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PAPERS READ AT THE CHICAGO MEETING OF THE AMERICAN CHEMICAL SOCIETY

EIGHTEEN different kinds of chemists, interested in everything from agriculture to water, gathered at Chicago on September 13 at a general meeting of the American Chemical Society, heard addresses on timely scientific subjects by four prominent American scientists. Furthest removed from the field of pure chemistry, but symbolic of the diversified interests of modern chemists, was the subject of "Cosmic Rays" discussed by Dr. W. F. G. Swann, director of the Bartol Research Foundation of the Franklin Institute. Dr. Swann reviewed the progress that has been made in the past year in determining the nature of this mysterious radiation that plows through celestial space to the earth. He concluded that the radiation consisted of high speed electrically charged particles and possibly bundles of very short wave-length light waves, called photons. Dr. C. E. K. Mees, director of the research laboratory of the Eastman Kodak Company, told of the advances that had been made in practical photography from studying and photographing the color picture or spectrum of the sun. The development of the "supersensitive panchromatic" films that are far more sensitive to visible light than the older types have allowed motion picture effects that were never dreamed of as being possible a few years ago. Infra-red or light waves of long wave-length invisible to the eye, having the remarkable property of penetrating atmospheric haze, have lent much to aerial photography. Dr. Francis C. Frary, director of research of the Aluminum Company of America, spoke on "Research in Metals and Alloys." He brought out the importance of minute quantities of foreign metals on the ultimate properties of alloys and discussed the technicalities of alloy testing and forging. "No longer," he stated, "can an inventor, working in a wood-shed, mixing metals by rule of thumb, hope to develop an alloy to meet modern requirements." In the field of pure organic chemistry and its application to industry, Dr. Charles R. Downs, chemical consultant of New York City, spoke on the American development of maleic acid and phthalic acid, which are widely used in synthetic resin and paint industries. One peculiar adaptation of these new products that was brought out by Dr. Downs was the use of succinic acid, a derived product. A six milligram tablet of succinchlorimide is sufficient to disinfect a canteen full of water in a few minutes.

THE expectation of life will be extended from seventy to seventy-seven years by the application of the chemistry of nutrition. Men will be at the height of their powers at sixty-five instead of fifty-eight. These are the beliefs of Professor H. C. Sherman, of Columbia University. Nutrition chemists are awakening to their duties towards human welfare and are concentrating their efforts around six "pillar concepts" enumerated by Professor Sherman as: "The quantitative studies of the energy relations, the protein chemistry of nutrition, the mineral elements, the vitamins, the inter-relationships between the different nutritional factors, and the principle that in the chemistry of nutrition the ultimate concern is essentially the nutritional reactions of the living body as a whole." Professor Sherman said that "while chemistry will not make blondes or brunettes, it will, by providing the suitable environment, make men and women more powerful constitutionally." Among the hopes held out for the future are: the age at which it is difficult to get new jobs in a field will be 52 instead of 45, age will yield less readily to youth, and newer generations will be taller and stronger than their parents. This last prediction is borne out by the fact that men and women at Harvard and Vassar are taller than their parents. This improved internal environment brought about by the application of the knowledge gained by nutritive chemists will pass on to succeeding generations, form a bulwark against disease, enlarge the prime of life, and postpone senility. The conclusions reached were based on experiments with more than 27 generations of rats. Popular belief attributes longevity to hereditary factors, but these experiments seem to establish very conclusively that it is greatly influenced by food.

DR. NICHOLAS D. CHERONIS, director of the Synthetical Laboratories of Chicago, told of his endeavors to find out the secret of the "marine fire" or "prepared fire" which twice wiped out besiegers' fleets and helped to defeat their armies on many occasions. "Marine fire" was the invention of an architect named Kallinikos, who came to Constantinople from either Syria or Egypt a short time before its first siege by the Arabs in the year 670. Swift boats armed with "siphons" to discharge his secret compound swept down upon the Arab galleys, and burned them to the water's edge. Again in 717 the Arabs came with a fleet and an army, and again the Greeks, using Kallinikos' fire, routed them utterly. The inventor's descendants, entrusted with his secret and guarding it jealously, manufactured the fire for the Emperors of Constantinople for many years, and it never failed to bring destruction and terror to the enemy. Some chemists have conjectured that it contained quicklime, which, when it touched the water, generated enough heat to set the compound afire. But Dr. Cheronis tried this, and also another chemical which had been suggested as the key to Kallinikos' secret, and found that combustion could not be started in that way. A more probable hypothesis, in his opinion, is that Kallinikos had discovered the possibilities of saltpeter, one of the ingredients of the later-invented gunpowder, and used it with the oils and resins to make his terrible flames. The "siphons" of the ships, he thinks, may have been the nozzles of pumps for discharging the liquid, which was then ignited by throwing a flaming dart or shooting a flaming arrow.

