

SECONDARY SEX CHARACTERISTICS AND THE GONADS

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THE general consensus of opinion seems to be that the secondary sex characteristics, in both the lower animals and man, are dependent chiefly upon the integrity and type of their respective gonads.

This opinion apparently is based upon the fact that castration of immature animals prevents full development of the secondary features. That these characteristics are not necessarily dependent upon the gonads is shown by several facts. Belfield mentions two observations, in this respect, that are worthy of consideration, viz.:

1. The complete sex features of mind and body, including the external genitalia, have been found in persons congenitally devoid of gonads, as proved by post-mortem examination. (Montfaleon relates a case, reported by Cabral, of a soldier who was hanged for rape, who, on dissection, was found to be without testes in either the scrotum or abdomen.)

2. The sex features including the external genitals of one sex have been exhibited by persons congenitally devoid of gonads normal to that sex (Figs. 1 and 2).

The belief that sex emanates from the gonads is based on the idea that the two sex complexes are separate entities which are immutable and antagonistic. The biologic conception of sex, on the contrary, is that it is but a single entity with variable degrees of femininity. According to Benda "the primary anlage of the entire sexual system of the vertebrae must be regarded as female," whereas Belfield claims that, "the fertilized egg is a potential female whose deviation toward the male is essentially a failure of potential development."

Early in the development of a neutral body, specialized reproductive tissue, or germ-plasm, is distinctly different from that of the body tissue, or somatoplasm, from which the gonads develop. This germ plasm is apparently of two types, that characteristic of the male and that of the female. The association of these reproductive tissues with the somatoplasm establishes sex. However, sex characteristics do not necessarily depend upon the presence of active germ-plasm nor the type of reproductive tissue present. The thyroid, pituitary, adrenal, and other glands all play a definite rôle in sex characteristics and may cause a more definite change in these when diseased than even those caused by the gonads (Fig. 3). Cases have also been reported in which the secondary features of the male, including pronounced beard development, and even hypertrophy of the clitoris, have developed in young girls because of hypernephromatic development as well as with diseased thyroids, that are similar to those caused by a cystoma of the ovaries (Fig. 4). In 1849 Berthold demonstrated the fact that the testes have a dual function: the production of spermatozoa, and the elaboration of an internal secretion, both of which served a common purpose.

At the present time there is no definite evidence that the sex characteristics of the male are associated with spermatogenesis. On the contrary, there is considerable evidence indicating that these characteristics are due largely to the action of certain cells lying in the interstices of the seminiferous tubules known as interstitial cells, which were discovered by Leydig in 1850. Kölliker in 1854 demonstrated these cells, not only in the interstices of the tubules but also under the tunica albuginea.

According to Borim and Ancel, Chapin, Allen and Whitehead, the interstitial cells make their appearance in the fetus and functionate even before the spermatic cells are fully differentiated. If the secondary sex characteristics are entirely due to the function of these cells it is obvious that they would be absolutely essential to all forms of life, yet Pezard claims that they are not present in certain forms of life.



FIG. 1. Man, aged forty-seven years, with normal masculine sexuality; penis of typical structure, smaller than the average. (After Neugebauer.)

He has failed to demonstrate the presence of interstitial cells in adult Orpington fowls, as well as in golden pheasants, and says that they are absent even during their greatest sexual activity. Boring and Pearl, however, claim that the interstitial cells are demonstrable in male chicks just before hatched but not in adults.

According to Felix, the interstitial cells develop in the human fetus in the second month of fetal life, and become quiescent

at the fifth month, when their formation ceases until after puberty. These cells in some instances remain long after complete degeneration of the spermatic tissues. Therefore the disappearance of the spermatic tissue does not alter the normal progress of sex characteristics, whereas, he claims, degeneration of the interstitial cells causes a loss of libido and the change of sex characteristics as seen in eunuchoi-

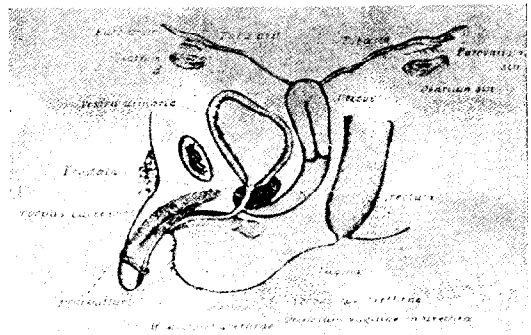


FIG. 2. Internal sex organs of man pictured in Figure 1; ovaries, tubes, uterus and vagina emptying into posterior urethra (utricle); prostate gland; suprarenal cortices (not portrayed), about five times as large as normal; no testes. (After Neugebauer, who compiled reports of 13 men so constructed.)

