SCIENCE

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FRIDAY, MARCH 2, 1906.

CONTENTS.

MSS. intended for publication and books, etc., intended for review should be sent to the Editor of SCIENCE, Garrison-on-Hudson, N. Y.

THE NEW ORLEANS MEETING OF SECTION C OF THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE AND OF THE AMERICAN CHEMICAL SOCIETY.[1]

THE meetings were held in the chemical laboratory of Tulane University. In the absence of C. F. Mabery, the vice-president, Section C was presided over by L. P. Kinnicutt.

At the first meeting the minutes of the preceding meeting at Philadelphia were read by the secretary, Charles L. Parsons. J. H. Long was elected a member of the council of the association, Charles H. Herty as a member of the general committee, W. J. Gies as a member of the sectional committee and C. E. Waters as press secretary.

J. H. Long read the report of the committee on tax-free alcohol for manufacturing purposes. This has already appeared elsewhere in SCIENCE.

In the afternoon the retiring chairman of Section C, L. P. Kinnicutt, delivered an address on 'The Sanitary Value of a Water Analysis.' This has already been published in SCIENCE, January 12, 1906, p. 56.

The American Chemical Society was then called to order by President F. P. Venable. Harvey W. Wiley delivered an address on 'Some Important Problems in Agricultural Chemistry.'

The realm of agricultural chemistry was formerly supposed to be confined to examinations of soils and fertilizers. In late years, however, investigations of agricultural chemistry have extended far beyond the original confines. The term agricul-

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[1] December 29 to January 2.

tural chemistry no longer represents a kind of chemistry, but the field in which all kinds of chemistry are utilized.

It is true that there are many problems yet unsolved relating to the source of plant fertility and even to definitions. For instance, the chemists and botanists use the term plant food in a different sense, thus creating more or less confusion.

The chemist regards plant food as that which enters the plant from without and is utilized for its growth and development. The botanist does not regard water and carbon dioxide as plant food, but only as food materials, which do not become real foods until united by photosynthesis.

In this country another problem relates to the supply of potash, which it is possible may yet be obtained by grinding potash-bearing feldspars.

Another problem relates to the composition and nutrition of foods. This problem now occupies the attention of a great many agricultural chemists, who, perhaps, are known also as physiological chemists.

The realm of physical chemistry is important here, since most of the phenomena of plant growth rest upon the principles of physical chemistry. Agricultural chemistry also follows foods through their preparations, and supervises their purity and ascertains their nutritive value.

Agricultural chemistry also has occupied the field of technical chemistry in all the processes which utilize the raw material produced from the field, the forest and the farm. Thus the chemical problems of tanning, paper making, sugar manufacturing, etc., come within the domain of research of agricultural chemists of the present day.

It is thus seen that every department of chemical activity and research may be utilized for the advantage of agriculture.

Dr. Wiley was followed by Louis Kahlenberg, whose address on 'Recent Experimental Researches in Osmosis' will appear in the *Journal* of the society.

On Saturday morning Wm. L. Dudley delivered an address on 'Laboratory Designing and Construction.' His ideas on the subject were illustrated by plans for a chemical laboratory. James F. Sellers followed with an address entitled 'A Symposium on Chemistry Requirements in the South.'

C. A. Browne, Jr., told of 'Recent Developments in Industrial Chemistry in the South.'

The writer restricts his paper very largely to Louisiana. The developments in the fertilizer industry, manufacture of ice, preservation of wood, distillation of turpentine, tar, methyl alcohol, etc., from wood and the utilization of wood waste for the manufacture of ethyl alcohol by Claassen's process are briefly discussed. The utilization of cottonseed by-products in a number of new ways is alluded to, and reference is made to a new process for extracting oil from rice and the improvement of the rice by-products for cattle feeds. The remainder of the paper is devoted to a discussion of recent developments in the sugar cane industry, particular stress being laid upon the recent work in improving the varieties of sugar cane and in the utilization of the by-products of the sugar house—the bagasse and molasses.

The address of the retiring president of the society, F. P. Venable, was on 'The Growth of Chemical Research in the United States.' It will appear in the February number of the *Journal* of the society.

The reports of the secretary, editor and treasurer were next read. The membership of the society is now 2,919, a net gain of 244 members. A new local section has been organized in Iowa and also one in western New York. An application for a local section in Minnesota is pending.

During the year 197 papers were submitted for publication, only 33 of which were unsuitable for the *Journal*. Reviews on different branches of chemistry were published. The total number of pages in the *Journal*, including the 'Review of American Chemical Research,' was 2,361.

The treasurer's report showed the financial affairs of the society to be in a satisfactory condition.

The officers for 1906 are:

President—W. F. Hillebrand.
Vice-Presidents—The presiding officers of the local sections.
Secretary—Wm. A. Noyes.
Treasurer—A. P. Hallock.
Librarian—E. G. Love.

The report of the librarian was followed by the report of the committee on uniformity of technical analysis. This will appear in the February number of the *Journal* of the society.

At the meetings of the different sections the following papers were presented on Saturday:

PHYSICAL CHEMISTRY.

Louis Kahlenberg, chairman.

The Antimony-Tin Alloys: W. D. BANCROFT.

Reinders thought that antimony and tin formed two series of solid solutions and two compounds. It is now found that no compounds occur and that there are four series of solid solutions. The β crystals, counting from the antimony end, are unstable below 309°. The paper will be published in the *Journal of Physical Chemistry*.

Amorphous Sulphur: ALEXANDER SMITH and R. H. BROWNLEE. (By title.)

The Thermochemistry of Chemical Combination: J. W. RICHARDS.

The paper discussed the real heat representing chemical combining energy, and one conclusion was that in order to eliminate from the measured heat of combination all physical heat effects, the reaction should take place from solid constituents to the gaseous products; because if liquid or gaseous constituents are brought together, the heat evolved will contain their latent heats of fusion or vaporization, and if the product condenses to the liquid or solid state, the heat evolved will contain its latent heat of vaporization or sublimation. The real chemical heat of reaction is that of solid constituents to gaseous products at the absolute zero. The heat of reaction at any other temperature is then equal to

$$Q_T = Q_0 + T \quad (S_m \text{ constituents} - S_m \text{ products}),$$

where Q_T is the heat of the reaction at any absolute temperature T, Q_0 the true heat of chemical combination at the absolute zero, S_m the mean specific heat from absolute zero to T. Another way of expressing this is the well-known Helmholtz formula

$$Q_T = Q_0 + T\frac{dQ}{dT},$$

where the differential coefficient represents the *mean* variation of Q with changing temperature between absolute zero and T.

The paper further discussed the great thermochemical generalization that the heat of formation of salts taken to dilute solution is additive, and concluded therefrom that (1) a salt in dilute solution is in a condition closely analogous to the gaseous state, (2) that the phenomena of osmotic pressure also substantiate this view, (3) that since for this condition the first great generalization of the thermochemistry of chemical combination has been discovered, and applies with exactness, that, therefore, the state of being in dilute solution is without question the most uniform and complete state of chemical combination known, thus absolutely debarring any idea of dissociation in any sense whatever.

