A REFERENCE HANDBOOK

OF

THE MEDICAL SCIENCES.

BLASTODERM.—Blastoderm is a term of somewhat varied signification according to the animal to which it is applied, and, indeed, according to the stage of development. The blastoderm of vertebrates is different from the so-called blastoderm of many invertebrates. The term is applied especially to meroblastic ova, but is also used in reference to the mammalian ovum; it designates the layer or layers of cells which partially or completely cover the yolk and directly participate in the formation of the embryo. *The blastoderm may be defined as the stratum of cells resulting from segmentation of the ovum, and not belonging to the yolk.* We cannot enter into a detailed comparison of the blastoderm throughout the animal kingdom; let it suffice to point out that the structures so called are by no means always homologous. Thus, in insects, segmentation is partial and produces a single layer of cells (Fig. 499), which gradually spreads over the yolk and apparently represents only the ectoderm. In vertebrates, however, the blastoderm is more complex, and consists, in most forms, of several layers of cells, or rather at first of a thick stratum of cells not separated into distinct layers until later stages. The typical vertebrate blastoderm can, perhaps, be best seen in the eggs of bony fishes. The disposition has been very carefully studied by Dr. C. O. Whitman, to whom I am indebted for the accompanying semi-diagrammatic figure (Fig. 500) of the ovum and blastoderm of a flounder. The ovum is surrounded by a vitelline membrane, z,

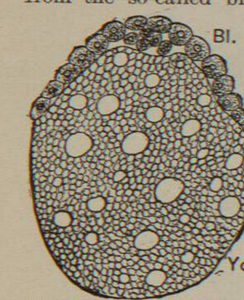

FIG. 499.—Section of Egg of Oniscus Murarius. (After Bobretzky.)

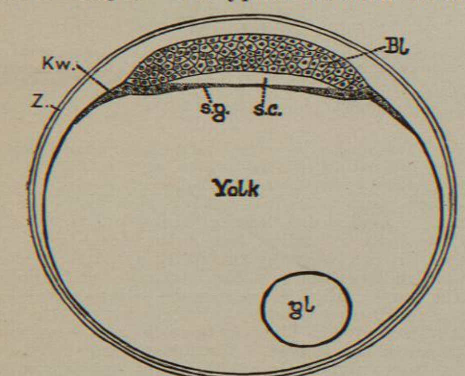

FIG. 500.—Ovum of a Flounder in Transverse Vertical Section, Semidiagrammatic. *z*, Vitelline membrane; *kw*, segmenting zone (Keimwall); *Bl*, blastoderm; *s.c.*, segmentation cavity; *s.g.*, subgerminal plate; *gl*, oil globule of yolk.

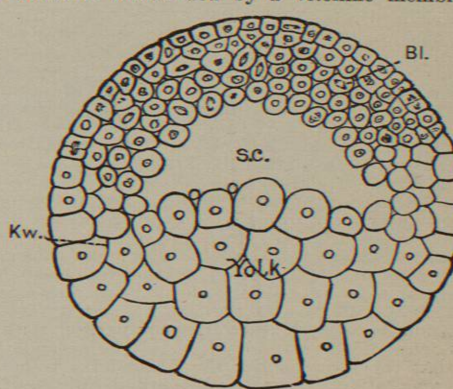

FIG. 501.—Egg of Axolotl after Segmentation. Transverse section. *Bl*, Primitive or ectodermal blastoderm; *s.c.*, segmentation cavity; *kw*, (Keimwall) germinal wall; *Yolk*, segmented yolk. (After Bellonci.)

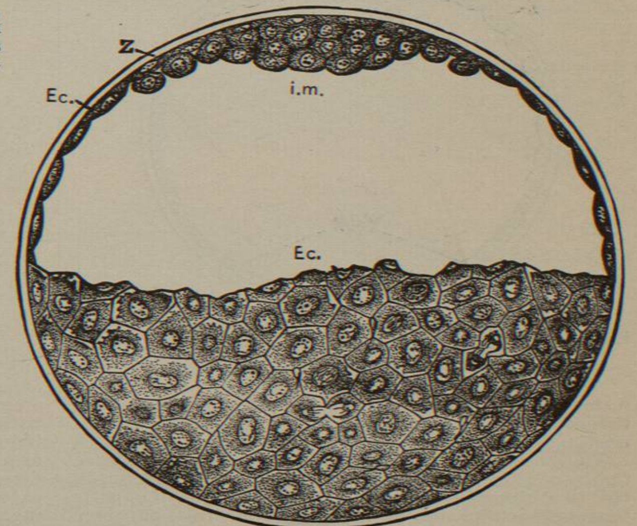

FIG. 502.—Ovum of Rabbit; ninety-four hours after coitus. *Ec*, External cell layer; *i.m.*, inner mass of cells; *Z*, zona pellucida. (The upper half represents an optical section, the lower half a surface view.) (After Van Beneden.)

from which it has slightly withdrawn, notably at the upper pole, where lies the thick cap of cells constituting the blastoderm, *Bl;* in the stage represented the outer layer of cells is just becoming marked off as a distinct

