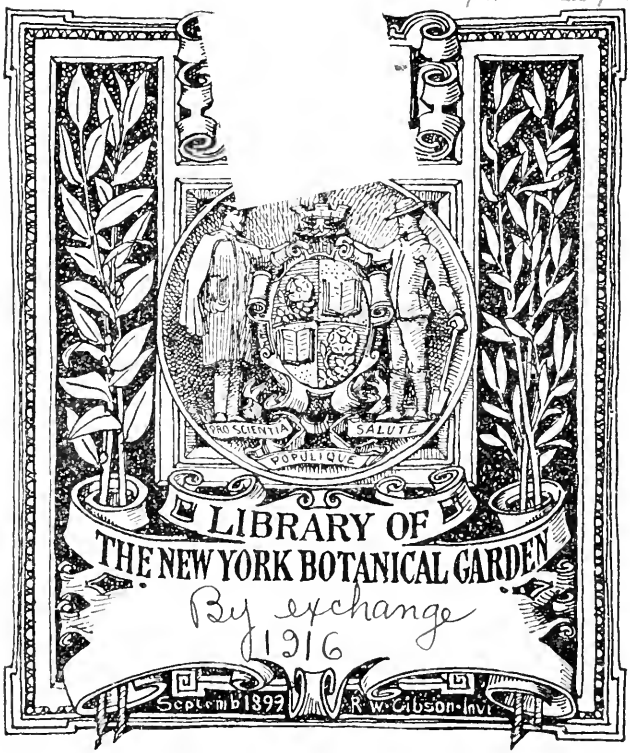
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ANNOUNCEMENTS

Future issues of the Biochemical Bulletin

Pursuant to a further change of plan, which is referred to editorially on page 58, this number is the first issue of Volume V of the BIOCHEMICAL BULLETIN. Hereafter, the BIOCHEMICAL BULLETIN will be issued **monthly.** The volumes of the BIOCHEMICAL BULLETIN will continue to coincide, in periodicity, with the calendar years.

The subscription price remains unchanged.

Kronecker Biochemical Prize

The establishment of a new prize, "to encourage biochemical research and improve biochemical literature," is announced on page 59.

New members of the Columbia University Biochemical Association

(Elected Feb. 4, 1916)

Honorary members: Prof. A. B. Macallum, Univ. of Toronto; Prof. Leon Asher, Univ. of Berne.

Corresponding members: Prof. Teodoro Muhm, Univ. of Chile; Dr. E. Winterstein, Zürich Institute of Technology; Prof. R. F. Ruttan, McGill Univ.

Professional assistance offered to Biological Chemists

The members of the Columbia University Biochemical Association will coöperate confidentially with any one who desires the services of biological chemists or who seeks a position in biological chemistry.

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BIOCHEMICAL BULLETIN

VOLUME V JANUARY, 1916 NO. 17

FRACTIONATION OF THE PHOSPHOTUNGSTIC-ACID PRECIPITATE WITH ACETONE AS A USEFUL METHOD FOR THE PREPARATION OF THE VITAMINE FRACTION FROM YEAST

CASIMIR FUNK

(Received for publication, June 1, 1915)

Introduction. Knowledge of the chemical nature of vitamines progresses slowly. In 1911 the author (1) was able to prove that the substance missing from polished rice, deficiency of which occasions beriberi, is undoubtedly an organic base. This fact is based upon certain precipitation reactions which were observed frequently and have been confirmed by several workers.

These new findings very powerfully stimulated research in the whole subject of nutrition. The vitamines were chiefly detected in materials that are rich in fat and lipoids (with the exception of yeast which, although rich in vitamines, is poor in fat and lipoids) and, therefore, the somewhat mystical physiological action of lipoids was ascribed to the new class of chemical substances: the vitamines.

Since 1911 numerous investigators, including the author, have endeavored more closely to characterize the active substance. It seemed, at first sight, to be a simple problem to isolate a substance showing the marked pharmacological power of curing beriberi after its experimental production in birds. Knowing its approximate nature, by application of the usual fractionation methods it was possible to obtain a very active solution, freed from inactive impurities, from which the vitamine could be crystallized. During the

first investigation the author noticed that the active substance seemed to diminish rather than increase. Our usual methods proved to be inadequate for its isolation. In this respect the substance reminded one very strongly of the behavior of certain hormones and products of the glands of internal secretion, whose isolation in the active state has not yet been effected.

The first attempt to isolate the vitamine, by the fractionation of rice-polishings, was made by the author by the following method: Rice-polishings were extracted with cold abs. alcohol, which was partially saturated with gaseous hydrochloric acid. The extracts were evaporated *in vacuo* at a low temp., and the fatty residue melted and extracted with water. These aqueous extracts were precipitated with 50 percent phosphotungstic acid sol., after addition of sulfuric acid to the extent of 5 percent, and the precipitate decomposed with baryta in the usual manner. The solution, entirely freed from baryta and sulfuric acid, was filtered, and the filtrate neutralized with hydrochloric acid and evaporated *in vacuo*. The residue was extracted with alcohol and the solution freed by filtration from inorganic chlorids. The alcoholic sol. was then precipitated with alcoholic mercuric chlorid sol. The active substance was found, to a small extent, in this precipitate but the bulk was in the filtrate. From each of these fractions the vitamine could be completely thrown down by silver nitrate and baryta. From this fraction, after decomposition with hydrogen sulfid, there was isolated a very small quantity of crystalline substance, with a melting point of 233°C. This was not recrystallized and possessed very marked curative power. The only substances isolated from 54 k. of rice-polishings were this crystallin material which, from our present knowledge, was undoubtedly impure nicotinic acid; and a large quantity of cholin. This work proved that vitamine is quantitatively precipitated by phosphotungstic acid, and by silver nitrate and baryta, partially by mercuric chlorid in alcoholic sol., but not by platinic chlorid or picric acid.

Shortly afterwards (1912) there appeared a paper on this subject by Edie, Evans, Moore, Simpson and Webster (2), who used a slightly modified method. The source of their material was yeast. This was extracted with alcohol, and the alc. extract evaporated,

cleared with lead acetate, and immediately precipitated with silver nitrate. This precipitate, when decomposed, gave a small quantity of crystallin organic substance that yielded ash. These authors did not claim, however, to have tested the curative power of this substance.

Later in 1912 the author endeavored (3) to isolate the vitamine from different foodstuffs, *e. g.,* yeast, ox-brain, milk, rice-polishings and lime-juice. To indicate some of the experimental difficulties that are encountered in this kind of work, these attempts may be briefly described.

Rice-polishings. An extract of rice-polishings was precipitated directly with silver nitrate and baryta. This process was chosen to shorten the procedure and to avoid the use of a large quantity of alkali, which was supposed to destroy the vitamine. No vitamine was detected in this case. Allantoin was found, which, when phosphotungstic acid is used, goes into the filtrate.

Yeast. The evaporated alc. extract of yeast was hydrolyzed for a short time previous to precipitation with phosphotungstic acid, with 10 percent sulfuric acid sol., preliminary experiments in collaboration with E. A. Cooper having been shown that even after prolonged hydrolysis with strong sulfuric acid sol. (4) the contained vitamine remained active. The hydrolyzate was worked up in a way similar to that for the first fractionation of the extract of rice-polishings, with the difference that sublimate was not used. The silver-fraction, when decomposed, yielded a crystallin substance, melting at 233°C., that gave a precipitate with mercuric acetate, but not with mercuric sulfate or nitrate.. No copper salt was formed in boiling water with copper oxid. The yield, 0.45 gm. from 75 k. of dry yeast, was too small for recrystallization or analysis; a rather large dose of the substance (0.02–0.04 gm.) proved, however, to be curative for beriberi pigeons. In another fractionation of yeast the alc. extract was simply extracted with water and not hydrolyzed; in this case the substance described above could not be isolated but some pyrimidin bases, *e. g.,* uracil and thymin, were obtained.

Milk and brain. Milk and brain were extracted with alcohol, the evaporated alc. extracts hydrolyzed with acid, and worked up

in the usual way. A curative fraction was obtained which, in both cases, yielded small quantities of crystallin substance, melting above 200°C., which was very likely nicotinic acid.

LIME-JUICE. Nothing definitely crystallin was obtained from lime-juice.

In the same year (1912) Suzuki, Shimamura and Odake (5) published a very interesting paper on the chemistry of rice-polishings. Their method of isolating the active principle was as follows: The rice-polishings were first extracted with petroleum ether, to remove the fat, and then with boiling alcohol. The evaporated alc. extracts were diluted with 3 percent sulfuric acid sol. and precipitated with phosphotungstic acid. The precipitate, after decomposition with baryta, yielded a fraction which these authors called *Rohoryzanin I.* This fraction, after hydrolysis with weak acid, gave two acids: α-acid of the formula, $C_{10}H_8NO_4$, and β-acid of the formula, $C_{18}H_{16}N_2O_9$; also, nicotinic acid, cholin and glucose. *Rohoryzanin I* was purified by precipitation with tannic acid.. This precipitate, after decomposition, yielded *Rohoryzanin II.* To the latter, picric acid was added, under conditions that excluded the precipitation of nicotinic acid, and a picrate was obtained which was called *oryzanin picrate.* This picrate was crystallized, by evaporation from acetone, in small, yellow-brown needles. The authors claimed that very small quantities of the decomposed picrate possessed strong curative action.

