usually receive the impulse from the underlying artery, it is always important to exclude the possible presence of an aneurism. At the age when branchial cysts are most frequent, aneurisms, except of traumatic origin, are exceedingly rare. Pressure does not affect the volume of a branchial cyst, and the pulsations are felt only in one direction, away from the artery. Auscultation furnishes another important negative symptom. An exploratory puncture, which should always be made in doubtful cases, will also furnish valuable information, as it will afford an opportunity to examine the contents of the tumor. In hæmato-cysts the contents may resemble venous blood, but a microscopical examination will show, in addition, the presence of epithelium or the products of epithelial degeneration.

2. *Angioma.*—Deep-seated angiomata are occasionally met with in children, and, as the skin may present a perfectly natural appearance, they might be mistaken for branchial cysts. If the tumor disappears under pressure it may be an angioma, but never a branchial cyst.

3. *Dermoid Cyst.*—As dermoid cysts may occur in the same localities and at the same age, they are frequently mistaken for branchial cysts, and *vice versa*. As both varieties of cysts require the same treatment, a positive diagnosis is not essential. A correct anatomical diagnosis can be made by examining the contents and the cyst walls. A branchial cyst contains only one constant histological element—epithelium,—as obliteration of the branchial tracts takes place long before the appendages of the skin are formed. A dermoid cyst, on the other hand, contains the products of secretion of the skin and its appendages. The walls of a branchial cyst are composed of a connective-tissue capsule lined with epithelium, while the sac of a dermoid cyst is composed of true skin.

4. *Retention Cysts.*—The only two forms of retention cysts which call for consideration in this connection are the true atheroma of the skin, the result of obstruction in the ducts of the sebaceous glands, and the retrotracheal cyst, which originates in a similar manner in the retrotracheal glands. Cysts arising from the second and third branchial clefts are always deeply located, and when first observed are distant from the skin, while an atheroma primarily develops in the skin, and usually grows in a peripheral direction. Lanuginose hair is sometimes found in the contents of an atheroma, the product of retained hair follicles; it is never seen in branchial cysts.

Virchow has called attention to a peculiar kind of retention cyst which is found between the œsophagus and the trachea, and which arises from an obstruction in the duct of one of the retrotracheal glands. These glands are situated between the trachea and œsophagus, but their ducts traverse the entire thickness of the tracheal wall and terminate upon the free surface of the mucous membrane. These cysts are so located that they give rise to distressing symptoms, referable to deglutition and respiration, before they attain any considerable size, differing greatly in this respect from the clinical history of a branchial cyst.

5. *Affections of Lymphatic Glands and Vessels.*—A deep-seated, isolated, caseous, lymphatic gland might be easily mistaken for a branchial cyst, more particularly after the cyst had become the seat of inflammatory infiltration. It is seldom that we meet any such extensive pathological changes in a single lymphatic gland as to simulate a branchial cyst, without participation of one or more adjacent glands. Again, in cases of diseases of the lymphatics, the general condition of the patient usually indicates the existence of a serious affection, while a branchial cyst is a purely local condition, never affecting the general health except when it interferes with important functions of the neighboring organs. Cancerous or sarcomatous affections of the lymphatic glands would reveal themselves by the clinical symptoms characteristic of these tumors.

6. *Struma Cystica.*—Cystic degeneration of the thyroid gland proper can never be mistaken for a branchial cyst, as the connection of such cysts with the thyroid body can be traced without any difficulty; but recently it has been ascertained that not infrequently small accessory thyroid glands exist in the neck which may undergo cystic degeneration, and Madelung has made the assertion that the so-called hydrocele of the neck is only a struma cystica of a supernumerary thyroid gland. The possibility of a cystic degeneration of such an accessory thyroid body should always be borne in mind in examinations for branchial cysts.

7. *Simple Serous Cysts.*—Virchow asserts that many of the serous cysts develop without a particular matrix, as new formations, in the connective tissue. It is a well-known physiological fact that the connective-tissue cells are occasionally converted into endothelia, as during the formation of new synovial membranes; hence we should *a priori* expect that in simple serous cysts, developed from connective tissue, the inner surface of the sac would be lined with endothelia the existence of which would be sufficient to disprove their branchial origin.

In repetition I will enumerate the following points, which should be considered in the differential diagnosis of cystic tumors of the neck with special reference to branchial cysts: 1. Primary seat of tumor; 2, effect of pressure; 3, general condition and age of patient; 4, character of contents.

