

## SCIENCE NEWS

*Science Service, Washington, D. C.*

## POISON GAS

Look out for poison gas in the war, Major-General William N. Porter, chief of the Chemical Warfare Service of the Army, warned in a dinner address delivered at Atlantic City before the American Chemical Society. General Porter pointed out that not treaties, but a careful balancing of possible advantages against disadvantages, is what has deterred the belligerents thus far from loosing gas.

He assured his audience that the United States has not been lagging in study and preparedness for chemical warfare, defensive as well as offensive. More than a thousand reserve officers, as well as the regular officers of the Chemical Warfare Service, are now on duty. In addition to a permanent advisory committee of twenty, more than a hundred members of the American Chemical Society have been appointed as consultants to the service.

General Porter stated that "We are well informed in the Military Intelligence Section of our Army of weapons, gases and instructions for their use by all belligerents, and have very considerable knowledge of the amounts and kinds of agents being manufactured to-day and stored in the arsenals of Europe, ready for use.

"Whether or not gas warfare will be used depends solely on whether Hitler's generals feel that the advantage to them would surely outweigh any disadvantages. Up till now they have not felt so, and I think rightly, since gas is primarily a defensive weapon and would have been of much more value to the retiring Russians than to the advancing Germans. Hitler understands well that mustard gas on British beaches would add materially to the precariousness of an invasion.

"On the other hand, should he believe that one gigantic overwhelming stroke with gas would win the war for him, I am convinced that he would use it without question. Treaties signed and sealed have not restrained dictators from any course of action suited to their purpose. This war will never be really 'all out' until gases once more flood the battlefields.

"Improvements in technique make possible gas attacks on a far wider scale than any seen in the World War. Fleets of airplanes equipped with chemical tanks make it possible to spray large areas with vesicant liquids not only on military personnel, but upon the civilian population as well."

## THE PRODUCTION OF CHLORINE

CHLORINE, a poisonous green gas needed in immense quantities in both defense and civil industries, is now available on an unlimited basis, through a new process reported at the Atlantic City meeting by its discoverers, Professor Arthur W. Hixson and Dr. Alvan H. Tenney, of Columbia University.

The best feature of the new process is that it does not require the use of any electric current, which is needed in the production process now most widely in vogue. Need for electricity in other vital defense activities, notably

aluminum manufacture, was in danger of creating a serious bottleneck in chlorine output.

The only raw materials needed are sulfur and common salt, both of which can be produced in this country by millions of tons. The sulfur is burned in air, producing dry sulfur trioxide. This gas is thoroughly infiltrated through salt. The material thus made, when heated, gives off chlorine gas, while the solid part remains behind as salt cake, or sodium sulfate, another chemical used in the manufacture of glass, rayon, paper and in many other industries.

The process is self-contained so far as energy requirement is concerned, for the heat produced by the burning sulfur is more than enough for the second step, where the chlorine is separated from the salt cake.

Uses of chlorine in industry are legion, and demand from defense-speeded plants is going up by leaps, according to Professor Hixson. He said:

"In 1940, when chlorine production was close to capacity, 605,000 tons were consumed in the United States, an increase of 120,000 tons over 1939. This year the demand is twice as great, and by 1942 it probably will double again.

"New uses for chlorine are found almost daily. Neoprene, principal ingredient of synthetic rubber, contains chlorine. Ethylene glycol, used to cool the latest high-speed airplanes, requires the chemical for its manufacture, as does ammonium picrate, the Navy's main source of explosives. Chlorine is also used to make the lucite windows of modern long-range bombers, and in the salt-water-proof plastic insulations of anti-magnetic cables which have recently been designed to combat the menace of magnetic mines.

"Huge amounts of chlorine may be needed at any time to purify emergency supplies of water for armies in the field, as it now purifies the nation's water supplies. Chlorine compounds have uses varying from cleaning women's dresses to scouring the sides of battleships before painting; from manufacturing health-restoring medicinals to preparing the latest types of war gases."

## SYNTHETIC RUBBER SUITABLE FOR TIRES

AMERICA'S automobiles would not necessarily be compelled to run on the rims or stay in their home garages if the overseas supplies of natural rubber were to be cut off. At least two of the several kinds of synthetic rubber developed in this country are suitable for tires, was reported to the society by E. R. Bridgwater, manager of the rubber chemicals division of E. I. du Pont de Nemours and Company.

The search for synthetic rubber was undertaken in the first instance in an effort to produce something suitable for tires, but qualities like high resistance to heat, abrasion and oil sidetracked practically the whole product into such uses as conveyor belts, gaskets and gasoline hose. Higher cost, too, has been a factor in preventing effective competition of the synthetics with the natural material.

Wartime or other emergency would of course practically eliminate cost considerations. The decisive factor then would be the physical possibility of providing sufficient plant capacity, skilled labor, raw materials and power to go into quantity production of synthetic rubber. Mr. Bridgwater estimated that an investment of half a billion dollars might provide for the synthetic production of 50 per cent. of the rubber needs of the country.

