SCIENCE NEWS

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THE UNSEEN LIFE OF THE SOIL

UNSEEN and unknown to almost everyone, invisible because of their microscopically small size and always hidden in subterranean darkness, there is a whole swarming world of life under our feet. Its members are often weird in form, sometimes beneficent, sometimes harmful in their acts, but never for a moment, day or night, without their effect on the giant world of plants and animals and men that lives forgetfully above them.

This world of the soil microbiota, forgotten or ignored by all save a relative handful of scientists scattered over the earth, was outlined before the first International Congress of Soil Science meeting in Washington by Sir John Russell, director of the oldest and greatest agricultural experiment station in the world, at Rothamsted, England.

The effects wrought by soil bacteria, fungi, protozoa and other forms of life are manifold. Lowly plants called algae capture carbon dioxide from the air, build it into their bodies, and eventually, when they die, release their organic substances as humus for the enrichment of the soil. Many kinds of soil bacteria, both free-living and associated with other plants, are able to capture the otherwise inert and useless nitrogen gas from the air, which is eventually turned by the higher plants into meat-making proteids.

Bacteria break down dead plant and animal bodies, returning them to the dust from which they came; if it were not for this activity, the earth's surface would soon be cumbered with carcasses, with all the material basis of life locked up in them beyond recovery. This process is not a simple one, carried on by only one class of bacteria.

One gang of these microscopic wreckers goes to work, carries the process as far as its nature permits, and then quits. Another takes its place, forwards the work another stage, and in its turn passes it on to still other groups. At last the complex substances of the dead body are again the simple compounds that plants can use, and the upbuilding process begins once more.

Tearing down is as important a process in the cycle as setting up; for there are only just so many bricks for life to build with, and they must be used over and over. These lowly creatures of the soil, which may be our own unrecognized evolutionary ancestors, do the cosmos a service by plucking down our abandoned dwellings so that our descendants may make houses for themselves.

CARBON DIOXIDE FOR PLANTS

THE carbon dioxide discarded by bacteria as a by-product of their life-processes comes to man's table as his daily bread. We live on the exhalations of billions of tiny beings which we never see.

This, in brief paraphrase, is the doctrine laid before the International Congress of Soil Science by Dr. Julius Stoklasa, of the Technical Institute and Experiment Station of Prague, recognized as one of the leading authorities in the world on the difficult science of plant nutrition.

The old theory that plants build their food out of carbon dioxide which they capture from the air by means of their leaves, Dr. Stoklasa said, is entirely inadequate. The supplies of this gas in the air, according to his measurements, are not sufficient to account for the sugars, starches and other substances formed by plants with the assistance of the sun's energy. But the soil solution contains a great deal of carbon in the form of bicarbonates, and this carbon is taken into the plant along with the other soil minerals used by the plant, and borne by the sap to the green parts where carbohydrate manufacture is going on.

The amounts of carbon taken in from the soil, Professor Stoklasa asserted, compare in quantity with the amounts of other minerals assimilated. Thus, for every hundred pounds of carbon so absorbed, 154 pounds of nitrogen, 113 pounds of phosphoric acid, 106 pounds of potash, 33 pounds of calcium oxide and 26 pounds of magnesium oxide are taken in. This indicates a hitherto little suspected and wholly unmeasured part played by carbon dioxide in the soil.

Of course not nearly all of the carbon dioxide given off by soil bacteria gets into the plants. A great deal of it escapes upwards into the air. But here the leaves are waiting for it, and it passes into the plants through the channels hitherto taught as orthodox according to the accepted doctrines of plant physiology.

Furthermore, according to Professor Stoklasa, fertilizers added to the soil are by no means entirely for the direct benefit of the corn or clover or other crops. A large share of these plant condiments fall to the share of the bacteria, stimulating them to greater activity in the production of materials eventually used in the production of foods by the higher plants.

BIRTH RATES IN EUROPEAN COUNTRIES

FRANCE'S birth rate is increasing, while the birth rates of all other principal nations engaged in the world war are dropping, according to Dr. Warren S. Thompson, of the Scripps Foundation for Population Problems at Oxford, Ohio. Dr. Thompson is now studying population trends in Europe. Records from Russia are not available, but figures from other nations show: France's births per thousand came up from 18.8 in 1913 to 19.2 in 1924. England and Wales dropped from 24.1 to 18.8, in the same period. The birth rate in Germany was 27.5 in 1913. In 1925 it was only 20.4. In the decade beginning just before the war Austria's rate dropped from 29.6 to 22.3; that of Hungary from 34.5 to 28.4; that of Italy from 31.7 to 29.1.

France is not only keeping its birth rate up to the prewar figure, but is even making a little gain. Propaganda for larger families and the influx of immigrants into industrial centers probably have an important bearing on the problem. It also seems likely that the expansion of French industry and its increased production exert a favorable influence. The general feeling of optimism

about the future that is prevalent in France is a marked contrast to the atmosphere of pessimism in Germany and Great Britain, and it seems reasonable to believe that the general tone of outlook on the future may have an important effect on a nation's birth rate.