The paper concludes with a careful discussion and tabulation of the most probable values of the thermochemical constants of bases and acid radicals, on the arbitrary basis of hydrogen gas being zero.

The paper should be published in the *Journal* of the society.

On the Specific Inductive Capacity of Solutions of the Oleates of the Heavy Metals: LOUIS KAHLENBERG.

The Separation of Solutes from Solvents by Absorbing Media: F. K. CAMERON and J. M. BELL.

Examples of the separation of organic solutes (dyes) from water or from one another, their separation from inorganic substances, and the selective absorption of ionized products were given. The absorbing media principally used were blotting papers, cotton and soils. A specially interesting case on account of its wide practical significance, was the absorption of the base from blue litmus test papers or solutions, leaving the residue apparently acid. An important practical feature of such separations is the relative rates at which solutes move capillarily through the absorbing media. It was found that such movements followed an empirical law, $y^n = kt$, where y represents the distance through which the movement has taken place, t the time of movement and n and k constants depending on the nature of the substances used, although n approximated 2.3 in most of the cases to which the formula has so far been applied. While this formula appears to hold remarkably well when neither the distance nor time is large, it ceases to hold whenever one of the variables assumes any considerable magnitude as in the cases so far recorded in the literature. For instance, the movement of water in soils has generally been measured at intervals of many hours or days, and through secondary gravitational or possibly other effects this formula ceases to hold. For the study of separations, however, the formula gives promise of much usefulness.

Molecular Absorption: F. K. CAMERON and B. E. LIVINGSTON. (By title.)

The Absorption of Potassium by Soils: OSWALD SCHREINER and G. H. FAILYER.

The absorption of potassium by soils has been studied in a manner identical with that of the phosphate. As far as investigated the potassium absorption can be represented by the equation

$$\frac{dy}{dv} = K(A - y),$$

where K is a constant, A the maximum amount of potassium the soil can absorb under the conditions of the experiment, and y the amount it has absorbed when the volume v of potassium solution has passed through the soil. The removal by water of the absorbed potassium is rapid at first, but the concentration of the percolates soon reaches a constant value, although only a fractional amount of the absorbed potassium has been removed. As far as the observations have been made the solutions obtained by percolating a solution of potassium chloride through the soil have always been acid.

The Absorption of Phosphate by Soils: OSWALD SCHREINER and G. H. FAILYER.

In view of the importance of the subject to a proper understanding of the chemistry of the soil and of soil solutions, a systematic study of the behavior of several soil types toward different phosphates was made. The phosphate solution was percolated through the soil at a slow and constant rate in an apparatus especially designed for this purpose. The separate fractions were then analyzed for phosphate and thus the amount absorbed by the soil determined. The graphical representation of the results indicates that the soils are approaching a saturated condition for phosphate, as is shown by the fact that each curve is evidently approaching a horizontal asymptote. It has been found that these absorption phenomena are quite accurately described by the differential equation

$$\frac{dy}{dv} = K(A-y),$$

which is of the same form as the equation for a reaction velocity of the first order and other analogous processes. Integrating we get

$$\log (A-y) - \log A = -Kv,$$

where K is a constant, A the maximum amount of phosphate the soil can take up under the conditions of the experiment, and y the amount it has taken up when the volume v of the phosphate solution has passed through the soil. A may, therefore, be defined as the specific absorptive capacity of the soil for phosphate. This absorptive capacity for phosphate varies greatly in different soils, being most pronounced in the clays and loams as a rule and less so in the sandy soils. The solubility of the phosphate originally present in the soils was also determined by percolating water through the untreated soils in the above-mentioned apparatus. It was found that the concentration of the separate fractions of percolate was practically a constant for each of the soils studied. If this concentration is reduced through any cause, such as the absorption by plants or influx of rain water, the original concentration will be again restored by more of the phosphate of the soil entering into solution. If, on the other hand, the solution is somewhat stronger than the natural concentration for that soil through any cause whatever, such as the application of a soluble phosphate, the concentration is reduced by absorption to the original strength. This is strikingly shown by the absorption results with the first few hundred cubic centimeters of phosphate solution. This constancy in the strength of the soil solution, so far as phosphate is concerned, is further shown by the removal by water of the absorbed phosphate, which has been similarly investigated. It was found that the concentration of the separate percolates decreases rapidly until the concentration is reduced approximately to that of the original soil solution. This concentration of phosphate is then maintained with much persistence, although only a fractional amount of the absorbed phosphate has been removed, thus indicating that while the absorbed phosphate is apparently rendered insoluble, it is, nevertheless, slowly but constantly going into the soil moisture and is, therefore, available to plants.

Citric Acid: F. L. KORTRIGHT.

A discussion of various unsuccessful attempts to make anhydrous citric acid according to the method of Buchner and Witter, was followed by a description of two methods used in getting the equilibrium relations between citric acid and water. The cryohydric point of the monohydrate and water, the transition point of the monohydrate to the anhydrous acid, and the transition point of one form of anhydrous acid to another, have been determined. The work is to be continued.

The Action of Metals on Complex Cyanides in Aqueous Solution: G. McP. SMITH. (By title.)

Electrolysis and Endosmosis in the Study of Rock Decomposition: A. S. CUSHMAN. (By title.)

AGRICULTURAL AND SANITARY CHEMISTRY.

H. W. Wiley, chairman.

Filtration and Purification of the Mississippi River Water at New Orleans: J. L. PORTER. (By title.)

A Method for the Determination of Small Amounts of Copper in Water: E. B. Phelps. (By title.)

A Trade Waste Study: Copper Salts in Irrigation Waters: W. W. Skinner. (By title.)

The Availability of the Phosphoric Acid of the Soil: G. S. Fraps.

The various factors which influence the amount of phosphoric acid dissolved by solvents are considered—nature of the soil phosphates, solution of soil constituents thereby exposing more phosphoric acid, fixation by the soil, and availability of the dissolved phosphoric acid. These factors appear to exclude the use of water, carbonated water, one per cent. acetic acid and *N*/200 hydrochloric acid. Soils must be divided into different classes according to the solubility of their constituents.

There is a relation between the chemically available phosphoric acid and soil deficiency in phosphoric acid, according to pot tests on a number of soils. The action of the plant makes available a considerable amount of phosphoric acid. Cotton and cow peas have a higher solvent power than rice or corn, corn being very low. Though cow peas and cotton take up nearly equal quantities, the soil was deficient for cotton and not for cow peas, showing that cotton requires more. With a given amount of chemically available plant food, the soil may be deficient for one crop and not for another with higher solvent power or lower needs.

The Effect of Climate on the Composition of Cotton Seed: G. S. Fraps.

From observations during two seasons, meal from the western part of the state appears to be much richer in nitrogen than meals from eastern Texas. The climate of the former section is semi-arid. No close relation could be traced between the rainfall and distribution of the meal. Texas meal appears, on the average, to be richer than meals from other sections.

On the Presence in Soils and Subsoils of Substances Deleterious to Plant Growth: W. K. Cameron and B. E. Livingston. (By title.)

The Fermentation of Sugar-Cane Products: C. A. Browne, Jr.

