

GENERAL SCIENCE

Spring Has Many Meanings

Spring comes before the snow leaves the ground, say some people. It is the first flush of yellow on a willow, the feel of moist soil, the sound of the frog peepers.

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See Front Cover

► WHO SAYS it's spring?

When is spring?

Spring is when the soil is soft enough for planting, say the farmers.

It is when the family tracks the house full of mud, grumble the housewives.

It is when the mallards start winging back from the south, muse the hunters.

City dwellers know spring is here when store windows exhibit pink clothes and real or paper daffodils.

"Ma, it's spring! Can I go break the ice from the stream?" shout the boys.

"There's a crocus in our window pot," say the girls.

The weatherman says that spring starts the beginning of March, when winter's weather patterns begin to change, and the land, water areas and air start to become warmer. It is the season of floods, the beginning of tornadoes.

Ask anyone, and he will tell you when spring comes—and the answer is always different.

Woods Show Early Color

A naturalist sees the earliest spring—in the first tinge of yellow-orange of the willow shoots, so subtle that when he stares full at them, the color seems to recede before his eyes. Or he hears it the moment when the hoarse croak of the purple grackle breaks, and becomes almost melodious.

The hiker through the snowy woods suddenly comes upon the brown-purple hood of the skunk cabbage, whose folded leaves encase the life-giving warmth released by oxidation of carbohydrates at temperatures sometimes 27 degrees above the temperatures of the air—enough to melt the snow as the plant pushes towards the sun.

Seen on this week's front cover is an early spring arrival. Bloodroot, *Sanguinaria canadensis*, is among the first flowers to come in spring, and among the first to go. This delicate flower gets its sanguinary name from the thick, orange-red sap that oozes out when its fleshy root is cut. If you get this sap on your fingers, be sure to wash it off immediately, for it contains an irritating substance that can cause a disagreeable rash.

The woodchuck's spring comes one fine day when the temperature is just right to wake him from his deep winter sleep. In a matter of a few hours, his body temperature rises from about 38 degrees Fahrenheit to 97 degrees, and his breathing becomes faster—from 10 to 12 breaths an hour, to

30 or 40 a minute. His metabolism soars quickly, his body functions at its normal pace again as he hastens about foraging for food.

People who watch ponds unfold have their definition of spring when the temperature on the pool surface plunges the warmed waters into the depths. Although most substances become heavier and denser when cooled, water has the peculiar property of reversing this process when it reaches a temperature of 39 degrees. This means that the ice remains on the top of the pond instead of circulating to the depths where its cold would kill off any plant or animal life sleeping there.

Pond Waters Turn Over

In the spring the pond turns over. The sun melts the ice at the surface and as the water becomes warmer, its density approaches that of the water at the bottom. The breezes stir up the pond, and the warm surface works its way down and awakens the sleeping metabolisms at its bottom.

For the pond-watcher, the slow but exciting rise of those tiny green plants called duckweeds from the dark depths is as sure a spring notice as he needs. All winter long those tiny winter buds, laden with starch grains and water that made them sink to the bottom in fall, have lain on the pond floor or hung suspended close to it. As the warmed waters flow down upon them, they form a gas that fills their intercellular spaces and increases their buoyancy. Like fleets of tiny submarines, they rise to the surface where they dangle, growing tiny rootlets and spreading their flat leaves to catch the energy-giving rays of the welcome sun.

Another pond-dweller expresses his spring awakening by a shrill plaintive call at twilight. That is the mating call of the spring peeper—a one-inch-long gray-green frog with a small dark cross on its back.

Spring comes to the great masses of plants and animals of the oceans also. One dramatic sea voyage triggered by spring is the journey taken by thousands of baby eels from the middle of the ocean to the East Coast of the United States. Here they work their way up rivers, creeks and brooks to find fresh-water pools.

After eight years of living in fresh water, those eels—adults now—that have survived the hardships of water birds, fish and anglers return down the waterways to the ocean depths where they lay their eggs. Two years later, their descendants will wait for spring to start their voyage for fresh water again.

Then later comes the full rush of spring

—the obvious, noisy, gaudy spring of the poets and advertisers, with its wheelbarrows of tulips, lilacs and hyacinths, and the flash of bluebirds and robins.

Only the careful observer would know that the lilac buds have been fat on the shrubs all winter long, and that the robins and bluebirds, false "harbingers of spring," often remain in the north all winter long. It is only the eyes of the spectators that have awakened to spring.

Sun Sets Exact Date

But like a stern unmoved monitor over all this flood of emotion stands the astronomer who, regardless of the sweet winds blowing across his brow, quietly states the exact minute and hour of the arrival of spring on this earth.

Spring comes, he says, at that moment when the sun is directly above the equator, on its northern journey as the earth tips to lean its Northern Hemisphere towards the sun. At this moment, at one particular spot on the equator, he says, the sun rises due east, and the hours of the night are exactly equal to those of the day. This is the vernal equinox, which in Latin means the equal nights of spring.

This year, says the astronomer, speaking from the U.S. Naval Observatory in Washington, D. C., spring occurs at 3:20 a.m. EST on March 21. The sun will then be directly over a point east of the African coast in the Indian Ocean.

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ZOOLOGY

Turtles Grow Faster When Gravity Increased

► YOUNG RED-EARED turtles grow faster when gravity is somewhat higher than normal.

When turtles in their "anti-gravity suits," as scientists call the shells, are exposed to five gravities (normal earth conditions are one "g," or gravity) for five weeks, they will grow about twice as fast in length as turtles under usual conditions.

When the gravity field is further increased, however, the growth rate decreases. Drs. Christopher H. Dodge and Charles C. Wunder of the State University of Iowa reported in *Nature*, 197:922, 1963.

These findings with turtles—as well as with mice, wheat and fruit flies—support the theory that there may be a specific gravitational field most likely to promote growth for any organism.

Different forces of gravity are simulated in the laboratory by continuous whirling in a centrifuge. The turtles, *Pseudemys scripta elegans*, were kept in plastic refrigerator boxes and exposed to centrifugal fields ranging from five to 28 gravities.

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