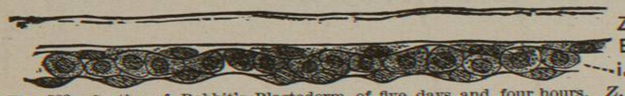

FIG. 503.—Section of Rabbit's Blastoderm, of five days and four hours. *Z*, Zona pellucida; *Ec*, ectoderm; *i.m.*, inner mass. (After Van Beneden.)

layer, the ectoderm; underneath the blastoderm is the well-marked segmentation cavity, *s.c.;* everywhere at the edge of the blastoderm lies the segmenting zone, *kw.*, a ring of granular protoplasm with rapidly dividing nuclei; the cells resulting from these divisions are added to the edge of the blastoderm, which thus enlarges by peripheral additions as well as by the proliferation of its component cells. The segmenting zone is prolonged inward, forming the floor of the segmentation cavity, or, as it is named, the subgerminal plate, *s.g.* This plate grows in from the periphery toward the centre; it contains nuclei and thins out from the edge of the blastoderm inward. The segmenting zone, *kw.*, is essentially the homologue of the germinal wall of the amniota, which has been described under *Area*, but it is sharply bounded against the yolk, and in that respect differs from the wall in the chick, because in the latter the germinal wall merges gradually into the yolk.

In the ovum of elasmobranchs (sharks, etc.), we find, at the so-called close of segmentation, that the blastoderm is a lenticular mass of cells, a little thickened at one point where the primitive streak arises later, and resting at its edge upon the very large yolk, which forms an encircling zone of segmentation around the blastoderm; between the mass of cells and the yolk there is a cavity commonly described as the segmentation cavity. If this designation be correct, then the comparison with the teleost ovum is direct and evident. It is possible, however, that the space under the blastoderm is not the true segmentation cavity, but the entodermic cavity, as

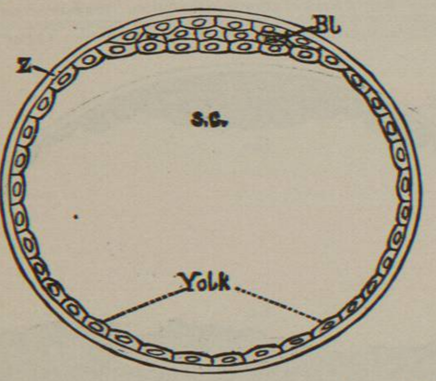

FIG. 504.—Diagram of a Segmented Mammalian Ovum. *Bl*, Blastoderm; *s.c.*, secondary cavity of the yolk; *Yolk*, layer of cells, representing the remnant of segmented yolk.

maintained by Balfour; in other words, that the disposition of parts is the same as in the birds, which we proceed to describe.

The birds and reptiles being very closely related, we find very close resemblances between the blastoderms in the two classes. The actual homologies of the parts have been worked out as yet only in the birds, but there cannot be much doubt that essentially the same features exist in the blastoderm of reptiles. Duval has recently shown that in birds the primitive blastoderm represents only the ectoderm, as is the case also with the amphibia; it is separated from the underlying yolk by a distinct cavity; in birds this cavity is very small, and is overlaid by a single row of cells, the ectodermal or primitive blastoderm; the cavity is very soon obliterated by the development of cells below it, and these cells, together with the outer layer first formed, constitute the secondary blastoderm, which, therefore, contains, first, the young ectoderm, and, second, a deeper-lying stratum of cells, shown by their subsequent history to be the mesoderm united with part of the entoderm; in other words, at this stage the mesoderm and entoderm are not distinct. Underneath this compound blastoderm appears a second cavity, which is not what it has been often called—the true segmentation cavity—but is entodermic, being bounded by the true entoderm above and the yolk below; the yolk, it must be remembered, is modified entoderm. In birds (and probably reptiles) the thick blastoderm of the teleost is represented

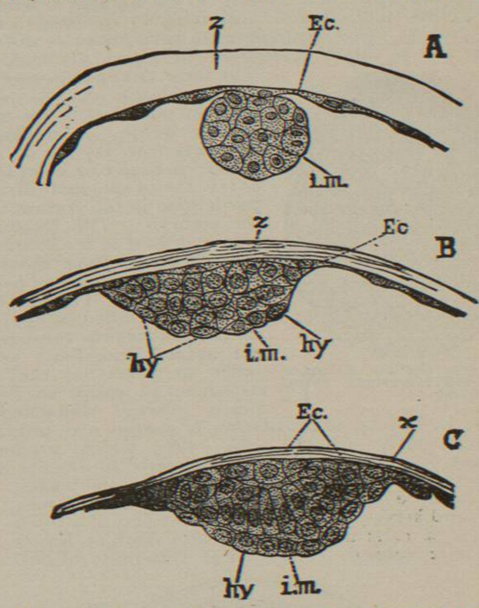

FIG. 505.—Sections through Three Successive Stages, Ovum of the Mole, to show the changes in the inner mass, *i.m.* *z* and *x* designate the zone pellucida; *Ec*, subzonal cell layer, usually called ectoderm, but probably entoderm; *hy*, portion of the inner mass, which enters into the composition of the entoderm of later stages. (After Heape.)

by only a few cells; the secondary blastoderm is another structure, consisting of two layers, and developed later.

