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AN ELECTRON MICROANALYZER

CHEMICAL elements composing such extremely minute submicroscopic objects as the tail or head of a germ or a virus, particles no larger than 1/100,000 of an inch in diameter, can be identified in a few minutes by a new instrument, the electron microanalyzer, developed by Dr. James Hillier, of RCA Laboratories at Princeton and reported by him in a communication to *The Physical Review*.

As a running mate to the electron microscope, the new instrument will allow the determination of the composition as well as the size, shape and internal structure of the particles which a few years ago were quite beyond the most powerful means of exploration in the microscopic world.

In the electron microanalyzer a very small area of the specimen is irradiated with an electron probe, a stream of these particles of electricity brought into a beam by a two-stage magnetic lens system. The electrons transmitted by the irradiated area of the specimen are focused by a third magnetic lens so that the electron probe is reformed. The amount of energy lost by the electrons is measured through a photographic exposure, and the position of markings in the electron velocity distribution indicates the presence of a chemical element in the specimen. The new instrument is now in experimental use.

In discussing the future significance of the microanalyzer, Dr. Hillier said that before the knowledge obtained by the use of the electron microscope can be applied by any of the physical, chemical and biological sciences, it must be translated into a form that is of significance to the individual problems being investigated.

"After looking at an electron micrograph and noting the physical characteristics of the object," he continued, "the scientist invariably asks, 'What is this?' He knows that he had a test tube of a specimen consisting of a number of chemicals, but now he has within his vision a number of different types of particles which are undoubtedly made up of some of the chemicals from the original bulk specimen.

"If the original specimen was a test tube of bacteria, the scientist knew that it consisted of a number of proteins and other organic materials. But on looking at the electron micrograph, he finds that the bacteria have flagella, cell membranes and structure in their protoplasm which often includes granules and particles surrounding it which he did not know existed. To find out the chemical structure of these particles, he must perform a number of tests on the bacteria. This procedure is very tedious, and not always successful."

VACCINATION AGAINST TUBERCULOSIS

INCREASED possibility of preventing tuberculosis by vaccination is seen in research by Dr. Truman Squire Potter, of the Laboratory of Preventive Medicine of the University of Chicago, according to an announcement from the university.

The vaccine which Dr. Potter believes will be effective, although it has not yet been tried on human beings, is made from tuberculosis germs that are killed by suffocating them. Vaccines against tuberculosis have in the past been made either from living but weakened strains of the germs or from germs that were killed by heat or chemicals. None of these has been generally accepted as safe and effective, although promising results have been reported with B.C.G. vaccine, made from living, attenuated tubercle bacilli.

The suffocation of the tuberculosis germs must be done under carefully controlled conditions which include an absence of oxygen, presence of moisture and a temperature high enough to keep the germs' metabolism active. Under these conditions the germs die partly as a result of self-sabotage. By continuing their living processes they deprive themselves of oxygen as they breathe, and since no more is supplied them, they suffocate.

Destruction of the germs by this method, Dr. Potter believes, is less likely than other methods to reduce or destroy the tuberculosis antigen. Antigen stimulates the body's defensive mechanism so that, when vaccination is successful, the body defenses are ever on guard in suitable strength to overcome fresh invasion of the germs that produce the antigen. This is the principle of vaccination in general. In the case of tuberculosis, the problem has been to find a way of getting enough antigen into the body to develop immunity without giving so much or giving it in such form, for example in living germs, that it will cause tuberculosis.

In his latest research, reported to the Society for Experimental Biology and Medicine, Dr. Potter used a vaccine from asphyxiated human-type tuberculosis germs to protect rabbits. Of 33 vaccinated rabbits, only four showed minimal lesions of tuberculosis when large doses of virulent germs were injected into their veins after the vaccination. Of 33 unvaccinated rabbits, 25, including three that died, showed frequent severe lesions.

PUTTING FLUORIDE ON TEETH ABOUT 40% EFFECTIVE IN REDUCING AMOUNT OF OF DECAY DURING YEAR

PUTTING a 2 per cent. solution of sodium fluoride on the teeth of a group of school children reduced by about 40 per cent. the amount of caries, or decay, in the teeth of these children during the following year, is reported by Dr. John W. Knutson, dental surgeon of the U. S. Public Health Service, and Professor Wallace D. Armstrong, of the University of Minnesota, in *Public Health Reports*, the official publication of the federal health service.

Fluorides in drinking water, it was discovered some years ago, will, if present in high enough concentration, cause the ugly tooth condition of mottled enamel. Lesser amounts of fluorides in the water, though failing to cause mottled enamel, apparently protect the teeth against decay. Efforts to use fluorides locally instead of through the drinking water to control teeth decay have previously

been made by other investigators on small groups of children, with apparently some success.

The group treated under the direction of Dr. Knutson and Professor Armstrong numbered 289. Their teeth were compared at the end of the year following treatment with those of a control group of 326 children in the same schools. Before the treatment, children of both groups had been suffering about the same amount of tooth decay.

