less he were sure of obtaining adequate accommodations and favorable hygienic conditions. These latter are quite as essential as a favorable climate in the selection of a health resort.

Edward O. Otis.

CEDAR SPRINGS.—Preble County, Ohio.

POST-OFFICE.—New Paris. Hotel.

ACCESS.—Take Pittsburg, Cincinnati, and St. Louis Railroad to New Paris, 35 miles west from Dayton; thence take carriage one mile to springs.

These springs are situated in a rolling section of country, about 1,000 feet above the sea level. The surroundings are very pleasant and attractive. There are said to be not less than one hundred springs within an area of two square miles. Several are used for medicinal purposes. We present an analysis of one of them by Dr. A. Fennel:

WASHINGTON SPRING.

ONE UNITED STATES GALLON CONTAINS:

Solids.	Grains.
Sodium carbonate	2.26
Magnesium carbonate	5.82
Iron carbonate	1.32
Calcium carbonate	3.96
Calcium sulphate	1.24
Sodium sulphate	.18
Calcium phosphate	2.13
Sodium chloride	.98
Alumina	.22
Total	18.11

The waters resemble those of the Bethesda Spring at Waukesha, Wis., but contain more iron. It is claimed that they are especially valuable in catarrh of the bladder, in renal diseases, and in dyspepsia.

James K. Crook.

CEDRON SEEDS.—The seeds of *Simaba Cedron* (R. Br.) Planch. (fam. *Simarubaceæ*). The plant is a small tree of Northern South America, and is considerably cultivated in the tropics. It yields an edible fruit about the size of, and somewhat resembling, a large peach. The solitary seed is similar to a Brazil nut in both form and size. In their home, the seeds have a high repute as an antiperiodic, and trials with them here have largely supported these claims. Their use as an alternative of the cinchona products appears well justified. The white or whitish crystalline volatile amaroid *cedrin* appears to be the active constituent, though the presence of an alkaloid has been claimed. Cedrin is soluble in both water and alcohol. Cedron seed is commonly given in the form of the fluid extract, the dose of which is .06 to .5 c.c. (♏i. to viij.).

Henry H. Rusby.

CELANDINE. CHELIDONIUM.—"The entire plant, *Chelidonium majus* L. (fam. *Papaveraceæ*)" (U. S. P.). In some pharmacopœias the root only has been recognized, but the composition and properties are the same throughout. The drug is little used and will probably be dropped from the Pharmacopœia at its next revision. This, the only species of the genus, is a perennial herb, with slender branching stem, bright yellow delicate flowers, and an acrid, irritating, disagreeable-smelling yellow juice. The plant is sufficiently described by the Pharmacopœia in its description of the dried herb. "Root several-headed, branching, red-brown; stem about twenty inches (50 cm.) long, light green, hairy; leaves about six inches (15 cm.) long, petiolate, the upper ones smaller and sessile, light green, on the lower side glaucous, lyrate-pinnatifid, the pinnæ ovate-oblong, obtuse, coarsely crenate or incised and the terminal one often three-lobed; flowers in small, long-peduncled umbels with two sepals and four yellow petals. Capsule linear, two-valved and many-seeded. The fresh plant contains a saffron-colored milk-juice and has an unpleasant odor and acrid taste."

FIG. 1198.—Celandine, Slightly Reduced. Seed enlarged about four times. (Baillon.)

Celandine is a native of Europe, but has been abundantly naturalized in the United States, where it affects rich, shaded dooryards. It is an old country medicine, and has been used to dissipate warts and as a dressing for ulcers. Its general composition is very similar to that of bloodroot, but the important alkaloid is *chelerythrine*, associated with *chelidonine, α* and *β homochelidonines* and *protopine*. There are also *chelidonic* and *chelidoninic acids*. Chelerythrine acts in a markedly different way from its close relative, sanguinarine, lacking entirely the irritating properties of the latter upon the motor centres, which it depresses or paralyzes from the first. It also depresses the muscles. The ends of the sensory nerves are first irritated and then depressed. Chelidonine tends to counteract this primary sensory stimulation. The homochelidonines and protopine are in very small amounts. Their effects are also in the general direction of both sensory and motor depression. Hence the effects of celandine are not violently irritating like those of bloodroot, and are finally soothing and depressing. There is, however, enough sanguinarine, in connection with the primary sensory irritation of the chelerythrine, to make the drug strongly irritating in the first stage of action. It acts as a laxative or a purgative, and has always been regarded as an active cholagogue. Large doses may cause emesis, but the tendency of this drug is purgative, as that of sanguinarine is emetic. There is no official preparation. The dose is 1 to 4 gm. (gr. xv. to lx.). The extract is mostly used, in doses of .5 to 1 gm. (gr. viij. to xv.). The drug has been a favorite domestic basis for poultices, and the juice is a counter-irritant, similar to bloodroot.

Henry H. Rusby.

CELASTRUS. See *Bittersweet, False Climbing.*

CELERY.—This well-known succulent vegetable, *Apium graveolens* L. (fam. *Umbelliferæ*), is distilled in the fresh state for a delicious volatile oil which is used for flavoring. The fruit, however, is the important part from the standpoint of materia medica. It is similar to the other cremocarps of the family, but is very small, only one-twenty-fifth inch in length, broadly ovate, dark brown, hard, smooth, and generally contains twelve oil tubes. It is largely used in its own form for flavoring purposes and as a carminative, similarly to its relatives, and in doses of grams ij. to iv. (ʒ ss. to i.). Its volatile oil, containing limonene, is also largely used for the same purposes.

Henry H. Rusby.

CELL.—A cell is one of the elementary forms of organized substances of animals and plants. It is irreducible into more simple parts except by mechanical or chemical means; it is therefore the *histological element*.

HISTORICAL.—It is to the botanists that the credit of the discovery of the minute structure of living matter is due. At the end of the seventeenth century Malpighi and Grew demonstrated the fact that plant tissue was made up of small spaces with firm walls, and that these spaces were filled with fluid. They called these spaces cells, from the Latin "cella," a little cavity or space. Further investigation showed that this plant cell contained, in addition to the fluid, a somewhat granular substance and that this granular mass contained a darker spot, which spot we now know to be the nucleus.

Investigation of animal tissue by Purkinje, Valentin, Müller, and Henle (1830–40) showed that it was composed of elements similar to those of plant tissue. In 1838 Schwann, as the result of his investigations, announced the fact that animal and plant tissues were made up of similar elements, and he defined these elements, the cells, as "small vesicles, with firm walls, enclosing fluid contents."

