big job is to find water where there is arable land, and then get the water on the land.

Ironically, the four largest rivers that cross Peru's narrow coastal plain must forever waste their water into the ocean, for there is no land worth irrigating near them. Also, it is impracticable to build storage reservoirs in the mountains, because the Andes rise too suddenly and steeply.

Reservoirs are natural ones, consisting of great masses of loose soil and gravel in the valleys, which get filled up with water, sponge-fashion, every year. The water is brought up by pumping from wells between 50 and 200 feet deep. A promising new project, fostered by the Peruvian government, has in view the diversion of flood waters, now almost entirely wasted.

Science News Letter, May 25, 1940

Sunspots Affect Weather

HEAVY sunspot outbreaks are followed by rain in southeastern Brazil, Dr. J. de Sampaio Ferraz, formerly director of the Brazilian Meteorological Service, told fellow-scientists at the Scientific Congress. A close statistical study of records covering 60 years of observations indicated that when sunspots are exceptionally large and numerous, the tropical interior of the country is heated up more than usual, and this is followed by rain-bearing storms migrating down to the warm-temperate state of Sao Paulo, where the observations were made.

This situation in Brazil is quite similar to that obtaining for North America, as studied for many years by Dr. Charles G. Abbot, secretary of the Smithsonian Institution. On this continent, Dr. Abbot has stated, heating effects over the interior plains are followed by storms migrating in an easterly direction.

Dr. Ferraz also found increases in rainfall without any preceding increase in sunspot activity. However, it appears that at times the output of solar energy increases steeply without any sunspot manifestations. The spots, after all, are symptoms, not causes of increased solar activity.

Science News Letter, May 25, 1940

GENETICS

Colchicine Treatment Produces Striking New Flower Varieties

See Front Cover

MARIGOLDS half a foot across, snapdragons with blossoms of deeper color and sturdier stems, spearmint of a different flavor are among the newest accomplishments in plant breeding made possible by colchicine. These and other plants have been developed at the New York State Agricultural Experiment Station (Geneva) by a husband-and-wife team of scientists, Drs. Bernhard R. Nebel and Mabel Ruttle Nebel.

The marigolds are perhaps the most spectacular, for their sheer size and brightness of yellow and orange colors. Original breeding stock was the familiar African marigold species. Young seedlings of this species, after treatment with colchicine solution grew up and produced offspring with double the usual number of heredity-bearing chromosomes. Technically such plants are known as tetraploids. Results have varied somewhat from variety to variety.

Another line of marigold breeding has been the production of a fertile strain out of the hitherto sterile hybrid between African and French dwarf marigolds, by doubling its chromosome number. This plant also bears flowers larger than those of either the untreated hybrid or the French Dwarf parent.

The new African tetraploid has also been crossed with French dwarf varieties, with results of horticultural promise.

Ten new tetraploid snapdragon varieties have been obtained. These show considerable variability in form, size, and fertility, depending on the variety from which they were derived. The flowers are larger than those of the parent and deeper in color; the corollas are more wavy; the plants are sturdier and more erect; the leaves are a deeper green.

The new tetraploid spearmint was produced by treating the underground shoots or runners of commercial spearmint plants with colchicine. Ordinary spearmint is a hybrid of unknown ancestry, and is sterile. The new tetraploid is fertile and has an odor unlike that of its parent.

Partly tetraploid apple stem tissue has been produced by treating buds with colchicine. If further growth produces entirely tetraploid shoots, new varieties and important material for further breeding work will be at hand.

Discovery of the great value of colchicine in plant breeding work was no lucky accident, the Nebels emphasize. It developed in the manner that can be considered normal for any major scientific advance: the step-by-step accumulation of knowledge about the properties and effects of the material in hand, contributed to by many workers, and the final application to a new problem when the time was ripe.

In the case of colchicine, the effects of

the drug in checking cell division at one particular point in its progress had been studied and reported on by a number of men, working mostly on animal cancers. Possibilities in turning this behavior to account in artificially producing cells with increased chromosome counts (and hence new genetic properties) suggested themselves to certain French investigators and simultaneously to the Nebels and to Dr. A. F. Blakeslee of the Carnegie Institution of Washington. They did their work independently, and published results almost simultaneously in the journals.

