

the Asiatic Society, in particular the Indian Science Congress, and mentioned the proposals which had been made for the formation of an Indian Academy of Sciences to effect co-ordination between these various interests in the sphere of science.

Following the President's Address, congratulatory messages were read from His Excellency the Viceroy, the Mayor of Calcutta, the League of Nations, Prof. C. Rockwell Lanman, Sir George Grierson, and Sir Thomas H. Holland, Honorary Fellows. Seven addresses were read from the British Museum, the Linnean Society, the Zoological Society of London, the Batavian Society of Arts and Sciences, the Indian Institute, Oxford, the Schopenhauer Society, Frankfurt, and the Prussian Academy of Sciences. Congratulations were presented by 26 delegates from 58 learned institutions, and in all 19 countries were represented,—Australia, Austria, Belgium, Ceylon, Canada, France, Federated Malay

States, Germany, Great Britain, Hungary, Italy, Japan, Netherlands, Spain, Sweden, Switzerland, Tasmania, United States and India.

In his speech His Excellency the Governor stressed the vigour of the Society in spite of its age, its permanence since the days of the French Revolution, and the esteem in which it is held abroad, as manifested by the spontaneous tributes received from all over the world. He drew attention to the traditional connection of the Ruling Princes with the Society, and hoped that this tradition might be widened, to the benefit of scholarship, by the inclusion in the Society's list of members of the name of every substantial Ruler in the country.

His Excellency paid special tribute to three members of the Society, Sir Rajendra-nath Mookerjee, Mr. Johan Van Manen, the General Secretary, and Dr. S. L. Hora, the Honorary Secretary of the Celebration Committee.

Research Notes.

Separation of the Heavy Hydrogen Isotope.

IN *Die Naturwissenschaften*, 21, p. 884, 1933, Prof. G. Hertz describes experiments performed by him in collaboration with H. Harmsen and W. Schütze to separate the heavy hydrogen isotope by means of the new separating apparatus developed by him. (A description of this apparatus has already appeared in a previous note in this journal.) Since the two isotopes of hydrogen have masses in the ratio of one to two, separation by diffusion should be easiest in this case. The hydrogen was produced by the action of magnesium vapour on the water in an electrolytic cell. Since this hydrogen contains H_2^1 and H^1H^2 molecules with only a very few H_2^2 molecules, a discharge tube was introduced at a suitable point of the apparatus so that H_2^1 and H_2^2 molecules were produced from the H^1H^2 molecules. In this way the H^2 isotope was obtained in such purity that discharge tubes filled with this gas after fully degassing the electrodes did not show even a trace of the ordinary hydrogen lines. The paper contains two interesting photographs, one giving the H_2 line of H^1 and H^2 taken on the same plate and the other giving the many-line spectrum of hydrogen from tubes containing ordinary hydrogen, a mixture of the two

isotopes in nearly equal proportions and pure heavy hydrogen respectively, all taken on the same plate. In this way one can distinguish between the lines of H_2^1 , H^1H^2 and H_2^2 and the comparison is very instructive. Further details are to appear in the *Zeitschrift für Physik*.

Experiments on the Adiabatic Cooling of Paramagnetic Salts.

IN *Physica* (1, 1, 1933) W. J. de Haas, E. C. Wiersma and H. A. Kramers describe experiments in which extremely low temperatures were sought to be obtained by the sudden demagnetisation of paramagnetic salts kept at the temperature of liquid helium. A sample of the salt was kept surrounded by liquid helium at a point in the field of a big electromagnet where $H \frac{\partial H}{\partial x}$ was a maximum. The sample was thermally well isolated and shut off from radiation. It was thus kept in the high constant magnetic field till it had acquired the temperature of the liquid helium. The field was then suddenly decreased and the force on the sample was then determined as a function of the time. Knowing the force immediately after the decrease in the field

and also its value in the same small field at the temperature of liquid helium, the lowest temperature reached could be calculated, assuming the product of susceptibility χ and absolute temperature T to be constant. Because of the assumption of the constancy of χT the estimated temperature is only an upper limit. The specimen thus serves as its own thermometer.