As the investigation of the plant cell advanced it was found that in many instances it was completely filled by this granular substance, and it was named protoplasm by Mohl. Further investigation of the animal cell showed that the cell wall was absent in many cases, and the question was raised as to whether these bodies could be classified as cells. It was also found that these bodies were identical in structure with the protoplasm of Mohl, and the term protoplasmic bodies was applied to them by Remak.

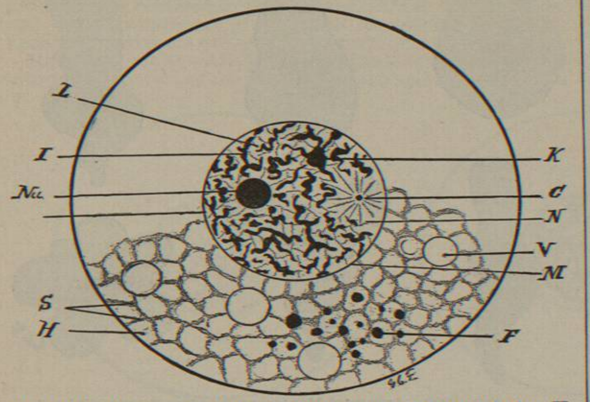

FIG. 1199.—Diagram of a Cell. *C*, Centrosome; *F*, foreign body; *H*, hyaloplasm; *I*, intranuclear network or reticulum; *K*, karyosome or false nucleolus; *L*, linin; *M*, nuclear membrane; *N*, nucleus; *Nu*, nucleolus; *S*, spongioplasm; *V*, vacuole.

In 1860 Max Schultze announced his protoplasmic theory of the structure of animal cells. He demonstrated that the cell wall or membrane of the earlier investigators was not an essential part of either the animal or the plant cell; that, as a general rule, the plant protoplasm had a firm wall, but under certain conditions it became divested of it and then assumed the same characteristics as those of the animal protoplasm. Having determined that the element was not a cell or little space filled with fluid, but a formed material, he still retained the term cell of the earlier investigators. We still continue to use the same term, as it has become a fixture in biological nomenclature. Schultze defined a cell "as a little mass of protoplasm endowed with the attributes of life."

As the investigation of the cell proceeded it was found that this mass of protoplasm was of a much more intricate structure than was at first supposed, and that the dark spot, the nucleus, was an important part. This necessitated a revision of Max Schultze's definition, and the following was formulated: "A cell is a little mass of protoplasm, which contains in its interior a specially formed portion, the nucleus."

During the last decade a vast amount of information in regard to the structure of the cell has accumulated. This is especially so in regard to the nucleus and the part it plays in the process of cell division. These discoveries will be considered in the discussion of the structure of the cell.

STRUCTURE OF THE CELL.

1. Cell body, Protoplasm, or Cytoplasm,
   - *a.* Spongioplasm or cytoreticulum,
   - *b.* Hyaloplasm,
   - *c.* Microsomes.
2. Nucleus, or Karyoplasm.
   - *a.* Nuclear membrane,
   - *b.* Intranuclear network,
     - *a.* Chromatin.
     - *b.* Linin.
   - *c.* Karyolymph or nuclear sap,
   - *d.* Nucleoli.
3. Centrosome.
4. Cell membrane.

Cytoplasm (cell body, protoplasm).—Under the ordinary powers of the microscope the cytoplasm has a granular, in some instances a homogeneous appearance; but upon analysis with the highest powers it is found to be composed of two distinct substances: the *spongioplasm* or *cytoreticulum* (Fig. 1199, *S*), which forms a network or reticulum the spaces of which are filled with what is believed to be a fluid substance, and the *hyaloplasm* (Fig. 1199, *H*). The proportion of these two elements varies. In young cells the hyaloplasm predominates, but as the cells grow it decreases relatively, and the spongioplasm increases. The amount of the spongioplasm, the thickness of its threads, and the size of its meshes also vary in different cells. Embedded in the cytoplasm are minute granules, the *microsomes*; these, together with the nodal points of the spongioplasm, give the granular appearance to the cell-body. The distribution of the microsomes is not uniform; usually the periphery of the cell is entirely free from them, and then in some cells they are grouped in masses or they may be distributed irregularly. If they are numerous and coarse in character, the cytoplasm has a dark look; if they are fine and less numerous it has a lighter or nearly clear appearance. In addition to the microsomes other objects are sometimes found in the cytoplasm, viz., pigment or fat granules and clear, spherical-shaped cavities—*vacuoles* (Fig. 1199, *V*).

In 1892 Butschli published the results of his observations on the minute structure of cytoplasm. He claimed that the reticular appearance was due to the fact that it was a *foam* or *emulsion*, being made up of numerous microscopic vacuoles, the walls of which were in close apposition, so that the microscope showed them only in optical section and not their surfaces. In order to confirm this theory he made numerous experiments and finally succeeded in producing what he called "artificial cytoplasm," which when viewed with the microscope had nearly the same appearance as the spongioplasm of a cell. This artificial cytoplasm was made by rubbing up olive oil with cane sugar or potassium hydrate. A drop of this mixture was placed on a slide, a small drop of water was added, and the whole was covered with a cover glass, the weight of which spread it out in a thin layer. From these experiments he concluded that cytoplasm was a mixture of fluids of different densities, the heavier forming the walls of the vacuoles, while the lighter collected in their cavities.

At present we have two theories as to the structure of cytoplasm: the *reticular*, which is supported by the majority of investigators, and the *foam* or *emulsion* theory, which is advocated by Butschli and his school.

Nucleus.—The *nucleus* or *karyoplasm* (Fig. 1199, *N*) is now known to be the important part of the cell, being the centre of all its activity. It is generally embedded in the cytoplasm, but in a few cells it projects above the surface. It stains, or, more properly speaking, some of its elements stain, with certain dyes, such as carmine, hæmatoxylin, etc.

It may be spherical, oval, rod-like, or irregular in its shape, and its size is generally in proportion to the size of the cell. In a few instances it is nearly as large as the cell itself (lymphocytes). Every cell, as a rule, has at least one nucleus, sometimes two or more, and in the large giant cells one hundred or more have been found. A few cells—red blood cells, the surface cells of the epidermis, and the respiratory cells of the terminal air passages of the lungs—are without nuclei.

These cells did at some previous time have a nucleus, but in the process of differentiation the nucleus disappeared.

