spasms, apathy and dyspnœa, which soon result in death. It has been suggested, therefore, that the functions of this body may be related to those of the thyroid tissues, but no convincing evidence is at hand to make this view probable. On the clinical side it has been asserted that the peculiar disease known as acromegaly is associated with lesions of the pituitary body, but a causal connection between the two is still very uncertain. Injections of extracts of the body give results that vary with the lobe used. Extracts of the anterior lobe or hypophysis proper give little or no effect when injected into the circulation of a normal animal. Extracts of the infundibular lobe, on the contrary, give a marked effect upon the heart and blood pressure similar in many respects to that caused by extracts of the adrenals. This difference in the effect of the extracts suggests that the two bodies may have different functions in spite of their close anatomical connection. We have no direct evidence that these bodies furnish an internal secretion, but the absence in the adult mammal of a duct would imply that any product formed by them must affect the body by way of the circulation. Cyon, however, contends that the chief function of the pituitary body is to co-operate with the thyroids in regulating the blood flow through the brain. His idea seems to be that the pituitary body fulfils a double function. In the first place it serves as an automatic regulator of intracranial pressure, acting in two ways—mechanically, in that a rise of intracranial pressure stimulates the pituitary body and brings about a slowing and strengthening of the heart beat, and chemically, by secreting substances which act upon the vagus and accelerator centres. In the second place it affects general metabolism also by an action of these last-mentioned substances on the vagi and sympathetic. For the experiments which lead him to this somewhat elaborate theory it will be necessary to consult the original paper, a reference to which is given at the end of this article.

Internal Secretion of the Pancreas.—Few discoveries in physiology have been more interesting and significant than that made by von Mehring and Minkowski regarding the internal secretion of the pancreas. Briefly stated, they found that complete removal of the pancreas brings on a condition of serious glycosuria known now as pancreatic diabetes. Acetone and β-oxybutyric acid are also present in the urine, and, as in the diabetes mellitus of man, the animal shows polyuria and an abnormal thirst and hunger. These symptoms are followed by muscular weakness, emaciation, and in a few weeks by death. If the pancreas is removed incompletely the glycosuria may be serious, or slight and transient, or absent altogether, according to the amount of the gland extirpated. If so little as one-fourth or one-fifth of the gland is left in the body the glycosuria may not show itself, and since the portion so left may have no connection with the intestine, this fact as well as others shows that the mere suppression of the pancreatic juice has nothing directly to do with the diabetes that results from complete removal of the gland. In pancreatic diabetes the glycogen disappears from the liver. The blood shows an increase in its sugar contents from 0.15 per cent. to 0.3 or 0.5 per cent., and the urine may continue to contain sugar in quantity when carbohydrate food is withheld completely. On the basis of these and similar results it is believed that the pancreas forms an internal secretion which is given off to the blood. This internal secretion is supposed to play an essential part in the metabolism of the carbohydrates. It has been suggested, for instance, that the internal secretion contains an enzyme of some kind which is necessary for the dissociation or oxidation of the sugar of the body, so that in its absence the sugar accumulates in the blood and is lost through the urine. A specific form of this hypothesis has been advanced by Lepine. It has long been known that sugar in the blood disappears on standing, and Lepine has shown that this glycolytic action of the blood is due probably to the presence of a definite enzyme. He assumes that this glycolytic enzyme is formed *intra vitam* from the leucocytes of the blood, but that its formation is a function of the internal secretion of the pancreas. When the internal secretion is prevented the blood loses its glycolytic power, and the sugar escapes oxidation. This hypothesis would seem to demand that in diabetes mellitus the glycolytic power of the blood, when tested out of the body, should be absent or distinctly below the normal. Several observers who have tested this point state, on the contrary, that the glycolytic action of diabetic blood is not less than that of normal blood. Other observers have adopted an entirely different view, holding that the pancreatic secretion normally regulates the output of sugar from the liver and other sugar-producing tissues. In its absence this output is increased and raises the sugar percentage in the blood to such an extent as to cause glycosuria. We must admit at present that the way in which the internal secretion of the pancreas affects the sugar consumption of the body is not known satisfactorily, although there is no doubt that in some way it is absolutely necessary in the process. Considerable experimental and nistological evidence has accumulated tending to show that the cells concerned in this important function of the pancreas are not the pancreatic cells proper, but the so-called islands of Langerhans. In man these islands are scattered through the pancreas and form round or oval bodies that may reach a diameter of as much as 1 mm. The cells are polygonal and their protoplasm is pale and finely granular, while the nuclei show a thick chromatin network which stains deeply. In each island there is a capillary network resembling somewhat the glomeruli of the kidney.

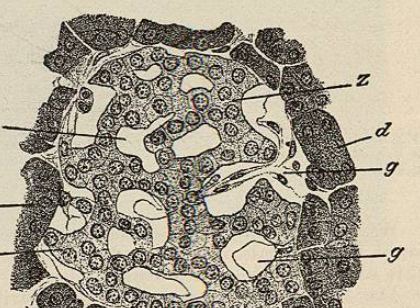

Fig. 4175.—Section Through an Island of Langerhans. *d*, The gland cells of the surrounding pancreatic tissue; *g*, blood capillaries; *z*, the columns of cells composing the island. (Kölliker.)