dism and pseudohermaphroditism. In birds, mammals, and other animals there is a close relationship between sex maturity and the appearance of secondary sex characteristics, which are more manifest in the male as shown by the lion's mane, the horns of the stag, the variegated plumage of birds, the phosphorescent organs of the firefly and glowworm, and the distribution of hair in man. Whether or not the sex characteristics are determined by the sex glands depends upon the form of life considered. In insects they are not. (Oudemans, Mersenhier and Kellogg.) Removal of the sex glands from the gypsy moth, for instance, in no way alters its characteristics.

In certain animals the sex characteristics are cyclic and appear only during their sexual activity as seen in the antler growth of the stag, nest building by the male birds, and the peculiar saliva of the crocodile.

During the rutting season, stags are

highly nervous and always ready to fight for possession of the hinds, fish exhibit marked coloration, the lyre bird develops an elaborate tail. When the season of sexual excitement is over, the prongbuck loses his horns, stags will herd together, nest building ceases, the fish lose their coloration and the lyre bird the tail, all to be assumed again the next season.

In warm-blooded species, the heavy

in these birds. Similar changes may occur in young hens after castration. The mutation from the female toward the male characteristics has been observed in all periods from fetal life to old age. Darwin recorded cases of an old duck which assumed the plumage of a drake, as well as a castrated duck which assumed the characteristics of a drake, and of an old sterile deer which developed antlers. Gold-

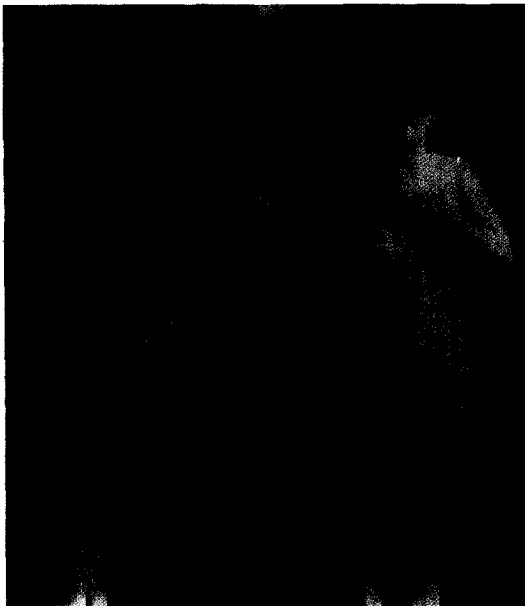


FIG. 3. Case of Dr. Gilbert Horrax. Reproduced by author's permission from *Arch. Int. Med.*, 1916, xvii, 629. Girl of eleven years, height 152 cm. (60 in., 114 lb.). At one year began to develop abnormally physically; menstruated regularly and showed other secondary characteristics just before eleven years. Supposed to be a case of pineal disease; roentgen ray showed enlargement of sella turcica.

burden of reproduction imposed on the female is transitory, and cessation of ovulation is sometimes accompanied by a change of feminine to masculine features. In the woman a change of the distribution of fat, development of beard, change of voice, and other features characteristic of the male are often seen after the menopause. The change of plumage of the female toward that of the male and the development of spurs in old hens are familiar, but such change cannot be ascribed to testes since they do not exist



FIG. 4. Normal menstruating girl at sixteen years; at right, same girl at nineteen, with full beard; no menstruation for two years; necropsy, multilocular cystoma of ovary. (From Alberti.)

schmidt contends that no animal, including the human, is purely male or female, that each has the potentialities of both. He thinks that sex intergrades are not degenerates, inasmuch as fifty per cent are found in normal families. He claims that they are the resultant of crossed matings in persons of different genetic constitutions, inasmuch as "contrary sexualis" is of greater ratio in these people than in those more sanguinely constituted. Forty years ago Pfluger found that of one hundred frogs caught in the spring, 84 per cent were females and only 16 per cent males, as determined by the gonads, whereas of 100 frogs in the fall, about 50 per cent were male and 50 per cent female. He found that in the newly transformed frogs the ovary constituted the greater part of the gonad: with time the ovary atrophied and the testicular portion developed in about half of them. In some of them transmuta-

tion was incomplete and the gonad became a composite ovo-testis.

