SCIENCE NEWS

Science Service, Washington, D. C.

MICROSCOPIC CRYSTALS IN PHOTOGRAPHY

If it were not for the plants eaten by animals whose skins are used in the manufacture of gelatin, we should have no sensitive film for our movie cameras or kodaks, according to Dr. C. E. K. Mees, director of the Eastman Kodak Company's research laboratory, who spoke before the Columbus meeting of the American Chemical Society.

"The sensitiveness of films is not due to the grains of silver bromide only, but is in some way connected with the presence on those grains of specks of some other substance," said Dr. Mees. "After a long and careful study it has been found that these specks are produced by an accidental impurity present in the gelatin. This impurity is derived from the plants eaten by the animals from whose skins the gelatin is made. There is only a very small amount of it in the gelatin, but it is a compound which contains sulphur, and when the gelatin is used for making the film, the sulphur reacts with the silver bromide and produces specks of silver sulphide on the crystals.

"In some way or other these specks increase the effectiveness of the light to which the film is exposed in the camera and enable the light to change the silver bromide so as to form a trace of metallic silver. Then this silver acts during development as a nucleus on which more silver can deposit by the chemical process until the whole of the silver bromide crystal is turned into silver. Each of the original crystals of the film, therefore, after exposure to light, becomes a grain of silver in the developed film, and it is of these grains of silver that the image projected on the screen is composed."

Though the motion picture on the screen looks smooth, the microscope shows that the picture on a film consists of myriads of tiny particles, each a grain of metallic silver. They are derived from minute crystals of silver bromide, which form the sensitive film that is exposed in the camera.

"The creamy white layer on the film is composed of billions of these microscopic crystals, of which there are more on a square inch than there are human beings on the surface of the globe.

"Recently, scientists have studied these microscopic crystals and have even studied the behavior of single crystals isolated from their neighbors. They have determined the way in which the atoms behave to build up these crystals and have measured the sizes and shapes of crystals which occur in different kinds of film. In the fast negative film used in the camera, for instance, there is a great range of sizes, and this enables the beautiful gradation to be obtained, while in the positive film, on which the pictures are printed and which is projected in the theater, the grains are much more nearly of one size, and this gives the life and sparkle to the pictures. The photographic manufacturer adjusts his processes so that these qualities are obtained; the distribution of the grains in the different films must be of the right amount."

THE MINERAL SUPPLY OF CROPS

If the human race is to continue healthy, the animals on whose meat they feed must be in best condition. And to achieve this, the food they eat must contain the proper supply of minerals and vitamins—a condition to which the farmer must see. This was the message brought to the American Chemical Society by C. H. MacDowell, a Chicago chemist. Mr. MacDowell told of the farm as a consumer of chemical products.

"The farm is a great bio-chemical factory," said Mr. MacDowell. "The farmer must concern himself with capital, labor, instruments of production and raw materials. The soil is his primary storehouse for raw materials. However, the supplies therein are seldom balanced or complete, and never illimitable. They must be augmented and replenished. Over large areas there are deficiencies of supply not only of the more common plant food elements such as nitrogen, phosphorus, potassium, calcium and sulphur, but also of the rarer tit-bits such as iodine, magnesium and manganese. The effect of total lack of any one of the latter is often as insidious and far-reaching as a poor supply of the former. If the crops are deficient there may result thinner and weaker livestock and poultry on the farm, milk lacking in vital minerals and vitamins, and so indirectly ill health and deficiency diseases in the city.

"Nor can the native supply of any of these elements in the soil be drawn on indefinitely, without replenishment, if economic stability and financial security are to be maintained on the farm. Inevitably with depletion of plant food supply comes decrease in both quality and quantity of yield. It doesn't rain minerals, and therefore mineral depletion must be counteracted from outside sources.

"Fertilizers undoubtedly comprise by far the largest tonnage of prepared chemicals used on the farm, but they are by no means the only ones. Plant life and animal life are subject to pests and parasites as well as disease and epidemics. These cause untold economic losses to the farmer. They are fought and controlled by chemicals, both inorganic and organic. The mine and smelter, the coke plant and the oil well, furnish their quota in fighting the farmer's foes. It is getting the proper mineral constituents into the food of cattle that the farmer must take as his responsibility.

"Agriculture must concern itself most definitely with the proposition of producing crops not only adequate in quantity, but so supplied with minerals and vitamins that the animals feeding on them will be in prime physical condition. Only in this way can human health be guarded. Food of proper composition is the greatest factor in the continued health of man. Entire civiliza-

tions have deteriorated and passed out, largely through diet deficiencies.

