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CHLOROPHYLL AND SUNLIGHT

POSITIVE evidence that sunlight acts on certain seeds through chlorophyll, the green coloring matter of vegetation, was presented to the conference on spectroscopy at the Massachusetts Institute of Technology by Dr. Lewis H. Flint, of the U. S. Department of Agriculture. The discovery opens a new approach to the study of light in relation to seed sprouting and growth, plant metabolism, the distribution of plants and other equally important allied problems of the science of life.

The research leading to the find was a continuation of that which Dr. Flint has been conducting on the effects of varying wavelengths of light on lettuce seed. Two years ago he reported to the conference that violet-blue light ranging between 4,400 and 4,800 Angstroms and nearly infra-red light at about 7,600 Angstroms inhibited the growth of the seeds. Yellow, orange and some types of red light, however, ranging from 5,200 to 7,000 Angstroms, were found to promote growth. This year he announces he has narrowed the limits of the growth-giving light and that the reddish-orange light in the vicinity of 6,700 Angstroms was best for plant growth. But most significant was the additional discovery that chlorophyll, the green coloring pigment, present in the seeds as well as in grown plants, absorbed more light at this 6,700 point and in the two inhibiting ranges than at any other bands.

"Here is an instance," he said, "in which the apparent critical wavelength of radiation promoting germination coincides with the major absorption in this region by a pigment common to all green plants. The radiation most effective in promoting germination in the seed is that most effectively absorbed by chlorophyll in the same region.

"In the violet-blue region a similar situation exists—the radiation most effective in inhibiting the germination is again that most effectively absorbed by chlorophyll. Thus chlorophyll becomes almost inevitably identified with the reactions of the seed to light, although it should be noted that the absorbed red light promotes germination and the blue light inhibits it.

"Blue light produces a set of physiological reactions quite different from that promoted by reddish-orange light, yet both groups of radiation appear associated with absorption of the respective sorts of radiation by chlorophyll. The close analogy places a distinct emphasis upon a new and promising viewpoint."

Dr. E. D. McAlister, of the Smithsonsian Institution, cooperated in the research.

SPECTROSCOPE TO CONTROL IRON CASTING

ROUTINE spectroscopic analysis of alloy cast iron by means of the light given off when it is highly heated was reported by Dr. H. B. Vincent, of the University of Michigan, before the conference at the Massachusetts Institute of Technology.

Research by Dr. Vincent, A. M. Sampson and Professor R. A. Sawyer has reduced the method to a routine operation of the use of instruments so that it may be handled successfully by the personnel of a production chemical laboratory. Most methods require the services of an expert spectroscopist and are controlled to some extent by guesswork.

Others had tried to perform analyses of iron and installations have been made, but were soon abandoned. The new method has been used for the analysis of cast iron in an industrial laboratory on foundry work for a period of six months and has given excellent results.

In his research Dr. Vincent found, as have all the scientists reporting at the conference, that the spectroscope is much more rapid than chemical methods, requiring less personnel for the same number of analyses. In addition to this high speed, low cost and very satisfactory accuracy feature the method.

Professor Sawyer, who worked with Dr. Vincent and Mr. Sampson, reported methods of analysis of other iron alloys, adapting the spectrograph to routine analytical foundry control. Each hour samples of at least eight different kinds of cast iron are analyzed to determine the amounts of six different constituents, copper, chromium, molybdenum, manganese, nickel and silicon.

"The 48 determinations involved can be reported by two spectroscopists with an accuracy of plus or minus 5 per cent. of the amount present in approximately 45 minutes," Professor Sawyer said. "The equivalent amount of chemical analysis by the methods in present use would require at least six chemists. A large saving is thus made, although chemists are still required for special analyses and control of sulphur, carbon, and phosphorus, which we are not yet handling, although we have developed methods for some of these elements."

Particular feature of this method, he said, was the great control possible over the sensitivity of any particular constituent.

SUBSTITUTE FOR EYE IN COLOR MEASUREMENT

SCIENCE is on the search for an eye-surpassing instrument that will measure light and color with as much reliability and ease as a voltmeter and ammeter measure electricity.

Dr. Herbert E. Ives, physicist of the Bell Telephone Laboratories, speaking before the Massachusetts Institute of Technology color conference, explained that such an instrument would be a definite improvement over the eye, not only because eyes vary from person to person, and tire easily, but because the eye is useless as an indicating instrument and can be employed only in comparative methods.

This ideal instrument has not yet been perfected, where highest accuracy is desired, for even the supposedly "infallible electric eye" or photoelectric cell has definite faults, although it has proved of great use because of its gains in speed and simplicity in routine measurements.

Imperfect in ordinary light measurement, electric eyes were for a long time out of the question in the complicated field of color measurement. Even with the development of new kinds of cells, which partially removed this obstacle, they have not been too satisfactory, for varying types are sensitive only to particular colors of the rainbow.