Current synthetic production of general purpose rubber will be equivalent to only about 1.5 per cent. of our crude rubber consumption for this year. With new plants coming into commission, production next year should be raised to at least 5,800 long tons per month, about 10 per cent. of normal requirements. Developments now under way may improve that figure.

### THE STAR TWENTY-SIX DRACONIS

EVIDENCE that nature repeats itself, and that the laws of universal gravitation apply everywhere, was presented to the American Astronomical Society meeting at the Yerkes Observatory. Dr. Peter van de Kamp, director of Sproul Observatory, Swarthmore, Pa., and Dr. Dorrit Hoffleit, on leave from Harvard Observatory, reported preliminary studies of the distance and motions of the star known as number 26 in the constellation Draco, the Dragon.

These astronomers have determined that this stellar system is remarkably similar to that of Alpha Centauri, the nearest star, which is really composed of three stars, two of them comparatively close together, and each about as large and bright as the sun, and the other, called Proxima Centauri, 10,000 times as far away from the first pair as the earth is from the sun. In the case of 26 Draconis, however, the third star is about 25,000 times as far from the first pair as the earth is from the sun, making it the most distant companion of this type known. Dr. van de Kamp was careful to state that many uncertainties in the measurements existed, and that these results are only of a provisional nature, but that they show that the star 26 Draconis deserves special attention on the part of other astronomers.

Twenty-six Draconis has long been known as a close double star, of which each component is very similar in mass to the sun. The distant faint body, of the tenth magnitude, was discovered to be connected with 26 Draconis by Dr. Adriaan van Maanen, of the Mount Wilson Observatory, and C. H. Gingrich, of the Goodsell Observatory, in 1921, even though it is 738 seconds of arc (12 minutes of arc, or one fifth of a degree) distant.

Thirty-five plates taken at Sproul Observatory since 1913 were measured and reduced. The magnitude of the bright binary was cut down by means of a rotating sector, to approximate equality with the faint companion. The distance of 26 Draconis from the earth was found to be about 30 light years, whereas that of Alpha Centauri and its companion Proxima Centauri is  $4\frac{1}{4}$  light years.

Proxima Centauri is estimated to take about a million years to revolve around its primary stars; the tremendous distance of the companion of 26 Draconis indicates that a few million years elapse while it completes a circuit around the two central stars. This is the longest period

indicated for any gravitational system known. The period of the close pair is about eighty years, the same as for Alpha Centauri.

### NEBULAE

EVIDENCE that all the millions of nebulae observed in the far-flung regions of space are composed of stars was presented before the meeting of the society. Dr. Lyman Spitzer, Jr., of Yale University, stated that failure to resolve the so-called elliptical nebulae into stars had led to the suggestion that they are composed of dust and not of stars at all. However, his recent investigation rules out this possibility and makes it fairly certain that the ellipticals, like their better-known relatives, the spirals, are composed almost entirely of stars.

Nebulae are diffuse patches of light seen in the sky. Some of these are clouds of gas and dust situated within our own Milky Way galaxy, whereas others are at tremendous distances (the nearest is 680,000 light-years away) and are considered to be other systems similar to the Milky Way as a whole.

These exterior galaxies are mostly classified into two main groups—the ellipticals and the spirals. The former range in shape from globular to elliptical, and appear highly concentrated, showing no resolution into stars. On the other hand, the spirals appear as flattened disks, and have often been called the "pinwheels of space." Many spirals have been resolved into stars, but the ellipticals, whether globular or flattened, can not be separated into stars with our present telescopes.

"An evaluation of the rate of energy dissipation for atoms and for dust shows that interstellar particles of low density require only 40 million years at most to lose any great initial energy, and to come to equilibrium, with velocities less than 12 miles a second," Dr. Spitzer said. "Any interstellar matter in a globular galaxy must be almost entirely concentrated to the center or, in the case of elliptical systems, to the equatorial plane. The total mass of such matter in a globular system can not exceed 1/500 of its total mass, although no such limit exists for elliptical systems. In any case, the amount of dust or atoms throughout most of an elliptical or globular galaxy must be quite negligible, and the visible light from a galaxy of this sort must be largely direct starlight, not diffuse or scattered light."

Many photographs of exterior galaxies seen edgewise show the presence of dark matter in their equatorial planes. This is possible, according to Dr. Spitzer's theoretical investigations. The stars in such systems form an extended envelope around the assumed highly flattened disk of dark, dense matter.

### "SHOOTING STARS"

"SHOOTING STARS" that flash in the night and burst in the air do not explode like an artillery shell, but instead seem to fly apart due to atmospheric pressure when they plunge toward earth.

Dr. Fred L. Whipple, of Harvard Observatory, described his studies of the trails of 28 meteors which broke apart or burst in the air while shining brightly enough to be photographed. These trails are included in the

Harvard collection of over a thousand meteor trails taken during the last few years.

