

*American Society of Animal Production* illustrates this point:

PERCENTAGE COMPOSITION OF RATION	
Feed	Range in Per Cent.
Corn .....	85.21 — 90.65
Shorts .....	1.53 — 4.11
Tankage .....	6.22 — 12.10

The method of individual feeding which Ashby and Malcomson used seems to be the only method available for the study of some of the problems of animal production and one to which more attention must be given, but there are many factors operative rendering such a method difficult.

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## THE AMERICAN CHEMICAL SOCIETY

(Continued)

DIVISION OF RUBBER CHEMISTRY

W. W. Evans, *chairman*.

Arnold H. Smith, *secretary*.

The day was devoted entirely to a discussion of the tentative procedure for the analysis of rubber goods.

Reports from the executive committee, abstract committee, accelerator committee, and physical testing committee were read.

*Thermal conductivity of some rubber compounds:* A. A. SOMERVILLE. Rubber mixes have been made containing different amounts of sulphur, with and without accelerators, with equivalent volumes of various fillers, and given a range of cures. The thermal conductivities of these samples have been compared and the results of the test indicate a wide variation in thermal conductivities due to different fillers being used.

*Contribution to the knowledge of the resins of Hevea rubber:* G. STAFFORD WHITBY and J. DOLID. A number of crystalline substances have been isolated from the acetone extract of plantation Hevea rubber. At least two of these are sterols. The less soluble of the two constitutes roughly 5 per cent. of the extract, it decomposes without melting, and forms an optically active acetate crystallizing in leaflets and melting at 169°. With this sterol another substance, not yet isolated in a state of purity, was associated. The soluble sterol consisted of matted, flexible leaflets, melting at 127°. A substance, optically inactive, melting at

62°, constituting roughly 5 per cent. of the extract, was obtained. Quebrachitol was isolated from the extract, and was found to occur generally in sheet and crepe. The results of a quantitative study of the oxidation of caoutchouc under the catalytic influence of copper are reported.

*The solubility of gases in rubber as affecting their permeability:* CHARLES S. VENABLE and TYLER FUWA. It was found that when rubber absorbs gas, the gas is held in true solution and not by absorption. In the case of carbon dioxide, which has about an average solubility, the amount of gas thus held in true solution by the rubber is directly proportional to the pressure and decreases with increasing temperature. This solubility is unaffected by degree of vulcanization or by the presence of compounding ingredients. Other gases seem to behave in a similar manner. Relative solubility values obtained for various gases in rubber show that there is a general relationship between the solubility and density of the gas and its rate of penetration through rubber. These results, in general, confirm the original hypothesis of Graham that the penetration mechanism consists in the solution of the gas at one surface of the rubber and the diffusion of the undissolved gas through the rubber and its evaporation at the other surface. The indications are, however, that the actual size of the gas molecule is also an appreciable factor. A striking relationship between the solubility of various gases in rubber and in water has been noted.

*Reactions of accelerators during vulcanization.* III. *Carbo-sulphydryl accelerators and the action of zinc oxide:* C. W. BEDFORD and L. B. SEBRELL. Reactions of accelerators producing mercapto groups by action of sulfur are discussed. Thio carbanilide with aniline in benzol solution will dissolve zinc oxide and will vulcanize a zinc oxide cement at room temperature. Other zinc salts of mercaptans such as zinc thiophenol and zinc-ethyl-xanthate will vulcanize pure gum cements containing sulfur at room temperature. These accelerators are free from nitrogen or alkali and also function in press or steam cures. Without zinc oxide no accelerator has been found which will vulcanize at room temperature. Zinc salts of carbo-sulphydryl accelerators furnish the key to the paper.

*The influence of piperidine-piperidyl-dithiocarbamate on vulcanization:* G. STAFFORD WHITBY and O. J. WALKER. Tested in a 90 : 10 rubber-sulfur mix, 1 per cent. of the base mentioned is

found to reduce the time of cure by seven eighths, and even at 130° to lead to curing in about one third of the time required at 141° in its absence. At the optimum cure rubber containing the base showed (a) a noticeably lower sulfur coefficient, (b) a very considerably higher breaking stress, (c) a noticeably smaller elongation, and (d) a lower position of the stress-strain curve (strains as ordinates) than did rubber from which the base was absent. On aging for 7 months, vulcanizates prepared with the base behaved in a manner essentially similar to that shown by vulcanizates prepared without it; the stress-strain curves coming down the paper to a similar extent and the breaking points altering in a similar way.