In the first part of the paper the writer discusses the influence of the various enzymes of the sugar cane upon the composition of the juice. The action of invertase in windrowed cane, the coloration phenomena produced by oxydases, and the physiological importance of the oxydases and catalases in the matter of protection against microorganisms are briefly presented.

The second part of the paper is devoted to a description of a few typical fermentations produced by bacteria, yeasts and molds, in cane juices, syrups and molasses. Particular attention is paid to the different compounds, dextran, mannite, cellulose, chitine, fat, etc., produced by these organisms and the influence of these upon the composition of the cane products is discussed. The writer concludes by noting the bearing which several of these compounds, such as glycerol and acetyl-methyl-carbinol, have upon the physiology of certain fermentations.

The Quantitative Estimation of Salicylic Acid: W. D. Bigelow and W. L. Dubois.

This paper is an attempt to define as exactly as possible the conditions to be followed for the estimation of salicylic acid by extracting with organic solvents and comparing the color given by treating the extracted salicylic acid with ferric solutions, with solutions containing a known amount of salicylic acid. The errors most frequently made in the use of the method are pointed out and exact conditions for its use prescribed.

The results obtained on uniform samples by twelve collaborating chemists using miscellaneous methods and also using the method suggested by the writers, are given. It is demonstrated that with proper precautions results can be obtained which are reasonably accurate.

The Estimation of Hydrocyanic Acid in Cassava: C. C. MOORE. (By title.)

The Artificial Coloring Matter in Whiskey: P. H. WALKER and J. H. A. SCHREIBER.

A series of tests for artificial coloring matter in whiskey were described and a summary of results on a very large number of whiskies, both pure and artificially colored, discussed.

A Uniform Method for the Determination of Reducing Sugars: P. H. WALKER.

The same solutions and manipulations are used in the determination of both dextrose and invert sugar. The alkaline tartrate solution is the same as Soxhlet's; but the copper solution contains 40 grams of crystallized copper sulphate to 500 c.c. Adhering to the directions given, the values for varying amounts of dextrose and invert sugar were determined and a table prepared showing the weight of cuprous oxide, dextrose and invert sugar corresponding to each milligram of copper from 10 to 466.

The Extraction of Tanning Materials for Analysis: F. P. VEITCH and H. H. HURT. (By title.)

The Ripening of Oranges: W. D. BIGELOW and H. C. GORE.

This work is in connection with the systematic study being made by the writers, of changes that occur in fruit during its growth and ripening. The oranges increased in actual weight of total solids and sugars from the beginning to the full maturity of the fruit. At all stages of the growth of the fruit, the total sugars are divided about equally between reducing sugar and sucrose. The marc of the orange is formed very early in its history and remains constant in weight during its growth and development. The acids are also formed at an early stage and apparently increase gradually but almost imperceptibly.

Storage of the fruit at all stages of its development results in slight loss of total sugar, a marked increase of reducing sugar, and a corresponding loss of sucrose. The loss of total sugar noted above is to be explained as in the case of apples, by the consumption of reducing sugar as a result of the respiration of the fruit. The weight of marc remains practically constant and the weight of acid appears to decrease slightly on storage during the various stages of the development of the orange.

The Growth and Ripening of Persimmons: W. D. BIGELOW, H. C. GORE and B. J. HOWARD.

This paper is a partial report on the systematic study of the ripening of fruits which is being conducted by the writers. In the other fruits thus far studied, the quantity of tannin was so low as to preclude any deductions from the results obtained at various stages of their growth. The persimmon was selected largely because of its content of a relatively large amount of tannin.

The weight of the pulp increases steadily during the entire period of observation and a marked increase was also noted in the case of total determined solids, sugar and marc. The sugar was found to consist almost entirely of invert sugar. The amount of sucrose is apparently almost within the limit of analytical error. The percentage of acids is also very low. During a later portion of the period of observation, the tannin was found to decrease in proportion to the increase in the weight of the marc.

The results obtained by the writers prove beyond a doubt that the tannin is not decomposed and does not actually disappear in the ripening of the fruit, but that it is converted into an insoluble form within certain specialized cells. No evidence was found of the combination of tannin with any other body in the formation of this insoluble compound. It apparently goes into insoluble form without entering into combination with any other substance.

At each date of picking sub-samples were ripened in the laboratory as in the case of fruits previously studied by the writers. The changes occurring on storage were similar to but more rapid than those occurring in the natural ripening of the fruit. Decreases are found in the solids and sugar of the stored fruit while the weight of marc in the fruit is found to increase owing to the tannin becoming insoluble.

INDUSTRIAL CHEMISTRY.

S. W. Parr, chairman.

The Cotton Oil Industry of the South: DAVID SCHWARTZ.

An interesting account of some of the methods used in purifying cotton oil, illustrated by samples of the seed, the crude and purified oil and some of the by-products. This will appear in full in the March number of the *Journal* of the society.

A Comparison of Methods used in Determining Total Soluble Bitumen in Paving Material: L. AVERY. (By title.)

The Durability of Cement Plaster: E. H. S. BAILEY.

The material sold as cement plaster is made from the gypsum dirt, or 'gypsite,' which occurs throughout many of the states of the central west, in patches of a few score of acres, by heating in a kettle to drive off most of the water of crystallization. This material, mixed with sand, is used in the place of lime mortar for plastered walls. In addition to the calcium sulphate and water, it contains considerable calcium and magnesium carbonates, silica and oxides of iron and aluminum.

A peculiar case of disintegration of the plastered wall of a room in which there was a fan blower for ventilating and warming the building, was investigated. It was noticed that in the upper part of the room the plaster crumbled and fell. The analysis of the hard plaster and of that which had fallen showed that the fallen plaster contained about 2 per cent. of moisture, while the hard plaster contained 4.5 per cent. This would indicate that the air which was heated by passing over steam pipes as it came into the fan room, had its capacity for absorbing moisture so much increased that it removed the water from the plaster of the wall, and so the crystals of gypsum disintegrated, and the plastering fell.

(Published in full in the *Trans. Kans. Acad. Sci.*, Vol. XX.)

Note on Sampling and Analysis of Coal: A. BEMENT.

Laid stress on the need of painstaking care in preparing samples of coal for analysis, in order to obtain reliable results.

The Examination of Writing Inks: L. S. MUNSON.

The paper gave the results of examination of a number of writing inks, made for the purpose of determining the suitability of these inks for record purposes.

Standard Samples of Iron and Steel: J. R. CAIN.

A brief statement was made with regard to standard samples of iron and steel which can now be furnished by the Bureau of Standards at Washington, and charts showing analyses of these samples by different well-known chemists were exhibited.

A Study of the Lignites of the Northwest: G. B. FRANKFORTER and E. P. HARDING. (By title.)

A Description of Improved Apparatus and of a Modification of Drehschmidt's Method for the Determination of Sulphur in Illuminating Gas: E. P. HARDING. (By title.)

Notes on Typewriter Ribbons: A. M. DOYLE. (By title.)

The American Chemist and the Gas Industry: H. B. HARROP. (By title.)

On Saturday afternoon there was an excursion across the Mississippi to see the New Orleans Acid and Fertilizer Works at Gretna. In the evening there was a general reception of the association in the Palm Garden of the St. Charles Hotel. On Sunday morning some of the chemists visited a sugar plantation some miles from the city.