Cells consisting of caesium oxide, for instance, are most sensitive to wavelengths in the infra-red end of the spectrum. Others of potassium hydride are most sensitive in the visible part of the spectrum. These are somewhat comparable to the human eye, which is most sensitive to the middle part of the visible spectrum, that is, to greens and yellows, rather than to blues or reds.

By using several of these special cells, each of them sensitive to various parts of the spectrum, Dr. Ives has found that it is possible to obtain more accurate color measurement than any one individual cell can record. This cell grouping has the added advantage of eliminating errors due to scattered light of different wavelengths.

TELEVISION IN GERMANY

THE Olympic Games in Germany mark a milestone in the history of television, according to a prediction by Dr. Rolf Moeller, engineer of Fernseh, A. G., the German television company, who is returning to Germany after a television survey of England and the United States.

Dr. Moeller spent some time at the laboratories of Farnsworth Television Incorporated, Philadelphia, the American associate of Fernseh; obtaining final data toward the perfection of arrangements for the televising of the games in Germany.

Regarding this important event, Dr. Moeller said: "Television laboratories in Germany are very busy developing new things, especially in the field of the electron camera, in order to be prepared for the televising of the Olympic Games. This will be a milestone in the development of television in Germany. Several electron cameras will be placed about the stadium to pick up scenes of action."

The intermediate film process, for the invention and development of which Dr. Moeller is largely responsible, makes it possible for scenes to be shown in motion picture theaters on large screens, via television, in less than three minutes after they happen at the stadium.

In this process an ordinary news-reel camera using special film is used. The scene is shot by the news-reel camera, and as fast as the film is shot it passes into a developer, fixing bath, and is washed, and partially dried all in less than one minute. Then this partly dry film is televised by a teleciné apparatus and transmitted over the air.

At the receiver the ordinary television picture, about five by seven inches, is taken on special film and the same quick developing-fixing-washing process is repeated. This partly dried film is projected in a motion picture theater in the regular way.

SUN ENGINE AT THE SMITHSONIAN INSTITUTION

SUN power will be translated into steam engine power in the near future at the Smithsonian Institution. Dr. Charles G. Abbot, the secretary, is now engaged in putting the finishing touches on an apparatus in which 36 square feet of aluminum mirror surface will capture enough of the poured-out energy of the world's central heating plant to run a one-half horse-power engine.

Dr. Abbot's new apparatus represents an improving evolution from earlier experimental models. Every part has been carefully planned to achieve a higher thermal efficiency than has ever been attained with solar boilers and other types of sun-heating apparatus.

The initial capture of the sun's rays is effected by means of three trough-shaped mirrors that can be turned so that they will constantly face the sun. They are surfaced with a highly polished, non-tarnishing aluminum alloy. Instead of being flat, as were most of the mirrors used by earlier experimenters, they are carefully figured to the same type of curve as that used in the great reflecting telescopes in the west, so that their focus is far more accurate and they therefore utilize a much larger percentage of the sun's rays. Their total reflecting area is 36 square feet.

Each mirror will focus the sun's rays on a long, double-walled tube of pyrex glass. Between the two walls a high vacuum is maintained. This permits radiation to pass in freely, but reduces the loss from re-radiation to a very low figure.

The inner tube contains a specially compounded black heat-absorbing liquid, of very high boiling point. If it were left stationary in the tubes, it would be raised to a calculated temperature of 700 degrees Centigrade. But it is kept flowing slowly by means of small electric pumps, so that it passes its heat on to water in a boiler, and maintains a more moderate temperature—from 175 to 200 degrees Centigrade above that of the surrounding air. This heat of course converts the water in the boiler into steam, at about 175 pounds pressure, and the steam will be used to drive the small engine.

Dr. Abbot states that the efficiency of his "sun-fired" boiler will be about 15 per cent., which compares favorably with the efficiency of a coal- or oil-fired boiler—with the advantage that its fuel cost is zero.

HARDSHIP IN YOUTH PROLONGS LIFE OF CRUSTACEA

HARDSHIP in youth is a good thing—for some of the lower animals at least. Half-fed through their infancy, cladocera or water-fleas live longer and more vigorously after they have passed what is for them middle life, according to experiments made by Dr. Lester Ingle and Professor A. M. Banta, of Brown University.

Cladocera are not fleas, though they do live in the water. They are really crustacea—minute relatives of lobsters, crabs and crayfishes. They are particularly well adapted to biological experimentation, because they are perfectly content to live in bottles on laboratory shelves. Requiring very little room per individual, they can be studied in statistically significant numbers at very little expense.

"The essence of Dr. Ingle's results is that limitation in quantity of food keeps the cladocera in a youthful condition," Professor Banta said, "so that when they are well fed in later life, beginning at a time when most of

the animals have 'lived rapidly' on abundance of food and have already died, these previously semi-fed animals assume rapid rates of growth and reproduction. In a way, their active life is just beginning. They are still young animals.

"As judged by the effects upon longevity, the most favorable period for the 'abundant life' is not during the earlier part of life, but at a later period when possibly the body of the organism is better able to withstand the effects of a fairly rapid dissipation of vital energy," Dr. Ingle said. "Suffice it to say that any and all the functions of the body, because of their utilization of vital energy, are factors in determining the life-span.