The similarity between the eggs of ganoids and of amphibians permits us to consider these two classes together. At first sight the segmented ovum of an amphibian seems very unlike that of the mesoblastic vertebrates, but if we begin by the study of parts obviously identical, I believe that we can determine the homologies of all the parts. Fig. 501 represents a transverse section of an ovum of an axolotl; the membranes of the ovum are not represented. The parts can be readily compared with those in the teleost. The blastoderm, *Bl*, is very large in proportion to the whole ovum, and is composed of several layers of cells, all of which belong to the ectoderm, and at this stage are found to be multiplying with extreme rapidity; the yolk is segmented, and accordingly consists of large cells. At the edge of the yolk, *kw*, is the zone in which cells are being added to the blastoderm, and which is therefore the homologue of the germinal wall. The segmentation cavity, *s.c.*, is very large; the yolk cells bounding it inferiorly may, perhaps,

be homologous with the nucleated subgerminal plate of teleosts. The segmentation cavity is ultimately obliterated, and a secondary blastoderm, including the three germ layers, is developed, as described in the article *Fœtus, Development of.* Underneath the secondary blastoderm arises a second distinct, or true entodermic cavity (Fig. 506). The relations are strictly comparable, therefore, to those in the birds.

The mammalia, according to the description hitherto given, offer no homology in the blastoderm stage with other vertebrates. The formation of the blastoderm is described under *Segmentation.* The result of segmentation is the so-called blastodermic vesicle, a hollow sac formed by a single layer of cells (Fig. 502, *Ec.*) lying close against the zona pellucida; at one pole, where the embryo is subsequently formed, lies a lenticular mass of cells, *i.m.* Now, the exact relations of this cell mass have never been thoroughly studied by any one with the view of elucidating the homologies of the parts, all investigators having apparently come to a tacit agreement to neglect this problem. Van Beneden, to be sure, attempted an interpretation by calling the outer vesicle the ectoderm, and the inner mass the invaginated entoderm, thus defining the whole as a modified gastrula. It has since been definitely settled that Van Beneden was in error in this. Our knowledge of the changes that take place in the inner cell mass is based almost wholly upon the study of various rodents (rabbits, guinea-pigs, and mice), all of whom pass, during their early development, through phases which obviously represent great modifications of the normal mammalian ontogeny. In the rabbit the cells where the inner mass lies soon form three layers (Fig. 503). These are not, however, the three germ layers; for, as Rauber has shown, the two outer layers form the ectoderm, and the third inner layer forms the entoderm; the mesoderm arises later. Here, then, we reach a definite point of comparison. The whole of this mass of cells performs the rôle of the secondary blastoderm in the chick, teleost, and frog; I therefore conclude that it is the mammalian blastoderm. The second point to be made is that the so-called cavity of the blastodermic vesicle is probably not the segmentation cavity, but the secondary yolk cavity, which later fuses with the notochordal canal (see *Notochord*) to form the definitive archenteron. Hence comes the third point, that the cellular vesicle represents not the ectoderm, as has hitherto been universally assumed, but the yolk sac hollowed out.

For convenience of comparison with Figs. 500 and 502, the accompanying diagram (Fig. 504) of a mammalian ovum after segmentation is given. According to the identification of homologies I have here hypothetically advanced, the blastoderm, *Bl*, must include both ectoderm above and entoderm within. If we imagine the yolk of the axolotl, Fig. 501, very much reduced, so as to form only a single layer of cells, we should have the mammalian condition, Fig. 504.

It appears to me that the invagination of the inner cell mass is a general phenomenon in the development of placental mammals, and that the remarkable inversion of the germ layers in the guinea-pig is only a persistence of this early invagination. It is a law which, as I pointed out several years ago, holds throughout the animal kingdom, that the result of segmentation is to produce two sets of cells: one of small-sized cells, belonging to the ectoderm, the other of larger cells, belonging to the entoderm. In mammals also segmentation produces the two kinds of cells, but the smaller ones (ectoderm) form most of the inner cell mass which Van Beneden erroneously called entoderm. It seems to me clear that this first invagination has nothing to do with a gastrula invagination. The inner cell mass gradually flattens out again in most cases, but in some mammals it remains permanently turned in (guinea-pig, arvicola, etc.). The process of the flattening out of the inner cell mass is shown in Fig. 505, which represents sections. In the mole the inner mass is nearly globular, A, and quite small in proportion to the whole vesicle. It soon becomes lens-shaped, B, and next separated into three layers, C, the outermost of which disappears; the middle layer becomes the ectoderm of the embryo; the innermost, part of the entoderm. These changes are discussed in the article *Fœtus.* For the present it must be said that we have no clear notions as to the passage of the segmented mammalian ovum into the embryo, because we do not know yet either the history of the segmentation cavity nor the origin of the entodermic cavity.

CONCLUSIONS.—The blastoderm of (probably all) vertebrates passes through two stages: the *primary blastoderm* consists of ectoderm only, which is separated, except at its edges, from the yolk by the segmentation cavity; the *secondary blastoderm* is constituted by portions of the three primary germ layers, which overlie a second cavity

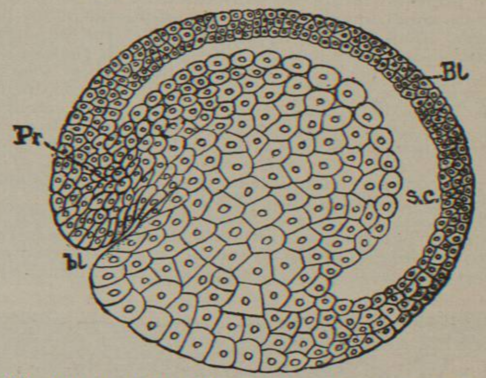

FIG. 506.—Egg of Axolotl, Longitudinal Section. (After Bellonci.) *Bl*, Primitive blastoderm; *Pr*, accumulation of cells, showing the commencement of the secondary blastoderm; this accumulation corresponds to the primitive streak of birds; *bl*, blastopore and commencement of the entodermic cavity.

belonging to the entoderm and lying behind and separated from the segmentation cavity; the secondary blastoderm is the commencement of the embryo.