According to Ssbolew, ligation of the pancreatic duct is followed by a complete atrophy of the pancreatic cells proper, but does not affect to any marked extent the islands of Langerhans. Since under these conditions no glycosuria occurs, while removal of the whole organ including the islands is followed by pancreatic diabetes, the obvious conclusion to be drawn is that it is the removal of the islands that causes the pancreatic diabetes, and that therefore it is these cells that form the normal internal secretion of the pancreas. This conclusion is further corroborated by pathological results upon the lesions of the pancreas in human beings in connection with diabetes mellitus. A number of recent observers (Opie, Ssbolew, Herzog, *et al.*) find that in diabetes mellitus the islands are markedly affected. They show signs either of hyaline degeneration or of atrophy, and indeed may in severe cases be absent altogether.

The Reproductive Glands.—The general interest in the subject of internal secretions in recent years was aroused largely by the work of Brown-Séquard upon the effect of testicular extracts (1889–92). The results of his experiments seemed to indicate that these extracts possess a marked stimulating or dynamogenic action upon the neuro-muscular apparatus. The effect was said to be

pronounced not only upon sexual power but upon general muscular and mental vigor. Pohl claims to have obtained from such extracts a definite substance, spermin, to which he assigned the formula $C_5H_{14}N_2$, and which he believes has a general tonic effect upon body metabolism. Similarly Zoth and Pregel report that these extracts increase the power of doing muscular work when measured quantitatively by means of an ergograph. These and other similar experiments give us some reason to believe that the testes may form an internal secretion of importance in regulating and stimulating the metabolisms of the body. If such a secretion is formed, however, its action is not absolutely necessary to normal metabolism as is shown by the fact that castrated animals live in apparently good health. Our natural inference would be that a secretion of this kind might act as a regulator of sexual desire, but it is very uncertain whether such an effect takes place. In the experiments reported the possibility of suggestion playing a part in the results obtained is not excluded entirely, and we must speak therefore of the internal secretion in these glands as a possibility only and not as a demonstrated fact. The evidence is perhaps stronger that an internal secretion is formed by the ovaries. Loewy and Richter have shown that ovariotomy in dogs results eventually in a marked diminution in physiological oxidations as measured by the amount of oxygen consumed. And when an animal is brought into this condition, the administration of ovarian extract is sufficient to bring the consumption of oxygen to its normal figure or to cause an increase beyond normal. Further probable evidence is found in the numerous gynecological cases involving the removal of the ovaries. Quite frequently in such cases disagreeable symptoms ensue, extreme nervousness, vaso-motor flushes, etc., and these results have been sufficiently marked to cause many gynecologists to be cautious in the removal of both ovaries. If one can be left the after-results of the operation seem to be less serious. This general fact, together with the undoubted influence of the ovaries upon menstruation and probably upon lactation, speaks strongly for the existence of an internal secretion; but we lack at present definite scientific proof, such as we have in the case of the thyroids and adrenals.

William H. Howell.

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The following general treatises contain references to the very extensive literature of the subject of secretions:

Heidenhain in Hermann's Handbook der Physiologie, vol. v., part i., 1883.

Langley, Edkins, Paton, Starling, Schaefer, Reid: Schäfer's Text-book of Physiology, vol. i., 1898.

An American Text-book of Physiology, vol. i., 1901.

Howell, Chittenden, Adami, Putnam, Kinnicutt, Osler: Internal Secretions. Transactions of the Congress of American Physicians and Surgeons, fourth session, 1897.

Pawlow: Die Arbeit der Verdauungsdrüsen, 1898. Contains the literature of the special work of the St. Petersburg laboratory, also English translation, 1902, by Thomson.

Oppenheimer: Die Fermente und ihre Wirkung, 1900.

Recent literature of importance not found in the above sources, and used in the preparation of this paper are as follows:

On the Mechanism of Pancreatic Secretion. Bayliss and Starling, Journal of Physiology, 1902, vol. xxviii., p. 325. See also Comptes rendus de la Société de Biologie, 1902, vol. liv., No. 9.

Cohnheim's Discovery of Erepsin. See Zeitschrift f. physiol. Chemie, 1901–1902, vol. xxxiii., p. 451 and vol. xxxv., p. 134.

Beddard: On the Secretion of Urine. Journal of Physiology, 1902, vol. xxviii., p. 20. See also Gwaritch: Archiv f. d. ges. Physiol., 1902, vol. xci., p. 71, and Cushny: Journal of Physiology, 1902, vol. xxvii. p. 429.

For Cyon's theories regarding the hypophysis see Archiv f. d. ges. Physiologie, 1901, vol. lxxxvii., p. 565.

For the recent work on the Relation of the Pancreas to Diabetes mellitus see Opie: Journal of Experimental Medicine, 1901, vol. v., pp. 397 and 527. Also Ssbolew: Virchow's Archiv, 1902, vol. 168, p. 91.