On Monday morning there was another session of Section C. In the absence of C. F. Mabery his address was read by Charles E. Coates. It was entitled 'The Composition of Petroleum from American Fields—Pennsylvania, Ohio, Texas, Kansas, Wyoming, Colorado, Kentucky and California.' It will appear in full in the March number of the *Journal* of the society.

S. W. Parr delivered an address on 'The Service Waters of a Railway System.' Numerous tests to determine the loss of efficiency due to scale having an average thickness of one eighth inch agree in showing approximately ten per cent. increase in fuel consumption. On the basis of a total annual cost for fuel of $1,500,000, and assuming the average condition of the locomotives as fifty per cent. better than the above the loss due to this cause aggregates $75,000. This expense is duplicated by another which would represent approximately the cost of overhauling and repairs chargeable directly to the presence of scale. We thus have a sum representing the annual interest on an investment at five per cent. of $3,000,000. This takes no account of accidents or disasters, due more or less directly to the use of poor water. At least five principal railway systems of the middle west have in operation, or are in process of installing, purification plants for the treatment of their service waters. This marks a decided advance over the condition of ten years ago, when in the same region no such plant was in existence.

Concerning treatment within the boiler itself, while this method is often applicable to stationary boilers, in the case of locomotives the construction and exigencies of service make such methods inadvisable.

The usual method of rating a water with reference to its scaling ingredients is no longer applicable. New types of water are now common, which involve entirely different properties, such as foaming and corrosion. For example, some twenty-five samples of water have been examined from Cairo to New Orleans on the lines of the Illinois Central Railway having less than fifty parts per million of scaling matter (three grains per gallon).

Two marked characteristics are present in these waters aside from their very low amount of scaling matter. One is the high content of organic matter and the other is the presence of free sodium carbonate. In general the first type includes the waters from streams or bayous and shallow wells, while the second characteristic is present in those samples from wells from 100 to 800 feet in depth, one well, indeed (at Hammond, La.), having a depth of 2,100 feet.

With these waters two problems, other than that of scaling, present themselves—first, corrosion, and second, foaming. A number of experiments were detailed, indicating the conditions which promote the corrosion of iron. As nearly as possible, the conditions existing inside a boiler were reproduced, using an autoclave, within which were placed vessels containing samples of iron submerged in various solutions and the whole maintained at 100 pounds steam pressure.

Briefly stated, the results showed active corrosion to occur in presence of organic material, especially the tannins, also when oxygen or carbon dioxide was generated with the steam, as well as with the well-known conditions where salts of calcium or magnesium nitrate or chloride were present. These results readily explain the cases of corrosion met with in these southern waters. The other difficulty, that of foaming, occurs in general when the alkalies of whatever sort are present to the extent of fifty grains and over per gallon. But this difficulty is greatly accentuated by the presence of free sodium carbonate and for the reason, as seems evident from experience, that the finely divided precipitate which results, in conjunction with the free alkali, are the chief elements in the promotion of foaming.

Along the same line is the explanation for foaming when the use of a water containing free alkali is followed by the addition of a turbid water, like that of the Mississippi River.

The very extended use for sanitary reasons in the regions farther north, of deep well waters has revealed the fact that this type of water having from three to fifteen grains per gallon of free sodium carbonate is distributed over very wide areas and brings into prominence their behavior when applied to locomotive use.

It is thus seen that the problems connected with railway service are altogether different from those that attend the use of stationary boilers. They involve no very profound chemical principles and perhaps on that account have received little attention, but the industrial importance of the matter is very great and if for no other reason the subject may be worth noting here as an illustration of an improved and more healthy state of affairs in the industrial world, which shows itself in giving attention to wastes and greater care in small economies. When we acquire, and there are many indications that we are attempting, the habit of looking after all possible wastes and losses from principle, the profits are more sure to look out for themselves.

This will appear in full in the *Journal of the American Chemical Society.*

W. D. Bancroft delivered an address on 'The van't Hoff-Raoult Formula.'

The apparent osmotic pressure depends on the molecular weight of the solute and on the heat of dilution. If the latter is zero, as at infinite dilution, the apparent and the theoretical osmotic pressures coincide. If the addition of one liter of solvent to one liter of a normal solution causes a heat effect of one gram calorie, the apparent molecular weight of the solute may be ten per cent. in error at 0°. In all cases in which there is a marked evolution of heat on diluting the solution, the apparent molecular weight will decrease with increasing concentration. Instances of this are sodium in mercury, resorcinol in alcohol, sulphuric acid, caustic potash, or cupric chloride in water. The abnormal behavior of sodium chloride in concentrated aqueous solution is due to another cause. The paper will be published in the *Journal of Physical Chemistry.*

After this the meetings of the sections were resumed.

BIOLOGICAL CHEMISTRY.

Wm. J. Gies, chairman.

Investigations on Salts of Casein: J. H. Long.

The Relation of Carbon Dioxide Excretion to Body Weight: G. O. Higley.

The Relation between Barometric Pressure and Carbon Dioxide: G. O. HIGLEY.

The Separation of Proteoses and Peptones from the Simpler Amido Bodies: W. D. BIGELOW and F. C. COOK.

The paper gives the results of the examination of several methods that have been employed for the purpose mentioned. It was found that the Sjerining method, employing a solution of tannin and sodium chloride, gave the most satisfactory results, but much better results could be secured by increasing the amount of both tannin and sodium chloride in the reagent. The maximum results were obtained when the proteid bodies were precipitated in a solution containing 15 grams of sodium chloride and 5 grams of tannin per 100 c.c.

The claim of earlier writers that an excess of tannin has a solvent effect on the precipitate was not confirmed, although solutions containing 7.5 grams of tannin per 100 c.c. were employed. It was found that when the precipitation and filtration were conducted at from 12° to 15° C. much more satisfactory results were obtained, and clear filtrations were much more readily secured than in the case of room temperature.

Attention is called to the fact that the precipitating power of various preparations of tannin is not quite uniform, and it is suggested that a uniform tannin be used in the prosecution of any particular investigation. It is also essential that correction be made for the nitrogen content of the tannin employed as reagent and that blanks be run with the reagent in order to determine the amount of nitrogen precipitated from the tannin of the tannin-salt solution. Attention is called to the fact that tannin undergoes fermentation and loses to a large extent its power of precipitating proteids. The reagent should, therefore, be kept in a cool place and for not more than a few days at a time.

The effect on a number of amido bodies of a solution containing 15 grams of sodium chloride and 5 grams of tannin was also studied. No precipitation was obtained with glycocoll, alanine, glutamic acid, aspartic acid, allantoin, asparagine, betaine, creatinine, glutamine, guanine, xanthine, hypoxanthine, leucine, diphenylamine, acetamide and sarcosine. Precipitates were obtained with creatine, trimethylamine and phenylenediamine. It is probable that phenylenediamine and trimethylamine do not occur in meat, but the latter is found in considerable quantity in fish and in beet root. The error occasioned by the partial precipitation of creatine may be corrected by determining creatine, beforé and after the precipitation with the tannin salt solution, by means of Folin's method for the estimation of creatine in urine.