I repeated this work very carefully but was not able to confirm it. Neither were the α- and β-acids detected, nor was a curative picrate obtained. On the contrary, it was found that the vitamine was not precipitated by picric acid. It was hoped that by using large quantities of rice-polishings positive results could be obtained. In the first instance 380 k. of rice-polishings were used and the method carried out exactly as described in my first paper on rice-polishings. The results have been published (6); and, recently, all the various fractions have been carefully re-examined in collaboration with Mr. Drummond (7). In another case an extract from 620 k. of rice-polishings was worked up. This extract was hydrolyzed with acid previous to fractionation. In both cases a most careful inquiry failed to detect any new chemical substance

that could be regarded as vitamine itself or a decomposition product of it. The results of the extraction of such enormous quantities have shown beyond doubt that, because of the instability of vitamine, ordinary methods are inadequate.

Yeast undoubtedly contains more vitamine than do any of the known food-stuffs. Extraction with alcohol, however, removes only a very small part of the total vitamine content. More promising results with yeast than with rice were described in the earlier paper (6). The alc. extract, after hydrolysis with acid, was fractioned according to the methods described in my earlier papers. From the silver-and-baryta fraction a crystallin product was obtained which melted at a temp. above 200°C. and which, when administered to beriberi pigeons, induced very quick recovery. When, however, maintenance experiments were performed, *i. e.*, with pigeons on a diet of polished-rice with daily injections of the product, the birds could not be kept alive for more than a few days(8). This shows that the vitamine originally in this product had already undergone chemical changes that were so profound as to cause it to lose some of the pharmacological properties of the original yeast. The product of this first crystallization was divided into three substances, one of which was nicotinic acid. The administration of these substances, individually or collectively, to beriberi pigeons did not show appreciable curative action.

Summarizing the results of previous chemical investigation of vitamine, we find that this substance is precipitated by a series of reagents; the curative fraction always contains, especially in the case of yeast, the three substances mentioned above (including nicotinic acid), which, however, when purified, do not exert curative action. Vitamine is extremely unstable and the most delicate methods destroy it completely. The destructive factor remains to be elucidated. Heat and acid (4) are not very important destructive agents. There is the further difficulty that vitamine is very readily adsorbed by colloidal precipitates. This tendency cannot, however, account for the total loss of vitamine, since the fractions thus obtained are markedly curative. Other probabilities are destruction by alkali, loss by oxidation, and the presence of one or several labile chemical groupings in the vitamine molecule.

The first possibility, destruction by alkali, is dealt with in the present paper. Several fractionings were performed without the use of alkali. Because vitamine is very labile it seemed desirable to separate, early in the procedure if possible, the bulk of the impurities from the phosphotungstate precipitate. For this purpose acetone was used. While this work was in progress it was found that Wechsler (9) had already described the solubility of several phosphotungstates in dilute acetone. By treating the phosphotungstates obtained from hydrolyzed alc. extracts of yeast, with acetone in a mortar, it was found that a very small part of the precipitate remained insoluble. Testing both the insoluble and the soluble parts on beriberi pigeons, it was found that all the vitamine remained in the small insoluble fraction. This result was very promising, for the bulk of the impurities remained behind. The phosphotungstates thus obtained were not decomposed with baryta but with neutral lead acetate. After evaporation of the lead-free acetone-insoluble fraction, the whole residue crystallized out. With this residue a series of curative experiments were performed which are described elsewhere (8, 10). The product proved to be highly curative and, given with polished-rice, kept the animals in perfect health.

This product was fractioned further, on several occasions; it consisted chiefly of adenin. After separating the latter substance with picric acid, the vitamine was found in the mercuric-chlorid fraction; it was not precipitated by platinic chlorid, in accord with previous findings. Vitamine has not yet been obtained in a crystallin state from the platinic-chlorid filtrate, but has been reprecipitated with mercuric chlorid, although the yield has not been sufficient for further investigation.

Since these results were very promising, attempts were made to isolate vitamine from autolyzed yeast, which, as was found by Cooper (11), contains as much vitamine as does the corresponding amount of fresh yeast It was thought best to combine the use of autolyzed yeast and of the acetone method, and it was proposed to separate the impurities from the vitamine at the phosphotungstate stage. For this purpose the solubility of the phosphotungstates of several bases occurring in nature, when in solution in different or-

ganic solvents, was systematically investigated in conjunction with J. C. Drummond. After the separation of impurities it was planned to transform the vitamine by benzoylation, acetylation or similar reaction into a stable compound. The experimental data follow.

Experimental. 1. EXTRACTION AND PRECIPITATION. Three k. of ordinary brewer's yeast were extracted with alcohol, and 116 gm. of the evaporated extract treated in the cold with 500 cc. of 10 percent sulfuric acid sol. for two days, with frequent shaking. The acid extract was filtered through a folded filter, the residue washed with 500 cc. of water, and the filtrate precipitated with 50 percent phosphotungstic acid sol. After standing over night, the precipitate was removed with suction.

PHOSPHOTUNGSTATE PRECIPITATE. The precipitate obtained by the foregoing process was ground up with acetone in a mortar. The small residue that remained was obtained, by suction, on a filter and washed repeatedly with acetone. This acetone-insoluble residue, amounting to 19.8 gm., was emulsified, in a mortar, with a little water and mixed well with 60 gm. of neutral lead acetate. The whole mixture was then shaken on a machine. The resultant lead phosphotungstate was separated by filtration and the filtrate freed from excess of lead with hydrogen sulfid. The acetone-soluble part was diluted with water and shaken with an excess of lead acetate. The lead phosphotungstate was separated by filtration and the excess of lead in the filtrate removed with hydrogen sulfid. All the lead salts obtained during the process were decomposed with hydrogen sulfid; the phosphotungstic acid was removed quantitatively by means of baryta.

Results of animal experiments. The solutions of all the fractions were diluted to known volumes and aliquot parts used for tests on beriberi pigeons. With the acetone-*insoluble* fraction three pigeons were cured by 1/50th of the total volume. Pigeons given polished-rice, and a dose of the solution every few days, maintained their health and weight as described elsewhere (8).

The acetone-*soluble* fraction was tested on two pigeons and found to be entirely inactive, although the dose was three times as large as that for the acetone-insoluble fraction. The action of each of the decomposed lead salts was tested on two pigeons with

completely negative results. The acetone-insoluble (curative fraction) did not contain phosphorus.

2. These preliminary results suggested repetition of the work on a larger scale. An evaporated alc. extract from 100 k. of dry yeast, which was semifluid and amounted to 2,580 gm., was extracted in three portions, each with 4 l. of 10 percent sulfuric acid sol. Each portion was macerated for 24 hr. and then shaken on a machine for 10 hr. After standing, oil collected at the top; the clear, dark, colored liquid was siphoned off and finally filtered through a wet folded filter. The oil was washed with 4 l. of water, in each case, and the second extract again siphoned off. The combined extracts, which amounted to 24 l., were precipitated with 50 percent phosphotungstic acid sol. After standing over night the precipitate was separated by filtration, washed several times with 5 percent sulfuric acid sol., and finally dried. The total amount of precipitate, 2,237 gm., was ground in a mortar with 2.5 l. of dry acetone and the fine suspension shaken for 15 min. The insoluble part was separated by filtration, ground in a mortar with acetone, and the liquid filtered. The insoluble residue weighed 124 gm., subsequent treatment with acetone diminishing this quantity to 114 gm., which amounted to 5.1 percent of the total phosphotungstate precipitate.

Acetone-insoluble fraction. The material obtained by the foregoing process (114 gm.) was treated in a mortar with 400 gm. of neutral lead acetate and shaken for 2 hr. The lead phosphotungstate was separated by filtration and twice treated in a mortar with small quantities of lead acetate to complete the decomposition. The combined filtrates and washings were freed from the excess of lead with hydrogen sulfid and concentrated *in vacuo* (temp. of the bath, 26–31°C.). During the evaporation a cotton-wool-like substance separated out. After complete evaporation the residue was entirely crystallin, colorless and curative in very small doses. The action was similar to that of the original yeast, but only when all of the residue was given. To the residue a little water was added and the liquid filtered. The quantity of insoluble substance was 7.8 gm. When recrystallized from water, 5.35 gm. were obtained in the form of prisms. These were dried at 110°C., *in vacuo;* they darkened on heating above 250° and did not melt at 320° (uncorr.).

Of this substance, 0.1056 gm. required, by the Kjeldahl method, 38.8 cc. of *n*/sulfuric acid sol., equivalent to 51.43 percent of N (adenin, 51.85 percent). The *combustion* of adenin, because of the high nitrogen-content, gives very poor results, a fact which has not been mentioned in the literature. Data obtained by the combustion method are appended:

0.1269 gm. substance gave 0.2269 gm. CO_2 and 0.058 gm. H_2O; 48.76% C; 5.11% H.

0.1579 gm. substance gave 0.2652 gm. CO_2 and 0.0794 gm. H_2O; 45.81% C and 5.62% H.

Calc., for $C_5H_5N_5$ (135.09), 44.41% C; 3.73% H; 51.85% N.

For further identification a small quantity of this substance was converted into acetyl-adenin. One gm. of adenin was dissolved in 25 cc. of boiling acetic anhydride, and the liquid poured into cold water. After evaporation of the solution, 0.95 gm. of product were obtained. This material was recrystallized from dilute acetic acid, the crystals washed with water, and the total yield, 0.6 gm., dried *in vacuo* (no water of crystallization) at 110°C. The crystals decomposed at 300° (uncorr.).

