straight lines, so that an actual gravitational field exists. We show that the totality of curved paths completely determines the field. Two Einstein fields which are essentially distinct can never have the same paths. In particular, the paths completely determine the behavior of light.

IV. Our final theorem is that the light equation determines uniquely the gravitational field. In particular, the paths of particles can be predicted from the behavior of light in the field.

It follows that the gravitational field produced by the sun can be explored *either* by observations on the orbits of the planets *or* by observations on the deflection of light rays. *It is not necessary to use both sets of observations.* There is, in particular, a connection between the deflection of light (1.7″ at the sun's limb) and the motion of the perihelion of Mercury (43″ per century): either could have been *theoretically* predicted from the other—but in this fairyland who can lay down a boundary between theory and practise?

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(*Concluded*)

Some proteins from the Georgia velvet bean, Stizolobium Deeringianum: C. O. Johns and H. C. Waterman. The Georgia velvet bean contains 23.6 per cent. of protein (N × 6.25). Salt solutions of optimum concentrations (3 per cent.) extract about 15 per cent. of protein. From such solutions 2 globulins, designated the α- and β-globulins, and an albumin may be separated, the 2 former by fractionation with ammonium sulfate and the latter by coagulation from extracts from which the globulins have been precipitated by prolonged dialysis. The proteins are sharply distinguished by their different sulfur- and nitrogen-content, by differences in the percentages of the basic amino-acids as determined by Van Slyke's method, and by the fact that the *β-globulin* does not give the Hopkins reaction for *tryptophane.* The latter observation is of particular interest inasmuch as this amino-acid has been found in all seed globulins heretofore tested. The α-globulin and the albumin from the Georgia velvet bean both contain tryptophane.

The deficiency of cystine in proteins of the genus phaseolus: C. O. Johns and A. J. Finks. Nutrition experiments with the proteins of the navy bean, *Phaseolus vulgaris,* lima bean, *Phaseolus lunatus,* and adsuki bean, *Phaseolus angularis,* show that they are deficient in cystine. This amino-acid must be added before they are adequate for normal growth. The proteins of the navy and lima beans must be cooked as well as supplemented with cystine before they are available. Similar experiments are in progress with the mung bean, *Phaseolus aureus.*

Studies on Neoarsphenamines: P. A. Kober. It was shown in a previous paper that arsphenamine made by Ehrlich's method contains methylalcohol. It is now shown that neo- and sodium arsphenamines made heretofore contain about 30–40 per cent. impurities, consisting chiefly of methyl alcohol, ethyl alcohol, sulphites and ether. Methods were described for the first time, for making sodium arsphenamine, neo-arsphenamine and a soluble mono-hydrochloride of arsphenamine base, which are chemically pure and whose arsenic and sulfur content is close to that required by the theory. Another method was described for making the dihydrochloride of arsphenamine base.

The colorimetric estimation of tyrosine by the method of Folin and Denis: Ross Aiken Gortner and George E. Holm. As the result of a study of the various factors influencing the color intensity of protein hydrolysates to which have been added the phenol reagent of Folin and Denis, according to their directions for the quantitative estimation of tyrosine, we are forced to conclude that: (1) Tyrosine can not be quantitatively estimated in a protein hydrolysate by the use of the phenol reagent because (2) Tryptophane, if present, will also produce intense colors with the reagent, the color produced by one milligram being approximately 85 per cent. of that produced by tyrosine at an equivalent concentration. (3) Indole and indole derivatives, contrary to the statement of Folin and Denis, react strongly with the phenol reagent to produce the blue color. (4) Ferrous iron, and apparently any other easily oxidizable material, also reacts with the reagent. (5) There is considerable evidence that tyrosine and tryptophane are not the only protein constituents which produce blue colors with the phenol reagent. (6) The amount of color which is developed in a solution is not a linear function of the concentration of the reactive material, but the color values fall off

