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P. H. POPE

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MODEL FOR ILLUSTRATING CELL DIVISION

Filed Oct. 2, 1922

Fig. 1,

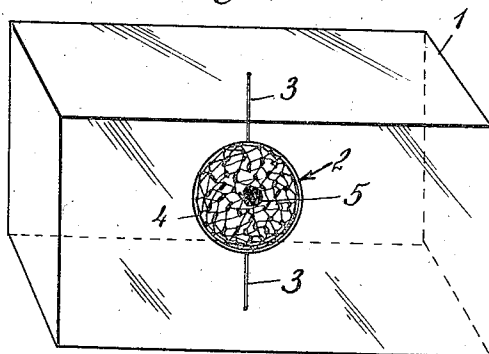


Fig. 2,

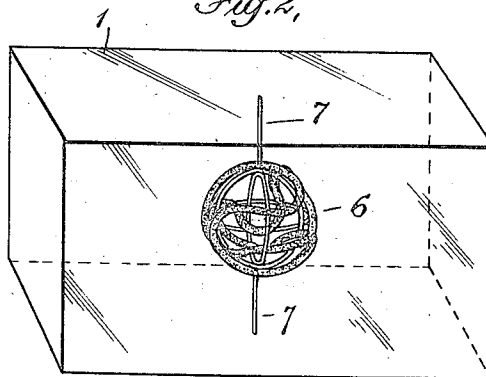


Fig. 3,

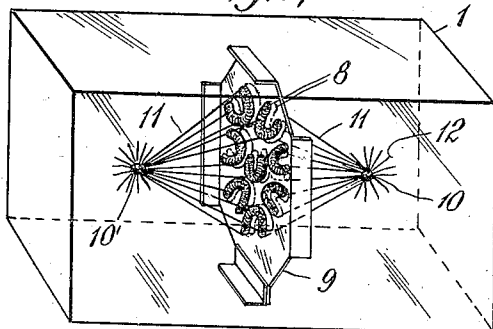


Fig. 4,

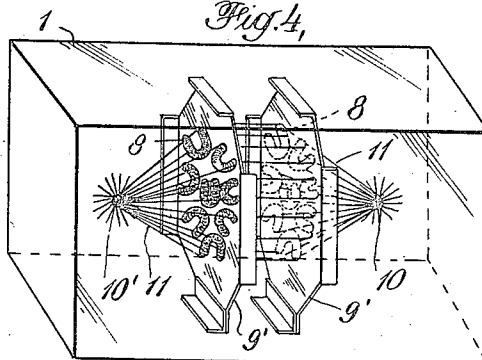


Fig. 5,

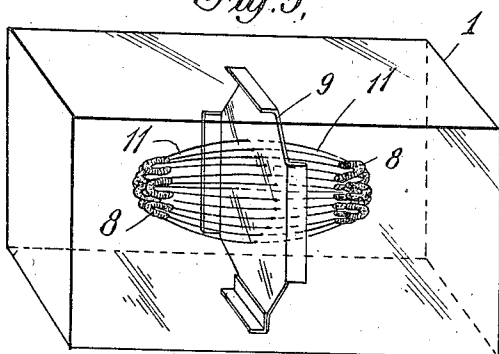
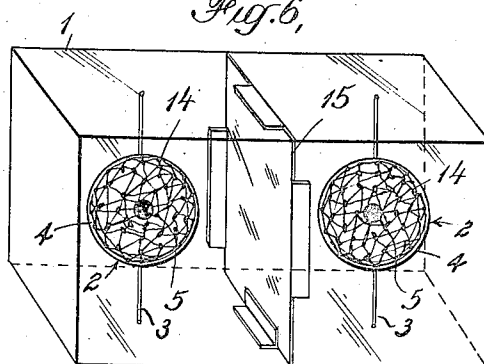


Fig. 6,



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MODEL FOR ILLUSTRATING CELL DIVISION.

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To all whom it may concern:

Be it known that I, PHILIP HUNTLEY POPE, a citizen of the United States, residing at Portland, in the county of Multnomah, State of Oregon, have invented certain new and useful Improvements in Models for Illustrating Cell Division; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

This invention relates to transparent models, and more particularly to transparent models designed for the purpose of illustrating cells. The principal object of the invention is to provide a series of cell models showing the successive stages in the process of cell division.

It is well known that, as a rule, a single cell is microscopic in size and consists of several distinct parts. The cell comprises a cell wall containing a semi-fluid or jelly like substance or cytoplasm, and a central body, or nucleus. The nucleus is surrounded by a thin membrane, and contains a jelly like substance slightly different from the cytoplasm. The nucleus usually, though not always, contains a small body, the nucleolus. A fine net work runs through the nucleus and supports a multiplicity of fine granules, or thread like bodies of a substance that stains readily with acid dyes, hence, it is called chromatin. A small body, called a centrosome, lies outside the nucleus.