0.1046 gm. of substance required, by the Kjeldahl method, 29.8 cc. of *n*/10 H_2SO_4; 39.88% N.

Calc., for $C_5H_4N_5$—CO—CH_3 (177.12), 39.54% N.

The mother liquor separated from the mass of the adenin crystals was precipitated with picric acid; 2.7 gm. of picrate were obtained. The picrate, which was very insoluble, was recrystallized from water; 2.2 gm. of yellow, silky needles were obtained. These had a melting point of 291°C. (uncorr.).

0.3478 gm. of substance lost, *in vacuo*, at 110° C., 0.0142 gm. H_2O : 4.08%.

Calc., for adenin picrate, H_2O : 4.70%.

0.1154 gm. of substance gave 30.7 cc. N (753 mm., 22.5° C.) : 30.44% N.

Calc., for adenin picrate, $C_{11}H_9N_8O_7$ (364.16) : 30.75% N.

The initial filtrate from the adenin crystals was also precipitated with picric acid. Excess of the reagent was required for this purpose, and there was obtained 2.9 gm. of picrate identical with adenin picrate. The filtrate from the picrate was shaken with 40 cc. of 20 percent sulfuric acid sol. and ether to remove the picric acid. The aqueous sol. was neutralized with 32 gm. of neutral lead acetate,

a little alcohol was added to make the lead sulfate more insoluble, the precipitate was filtered off, and the filtrate freed from excess of lead with hydrogen sulfid. This filtrate was evaporated *in vacuo* at 25°C., but the residue did not crystallize, The results of the animal experiments are indicated on page 7.

Precipitation tests were applied to the solution with the results indicated below:

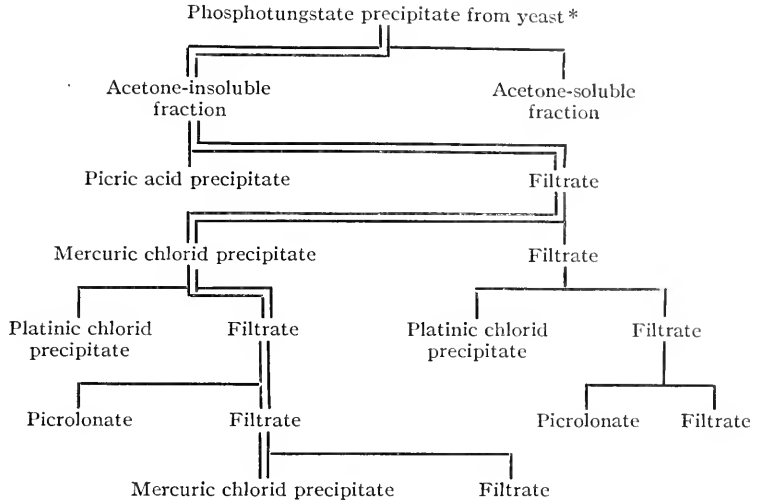
Picrolonic acid, +
Picric acid, —
Gold chlorid in water, +; in alcohol, —
Platinic chlorid in water, —; in alcohol, +
Mercuric chlorid in water, +; in alcohol, +

To the residue alcohol was added, and then an alcoholic sol. of mercuric chlorid, till complete precipitation occurred. The precipitate, separated by filtration and washed with alcohol, weighed 3.5 gm.

Mercuric chlorid precipitate. The mercuric chlorid precipitate was decomposed with hydrogen sulfid. After evaporation the filtrate did not crystallize. The residue was dissolved in alcohol and, after precipitation with alc. platinic chlorid sol., yielded 0.68 gm. of platinum compound. The filtrate, freed from platinum with hydrogen sulfid and precipitated with picrolonic acid, yielded 1.25 gm. of picrolonate. The filtrate was freed from picrolonic acid by extraction with ether. The solution still contained 0.0317 gm. of nitrogen, estimated by the Kjeldahl method, but did not crystallize. An alcoholic sol. gave, with an excess of mercuric chlorid, a small quantity of precipitate, but not enough for chemical study.

Mercuric chlorid filtrate. The liquid was freed from mercury with hydrogen sulfid, filtered and the filtrate evaporated *in vacuo*. The residue, which did not crystallize, was dissolved in alcohol and, precipitated with platinic chlorid, yielded 1.48 gm. of platinic compound. The filtrate was freed from platinum with hydrogen sulfid and precipitated with picrolonic acid. The resultant picrolonate was more soluble than the product with mercuric chlorid, and weighed 0.9 gm. The filtrate from the picrolonate, freed from picrolonic acid with ether, contained 0.0522 gm. of nitrogen (Kjeldahl method).

Experiments on animals. The influence of each of the above fractions was tried on two pigeons. The results, for presence of vitamine in the fraction, are summarized below:



3. The fractionation of yeast was repeated, by a method that was practically the same as that described in section 2. In this case 2,310 gm. of concentrated alc. extract from 90 k. of yeast were first treated, on a shaking machine, with 3 l. of 10 percent sulfuric acid sol. The acid extract was separated from the fat and, with phosphotungstic acid, 2,496 gm. of precipitate (slightly moist) were obtained. The acetone-insoluble fraction amounted to 213 gm. The extracted fat, treated again with 2 l. of 10 percent sulfuric acid sol., gave, with phosphotungstic acid, only 45 gm. of precipitate. This shows that the first extraction was very nearly a complete one.

Acetone-insoluble fraction. This fraction was treated with 460 gm. of neutral lead acetate sol. in a mortar and the filtrate, after being freed from lead, was precipitated with picric acid. The resultant picrate (7.1 gm.) was identical with adenin picrate. The filtrate was acidified with sulfuric acid and extracted with ether to remove the picric acid. From this solution sulfuric acid was re-

* The double lines indicate the presence of vitamine.

moved with lead acetate and the excess of lead with hydrogen sulfid. The last filtrate was evaporated to dryness *in vacuo,* the residue dissolved in alcohol and precipitated with alcoholic mercuric chlorid sol.

Mercuric chlorid precipitate. The 14.4 gm. of mercuric chlorid precipitate obtained by the foregoing treatment were suspended in water, decomposed with hydrogen sulfid, and the filtrate evaporated to dryness *in vacuo.* The residue was dissolved in water, freed from chlorin with silver acetate, the silver removed with hydrogen sulfid and the filtrate evaporated, yielding 0.1 gm. of crystallin substance which was not investigated further. The filtrate from this substance was precipitated in alcoholic sol. with platinic chlorid; 3.9 gm. of a very insoluble platinum salt were obtained. This salt was recrystallized from water. After decomposition with hydrogen sulfid and subsequent evaporation it yielded crystals which, dried *in vacuo* at 110°C., blackened when heated over 200° but did not melt even at 300° (uncorr.). The estimation of platinum did not give constant results; 44.8 percent and 42.5 percent were obtained.

The filtrate from the salt was freed from platinum and evaporated *in vacuo.* The residue gave no precipitate with picrolonic acid, nor with mercuric acetate, sulfate or nitrate.

Mercuric chlorid filtrate. The filtrate, freed from mercury, yielded, by evaporation, a crop of crystals weighing 1.1 gm. The filtrate from this substance was evaporated *in vacuo.* The residue, dissolved in alcohol and precipitated with platinic chlorid, yielded 1.9 gm. of the salt; this has not as yet been investigated. The filtrate from the salt, freed from platinum, gave no picrolonate.

The investigation of all these fractions is in progress. The acetone-insoluble fraction was active, as has been stated elsewhere (10).

4. Fractionation of autolyzed yeast. Two k. of pressed baker's yeast were moistened with water and left for 48 hr. at 37°C. To the mixture an equal vol. of alcohol was added, the liquid filtered, the residue washed, and the filtrate and washings evaporated *in vacuo* to dryness. To the residue, 500 cc. of 10 percent sulfuric acid sol. were added and allowed to stand over night. On the following day 500 cc. of water were added, the resultant precipitate

filtered off, and the filtrate precipitated with 50 percent phosphotungstic acid sol. The dried precipitate weighed 750 gm. and was quite white in color. The precipitate was treated with acetone in a mortar as previously described. After several treatments with acetone the insoluble residue weighed 259 gm., considerably more than in the case of the alc. extract of yeast. The acetone-insoluble residue was practically insoluble in methyl and ethyl alcohols, chloroform and other organic solvents, so that no further fractionation could be effected in this way.

Acetone-insoluble fraction. The 259 gm. obtained by the foregoing process, were treated, as previously described, with lead acetate. The filtrate, freed from lead and containing a large amount of acetic acid, was treated with nitric acid and then with silver nitrate. It is very surprising that no precipitate was obtained. Powdered baryta was added to the liquid until an alkaline reaction was obtained, the precipitate decomposed with hydrogen sulfid, traces of baryta removed with sulfuric acid, and the filtrate evaporated *in vacuo*. The residue gave a white precipitate, with alcohol, which will be investigated later. The filtrate from the silver salt, freed from silver, gave only a very small amount of precipitate with phosphotungstic acid.