Now all plant breeders are using colchicine. Some of them have produced plants which promise to be of considerable economic value.

The illustration on the cover of this number of THE SCIENCE NEWS LETTER is from a photograph of one of the Nebels' colchicine-produced marigold varieties. The improved tetraploid flower is contrasted with one from a plant of the original parent variety, shown at lower right.

Science News Letter, May 25, 1940

BIOLOGY

Food Made Without Sun And Without Chlorophyll

One-Celled Water Organism, Chilomonas Paramecium, Can Also Grow and Reproduce on Only Inorganic Salts

MAKING food substances (starch and fat) without chlorophyll and in the dark, rated as a biological impossibility by all accepted standards, is a regular performance of a one-celled water organism known scientifically as *Chilomonas paramecium*. Not only that, but Chilomonas can make food, grow and reproduce in a solution containing only inorganic materials, Prof. S. O. Mast of the Johns Hopkins University told fellow biologists at the meeting of the Eighth American Scientific Congress.

In Prof. Mast's experiments, single individuals of this microscopic aquatic species were isolated and kept in bacteria-free drops of water in hollowed microscope slides. Rate of growth was determined by the rapidity of reproduction by division. Starch grains and oil droplets could be seen through the transparent body substance of the tiny creatures.

Chilomonas can form food in light as well as in darkness, Prof. Mast reported, but he found that starch accumulated in its body more rapidly when it did its work in the dark. It can use organic substances if they are present, but it can get along perfectly well with only inorganic salts and carbon dioxide.

Increasing the amount of carbon dioxide in the atmosphere in contact with their tiny watery world enables the organisms to produce more food, and up to a certain point also to divide more rapidly. At the highest carbon dioxide concentrations reproduction stopped. Non-reproducing Chilomonas individuals, however, were found to be more heavily stocked with starch than the others.

Chilomonas belongs to the primitive group of organisms known as flagellates, which occupy a position near the bottom of the evolutionary ladder. Botanists and zoologists have sometimes disputed whether they are really plants or animals. They have been known to science for a long time, for they are extremely common. But until now the ability of this animal-like species to do a plant's work and make food out of inorganic substances—and without the supposedly necessary tool, chlorophyll, at that—has never been suspected.

Science News Letter, May 25, 1940

GEOGRAPHY—MILITARY SCIENCE

Alaskan Defense Can Be Learned from Finland

AMERICA can learn vivid lessons in Alaskan and Canadian defense from Arctic battling in the present European war, in the opinion of Dr. Vilhjalmar Stefansson, noted Arctic explorer, in Washington to consult with government officials on Arctic problems.

As a scientist concerned with geographic and climatic problems of the Far North, Dr. Stefansson said that a huge area of the world's surface is country where warfare—if and when it comes—must be on the Arctic and sub-Arctic plan. And as the course of military power is steadily moving northward, and has been for several thousand years, he points out, understanding Arctic conditions becomes increasingly vital.

"A vast area where wars will be winter wars exists in Alaska, Canada, northern Europe and Siberia," said Dr. Stefansson. "This coincides roughly with the area where the subsoil is continually frozen. Where the land is flat or rolling, incredible numbers of lakes form in such conditions, interspersed with thick forests.

"In summer, mechanized units cannot make progress in such country. But in winter, the rivers, such as Alaska's Yukon and Canada's Mackenzie, become broad ice boulevards into the heart of the country. And the innumerable lakes frozen over and linked by stream channels can be traversed by troops moving from one to another, guided by maps or by airplanes."

If well defended, all such countries can hold off invaders by the type of fighting the Finns did from the forests, lying in ambush for the invading army, exposed to attack on the expanses of the ice. If, however, invasion is not opposed, the lakes and rivers of Far Northern areas provide opportunity for amazingly rapid advance of mechanized troops, Dr. Stefansson points out.

Greenland, he explained, is an exception, in which this type of fighting would not work. The fringe of land surrounding the enormous central ice cap