SCIENCE NEWS

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A NEW FORM OF COPPER

FOLLOWING on his announcement that he has produced big crystals of copper differing from ordinary samples of the metal, is the discovery by Dr. W. P. Davey, research physicist of the General Electric Company, that the metal prepared in this way possesses increased electrical conductivity to the extent of 13 per cent. Dr. Davey reported his investigations at the meeting of the American Physical Society held in affiliation with the American Association for the Advancement of Science at Washington on December 31.

While the use of single crystal copper is at present not a commercial possibility, the time is in sight when electrical machinery and conducting wires will be made of the new copper, thereby cheapening the cost of new power lines, and releasing a proportion of the metal which would otherwise be tied up in cables. Another way of regarding the superconducting copper is to consider that with conductors maintained at their present weight, energy losses on transmission lines would be reduced by 13 per cent., or, if the losses are permitted to remain the same, then smaller conduits could be used for underground work, and lighter towers could be erected for the support of overhead wires.

When Professor P. W. Bridgman, Harvard University, discovered that copper could be produced in relatively large crystals by the process of heating gradually in an electric furnace, and cooling down again equally slowly, Dr. Davey set himself to make copper crystals of appreciable size, and he succeeded in producing pieces nearly an inch in diameter and six incres long.

It was at once observed that these specimens could be bent without effort, but that they could not be straightened again. This is due to the fact that the distortion upset the balance of the atoms of copper, and they readjusted themselves into small crystals, so that the bar was to all intents and purposes, a piece of ordinary copper, and quite as inflexible.

Dr. Davey proved by X-ray examination that the treated copper really was just one big crystal, with the atoms arranged in regular rows from end to end, and he found that one of the axes of the cubic form in which copper crystallizes, ran through the single-crystal rod. Knowing that different axes of a crystal possess different electrical conductivities, he decided that his new copper should also conduct differently in different directions, and when the measurement was made it turned out that the resistance of the metal in the direction of its long axis was 13 per cent. less than before it had been treated. In order to make sure that there was no flaw in the argument, the crystal was hammered and them annealed, so that its uniform structure was spoiled, and then its conductivity was found to be the same as an untreated piece of copper.

Commercial copper was used in the test, and it was found that it would submit to the warming and cooling process. The important result was obtained, however, that single-crystal, commercial copper conducted better than the purest obtainable samples of the metal which had not been processed, and it exceeded even silver in the facility with which it permitted the passage of the electric current. Silver is the best conducting metal known.

THE CLIMATE OF MARS

THE climate on Mars is such that it may support life, mosses and lichens or trogdolytic animals able to withstand a freezing night and a thawing midday on that ruddy planet. These are the conclusions presented to the American Physical Society by Dr. W. W. Coblentz, of the U. S. Bureau of Standards, who, with Dr. C. O. Lampland, of the Lowell Observatory, Flagstaff, Ariz., has measured radiation from this planet and determined its temperatures accurately.

The north pole during the Martian winter has a temperature of 94 degrees below zero, Fahrenheit, and in summer the south pole is 76 degrees below zero. An estimated value for the night side of the planet is 112 degrees below zero, Fahrenheit. In the equatorial regions of the planet, higher temperatures corresponding to those on earth are attained during the day, reaching 41 degrees Fahrenheit. In the equatorial regions of the planet, higher temperatures, corresponding to those on earth, are attained during the day, reaching 41 degrees Fahrenheit in the bright regions and 59 degrees Fahrenheit in the dark regions. The integrated temperature of the whole disk is 22 degrees below zero.

"What about life on Mars?" Dr. Coblentz said: "That depends upon our point of view; whether we think of palm trees growing in our tropics, or mosses and lichens which grow on the apparently bare piles of vol canic cinders of Arizona and under our Arctic snows

"The foregoing measurements show that for a few hours at noonday on the equator of Mars the surface temperature is not unlike that of Washington on some bright day in March. But consider the exceedingly cold nights and the great daily variation in temperature, amounting to perhaps 180 degrees Fahrenheit. Water is not present on Mars in sufficient quantity to form permanent lakes.

"Hence, with noonday temperatures of only 40 to 60 degrees Fahrenheit, even on the hottest spots on the equator, and with temperatures so low that probably all the water vapor freezes out of the atmosphere at night, it is evident that while vegetable and perhaps animal life appears to be possible on Mars it must be adapted to withstand prolonged drought and intense cold. Moreover, with such rapid temperature changes the reactions must be rapid. With most of the surface at Arctic temperatures it is reasonable to assume that if vegetable life similar to ours can exist on Mars, it must be like the mosses and lichens which thrive under our Arctic snows. Similarly, animal life must be trogdolytic, able to bur-

row deep and hibernate; or able to withstand the intense cold in a benumbed state, as do, for example, the torpid grasshoppers, wasps and ants one finds on warm days in winter."

