

The intensity distribution in the solar spectrum: H. H. PLASKETT.

The spectroscopic orbit and dimensions of TV Cassiopeia: J. S. PLASKETT.

The radial velocities of 594 stars: J. S. PLASKETT, W. E. HARPER, R. K. YOUNG, and H. H. PLASKETT.

A probable influence of the earth on the formation of sun-spots: LUIS RODÉS.

The relation between the diameter of a photographic star image and its magnitude: FRANK E. ROSS.

Systematic corrections and weights of catalogs. An addition to Appendix III of Boss's Preliminary General Catalog: ARTHUR J. ROY.

Orbits of three spectroscopic binaries: R. F. SANFORD.

Phenomena in connection with our transit of the plane of Saturn's rings in 1920-1921: E. C. SLIPHER.

Further notes on spectrographic observations of nebulae and clusters: V. M. SLIPHER.

Some recent results of plate tests at the Harvard Astronomical Laboratory: HARLAN TRUE STETSON.

The diurnal variation of clock rates: R. H. TUCKER.

The Elgin Observatory: FRANK D. URIE.

Progress in the chronographic registration of radio time signals: FRANK D. URIE.

The San Diego Radio Time Signals: FRANK D. URIE.

Internal motion in four spiral nebulae: ADRIAAN VAN MAANEN.

Atomic structure: FRANK W. VERY.

Solar hot-box studies: FRANK W. VERY.

Observations of 12 Lacertæ, 1919, 1920, 1921: R. K. YOUNG.

Orbit of the spectroscopic binary Boss 5442: R. K. YOUNG.

JOEL STEBBINS,
Secretary

NEW YORK MEETING OF THE AMERICAN CHEMICAL SOCIETY

DIVISION OF BIOLOGICAL CHEMISTRY

Arthur W. Dox, *Chairman.*
Howard B. Lewis, *Secretary.*

Symposium on Vitamines

The antineuritic vitamine: CASIMIR FUNK.

Experiments on the isolation of crystalline antineuritic vitamine: ATHERTON SEIDELL.

The antiscorbutic vitamine: A. F. HESS.

Factors influencing the vitamine content of food materials: R. ADAMS DUTCHER.

Standardized methods for the study of vitamines: A. D. EMMETT. In view of the great stress that is being placed upon vitamines with respect to the etiology of certain deficiency diseases and to the relative content of various products and foods, it would seem almost imperative to follow a more definite method of procedure than is now used in carrying out the biological tests. Otherwise, it is quite conceivable, due to the many possible variables that may easily enter, that the results obtained by the workers from different laboratories may be contradictory or even misleading at times.

It is suggested, as a step in correcting this condition of affairs, that it would be well to outline definitely and in detail the various stages of the procedure so that there can be provisional methods to refer to as standards. If these are established and followed, they will serve as a guide from and to which it will be possible to correlate the results obtained when the animal diets or rations are varied in accord with the needs of the individual projects and make it easier to conclude with more definiteness the significance of the results.

Standardized methods for the study of vitamines: A. D. EMMETT.

Vitamines from the standpoint of structural chemistry: R. R. WILLIAMS.

Vitamines from the standpoint of physical chemistry: V. K. LA MER.

General Discussion—KATHERINE BLUNT, G. H. A. COWLES, and others.

The influence of the vitamine content of a feed on the nutritive value of the milk produced: J. S. HUGHES, J. B. FITCH, and H. W. CAVE. Four calves were started on the experiment; two were from cows which had received a food low in vitamine during the entire gestation period, the other two were from cows which had received normal feed. During the first week the two calves from the experimental cows received their mothers' milk. At this time one of these cows died and her calf was then given the other experimental cow's milk. The two calves from the cows receiving normal feed were fed on herd milk exclusively. All four calves wore muzzles so they could get no other feed. All the calves seemed to be normal for the first five weeks, at which time one of the calves receiving the

experimental milk became blind. It died when it was forty-two days old, showing nervous symptoms very much like an animal with beri beri. The other experimental calf became blind when seventy-eight days old and died nineteen days later with symptoms like the first. A calf from a cow receiving normal feed was placed on the experimental milk at the time the first calf died. It did not become blind but died at the end of nineteen weeks. The two calves receiving the herd milk are still normal after a period of eight weeks.