Prognosis.—Branchial cysts always remain purely local affections and manifest no tendency to destroy life, except when they are of sufficient size to interfere, by their pressure, with the performance of important functions of neighboring organs. On the other hand, it may be said that they manifest no tendency to spontaneous cure, and prove exceedingly obstinate to all forms of treatment short of complete extirpation.

Treatment.—The inner surface of branchial cysts being lined with epithelium, it is evident that obliteration of the sac can be obtained only after the destruction or removal of this epidermal lining. The radical treatment for the removal of these tumors must have for its object either the production of an artificial inflammation, in the inferior of the sac, of sufficient intensity to destroy the epidermal matrix, or complete extirpation of the cyst. The former procedure is exceedingly unreliable, and extirpation in many instances must be looked upon as a very formidable and dangerous operation. The following means have been employed in the treatment of branchial cysts: 1, incision; 2, actual cautery; 3, seton; 4, puncture, with subsequent injection; 5, extirpation; 6, antiseptic drainage.

1. *Incision.*—In all cases in which incision was practised, the relief from existing symptoms was prompt; the cyst collapsed, a certain amount of inflammation was established, suppuration followed, and in some instances the patient and surgeon were led to believe that a radical cure was obtained. Usually, after healing of the wound, a small nodule remained, which in a few months again became the seat of active tissue growth, and a speedy relapse was an almost constant occurrence. In infants the laying open of cysts is a perilous plan of treatment. Volkers relates a case in which a cystic tumor was laid open in a new-born child, who died sixteen days afterward in consequence of the operation. A branchial cyst cured by simple incision is reported by Billroth. In the case of serous cysts, in which the seton and iodine injections have occasionally been successful in producing obliteration, it seems to me that the same object would be accomplished more speedily and safely by incision and drainage practised in a similar manner as in Volkmann's operation for hydrocele.

2. *Actual Cautery.*—Dieffenbach employed the actual cautery in opening the cyst in one of his cases, after he had made an unsuccessful attempt at removing it by extirpation, and after incision had failed in producing obliteration of the sac. The use of the cautery met with no more encouraging result. It would seem to me that incision, combined with an energetic use of the cautery, would be most applicable in the most dangerous and formidable class of cases, viz., cysts which have become

firmly adherent to the sheath of the cervical vessels by repeated attacks of inflammation.

3. *Seton.*—This form of treatment proved successful in several of Thomas Smith's cases of serous cysts of the neck, but in some of them their branchial origin does not appear to be established. Smith uses a single thread of silk, and removes it before suppuration sets in. If the tumor is polycystic, he attacks only one cyst at a time. Gurlt very justly has entered his protest against the use of the seton. As in the case of hydrocele, the seton is an exceedingly uncertain agent in calculating with precision the amount of inflammatory action which will follow its use. The degree of irritation produced by it is very liable to be inadequate to produce adhesion, or it exceeds the desirable boundary, and induces suppuration with all its evil consequences. Butlin reports the case of a young child in whom a seton was passed through a serous tumor, and which was followed by death on the third day from the violence of the inflammation. For this and other obvious reasons the seton should never be used in the treatment of branchial cysts.

4. *Puncture, with Subsequent Injection.*—In the transactions of the Fourth Congress of German Surgeons, the treatment of branchial cysts by puncture and injection was fully discussed. Esmarch's experience appeared to be the most extensive, and his results were more uniformly favorable than the practice of any other surgeon. He claims to have cured about a dozen cases by puncture and subsequent injection of Lugol's solution of iodine (Iodi, pot. iod., āā 1.25; aquæ, 30.0). Whenever complete obliteration does not follow the first puncture, he repeats the operation. This method of procedure is as follows: By means of a fine hydrocele trocar the sac is emptied of its contents, when repeated injections of a one-per-cent. solution of carbolic acid are made to remove the masses of epithelium adherent to the cyst wall. These injections are continued until the water returns perfectly clear, then Esmarch injects from 10 to 20 gm. of Lugol's solution of iodine, which, after gentle pressure, to bring it in contact with the inner surface of the sac, is allowed to escape. The patient is then directed to return in six or eight weeks. Like a hydrocele, the cyst refills rapidly and becomes somewhat painful. If after the lapse of the time mentioned the tumor has not greatly decreased in size, the same operation is repeated, and in about six months the cyst will be found atrophied to a small tubercle. According to Esmarch, the cure in most cases has been permanent. From the discussion which followed Esmarch's remarks, it is evident that the majority of German surgeons have no confidence in the efficacy of iodine injections in obliterating branchial cysts. If we consider the numerous failures of iodine injections in cases of hydrocele, in which the anatomical conditions for success are so much more favorable, we shall be better prepared to appreciate the causes of its still more frequent failures when used in the treatment of branchial cysts. In infants, even simple tapping is not always devoid of danger, as one instance of death is recorded caused by puncture. The case occurred in the practice of Volkers, who tapped a cystic cervical tumor in an infant eight days old, the child dying of trismus on the third day.