Acetone-soluble fraction. To the acetone sol. a sol. of neutral lead acetate was added until complete precipitation occurred. The precipitate was obtained by filtration and washed with 30 percent acetone sol. A peculiar camphor-like smell was noticed during this operation. The filtrate, freed from lead, gave, after evaporation, a crystallin substance which proved to be unchanged phosphotungstate. It seems that, in the presence of a large amount of acetone, the decomposition of phosphotungstates with lead acetate is incomplete. To finish the process, acetone must be wholly removed by evaporation. When lead acetate was used, all the phosphotungstic acid was removed. After the removal of its excess of lead and its evaporation *in vacuo,* the filtrate yielded a completely crystallin residue which, so far, has proved to be without power to cure beriberi pigeons.

5. Fractionation of the phosphotungstate precipitate obtained from autolyzed yeast, by the use of acetone-water

SOLUTIONS OF DIFFERENT CONCENTRATIONS. In preliminary study of this problem, phosphotungstates of several naturally occurring nitrogenous bases were prepared and their solubility in 25 percent, 50 percent, 75 percent, and 100 percent acetone sol. estimated.* The following bases were used: cholin, betain, stachydrin, guanin, adenin, guanidin, creatinin and nicotinic acid. It was found that the phosphotungstates were increasingly soluble in the direction of the arrow: 25 percent→100 percent→50 percent→75 percent (acetone). The solubility in 75 percent acetone sol. was many times greater than that in pure acetone. Although mixtures of phosphotungstates may exhibit a behavior different from that of the individual substances—a point which has not as yet been determined—it seemed promising to adopt this method for the investigation of the phosphotungstates obtained from autolyzed yeast; in which case, as we saw from the data in the preceding section, a large fraction is insoluble in pure acetone. By applying this method to the mixture of phosphotungstates from autolyzed yeast, five fractions were obtained, the last insoluble fraction having been much smaller in bulk, than that with pure acetone. It is not known, at present, in which of the five fractions the vitamine is contained but, from previous findings, one is inclined to assume its presence in the insoluble fraction, which is freed from the bulk of inactive substances without sustaining loss by decomposition.

The fractionation was conducted as follows:

Ten lb. of wet brewer's yeast were autolyzed for three days. To the semi-liquid mixture a third of its volume of alcohol was added and the liquid was filtered. The filtrate was concentrated *in vacuo* and the residue shaken with 1 l. of 10 percent sulfuric acid sol. for 24 hr. The residue was obtained by filtration and washed on the filter with sufficient water to make 2 l. of filtrate and washings. This liquid was treated with 50 percent phosphotungstic acid sol. After standing for 24 hr. the precipitate was separated by filtration and washed four times with 200 cc. portions of 5 percent sulfuric acid sol. and finally dried. The dry precipitate weighed 1,125 gm.

For fractionation, the precipitate was powdered, passed through

* The estimations were made by my assistant, Mr. J. C. Drummond.

a fine sieve, and shaken for 1 hr. with 3 l. of 25 percent acetone. The insoluble part was sucked off and washed three times with a total of 500 cc. of 25 percent acetone sol., dried and weighed; 400 grams of the precipitate dissolved. The insoluble fraction was again powdered and extracted, for 1 hr. on a shaker, with 2 l. of 25 percent acetone sol. This time 122 gm. dissolved. The remaining 603 gm. were powdered and extracted in the above-mentioned way with 2 l. of pure acetone. The insoluble portion was separated and washed with 250 cc. of acetone; 155 gm. dissolved. The extraction was repeated with 1 l. of acetone; 35 gm. dissolved. The remaining 413 gm. were extracted with 1 l. of 50 percent acetone sol. as previously described. The insoluble residue was separated and washed with 100 cc. of 50 percent acetone sol.; 95 gm. dissolved. The extraction was repeated with 1 l. of the solvent and the precipitate washed three times with 100 cc. of 50 percent acetone sol.; 60 gm. dissolved. The remaining 258 gm. were extracted with 1,200 cc. of 75 percent acetone sol., and the precipitate washed twice with 100 cc. of 75 percent acetone sol.; 68 gm. dissolved. The extraction was repeated with 1 l. of 75 percent acetone sol. and the material washed twice with 100 cc. of the solvent of the same concentration; 25 gm. dissolved. The extraction was repeated with 680 cc. of 75 percent acetone sol. for 1 hr. and washed twice with 100 cc. of 75 percent acetone sol.; 15 gm. dissolved. The insoluble residue finally amounted to 150 gm.

The degrees of solution in the acetone media of different concentrations are indicated in the following summary:

Total precipitate, gm.	Soluble in 25 percent acetone sol., gm.	Soluble in 100 percent acetone, gm.	Soluble in 50 percent acetone sol., gm.	Soluble in 75 percent acetone sol., gm.	Insoluble residue, gm.
1125	522 (46.4%)	190 (16.8%)	155 (13.7%)	108 (9.6%)	150 (13.3%)

These results indicate that, in the case of the phosphotungstate from autolyzed yeast, the residue with pure acetone amounted to 34 percent of the total precipitate, whereas, with acetone-water sol. of different concentrations, the residue amounted to only 13.3 percent—and might have been further diminished by additional extrac-

tions. The various phosphotungstates obtained by this method show entirely different aspects, so that certainly a crude separation was affected.

Summary of general conclusions. The phosphotungstate percipitate from alc. extract of yeast can be divided, by means of acetone, into two fractions: a small *insoluble* fraction, which *contains the bulk of vitamine;* and a large *soluble* one, which is *totally inactive.* The phosphotungstates were decomposed with lead acetate instead of with baryta. This method offers two advantages: it yields very clear solutions, which facilitate further purification, and it avoids the use of alkali.

In the case of autolyzed yeast, from which a larger yield of vitamine may be expected, the acetone method produces an insoluble fraction which represents 34 percent of the total precipitate. By using 25 percent, 100 percent, 50 percent, and 75 percent acetone sol., in this order, it is possible to separate the phosphotungstate precipitate into four soluble fractions, and into a fifth insoluble one representing only about 13 percent of the total precipitate.

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3. Funk: *Jour. of Physiol.,* 1912, xlv, p. 75.
4. Cooper and Funk: *The Lancet,* 1911, ii, p. 1266.
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11. Cooper: *Biochem. Jour.,* 1914, viii, p. 250.

THE BROMINE AND IODINE COMPOUNDS OF HEXAMETHYLENETETRAMINE

KANEMATSU SUGIURA AND K. GEORGE FALK

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(Received for publication, November 16, 1915)

The extensive therapeutic use of hexamethylenetetramine (urotropin, cystogen, formin, etc.), made a simple quantitative method for its estimation desirable. A study of the compounds which it forms with bromine and iodine showed that such a method may be based upon the formation of the tetraiodide.

The nitrogen content of a number of preparations of hexamethylenetetramine on the market was determined by the Kjeldahl method and found to be very close to the calculated value for a substance of the formula $(CH_2)_6N_4$.

BROMINE DERIVATIVES. Legler[1] described a dibromine derivative and Horton[2] both a di- and a tetrabromine derivative. When bromine and finely powdered hexamethylenetetramine were allowed to stand under a bell jar or in a desiccator, in separate vessels, bromine was taken up as described by Horton; but, contrary to his results, a product of a definite composition could not be obtained in this way. The number of bromine atoms taken up varied with the length of time the reaction was allowed to proceed and the amount of washing, with ether, of the resulting product. Nitrogen determinations showed that, after long continued action as many as five atoms of bromine were taken up per molecule of hexamethylenetetramine. Under the microscope it was evident that mixtures were present, consisting of yellow dibromine derivative and red compounds containing a greater proportion of bromine. Similar mixtures were obtained in the reaction between aqueous solutions of hexamethylenetetramine and bromine water. The preparation and

[1] Legler: *Ber.*, **18**, 3350 (1885).

[2] Horton: *Ber.*, **21**, 1999 (1888).

properties of the dibromine derivative, $(CH_2)_6N_4Br_2$, described by Legler and by Horton, were fully confirmed. Attempts at recrystallization were unsuccessful.

IODINE DERIVATIVES. Horton, in 1888, described di- and tetraiodine compounds of hexamethylenetetramine.

The tetraiodine compound may be prepared by adding to 5 gm. of hexamethylenetetramine in 100 cc. of water, 18.1 gm. of iodine in 300 cc. of 95 percent ethyl alcohol. The precipitate first formed is dark grey, becomes lighter colored after further addition of iodine, and finally red. After standing over night it is filtered and washed three times with 5–10 cc. of 95 percent ethyl alcohol. After drying in a vacuum desiccator, 22.0 gm. (calc., 23.1 gm.) of brownish red crystals are obtained. The *nitrogen* determinations (Kjeldahl) yielded the following results:

0.1038 gm. of substance gave 0.00878 gm. of N, or 8.46 percent of N
0.1008 gm. " " 0.00862 gm. " " 8.55 percent of N
0.1038 gm. " " 0.00894 gm. " " 8.61 percent of N
Mean: 8.54 percent of N; calc. for $(CH_2)_6N_4I_4$, 8.65 percent of N.

The best medium for recrystallization was found to be chloroform, from which the substance was deposited in characteristic, well formed, mahogany-red, monoclinic crystals. *Nitrogen* determinations of the recrystallized material gave the following results:

0.2003 gm. of substance gave 0.01695 gm. of N, or 8.46 percent of N
0.2018 gm. " " 0.01706 gm. " " 8.45 percent of N
0.2050 gm. " " 0.01744 gm. " " 8.51 percent of N
Mean: 8.47 percent of N.