The influence of excessive oxidation upon the nutritive and antiscorbutic properties of cow's milk: R. ADAMS DUTCHER and CLIFTON W. ACKERSON. Eight guinea pigs, used as controls, were fed a diet of oats ad libitum and 30 c.c. (daily) of fresh raw milk from the university dairy herd. Ten guinea pigs were fed oats and milk powder (prepared from the herd milk). The milk powder was diluted back to the same composition as the original raw milk and 30 c.c. were fed daily to each animal. The milk powder was prepared at intervals of 2 to 5 days by spraying the milk into a blast of hot air in a cell four feet square. Each quart of milk came in contact with approximately 1,400 cubic feet of hot air. The air in the cell was kept at a temperature of 115° C. while the temperature at the spray nozzle never exceeded 100° C. The milk powder was allowed to remain on the floor of the cell during the drying process (2-3 hours). No attempt was made to approximate commercial conditions. The entire group of guinea pigs receiving the milk powder died with pronounced scurvy lesions in periods ranging from 16 days to 42 days. At the end of 42 days all of the control animals, which had consumed their daily ration of raw milk, were living and in much better physical condition than the group receiving the dried milk.

The relation between the vitamine content of feed and hatchability of the eggs produced: J. S. HUGHES, L. F. PAYNE, and F. E. FOX.

A comparison of the yeast and bacteria growth promoting vitamins: LOUIS FREEDMAN. It was found experimentally that beef and beef-heart infusion, peptone and autolyzed yeast contain substances which are equally active for growth of hemolytic streptococci and yeast cells. This substance was found present to a limited extent, in casein and other animal and vegetable proteins which were specially prepared and purified. The substance active for streptococci is of similar nature if not identical with the yeast growth pro-

moting vitamine present in autolyzed yeast. There is also present in beef heart another substance, associated with blood, which is necessary for growth of streptococci. The nature of this has not yet been determined. Further work on these problems is now in progress.

The vital problem of vitamins—a plea for a vitamine institute. Food products rich in vitamins: B. DASS. Since the indication of the existence of vitamins some twelve years ago, this subject has been receiving increasing attention. The results of many investigations have proved beyond doubt the utmost importance of the presence of vitamins in foods and also have established the relative vitamine content of the various articles of food. Nowadays there are in the market quite a few food products advertised to be rich in vitamins. The necessity of such products can not be overestimated provided they are truly rich in vitamins and at the same time reasonably low in price so as to be available to the poorer classes of people who are, generally speaking, the victims of diets deficient in vitamine-content.

The distributor of vitamins in natural food-stuffs: W. D. RICHARDSON.

Some experiments with the vitamins of autolyzed brewer's yeast. Preliminary communication: HARRY E. DUBIN and CASIMIR FUNK. Pigeon and rat experiments were conducted in order to test the influence of vitamine B and the substance (called provisionally "vitamine D") promoting the growth of yeast. The above vitamins were obtained, one practically free from the other, from autolyzed yeast by means of fractional shaking with fuller's earth. The results show clearly that pigeons require vitamine B while rats require vitamine D for maintenance and growth. On vitamine D alone, after one month, pigeons have not developed beriberi, although they have lost considerable weight. On vitamine B alone, rats have consistently lost weight and present a poor physical appearance. Both pigeons and rats thrive best on a mixture of vitamins B and D.

Proof of the presence of lipase in milk and a new method for the detection and estimation of the enzyme: FRANK E. RICE and ALTON L. MARKLEY. (1) Lipases are defined as enzymes which split natural fats. (2) Methods for determining lipase are not satisfactory unless the fat-substrate is well emulsified in the suspension medium, and unless a preservative is used which prevents all bacterial

growth but does not check the action of the enzyme. (3) The following method is suggested: Boiled cream of high fat content is used as substrate. Cane sugar is added in sufficient quantity to form a saturated solution with all the water present. After addition of the enzyme, the mixture is titrated at the beginning and end of a digestion period. (4) It is proved that milk normally contains lipase. (5) Lipase doubtless is a factor in the development of rancidity in seed oils, butter and cheese. (6) Direct proof is offered that sweetened condensed milk becomes rancid on account of an admixture of raw milk, the lipase therein producing the phenomenon.

