

SCIENCE NEWS

*Science Service, Washington, D. C.***MUTATIONS CAUSED BY RADIATIONS
FROM THE EARTH**

RAYs from the earth itself may be the exciting cause of evolutionary changes in animals and plants. Invisible, short-wave radiations, similar to those given off by radium, have been shown by two University of California experimenters, Dr. E. B. Babcock and Dr. J. L. Collins, to cause mutations, which are the type of change now believed to be responsible for most evolutionary development. This is the first experimental demonstration of an actual evolutionary driving force, emanating from the earth itself.

Not long ago, the scientific world was excited over the wholesale production of mutations by shooting heavy doses of X-rays through the germ-plasm tissues of animals and plants. It was suggested then that similar changes might occur in nature, through the agency of similar radiations known to be given off by the earth. These natural rays are, of course, much feebler than the powerful units used in the laboratory, so that the number of mutations to be looked for in nature would be only a small fraction of those produced under the X-ray tube.

The method of testing that occurred to Dr. Babcock and Dr. Collins was to expose genetically similar strains of fruit-flies in two different localities, one of which was known to have more earth-radiation than the other. By means of sufficiently delicate instruments, they found that the rocks in Twin Peaks tunnel, San Francisco, gave off about twice as much radiation as did the soil of the University of California campus at Berkeley. Accordingly they arranged to expose their comparison cultures in these two places.

The strain of fruit-flies they used was known to be liable to produce a mutation of the kind called "sex-linked lethal." That is, every once in so often a culture would arise in which all the males died before hatching, leaving nothing but females in the bottle. Not a very useful sort of mutation, of course, but for demonstration purposes as good as any.

After five months of industrious fly-culturing, the two researchers checked up their records, and found that in the more highly radiant tunnel locality the mutation they were watching occurred about twice as often as it did on the university campus. It turned up in only a small fraction of the cultures in either place, but the percentage was constant and consistent. They regard it as a fair demonstration of the connection between X-ray-like radiations from the earth and the occurrence of evolutionary changes.

"It seems fairly safe to conclude even now," they state, "that the natural ionizing radiation of the earth is an important factor affecting the rate at which new inherited characters appear in animals and plants. While it may not be inferred that ionizing radiation is the direct cause of mutation, yet a way is now open by which this question can be attacked experimentally. But no matter

whether earth radiation actually causes mutation or whether it only affects its rate of occurrence, there can be little doubt that it has played and is playing an important rôle in the great drama of organic evolution.

"It is well known that there is always more or less ionizing radiation at the surface of the earth; also that there are various natural sources of radioactive materials. Radioactive mineral deposits which lie near the surface of the earth may perhaps be considered the most important sources of the ionizing radiation which presumably affects the course of evolution. Comparative biological surveys of the natural flora and fauna in regions found to have constantly higher rates of ionizing radiation than those which obtain as a general rule on the surface of the earth may reveal valuable confirmatory evidence in support of these findings.

"Of broad theoretical interest, this discovery has equally important practical aspects for agriculture and perhaps even for man himself. The possibilities appear especially attractive in the case of domestic animals which are not so easily treated experimentally with X-rays or radium, as are plants for the purpose of inducing new hereditary characters."

MAGNETIC STORMS WITH SUN-SPOT

A LARGE sun-spot, with an extraordinary magnetic field, has passed across the sun's face. It was seen in the solar telescopes of the Mount Wilson Observatory by Dr. Seth B. Nicholson and his associates. To it are attributed the magnetic storms of a few days ago that affected instruments in various parts of the world.

The ordinary solar magnetic field, surrounding a spot, has a value of 50 gaussses, the units in which the physicist measures magnetic intensity, but the sun-spot just observed has a value of 4,000 at its center. The earth's magnetic field, measured in the same units, is only one half a gauss, but ordinary magnets used in electrical work often have fields of over 10,000 gaussses.

Seldom does the astronomer encounter such a highly magnetic spot. Intensities of 3,500 are usual. Although a greater intensity would not be unusual in a small magnet here on the earth, it is unusual when it occurs in a sun-spot, such as the recent one.

This spot was 33,000 miles long and 20,000 miles wide. It was a single solar marking located about sixteen degrees to the south of the sun's equator. Two weeks from now it is likely to reappear on the sun's surface, as by that time the sun's slow rotation will have carried it completely around. Mount Wilson astronomers say that it will again cross the sun's meridian on August 14, if it survives. Then it may again be accompanied by magnetic storms on the earth.

Sun-spots occur in the surface of the sun—the layer that astronomers call the photosphere. A mass of hot gases shoots up from the interior of the sun to the surface, rapidly revolving like a bullet in a rifle barrel. As

they get to the surface, a whirlpool of gases results, the pressure is reduced and they are rapidly cooled. This sudden cooling causes a reduction in brilliance, and so the spots appear dark against the more brilliant solar background. They shoot out streams of tiny electrical particles, or electrons, which may reach the earth when the spot is on the right side of the sun. These electrons, acting in conjunction with the magnetic field of the earth itself, produce such effects as the northern lights and the magnetic storms that may tie up telegraphic communication.