After standing for nine months in diffused daylight, in a stoppered bottle, the crystals had become black but still retained their monoclinic shapes. Nitrogen determinations gave a mean value (for four analyses) of 8.44 percent. An iodine determination by the Carius method, with recrystallized substance, gave 0.2869 gm. of silver iodide from 0.1998 gm. of substance, or 77.6 percent of I; calc. for tetraiodine compound, 78.4 percent. The iodine in the complex may also be titrated directly with $m/25$ thiosulfate sol. after addition of 50 cc. of water and 3 cc. of glacial acetic acid. Starch sol. is added near the end, and the lumps of tetraiodine compound must

continually be broken up with a stirring rod. The end point is not considered to have been reached until after all the material is in solution. One cc. of *m*/25 thiosulfate sol. is equivalent to 0.00508 gm. of iodine, or 0.0014 gm. of hexamethylenetetramine. Two results of *iodine* determination by this method may be given:

0.1013 gm. of substance required 15.73 cc. of *m*/25 thiosulfate sol., equivalent to 0.0799 gm. of I, or 78.9 percent of I.

0.1044 gm. of substance required 16.16 cc. of *m*/25 thiosulfate sol., equivalent to 0.0820 gm. of I, or 78.6 percent. of I.

Mean *iodine* content: 78.7 percent.

The diiodine compound may be prepared by adding the requisite amount of iodine dissolved in alcohol to hexamethylenetetramine dissolved in water (Horton), or by extracting the tetraiodine compound with ether eight or nine times in a separatory funnel, with shaking. In this way a dark greenish yellow diiodine compound was obtained, which gave the following analytic results for *nitrogen:*

0.2020 gm. : 0.02787 gm. of N, or 13.80 percent of N
0.2016 gm. : 0.02798 gm. " " 13.88 percent of N
Mean: 13.84 percent of N; calc. for $(CH_2)_6N_4I_2$, 14.23 percent.

The diiodine compound is much less soluble than the tetraiodine product, being almost insoluble in the ordinary common organic solvents.

Method of estimating hexamethylenetetramine. The method, based upon the properties of the tetraiodide, is conducted as follows.

To the solution in question, 50 cc. being a convenient amount to use, containing no proteins or similar substance precipitable by iodine, there is added from a buret or pipet with stirring, an alcoholic iodine sol. containing 3.6 gm. of iodine in 100 cc. of 95 percent ethyl alcohol. If hexamethylenetetramine is absent, no precipitate is formed at first but after further addition, bluish black iodine precipitates. On the other hand, if hexamethylenetetramine is present, a precipitate is formed, which is first brownish yellow in color; finally, reddish to dark brown. About 20 percent excess of iodine is advisable; if more is added, iodine may be precipitated. The amount needed may be judged by the formation of the precipitate as the iodine sol. is added, or the mixture is filtered and treated with more

iodine sol., or an approximate determination is made first and then a more accurate one with new solution. After all the iodine has been added (as a rule, 5–8 cc. are required), the mixture is allowed to stand about 10 min., with occasional stirring, and filtered with suction through a Gooch crucible containing an asbestos mat (filtration through paper is unsatisfactory). Re-filtration through the same mat is advisable. The precipitate is washed five to ten times with cold water. The precipitate and crucible may be dried in a vacuum desiccator over calcium chloride to constant weight (no appreciable loss of iodine occurs at room-temperature within reasonable time-limits), and weighed as tetraiodine compound. Better than weighing the precipitate is the titration of the iodine present with thiosulfate sol. For this purpose, the precipitate and crucible are transferred to a beaker, 50 cc. of water and 3 cc. of glacial acetic acid added, and the mixture titrated with $m/25$ sodium thiosulfate sol., with added starch sol. as described above.

If the liquid, in which hexamethylenetetramine is to be determined, contains protein matter (such as albumin in urine, etc), an equal volume of methyl alcohol is first added, the mixture allowed to stand 1–2 hr. at room-temperature, filtered by decantation through folded filter paper, evaporated to one-third the volume in a current of air or under diminished pressure, iodine sol. added, and the determination carried out as already described. The presence of glucose does not interfere with the estimation of hexamethylenetetramine.

The results of the analyses of the tetraiodine preparations given before, in the description of the substance, show that, as precipitated directly, the product is practically pure. Test analyses with different mixtures showed, however, that errors may be introduced by incomplete precipitation of the hexamethylenetetramine, as well as by iodine that may be carried down with the precipitate. A few of these results are given below:

Two samples of 0.0502 gm. each of hexamethylenetetramine in 50 cc. of water, precipitated with 6 cc. of iodine sol., filtered, etc., required 40.02 and 41.01 cc. respectively of 0.0388 *m* thiosulfate sol., corresponding to 0.0543 gm. and 0.0557 gm., respectively, of hexamethylenetetramine.

Two samples of 0.0251 gm. each of substance in 50 cc. of water, precipitated with 3 cc. of iodine sol., treated similarly, required 17.80 and 17.64 cc., respectively, of the thiosulfate sol., corresponding to 0.0242 gm. and 0.0239 gm. respectively of original substance.

A series of experiments, in which the *nitrogen* was determined in the filtrate from the tetraiodine compound, gave the following data:

0.0502 gm. of hexamethylenetetramine in 25 cc. of water, precipitated with 8.5 cc. of iodine sol., gave 1.8 mg. of nitrogen in the filtrate. In 50 cc. of water, 2.9 mg. were found; and in 100 cc., 4.1 mg. The same amount of iodine sol. was used in each experiment.

The results of further test-analyses will not be given here, only the conclusions drawn therefrom.

The error in the estimation of hexamethylenetetramine in aqueous sol. is at most 15 percent of the amount present; but, as a rule, it is much less. In urines, a compensation of errors apparently occurs and the accuracy of the results is greater, perhaps within 5 percent of the amount present. Although this is not a very satisfactory degree of accuracy for analytical work, it is sufficient for the purpose in view; that is, for the determination of the amounts of hexamethylenetetramine eliminated by the body under various conditions.[3]

Very often, in the precipitation of urines with iodine sol., the tetraiodine compound forms fine needles. If a qualitative identification of the substance is desired, a recrystallization from chloroform with production of the characteristic, mahogany-red, monoclinic crystals suffices. In the recrystallization, about 25 percent of the substance is lost, so that in this way, a rough idea of the amount originally present may be obtained.

[3] The results obtained so far in this part of the investigation will be presented in the *Journal of Pharmacology and Experimental Therapeutics*, January, 1916.

BRIEF CONTRIBUTIONS TO BIOCHEMISTRY

Numbers 1–7

JACOB ROSENBLOOM

(*Biochemical Laboratory of the Western Pennsylvania Hospital, Pittsburgh, Pa.*)

(Received for publication, December 29, 1914)

1. Report of chemical examination of the brain of a luetic fetus

Through the kindness of Dr. A. L. Garbat and Dr. O. Hensel there was placed at my disposal the brain of a luetic fetus obtained at the sixth month of gestation. It was thought that a chemical examination of this organ would prove of interest on account of the marked changes that this disease causes in the cerebro-spinal system.

Methods. The desiccation of the material, extraction of the lipins and the chemical analysis were carried out according to the methods described in former papers.[1] Phosphorus was estimated by Neumann's[2] method (weighed as magnesium pyro-phosphate); nitrogen by the Kjeldahl-Gunning method; sulfur by Benedict's[3] method, with fuming nitric acid to oxidize before adding the sulfur reagent; calcium and magnesium in the ash by McCrudden's[4] method. The water content of the brain was estimated by Benedict's[5] method. The cerebro-galactosids were estimated by determining gravimetrically, with Fehling solution, the amount of galactose split off with dilute hydrochloric acid.

Table 1 presents the results obtained in this study, together with certain data found in the literature.

[1] Hanes and Rosenbloom: *Jour. Exp. Med.*, 1911, xiii, p. 355. Rosenbloom: *Jour. Biol. Chem.*, 1913, xiii, p. 511.

[2] Neumann: *Zeit. f. physiol. Chem.*, 1902, xxxvii, p. 129; 1904, xliii, p. 35.

[3] Benedict: *Jour. Biol. Chem.*, 1909, vi, p. 363.

[4] McCrudden: *Ibid.*, 1911, x, 187.

[5] Benedict: *Amer. Jour. Physiol.*, 1905, xiii, 309.

TABLE I

Data pertaining to the percentage composition of the brains of human fetuses

Observers	† Siwertzeff[1]			† Koch and Mann[2]	‡ Quest[3]			§ Cohn[4]				Rosenbloom §
Source	6 mo. fetus	8 mo. fetus	9 mo. fetus	Undeveloped child of six weeks	7 mo. fetus	8 mo. fetus	New born	25 cm. fetus	7 mo. fetus	8 mo. fetus	Child 1 day old	6 mo. luetic fetus
Brain weight (gm.)	—	—	—	640	63.9	145.0	339.6	56.0	63.9	145.0	495.0	185.0
Water	—	—	—	88.78	—	—	—	91.1	13.4	11.7	89.3	90.0
Total solids	—	—	—	—	—	—	—	—	—	—	—	10.0
Total lipins	—	—	—	—	—	—	—	—	—	—	—	5.0
Cholesterol	—	—	—	1.9	—	—	—	—	—	—	—	2.5
Cholesterol-esters	—	—	—	—	—	—	—	—	—	—	—	0
Phospholipins	9.39	11.95	12.86	24.2	—	—	—	—	—	—	0.75	1.04
Fatty acids	—	—	—	—	—	—	—	—	—	—	—	0.02
Neutral fat	—	—	—	—	—	—	—	—	—	—	—	1.00
Cerebro-galactosides	—	—	—	6.9	—	—	—	—	—	—	—	0.50
Nitrogen	—	—	—	—	13.4	11.7	10.63	9.44	—	—	9.70	7.1
Sulfur	—	—	—	0.52	—	—	—	—	—	—	—	0.85
Phosphorus	—	—	—	1.72	—	—	—	—	—	—	1.70	0.91
Calcium	—	—	—	—	0.168	0.164	0.110	0.063	0.168	0.164	0.052	0.09
Magnesium	—	—	—	—	—	—	—	—	—	—	—	0.04

[1] Siwertzeff: *Zentr. f. Biochem.*, 1903, i, p. 589.

