consequently the consistency of the cell too great, their motility is diminished. If it is used in too weak a concentration, the spreading out and solution processes are not sufficiently delayed. In an intermediate concentration of the acid, the consistency is such that the migration of the cells out of the piece is readily possible and at the same time the cells are preserved and the stereotropic reaction is retarded. But ultimately the cells begin to spread out and now retrogressive changes set in even in these favorable media. However, it may be possible to keep the cells active for six days or longer even at room temperature, at which under ordinary conditions the cells spread out and become hyaline on the first or second day.

In this case we recognize thus as the principal cause of cell death an extreme degree of reactivity of the cells in contact with solid surfaces. There is good reason for assuming that this reaction leads to an increased permeability of the surface of the cell which reaches a degree which is injurious and is thus responsible for the subsequent degenerative processes.

Conditions which prevent this extreme stereotropic reaction tend therefore to prolong the life of the cells. Acid acts in this way apparently by increasing the consistency of the cells, at least of its outer layer.

As we have shown elsewhere [4] there exists a striking analogy between the behavior of the amoebocytes and ordinary tissue cells. Through agglutination the amoebocytes produce sheets of a tissue-like material. After an incision in such a tissue cells migrate from the cut edge into the defect, in a way similar to tissue cells adjoining a wound. In both cases two factors determine the direction of migration: (a) The stereotropic reaction, (b) a tendency towards centrifugal movement.

During the process of movement the amoebocytes spread out and thus produce structures totally unlike the original amoebocytes, but closely resembling various tissues. A similar change from agglutinated round cells to cells spreading out in contact with a solid or viscous substratum underlies the embryonic tissue formation. Under the influence of mechanical factors a system of fibrillation can be produced in this experimental amoebocyte tissue which indicates the direction in which the mechanical factors act. In an analogous way we know that certain mechanical effects determine the fibrillation in certain higher tissues. In both cases the tissue formation leads to the production of an elastic tension under which the tissues are held, which latter retract after an incision had been made. The processes of tissue formation had led to the production of potential energy stored in the tissues.

The transformations which we observe in the amoebocytes in the case of tissue formation are, as far as our evidence shows at present, due mainly to two factors: (a) changes in consistency primarily in the outer layer of the cells; this depends in all probability upon a taking up of fluid from the surrounding medium and a different distribution of fluid within the cell, and (b) an increased permeability of the outer layer of the cell. These changes may lead to degenerative processes in the cell.

In some respects the differentiation and specialization of tissue cells in higher organisms has likewise the aspect of retrogressive changes; it may diminish the power of resistance of these differentiating cells. This suggests very strongly that changes of a similar character, although perhaps quantitatively weaker, may take place in the higher tissue cells during the process of tissue formation.

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THE AMERICAN CHEMICAL SOCIETY

(Continued)

DIVISION OF CHEMISTRY OF MEDICINAL PRODUCTS
CHARLES E. CASPARI, chairman.
EDGAR B. CARTER, secretary.

Arsphenamine and neoarsphenamine: GEORGE W. RAIZISS, JOSEPH GAVRON AND M. FALKOV. Arsphenamine and neoarsphenamine are indispensable in the treatment of spirochaetic infections. The elimination of the alarming symptoms or "reactions" attendant upon the use of these drugs is a problem of increasing importance. These have been attributed to chemical impurities which the authors have tried to identify. Incidentally, samples, of unusually high chemotherapeutic indices have been obtained. Methyl alco-

hol and crystallization have been found in two of the American made products. Experiments show that this does not exert any untoward effect upon the drug. A study of the colloidal properties and the relationship to toxicity has also been undertaken in order to explain the above "reactions."