5. *Extirpation.*—A positive diagnosis made, the best plan to pursue is to make an incision over the most prominent portion of the tumor, and, in case the adhesions can be separated without endangering the deep cervical vessels, the entire cyst should be removed. If inflammatory infiltrations obscure the field of operation at the base of the tumor, and after careful examination it is not deemed advisable to perform complete extirpation, the sac should be opened and the lateral walls excised; then the epidermal matrix which remains adherent to the sheath of the cervical vessels can be destroyed completely by a careful but vigorous use of the actual cautery. If an early diagnosis is made, and prompt treatment instituted, complete extirpation should always be attempted, and will, in the majority of cases, prove successful and comparatively free from danger.

6. *Antiseptic Drainage.*—In the case of infants and very young children suffering from large serous cysts, it would be imprudent to resort to any of the severer measures with a view to a radical cure. In such instances, drainage under antiseptic precautions should be resorted to as a temporary measure, and in some instances it may be followed by permanent results. The same course of treatment should be adopted in adults suffering from cysts which are inaccessible to any other operation, and in which irritating injections are contraindicated.

Nicholas Senn.

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BREAST, FEMALE.—The breast (L. *pectus*, Ger. *Brust*, It. *petto*, Fr. *sein*) is one of the two rounded eminences situated, in the human species, one on either side of the thorax, and in the female secreting the milk for the nourishment of the new-born. They constitute the mammary glands and associate structures, that is, the true gland tissue, the stroma, and integument including nipple and areola.

The presence of mammary glands (L. *mammæ*, Fr. *mamelles*, Ger. *Brustdrüsen*, It. *mamette*), zoologically considered, constitutes one of the most important considerations for grouping into one class (mammalia) all those animals possessing them. They are found in both male and female, but the size and development differ; the male gland as a rule remains throughout life in the embryonic condition, while the female breast passes through marked and important changes at puberty, at conception, after lactation, and at the menopause.

Embryology.—In very early embryos, there is observed on either side a slight streak, running from the root of the stump-like fore-limb to the hind-limb, and situated a little behind and parallel to the membrana reuniens inferior. This is observed in rats of 2.5 to 5.25 mm. (Henneberg) and in human embryos of from 4 to 8 mm. (Hirschland and Strahl), and was named by Schwalbe-Schmidt mammary streak (Milchstreifen). It is due to the cells of the ectoderm becoming deeper and more cubical.

From the mammary streak there is soon produced, by multiplication of the cells, a well-marked ridge, the mammary line (Milchlinie or Leiste) (*Ml*, Fig. 1035, A). This well-marked microscopic ridge was first studied by O. Schultze in the pig, and more recently by Kallius, Stahl, and Hirschland in human embryos of about 15 mm.

In this line the epithelium develops more rapidly at certain spots, corresponding in situation and number to the future mammary glands. The line becomes moniliform, and finally isolated, spindle-shaped enlargements are produced by atrophy of the portion of the milk line lying between the enlargements (Fig. 1035, B). Thus the mammary hillocks ("Milchhügel") of Bonnet are produced (Fig. 1036). The projection of the line of hillocks, above the surface of the skin, is only very transient. In human embryos, toward the end of the second month of intra-uterine life, the small tubercular thickenings, grad-

ually increasing in size, become lens-shaped, and their convex surfaces project into the cutis, forming the mammary points (Milchpunkte). Large numbers of the meso-

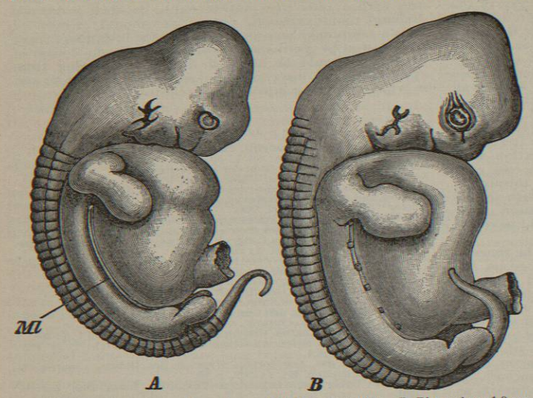

FIG. 1035.—A, Pig Embryo 1.5 cm. long. *Ml*, Mammary line. B, Pig embryo 1.9 cm. long, with mammary hillocks. (O. Schultze.)

dermic cells of the cutis collecting around the epithelial ingrowth form a condensed zone (nipple zone; *cf.* Fig. 1036), from which later the nipple is developed.

