

igneous rock to fairly represent the volcanic ash, which is another large part of the abysmal clay, a meter thick would contain 192.5 tons of nickel extra per square kilometer. It would take 8,700 years to accumulate this extra 192.5 tons of nickel in a meter at the rate of 20,000 grams per year. Now the red clay has, certainly, formed very slowly, as shown by the abundance of sharks' teeth and whales' ear bones, as well as the manganese and meteor dust.⁶ The man in the world best qualified to guess in an after-dinner conversation expressed to me his guess that 500 feet of the red clay would represent all geologic time. At the above rate, 500 feet, *i. e.*, 152.5 meters, would equal 13,000,000 years. Now this is of the order of the figures of other estimates of the earth's age, suggestively near to other short estimates, when we see that we have taken Pickering's maximum estimate of the size of meteors. If we took Pickering's smaller figures for the size of the meteorites, we could get estimates of age as great as the larger estimates of the age of the earth.

My object, at this time, is to urge the members of the talked-of Arctic and Antarctic expeditions, or, in fact, any one in snowy climates, to complete Nordenskjöld's observations by finding the amount of cosmic dust in a large amount of snow, accumulated in a known time, determined by annual rings or otherwise. It may, also, be well to test especially for the amount of nickel in strata which are thought to have formed very slowly.

I have no doubt, also, that within this century, there will be drilled a hole in the bottom of the sea which will give us the other datum to be determined.

ALFRED C. LANE

TUFTS COLLEGE, MASS.

THE MILWAUKEE MEETING OF THE AMERICAN CHEMICAL SOCIETY

ALTHOUGH the American Chemical Society changed its time of meeting from winter to spring there was no falling off in the attendance at the Milwaukee meeting, for in spite of the distance

⁶*Bull. Mus. Royal*, 1884, p. 35. "Sediment de Mer Profonde."

from many of the local sections some four hundred members gathered for the meeting, as well as thirty guests.

The council meeting was held on Monday evening, March 24, and it was voted that the next meeting should be held in Rochester, New York, early in September. Other business of a general character was considered and the reports of all committees received.

On Tuesday morning the following four papers were given in general session, and with the exception of the last were fully illustrated:

Joel H. Hildebrand: "Some Applications of the Hydrogen Electrode in Instruction, Analysis and Research."

D. M. Buck: "Copper in Steel. The Influence on Corrosion."

H. E. Howe: "Some Projection Experiments with Spectra."

Wilder D. Bancroft: "The Theory of Emulsions."

On Tuesday afternoon excursions were held to the plant of the Jos. Schlitz Brewing Company, to the gas and coke plant; and the works of the Pfister & Vogel Leather Company and the Vilter Manufacturing Company were also open to the members.

In the evening a complimentary smoker was held in the Fern Room of the Hotel Pfister, at which Mayor Bading of Milwaukee was present.

On Wednesday there were meetings at Marquette University of the Agricultural and Food Division, the Biological Chemistry Division, Industrial Chemists and Chemical Engineers, the Pharmaceutical Chemistry Division, the Physical and Inorganic Chemistry Division and the Rubber Section.

On Wednesday evening Professor Julius Stieglitz, of Chicago, gave a public lecture on "Combustion," which was largely attended by the members as well as by the citizens of Milwaukee, probably eight hundred people being present.

On Thursday the meetings of the Divisions continued and the Organic Chemistry and Fertilizer Divisions also met.

In the afternoon excursions were taken to Pabst Brewing Company and the Pfister & Vogel Leather Company and in the evening a subscription dinner was held at the Hotel Pfister.

On Friday seventy-five of the members went by special train to Madison, Wisconsin, where they were received by committees of the Wisconsin Section of the American Chemical Society and con-

ducted to the various places of interest in Madison. The chemical laboratories of the University of Wisconsin, the capitol and the forest products laboratory were visited. A luncheon was served to the visitors, at which President Van Hise presided.

All members of the society who went to the Milwaukee meeting were well repaid for the journey.

The following is a list of papers presented, with abstract where abstract was furnished:

GENERAL MEETING OF ALL DIVISIONS AND SECTIONS

JOEL H. HILDEBRAND: *Some Applications of the Hydrogen Electrode in Instruction, Analysis and Research.* (Illustrated.)

The change of hydrogen or hydroxyl-ion concentration during the neutralization of acids and bases, the precipitation of hydroxides, etc., gives a very remarkable insight into the nature of the reaction. This change can be followed by means of the hydrogen electrode, of which a simple form was described, together with apparatus allowing its potential to be easily determined with a voltmeter. Curves were thrown on the screen showing the variation of potential, and consequently of hydrogen and hydroxyl-ion concentration, during the neutralization of various acids and bases. From these it was pointed out how such things could be easily determined as the proper indicator to use in a given titration, the degree of hydrolysis of salts, the dissociation of weak acids and bases, the way to prepare normal salts where hydrolysis takes place, the effect of structure on the strength of organic acids, etc. Curves representing the titration of salts such as borax and sodium carbonate were shown and conclusions drawn similar to those just mentioned. Others were shown representing the precipitation of various hydroxides, from which could be drawn conclusions regarding the behavior towards various reagents and the separation from each other. Owing to the difference in solubility of magnesium and calcium hydroxides, magnesium can be titrated in the presence of calcium, allowing its rapid determination in limestone, etc. The same method can be used with a platinum electrode to determine the oxidizing power of solutions, illustrated by the titration of iron with bichromate, avoiding the use of the external indicator.

D. M. BUCK: *Copper in Steel. The Influence on Corrosion.* (Illustrated.)

H. E. HOWE: *Some Projection Experiments with Spectra.* (Illustrated.)

WILDER D. BANCROFT: *The Theory of Emulsions.*

DIVISION OF AGRICULTURAL AND FOOD CHEMISTRY

H. E. Barnard, *chairman*

Glen F. Mason, *secretary*

H. E. BARNARD: *The Status of Food Legislation in the United States.*

A brief sketch of the history of food legislation in the United States followed by a discussion of the various types of laws, such as the Pure Food Law, Meat Inspection Law, Sanitary Food Law and Cold Storage Law, enacted for the improvement and control of the food industry. The special features of each law are described and the methods employed in their enforcement detailed.

CARL L. ALSBERG, F. RABAK, H. H. BUNZELL and O. F. BLACK: *Studies upon Maize.*

W. D. BIGELOW: *The Equilibrium between Sugars and Sulphur Dioxide in Dried Fruit.*

The time required for sulphur dioxide and aldehydes to unite prevents the formation of this compound in fruit that is dried quickly by artificial heat, but permits its formation in fruits that require a number of days for drying. Thus evaporated apples are nearly free from sulphur dioxide, while sun-dried peaches and apricots contain considerable amounts. The content of the latter is much greater because of the practise in the packing-house of dipping the dried fruit in water and again sulphuring and packing in boxes without subsequent drying.

The gradual disappearance of sulphur dioxide in dried fruit depends on temperature and humidity. The dextrose sulphurous acid compound is quite stable but is broken up by water to a sufficient extent to form an equilibrium between this compound and the free sulphurous acid. The free acid is subject to evaporation and oxidation and the equilibrium is, of course, maintained by the hydrolyzation of an additional amount of the compound.

W. D. BIGELOW: *The Influence of Cooking on the Sulphurous Acid Content of Dried Fruit.*

The methods usually employed in cooking fruit were ascertained by 525 letters of inquiry sent to residents of 21 states. The usual method appears to be to soak a number of hours without previous washing and cook for one or two hours in the water in which it is soaked. During the cooking about 10 per cent. of the sulphur dioxide present is oxidized to sulphate and 25 to 35 per cent. of it is volatilized. Preliminary washing removes 2-3 per cent. of the sulphur dioxide, and 35-50 per cent. more is removed when the fruit is soaked overnight in two or three times its weight of water and the latter is poured off and

discarded. By the latter practise there is also lost from a quarter to a third of the soluble solids of the fruit.

EDWARD BARTOW: *The Effect of Chicago's Sewage on the Illinois River.*

Tests made during a dry season in July show a very low content of dissolved oxygen in the river as far down as the Marseilles dam. Below the dam there is a gradual rise as far as Peoria, below which there is a slight drop, followed by a rise and higher values throughout the remainder of the river. During high water and in colder weather more oxygen is present in the upper part of the river, but there is evidence that the sewage is carried farther down the stream. A study of the fish life of the river by Professor S. A. Forbes shows no fish present in the river above the Marseilles dam. There is an increase in the number of fish found in the lower part of the river and the amount of plankton is very much greater than before the opening of the drainage canal.