Hydrogen peroxide, its manufacture and preservation: PAUL POETSCHKE. The quality of the chemicals needed and the equipment required for manufacturing the product and a detailed account of the various stages of the process are given. Briefly, the process consists in hydrating barium peroxide with distilled water and adding this mixture to a dilute solution of phosphoric acid which forms barium phosphate and hydrogen peroxide. Sulphuric acid is then added which regenerates the phosphoric acid converting the barium phosphate into barium sulphate and phosphoric acid. In this way the phosphoric acid is used over and over again. The insoluble barium sulphate and phosphate is then removed by filtration and the filtered hydrogen peroxide purified and adjusted to the proper strength. Experiments with quinine sulphate show that this substance has many advantages over acetanilid as a preservative, particularly in that only 1/10th the amount is required and it does not cause any foreign odor or discoloration. A mixture of benzoic acid and salicylic acid is also effective. Storage in glass bottles of suitable quality, and exclusion of light, are far more effective in restraining decomposition than any of the preservatives studied.

Developments in mercurial antiseptics: EDWIN C. WHITE AND JUSTINA H. HILL.

The preparation of certain arsenic-free reagents: G. D. BEAL AND K. E. SPARKS.

The preparation of pure fatty acids: G. D. BEAL AND J. B. BROWN.

The preparation of cholesterol esters of fatty acids: G. D. BEAL AND J. B. BROWN.

The determination of aldehydes in essential oils: FRANCIS D. DODGE. The use of bisulfite solutions in the technical determination of aldehydes is sometimes inconvenient, owing to the relative insolubility of the bisulfite compounds. The writer has found the solution of lithium bisulfite quite useful in such cases, the lithium compounds being in general more soluble than the sodium or potassium derivatives. A serious error arises, however, when unsaturated alcohols such as geraniol, linallol, or terpineol are present. The latter react slowly with bisulfite, yielding soluble sulfonic compounds and the aldehyde determination becomes quite inaccurate. Details are also given of experimental work with some other aldehyde reagents.

Crystalline ethyldihydrocupreine (optochin) base: MICHAEL HEIDELBERGER AND WALTER A. JACOBS. Hitherto only crystalline salts of ethyldihydrocupreine (optochin) have been reported. Having found that dihydroquinine could be advantageously recrystallized from toluene, we dissolved ethyldihydrocupreine in this solvent and allowed the solution to evaporate spontaneously, crystals forming after several days. On seeding a concentrated solution and letting stand the base separated as irregular leaflets containing toluene of crystallization, a portion of which was retained on air-drying, but could be removed by heating *in vacuo*. The base so obtained has approximately the properties of the purest commercial samples of the substance.

Crystalline ethyldihydrocupreine (optochin) base: MICHAEL HEIDELBERGER AND WALTER A. JACOBS.

The purification of tuberculin and the preparation of ophthalmic tuberculin discs: M. DORSET AND J. A. EMERY.

Food as a medicine: HARVEY A. WILEY.

The need for an improved formula for infusion of digitalis, U. S. P.: A. RICHARD BLISS, JR. In response to the complaints of clinicians concerning the unreliability, lack of uniformity, etc., of the Infusion of Digitalis of the U. S. Pharmacopoeia, a pharmacodynamic study of twenty samples of the Infusion was made. Fifteen of the samples were collected at random from retail drug stores, and five of the samples were prepared in the laboratory according to the unofficial method advocated by Hatcher and Eggleston. The method of pharmacodynamic assay employed was that known as the Hatcher and Brody Cat Method, a total of seventy-four estimations being made by this method. Ten of the drug store samples, prepared by the method of the U. S. P. IX, showed an average activity of but 38.1 per cent. of the theoretical activity; five of the drug store samples, prepared by diluting the fluid extract, showed an average activity of but 62.6 per cent. of the theoretical activity; and the five samples, prepared according to the method of Hatcher and Eggleston, showed an average activity of 95 per cent. of the theoretic activity. The dropping of the infusion as prepared by the present U. S. P. method, or the substitution of an improved formula, such as that

of Hatcher and Eggleston, is recommended by the author.

The toxicity of Benzyl alcohol and its homologues: OLIVER KAMM. The acute toxicities towards paramecia of homologues of benzyl alcohol agree well with the values predicted on the basis of experimental results obtained with aliphatic alcohols. Given the experimental value for one straight-chain aliphatic alcohol, the toxicities of the remaining members may be calculated by means of the "rule of thirds." The common branched-chain members also fit into the prediction scheme, two methyl groups in the form of side-chains being equivalent to one additional carbon atom in a straight-chain. To predict toxicities in the benzyl series it is simply necessary to apply in addition the previous presented "molecular volume relationship." Illustrative examples are presented.

