

Chemistry of Vegetable Physiology and Agriculture.

Influence of Copper on Lactic Fermentation. MARC FOUASSIER (*Compt. rend.*, 1923, 176, 606—608).—The influence exercised on lactic fermentation by contact with certain metals either previously to, or during the action of, the ferment was studied. Lamellæ of the following metals, zinc, aluminium, lead, silver, iron, nickel, copper, and tin, were placed in contact with sterilised milk, which was then inoculated with the lactic ferment, and observations were made of the increase in acidity. It was found that this increase was more rapid in presence of iron, much retarded by copper, and uninfluenced by the other metals. The inhibiting action of the metallic copper on the fermentation was just the same, whether the metal was present during the fermentation or whether the milk had previously been exposed for eight hours to the metal, which was then removed before inoculation. The antiseptic action of copper was further demonstrated by the gradual loss in activity of the ferment suspended in pure sterile water in presence of a piece of copper foil. G. F. M.

Bacteria which Split Nucleoprotein and their Importance for the Liberation of the Phosphorus Reserve in Surface Soils. ALFRED KOCH and ALICE OELSNER (*Biochem. Z.*, 1922, 134, 76—96).—Phosphates are liberated from nucleoproteins and their breakdown products by various soil bacteria (nucleobacter). Chalk is suitable to the liberation of inorganic phosphate, as it gives an alkaline reaction favourable to the bacteria. For analyses of inorganic phosphate in presence of organically bound phosphorus, ammonium molybdate was found suitable, and ultra-filtration was employed for removing bacteria from nutrient media before analysis. H. K.

The Chemotherapy of the Acridine Dyes in Experimental Tuberculosis. MAURICE I. SMITH (*J. Pharm. Expt. Ther.*, 1923, 20, 419—434).—Certain acridine derivatives, namely, acriflavine, proflavine, acridinium-yellow, and acridine-orange, inhibit to a marked degree the growth of the tubercle bacillus in vitro. The pathogenicity of the bacillus is not, however, altered, neither is the tuberculosis process in experimentally infected animals modified by injections of these substances. E. S.

Occurrence of *p*-Hydroxybenzaldehyde and *p*-Hydroxybenzoic Acid in the Bacterial Decomposition of Tyrosine, with Special Reference to Melanin Formation. KINSABURO HIRAI (*Biochem. Z.*, 1923, 135, 299—307).—By the prolonged action of *Proteus vulgaris* on *l*-tyrosine in Ringer's solution, *p*-hydroxybenzaldehyde and *p*-hydroxybenzoic acid were formed in small yield. In addition, after three weeks a black colouring matter was produced, but not if the medium contained glycerol. The production of this melanin is favoured by use of Henderson's phosphate mixture as a nutrient medium, or by the presence of platinum sponge. The melanin is amorphous, but is soluble in alkali, alcohol, glacial acetic acid, acetone, or ethyl acetate. Its production is probably due to a tyrosinase, as under parallel conditions it is not formed from tryptophan, phenylalanine, or leucine.

H. K.

Oxidation of Zinc Sulphide by Micro-organisms. W. RUDOLFS and ANDRÉ HELBRONNER (*Soil Sci.*, 1922, 14, 459).—A culture of organisms was isolated which were capable of oxidising zinc sulphide to sulphate without suffering injury from the soluble zinc salt. The addition of elementary sulphur to an impure culture increased the rate of oxidation of zinc sulphide. The "Lipman" sulphur oxidising bacteria produce sufficient sulphuric acid to dissolve zinc carbonate and silicate. The possibility of a biological process for utilising low-grade zinc blends is noted.

A. G. P.

Cell Respiration. I. The Respiration of Yeast-cells. P. RONA and K. GRASSHEIM (*Biochem. Z.*, 1922, 134, 146—162).—The optimum hydrogen-ion concentration, whether produced by phosphate or acetate buffer mixtures, for the respiration of yeast-cells (*Torula pulcherrima*) lies between P_H 4.5 and 6.6. Just outside these limits, the respiration falls off considerably. The oxygen consumption, using acetates as buffers, is about 30% more than when using phosphates, the most favourable concentration of the latter being one-third molar. The respiration is affected by the age of the yeast, for it falls off after seven days; it is not, however, affected by repeated freezing and thawing of the yeast-cells.

