"is performed in a very restricted zone —quite near to the very surface of our small planet. Even bacteria are known to disappear in the upper reaches of the atmosphere, and other life extends downward only to the limits set by the ocean depths. At no earlier time in the earth's history does this seem to have been different. Fossil remains of living things are found in coal and rock strata now some thousands of feet beneath the soil on which we walk, but it is clear that these veins were land surfaces or ocean floors when they trapped the dead bodies of organisms.

"If, in an Arabian Night's excursion, we might leave the earth and look at the present living world from afar—say, from the 24,000 miles which is one-tenth of the distance to the moon—we could rightly sense the narrow pinions of life. Then, on the great sphere which would nearly fill our view to east or west, we should see all life imprisoned in a thin film—a living skin—tightly fitted to the very surface of the earth. As we now know it the entire story of life sticks to the place where there is liquid water, with earthly salts dissolved in it; where gaseous oxygen, carbon dioxide and nitrogen abound; and where surfaces can absorb sunlight for a continuous flow of free energy."

Science News Letter, January 21, 1939

PHYSICS

Fluffiest Snow Known Reported From Blue Hill

WHAT is believed to be the fluffiest snow on scientific record is reported by Prof. C. F. Brooks of Harvard University.

It fell at Milton, Mass., where Harvard's meteorological station, the Blue Hill Observatory, is located. There was only half an inch of it, and it took three hours for it to accumulate, for the flakes fell very slowly—less than two feet per second.

Prof. Brooks blocked out a square yard of it, as it lay on the hard crust of an earlier snow. He packed it into snowballs and weighed it. He found that the water equivalent was only 1/63; that is, it would have required 63 inches of this snow to make one inch of water. Ordinary snow has a water equivalent averaging 1/10, and the fluffiest snows commonly observed range from 1/20 to 1/30.

Prof. Brooks, through the *Bulletin of the American Meteorological Society*, (Nov. 1938), asks if any one has ever made an accurate observation of snow any fluffier than his downy 1/63 variety.

Science News Letter, January 21, 1939

PHYSICS—PHOTOGRAPHY

Nature's Jewels, Snowflakes, Are Copied in the Laboratory

Japanese Scientist Creates Lovely Water Crystals For the First Time By Imitating Natural Conditions

See Front Cover

SNOWFLAKES have fallen in uncountable, unimaginable billions since winter first came to the earth. The bounty of nature in these miniature pearly stars has been unlimited. Now, however, they are being made "synthetically" for the first time.

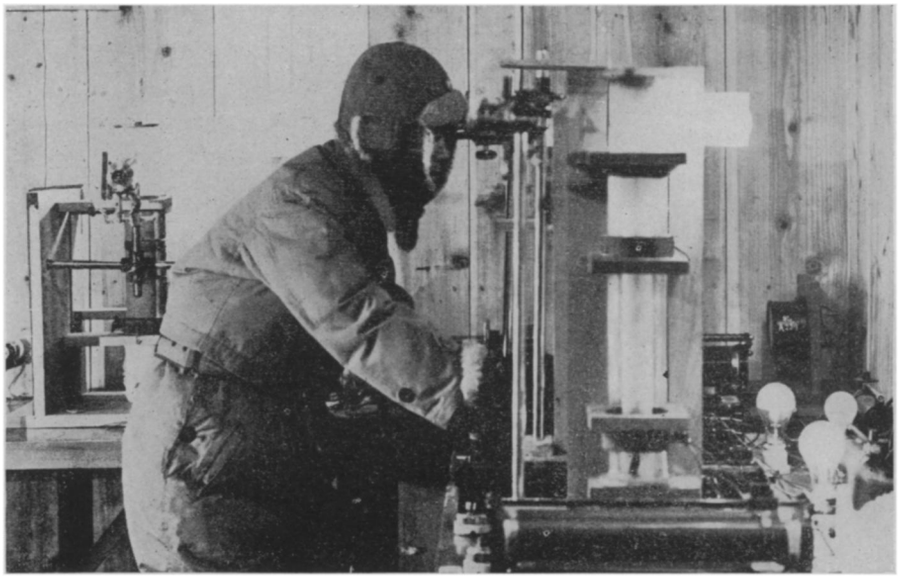
In an unheated, shed-like board building, Prof. Ukitiro Nakaya of Hokkaido University, Sapporo, Japan, makes snow crystals to order, producing them either "plain" or "fancy" as he desires. He measures, photographs, and studies them for the information they can yield in the solution of baffling puzzles in meteorology, the science of the weather.

It gets cold in Sapporo. That city is the northernmost of the more important Japanese centers of population, and is in about the same latitude as Vladivostok. So Prof. Nakaya wears a fur-lined aviator's suit while he is at work.

The Japanese physicist makes snowflakes that rival the natural product by imitating the method of nature as closely as can be done in less space than the whole sky. To make a snowflake, three things are necessary; a supply of moist air, some small solid object on which condensation can start, and a relatively quick drop in temperature to set the process going.

