BIOLOGY

Visits to the World of Cells

Ingenious Combination of Microscope and Projection Lantern Shows One-Celled World in Living Pictures

By DR. FRANK THONE

WHEN ALICE went down the rabbit hole into Wonderland, she found herself in a world where size went topsy-turvy. By going through the proper magic rites, she alternately made herself a giantess, and then a dwarf so small that a toadstool towered like a high tent, and a caterpillar was as large as herself.

Visitors to the wonderland housed in the great blue-towered Hall of Science at the Century of Progress exposition in Chicago find themselves in a world where sizes of things have taken even greater liberties with themselves. Alice's changes of big and little all took place in the world of visible objects, but here we find the invisibly small suddenly grown gigantic. Single cells loom big as bushel baskets, microscopic animalculae are as large and as lively as jackrabbits. The biologists have gone Lewis Carroll one better, and have given modern Alices—and their brothers—eyes as good as microscopes.

Dramas in a Drop

Probably the most-sought-for of all the exhibits in the biology section of the Hall of Science is the micro-vivarium, presided over by Dr. George Roemmert, formerly of the University of Munich, now of Columbia University. The popularity of this display is easily understandable, for the creatures which Dr. Roemmert shows are alive, and by the magic of a clever combination of projection lantern and microscope, he throws their living images on the screen thousands of times their natural size, so that people who never have looked through a microscope, never imagined the existence of such creatures, can watch the fascinating, often tragic, dramas that go on in the little animal world that lives in a drop of water.

Basically, Dr. Roemmert's magic is very simple: it consists in substituting a thin layer of water containing a collection of one-celled plants or animals for the conventional stereopticon slide, and magnifying the image up to suitable size. But there is hard work behind this simplicity. The tiny creatures are very tender and sensitive, and they must be properly fed and handled, protected against the harmful rays in the fierce glare of the arc light used in the apparatus.

Dr. Roemmert has spent some fifteen years perfecting his methods, so that his display is as different, to use his own phrase, from the ordinary efforts to project living images on the screen as a fully developed zoological garden or aquarium is from the old-fashioned birdcage or goldfish bowl.

Trumpets, Slippers and Globes

In the large double booth assigned to the micro-vivarium there are six of the projectors, which throw their living pictures as four-foot circles of light on the walls. Each projector consists of an arc-light as illumination source, a train of lenses and a vessel of liquid to direct and cool the light, a mirror to direct it up through the slide of living creatures into the powerful lenses of the microscope, and finally a second reflector which throws the moving image on the screen.

And what a world of astonishing life the German scientist displays before your eyes, as he slips one slide after another under the object-lens of the microscope! One-celled animals shaped like trumpets, like slippers, like little globes, whirling and swimming and darting across the brilliantly illuminated field, while Dr. Roemmert delivers a rapid fire of comment, and points out the stars in his little drama of the microscope. Here is a trumpet-animulcule that has swallowed a tiny worm, an animal higher in the evolutionary scale than itself. Here is the transparent larva of a mosquito, obligingly showing the wave-like motions of the walls of its digestive tract. Here is the equally transparent water-flea, showing its rapidly beating heart, and even its cluster of unborn young water-fleas in its brood-pouch. Here is the fresh-water hydra, which produces offspring by throwing out branches, exactly as a plant branches, and then letting go of them. Here is a larger view of the same hydra, showing a whole population of parasitic beastlets crawling about on it, like fleas on a dog. Here is a spinning colony of the primitive plants called *Volvox,* a swarm of dancing vinegar worms, the grotesque larvae of damsel-flies and day-flies.

Fierceness and Flesh-Hunger

But the part of Dr. Roemmert's "show" that gets the most fascinated attention from the crowds is a veritable Roman holiday of the microscopic world, a display of fierceness and flesh-hunger on the part of invisibly small one-celled creatures that is as awesome as though they were tigers or leopards.

First Dr. Roemmert shows you his little beasts of prey—small, apparently completely round objects that swim about actively but do not look at all formidable. Indeed, they look more like a lot of rolling marbles than anything else. But each of them has a tiny, nose-like beak, which it can use most effectually when occasion demands.

Then he displays a screenful of the animals that are to be the victims in the coming show; they are the common, harmless one-celled creatures called slipper animalculae or, more learnedly, *Paramecium.* They are larger than their prospective devourers, but as defenseless against them as cattle are against leopards.

Dr. Roemmert now pushes the edges of the two slides together, permitting the liquid drops under each to mingle with the other. The round animalcules mingle with the slipper-shaped ones. There is a second's swimming about, as they orient themselves, and then, with a ferocity that makes you shudder, each predatory beastlet selects its victim, seizes it with an unshakable grip, and proceeds to devour it alive. Sometimes two will seize the same victim at opposite ends and eat away until they meet in the middle. Then they let go and pursue their separate ways. The predators never fight each other, and, strange to say, never attack anything but just one species of victim.