How modern chemistry has developed a commercial process producing a 300 per cent. increased yield in refined gasoline of higher quality as well as invading the manufactured gas and coal industries was told by Dr. Gustav Egloff, of the Universal Oil Products Company. The cracking process controls the number and quantity of the different products obtained by refining crude oil. When the process was put into commercial operation twenty years ago the gasoline it produced was considered to be inferior to the natural gasolines. In 1932, 43 per cent. of the gasoline sold was manufactured by this process and the motor fuel was recognized to have improved properties and anti-knock value. Savings of over $100,000,000 a year to the motorist and the conservation of 500,000,000 barrels of crude oil annually are the chief economic advantages to the public. The process has proved so successful in producing anti-knock gasolines for modern high compression motors that even natural gasolines are now processed. Cracking is not limited to gasoline production, Dr. Egloff emphasized, but is an important economic factor in the gas and coal industries, in the field of alcohol production, and in other industries. He pointed out that this process produces 250 billion cubic feet of high heating value gases annually, which are used to enrich gases of low heat content. A large proportion of these gases can be condensed and shipped in tank cars to small communities that do not maintain gas-making plants. As a fuel the supremacy of coal is being challenged by fuel oil. Dr. Egloff showed that the production of coal reached a peak in 1926 and then declined, whereas the fuel oil industry followed the general economic trend in 1929, when nearly 450,000,000 barrels were produced. Since 1913 the coal industry has declined 35 per cent. and the fuel oil industry has increased 150 per cent.

SYNTHETIC rubber made from chemicals is claimed to be superior to natural rubber for special purposes. Tests that showed its advantageous properties were described by E. R. Bridgewater, of E. I. du Pont de Nemours and Company. Although the synthetic rubber known as DuPrene is quite similar to natural rubber in its mechanical properties, it has entirely different chemical properties. This industrial rubber will resist swelling and dissolving in oils and greases. For example, ordinary soft rubber will dissolve completely when kept in hot crude oils for a week, whereas the synthetic rubber swells but does not lose its rubber-like properties. The deterioration of rubber on exposure to air and sunlight is less marked with DuPrene. It is vulcanized by heat alone without the addition of sulfur that sometimes proves objectionable in vulcanized natural rubber products. Automobile tires have not been made from the synthetic rubber, mainly because of its expense. It is used for special purposes such as: fabric belts, gasoline hoses, insulated wires, bottle stoppers, etc., that are exposed to oil, and conveyor belts that handle hot abrasive materials. Dr. Wallace H. Carothers, research chemist of the du Pont Company, concluded that the problem of synthetic rubbers is not solved completely as yet. The chemical mechanism underlying the synthetic manufacturing process is not clear, nor are the reasons for the physical properties of all rubbers. He expressed the opinion that a further study of the giant chemical molecules in rubber would make possible synthetic rubbers of still better properties, particularly in connection with highly specialized uses.

RUBBER from the only source within the borders of the United States, the guayule shrub, has been given a commercial test in automobile tires and tubes. What the motorist and the army could expect from tires that would have to be made from this local source in case of a war embargo was told by J. Harvey Doering, of the Firestone Tire and Rubber Company. The test tires built by this company from rubber that was exclusively guayule failed between 8,500 and 10,200 miles because of tread wear. The inner tubes proved satisfactory throughout the test. The chief difficulty with the extensive use of guayule rubber is its high resin content, Mr. Doering said. This can be overcome by an expensive process that will remove the resin. The tires tested were not made from treated rubber, but contained from 18 to 20 per cent. of resins. These rubbers are extremely soft and sticky so that it was found necessary to add several "drying" pigments before the tires could be built. Small quantities of dirt and bark in the rubber made it very difficult to build good tubes. Mr. Doering expressed the opinion that these foreign substances could be removed by some straining method, such as is used in cleaning reclaimed rubber. It seems very improbable that the guayule product will take the place of Hevea rubber imported from the East Indies except as an emergency measure, such as war.

A NEW process of soaking lumber in salt solutions to prevent shrinkage in dry weather that may eliminate the oven drying method was described by Dr. Alfred J. Stamm, chemist of the U. S. Forest Products Laboratory of Madison, Wisconsin. Lumber used in buildings must withstand changes in dampness from 30 to 80 per cent. humidity without appreciable change in shape. Wood treated with a definite amount of lithium chloride salt will not shrink until the relative humidity is less than 11 per cent., according to tests conducted by Dr. Stamm. This dryness is rarely attained under natural conditions. Although lithium chloride is the most effective agent in preventing shrinkage it leaves the wood wet and sticky so that it is useful only in special cases. Other salts show a smaller anti-shrink effect, but leave the lumber much drier and more adaptable to commercial use. Oven drying of green wood is equivalent to reducing the dampness from 100 per cent. to 0 per cent. humidity. This is unnecessary because lumber is never subjected later to such dryness. The new process depends on the salts binding the water in the wood and also an initial swelling effect.