[2] Koch and Mann: *Arch. of Neurol. and Psychol.*, 1909, iv, p. 1; *Jour. Physiol.*, 1907, xxxvi (*Proc. Physiol. Soc.*).

[3] Quest: *Jahr. d. Kinderheilk.*, 1905, lxi, p. 114.

[4] Cohn: *Deut. med. Woch.*, 1907, xxvii, p. 1987.

† Calculated as percentage of *dry* brain substance.

‡ Calculated on the basis of "*fat-free*" *dry* substance.

§ Calculated on the basis of *fresh* brain substance.

2–5. Chemical analyses of human hydramnios fluid (2), normal human pericardial fluid (3), normal human bile (4), and human cerebro-spinal fluid (5)

The methods of analysis were those referred to in section 1, or others equally satisfactory and in general vogue. See Tables 2–5.

TABLE 2

Data pertaining to the composition of human hydramnios fluid: Parts per 100

Constituent	Specimens					
	1	2	3	4	5	6
Specific gravity	10.10	10.08	10.07	10.05	10.12	10.11
Protein	0.15	0.29	0.34	0.36	0.41	0.45
Total nitrogen	0.112	0.092	0.098	0.122	0.089	0.093
Ammonia nitrogen	0.0042	0.0052	0.0063	0.0054	0.0072	0.0070
Sulfur	0.007	0.009	0.013	0.015	0.017	0.0190
Urea	0.117	0.112	0.121	0.120	0.119	0.116
Creatin	0	0	0	0	0	0
Creatinin	0	0	0	0	0	0
Uric acid	0.0050	0.0062	0.0063	0.0054	0.0062	0.0053
Ash	0.724	0.782	0.737	0.692	0.702	0.714
Total solids	11.04	11.12	10.91	10.98	11.07	11.29
Water	88.96	88.78	89.09	89.02	88.93	88.71

TABLE 3

Data pertaining to the composition of normal human pericardial fluid: Parts per 100

Constituent	Specimens			
	1	2	3	4
Specific gravity	10.13	10.11	10.10	10.14
Protein	2.7	2.6	2.1	2.8
Nitrogen	0.644	0.620	0.670	0.580
Sulfur	0.031	0.038	0.029	0.026
Phosphorus	0.125	0.132	0.138	0.127
Water	97.1	96.4	96.3	96.6
Total solids	2.9	3.6	3.7	3.4
Sodium chlorid	0.71	0.78	0.64	0.68

TABLE 4

Data pertaining to the nitrogen, sulfur and phosphorus contents in normal human bile: Parts per 100

No.	Source	Sulfur	Nitrogen	Phosphorus
1	Male, 30 yr.	0.081	0.434	0.081
2	Male, 42 yr.	0.072	0.395	0.072
3	Male, 46 yr.	0.053	0.421	0.059
4	Female, 48 yr.	0.071	0.398	0.068
5	Female, 36 yr.	0.087	0.445	0.087
6	Male, 19 yr.	0.076	0.462	0.079
7	Male, 22 yr.	0.069	0.397	0.073
8	Male, 34 yr.	0.079	0.438	0.080

TABLE 5

Data pertaining to the nitrogen, sulfur and phosphorus contents in human cerebro-spinal fluid: Parts per 100

No.	Source	Nitrogen	Sulfur	Phosphorus
1	Female, 40: Diabetes	0.196	0.034	0.050
2	Male, 30: Normal	0.172	0.029	0.048
3	Male, 34: Normal	0.177	0.032	0.052
4	Male, 26: Tbc. meningitis	0.298	0.057	0.124
5	Male, 52: Cerebral lues	0.310	0.062	0.140
6	Male, 48: Cerebral lues	0.276	0.049	0.075
7	Male, 30: Normal	0.192	0.030	0.054
8	Female, 34: Normal	0.186	0.029	0.048
9	Male, 18: Meningitis	0.362	0.062	0.170
10	Male, 34: Gen. paresis	0.270	0.045	0.092
11	Male, 39: Gen. paresis	0.268	0.049	0.087

6. On the absence of creatin and creatinin from human cerebro-spinal fluid

Examination of 200 cc. of human cerebro-spinal fluid collected from different cases, failed to show any trace of creatin or creatinin. The Jaffé method was employed.

7. A modification of Gerhardt's test for diacetic acid in urine

The precipitate that forms with the addition of ferric chlorid sol. to urine, on testing for diacetic acid, often obscures the development of the port wine color due to the presence of diacetic acid. Some have recommended that this precipitate be filtered off so as to prevent this difficulty. I have found, however, that if this test is carried out as a contact test, similar to Heller's test for protein in urine, the precipitate does not interfere but the test is made more delicate and positive reactions are more striking. One simply pours about 5 cc. of urine on top of 5 cc. of 10 percent ferric chlorid sol. and, if diacetic acid or the other substances that form port wine colors with ferric chlorid are present, a fine port wine color appears in the zone of contact.

THE BIOCHEMICAL SOCIETY, ENGLAND

Scientific programs

R. H. A. PLIMMER, SECRETARY

November 8. PHYSIOL. LAB., KING'S COLLEGE, STRAND, LONDON. (5.30 P. M.)[1]

A. T. Cameron: Distribution of iodine in plant and animal tissues.

J. C. Drummond: Volumetric estimation of total sulphur and sulphates in small quantities of urine.

H. Maclean: Action of diabetic blood on sugar.

H. Maclean: Observations on the quantitative determination of carbohydrates by means of the ordinary alkaline copper solutions.

A. J. Ewins: Note on the separation of creatinine and methylguanidine by the silver method.

December 13. LISTER INST., CHELSEA GARDENS, LONDON, S.W. (5.00 P. M.)[2]

S. W. Cole and *Hon. H. Onslow:* Differential diagnosis of bacteria by the final hydrogen concentration.

S. W. Cole: Estimation of uric acid.

W. Brown: Preparation of collodion membranes of any required degree of permeability.

J. C. Drummond: Observations upon the growth of young chickens under laboratory conditions.

J. C. Drummond: Growth of rats upon artificial diets.

W. A. Davis: Distribution of maltase in plants and its function in starch degradation.

A. J. Daish: Presence of maltase in the leaves of plants.

A. J. Daish: Presence of maltase in germinated barley.

S. Walpole: Demonstration of plate form of ultra-filter.

E. E. Atkin and *A. Bacot:* Demonstration of association between the development of mosquito larvæ and the presence of bacteria.

S. Walpole: Demonstration of still for conductivity-water.

University College, London.

[1] The last two preceding meetings were held on May 5 and June 12. See BIOCHEMICAL BULLETIN, 1915, vol. iv.

[2] The next two meetings are scheduled for Feb. 12 and Mar. 9.

SOCIETY OF PUBLIC ANALYSTS AND OTHER ANALYTICAL CHEMISTS

E. Richards Bolton, Secretary

Ordinary Meeting, December 1, 1915. Held at the Chemical Society's Rooms, Burlington House, London. Mr. A. Chaston Chapman, President, in the Chair.

Dr. *Eric Keightley Rideal* and Mr. *Arthur Stanley Carlos* were elected members of the Society. Certificates were read, for the first time, in favour of Messrs. *Thomas John Hitchcock* and *Nelson Trafalgar Foley*. Certificates were read for the second time in favour of Messrs. *Thomas Featherstone Harvey, Cyril Herbert Manley, Caryl Cameron Roberts* and *Frank Thomas Shutt*.

ABSTRACTS OF THE PAPERS THAT WERE READ

The "presumptive coli test" on unchilled waters: *W. Partridge,* F.I.C. The author pointed out that if positive results are ignored and negative results only considered, the 'presumptive *B. coli* test' often usefully supplements the ordinary chemical analysis of unchilled water.

Notes on methods of analyzing oleaginous seeds and fruits: *E. Richards Bolton.* It is shown that the errors in the estimation of oil in oleaginous seeds and fruits (copra in particular) are due rather to sampling than to actual analysis. Methods of sampling, grinding and analysis were demonstrated to show that while the oil in copra could be estimated with great accuracy by the methods given, departure from the procedure would be liable to cause considerable error.

46 Stamford Brook Road, W., London.

PROCEEDINGS OF THE THIRD ANNUAL MEETING OF THE FEDERATION OF AMERICAN SOCIETIES FOR EXPERIMENTAL BIOLOGY, IN BOSTON, DEC. 26–29, 1915

PAUL E. HOWE

PREPARED FROM REPORTS BY THE SECRETARIES OF THE CONSTITUENT SOCIETIES, C. W. GREENE, P. A. SHAFFER, JOHN AUER AND PEYTON ROUS

I. FEDERATION OF AMER. SOCIETIES FOR EXP. BIOLOGY: THIRD ANNUAL MEETING

John Auer,

Secretary of the Executive Committee for 1915

The third annual meeting of the Federation, comprising the Amer. Physiol. Soc., the Amer. Soc. of Biol. Chemists, the Amer. Soc. for Pharmacol. and Exp. Therapeutics, and the Amer. Soc. for Exp. Pathol., was held in the laboratories of the Harvard Med. Sch., Boston, Dec. 27–29, 1915.

