SCIENCE NEWS

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MATHEMATICAL STATISTICS SPEEDS MASS PRODUCTION

MATHEMATICS can aid America's defense production in many ways, it was stated at the Symposium on Applied Mathematics, held by the American Mathematical Society at Columbia University on February 21. The speeding of mass production by showing the most efficient way of producing parts of a specified tolerance and determination of the most efficient design of airplane wings were cited among other instances.

Dr. Walter A. Shewhart, of the Bell Telephone Laboratories, discussing "Mathematical Statistics in Mass Production," said that "a basic engineering problem in mass production is to devise an operation of using raw and fabricated materials which, if carried out, will give some particular thing wanted. The specified tolerance ranges for the quality characteristics of the thing wanted are the engineer's target. He devises a production operation and predicts that it will hit the target if carried out; but, since he does not have certain or perfect knowledge of facts and physical laws, he can not be sure that a given operation will hit its target. In fact, the best that he can hope to do is to know the probability of hitting the target. Here then is a fundamental way in which probability enters into everything that an engineer does. "Furthermore, if the thing produced fails to meet tolerance requirements, the engineer is penalized in one way or another. For example, if the quality of any piece-part fails to meet its tolerance requirements, a loss is incurred through rejection or modification of the defective part. If the time-to-blow of a protective fuse fails to meet its tolerance range, loss of property and even loss of life may result. If the time-to-blow of a fuse in a shell fails to meet its tolerance range the shell may even burst within the gun and kill members of the gun crew, and, in any case, will fail to fulfil its function of destruction within the ranks of the enemy."

By using statistical control, he explained, it is possible to provide "a technique for modifying and coordinating the three fundamental steps in the process of mass production, namely, specification, manufacturing and inspection, so that the maximum number of pieces of product having a quality within specified tolerance limits can be turned out at given cost. It does this by showing how to minimize the cost of inspection and the cost of rejection. Statistical theory plus mass production provides a means of maximizing our physical comforts in time of peace and our strategic factors in time of war."

RADIUM-LIKE CARBON MADE FROM NITROGEN

MODERN alchemy, which turns one element into another, has now made from nitrogen a form of carbon which promises to have important uses in medicine and other sciences, announce two researchers at the University of California.

This kind, or isotope, of carbon is of mass 14, somewhat heavier than normal carbon, principally composed of the isotope of mass 12. Unlike ordinary carbon, the new kind, C–14, gives off beta rays, one kind of radiation emitted by radium. It consists of atomic fragments called electrons. C–14 does not, however, give off gamma rays, which resemble x-rays, and are responsible for the medical effects of radium.

In a report to *The Physical Review*, Dr. Samuel Ruben and M. D. Kamen, of the University of California, reveal their success in preparing appreciable quantities of C–14 with the cyclotron, or "atom smasher," of the university.

For six months two five-gallon carboys of a concentrated solution of ammonium nitrate, in which no carbon is present, were exposed to a constant rain of neutrons from the atom-smasher. Some nitrogen atoms, which have the same mass as C–14, were converted into the carbon isotope. These were extracted in the form of various carbon compounds. Their radioactivity was tested by means of a Geiger counter, which detects the beta rays. The samples showed considerable activity, far more than any of the materials used originally, before the bombardment with neutrons.

It is expected that C–14 will prove important as a tracer element, in medical and botanical research, and it may be prepared commercially in large quantities for such use. Carbon is the most wide-spread element in living organisms. Ordinarily it is not possible to distinguish one carbon atom from another, but radioactivity forms a tag for identification. If C–14 atoms are introduced at one part of a living organism, they can be located elsewhere by their effect on a Geiger counter. Another advantage of C–14 is that it has a long life. Continually giving off energy, radioctive elements are gradually used up. C–14 disintegrates so slowly that after 1,000 years there will still be at least half of the original quantity remaining.

Dr. Ruben and Mr. Kamen point out that in some ways the long life of C–14 is unfortunate, since it requires a long time to prepare it. They point out, however, that there are methods for concentrating it from the other isotopes. In addition, they suggest, end products of a reaction in which it is used can be collected, the C–14 reconcentrated, and used over again.

P-RADIATION

CLOUDS of bullets which are continually shot from the sun make it possible for radio waves to travel long distances by night as well as by day.

Recent studies by the staff of the Department of Terrestrial Magnetism of the Carnegie Institution of Washington have revealed new facts about these material particles which cause the aurora borealis and are mainly studied by their effect on the magnetic condition of the earth.

These particles travel across the 92,900,000 miles separating sun and earth much more slowly than the visible and invisible light waves, which make the trip in about eight minutes. That is why they produce an effect at night.

Invisible ultra-violet waves, similar to light, strike atoms in the uppermost parts of our atmosphere, ionize them by knocking electrons from them. This makes an electrical ceiling that prevents radio waves from escaping into space, reflecting them downwards instead, perhaps many times, and thus sending them around the curved globe.