MAGNETIC STORMS AND SUN SPOTS

MANY large spots have appeared on the sun in the last few months. With them have come magnetic storms on the earth, disturbances of the earth's magnetism. The compass needle behaves in an erratic manner, and telegraph lines are deranged.

Miss Hazel M. Losh, of the Mt. Wilson Observatory, told members of the Pacific Division of the American Association for the Advancement of Science meeting at Reno, Nev., of the magnetic observations that she has made. Last September 12 a large group of spots appeared. A magnetic storm began on the fourteenth, and continued until the spot was carried out of sight by the sun's rotation. Then it was carried around in front again, and the magnetic disturbances were again evident.

In April of this year a long stream of spots appeared. These were in the center of the solar disc, as we see it, between the eleventh and thirteenth. On April 14 there was another great magnetic disturbance.

Every eleven years the spots on the sun become very numerous. This year or next will bring such a period of maximum, but probably with even more spots than normally come at such a time. Therefore, more magnetic storms can probably be expected.

At the same meeting Miss Losh's colleague, Dr. Lewis H. Humason, told the astronomers of his study of a group of spots that appeared in March. These were also accompanied by magnetic disturbances on the earth. The chief point of interest, however, was their own magnetism. Sun spots are huge magnets. Reversing the usual procedure, the forward one in the March group showed a north-seeking pole. Those that followed showed south-seeking poles.

AIRPLANE OBSERVATIONS OF THE ECLIPSE

FOR the first time an astronomer will observe a total eclipse of the sun from his own airplane. Gerald Merton will fly over England to see and photograph the eclipse of June 29. Merton was a pilot in the Royal Air Force during the war. He recently bought an airplane of his own for scientific use. With him will be Major P. H. Hepburn, war aviator and formerly president of the British Astronomical Association.

Another attempt to photograph the eclipse from the air, and so to rise above the clouds that may prevent terrestrial observations, will be made by two astronomers from the Royal Observatory at Greenwich, William M. H. Greaves, chief assistant, and William M. Witchell, head of the Observatory's Magnetic and Meteorological Branch. They will fly in a Handley-Page air liner provided by a London newspaper. At first, it was stated, they agreed to make the trip merely for the fun of it, but that now they expect to secure good observations.

With the large machine they have chosen, they hope that difficulties from vibration will be minimized, and the pilot thinks that he will be able to keep the machine pointed at the sun. Photographs will be made with lenses of great speed, so that exposures can be made in one fifth and one twenty-fifth of a second.

Another astronomer, F. J. Hargreaves, director of the photographic section of the British Astronomical Association, will accompany Greaves and Witchell. With an ultra-rapid lens, what the photographer calls F. 2, he will try to photograph from the air the shadow of the moon as it sweeps across the earth. If successful, it will be the first time that this has been done.

PASSENGER AIR LINES

BY August 1 anyone will be able to fly from New York to San Francisco with the speed of air mail. By July 1 the western half of this route from Chicago to San Francisco will be open. Later airliners will ply between New York and Miami, *via* Atlanta. America will then begin to rival Europe's passenger airlines just as it now excels in air mail routes. The New York-San Francisco route will be the world's longest airplane passenger line. Information obtained from Major Ernest L. Jones, of the Department of Commerce's new organization controlling commercial aviation, indicates that these important advances in aviation will occur.

The cost of transcontinental flying will be about fifteen cents a mile or less than $400 for the 2,500-mile trip. Rail fare and Pullman for the same trip cost about $140. The fastest rail time from coast to coast is slightly less than four days (87 to 96 hours) while the air time will be about a day and a third (31 to 32 hours). Thus nearly three days of time will be saved by traveling by air. Those who prefer wings to wheels can travel now from Boston to New York for $30. The air time-tables are out with directions for passengers. The table looks like a railroad one with arriving and leaving times for the cities *en route*.

Other passenger air routes now running are: The Colorado Airways, Inc., operating from Cheyenne to Pueblo, $45 round trip. The Western Air Express, 589 miles, from Salt Lake City to Los Angeles, $150 round trip. The Pacific Air Transport, from Seattle to Los Angeles, 1,073 miles for $132 one way. The Stout Air Services, between Detroit and Grand Rapids, is the only company issuing commutation books of ten trips. These books are to be had for $160. The Northwest Airways will also begin service from Chicago to Minneapolis-St. Paul in the immediate future, with a round trip ticket rate of $75.

The following airways are now completely lighted: New York to Boston, St. Louis to Chicago and the transcontinental route from New York to Salt Lake. The following routes will be lighted this year: Dallas to Chicago and Cheyenne to Pueblo (nearly finished); Salt Lake to Los Angeles; Salt Lake to San Francisco; Pasco, Washington to Elko, Nevada; Seattle to Los Angeles; Minneapolis, St. Paul to Chicago; Detroit to Cleveland and New York to Atlanta. The New York-Chicago route is now the only regular night mail service.