In the resting state the nucleus is surrounded by a membrane, the *nuclear membrane* (Fig. 1199, *M*), which encloses the nuclear contents or *karyoplasm*. This membrane is divided into two layers, an inner or *chromatic*, and an outer or *achromatic*. By some investigators it is considered as a special condensation of the cytoreticulum. The karyoplasm is made up of a formed material, the *intranuclear network* or *reticulum* (Fig. 1199, *I*), and of what is believed to be a fluid substance, the *karyolymph* or *nuclear sap*, which fills the spaces formed by the reticulum. The intranuclear network is composed of two elements: *chromatin*, which stains with the nuclear dyes, and *linin* (Fig. 1199, *L*), which does not stain. The chromatin occurs in the form of irregular anastomosing threads, which are supported by the linin. These chromatin threads vary in their thickness and arrangement. In some nuclei they appear in the form of a thick or thin convoluted thread; in others as rounded or irregularly shaped granules. Some investigators believe that the chromatin occurs in the form of short, rod-like masses and that these masses are embedded in the linin. The linin is a transparent, unstainable substance, only to be demonstrated by special methods of preparation.

The *Nucleoli* are of two kinds: the true nucleoli or *plasmosomes* (Fig. 1199, *Nu*), and the net knots or *karyosomes* (Fig. 1199, *K*). The true nucleoli are spherical in shape and they stain intensely with the nuclear dyes. They may lie free in the nuclear sap or they may be attached to the threads of the intranuclear network. The karyosomes or false nucleoli are thickened nodal points of the reticulum. The function of the true nucleoli is unknown.

Centrosome.—This is a minute spherical-shaped body (Fig. 1199, *C*) found within the nucleus in the resting state. It is the special organ controlling the process of cell division. In the earlier stages of this process it passes into the cytoplasm, remaining near the nucleus, and is surrounded by a zone of fine, radiating fibrils, the *attraction sphere* or *archoplasm*. In some few cells no centrosome has been discovered as yet, but this is believed to be on account of its minute size and difficulty of demonstration.

Cell Membrane.—The cell membrane is now believed to be an unimportant part of the animal cell. It is present in but a few instances—fat cells and the ovum being exceptions. In the ovum it is well developed and has structural differences; in other cells, however, it is generally of a homogeneous appearance and is considered by many to be a condensation of the cytoplasm.

Cells differ greatly in shape. They may be oval or spherical—the form of all young cells; discoid, as in the case of the red blood cells; flat, as in some forms of epithelium; cylindrical or columnar, as in the epithelium of the intestine; or, finally, irregular, as in the connective-tissue cells and nerve cells. The element of pressure is an important factor in the modification of the shape of cells, and is well exemplified in the various forms of stratified epithelium.

Vital Properties of Cells.—Under this heading are grouped the phenomena of *movement, irritability, metabolism*, and *reproduction*.

Cells exhibit the phenomena of movement under three forms: *protoplasmic, amœboid*, and *ciliary*.

Protoplasmic movement is difficult of observation on account of the slowness of the process. It has been demonstrated in a few animal cells, and in plant cells it is easily observed, the streaming of the cytoplasm being an example. All animal cells are believed to possess it to a greater or less degree. It is made manifest by the changes in the form of the cytoplasm, by the movements of the microsomes, and by the changes in the position of the nucleus.

Amœboid movement is similar to that exhibited by the unicellular organism, the amœba. Nearly all animal cells possess it to some extent, it being well marked in a special few, viz., the leucocytes, lymph cells, and wandering connective-tissue cells. If a living leucocyte be studied under the microscope, it will be seen to change continually its form (Fig. 1200). Gradually a bud-like mass of the cytoplasm will push out from some point, or several may start from different points. These *pseudopodia* may retract, or one may be extended for a considerable distance, the remainder of the cytoplasm flowing into it. Other pseudopodia are given off and the above process is repeated. By this means the cell will gradually crawl through the field of the microscope. It is by means of this amœboid movement that the leucocytes pass through the walls of the capillaries and wander through the spaces of the tissues and organs or between other cells.

Ciliary movement is the power possessed by the hair-like appendages of certain cells (see *Epithelium*).

Irritability is the property that cells have of responding to external stimuli. These stimuli, though almost innumerable, may, in a general manner, be grouped as mechanical, electrical, and chemical in their nature, or as due to heat and light.

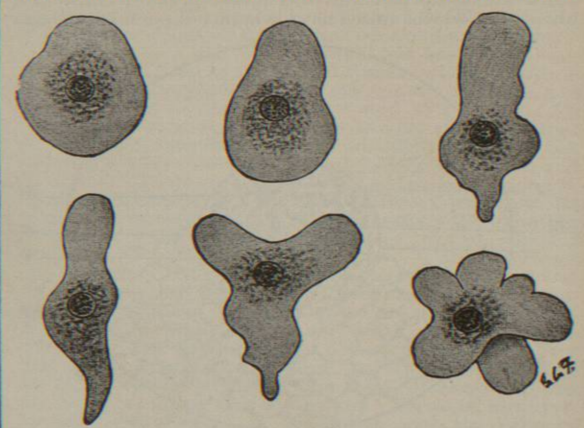

Fig. 1200.—Amœboid Movement. (After Verworn.)

All cells do not react in the same manner to the same stimulus, nor do all stimuli cause the same reaction in an individual cell. The response of a cell to a specific stimulus depends upon its structure. Some, those of the organs of vision, for example, respond to light only; while others may respond to one or more stimuli.

Under mechanical stimuli are classed pressure, violent shaking, and crushing, any one of which causes cells to react in some manner.

While heat is a necessary condition for the vital activity of cells, it must be confined within rather fixed limits; these varying considerably, however, for different cells. If the temperature be raised to 40° C. the vitality of the cell is destroyed, but, on the other hand, the temperature may be lowered to a considerable extent without the cell being killed. An increase of heat above that at which a cell normally exists causes a marked increase in its vital processes, until the heat-rigor point (40° C.) is reached, when a coagulation takes place and the cell is killed. Lowering of the temperature below the normal produces a gradual diminution of activity until the cold-rigor (0° C.) point is reached, when the cell passes into a "narcotic" state. Apparently cells can remain in this state for a considerable length of time without their vitality being destroyed, for if they be gradually warmed up to their normal temperature their vital functions are resumed.

Light, in the higher order of animals, is believed to be a stimulus to the cells of the organs of vision only. In some of the lower animals, other tissue cells, especially those of the skin, respond to its stimulation.