A. HUGH BRYAN: *The Polarization of Light-colored Sugar Solutions.*

In polarizing light-colored sugar solutions, such as syrups, honeys, extracts, etc., with saccharimeters, using white light, it is often hard to neutralize the field, one side possessing a bluish or greenish tinge and the other a white or reddish one. This results from differences in rotation dispersion of the sugar solution and quartz wedges. In order to reduce this to a minimum, the white light used as a source of supply for the polariscope should be filtered through a neutral solution of bichromate of potash. This removes the blue and violet rays which are the main disturbing ones. For solutions of sucrose, a layer $1\frac{1}{2}$ cm. thick of a 6 per cent. solution or 3 cm. layer of a 3 per cent. solution has been found sufficient, while for commercial glucose the percentage composition should be double for the same layer of solution, that is, 12 per cent. for a $1\frac{1}{2}$ cm. cell or 6 per cent. in a 3 cm. cell. Dark-colored sugar solutions naturally tend to filter the light. Hence, there is little trouble experienced when polarizing them without the light filter cell, but many sugar chemists use the cell in case of all polarizations.

SLEETER BULL and A. D. EMMETT: *The Protein and Energy Requirements of Fattening Lambs as Determined by a Study of American Feeding Experiments.*

In this compilation of the American literature upon the protein and energy requirements for fattening lambs, 49 experiments from 16 different

agricultural experiment stations were reviewed. The experiments embraced 259 lots of 5,005 lambs. The data were classified into four groups, lambs weighing 50-70 pounds, 70-90 pounds, 90-110 pounds and 110-150 pounds. The average daily consumption of digestible protein in pounds, the average net energy in therms, and the average daily gains were reported and summarized for each group.

JOHN G. DIGGS: *Analyses showing the Composition of the Different Grades of Commercial Pack Peas.*

This paper gives a complete analysis of the various grades of canned peas put out by a single packing concern. It was thought that in one plant where uniform methods were used in grading, sizing and packing a closer distinction might exist between the composition of the different brands or grades. The basis for determining the three brands was the gravity of the first pea. The average of analyses of grades of each brand show: the younger immature peas contain eighteen per cent. more water than the oldest ones, the crude fiber decreases from 10.25 per cent. to 7.15 per cent. (water-free basis) as the pea matures, starch increases from 41 per cent. to 53 per cent. with maturity, sugar decreases as the pea grows older.

JOHN G. DIGGS: *Some Abnormal Factors of So-called Farmers' Cider Vinegar.*

This paper gives the analysis of eighteen samples of supposed cider vinegar produced by cask fermentation. In many of the samples fermentation was found to have been arrested before completion, these samples containing high percentages of sugar. The maximum factors in grams per 100 c.c. were: acid, 10.25; total solids, 9.64; sugar, 5.97; non sugars, 5.06; and glycerine, .51. Some of the samples were watered and to some sugar and acetic acid had been added. The difficulty of manufacture of vinegar by this process without at least some training is shown.

J. T. DONALD: *Methods for the Accurate Determination of Saltpeter.*

J. O. HALVERSON: *The Modified Babcock Method for Fat in Sweetened Dairy Products—Ice Cream.*

The need of a rapid volumetric method for ice cream is shown. The Babcock test is not applicable to sweetened dairy products on account of the well-known charring action of the acid on the sugar. If the sugar solution could be readily drained off, the ordinary Babcock method could then be used. This is accomplished by centri-

fuging the fat to the top as in the Babcock test, then drawing off the acid-sugar solution through a small glass stopcock fused on near the bottom of the test-bottle. This is the essential modification in this method.

A new ice-cream modified test-bottle, graduated to 25 per cent. for an 18-gram charge, is shown.

Results of 350 determinations on different ice-creams show that results consistent with the Roesse-Gottlieb ether extraction method are obtained, though running 0.6 per cent. low. The residual fat lost in the drained-off acid-sugar portion is shown to average the same as that lost in the Babcock test of cream.

The maximum variation of the individual readings compare favorably with those of the Roesse-Gottlieb method.

The modified method in detail with numerous tables of data are given, also two figures of the modified Babcock test and of the modified test bottle.

P. W. HOLTZENDORFF: *The Separation and Identification of the Permitted Coal-tar Colors in Foods.*

The method is confined to the permitted colors. Advantage is taken of difference in chemical composition and extraction by immiscible solvents to effect separation. Identification tests are made on the dry color and in aqueous solution, after well-known methods, particularly the reactions obtained with concentrated H_2SO_4 .

ARDEN R. JOHNSON and B. W. HAMMAR: *Specific Heat Observations on Milk and Cream.*

ARDEN R. JOHNSON and ROY E. SMITH: *A Thermal Method for the Determination of Ratio of Congealed to Uncongealed Moisture in Frozen Soils.*

A. MCGILL: *Some Phases of National Food Control.*

A. E. PERKINS: *A Simple and Convenient Method for Determining the Salt Content of Butter.*

This paper describes a method for the determination of salt by titrating a solution of 5 or 10 grams of butter in 20 or 30 c.c. of commercial acetone with silver nitrate, using potassium chromate as an indicator. The author states that the method yields results entirely comparable with the longer volumetric or gravimetric methods formerly used.

Equal parts of commercial alcohol and ether may be substituted for the acetone with equally good results.

A. E. PERKINS: *A Note Regarding an Absorption Tube and Receiver used in the Kjeldahl Nitrogen Determination.*

The author states that successful use has been made of a 2-inch glass funnel and glass jar with straight sides used as the absorption tube and the receiver, respectively.

He states that the advantage is the large surface of acid that is present for the absorption of ammonia vapors, and very little bubbling occurs. No trouble has been experienced with the acid striking back towards the distilling flask.

C. S. ROBINSON and O. B. WINTER: *The Nature of Nitrogenous Compounds in Peat Soils.*

This paper takes up the study of the protein content of peat soils. Van Slyke's method for the determination of amino nitrogen is used to study the amount of nitrogen converted into the amino form under various conditions of acid and alkaline digestion. About 27 per cent. of the total nitrogen was converted into the amino form on heating with 25 per cent. sulphuric acid 96 hours and about 50 per cent. by heating with 5 per cent. NaOH for 150 hours.

R. H. ROBINSON: *Some Chemical Changes taking Place during the Embryonic Development of the Chick.*

S. H. ROSS and N. HENDRICKSON: *A Simple and Efficient 20° C. Bacteriological Incubator.*

A very satisfactory 20° incubator was made from an ordinary refrigerator, size 20 in. × 29 in. × 46 in., by installing two heating coils, 0.2 ampere, and a disc type thermoregulator in the refrigerating compartment. The thermoregulator actuated a circuit breaker and connection was made to a lighting circuit. With care in regulating the amount of ice the temperature was easily maintained between 19.5° and 20.5° C.

J. F. SNELL: *The Detection of Adulteration in Maple Syrup and Sugar.*

H. V. TARTAR and B. PILKINGTON: *A Comparative Study of the Composition of Hops Grown in Different Parts of the World.*

H. V. TARTAR and L. A. BUNDY: *A Note on the Soluble Arsenic in Mixtures of Lead Arsenate and Soap.*

J. BOSLEY THOMAS and EDGAR A. SANDMAN: *Some Results of the Hypochlorite Disinfection of the Baltimore City Water Supply.*

The period covered by this report extends from January 1 to December 31, 1912. Calcium hypochlorite was applied at the effluent of the im-

pounding reservoir just before the water entered a seven-mile conduit, in amounts of 1.0 part per million available chlorine from January 1 to July 15, and 1.5 p.p.m. from January 15 to the end of the year.

Samples were taken daily from the untreated water and from the treated water at the end of the tunnel as well as from the effluents of several storage reservoirs. These samples were examined for the bacterial count and members of the *B. coli* group, and averaged by months, the *B. coli* organisms being calculated to numbers per cubic centimeter by the use of portions of the samples varying by a multiple of ten from .01 to 100 c.c.

The results of the treatment of this water supply have been reductions varying between 92 and 99 per cent. in the bacterial count and almost entire elimination of members of the *B. coli* group, the reductions in these organisms being between 92 and 100 per cent., with 99.99 per cent. reductions during five months and 100 per cent. during two months of the year.

The reduction in the number of cases of typhoid fever occurring in Baltimore during 1912 is 31 per cent., compared with an average of the number of cases occurring during the years from 1906 to 1910, and 24 per cent., compared with the cases occurring during 1911, in the last six months of which the water supply was treated.

J. E. HARRIS: *Soil Acidity*.

EDWARD GUDEMAN: *Glucose Analyses*.

Determinations of the mineral constituents of confectioner's glucose, representing over 1,000 samples examined during the years 1902 to 1913, were submitted in chart form, the curves showing the maxima, minima and averages of the total ash, chlorides and sulphurous oxide.

The results show that no fixed ratio exists between these ingredients. The chlorides approximate two thirds of the total ash, figured as sodium chloride. The sulphurous oxide (SO_2) seems to vary inversely to the other ingredients. The fluctuations in these ingredients are so great that determinations of mineral matter in glucose give no bases for judging the quality of the product.