Although an internal explosion due to external heating and expansion may break the original meteoroid as it passes into the atmosphere, Dr. Whipple believes that the evidence of these trails shows that atmospheric pressure on the irregular surfaces of the broken fragments produces the observed changes in their direction. However, the process of splitting should result in deformations that would soon be smoothed by melting and vaporization by friction with the air.

There are photographs of two trails in which three successive divisions occurred as the meteor broke into more and more pieces, and one in which a double or multiple division can be detected. In another case the brighter component and the fainter one deviate together in the same direction, and the brighter (presumably the heavier) deviates more than the fainter. This would be explained on the basis of atmospheric pressure acting for a fraction of a second on irregular surfaces of the fragments.

Dr. Whipple said that "one meteor divided at a height of 48 miles, and two others at about 35 miles each. The splitting usually occurs at maximum light, or about two thirds of the distance along the meteor trail. Both slow and fast meteors are represented by the split trails, and at least three are members of meteor showers. Split trails do not appear unusual and do not seem to represent a distinct class of meteors."

### GROWTH HORMONES

A GROWTH-PROMOTING hormone, more powerful than any of the synthetic chemicals now in use for speeding root formation, inducing growth of seedless fruits and other recently discovered "plant magics," has been found in pollen by Dr. John W. Mitchell and Miss Muriel Whitehead, of the U. S. Department of Agriculture.

They obtained their material by extracting ripening corn pollen in ether and then evaporating the ether. A fatty substance is left, which is mixed with lanolin in a ratio of one to ten. This paste or ointment is then spread on the plant part where growth-stimulating effects are desired. A ring of it around the stem of a seedling bean plant caused an elongation between 1.5 and 2.5 times greater than that obtained by treatment of comparison plants with any of the synthetic growth regulators.

It is not unlikely that the pure substance itself, when it has finally been isolated, will have even more powerful effects, for the crude ether extract of pollen is very likely a mixture of several substances, not all of which have growth-stimulating properties.

Chemical analyses of the ether extract will be actively pushed, for if the active principle can be isolated and its chemical structure determined, it may be possible to make it artificially, at much lower cost than by extracting it from pollen.

The effectiveness of the newly discovered substance in making plant stems grow longer may be put to practical use by florists in getting longer-stemmed flowers or in producing longer-fibered stems in such textile plants as flax, hemp and ramie. Such large-scale uses will depend, of course, on working out large supplies of the chemical at low cost.

Another use that has been discovered recently for growth hormones has been in producing seedless fruits from unpollinated flowers. A large range of plants, from holly berries to tomatoes, has been thus treated with good results. Spraying orchard trees with the hormones has had the effect of restraining flower buds from opening until danger from late frost is past, of inducing apple and other trees to hang on to their fruit instead of dropping much of it prematurely and of hastening the ripening of oranges.

To obtain a supply of pollen for their researches, Dr. Mitchell and Miss Whitehead exploit bees bringing the yellow dust back to the hive. The bees are compelled to pass through a narrow, screen-lined pollen trap, which scrapes off their loads of pollen and lets them drop into a collecting box.

### ITEMS

WARNING against any repetition of the "hate" resolutions that marred the record of the American Chemical Society during World War I was sounded by Professor Harrison Hale, of the University of Arkansas, at the Atlantic City meeting of the society. Professor Hale called attention to the action of the society in 1918, in withdrawing honorary membership from three noted German chemists, Nernst, Ostwald and Fischer. "The inevitable effort to make amends for this inconsistent error of hasty action came in 1927, when Nernst and Ostwald were restored. Fischer died in 1919, but not before he is said to have refused to consider restoration. This bit of history is given so that as American chemists we may reaffirm our faith in the internationality of science and seek to protect this belief from any emotional attack that may come either from ourselves or from others."

PROPERLY cared for grazing land not only keeps cows contented; it supports larger populations of small birds, according to Gale Monson, of Albuquerque, New Mexico. To study the relation of overgrazing to reduction in bird numbers, four 160-acre plots were selected. Two of them were within an area formerly overgrazed, but now recovering its range value under the scientific management of the Soil Conservation Service. The other two were in a nearby area still subject to severe overgrazing. Careful censuses of the bird populations of all four areas were made. It was found that the two overgrazed plots were home to 92 birds representing 12 small-bird species, while the scientifically managed, better covered plots yielded a count of 186, with 14 species represented.

TAKING a cue from the Army, civilians in the United States may soon be buying their groceries in increasing quantity in the form of food powders. Since a pound of potatoes in powdered form equals ten pounds of spuds in the round, the saving which can be effected in transportation space is very large. Dehydrated foods developed in the Quartermaster Corps' research laboratory in Chicago are pronounced far more satisfactory in flavor and food value when they are cooked than dehydrated beans, peas and onions that were shipped over-seas to the American Expeditionary Force in the World War.