internal sex gland secretion via implantation, has a very useful field in the treatment of impotence in the male.

11. Implantation, with or without anastomosis in the male, possibly may have a certain range of usefulness in sterility in both sexes.

12. Defective and aberrant psychical or physical sex development and differentiation—inversions and perversions—are definite indications for sex gland implantation. Certain cases of cryptorchidism and imperfect testicular development, or atrophy from disease, are an especially promising field for it.

13. Intractable neurasthenia probably is relievable by it in a large proportion of cases.

14. Chronic diseases of the skin due to, or modified by nutritional disturbances—notably certain types of chronic eczema, psoriasis, and ichthyosis—in a certain proportion of cases apparently are likely to be benefited, and possibly cured by sex gland implantation.

15. That arteriosclerosis will in its early stages be benefited by sex gland implantation is probable. Inferentially, if taken early, senile dementia possibly may show beneficial results. It has a positive action in restoring blood pressure equilibrium and improving cardiac tone and efficiency.

16. All conditions incidental to sex gland mutilations in either sex afford a positive indication for sex gland implantation, the probability of benefit being inversely as the length of time that has elapsed since the mutilation, and dependent on the age at which it occurred.

17. Such diseases as chronic nephritis and diabetes would seem to be indications for implantation.

18. What is true of sex gland implantations in a general way, probably applies to implantation of other organs taken from dead human bodies in various diseases.

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19. The most important point of all is that, in properly selected cases, successful implantation ought inevitably to increase physiologic efficiency, with all the benefits accruing therefrom. With increased physiologic efficiency come individual and social efficiency.

20. Opportunities should be sought in the human subject for histologic study of implanted glands at varying periods after implantation, to determine in what degree both generative and internal secretion gland tissues endure.

21. Every effort should be made to so amend our laws that viable tissues of all kinds, notably internal secretory glands, shall become available to science. To this end the public especially should be made to understand that the sacrifice of a portion of thyroid or of a single ovary or testis by a living subject is not disastrous. The author believes that there are times when tissues obtained by such a sacrifice will restore reason, perhaps even life. Legislation and public sentiment should favor scientific research. Between the antivivisectionists, on the one hand, and popular reverence for the dead human body, on the other, we are in sore straits. Why should there be a waste of material which, if properly used, possibly might add so much to the health, happiness, efficiency, and even to the longevity of the human race? Let us strive for the conservation of biologic energy.

As matters now stand, only persons in affluent circumstances, and very few even of these, and a limited number of the poor in our institutions can avail themselves of sex gland or other organ implantations.*

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* Those interested in the dates of publication of the author's various papers on sex gland implantation are referred to the Bulletin of The Chicago Medical Society for March 7, 1914, and the N. Y. Medical Journal for March 21, April 4, July 11, October 17, 24, 31, and November 7, 1914. In the latter number of the Journal will be found a fairly complete bibliography.

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