*A rapid bomb method for the determination of sulfur in rubber compounds:* W. W. EVANS and RUTH E. MERLING.

*The direct determination of the sulfur of vulcanization:* S. COLLIER and MICHAEL LEVIN. The sulphur actually combined with the rubber is determined by dissolving the rubber and polyprene sulphide in cymene. The solution is diluted with petroleum ether and filtered after the fillers have settled out. The filtrate containing the polyprene sulphide is evaporated to dryness by heating on the steam bath and by means of a gentle current of air. The residue is dissolved in nitric acid and the solution evaporated to dryness. Three c.c. of nitric acid are added to the residue and then 5 grams of sodium carbonate. The mixture is fused and the amount of sulphur determined.

*Volume increase of compounded rubber under strain.* (Lantern.) (With comments on the work of H. F. Schippel.): HENRY GREEN.

A general round table discussion followed on the topics of factory control of vulcanization, testing of crude rubber as received at the factory, reactions between sulfur and various softeners, and others.

#### DIVISION OF BIOLOGICAL CHEMISTRY

A. W. DOX, *chairman*.

H. B. LEWIS, *secretary*.

*A study of the highly unsaturated fatty acids occurring in fish oils:* G. D. BEAL and J. B. BROWN. A proximate determination of the composition of five commercial fish oils was made by converting a kilo of each of the oils into its methyl esters by a modified Haller methanolysis, distilling these into ten-degree fractions under

reduced pressure and analyzing these fractions. Evidence for the presence of myristic, palmitic and clupanodonic acids was given, and also for acids more highly unsaturated and of greater molecular weight than clupanodonic acid. When the refractive indices of the fractions were plotted against the corresponding iodine numbers and mean molecular weights of the acids, curves which were nearly straight lines were produced. The analytical data showed a decided similarity for the oils examined, which included salmon, menhaden, herring, cod and sardine oils. The pure highly unsaturated acids were prepared in more than 50 per cent. yield by reduction of their methyl ester polybromides in methyl alcohol with zinc dust. The mean molecular weight of these acids by titration was over three hundred, a value much too high for clupanodonic acid. Distillation of the methyl esters of these acids and analysis of the fractions gave good evidence for the presence of the following acids—hexadecatrenoic,  $C_{16}H_{30}O_2$ , clupanodonic,  $C_{18}H_{32}O_2$ , arachidonic,  $C_{20}H_{34}O_2$ , eicosapentenoic,  $C_{20}H_{30}O_2$ , docosapentenoic,  $C_{22}H_{34}O_2$ , and docosahexenoic,  $C_{22}H_{32}O_2$ .

*Further studies on the mosaic disease of spinach:* S. L. JODIDI. Mosaic disease affects many crops of vast economic importance such as the Irish potato, tobacco, corn, sugar beet, sugar cane, spinach, cabbage, lettuce, tomato, cucumber, and others. It seemed quite desirable to study the mosaic disease of at least one crop—in this case spinach—from various angles and by various methods. The results of the investigation have led to the following conclusions: (1) The physical and chemical properties of the soil taken from under diseased spinach plants were found to approach very closely those of the soil taken from under healthy plants. (2) The differences in the biological behavior of the two soils under consideration, as shown by their ability to ammonify various organic nitrogenous compounds, were so small as to be negligible. (3) The mosaic disease of spinach does not seem to be due to malnutrition, since in the experiments reported the diseased condition of the plants can not be ascribed to physical, chemical and biological conditions obtaining in the soil.

*Chemical, physical and insecticidal studies of arsenicals:* F. C. COOK and N. E. MCINDOO.

*Cysteine as a product of the intermediary metabolism of cystine:* H. B. LEWIS and LUCIE E. ROOT. After the administration either orally or subcutaneously of 1-phenyluraminocystine to rabbits,

a product was isolated from the urine which has been identified as the phenyluramino derivative of cysteine.

*Avian versus mammalian dietary requirements:* W. D. RICHARDSON.