The Influence of Salicylic Acid on the Excretion of Urea and Uric Acid, and a Comparison of the Mörner-Sjiqvöst and Braunstein Methods for Determining Urea: F. C. WEBER.

The Influence exerted by Chemical and Physical Agents on the Virulence and Speed of Development of Mouse Tumors: G. H. CLOWES.

The Effect of the Rays of Radium on Plants: C. S. GAGER.

Experiments of the writer show that the rays of radium and of other radioactive substances, such as radio-tellurium and thorium, act as a stimulus to the various life processes of plants. There are doubtless minimum, optimum and maximum points, depending upon the strength of the radium preparation, the distance and time of exposure, and the intervention of substances more or less opaque to the various rays. The quantitative determination of these points has not yet been made.

When seeds, either dry, or during the imbibition of water, are exposed to radium bromide of 1,500,000 and of 10,000 activity in a sealed glass tube, for twelve hours or more, germination and subsequent growth are retarded. If the same radium preparations are inserted in the soil in pots containing germinating seeds, there is a decided acceleration of germination and growth. In such plants there is a marked increase in the number and length of root-hairs.

When plants are grown under a bell-jar containing decaying radium emanation drawn from a hollow tube lined with Lieber's radium coating, germination and growth are either retarded, completely inhibited, or acceleratel, according to the amount of the emanation supplied, and the duration and distance of exposure.

When the stimulation is of such intensity as to accelerate growth, the rate of growth at first increases, and then gradually decreases until it falls below that of the control plants.

Marked anatomical changes are effected by exposure to the rays, the cross-section of the stem of a radiated plant, for example, showing no signs of cambium.

Respiration and alcoholic fermentation may be accelerated. By strong exposure chloroplasts in the cell take up a position similar to that assumed under intense sunlight, and eventually the radiated portion becomes etiolated.

It is hoped to be able still further to study the effect of the rays on cell activities by means of radioactive microscopic slides now being prepared at the writer's suggestion by Mr. Hugo Lieber, of New York. Grateful acknowledgment is here made of Mr. Lieber's liberality in supplying some $2,000 worth of radium preparations, without which these experiments would not have been possible.

Experiments to Determine the Effects of Radium on Minute Animals: L. Hussakof.

These experiments were intended primarily to show the influence, if any, of radium rays on the protoplasm of *Amœba proteus.* Other microorganisms (*Vorticella, Paramœcium,* etc.) were also subjects of experiment. Radium bromide preparations of 600, 1,000, 10,000 and 1,500,000 activity (in thin glass tubes) were used, and several celluloid rods covered with Lieber's 'radium coatings' of 10,000 to 25,000 activity were also employed. The radium container was held in the water within from 1 mm. to 3 mm. of the organism under observation.

Under these conditions no visible effects were produced, by even the strongest radium preparations, during periods of observation of about an hour. The water surrounding the animal may have prevented radiant effects.

The Effects of Intravenous Injection of Radium Bromide in Dogs: R. B. Opitz and G. M. Meyer.

The paper dealt principally with effects on circulation and respiration. Light ether narcosis was employed. With radium bromide of 240 and 1,000 activity there was a marked rise in blood pressure, caused by a general vaso-constriction, followed by a marked decrease in the frequency of the heart, causing fall in pressure. These effects are the same as obtained with pure barium bromide. With radium bromide of 10,000 activity there was a much less noticeable initial vaso-constriction, and the short forcible contractions of the heart which caused the pressure to rise suddenly in jerks beyond any ordinary level, are now succeeded by slow pulsations. The blood pressure thus remained below normal. A moderate decrease in the frequency and depth of respiration was noted.

The Radioactivity of the Organs of Dogs after Administration of Radium Bromide: G. M. Meyer.

The organs were incinerated in a porcelain dish and tested for radioactivity by means of a quadrant electrometer. With injections of radium bromide of 240 activity only the blood was radioactive. If injections are made for several days and time is given for the radium to be eliminated, the blood is no longer active, though the kidneys, urine and feces are. With radium of 10,000 activity most of the organs were radioactive. There was considerable salivation and the saliva was active. Though the radium is excreted through the kidneys and intestines, the latter do not become radioactive.

Experiments to Determine the Influence of Radium Bromide on Protein Metabolism in Dogs: W. N. BERG and W. H. WELKER.

The experiments are being carried out on dogs in nitrogenous equilibrium. Radium bromide preparations of 240, 1,000 and 10,000 activity have been employed. One animal (6.6 kilos) has been fed 1.100 gms. 240 activity, 0.250 gm. 1,000 activity, and 0.125 gm. 10,000 activity in small amounts daily (during twelve days), without causing any gross symptoms, except diarrhœa during the period of administration of the preparation of 240 activity with its large content of barium. Proteid metabolism did not appear to be materially affected. Total sulphate (SO_4) in the urine was markedly increased, especially during the period following the administration of the preparation of highest activity, and when diarrhœa as well as constipation was entirely absent.

In control experiments with barium bromide, much larger quantities *per os* (as much as 0.5 gm. daily to a dog weighing only 4.5 kilos) were without any gross symptoms whatever. In the case of barium, also, proteid metabolism was practically unaffected by the quantities used. The quantity of total sulphate in the urine, unlike the result with radium, appeared to be practically unaffected by the barium bromide.

Injection (subcutaneous) experiments have also yielded negative results.

The Cutaneous Excretion of Nitrogenous Material: F. G. BENEDICT.

During rest, there is an average excretion in the perspiration of 0.071 gram of nitrogen per day. That it is in large measure urea or ammonium compounds is highly probable, though the presence of soluble proteids is not at all impossible. With hard muscular labor the amount of nitrogen excreted may amount to 0.22 gram in one hour. The amount excreted is roughly proportional to the work done. In accurate metabolism experiments these amounts should be taken into account.

The Incapacity of the Date Endosperm for Self-digestion: R. H. POND.

The conclusion drawn from a number of experiments conducted under varying conditions is that the endosperm of *Phœnix dactylifera* is incapable of autodigestion.

The Influence of Aluminium Compounds on the Growth of Lupin Seedlings: H. D. HOUSE and WM. J. GIES.

Aluminium sulphate, nitrate and chloride, aluminium sodium chloride and potassium and ammonium alums were used. In nearly all cases little or no effect was produced by solutions of 1/65,536-molecular concentration, but at greater concentrations growth was usually markedly inhibited. At greater dilutions there was usually a stimulation to growth.

Studies on the Banana: L. B. MENDEL and E. M. BAILEY.

