The purse-string suture is used by some of the best operators for closing the scleral opening, after which the conjunctival wound is closed with another purse-string suture. Some operators advise the removal of the conjunctival suture at the end of forty-eight hours. Mr. Collins, of Moorfield Hospital, believes that many failures of this operation are due to allowing the superficial suture to remain too long.

Indications.—The chief indications for this operation, as given by de Schweinitz, are: Staphyloma of the cornea and sclera, ruptured or injured eyeballs when the sclera is not too much lacerated and when the accident is of recent date, absolute glaucoma, buphthalmos and non-traumatic iridocyclitis.

Contraindications.—The following contraindications are enumerated by the same authority: Suppuration of the eyeball; morbid growths; much shrunken eyeballs, the contents of which have undergone bony or calcareous change; sympathetic ophthalmitis; sympathetic irritation and pathologic conditions of the eyeball which are likely to produce either of the last-named affections; extensive injuries of the eyeball, with much bruising and laceration of the sclera; dacryocystitis and ocular conditions demanding enucleation or its equivalent in very old persons.

Accidents and Complications.—The operation may be followed by excessive reaction manifested by marked swelling of the lids and chemosis of the conjunctiva, headache, nausea and vomiting, and elevation of temperature. It is probably always caused by faulty technique, as imperfect asepsis, failure to arrest hemorrhage, the use of strong antiseptics and undue dragging upon the optic nerve. Sloughing of the sclera and consequent cutting out of the stitches occur in about eight per cent. of all cases. Extrusion of the artificial vitreous within the first week or at a much later period took place in seventeen per cent. of the three hundred and sixteen cases in the hands of thirty-three different operators, tabulated by de Schweinitz. The chief cause of escape of the artificial globe is failure of the edges of the scleral wound to unite. Another important cause of the throwing-out of the glass ball is that it may have been too large or too small for the scleral cup. An irritable and painful stump requiring removal has been met with as a complication following the operation. Sympathetic inflammation has been met with as an unfortunate complication in a number of instances. While in most cases it was due to the seeds of the disease having been planted before this operation was performed, it seems in several instances, as in the case reported by Carrow, to have been directly due to the operation itself. The report of the committee of the Ophthalmological Society of the United Kingdom in 1898 contains the following statements: "We have not found a record of any case of sympathetic ophthalmitis following evisceration without the implantation of an artificial globe, and we have collected records of five cases of sympathetic ophthalmitis after the operation of evisceration and the introduction of an artificial globe into the emptied sclerotic." Sympathetic irritation has been met with on rare occasions and required the removal of the stump.

Special Advantages with Relation to the Wearing of an Artificial Eye.—After a successful Mules' operation the motility of the stump and artificial eye is usually better than that after enucleation, the implantation of a ball in Tenon's capsule, or simple evisceration. The cosmetic result is extremely satisfactory, for the natural contour of the lids being preserved, there is none of the shrunken appearance so often presented by artificial eyes. The absence of accumulations of mucus and tears adds to the patient's comfort and satisfaction. The high percentage of failures, due to extrusion of the artificial vitreous, must be greatly reduced before the operation can take a permanent place in ophthalmic surgery. At the present time the prevalent feeling among ophthalmologists regarding the operation of Mules is one of disappointment.

Edmund W. Stevens.

FACIAL HEMIATROPHY.—(Synonyms: Unilateral atrophy of the face; Progressive facial hemiatrophy; Progressive laminar aplasia; Facial trophoneurosis; Facial circumscribed atrophy.)

The first known description of facial hemiatrophy is that by Parry, written in 1825. In the year 1846 Romberg described the condition more definitely and called it a trophoneurosis.

The disease consists of an acquired circumscribed atrophy of the face. The atrophy, involving soft tissues and bone, follows a chronic course, and finally becomes spontaneously stationary.

Something over one hundred authentic cases have been reported.

Etiology.—The disease belongs to the period of youth. Practically all of the reported cases began before the thirtieth year. Women are more frequently affected than men, in the proportion of about two to one. It does not appear that nationality, station in life, or heredity has any influence on the development of the syndrome. In the reported cases it has followed typhoid fever, measles, scarlet fever, syphilis, and other infectious diseases. It has been observed in the course of multiple sclerosis, syringomyelia, multiple exostoses of the face and head, scleroderma, insanity, epilepsy, and hysteria. It is not unusual for the patient to ascribe it to blows or other injuries to the face. In a number of cases the early symptoms have been those of a severe trigeminal neuralgia. In one case which I saw there had been a severe malarial infection one year before.

