

## BIOLOGY

# Life in a Drop of Water

Unnoticed by the casual observer, tiny one-celled creatures of fragile beauty and destructive powers are born, reproduce and die in teeming microcosmic worlds.

By BARBARA TUFTY

See Front Cover

► WHERE A DROP of water is a universe, billions of tiny organisms pulsate with the ancient struggle of life, survival and death.

Some of these almost infinitesimal creatures have helped feed man and the higher animals. Some have helped destroy him. But all carry on complex activities that have persistent impact upon the environment and life on earth.

These one-celled plants or animals or a mixture of both have vast, intricate ranges of shapes, sizes, and habits of feeding, resting, moving and reproducing. The life span of one of these individuals may be only a few hours or less, yet this life is packed with dangers and experiences similar to those encountered by larger living things.

## Many Small Worlds

Their tiny worlds are all around us—in a puddle of mud, in rain-filled hollows of old trees and stumps, under a flower pot, in a piece of cheese, along running brooks and rivers or melting glaciers and hot steaming springs, in stagnating swamps and in huge salty oceans—as well as in the bloodstreams and tissues of animals and man.

Billions of protozoa, *Aulonia hexagonia*, about one-eighth of an inch in diameter, float in the warm Atlantic Ocean. Each single-celled creature makes a sphere of fragile glass spikes around its soft cell, as seen in the model on this week's front cover.

Scientists used to divide all earthly living things into two basic kingdoms—plants and animals. An organism is considered a plant if it is rooted or attached in one place and contains green-pigmented chlorophyll that enables the cell to manufacture its own food from available chemicals and gases in the presence of sunlight. An organism is classified as an animal if it imbibes or eats its food particles and has some sort of structure like a foot, whip, fin or wing with which it can move from one place to another.

But scientists often find the line between plant and animal not so clear in the lower organisms. For instance, the one-cell *Euglena* has both plant and animal characteristics: chlorophyll for making its own food and also a whip-like structure to propel it through the water. So a new system was devised to classify individuals in this in-between group. They are called "protists" and become the third major kingdom of living things.

Most of these unicellular organisms are

made of the basic material of life called protoplasm, surrounded by some sort of cell membrane or wall. This protoplasm is a jelly-like substance containing such vital materials as water, proteins, carbohydrates, fats, pigments, vacuoles and mitochondria that help convert food molecules into more readily usable energy needed for the life processes of the organisms.

The complex cell activities are usually coordinated by a center or nucleus with the all-important molecules deoxyribonucleic acid, DNA, and ribonucleic acid, RNA. These molecules bear the coded hereditary information by which each organism reproduces itself, either by fission splitting to form two new organisms or by sexual reproduction to create new offspring.

Some of the smallest protists are bacteria, the tiny single-celled organisms found nearly everywhere, existing in hot spring waters or in the eternal snows of the polar regions, riding the atmospheric dust or inhabiting the throats, intestines and other organs of human beings. There are about 1,600 species of these creatures, some of which are spherical, some cylindrical and some shaped in spirals.

Most bacteria are harmless and even beneficial to man, rapidly breaking down chemicals of their environment to form rich humus for the forests or to make man's food such as cheeses, sauerkraut or pickles. Yet several bacteria get their life food and energy by breaking down tissues of the living body, thereby causing such diseases as diphtheria, tuberculosis, pneumonia and tetanus.

## Viruses Extremely Small

Some organisms, the viruses, are so small they can be seen only with an electron microscope. Scientists do not agree as to whether they are living or non-living, since some crystalized forms are capable of infecting living tissues. So tiny that 2.5 million can be placed side by side in a row an inch long, viruses consist mainly of nuclear material and some sort of protein covering, without any of the recognizable structures of the generalized cell.

Viruses are able to duplicate themselves only within a living cell, into which they filtrate to cause more than 60 diseases of man, animals and plants, such as measles, rabies, influenza, polio and smallpox.

Some of the oldest living things on earth are the blue-green algae, which are so primitive they have no distinct nucleus or chloroplasts. Sometimes these single-celled blue-green algae join together to form slender filaments that ripple in fresh ponds and ocean waters or make the greenish scum

you see on flower pots, and in certain soils.

Other microscopic plants include the green algae that thrive in dark, moist mines and caves as well as in hot springs, and on the north side of trees; and the yellow-green algae that include the curious silica-bearing diatoms, those tiny geometrically shaped plants looking like strange boxes with lids. When these cells die, they sink to the bottom of the ocean to form an ooze called diatomaceous earth, used in the manufacture of tooth powders and various polishes.

These small plants form an important part of the sea plankton, the free-floating mass of tiny plants and animals that feed the creatures of the sea and which scientists have been considering as a source of food for humans.

