has reported the casting of the amnion of *Melanopus spretus* while the nymph is free from the egg and mentions observing this condition in the hatching of several other insects. In fact, it has been observed that very many insects, including the seventeen year cicada, are entirely enclosed in this membrane after hatching.

In the aphids as the embryo revolves the serosa contracts and draws with it the cells of the polar organ and the serosa and polar organ from the dorsal plate. This then invaginates, forming the dorsal body which separates itself from the amnion completely and is ultimately absorbed. Thus only the serosa and polar organ disappear while the amnion closes the gap and remains as a distinct membrane over the embryo. This membrane separates, remains distinct, and, as previously indicated, is left behind as a thin, transparent membrane by the hatching nymph.

Headlee[4] has stated that "A third layer may be seen as the nymph hatches, but this is probably the first-cast skin of the nymph," and this view seems to be held also by Peterson (*l. c.*, p. 10) who says, "This layer is shed by the nymph as it emerges, consequently it must be an exuvium." The writer is unable to agree with this view for the exuvia cast by the nymph during its growth are quite different from this embryonic membrane which it leaves behind when hatching.

After the embryo has revolved and is proceeding toward hatching the egg is in much more critical condition than during the dormant period. It is less protected by reason of the fracture of the gelatinous matrix enclosing it and the embryo which is actively growing is more susceptible to the effect of spray solutions. This undoubtedly explains the varying results obtained by different workers in spraying experiments on aphid eggs. In many lots wherein the embryo had revolved good results were obtained, whereas in other lots where no revolution had taken place, hatching was about normal. In this connection it is important to bear in mind that *pomi* and *malifoliæ* revolve at about the same period, the middle of March in Washington, and that early in April these eggs are very susceptible to treatment with such sprays as lime sulphur. At the time these eggs are in this critical period of embryonic development those of *prunifoliæ* have hatched and the young are in the first or rarely the second instar. These young nymphs are not affected greatly by lime sulphur but are easily killed by nicotine sprays.

It seems clear therefore, than in interpreting hatching records of aphid eggs in the course of spraying or other experiments, account must be taken of the condition of the embryo in regard to revolution. Knowledge of this fact is also essential in practical control work. Thus in the case of the three apple aphids here considered, the recommendations for use of the combined lime-sulphur-nicotine spray as a "delayed dormant" treatment, is seen to be based on scientific reasons —the lime sulphur to destroy the later hatching eggs, principally *pomi* and *malifoliæ*, and the nicotine for the already hatched aphids.

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WASHINGTON, D. C.

[4] New Jersey Agr. Exp. Sta. Bull. No. 328, 1918.

THE AMERICAN CHEMICAL SOCIETY

(*Continued*)

SECTION OF CELLULOSE CHEMISTRY

Harold Hibbert, *chairman.*
G. J. Esselen, Jr., *secretary.*

Effect of adding various chemicals to wood previous to distillation: L. F. HAWLEY. Several different chemicals have been mixed with wood and the mixture distilled for the determination of the effect of the chemical on the yield of valuable products. The chemical was mixed with the sawdust by sprinkling in case it was water soluble or by mixing the solid in case it was insoluble. The mixture was then briquetted and the briquets distilled in a special retort in which mechanical pressure could be applied to the briquets during distillation. The only chemical tried which had a beneficial effect when used in reasonable quantities was sodium carbonate. When about one per cent. of sodium carbonate is mixed with wood previous to distillation the yield of methyl alcohol

is increased by about 50 per cent. The yield of acetic acid is not decreased by the sodium carbonate.

The removal of free acid from nitrated cellulose, with special reference to the use of saline leaches: S. E. Sheppard.