Electrical stimuli, when applied in the form of weak currents, cause an increase, strong currents a decrease, in cell activity. If the latter are continued for a considerable length of time they cause the death of the cell.

Chemical stimuli are almost numberless, and at present their manner of action is not thoroughly understood. Some cause contraction, some increased movement, others increased secretive activity, etc. A striking example of the effect of chemical stimuli is that known as *chemotaxis*. This is the property possessed by certain cells of responding to the stimulation of chemical substances introduced into or formed in the

body. Some substances cause the cells to approach them—*positive chemotaxis*; others repel them—*negative chemotaxis*. The leucocytes respond quickly to this form of stimulation.

Metabolism is the property which cells possess of absorbing and of giving off materials. The former process is termed constructive metabolism or *anabolism*, the latter destructive metabolism or *katabolism*. The anabolic products are retained in part by the cell for its nutrition and the remainder are given off as its specific secretion. Katabolic products are mostly thrown off as excretions.

Reproduction.—All of the multitude of cells entering into the formation of the various tissues and organs of the adult animal body are derived from one original cell, the ovum. Every cell is the result of the division of a pre-existing cell (mother cell) into two cells (daughter cells). This process is known as *cell division*.

Two chief forms of cell division are now recognized: indirect cell division (*karyokinesis, karyomitosis*, or *mitosis*) and direct cell division (*amitosis*).

Indirect cell division, or mitosis, is the process by which the vast majority of the cells of the animal body divide. In this form of division the intranuclear network undergoes a series of complicated changes; the nucleus divides, and finally the cell body itself, into two equal portions.

The process is divided into four stages: the first

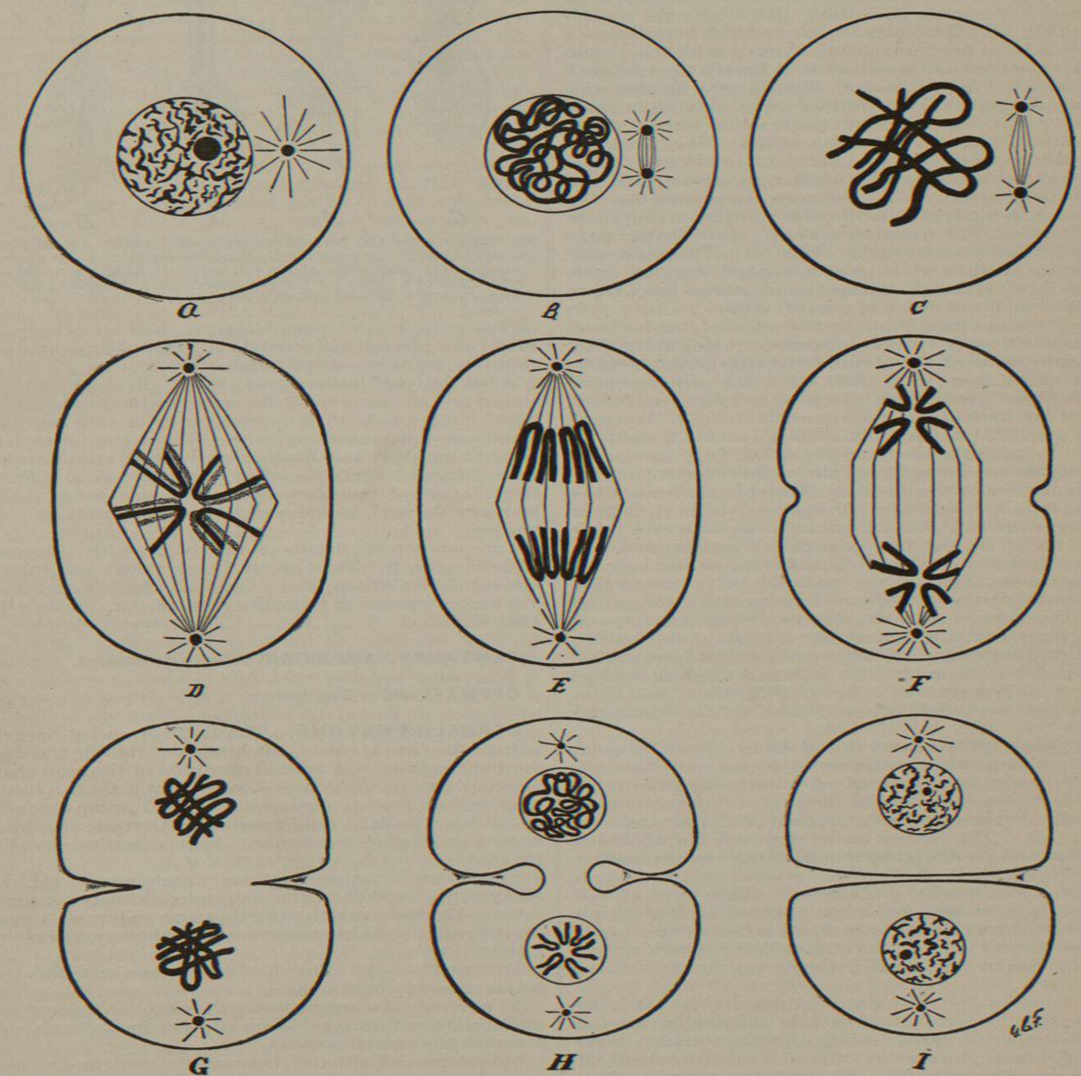

Fig. 1201.—Diagram of Indirect Cell Division or Mitosis. (After Böhm and von Davidoff.) *A*, Cell with resting nucleus; *B*, prophases; nucleus showing thickened convoluted thread of chromatin, daughter centrosomes, and early stage of the formation of the achromatic spindle; *C*, prophases, formation of the chromosomes; *D*, prophases, achromatic spindle in long axis of the nucleus, chromosomes dividing; *E*, anaphases, chromosomes moving toward the centrosomes; *F*, anaphases, chromosomes collected at the poles of the nucleus forming the diaster; commencing constriction of the cell body; *G*, telophases, further constriction of the cell body, daughter nuclei returning to the resting state; *H*, telophases, deeper constriction of the cell body, daughter nuclei showing monaster and convoluted thread of chromatin; *I*, telophases, complete division of the cell body forming daughter cells the nuclei of which have returned to the resting state.

stage, *prophases*, in which the nucleus undergoes a series of preparatory changes; the second stage, *metaphases*, in which the first steps in the division of the nucleus take place; the third stage, *anaphases*, in which the nuclear material is distributed to the new-forming nuclei; finally the fourth stage, *telophases*, in which the complete division of the nucleus and cell body takes place, with the formation of daughter cells.