Only the teeth in the upper and lower left quadrants of the mouth were treated. There were 39.8 per cent. fewer new carious teeth in the treated than in the untreated teeth at the end of one year. The treatment did not, however, prevent decay from attacking undecayed surfaces of teeth previously attacked by decay. In other words, about 40 per cent. of teeth that had no decay or cavities were protected from caries, but teeth that already had cavities or decay spots were not protected.

If this is borne out by further studies, it means that the fluoride treatment can prevent caries, but not arrest it once it has started. In that case, it probably is a more effective preventive than the 40 per cent. figure indicates, because undoubtedly, it is pointed out, some of the new caries developing in the treated teeth had started before treatment, but was not far enough along to be detected when the teeth were examined before treatment was started.

The 2 per cent. solution of sodium fluoride used is highly poisonous and must be used and guarded with extreme caution. Whether this is the weakest effective solution and whether eight treatments, the least number given in the study, are more than needed are among questions to be answered by further studies.

FORMOSA

THE Island of Formosa has or had an air field important to Japan in her attempts to hold the Philippines and other areas to the south. It is strategically important for other reasons. It lies only 90 miles off the Chinese mainland shore. Shipping bound from Japan to Singapore, Sumatra, Java, Borneo, and to ports in Indo-China, Thailand and Burma passes close to its eastern shore.

Formosa, acquired by Japan in 1895 after the Sino-Japanese war, is called by them Taiwan, the Chinese name. The name Formosa, meaning "the beautiful," was given to it by early Spanish navigators who were impressed with the beauty of its scenery.

The area of the island is about 14,000 square miles, nearly equal to that of Massachusetts, Connecticut and Rhode Island combined. It had a pre-war population of over 5,500,000, the great majority of whom were of Chinese blood. It had also some 115,000 people of so-called native blood. It produced before the war large quantities of rice and sugar and other agricultural products, exporting annually approximately $130,000,000 worth, most of which went to Japan proper.

Formosa is an elongated oval about 225 miles in length from north to south, and 60 to 80 miles wide near its center. It is just beyond the string of islands called Ryukyo which extend southwesterly from Japan. It is mountainous, particularly on its eastern side. Mt. Morrison, or Niitaka Yama, is 14,700 feet in height, and Mt. Sylvia, or Setzu-Zan, is nearly 12,500 feet in altitude. The eastern shores are precipitous. The Pacific waters off the shore are deep. Agricultural lands lie to the west of the mountains. The Formosa strait, between the island and the Chinese mainland, is indicated on charts as shallow.

From northern Formosa to Toyko is approximately 1,300 miles. It is about 700 to the southern portion of the southern island, Kyushu, in the homeland group of the four principal Japanese islands. Formosa is about 175 miles from the northern extremities of the Philippines.

ITEMS

A NINTH magnitude comet has been discovered by the Dutch astronomer, Dr. H. van Gents, at present on the staff of the Union Observatory at Johannesburg, South Africa. Moving rapidly it was diffuse in appearance. The comet was found very close to Nova Puppis, the new star which blazed out so brilliantly in November a year ago. This is purely a coincidence, however, there being no physical significance in this fact. Observers in the United States will have difficulty in studying the comet, which is moving rapidly to the southwest. Its path may carry it so far south as to bring it completely below our southern horizon so that professionals and amateurs in Mexico, South America, South Africa and Australia will have to carry on the study. At the time of its discovery on November 27 at 5: 15 P.M., EWT, the new comet had a right ascension of eight hours, seven minutes and a declination of minus 34 degrees, 14 minutes. Its daily motion, as reported to Harvard Observatory, clearing house in the United States for such information, was eight minutes, six seconds to the west and one degree, 30 minutes to the south.

THE shortest day of the year will be Wednesday, December 22. Winter officially comes to the northern hemisphere that day at 1: 30 P.M., EWT, the time of the winter solstice. The word solstice literally means sun-standing-still, for the sun appears to rise always to the same height at noon for several days around that time. Ancient peoples, who regarded the sun as a god, must have watched with apprehension the gradual sinking of the noon-day sun. Would it begin to climb again as they had been taught, or disappear forever? The sun finally appeared to stand still and then reversed its direction. But a few days after the actual solstice were always needed in order for the ancients to be absolutely sure, then there was great rejoicing. This festival occurred each year at just about the time that Christmas is now celebrated.

ALLOY steels and the development of the ferro-alloy industry are responsible for the great strides made in engineering, was stated by Dr. B. D. Saklatwalla, consulting Pittsburgh metallurgist, in the Richards lecture of the Electrochemical Society. Low-alloy structural steels are widely used now in artillery equipment, army trucks, railroad cars and for other purposes. "The economic implications of alloys are very far-reaching. Their ability to impart high strength to steel, whereby lighter structures with equal strength can be produced, was recognized early and formed the basis of our mass production automotive industry." Low-alloy, high-strength, corrosion-resisting steels may be the steel industry's answer to the challenge of aluminum, magnesium and plastics.