SEDATIN, para-valeryl-amido-phenetol, para-valeryl-phenetidin, $C_6H_4.OC_2H_5.NH.C_4H_9CO$, is obtained by the action of valeric acid on para-amido-phenetol. It is insoluble in water, sparingly soluble in ether, chloroform, and benzin, and readily soluble in hot alcohol. It is analgesic and antipyretic in dose of 0.2–0.7 gm. (gr. iij.–x.). Sedatin is also an old name for antipyrin.

W. A. Bastedo.

SEGMENTATION OF THE BODY.—Segmentation of the body, or metamerism, is an expression used to convey the idea that the body is composed of a series of segments, also called *metameres*, or *somites*, that are arranged in a series along the principal axis, and in each one of which the principal organs are repeated. Familiar examples of metamerism are furnished by the earthworms and tapeworms. A better example is a typical marine annelid like Polygordius or Nereis, in which each somite, beside the integument, ventral nerve cord, main blood-vessels, and gut, which are continuous through the length of the body, has its own body cavity separated by a partition from its neighbors fore and aft, a pair of limbs (parapodia), a pair of nephridia, a pair of gonads, and several pairs of lateral blood-vessels and nerves, the same arrangement being found in each somite except the terminal ones.

In the vertebrates there is an indication of a similar metamerism. Thus in all vertebrates the vertebræ, the ribs, and the spinal nerves are arranged metamerically, and in the fishes the trunk muscles are divided by transverse tendinous plates into myotomes, which are likewise metamerical in arrangement. This metamerism of the musculature is present to a less degree in the amphibia, but in the higher vertebrates, including man, it has almost disappeared in the adult, as the result, doubtless, of adaptive modifications. But in the embryo metamerism is very evident, even in the highest forms, and has its foundation in the primitive segmentation of the mesoderm, forming the so-called protovertebræ. The divisions of the body being thus outlined at an early stage the spinal nerves, lateral blood-vessels, vertebræ, ribs, and the primitive nephredial tubules are developed in definite relation to them.

The body of a vertebrate may be divided into three main regions—head, trunk (extending from the first cervical vertebra to the anus), and the tail. The segmentation of the trunk and tail is very evident in the embryo, if not in the adult, and the number of segments may be counted. Thus in man there are thirty-seven or thirty-eight originally, of which four or five are caudal segments that disappear during the second month of fœtal life.

The segmentation of the head is not so clear, even in the embryo, and has been a subject for earnest investigation and discussion for a long time. While it is evident that the head is a segmented structure, the actual number of segments and the organs appertaining to each one can be determined only after very minute comparative study of the development of the whole complex of muscles, nerves, ganglia, sense organs, and other structures composing the head, and it is not surprising, therefore, that there should be considerable difference of opinion. Thus Rabl denies that the head contains any segments in front of the ear that can be regarded as homologous with the trunk segments. This opinion is contrary to that of Minot and Hertwig, who regard the whole head as composed of homologous segments. But Hertwig estimates the number as nine, while Minot makes it thirteen.

The segmentation of the body in vertebrates has been held to indicate the descent of this group from the annelids. Comparative anatomy shows, however, that the most primitive known allies of the vertebrates present no likeness to the annelids, but, on the contrary, resemble in some respects the echinoderms, or rather their larvæ; therefore the annelid theory of the origin of the vertebrates seems of very doubtful validity. It is more probable that the metamerism of the body arose independently in the primitive forms of the two groups in adaptation to a similar mode of life.

Robert Payne Bigelow.

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Gaupp, E.: Die Metamerie des Schädels, *loc. cit.*, vii., 1898.

Kupffer, C. von: Entwickelungsgechichte des Kopfes, *loc. cit.*, ii., 1893; *loc. cit.*, v., 1896.

SEGMENTATION OF THE OVUM.—The segmentation, or cleavage, of the ovum is the first stage in the development of an embryo from an egg. It begins with

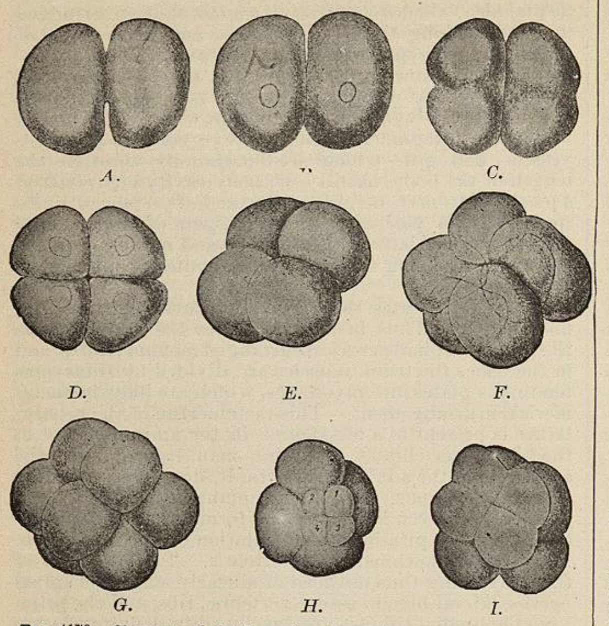

FIG. 4176.—Cleavage of the Egg of an Irregular Sea Urchin, Echinocardium. *A*, First cleavage furrow; *B*, two-cell stage; *C*, beginning of second furrow; *D*, *E*, four-cell stage; *F*, third cleavage, two cells have divided and two are in process of division; *G*, eight-cell stage complete; *H*, sixteen-cell stage, seen from animal pole; *I*, same from vegetative pole. Magnified. (After Fleischmann.)

the first cell division after fertilization (or after the last maturation division in case of parthenogenesis, *q. v.*) and ends with the beginning of differentiation of organs (see *Ovum*, *Gastrula*, and *Area embryonalis*).