The table following shows the great variation in the maxima, minima and averages for the years 1902 to 1913:

Total Ash:

	Parts Glucose (D.S.)
Maxima :	84-158 parts to 10,000
Minima :	30- 50 parts to 10,000
Averages :	52- 82 parts to 10,000

Chlorides:

(NaCl)	Maxima :	68-92 parts to 10,000
	Minima :	18-38 parts to 10,000
	Averages :	36-82 parts to 10,000

Sulphurous Acid:

(SO_2)	Maxima :	160-350 parts to 1,000,000
	Minima :	10-165 parts to 1,000,000
	Averages :	60-240 parts to 1,000,000

DIVISION OF ORGANIC CHEMISTRY

Treat B. Johnson, *chairman*

William J. Hale, *vice-chairman and secretary*

LLOYD M. BURGHART and RALPH H. MCKEE: *The Action of Cyanimido Ether on Esters of Amido Acids*.

It has previously been shown that cyanimido ethyl ether gives with esters of anthranilic acid the oxygen ethers of benzoylen urea. The study of the reaction has been continued, particularly as to the character of the intermediate steps in the reaction and also as to the possibility of forming seven and eight atom rings containing either the group $-\text{CO}-\text{NH}-\text{CO}-\text{NH}-$ or the group $-\text{CO}-\text{N}=\text{COC}_2\text{H}_5-\text{NH}-$.

The evidence obtained indicates that there is first formed an open chain compound by the elimination of prussic acid and that this is followed by the elimination of alcohol with the consequent formation of a ring of four carbon and two nitrogen atoms.

The authors were unable in any case to bring about the formation of a similar eight-atom ring, though many trials were made using para amino-benzoic ethyl ester as a starting material.

F. W. HEYL, F. E. HEPNER, S. K. LOY: *Zygadenine. The Crystalline Alkaloid of Zygadenus intermedius*.

Among the poisonous plants of the range death camas is most abundant and is the cause of most cattle poisoning in Wyoming. In the work which has been taken up at the Wyoming Experiment Station, upon the problem of poisonous plants, this one has been examined first.

A crystalline alkaloid melting at $200^\circ-201^\circ$ and having the formula $\text{C}_{28}\text{H}_{33}\text{NO}_{10}$ has been isolated and its toxic effects studied. It was found to be similar to veratrine.

F. W. HEYL and F. E. HEPNER: *Some Constituents of the Leaves of Zygadenus intermedius*.

The study of this plant was continued and the resin examined, as statements occur in the literature ascribing poisonous properties to this part of the plant.

The chemical and physiological study demon-

strated the inert nature of the resin and proved that the poisonous properties reside in the alkaloidal fraction entirely.

The substances isolated from the plant include quercetin, dextrose, a phytosterol, a hydrocarbon hentriacontane, oleic acid, linoleic acid, iso linoleic acid. The solid fatty acids present were stearic, palmitic and cerotic. A neutral substance to which no formula has been assigned was found in the ether extract of the resin, and this fraction also contained a polyhydric alcohol similar to ipuranol.

C. G. DERICK and J. H. BORNHANN: *Rearrangements of N-Acyl Aromatic Amines.*

The fact that intramolecular rearrangements of the N-acyl aromatic amines proceed in the direction to decrease their ionization is tested out for N-diacetyl, N-dipropionyl, N-acetyl anilines and their corresponding aminoketones. It is found to hold and is a very satisfactory criterion for the possibility of rearrangements of this type. The criterion is found to hold for the rearrangement of acetophenone oxime into acetanilide. By combining the senior author's measure of negativity with the above work, it is possible to state a limit beyond which two acyl-radicals must be substituted for the aminic hydrogen before rearrangement will be possible.

P. N. EVANS and LENA M. SUTTON: *The Efficiency of the Preparation of Ether from Alcohol and Sulphuric Acid.*

The completeness of the reaction was determined by comparing the fractionation results of the successive distillates with those of artificial mixtures corresponding to the theoretical products at various degrees of completeness; the efficiency proved to be about 40 per cent., and this was maintained until there remained in the generating flask a charred and semi-solid residue amounting to only about one twentieth of the original acid in weight.

The yield of distillate was in some experiments as high as 176 times the volume of the original acid, containing ether amounting to 40 times the volume or 16 times the weight of the acid used.

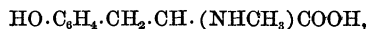
The final fall in efficiency was due, therefore, to the loss of sulphuric acid and not to the accumulation of water formed in the reaction. That the accumulation of water is not the interfering factor was further shown by the normal course of the reaction when dilute sulphuric acid was employed.

From 15 to 20 per cent. of the sulphuric acid

used was accounted for as sulphur dioxide. Other by-products are being further investigated.

BEN H. NICOLET and TREAT B. JOHNSON: *The Constitution of Surinamine.*

Surinamine, which was isolated by Giutyl in 1868 from a species of leguminous trees from Brazil (*Ferreira spectabilis*) is a methyl derivative of tyrosine,



and not a higher homologue,



This methyl derivative of tyrosine has been synthesized in this laboratory and found to be identical with the natural base, which was isolated by Giutyl. This conclusion has been confirmed by Professor Dr. Guido Goldschmidt, to whom we are indebted for a sample of Giutyl's original base.

TREAT B. JOHNSON: *A New Method of Synthesizing β -Ketone Esters.*

A new method of synthesizing certain types of β -ketone esters has been developed by the application of Refounatsky's reaction. Our synthesis represents the first phase of Refounatsky's reaction. Substituted ketone esters of the general formula $\text{C}_6\text{H}_5\text{OCH}_2\text{COCH}(\text{R})\text{COOC}_2\text{H}_5$ can easily be obtained by the action of esters of α -halogenated acids on esters of hydroxy acids in the presence of amalgamated zinc. The method has been applied successfully in several cases.

LEWIS H. CHERNOFF and TREAT B. JOHNSON: *Pyrimidine Nucleosides.*

ROBERT BENGIS and TREAT B. JOHNSON: *New Thiohydantoin Condensation Products.*

A continuation of the hydantoin researches from the Sheffield Laboratory. This investigation deals with the possible precursors of the naturally occurring base adrenaline. By application of our own methods of synthesizing α -amino acids from thiohydantoins, several new amino acids of biochemical interest have been prepared.

WILLIAM J. HALE: *The Constitution of "Acetylacetone-Urea."*

This compound is to be considered as a dimethyl-oxypyrimidine or dimethyl-pyrimidone. The presence of an hydrogen atom attached to one of the nitrogen atoms of the pyrimidine nucleus was proved by methylation of diazomethane.

W. A. NOYES and L. F. NICKELL: *Decomposition of Isodihydroaminocampholytic Acid with Nitrous Acid.*

Isodihydroaminocampholytic acid was prepared by the method of Noyes and Knight (*Jour. Am. Chem. Soc.*, 32: 1669). In the saponification of β -amidoisocamphoric ester some d-camphoric imide was formed. Isodihydroaminocampholytic acid forms the same anhydride as dihydroaminocampholytic acid; the free acid does not form an inner salt in solution. By decomposing this acid with nitrous acid, a hydrocarbon, d-campholytic acid, l-trans-dihydrohydroxycampholytic acid and l-campholytolactone are formed. l-campholytolactone on hydrolysis gives l-cisidihydrohydroxycampholytic acid. The Walden inversion occurs only in the formation of l-campholytolactone, which is 1.8 per cent. of the acid decomposed.

R. S. POTTER and W. A. NOYES: *Are Ammonium Compounds Atomic or Molecular?*

The authors have shown that in amino camphonic acid the amino and carboxyl groups combine to form an inner salt. Similar acids, amino dihydrocampholytic, amino homo camphonic and amino homo dihydrocampholytic, probably do not form this inner salt. The above conclusions were arrived at through a consideration of the rotations of the acids mentioned, their hydrochlorides, sodium salts. The anhydrides and nitroso derivatives of the acids were also prepared. The conclusion as to the structure of the ammonium inner salt is taken as a refutation of Werner's theory of the structure of ammonium compounds.

O. A. BEATH and EDWARD KREMERS: *A Crystalline Resin Acid from the Digger's Pine.*

The oleoresin of *Pinus sabiniana* is of special interest not only because it contains heptane in place of pinene of the corresponding oleoresins of the genus *Pinus*, but also because its resin acid until recently defied all attempts at crystallization. A crystalline product has been obtained by two different methods.

C. D. GEIDEL and EDWARD KREMERS: *The Oxidation of Indigo Blue by Phellandrene "Peroxide."*

A preliminary report on the relative capacity for oxygen conveyance of phellandrene as compared with pinene and limonene.