Pharmacological examination of isopropyl alcohol: DAVID I. MACHT. Acute toxicity of isopropyl alcohol on intravenous injection in cats is greater than that of isopropyl alcohol; but is somewhat less than that of the normal propyl alcohol. The toxicity by mouth gives figures which run parallel to those for intravenous injection. Administration of small doses of isopropyl alcohol (2 cc per kilo) through stomach tube to dogs produced no marked permanent deleterious effects even when continued repeatedly over a number of days. Rats exposed to the fumes of isopropyl alcohol for a series of days showed no signs of poisoning. A large number of experiments performed for the purpose of ascertaining whether isopropyl alcohol would produce toxic symptoms after repeated applications to the skin yielded negative results. In common with other alcohols of the fatty acid series both normal and isopropyl alcohols are toxic for the isolated heart and excised muscle tissues. The effect on circulation is not much depressant in the *intact* animal when the drug is administered in smaller doses. Death after lethal doses is due in most cases to paralysis of the respiratory center but smaller doses produce no dangerous depression of the respiration.

SECTION OF SUGAR CHEMISTRY

C. A. BROWNE, chairman.

FREDERICK BATES, secretary.

Modified sulfate methods for ash in sugar and molasses: E. H. ADKINS AND J. R. WITHROW.

Some studies on decolorizing chars: C. E. COATES. A study was made of the possibility of making a decolorizing char for use in the cane industry from cane bagasse. The material was charred boiled with caustic soda and washed with hydrochloric acid and heated to 850 degrees. An excellent carbon was obtained by this method. Certain observations are given concerning methods for color comparisons with various types of tintometers and colorimeters.

The comparison of various carbons upon the American market: CHR. E. G. PORST AND JOHN M. KRNO. The decolorizing value of various carbons on the market was determined. By the use of steam activation and leaching and other means, carbons were produced from lignite, sawdust, spent boneblack and other materials. These were equal, and in some cases superior, as regards their decolorizing value, to those on the market. A method of grading the carbon was suggested.

Absorption isotherms of some decolorizing carbons: F. W. ZERBAN AND S. BYALL. Isotherms have been determined for the decolorization by six different decolorizing carbons of molasses solutions of varying concentration, and it has been found that, while for one carbon and one concentration the logarithmic curves closely approximate straight lines, there is a marked difference in the constants of the adsorption formula for one carbon at varying initial concentrations of molasses solution, and for the same initial concentration, using different carbons.

Mechanical clarification of cane sugar liquors: A. S. ELSENBAST. Cane sugar liquors are clarified and filtered without the use of chemical defecants by means of the specially prepared filtering medium, Filter-Cel. Details are given for operating with plantation white sugar, plantation white sugar by lime sulphur process, cane and sorghum syrups, raw sugar and standard granulated white sugar in cane sugar refineries.

Decolorizing carbons: H. H. PETERS AND F. P. PHELPS. Twenty different carbons have been used, under identical conditions, for the decolorization of one quality raw sugar, and some of them on the affined sugar and the raw wash resulting from the affination process. The effect is shown on the basis of spectrophotometric analysis which establishes new standards for a correct judgment, far more rigorous than at present accepted by technical colorimetric methods. The names of the carbons are withheld at this time. Not only does the quality of some carbons vary, but new equipment had to be ordered for a systematic and complete inquiry into the nature of the coloring bodies.

Comparison of the various corn product starches: CHR. E. G. PORST AND M. MOSKOWITZ. The Bingham-Green Plastometer is adapted to the examination of various corn starch pastes, alkali, acid and thin boiling (Herschel and Bergquist, Journal of Ind. & Eng. Chem., Vol 13, 703). A short review of the derivation of the formulas required is given. Type curves and tabulated data on the various starches investigated are included. The effect of the temperature of cooking on the properties of the pastes is noted and the need of more accurate formulas suggested.