Belfield says that tadpoles usually develop into male and female frogs in equal number, but that by feeding them tumors of the human suprarenal cortex they are transformed almost exclusively into male frogs. There are a number of cases on record of hens that carried on all the functions of a hen and later developed

tuberculous, the infection having destroyed the ovary, which was replaced by a sperm-producing testis.

The intersexual or composite gonad-ovo-testis has been found in such female mammals as the mole, goat, pig, dog and woman (Fig. 6). Belfield says "such ovo-testes are probably not rare in the human subject. Three are reported by one observer, but have been until recently rarely looked for."



FIG. 5. Bird above shows comb and wattles of cock, tail and spurless legs of hen; bird in middle, transformed hen with one sperm-producing testis, and an atrophied ovary, with one corpus luteum; bird below, ovary, no testes. (From Boring and Pearl.)

all the characteristics of a cock, including plumage and the development of wattles and comb (Fig. 5). Crew reports an instance in which a chicken was an egg-laying hen until three and one-half years old, when in successive moltings, she was transformed into a cock, which fertilized a hen from whose eggs young chicks were raised. Post-mortem examination showed the transformed hen to be extensively

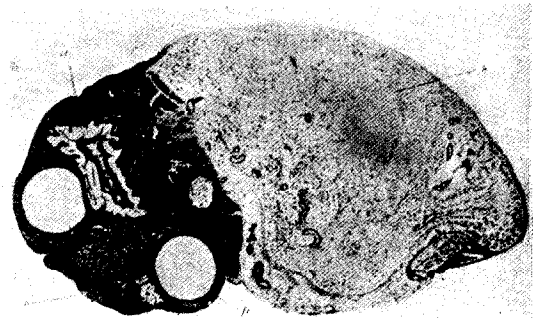


FIG. 6. Gonad of pregnant mole: At left, ovary with typical follicles and corpus luteum; at right, spermatic tubules. (After Kohn.)

Steinach and Sand successfully grafted ovaries from female guinea pigs into previously castrated males and state that these "feminized males" developed characteristics peculiar to the female, such as hypertrophy of the mammary glands, female skeleton, and texture of hair. "Masculized females" also took on the somatic characteristics of the male.

The mutation of sexes is chiefly from the female to the male. This is well demonstrated in the observations made by Lillie on the free-martin, a female twin of the male calf, which develops sexually indifferent to cows and bulls alike and resembles an ox. In the free-martin, the internal reproductive organs are chiefly male whereas the external are female. Lillie's observations show the free-martin to be primarily a female, with ovaries, tubes, uterus, and vagina, which later becomes modified to the male type by means of a male sex hormone, thought to be from the secretion of the interstitial cells which circulate in the fetal circulation supplying both twins. If the circulation of both twins

is separate this does not take place, and in case of both twins being male they develop normally and are fertile.

Edmunds⁵ reports a case of an apparent girl who manifested all characteristics of a girl until she was fourteen years of age when the testicles descended and revealed the true sex. Betts² reports a case of a man weighing 190 pounds, who had a scanty beard with feminine pubic hair, a hip measurement of 42 inches, and a large pendulous breast 8 inches in diameter, with a clitoris $1\frac{1}{4}$ inches long and 3 inches in circumference, with a rudimentary vagina, but no scrotum or vulva. On operation, a mass 8 pounds in weight was removed from the abdomen. It consisted of 8 small masses all of which, Betts claims, resembled ovaries. His amorous desires were toward females and he was said to have been happily married.

BISEXUALITY A NORMAL INHERITANCE

Bisexuality has been recognized as long as there has been an historical account of mankind. In fact, the Biblical account of creation not only records the dual nature of man but likewise that of his creator. In Genesis 1:26-27 we read, "God said let *Us* make man in *Our* own image after *Our* own likeness, and let *Them* have dominion over the fish of the sea, and over the fowl of the air and over the cattle, and over all the earth and over every creeping thing that creepeth upon the earth. So God created man in *His* own image, in the image of God created he him: *male* and *female* created he them," whereas in Genesis 5:2 we read, "male and female created he them, and blessed them and called *their* name Adam in the day when they were created," which, according to Scripture, was the sixth day of creation. Later, after Adam had named all the beasts of the field but was without "a helpmeet," God caused him to fall into a deep sleep, and, after removing one of his ribs, made woman. Adam, recognizing her, said, "this is now bone of my bone, flesh of my flesh; she shall be called woman because she was taken out of man." It is quite obvious

that Adam was created a composite male-female as God "let *them* have dominion over the earth" and "called *their* name Adam." It was only after the feminine component of Adam was removed and became a distinct separate entity that she was known as woman. Pagan history and mythology frequently refer to the bisexuality of man. Even the Greek god of masculinity, Hercules, was also represented