At the beginning of the division process the centrosome divides in two; the two new centrosomes draw apart and become surrounded with thread like structures radially disposed with respect to the centrosomes. Some of these threads extend from one centrosome to the other and form a spindle shaped figure. Meanwhile, the chromatin gathers into a single coiled thread gradually increasing the size. This thread finally breaks up into a number of rod like bodies called chromosomes (color bodies). The chromosomes then become arranged in a sort of disc or plate transverse to the long axis of the cell, the centrosomes having drawn to the opposite poles of the cell. At this point a striking change takes place in the cell structure. Each chromosome splits longitudinally into exact halves, and one-half is drawn toward each pole

along the spindle fibers or threads. The chromosomes cluster around the centrosomes and then the body of the cell begins to divide. When this division becomes complete the two new cells are completely formed. The spindle fibers have disappeared and the new cells appear exactly the same as the original cell.

This process of cell division occurs in all the cells that make up the bodies of plants and animals. Accordingly, the subject of cell division must be taught in all biology courses. As the subject is ordinarily taught the student is given specimens to view under a microscope, and is provided with charts and drawings illustrating the various stages in division process. In the ordinary method of teaching this subject the student is able to see the illustrations of the cells in two dimensions only, and it has been found that the student oftentimes gets a wrong impression of the true nature of the cells, due to this representation in two dimensions only.

Accordingly, one object of the present invention is to provide representations of a cell in different stages of cell division, making them of such size that all of the details can readily be seen and examined from any angle. The main purpose of the invention is to provide transparent cell models which may be used to supplement either the microscopic slides in the laboratory or the blackboard sketches and lantern slides on the lecture platform. Various other objects will be apparent from the following detailed description which is to be taken in conjunction with the accompanying drawings.

In the drawings:

Fig. 1 is a perspective view of a model representing a typical cell in the resting condition;

Fig. 2 is a perspective view of a model representing the prophase of cell division;

Fig. 3 is a perspective view of a model representing the metaphase of cell division;

Fig. 4 is a perspective view of a model representing the anaphase of cell division;

Fig. 5 is a perspective view of a model representing a later anaphase of cell division than that shown in Fig. 4; and

Fig. 6 is a perspective view of a model representing the completion of the process of cell division.

By referring to the drawings and more

particularly to Fig. 1 it will be noted that the cell models comprise a transparent prismatic box 1 representing the cell wall, and enclosing the nucleus 2. The cell wall 1 may be made of celluloid, glass, or other suitable transparent material. Celluloid has been found to be superior to glass due to the fact that the celluloid is tough and durable. The shape of a cell is typically spherical, but in animal or plant tissues the pressure of contiguous cells usually renders it polyhedral, and in many of the membranes of the body it takes the shape of a prism. The square prismatic shape illustrated in the drawings represents a possible shape of a cell, this particular shape being chosen for its ease of manufacture, and also because models of this configuration may be easily packed for shipping, and will not roll off a table or desk. It is to be understood that octagonal, hexagonal, spherical and other shapes may be used, if it is so desired.

As shown in the drawings, the nucleus 2 is suspended in the center of the model by means of two members 3. These members 3 may be made of strips of celluloid, or the nucleus may be suspended by other suitable means.

The nucleus 2 comprises a nuclear membrane 4 of transparent material, such as celluloid, or glass; this membrane being spherical in shape. The space within the nuclear membrane is filled with a net work of fibers having granules of a dark substance supported thereon. The linen fibers, or net work within the nuclear membrane, may be made of slender strips of celluloid cemented together with acetone, or they may be made of spun glass. The granules representing the chromatin may be made of a thick solution of celluloid in acetone and colored in any suitable manner. Wax or other plastic substances may be used also for the purpose of representing the chromatin. The dark body 5 shown in Fig. 1 represents the nucleolus. This nucleolus 5 may be made of wax and colored blue or any other suitable color. It may be supported within the nuclear membrane by means of the linen fibers.

The model shown in Fig. 2 represents the prophase of cell division. From the drawing it is apparent that the model shown in Fig. 2 is similar in all respects to that shown in Fig. 1, except that the chromatin is gathered into a thick thread 6 coiled within the nucleus and called the spireme; and the linen fibers and nuclear membrane shown in Fig. 1 have disappeared. The spireme thread 6 may be made of a slender rod of paraffin warmed and bent into position, the thread being held in place by a frame work of strips 7 of celluloid cemented with acetone.

The model shown in Fig. 3 represents the metaphase and shows the spireme thread broken up into a definite even number of chromatin bodies 8, these bodies having split longitudinally into halves and arranged themselves in a plane transverse to the long axis of the cell. The number of chromosomes 8 shown in the drawings is eight, but this number may be varied in different series. The chromosomes 8 are supported in the center of the model by means of a transparent plate 9 supported by the cell wall. This plate 9 may be made of celluloid or other suitable transparent material and may be fastened to the cell wall in any suitable manner. Two centrosomes 10 and 10' are shown disposed near the ends of the cell. These centrosomes are supported by a plurality of fibers 11 connecting them with the chromosomes and representing the spindle fibers which exist in the cell at this stage of cell division. One fiber goes to each chromosome and accessory fibers run parallel to these and interconnect the centrosomes 10 and 10'. Short fibers 12 extend out radially from the centrosomes.