*The influence of fasting and of vitamine B deprivation on the non-protein nitrogen of rat's blood:* H. A. MATTELL. The non-protein nitrogen of the blood of fasting rats is 30-40 per cent. higher than that of normal animals, the most marked increase being in urea. Creatinine and creatine are very slightly increased as are total solids. The blood of rats deprived of vitamine B shows practically no variation from the normal except that creatinine is at the fasting level and creatine is slightly higher than the fasting figure. In the present state of uncertainty with reference to the determination of blood creatine and creatinine these variations are of little significance but at least the total solids, the non-protein nitrogen and the urea fraction in the blood of rats on a diet deprived of vitamine B are normal and not increased as in the blood of fasting rats. The desirability of obtaining information on the gaseous metabolism as well as on creatine metabolism in animals deprived of vitamine B is suggested.

*The effect of temperature and the concentration of hydrogen ions upon the rate of destruction of the antiscorbutic vitamin:* H. C. SHERMAN, V. K. LAMER and H. L. CAMPBELL. The time curve of the destruction in filtered canned tomato juice follows neither the unimolecular nor the square root law of Schütz when the heat treatment is conducted at 60°, 80°, 100° C. for 1 to 4 hours. Empirically the destruction in these cases was found to be a function of the fourth root of the time. The temperature coefficient of the destruction of the vitamin was low:  $Q_{10}$  (60°-80°) = 1.23;  $Q_{10}$  (80°-100°) = 1.12. The low temperature coefficient and the colloidal nature of the material indicate that in tomato juice, at least, the reaction is of the heterogeneous type with diffusion playing an important rôle. Oxidation by oxygen can not be an important factor in these experiments. The velocity of the reaction at 1 hour at 100° C. progressively increases with decreased ( $H^+$ ). The omission of reacidification following such treatment produces an even greater destruction due no doubt to the continued action of the greater ( $OH^-$ ) even at low temperature.

*The quantitative measurement of the antiscorbutic vitamin:* H. C. SHERMAN, V. K. LAMER and

H. L. CAMPBELL. Guinea pigs are fed a basal diet consisting of oats 59 per cent.; skim milk powder heated 2 hours at 110° C., 30 per cent.; butter fat, 10 per cent.; NaCl, 1 per cent. In addition to the determination of the minimum protective dose of antiscorbutic the degrees of scurvy produced, as measured by the autopsy findings, retardation in growth, and symptoms in life, are determined for a series of animals receiving graduated sub-protective doses of antiscorbutic food. When the dosage is calculated per unit of body weight it is possible to distinguish the degrees of scurvy produced for addenda of antiscorbutics differing by 15 per cent. or less. The per cent. destruction due to a deleterious process is obtained by comparison of the degree of scurvy produced in a series of standard animals fed a similarly graduated series of doses of the treated product. The probable error of the mean in a series of 5 or more animals is less than 4 per cent.

*The action of nitrous acid on casein:* MAX S. DUNN and H. B. LEWIS. Deaminized casein has been prepared by the action of nitrous acid on casein. Analysis by the Van Slyke method for free amino nitrogen showed the absence of free amino nitrogen. Casein and deaminized casein were hydrolyzed and analyzed by Van Slyke's procedure for the determination of characteristic groups. In harmony with the current theories as to the nature of the free amino groups of the protein molecule, lysine was found to be absent in deaminized casein. No other notable differences were detected between casein and deaminized casein. Tyrosine was determined by the Folin-Denis colorimetric method. Deaminized casein was found to contain a lower percentage of tyrosine than casein.

*Lipase studies. The hydrolysis of the esters of some dicarboxylic acids by the lipase of the liver:* A. A. CHRISTMAN and H. B. LEWIS. On the basis of the acidity developed when the lipase of hog liver was allowed to act on the diethyl esters of succinic and malonic acids, it is considered that the reaction proceeded to an equilibrium which corresponded to the removal of one ethyl group from the diethyl esters. A substance was obtained from the products of the reaction between diethyl malonate and lipase which gave on analysis figures which were in good agreement with those required for monoethyl malonate. Lipase of hog liver was not able to hydrolyze monoethyl malonate or potassium ethyl malonate.