VOLCANOES AND OCEAN SALT

THE 485 known volcanoes of the world, discharging every year more than a hundred million tons of hydrochloric acid, supply the chlorine that keeps the ocean salty. This is the opinion of Dr. Thomas A. Jaggar, director of the Hawaiian Volcano Observatory at Honolulu, T. H. Even though the amount of hydrochloric acid gas in steam from volcanoes is almost negligible, the ceaseless emission of this steam puts the gas into the air, and thence into the rain. With the average rainfall of about 40 inches a year the world over, rain-water would only need to contain about one part of chlorine in five million to supply the ocean's needs. This chlorine unites with the sodium brought into the sea by the rivers and forms sodium chloride, or common salt.

The volcanoes of the Katmai area in Alaska alone supply about one per cent. of the hundred million tons of hydrochloric acid gas needed. Even the great Hawaiian volcano, Kilauea, the steam of which contains only a trace of the gas, contributes something like thirty thousand tons a year. And in addition there are many unknown submarine volcanoes, each of which is doing its bit.

Dr. Jaggar also explained the presence of calcium carbonate, which is the same as marble, in sea-water.

"This is secreted from the water in the body of globigerina, a tiny organism ceaselessly dying and depositing billions of skeletons that make chalk on the ocean bottom. Locally the ocean floor is built up a foot per annum. Ten thousand years would shoal the ocean, but there have been millions of years, and the ocean is still deep.

"But though globigerina is everywhere in the upper waters, two thirds of the seabottom has no chalk. What could account for chalk banks being absent? The chalky bottoms are where the ocean is not so deep. It was found by Dr. J. Stanley Gardiner, professor of zoology at Cambridge University, that where the ocean is more than two and a half miles deep, where the pressure approaches three tons per square inch, sea-water can readily dissolve the chalk skeletons. And so, with the circulation of the oceans the lime salts are brought back and secreted over again by the live organisms."

THE CAUSE OF TYPHUS FEVER

TYPHUS fever, scourge of hospitals, jails and armies a generation ago and present even during the World War, may now be completely overcome by the discovery of its

cause. Though this disease has long ceased to be the menace that it once was, the germ or virus that causes it has been sought in vain. Now a Polish woman scientist, Dr. Bronislawa Sejgin, claims that she has succeeded in the quest.

Though medical research workers are skeptical of her claims, Dr. Sejgin told of her work at a recent meeting of medical men and students of the University of Michigan. She described her continental experiments in which she produced the malady in guinea-pigs by the inoculation of especially prepared emulsions of the otherwise harmless organism known as *Bacillus proteus* X 19.

For some time workers have considered that an intimate relationship existed between this organism and the disease, but never were able to prove it by producing the fever as the result of animal inoculations of the ordinary germ culture.

Dr. Sejgin caused a healthy growth of *Bacillus proteus* on a culture medium to disappear, apparently, by means of an agent known to science as the "bacteriophage." However, some workers had stated that a "phaged" culture does not die, but that the germ merely undergoes a form change in which it becomes invisible, even to the most powerful microscope. Dr. Sejgin, therefore, took a phaged culture and inoculated lice with it. Lice are known to transmit the disease from the sick to the well. Then she permitted the lice to bite healthy guinea-pigs. The pigs became sick of typhus-like fever and died. Once she permitted a louse to bite her arm. She fell sick, but recovered. Dr. Sejgin repeated the animal experiment many times with success, although never able to infect a pig with unphaged cultures.

She has concluded that the invisible life-stage of *Bacillus proteus* X 19 is the only virulent stage. She suggests that in other diseases for which the causative agent is suspected, but not proved, a similar laboratory procedure be applied. Such a method might definitely establish the trouble maker in influenza, it was said, as in this case, *Bacillus influenzae* is suspected.

However, American scientists do not entirely agree with her. For one thing, they are not sure that the disease Dr. Sejgin has produced in her guinea-pigs is typhus fever. Scientists at the U. S. Hygienic Laboratory do not think Dr. Sejgin has yet proved that she has found the organism or agent causing this disease.

THE EVOLUTION OF PLANTS IN THE SOUTHERN HEMISPHERE

BOTANISTS in attendance at the meetings of the British Association for the Advancement of Science at Johannesburg, South Africa, were taken on a botanizing excursion further back into time than they have journeyed in space to reach South Africa. In his address on "Botanical Records of the Rocks," Professor A. C. Seward, of Oxford University, one of the world's foremost authorities on fossil plants, led them on a journey through the forests that once thrived in the southern hemisphere.

