SCIENCE NEWS

Science Service, Washington, D. C.

COSMIC RAYS

COSMIC rays are probably the hearts of atoms of ordinary matter, positively charged by the action of starlight on interstellar gas, and accelerated in some cosmic or possibly terrestrial electric field.

Ten thousand observations of cosmic-ray intensities just completed in Panama and Peru and earlier studies in this country and Mexico have led Dr. Thomas H. Johnson, of the Bartol Research Foundation of the Franklin Institute, at Swarthmore, Pennsylvania, to this conclusion, which is contrary to other theories of cosmic ray formation.

Using a sort of cosmic ray "telescope" that "sees" on a motion picture film only the cosmic rays that pass through three-in-line Geiger-Mueller counting devices and set off in them simultaneous electrical pulses, Dr. Johnson has now definitely established that the western sky is "brighter" with cosmic rays than the eastern sky. If our eyes could see the cosmic ray corpuscles as they do the waves of ordinary visible light, they would see more cosmic ray light in the west. This difference in cosmic ray brightness between the east and west is also greater at higher elevations and the closer the observer goes to the magnetic equator.

Dr. A. H. Compton, of the University of Chicago, Nobel laureate in physics, and Dr. J. Clay, a Dutch physicist, have shown by their researches that the total intensity of the cosmic radiation decreases towards the magnetic equator. The lower equatorial intensities were readily explained by the supposition that part of the primary radiation consisted of electrified particles, but these studies could not determine whether the electrical charges were positive or negative. By the same physical laws that make it possible to determine which way the electric current is flowing in the wires of a motor from the direction in which its armature rotates, it is also possible to determine whether the charges of the cosmic rays are positive or negative from the way their paths are bent by the magnetic field of the earth. The fact that they are bent towards the east and therefore enter from the west means that the rays are mostly positively charged as any high school physics student can verify. This fact was first indicated a year ago as a result of Dr. Johnson's studies on Mount Washington, New Hampshire.

His most recent work on the equator in Peru now gives him data which allow him to conclude that all the cosmic ray corpuscles in the energy range which is affected by the earth's magnetic field in equatorial latitudes are positive and that there are no negative rays. The fraction of the total radiation which now can be directly attributed to the electrified radiation is also much higher than had been supposed previously. In fact these measurements show that at least forty per cent. of the total radiation is of this nature.

Most of the rays which are actually observed are known to be of secondary origin produced in the atmosphere by the bombardment of the primary radiation. These secondary rays are positively and negatively charged corpuscles in about equal numbers, as Dr. Carl D. Anderson, of the California Institute of Technology, has shown, but since their directions of motion are the same as those of the primary rays it is possible to use their directions as an indication of the directions of the primary rays before they enter the atmosphere.

THE TEMPERATURES OF THE STARS

THE photographs that are made of the stars when a spectroscope is used in conjunction with a telescope show gradations in character as well as in brightness. These gradations have long been known to indicate the temperatures of the star's surface. Only recently, however, has it been learned how to read the actual temperature from these so-called star spectra. The method has been worked out by Professor H. N. Russell, of Princeton University, in conjunction with the Mount Wilson Observatory.

We must be satisfied with surface temperatures, Professor Russell explains, because we can look into a star only through a small mass of its atmosphere. If our atmosphere were as opaque as the hot atmosphere of a star, we could see only a few feet in it. The opacity is due largely to the abundance of free electrons and ions which are partly separated from each other on account of the high temperatures. The extent of this so-called ionization can be calculated according to the law of mass action which has proved so powerful in studying chemical reactions.

The extent of the ionization also determines the character of the spectrum. Professor Russell described how certain lines in the spectrum at first became stronger as the temperature increased and then became weaker again. By studying the relative strength of many lines he tells how hot is a star. By this method he expresses in degrees the temperatures of many stars which have previously been classified only as to color.

Using this information Professor Russell is able to determine the relative abundance of different elements in the stars. It turns out that hydrogen, for example, is usually a thousand times more abundant than all the metals put together. The fact that hydrogen is not preponderant on the earth indicates that it has escaped because of its lightness.

THE AGE OF THE EARTH

UNCERTAINTIES in estimates of the earth's age are being clarified by determinations of the leakage of helium through geologic rock materials. The modern geologist's estimate of the earth's antiquity is 3,000,000,000 years. But the two methods used do not always agree. Work reported to the *Journal* of the American Chemical Society by Dr. William D. Urry, of the Massachusetts Institute of Technology, now settles some of these uncertainties.