The further growth results in flattening above with a projection of the deeper convexity of the lens, especially in the centre. In this way there is produced a cone-shaped mass of the cells which sink deeper into the cutis.

Around the apex of the cone the greatest activity is manifest; the cells push deeper into the cutis, and spread out below to produce a large ball-like mass (body) connected with the surface by a narrow elongated part (neck; Fig. 1037). This is the so-called club-shaped stage.

There now appears on the free surface of the skin a small cavity, the "gland area" (Drüsenfeld of Huss),

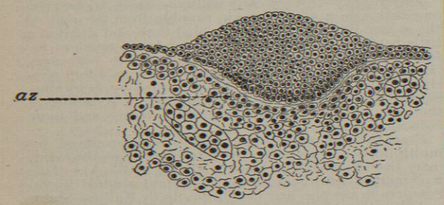

FIG. 1036.—Mammary Hillock of a Pig Embryo 1.5 cm. long, with the Nipple Zone (*az*) becoming Differentiated.

which soon deepens. In the formation of this not only the deep but also the superficial layer of the epithelium takes part. Around the border of the depression a ring-like ridge of cutis, the first rudiment of the areola, is raised up.

Upon the deep surface of the club-shaped mass, at about the twelfth week of intra-uterine life, small bud-like masses of the epithelial cells appear (Fig. 1038). These rapidly increase in length, and force their way as solid plugs into the mesoderm beneath (Fig. 1039). This secondary epithelial development is the rudiment of the true secreting portion of the gland. The number of epithelial sprouts now seen (fifteen to twenty) corresponds with the number of excretory ducts which the mature glands will possess. The upper ends of the plugs are in the nipple zone, but the greater part of their lower ends project into the loose connective tissue of the cutis.

There is now developed a new zone beneath the nipple zone, composed of young, round, closely packed connective-tissue cells. Surrounding and supporting the epithelial elements of the gland, these form the stroma of the gland (stroma zone).

A retrograde metamorphosis next begins in the central cells of the primary epithelial ingrowth, and from the centre the degeneration proceeds peripherally and downward. It takes the form of a cornification (Fig. 1039, *hp*) and proceeds at first very rapidly, though its final progress is so slow that sometimes it is not complete until after birth. Ultimately it leads to the complete disappearance of the primary epithelial ingrowth or mammary point.

At the same time as the primary ingrowth is degenerating the secondary ingrowth, nipple zone, and stroma zone are continuing to develop. As the secondary epithelial plugs push their way into the underlying mesodermic stroma, they become clubbed below. At the same time the originally solid plugs are hollowed out and converted into tubes, and during the seventh month of intra-uterine life, or about that time, give off numerous buds (Fig. 1039). In connection with these latter, small irregular groups of epithelial cells may be seen, the

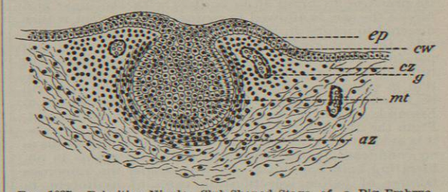

FIG. 1037.—Primitive Nipple, Club-Shaped Stage, of a Pig Embryo 6.5 cm. long. *ep*, Epidermis; *cz*, layer of cylindrical cells; *cw*, cutis wall; *mt*, mammary point; *g*, blood-vessel.

matrix of the acini. The branching of the ducts, even up to the time of birth, is but slightly advanced. At birth the milk ducts do not extend beyond the areola, and the whole gland shows an expansion of but 1 cm. and weighs only 30 to 60 cgm. (Puech).

A rudimentary corpus mammæ is represented by a well-defined rounded mass, around the circumference of which the lobes project irregularly. The whole is embedded in a well-developed stroma, which is surrounded by fat lobules of the subcutaneous tissue. The coarse connective-tissue fibres of the stroma radiate from the corpus mammæ and become continuous with the fibrous capsules of the fat lobules. These latter surround but do not mix with the stroma. Beneath, the stroma is continuous with the fascia covering the pectoral muscle.