Prophases.—The resting nucleus enlarges and the centrosome passes into the cytoplasm, where it divides in such a manner as to form daughter centrosomes. The daughter centrosomes lie near the nucleus, separated by quite an interval, each being surrounded by the radiating fibrils of the *archoplasm*, some fibrils of which, stretching between the centrosomes, form the *achromatic spindle* (Fig. 1201, *B*). The intranuclear network becomes converted into a fine convoluted thread, which in some cases is continuous; in others it is broken up into several threads. The thread or threads next shorten and become thicker, the convolutions being reduced in number. At this stage the chromatin stains intensely and resists the action of decolorizing agents. The chromatin next becomes arranged in a series of connecting loops, forming the *wreath*. The nuclear membrane and the nucleolus disappear. In some cases it appears that the nucleolus is thrown out into the cytoplasm and there degenerates. The wreath breaks up into V-shaped segments, the *chromosomes* (Fig. 1201, *C*). These chromosomes are always of an equal number, varying from two to thirty-six, and each species of animal has a characteristic number, which in man is sixteen.

The centrosomes migrate to the poles of the nucleus, and the achromatic spindle appears in its long axis, being formed by some of the fibrils of the archoplasm stretching between them (Fig. 1201, *D*). The chromosomes, which have become much shorter and thicker, collect around the axis of the nucleus at its equator, the *equatorial plane*, their closed ends being directed toward the centre, forming the *monaster* (Fig. 1201, *D*).

Metaphases.—This stage is the commencement of the actual division of the nucleus. The chromosomes of the monaster split lengthwise into halves, which at first lie close together, but gradually draw away from each other (Fig. 1201, *D*) and form daughter chromosomes, the original chromatin being divided into equal portions.

Anaphases.—The nuclear material is, in this stage, equally distributed to the now forming daughter nuclei. The chromosomes separate into two equal groups, and each group gradually moves toward one of the centrosomes (Fig. 1201, *E*), where they collect in a form similar to that of the monaster; this is termed the *diaster* (Fig. 1201, *F*). Toward the close of this stage the cytoplasm becomes slightly constricted at the equatorial plane.

Telophases.—The constriction of the cytoplasm noticed in the previous stage continues to deepen until the cell-body is divided into equal halves, forming daughter cells, each of which receives one of the groups of chromosomes, one-half of the remaining nuclear material, and one centrosome. The nuclear membrane and the nucleolus reappear and the daughter nuclei return to the resting state (Fig. 1201, *G*, *H*, *I*).

Direct Cell Division or Amitosis.—This form of cell division is now believed to be confined to the lymph cells and leucocytes. The nucleus in this form of cell division divides without the intranuclear network undergoing the same complicated changes as in the indirect form.

The nucleus first becomes constricted (Fig. 1202, *A*); this constriction gradually increases and finally cuts the nucleus into two parts, forming daughter nuclei; these daughter nuclei draw away from each other by amœboid movement (Fig. 1202, *B*). At times the complete division is delayed and the nuclei remain connected, for some time, by a narrow thread of the nuclear material (Fig. 1202, *C*). Division of the cytoplasm take splace by the development, at first, of a constriction between the nuclei, and then finally by the entire separation of the daughter cells thus formed. Like the nucleus, the cytoplasm may in some instances remain connected (Fig. 1202, *D*), or its division may be delayed while the nuclei go on dividing, the result being an accumulation of nuclei and the formation of multinucleated cells.

The innumerable cells found in the adult organism, though derived from a common parent, the ovum, lose

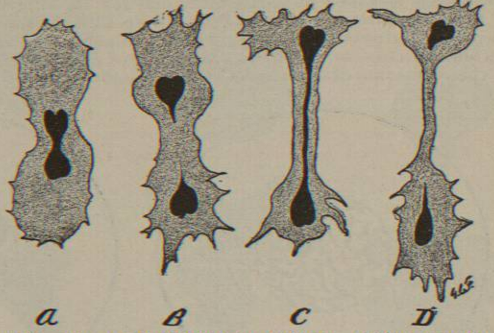

FIG. 1202.—Direct Cell Division or Amitosis. (After Arnold.) *A*, Constriction of the nucleus; *B*, complete division of the nucleus, commencing constriction of the cell body; *C*, daughter nuclei still connected by a thread of nuclear material; *D*, daughter cells still connected by a narrow band of cytoplasm.

in many respects all resemblance to that cell. They assume new forms and functions, these being brought about by a process of cell differentiation.

After the fertilization of the ovum it divides by mitosis and at first the daughter cells resemble the mother cells. Soon changes make their appearance in the cells and they can be grouped into two forms. These two forms continue to multiply and finally they become arranged into three distinct layers—*the layers of the blastoderm*. From these layers of the blastoderm all of the tissues of the body are derived, each layer furnishing certain specific tissues.

For more minute details of the structure and function of cells consult "The Cell in Development and Inheritance," E. B. Wilson, and "General Physiology," Max Verworn, translated from the German by Frederic S. Lee, M.D. *George C. Freeborn.*

CENTAURY, AMERICAN. See *Gentianaceæ*.

CEPHAELINE. See *Ipecac*.

CEPHALHÆMATOMA.—The name given by Naegele is from the Greek, *κεφαλή*, the head, *αἷμα*, blood, and *ὦμα*, morbid condition. A morbid condition of the head characterized by an effusion of blood. Latin *Cranii tumor sanguineus;* French, *Céphalématome*, or *Tumeur sanguine de la tête;* Italian, *Cefalhæmatoma;* German, *Kephalämatom*, or *Kopfblutgeschwulst*. First described by Michaelis.

SYNONYMS.—Cephalæmatoma; ecchymoma capitis; ecchymoma capitis recens natorum; thrombus neonatorum; abscessus capitis sanguineus neonatorum; tumor capitis sanguineus neonatorum; cephalophyma; craniohæmatoncus.

DEFINITION.—An effusion of blood upon or within the crania of newly born infants.

VARIETIES.—Subaponeurotic, the simplest, but not the most common form—a bloody effusion immediately underneath the cranial muscles.

Subpericranial, situated between the pericranium and cranial bone—the most common form.