"Man is basically dependent on his food supply. The soil is its primal source. If the soil is deficient in nutrients for its benign bacterial inhabitants and for ample plant health and production, the crop suffers. Properly and adequately feed our plant crops to insure their well-being, and they will in turn directly and indirectly assure us of our proper food supply.

"Chemical science and chemical products are destined to play an increasingly important and necessary rôle. Chemicals will continue increasingly to benefit crops, not only as direct plant foods but by policing the crops from fungus and insect attack affecting quality as well as quantity of product. All for the good of man."

QUARANTINE OF THE MEDITERRANEAN FRUIT-FLY

SEVERE restrictions upon the movement of all Florida fruits except watermelons and pineapples went into effect when Secretary of Agriculture Hyde signed an order placing the state under quarantine to prevent the spread of the recently discovered Mediterranean fruit-fly.

The quarantine and attendant regulations bring the whole state under restriction, but do not forbid interstate movement under what are believed to be adequate safeguards. Certain types of movement, however, such as truck, mail and bulk shipments are prohibited altogether, since movements of these kinds involve a maximum risk and can not be safeguarded adequately at a moderate expense.

In addition to covering all fruits, with the exceptions mentioned, and peppers, beans, tomatoes, squashes, gourds and eggplants, among vegetables, the federal quarantine includes special restrictions on the movement of soil, earth, peat, compost and manure, fruit-packing equipment and nursery stock. It further provides that railway cars, boats and other vehicles and containers used in transporting restricted articles must be cleaned at the unloading point and fumigated when this is considered necessary.

The regulations provided have been discussed and amended to meet certain suggestions of the State Plant Board of Florida, growers and transportation officers, and its restrictions become immediately effective in areas designated as infested in the state quarantine of April 15, and additional infested points now under state control. For purposes of administering the quarantine the state will be divided into infested zones, protected zones and the state as a whole outside these two types of zones. Orchards found to have been reached by the fly and an area of at least one mile surrounding such orchards are ruled "infested," and all fruits and vegetables within these areas must be destroyed or processed, and no more can be allowed to develop during the time the zone is under regulation.

The protective zones will include all properties within nine miles, surrounding the infested zones, and will be adjusted according to natural boundaries. All groves and all plantings of host vegetables will be subject to intensive inspection but the fruits and vegetables will be allowed to move under certain safeguards in interstate commerce.

Areas outside these two types of zones are under restriction only to the extent of providing for inspection and certification of fruits and control of host vegetables to make sure they have not been infested. All groves in the state will be inspected and in view of the magnitude of the work mapped and the large force of men that will be needed to carry out the program, the $4,250,000 appropriation now being considered by Congress is believed to be fully warranted.

RICKETS AMONG FISH

THE first wide-spread outbreak of rickets among fish has been recognized in the so-called "knothead" carp of the middle Illinois River, by Dr. David H. Thompson, of the Illinois Natural History Survey. Like rickets in human babies and in the lower animals, fish rickets seems to be due to a lack of vitamins.

The symptoms in the carp, according to Dr. Thompson, are a small deformed head, which gives the disease its name, together with swollen gill-coverings, defective skeletal parts, and drooping fins without the normal number of notches. The scales, skull-bones and vertebrae have numerous secondary growth rings, which make age determination difficult.

The cause of this rachitic knothead disease, which afflicts from 30 to 90 per cent. of the commercial catch at certain points in the river, is believed to be vitamin deficiency in the diet of the carp. The Illinois River bears the whole of Chicago's sewage, and is one of the most heavily polluted streams in the world—without much question the worst in America. The unhappy condition of the water precludes the growth of the plants which are the primary sources of rickets-preventing vitamin D, and thus permits the development of diseased bones. The distribution of the disease coincides with the worst pollution in the river, and it is further noted that the deformed fish first began to be noticed after the river was turned into an extension of Chicago's sewer system.

Near Utica, Illinois, where the disease reaches its farthest upstream point, there are almost no fish except carp; farther downstream other fish are taken, and these are free from the knothead deformity. In the opinion of Dr. Thompson, this is because only the carp are so tolerant of pollution that they will swim and feed in the main stream; the other fish take to the cleaner backwaters.

Carp with extreme development of knothead are somewhat softer-fleshed than normal, and have a slight tendency to a "gassy" taste. Although the meat is not known to be unwholesome, such specimens are thrown out by the fishermen and do not find their way to the market.

LIVER AS A SUBSTITUTE FOR INSULIN

LIVER, which is now being used extensively as a cure for anemia, may become a substitute for insulin in the treatment of diabetes, it appears from studies made at the Peter Bent Brigham Hospital, in Boston, by Dr.

Harry Blotner and Dr. William P. Murphy. Dr. Murphy, with Dr. G. R. Minot, developed the liver treatment for pernicious anemia. In the study just reported, Drs. Blotner and Murphy found that liver contains a substance that will reduce the blood sugar concentration of the blood as insulin does.