FIG. 7. Hercules.

as being composite male and female (Fig. 7).

The old Hebrew idea of Urim and Thummim, male and female principles, clearly demonstrate their belief in bisexuality. Paul Carus relates in the Oracle of Yahveh that in Chinese documents written 5000 B.C. known as Yih King (Book of Changes), Fuh Hi, the mythological founder of Chinese civilization, carries a tablet in his hand on which are inscribed the symbols of Yang and Yin, the two sets of opposite contrasts, male and female, both of which are supposed to hold the secrets of the universe. The Chinese claim that "all things that exist are but a mixture of these two, and the conflict between these influences is responsible for all problems."

Freud⁶ was one of the first investigators to give us a comprehensive idea of the bisexual nature of mankind but was inclined to consider it as physical hermaphroditism and abnormal, whereas recent writers are inclined to consider it a normal-

ity and primarily a part of each individual. Hence man and woman are not purely masculine and feminine but a variable mixture of both, the characteristics being largely determined by the sex element predominating. Physically these rudiments of sex organs of both sexes are in each person at birth. These atrophied remnants in the primitive body remain inactive and dormant until activated by some specific



FIG. 8. Case of Dr. Wills, U. S. Veterans' Hospital 100.

stimulus, when the castrate may become feminine and the woman develop the male attributes frequently seen after the menopause. Berman² maintains that femininity and masculinity have a definite basis in the reaction of the internal secretions, but there is no absolute feminine or absolute masculine.

Fleiss, while studying the nasal mucous membrane of women, noted definite changes in the nose during menstruation, and furthermore was able to obtain relief of menstrual disturbances through treatment of the nose. He observed definite congestion and exfoliation in the nose in cycles of twenty-eight days, when there was an exhibition of the sex characteristics of the female. In males he found a similar sex cycle of twenty-three and a half days. In a series of female cases he observed, the sex cycle would come every twenty-three days, the female masculine phase, during which time the behavior was of a more

masculine type, when she was more prone to commit crime, and it is claimed that pregnancy during this period is practically impossible. A series of male cases exhibited this phenomenon every twenty-eight days, when they were said to be in their feminine phase, and exhibited definite feminine characteristics. This may account in a measure at least for homosexuality. We had two male patients who had, without apparent cause, bloody discharges from the urethra every twenty-eight days. We also had a number of cases who regularly had conjunctivitis of one or the other eye which occurred about every four weeks, and for which no definite etiology was determined.

Dr. Martin related that while in Europe he came in contact with representatives of homosexual societies who were apparently proud of their bisexual characteristics. They claimed that it was just as normal to be a homosex as to have red hair. He says they had societies in all the large cities, with a membership of some 40,000 in Berlin alone, also that they had their own club rooms, restaurants, periodicals, and even a small island in the Black Sea wherefrom all women were excluded. Freud assumes that the sex instinct is sublimated or refined into many qualities but apparently he did not recognize the importance of the maternal instinct. In both sexes the sexual, aggressive or masculine, and the maternal, protective or feminine instincts co-exist. Males may exhibit great femininity or females great masculinity, but inasmuch as the sexual instinct is dominated by the sympathetic, and the maternal by the autonomic, it is evident that both cannot dominate at the same time. In the recognition of this fact, we may find the basis for the instabilities and sex perversions of homosexuality, and agree with Berman in that, "the functional hermaphrodite must satisfy two doubly flowing streams of visceral pressure within himself." Nevertheless it would be interesting to know the masochistic motives of a patient who obtains keen sexual pleasure by making himself a human pincushion (Fig. 8).