Diploic, situated within the diploë—a rare form, and differing from others in that it continues to bleed when laid open. (This is explained by the abundant supply of arteries and veins in the reticulated structure of the diploë.)

Subcranial, generally situated between the skull and dura mater, and sometimes in the cavity of the arachnoid. A case of triple cephalhæmatoma is reported by Oui; it appeared after an easy spontaneous accouchement; spontaneous suppuration and opening of the occipital tumor; puncture of the left parietal tumor (the larger one of the two parietal tumors), followed by rapid recovery; nonintervention with the right parietal tumor, which very slowly underwent resolution.

PATHOLOGICAL ANATOMY.—The scalp generally retains its natural aspect. Exceptionally its appearance becomes red and livid. Its substance remains uninjured, and the pericranium preserves its transparency. The effused blood is contained in a sac of fine membrane, having all the characteristics of condensed cellular tissue. It rests on the bone, from which it can be easily detached, and underneath the pericranium, to which it adheres more firmly. Points of ossification can be observed on the under surface of this membrane. The earlier writers thought that the outer table of the skull was necrosed, carious, and destroyed, and that the ruptured vessels of the diploë gave rise to the hemorrhage. A bony ring forms in the majority of cases. It begins as soon as the separation of the pericranium is arrested, which is about the second day. This has been said to be only a delusion of the sense of touch, but its presence has been demonstrated by numerous autopsies. It is not, however, always present, being absent in tumors situated near a suture. There are many theories as to its causation. The following, by Virchow, is probably not only the most beautiful, but also the most plausible: The healthy cranium grows by proliferation of the inner layers of the periosteum. If, then, the pericranium, through the blood which is poured out, is held apart from the cranium, the bone-forming layers of the periosteum being still thrown off, they cannot reach that part of the bone for which they are intended, on account of the presence of the blood. Eager, however, to fulfil their office, they join themselves to the bone at the border of the tumor where the bone is still attached. Bland Sutton reports a case which had occurred in a monkey. Autopsy showed the bony ring. Similar formations of bone are observed in rabbits subjected to experimental elevation of the pericranium.

ETIOLOGY.—The etiology has occasioned much discussion. The reception of some injury by the child during parturition was long thought to be the cause. A number of observers failed to note that it succeeded difficult labors. The tumor occurred on parts not liable to pressure. Cases are reported after breech presentations, after Cæsarean section, and after painless labor, and it has been observed that a narrow pelvis in the mother is an infrequent accompaniment. It occurs in premature births. These tumors form on children of advanced age and on adults; sixty-six and two-thirds per cent. of the cases are males. While it is very easy to imagine how pressure during parturition might cause the tumors, yet it is very evident that in a large proportion this is not the cause but that it must be some fault of the blood-vessels. Intracranial hemorrhage is in reality a form of apoplexy, and it is quite probable that the tendency is inherited. One case is on record in which the same mother gave birth to three children successively who had cephalhæmatoma. In a case reported by the author, the mother said: "Three of my other children died of convulsions, and I gave this one up as soon as they came on." These other children, too, might have had cephalhæmatomas, and there might have been an inherited tendency; or an unusual friability or thinness of the vessels, or incomplete development of the outer layer of the skull, might have been the cause. If cephalhæmatomas are caused by pressure in breech presentations, this must be due to the action of the cervix on the cord or neck of the child. Pressure during delivery undoubtedly has something to do with the causation of a considerable number of these tumors, yet there are many others which must result from a diseased condition of the blood-vessels, inherited or acquired. Heydecker reports a case which was due, in his opinion, to imperfect ossification of the cranial bones.

FREQUENCY.—The average, so far as it can be learned from the statements of authors, is 1 in every 235 children born.

LOCATION.—It is most frequently situated on the right parietal bone, then on the left, occasionally on the frontal, more rarely on the occipital and in the temporal regions.

DIAGNOSIS.—It is a disease of the newly born. Exceptions: One case has been reported in a child of six months, another in one of twelve months, a third in a man of twenty-six years, a fourth in one of thirty-six, and a fifth in a woman of forty-nine. These, however, are anomalies. One notices a tumefaction, usually one, two, or three days after birth. It develops gradually; it is of fluid character. It pulsates forcibly at the beginning, if connected with an artery; it loses this later, but fluctuation is always present. In size the tumor ranges from that of a hazelnut to that of a mass involving the whole surface of the parietal bone. The tumor is limited by the sutures in the three varieties situated between the pericranium and the dura mater; in the subaponeurotic and arachnoid varieties this is not so. The scalp is natural in appearance in the subaponeurotic variety. The bony ring is almost pathognomonic in the subpericranial variety, but is not so often present in those situated between the cranium and dura mater; in the other varieties it is absent. The diagnosis of internal cephalhæmatoma must be made from the symptoms of brain pressure, twitchings, convulsions, stupor, or paralysis which it may produce. The caput succedaneum occurs in the first twelve to thirty-six hours. Cephalhæmatoma is at birth either absent or scarcely noticeable, grows from day to day until, on the eighth day, it attains its full size, and then, perhaps, the bony ring can be felt. The caput succedaneum pits on pressure, while the cephalhæmatoma does not. From hernia cerebri congenita it may be distinguished by the fact that this pulsates, while cephalhæmatoma simply fluctuates; hernia cerebri, furthermore, is not found on the parietal bones, but on the sutures and fontanels; it protrudes during the acts of coughing and crying, is partly reducible, and then causes slight convulsions. The rim of bone resembles somewhat the elevated ring, but pressure of the finger on the tumor does not find a bony floor as in cephalhæmatoma. The skin over hernia cerebri is thin and hairless, in cephalhæmatoma it is normal. Fungus of the dura mater does not contain fluid, does not fluctuate nor feel doughy, has no bony ring, and the overlying skin is thick and blue. This form of tumor becomes smaller under pressure, and, besides, it seldom occurs in children. Atheroma and fatty tumors occur rarely at such a tender age. They can be differentiated by the trocar, but one must be careful to exclude hernia cerebri before using this instrument. There is no danger of confounding cephalhæmatoma with hydrocephalus externus, and the osseous circle will distinguish the former from aqueous cysts. Telangioma occupies the favorite seat of hæmatoma, but is not covered with hair, pulsates weakly, and is somewhat diminished in size by pressure.