The fat layer of the skin becomes locally thickened in the region of the gland, but not until five or six years after birth does fat develop in the stroma between the gland lobules.

At birth the ducts possess a simple epithelium, cubical in the deeper parts, but cylindrical in the region of the nipple.

The time at which the various changes noted above occur varies considerably, being by no means constant. Even in the new-born the development is not always equally far advanced.

The nipple is developed in the human species toward the end of intra-uterine life. Then the mesodermic tissue which constitutes the nipple zone rapidly increases, and between the elements smooth muscle cells soon appear.

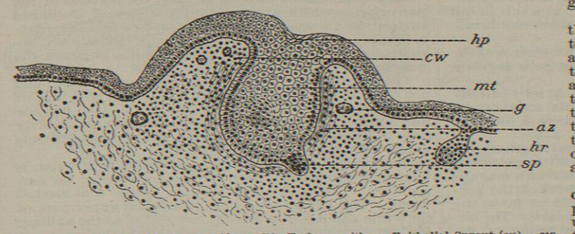

FIG. 1038.—Primitive Nipple of a 12 cm. Pig Embryo with an Epithelial Sprout (*sp*). *cw*, Cutis wall; *mt*, mammary point. (For other letters, see Figs. 1036 and 1037.)

The centre of the originally depressed gland area becomes situated upon the tip of a cone-shaped projection. The exact time of the elevation of the nipple varies, though sometimes occurring in embryonic life; yet frequently in children of from ten to twelve the depressed gland area with its surrounding wall still persists.

Although in some respects in development the mammary glands resemble the sweat glands, yet I think it is now generally conceded that in the higher mammals they represent modified sebaceous glands.

Upon the areola, sebaceous and sweat glands are developed. Rein has shown that the enlarged sebaceous glands of the areola (tubercles of Montgomery) are accessory rudimentary milk glands.

Condition at Birth.—It will be seen that the new-born of both sexes possess all the skin ingredients of the gland, and moreover the gland can secrete milk, which is called in German "Hexen Milch" (witches' milk). This occurs from the fourth to the tenth day after birth, and is accompanied by a swelling of the gland. It has been shown by Rein and others to be true milk. According to De Sinéty considerable changes take place in these first ten days, after which there is some acinous tissue resembling that which is seen in the adult. But only the main ducts are excavated.

From birth till puberty the breasts remain rudimentary, simply keeping pace with the general body growth. The intralobular ducts and beginning of the acini remain solid, and though there are some slight changes, such as the development of a few acini buds, yet the condition found shortly after birth persists.

In the male no further change, as a rule, occurs.

Changes at Puberty.—In the female at puberty an abrupt change like that affecting the entire organism takes place. This consists in further branching and growth of tubes into the surrounding tissue, and the stroma is also further developed. The fat which appeared in the stroma at the fifth to the sixth year rapidly increases in amount. Now development proceeds rapidly, but there is no distinct subdivision into the lobules, the true secreting acini being few in number. At each succeeding menstrual period a slight engorgement occurs, and it is probable that it is accompanied by increased development. At these times slight pricking sensations and pain may be felt, and in some cases a yellow secretion is expelled. Soon after puberty the breasts become very well developed, but they consist mainly of stroma and excretory ducts, with a relatively small amount of glandular tissue.

Situation.—The breasts are situated in the superficial fascia, above the pectoral muscles; as usually described they are said to extend from the second or third to the fifth, sixth, or seventh rib, and from the edge of the sternum to the fold of the axilla. These estimations are undoubtedly based upon external conformation, and of necessity, therefore, refer only to those portions of the gland which cause its projection above the surrounding surface.

Stiles, who witnessed the removal of over one hundred breasts which he had previously examined, found that the usual description takes no account of the peripheral processes, which extend in the subcutaneous tissue, often far beyond the prescribed limit. Moreover, he has shown that this holds true for nulliparæ, as well as for multiparæ, though of course the processes are much more marked in the latter. He gives the following description of the situation and relations of the breast:

It is divided by two intersecting lines, a vertical (1–2) and a horizontal (3–4), into four segments (Fig. 1040), named respectively cephalo-mesal, cephalo-lateral, caudo-lateral, and caudo-mesal. For purposes of more careful description, a second division is made by two oblique lines (5–6), and (7–8) into four other segments, cephalic, lateral, caudal, and mesal.