The helium method of determination of geologic time depends on the amount of helium in rocks. Helium, the

second lightest gas, first discovered in the sun and now used for filling airships, is split off when one radioactive metal changes into another. Knowing that radioactive decay goes on at a constant rate, it is possible to find the proportion of helium in a rock and compute its age.

But if the helium generated within the rock leaks out of the various metals, estimates of the age with this method will be too low. To determine the rate of this leakage Dr. Urry has placed helium in iron and bismuth containers and measured the loss after it had been subjected to various treatments. He found that there was no appreciable leakage.

Since many rocks are composed largely of quartz a single large crystal of quartz was tested. This also showed no loss. Various glasses, however, do allow the passage of helium. If the helium is free inside a porous rock it will slowly diffuse through the pores. Dr. Urry has set up a mathematical expression to account for this leakage.

In determining the age of meteors by the helium method geologists have suggested that the material might pick up this gas in its passage through helium-filled space. The objection is overcome by Dr. Urry's work, which showed that steel did not adsorb helium.

The 3,000,000,000 year estimate of the earth's age is obtained from a different method. It is based on the conversion of the metal uranium into lead. The lead-uranium ratio has been used as the most satisfactory method of measuring geologic time. It is the purpose of Dr. Urry's work to bring the helium analysis figures into better agreement with the former method.

HEREDITARY CHANGES IN SEX-CELLS

WHEN the male of a white mouse is poisoned with alcohol or certain plant toxins, such as ricin, the sex cells are affected in a specific way. A true mutation, that is transmitted as a functional change in the animal's descendants, is caused. These observations have been reported by Dr. Agnes Bluhm, of the Kaiser Wilhelm-Institut of Biology in *Forschungen und Fortschritte.*

The change shows itself in the children in the fact that there is a greater mortality in their litters. If, however, the children of an alcoholized male are mated among themselves, the mortality rate is less in the grandchildren and may disappear entirely in the great-grandchildren. This fact would seem to indicate that the alcohol had simply a harmful effect which was wiped out in two generations and had not produced a really hereditary characteristic.

Dr. Bluhm believes, however, that a distinct mutation is produced in the sex chromosomes of the male, which in interbreeding is obscured by the fact that in the fertilization of an egg by the affected sperm cell there is produced in the egg an antagonistic substance, something after the manner of a toxin-antitoxin reaction. The reason for this belief is based on the results of cross fertilization. When a male of the alcoholized strain is mated with a normal female the mortality in the young is always greater than when a female of the alcoholized strain is mated with a normal male.

When the male mouse was poisoned or immunized by gradually increasing doses of ricin, his immediate progeny showed hypersensitivity to small doses of ricin. Like the alcohol effect this physiological reaction tended to disappear in the successive generations, but its existence in the male cell could be brought out by cross fertilization. That the effect was specific for the ricin and not simply a general weakening or injury was demonstrated by testing the progeny with other poisons, snake venom, for example, or abrin.

It has long been known from the work of Muller and others that radiation of the sex organs with x-rays will produce definite mutations which express themselves in structural features of the descendants. Dr. Bluhm's work indicates that chemical reagents may cause similar mutations, which express themselves, however, in specific functional alterations in succeeding generations.

A NEW WEIGHT-REDUCING DRUG

ENCOURAGING results with the new weight-reducing drug which enables fat persons to lose weight while eating an ordinary diet have been obtained by Professor E. C. Dodds, of the Courtauld Institute, and Dr. J. D. Robertson, of the Middlesex Hospital, London. The results are to be announced in *The Lancet.*

The new weight-reducing drug has the chemical name of dinitro-ortho-cresol and is said to be five times more powerful than dinitrophenol, which American physicians have been trying out clinically. Both drugs act to cause weight reduction by speeding up the rate of metabolism, the process of tissue change constantly going on in the body and embracing the change of foodstuffs and tissue into energy for the body's use. When the metabolism is speeded up, the body uses up energy faster, calling on the reserve stores of fat to augment the daily food supply. As a result, weight is lost.