sharply as concentration increases until only an insignificant fraction of the reactive material is indicated by a measurement of the color values of the solutions containing any considerable amount of the reactive substance. (7) Because of the peculiar form of the color curves in relation to concentration, it becomes necessary for one to know the approximate concentration of reactive material in advance of the colorimetric determination so that the colors may be developed and read at such a concentration that the maximum color values will be developed. (8) Because of the fact that solutions of tyrosine and tryptophane do not give the same color values at equivalent concentrations, it is impossible to measure accurately the sum of these amino acids in a mixture which contains no other reactive substances. (9) Protein hydrolysates must not be boneblacked if they are to be used subsequently for a quantitative determination of amino acid content, for the boneblack adsorbs at least tyrosine, tryptophane and tryptophane decomposition products in appreciable amounts. Whether or not other amino acids were adsorbed was not determined. (10) Boneblack contains some easily oxidizable material, probably reduced iron; which dissolves in acid solutions. These acid solutions give the blue color with the phenol reagent.

The humin formed by the acid hydrolysis of proteins. VI. The effect of acid hydrolysis upon tryptophane: GEORGE E. HOLM and ROSS AIKEN GORTNER. Tryptophane was boiled with 20 per cent. hydrochloric acid for various lengths of time up to 144 hours and the solutions studied with respect to deaminization, humin formation and nitrogen distribution. The following conclusions were drawn: (1) Tryptophane is slowly altered and parts of the molecule are broken down by long acid hydrolysis. (2) Tryptophane, in the absence of aldehydes or other reactive compounds, contributes but an insignificant fraction of its nitrogen to the "acid insoluble" humin. A much larger amount of the tryptophane appears in the "soluble humin" after 144 hours' boiling with acid. Since, however, a normal protein hydrolysis rarely requires more than 24 hours' boiling, it appears extremely improbable that the "total" humin of such a hydrolysate is derived from tryptophane without the intervention of some other reactive compound, which we have postulated in our earlier papers to be of the nature of an aldehyde. (3) Tryptophane is relatively easily deaminized by boiling with 20 per cent. hydrochloric acid. probably some of the ammonia of a normal protein hydrolysate is derived from tryptophane instead of being entirely derived from amide groupings. (4) When tryptophane has been boiled with 20 per cent. hydrochloric acid the distribution of the nitrogen is such that errors may be introduced into both the "basic" nitrogen and the "non-basic nitrogen" fraction of a Van Slyke determination.

The alkali reserve in pellagra: M. X. SULLIVAN and R.-E. STANTON. Of fifty-six separate cases tested by alkali reserve by the alveolar air method and by the determination of the carbon dixide bound by the blood plasma, none showed a marked depletion of the alkali reserve, about one third showed a slightly subnormal level, while the greater number of cases were within normal limits. There is little acidosis in pellagra.

The mosaic disease of spinach as characterized by its nitrogen constituents: S. L. JODIDI, S. C. MOULTON, K. S. MARKLEY. Spinach plants, especially their tops, affected with mosaic disease, have a smaller percentage of total, nitrate, acid amide, mono and diamono nitrogen, but a somewhat larger percentage of ammonia than normal plants, nitrous acid being present in diseased plants only. This is due to the fact that denitrification takes place whereby nitrates are reduced to nitrites which reacting on the various nitrogenous compounds present in the spinach bring about elimination of nitrogen in a free state, involving also a loss of nitrogen in the form of ammonia. Very little denitrification, if any, takes place in the roots of diseased spinach. This is evident from the fact that the differences in total, nitrate, amino nitrogen content, etc., of the roots of healthy and diseased plants are usually quite small, running sometimes in opposite direction. Conditions with regard to peptide and protein nitrogen are apparently somewhat more complicated. In the samples examined the proportion of peptide nitrogen is higher in diseased tops than in normal, while the proportion of protein nitrogen is higher in diseased roots than in normal, this being also true of diseased leaves when related to the total nitrogen. This is conceivable since the latter is here *smaller* due to loss through denitrification. In round figures the spinach nitrogen is made up of 55 per cent. protein nitrogen, 4.5 per cent. diamino nitrogen, 5.5 per cent. monoamino nitrogen, and 6 per cent. peptide nitrogen. This means that over 70 per cent. of the nitrogenous compounds occurring in spinach have direct nutritive value.