H. K.

The Transformation of Tertiary Amino-acids by Yeast. K. KURONO (*Biochem. Z.*, 1922, 134, 424—433).—When a large amount of sucrose was fermented by yeast in the presence of *dl*- α -amino- α -methyl-*n*-valeric acid, the products isolated were the same amino-acid exhibiting *laevo*-rotation, and methylpropylcarbinol also exhibiting *laevo*-rotation. The identity of this alcohol was proved by preparation of its α -*naphthylurethane*, m. p. 46°, by its oxidation to methyl propyl ketone, which gives a *p*-nitrophenylhydrazone, m. p. 112°. During the fermentation, it is therefore supposed that the degradation takes place via the ketone, $NH_2 \cdot CRR' \cdot CO_2H \rightarrow CORR' \rightarrow CHRR' \cdot OH$.

H. K.

The Behaviour of Pyruvic Acid and Acetaldehyde to Oxygenated Yeast. FRITZ LIEBEN (*Biochem. Z.*, 1923, 135, 240—247).—Pyruvic acid as its sodium salt is partly decomposed with evolution of carbon dioxide and partly utilised by the yeast-cells for body building, when shaken with yeast-cells in a stream of oxygen. Acetaldehyde under similar conditions is for the most part unchanged. Pyruvic acid can be quantitatively estimated by Fürth and Charnass's method if it be first of all reduced to lactic acid by zinc dust and hydrochloric acid. H. K.

The Oligodynamic Action of Metals. JOSEF SCHUMACHER (*Biochem. Z.*, 1922, 134, 398—404).—Pure methylene-blue reduced to leucomethylene-blue by sodium formaldehydesulphoxylate can be used for detecting silver in oligodynamic quantities. Water in which a silver coin has been boiled restores the blue colour instantaneously, and immersion of the coin in a leucomethylene-blue solution gives rise to blue layers over the coin, whereas the main bulk of the solution remains colourless. H. K.

The Influence of Hydrogen-ion Concentration on the Antiseptic Effect of Sublimate. GEORG JOACHIMOGLU (*Biochem. Z.*, 1923, 134, 489—492).—The antiseptic effect of mercuric chloride disappears in weakly alkaline reaction between P_H 7·8 and P_H 10·1, and appears to be most marked in weakly acid reaction between P_H 5·0 and P_H 6·6. W. O. K.

Formation of Oxygen from Carbon Dioxide by Protein-Chlorophyll Solutions. M. EISLER and L. PORTHEIM (*Biochem. Z.*, 1923, 135, 293—298).—The filtrate from a 95% alcoholic extract of grass was treated with four volumes of twenty-fold diluted horse-serum and the flocculated precipitate collected by centrifuging. The protein-chlorophyll mixture was dissolved in 0·85% sodium chloride solution, and using a differential blood-gas apparatus the solution in one bulb was exposed to bright sunlight in an atmosphere of carbon dioxide. The bulb exposed to sunlight exhibited an excess pressure which analysis showed was due to liberation of oxygen. H. K.

A New and Efficient Respirometer for Seeds and other Small Objects. GEORGE T. HARRINGTON and WILLIAM CROCKER (*J. Agric. Res.*, 1923, 23, 101—116).—After discussing various types of respirometers, previously advocated, the authors describe a new form of respirometer, a sketch of which is given in the original. With this apparatus, oxygen consumption and carbon dioxide production are determined in the same apparatus and for the same period of time, using the whole volume of air instead of a sample. The gaseous exchanges are determined at the end of an experimental period by means of a manometer, which is an integral part of the apparatus. The pressure readings are made the basis of direct calculations, both of oxygen consumed and of carbon dioxide given off. W. G.