The behavior of green bananas subjected to various abnormal atmospheres and to inert surface coatings has been studied with reference to the effect on ripening processes. Chemically considered the phenomenon of normal ripening is essentially an almost complete conversion of a large store of starch into soluble carbohydrate, attended by a decrease in the total carbohydrate. Failure to effect this chemical change, together with an absence of characteristic color changes of the peel, is taken as evidence of non-ripening. Bananas placed in atmospheres (hydrogen, carbon dioxide, illuminating gas) in which available oxygen was lacking failed to produce notable amounts of soluble carbohydrate, or to show any considerable decrease in total carbohydrate, the same being true when they were enveloped by an inert surface coating such as paraffin. Furthermore, the respiratory products of the fruit appeared to effect an inhibitory action upon its healthy development and ripening. Two experiments with an atmosphere of oxygen indicated that this gas somewhat accelerated ripening processes. These studies were preliminary to an attempt to detect and isolate enzymatic agencies which may be present. Autolyses with the green pulp, or the green pulp and scrapings of the inner surfaces of the peel, or of the partially ripened pulp, carried out with toluene water under varied conditions, have yielded negative results. The investigation is being extended in various directions.

The Action of Eosin upon Tetanus Toxin and in Tetanus: S. FLEXNER and H. NOGUCHI.

1. Eosin and certain other aniline dyes have the power of destroying *in vitro* the hemolytic property of tetanus toxin.

2. Eosin when used in sufficient quantity destroys tetano-spasmin *in vitro*.

3. Simultaneous injection of tetanus toxin and eosin into rats delays or prevents the appearance of the symptoms of tetanus. When the symptoms appear they progress more slowly than in control animals.

4. Spores of tetanus bacilli when introduced in threads into rats together with immediate eosin injections, do not produce tetanus. The treatment of animals with eosin, after the first appearance of the tetanic symptoms following spore-infection, may prevent the further developments of the symptoms of tetanus. Eosin injections into the same locality as spore inoculations are the most effective, but injection into other parts of the body delays or modifies the tetanus process.

5. Rats are more resistant to tetanus than guinea-pigs, and hence are more easily protected by eosin from tetanus poison. But in guinea-pigs the fatal issue can be delayed by eosin.

The Action of Eosin and Erythrosin upon Snake Venom. H. NOGUCHI.

1. The hemolytic principles of venom react differently to eosin depending upon their native labilities. The hemolysin of *Crotalus* venom suffers most; that of *Daboia* next, while that of *Cobra* is most resistant.

2. The toxicity of different venoms is more or less diminished by eosin in the light. *Cobra* is least affected; *Crotalus* and *Daboia* venoms are most affected. *Crotalus* venom loses its toxicity chiefly by destruction of hemorrhagin; and *Daboia* by destruction of coagulin.

3. Neurotoxin is little or not at all affected by eosin or erythrosin.

4. There is a parallel between the susceptibility of the toxic principles of snake venom to fluorescent anilines and their susceptibility to other injurious influences. Hemorrhagin and coagulin are less stable at high temperatures than neurotoxin, and more easily destroyed by acids than neurotoxin and hematoxin.

On the Decomposition of Purine Bodies by Animal Tissues: P. A. LEVENE and W. A. BEATTY.

The authors aimed in this work to study the products of decomposition of purine bodies in the tissues. Jones, Schittelhelm and Levene have observed that aminopurines are transformed into oxypurines. It is well known that purine bodies undergo complete destruction in the course of tissue autolysis.

The authors have studied the conditions most favorable for the process of purine decomposition by animal tissues and have endeavored to ascertain the general nature of the substances formed during the process. It was found that the presence of 0.5 per cent. of sodium carbonate in mixtures of spleen pulp facilitated the decomposition of purine bodies to such an extent that even uric acid is broken up by that tissue. It was also noticed that the decomposition products were non-basic in nature, for they were not precipitated by phosphotungstic acid. On decomposition of uric acid by tissue extracts, formation of ammonia could not be detected.

On the Biological Relationship of Nucleoproteid, Amyloid and Mucoid: P. A. LEVENE and JOHN A. MANDEL.

The authors endeavored to ascertain the nature of the carbohydrate groups in the proteid molecule. It was found that by heating nucleoproteid on a water bath with a 5 per cent. solution of sulphuric acid, a product could be obtained that had the properties of a polysaccharide or of a glucosoid and which contained in its molecule a small proportion of sulphuric acid ($S = 0.5$ per cent.). On treating nucleoproteids with alkali, substances were obtained containing a much greater proportion of sulphuric acid ($S = 3.5$ per cent.; $N = 8.8$ per cent.). The substances thus obtained were found to possess the properties of glycothionic acids containing small quantities of nucleic acid.

Glycothionic acid has hitherto been recognized as a constituent of mucoid and amyloid. The results of this investigation place the three groups of substances in genetic relationship.

Contributions to our Knowledge of the Chemistry of Carbamates: J. J. R. MACLEOD and H. D. HASKINS.

A description of a method for the quantitative determination of carbamates, even in the presence of soluble carbonates and ammonium salts. Also a study of the formation and stability of carbamates under these conditions.

The Effect of Alcohol on the Secretion of Bile: WM. SALANT.

With dogs there is a diminished secretion of bile following intravenous injection of alcohol. There was also a decrease in the organic and inorganic constituents, though little change in their relative amounts. When alcohol was injected into the stomach there was from 30 to 365 per cent. increase in the amount of bile. The solid constituents were also markedly increased, in one case as much as 132 per cent. The increase in inorganic matter did not keep pace with the organic matter excreted.

The Relation between the Concentration of Hydroxyl Ions and the Rate of Tryptic Digestion in Dilute Solutions of Various Bases: W. N. BERG.

Experiments were made in which the speed of tryptic digestion, in solutions of various bases, which contained the same concentration of hydroxyl ions, was measured.

The results seem to show that the speed of tryptic digestion is a function of the concentration of hydroxyl ions; but the accompanying action and non-ionized molecules also affect the speed. In the solutions of the bases used the speed was fairly uniform when the concentration of hydroxyl ions was the same.

On the Decomposition of Thymus Nucleic Acid by an Extract of Pig's Spleen: WALTER JONES.

1. Fresh dog's spleen converts guanine into uric acid, the ferments of this spleen not being different from those of ox spleen.

2. By the action of an aqueous extract of pig's spleen on thymus nucleic acid guanine is produced in considerable quantity; xanthine, not at all.

Concerning Peptone: L. B. STOOKEY.

This paper is a continuation of a study of peptone carried out in the laboratory of Professor Hofmeister. One of the fractions, designated as 'I B Benzoyl Chloride γ' has been investigated further. This substance gives the following reactions: Biuret, Molisch and an extremely faint xanthoproteic. Hopkins and Millon are negative. Sulphur is not present. Five grams were boiled with five per cent. sulphuric acid until the Biuret reaction disappeared. A residue remained. This residue gave the Molisch reaction more intensely than the original substance. It is not impossible that the residue was glucosamine benzoyl chloride. The filtrate was examined in the usual manner. Neither arginine nor histidine could be detected. Lysine was present and was identified as the picrate. Neither aspartic nor glutamic acid could be found. Alanine was isolated and identified as a copper salt. On account of the small amount of substance examined, these findings can not be looked upon as conclusive; yet the fact that a condensation product of two benzoyls, one lysine, one glucosamine and one alanine would have the following composition: C 57.80 per cent., N 9.30 per cent., H 6.31 per cent., O 26.57 per cent., while this fraction gave as follows: C 58.68 per cent., N. 8.96 per cent., H 5.88 per cent., O 26.48 per cent., may be regarded as suggestive and might indicate a molecular formula of $C_{29}H_{38}N_4O_{10}$.