Dr. Roemmert explains, with considerable emphasis, that he is not running a commercial exhibit of any kind. He is not selling the projectors he uses, nor

any of the parts used in making them. He is interested only in promoting the idea of using this type of projection in educational work and for the interest of the general public. He believes, as do all educators who have seen his exhibit, that this method can be used with great advantage in school and college classrooms, and for popular lectures and demonstrations as well. Various types of projectors can be had at reasonable prices, or if you have a microscope and an old-fashioned stereopticon lantern you can even build one yourself. But to deal with the animals you will need patience and experience.

Other fascinating biological exhibits in the Hall of Science win their crowds not because they are alive, but because they are so ingeniously constructed that they seem to be alive. Prominent among these is one showing just three cells of a green plant, painted out so huge that the tiny green color-disc or chloroplasts in them show up as big as soup-plates. These cells demonstrate the processes that go on in all green plants, in the manufacture of food and in its use by the plant itself.

Trains of moving light-flecks, projected against the transparency from behind, show the courses followed by water, oxygen and carbon dioxide in the vital economy of the plant. One set of these moving light-flecks shows how carbon dioxide enters the cell and passes into the chloroplast. Into the same chloroplast water is also being absorbed. The sun shines upon it, and the carbon dioxide and water unite in the presence of the green color-stuff, chlorophyll, to form sugar, the foundation of all foodstuffs. Out of the chloroplast comes oxygen, which passes from the cell.

All this illustrates but one of the two outstanding vital processes that takes place in the living plant cell. The other is the reverse, consisting of the use of food in respiration. Into the same cell you see another train of moving flecks passing, representing oxygen, this time going in, not coming out. In the cell it combines with sugar or other food, releasing energy for the use of the plant. The products of this chemical reaction are carbon dioxide and water, which are shown passing from the cell.

Thus plant cells, unlike animal cells, both make food and use it up. It is their trick of taking in carbon dioxide, which animal cells do not do, that led to the old-fashioned botanical heresy that the respirations of the plants and animals are opposite processes. Plant and animal respiration are exactly alike: the intake of oxygen, its combination with food, the outgo of carbon dioxide and water. The opposite process, which plant cells alone carry on, has nothing whatever to do with respiration: it is the building of food which respiration eventually uses up. This graphic display in the Hall of Science should do something toward the correction of the ancient error.

Another exhibit, showing cells on a smaller scale but more of them, is an exact reproduction of a bit of corn leaf, shown as though in cross-section under a gigantic magnifying glass. It shows the layers of skin-cells on top and bottom, the masses of green food-making cells between, the mouth-like openings that control the plant's intake and outgo of gases and water vapor, and the complicated structure of the veins that carry water and dissolved foods—the plumbing and supply pipes of the plant. The realization that every corn plant in the millions of acres now growing in the Midwest repeats this same structure millions of times, not to mention similar repetitions in other green plants everywhere, is a bit dizzying when you stop to think about it.

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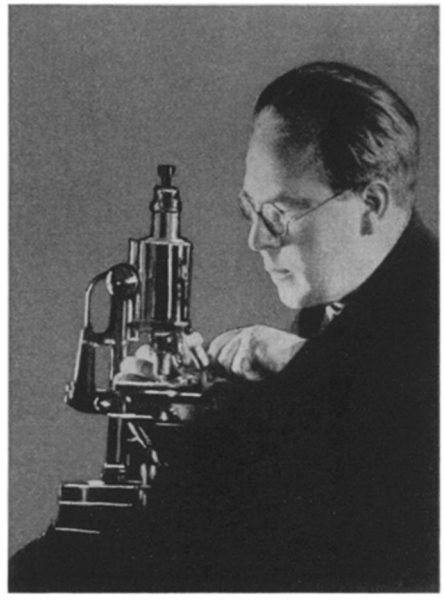

DR. GEORGE ROEMMERT

His "Microvivarium," which projects enormously enlarged images of living microscopic plants and animals on a screen, is a prime attraction of the Hall of Science at the Century of Progress. It has given thousands who have never looked through a microscope their first view of the amazing life that can be found in a drop of water.

PSYCHOLOGY

Most Intelligent College Men Choose Most Intelligent Mates

THE OLD idea that men prefer "dumb" women for wives is disproved by a study made by Wesley Carroll, graduate student at Iowa State College, under the direction of Dr. M. F. Fritz.

Intelligence ratings of boys and girls whose engagements were announced in the college newspaper show that the men tended to choose girls of equal or superior intelligence, either intentionally or unintentionally.

Nearly 200 announcements of engagements were collected from the files of the newspaper. For 126 of the couples, the scores which both boy and girl made in the college aptitude tests were available.

The men tended to choose women who were mentally equal or superior, Dr. Fritz said, explaining that when the rating of each boy was compared to that of his intended wife, a slightly positive correlation was discovered.

Of the 126 cases, 51 high ranking boys became engaged to high rating girls and 34 low rating boys became engaged to girls with high intelligence ratings. Twenty-six high rating boys became engaged to low rating girls. Fifteen low ranking boys chose girls of similar intelligence rank.

The study also indicated that more engagements were made among the students of high intelligence than among the ones with low ratings but this assumes that no selection in the reporting of engagements has occurred. Dr. Fritz suggests it is possible that the more intelligent students may be confident of their ability to make a living and a success of life.

Similar results were obtained a few years ago at Kansas State College where such a test was conducted, Dr. Fritz said.

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