Respiration of Apple Seeds. GEORGE T. HARRINGTON (*J. Agric. Res.*, 1923, 23, 117—130).—Using the respirometer previously

described (preceding abstract), the author has made a study of the respiration of apple seeds under different conditions.

The respiratory intensity of dormant apple seeds is low, but the intensity in the case of seeds capable of germination is higher and becomes very high with advancing germination, but soon falls if the germinated seeds are kept at too high a temperature. Removal of the outer seed coats increases the respiratory intensity and accelerates germination, but does not affect the respiratory quotient. At the ordinary temperature, the respiratory quotient corresponds with complete oxidation of fats or only slight increase in sugars. With rise in temperature, there is an increase in the respiratory quotient, causing impoverishment in easily oxidisable substances, and with fall in temperature there is a fall in the quotient and a storage of oxygen which probably leads to an increase in acids and sugars. With a relatively high rate of oxidation at high temperatures, there is a tendency for the seeds to become dormant. With advancing germination, the respiratory quotient becomes low, indicating the rapid transformation of fats and accumulation of sugars, but this is preceded by a brief initial rise, which indicates that oxygen-rich substances are being broken up more rapidly than they are replaced.

Respiratory intensity, respiratory quotients, and temperature coefficients are affected by the previous treatment of the seeds, being higher after treatment which tends towards after-ripening, and lower after treatment which induces deeper dormancy. W. G.

Ferment Formation in Germinating Plant Seeds. A. BACH and A. OPARIN (*Biochem. Z.*, 1922, **134**, 183—189).—The authors have estimated the content of respiratory ferments (catalase, peroxylase, oxygenase) and of hydrolytic ferments (amylase, protease) in germinating wheat grains and sunflower seeds. During germination, the content of ferments rises to a maximum in six to eight days except for catalase in wheat, which reaches its maximum in three to four days. The catalase content of sunflower seeds is greater than that of wheat, but the reverse is the case for the other ferments. H. K.

The Influence of Oxygen on the Formation of Ferments in Germinating Wheat Grains. A. OPARIN (*Biochem. Z.*, 1922, **134**, 190—193).—Increased partial pressure of oxygen has no influence on the formation of ferments (preceding abstract) with the exception of oxygenase, which is inhibited, but replacement by an inert gas such as hydrogen is inimical to all ferments except oxygenase. H. K.

Ammonia as Primary and End-product of Nitrogen Metabolism in Plants. D. N. PRIANISCHNIKOV (*Landw. Versuchs-Stat.*, 1922, **99**, 267—286).—The author further develops his earlier theories on the nitrogen metabolism of plants. In seedling plants receiving ammonium salts, the changes depend on the amount of carbohydrates present. Where, as in barley and maize, abundant carbohydrate is present, asparagine is formed and comparatively little ammoniacal nitrogen is found. Where, as in

lupines, the proportion of carbohydrate to protein is less, more ammoniacal nitrogen is found, and the formation of asparagine is depressed. By artificially decreasing the amount of carbohydrate, either by starvation or by removal of cotyledons or endosperm, plants rich in carbohydrate can be made to behave in the same way as those poor in carbohydrate. Similarly, by supplying dextrose to lupine seedlings, increased formation of asparagine and decrease in ammoniacal nitrogen may be induced. Asparagine is held to fulfil the same function in plant metabolism as carbamide in animal metabolism. G. W. R.

The Chemical Mechanism of the Formation of Fat in the Living Cell. HUGO HAEHN and WALTER KINTTOF (*Ber.*, 1923, 56, [B], 439—445).—A preliminary communication. It has been suggested previously (HaeHN, *Z. tech. Biol.*, 1921, 9, 217) that acetaldehyde is an intermediate product in the conversion of carbohydrates into fats within the living cell, and that the process occurs in accordance with the scheme: dextrose \rightarrow pyruvic acid \rightarrow acetaldehyde \rightarrow aldol \rightarrow glyceryl ester. It is suggested that aldol is transformed into γ -dihydroxy-*n*-hexaldehyde or the corresponding unsaturated substance, which is converted by successive oxidation and reduction into sorbic and hexoic acids. Condensation of three molecules of the unsaturated aldehyde leads to the production of the carbon chain of oleic and stearic acids, whereas that of palmitic acid is derived from two molecules of hexaldehyde and one molecule of aldol. In the present communication, it is shown that the assumed intermediate products are assimilated by the cell, and that the presence of certain of them can be established by suitable methods.