"The prolongation of the period of youth is perhaps after all not merely a vague dream, but quite possibly may have a basis for realization in temperate living, resulting in the moderate dissipation of vital energy."

ITEMS

LARGE enough to subject a human being to bombardment by neutrons, a new "atom smasher" or cyclotron is under construction at the radiation laboratory of the University of California, where Dr. Ernest O. Lawrence invented this powerful instrument and where he and his associates are continuing its use. Neutrons are more effective than x-rays in killing animal tumors, it was shown by animal experiments by Dr. John H. Lawrence, of the Yale School of Medicine, working with his brother at Berkeley. It is therefore possible that medicine is on the verge of applying a new weapon to human cancer. The electromagnet for the new cyclotron will measure 15 by 20 feet and weigh over 200 tons. It will be capable of producing 15 million electron volt energy particles. A small model of the electromagnet is now being tested in the laboratory under the direction of Dr. E. O. Lawrence.

ABSOLUTE identification of silicon in the lungs of supposed victims of silicosis, the dust disease now being intensely combated after the national attention focussed on the Gauley Bridge, W. Va., situation, is possible through use of the spectroscope, Miss Mary E. Warga, of the Mellon Institute of Industrial Research, University of Pittsburgh, announced to the conference on spectroscopy at the Massachusetts Institute of Techonolgy. By breaking up light from the suspected material by means of a prism, the chemical elements contained can be detected from the rainbow produced. In the case of suspected silicotic lungs, amounts of silicon as minute as one or two parts per thousand are positively detected by the spectroscope whereas usual chemical methods of detecting silica in such small amounts are difficult and time-taking. Miss Warga has also turned the spectroscope to practical use in detecting glass impurities, dust composition, coal ingredients, tin impurities and the cause of stains on cloth.

SUNLIGHT is a better and more permanent preservative of a commonly used tonic, syrup of ferrous iodide, than the chemicals ordinarily employed to keep the medicine, it appears from the report of Professor H. V. Arny and his associate, Dr. W. C. Mende, of Columbia University. Syrup of ferrous iodide when freshly prepared is "of an attractive green color," but when allowed to stand in a dark place or in diffused light for a few weeks it turns brown. This is due to the liberation of free iodine. "Such darkened syrup of ferrous iodide is dangerously irritating when taken internally and must not be dispensed by the pharmacist in such shape. Old time apothecaries found that the brown syrup returned to its original green color by the simple expedient of exposing it for a few hours to direct sunlight." Since 1876 chemical preservatives have been added to the syrup, but with little effect. The best of them kept the syrup green for only six months. Turning back to the notion of the old-time apothecaries, Dr. Arny again tried the effect of sunlight. He found that by keeping the syrup alternately in the sun and in the dark, making about five or six exposures to sunlight, he finally obtained a syrup of ferrous iodide which had a permanent green color.

A GAP between historic Indians and the vanished Moundbuilders may be closed by a clay figure in human form found in east central Louisiana. The hollow figure, decorated with animal patterns and a feathered robe, was found by Mrs. U. B. Evans, of Alexandria, La., an enthusiastic student of local archeology, and sent to Frank M. Setzler, curator of anthropology at the Smithsonian Institution. The image had been broken into six pieces, which, however, can be fitted together. The Indians inhabiting this region when the Spaniards, under De Soto, first entered the land were of the Caddo tribe. The newfound effigy appears to be a link between a prehistoric Caddo culture and a Moundbuilder culture known as Southern Hopewell, discovered in the same region. This in turn links with other Moundbuilder cultures in the South and with the highly developed Northern Hopewell culture of the Ohio Valley.

IT is now possible for the chemist to sort out molecules by using cellulose membrane of the kind employed to wrap cigarettes. How the "holes" in transparent cigarette wrapping material can be varied in size to allow such sorting was described by Professor James W. McBain and Dr. R. F. Stuewer, of Stanford University, before the concluding sessions of the Thirteenth Colloid Symposium of the American Chemical Society at St. Louis. "The holes may be adjusted smaller and smaller so that it is possible to put a solution of sugar or of salt or milk through and get only pure water." Application of the molecule sorting, it was indicated, is in finding out how far certain molecules in a solution exist independently of one another, or whether some are in chemical combination.

THE little color-changing lizards they call chameleons in Florida do not depend on their nerves to control their shifts in hue, but on the secretion of one part of the pituitary gland, a tiny organ situated close to the brain. This is indicated by recent researches of Dr. L. H. Kleinholz, of Harvard University. Dr. Kleinholz used several approaches to the problem. He found that cutting nerves did not affect the lizard's color-changing ability, but that removal of the pituitary gland left them unchangingly green. But injection of extracts of the gland, from other animal sources, at least temporarily restored the color responses. Dr. Kleinholz reports his results in some detail in the *Proceedings* of the National Academy of Sciences.