The course of cleavage differs greatly in different groups of animals. Eggs having comparatively little deuto-

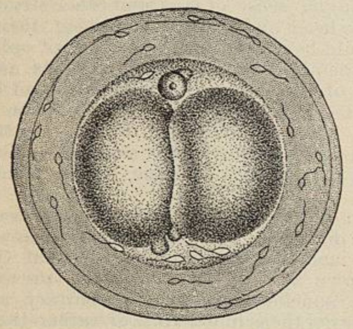

FIG. 4177.—Egg of a Rabbit of Twenty-four Hours; the first cleavage has been completed. (After Coste.)

plasm, or yolk, divide completely into two, four, eight, sixteen, . . . etc., cells. The cleavage is then said to be *total*, and the egg is described as *holoblastic*. The cells derived from the division of the ovum are called *blastomeres*. The blastomeres may be very nearly of the same size or some may be much smaller than the others. In the first case the cleavage is said to be *equal*, in the second it is *unequal*. When the blastomeres are not of the same size, the smaller ones are called *micromeres* and the larger ones *macromeres;* and usually they differ in the parts they play in the development of the embryo. Equal cleavage

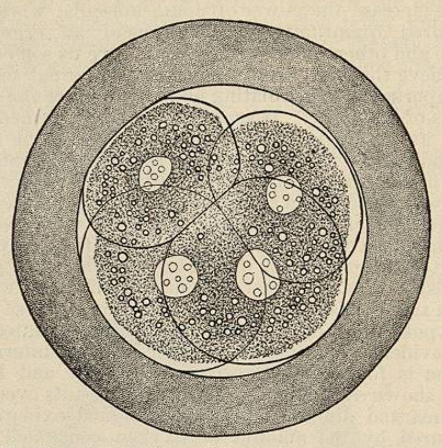

FIG. 4178.—Egg of a Bat, Vespertilio Murina, in the Four-cell Stage. (After Van Beneden and Julin.)

is found in the eggs of sponges, cœlenterates, echinoderms (Fig. 4176), truncates, amphioxus, and mammals (Figs. 4177 and 4178), and in some annelids, crustacea,

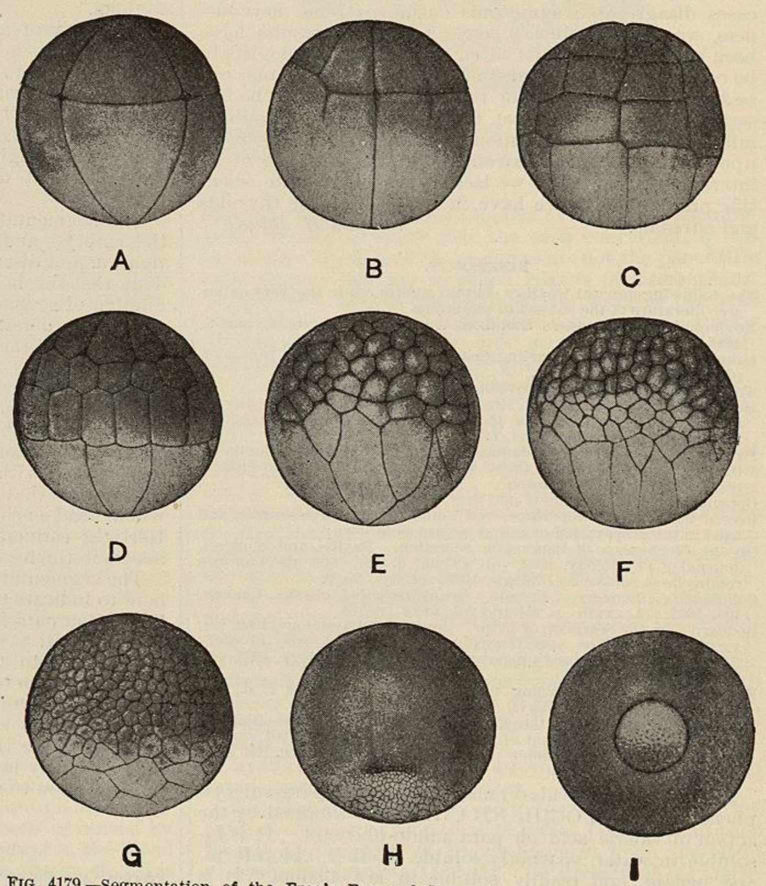

FIG. 4179.—Segmentation of the Frog's Egg and Formation of Blastopore. *A*, Eight-cell stage; *B*, beginning of sixteen-cell stage; *C*, thirty-two cell stage; *D*, forty-eight cell stage (unusually regular); *E*, *F*, *G*, later stages; *H*. *I*, stages in the formation of the blastopore. Magnified. (From Morgan.)

and molluscs. Unequal cleavage is typical of the annelids, molluscs (Fig. 4180), lampreys, gonoid fishes, and amphibia (Fig. 4179).