Endomyces vernalis is grown in a normal culture solution which is replaced as soon as the mycelium is developed by pure solutions of acetaldehyde, pyruvic acid, or aldol, respectively, which are adjusted to P_H 6.8 by potassium hydrogen phosphate. In every case, the appearance of fat within the cells is noticed within twenty-four hours. Similar observations are recorded with maltose. The process of fat formation probably occurs in two phases, in the first of which the sugar is converted by zymase through pyruvic acid into acetaldehyde, probably in accordance with Neuberg's scheme of alcoholic fermentation; the hypothesis receives support from the observation that carbon dioxide is freely evolved, whereas the presence of ethyl alcohol cannot be detected. In the second phase, the synthesising enzymes, probably of the carboligase type, cause the formation of fat from the acetaldehyde.

The formation of acetaldehyde as intermediate product has been demonstrated by the aid of the sulphite process; in experiments in which the acetaldehyde is thus fixed, the production of fat is very small. The yields of acetaldehyde correspond approximately with those obtained by Neuberg in experiments with moulds.

For the estimation of fat, the mould is dried at 100° and cautiously heated in an iron crucible with water and solid potassium hydroxide. The molten mass is cooled, dissolved in water, and acidified

with sulphuric acid. The free fatty acids are extracted with light petroleum, dissolved in alcohol, and titrated with alcoholic potassium hydroxide solution; the results are expressed as triolein. H. W.

The Genesis of Peroxydase in Plants. Conditions determining Fission of Peroxydase from the Protoplasts and Liberation in the Cell-juice. W. PALLADIN and (FRL.) S. MANSKAJA (*Biochem. Z.*, 1923, 135, 142—157).—Using the colour reaction given by peroxydase with guaiacum-resin or guaiacol and hydrogen peroxide, peroxydase is found in the cell-sap, but also found in the protoplasts. During autolysis, the peroxydase is split off from the protoplasts, and especially so in the presence of salts. The results are interpreted in terms of Ehrlich's side-chain theory, the postulated existence of pro-ferments being unnecessary. Peroxydase is also found in the woody fibre of the beech. H. K.

The Constituents of Green Plants. XXIII. Malic Acid in Plants. HARTWIG FRANZEN and ERNST KEYSSNER (*Biochem. Z.*, 1923, 135, 183—216).—A critical review of the whole of the available literature on the occurrence of malic acid in plants leads to the conclusion that, contrary to general opinion, the wide distribution of malic acid is untenable. The proof of the identity of this acid is insufficient in numerous cases. H. K.

Identity of the Sugar Extracted from the Manna of the Carob Tree with Pinitol or Methyl-*d*-inositol. C. CHARAUX (*Bull. Soc. Chim. biol.*, 1922, 4, 597—600).—An exudation found on the trunk of the carob tree (*Ceratonia siliqua*, L.) yielded 84% of pinitol when extracted with alcohol. E. S.