Some of the protists move through their environment by lashing about slender flexible whips, a projection of the protoplasm. Other protists, called Ciliata, move by means of thousands of tiny hair-like oars, or cilia, from the Latin word meaning eyelash. The streamlined slipper-shaped paramecium, probably the most studied creature of all protozoa, move swiftly through fresh water by gyration of thousands of these cilia.

## Cilia Capture Bacteria

Bacteria and other tiny creatures are captured by these cilia, which sweep them down a grooved depression in the side of the paramecium, through the mouth opening into the interior of the cell where they are digested.

The Rhizopods can occur as naked protoplasm without any definite permanent form. An example of this kind of organism is the amoeba, a living mass of protoplasm that performs all essential life activities in one cell. This remarkable creature changes its shape constantly by the flowing of protoplasmic material. It feeds itself by encircling and engulfing food particles and leaves its wastes behind.

Amoebas, sometimes called the simplest of the protozoa, live in salt as well as fresh water. Most of them are not harmful to man, but one species causes a very severe intestinal disease known as amoebic dysentery.

Rhizopods also include the Foraminifera, one-celled protozoans that secrete many chambered shells. These interesting creatures are almost all marine, inhabiting the deep seas. They are extremely important in the location and development of oil fields under the sea, since their fossilized ancestors give clues to the oil geologists as they drill through layers of rock.

Early in their life, these organisms have a soft, shapeless cell. Soon, however, the individuals begin to secrete a chalky substance that forms chamber after chamber, resembling miniature snails smaller than the head of a pin. These shells are covered with

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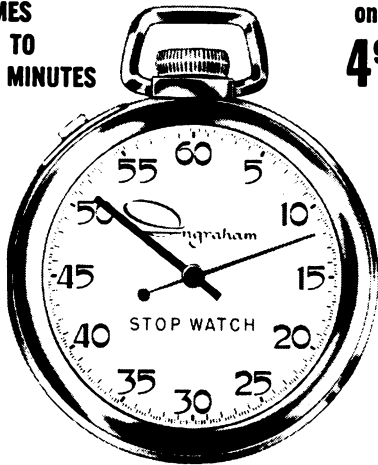


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## Life in a Drop of Water

(Continued from p. 134)

holes through which the animal pushes pseudopods, or false feet, in order to capture its food.

As the Foraminifera die, their shells drop to the bottom of the ocean, forming a thick grey mud called the globigerina ooze which covers about 30% of the Atlantic Ocean floor.

The soft, single-celled Radiolaria construct beautiful fragile structures of natural glass from the silicon dissolved in seawater. These ocean dwellers sink slowly to the bottom of the sea, forming the radiolarian ooze that covers about three million square miles in the Indian and Pacific Oceans.

Another group of one-celled creatures, called the Sporozoans, or spore-formers, reproduces by means of spores.

Perhaps the most hated Sporozoans are the malarial parasites. The microscopic malarial pest enters the bloodstream of man by the bite of an infected *Anopheles* mosquito. Once inside the red blood cells of a human being, it undergoes sporulation to form more of the parasites, which spread throughout the body of the victim.

Thus live the complex microscopic organisms, each with a life of its own, forming tiny worlds of great beauty or creating some of man's most deadly diseases.

• Science News Letter, 89:134 February 26, 1966

## Nature Note

### The Stinging Scorpion

➤ A FIERCE SCORPION can look its foe in the eye while it flips its tail up over its back and stings that enemy with a curved stinger.

The poison injected from the sharp hook can inflict a wound severe enough to quell the struggles of a spider or insect, or it can kill the adversary. Even larger animals have succumbed to this poisonous creature, and many human deaths have been attributed to the scorpion.

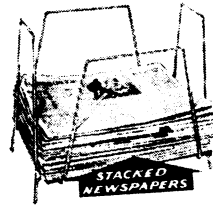
These creatures belong to the largest group of animals without backbones, or invertebrates, and are of phylum Arthropoda, which means jointed feet. Scorpions are relatives of spiders, ticks and mites, and all are in the Arachnida class.

Scorpions vary in size from the shining black eight-inch species that inhabit the tropical jungles to the thin pale, one-inch fellows that prefer to live in sandy or desert areas. They all have the same basic body shape—eight legs, two lobster-like pincher claws, and a jointed tail that flicks up over their backs when they are angry or alarmed.

About 400 species are known in the tropical and temperate zones of the world, many of which are found in southern Europe and northern Africa.

Of the 35 species inhabiting the United States, most are in the West and Southwest.

• Science News Letter, 89:142 February 26, 1966



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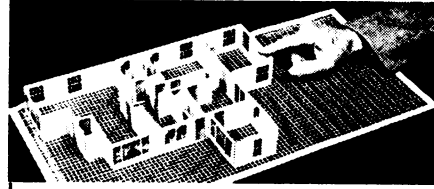
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