EDWARD KREMERS: *Direct Halogen Substitution as a Laboratory Experiment in Organic Chemistry.*

Text-books have always emphasized the direct substitution of hydrogen of the methane series of hydrocarbons by halogen. Nevertheless, there possibly does not exist a laboratory manual to-day

which provides an experiment illustrating this important reaction. This is due, no doubt, to the absence of suitable hydrocarbon material. Such a material, however, can now be provided, if wanted, in the form of normal heptane from either the Diggers pine or Jeffrey pine of California. The substitution experiment can be supplemented by a series of reactions illustrative of Schorlemmer's classical experiments on the constitution of the paraffin hydrocarbons.

CARL O. JOHNS and EMIL J. BAUMANN: *Researches on Purines. 2-Methylmercapto-6, 8-dioxypurine and 2-Methylmercapto-6-oxy-8-aminopurine.*

2-Thio-4-amino-6-oxypyrimidine was alkylated in alkaline solution by means of dimethyl sulphate giving 2-methylmercapto-4-amino-6-oxypyrimidine. By means of nitrous acid this substance was converted to 2-methylmercapto-4-amino-5-nitroso-6-oxypyrimidine. This latter compound was reduced to 2-methylmercapto-4, 5-diamino-6-oxypyrimidine by means of ammonium sulphide. The diamino pyrimidine was heated with urea and gave 2-methylmercapto-6, 8-dioxypurine which on hydrolysis with hydrochloric acid gave uric acid. When the above-mentioned diaminopyrimidine was heated with guanidine thiocyanate it gave 2-methylmercapto-6-oxy-8-aminopurine, which could also be hydrolyzed to uric acid.

CARL O. JOHNS and ALBERT G. HOGON: *Researches on Purines. 2-Thio-6, 8-dioxypurine; 2, 8-dithio-6-oxypurine; a New Method of Preparing Xanthine and Uric Acid.*

When 2-thio-4-amino-6-oxypyrimidine was heated with urea it gave 2-thio-6, 8-dioxypurine. When the latter compound was boiled with chloracetic acid we obtained 6, 8-dioxypurine-2-thioglycollic acid, which on heating with hydrochloric acid gave uric acid. When 2-thio-6-oxypurine was heated with chloracetic acid we obtained 6-oxypurine-2-thioglycollic acid. On hydrolysis with hydrochloric acid this gave xanthine.

When 2-thio-4-amino-6-oxypyrimidine was heated with urea it gave 2, 8-dithio-6-oxypurine. With chloracetic acid this gave 6-oxypurine-2, 8-dithioglycollic acid.

BIOLOGICAL CHEMISTRY SECTION

Carl L. Alsberg, *chairman*

I. K. Phelps, *secretary*

J. H. LONG: *Some Conditions Affecting the Stability and Activity of Certain Ferments.*

The action of certain body ferments on each other has been long discussed. As to the extent of this mutual action there is still much confusion, which is in a large measure due to a failure to give proper weight to the behavior of the medium in which the ferments act.

It is not possible to explain the action of pepsin on trypsin and amylopsin, for example, until the influence of the acidity, the alkalinity or the salt content of the medium is eliminated or fully defined. The paper deals with determinations in this direction, with special reference to the condition of amylopsin action. Glycerol extracts of the pancreas, as well as a number of commercial products were used in the investigations.

JACOB ROSENBLUM: *The Cholesterol and Cholesterol-esters of the Blood in Xanthoma Tuberosa Multiplex.*

JACOB ROSENBLUM: *A Chemical Examination of the Brain of a Syphilitic Fetus.*

W. D. BANCROFT: *A Problem in Metabolism.*

F. M. McCLENAHAN: *The Development of Fat in the Black Walnut (Juglans nigra).* II.

W. A. WITHERS and J. F. BREWSTER: *A Study of the Renal Output of Rabbits Dying from Cottonseed-meal Poisoning.*

R. A. GOETNER: *Studies on the Chemistry of Embryonic Growth. I. Certain Changes in the Nitrogen Ratios of Developing Trout Eggs.*

The distribution of certain fractions of the nitrogen was determined in trout eggs at various stages of embryonic development, beginning with eggs less than 24 hours old and ending with the young fish which were ready to take food.

It was found that no nitrogen left the egg before hatching, but that the monamino-acid nitrogen diminished and a gain of basic nitrogen took place. No considerable amount of urea or uric acid was formed.

After hatching the nitrogen is rapidly lost, until 21 days after hatching 21.96 per cent. of the total nitrogen has been eliminated. At this period the total weight (dry at 100°) has diminished 25.35 per cent.; 37.26 per cent. of this loss being due to non-nitrogenous compounds (fats, etc.) and 62.73 per cent. to proteins ($N \times 6.25$).

A study of the form of the nitrogen which is eliminated showed that nearly all of the basic nitrogen is retained in the new organism, nearly all of the nitrogen liberated being monamino-acid nitrogen.

The significance of these findings as regards our

present knowledge of the chemistry of embryonic growth, is discussed.

The paper will be published in *The Journal of the American Chemical Society.*

PHILIP ADOLPH KOBER: *The Nephelometric Determination of Proteins. I. Casein and Globulin in Milk.*

Results in previous papers showed that proteins can be rapidly and accurately estimated with a nephelometer. After removing the fat from milk, casein and other proteins may be estimated directly in this way. While the official method takes two or more days to determine casein, globulin and albumin in milk, it can be done nephelometrically in less than 30 minutes. The nephelometer described in a previous paper is shown with several improvements.

G. O. HIGBY: *A Study of Well Water as a Cause of Typhoid Fever.*

This investigation was begun in August, 1910, at Delaware, Ohio, because of the prevalence of typhoid fever in the city, there being 26 cases on August 1 in a city of 10,000 inhabitants. The hydrant water having been proved safe, suspicion fell upon the well water, and samples from 65 wells were collected and examined chemically and for the presence of the colon bacillus between September 1, 1910, and June 1, 1912.

Serious local pollution of the wells was discovered and reported to the city health officer, resulting in the closing of some wells and the cleaning and abandoning of many cesspools. The number of typhoid cases in the city has been as follows: 1909, 18 cases; 1910, 34 cases; 1911, 7 cases; 1912, 10 cases (seven of these on the outskirts of the city, where the water pipes have not been laid); 1913, no cases up to March 22.

L. KNUDSON: *Influence of Cane Sugar on the Production of Tannase by Aspergillus Niger.*

M. X. SULLIVAN: *Molds as a Factor in the Formation of Certain Nitrogenous Organic Soil Constituents.*

Some thirty-five to forty different substances have been found in the organic matter of the soil. In some of the soils, mold growth was very evident. Molds were taken from soil and implanted on Raulin's solution. After several replantings 70 liters in bottles were inoculated with what has been identified as a variety of *Penicillium glaucum*. After a period varying from three to five weeks, the mold mycelium and the culture solution were examined for various organic constituents. On the air-dried molds have been found, a trace

of xanthine, much hypoxanthine, some guanine, adenine, histidine, arginine in very small quantity, probably lysine, thymine, choline, mannite, pentoses, cholesterol bodies and lipoids resembling cerebroside, a small amount of an unidentified hydroxy-fatty acid, and large amounts of oleic and palmitic acid and some stearic acid. In the culture solution was found fatty acids, guanine, adenine and hypoxanthine, a small amount of histidine, pentose sugar, unidentified aldehydes, mannite and probably thymine. The general conclusion is drawn that molds, and other microorganisms play a considerable rôle in the formation of organic soil constituents.

J. J. SKINNER: *Effect of Salicylic Aldehyde as a Soil Constituent.*

The isolation and identification of salicylic aldehyde in soils is pointed out.

The effect of this soil organic compound on growth was studied by growing plants in nutrient culture solution, in soil and in sand.

In culture solutions salicylic aldehyde was very harmful to wheat, corn, cabbage and cow-pea plants, in amounts of 10 parts per million. Amounts from 50 to 100 parts per million killed the plants. The aldehyde was harmful in cultures containing phosphate, nitrate and potash, regardless of whether the salts were used singly or in combinations. The aldehyde in small amounts was also harmful when added to soil and to sand.

Forty-five unproductive and thirty productive soils from various parts of the United States were examined for salicylic aldehyde. Seventeen of the unproductive soils and three of the productive soils contained the aldehyde. The extracted soil aldehyde was tested in water cultures as to its effect on growth and in each case proved harmful.

MARY LOUISE FOSTER: *A Comparative Study of the Metabolism of Pneumococcus, Streptococcus, Bacillus lactis erythrogenes and Bacillus anthracoides.*

Two strains of pneumococcus grown at 37°–40° C. on serum with three parts of water showed that proteolysis is progressive, the largest phosphotungstic fraction being found at the highest temperature. Sterilized milk at 37° C., inoculated with streptococcus, bacillus lactis erythrogenes, or bacillus anthracoides showed hydrolysis of the native protein, diamino and monoamino acids being formed. The amount of monoamino acid increased with the time of the interaction.