Pathological Anatomy.—Various theories have been advanced in regard to the lesions which may produce facial hemiatrophy. Disease of the sympathetic nerves, of the peripheral distribution of the fifth cranial nerve, of the Gasserian ganglion, of the nuclei of the fifth nerve, and of the cortex of the cerebrum have in turn had their theoretical advocates. The principal anatomical evidence rests on the findings in Mendel's case; this was a woman who for fifteen years had suffered from left facial hemiatrophy. The autopsy showed the epidermis normal except for a moderate degree of thinning, the connective tissue was diminished, the blood-

Fig. 5137.—Facial Hemiatrophy Beginning in a Woman Twenty-four Years Old. (After Fromhold-Treu.)

vessels were few and small, the fibres of the muscles were somewhat thinned without degeneration or nuclear changes, and the facial nerve was normal. In the trigeminus the connective tissue around and penetrating the nerve was much thickened. In many places the number of nerve

fibres was diminished. Most of the changes were in the second division of the nerve. There was also atrophy of the descending root of the trigeminus and of the substantia ferruginea. Mendel believed that the facial atrophy was due to the proliferative interstitial neuritis of the trigeminus. In this case there was also an atrophy affecting the left upper extremity and some of the muscles of the shoulder and back. To account for this Mendel found an interstitial neuritis of the musculo-spiral nerve and a diminution in size and number of the cells of the anterior horn of the cord at the level of the fifth cervical nerve.

The antecedent neuralgias of the fifth nerve point to this as the site of the lesion. But how many severe neuralgias of this nerve have we not seen with no subsequent atrophy? Section of the posterior root of the trigeminus may be attended by unilateral atrophy of the muscles of the face, tongue, and bones of the face, and changes in the amount and color of the hair. Operations on the Gasserian ganglion have been said to be unattended by trophic changes in the skin.

Other autopsies in patients showing facial atrophy have shown other lesions which take them out of the group of cases now under discussion. Such was Graff's case, which showed on autopsy a progressive muscular atrophy, and that of Jolly and Recklinghausen, in which was found a disseminated sclerosis of the brain.

Symptoms.—Patients who develop facial hemiatrophy usually present themselves to the physician complaining of a neuralgia in the distribution of the trigeminal nerve. After this has lasted for several weeks or months the cardinal symptom of the syndrome appears. This consists in an atrophy commencing in the skin of the face. There appears on the face a whitish spot which may soon be followed by other similar spots. These may extend until they cover half of the face, or may be limited to a small area. Gradually these areas change in color to a yellowish-brown, while the skin becomes thin and tightly stretched over the subcutaneous tissues. The extent of the atrophy may vary to a considerable degree. Fromhold-Treu indicates the varieties in his attempt to classify them: (*a*) Typical cases involving one-half of the face. (*b*) Incomplete cases involving a portion of one side of the face. (*c*) Double cases involving both sides of the face. (*d*) Cases in which other parts of the same side of the body are involved. Following the atrophy of the skin there is a falling away of the underlying tissues. The fat may totally disappear, but at times is said to be replaced after the atrophic process has come to a standstill. The frontal, malar, upper and lower jaw bones may atrophy. The muscles supplied by the fifth nerve become very thin, but their electrical reactions remain normal and their function is not wholly destroyed, though much weakened. The nasal cartilages usually waste; less frequently the auricle is involved. The hair of the head, eyebrow, and beard may change color, become thin, or fall out altogether on the affected side. The glands of the skin are usually unaffected, but anidrosis has been noted as well as diminished lachrymal secretion. The blood-vessels may show through the attenuated skin, marking it with an underlying network. The tongue and gums are frequently atrophied on the affected side. The tightening of the skin may interfere with the movements of the jaw. In the one case which I have observed the mouth was drawn to the normal side by the overaction of the healthy muscles. Taste, touch, and the electrical reaction are usually normal, even in the wasted half of the tongue. The trigeminal pain is occasionally associated with spasmodic contractions of the muscles, or with fibrillary twitchings. As the atrophy advances the pain usually subsides. There may be paræsthesias or spots of hyperæsthesia (probably due to thinning of the skin). Anæsthesia and changes in the temperature sense are exceedingly rare. The muscles supplied by the seventh nerve are usually unaffected. Mills reports a case in which the hearing was affected, probably on account of an atrophy of the tympanum. The pupil may be contracted; or, as in Mailhouse's case, may be dilated and fail to react to light or accommodation. The eyeball on the affected side appears prominent on account of the atrophy of the surrounding tissues.