PROGNOSIS.—For the extracranial tumors the prognosis is good, for the intracranial it is bad. Death takes place mostly from exhaustion, brain pressure, and secondary hemorrhage; from rupture of the tumor; from necrosis or caries of the bone leading to perforation; from thrombosis of the cerebral sinus; from extension of the inflammation into the meninges and brain itself; from absorption of ichorous discharge, and from pyæmia. Arthritis, phlebitis umbilicalis, pleuritis, scleroderma, intestinal hemorrhage, caries of the skull, and, in the internal variety, idiocy are among the results which may follow cephalhæmatoma.

TREATMENT.—Authors are divided; some follow the expectant, others the active plan. Some of those who use the knife wait till the eighth to twelfth day; a few make the incision earlier. The artificial evacuation of the blood is usually unnecessary, and may do harm; as a rule, non-interference is best. If pus forms it should be evacuated. Patton, in the case of his own son, aspirated on the twelfth day, removing twelve fluidrachms of blood. Result was good and Patton recommends it highly. For the external varieties, warm aromatic fomentations, cold spirit lotions, pressure, and setons have all had their day. As treatment in intracranial cephalhæmatoma has not yet been attempted; as the internal is almost always associated with the external variety, the latter being situated directly over the former, in the writer's opinion it would be advisable to trephine the skull to evacuate the tumor.

Edward Sydney McKee.

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CEPHALOCELE. See *Brain.*

CEPHALOMETRY; CRANIOMETRY. See *Skull.*

CEREBELLUM. See *Brain.*

CEREBRO-SPINAL INJURIES. (MEDICO-LEGAL.) See *Traumatic Affections. (Medico-Legal.)*

CEREBRO-SPINAL MENINGITIS, EPIDEMIC.—DEFINITION.—Cerebro-spinal meningitis (*μῆνιγξ*, a membrane) is an acute infectious disease, with its main local expression, as the name indicates, in the membranes of the brain and spinal cord. Two sets of symptoms distinguish this disease: one common to all the acute infections, and characteristic of general poisoning of the blood; the other peculiar to the local lesion in the coverings of the brain and spinal cord. The combination of these two sets of symptoms and lesions individualizes the disease.

SYNONYMS.—No disease has received so many names, while there is not one against which valid objection may not be raised. Of *cerebro-spinal fever* (Royal College of Physicians) it may be said that while it recognizes the general infection it fails to indicate the part of the brain and cord affected. Cerebro-spinal fever is neither clear nor classic. It is a term "which may be pardoned when used by the laity, but which educated physicians ought not to tolerate" (Stillé). More glaringly faulty, though with abundant recognition of the brain symptoms, are the designations of the older French authors: *Fièvre cérébrale, phrénésie, cephalalgie épidémique, meningite purulente epidémique*, with which may be cited also the German *Hirnseuche*, and the old English terms *malignant meningitis* and *epidemic meningitis*. The early erroneous view of the disease as a variety of typhus fever is perpetuated in the names *cerebro-spinal typhus, typhus cerebralis apoplecticus, typhus syncopalis, phrenitis typhodes, typhoid meningitis.*

The appearance of an hemorrhagic eruption, which characterizes the graver cases of nearly all the acute infections, has been more distinctly associated with this disease in the names *spotted fever* (Gallup), *petechial fever* (Wood), *malignant purpura* (McSwinney), *malignant purpuric fever* (Stokes,) *pestilential purpura* (Banks), *febris nigra* (Lyons), and in its association in this connection again with typhus as a *typhus petechialis* (North), and with a neurosis, as *neuro-purpuric fever* (Mapother). Moreover, cerebro-spinal meningitis, on account of its eruption, has not escaped inclusion under the all-embracing title, *black death* (A. Smith). As was correctly remarked by Minet, nearly a century ago: "It is quite unfortunate that a single symptom—petechiæ—and one that is wanting in a great majority of cases, should have been seized upon to give it the odious and deceptive name of spotted fever, as that name has been applied by European writers to a very different kind of fever."

The opisthotonos, perhaps the most striking single symptom of the disease, which is, however, by no means universally present, has been selected by the Germans to name the disease a *Genickkrampf, Genickstarre, Nackenstarre;* by the Swedes a *Nacksjucka, Dragsjucka;* and by the Italians a *torticollo.* Fancy has exercised its ingenuity in the title *cerebro-spinal arachnitis* (Mayne), a refinement totally unjustified in the morbid anatomy of the disease; and the limits of frenzy have been almost attained by the frantic efforts of Italian writers to cover the entire field of the disease with the names *tifo-apoplettico tetanico* and *febbre-soporoso-convulsivo.* Terms as delusive and diffuse as spotted fever are the popular names *congestive fever, winter epidemic,* and *cold plague.*

From this array of titles, which is by no means exhausted, may be appreciated the difficulty of securing a proper name for a disease from its symptomatology or pathology. The name *cerebro-spinal meningitis* (Hughes, Law, Banks, Moore, and others) is at present the least of all objectionable, and has hence, in the course of time, come into common use, though it gives undue prominence to the local lesion to the exclusion of the infectious character of the disease. As was observed by Valleix, it is "begotten of anatomical bias and an incomplete appreciation of the facts." Gordon attempted to cut the knot of difficulty by calling the disease *cerebro-spinal fever*, with *cerebro-spinal meningitis*, a combination too bulky for practical use.

HISTORY.—Epidemic cerebro-spinal meningitis is a disease of modern origin; perhaps it would be more strictly true to say of modern recognition, for previous to the nineteenth century there was no possible differentiation of this disease and forms of typhus fever, pernicious malarial fever, tetanus, and the various inflammations of the brain and cord, diseases known to be as old as the history of medicine. More recently Davis was justified in the statement that "in regard to the disease promiscuously styled 'spotted fever' and 'cerebro-spinal meningitis,' as reported in our literature, no less than three or four diseases have been confounded together" (Trans. Amer. Med. Assn., xvii., 1866). Hence the possibility is not to be excluded that cases, or even epidemics, of cerebro-spinal meningitis occurred in ancient times. Medical historians (Ozanam, Alpin) have made repeated endeavors to identify this disease with the *phrenitis* of Hippocrates, and with certain epidemics of ancient Egypt, or (Tourdes, Boudin) at least to find its most essential features in the later writings of Forestus, Ignassias, Felix Plater, and Saalman; but the references cited go further to show interest and assiduity in antiquarian research than to confirm their views.

It is, however, not just to claim that there could have been no possible recognition of this disease before the fifteenth century, when the first dissections were made of the spinal cord, for diagnoses in ancient times were wholly based on symptoms; but it is unreasonable to assume the distinct recognition of a disease whose symptoms were not separated from other acute infections or from purely local lesions.