The following table shows the results obtained:—

Date	Salt	Lowest Temperature Reached
6th April	CeF ₃	0°·27 K.
24th May	"	0°·19 K.
15th June	Dy ethyl sulphate	0°·15 K.
7th July	"	0°·12 K.
"	Ce ethyl sulphate	0°·10 ⁵ K.
"	"	0°·08 ⁵ K.

In a note added in proof, the authors report the conclusion of experiments with potassium chromic alum which gave a calculated lowest temperature below 0°·05 K. The authors remark that because of its cheapness, its high moment which leads to saturation even under low fields, and its regular crystalline shape which removes difficulties of orientation, this salt is best suited for experimental production of the lowest temperatures.

Diffraction of Light by Supersonic Waves.

R. BÄR (*Helvetica Physica Acta*, 6, 570, 1933).

THE diffraction patterns resulting from the diffraction of light by supersonic waves obtained by the method of Debye and Sears (*Proc. Nat. Acad. Sci.*, 18, 409, 1932) are reproduced in the paper. These photographs show that the intensity of the individual diffraction pattern is a function of the order of interference, showing maxima and minima. The position of these maxima and minima is a function of the intensity of the supersonic rays, the value of the ratio of the wavelength of the supersonic waves to that of the light waves, and also of the distance traversed by the light rays through the supersonic waves. Using the method developed by the author and Meyer (*Phys. Zs.*, 34, 393, 1933) for obtaining photographs of supersonic wave fields in liquids, the diffraction of a supersonic wave by a wire grating has been investigated. Photographs are also given showing the reflection and refraction of supersonic waves at the boundary between two liquids, e.g., with p-Xylol above and water below.

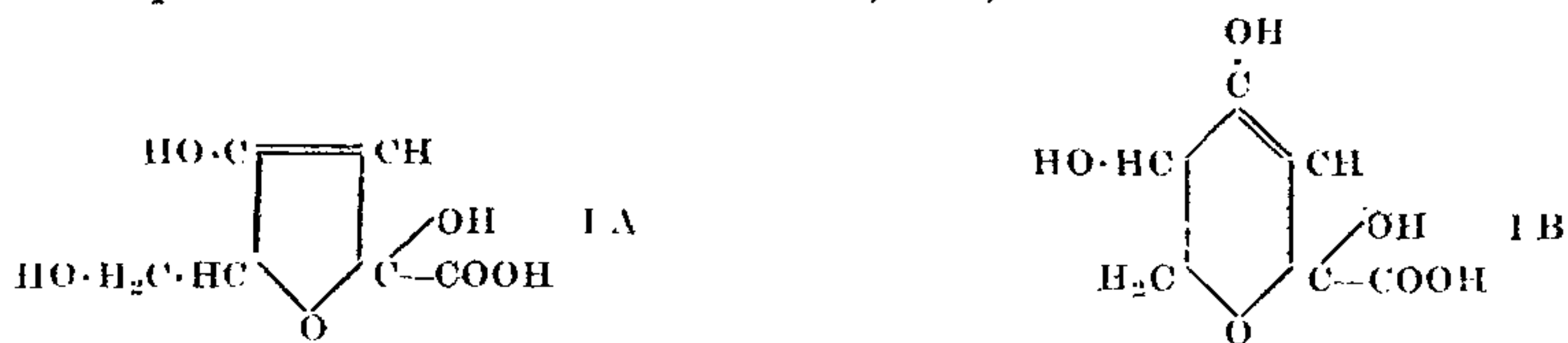
Ascorbic Acid.

SZENT GYÖRGYI isolated from the cortex of the suprarenal capsules, a strongly reducing acid, C₆H₈O₆, which is also widely distributed in plants and animals (*Biochem. J.*, 22, 1387, 1928). This acid answers the colour reactions given by carbohydrates. King and Waugh isolated an identical substance from lemon juice (*J. Biol. Chem.*, 97, 325, 1932). Györgyi's acid was originally named hexuronic acid because it was supposed to be derived from some non-specified hexose in the same way as glycuronic acid is produced by the oxidation of glucose in the animal body. But, later work has shown that it is not a member of the uronic acid group. In view of its strong antiscorbutic activity, Haworth and Györgyi have altered the name to ascorbic acid (*Nature*, 131, 24, 1933).