METHODS of removing fluorine, the cause of unsightly mottled teeth, from water supplies, were reported by Dr. C. S. Boruff, research chemist of the State Water Survey of Illinois. Although several methods have been discovered, Dr. Boruff hesitated to recommend any one

method before further research work is done. All but one of the processes investigated are fairly expensive and troublesome. Only one or two parts per million of fluorides in drinking water are now known to cause mottled teeth. This dental decay is a very disfiguring condition consisting of dark and almost black discoloration over the upper front teeth. Every tooth in the head is affected and the injury, consisting of imperfect calcification of the enamel, is permanent. The purification of the water supply would not be expected to cure the existing cases of this dental decay and the success of any change would not be apparent for six or seven years, when the teeth formed subsequent to the water change would be appearing in children's mouths. Two cities, Bauxite, Arkansas, and Oakley, Idaho, have discarded former water supplies in favor of others containing less fluorides. Dr. Boruff stated that some cities, especially in the southwestern part of the United States, may not be able to find suitable alternate supplies and will be forced to attempt purification. The difficulty inherent in the removal of this very soluble and injurious ion are made apparent by the fact that from 8 to 16 pounds of fluorides to a million gallons of water are sufficient to cause mottled teeth.

BLAME for hay fever may be pinned on the proteins in the sneeze-producing pollens, rather than on their sugary or starch constituents. This was indicated by a paper presented by Dr. Marjorie B. Moore, of the Abbott Laboratories, and Dr. Leon Unger, of Northwestern University Medical School. There has been some division of opinion in scientific circles over the ultimate cause of hay fever. Some investigators have held that it is due to pollen proteins, while others have been of the opinion that certain sugar- or starch-like bodies, called polysaccharides, are to blame. Drs. Moore and Unger exposed hay-fever-causing pollens to the action of pepsin, which digested away most of the protein in them, leaving the polysaccharides unchanged. The pollens thus treated lost much of their mischief-raising power. The case against the pollen proteins is thereby strengthened and the polysaccharides exonerated of the suspicions which had been raised against them.

"LOST time," which amounts to 250,000,000 days annually in the United States, can be reduced by a proper diet for workers, according to a report made by Dr. Arthur D. Holmes and collaborators. Their experiments, which were carried on for three years, showed that very fat or very thin persons are likely to be absent from their work through illness more than similar workers of nearly average weight. This absenteeism increases the cost of all manufactured goods by interrupting production schedules. They state: "Our studies, carried out along sound research lines, have indicated that the addition of cod-liver oil to the usual home diet is a valuable aid for reducing such absenteeism. Comparing the amount of absence due to two groups of industrial workers, it was found that the men and women who received cod-liver oil were absent 1.1 per cent. of their working hours, whereas control subjects working in the same rooms with the cod-liver oil subjects were absent 3.1 per cent. of the time." Considering their results on the basis of the weight of the subjects they conclude that employment managers of industrial concerns should give preference to prospective employees whose body weight was not far from the average for his or her height and age.

CHEMICALS undergoing bombardment by hearts of helium atoms which are thrown out by the explosion of radioactive substances, are changed in many strange ways. Water is formed from hydrogen and oxygen at all temperatures from the super-freezing cold of 180 degrees below zero to the enormous heat of 500 degrees Centigrade. This is just one of the hundred or more reactions that have been forced to occur by subjecting the constituent atoms to the destructive forces of the radioactive projectiles called alpha particles by Professor Samuel C. Lind, of the University of Minnesota. He found that these same reactions between gases could be made to occur by passing an electrical discharge through them. Both the alpha particles and the electrical spark knocked off some of the outer negatively charged electrons of the atoms, leaving positive electrically charged clustering points to serve as centers for the gathering and combination of atoms. Professor Lind considers that the evidence which has so far been gathered is not sufficient to determine exactly the mechanism of the chemical reaction.

THE architecture of simple chemical molecules can be determined to within one-100,000,000th of an inch by means of x-rays. X-rays accomplish this feat by being shot through a small container filled with vaporized chemical compounds where they are bent by the parts of the molecule and so form a pattern when they fall on a photographic plate. Professor Willis C. Pierce, of the University of Chicago, told how these patterns could be interpreted to give the distances between the atoms and the arrangement of the atoms in benzene molecules. This extension of the use of x-rays was perfected recently by Professor Peter Debye, of Leipzig, Germany. The mechanism of the process is very similar to the older method of determining the position of atoms in crystals. The molecules in the gas are so far apart that they do not have a combined effect of bending the x-rays and so the pattern is due to the arrangement of atoms within each separate molecule. Professor Pierce found that the carbon atoms in a benzene molecule were arranged in a flat hexagonal ring with other atoms lying outside the ring and in its plane.

EXAMINING scraps of mortar and stucco from old Greek fountain houses, pebble pavements and tombs, found by Dr. T. Leslie Shear, of Princeton University, a Princeton chemist reports that mortars used then were about like modern mixtures. The specimens contain on the average about 25 per cent. of sand and 36 per cent. of lime. Mr. Foster said that his analyses disagree with the record left by Vitruvius, an architect who lived in Augustus' reign. Roman glass of the second century A. D., also tested chemically, proves to be of the soda-lime type, somewhat similar to modern window glass.