The thyroid gland is a regulator of the rate of this process, and when because of disease or some other condition, it fails to function normally and the rate is very much slowed up, the condition of myxedema results. Thyroid extract restores the rate to normal and relieves the symptoms. The new drug which stimulates metabolism also restores the lowered rate of myxedema patients to normal, but without relieving the patient of the other symptoms of the disease.

This suggests a new and interesting point: either the relief of myxedema is independent of the raised metabolic rate or else metabolism induced by medication differs from normal metabolism.

Dinitrophenol is a potent and dangerous substance, not to be used without a physician's direction. Deaths have already occurred from its indiscreet use. Dinitro-ortho-cresol is said to be safer than dinitrophenol, but it is not intended for use without medical guidance.

PREVENTABLE MATERNAL DEATHS

NEARLY two thirds of the mothers dying in childbirth could have been saved if they had had proper care, a committee of the New York Academy of Medicine has found in their three-year survey of maternal deaths in New York City.

Physicians were held responsible for three fifths of the

preventable deaths. The patients themselves were responsible for more than a third of these deaths and midwives for about two in every hundred.

Lack of judgment, lack of skill or careless inattention to the demands of the case were faults of the physicians that contributed to the large number of maternal deaths. The patients' fault was failure to take advantage of those facilities which are at hand for safeguarding them during and before the birth of children.

The committee believes that the number of deaths can be reduced by reducing the amount of surgical interference during the birth of the child. At present surgical procedures are resorted to four or five times oftener than actually necessary. The death rate when childbirth is assisted by operative measures is five times as high as in spontaneous births.

Comparing the number of deaths when the child is born at home and in a hospital, the committee found that the increase in hospitalization failed to reduce sickness and deaths among the mothers as much as had been hoped for. However, it was observed that only normal, uncomplicated births take place in the home, as a general thing.

Contrary to generally accepted opinion, the midwife is an acceptable attendant for properly selected cases of childbirth. The committee recommended provision for proper training and supervision of these assistants.

ITEMS

BIRDS are frequently so sensitive to climatic factors that slight differences in temperature or moisture will keep two related species separate, although their range boundaries touch and even overlap. An illustration of this principle, in the case of the two American species of magpie, was given before the meeting of the American Ornithologists' Union by Dr. J. M. Linsdale, of the University of California. The common black-billed magpie of the West has a wide range, extending roughly from the Missouri to northern and central California. Here it gives way to the much less numerous yellow-billed magpie, whose range is limited to the valleys of central and southern California and adjacent southwestern states. No insuperable physical barriers separate the territories of the two species. The only thing that keeps them from mingling is a slight difference in choice of climate on the part of the birds. Seasonal changes in climate work in such a fashion that in some places the two species occupy the same territory, but never at the same time. When it is moist enough for the black-bills to come down into yellow-bill country, it is too cold for the yellow-bills and they retreat toward the lowlands. Then, when it is warm enough for them to come back the drought is too much for the black-bills, which vacate before their cousins can return their call.

UP in the stratosphere twelve miles above the North Pole, proverbially a cold place, it is 25 degrees warmer than at the same height over the equator. Dr. G. C. Simpson, director of the British Meteorological Office, explained in connection with the results of the British Polar Year Expedition to Fort Rae, Mackenzie, Canada, that the cause of this greater warmth over the pole is not known. The curious fact that it is warmer over the North Pole than over the equator in the upper air has been studied at some length in the United States. Dr. Hurd C. Willett, of the Massachusetts Institute of Technology, in a report to the National Research Council some years ago observed that the higher the earth's atmosphere is probed, the colder it gets, until a point is reached where there is no more decline. Above this there may even be a slight warming. An explanation of this upper-air reversal of the temperature relationships at the surface of the earth involves, according to Dr. Willett, the way in which the sun's heat is received in the atmosphere and the mechanism of the general circulation of the atmosphere.

FERTILIZERS help plants to form more foodstuffs, but they do it by increasing the total area of the leaf surface and not by raising the efficiency of the individual leaf as a synthesizing unit. This conclusion was reached by E. Basyrina and V. Tchesnokov, of the plant physiological section of the Russian Academy of Sciences, as a result of their experiments with oats grown in culture solutions. Given varying rations of phosphorus, nitrogen and potassium, the plants responded by varying their leaf areas, but unless the leaves became deficient in chlorophyll, the amount of food formed by a given unit area did not change.