The large expansion of aerial passenger lines will occur when the Post Office Department relinquishes actual operation of the air mail lines and lets them out on contract. The government will be entirely out of the business of operating the air mail routes on August 1. Private air mail contractors will be able to carry passengers and express along with mail just as the railroads do.

ITEMS

A CLUE to the puzzling question of why one individual who takes syphilis develops general paralysis, and becomes a helpless mental and physical wreck, while another syphilis patient escapes this catastrophe, was suggested before the American Psychiatric Association on June 2 by Dr. H. A. Bunker, of the New York Psychiatric Institute at Ward's Island. Dr. Bunker has taken extensive body measurements of 100 men suffering from general paralysis, or paresis, he told the psychiatrists. He also measured 64 normal men for purposes of comparison. Dr. Bunker said: "We believe we have worked out a certain number of anatomical differences between paretics and non-paretics which appear to be significant differences, that is, they appear not to be merely chance differences. It would seem, in short, that syphilitics who develop general paralysis are in some way a different kind of people from syphilitics who do not. What is here noteworthy is that one of the differences between them should consist in certain purely anatomical features, even though it be true that these anatomical differences are but an outward expression of, or merely coordinated with, a more deep-seated and fundamental difference, the full nature of which remains as yet obscure."

DO children grow faster at one time of the year than another? A scientific attempt to find out just how much effect the factors of climate, infectious diseases and diet have on this subject of perennial interest to every parent has recently been made by Dr. Haven Emerson, of Columbia University. As a result of his studies made on the growth of 600 children in the widely separated localities of New York, Toronto and Honolulu, he has found that under certain favorable conditions most children "just grow" without much regard for what time of the year it is. These conditions constitute plenty of sensible food, healthful climate and absence of respiratory infections like colds. Dr. Emerson did find, however, that spurts of growth follow the preventable infections of children, which in the temperate zone frequently make their appearance in the spring and late winter. This condition is believed to be the basis of the idea that children's growth displays a seasonal variation.

THE Madagascar rubber vine, with which Edison is experimenting as a possible source of tires for the products of Ford, is a relative of the common milkweed, according to Dr. O. F. Cook, senior botanist of the U. S. Department of Agriculture. About four per cent. of the total weight of the plant is rubber, and the product as exported from Madagascar has been considered of good quality, though not equal to the rubber of the Brazilian Hevea tree. The lower quality, however, may possibly be due to the primitive methods now used in obtaining the Madagascar rubber, and more scientific chemical treatment may serve to remedy this. Though no serious efforts have hitherto been made to exploit the vine commercially, it is known that it will grow freely in southern Florida, and efforts to extend its range northward into the regions of occasional frosts will be followed with interest. The vine belongs to the genus known to botanists as Cryptostegia.

DR. EDWARD P. CATHCART, professor of chemical physiology at the University of Glasgow, has just conducted a survey of over 3,000 women in factories both in Glasgow and in London and in the industrial section of the north of England, to determine how heavy a weight women are physically capable of carrying. A group of over 400 college girls examined as controls were relatively taller and heavier than their industrial sisters and were excelled in strength by only a few physically superior groups in certain industries. The average British woman in industry weighs approximately 109 pounds, is 62 inches tall, and has a pull of 183 pounds, a grip of 58 pounds and a crush of 50 pounds.

A specially constructed dynamometer was used to measure the pulling capacity in the tests in which Dr. Cathcart was assisted by Elizabeth Bedale and Dr. Katherine Macleod. In the brick-laying industry, the observers saw one woman who shoveled twenty to twenty-five tons of raw material a day, lifting it to a height of two and a half feet. Girls in the same business as a rule carried over 100 pounds at a time though they were allowed to select their own load. The average age of the women in factories is between 17 and 22 years.

HEADLIGHTS on surgical scalpels, scissors and other instruments are a recent invention by Dr. H. Haebler, a German surgeon. They are designed especially for operations in the deeper body cavities, where the floodlight of the operation room is not always sufficient. The electric lamp is about the size of an ordinary bean, and receives its surrent through a pair of slender wires. The whole apparatus can be heat-sterilized as thoroughly as the metal instruments themselves.

WHEN the rain fails to fall in sufficient quantity, the farmer and the engineer bring water to the crops by irrigation. Usually this consists of flowing water through ditches, from which the moisture seeps to thirsty roots. But in California orchards overhead irrigation which showers the trees with artificial rain is being given a trial. Professor H. A. Wadsworth, of the University of California, after an investigation finds that irrigation by overhead sprinkling is at present limited to the production of high-priced crops on land of high value.

A CALL has been issued to American chemists to turn their attention to the research problems that must be solved before the eleventh revision of the U. S. Pharmacopoeia can make its appearance in 1930. Every ten years this authoritative treatise on drugs and their preparation is revised and brought up to date and issued under the supervision of a national committee. A list of the chemical problems involved has been sent out to the chemists of the country in the hope of stimulating research on drugs about which new information is desired.