Dinners. Two informal subscription dinners were given on the evenings of Dec. 27 and 28 at the Hotel Lenox. At the first dinner the Chairman of the Exec. Commit. of the Fed. for 1915, Torald Sollmann, gave a brief review of the history of the Fed. and pointed out some possible future developments.[1] The Chairman then called upon Drs. W. B. Cannon, Walter Jones, and John Auer, who responded with pithy speeches.

Scientific program. Only two joint scientific sessions could be arranged, the large number of papers offered, and the limited time, preventing other general meetings.

[1] The substance of Prof. Sollmann's address is given on page 30.

First session. Monday, Dec. 27, 9.00 a. m. Presiding officer: *President of the Pharmacol. Soc., and Chairman of the Exec. Commit. for 1915, Torald Sollmann.*

Symposium: Food accessories. Discussion opened by T. B. Osborne and L. B. Mendel, Casimir Funk (absent), E. V. McCollum, and Carl Voegtlin.

W. H. Howell: Formation and structure of fibrin gel.—*Jacques Loeb:* Mechanism of osmosis.—*W. B. Cannon* and *R. Fitz:* Overactivity of the cervical sympathetic.—*Otto Folin* and *R. D. Bell,* with the assistance of *G. Le B. Foster:* New observations on the uric-acid content of the blood.—*A. L. Meyer* and *S. J. Meltzer:* Continuous insufflation through the humerus in fowl.—*E. K. Marshall, Jr.,* and *D. M. Davis:* Influence of the adrenals on the kidney.—*Leo Loeb:* Heredity and internal secretion in the origin of cancer in mice.—*J. B. Murphy:* Effect of X-rays on cancer immunity.—*Harvey Cushing* and *Gilbert Horrax:* Presence of posterior-lobe secretion in the cerebro-spinal fluid.

Second session. Tuesday, Dec. 28, 2.00 p. m. Presiding officer: *President of the Pharmacol. Soc., and Chairman of the Exec. Commit. for 1915, Torald Sollmann.*

Demonstrations. *F. R. Miller:* Deglutition centre in the medulla oblongata.—*C. G. Bull:* Demonstration of the agglutination of bacteria in vivo.—*Peyton Rous* and *F. S. Jones:* Method of obtaining suspensions of living somatic cells of the higher animals.—*G. H. A. Clowes:* Analogous antagonistic effects exerted by electrolysis and anesthetics on physical systems and living cells.—*W. B. Cannon* and *McKeen Cattell:* Action current of glands.—*H. B. Williams:* New type of string galvanometer and accessory apparatus.—*Robert Gesell:* Apparatus for the investigation of cardiodynamics.—*A. L. Prince:* Circulation model.—*Theodore Hough:* Improved slide for blood counting.—*W. B. Cannon:* Motor-driven airblast interruptor for artificial respiration.—*Yandell Henderson:* Mine-rescue breathing-apparatus.—*H. G. Barbour* and *L. L. Maurer:* Method of studying respiration in the rat.—*A. L. Meyer* and *S. J. Meltzer:* Insufflation through the humerus in fowl.—*W. McK. Marriott:* Simplified procedure for the determination of carbon dioxide tension in alveolar air.—*R. T. Woodyatt:* Quantitative pump for

prolonged intravenous injections.—*D. E. Jackson:* New apparatus. —*Raymond Spaeth:* Apparatus for recording graphically the movements of melanophores.—*E. C. Rosenow:* Elective localization of streptococci.—*P. A. Kober:* Nephelometric methods; Reagents for the estimation of proteins, nucleic acids, purin bases, uric acid, phosphorus, and ammonia (Graves' reagent).—*G. W. Fitz:* Perfected "shadow pupillometer."—*E. G. Martin:* Simple rheostat for laboratory use; A motor-driven circuit-breaker.

Executive proceedings. Exec. Commit. for 1916. Chairman, *Simon Flexner;* secretary, *Peyton Rous* (Pathol. Soc.); *W. B. Cannon, C. W. Greene* (Physiol. Soc.); *Walter Jones, S. R. Benedict* (Biochem. Soc.); *Reid Hunt, John Auer* (Pharmacol. Soc.).

Next meeting. The next annual session of the Fed. will be held in New York City, in affiliation with the Amer. Assoc. for the Adv. of Science.

Chairman Sollmann's address at the dinner. Prof. Torald Sollmann, Pres't of the Pharmacol. Soc., and Chairman of the Exec. Commit. of the Fed., for 1915, addressed the Fed. at the first "joint dinner and smoker," on Dec. 27th, in substance as follows:

It may not be useless to review the objects that the Fed. was intended to accomplish; to see how well these have been attained; and to examine what if any changes may be desirable.

The object of the Fed. was to facilitate the affairs that concern all the constituent societies—societies with common ideals, and common standards; differing only in their technical features. To the founders it seemed that a working federation of these societies would prevent a good deal of unnecessary motion and dissipation of energy. It would effect a saving of time for the councils and secretaries in arranging places of meetings and other associated details, and in preparation of the programs. It would provide a method of taking care, at least temporarily, of the growing number of papers, and to a certain extent distribute them more equally among the various societies. It would be a standing invitation to hold joint meetings and thus to heal the wounds of fission that modern specialization has made unavoidable. Above all, it would constantly keep before the consciousness of the members of the spe-

cial societies the fact that they are also members of the larger brotherhood of the biological sciences. In brief, the objects of the Fed. may be summed up as greater efficiency and broader ideals.

Although the existence of the Fed. has been short, it has given a pretty fair opportunity of testing how far these objects could be accomplished. It will therefore repay us to review briefly its accomplishments. In the first place, the Fed. has not realized the fears of those who believed that it would infringe on the independence or identity of the various constituent societies. Each society, in its individual affairs, remains as independent as it pleases, as independent and individualistic as it ever was. The individual societies have merely been relieved of individual drudgery—and they have their own turn at this every four years.

The mechanism by which the Fed. guards the individual rights and likes of its constituent societies is most interesting. The Fed. stands almost unique among societies, in that it has no constitution; and, strictly speaking, no officers, for the societies undertake the management of the meetings in the order of their seniority.

The question naturally arises: Is this arrangement the best one? Or, Should the Fed. adopt a formal constitution, possibly extending its functions? These, as well as other questions, I leave to the consideration of future councils and officers. My personal preference would be to let the Fed. continue its present abstract and ideal existence, rather than to confine it in fetters of rigidly formulated rules.

It might, however, be advisable for the individual societies, when they have occasion to revise any part of their own constitutions, to bring these, as far as it is wise, into harmony with the constitutions of the other societies in the Fed.

In the direction of the energetic imperative, in saving energy, time and expense, the Fed. has been an unqualified success. The meeting places have been selected and the arrangements made with a minimum of labor, and, through the distribution of the constitutions and the membership lists of all the societies to every individual member, the experimental biologists have come to know each other better.

These results, it is true, are due largely to the devotion of the

secretaries, who have served the Fed. Nevertheless, it is the Fed. that gave them the opportunity to direct their energies into these really productive channels. They have earned and no doubt receive the fullest appreciation of the members of the Fed., and by the same token, we may justly expect equal devotion from the future secretaries.

In the matter of program, the success of the Fed. has been equally great, although perhaps not as complete. The cooperation of the secretaries, which is made possible by the Fed., has resulted in a more evenly balanced program and in a more logical distribution of papers, both as to subject and time. The society that has too many papers can transfer some of these to the societies with smaller numbers. The members of any one society are given the opportunity of hearing papers presented before any other society; and a worker in any special subject has the privilege of presenting his data before the society most interested, regardless of his individual membership. This condition lessens the need of belonging to the several societies, a matter of financial importance to some of the members. The societies themselves gain by this natural limitation of their membership to those who are continuously interested in their special subject.

On the other hand, the fact that a member of one of the societies is, in a sense, a member of all the societies of the Fed., makes it doubly important that every society shall use due care in admitting new members; and in maintaining its membership above reproach. Incalculable harm must come to American science if the membership of its scientific societies is abused for commercial advertising purposes.

In one respect the Fed. has failed to accomplish all that was hoped from it, namely, in relieving the pressure of papers. For the first year or so there did, indeed, appear to be a noticeable measure of relief; and the beneficial practice of joint sessions could be maintained. It could have been foreseen, however, and doubtless was foreseen, that this relief would be only temporary. In fact, any measure can give only temporary relief whilst American science is growing. Permanent relief could be given only by restricting the output of American research; and no one has any doubt as to which

of the two evils is the smaller. Whilst permanent relief is not to be foreseen, we may safely leave a few problems to our intellectual and academic descendants.

We will have done our full duty if we meet this problem in our own generation. There are several possible ways of relief for the present congestion. It is not necessary to discuss all of them. There are objections to each and one need not take up the more objectionable until that becomes necessary. The mildest method is that already adopted by most of the societies, namely, of progressively limiting the number of papers that may be offered by any one worker, if the program is congested.