*Vitamines in milk:* (By title.) H. STEENBOOK, MARIANA T. SELL and E. M. NELSON. The writers have been able to substantiate Osborne and Mendel's findings that at least 15 c.c. of milk are required daily to cover a young rat's requirements for the water soluble vitamine. Generally speaking, milk can not then be considered a good source of either the water soluble vitamine or the antiscorbutic vitamine, as our previous investigations and those of others have already shown. This conclusion is emphasized by the fact that it has now been found that approximately 2 c.c. of milk are necessary to furnish a sufficiency of the fat soluble vitamine, which shows that milk fully equals in value, with one exception, our best known sources of this dietary constituent. This figure can not be taken as absolute, however, for even under practical farm conditions a many fold variation in fat soluble vitamine content easily obtains as the ration of the cow changes. Sudden variations in vitamine content are probably in large part prevented by drainage of the storage reservoirs of the animal. Liver tissue for one has been found to depreciate in fat soluble vitamine content on a fat soluble vitamine poor diet. Yet in the aggregate even this effect can not be very prolonged.

*Further experiments on the isolation of the antineuritic vitamine:* ATHERTON SEIDELL. In a previous paper (Public Health Reports, April 1, 1921) it was shown by control tests on pigeons that the precipitate obtained by addition of ammoniacal silver nitrate to a purified vitamine extract made from yeast "activated" fuller's earth is highly antineuritic. This vitamine silver complex is amorphous and its conversion to a crystalline condition has not been effected. Attention has, therefore, been directed towards the preparation of crystalline derivatives of the active constituent of the compound. Among those which have been obtained are the picrate, nitrate and what appears to be the free base. Of these, the picrate does not give a constant melting point and yields picric acid by ether extraction. The nitrate melts with decomposition at 146°. The base is very slightly soluble in strong alcohol but so soluble in water that a viscous pellicle is usually obtained on slow evaporation of the aqueous solution. The physiological testing of these products has not been completed.

*The occurrence in the animal organism of two types of lipases:* VICTOR E. LEVINE and FRANCIS J. McDONOUGH. Lipase was found in all the

organs of the pig that have thus far been examined. By the action of bile or bile salts (sodium glycocholate and sodium taurocholate), the lipolytic enzyme may be differentiated into two types:  $\alpha$ -lipase and  $\beta$ -lipase. The former is observed only in the pancreas or in its secretions. Its activity is accelerated by bile or bile salts and by heated blood serum. The latter is found in all the other tissues tested. Its activity is also accelerated by serum, but is markedly inhibited by bile or bile salts. The contrasting effect of bile salts therefore serves to distinguish the exo-lipase of the pancreas from the endo-lipase of all other organs. In the light of these experimental results Cohnheim's contention, that no difference exists between an exo-enzyme and its corresponding endo-enzyme, is untenable. In view of the similarity in the action of serum upon  $\alpha$ -lipase and upon  $\beta$ -lipase it is probable that the two types possess the same groupings or chemical nuclei in their molecular structure. The dissimilarity in the effect of bile salts may be the result of tautomeric modification, or may indicate a difference in stereoisomeric configuration or a variation in the side chains or substituents in the major groupings of the enzyme molecule.

*The distribution of lipolytic activity in the kidney:* VICTOR E. LEVINE and SALVER A. GIANELLI. Studies were made of the lipolytic activity of the kidney of the rabbit, dog, sheep, pig and cow. The source of enzyme was a chloroform-water extract of the anatomical regions of the kidney, cortex, upper medulla and lower medulla (papillary portion). Ethyl acetate, ethyl butyrate, methyl salicylate, olive oil and castor oil served as zymolytes or substrates. Quantities of extract equivalent to 80 mgs. of tissue were employed, and the lipolytic activity determined by titration, in the presence of phenolphthalein, with N/25 or N/50 sodium hydroxide. When olive oil or castor oil was used, titrations were made after the addition of alcohol. The two kidneys in the same animal always show a distinct variation in lipolytic activity. The greatest lipolysis is regularly observed in the cortex, the least in the lower portion of the medulla (papillary region). The relative extent of lipolytic activity corresponds to the relative distribution of fat in the kidney as recently reported by Christianna Smith (*Amer. Jour. Anat.*, 1920, 27, 69). This distribution in accordance with the anatomical divisions of the kidney explains the preponderating occurrence of fat in the cortex under normal conditions

and also under those of fatty degeneration. The large number of contradictory findings concerning the presence or absence of enzymes in the kidney and the inability of investigators to find normals for this tissue rest upon the failure on their part to consider the kidney with reference to its anatomical regions.