L. W. FETZER: *A Biochemical Interpretation of the Inheritance of Acquired Characters.*

W. T. BOVIE: *The Chemical Effects of Ultra-violet Light on Albumin.*

Ultra-violet light causes egg white and crystallized egg albumin to coagulate and to give off a peculiar odor similar to the odor of burned hair. Coagulation can be produced while the albumin is cooled in ice water. The albumin is decomposed by the light. Lead-blackening gases are given off. Cystine and hydrogen sulphide are also decomposed. The coagulation and decomposition are produced almost entirely by the ultra-violet light not found in sunlight. Protoplasm is unstable in light of shorter wave-lengths than is found in sunlight. Life as we know it would be unstable in a world unprotected by an atmosphere at least as opaque as ours.

ALFRED DACHNOWSKI: *Plant Growth in Relation to Acid and Alkaline Solutions.*

A. P. MATHEWS: *The Nature of Irritability and the Action of Anesthetics.*

Confirming his earlier work, the author finds that the anesthetics act chemically, not physically, as generally supposed. By means of the method of computing valences in molecules, it is shown that all anesthetics have residual valences by which they may unite with protoplasm. Thus nitrous oxide has six valences, the oxygen having two free valences; the esters, alcohols, aldehydes have free valences on the oxygen; this is also true in the urethane group; in carbon monoxide, the free valences are probably on the carbon; in ether, on the oxygen; in chlorine compounds, on the chlorine; in bromine compounds, on the bromine; in carbon bisulfide and sulphuretted hydrogen, on the sulphur; in the cyanides and nitriles, on the carbon; in the terpenes, benzenes and aliphatic hydrocarbons some of the carbons are hexavalent. The ease of dissociation of the anesthetic from the protoplasm also points to a molecular union. All anesthetics probably unite with hemoglobin, forming molecular unions similar to oxyhemoglobin. The interpretation offered of irritability based on the work of the author, Tashiro and others, is as follows: The irritable compound in most protoplasm is a molecular union with oxygen. This is unstable like oxyhemoglobin, which passes easily to methemoglobin. When stimulated in a variety of ways it passes into firm union, oxidation taking place. This is at the basis of most cell syntheses. The anesthetics act by displacing the oxygen from its molecular union, just as CO displaces O₂ in oxyhemoglobin, the anesthetics uniting by their residual valences in molecular

union with the oxygen receptors. Such compounds can not be oxidized by shock, hence respiration is reduced; conduction which is analogous to an explosion wave of oxidation is blocked; irritability is lost; growth and synthesis stops.

H. C. GORE: *Note on the Volatilization of Sulphuric Acid when Used as a Desiccating Agent in High Vacuum.* (Lantern.)

H. C. GORE: *A Constant Temperature Humidor.* (Lantern.)

H. C. GORE: *Study of the Chemical Changes in the Banana during Ripening with Special Reference to the Transfer of Water from Peel to Pulp.* (Lantern.)

H. C. GORE: *Study of the Effect of Uranyl Acetate and Ammonium Molybdate on the Polarization of l-Malic and d-Tartaric Acids.* (Lantern.)

ARTHUR W. DOX and RAY E. NEIDIG: *Cleavage of Hippuric Acid by Molds.*

The formol-titration method of Sörenson was found admirably adapted to a study of enzymotic cleavage of hippuric acid. All of the mold species examined contained an enzyme capable of hydrolyzing 80 per cent. or more of the hippuric acid in the presence of toluol. The age of the culture (1 to 4 weeks) seemed to have little influence upon the amount of enzyme. The enzyme was produced in all cases in the absence of the corresponding zymolyte from the medium.

P. E. BROWN: *Bacterial Activities and the Rotation of Crops.*

GEORGE PEIRCE: *The Purification of the Esterase from Pig's Liver.*

The esterase is obtained by crushing pig's liver with sand, mixing with water and straining through cloth. The purification is accomplished by dialysis, half saturation with $(\text{NH}_4)_2\text{SO}_4$, rejection of ppt., complete saturation with $(\text{NH}_4)_2\text{SO}_4$, and dialysis of a suspension of this ppt. After filtration the solution will hydrolyze 200 times its weight (reckoned as dried material) of ethyl butyrate in 1 hour, the final acidity being $N/100$, the ethyl butyrate solution being about two thirds saturated ($N/28$).

The enzyme is strongly inhibited by NaF, the inhibition being due to an inert compound formed by the enzyme and the NaF. The amount of inhibition followed the mass law. A possible method of working out the maximum molecular weight of the grouping with which the NaF combined was indicated.

R. E. SWAIN and J. P. MITCHELL: *The Determination of Sulphur Dioxide in the Air.*

The sample of air is collected for analysis in a flask of about ten liters' capacity. The latter is fitted with a glass stopper carrying a dropping funnel and a short outlet tube. $N/100$ iodine solution (10 c.c.) and 150 c.c. of water are then added, and the flask and contents shaken vigorously for ten minutes. Stopper and fittings are rinsed off and removed, and $N/100$ arsenious acid added until only a faint brown color remains. The solution is finally rinsed into a titrating flask and the titration finished with starch as an indicator. Results on known amounts of sulphur dioxide indicate an error of less than five parts per million parts of air.

EDWARD KREMERS: *The Methyl and Methylene Ethers of Phenols Found in the Vegetable Kingdom and the Light which they Seem to Throw on Certain Phases of Plant Metabolism.*

The importance which formaldehyde or its hydration product, the methylene glycol, plays in plant metabolism is universally recognized. The minor rôle played by the other reduction products of carbon dioxide has been largely overlooked. The rational classification of the methyl and methylene ethers of the phenols, together with that of glucosidal compounds of the phenols, seems to throw a ray of light on the rôle which these two simple alcohols play in common with the simple sugars.

WM. MANSFIELD CLARK: *The Analogy between the Formation of "Eyes" in Emmental Cheese and Crystal Growth.*

A review of the literature reveals no conclusive evidence that the characteristic holes or "eyes" of Emmental cheese are localized at points of great bacterial growth. The alternative, that the eye-inflating, gas-producing bacteria are more or less generally scattered throughout the whole body of the cheese is confirmed by the comparison of the gas production of eye walls and of solid regions distant from eyes.

That the gas produced by bacteria in gels may separate at points distant from the colonies, and that this gas separates preferably where a pre-formed bubble is already found has been experimentally demonstrated. Instances are also cited to show that large bubbles grow at the expense of small.

The theoretical reasons are presented as well as the analogy between the formation of gas

bubbles and the growth of raindrops and solid crystals.

From these principles it is deduced that with a rapid gas formation in cheese the gas must necessarily tend to separate at many points, each more or less near to colony growth, while with a slow gas production the gas has time to find its way to points where it may separate from solution most advantageously and then continue to form accretions. It was found by using curd superficially stained with Congo red which outlined each curd particle in the cheese, that "Nissler" holes which are small and rapidly formed were situated both within and between curd particles, while normal eyes universally developed between the curd particles, points long ago described by Bachlor as "weak spots" favorable to eye growth.

F. ALEX. McDERMOTT: *Chemiluminescent Reactions with Physiologic Substances.*

The products of the alkaline hydrolysis of peptone and glue, done in the absence of oxygen, give a faint light when oxidized with strong alkaline hydrogen peroxide, and a somewhat brighter light when formaldehyde is added before the peroxide. Urin may be caused to give light in a number of ways, particularly upon the addition first of formaldehyde and then of alkaline hydrogen peroxide. The cause of the latter phenomenon is not known.

F. ALEX. McDERMOTT: *A Note on an "Oil Nut," Pyralia pubera (Buffalo nut).*

The fruit of *Pyralia pubera* contains about 27 per cent. of oil. The cause of the astringent taste was not located.

O. RIDDLE: *On the Absorption of Water by Egg Yolk from Egg Albumen.*

SECTION OF INDIA RUBBER CHEMISTRY

D. A. Cutler, *chairman*

Dorris Whipple, *secretary*

CHARLES P. FOX: *Wild Lettuce Rubber.*

Descriptive notes concerning two well-known Compositæ common throughout central United States and suggesting their possible use as a source of *crude rubber* and *drug*. Characteristics of this rubber, the by-products and methods of obtaining them, are given.

CHARLES P. FOX: *An Adopted Wiley Extractor for Rubber Extractions.*

Author notes the unsatisfactory service given by the usual forms of extractor used in raw rubber extractions. Paper describes a simple, economical and efficient apparatus for this work.

JOHN B. TUTTLE: *The Sampling of Rubber Goods.*

Attention is called to the importance of obtaining proper samples for chemical analysis. Illustrations in support of the argument are given; also precautions regarding care of samples, and a table of the minimum amounts required by the Bureau of Standards for physical and chemical tests.