Motor fuel from vegetation: T. A. Boyd. The use of motor vehicles in the United States has increased very much more rapidly than the production of crude oil and considerably faster than the production of gasoline, although the volatility of gasoline has beeen decreasing from year to year. This, coupled with the fact that reserves of crude oil are being rapidly depleted, makes it essential that other sources of motor fuel be developed. Alcohol makes a desirable motor fuel, and it appears to be the most promising ally to petroleum oils for the purpose. The preparation of sufficient alcohol for motor fuel from foodstuffs does not appear to be feasible, and it seems advisable to make a further and more intensive investigation of cellulose as a source of this material.

Possibilities of the moist tropics as a source of cellulose and carbohydrates: H. N. Whitford. The subject resolves itself into three headings, (*a*) an inventory of present resources of the tropics, (*b*) growth in moist tropical forests, (*c*) bamboo and other plants as sources for cellulose and industrial alcohol. (*a*) From an economic standpoint tropical forests are not so complex as usually believed. A rough estimate of the great forested regions of South America and Asiatic tropics shows more than twice as much standing timber as in the United States. (*b*) Actual knowledge of growth of certain forest crops shows that practically the annual increment per unit area as fully stocked stands is usually more than twice that in the United States. (*c*) Heavy yields of bamboo indicate that it may be the most promising plant for the production of cellulose and possibly alcohol. Nipa palm possesses possibilities for alcohol.

The possibilities of a future fuel supply from our forests: R. C. Hawley.

The rôle of the chemist in relation to our future fuel supply: Harold Hibbert. Up to the present attention has been concentrated primarily on the production of alcohol from cellulose products. In view of the fact that in the fermentation of sugar not more than 80 per cent. of the theoretical quantity of alcohol is obtained while 50 per cent. by weight of the original material is lost in the form of carbon dioxide, it seems desirable to subject cellulose to intensive investigation with a view to ascertaining how far it is possible to convert it into other materials such as furfuraldehyde, etc., in which a better yield could possibly be obtained of a material suitable for use as a liquid fuel.

The effect of chemical reagents on the microstructure of wood: Allen Abrams. A method has been devised for treating very thin sections of wood with chemical reagents under different conditions of temperature and pressure. This method has been used in treating sections with a considerable variety of reagents, such as cellulose solvents, acids, alkalies, oxidants and chemicals used in paper-making. The effects on the microstructure of wood have been studied both by microscopic observation and by cell measurements. Some of these effects may be summarized as follows: (1) Cellulose solvents act strongly and proportionately on both the middle lamella and the cell wall. (2) Strong oxidants act on the cell wall but have little effect on the middle lamella. (3) The ordinary paper-making reagents act strongly on the middle lamella, with but relatively little visible effect on the cell wall. Whereas caustic soda solutions cause swelling of the cell wall, solutions of sodium bisulphite and sodium sulfide cause little or no swelling.

Measuring soil toxicity, acidity and basicity (cooperative work with the U. S. Dept. of Cereal Investigation): R. H. Carr. There is a close connection between an acid soil, the amount of easily soluble iron and aluminum present, and the soil's capacity to grow a good crop. A quantitative method has been developed to measure the presence of easily available iron and aluminum by extracting the dry soil with an alcoholic solution of potassium thiocyanate. A red color will develop if the soil is acid, due to the formation of ferric thiocyanate. This solution is titrated with a standard alcoholic base until the color just disappears. If no color develops the soil is neutral or basic and it may be titrated with a standard alcoholic acid, and the limestone equivalent determined. A special tube has been devised for this work.

Influence of mixed acid on the character of nitrocellulose: W. J. Waite. The vapor tension of nitric acid in the nitrating bath controls the degree of nitration of the nitrocellulose. The dehydrating value of sulphuric acid is a factor which

influences the vapor tension of the nitric acid. The hydrolyzing action of sulphuric acid in the nitrating bath sets up secondary reactions, which are responsible for variations in yield, formation of insoluble bodies, gelatinous products, and unstable esters. The solubility of nitrocellulose is determined by the dehydrating value of sulphuric acid in the nitrating bath. The nitrocelluloses used in the commercial world are divided into seven types based on their specific uses. Degree of nitration curves based on factory experience, showing the degree of nitration as a function of the actual nitric acid and the nitrating bath, indicates that, for the same degree of nitration, as the actual nitric increases a corresponding increase in the nitrating total is required in order to maintain the same molecular ratio between the water and sulphuric acid in the bath.

