PHYSIOLOGY

Body Cells Follow Pattern Seen in the Bees' Honeycomb

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(In presidential address before the American Association of Anatomists at Toronto.)

THE bodies of animals and plants are built of cells which are primarily liquid drops. We begin our existence—turning a deaf ear to Aristotelian and scholastic dialectic—as a spherical drop of liquid. We arise as a cell which has the form of a soap bubble or rain drop. The wonderful globular form of a drop of rain is due to an enveloping skin, which has the properties of a stretched elastic membrane. Robert Boyle, in 1676, warily let fall some drops of oil into rectified spirit supernatant to a solution of niter, thinking to explain the structure of the universe. It was the beginning of physical and chemical studies of the tension which abides in the external layer of the drop, whereby the drop constantly strives to contract and occupy the least possible space. It makes a handsome sphere of the egg yolk or the smaller rabbit's ovum, both of which are single initial cells.

The first drop then divides into a pair, Siamese twinned, joined to one another by a membrane of the same tension as that which covers their exterior. More divisions follow, resulting in a cluster of liquid drops, arranged in accordance with laws established by the Belgian physicist, Plateau, in his masterly study of soap suds (Statique des liquides, 1873). Three films, belonging to three bubbles, meet along every edge: six films, belonging to four bubbles meet at every corner. Hence, as shown by Lord Kelvin, an entire bubble, surrounded by other bubbles of the same size and filling space without interstices, will have 14 facets of contact with its neighbors. If the tension of its walls keeps its surface minimal, it will have eight hexagonal facets and six square facets. Cells of elder pith show a recognizable approach to this ideal pattern. Other cells of plants and animals, more irregular in size and arrangement, likewise present the average of 14 facets, though diverse in outline. There are many pentagonal faces. This outcome is a mathematical necessity for liquid drops in masses when obedient to Plateau's laws.

When tension causes three facets to meet at every corner of the faceted drop (and any other arrangement is unstable) then the total number of sides of the polygons covering a cell will be twelve less than if they were all hexagons. In a cube, three faces meet at every corner; the six squares which bound the cube have twelve sides less than six hexagons. This will apply to every cell with 3-rayed vertices, as, for example, to the 14-hedron with its eight hexagonal and six square faces. It is a corollary of Euler's famous theorem for all polyhedra, invented by the eminent Swiss mathematician in 1752.

Under these conditions the cellular mosaic, forming, for example, the epidermis of a cucumber, or lining the human intestine, will approach the hexangular pattern of honeycomb. As the cells grow and divide, pentagonal and heptagonal elements are introduced, but the average of six sides is maintained along the tube. Whenever an element is pushed out, regardless of its number of sides, and the gap is closed with none but 3-rayed vertices, the mosaic loses just six sides. When, by division, a new cell is added, having any number of sides but making 3-rayed vertices only, the mosaic will gain six sides. Under these stringent mathematical requirements, cells present an array of beautiful patterns, complicated by the development of spaces at the corners and edges, where the tension that makes cells round prompts them to separate most readily. For all these patterns there is a simple hydrostatic basis. Cells are fundamentally liquid drops—gland lobules and vascular units are larger drops—all subject to Plateau's law and to the corollary of Euler's theorem for polyhedra. Thus neatly, in making cells and glands, "nature Geometrizeth and observeth order."

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MEDICINE

Mass Attack on Cancer Will Be Made by New Foundation

A MASS attack on cancer is now in prospect as a result of the creation of the Finney-Howell Cancer Foundation in Baltimore.

This research foundation, provided for in the will of Dr. George Walker, eminent cancer researcher who was himself a victim of the disease, is unlike most other foundations for scientific research. Instead of perpetuating itself and devoting only the income of the fund for research, the entire principal and income of the foundation is to be spent within ten years.

The foundation is not a cancer institute. It will have no laboratories of its own. Its money, according to the terms of Dr. Walker's will, is to be used to establish a number of fellowships in cancer research, each with an annual stipend of $2,000. The fellowships will be established in whatever laboratories or universities the world over are approved by the board of directors. Wherever a hopeful idea on cancer research and the man to carry it out can be found, the foundation will be ready to give support in the shape of either a fellowship or a grant-in-aid.

Man's fight against cancer will therefore be given the added impetus of a body of scientific shock troops destined for destruction within ten years.

Hope that these shock troops or cancer workers elsewhere will turn the tide of victory over cancer is seen in the fact that Dr. Walker provided for other use for the funds if a successful treatment of the disease is found by these or any other researchers within the ten-year