L. G. WESSON: *Preliminary Note on a New Method for the Direct Determination of Rubber.*

To avoid errors due to variations in the composition of the derivatives of rubber heretofore used in its analysis, the method outlined attempts to estimate rubber by burning its nitrosite, and subsequently weighing the carbon dioxide formed. For the expeditious combustion of the nitrosite, an electric combustion furnace has been developed. Some results for rubber, on both raw and vulcanized samples, are given. The method possibly offers an opportunity for the simultaneous determination of sulphur of vulcanization. Further work is under way.

DIVISION OF PHARMACEUTICAL CHEMISTRY

B. L. Murray, *chairman*

F. R. Eldred, *secretary*

H. T. GRABER: *Observations upon the Assay of Digestive Ferments.* (Second paper.)

A. ZIMMERMAN: *Blood Fibrin in the Assay of Pepsin.*

FRED KLEIN: *Some New Reactions of Peptones and Enzymes.*

JOSEPH P. REMINGTON: *The United States Pharmacopœia—Progress of the Ninth Revision.*

Changes in the method of revising the book as compared with the revision of previous pharmacopœias. The influence of the Food and Drugs Act in obtaining information from manufacturers about their products. Improvements in preparing the text.

ATHERTON SEIDELL: *The Analysis of Thymol Capsules.*

ATHERTON SEIDELL: *The Riegler Method for the Determination of Thymol.*

F. O. TAYLOR: *Interpretation of the U. S. P. Assay Processes.*

This paper deals with the possibility of different interpretations of the assay methods for alkaloidal drugs and their extracts as given in the U. S. P., with particular reference to some specific instances where discrepancies have occurred because of a

different understanding of the assay processes by various chemists. It directs special attention to the difficulties involved in transferring the alkaloid from an aqueous solution to one in chloroform or ether, or from these solvents to an acid aqueous liquid as is regularly done in these assay processes. Also some of the peculiar difficulties involved in the assay of the mydriatic drugs, and differences liable to be caused by variations in the method and time of shaking aqueous liquids with the immiscible solvents, and in the final titration of the alkaloidal residue where this volumetric method is used. Experimental proof is also submitted of the liability to such variations when these processes are applied by different men.

W. D. McABEE: *Patent Medicine Ethics.*

W. A. PEARSON: *Ergot.*

L. E. SAYRE: *The Recovery of Alkaloids when Precipitated by Alkaloidal Reagents.*

There is, of necessity, an appreciable loss of alkaloid in any analytical process designed for its recovery. A complete recovery is practically impossible. In certain analyses consisting of a separation of alkaloids from dilute solutions, it is frequently desirable to precipitate them by well-known alkaloidal reagents, as a first step in the separation and estimation. The question arises: What is the probable loss of alkaloid by such a preliminary step and subsequent treatment for recovery?

Operating upon four well-known alkaloids with different procedures for their recovery, certain data were obtained and tabulated. The authors feel this may be considered as a fair average of loss, this opinion being based upon a much larger number of experiments than are tabulated.

F. P. SUMMERS and CHAS. EARLE: *Oxysulphobenzide, its Presence in Commercial Phenolsulphonates.*

In applying the routine tests for phenol upon the various phenolsulphonates of the market, there was obtained an ether-soluble residue which in some of its properties resembled phenol. On further examination it proved to be oxysulphobenzide. This impurity has been found in quantities of 0.1 to 0.4 per cent. It is a white crystalline body melting between 215° and 231° C.

F. P. SUMMERS and H. MCCAUSLAND: *Boldine, an Alkaloid from *Peumus Boldus*.*

A brief résumé of the literature on the chemical constituents of *Peumus boldus* is given. The method of producing the alkaloid boldine is described. It is a white crystalline body melting at

185° C. (corrected). Boldine hydrobromide is also described. It is a white crystalline body melting with decomposition at 240° C. Tables of reactions with the various alkaloidal precipitants and other reagents are given. An empirical formula is promised for a subsequent paper.

F. A. MILLER and J. W. MEADER: *The Alkaloidal Content of Individual Plants of *Datura stramonium*, *D. tatula* and other Species and Varieties.*

F. A. MILLER and R. N. REED: *A Study of American-grown *Belladonna*.*

R. N. REED and W. J. RICE: *The Stability of Tinctures and Fluid Extracts of *Belladonna*.*

A. B. DAVIS: *Improvements in Mercury Gas-Regulators.*

G. H. MEEKER and E. L. MAINES: *Prevention of Emulsification in Extractions by Immiscible Solvents.* (Second paper.)

FRANK R. ELDRED: *An Automatic Apparatus for the U. S. P. Pepsin Test.*

W. O. EMERY and S. PALKIN: *Crystalline Periodides of Antipyrine.*

H. T. GRABER: *Laboratory Studies on Malt Extract.*

C. H. BRIGGS: *The Determination of Uncombined Hydrochloric Acid in Solution Ferric Chloride.*

The total chlorides are determined by titration with silver nitrate in acid solution. The combined chlorides are calculated from the amount of iron present and subtracted from the total chlorides, giving the amount of free hydrochloric acid.

O. A. BEATH and EDWARD KREMERS: *An Oleoresin of *Pseudotsuga taxifolia* (Lam.) Britton.*

A sample of this oleoresin was obtained through the cooperation of the Forest Products Laboratory. Its examination was undertaken with a view of throwing more light, if possible, on the possible sources of the so-called Oregon balsam. The physical and chemical constants of the oleoresin, the volatile oil and the resin were ascertained so far as the limited amount of material permitted.

EDWARD KREMERS: *Some Aspects of Pharmacopœial Revision.*

The conflict between the pharmacopœia as a codex and a scientific treatise is unnecessarily emphasized by the present mode of revision. This conflict and the attitude of certain critics is illustrated by means of data that have come to the attention of the writer in the work in which he is more particularly engaged. The revision of the

U. S. Pharmacopœia in the future should be carried out by a method of publication more in harmony with modern practise.

DIVISION OF INDUSTRIAL CHEMISTS AND CHEMICAL ENGINEERS

G. D. Rosengarten, *chairman*

M. C. Whitaker, *secretary pro tem.*

CARL A. NOWAK: *The Training of the Fermentologist.*

The constant demand on the part of the fermentation industries for university-trained men offers a profitable field of work for the young chemist. The future fermentologist should possess considerable specialized training in analytical and research work pertaining to the raw materials entering into these industries. The paper discusses the manner in which such scientific training is provided abroad, in England and on the continent, and points out that while, as yet, there is no such provision made at any of the universities in this country it does not seem improbable that with the financial assistance of the men interested in the fermentation industry this could easily be accomplished.

JOHN SAMUEL STAUDT: *The Training of the Technical Chemist.*

The paper makes a survey of what the training of the technical chemist is at present, and points out what the training of the technical chemist ought to be. A comparison and analogy of the training of the technical chemist is made with that of the civil, mechanical and electrical engineer. The paper reviews technical education as it exists in England, Germany and America, and makes a comparison of the methods in vogue.

In discussing what the training of the technical chemist ought to be, the writer points out what the world demands, and in what respects our present system of technical education is faulty. It advocates a more thorough study in the liberal arts and more cooperation between the university, or technical institution and the industries, favoring a permission of technical students to work for the cooperations during their summer vacations.

Graduate study as a direct continuation after graduation is not favored, but is recommended after a year or two in practise.

FRANCIS C. FRARY and M. GORDON MASTIN: *The Determination of Zinc in Treated Ties.*

Over nine million railroad ties were preserved by treatment with chloride of zinc in 1911. Prac-

tically all these are bought under the specification that they must contain half a pound of zinc chloride per cubic foot. The method of determining the zinc after decomposing the wood of the sample with nitric and sulphuric acids, as generally used, is slow and troublesome, and with red oak ties it appears to be impossible to destroy all the organic matter. This prevents the precipitation of the zinc, and the result is that analysis of such ties will show less than half of the zinc actually present.

The authors have worked out a method of decomposing the wood by fusion with caustic potash and a little saltpeter, which removes every trace of organic matter, and leaves the solution in such a condition that the zinc can be determined by titration with potassium ferrocyanide solution. Accurate results are easily and quickly obtained. Check determinations with shavings from untreated red oak ties, to which known amounts of zinc chloride solution were added, showed that the recovery of the zinc was practically complete.

A. M. MUCKENFUSS: *Preliminary Report upon a Practical Accelerated Test for Paints and Varnishes.* (Lantern.)

S. W. PARR: *Coal Ash.*

EDWARD GUDEMAN: *Analyses of Glucose and Starch Sugars.* (See Agricultural and Food Chemistry.)

HORACE C. PORTER and GUY B. TAYLOR: *The Specific Heat of Coal and its Relation to the Presence of Combined Water in the Coal Substance.*

The specific heats of four coals were determined by the method of mixtures with an accuracy of 2 to 3 per cent. The values for dry coal ranged from 0.261 to 0.315, according to the type of coal, within the temperature interval 28°-63° C. A Wyoming sub-bituminous, of 11 per cent. moisture showed a value of 0.370. At higher temperatures the specific heats were higher.