ATMOSPHERIC NITROGEN

DIFFICULTIES in the path of those who would capture the nitrogen gas of the atmosphere, famous for its aversion for other chemicals, were brought to the attention of the American Chemical Society at its meeting in Washington by Dr. J. A. Almquist, of the Fixed Nitrogen Research Laboratory. Among the most promising of the methods so far introduced for accomplishing this result, which would cheapen fertilizer, is the making of synthetic ammonia. This pungent gas, formed by the union of three atoms of hydrogen with one of nitrogen, would then serve as the starting point for the manufacture of other nitrogen-containing substances.

Nitrogen and hydrogen can be caused to unite by the agency of catalysts, which are substances capable of producing reactions between chemicals unwilling to unite, although the catalysts themselves do not actually form a part of the new substance. This is the method to which Dr. Almquist has devoted his attention.

"We have made an extensive investigation of catalysts for this reaction," he said. "Observations with materials of the iron type have shed light on the nature of the process involved." Just why the presence of one substance will set off a reaction between others when none of it is used up in the operation, is a point which still puzzles chemists, and one which is the subject of much investigation.

Dr. Almquist and his associates have found, in the case of the iron catalyst in ammonia synthesis, that the pressure under which the nitrogen and hydrogen gases are kept influences the efficiency of the catalyst; they find that the absorption of the product, ammonia, slows up the operation. It was previously thought that the iron had to take up some of the ammonia before it would work, but the experiments now show that this view is wrong.

Another difficulty in the way of large scale application of the technic is the fact that nitride of iron may be formed on catalysts which cuts down the surface at which the union between the two gases takes place.

ARTIFICIAL FAT AS A FOOD

TESTS under way at Teachers College and Columbia University for the purpose of deciding whether intarvin, an artificial fat for cases of chronic diabetes, exerts a harmful effect on the body, have shown to date that no evil results follow the inclusion of the material in the diet of rats, according to the report of Hattie L. Heft, Max Kahn and William J. Gies to the American Society of Biological Chemists meeting this week in Washington.

This material was invented recently for the purpose of providing a utilizable fat for persons suffering from acute diabetes who could not eat fat from natural sources. Sugars and fats are built upon a framework of strings of carbon atoms, to which atoms of oxygen and hydrogen are attached, and the surprising feature about the compounds containing a large number of carbon atoms, arm in arm, is the fact that nature invariably makes the chains out of an even number of links. It is on this point that the success of the artificial fat swings.

When a natural fat is utilized or "burned" in the body of a person afflicted with diabetes, substances such as acetone are formed which have for a backbone a chain of three carbon atoms, and then the breakdown process stops, instead of being carried on to the ordinary harmless end-products, water and carbon dioxide. But the diabetic products are poisonous and consequently the sufferer has to cut down on fat as well as on sugar. The inventors of intarvin decided to prevent the formation of these unfavorable materials by providing in place of natural fats an artificial one, containing an uneven number of carbon atoms. The idea stood the test of experiment. Artificial "odd carbon" fat was found edible and nourishing, and its manufacture is now carried on by the ton, the principle of the method being to knock one of the carbon atoms from the end of the chain which occurs in stearin, a common natural fat with an 18-carbon chain.

Consequently, intarvin is an alternative to insulin for coping with diabetes, the difference being that a special food is substituted for periodic injections of the hormone, insulin. In order to find out whether any deleterious effects may result in the long run from feeding on the synthetic fat white rats were provided with a natural, balanced diet, to which was added up to twelve per cent. of intarvin for half of the subjects of the experiment, while the remainder received instead an equivalent quantity of rendered lamb fat.

Mating was permitted between the corresponding animals in the two groups, in such a way as to prevent inbreeding, and, after seven generations, the rats eating synthetic food have shown themselves to be in every way the equals of those provided with natural fat. "There have been no discernible effects on the animals treated with intarvin," these workers said. "Their fecundity has not been impaired.

"Our study of the beneficial effects of intarvin in the treatment of diabetes has confirmed the earlier indications of its utility, and also of its lack of toxicity."

THE ANTIRACHITIC VITAMIN

FURTHER clews in the tracking down of the mysterious accessory food factor or vitamin which prevents rickets were pointed out to the American Society of Biological Chemists by Drs. Alfred F. Hess and Mildred Weinstock, of New York, who are on the trail of the component of cod liver oil now well known as an effective substitute for the ultra-violet rays of sunshine in the banishing of bow legs, bad teeth and bending bones.