On the Composition and Toxic Properties of Ibervillea Sonoræ: JULIA A. EMERSON and W. H. WELKER.

The Comparative Chemical Composition of the Hair of Different Races: P. B. HAWK and T. A. RUTHERFORD.

On the Chemical Composition of the Nasal Mucous Membrane: B. RUSSELL and WM. J. GIES.

The following percentage data on general composition represent average results of analyses of tissue from many oxen:

Portion.	Water.	Solids.	Organic Matter.	Inorganic Matter.
Anterior	76.69	23.31	22.34	0.97
Median	78.68	21.34	20.34	1.00
Posterior	79.61	20.39	19.38	1.01
Longitudinal sections selected at random.	77.64	22.36	21.49	0.87
Transverse sections selected at random.	77.74	22.26	21 46	0.80

The quantity of ether-soluble material is equal to about 8 per cent. of the solid matter. Reducing substance was absent from the aqueous extracts. Neither proteolytic nor amylolytic enzymes have thus far been detected. Autolytic changes will be investigated.

Much of the proteid in the tissue dissolves in water and salt solutions. Successive extractions of the fresh tissue in water, 5 per cent. sodium chloride and 0.5 per cent. sodium carbonate yielded solutions from which the following quantities of pure proteid (in terms of percentage of fresh tissue) were precipitated: water, 4 per cent.; sodium chloride, 2 per cent.; sodium carbonate, 0.5 per cent. A collagenous residue, amounting to 10.5 per cent. remained.

Conspicuous among the soluble proteids present in the extracts is an acid-precipitable material, equal to about 2 per cent. of the fresh tissue. Its properties have not yet been distinguished in detail. It appears to be nucleoproteid or a mixture containing nucleoproteid in large proportion. It does not appear to be coagulable. Preliminary tests have failed to show the presence of mucoid in the extracts.

Nearly ten per cent. of the fresh tissue is indigestible in artificial pancreatic juice, and gelatin is readily obtained from this residue. Only about one per cent. of the fresh tissue remains undissolved in artificial gastric juice. This residue contains nuclein.

ORGANIC AND INORGANIC CHEMISTRY.

Wm. L. Dudley, chairman.

Some Hydrocarbons in Louisiana Petroleum: C. E. COATES.

In the investigation of the petroleum from Jennings, Louisiana, the lighter fractions were found to consist of the compounds C_8H_{14}, C_9H_{16}, $C_{10}H_{18}$, $C_{11}H_{20}$, $C_{12}H_{22}$, etc., all of the series C_nH_{2n-2}. The petroleum is of an asphaltic base and the substances $C_{12}H_{22}$, $C_{13}H_{24}$, etc., seem to be identical with those previously obtained from asphaltum and asphaltic oils. These have been assumed to be derivatives of dihexahydrodiphenyl because $C_{12}H_{22}$ was the lowest known member. The occurrence of members still lower would seem to make this theory improbable. The series is, therefore, of a constitution as yet undetermined.

Diphenylamine Compounds of Chloral: A. S. WHEELER. (By title.)

The Chlor-hydrochlorides of Pinene and Firpene: G. B. FRANKFORTER and F. G. FRARY. (By title.)

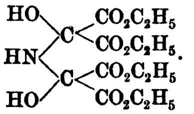
Aluminum Phenolate: A. N. COOK. (By title.)

The Methoxy- and Ethoxydibromphenanthrenes and Some of their Isomers: G. B. FRANKFORTER and C. R. CRESSY. (By title.)

Ethyl Oxomalonate and its Behavior toward Ammonia: R. S. CURTISS.

Ethyl oxomalonate, has always been a costly substance to make in any considerable quantity. It can be readily prepared with a large yield (95 per cent.) by the action of nitrous anhydride on ethyl malonate at a low temperature. The product is purified by vacuum distillation.

Dry ammonia gas reacts strongly with ethyl oxomalonate, or with its hydrated form, ethyl dioxymalonate. Under certain exact conditions it produces a white crystalline substance, dioxyiminodimalonic ester,



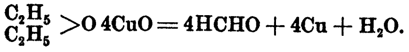
This body is very unstable, and dissociates into ammonia and ethyl dioxymalonate if allowed to stand in moist air. The same change occurs rapidly if it is placed in water.

Note on the Action of Hot Cupric Oxide on Sulphuric Ether: J. P. ATKINSON and H. DURAND. (By title.)

We noticed while examining medicinal prescriptions, containing ether, for methyl (wood) alcohol, that we invariably obtained a strong formaldehyde reaction, both by odor, Hehner's test, and the morphine-sulphuric acid test.

Believing that it was impossible that all the prescriptions could be adulterated, we tested samples of pure ether separately, and found that this compound would yield formaldehyde upon oxidation with hot copper oxide. We have since tested many samples of ether of undoubted purity, manufactured by the best known chemical houses, and have always obtained the same result.

The reaction can be written as follows:



$$\begin{matrix} C_2H_5 \\ C_2H_5 \end{matrix}\!>\!O\ 4CuO = 4HCHO + 4Cu + H_2O.$$

In Watt's 'Dictionary of Chemistry' platinum black is mentioned as a reagent which produces this reaction, but since a hot copper spiral is usually used in the qualitative method of determining the presence of methyl alcohol, we call attention to this reaction.

The Use of Porcelain Dishes in Silicate Analyses: F. L. Kortright.

Platinum dishes are usually preferred for evaporations in silicate analyses, on the assumption that porcelain dishes are liable to be corroded and thus an excess of silica obtained. In a few cases where a loss of silica is assumed to occur through the use of porcelain dishes, the statement is made that the loss occurs through not being able to see the silica adhering to the white surface of the porcelain.

It has now been found that the difficulty in seeing the adhering silica is not the chief cause of loss when porcelain dishes are used, but that a portion of the silica adheres so tightly to the dish that it is not possible to remove it by any ordinary methods. In one case where 17.93 per cent. of silica was obtained by using a platinum dish, only 17.09 per cent. of silica was obtained when a porcelain dish was used. By suitable treatment with ammonia, however, the silica adhering to the porcelain dish was separated, and the total silica, when using a porcelain dish, was then found to be 17.97 per cent. Other determinations of silica in porcelain were reported, and although the variations from the values obtained in platinum were not so striking, the results were all low when ordinary methods were employed for removing the silica from the dish.

An Occurrence of Native Sulphur in Oconee County, Ga.: H. C. White. (By title.)

Report on the Water of Death Gulch, Yellowstone National Park: G. B. Frankforter. (By title.)

The Determination of Silica: N. Knight. (By title.)

On the Occurrence of Helium in Natural Gas: H. P. Cady and D. F. McFarlane. (Read by E. H. S. Bailey.)

PHYSICAL CHEMISTRY.

Louis Kahlenberg, chairman.

The Transition Temperature of Sodium Bromide. A New Fixed Point in the Thermometric Scale: T. W. Richards and R. C. Wells. (Read by the chairman.)

The results of this paper may be summed up in the following sentences:

1. Pure sodic bromide is not to be obtained by recrystallizing the ordinary commercial samples, but must be made from pure bromine and pure sodic carbonate.