Course and Prognosis.—The disease is insidious in its origin and slow in its development. It may continue to advance for two or three years, but all the cases ter-

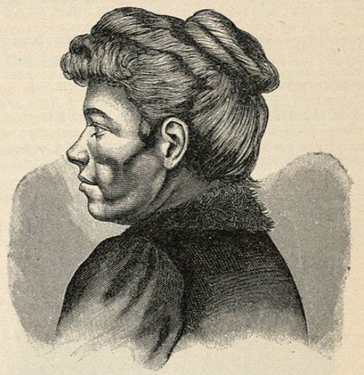

Fig. 5138.—Facial Hemiatrophy Following Pneumonia in a Woman Nineteen Years Old. (After Möbius.)

minate spontaneously, the majority at the end of one year, leaving an area of atrophy from which recovery is unknown. At the beginning one cannot predict the extent or duration of the atrophic process; it may involve a narrow furrow only, or half of the face, or even both sides of the face. As a rule a long and severe antecedent neuralgia suggests a less favorable prognosis. A cure or even an improvement in the atrophied parts is almost unknown, though some competent observers have claimed that in a few cases the face has filled out to a moderate degree; this was probably due to an increase in the fat. To the patient, however, cessation of the pain and muscular cramps is an improvement.

Diagnosis as a rule is not difficult. The points particularly to be borne in mind are that the disease is an acquired one, developing before the thirtieth year. There is a change in the color of the skin followed by atrophy; the muscles usually affected are those supplied by the fifth nerve. Congenital asymmetry and forms of degeneracy should be easily differentiated. Confusion in cases of hemiplegia and the malnutrition of sympathetic paralysis is hardly possible. In Bell's palsy the muscles supplied by the seventh nerve only are affected. In these muscles there is a reaction of degeneration to the electric current, and tissues other than muscular are not involved. In the type of progressive muscular atrophy which first involves the face, the muscles alone atrophy; the skin, connective tissue, and bone are not affected. This disease, moreover, is progressive, and later other parts of the body are involved. Atypical cases of scleroderma may be confounded with facial hemiatrophy. The skin of scleroderma is usually harsh and infiltrated, while that of facial hemiatrophy is thinned.

Treatment.—At the present time we know of no measure that will limit the course of the disease. Neuralgias following abscesses of the teeth, tonsillitis and the infectious diseases should receive careful attention. Electricity and massage appear to have no influence on the course of the disease or in restoring the atrophied tissues. No drugs which have been tried have been proved of benefit excepting in so far that they control the neuralgic pains and muscular spasm. Sachs suggests thyroid extract. The value of this, as far as I know, has

not been demonstrated. Section of the trigeminus, on the theory that the nerve stimulus is perverted, should be considered. Various contrivances have been devised for correcting the resulting deformity. Sachs has used a pad or rubber plate in the mouth. Eckstein has improved the appearance with subcutaneous injections of paraffin. *T. Stuart Hart.*

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FACIAL HEMIHYPERTROPHY is a rare affection consisting of circumscribed enlargement of one side of the face. The process usually involves the skin, connective tissue, blood-vessels, muscles, and bone. In some cases

Fig. 5139.—Facial Hemihypertrophy in a Child. (After Sabrazès and Cabannes.)

the skin is harsh and rough, while the sebaceous glands are much hypertrophied and clogged with an abnormally thickened secretion of gummy consistence. The hair is often thick and coarse. In the case reported by Dana the bones were alone involved in the process; the soft tissues were not hypertrophied. The external ear may take part in the enlargement. Here either the cartilage alone or all the tissues may be involved. The hypertrophy may extend into the mouth implicating the gums, soft palate, and jaw. The hypertrophy may be limited to a part of the face on one side, or may extend somewhat across the median line.