HERMAPHRODITISM

In considering the subject of hermaphroditism an embryological résumé may be advantageous at this time. As already stated, in fetal life the sexual apparatus in both sexes is indifferent, therefore neutral, and the germ-plasm designated for the sexual organisms is separate and distinct from that of the body tissue or somatoplasm. From this germplasm develop the sexual progenitors known as the indifferent genital gland, and the Wolffian and Muellerian ducts. The indifferent genital gland originates from the mesothelium of the body cavity and becomes part of the Wolffian body. The latter undergoes proliferation to form the genital ridge which gives rise to the ovaries and testes, from which the mesothelial cells form the "germinal epithelium of Waldeyer," and become the progenitor of the ova and spermatozoa of the future sex. The vas deferens and epididymis develop from the Wolffian duct; from the Muellerian duct, which develops shortly after the Wolffian duct, and which it parallels to the cloaca where both terminate, develop the uterus, Fallopian tubes, and vagina in the female, and uterus masculinus in the male. The fusion of both the Wolffian and Muellerian ducts form the urogenital sinus, from which develop the external genitalia of both sexes, any unusual or faulty development of which gives rise to hermaphroditism.

Hermaphroditism is common in both the vegetable and animal kingdom. Humanity begins its existence in the state of hermaphroditism. This condition is found until the end of the second month of the human embryo as well as in the lower animals. After the fourth day, in the chick, the genital gland begins to indicate whether it will be testicle or ovary. In the rabbit, the change takes place on the fifteenth day, and in the human embryo, on the thirtieth day. Hermaphroditism, however, does not occur until the external genitalia simulate one or the other sex.

According to Greek mythology, Hermaphroditus, the son of Venus and Mercury,

was educated by the Naiades who dwelt on Mount Ida. At the age of fifteen, while resting in the cool shades on the woody banks of a fountain and spring near Caria, he was solicited by Salmacis, the nymph of the fountain. His refusal provoked her and caused her to pray to the gods to amalgamate poor Hermaphroditus to her body thereby making them one. Apparently she won the favor of the gods since her request was granted, although the distinct characteristics of each remained unchanged. Thus began the bisexual race of the Androgynes of the ancients.

Remondimo³ claims that the early Franciscan missionaries to California found men of uncertain sex dressed like women. They were thought to be hermaphrodites and were used by the Indians chiefly for pederasty as a part of their dance ceremonies. Hammond also mentions this practice as being in vogue among the Indians of the Southwest. These men were previously eunuchized by persistent onanism. Debieyre reports the case of Marie-Madeleine LeFort, whose head was masculine, with a full beard and masculine expression, her chest was covered with hair, yet her breasts were developed and her genitalia were feminine except that the clitoris was greatly hypertrophied. Her development was said to be "sexually that of a perfect woman and she menstruated regularly."

Burden⁴ reports a case of a British soldier, aged forty, who served for five years in the British Army and who attended the Mayo Clinic and was examined for recurring attacks of hematuria. For ten years prior to examination he had spontaneous hematuria every four or five weeks accompanied by a distinct pain in the lower abdomen. Physically he was of feminine build, with a light beard and masculine voice, normal penis and scrotum but without testes in the scrotum. The pubic distribution of hair was feminine (Fig. 9). Rectal examination failed to reveal the presence of a prostate or seminal vesicles. In his sex sentiments he preferred male society. A diagnosis of vicarious hematuria with

developmental anomaly of the genitourinary tract, and solitary left kidney, was made. Exploratory laparotomy was advised. An operation was performed at which time the following structures were removed: uterus, tubes, ovaries, testes, epididymis and appendix (Fig. 10). Spermatozoa were demonstrated in the testicular tissue. The patient made an uneventful recovery. Burden states that "this is an

quence, was imprisoned in the ecclesiastical court prison. There was no definite information in either case as to the possibility of autopregnancy.

One of the most interesting cases of hermaphroditism recorded is reported by J. Allen Gilbert.⁷ A medical student who went through school as a girl was of a decided dual nature but preferred the masculine. Her sexual nature was both

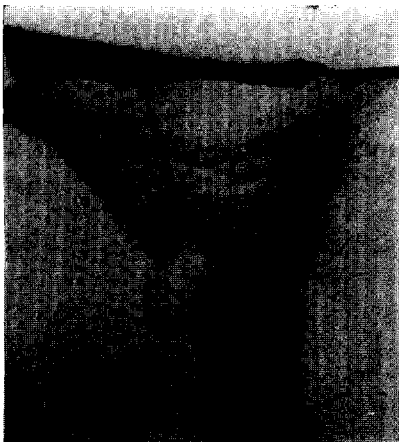


FIG. 9. Pubic region showing normal development of penis and feminine distribution of pubic hair.

instance of the hermaphroditism of bilateral type, as evidenced by the presence of ovaries and testes of both sides. There is also proof of functional activity of the two different genital glands."