Other animals produce eggs that contain a very large proportion of deutoplasm. In such cases only a part of

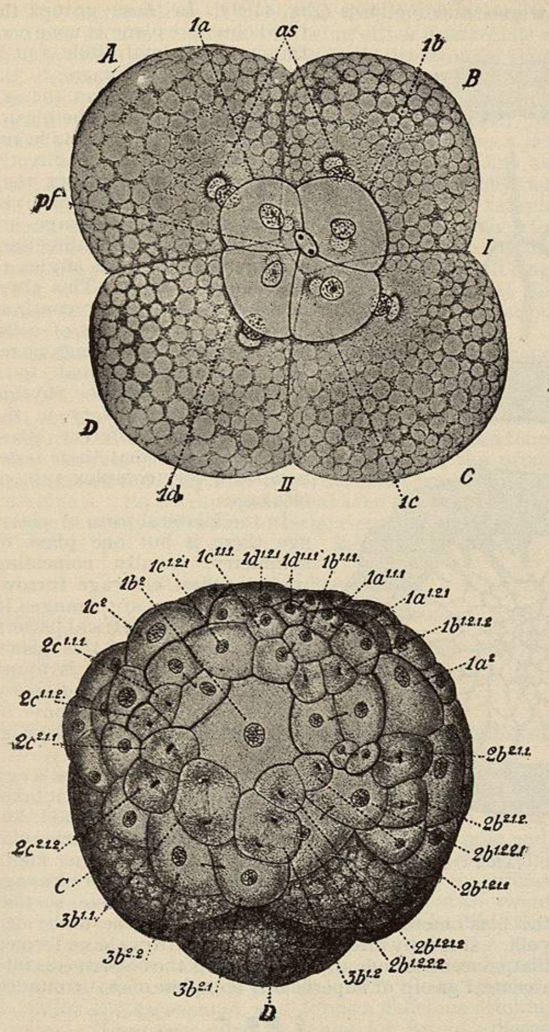

FIG. 4180.—Two Stages in the Development of Crepidula. Upper figure, four-cell stage viewed from above; lower figure one hundred and nine-cell stage, viewed from the side. *I.* and *II.*, first and second cleavage furrows; *A*, *B*, *C*, *D*, macromeres; *1a*, *1b*, *1c*, *1d*, micromeres; *as*, aster. Highly magnified. (From Conklin.)

the egg undergoes segmentation, the rest of the yolk dividing incompletely and being finally absorbed as food by the growing embryo. This form of cleavage is called *partial*, and the egg is described as *meroblastic*.

Meroblastic eggs may be *centrolecithal*, having the yolk chiefly at the centre, or *telolecithal*, having it concentrated toward the vegetative pole (see *Ovum*). Centrolecithal eggs have a *superficial* cleavage, the blastomeres forming a layer of cells, the *blastoderm*, surrounding the unsegmented yolk. This form of cleavage is characteristic of the arthropods. Telolecithal eggs have a *discoidal* cleavage, the blastoderm forming a disc at the animal pole of the egg. This is the form of cleavage to be found in the eggs of cephalopods (Fig. 4181), sharks and rays, bony fishes, reptiles, and birds (Fig. 4182).

The position of the planes of cleavage depends somewhat upon the type of the egg. In centrolecithal eggs the cleavage nucleus takes a position near the centre of the egg previous to division. Then follows a number of nuclear divisions without division of the cytoplasm. The resulting nuclei migrate to the surface of the egg, and the mass of cytoplasm gathered around each nucleus becomes separated from its neighbors by cleavage furrows starting from the exterior.

In alecithal and telolecithal eggs the first two planes of cleavage are always at right angles to one another and cross at the animal pole of the egg (Fig. 4176, *A*, *E*). In the subsequent stages there are developed three types of cleavage—radial, spiral, and bilateral. As examples of the radial type we may take the eggs of sea urchins and of frogs, both holoblastic eggs, the one having equal cleavage, the other unequal. Any one provided with a good microscope can easily observe the cleavage of the eggs of sea urchins or of starfish. The eggs are obtained by cutting up the ovaries of a ripe female. If these are placed in a dish of clean sea water and a small piece of the testis of a ripe male is cut into small pieces and mixed with the eggs, fertilization will take place, and then it requires only a little patient watching of eggs placed from time to time under the microscope for one to observe all