An inquiry into fundamentals of sugar colorimetry: H. H. PETERS AND F. P. PHELPS. The spectrophotometric investigation of impure sugar products is continued, and the asbestos method of colorimetric clarification and filtration, which was reported in a previous paper, is further critically examined. Beer's Law is valid for concentrated impure sugar liquors (50 Brix), but dilution with water changes the degree of dispersion and colorimetric value of the colloidal nonsugars, invalidating Beer's Law. A new method, using concentrated granulated syrup of known spectral transmissivity for the dilution of heavily colored, concentrated syrups in place of water is presented.

The testing of quartz control plates: F. P. PHELPS. Quartz control plates are used in precise sugar work to eliminate all errors due to variations in the polariscope itself. All quartz plates sent to the Bureau of Standards are subjected to the following tests: (1) Examination of the mounting. (2) Homogeneity of the quartz. (3) Planeness of the faces. (4) Parallelism of the faces. (5) "Axis Error." (6) The precise measurement of the rotation from which the sugar value is calculated. A tentative set of specifications for quartz control plates has been drawn up as an aid in the production of plates of uniformly good quality. It is very important that all quartz control plates be standardized at some central agency such as the Bureau of Standards. The maker's value, which is stamped upon the mounting, can not be relied upon, in fact, plates have been tested at this bureau whose true sugar value differed from the maker's value by approximate 0.°2 of a sugar degree.

The origin and development of the cane sugar industry in America: C. A. BROWNE. The history of plantation cane sugar manufacture in America is briefly sketched with help of lantern slides and old engravings from 1493 down to the present day. The evolution of the mill, evaporator and other machinery is traced with descriptions of such curiosities as Stuart's steam mill and Bessemer's crusher. The methods of white sugar manufacture in Cuba by means of bone black between 1850 and 1860 are described. In conclusion the origin and development of the modern central system are discussed with particular reference to the future growth of the industry.

Enzyme method for determination of raffinose in beet sugar-house products: H. S. PAINE AND F. W. REYNOLDS. The method of Hudson and Harding, which depends on the hydrolysis of raffinose by invertase with formation of melibiose and fructose, and subsequent hydrolysis of melibiose by means of the enzyme melibiase, was adapted for the examination of beet molasses and other sugar-house products. The molasses solution is clarified with basic lead acetate and a small amount of norit, and, after suitable adjustment of the acidity, top yeast extract, containing the enzyme invertase, and bottom yeast extract, containing the enzymes invertase and melibiase, are added to equal portions of the clarified molasses. The difference in the polarizations is a measure of the amount of raffinose present. The success of the method depends upon the use of highly purified and concentrated enzyme preparations.

Rôle of fermentation in the deterioration of cane sugar products: C. A. BROWNE, C. A. GAMBLE, G. H. HARDIN AND M. H. WILEY. The average quality of the raw cane sugar manufactured in the tropics has shown but little improvement during the past five years. Only about 35 per cent. of the Cuban factories make good-keeping sugar of low moisture content. Sugars during deterioration become more hygroscopic, owing to the invert sugar that is formed, and the additional moisture absorbed from the atmosphere accelerates the activity of the destructive microorganisms. The chief requirements for making a good-keeping sugar are: (1) Cleanliness in the factory to prevent infection; (2) A moisture content sufficiently low to retard the growth of yeasts, moulds and bacteria; (3) Bagging the sugar after it has cooled to prevent sweating; (4) Storage in clean, dry warehouses in piles that are not high enough to burst the bags. The deterioration of soft refined sugars is less rapid than that of raw cane sugars of the same polarization. Sugar cane molasses also undergoes deterioration during storage with destruction of both sucrose and invert sugar.