A quantitative method for the determination of peroxidase in milk: FRANK E. RICE, and T. HANZAWA. (1) The method of Bach and Chodat¹ is modified for application to milk. It depends upon the oxidation of pyrogallol to insoluble purpurogallein with hydrogen peroxide, the reaction being catalyzed by peroxidase. (2) The milligrams of purpurogallein obtained per 10 c.c. of milk is taken as the "peroxidase number." (3) Since several days are necessary for the attainment of equilibrium air must be excluded from the reaction. (4) The dependence of the peroxidase number on the amount of peroxidase present was proved by making determinations on various mixtures of raw and boiled milk.

Effects of certain antiseptics upon the activity of amylases: H. C. SHERMAN and MARGUERITE WAYMAN. The influence of toluene, formaldehyde and copper sulphate upon amylases of both animal and vegetable origin was studied. Toluene had very little influence upon the activities of the amylases either in their natural or purified condition. Formaldehyde even in small amounts (0.00006 molar and less) was found distinctly injurious to all of the amylases studied, viz., commercial pancreatin, purified pancreatic amylase, saliva, malt extract, purified malt amylase, commercial takadiastase, and the purified amylase of *Aspergillus oryzae*. Takadiastase was the least, and purified pancreatic amylase was the most, affected. All of these enzymes were also found to be very sensitive to copper sulfate. The percentage loss of enzyme activity under the influence of formaldehyde or copper was determined by the concentration of the antiseptic in the solution and not by the ratio of antiseptic to enzyme or to substrate. The results as a whole, in addition to their bearing upon the problem of quantitative distinction between organ-

ized and unorganized ferment action, are of interest in that they afford a new indication of the protein nature of these typical enzymes.

The influence of certain amino acids upon the enzymic hydrolysis of starch: H. C. SHERMAN and FLORENCE WALKER. Addition of glycine, alanine, phenylalanine or tyrosine caused an undoubted increase in the rate of hydrolysis of starch by purified pancreatic amylase, commercial pancreatin, saliva, or purified malt amylase. Less marked results were obtained with the less sensitive enzyme materials malt extract, takadiastase, and an *Aspergillus* amylase product prepared in the laboratory from takadiastase. Each of the four amino acids here studied, as well as aspartic acid and asparagine previously reported, showed a similar favorable influence upon the enzymic hydrolysis of the starch. The addition of a mixture of two of these amino acids produced no greater effect than would result from the same concentration of one of them. In these experiments the favorable effect of the added amino acid was not due to any influence upon hydrogen-ion concentration nor to combination of the amino acid with the product of the enzymic reaction. On the other hand, it is shown that the addition of one of these amino acids is a very effective means of protecting the enzyme from the deleterious effect of copper sulfate and may even serve to restore to full activity an enzyme which has been partially inactivated by copper.

A study of the influence of arginine, histidine, tryptophane and cystine upon the hydrolysis of starch by purified pancreatic amylase: H. C. SHERMAN and MARY L. CALDWELL. Arginine, histidine, tryptophane and cystine were tested as to their influence upon the amylolytic activity of a purified preparation of pancreatic amylase and it was found that arginine and cystine have a favorable influence, while histidine and tryptophane do not. Since the conditions of the experiments were carefully controlled and were uniformly favorable as to hydrogen-ion concentration and kinds and amounts of salts present, the differences in results are due to the specific effects of the individual amino acids. That histidine and tryptophane should have a different influence from all the other amino acids studied in this and the preceding investigations may be due either to their heterocyclic structure or to their position in the protein complex which doubtless constitutes either the enzyme molecule itself or an essential part of it, or to both. The influence of chemical structure of added substances upon their effects on enzyme action is being studied further.

¹ Ber. d. d. Chem. Ges., 37 (1904), 1342.