The history of the changes in the secondary blastoderm is given under *Fœtus.* We will note here only the nature of the first step, which is an accumulation of cells, appearing at the posterior end of the blastoderm, and which is known in the higher vertebrates by the name of *the primitive streak.* It is almost the first step toward the addition of inner layers to the ectoderm or primary blastoderm, and it remains recognizable for a considerable period at the hind region of the blastoderm or germinal area.

Charles Sedgwick Minot.

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BLASTOPORE.—In the lower vertebrates, notably in the Elasmobranchiata, Ganoidea, Dipnoe, and Amphibia, there appears during the formation of the entodermic cavity a small opening at the posterior edge of the blastoderm. This opening leads directiy into the entodermic cavity, and is known as the blastopore. It persists during early embryonic life. This opening is best seen in a longitudinal section (Fig. 507). The blastoporic opening leads into a descending canal, which directly communicates with the posterior, or caudal, end of the entodermic space, which lies between the yolk, *Vi*, and the dorsal entoderm, *Ent*. The appearances of the ova of the lamprey, or of any amphibian, at a corresponding stage, are closely similar to those of Fig. 507.

The blastopore is also found in reptiles, birds, and mammals, but the recognition of its occurrence in these forms was long hindered by the fact that it does not exist at first as a canal. The blastopore is the external opening of a tube passing through the primitive streak, or the thick mass of cells at the posterior end of the blastoderm (or later embryo). Now, if from any cause the walls of the tube grew together, the lumen would dis-

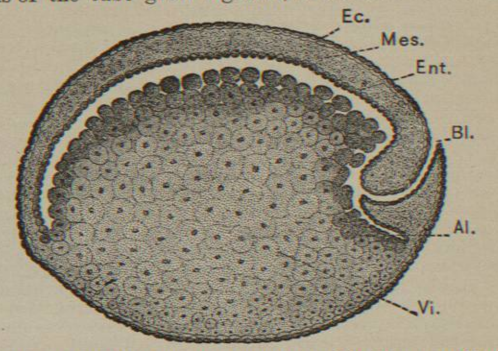

Fig. 507.—Longitudinal Section of an Ovum of the Sturgeon After the Formation of the Entodermic Cavity. *Ec*, ectoderm; *Mes*, mesoderm; *Ent*, entoderm; *Bl*, blastopore; *Al*, diverticulum of the digestive tract; *Vi*, yolk. (After Salensky.)

appear, and the primitive streak would become a solid mass of cells. This is the condition we actually find in the mammals (Fig. 508, A). Now, since the primitive streak really is morphologically the thick wall of the