This effect is only in the daytime hemisphere—that which faces the sun, yet the radio ceiling persists into the night. But the particles being slower, even the night time part of the earth is constantly running into them, and the effect, in ionizing the upper atmosphere, is similar to that of the light waves.

The bombardment is described, in a statement issued by the Carnegie Institution of Washington, as "coming in clouds of particles, of various sizes from mere wisps to diameters many times the earth's radius, which form a more or less continuous stream, perhaps of the structure of a string of pearls and in shape like the arms of a spiral nebula."

This "P-radiation," as the stream of bullets is called, is presumed to come from hypothetical "M-regions" of great activity on the sun's surface.

AERIAL PHOTOGRAPHS

AERIAL photographs, taken and printed in the air within seven minutes after exposure, are among the latest accomplishments of technicians of the U. S. Army Air Corps at Wright Field.

By making the pictures so rapidly, then dropping them to the ground in a metal container to which a streamer is attached to make it easy to find, information gained on flights over enemy territory can be quickly delivered to headquarters. Hitherto, the general practice has been for the plane to land with the undeveloped films, which were then finished.

According to H. F. Stiffler, Wright Field mechanical engineer, who describes the new system in an Air Corps publication, the advantage of such a system has long been realized, but earlier attempts were held back, chiefly through lack of interest, and also because of the danger to airplane structure and controls caused by corrosion from the photographic chemicals.

In 1939, he says, the photographic laboratory at Wright Field experimented with a quick-work unit that made pictures on reversal-type paper instead of film. In the developing process, a positive print could be obtained without the intermediate stage of a negative.

Disadvantage of the method was that the paper is much slower than aerial film, so exposures could only be made under fairly good lighting conditions. In addition, its processing requires close regulation of the temperature of the solutions. This made necessary tanks with automatically controlled cooling and heating units.

High-speed film is now used, with processing solutions that work satisfactorily in temperatures as warm as 80 degrees Fahrenheit. The film holder is made of materials that are not affected by the solutions, which are contained in five half-gallon tanks, each with a trap door lid that keeps light out and prevents splashing.

After a piece of the film has been exposed and the dark slide of the holder is closed, the holder is removed from the camera and inserted in the first tank, which contains the developer solution. The dark slide is then withdrawn. After one minute in this tank, the dark slide is again closed and the holder transferred to the second tank, and so on until the processing is complete. The wet negative is removed from the holder and placed on the printer.

In printing, a thin piece of clear film over the negative keeps the paper dry. It is then placed in a dry film holder. This is then put through the five tanks, just like the original film. The final result is the finished print which is dropped to the ground, still wet, in the metal container. While the present equipment is still in the experimental stage, satisfactory prints have been produced with it while in flight in seven minutes from the time of exposure of the films. Tests indicate that a satisfactory solution to the quick-work program is within sight, and it is expected that standardization and procurement for a service test will be accomplished in the near future.

TOXOPLASMA

THE deaths of two adults and one six-year-old boy from infection with Toxoplasma, and a non-fatal case in another little boy, are reported in the *Journal* of the American Medical Association. The ailment may or may not be rare. How often it occurs is one of the unknowns in the problem.

The two little boys had "atypical encephalitis," according to Dr. Albert B. Sabin, of the Children's Hospital Research Foundation and the University of Cincinnati College of Medicine. Encephalitis means "sleeping sickness" to most laymen, but they did not have typical sleeping sickness. Convulsions, fever, disorientation and an increased number of a certain kind of white blood cells in the spinal fluid were the chief features of the disease.

In the adults, the ailment might have been mistaken for Rocky Mountain spotted fever or endemic typhus fever, according to the report of these cases by Dr. Henry Pinkerton and Dr. Richard G. Henderson, of the St. Louis University School of Medicine. Rash, fever and lung involvement were the outstanding features in these cases.

Toxoplasma, the "germ" that caused these quite different ailments, was first discovered in 1908 in the gondi, a North African rodent. Since then it has been found in many animals, such as guinea pigs, rabbits, rats and mice, and has been reported as causing disease in man. Hitherto, it has been doubted that Toxoplasma could or did cause sickness in man because the evidence in the earlier reports, with one exception, was inconclusive. Now, however, the proof is more definite. Both Dr. Sabin and Dr. Pinkerton and Dr. Henderson report laboratory tests, including transmission of the disease to guinea pigs by inoculation with blood or spinal fluid from the patients, which are pretty convincing evidence that the Toxoplasma caused the illnesses.

How the patients got the disease is part of the mystery that remains to be solved. In the cases of the two adults, there was a suggestion that ticks, such as transmit Rocky Mountain spotted fever, might be responsible. A cat in the home of one of the little boys became sick and had

convulsions about the time the child got sick. This was suggestive, but the cat had been disposed of, so no tests could be made to determine whether it also was infected with Toxoplasma. Mosquitoes had been troublesome around this home, but no ticks had been seen. Some cases of Toxoplasma infection have been reported in infants and it was thought these babies got the sickness from their mothers, although the mothers themselves did not have it. Because the two adults who died of toxoplasmosis had lung involvements, it is pointed out that the ailment might be transmitted directly from person to person.