Cod liver oil supplies a curative and preventive principle, which is absent in vegetable oils, such as olive or cottonseed oils. But these oils, as well as green vegetables, such as lettuce or wheat, can be likewise endowed with the power of preventing rickets by exposing them

to the rays of ultra-violet light from a mercury vapor or carbon arc light. The power so acquired is not immediately lost, but is retained by the lettuce for several days.

Further, according to the statement of the authors, the property imparted to otherwise inactive oils by the exposure to ultra-violet rays is of a permanent nature, and is retained for many months. "While it is impossible to state definitely that the substance which is formed is the same as that which is responsible for the remarkable curative value of cod liver oil, it has been found by means of chemical examinations that cod liver oil can be separated into two definite portions—one which is of value and one of no value in curing rickets," they stated. "The vegetable oils which have been exposed to the ultra-violet rays can likewise, and by the same chemical means, be separated into a portion which is of no value, and another which acts as a specific in warding off or curing rickets. It would, therefore, seem that a substance has been formed in the vegetable oils by the action of the ultra-violet rays, similar to that which is naturally present in the oil of the liver of the cod."

NUTRITIVE CONDITION AND HABIT FORMATION IN RATS

FEED a rat an imperfect or insufficient diet, and you sharpen her wits. Drs. Arthur H. Smith and John E. Anderson, who reported their experiments to the Washington meeting of the American Psychological Association, speak of their animals as "she's", not by analogy to the catty tribe, but because they chose female rodents in their studies of the relation between nutritive conditions and habit-formation. They thereby side-stepped the issue as to the relative brain power of the females and males.

They put a number of female rats into a maze, and noted the time they required to effect an exit. Next they divided their performers, by this time familiar with some of the wrong turnings in the maze, into three groups so that each one contained approximately an equal number of smart ones and slow ones, and each group was given a different diet for another month.

One third were given as much as they desired of food known to be adequate for health and growth; an equal number had a full supply of fat, sugars and vitamins, but were restricted in their nitrogenous food to a single source; and the rest were given just enough of a menu which included all the essentials that would maintain their weight. At the end of the training period, Group 1 had thrived, Group 3 were stunted and Group 2 showed that something was wrong with their food. When the animals were put into the maze again, it was found that those which had been partially starved were quickest to find their way to freedom and food, and similarly, the poorly fed rats won the race to find the way out of a new and different maze.

The new maze brought out the difference that the stunted rats made more mistakes on the new maze, even though they found the door first, and thus, although their starvation treatment had sharpened their intellects to the extent of refreshing their memories about the maze which they previously knew, it made it harder for the poorly developed ones to learn the route out of the new blind alley, even though the desire for food made them hustle along the wrong paths to such an extent that they got out first in the end. When all the rats were given normal rations again, they were equally adept in solving the puzzle.

The experiments indicate that habit formation is akin to physiological processes in the body, according to Drs. Smith and Anderson, and the results of these will be presented to the American Physiological Society shortly.

"The normal functions of the organs concerned with the process of habit formation are interfered with by the same alterations in nutritive conditions as have been found to bring about the well-known disturbances in metabolism, growth and reproduction."

ITEMS

ARE "peculiar properties" of a chemical substance simply an exaggeration of a quality possessed by many of its chemical cousins, due to special physical conditions, such as a favorable temperature, under which it finds itself? This was the question raised by the report of Dr. Russell S. Bartlett, of Yale University, to the American Physical Society meeting in Washington. The electrical resistance of the metal, selenium, is known to vary with the amount of illumination which its surface receives, and this peculiarity is finding increasing practical applications in the construction of cells which vary an electrical current to a measurable degree when different amounts of light are allowed to fall on them. Among uses to which they have already been put is the turning off of beacon lights in the day time and the electrical transmission of photographs. Dr. Bartlett now finds that this is a property which many other metals possess, if they are kept at the temperature of liquid air. Bismuth was found to decrease in resistance to an electric current, when light shone on sheets kept in this extreme cold. Copper and platinum behaved similarly. "These results were first predicted from theoretical considerations," the physicist stated. Perhaps selenium's mysterious power is no more mysterious than the fact that mercury is unique among metals in existing in the liquid state at ordinary temperatures. Other metals are fluid when heated, while a mixture of the two metals, sodium and potassium, remains liquid.

METHODS for getting purer extracts of chlorophyll, or the green coloring-matter of leaves, for use in medicine, industry and science, were described before the American Association for the Advancement of Science by Dr. Frank M. Schertz, biochemist of the U. S. Department of Agriculture. Chlorophyll is important in medicine as the basis for a remedy used in anemia. It is used in industry as a coloring for foods, toilet articles, soaps and leather. A pure extract is important in biochemical study because plants depend on chlorophyll and sunlight in the making of foods. Dr. Schertz's method involves the use of successive extractions and separations by means of acetone, petroleum ether, alcohol and distilled water.