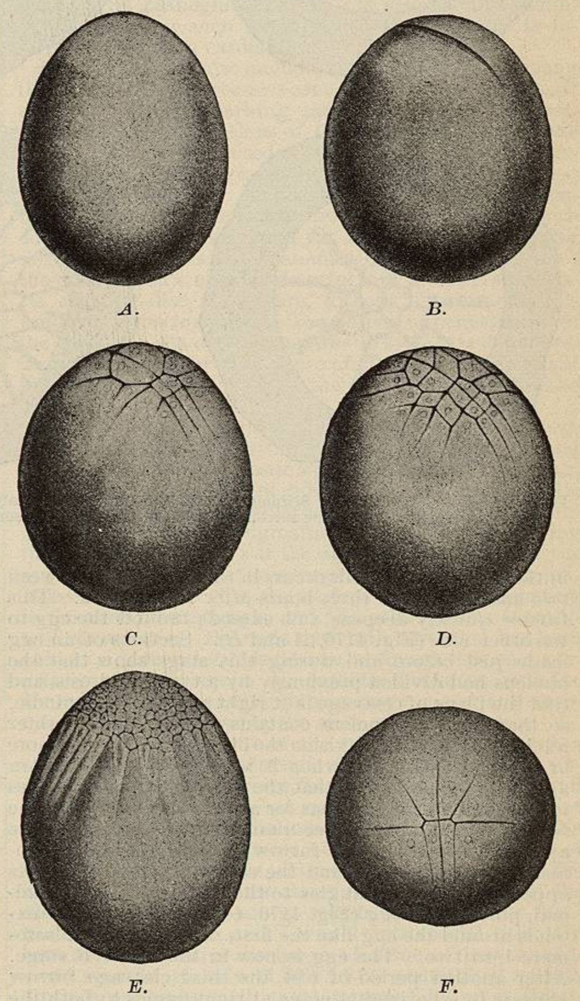

FIG. 4181.—The Discoidal Cleavage of the Egg of a Squid. *A*, Unsegmented egg and polar bodies; *B*, first cleavage furrow; *C*, *D*, *E*, later stages; *F*, eight-cell stage viewed from the animal pole and showing the marked bilateral symmetry of the cleavage furrows. × 30. (After Watasé.)

stages up to the formation of the larva. Freshly laid and fertilized frog's eggs may be obtained by careful search of the ponds in early spring. By packing the eggs with ice, development may be delayed until the laboratory is reached. After the eggs have been placed in fresh water at the normal temperature, the cleavage will proceed and may be followed easily with a hand lens or a microscope.

The first indication of cleavage is the appearance of a slight furrow at the animal pole—the position of the polar body in the echinoderm's or the centre of the black half in the frog's egg. This occurs in the frog's egg between two and a half and three hours after fertilization. This furrow quickly deepens and extends around the egg to the other side (Fig. 4176, *A* and *B*). Sections of an egg made just before and during this stage show that the nucleus had divided previously by a typical mitosis, and that the plane of cleavage is at right angles to the spindle, so that each blastomere contains one of the daughter nuclei. During the division the blastomeres become more or less rounded. But when it is completed they flatten against one another, so that the line of division becomes indistinct, and the egg rests for a time. At the end of the resting period, about three-quarters of an hour after the appearance of the first furrow in the frog, the blastomeres round up again and the second furrow makes its appearance at right angles to the first at the upper, animal, pole of the egg (Fig. 4176, *C–E*). This furrow extends around the egg like the first, dividing each blastomere into two. The egg is now in the four-cell stage. After another period of rest, the third cleavage furrow appears in a horizontal plane at right angles to both the first and the second. In the echinoderm egg this is very nearly at the equator of the egg, but in the frog it is somewhat above the equator, so that in the eight-cell stage we find four black micromeres and four white macromeres. Compare *F* and *G*, Fig. 4176 with *A*, Fig. 4179. The fourth cleavage in the frog occurs from one-half to three-quarters of an hour later. When this is regular each blastomere is divided into two in a plane at right angles to the preceding one. The planes of division form two great circles bisecting the angles between the first two. But in the frog the eggs are seldom so regular as this and the following cleavages are quite irregular (Fig. 4179).