The disease is probably relatively rare, although there is as yet no indication how frequent such infection is. Owing, however, to its similarity to recently reported cases of atypical pneumonia of unknown cause it is not at present justifiable to assume that it is a rare disease.

Treatment so far has been directed to relief of symptoms, but Dr. Sabin's report indicates that the newer sulfa drugs may prove effective. He gave sulfanilamide to one of the little boys, but without success. Later tests with mice showed that sulfapyridine and sulfathiazole have a curative effect on the infection in mice, but that sulfanilamide "only delays death but can not prevent it."

BLOOD IN PHARMACEUTICAL STANDARDS

BOTTLES and flasks of vital red fluid stored in hospitals for emergency lifesaving may in the future bear labels reading: BLOOD U. S. P. The three letters are initials for the Pharmacopoeia of the United States, and when they are on the label of a bottle the contents of that bottle must, by law, come up to the standards described for the substance in the Pharmacopoeia.

Whole blood, blood serum and blood plasma for transfusion are recommended for inclusion in the twelfth revision of the Pharmacopoeia, according to Dr. E. Fullerton Cook, chairman of the revision committee of the U. S. Pharmacopoeia. The Pharmacopoeia is revised every ten years, with occasional interim revisions to keep up with the rapid development of scientific knowledge.

Quinine, according to Dr. Cook's announcement, may come out of the next Pharmacopoeia. Physicians now-a-days seldom prescribe quinine for treatment of malaria. Instead, they prescribe various salts of quinine such as quinine sulfate. These will remain in the Pharmacopoeia.

Antipneumococcus serum, immune serum for scarlet fever, and immune serum for measles are recommended for the U. S. P. XII. So is tetanus toxoid. Among other articles recommended for inclusion are radium, nicotinic acid amide, halibut liver oil, vitamin A and D in oil, riboflavin (one of the B vitamins), and cortin, an adrenal gland extract used in treatment of Addison's disease. Extract of rice polishings, standardized for vitamin B_1 potency for use in the Philippines, is also recommended for inclusion.

Among recommended deletions of articles now in the Pharmacopoeia are such standbys as asafetida, cantharides, capsicum, pepsin, iodoform, powder of ipecac and opium, creosote and one reminiscent of the world war surgery, modified Dakin's solution.—JANE STAFFORD.

ITEMS

BY shooting high energy atomic bullets, or neutrons, at them, University of California physicists have succeeded in breaking the nuclei of both uranium and thorium atoms into equal parts, it was announced recently. Importance of this is that the form of uranium used is of mass 235, the kind that, it is hoped, will make possible practicable atomic power with such a splitting or fission process. In previous experiments, by using slow-speed neutrons, uranium was divided very unevenly, into a light element and a heavy one. However, Dr. Emilio Segre, of the Radiation Laboratory, and Dr. Glenn Seaborg, instructor in chemistry, used high-speed neutrons, with energies of 16 million electron volts, or more than three times that used earlier. These neutrons are produced by bombarding atoms in the cyclotron or "atom-smasher." In the splitting process, energies of 100 million or more volts are produced. Difficulty of separating uranium of mass 235 from the ordinary kind, which contains it in rather small amounts, has so far prevented actual tests of uranium power.

THE star Sirius, changing in color from red to light green, was the startling sight observed recently from a ship in the tropical Pacific Ocean, west of the Galapagos Islands. In a report to the Hydrographic Office of the U. S. Navy, the observer, whose name and ship are not revealed, says that he was taking a sight on the star, when he noticed the color changes. Then he looked through binoculars, "and it was found that nearly all the colors of the spectrum were included in its changes." Sirius was then just rising in the east. As it climbed higher the colors faded. Such an effect is an exaggerated form of the familiar twinkling. As the star's light passes through regions of the air of different temperatures it is bent one way, then another. When the temperature differences are unusually great, the air acts as a prism, and spreads the beam out into an actual spectrum. Because of the movement of the air and also, in this case, of the ship, the observer sees changing parts of this spectrum, and hence the changes of color.

DEADLY to apple worms, harmless to bees, is a new virtue found in the new poison-spray material, phenothiazine, now being tested by the U. S. Department of Agriculture. The discovery is subject of a joint report by L. M. Bertholf, of the Bureau of Entomology and Plant Quarantine, and J. E. Pilson, of Western Maryland College. One of the great problems involved in control of the worst of apple enemies, the codling moth (whose larvae are the "worms" found in apples), is the deadliness to bees of the arsenical sprays commonly used. In these tests, bees were given heavy doses of phenothiazine without any apparent ill effects. In contrast, minute doses of calcium arsenate proved deadly, and lead aresnate was also an active bee poison in the doses bees are likely to get in gathering pollen from sprayed orchards. Phenothiazine is not yet recommended for general use in orchard spraying, because thus far it has not produced uniform results on the codling moth larvae. It is hoped that further experiments will make it more completely dependable.