The manufacture of chemically pure dextrose: C. E. G. PORST AND N. V. S. MUMFORD. The development of a method of manufacturing chemically pure dextrose using crystallization from water only is described. The first method used necessitated an alcohol wash and a crystallization from alcohol. This method had to be abandoned owing to excessive cost and another method developed. This method used "Cerelose" as a raw material and "Eponite" as a decolorizing agent. This method had to be abandoned to allow an increase in capacity. Boneblack is now used for decolorizing and the raw material is "Refined Cerelose" made by the Porst and Newkirk method. Difficulties encountered and methods of overcoming them are described.

The purification and concentration of enzyme solutions for the rapid analysis of sugars by enzymotic hydrolysis: F. W. REYNOLDS. Preparations of the enzymes invertase and melibiase were purified by dialysis followed by treatment with a very small proportion of acetic acid, which caused flocculation of impurities. Substances which stabilize the impurities flocculated by acetic acid are apparently removed by dialysis. This treatment is fully as efficient as clarification with neutral lead acetate and does not cause loss of enzymic activity. The filtrate may then be concentrated to practically any desired extent by ultra-filtration, using collodion filters of special composition. Highly active and brilliantly clear solutions of invertase and melibiase of great stability were thus obtained. This method of purification and concentration permits the use of these enzymes as analytical reagents, for rapid analysis of sucrose and raffinose. The construction of a suitable ultra-filter from materials generally available is described.

The estimation of raffinose and sucrose in beet products: R. F. JACKSON. A modification of the enzyme method permits an accurate determination of true raffinose without the difficulty of measuring small changes in polarization in the presence of large amounts of invert sugar. After sterilization of the molasses, the greater part of the invert sugar is removed by fermentation with bakers' yeast. The solution containing the melibiose is filtered, evaporated and divided into two aliquots, which are diluted one tenth, one with water, the other with the invertase-melibiase solution extracted from brewers' yeast. After hydrolysis, both are analyzed for reducing sugar. The difference between them is a measure of raffinose. The method is not standardized against pure raffinose. By the above method analyses were made of samples of Colorado beet molasses. True raffinose was found to be sometimes less and sometimes greater than that indicated by Clerget. From the true raffinose and true sucrose, the direct polarization of the sugars was computed. The difference between the calculated and observed direct polarizations give the rotation of the non-sugars. In every case these proved to be negatively rotating.

A simple diffusion battery for laboratory and lecture room experiments: M. J. PROFFITT. Each cell of the battery consists of a friction top tin can to the inner walls of which near the bottom is soldered a circular woven wire screen molded to a concave shape. A suitably bent copper tube is soldered with a perforation in the side of the can below the screen, and it extends on the outside above the top of the can, to connect with the juice line. It may be provided with a steam jacket for a colorisator. Two short copper tubes are soldered into perforations in the lid of the can, one for an air-vent and the other for connecting to the water-line. The juice, water and cross-over lines consist of glass T-tubes with rubber connections and pinch-cocks. A 14-cell battery without colorisators requires 14 friction top cans, enough wire screen to make the screens, depending upon the size of the cans used, about 60 pinch-cocks, 60 glass T-tubes, 20 feet of copper tubing, some solder, and 50 feet of thin-walled rubber tubing. At current prices, it will cost about $30 and require one day's time to set up. It serves for experiments on water extractions and for familiarizing students with the actual operation of the diffusion process as carried out in the manufacture of beet sugar.

Precipitation of gum from beet molasses: H. S. PAINE AND C. F. WALTON, JR. In order to permit a study of the properties of the gums present in beet molasses, and the effect of such gums on the analytical control and certain phases of the factory process, the following method of preparation was evolved. It is considered more rapid than the dialysis method previously described. Each kilogram of molasses is diluted with 10 liters of water, and to this solution are added 1.4 liters of ammoniacal lead acetate and 0.4 liter of strong ammonium hydroxide. After filtration of the precipitate, it is suspended in water and decomposed with 1:4 H_2SO_4 in carefully regulated amount. The filtrate is neutralized with solid barium hydroxide in the cold, concentrated in vacuo and dialyzed against running tap water.

This solution is clarified with neutral lead acetate, and after removing excess lead with H_2S the dialysis is completed against distilled water. The specific rotation of the gum obtained, on the basis of total solids in the purified solution, was $-38.°8$.