But little is known of causes underlying the condition. Of the twenty-three cases collected by Sabrazès and Cabannes eighteen were congenital. In Schick's case the hypertrophy commenced in the second year with no known cause. In Berger's case there was an obstinate antecedent neuralgia of the fifth nerve. Montgomery's patient had brain fever when two years old. There was no neuralgia. When nine years of age the patient had an osteomyelitis of the left maxilla. About one year later hypertrophy first appeared in the gums of the left side. In Dana's case the patient was also affected with gigantism. It is probable that several distinct conditions have been described under the term of hemifacial hypertrophy. Among the theories advanced as to the etiology of the acquired cases may be mentioned irritation of the fifth nerve through its roots or the Gasserian ganglion, and chronic hyperæmia of vascular origin.

The enlargement may be first noticed in the bones, particularly about the orbit, giving the eyeball the appearance of being depressed in its socket. The bony hypertrophy gradually extends until the entire side of the head is included. In other cases (*e.g.*, Montgomery's) the process may begin in the soft parts, and the gums, skin, sebaceous glands, hair, connective tissue, muscle, and the bones become later involved. The enlargement of the blood-vessels may cause a reddening of the skin. The flow of saliva may be considerably increased.

There are few conditions which could be confounded with hemifacial hypertrophy. It has been suggested that it might be mistaken for hemifacial atrophy of the other side of the face; but anything more than a cursory examination could not fail to disclose the differences.

We know of no cases in which the hypertrophied tissues have been replaced by normal ones; but after a progression covering a period of several years it is probable that the condition may become stationary.

Treatment thus far has proved unavailing, either in limiting the course of the disease or in reducing the hypertrophy. *T. Stuart Hart.*

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FŒTUS, DEVELOPMENT OF.—Our knowledge of the development of the fœtus was in an exceedingly fragmentary condition until Wilhelm His, the distinguished German anatomist, published twenty years ago his noteworthy "Anatomie menschlicher Embryonen." This was the first, and is to-day the most important work on human embryology. Previously there were isolated descriptions here and there of embryos of the first two months of pregnancy. Uncertainty as to the normal appearance often leads to the description of abnormal for normal ones, and the great difficulty in obtaining embryos of the first two months of pregnancy renders progress comparatively slow. The main sources of such material are from post-mortem examinations, operations, and abortions; so the human embryologist is thus dependent upon the courtesy of physicians and surgeons for his material.

Age.—In regard to the ages of embryos of the first two weeks much uncertainty exists. Length is not entirely reliable, owing to distortions and variability in size. In attempting to determine age from the last day of the last menstrual period as the date of conception, there is often the difficulty of inexact history. The following table indicates in a fairly accurate way the length and ages of embryos:

Age.	Length.	Age.	Length.
Two weeks	2 mm.	Three months	50 mm.
Three weeks	5 "	Four months	100 "
Four weeks	8 "	Five months	200 "
Five weeks	11–12 "	Six months	300 "
Six weeks	16 "	Seven months	370 "
Seven weeks	20 "	Eighth months	425 "
Eight weeks	25 "	Nine months	500 "

According to Mall their ages in days corresponds to the formula $\sqrt{100 \times (\text{length in millimetres})}$ for all embryos from 1 to 100 mm. long. Multiply the length of the embryo from vertex to the breech in millimetres by one hundred, and extract the square root, and the result will be its age in days. In embryos from 100 to 220 mm. long from vertex to breech their length in millmetres equals their age in days. Fig. 5140 indicates the relative sizes during the first eight weeks.

There are but few good collections of embryos in the world; the one at Leipsic and the one at Baltimore are the most important.

In development it is convenient to distinguish the three stages suggested by His. The stage of the ovum embraces the first two weeks; the embryonal stage from the third to the fifth week, during which time the characteristic embryonal features and the principal organs are established; lastly the fœtal stage, during which time the embryonal features change to those of the fœtus and full-term child.

The Ovum Stage.—There are no observations on normal ova of the first nine or ten days. It is evident

from the material of the latter part of the stage of the ovum that there is an early and precocious development of the chorion and villi.

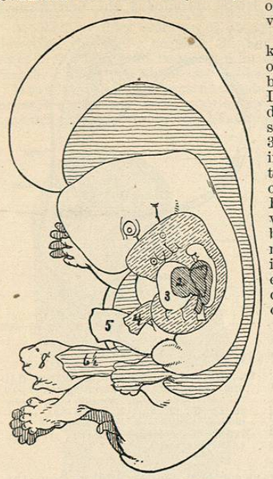

Fig. 5140.—Six Human Embryos taken from His' Standard Chart. Enlarged three times. The figures in the cut indicate the ages of the embryo in weeks. 2 is His' embryo S R.; 3, embryo Lr.; 4, embryo A.; 5, embryo O"; 6½, embryo XCI.; 8, embryo Wt. (After Mall.)