Some commercial possibilities of corn cob cellulose: F. B. LAFORGE. Brief outline of our process for the preparation of adhesive, furfural and cellulose from corn cobs; proposed uses of the three products. Preparation of corn cob cellulose in powder form and uses as substitute for wood flour for nitration and acetylation; preparation in the form of pulp and uses in paper manufacture. Corn stalks and husks as a source of adhesive furfural and fiber.

A color test for "remade milk": OSCAR L. EVENSON. A yellow color produced by the action of sodium hydroxide on the washed curd of milk made from milk powder, serves as a test for the presence of milk powder in natural milk. The curd precipitated from 25 c.c. of milk with acetic acid is washed and placed in a vial with 10 c.c. of 5 per cent. sodium hydroxide. Natural pasteurized milk treated in the same manner is used as a control. The color is probably due to the presence in the curd of a residue of aldehydic nature resulting from the action of heat and desiccation.

Nitro-cellulose and its solutions as applied to the manufacture of artificial leather: W. K. TUCKER. (1) Properties of the nitro-cellulose: (*a*) Degree of nitration and why lower and higher nitrations are objectionable; (*b*) viscosity; (*c*) degree of purification and the effects of the purification on viscosity; (*d*) stability; (*e*) ash. (2) Solution: (*a*) solvents and non-solvents generally used and why; (*b*) viscosity of solutions generally used. Granular and short solutions; (*c*) effect of various solvents and non-solvents on the viscosity of solutions; (*d*) proportion of nitro-cellulose in solutions generally used and short discussion of the use of solution with a larger percentage.

An experimental study of the significance of "lignin" color reactions: ERNEST C. CROKER. An investigation of the so-called color reactions showed that the following phenols gave strong red, violet or blue colors with wood of any kind when applied in strongly acid solution: phloroglucinol, orcinol, resorcinol, and pyrogallol. Likewise, all primary aromatic amines gave yellow to orange colors when applied in acid solutions of any strength. The secondary amine, diphenylamine, also gave an orange color even when highly purified and freed from traces of primary amines. Pyrrole gave a deep red color in hydrochloric acid solution. Various materials were substituted for wood, and tested with above types of reagents for color formation. It was found that only (but not all) *aromatic aldehydes* gave color reactions similar to those given by wood. Spectroscopic investigation and comparison of colors obtained showed that the principal color source of wood is not vanillin or furfural, as several writers have claimed, but a different aldehyde—possibly coniferyl aldehyde. It was found that certain natural phenols and ethers such as eugenol and safrol, which are reported as giving colors with the phenols and aldehydes, do so only because of aldehydic impurities. The Mäule test was found to give a distinct red color only in the case of deciduous woods. The test was found to be caused by a component of the wood, which after chlorination turns red when made alkaline. Apparently no color test is an indicator of *lignin*, but of traces of materials (aldehydic for most of the tests) which usually—perhaps always—accompany lignin.

A proposal for a standard cellulose to be available for research: B. JOHNSEN.

A discussion of some beater furnish reactions from the standpoint of colloidal chemistry: JESSIE E. MINOR. This discussion is based upon a series of experiments performed for the purpose of obtaining some more exact information as to the changes in the physical properties of a paper which are brought about by each addition made to the furnish. The increased strength attained by beating is due to the mucilaginous product of hydrolysis and the decrease in strength by excessive beating is due to the loss of fiber structure. Alum coats the fiber with a gelatinous layer of aluminum hydroxide and changes the electrical charge on the fiber. It thus aids in size retention as does calcium sulphate, though the latter is less effective. In-

soluble fillers which give almost no ions are still less effective. Their chief effect is to weaken the paper as do calcium chloride and sodium carbonate. Explanations for these various phenomena are given based on the modern concepts of colloid chemistry.