Comparison of the specific heats of dried and undried coal shows the specific heat of the water present to be about 0.72 and indicated thus that the water is present in a state other than that of free superficial moisture. The facts also that heat is developed by the action of water on dry or partially dried coal, and that coal containing water has a vapor pressure considerably below the normal aqueous tension of free water, tend to support the theory of the presence of combined water, although the low vapor tension may possibly be explained also as due to capillarity or adsorption.

OTTO M. SMITH: *Concrete Analysis.*

CHARLES L. PARSONS: *Fuller's Earth—Its Occurrence, Mining, Preparation, Use and Recovery.*

CHARLES L. PARSONS: *The Uranium, Vanadium and Radium Situation.*

C. E. WATERS: *A Simple Gasoline Gas Generator for Sulphur Determinations.*

R. S. MCBRIDE and E. R. WEAVER: *The Determination of Sulphate in Ammonium Sulphate with Special Reference to the Determination of Sulphur in Illuminating Gas.*

Four methods for the determination of sulphate in ammonium sulphate solutions such as are obtained in testing of illuminating gas, have been examined and the proper conditions for their use are described. One volumetric and one turbidimetric procedure are given, both of these being rapid and fairly precise methods suitable for general use. It is suggested that the rapid turbidimetric procedure may be used in cement, rubber, iron and steel and other analytical work where an accuracy of one per cent. of the sulphur present is satisfactory.

R. S. MCBRIDE and E. R. WEAVER: *The Determination of Sulphur in Illuminating Gas.*

The several forms of apparatus commonly used for the determination of sulphur in illuminating gas have been tested, giving particular attention to the Referees', the Hinman-Jenkins and the new form Elliott apparatus. These three are all capable of giving satisfactory results if properly operated, three important conditions for correct results being: (1) a proper rate of burning the gas, (2) a strongly alkaline atmosphere in the condenser chamber and (3) the elimination of all rubber connections between the burner and condenser.

General Discussion of Industrial Problems

A general experience meeting was held on Thursday morning, in which members discussed general industrial problems.

DIVISION OF FERTILIZER CHEMISTRY

Paul Rudnick, *chairman*

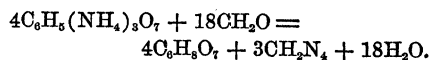
J. E. Breckenridge, *secretary*

ANDREW J. PATTEN and WM. C. MARTI: *A Simple Method for Preparing Neutral Ammonium Citrate Solution.*

This method is based upon the reaction observed

¹Liebig's *Annalen der Chemie*, 1901, 319, 76.

by Schiff¹ to take place between formaldehyde and ammonium salts, resulting in the liberation of the acid and the formation of hexamethylenetetramin, according to the following equation:



It depends upon the determination of the exact amount of ammonia and anhydrous citric in the solution and establishes the ratio for the neutral solution as 1:3.765.

J. W. TURRENTINE: *A Survey of the Menhaden Industry.*

DIVISION OF PHYSICAL AND INORGANIC CHEMISTRY

S. L. Bigelow, *chairman*

R. C. Wells, *secretary*

S. L. BIGELOW: *Some Surface Tension Phenomena.*

O. F. TOWER: *The Oxygen Content of the Atmosphere.*

D. A. MACINNES: *The Role of Adsorption in the Catalysis of the Decomposition of Hydrogen Peroxide by Colloidal Platinum.*

O. L. BARNEBEY: *Detection of Cyanides in the Presence of Ferri-, Ferro- and Sulpho-Cyanides.*

When hydrogen sulphide is passed into a dilute ammoniacal copper solution a black precipitate of copper sulphide or a brownish black coloration is imparted to the solution, depending upon the amount of copper present. A cyanide in ammoniacal solution will bleach such a suspension or coloration. By this bleaching a cyanide can be detected. By the amount of standard copper solution bleached an approximate determination of cyanides can be made in the presence of ferri- and sulpho-cyanides. Ferro-cyanides interfere with estimation, but not detection.

ALBERT P. MATTHEWS: *A Method for Determining the Number of Valences in Molecules.*

O. L. BARNEBEY: *The Permanganate Determination of Iron in the Presence of Chlorides.*

The Reinhardt-Zimmerman method for the determination of iron gives the correct result. Sulphuric acid with manganese sulphate, strong solutions of certain sulphates, certain phosphates with phosphoric acid and cerium sulphate with sulphuric acid can be substituted for the usual "manganese solution" employed to prevent the action of hydrochloric acid during titration. Theories proposed for the explanation of the rôle of these "preventive solutions" are discussed.

EDWARD C. FRANKLIN: *Some New Ammonio Salts.*

HERBERT N. MCCOY: *The Alpha-ray Activity of a Layer of Radioactive Solid as a Function of its Thickness.*

HERBERT N. MCCOY: *The Periods of Transformation of Uranium and Thorium.*

ARDEN R. JOHNSON: *A Theory of the Origin and Continuance of Optical Activity in Nature without the Assumption of an Asymmetric Form of Energy or "Vital Force."*

JAMES E. EGAN and CLARENCE W. BALKE: *Atomic Weight of Yttrium.*

W. E. RUDER: *The Intergranular Cement in Metals.*

An investigation is made of the "cement" material between the grains of an iron-silicon alloy of about 4 per cent. Si content. It was found that this material gave exceedingly large grains under the proper conditions of anneal. These grains were separated in two ways: (1) by heating to near the melting point in H and (2) by electrolysis in a solution of $K_2Cr_2O_7$ (as anode). The first process merely weakens the grain boundaries, which are again reverted to their original strength by firing in a diluted hydrocarbon atmosphere; the second process causes the grain to actually fall apart. From these experiments it is held that the great strength of the intergranular boundaries is due to the presence of certain foreign materials, and not alone to the grain substance in the amorphous phase.

WILLIAM D. HARKINS, H. M. PAINE and R. D. MULLINIX: *The Intermediate Ion Hypotheses and the Solubility of Salts of Higher Types.* (Lantern.)

STUART J. BATES: *The Significance of the Exponent in Storch's Equation.*

For di-ionic electrolytes the exponent in Storch's equation, $C_i^n/C_u = K$, has the significance

$$n = 2 \frac{d\pi_i / dC_i}{d\pi_u / dC_u}$$

where C_i and π_i are the concentration and the osmotic pressure, respectively, of the ions and C_u and π_u those of the undissociated molecules. From freezing point and conductance data it is possible to calculate the osmotic pressure of the ions and also that of the undissociated molecule as a function of the concentration. For KCl from 0.05 N to 0.5 N the osmotic pressure of the ions is 4 to 5 per cent. less than that calculated from

the gas laws, while that for the undissociated molecules is 30 to 45 per cent. greater.

STUART J. BATES: *The Calculation of Equivalent Conductance at Infinite Dilutions.*

A mathematical analysis of the methods employed by Kohlrausch and by Noyes for calculating the equivalent conductance at infinite dilution (Λ_0) shows that these assume that the expression for the "ionization constant" $(C\gamma)^2/(1-\gamma)C$ becomes zero at zero concentration. A method is developed based upon a consideration of the exponent in Storch's equation (cf. above abstract) which sets limits between which the value of Λ_0 must lie. A graphic empirical method for determining Λ_0 values was also developed. In general the values thus obtained lie within, while those calculated by Kohlrausch lie without the theoretical limits. The final adjusted Λ_0 values are smaller than those generally employed, for un-univalent salts by about 0.4 per cent., for uni-bivalent salts about 0.7 per cent. and for bi-bivalent salts about 1.7 per cent.

HARRY N. HOLMES: *Electrostenolysis.*

ARDEN R. JOHNSON and B. W. HAMMAR: *Design for Specific Heat Apparatus (Electrothermal).*

J. CULVER HARTZELL: *The Relation of Geochemistry to Proposed Standard Types of Potable Waters.*

The author considered the geochemistry of waters and distinguished between voluntary or esthetic tolerance and involuntary or human system tolerance. He also considered bacterial count and put emphasis on *B. coli*. Comparative tables from the sanitary and geochemical standpoints were given. The author recognizes the impracticability of standard types of potable waters for universal application; but is strongly impressed with the practicability and necessity of regional standard types to which all municipalities could and should bring their domestic and industrial supplies. Cincinnati, New Orleans and Fargo were cited; the latter showing the most striking results from a most difficult water. Regional types of standard waters were proposed.

