BOTANY

Spring—Return to Life

Spring arrives, bringing warm air, sunlight and melting ice to unlock sleeping seeds and start again the intricate process of sprouting and growing.

By BARBARA TUFTY

See Front Cover

➤ EACH SPRING, an ancient ritual millions of years old is repeated anew: the bursting of vibrant life from the static dormancy of winter.

As the warming rays of a returning sun touch the white snows, the frozen mud and iced debris that cover our northern lands, the earth shudders and melts, and billions of tiny cells begin to stir, in a pageant of one of the world's greatest marvels: Life!

Within the softening soil, trillions of microscopic creatures such as bacteria, yeasts and protozoa speed up their enzyme activities—tearing down dead plant and animal materials, creating fertilizers with decay, and releasing chemicals and nutrients needed by plants for cell division and growth. Dark communities of small animals—the earthworms, grubs, ants, mice and moles—stretch and start to tunnel, chew, push and turn through their shadowy home labyrinths, aerating and loosening the soil for the plunging roots of plants.

In the thawing ponds, minute one-celled protozoa and amoebas pulsate through the water, and strands of algae drift in the currents, their tiny drops of green chlorophyll moving ceaselessly around each cell, converting the energy of sunlight into energy of movement and growth. Frogs push from their winter mud homes at the bottom of the pond and croak; silvery fish slip silently through the rushes at the water's edge; and a red-winged blackbird flashes past nearby pussy willows.

Buds Unfurl

On the tips of trees, buds that have been fat with hidden life all winter long start to shed their brown scaly covering and unfurl fragile red and yellow leaves. The red pigment anthocyanin within cells of the tender new leaves soon is hidden by the more numerous green chlorophyll plastids as the leaves mature under the sun.

Most spectacular of this early spring stretching and return to life is the unlocking of seeds, those compact storehouses of nature.

Seeds are many sizes, shapes and colors. Some, like the orchid seeds are as small as a dust mote, while others are huge like the 40-pound seed of the double coconut palm, Coco de Mer. Some are round, fat and hard like the acorn, while others are flat and striped like the sunflower. Seeds of carrots are shaped like cockleburs, dandelions like parasols, cornflowers like paintbrushes, and marigolds like two-pronged rockets.

Yet most plant seeds have the same three basic ingredients—a sleeping unborn plant, complete with potential stem, root and leaves; a storage of food to last until the young plant can manufacture its own; and a protective seed coat that shelters its precious burden from hardships of winter frosts and darkness or of desert droughts and heat.

This sleeping seed can be roused to quick action only if certain conditions of moisture, warm weather and light are favorable. In the northern lands, as temperatures rise above the freezing point of 32 degrees Fahrenheit and melt the ice in the soil, molecules of water enter the seed coat and embryo. Special patterns of light and darkness trigger individual seeds to germination —some seeds needing only a single ray of light to start life growing, some needing none at all, and some containing the special blue pigment called phytochrome which absorbs radiant energy in the form of red or infrared rays.

With the proper combination of these outside forces, enzymes within the seed start to work, changing the stored starches to energy and sugars that the baby plant needs for growth. With tiny but mighty force, the embryo expands, breaking the walls of the seed covering and pushing aside soil, rocks and even concrete blocks in its explosive surge of life.

On this week's front cover a germinating seed is shown popping above the ground and unfolding its first new leaves to welcome warm air and sun of spring. Its food storage chambers, seen on each side of the leaves, soon will be used up and disappear as the baby bean seedling continues its growth.

George A. Smith

HELLO, SPRING—Found in the open woodlands of eastern North America, this slender-stemmed rue anemone shyly welcomes spring with its delicate white or pink flowers.

Thirsty Roots

First to emerge from this minute dynamo is the hungry primary root, the radicle as botanists call it, pushing downward into the soil in a positive response to gravity. This delicate structure lengthens rapidly, nudging and wriggling its way down past particles of soil. From this primary root sprout thousands of tiny transparent hairs that furiously imbibe water and minerals for growth. Botanists estimate that root hairs of a single mature grass plant, placed end to end, could extend for more than 6,000 miles.

As the fuzzy root pushes down, the tiny stalk, called the hypocotyl, elongates up through the soil toward the air, in a negative response to gravity. This stalk feeds from the cotyledons, a mass of cells with the food supply created last autumn by the mother plant. Some plants called monocotyledons, such as corns, lilies and grasses, have only one cotyledon. Others, such as beans and squash have two, which are carried above ground with the growing stem. With pine seedlings, six to 15 needlelike cotyledons radiate out in a delicate star pattern.

As the first true leaves unfold from the stem and expand enough to catch the sun's

rays and start manufacturing their own food, the used-up cotyledons shrivel away. The baby seedling is now launched on its own life.

Seedling Factory

Inside the silent seedling is a factory of astonishing activities. Cells divide, grow, and become differentiated into special life functions, each contributing to the complex balance of biological processes that is the wonder of the most simple plant.

Thousands of different cells work in different ways. For instance, root hairs absorb water and minerals from the soil; xylem cells inside the roots and stems transport this nutritious water to other parts of the plant; phloem cells carry the sugars and starches which have been manufactured in the leaves down to the roots for storage; parenchyma cells in the leaves contain chlorophyll to manufacture foods; guard cells regulate the amount of atmospheric gases taken into or given from the plant; colored epidermis cells of petals lend pink, blue or yellow beauty to a flower; and sperm and egg cells fuse to form the embryo of the future plant which will be severed from the parent next autumn, ready to burst forth the following spring.