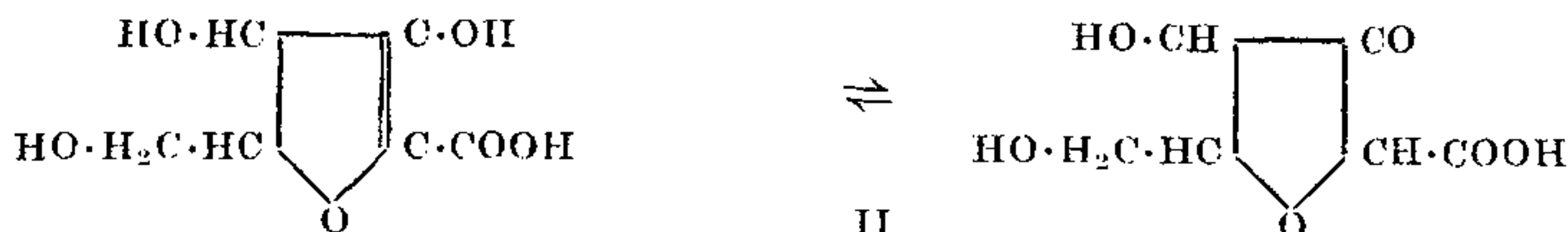
The essentially complete parallelism existing between the antiscorbutic activity and the ascorbic acid content of plant and animal tissues has been pointed out by Harris and his co-workers (*Biochem. J.*, 27, 303, 1933). This acid does not owe its antiscorbutic activity to any contamination with a highly active substance, for the acid liberated from the thoroughly purified mono-acetone derivative, is strictly identical with the original substance and possesses undiminished antiscorbutic activity. Ascorbic acid is now regarded as vitamin C in a pure crystalline form (Szent Györgyi, *Nature*, 131, 225, 1933).

The remarkable chemical property of the acid is its high reducing power. When oxidised by iodine in acid solution, a dehydro acid is formed which is still antiscorbutically active. This acid can be reduced to the original acid by hydrogen sulphide or hydriodic acid. Colour reactions with ferric chloride and sodium nitroprusside are indicative of an enolic group; the presence of a double bond is deduced from its reaction with tetranitromethane, with which a deep yellow colouration is produced (Karrer, Salomon, Schöpp and Morf., *Helv. Chim. Acta.*, 16, 181, 1933). The presence of a primary alcoholic group is evidenced by the formation of a triphenyl methyl derivative. The formation of a di-p-nitro phenyl hydrazone shows the presence of two carbonyl groups. One of these is adjacent to the carboxyl group, since oxidation with hydrogen peroxide readily yields oxalic acid. On the basis of these observations Karrer,

Schöpp and Schwarzenbach suggested I A and I B as the probable alternative formulæ for ascorbic acid (*Helv. Chim. Acta.*, **16**, 302, 1933):



Micheel and Kraft, however, favoured the structure II (*Nature*, **131**, 274, 1933):