The vertical diameter (1–2) extends from the lower border of the second rib to the sixth costo-cartilage, where it begins to sweep upward toward the sternum. The horizontal (3–4) begins opposite the fourth rib or fourth interspace, just within the lateral border of the sternum, and extends to the mid-axillary line at the level of the

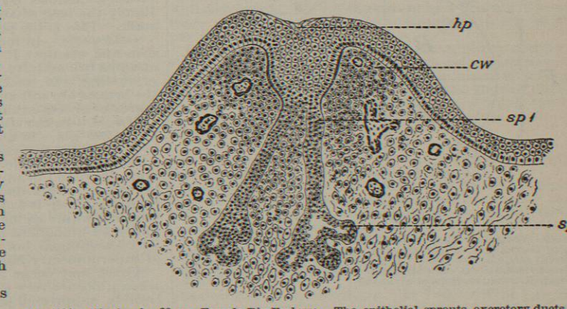

FIG. 1039.—Nipple of a 20 cm. Female Pig Embryo. The epithelial sprouts, excretory ducts *sp 1*, have near their terminal end a lumen; secondary sprouts (*sp 2*) are also seen; *hp*, cornification of the epithelium is beginning.

fifth rib or fifth interspace. The oblique line (5–6) extends from the upper border of the third costo-cartilage, a little external to the border of the sternum, to the seventh rib a little in front of the mid-axillary line. The oblique line (7–8) begins on the third rib a little beyond the anterior axillary fold, and extends to the sixth costo-cartilage

midway between its angle and sternal end. The circumference is obtained by connecting the extremities of the lines.

When the arm is raised, as for operation, the nipple, in nulliparæ, is opposite the fourth rib or fourth interspace and 2.5 cm. mesad to the axillary border of the pectoralis major. Thus the extent to which the breast overlaps the border of the pectoralis major is considerable. The level varies with the stature; as a rule in tall women the breast is low, while with short and broad-chested women it is high.

Relations.—The relations of the posterior surface of the breast can best be treated by describing each segment separately.

The meso-cephalic segment (Fig. 1040, A) rests entirely upon the pectoralis major; so also does the meso-caudal segment (D), except at its lower edge where it overlaps the aponeurosis of the external oblique.

The cephalic half of the cephalo-lateral segment (B) rests upon the pectoralis major, the edge of the pectoralis minor, and for a slight extent upon the serratus magnus muscles. Upon the latter and under cover of the pectoralis major it extends up into the axilla as far as the third rib. This is the axillary tail of Spence. The circumference of this segment crosses the border of the pectoralis major muscle, where its fibres leave the third rib to form the ventro-axillary fold.

The caudal half of the cephalo-lateral segment (B) and the cephalic half of the caudo-lateral (C), with the exception of a small portion near the nipple which is over the pectoralis major, lie upon the serratus magnus. The caudal half of the caudo-lateral segment (C) overlies those portions of the external oblique and serratus magnus which arise from the fifth and sixth ribs, except a portion near the nipple which is over the pectoralis major.

Thus it will be seen that, with the arm in the position assumed for operation, fully one-third of the whole breast lies caudo-lateral to the axillary border of the pectoralis major. One-half of this overlies the axilla, filled with

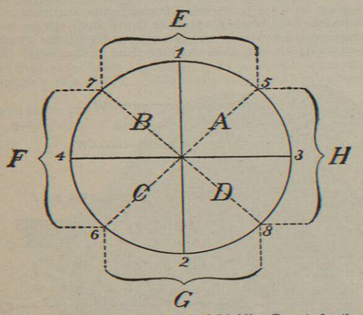

FIG. 1040.—Diagram to Show Method of Dividing Breasts for the Purpose of Description. *1* to *8*, Lines of division for the location of the different sections (see text). A, Mesocephalic; *B*, cephalo-lateral; *C*, caudo-lateral; *D*, meso-caudal; *E*, cephalic; *F*, lateral; *G*, caudal; *H*, mesal sections or divisions.

its fatty fascia containing numerous lymph nodes. These lymph nodes appear to be in direct contact with the breast tissue.

The dorsal surface of the breast is concave, composed mainly of stroma containing projecting processes of the parenchyma. The stroma is continuous with a loosely interlaced network of connective tissue which forms the pectoral fascia. This fascia sends numerous septa between the fibres of the muscle. It is quite thin and it is difficult to separate it from the muscle, particularly in spare subjects. In some it attaches the gland so closely to the subjacent muscles that movement of the arm causes considerable movement of the gland. In others it is very loose, but even with these some movement is observed when the arm is raised. In this latter loose areolar tissue spaces have been described by Chassaignac as serous bursæ (sub- or retro-mammary bursæ).