2. Prepared in this way, our salt upon analysis was found to correspond very closely with the new atomic weight of sodium, 23.008, if silver be taken as 107.93, and bromine, 79.955, therefore, it was presumably pure.

3. The less pure material on successive recrystallization gave in every case a slightly rising transition temperature as the crystallization proceeded. Only the purest material melted at a perfectly constant point, therefore, constancy of melting point is an indication of purity; but it is safer to analyze the salt as well.

4. When all precautions are taken it is possible to duplicate the results for the transition temperature with samples of salt prepared in different ways and at different times without great difficulty; a value within .01 of the truth may be easily obtained and further precautions make a much greater accuracy possible. Therefore, the point is one suitable to use in the

calibration of thermometers, although its determination requires more chemical skill than that involving sodic sulphate.

5. The actual value of the transition temperature on the international hydrogen scale is 50.674°.

(To be published in the *Proceedings* of the American Academy and the *Journal* of the society.)

A Method of Standardizing Thermometers Below Zero: T. W. RICHARDS and F. G. JACKSON. (Read by the chairman.)

This paper describes a simple method of calibrating thermometers at temperatures below the freezing point of water, by using as a standard of comparison the depressions of the freezing point caused by given additions of hydrochloric acid. Data, based upon a very accurate thermometer standardized at the Bureau International at Sèvres, are given for the construction of a curve enabling direct comparisons of a thermometer to be made with a minimum of labor. The manipulation consists simply in stirring hydrochloric acid into a mixture of pure ice and water until the desired point on the doubtful thermometer is reached. Analysis of the solution then gives, by reference to the curve, the true freezing point; and the difference between this value and that read on the thermometer gives the error of the thermometer. The method is shown to be both practically and theoretically satisfactory. This paper is preliminary in nature, and does not pretend to give final values, because only a single standardized thermometer was used.

(To be published in the *Proceedings* of the American Academy and the *Journal* of the society.)

The Heat of Dilution of Resorcinol in Alcoholic Solutions: S. T. LINCOLN.

The Solubility of Gypsum in Solutions of Ammonium Sulphate: J. M. BELL and W. C. TABER.

The solubility of gypsum in ammonium sulphate solution has been investigated by Droeze, Cohn and Sullivan at temperatures not exceeding 25° C. At 50° C. the authors have found that the compositions of solutions lie on three curves, one representing solutions in equilibrium with gypsum, one representing solutions in equilibrium with ammonium sulphate, and the third representing solutions in equilibrium with a double salt which was found to have the composition $CaSO_4 \cdot (NH_4)_2SO_4 \cdot 2H_2O$.

The Solubility of Gypsum in Solutions of Magnesium Sulphate: F. K. CAMERON and J. M. BELL.

Owing to the difficulties in determining small amounts of calcium in the presence of large amounts of magnesium the authors have adopted the following method for the determination of the solubility of gypsum in solutions of magnesium sulphate. Weighed plates of selenite were placed in known amounts of solutions of magnesium sulphate of concentrations which had been determined previously. The loss in weight of the plates is a measure of the solubility in these solutions. The solubility curve at 25° is rather remarkable, as it has both a minimum point and a maximum point. At low concentrations of magnesium sulphate the solubility of gypsum decreases as the content of magnesium increases, but above 14 grams $MgSO_4$ per liter the solubility of gypsum increases up to a concentration of about 100 grams $MgSO_4$ per liter. From that point the solubility decreases again. The solution in equilibrium with both solid phases contains 355 grams $MgSO_4$ and 0.50 gram $CaSO_4$ per liter.

Two tentative explanations are offered to account for the peculiar shape of the curve. The change of density of the solvent due to the presence of solutes (concerning which change practically nothing is known) may account for the peculiar curve. The second explanation is that the magnesium ion, the sulph-ion and the undissociated $MgSO_4$, the proportions of which change with the concentration, have altogether different effects upon the solubility of gypsum.

On Monday afternoon the society visited Audubon Park and the sugar experiment station, where opportunity was given to witness all the processes of sugar-making, from the growing cane to finished sugar.

On Tuesday morning a special train was chartered on the Louisiana Southern Railroad to take the party to the Braithwaite Sugar Factory where about one thousand tons of cane are worked up per week. In the afternoon a sugar refinery and the National Rice Mills were visited.

CHAS. L. PARSONS,
Secretary of Section C,
C. E. WATERS,
Press Secretary.

SCIENTIFIC BOOKS.

The Organization and Cell-lineage of the Ascidian Egg. By Professor E. G. CONKLIN, Journal of the Academy of Natural Sciences of Philadelphia, Second Series, Volume XIII., Part I., 1905.

The work on cell-lineage which produced so large a number of papers a few years ago has very naturally led to the study of the visible organization or differentiation of the egg, not only during cleavage, but in earlier stages. The search for cell homologies has given place in large measure to the search for 'formative substances,' 'morphogenic substances' or 'morphoplasmic substances' as the visible differentiations of the egg have been variously called. And since it is true in biology as elsewhere—perhaps more so—that 'they that seek shall find,' our knowledge of the visible differentiations of the egg-substance is rapidly increasing.

The paper under review constitutes an important contribution to this subject. It is an exceedingly careful study, based primarily upon the egg of *Cynthia* (*Styela*) *partita* Stimpson, with comparative observations on the eggs of *Ciona intestinalis* (L.) Flemming and *Molgula manhattensis* Verrill.

The titles of the seven sections, which with the introduction compose the paper, indicate its scope: I., 'The Ovarian Egg'; II., 'Maturation and Fertilization'; III., 'Orientation of Egg and Embryo'; IV., 'Cell-Lineage'; V., 'Later Development'; VI., 'Comparisons with Amphioxus and Amphibia'; VII., 'The Organization of the Egg.'

The most important cytological observations concern the character of the spindles in maturation and the first two cleavages. The maturation spindles are without centrosomes and are formed wholly within the nuclear area: at first their fibers radiate in all directions, but finally form a barrel-shaped spindle. Influence of centrosomes and traction of spindle fibers are not concerned in the separation of the chromosomes in the maturation divisions. In the first cleavages a small nuclear spindle similar to the maturation spindles lies between two large asters.

The spermatozoon enters near the lower pole and rotates after entering. The centrosome is derived from the middle piece and gives rise to the cleavage centrosomes. As regards orientation of the ascidian egg much difference of opinion has existed. Conklin reviews the various systems of orientation, viz., those of Van Beneden and Julin, Seeliger, Samassa and Castle, and gives what appears to be convincing evidence in favor of the first mentioned. According to this the first cleavage plane corresponds with the median plane, the spindle being eccentric toward the posterior pole. The second cleavage is transverse. The intersection of these two planes corresponds with the dorso-ventral axis of the gastrula and the third cleavage separates dorsal from ventral cells.

The account of cell-lineage is complete to a stage consisting of 218 cells. Gastrulation begins at about the 112-cell stage. Development is remarkably rapid, *Cynthia* and *Ciona* attaining the tadpole stage in twelve hours after fertilization and *Molgula* in eight hours.