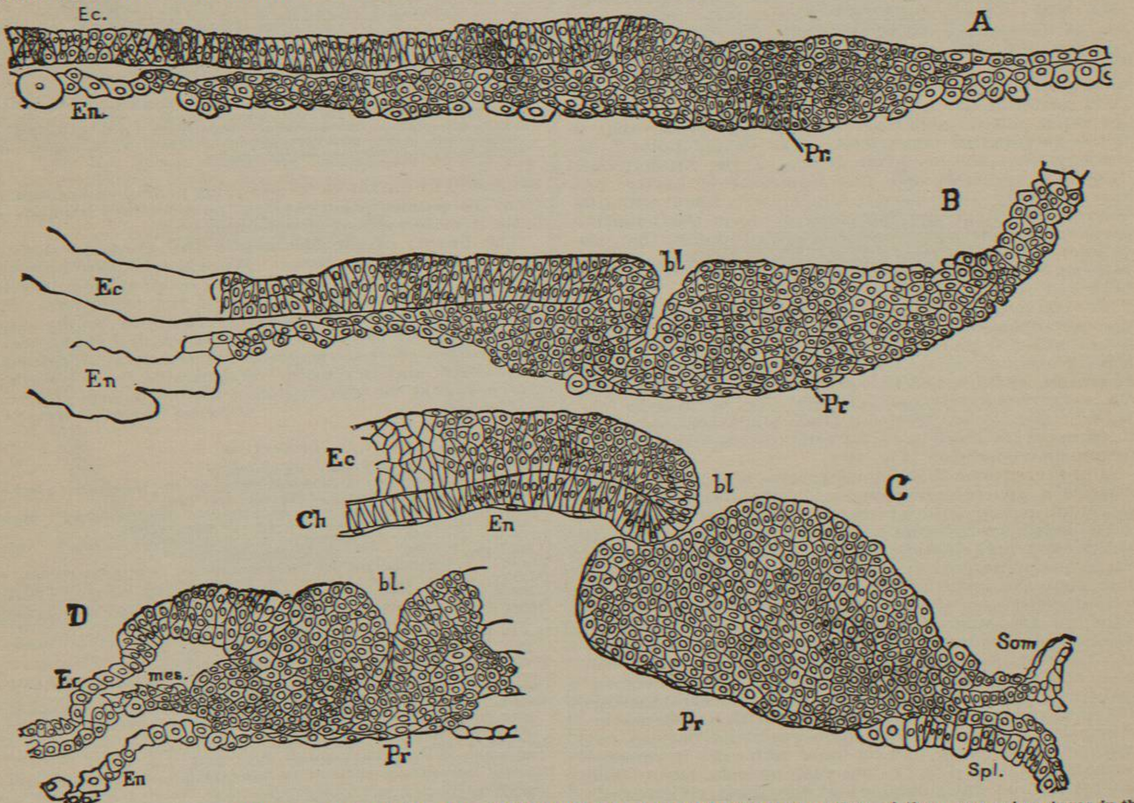

Fig. 508.—Formation of the Blastopore in Lacerta Muralis. (After Weldon.) A, B, C, longitudinal sections of three successive stages in the development of the blastoderm, made after its removal from the yolk; D, transverse section of the posterior part of a blastopore a little younger than C. *Ec*, ectoderm; *En*, entoderm; *Pr*, primitive streak; *bl*, blastopore; *Ch*, notochord; *mes*, mesoderm; *Som*, somatopleure; *Spl*, splanchnopleure.

blastopore, the homologies are not altered by the temporary disappearance of the canal, especially as the canal reappears as such in later stages, at first as a pit upon the external surface (Fig. 508, B, *bl*); this pit soon becomes a complete perforation (Fig. 508, C, *bl*).

It is a remarkable but very common phenomenon in vertebrate development to encounter tubular organs existing temporarily as solid cell masses in the embryo. This occurs with most glands, the Wolffian duct, the vagina of man, the urethra in the penis, the nares, the meatus auditorius externus, the posterior part of the medullary canal in the axolotl, the intestines of teleosts, etc. There is, therefore, nothing specially remarkable in the temporary absence of the blastoporic lumen, and the want of an opening is not a valid argument against the homology of the amniote blastopore with that of the amphibia and similar forms.

(For the relation of blastopore to the nervous system, see *Neurenteric Canal.*)

The blastopore usually disappears by closure, and a new posterior opening, the true or permanent anus, is formed. Miss Johnson states that in the Triton the anus is the persistent blastopore, an observation of great theoretical importance. *Charles Sedgwick Minot.*

LITERATURE.

The literature of the blastopore is very extensive. The following list cites only a few of the most important articles; those by Balfour and Bellonci may be signalized as of especial value.

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BLENNOSTASINE is a compound of unstated formula derived from one of the cinchona alkaloids. It is sedative to the central nervous system and has given much relief in hay fever, coryza, laryngitis, etc. It is not applied locally, but is given by the mouth in doses of gr. i. to iv. frequently repeated. *W. A. Bastedo.*

BLEPHAROSPASM. — DEFINITION. — Spasmodic contraction of the orbicularis palpebrarum muscle, tonic or clonic in character, evidenced by occlusion of the palpebral fissure when the entire muscle is affected, or by fibrillary contraction of a limited portion.

It occurs generally as a symptomatic affection, although it can exist as a disease by itself.

Its causes may be divided into three groups: first, affections of the eye and ear; second, affections of the nervous system; third, general diseases. The first group includes foreign bodies in the conjunctiva or cornea, inflammations of the conjunctiva, cornea, iris and ciliary body, sympathetic irritation, ectropion, entropion, trichiasis, heterophoria, ametropia, foreign bodies in the external auditory canal, and otitis media.

The second group comprises affections of the facial and trigeminal nerves, hysteria, and chorea.

The third group includes as causes, chlorosis, pernicious anæmia, malaria, rheumatism, and influenza.

SYMPTOMS.—It occurs in the form of a tonic or of a clonic spasm. In the tonic form the palpebral fissure is tightly closed, great force often being required to open it. It is an excessive action of the normal reflex mechanism, often persisting as a troublesome affliction in excess of its cause. It may be intermittent in character, coming on suddenly, and frequently placing the patient in great danger, when it is binocular; or continuous, sometimes to such a degree as to cause a temporary amaurosis. The latter condition is usually observed in children of three or four years of age, after relief from a very protracted blepharospasm. They are unable to see large objects, and orientation is practically impossible. The pupillary reflex will be found active, strong light painful, and ophthalmoscopic examination negative. The amaurosis is believed to be cortical in nature (Leber, Uthoff), owing to the absence of peripheral stimulation. Samelsohn has considered it to be analogous to the suppression of the image in alternating strabismus. Others believe it to be due to the disturbance of the intra-ocular circulation by the prolonged pressure of the eyelids, in support of which belief they cite individual cases which have exhibited choroidal and retinal changes.

In clonic blepharospasm there are intermittent contractions of the entire muscle, manifested by constant opening and closing of the palpebral fissure, or by contractions of a limited number of fibres, as evidenced by a slight twitching of the lids, more often of the lower lid. While the spasm may be intermittent at the outset, its continuance engenders its becoming constant and permanent, and frequently the spasmodic impulse extends to neighboring muscles.