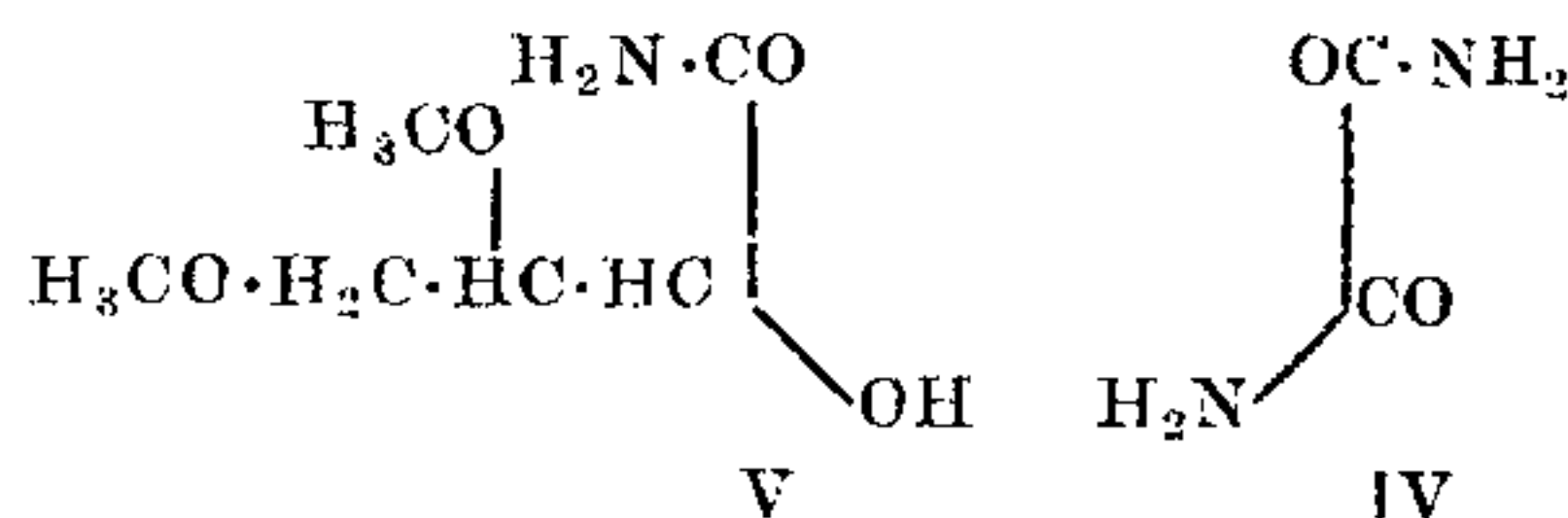
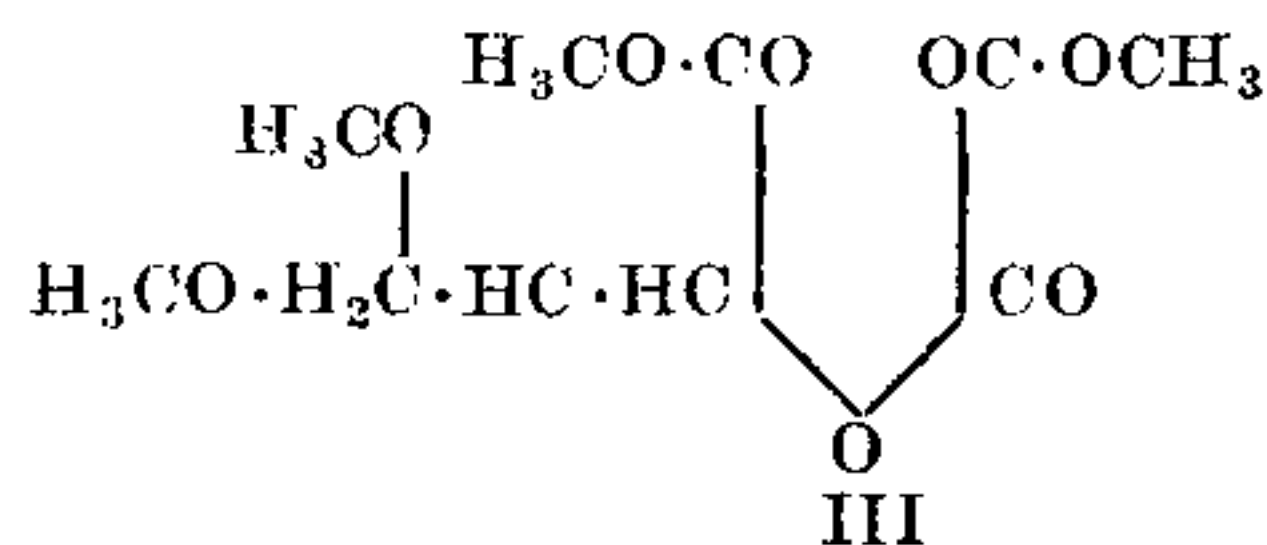


