SCIENCE NEWS

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CHEMICAL REACTIONS WHICH OBEY THE LAWS OF CHANCE

A "GAMBLING" type of chemical reaction, new to science, promising important developments in America's $200,000,000 organic chemical industry, was announced at the Boston meeting of the American Chemical Society, which opened its ninety-eighth semi-annual convention on September 10. It may explain even the aging of wines and liquors. The new reaction, revolutionary in its fundamental concepts, obeys the laws of chance by which mathematicians can determine the odds in games like dice, poker and bridge.

One might call the new reaction a "chemical dice game," said Dr. George Calingaert, director of chemical research of the Ethyl Gasoline Corporation, who describes the new discovery. It takes place between chemicals ordinarily considered inert to one another and without chemical affinity which is usually thought to produce chemical activity. So new is the discovery that its potentialities are as yet unrealized, but they are believed to be very important. By what is called the "redistribution reaction," chemical compounds are found to redistribute themselves into a number of compounds in the presence of a proper catalyst. It is possible to predict by the mathematical laws of chance, or probability, just what the end distribution of these new compounds will be.

The new reaction may help to explain the reactions which occur during the aging of wine or liquors. These subtle changes do occur, for man's taste is able to detect the differences. But chemical tests are worthless to measure the changes. Why they occur is still more of a puzzle. "It may well be that this aging is in fact a 'natural redistribution' among the esters which are known to constitute the flavoring portions of these liquids," Dr. Calingaert said. "If such should prove to be the case, it seems likely that a better understanding of the nature of the aging process will soon lead to improvement in the technique of accomplishing this all-important result. Simple catalysts were used throughout the experiments. These catalysts weaken intramolecular attractive forces commonly considered to be quite firm. The groups of atoms, which break loose from the molecules, interchange purely at random with other similar groups. After these random interchanges have taken place long enough, a state of 'mathematical equilibrium' is reached in which the composition of the reaction mixture exactly equals that which can be predicted by the laws of chance."

Dr. Calingaert's initial experiments were carried out in research on the nature of tetraethyl lead and related "anti-knock" compounds for gasolines. It is already known, however, that the new type of chemical reaction takes place between compounds which chemists say are inert to one another, such as gasoline and kerosene, or milk and cream. All customary signs of chemical reaction are absent. There is no formation of a solid precipitate, or a gas, or even the heat so common to many chemical reactions.

THE CHEMICAL STRUCTURE OF VITAMIN K

THE chemical structure of vitamin K has been discovered. Behind that simple announcement at the meeting of the society is the story of more, better, healthier babies, cleaner operations by surgeons with less risk, and help for one group of sick people whose blood does not clot in normal fashion. Vitamin K plays an essential rôle in making blood clot. Without it every one would be in the dangerous position of people afflicted with hemophilia, who may bleed to death from a tiny scratch. Hemophiliacs, however, do not suffer from lack of vitamin K but from a different disorder of the blood-clotting mechanism.

Two research teams of outstanding chemists, working independently at Harvard University and St. Louis University School of Medicine, have both arrived at the same structural formula for vitamin K. Using different methods, the exactness of their agreement leaves little doubt of the certainty of their findings. At Harvard Dr. Louis F. Fieser, with William P. Campbell and Edward M. Fry, synthesized the vitamin and determined the structure. At St. Louis Drs. Edward A. Doisy and D. W. MacCorquodale, with S. B. Binkley and S. A. Thayer, who were the first to isolate vitamin K in pure form, carried out an independent determination of the vitamin's structure.

The synthesis of vitamin K by Dr. Fieser's method is said to be efficient and practical for manufacturing purposes and the pure vitamin will thus be available to medicine to prevent and control hemorrhages. Dr. Doisy has also evolved a synthesis for vitamin K and found, moreover, another compound, a naphthaldehyde which is about one eighth as active as the pure vitamin but which has shown excellent results in use at the Mayo Clinic. The structural formula of vitamin K is 2-methyl-3-phytyl-1, 4-naphthoquinone.

Because the blood of a new-born baby does not possess the ability to coagulate, or clot, rapidly until several days after birth, hemorrhages are among the causes of a great many injuries to infants at birth. Estimates indicate that 25 per cent. of the damages associated with birth are due to bleeding, usually through a slow seeping of the blood in the skull cavity caused by a compression of the infant's head. To prevent such hemorrhages will be one of the greatest contributions of vitamin K that now should be available widely by synthetic manufacture.

THE COLDEST REFRIGERATOR

THE world's coldest refrigerator, operating at 450 degrees below zero Fahrenheit, is in prospect as the result of discoveries reported at the opening meeting of the American Chemical Society by Professor S. C. Collins, of the Massachusetts Institute of Technology. The new type refrigerator would operate on compressed helium, the light inert gas used to inflate airships. When liquefied, helium produces the coldest cold known to man, only a few degrees above absolute zero.