The effect of conditions on the relation of seed plants to H-ion concentration of nutrient solutions: B. M. Duggar. The results of work previously reported indicate that in the preparation of salt (or so-called mineral nutrient) solutions for the solution culture of seed plants under the most favorable conditions, consideration must be given to the hydrogen ion concentration as well as to salt proportions. The hydrogen ion concentrations of carefully prepared and analytically pure monobasic phosphates are for some plants near or above the critical point for growth maintenance. The effects of changes in the environment, especially temperature and humidity affect in no simple manner the response of the plant to changes in P_H. The optimum P_H like the optimum temperature may be represented by a considerable range of values and may be defined closely only in relation to other environmental conditions.

The relation of dextrose to hydrogen ion concentration with B. Coli: William H. Chambers. By correlating the property of *B. coli* to produce acid from dextrose with the property of alkali formation in dextrose-free bouillon, it was possible to control the hydrogen ion concentration of a growing culture within a narrow zone by the addition of small amounts of dextrose at frequent intervals. The initial amount of dextrose furnished determined the maximum hydrogen ion concentration attained. Reversion of reaction is demonstrated in bouillon with .3 per cent. or less of dextrose. Growth curves plotted from plate determinations show the inhibitory and lethal effects of alkali and acid.

The determination of small amounts of chlorine in tissues: Richard D. Bell and E. A. Doisy. A method, based on that of Neumann, is described for the rapid determination of 3–10 mg. of chlorine in tissues. The tissue is digested with sulfuric acid and persulfate and the gases absorbed in alkali. No cyanide is formed by this digestion process. The sulfur dioxide evolved reduces hypo-chlorite to chloride. The chlorides are precipitated with standard silver nitrate. The mixture is concentrated to a small volume, made up to 25 c.c. and filtered. The filtrate is titrated using the solutions of McLean and Van Slyke. For whole blood and plasma, the results agree with those obtained by Foster's modification of the method of McLean and Van Slyke.

Pectin studies; I. Effect of pectin on the hydrogen ion concentration of acid and of alkaline solutions: H. E. Patten and T. O. Kellems.

The oxidation of acetoacetic acid by hydrogen peroxide in the presence of glucose: P. A. Schaffer.

Influence of fermentation on the starch content of experimental silage: A. W. Dox and Lester Yoder. A study of experimental corn silage at different stages of fermentation which was normal as regards development of aroma and changes in acidity, alcohol and sugar content, leads to the following conclusions: (1) Changes in total acidity, alcohol and sugar are independent of the starch content of the ensiled corn and of the silage produced from it. (2) The first intermediate products resulting from decomposition of starch are not present in demonstrable quantities. (3) The starch content remains constant throughout the fermentation process. (4) The starch granules remain intact, undergoing no physical change that can be detected by microscopic examination.

Water-soluble B vitamines: II. Are the antineuritic and the growth-promoting vitamines the same? A. D. Emmett and Mabel Stockholm. In previous work in feeding pigeons and young rats the same basal diet as the only source of water-soluble B vitamine, we found that the antineuritic vitamine (pigeons) and the growth-promoting (rats) were not the same. In further studies, carried out on yeast, rats and pigeons, it has been ascertained, by using the Williams quantitative yeast method, that the "vitamine" that stimulates growth in the yeast cell is not antineuritic, as has been claimed, but simply growth-promoting. Further, this "vitamine" apparently has very little if anything to do with the growth of the rat. Therefore, the water-soluble B vitamine appears to be much more complex than many have been led to believe.

Charles L. Parsons,
Secretary

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