This formula was in harmony with Reichstein, Grüssner and Oppenauer's original interpretation of their synthesis of the dextro isomer of ascorbic acid (*Helv. Chim. Acta.*, **16**, 561, 1933)

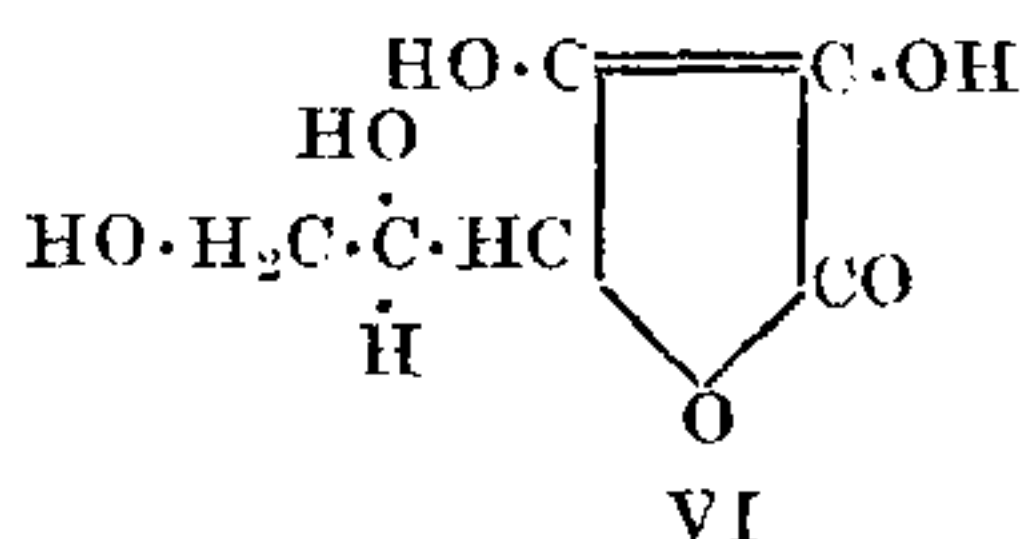


Based on a study of methyl derivatives and other reactions of ascorbic acid, Hirst and his collaborators have arrived at an entirely different structure (*Nature*, **131**, 617, 1933; *J. Chem. Soc.*, **299**, 1270, 1933). Ozonisation of the tetramethyl derivative of ascorbic acid results in the rupture of the

pre-existing double bond and the formation of a neutral product III identified as methyl-3:4-dimethyl-1-threonate, substituted in position 2 by a methyl oxalate residue. This product on treatment with methyl alcoholic ammonia yielded oxamide IV and 3:4-dimethyl-1-threonamide V:



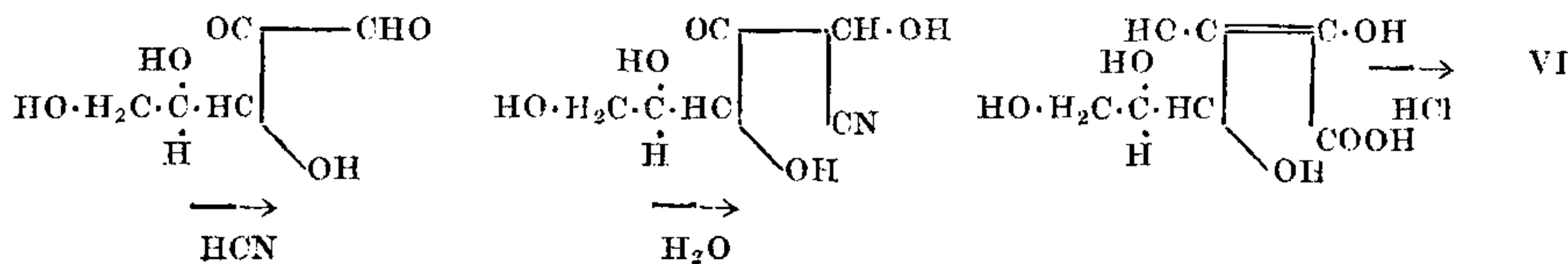
These observations are easily explained by the structure VI given by them to ascorbic acid:



This also accounts for the formation of l-idonic acid by catalytic hydrogenation and

of formaldehyde by the oxidation of dimethyl ascorbic acid with lead tetra-acetate (Micheel and Kraft, *Z. physiol. Chem.*, **218**, 280, 1933). This is also more in harmony with the X-ray data of the crystalline material, which demands an extraordinarily flat molecule (Cox, *Nature*, **130**, 205, 1932).