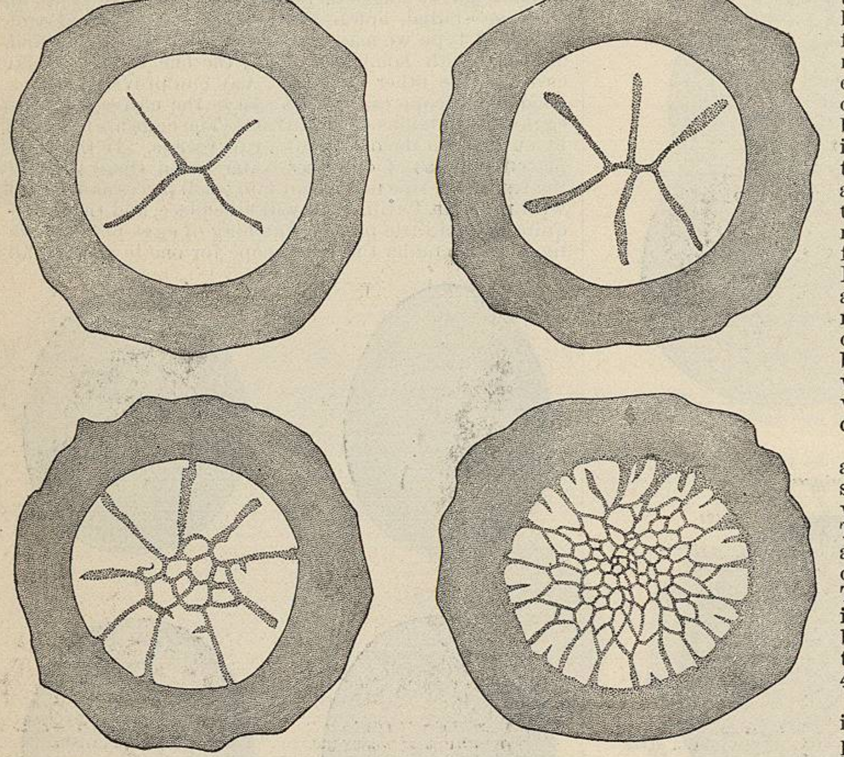

FIG. 4182.—Four Stages of the Segmentation of the Hen's Egg. Only the germinal disc, seen from above, and part of the surrounding yellow yolk are represented. (After Coste.)

The spiral form of cleavage is characteristic of the worms and molluscs (Fig. 4180). In these groups the third cleavage plane is not a continuous horizontal circle, but is tilted in each blastomere, to the left usually, looking at the egg from the side. Thus the blastomeres of the two quartets in the eight-cell stage do not lie directly one above the other, but they break joints. The lines of division in the next cleavage are tilted in the opposite direction, and are thus at right angles to the preceding ones. This alternation of spirals may continue for several generations of cells. In these forms the blastomeres are frequently unequal to a marked degree, and the rhythm of cleavage may vary in the blastomeres of different sizes, with the result that there is developed a very complex type of cleavage.

In the bilateral form of cleavage there is but one plane of symmetry, usually coinciding with the first cleavage furrow. The blastomeres are arranged in a bilaterally symmetrical pattern on the two sides of this plane. This form of cleavage is found in both holoblastic and meroblastic eggs, namely, those of tunicates and cephalopods (Fig. 4181).

The cleavage of the hen's egg is not easy to observe, for it takes place before the egg is laid, but it appears to be of an irregular radial type. As in other meroblastic eggs, the earlier cleavage furrows are incomplete, so that the blastomeres are not separated from the undivided yolk. It is only after several radial furrows have formed that concentric ones appear, dividing the blastomeres into a central group of superficially complete ones surrounded by a circle of larger blastomeres still connected with the yolk at the surface (Fig. 4182); and it is still later when a horizontal division occurs, separating the central blastomeres from the yolk beneath.

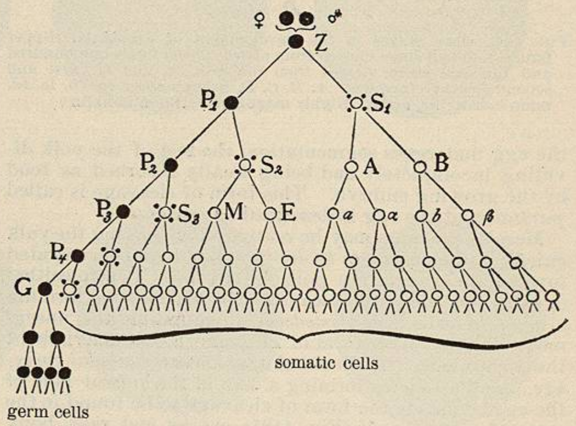

FIG. 4183.—Diagram representing the Determinate Segmentation of the Ovum of Ascaris. *Z*, Fertilized egg; P_1, P_2, etc., protogonocytes; *G*, primordial germ cell (P_5, Fig. 2614, article *Heredity*); S_1, S_2, etc., primary somatic cells; *A* and *B*, primary ectodermal cells; *a*, *b*, daughter cells of the right side; α, β, of the left side; *E*, primary endodermal cell; *M*, cell which produces mesoderm and part of ectoderm. (Modified from Boveri.)

The segmentation of the ovum differs also among the various groups of animals in being either *determinate* or *indeterminate* in character. Typically determinate types of cleavage are found in the eggs of worms (Fig. 4183) and molluscs. In these forms the cleavage is often very complex, and at first glance appears very irregular, but careful study shows that each cell division follows a law that is perfectly definite within the species. Thus the history of each cell may be traced from the first cleavage to the formation of the organs. Conklin, for example, has constructed a remarkable genealogical tree showing the history of each cell in the eggs of Crepidula, the common slipper shell, to the one-hundred-and-nine-cell stage (Fig. 4180), and from the groups of cells present at that stage he was able to observe the development of various important organs.

In the echinoderms and vertebrates, on the other hand, the cleavage soon becomes irregular and no one has succeeded, so far, in tracing the history of the blastomeres. So, for the present, the cleavage of these forms must be regarded as indeterminate. In the frog it has been found that the first cleavage furrow coincides with the principal axis of the body, but this rule is not true for all individuals. So we cannot say that even the first two blastomeres always give rise to certain parts of the body.

Robert Payne Bigelow.

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SEIGLER'S SPRINGS. — Lake County, California. Hotel.