Liver has been heretofore excluded from the diet of persons suffering from diabetes, because liver contains glycogen, a carbohydrate which may be turned into sugar in the body. In these studies diabetic patients were given liver to eat in place of insulin injections, and their blood sugar remained at a low level. Liver may not prove as effective in reducing the blood sugar of all diabetic patients as it did in the cases studied by Drs. Blotner and Murphy. However, it will be of economic advantage to those for whom it is effective, particularly in the case of patients who can not give themselves the insulin injections and must add the cost of a nurse to the cost of the insulin itself.

When liver is analyzed chemically, the fractions or parts that are effective in the treatment of pernicious anemia have no effect on the blood sugar, while certain liver fractions that are ineffective in the treatment of pernicious anemia have an effect on the blood sugar like that of whole liver.

MUDBANKS AND TREES AS WEATHER RECORDS

MAN has been keeping consistent weather records for only a few generations; but far back in the days when cavemen hunted reindeer in Europe weather records were nevertheless kept. They were kept on a natural calendar, which men have learned how to read only during the past few years.

This was one of the points developed at the meeting of the American Geophysical Union in Washington, D. C., in a survey of weather-keeping devices and methods by C. F. Marvin and A. J. Henry, of the U. S. Weather Bureau. The natural weather record of stone-age days consists of certain deposits of very fine-grained clays, called "varve clays." They were laid down by streams pouring from the melting glaciers into lakes and ponds, bearing loads of silt which they dropped when they flowed into still water. When the streams were swollen, as in spring, they carried heavier particles, making a coarse layer; in late summer, when they were not so high, the particles they carried were finer, making a closer-grained layer on the bottom. Each year is represented by one of these composite layers, grading from coarse in the spring to fine-grained in the fall.

Naturally, a year of heavy rains would build a thicker layer than a year of drought when the streams flowed thin and clear, so that it is possible by counting back on these sheets of varve clays to tell what the weather was like 10,001 or 10,002 years ago, almost as well as though it were only one or two years ago. The varve clays have shown that the last of the glaciers in northern Europe melted about 6500 B. C.

A second kind of natural weather-record has been found in the annual rings of California big-trees and other old trees. Although these records are not nearly so old as those written in the clays, they carry the weather reports back beyond the beginning of the Christian era, telling of years of rain or years of drought and fire by the thickness of the annual layer of wood laid down in their trunks.

ITEMS

COLORADO sunshine, which is as efficient in winter as in summer, has a high degree of efficiency in curing rickets. White rats were fed on a diet calculated to produce rickets and were kept in the dark for all but short daily exposures to the sunshine in Denver. X-ray pictures of the bones and teeth of the rats showed that from ten to twenty minutes' exposure to this sunshine was enough to prevent the development of rickets, according to a report by Professor Robert C. Lewis, Herman B. Stein and Gerald M. Frumess, of the University of Colorado, at the meeting at Columbus of the American Chemical Society. The lack of seasonal variation in the antirachitic action of Colorado's sunshine is due to the fact that a large amount of ultra-violet light reaches the earth there in winter as well as in summer. The high percentage of winter sunshine, the relatively thin atmosphere, the low humidity and the comparatively small amount of smoke in the air account for this.

FOSSIL plants 155,000,000 years old, that grew on the earth when it was ruled by the dinosaurs, have been found in the Sutschansk mines near Vladivostock by Professor A. N. Kristovitsch, the Russian paleontologist. They take rank with the oldest of all known higher seed-plants, specimens of which have hitherto been known from only three places on earth: Greenland, the Potomac shales of the United States and Portugal. The plants discovered in the Siberian rocks are represented by leaf-prints only, but these are recognizable as belonging to the genus Aralia, and the new fossil species has been given the name *Aralia lucifera*. Although so ancient the genus still exists. There are several native species in North America, two of the best-known being the tall spiny-stemmed shrub known as "Hercules' club" and the wild sarsaparilla.

AMONG the foreign trees whose cultivation has been tried in Switzerland, the American Douglas fir takes the very first place according to an opinion expressed by a noted Swiss botanist, Professor Henri Badoux, of Zurich. The Douglas fir has been known in Europe for many years. It has especially been used during the past 25 years in England, France, Belgium and Germany. Everywhere it has given highest satisfaction. Wherever it has been planted in the Swiss foothills or on the Swiss plateau, it has shown a remarkable and rapid growth. The Douglas fir has found very few insect or fungus enemies in Switzerland. Professor Badoux lays much stress on the fact that in Switzerland the American tree grows faster and taller, and produces more wood than the native spruce. The wood is suitable for a great number of purposes.