The synthesis by Reichstein, Grüssner and Oppenauer (*Helv. Chim. Acta.*, **16**, 1019, 1933) and Haworth and collaborators (*Jour. Soc. Chem. Ind.*, **52**, 645, 1933; *Jour. Chem. Soc.*, **332**, 1419, 1933) is now explained thus:



The reaction between acetone-dimethyl-ascorbic acid and magnesium methyl iodide gives additional support for the lactone formula (Karrer, Schöpp and Zehnder, *Helv. Chim. Acta.*, 16, 1161, 1933). The analytical results of the product of reaction agrees closely with those to be anticipated on the basis of VI.

P. R. KRISHNASWAMY.

Blister Rust of Pine.

BLISTER rust is a fungus disease attacking young pine plants causing considerable damage to the healthy regeneration of this valuable species. As in the case of other rusts, the organism belongs to the group of heteroecious fungi which pass their life cycle in more than one host and the inadequate knowledge of the alternate host in the present instance, was responsible for the slow progress on the subject although the fungus (*Peridermium himalayense*) was isolated long ago. The occurrence of rusts on plants which form constant associates of pine acting as the possible alternate stage of this fungus, the identification and description of new organism, its biological relationship to the chir parasite, and the control measures for checking the spread of this pest after elaborate studies, form the subject of a contribution by Dr. K. Bagchee (*The Indian Forest Records*, Botany Series, 18, Part 11, 1933).

The author discovered in the course of his studies that certain annual plants belonging to the genus *Swertia* were found always associated with pines in the pine stands, and that some species of this genus suffered from a rust disease the most prominent of which was *Swertia alata*. Strangely enough where pine was not diseased, these species also were free from infection. The several silvicultural observations relating to the occurrence and spread of these diseases are recorded by the author. It occurs from the above that an inter-relationship possibly exists between the pine rust and *Swertia* attack. In fact, a biological inter-relation has been definitely established in this publication between the accidial spores of the *Peridermium* and the *Cronartium* fungus which is the cause of *Swertia* infection. The latter is visible only in a few species of *Swertia* but not in all. This new fungus is named as *Cronartium himalayense*, and its morphological characters are described in the paper at great length.

A variety of inoculation experiments with the æcidiospores of the coniferous rust fungus were carried out under controlled conditions on the *Swertia* plants. In a fortnight's time the *Cronartium* stage of infection was actually reproduced on the new hosts. The various conditions, such as humidity, temperatures, the quantity of the inoculum and the age of the inoculated plant for successful infection, have been worked out by the author. The incubation period extends generally from 7 days to 3 weeks for all the hosts examined. This successful transmission gives the direct clue to short distance transference of the disease in nature to the pine plants, through the widely distributed *Swertia* plants acting as alternate hosts to the organism. The long distance dissemination can be assumed to be caused by wind-borne æcidiospores. In the field, these spores gain access into the plants through the stomata of the leaves. Thus the infection spreads to the broad-leaved hosts (*Swertia Sp.*) during the early monsoon rains and re-infection of pine takes place through sporidia derived from the germinating teleutospores during the latter part of the monsoon. The several stages of the rust fungus, such as æcidiospores, teleutospores, uredospores and sporidia characteristic of such organisms are detailed. The phenomena of over-wintering of the various spore forms does not appear likely. The æcidiospores do not over-winter in the pine plants. The alternate hosts, being annuals, do not permit the fungus to over-winter in the uredostage.