Professor Collins said: "One does not ordinarily think of a steam or a compressed-air engine as being a refrigerating machine, yet the well-known principle on which they operate consists of the withdrawal of heat from the working gas and its conversion into work. Any gas expanding against a working piston is cooled by expansion. For instance, the temperature of a sample of air originally at 70 degrees Fahrenheit will fall more than 100 degrees if allowed to double its volume in an engine cylinder."

The major trouble to be overcome in a compressed helium engine is the matter of lubrication, for at 450 degrees below zero Fahrenheit all lubricants are frozen solid. Professor Collins solved this difficulty by doing away with lubricants and replacing the conventional piston of an engine with a flexible diaphragm of stainless steel. This diaphragm is sealed at its edges by a copper gasket between two steel plates. The expansion of the helium occurs between the diaphragm and one of the plates.

Two or even three such engines will be used in consecutive stages in refrigeration, for it is not practical to try to reach the extreme low temperatures in one single jump down the temperature scale.—ROBERT D. POTTER.

WORLD MAPS

THE Great Triangulation of India, most famous of all the world's mapping projects, will some day become a geodetic "Garden of Eden" for half the world's maps. This thought that the vast and careful mapping of India will be the center of origin of a far-flung network of coordinated maps for all of Asia, Europe, Australia and the Philippines was contained in the address prepared by Brigadier H. S. L. Winterbotham, mapping expert of Great Britain and general secretary of the International Union of Geodesy and Geophysics.

The address of Brigadier Winterbotham, who was recalled to England on account of the war, was read by Dr. William Bowie, formerly of the U. S. Coast and Geodetic Survey, who also took his place as general secretary.

While war will now temporarily stay the project, Brigadier Winterbotham stated that plans were being considered for pushing the century-old mapping work of India "to Australia, and the Philippines, to Moscow on the north and to Valentia (Ireland) and Casa Blanca (Morocco) on the west."

World maps, his address continued, rest on exactly known great arcs on the earth's surface which give stability and definiteness to maps as does a skeleton to a fish. Any one with competent knowledge, Brigadier Winterbotham's address stated, can carry out surveying of a small region, but it is only when each of these individual surveys can be "tied" to the general large-scale arcs of geodesy that all the little pieces will fit together exactly like parts of a huge jig-saw puzzle.

The "father" of the great mapping project in India was Sir George Everest, for whom Mt. Everest in the Himalayan Mountains was named. It was Sir George who as surveyor general of India in 1830 discovered the gravitational effect of large masses (like mountains) on plumb bobs whose timing helped determine gravity and the horizontal lines created by surveying levels. The near-by, giant Himalayan Mountains seemed at the time to circumvent Everest's astronomical observations by which he was determining latitude.

One of the great unfinished mapping projects of the world is the determination of the thirtieth meridian of longitude which runs from Cape Town to Cairo, through Africa, and later is to be extended to North Cape in Norway so that it will link the Arctic and Antarctic. Until this project is completed the mapping of Africa will be in the same stage of India at the time of Everest. "Until it is finished no lesser survey can hope to take its precise place on the map of Africa."—ROBERT D. POTTER.

PLAGUES TO COME IN THE WAKE OF WAR

INFLUENZA is almost certain to be wide-spread again if there is a general war, was predicted by Dr. Thomas M. Rivers, of the Rockefeller Institute for Medical Research, president of the New York meeting of the third International Congress of Microbiology. No effective weapon yet exists for this plague. Dr. Rivers pointed out that microbes will play a tremendous part in the war that has now started in Europe. He said no one is going to start a war of microbes. That would be next to impossible. Epidemics of influenza, typhus fever, trench fever and dysentery, however, are sure to follow in the wake of this war as they did during the last world war. Meningitis and European sleeping sickness, technically termed epidemic encephalitis, may also appear.

Dr. Rivers pointed out that medical men are better equipped to fight some of these war-born plagues than they were in 1914. Sulfanilamide, the new disease-conquering chemical, will not prevail against influenza or typhus fever, but it cures meningitis and gas gangrene. Serums also have been developed for fighting these deadly ailments.

The idea of using germs as a weapon of war is out on two counts. In the first place it is almost impossible for man to start an epidemic deliberately by releasing germs among a group of people or putting them into water or food. Not even cholera could be spread this way. Many factors besides germs are needed to start an epidemic. Even in laboratories, where conditions can be controlled far better than in communities of men and women, it is difficult if not impossible.

The second reason why germs will not be used as a weapon of war is that such a weapon would boomerang on the nation starting it. If an epidemic really got going, it would be impossible to prevent its spreading to people in the nation starting it as well as among their enemies. Germs, Dr. Rivers said, neither recognize nor stop at the front line.

NEW TREATMENT FOR CANCER

A NEW treatment for cancer has been introduced with considerable success in laboratory experiments. Almost 50 per cent. better results from x-ray or radium treatment of mouse cancers were obtained with a new "death-by-drowning technique," according to figures reported by Dr. Kanematsu Sugiura, of New York City, at the International Cancer Congress on September 12.