CAUSES.—Tonic spasm is particularly induced by foreign bodies in the conjunctiva and cornea, and by abrasions or inflammations of the conjunctiva and cornea, the phlyctenular variety particularly giving rise to it. This form of inflammation, which is seen in strumous children, is frequently accompanied by nasal disease, which may cause a persistence of the spasm long after the conjunctival and corneal disease has disappeared. The intense photophobia, and the œdema of the lids, particularly of the upper, caused by the compression of the veins of the lids by the firmly contracted muscle, render the examination of the eye extremely difficult. Fissures of the commissures and spastic ectropion or entropion are induced. It is believed that the blepharospasm in keratitis is due to direct irritation of the corneal nerves; Iwanoff having found that the cellular infiltration extended along the course of the corneal nerves. It is, however, in part voluntarily induced by the patient for the purpose of relieving the photophobia. The forcible separation of the lids is often accompanied by pain, sufficient in some cases to induce epileptiform convulsions, and by sneezing, reflex in character, caused by the hyperæsthesia of the retina to light. The violence of the spasm is by no means in direct proportion to the severity of the disease of the eye, slight corneal abrasions or a small foreign body frequently inducing the most violent tonic spasm. Iritis and cyclitis are occasionally accompanied by blepharospasm. Donders speaks of it occurring as a sympathetic neurosis in cases of irido-cyclitis. Rampoldi reports cases that were caused by the presence of foreign bodies in the external auditory canal, Ziem a case following syringing of the cavity of the tympanum, and Berger cases accompanying suppuration of the sinuses adjacent to the orbit.

Clonic blepharospasm is frequently observed in young children on their commencement of school life, either as a decided complete contraction of the muscle, or in the form of fibrillary twitchings, often difficult to discover on close inspection, though extremely annoying. In the first instance it is often a manifestation of commencing chorea, the children presenting a marked anæmia. The fibrillary form is generally due to uncorrected errors of refraction. Adults presenting heterophoria and ametropia, particularly hypermetropic astigmatism, are prone to this variety.

Affections of the facial nerve through traumatism or cerebral lesions may give rise to blepharospasm, though it is more often a reflex phenomenon due to a local or distal irritation of one of the branches of the trigeminus. Supra- and infra-orbital neuralgia, caries of the teeth or maxillæ, ulcerations of the tongue, mouth, and palate, and chronic affections of the lachrymal canal may be cited as causes of such irritation. Saemisch has mentioned cases which were caused by the imprisonment of sensitive nerve filaments in cicatrices. In neuralgia of the different branches of the fifth nerve sensitive points can be found, pressure upon which will often arrest the spasm. These spots may be situated at the point of exit of the nerves from their foramina, or may be located some distance from the affected muscle, as at the back of the neck, over the spines of the vertebræ. Romberg found that pressure upon the facial nerve at its exit from the stylo-mastoid foramen would arrest the spasm in some cases. The patient often discovers where these pressure points are situated, and will avail himself of this knowledge to obtain relief. Pressure upon certain parts of the body has been known to bring on blepharospasm, as in the case reported by Zehender, in which pressure in the region of the first cervical vertebra induced it. Cases like this one are undoubtedly of hysterical origin. Indeed, not a few cases of blepharospasm are of hysterical nature. The spasm may be caused primarily, in these subjects, by traumatism, by a carious tooth, or by a foreign body in the conjunctiva, cornea, auditory canal, etc. Its continuation after removal of the cause and disappearance of all irritation would indicate its hysterical character. It is usually binocular, tonic in character, and rarely preceded by clonic movements. Its disappearance is as sudden as its invasion, and its duration varies greatly. Dr. Charles Lasègue cites a case of monocular hysterical blepharospasm, caused by traumatism, which lasted four months, while the immediate effects of the traumatism lasted but twenty-four hours. A constant twitching of the upper lids repeated about twice a second is characteristic of hysteria, and is believed by Knies to be due, like nystagmus, to a weakening of the motor cortical innervation of the muscles. Anæsthesia of the palpebral skin may be noticed as an accompanying symptom, as shown by Gilles de la Tourette. In anæmic and nervous children blepharospasm occurs as the commencement of general chorea. The habit-chorea (Weir Mitchell), which commences in childhood, ceases after a few months or years, although it occasionally goes on to middle life. When it commences in middle life it is generally permanent. It is more common in females, following some impairment of the general health, fright, injury or overwork, and in boys, as the result of masturbation. Imitation can bring it on and observation increases it. Refractive errors, follicular conjunctivitis, and blepharitis are also found as frequent causes. It is often associated with symptoms of hysteria in young women, making it difficult to determine to which disease the spasm properly belongs. Anæmic women occasionally present a clonic monocular spasm, due to the general debility induced by uterine and ovarian disease.

Prognosis.—The prognosis in blepharospasm is uncertain except where it is due to hysteria, traumatism, conjunctival or corneal disease. Prolonged contraction may involve serious consequences to the eye, through the pressure of the lids causing definite lesions of the choroid or retina.