Close examination has shown that the portions of the parenchyma which project into the stroma of the dorsal surface send numerous minute processes into the retro-mammary connective tissue. Some of these even accompany the septa of the pectoral fascia between the muscle fibres.

The anterior surface is for the most part smooth and convex. It is covered with skin continuous with that of the surrounding surface. The skin is thin and delicate and differs from that of the ventral surface of the body only at its centre, where the raised and pigmented areola surmounted by the nipple is seen.

The circumference, although in the main circular, is more or less irregular owing to the processes of the parenchyma. There are usually three fairly well-marked cusps. The largest projects toward the upper part of the axilla and has been already referred to as the axillary tail; another, much smaller, extends toward the lower part of the axilla; the third reaches toward the sternum.

At the caudal border (Fig. 1044), the circumference of the breast, the parenchyma presents a furrow but slightly marked in young thin nulliparæ, more marked in fat women, and especially prominent in multiparæ.

The cephalic border of the circumference is as a rule ill-defined, the breast arising in a gentle slope from the surrounding tissue.

Shape.—Emaciated subjects present a flat, discoidal breast with irregular surface; well-nourished subjects a hemispherical or conical with smooth surface. In adult nulliparæ (Figs. 1044 and 1045) it is somewhat conical, due to the relatively large amount of gland substance compared with the stroma. In stout subjects the relatively greater amount of circummammary fat produces a hemispherical breast. After lactation it frequently becomes pendulous, a very marked sulcus being produced where it overhangs its base. This is due to the atrophic fatty changes which at this time affect the secreting structure and produce a flabby condition. In these cases the breast sometimes becomes almost cylindrical in shape. Rarely the base of the breast is contracted, producing a stalk. This is the pedunculated breast.

Consistence.—In the virgin and nullipara the breast is firm and elastic. It loses its consistency after having attained full activity, especially if there has been a period of nursing. In women who have had several children the breasts are soft and flabby, overhanging their base to a greater or less extent.

Weight.—In the adult nullipara the breast weighs from 140 to 200 gm.; in nursing women from 400 to 500, and in exceptional cases as much as 900 gm.

Number.—A single pair of breasts is the least number normally found in any mammal. This is the usual number in man, as also in apes and a few other animals. The largest number is found in certain of the insectivora, in whom there are as many as eleven pairs. Between these limits all gradations exist. Reduction of this number is very exceptional, but there are numerous cases on record of supernumerary breasts.

Arrest may occur in their development at any time; when it occurs very early in embryonic life the breast is entirely suppressed (amazia). This is extremely rare in the human subject, and is frequently associated with other defects in development. Williams has written two very excellent articles, one on polymazia, the other on amazia. He finds complete absence of both breasts one of the rarest anomalies; outside those occurring in acephalic monsters with deficient chest walls, only four cases are recorded in literature. Complete absence of one breast is slightly less rare. A more frequent condition is the arrest of development at a later stage leading to rudimentary but functionless organs (micromazia). This

also may affect one or both sides, and as with amazia may or may not be associated with deficiencies in the sexual organs or chest wall.

Absence of the nipple (athelia) is much commoner than the above. Williams has pointed out that in these cases there is really no absence of nipple structures, but simply

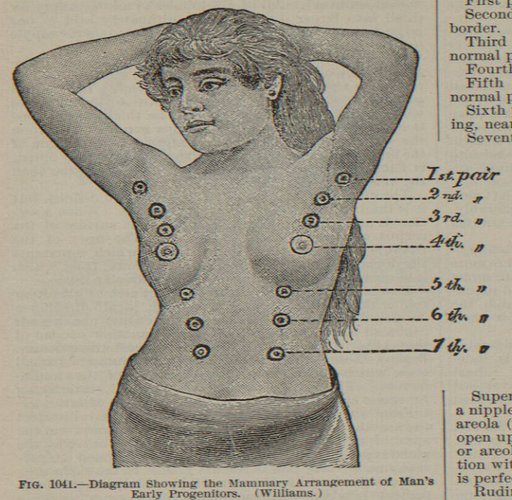

FIG. 1041.—Diagram Showing the Mammary Arrangement of Man's Early Progenitors. (Williams.)

a failure of the embryonic gland area to become elevated. This is usually unaccompanied by other anomalies, and generally affects both breasts. The areola is rarely absent when the nipple is well developed, but with athelia the areola may be absent or slightly formed. Intermediate conditions between complete absence and the perfect nipple, due to degrees of elevation of the embryonic gland area, produce the various recorded congenital imperfections.