Concerning the nature of the toxic products of Bacillus botulinus: J. BRONFENBRENNER and M. J. SCHLESINGER. As a result of growth of *Bacillus botulinus* on appropriate medium rich in nitrogen, there can be demonstrated in the culture filtrate toxic products of two kinds. One is heat resistant, soluble in alcohol and acts without the incubation period. This toxic product consists of ammonia salts and is readily destroyed by the addition of strong alkali. The other possesses the properties of a true bacterial toxin. It is thermolabile, it acts only after a definite period of incubation, is not soluble in alcohol, has antigenic properties, and is neutralized by a specific antibody. This toxin is quite distinct from other bacterial toxins in that (in its crude state) it is poisonous when taken by mouth, in addition to being poisonous by injection, as is also the case with other bacterial toxins. When purified, however, this toxin loses its toxicity by mouth, while its activity by injection remains unimpaired. When the fraction removed by purification is reunited with the purified toxin, the mixture recovers its toxicity by mouth. In addition to the properties already mentioned, this toxin exhibits other characteristics unobserved in connection with other bacterial toxins. For example it is not digested by either pepsin or trypsin. By a proper adjustment of the hydrogen ion concentration it can be rendered as much as 10^{12} times more potent than other toxins. Unlike other toxins, it must be of a comparatively simple chemical composition, as its molecular weight is not more than 260 with only 3×10^{-23} gms. of total nitrogen in one lethal dose for a mouse of 18 gms. It appears to be the most potent substance ever described.

The internal factor in photosynthesis: H. A. SPOEHR.

Comparative stability of alkylbarbituric acids as determined by availability of nitrogen for fungus cultures: A. W. DOX, LESTER YODER, and ADELIA MCCREA. One of the criteria of synthetic hypnotics appears to be chemical stability. In the barbituric acid series, hypnotic properties are confined to the 5, 5-dialkyl derivatives, the 5-monoalkyl derivatives being physiologically inert. This difference may be due to a difference in chemical stability, since the monoalkyl derivatives contain a reactive hydrogen which might be a point of attack for biological oxidation. On this assumption, a difference should be expected in the utilization of the nitrogen by fungi. Cultures of *Penicillium expansum* were inoculated into a synthetic medium containing M/50 nitrogen in the form of alkylbarbituric acid. The

series included eight mono- and seventeen di-alkyl-barbituric acids. A slight growth, far from normal, was obtained on all of the mono-alkyl derivatives, whereas the di-alkyl derivatives gave only germination similar to the controls without nitrogen.

The chemical composition of the body fluids of the sea-lion: R. E. SWAIN, and N. W. RAKESTRAW.

The molecular weight and transition point of gelatin: E. T. OAKES, and C. E. DAVIS.

The non-protein nitrogen of the hen's egg: J. S. HEPBURN.

Biochemical studies of insectivorous plants: J. S. HEPBURN, E. Q. ST. JOHN, and FRANK M. JONES.

Studies on the digestibility of proteins in vitro. III. *On the chemical nature of the nutritional deficiencies of arachin:* D. BREESE JONES, and HENRY C. WATERMAN. Estimations of the digestibility *in vitro* of variously treated preparations of arachin (the principal protein of the peanut, *Arachis hypogaea*) by the method of Waterman and Johns indicate: (1) that this protein is incompletely digestible, and that this condition is not altered by boiling with water at ordinary pressure or by cooking under a steam pressure of 15 lbs.; and (2) that the nutritional failure of arachin is due to the retention of a considerable part of one or more of the essential amino acids, the most conspicuous of which is histidine, in the indigestible complex. The total amino acid composition of arachin would almost certainly be quite adequate, if it were available. The experiments indicate that the incomplete digestibility of arachin is not due to changes brought about by the treatment involved in its isolation, but is a native property of the protein. The high nutritional efficiency of peanut meal is therefore to be attributed to the presence in the meal of sources of amino acids which supply essentials contained in an unavailable form in arachin.

A chemical study of the proteins of the adzuki bean, Phaseolus angularis: D. B. JONES, A. J. FINKS, and C. E. F. GERSDORFF. Two globulins and a small amount of albumin have been isolated from the total proteins of the Japanese adzuki bean, *Phaseolus angularis*. The α globulin, obtained in 0.35 per cent. yield, was precipitated from a 5 per cent. sodium chloride extract of the bean meal by making the extract 0.3 saturated with ammonium sulfate, dissolving the resulting precipitate in distilled water and dialyzing the solution in running, chilled water for 9 to 12 days. This globulin coagulated at about 88° C. Elementary analyses of several preparations showed them to

have the following average percentage composition: C 52.75, H 6.97, N 15.64, S 1.21. Analyses by the Van Slyke method gave the following percentages for the diamino acids: Arginine 5.45, histidine 2.25, lysine 8.30, cystine 1.63.