Treatment.—The treatment of blepharospasm resolves itself into treatment of its causative conditions. A careful search should be made for foreign bodies in the conjunctiva, cornea, nose, and ear. If conjunctivitis and keratitis, particularly of the phlyctenular variety, are present, they should be carefully treated. Cocaine, while often of value in relieving blepharospasm and rendering the examination of the eye easier, should be avoided in cases in which there are corneal ulcerations; holocain should be used instead, in one-per-cent. solution. The dilatation of the pupil with consequent increase of the photophobia, owing to the hyperæsthesia of the retina and the softening of the corneal epithelium following the use of the cocaine, are avoided by the substitution of the holocain, the latter being primarily an anæsthetic and secondarily an antiseptic. In cases in which the spasm persists after the conjunctival and corneal disease has been cured, forcible opening of the palpebral fissure, during chloroformization, with canthotomy if necessary, and the dropping of iced water on the exposed eyeball at half-hour intervals, will usually suffice to produce a cure. These children should not be allowed to remain in the dark, nor should dark glasses be given. Fissures of the canthi may be touched with a crystal of sulphate of copper or with nitrate of silver, and the accompanying nasal disease, when present, should be treated. In cases in which eserin is seemingly indicated it may be found that the spasm is increased by its use, eserin having been known to cause violent blepharospasm. De Wecker recommends its use as a curative agent, believing that it diminishes the tendency to reflex transmissions. Errors of refraction must be corrected under atropinization, and muscular errors should be carefully remedied. In cases due to irritation of some branch of the fifth nerve, careful search must be made for pressure points. Hypodermic injections of morphine, in doses of from gr. $\frac{1}{16}$ to $\frac{1}{8}$, may be made at these points. Conium, in the form of the fluid extract, may be given in doses of ten drops, from three to six times daily, until the physiological effects of the drug are shown. The extract of conium may at the same time be used externally in the form of an ointment. Gelsemium may be found of benefit in the cases of true tic doloureux. Galvanism, used after the method of Remak, the negative pole being applied over the muscle and the positive over the fifth cervical vertebra, is sometimes efficacious.

The careful examination of the mouth and teeth by a competent dentist should always be insisted on, the patient often being unaware of the presence of dental or buccal trouble. Other remedies having failed, and pressure upon sensitive points having been found to give relief, division of the offending nerve may be practised. This operation was first performed by von Graefe in a case following the lodgment of a foreign body in the folds of the conjunctiva. The nerve divided was the supra-orbital, and success followed the operation. The supra- and infra-orbital nerves should be divided at their exit from their respective foramina, the temporal branch of the malar in the temporal fossa, and the inferior dental in the mouth. The nerve should be completely cut through; in fact, some authorities think that a better result is obtainable by the excision of 1 to 2 cm. of the nerve. The relief given by section of the nerves is not always permanent, the spasm after a short period returning and being accompanied by the development of new pressure points. This is particularly true in senile blepharospasm. Excision of a portion of the nerve is productive of more lasting relief, although it gives rise to a prolonged anæsthesia of the region supplied by the nerve. Stretching of the nerves has been advocated by Panas. Dieffenbach practised subcutaneous division of the orbicularis muscle, but without much success.

Treatment of hysterical blepharospasm is decidedly unsatisfactory. Tonics, sea bathing, the use of the appliance devised by Mathewson and used with success by Strawbridge, and the application of the Charcot magnet with suggestion, may be tried. The device of Mathewson consists of a rubber band fastened to the upper lid below, and to the forehead above. The constant traction eventually overcomes the resistance offered by the muscle. Arsenic given internally, or hypodermically, as suggested by Weir Mitchell, appears to be the most efficacious remedy in the cases of habit-chorea.

C. Cole Bradley.

BLINDNESS.—(Lat., *Cæcitas;* Ger., *Blindheit;* Fr., *Aveuglement.*) *Amaurosis* is sometimes used synonymously with blindness, and in selected cases—the cause of which is obscure, or is located in the nervous apparatus—this is admissible, with the same limitations that apply to blindness. Blindness is a misleading term, being a symptom only, and should not be used in scientific language (except in a generic sense) without a qualifying phrase which describes the condition upon which it depends—as blindness from optic-nerve atrophy. A strict application of the term would include only such

eyes as are not possessed of light perception. It is, however, usually understood to embrace all eyes incapable of recognizing the outline or shape of objects; and practically it should include all eyes with vision less than $\frac{1}{200}$, *i.e.*, all eyes which are able to count fingers at only one foot, for such individuals have to be *led* around.

Economic Effects of Blindness.—Blindness is a misfortune not only to the individual, but to a community, for a blind person has to be *supported*, and, too, he is not a *producer*. To illustrate the importance of these two factors, let us apply them to the United States, which, according to the census of 1890, had 50,411 blind inhabitants. The *cost* of supporting one blind person in an economical manner may be placed at \$132 annually (\$2 per week for board, \$28 for clothing), so that the *cost* to this country for caring for its blind is \$6,654,252 annually. The *producing* capacity of a man at \$1.20 for each working day and of a woman at \$0.40 a day would be \$404 and \$256 respectively annually, which would give \$17,024,480 as the annual earning capacity lost to this country by its blind—cost and loss together amounting to \$23,678,732.

The geographical distribution of blindness as shown in Table I., compiled by Mayr, of Munich, in 1877, has been subject to slight changes by later statistics, so far as the proportion of the blind to the population is concerned.

Table I.