It is generally conceded of cerebro-spinal meningitis that it first attracted notice as a separate disease in Geneva, February, 1805. Perhaps this first notice is due to the fact that the cases occurred in the practice of Vieusseux, an observer as keen as he was frank. He called the malady a *fièvre cérébrale ataxique*, and admitted that neither he nor his colleagues had ever seen a similar disease. These first victims were a woman and three children, two of whom died within twenty-four hours. The disease extended gradually to neighboring houses, in one of which four out of five children were attacked, and died within fifteen hours. It was characterized by suddenness of attack, vomiting, excruciating headache, stiffness in the back of the neck, dysphagia, and convulsions (Laveran, "Dict. encyclop. des sc. med.," 2d ser., 5 to 6, p. 648). A young man in an adjoining house died on the same night of the attack, showing a violent discoloration of the whole body. Thirty-three persons fell victims to this first outbreak of the disease, which lasted until May. The post-mortem examinations made by Mathey upon some of these cases revealed gelatinous exudation covering the convex surface of the brain, yellow pus posteriorly and about the optic commissure, cerebellum, and medulla oblongata. It is remarked of this first attack that it remained quite strictly localized.

The next outbreak of the disease, with unmistakable signs, occurred in our own country, with the first cases at Medfield, Mass., March 1806. These cases formed the preface to a long chapter in the history of the disease, known then as "sinking typhus," ten years in duration, during which time it extended over, but remained confined to, the New England States. Meanwhile the disease made its first appearance in France, at Grenoble, where it prevailed during the months of the spring of 1814, remaining confined to the soldiers lately arrived from the army of Mont Blanc. Comte describes it as a malady characterized by stiffness of the neck, with headache and delirium among its prominent symptoms, with traces of inflammation in the brain and cord observed on autopsy among its lesions. During the next year, Rampont described four cases at Metz, distinguished by the same array of symptoms and lesions. With the exception of an extensive endemic in Vesoul, in 1822, which differed from previous attacks in its preference for the civil population, the disease did not show itself again in France until January, 1837, when it broke out with great virulence in the garrison at Bayonne, and rapidly extended to invade the neighboring barracks at Dax, Meignon, and Tartos, and to assume, later in the course of the year, epidemic proportions, reaching Bordeaux by December of the same year; Rochefort, January, 1838; and Nîmes and Avignon, in the interior, by the end of the year. It is remarked of this outbreak, at a place appropriately named Aigues-Mortes, where it first appeared in November, 1841, remaining confined to the civil population, and continuing until March, 1842, that it attacked 160 persons of whom 120 died.

The same regiment of light infantry which transported the disease from Bayonne to Rochefort conveyed it also to Versailles, where it appeared in February, 1839, six men inhabiting the same room being attacked within a period of a few days. Paris made its first acquaintance with the disease, after the lapse of several years, in December, 1847. It continued to prevail in Paris up to May, 1849, confined exclusively to the inmates of the garrison and the prisoners at La Force, in which latter place ten of the twelve persons attacked fell victims to the disease.

After France, Italy was invaded, the disease first appearing in the kingdom of Naples, in the winter of 1839–40, and spreading thence, in the following winter, to the lands of the church. In the same year (1839), the most eventful in the history of the disease, as that from which dates any exact knowledge concerning its nature and individuality, cerebro-spinal meningitis first showed itself in Algiers, where it continued to number victims with annual recurrence in various parts of the land up to 1847.

After the first recognized appearance of the disease, from 1805 to 1816, accounts of it cease for six years, when, in 1822, it reappeared at Vesoul, in France, and at Middletown, Conn., to which remotely separated places it remained quite strictly confined. Then, after an additional five years, it again showed itself, in 1828, in Trumbull County, Ohio; in 1830 in Sunderland, England, and in 1833 at Naples. In 1842, when the disease again visited the United States, it appeared almost at the same time in Louisville, Ky.; Rutherford County, Tenn.; and Montgomery County, Ala.

Sweden was not reached by the disease until 1854, when it suddenly appeared in Gothenburg, extending thence in the course of the following year as far north as the city of Kalmar. Then, after a complete cessation of six months, it showed itself in a series of small epidemics extending a degree and a half farther north, and with this fitful, almost freakish appearance and disappearance, it hovered about that country for seven years, striking lightly in one place and like lightning in another, until it had killed in all 4,138 of its inhabitants. It was only during the last two years of this visitation of Sweden that the disease first showed itself in Norway (March, 1859), in very limited extent, but in such severe degree as to have carried off in the county of Opdal 14 of the 29 persons attacked.

Strange to relate, the first invasion of Germany did not occur until very late in the history of the disease. Disregarding as unauthentic the earlier communications of Würtemberg physicians, Hirsch feels compelled to accept the statements of Rinecker, who reports with due detail cases occurring in Würzburg, June, 1851, both in hospital and in private practice. But the first attack of any severity or extent was reserved for a later date and place, namely, for Silesia, Posen, and Pomerania, in 1864. Excepting Bamberg, anything like alarming proportions were not reached anywhere in Germany, though the disease prevailed with some severity at Erlangen, in July, 1864.

The comparative exemption of certain countries is another, and as yet inexplicable, feature of the disease, more especially of countries contiguous to and under the same general conditions as those severely visited. Thus while Ireland has suffered repeated attacks—a severe epidemic having occurred in Dublin, in 1866, wherein "the British forces suffered much in proportion to their average strength"—England has never had anything more than isolated cases, and Scotland, where the elements of crowd-poisoning are greatest, has never experienced an epidemic of the disease. And while epidemic proportions have been reached in Germany on the north, and in Italy on the south, Austria has remained almost entirely free from attack.

Our own country seems to have offered from the start a fertile soil for the development and spread of cerebro-spinal meningitis, and since the year 1842, when the disease began to make excursions over the various lands of Europe, it has become almost indigenous with us. Mention has been made already of the simultaneous occurrence of the disease in Alabama and Pennsylvania, in 1848. In the following year it made its first appearance in New Orleans, and during the following decade sporadic cases occurred over various parts of the country, as in North Carolina, in 1856, and Massachusetts, in 1857. Four years later (1861), more and more frequent cases are reported, from Connecticut, Indiana, Kentucky, and Missouri. Three years later still (1864), the disease again appeared in Pennsylvania, carrying off 400 children of the 6,000 inhabitants of Carbondale. It was during