Thus the control of these rusts is a problem of supreme importance. The introduction of pines resistant to the disease, derived from foreign localities, is beset with considerable difficulties. Other diseases not known locally should not be imported and the successful generation of those plants should be ensured under new environmental conditions. The indigenous pine species have not yielded encouraging results. Several silvicultural operations, such as admixture of pine with other species, departmental burning, etc., have proved difficult. The control of the chir rust is easy if one of the hosts can be eradicated. In this case, the alternate host being an annual, seems to be apparently easy to get rid of. The author has suggested a scheme of operations to check the malady by destroying the *Swertia* plants soon after the rains till early autumn. But it is rightly feared that

the same for several reasons may not find favour with the authorities, although a trial will not be a useless proposition. It is suggested here, however, that the increasing application of chemicals for the removal of the annual weeds—*Swertia* here is actually a weed—is a virgin field for investigation and it is hoped the same may commend itself to the author and to the authorities. It is sure to be cheap, efficacious and simple.

V. I.

The Tongue of *Rana hexadactyla*.

IN an interesting article in the *Records of the Indian Museum* (Vol. 35, part II, 33) C. P. Gnanamuthu describes how exactly the tongue in the frog is brought into action. According to the older authors either the pressure due to the lymph was responsible in exerting the tongue or the muscles, *genioglossus* and *hyoglossus* acted as protractors and retractors respectively. The present author clearly points out that the hyoid muscles subserve a different function; the two muscles *genio-* and *hyoglossi* are the only ones concerned in governing the movements of the tongue. The muscle *hyoglossus* remains in a contracted state and is relaxed when the tongue is pushed forward; the dorsal part of *m. genioglossus* reduces the length and breadth of the tongue while the basal part serves for the pivotal movement of the anterior part of the tongue.

The Thermal History of the Earth.

ARTHUR HOLMES has published a very interesting paper on "The Thermal History of the Earth" in a recent number of the *Jour. Washington Acad. Sci.* (Vol. XXIII, No. 4, 1933). In this paper the physical assumptions involved in the various hypotheses bearing on the earth's thermal history are reviewed, in the light of what is known of the actual behaviour of the earth. The Thermal Contraction Hypothesis of Jeffreys and the Hypothesis of Thermal Cycles of Joly have both been critically examined and found untenable. The hypothesis of Sub-crustal Convection Currents advocated by Bull and Holmes is next considered and is shown to give a reasonable explanation for the distribution of mountains in space and time, for the associated geosynclines and oceanic deeps, and for igneous activity in general.

The New Mineralogy.

IN a recent number of the *American Mineralogist* (Vol. XVIII, No. 3, March 1933) A. N. Winchell has a very important paper on what he calls 'The New Mineralogy'. The author first describes the various ways by which minerals vary in composition and illustrates the relations between these variations and variations in optic properties, giving a new diagram of the diopside-hedenbergite-clinoenstatite system. He states further: "It is only very recently and very gradually becoming apparent that any fixed and definite composition within the limits of variation of any mineral has fixed and definite physical characters. This correlation of physical and chemical properties was impossible in many cases as long as the mineralogist had no key to unlock the door of his crystal palace. Now that he has entered these palaces, he has learned for the first time to understand how they vary in composition; such a knowledge was necessary in order to make it possible to show the relations between physical characters and chemical composition. The aim in the scientific studies of minerals should no longer be merely the name of the mineral but the determination of the precise composition in terms of end-members and for this purpose, accurate measures of optical constants are second in importance only to complete chemical analyses of carefully purified samples."

Carotenoids and Flavines.

IN a paper presented before the Leicester Meeting of the British Association for the advancement of Science, Richard Kuhn has discussed the properties of these important colouring matters. The first products of synthesis in plants are dye-stuffs with 40 carbon atoms, and these undergo oxidative disintegration into carotenoids with fewer carbon atoms. The α , β and γ carotenes are provitamins A. The widely distributed yellow, water-soluble colouring matters fluorescing with green are the flavines. Lactoflavine prepared from milk promotes normal growth in rats deprived of vitamin β_2 . The flavines can be reversibly reduced, and these act as transporters of oxygen in the cell. When combined with carriers of high molecular weight they appear to act as oxidation enzymes. The properties of the carotenes and flavines appear to be complementary in many respects.