Country.	Population.	Total number of blind.	Number of blind in 10,000.
England and Ireland	31,631,212	31,159	9.85
Denmark	1,864,496	1,465	7.86
Norway	1,701,756	2,320	13.63
Sweden	4,168,525	3,359	8.06
Finland	1,732,621	3,891	22.46
Austria	20,394,980	11,329	5.55
Hungary	15,417,327	18,523	12.01
Switzerland	2,669,147	2,032	7.61
Netherlands	3,575,080	1,593	4.46
Belgium	4,529,560	3,675	8.11
France	36,102,921	30,214	8.37
Spain	15,658,531	17,379	11.26
Italy	26,413,132	26,826	10.16
United States of America	38,558,371	20,320	5.27
Argentine Republic	1,743,199	3,529	20.24
British colonies in—			
North America	583,535	361	6.19
West Indies	905,730	2,030	22.41
Africa	330,460	416	12.53
Australia	305,730	116	3.79
Germany	39,862,133	35,048	8.79
Totals	248,148,446	215,585	8.74

The population of the United States in the above table is taken from the census of 1870. The census for 1880 shows a population of 50,155,783; number of blind, 48,928; number of blind in ten thousand, 9.73. A striking difference is the great increase of blindness in the United States in the subsequent decade, as is shown in the figures for 1880. Various causes must be considered in determining the reasons for this increase in blindness, the most important of which are the following: 1. The census returns were more complete for the last census than they have been heretofore. 2. Injuries more or less remote from the eye, sustained during the late war, continue to swell the ranks of the blind, and with pensions in view a considerable number make the claim unjustly. 3. The foreign element in our population adds to the percentage of blind; for natives of the United States furnish 9.13 blind to 10,000 inhabitants, while 13.45 blind are found in the same number of our foreign population. 4. The increase of manufacturing interest and its spread to localities remote from competent professional care. 5. The increase of those competitive trades that bring bodily and mental strain, which are liable to produce changes in the nervous system, in which the eyes participate.

The last decade—census for 1890—shows a gratifying reduction in the proportion of blindness: population, 62,622,250; blind, 50,411; number of blind in 10,000, 8.1; number of natives blind in 10,000, 7.4; number of foreigners blind in 10,000, 10.1. This improvement is due to two causes: first, the proportion furnished by the late war has been depleted by death, and the proportion of foreigners has been lessened by laws restricting emigration; second, people are being educated to seek proper relief for diseases and injuries of the eyes.

The latest foreign statistics, as obtained from Eulenburg's *Real-Encyclopädie*, p. 502 (1894), show the number of blind to 100,000 inhabitants of the countries referred to, as follows:

Table II.

Holland	44	Prussia	83	Norway	134
Canada	62	France	84	Spain	148
Poland	70	Germany	85	Caucasia	150
Italy	75	England	88	Argentina	202
Switzerland	76	Austria	94	European Russia	210
Denmark	79	United States	97	Finland	211
Sweden	80	Ireland	120	Portugal	219
Belgium	81	Hungary	128	Iceland	340

The statistics in Prussia, according to Guttstadt, show that in 1871 there were 22,977 blind—*i.e.*, 9.5 per 10,000—whilst in 1880 there were 22,678, or 8.2 to 10,000. This shows a diminution of 1.3 per 10,000, although the population had increased 10.6 per cent. In Saxony the figures declined from 7.9 to 7.1.

The latest blind census in Austria, on December 31, 1890, showed 81 blind to 100,000, there being 907 females to 1,000 males.

The climatic influence, as illustrated in Europe, is shown in Table III., from Magnus, of Breslau, 1883.

Table III.

Between latitudes	30°	and 40°	the number of blind in	10,000	is 11.09
"	40	" 50	" " " "	" 10,000	" 8.63
"	50	" 60	" " " "	" 10,000	" 7.55
"	60	" 70	" " " "	" 10,000	" 18.04

It is true also of the United States that the proportion of blindness gradually increases from the north to the south. The proportion of blindness is greatest in the Eastern portion of the United States, less in the middle, and least in the Western.

And for the Western continent the same author gives Table IV.

Table IV.

Between latitudes	10°	and 20°	the number of blind in	10,000	is 22.41
"	20	" 30	(vacant).		
"	30	" 40	the number of blind in	10,000	is 8.96
"	40	" 50	" " " "	" 10,000	" 5.36

The hot southern latitudes are injurious, because of their dry, sandy interiors (in which the glare and the prevalence of high winds, accompanied by clouds of a fine sandy dust, exert an irritating influence upon the eyes), and their moist, swampy, miasmatic borders and water-courses. The cold northern latitudes are injurious, because confinement in badly ventilated quarters is a necessary concomitant; and, the days being short during the long winters, the work of the eyes is crowded into a limited time, or is prolonged in insufficiently lighted rooms, where work becomes injurious. The most temperate zone presents the least number of these objections, hence we find here the smallest percentage of blindness. There are also geological causes which influence the percentage of blindness; for instance, it is more frequent on one side of the Jura Mountains than on the other.

It has been asserted that blindness was more frequent in cities than in rural districts, and this, aside from such causes as lead to blindness from injuries, trades, etc.; but investigations in Russia, and by Howe in this country, would seem to refute that claim under the present existing circumstances. Investigation of the number of blind in cities of the United States containing fifty thousand and upward inhabitants showed that the proportion was thirty-three per cent. less than in the country; and still further investigation by Howe seemed to show that this improvement was due to the