These springs are located at the foot of Seigler Mountain, at an elevation of 2,372 feet above the sea. They are in the neighborhood of Adams and Bonanza Springs, and lie in Seigler Valley, which is about one mile and a half long by half a mile in width. The surrounding country affords many excellent drives, and magnificent views are encountered on every hand. There are twenty or more springs, which yield approximately three thousand gallons per hour. The "Arsenic" Spring has a temperature of 96° F., and is much used for syphilis, scrofula, and cutaneous disease. The "Soda" Spring is alkaline and carbonated, and forms a delicious drinking-water. It has been much in vogue for Bright's disease, bladder troubles, etc. The "Magnesia" Spring is heavily charged with Epsom salts and carbonic acid gas. A glassful before breakfast insures an easy and painless evacuation of the bowels. The Sulphur Spring is mostly used for bathing and for lung, liver, and rheumatic troubles. There are very good accommodations at the springs.

James K. Crook.

SEMILUNAR GANGLIA, PATHOLOGY OF.—A search through the literature of recent years for the results of work on the pathology of the semilunar ganglia is not very satisfactory. The facts that these organs are such near neighbors of the suprarenal capsules and the pancreas, and that they have such intimate nervous relations, especially with the former, have led to many efforts to establish their pathological association; but these attempts seem to have failed of convincing demonstration, the conclusions reached being largely theoretical. The result is that while the journals contain many articles showing extensive research and experimentation and faithful observation of cases and autopsies, the number of established facts bearing on this subject which can be found in the systematic treatises is small and disappointing.

Romberg was among the earliest to ascribe to the semilunar ganglia definite pathological manifestations. Under the title of NEURALGIA CŒLIACA he describes "a sudden and violent epigastric pain or one preceded by a sense of oppression. It generally extends to the back and there are a sense of fainting, cold extremities, and small intermittent pulse. The region of the stomach is either swelled or sunken and the abdominal parietes are tense. Pulsation at the epigastrium is common. Pressure gives relief. Sympathetic sensations occur often in the thorax, under the sternum, or in the pharyngeal branches of the vagus, but seldom in superficial parts. It lasts for from five minutes to half an hour, and is succeeded by extreme exhaustion. If it breaks off suddenly it is followed by eructations of gas or fluid, by vomiting, gentle perspiration, or copious enuresis. The suppression of accustomed hemorrhages gives rise to it, also it often precedes rheumatism and melæna. Gout predisposes to it, and the development of carcinoma ventriculi is often preceded for years by cœliac neuralgia. The peculiar sense of fainting and annihilation which accompanies it is pathognomonic of this disease, and distinguishes it from such neuralgia of the vagus as is included in the term cardialgia."

Byron Robinson also includes neuralgia cœliaca among the functional disturbances connected with the semilunar ganglia. After remarking that "there may be post-mortem findings of lesions of the sympathetic, but these may not have been preceded by records of physical complaints in life, and they may be secondary," he continues: "Hyperæsthesia or exalted irritability of the sympathetic nerves is liable to manifest pain irregularly, periodically, spasmodically, and yet retain some irritability during the intervals. Anatomically we know little of the characteristic changes in structure in hyperæsthesia. Its etiology also is obscure, although malnutrition is probably a bottom fact. The active hyperæsthesia of the great ganglia of the sympathetic system is characterized by an overpowering sense of prostration, a sense of impending dissolution, as if the centre of life would be destroyed."

These views are quite in line with those of Romberg, and correspond closely with those given by F. A. Hoffmann in discussing the diagnostic significance of subdiaphragmatic pain. He considers radiating pain as characteristic of irritations of the retroperitoneal structures as distinguished from those originating in affections involving the mucous membranes or the parenchyma of organs, the muscular tissue of hollow organs, or the peritoneum. Moreover, he finds that the tendency of pain originating in the aorta, the adrenals, and the solar plexus is to extend downward. He finds that little attention has been paid to a neurosis of this plexus, although it is one comprising very numerous sympathetic filaments, and the neuroses of which must exhibit sensory, motor and vasomotor lesions, suggesting the analogue of migraine.

The characteristic site of the pains which belong to a neurosis of the cœliac plexus is the upper part of the abdomen, and from this point they radiate to the sacral and gluteal regions behind, but not to the genital organs or legs in front. These, with sheeps'-dung fæces and polyuria form a group of symptoms pointing, in the absence of hysteria and tabes, to a diagnosis of a neurosis of the cœliac plexus. He cites three cases in support of his views, two of his own, in which the symptoms mentioned were present, and I would call special attention here to the excessive discharge of urine of low or moderate specific gravity (1.008–1.012) containing neither albumin nor sugar and unaccompanied by great thirst, as one of the pathological features ascribed to the semilunar ganglia.

With reference to the pathological relations said to exist between the semilunar ganglia and the kidneys, as shown in the occurrence of *diabetes insipidus*, the following quotations voice the prevailing opinions: Shapiro says, "that physiologists ascribe an especially weighty influence to the splanchnic nerve in regulating the quantity of urine secreted by the kidneys." He gives the history of a case of diabetes insipidus, the patient having