*Uric acid and phenols in the saliva:* M. X. SULLIVAN and PAUL R. DAWSON. Salivas collected in 30 minutes under stimulus of chewing paraffin were freed from protein by treatment with 10 per cent. trichloroacetic acid followed by 10 per cent. sodium tungstate in  $2/3$   $N$   $H_2SO_4$  and were then tested for uric acid and phenol. The uric acid precipitated by silver lactate in 5 per cent. lactic acid, after appropriate treatment, was estimated colorimetrically. The phenols in the filtrate from silver urate, after appropriate treatment, were estimated colorimetrically with resorcinol as standard. Both uric acid (urates) and phenols (free and conjugated) were found in normal saliva and in the saliva of pellagra patients.

*Extraction and estimation of lipoids in cereal products:* O. S. RASK and I. K. PHELPS. Ether extracts from cereal products, raw or cooked, do not represent their total lipid content (fatty matter). A preliminary treatment of such products by an ammoniacal alcohol solution and a subsequent extraction by a mixture of ethyl ether and petroleum ethers in a manner similar to that specified in the Roese-Gotlieb method for fat in milk, yields higher results which appear to represent more nearly the true lipid content of cereal products. Ether extracts of uncooked cereal products represent on the average 65 to 70 per cent. of the results obtained by the above procedure.

*Estimation of phospholipins in cereal products:* O. S. RASK and I. K. PHELPS. A further study of the lipoids referred to in the preceding abstract indicates that they contain all phospholipins present in cereal products and the lipid phosphorus of cereals may be estimated by determining the phosphorus content of their lipoids thus obtained.

*Resemblance of the thermal death point of bacteria to chemical reaction:* W. D. BIGELOW. The data presented by W. D. Bigelow and J. R. Baty in the *Journal of Infectious Diseases* for December, 1920, can be expressed in the form of semilog curves which are straight lines between the temperatures of  $105^\circ$  and  $125^\circ$  C. At higher temperatures the experimental evidence is inconclusive because of error produced by the time required for heat to penetrate to the center of the tubes.

For this reason the time secured by extending the semilog curves mentioned above is more nearly correct than the experimental data for temperatures above  $125^\circ$  C. At temperatures below  $105^\circ$  C. the time necessary for the destruction of spores appears to be less than would be indicated by an extension of the semilog curves. The semilog curves showing the thermal death point of spores of the fifteen bacteria referred to are all parallel to each other. It is suggested that if other spores follow the same law the position of the curve showing the time necessary to destroy the spores at various temperatures is fixed by the determination of the time at one temperature. It is suggested that the thermal death point of non-spore-bearing bacteria at different temperatures will probably follow the same law or a similar law.

*The intensity of light necessary to initiate a photochemical change in the retina:* E. L. CHAFFEE and W. T. BOVIE. This investigation concerns the potential differences which are set up in the retina when it is illuminated. An apparatus is described in which the differences in potential are amplified by audions through stages. An Eindhoven galvanometer is used. The changes are recorded photographically. A single exposure gives three distinct deflections. It was shown as a new contribution that these deflections are greatly influenced by experimental conditions, such as the length of time which has elapsed since the eye has been excised. Over a range of intensities which are very close to the threshold for human vision the height of the first deflection is proportional to the amplitude of the light vibration.

*An "antidote" for a "poisoned electrode":* W. T. BOVIE.

*Abiotic action of rays due to ozone and the heat sensitization of protoplasm by ultra-violet light:* W. T. BOVIE. The experiments concern the processes which take place in *Paramecium caudatum* during the time between the exposure to fluorite rays and the appearance of the first visible effects of the radiation; that is, during the so-called "latent period." The latent period is shorter and the effects of the rays are more intense the higher the temperature to which the organism is raised and the longer the time the organism is maintained at the higher temperature. No similar effects are observed if the organism is subjected to the increased temperature immediately before the radiation instead of after it.

CHARLES L. PARSONS,  
Secretary