Chemical properties of the gum from cane affected by Cobb's gumming disease and its influence in the sugar-house: C. F. WALTON, JR., AND O. S. KEENER. Observations were made in Porto Rico of the effect of a gum similar to that from Cobb's gumming disease on factory operations. A somewhat concentrated solution of the gum purified by filtration and dialysis was found to polarize $-0.°6$ V. in a 2-decimeter tube. After hydrolysis with 1 per cent. hydrochloric acid this rotation changed to $+0.°1$ V. The solution after hydrolysis reduced Fehling's solution strongly but gave no test for pentose. Total solids by the Westphal balance corresponded closely to the amount found present by drying. Although the substance was found to be optically active, it was completely precipitated by basic lead acetate as in the usual method of analysis. On the basis of these and other experiments, it is believed that the presence of this gum in cane juice does not interfere with the laboratory analyses.

The dietetic value of sugar: W. D. HORNE. The extremely high food value of sugar is not adequately realized. As a producer of heat and energy in the body it is cheaper than almost any other food. With its high calorific efficiency, quick digestibility and present low price, it should logically be used in much larger quantities in old world countries where food and money are scarce. Europe averaged 37 pounds per capita per annum before the war. The United States now averages 86, and New Zealand in 1911 averaged 130. The United States could increase her consumption 20 to 30 per cent. advantageously and Europe much more.

Organic and inorganic composition of corn: C. E. G. PORST AND MISS J. F. MOHRING.

Some new processes in the sorghum syrup industry: J. J. WILLAMAN. The sorghum syrup industry is being given a new impetus by certain developments in its process of manufacture in a Minnesota factory. The principal ones are: (1) A cleaning machine, which does away with hand labor entirely in the harvesting and cleaning of the cane. (2) Instead of the wasteful settling process of clarification, the whole juice, after defecation with heat and lime, is filtered, infusorial earth being an ideal filtering medium. (3) Treatment of the filtered juice with activated charcoal produces a light colored, mildly flavored product. (4) Evaporation in a vacuum. (5) The seed heads are dried and constitute a valuable by-product. (6) The leaves and bagasse are continuously fed into the fire-boxes, and constitute 85 per cent. of the fuel. (7) The cleaner has reduced the labor hour cost per gallon of syrup from 1.3 hours to 0.7 hour. (8) The cheapening of the processes, the improvement of chemical control, and the breeding of pedigreed and improved cane, have inaugurated a new era in sorghum syrup manufacture.

Note on the first uses of the polariscope in the United States for sugar testing: C. A. BROWNE. A search of available records indicates that one of Biot's early polariscopes was used in the sugar refinery of J. S. Lovering & Co. in Philadelphia as early in 1843. Two Ventzke polariscopes were imported about the same time, one by the chemical firm of Booth & Boye of Philadelphia, and one by Professor R. S. McCulloh, of Jefferson College, for his research upon sugar and hydrometers for the U. S. government. Information is lacking as to the date of the importation of the first Soleil saccharimeter. An old Soleil instrument used by Valcour Aime of Louisiana and now in the Louisiana State Museum is probably of about the date 1850.

Preparation of fructose from invert sugar: T. SWANN HARDING. Fructose was prepared by fractional crystallization from invert sugar obtained by the hydrolysis of sucrose by invertase. It was found necessary to recover by the first crystallization 36 to 37½ per cent. of the weight of sucrose taken as glucose. The yield of fructose subsequently crystallized amounted to 23.5 to 28 per cent. of the weight of sucrose taken. The sirups were mixed with glacial acetic acid before setting aside to crystallize. The fructose was recrystallized from alcohol. The effect is discussed of various factors, such as acidity and temperature, on the crystallization of fructose.

Analyses of mixtures of reducing sugars and sucrose with Quisumbing's Fehling solution method. A. W. THOMAS. Analyses of known sugar mixtures containing sucrose give more nearly correct results when using the new Fehling reduction method than has been possible by any of the older reduction methods.

CHARLES L. PARSONS,
Secretary