The chromosomes 8 may be made of paraffin or other plastic material and may be attached to the plate 9 by any suitable means. For example, if the plate 9 is made of celluloid, the chromosomes may be attached thereto by means of Canada balsam or other adhesive. The spindle fibers 11 may be made of fine wires and the centrosomes 8 of wax or other suitable material. The plate 9 is merely for the purpose of support and does not represent any part of the cell.

The centrosomes 10 and 10' may be omitted and the fibers fastened in some other way if it is desired to represent a plant cell in which the centrosomes do not occur. For example, the fibres may be brought together and held in place by a suitable cement, such as celluloid acetone.

The model shown in Fig. 4 shows the anaphase, the chromosomes 8 having begun to migrate toward the poles of the cell, leaving the fibers 11 stretched between them. Two diaphragms or plates 9' are used for the purpose of supporting the chromosomes. The structure of this model is substantially the same as that of the model shown in Fig. 3. The fibers 11 extend from the centrosomes 10 and 10' to the chromosomes 8 and interconnect the latter. The different parts of the model of Fig. 4 are composed of the same materials as the corresponding parts of the model shown in Fig. 3.

The model shown in Fig. 5 shows a later anaphase than that shown in Fig. 4. In Fig. 5 the chromosomes 8 have drawn together at the two poles, and the centrosomes have disappeared. The fibers 11 extend between the chromosomes forming a spindle

shaped body. The parts of the model shown in Fig. 5 may be made of the same materials as the corresponding parts of the other figures. The plate 9 supporting the spindle fibers 11 is merely for the purpose of support and does not represent any part of the cell.

Fig. 6 shows a model representing the completion of the division process, the two new cells being completely formed. The chromosomes are broken up into granules 14 that are scattered through the two nuclei on linen fibers as in the resting cell shown in Fig. 1. The nucleoli 5 have reappeared. The plate 15 represents the cell wall which has formed across the equator of the original cell thus dividing the original cell in two.

It is to be understood that the size and proportions of the various parts may be varied as desired, or special features may be added. For example, the hereditary characters of some cells may be shown on the chromosomes. For instance, the hereditary characters of *Drosophila* may be represented by painting the chromosomes in rings of different colors. The beaded appearance seen in the chromosomes of some forms could be represented by making these structures of strings of beads on wires.

It is to be understood that the term "plastic materials", applied to the materials of which some of the various parts are made, is intended to include all plastic compositions such as wax, paraffin, celluloid, and glass,—glass being plastic at high temperatures.

I claim:

1. A model of the type described comprising a cell wall consisting of transparent material, and plastic bodies within the cell wall representing the other parts of the cell.

2. A model of the type described comprising a cell wall consisting of transparent material, plastic bodies within said cell wall representing the inner parts of the cell, and means for supporting said plastic bodies within the cell wall.

3. A model of the type described comprising a cell wall consisting of transparent material, and a nucleus comprising a plurality of plastic bodies.

4. A model of the type described comprising a cell wall consisting of transparent materials, a nucleus comprising a plurality

of plastic bodies and means for supporting said nucleus within the cell wall.

5. A model of the type described comprising a cell wall consisting of transparent material, a nucleus comprising a plurality of plastic bodies, and a transparent casing enclosing said plastic bodies and representing the nuclear membrane.

6. A model of the type described comprising a cell wall consisting of transparent material, and a nucleus comprising a plurality of thin strips of plastic material representing linen fibers, a plastic body representing the nucleolus and granules representing the chromatin.

7. A model of the type described comprising a cell wall consisting of transparent material, and a nucleus comprising a plurality of thin strips of plastic material representing linen fibers, a colored body representing the nucleolus, chromatin granules consisting of celluloid dissolved in acetone, and a transparent casing representing the nuclear membrane.

8. A model of the type described comprising a cell wall and a membrane fixed to said cell wall for supporting bodies representing the inner parts of the cell.

9. A model of the type described comprising a cell wall consisting of transparent material, a membrane fixed to said cell wall, a plurality of wires supported by said membrane and representing the fibers of the cell.

10. A model of the type described comprising a cell wall consisting of transparent material, a membrane fixed to said cell wall, a plurality of wires supported by said membrane and representing the fibers of the cell, a plurality of plastic bodies in contact with said wires and representing chromosomes.

11. A model of the type described comprising a cell wall consisting of transparent material, a membrane fixed to said cell wall, a plurality of wires supported by said membrane and representing the fibers of the cell, a plurality of plastic bodies in contact with said wires and representing chromosomes, and a plastic body at each end of said cell representing a centrosome and forming a center from which the fibers radiate.

In testimony whereof I affix my signature.

PHILIP HUNTLEY POPE.