After the days of the Coal Age, millions of years ago, there came, during the age known to geologists as the

Permian, a time of meager opportunity and pinched living for plants of the northern hemisphere. At the same time there existed to the south a vast continent, connecting what are now separate land masses of Africa, Australia and South America; this is now called "Gondwanaland." On this continent, separated from the northern lands by a broad sea, a new and progressive world of plants evolved, some of whose descendants later migrated northward and settled in the northern hemisphere.

It was not exactly a paradise for vegetable existence that these plants found in Gondwanaland, however. Professor Seward pointed out to his audience that there are many evidences that in this remote time, millions of years before the period we usually call the Great Ice Age, there was another Ice Age, during which glaciers crept northward from the austral borders of the land, and then gradually retreated, followed as they went by the pioneers of the plant world.

In closing, Professor Seward disagreed with the widely accepted idea that the presence of warm- and temperate-climate plant fossils in Arctic regions necessarily indicated a very great difference in climate between ancient times and the present. A rearrangement of land masses, permitting ocean currents to flow where they are now barred and preventing the year-by-year accumulation of snow that turns to ice, could very well permit a much more temperate-climate type of vegetation in high latitudes without violent changes in the climate itself.

BLINDNESS AMONG MEXICAN INDIANS

PROGRESS in the treatment of blindness which affects entire villages of Indians in certain sections of mountainous Oaxaca is reported by Dr. José Zozaya, who recently returned from that region.

Tiltepec, one of these villages of blind in the Sierra of Ixtlan, where Dr. Zozaya made observations and clinical tests, is typical of other such villages. It has about 40 houses scattered over the steep mountain side of a region unsurpassed for its natural beauty. Deserted huts in ruins point to a once greater population. Children are few and look old, and at 14 or 15 the great majority of the population are partly or wholly blind. Dr. Zozaya estimates that there may be from 5 to 6 thousand people in that part of Oaxaca thus affected.

The people raise coffee which they barter for chili and corn or a little cloth. They are without ambition and anemic. This is partly due, Dr. Zozaya believes, to a vampire species of bat which feeds on the natives at night. They are also bitten by flies which seem to cause tumors on the head, and which may be the cause of the blindness, for when the tumors are removed the blindness gradually disappears. Dr. Zozaya found no germs in the blood in his preliminary tests, but micro-organisms are present in the tumor tissues. The disease is known also in Africa, Chiapas and Guatemala.

In spite of their extreme physical degeneracy, Dr. Zozaya finds that these villagers have the highest moral standards. They are Zapotec Indians who as a rule have not learned to speak Spanish. They willingly submitted

to blood tests and operations and were not afraid of the strangers and their instruments. They were extremely curious about the modern clothes and camp equipment, but very delicate about property rights.

Dr. Zozaya has been the director of the Institute of Hygiene in Mexico City for several years, but has just left for the United States where he will be director of an American biological laboratory.

ITEMS

A DIET which will prolong life and relieve pain somewhat in patients suffering from certain types of cancer was reported by Dr. S. Monckton Copeman to the British Association for the Advancement of Science. The dietary measures can only be adopted when the disease does not interfere with normal eating. The diet restricts as far as possible the eating of foods rich in fat-soluble vitamins of animal origin, such as meat other than pork, as well as eggs, butter and cream. The necessary vitamins are obtained mainly from fruit and vegetables, especially water cress. However, Dr. Copeman emphasized that the diet is by no means strictly vegetarian, as white fish of all kinds are allowed. Some patients put on this diet actually gained in weight, Dr. Copeman reported. The treatment is reported to be especially helpful after operation, with the object of preventing, if possible, recurrence of the disease.

THE continued spread of smallpox in California is becoming alarmingly prevalent in the opinion of Dr. Frederick Eberson, assistant professor of medicine at the University of California Medical School. Dr. Eberson attributes to the rescinding of California's compulsory vaccination laws in 1923 the increase of more than 800 per cent. since that date. Soviet Russia is an example of the improvement following compulsory vaccination. In Russia there is less smallpox than in the United States in spite of the fact that in 1919, when compulsory vaccination came into effect, there were 169,000 cases.

DR. G. W. DUNKIN and Dr. P. P. Laidlaw, working at Mill Hill for the British Medical Research Committee in cooperation with the Distemper Research Council, have carried out an investigation of the virus that causes distemper in dogs, and after prolonged research have been able to prepare a special protective vaccine. Over 1,000 animals have now been inoculated and the results have been strikingly successful. In this part of the work the investigators have had the cooperation of many masters of foxhounds. In the Warwickshire pack, 44 inoculated hounds were exposed to infection and none took the disease; 91 uninoculated hounds that were kept with them took distemper and 49 died. In a kennel of Dandie Dinmonts, 52 puppies were inoculated and remained free from distemper although there has been repeated exposure to infection, and uninoculated dogs in the same kennel have taken the disease in a fatal form. A commercial laboratory is hoping shortly to put distemper vaccine on the market.