Numerous records of supernumerary mammæ or nipples are found in literature. The condition is much more common than previously supposed. Bruce found in 315 individuals, of both sexes taken indiscriminately, polymastism in 7.6 per cent.; in 207 males 9.1 per cent., and in 104 females 4.8 per cent.

It has been supposed by some that any sebaceous gland may develop into a supernumerary mammary gland. There is nothing to lead us to believe that complex structures like the mammæ may be developed suddenly on any part of the body. A study of comparative anatomy and embryology seems to point clearly to an atavistic origin for their explanation. In the lemurs the inguinal and abdominal mammæ are rudimentary, only one pair of pectoral mammæ becoming developed. From them through the different types of animals, conditions are found indicating that the number of breasts is being gradually reduced.

In embryology the investigation of the development of the mammary hillocks from the mammary line, although not yet worked out in all of its stages, has been carried far enough so that we are quite sure that the conditions as found in the pig and other animals are the same in man.

By a careful study of all recorded cases Williams found that the position occupied by the mammæ in lower animals and by the mammary hillocks in embryos was the same as that occupied by aberrant mammæ. He considers that man's early progenitors were possessors of seven pairs of breasts (Fig. 1041), three cephalo-lateral to the normal, and three caudo-mesal to them.

First pair—in the pit of the axilla.

Second pair—in the middle of the ventro-axillary border.

Third pair—just cephalad and slightly laterad of the normal pair.

Fourth pair—the normal mammæ.

Fifth pair—just caudad and slightly mesad of the normal pair.

Sixth pair—caudad and slightly mesad of the preceding, near the costal margin.

Seventh pair—caudad and slightly mesad of the preceding, on the upper part of the abdomen.

Out of 166 cases collected by Leichtenstern and Bruce, there were only 4, 2.41 per cent., which could not be assigned to one or another of these positions. These mammæ erraticæ are supposed to be due to reversion to the ancestral characters much more remote than those given above.

The following table of 105 cases recorded by Leichtenstern shows the relative positions of the accessory mammæ. On the anterior side of the thorax, 96 cases (91 per cent.); in the axilla, 5 cases (4.7 per cent.); on the back, 2 cases; over the acromion, 1 case; over the outer side of the hip, 1 case. Of those on the anterior side of the thorax 94 per cent. were developed caudad of the normal pair and in a converging position.

Supernumerary mammæ often are represented only by a nipple, which may or may not be surrounded by an areola (true polythelia); or the duct of the gland may open upon the surface by one or more openings, no nipple or areola being present; or there may be no communication with the surface whatever. Rarely the extra gland is perfectly developed and functional.

Rudimentary breasts cephalad of the normal ones are rare—but 12 out of 166 cases, or 7.2 per cent. Abdominal mammæ are very rare. In polymazia the normal pectoral mammæ are always present in their proper position and well developed. Of Leichtenstern and Bruce's 166 cases, there was only a single extra structure in 112, or 67.4 per cent.

Out of 2,189 men recruited in the military district of Donaueschingen 62 were found with one supernumerary teat and 4 with two—that is, 1 case in every 33, or 3 per cent. Besides, 48 others were found who showed discrete pigmented patches symmetrically placed upon the line usually occupied by supernumerary mammæ or nipples. These represented small areolæ.

Supernumerary mammæ are more often found on the left than on the right side. So also in amazia, the right mamma is more frequently absent than the left.

Anomalies arising late in the developmental process lead to two nipples on one areola (intra-areolar polythelia); or two on one breast (intramammary polythelia).

Supernumerary mammæ or nipples are probably found in all races. They have been noted by Owen in the orang and by various observers in many animals. Women with more than one breast are no more liable than other women to bear twins. Supernumerary mammæ appear often to be hereditary. In 7 out of 92 of Leichtenstern's cases, or 7.6 per cent., there was a history of such condition in near relatives. It is not usually associated with other malformations.

Size and Volume.—The breast, which at birth measures but 10 mm. in diameter, increases but little until after puberty, when it rapidly attains a diameter of 100–130 mm. and a thickness of 50–60 mm. The greatest length is parallel to the border of the pectoralis major.

Soon after impregnation it again increases in volume, and although it decreases somewhat at the fourth or fifth