The Prolamine of *Coix lacryma*, L. GISABURO HATTORI and SHIGERU KOMATSU (*J. Biochem. [Japan]*, 1922, 1, 365—369).—Kernels of *Coix lacryma*, L., gave: Water 12.33, ash 7.06, protein nitrogen 2.92, crude protein 18.68, crude starch 50.66, soluble non-nitrogenous matter 4.93, crude fat 4.69, and crude fibre 7.42%. Coicine was prepared by extracting the meal with 80% alcohol at 78° and after further purification formed a yellowish-brown powder containing 0.6% of ash. The distribution of nitrogen in the pure prolamine was determined by the method of Osborne and Harris (*J. Amer. Chem. Soc.*, 1903, 22, 323) as follows: Humin nitrogen 0.1%, ammonia nitrogen 3.32%, basic nitrogen 0.94%, non-basic nitrogen 0.23%, monoamino-nitrogen 5.50%, imino-nitrogen 6.95%, total nitrogen 16.84. Determinations of the amino-acids gave glutamic acid 20.65%, leucine 4.10%, tyrosine 1.46%, arginine 0.20%, histidine 1.88%, and lysine 0.76%. K. K.

The Influence of Hexamethylenetetramine and Formaldehyde on the Internal Morphology and the Chemistry of the Haricot Bean. E. NICOLAS and G. NICOLAS (*Compt. rend.*, 1923, 176, 404—407).—Both hexamethylenetetramine and formaldehyde in small doses are nutrients for the haricot bean. They cause, not only an increase in the weight of the plant (cf. this vol., i, 77) and a great development of leaf surface, but they are used, in addition,

for the differentiation and even lignification of the wood and of the pericycle, as well as for the formation of starch. W. G.

The Changed Content of Urea in the Ripening of the Fruit of *Lycoperdon*. NICOLAUS N. IVANOV (*Biochem. Z.*, 1923, 135, 1—20).—During ripening of *Lycoperdon gemmatum* (Puff-ball) there is a disappearance of carbohydrate (trehalose) and accumulation of nitrogen from 7.1 to 8.7%. The urea content increases during ripening, but disappears from the spores. The urea appears to be in the combined state, as it is not extracted by alcohol in an extractor, but is so by hot water. The urea probably functions as a reserve substance for the synthesis of arginine and purine bases, and for the production of ammonia used in building up tissue. H. K.

Microchemical Researches on Coumarin. ALBERT NAVEZ (*Bull. Acad. roy. Belg.*, 1922, [v], 8, 159—173).—From the fact that tannins can be localised by microchemical methods in *Melilotus albus* and *M. altissimus* in the same regions as the glucoside discovered by Bourquelot and Hérissé (A., 1920, i, 586), it is considered likely that the glucoside (coumarigenin), which is derived from dextrose and coumarin hydrocoumarate, is combined, in the plant, with a second glucoside, melilotannic acid, derived from melilotic acid and tannin. E. E. T.

Quantitative Composition of Coniferous Wood. ASTRID CLEVE VON EULER (*Cellulosechem.*, 1923, 4, 1—11).—The mineral constituents, the protein, and the fat-resin components are regarded as not belonging to the true wood substance, and the analytical results are calculated, with the exclusion of these, in terms of carbohydrates and lignin. To the lignin belongs the so-called "alcohol resin," which is regarded as a lignin derivative soluble in alcohol. This is estimated, after removal of the fat and oleo-resin by extraction for six hours in benzene, by a further extraction with 96% alcohol for twenty-four hours. It is extracted very slowly, and the dried alcoholic extract is not completely soluble in alcohol. In the estimation of the lignin by hydrolysis of the carbohydrates with 72% sulphuric acid, the result is always higher than when 40% hydrochloric acid is used, owing to the combination of sulphuric acid groups with the lignin. A correction of 5.7 units should be deducted from the lignin value found by the sulphuric acid method. By both methods, the acetyl group is eliminated from the lignin as the result of hydrolysis, and this is compensated by adding 2.0 units to the percentage of lignin found. All results are then calculated in terms of the pure wood substance, the "alcohol resin" being added to the insoluble lignin under the designation of lignin soluble in alcohol. The lignin value of the wood is not a specific constant, but varies within limits according to the origin of the sample. Recalculated on the above principle, the analysis published by Klason in 1921 becomes: Cellulose, 54.10; hemicelluloses comprising hexosans, 3.06, and pentosans 12.25; total carbohydrates, 69.40%; lignin, including the acetyl group, 30.60%. J. F. B.