A very unusual case of hermaphroditism was that of Hohman of Vienna, who died at the age of forty, and was reported by Rokitansky. Autopsy revealed two ovaries and tubes, a rudimentary uterus and one testicle. His penis was hypospadiac and the scrotum bifid. Both ovulation and spermatogenesis were demonstrated. It is claimed that he copulated with both male and female. Of equal interest was a hermaphroditic soldier of the Hungarian Army who was reported by Montaigne as having been confined of a well-developed infant while in camp. He also reported a monk who was brought to successful accouchement in a convent cell, whereas Duval reports a similar case of a priest in Paris who was found pregnant, and, as a conse-

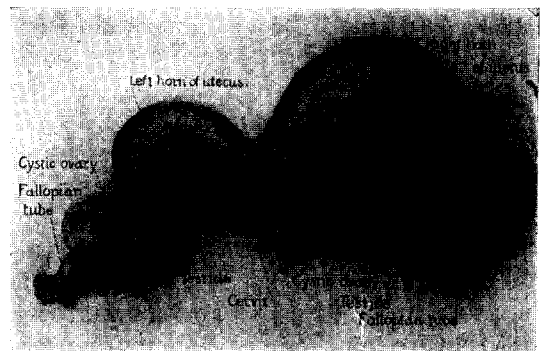


FIG. 10. Structures removed at operation.

male and female and copulation with each was not only possible but also indulged in. She had both male and female sex organs and was pregnant as a woman. Later, at her own suggestion because she wanted to be a male, a hysterectomy was performed. She graduated as a man and married a woman by whom she had three children, all of whom are living. At present she has an active practice, as a man, in a certain western city. Incidentally she was a schoolmate of a colleague of mine who knows her history intimately and who vouches for the verification thereof.

The *Illinois Medical Journal*, February, 1924, page 90, gives an interesting account of an unusual case of a "Man Pregnant with Twins."

Hermaphroditism in the human being can be readily understood when we consider the presence in the human fetus of both the Wolffian body and the Mullerian duct, which fact alone attests to a normal primitive condition of hermaphroditism. According to Bell,¹ "it appears that the determining causes of sex originally pre-

dominate in the direction of the defined nature of the gonads, but that masculinity-producing factors arise at a later period, possibly in the last weeks of pregnancy or soon after birth—and counteract the original femininity-producing influences. Moreover, since we know that every person is bisexual, however masculine or feminine in characteristics, it is probable that in cases such as these, forces producing masculinity are so overwhelming that not only is femininity suppressed and masculinity produced, but even precocious masculinity.”

EMASCULATION AND THE SEX CHARACTERISTICS

In the consideration of bisexuality the subject of castration may be apropos. We know that in the case of man double castration before puberty produces feminine characteristics, and the penis remains juvenile. The individual becomes a sterile, impotent eunuch, chiefly feminine in habitus. On the contrary, removal of both testicles from the adult results in immediate sterility, but potency, libido, and the male habitus may persist either for a variable time or permanently.

The Italians allowed their children to be eunuchized for singers in cathedral choirs, as well as to grow up to take female parts in comedies, their voices simulating that of the other sex. On the same principle, the basso-profundos were infibulated that they might retain their bass.

Castration of a young bull will not prevent the growth of the horns, which may even grow longer than in the case of the cow. On the other hand castration of the boar prevents the tusks from developing. In the eland and reindeer, of which both sexes have well-developed antlers, castration does not affect the horns. On the other hand castration of a young male deer, before the antlers begin to develop, prevents their development, whereas if castration takes place in the adult deer after the antlers have fully developed, it results in their precocious shedding. Castration

of the ram of Herdwick sheep causes a cessation in the growth of the horns, but spaying of the female does not result in horn development.

According to Potts, Smith and others, certain male crabs which become parasitized by other crustacea develop female characteristics, but removal of the ovaries of the female crabs does not produce any change. Female fowls and golden pheasants assume in old age the characteristics of the male, as is also the case when female chicks and ducks are spayed. Castration of the Seabright cock causes its female plumage to become like that of the ordinary male, but the plumage of the ordinary rooster is not altered by castration, although the spurs, combs and wattles are not well developed.