Ancient Plant

It was perhaps 200 million years ago that plants of our earth began developing seeds. Before that time, earlier forms of life used different methods of reproducing themselves. The first sparks of life on our planet were single-celled creatures, somewhat similar to our green algae living today. These living cells perpetuated their species in the warm primeval oceans by fission—simply by dividing themselves.

As time went by, the cells began to group themselves in clusters, or in threads and chains, and reproduced by forming cysts or spores—one-celled plants which break off from the parent group to become a separate plant. Other algae developed sex: a male cell swam to mate with a female cell, and their union was the germ of a new life.

For a long time these plants stayed in the ocean, then they began invading the estuaries and shores, anchoring themselves on a rock and surviving in the air when the tides went out. Gradually the mosses and ferns began to creep out of the swamps to put their green fingers over the earth's gray rocks, and evolve another system of reproduction—by millions of microscopic spores held upright in a capsule on a stalk. The ferns, flourishing in the moist soil and growing as high as trees in the dinosaur age, reproduced with an alternation of life cycles. Here the spores do not produce identical plants but grow into tiny heart-shaped plants which cling closely to the damp earth. These gametophytes in turn produce male and female cells which mate in water to form the new plant.

Other primitive plants appeared, simple in structure and reproducing by spores—the strange fungi with no chlorophyll, feeding on dead material; slime molds flowing over the rocks; tough vigorous lichen, a combination of fungus and algae; and the flat, liver-shaped liverworts.

As plants became more complex, they formed more specialized reproductive cells which united to form a many-celled embryo. Developing first without a protective cover, "naked seeds" appeared in gingkos and cone-bearing trees—the pines, spruces and firs.

Then about 100 million years ago, plants began to develop a case or shell protection around the seeds. As eons passed, parts of fruits and nuts evolved as nutritive storage surrounding the embryo.

Today, in uninhabited corners of the earth, plants still carry on unmolested their slow process of evolution. But in other parts of the world, man is speeding up the development of plants and their seeds. With intricate processes of selection, cultivation and hybridization, man is perfecting those storehouse of plants into bigger, juicier tomatoes, fleshy watermelons, succulent corn, rust-resisting wheat—adding to the store of energy nature originally designed for children of the plant, but which are now relished by children of man.

For a seed packet full of delightful spring surprises get the new seed unit of THINGS of science. Delicate lovely nasturtiums, also known as the salad plant, with edible leaves and seed pods to garnish salads; an unusual bean variety with sweet pea-like flowers to decorate the table and beans to eat fresh or dried; an edible gourd that will grow three feet long and a decorative gourd for colorful centerpieces; and new this season, the only early aster plant producing large flowers. Seeds for all these are contained in the unit. For the curious student botanical information is also included. Send 75¢ for THINGS of science unit No. 280 to SCIENCE SERVICE, Washington, D. C. 20036.

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OPTICS

Vision Increased 400% With Tiny 'TV Tubes'

➤ TINY LENSES that look like miniature television tubes can increase working vision up to 400% for millions of professional and technical workers, a New York inventor reported.

Ground from "rare earth" glass, now used only for precision camera lenses and optical systems for space vehicles, the lenses clip on to regular prescription glasses or safety goggles. When not in use, they are flipped up out of the way.

This new optical aid would permit visual detection of dust particles as tiny as one ten-thousandth of an inch, Dr. William Feinbloom, chief of the department of subnormal vision at the Optometric Center of New York, told the National Association of Optometrists meeting in New York.

Eyeglass wearers engaged in especially close work, such as industrial miniaturization, surgical and dental operations, precision assemblies, bookkeeping, proofreading, drafting, small part inspection or space instrumentation will benefit most from the new lenses.

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SURGERY

'Do-It-Yourself' Spare Heart Parts

➤ PATIENTS in St. George's Hospital, just behind Buckingham Palace in London, are growing "spare parts" in their own bodies to replace the diseased main valves in their own hearts.

This "do-it-yourself" heart valve replacement project is being done by Dr. Charles Drew, a surgeon at St. George's, and his team of assistants.

Experimental work on dogs in the same field has proved very promising. Tissue removed from the patient's abdominal wall is placed in a porous plastic mold in the shape of the main heart valve. The mold is inserted in the patient's abdomen for six weeks, when the tissue will be capable of being sewn into his heart for use as a valve.

The heart's main valve has to open and shut some 100,000 times a day, but sometimes it wears out or becomes "gummed up."

Already faulty valves are being replaced by grafts from other persons, plastic grafts or a ball and cup device in stainless steel, rubber or plastic. But Dr. Drew says: "There is no substitute for a patient's own tissue."

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Nature Note

Water Boatman

➤ THE WATER BOATMAN or corixid is a familiar fresh water insect that can dive, swim or fly, but only flops about when it travels on land.

Because he is heavier than the water, the boatman habitually remains near the bottom where his dinner of organic ooze and filamentous algae can be found. However, a tiny bubble of air can be trapped between his wings and back and keep the insect lighter than water. Thus he pops to the surface whenever his hold on a submerged object is released. The boatman uses his powerful hind legs as oars to propel him down again.

The corixid forms an important link in the food chain between the organisms found in the bottom ooze and the predatory aquatic animals that in turn use it for food. The eagerness with which other animals eat boatmen is reflected in the use of dead and dried boatmen in commercial pet foods for birds, fishes, and turtles.

In some countries, people also eat the insect. In the lake region near Mexico City, the eggs, "ahuatle," are gathered and dried for human food. Sometimes they are toasted and sometimes they are added to soups or as a dressing for meat.

They make very interesting aquarium animals as they pop to the surface for fresh air or swim wildly to the bottom to hide. The boatmen produce a shrill chirping sound by rubbing their front legs against their heads.

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