The *b* globulin was precipitated from the saline extract of the meal at 0.65 to complete saturation with ammonium sulfate. This globulin coagulated at about 97° C, which is 10° higher than that of the *a* globulin. It had the following average elementary percentage compositions: C 53.57, N 6.79, N 16.46, S 0.40, and gave by the Van Slyke method: Arginine 7.00 per cent., histidine 2.51 per cent., lysine 8.41 per cent., and cystine 0.86 per cent. The bases were determined also by the absolute method of Kossel and Kutcher with the following results: Arginine 5.08 per cent., histidine 1.75 per cent., and lysine 4.17 per cent. A yield of 2.13 per cent. of tyrosine was also isolated. The most striking difference between the two globulins lies in their sulfur content. Both gave a qualitative test for tryptophane, although faint and slow to develop in the case of the *a* globulin.

The hydrolysis of casein and deaminized casein by enzymes: HOWARD B. LEWIS, and MAX S. DUNN. A study has been made of the digestion *in vitro* of casein and deaminized casein by pepsin, trypsin and erepsin. Both proteins were readily digested by pepsin and trypsin. Erepsin digested casein readily, but attacked deaminized casein only after the preliminary action of pepsin or trypsin. In every case the digestion of deaminized casein proceeded at a slower rate than the digestion of casein.

Synthesis of glycocoll and glutamine in the human body. C. P. SHERWIN.

Revision of Rosanoff's diagram of the aldose sugars: J. J. WILLAMAN and CLARENCE A. MORROW. Rosanoff's diagram showing the structural and genetic relationships among the aldoses is modified and extended. The objects of the revision are: (1) to include all aldoses so far prepared; (2) to rearrange the positions in the diagram so as to obtain geometrical perfection in showing the stereochemical progressions; and (3) to include in the diagram the following facts which were not included in the original: (a) the name of the sugar, (b) its specific rotation, and (c) its occurrence, whether natural or synthetic. Besides these, the facts in the original are also retained: (d) the projection formula by means of a symbol, (e) the original Fischer designation of family relationship, whether *d* or *l*, and (f) an index number, which, referred to a legend, gives the name of the alcohol

and the dicarboxylic acid derivative of the sugar. The revised diagram simplifies the study of stereoisomerism in the sugar group, and argues for the adoption of a rational system of nomenclature in this group.

The constitution of inulin: J. J. WILLAMAN.

Biochemistry of plant diseases. IV. Effect of the brown rot: Fungus on plums: J. J. WILLAMAN and F. R. DAVISON. Two varieties of plums resistant to brown rot, and two non-resistant, were picked at three stages of maturity, and subjected to analysis before and after rotting by *Sclerotinia cinerea*. The ash, nitrogen, CaO, ether extract, and crude fiber were consistently higher in the rotted samples, due no doubt to loss of dry matter by respiration. The resistant varieties contained much more crude fiber, but less of the other constituents than the non-resistant. The quality and quantity of the structural elements in the flesh are apparently important factors in resistance properties.

Rennet content of pancreatic extract—method for its isolation: ALBERT A. EPSTEIN. The presence of this enzyme in the pancreas can be readily demonstrated in a number of ways: (1) By heating the secretion or extract of the pancreas (in solution) to temperatures ranging from 50° to 65° C. for a period of 10 to 15 minutes, the most favorable temperature being 60° C. At this temperature and those above it, flocculation occurs and the ferment, which is soluble, remains in the fluid portion. (2) Treatment of the pancreatic ferments by means of colloidal iron and other precipitants such as uranium acetate, alcohol, and sodium sulphate (to saturation). (3) Addition of peptone mixtures such as those of gliadin and Witte's to the pancreatic juice or extract liberates the rennet. (4) Serum of a rabbit immunized by intravenous injections of pancreatic extract when added to the pancreatic extract liberates the rennet. It is concluded from these experiments that rennet is constantly present in the pancreatic secretions and extracts, not as a pro-enzyme but as an active enzyme admixed with substances which are antagonistic to it.