Eunuchs have always been considered an essential part of the social life of Oriental countries, hence demand for them has been correspondingly great. Eunuchism may be congenital, or due to accident or design. The classical eunuch is either produced by surgery, usually crude, or the genitalia accidentally removed when young. It is achieved by such practices as using animals to bite off the scrotum and contents, repeated ligation of scrotum, repeated slight trauma of the testicles several times daily, crushing, repeated compressing of testes, and their excessive function to break down the normal testicular substance.

The old pagan priests prepared themselves for a life of chastity and celibacy by soaking the scrotum in hot water followed by frequent repeated compressions, thereby causing the testicle gradually to disappear.

In order to be valuable guards for the Turkish harem, as well as trusted eunuchs for the aristocratic oriental households, complete abolition of the genitalia was required. In most cases this was produced by the *taille à fleur de vente* method, or entire removal of the external genitals by a quick stroke of a razor. Bison states that the mortality by this method was about 90

per cent. The Soudan alone furnished over 3800 eunuchs annually, the material for which was obtained from Abyssinia and neighboring countries, where they were gathered by war, kidnapping parties, and by purchase. The great eunuch factory of that country was a large monastery located on Mount Ghebel-Eter at Abu-Girgeh where the unfortunate African children were gathered and either simply castrated or had complete abolition of the parts, depending upon the type of eunuch demanded. Inasmuch as there was no attempt to stop the hemorrhage, with the exception of a little styptic powder, the mortality was said to be 9 out of 10. The Coptic monks did a thriving business and furnished Constantinople, Arabia, and Asia Minor with many of the much sought for eunuchs. Remondimo says, "It is estimated that 35,000 little Africans are annually sacrificed to produce the Soudanese average quota of its 3,800 eunuchs."

In Mexico descendants of the Aztecs, the *Mujerados*, were developed for religious purposes. Men between the ages of twenty and thirty-five years were selected and subjected to repeated masturbation several times daily, and compelled to ride horseback, thereby keeping the genitals in a state of constant irritability, thus causing a gradual atrophy of the testes and penis, and the disappearance of pubic hair. Suckling babes were also used to produce marked hypertrophy of the breasts.

Throughout the ages religious fervor and the idea that to be "carnally minded is death" has promulgated the idea that since the sex organs were the basis of carnal-mindedness, entry into the celestial realms meant their subjugation or removal; therefore both the clergy and their devotees resorted to emasculation in order to be fitted for the heavenly kingdom. The *Skoptsi* of Russia and *Lipovans* of Rumania, interpreting Matthew 19:12, "For there are some eunuchs, which were so born from their mother's womb and there are some eunuchs which were made

eunuchs of men, and there be eunuchs which have made themselves eunuchs for the kingdom of heaven's sake. He that is able to receive it let him receive it," as a direct commandment for heavenly bliss, emasculated themselves. This sect or cult was started by an ignorant Russian peasant by the name of Andrei Ivanov but got its greatest impetus through the efforts of his assistant Selivanov, a religious fanatic, who was apparently a paranoiac who proclaimed himself "the Son of God incarnate in Peter the Third," and claimed the title of "God of Gods and King of Kings." Strange to say, although incarcerated in an asylum from which he escaped, he soon had thousands of followers, many of whom were from the noble and aristocratic families of Russia. The *Skoptsis* are millenians and claim that the world will come to an end just as soon as their number reaches the 144,000 mentioned in Revelation 14:1.

Inasmuch as their religion permits them to have one or two children before mutilating themselves, it would be interesting to get their interpretation of the fourth verse, i.e. "These are they which are not defiled with women for they are virgins," etc., and the application thereof in respect to their religion.

In Smith's Dictionary of Greek and Roman Biographies and Mythology, it is related that Uranos, the progenitor of all the gods, and the first king of Atlantis, was a eunuch. It seems that when Uranos imprisoned his second progeny, the Cyclops, in Tartarus because of their great strength, his wife Gaa became angry and incited her next-born children, the Titans, to rebel against their father. It is related that Saturnus, the youngest son, made a sickle of a diamond and successfully emasculated his father Uranos, thereby deposing him. This made the sea angry so that great commotion took place when the members fell into this element: but it is said that contact of the genitals with the foam miraculously produced Venus, which apparently appeased its anger.