If human cancers react to the new treatment in the same way as the mouse cancers, the successful application of x-rays in treatment of cancer will be materially increased. Cancers so insensitive to x-rays that they can now only be killed by doses so large that the surrounding normal tissue would be damaged may some day be successfully irradiated by the new technique.

In the laboratory experiments, the mouse cancers are first bombarded with x-rays, gamma rays from radium, or the newer, faster neutron rays may be used. This increases the flow of fluid into the cell from the outside, according to one explanation of x-ray destruction of cancers. The cell swells up and its life essential chemicals are greatly diluted and eventually the cell may die.

To hasten the death-by-drowning, if that is what it is, sterile distilled water is injected into the cancer after the x-ray treatment. In mice a very small amount of the water was injected two to four times daily for three or four successive days after irradiation. Without the distilled water, an x-ray dose of 1,000 roentgens caused regression of the cancers in about 50 per cent. of the cases. The same x-ray dosage caused regression of cancers in 95 per cent. when the sterile distilled water was injected.—JANE STAFFORD.

ITEMS

SOLAR activity has been rapidly increasing with the number of spots greatly augmented, according to new photographs taken at the U. S. Naval Observatory. There were, last week, 209 spots observed on the sun, divided into 16 groups. One large group has appeared in the sun's southern latitude and it may menace foreign short-wave radio reception because of its angry character. It is believed that the increased intensity of radiation poured out by the sun at such times creates ionosphere storms in the radio reflecting layers miles above the earth. These layers act as "mirrors" for long-distance radio waves. The effect of ionosphere storms appears to "break the mirror" and cause distorted reception or even radio blackouts in severe cases.

LEADERSHIP in chemistry throughout the world is now in possession of the United States, according to a report submitted to the American Chemical Society by Professor E. J. Crane, of the Ohio State University, editor of *Chemical Abstracts*. Germany, which ranked first during the World War period and even a decade ago, has now dropped to third place with Great Britain second. Russia and Japan show striking gains. English is predominantly the language of science, the United States and England accounting for 40 per cent. of all scientific periodicals published. The report is based on an analysis of 65,000 abstracts of chemical discoveries reported last year in *Chemical Abstracts*. Chemical patents account for much of the leadership of the United States. During the last five years U. S. chemical patents have increased fifteen per cent. in number over the preceding five years. During this same time British chemical patents have declined twelve per cent., French chemical patents have decreased twenty-three per cent. and German chemical patents have dwindled to thirty per cent. of their former number.

ANTI-FLEA-BITE vaccination has been tried with "encouraging results," according to Drs. L. S. Cherney, C. M. Wheeler and Alfred C. Reed, of the University of California and the Hooper Foundation for Medical Research, in a report printed in the *American Journal of Tropical Medicine*. A group of susceptible persons has been actively immunized against the bite of this insect, which is both irritating and dangerous, since it may carry the germs of serious ailments such as typhus fever and plague. It is pointed out that "If it is possible to induce 'immunity' against flea bites, it is probably likewise possible to 'immunize' against bites of other insects. If so, this would be an extremely valuable adjunct in the control of insect-borne diseases. Insect bites may result in plague, yellow fever, malaria and other often fatal diseases, if the biting insects are carrying the germs of such ailments. The flea was chosen rather than the mosquito for the first attempts at anti-insect vaccination because it is the most common blood-sucking insect encountered in the San Francisco region. While the results are encouraging, a certain number of relapses after the immunization against flea bites have occurred, and no acute cases have been treated as yet.

PLANS for forest fire insurance are being perfected by economists attached to the U. S. Forest Service which should bring at least financial relief to the estimated $43,000,000 lost annually throughout the nation from this cause. "An unquestionably sound basis" for insuring standing timber against the menace of fire has been worked out in a report prepared by H. P. Shepard, of the division of forest economics, after a three-year study. The northeastern states and the Pacific Coast lumbering area have already been surveyed in the research study of the feasibility of the plan. A nation-wide expansion is believed possible. For the northeastern area it is estimated that premiums of only 13.5 cents per $100 of valuation would be needed to make the plan satisfactory.

TWO new bacterial diseases have been discovered by Drs. P. H. DeBach and W. A. McOmie, of the University of California. But nobody is expected to be worried, much. For the only creatures they are known to kill are termites. One bacterial species turns the heads of the dead termites black. The other turns the heads and legs red. The red disease is more than twice as deadly to termites than the black. In two lots of fifty termites each, infected with the two diseases by laboratory feeding, there were twenty-five "red" deaths as against eleven "black" fatalities.

NORWEGIAN and Italian chickens of the same breed differ markedly in temperament, according to Professor N. Jaensch, of the University of Marburg. Professor Jaensch's description of the behavior of northern and southern chickens reads almost like a popular statement of the difference between Nordic and Mediterranean human races. The northern fowl, he says, walks more proudly, goes quietly and directly on its intended course; the southern bird is more excited and agitated and dashes about moving its head continually. The Norwegian chicken eats until it has had enough and then quits; the Italian can be induced to overeat if it sees its fellow-fowls picking up grain.