The solubility of cellulose acetate in chlorinated hydrocarbons: Gustavus J. Esselen, Jr. The present paper offers an explanation of the fact that cellulose acetate is soluble in certain chlorinated hydrocarbons but not in others, as for example, in chloroform but not in carbon tetrachloride. The internal pressures of the chlorinated derivatives of methane and ethane have been calculated and it is shown that the corresponding solvent action on cellulose acetate is in general what is to be expected from the relative values of the internal pressures. The fact that the addition of a little alcohol increases the solvent action of certain of the solvents in question is also shown to be in accord with what is to be expected from the accompanying change in the polar environment.

The action of dry hydrobromic acid on cellulose and related derivatives: Harold Hibbert and Harold S. Hill. The authors have reinvestigated the action of dry hydrobromic acid in chloroform solution on cellulose, viscose, dextrose, α methyl glucoside, sucrose and certain other derivatives. Higher yields of brom-methyl furfuraldehyde were obtained in the case of cellulose and viscose, while with dextrose as much as 12–15 per cent. of the crystalline product was obtained. Good yields were also obtained in the case of α methyl glucoside and other derivatives. The evidence would seem to prove that the formation of brom-methyl furfuraldehyde is no longer to be associated with the presence of a free carbonyl (keto) group in the cellulose molecule.

The oxidation of cellulose: W. S. Holzberger.

European practise in cellulose acetate and dopes during the war: Philip Drinker. (1) Cellulose acetate developments from commercial and scientific aspects. (2) Cellulose acetate solvents, non-solvents, plastics, high-boilers, etc., as developed for airplane dopes. (3) Various dope formulæ as shown by their historical development as the war progressed, the "standard forms" ultimately decided upon, etc. (4) The effect of sunlight and other agents on fabrics and means of preventing said effects with account of researches on these subjects. (5) Recovery of solvents in doping and recovery of cellulose acetate from discarded airplane fabrics.

The influence of temperature on hemi-cellulose production: W. E. Tottingham. Red clover and buckwheat plants grown at temperatures of about 15° to 18° in one case and 20° to 23° in another, in the latter case with the evaporating power of the air kept nearly the same for the two temperature ranges, have shown an increase of acid hydrolyzable material at the lower temperatures. This difference amounted to about 5 per cent. of the total dry tissue of the plant. No evidence has been obtained as yet of definite variations of the fundamental cellulose with temperature differences attending growth. It appears that the hemicellulose which would be included in the acid hydrolyzable material may form an important carbohydrate reserve in the plant economy. It is suggested that the depression of respiration in proportion to photo-synthesis at the lower temperatures may favor the accumulations of hemi-cellulose observed.

The chemical changes involved during infection and decay of wood and wood pulp: Mark W. Bray and Joseph A. Staidl. The results and significance of the determination of various constants are given on a number of samples of sound and decayed spruce woods, pulps and waterleaf papers made from them by the groundwood, sulphite and soda processes. It was found that the water soluble materials, the alkali soluble substances, the copper numbers, and the beta cellulose, increase, while the alpha and gamma cellulose constants decrease with the progress of decay, in all the woods, pulps, and papers studied. The lignin content shows an apparent percentage increase in decayed wood. If the calculations are based on the original weights of the sound wood, however, there is a slight decrease in this constant. The data given show the relation of the lignin or non-cellulose encrusting material of sound and decayed woods and pulps. Certain organisms of decay have a selective action on the constitutents of wood and wood pulp, attacking the cellulose in preference to the non-cellulose encrusting substances. Gamma cellulose is so unstable that a very small percentage was obtained in decayed woods and pulps. The losses sustained by the paper industry as a result of the use of decayed woods and pulps are pointed out.

The chemical constitution of soda and sulfite pulps from coniferous woods and their bleaching qualities: Sidney D. Wells.

Charles L. Parsons,
Secretary