Castration has practically always been a means of punishment for criminals in both oriental and occidental countries. Among certain tribes castration of prisoners of war was commonly resorted to with much the same significance of victory as scalping was with the Indians. At the same time it was a mark of servitude and reduced the prisoner to slavery. The Caribbeans made eunuchs of their prisoners of war on the same principle that castrating is done today. They found them easier to fatten and more tender when cooked. When the British first found the Hottentots, it was customary with the males to remove one testicle, supposedly for the purpose of enabling them to run more swiftly, but they also had the idea that twins came from two testicles, hence in order to avoid having more than one child at a time one testicle was sacrificed. In case of mixed twins, the female child was smothered, but if there were two boys or two girls, the weaker one was destroyed.

Wheeler⁹ and others have made some interesting observations on the effect of castration on prostatic development. In case of white rats, they found that castration not only inhibits development of the prostate but leads to involution of the fully developed gland. Normally in old age, in man, the prostate undergoes atrophy but in a large per cent of cases hypertrophy instead takes place. This, according to Wheeler, is due to an overproduction of the testicular hormone in combination with reduced spermatogenesis. Harrison and White perform and advocate castration as a curative means for prostatic hypertrophy. On the other hand, Remete claims that only normal prostates atrophy as a result of castration, whereas little benefit can be expected from this method in the more hypertrophic types.

CONCLUSIONS

Summarization of the more recent observations proves that the secondary sex characteristics do not necessarily depend upon

the secretion of the interstitial cells of the gonads, inasmuch as it has been shown by Pezard and others, that certain forms of animal life with most elaborate secondary characteristics, as for example the golden pheasant, do not possess interstitial cells in their gonads. Until forty years ago the contrary was thought to be the case, but now we know that the sex characteristics are more dependent upon the integrity and normal function of certain of the endocrine glands, and without at least a functioning thyroid, these features are impossible.

We know that the complete sex characters of the male or female have been observed in persons congenitally devoid of gonads, or having gonads of the opposite sex, and frequently observations have shown that the sex characters of the female can be replaced through natural causes by those of the male, even to the replacement of the ovary by a testis. Moreover certain pathological conditions, such as a hypernephroma, will cause arrested ovulation in young girls, and produce atrophy of the ovaries with hypertrophy of the clitoris, as well as changes in somatic development even to the development of a full beard. These and other facts lead us to agree with Belfield that "it is demonstrated that the gonad does not originate sex; that it is less essential to the maintenance of sex than is the thyroid or the suprarenal; and that it is indeed one of a chain of interesting endocrine glands, efficiency in every link of which is essential to normal function, sexual or somatic."

It is evident that some force independent of the gonads enters into the determination of sex which is associated with the chromatin formation in the fertilized egg. It is well known that various types of animal life have definite chromatic factors known as determiners. For instance every cell of the male housefly can be differentiated from the female cells by the number of chromosomes present. Inasmuch as the fertilized egg is the primary structure in which somatic life begins it seems logical to conclude that the fertilized egg not

only produces the sex gonads but likewise the sex characters. Moreover, inasmuch as during the stage of maturation a blending of equal ratio of male and female chromosomes is essential for the development of the egg structure, the feasibility of bisexuality can be readily seen. Although at first the germ plasm is neutral, it is said to be potentially feminine, but may become masculine by certain factors that predominate during its development. However, at no time is there absolute femininity or absolute masculinity, there being a variable admixture of both male and female sex features in both sexes. A faulty, or cessation of, embryonal development may result in hermaphroditism; hence, not only is each individual potentially feminine but primarily hermaphroditic.

It is well known that changes in these characteristics can be caused by either pathological processes or castration, as seen in the case of the former in the menopause, or in the latter by the failure of antler growth in deer, and that of the tusks in boars, or in the maintenance of the juvenile voice and feminine characteristics of the Italian singer, or choir boy, when castration is performed before matur-

ity, whereas if done in adult life no apparent changes are manifest. On the other hand, in some forms of life, like the gypsy moth, there is no change whatsoever through removal of the gonads. Whether or not the change in sex features through castration is due directly to the loss of the gonads and their internal secretion prompts the query: Are not such changes largely due to changes and imbalance of the endocrine system resulting because of it?

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