The immunizing substance of the pneumococcus: WILLIAM A. PERLZWEIG. The immunizing substance of the pneumococcus was found to be attached to the protein fraction of the cell. Being resistant to the action of proteolytic enzymes, it can be detached from the proteins by subjecting the bacteria to prolonged tryptic action and further separated by extraction of the digest with an excess of alcohol or acetone. The alcohol soluble

antigen is soluble in water, but it is not extracted from its aqueous solution by lipin solvents. It is heat stable in acid solution. The aqueous solution obtained from the alcoholic extract appears to possess the complete immunizing properties of the original pneumococci when tested prophylactically upon white mice, inducing in the animals an active immunity of a high degree. The antigenic fraction of pneumococci appears to be associated with the vitamine fraction.

Biochemical studies in pellagra: M. X. SULLIVAN. In the chemical studies of the patients at the Pellagra Hospital, Spartanburg, S. C., no marked evidence of acidosis was noted, though the patients as a whole tended to minimum normal levels. In general the mixture afforded by the results of the biochemical study of patients in the active stage of the disease is that of malnutrition and low protein metabolism with in general a low total nitrogen excretion, a heightened ammonia ratio with low uric and creatinine and a low ratio of urea nitrogen to total nitrogen. The undetermined nitrogen in the active stage of the disease is much higher than normal and contains basic material.

The chemical composition of decayed tomatoes: R. T. BALCH and I. K. PHELPS. A chemical study of tomatoes decomposed by two molds that cause "soft rots," namely, "*Rhizopus nigricans*" and "*Oidium lactis*" showed a decrease in the sugar content, the acidity, the nitrogen, and to a slight extent the citric acid. There was always a formation of ammonia. These determinations as well as those of the phosphorous in the insoluble solids, the nitrogen in the insoluble solids before and after treatment with 50 per cent. potassium hydroxide, the soluble protein nitrogen and the distribution of the soluble nitrogen would not serve as a means of detecting spoilage in tomato products, excepting in cases where a physical examination would suffice, for the following reasons: (1) The constituents of the tomato are variable. (2) The percentage composition of the tomato is not dependent upon the composition of the tomato alone but varies with the many different processes through which the product goes during its manufacture. (3) The small amount of spoilage that would probably be present would not materially change the composition of the product.

Energy expenditure in sewing: C. F. LANGWORTHY and H. G. BAROTT. The respiration calorimeter was used to measure the energy expended by a woman hemming by hand on various materials and at different speeds, and doing similar sewing on a machine driven by foot power and by elec-

tricity. Little variation was found in the energy required for hand hemming on fine handkerchiefs, cotton sheets, 8-ounce cotton duck, and army blankets, the energy required for the actual sewing ranging from 4.3 calories per hour in the case of army blankets to 5.8 calories in the case of handkerchiefs. When the speed of sewing was increased, the energy output increased proportionately. Hemming sheets on a foot-driven machine required about six times as much energy per hour as doing the same work by hand, but the energy used per meter of sewing was hardly one half as great. When an electrically driven machine was used the energy required per hour was not quite twice that used for hand sewing and about one fourth that for the foot-driven machine; the energy per meter of sewing was about one fifth of that measured on the foot-driven machine and less than one tenth that of hand sewing. A three weeks' attack of influenza during the progress of the experiments made it possible to compare the energy output of the subject before and after the infection. For five weeks after apparently complete recovery her energy expenditure per kilogram of body weight averaged nearly 4 per cent. lower than before her illness.

Loss of carbon dioxide from dough as an index of flour strength: C. H. BAILEY and MILDRED WEIGLEY. Two groups of factors appear involved in determining baking strength of flour: (a) the rate of gas production and (b) gas retention in the dough. The former can be varied in the desired direction, while the latter is apparently related to the percentage and physical properties of the gluten proteins and is more difficult to control. A study of the rate of expansion, and the loss of carbon dioxide from doughs made with strong and weak flours indicates that weak flour doughs lose more carbon dioxide per unit increase in volume than do strong flours. The loss of carbon dioxide per unit volume increase is suggested as a useful criterion of comparative strength of flours.

Studies of wheat flour grades. III. Effect of chlorine bleaching upon the electrolytic resistance and hydrogen-ion concentration of water extracts: C. H. BAILEY and ARNOLD JOHNSON. Bleaching of flour with chlorine effects an appreciable increase in the conductivity and hydrogen-ion concentration of its water extract. The modification of these properties is in direct ratio to the quantity of chlorine employed in treating the flour.

CHARLES L. PARSONS,
Secretary