The youngest known normal ovum was described by Peters in 1899. It is ten to eleven days old and consists of a vesicle 3 × 1.5 × 1.5 mm. in size. A section through the entire ovum is seen in Fig. 5141. The vesicle is formed by the chorionic membrane, consisting of an outer layer of epithelial cells covered by numerous villi which are in contact with the uterine wall of the mother, and an inner layer of mesenchyme. Attached to this inner layer at one side is the small embryo, but .19 mm. in length. It is apparently simple in structure, consisting of an epithelial plate facing the small amniotic cavity lined by flat epithelial cells, which are continuous with the epithelial cells of the plate. On the other side of the plate is a layer of mesenchyme, and projecting from this is the yolk sac lined by entodermal cells. The epithelial plate of the embryo, as well as the epithelium of the amnion, was probably at an earlier stage continuous with the epithelium of the chorion and the embryo, subsequently cut off after its sinking down or projecting into the vesicular cavity. One stage of such a process has been found in the monkey by Selenka. The projecting embryo is surrounded by mesenchyme continuous with that lining the chorion, as well as with that between the yolk sac and epithelial plate.

Already, then, in the youngest known ovum the so-called three primary germ layers are present. From these at a later period various structures arise. From the epithelial layer develop the epidermis of the skin and its appendages, such as hairs, nails, sweat glands, etc., the central nervous system, and portions of the eye and ear, mouth and nose. From the middle or mesenchymal layer develop the skeletal, muscular, circulatory, and urogenital systems; and lastly from the inner or entodermal layer, which is here represented by the lining of the yolk sac, develop the alimentary tract (pharynx, œsophagus, stomach, and intestines), the trachea and lungs, liver and pancreas, and bladder.

The next important human ovum was described by Spee in 1896. It measures 7 × 5.5 mm. and the embryo within is 0.37 mm. in length. Its age is about eleven days. The chorion is covered with villi and lined with mesenchyme (see Fig. 5142). The embryo is attached at one side by a broad pedicle, the so-called belly stalk. The amniotic sac is small and is continuous with the epithelial plate of the embryo, as in the preceding ovum. The primitive streak is represented in this embryo by a slight groove along the centre of the epithelial plate. Mesenchyme separates the epithelial plate from the large

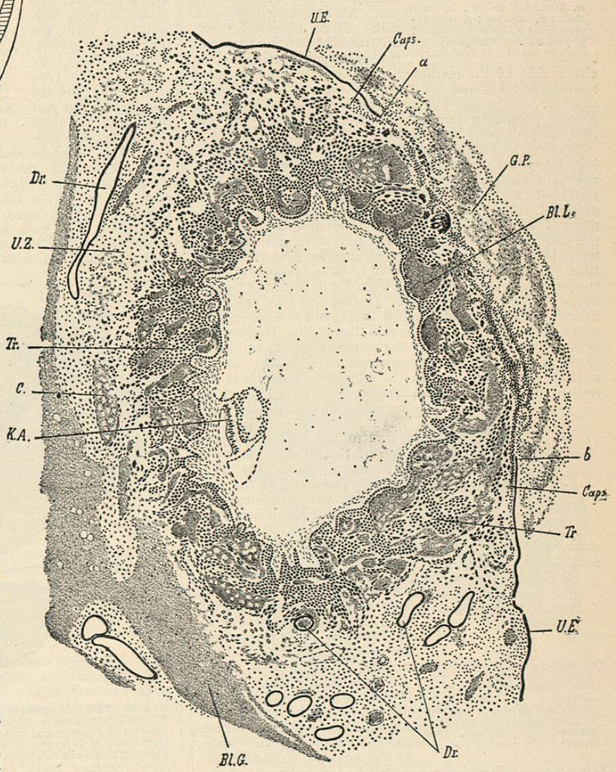

Fig. 5141.—Peters' Early Ovum. (Enlarged about 35 diameters.) *U.E.*, Uterine epithelium; *Bl.L.*, lakes of blood; *Caps.*, decidua reflexa; *G.P.* "Gewebspilz"; *Dr.*, uterine glands; *U.Z.*, decidua vera; *Tr.*, trophoblasts; *C.*, capillaries; *K.A.*, beginning embryo; *Bl.G.*, large blood-vessels; *a–b*, point of entrance of ovum.