E. H. ARCHIBALD: *The Teaching of Quantitative Analysis.*

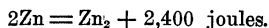
J. W. TURRENTINE: *The Structure of the Trinitride Radical.*

R. H. BROWNLEE and R. H. UHLINGER: *Demonstration of the Zeiss Gas Interferometer for the Estimation of Minute Traces of Gases.*

JOEL H. HILDEBRAND: *The Constitution of Certain Liquid Amalgams.*

The formula given in a previous publication for the E.M.F. of liquid amalgam concentration cells was integrated exactly and applied to those amalgams which have thus far been investigated with sufficient accuracy, with the following results:

1. The results of E.M.F. and vapor pressure measurements with zinc amalgams are shown to be in very good agreement. In the light of the vapor-pressure law this is shown to indicate that in these amalgams the zinc exists uncombined with the mercury but associated according to the equation



The equilibrium constant of this reaction, and accordingly the degree of association at different dilutions, is given, and shown to be in excellent agreement with the measurements of E.M.F. and its temperature coefficient.

2. With lead and tin amalgams the same formula relating E.M.F. with constitution as was deduced for zinc is shown to apply, but with a different constant corresponding to a much greater degree of association.

3. The measurements on thallium amalgams are shown to correspond to the formula derived for the cases where combination exists between the solute and the mercury. The compound indicated in this case is TlHg_2 , which gives evidence of breaking up into some simpler compound, probably TlHg , in the more concentrated amalgams.

4. Indium amalgams, on applying the same formula, seem to contain InHg_2 , breaking down into some simpler compound in the more concentrated amalgams.

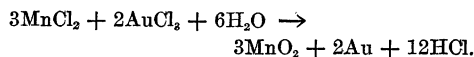
5. Cadmium amalgams seem to contain both free Cd and the compound CdHg , in proportions depending on the law of mass action. The E.M.F. formula is derived for this case and shown to give the observed values of E.M.F. very closely. The per cent. of the cadmium as CdHg is calculated. In the most dilute amalgams two thirds of the cadmium is present as CdHg .

The validity of the formula is discussed and its value is pointed out in determining the constitution of metallic solutions and as a means of investigating the present unknown factors influencing the vapor pressure of solutions.

ALBERT D. BROKAW: *The Precipitation of Gold by Manganous Salts.*

Ordinary solutions of gold chloride are rather strongly acid, and from such solutions manganous salts do not precipitate gold even when high con-

centrations are used and the solutions kept boiling for some little time. When the acidity is sufficiently reduced manganese dioxide and gold are precipitated simultaneously, probably according to some such equation as follows:

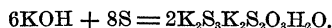


A suggested explanation is that minute amounts of MnCl_4 are formed and this substance hydrolyzes when the acidity falls below a certain concentration, giving a precipitation of hydrated manganese dioxide. In more acid solution the acidity suppresses hydrolysis and no reaction takes place.

HANS MANNHARDT: *Tetravalent (?) Nitrogen and Di-Valent (?) Chlorine.*

H. V. TARTAR: *On the Reaction of Sulphur with Potassium Hydroxid in Aqueous Solutions.*

Methods have been worked out in connection with some investigations on the lime-sulphur spray which enable one to ascertain the primary reaction taking place between sulphur and any of the hydroxids of the alkali metals in aqueous solution. Experiments were tried using sulphur and potassium hydroxid in different amounts and in solutions of varying concentration. The results show that the primary reaction of sulphur with potassium hydroxide in aqueous solution is as represented by the following equation:



FRITZ FRIEDRICHS: *Binary Systems. I. Hydrazine, Ammonia.*

In this research, which constitutes the first chapter of an extended investigation of the nature of supplementary valence, the relation of ammonia to hydrazine, the next member of the hydro-nitrogen series, has been studied.

A dilatometric study of the purest hydrazine (shown by analysis to contain 100 per cent. N_2H_4 and subsequently distilled twice in vacuo over pure barium oxide directly into the dilatometer) showed a unary melting point of $+3.3^\circ$, indicating a very high degree of purity. This pure hydrazine forms no compounds with anhydrous ammonia. The presence of the slightest trace of water, however, leads to the formation of mixed crystals. The complete pressure, temperature, concentration diagram of this system was investigated. The three-phase surface shows a pressure maximum of 630 mm. at -19° , the solubility line a eutectic at -81° and a concentration of 85 per cent. NH_3 .

FRITZ FRIEDRICH: *Binary Systems. II. Ammonium Trinitride, Ammonia.*

Ammonium trinitride forms with ammonia three compounds containing, respectively, 1, 2 and 4 molecules of ammonia. All of these ammonates show metastable melting points. The inversion point of the diammonate into saturated solution of the anammonous salt is at -8.5° , that of the tetrammonate into saturated solution of the diammonate is at -71° , and the eutectic is at -87° with a concentration of 75 per cent. NH_3 . The remarkable circumstance that the first two of these ammonates $\text{NH}_4\text{N}_3 \cdot \text{NH}_3$ and $\text{NH}_4\text{N}_3 \cdot 2\text{NH}_3$ were never observed to exist together seems to point toward a tautomerism of hydronitric acid. It is not impossible then that the compound may under certain conditions have the older ring formula and under others the chain formula independently suggested by Angeli, Thiele and Turrentine.

FRITZ FRIEDRICH: *Binary Systems. III. Ammonium Bromide, Ammonia.*

In extension of the work of Roozeboom, who studied a limited portion of this system, ammonates containing, respectively, 1, 3, 6, 9 and 18 molecules of ammonia were shown to exist and the boundaries of their fields were established. All of the three ammonates with the exception of the tri- and the octodecammonate possess metastable melting points. The stable melting points of the two just named were found at $+9.5^{\circ}$ and -79° , respectively. Inversion points were found for the transition of $\text{NH}_4\text{Br} \cdot \text{NH}_3$ into saturated solution of anammonous salt at $+36^{\circ}$, of $\text{NH}_4\text{Br} \cdot 3\text{NH}_3$ into saturated solution of $\text{NH}_4\text{Br} \cdot \text{NH}_3$ at $+6.5^{\circ}$, of $\text{NH}_4\text{Br} \cdot 6\text{NH}_3$ into saturated solution of $\text{NH}_4\text{Br} \cdot 3\text{NH}_3$ at -69.5° , of $\text{NH}_4\text{Br} \cdot 9\text{NH}_3$ into saturated solution of $\text{NH}_4\text{Br} \cdot 6\text{NH}_3$ at -72° . The zone of the saturated solution of the triammonate shows a pressure maximum of 1,600 mm. at $+4^{\circ}$.

As may be seen from the foregoing examples the ammonates are entirely analogous with the hydrates contrary to the recently expressed opinion of Fritz Ephraim (*Zeitschr. phys. Ch.*, 81: 539-542, 1913), who on the basis of an investigation upon the ammonates of certain metallic salts (all of which happened to be insoluble in liquid ammonia) believed that he had discovered a fundamental difference between ammonates and hydrates, since the former apparently showed no inversion points or definite fields of existence.

CHARLES JAMES and E. H. HOLDEN: *Sulphates of Yttrium.*

W. A. NOYES: *Nitro-Nitrogen Trichloride an Electromer of Ammono-Nitrogen Trichloride.*

Ordinary, or ammono-nitrogen trichloride hydrolyzes to ammonia and water. An attempt is being made to secure nitro-nitrogen trichloride, which should hydrolyze normally to nitrous acid and water. To prepare the compound a mixture of nitrosyl chloride, NOCl , and phosphorus pentachloride is passed through a porcelain tube heated to 1000° - 1200° and containing a little platinum. A mixture of gases which can be condensed with a freezing mixture or by cooling with liquid air is obtained. The analyses indicate the presence of a trace of phosphorus oxychloride, a small amount of silicon tetrachloride, nitrosyl chloride, free chlorine and, in some cases, about ten per cent. of nitro-nitrogen trichloride. C. L. PARSONS,

Secretary

SOCIETIES AND ACADEMIES

THE AMERICAN PHILOSOPHICAL SOCIETY

MR. HERBERT E. IVES read a paper before the society on April 4, 1913, on "Illuminants—Present and Future." Modern illuminants are interesting as applications of radiation laws and the science of spectroscopy. The earlier illuminants, such as oil, the candle, the gas flame, the carbon filament electric lamp, are approximations to black-body radiation. Increased efficiency is with these dependent on the attainment of very high temperatures. More recent illuminants possess higher efficiency owing to selective radiation, in accordance with Kirchhoff's law for selectively reflecting or transmitting bodies. Thereby their radiation is relatively more intense in the visible spectrum. This is the case in the Welsbach mantle and the tungsten filament. Another class of selective radiation is met in non-temperature or luminescent sources, where isolated spectrum lines or bands are the source of the light. The mercury vapor lamp falls in this class. The illuminants of the future will be marked by greater efficiency, which may be attained through selective radiation. Whether this will be brought about by the use of gaseous energy or electrical, or through little understood chemical processes such as the firefly exemplifies, is of course as yet unknown. Calculations show that if there were none of the present enormous losses in transforming the energy of coal into light something like 1,200 times as much light could be obtained for the same consumption.