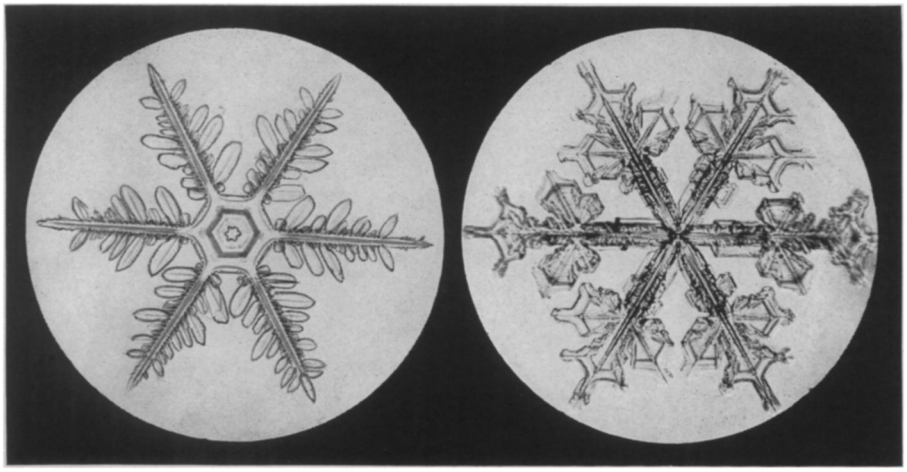
Prof. Nakaya provides the moist air by heating a vessel of water with an electric coil. The warm, saturated air rises through a chimney-like glass tube. This is enclosed within a larger glass tube, which continues above the end of the chimney into a cold chamber, where the temperature can be pushed down to 60 degrees below zero Fahrenheit.

Under natural conditions the tiny solid particles on which snow crystals start to condense are microscopic dust grains, salt particles, etc., floating in the atmosphere. To hold his synthetic snow crystals still, so they will "stay put" while he observes and measures them, Prof. Nakaya



MAKER OF SNOWFLAKES

Prof. Ukitiro Nakaya of Hokkaido University peers through a horizontal microscope at a crystal forming in the cold chamber of the apparatus before him. Since the laboratory must be kept unheated, the Japanese physicist wears a fur-lined flying suit.



NATURE'S JEWELS

These snow crystals photographed by Prof. Nakaya are products of a natural snowstorm. The one on the front cover of this week's SCIENCE NEWS LETTER is a laboratory product—note the curving rabbit hair on which it was formed.

hangs a single rabbit hair in the cold chamber at the top of his glass cylinder. When the saturated air from below is suddenly chilled there, tiny crystals immediately start to form, centered on the rabbit hair, like minute beads on a string.

Their form and pattern can be controlled both by varying the amount and temperature of the warm, saturated air from below and by adjusting the temperature of the cold chamber at the top. The finely branched, lacy crystals that look like filigree jewelry result from sending up very moist air and chilling it only moderately. The plainer, straighter patterns are produced by more severe freezing of air that is not quite so moist. Sudden chilling of supersaturated air results in irregular masses of ice crystals or even round, sleet-like droplets.

This agrees rather well with theories based on field observations by meteorologists. It has long been the opinion of other weather scientists that the fine, lacy snow crystals form in the lower, moister air levels, while the plain, straight-sided ones are built from scantier supplies of moisture in the higher atmospheric strata where it is very cold.

In addition to "standard" six-pointed snow crystals, Prof. Nakaya is also able to produce the fine-pointed needles of rime, the clear little pellets of sleet, the curious white, sugar-like stuff that is known in Germany as graupel and in England as soft hail, as well as a number of other varieties of aerial ice.

His snowflakes are not always perfectly symmetrical. One-sided supplies of moisture, or one-sided electrical influences, he believes, may cause a snowflake to grow faster on one side than on the other. He says that asymmetrical snow crystals are a good deal more common in nature than most people believe. As a matter of fact, no snowflake is absolutely symmetrical; there are always at least small differences between sides and points.

Skilled as he is in producing synthetic snow crystals in his laboratory, Prof. Nakaya is equally skilled in making photographs of them and of the natural flakes that fall outside his windows. He has a collection of many thousands of photomicrographs which he has taken of his lovely perishable jewels of frozen water.

Photographing snow crystals is a job both delicate and difficult. They are so fragile that extreme care must be exercised in handling and arranging them on the glass side or other background on which they are mounted for placing under the microscope.

The whole operation must be performed in the cold, and with microscope and all other apparatus just as cold as the snowflakes. The scientist-artist must hold his breath while he is focussing and adjusting, lest a whiff of his body heat crumple the delicate beauty like a fairy-tale princess caught in the breath of a dragon. In the austere rites of the snow-crystal laboratory, one spoken word might break the spell and bring destruction.

One American achieved wide recognition for taking snow photographs like the ones Prof. Nakaya is making. He has been dead for several years, but he left his monument behind him in a book of pictures edited by Dr. W. J. Humphreys of the U. S. Weather Bureau. His name was W. A. Bentley, and he was not a scientist but a New England farmer, who took up snow crystals for a hobby.

There is a difference between the photographic techniques used by the two men. Mr. Bentley carefuly cut away all the emulsion on his plates except the parts occupied by the photographic images themselves. This left the crystals showing up boldly against a black background, like diamond brooches on velvet. Prof. Nakaya photographs his crystals against a white background, leaving his pictures in delicate white-and-gray.

Science News Letter, January 21, 1939

● Microfilm Documents

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