Whilst we would all like to hear about all the work that each member has done each year, that is manifestly impossible. And, since it is impossible, it may not be too much of an imposition to ask each worker to present only the one topic which he himself believes to be most interesting or valuable. I suggest, therefore, that each member be entitled to read but one paper before the Fed. each year but that additional papers may be accepted by the secretaries, if the condition of the programs permits. Before admitting these additional papers, however, the secretaries should arrange for the desirable number of joint sessions; and should also assure themselves that enough time is given to encourage discussion.

A final subject, which future councils will have to take up, is the question of loose or close affiliation with other societies, for instance the Anatomists. This subject is too large for consideration tonight.

Further general comment, on the affairs of the Fed., is published on p. 44.

II. AMERICAN PHYSIOLOGICAL SOCIETY: TWENTY-EIGHTH ANNUAL MEETING

C. W. Greene, Secretary

The Amer. Physiol. Soc. held its twenty-eighth annual meeting at the Harvard Med. Sch., Boston, Mass., Dec. 26–29, 1915. An unusually strong program of scientific papers was presented. Many papers called for vigorous discussion and the interest in the meet-

ings was rendered thereby noticeably more enthusiastic. Six scientific sessions were held, two of which were joint sessions with the other societies of the Federation. At the independent meetings the following papers were presented.

Scientific program. First session. Monday, Dec. 27, 2.00 p. m. *J. R. Murlin* and *J. E. Sweet:* Influence of gastrectomy on subsequent pancreatectomy in dogs.—*M. E. Fulk* and *J. J. R. Macleod:* Distribution of suprarenin-yielding tissue in different animals. —*W. J. Meek:* Action of minimal doses of adrenalin.—*R. G. Hoskins* and *Augusta D. Hoskins:* Effects of suprarenal feeding on the white rat.—*E. A. Bedford* and *H. C. Jackson:* Adrenalin content of the blood in conditions of low blood-pressure and "shock."—*R. S. Lillie:* Rhythmical changes in the resistance of dividing sea-urchin eggs to hypotonic sea-water; Mass-action in the activating effect of butyric acid on unfertilized starfish eggs.—*W. J. V. Osterhout:* Permeability of animal and plant cells.—*G. H. A. Clowes:* Rôle played by electrolytes in determining the permeability of protoplasm.—*G. H. Parker:* Three types of muscular response in sea-anemones.—*F. S. Lee, A. E. Guenther* and *H. E. Mcleney:* Relation of certain muscles to oxygen.—*W. P. Lombard:* Influences affecting voluntary muscular work, especially age and tobacco.—*W. C. Quinby:* Function of the kidney when deprived of its nerves.

Second session. Tuesday, Dec. 28, 9.00 a. m. *E. B. Krumbhaar:* Electrocardiographic studies in normal infants.—*C. J. Wiggers:* Time relations of auricular systole.—*A. L. Dean:* Movements of the mitral valves in relation to auricular and ventricular systoles. —*H. Steenbock, J. A. E. Eyster* and *W. J. Meek:* Relation of the chronotropic action of the vagus to the nodal tissues.—*W. M. Boothby* and *I. Sandiford:* Tension of carbon dioxide and oxygen in venous blood at rest and at work.—*Clyde Brooks* and *A. B. Luckhart:* Chief physical mechanisms concerned in clinical methods of measuring blood-pressure.—*R. Burton-Opitz:* Hemodynamic studies.—*Joseph Erlanger:* Mechanism of the arterial-compression sounds of Korotkoff.—*C. M. Gruber:* Responses of the vaso-motor mechanism to different rates of stimulation.—*E. G. Martin* and *P. G. Stiles:* Vaso-motor summations.—*Theodore Hough* and *J. A. Waddell:* Blood changes following hemorrhage and infusion.—*A.*

W. Peters and *C. D. Blackburn:* Experimental and clinical studies on mental defectives: (III) Relation of systolic and diastolic blood-pressures and their power of adjustment to body position.—*R. T. Woodyatt:* Prolonged uniform intravenous injections.

THIRD SESSION. WEDNESDAY, Dec. 29, 9.00 a. m. *W. E. Burge:* Mode of action of ultra-violet radiation in destroying hormones, pro-enzymes, enzymes and living cells.—*Robert Gesell:* Initial length, initial tension, and tone of auricular muscle in relation to myo- and cardiodynamics.—*C. D. Snyder:* Is the contraction of smooth muscle accompanied by heat-production?—*P. M. Dawson* and *P. C. Hodges:* The experiment of Valsalva.—*T. L. Patterson:* Comparative studies in the physiology of gastric hunger-contractions in amphibia and reptilia.—*F. R. Miller:* Localization by faradic stimulation in the floor of the fourth ventricle.—*W. H. Spencer, G. P. Meyer* and *P. B. Hawk:* Direct evidence of duodenal regurgitation and its influence upon the chemistry and function of the normal human stomach.—*F. P. Knowlton:* Diuretic action of tissue extracts.—*R. G. Pearce:* Appearance of sugar in the digestive secretions in phloridzin glycosuria.—*H. L. Higgins:* Rapidity with which alcohol and some sugars are available as nutriment.—*W. B. Cannon* and *McKeen Cattell:* Electrical changes in glands.—*J. Auer:* Action of the depressor nerve on the pupil.—*Raymond Spaeth:* Evidence showing the metaphore to be a disguised type of smooth muscle.—*E. G. Martin* and *R. W. Lovett:* Voluntary innervation of skeletal muscle.

FOURTH SESSION. WEDNESDAY, Dec. 29, 2.00 p. m. *M. L. Koch* and *Carl Voegtlin:* Comparison of chemical changes in the central nervous system, in pellagra and in animals on an exclusive vegetable diet.—*E. L. Scott:* Lecithin-glucose preparation.—*J. H. Pratt:* Effect of excluding pancreatic secretion from the intestine on the absorption of nitrogen and fat.—*J. R. Murlin* and *J. A. Riche:* Fat of the blood in relation to heat-production, narcosis and muscular work.—*C. W. Greene* and *W. S. Summers:* Fat and lipase content in the blood in relation to fat feeding and to fasting.—*T. B. Osborne* and *L. B. Mendel:* Practical applications of feeding experiments with albino rats.—*Aaron Arkin:* Influence of chemical substances on immune reactions, with special reference to oxida-

tion.—*Sutherland Simpson* and *A. T. Rasmussen:* Effect of thyroparathyroidectomy on the blood-coagulation time in the dog.—*A. Forbes* and *R. H. Miller:* Detection with the string galvanometer of afferent impulses in the brain-stem and their abolition with ether anesthesia.—*C. D. Snyder:* Smooth-muscle nerve preparation.—*F. H. Pike:* Cinematograph and lantern demonstration of some effects of lesions of the nervous system.—*V. N. Shamoff:* Secretory discharge of the pituitary body produced by stimulation of the superior cervical ganglion; Action of various pituitary extracts on the isolated intestinal loop.

PAPERS READ BY TITLE. *C. C. Fowler, M. E. Rehfuss* and *P. B. Hawk:* Influence of certain cereal foods on gastric secretion.—*Sergius Morgulis:* Changes in the composition of the bodies of fasting lobsters.—*Joseph Erlanger:* Contractility of the musculature of auriculo-ventricular valves.—*R. J. Miller, M. E. Rehfuss* and *P. B. Hawk:* Psychic secretion of gastric juice.

Executive proceedings. PHYSIOLOGICAL ABSTRACTS. The most important act of the Society was the passing of a resolution to collaborate with the British Physiological Society in the publication of a periodical to be named *Physiological Abstracts.*

NEW MEMBERS: *G. A. Baitsell,* Yale Univ.; *N. R. Blatherwick,* U. S. Dep't Agr., Wash., D. C.; *W. R. Bloor,* Harvard Univ.; *W. M. Boothby,* Peter Bent Brigham Hosp., Boston; *T. M. Carpenter,* Carnegie Nutr. Lab.; *E. C. Day,* Syracuse Univ.; *C. K. Drinker, Katherine R. Drinker,* Johns Hopkins Univ.; *H. S. Gasser,* Univ. Wis.; *T. S. Githens,* Rockefeller Inst.; *A. Gulick,* Univ. Mo.; *C. W. Hooper,* Hooper Foundation, San Francisco; *B. Kramer,* State Univ. Iowa; *E. K. Marshall, Jr.,* Johns Hopkins Univ.; *W. L. Mendenhall,* Dartmouth Coll.; *Maud L. Menton,* Barnard Skin and Cancer Hosp., St. Louis; *Geo Peirce,* Johns Hopkins Univ.; *A. L. Prince,* Yale Univ.; *S. W. Ranson,* Northwestern Univ.; *R. A. Spaeth,* Yale Univ.; *D. W. Wilson,* Johns Hopkins Univ.

OFFICERS-ELECT. President, *W. B. Cannon;* secretary, *C. W. Greene;* treasurer, *J. Erlanger;* member of the Council, 1916–1919, *W. J. Meek.*

Comment. The general sentiment among those who attended the meeting was that this was one of the most enthusiastic and suc-

cessful ever held, a success that was due largely to the efficiency and hospitality of the Local Committee.

III. AMERICAN SOCIETY OF BIOLOGICAL CHEMISTS: TENTH ANNUAL MEETING

P. A. Shaffer, Secretary

The tenth annual meeting of the Biochem. Soc. was held in Boston, Mass., on Dec. 26–29, 1915, in the laboratories and lecture rooms of Harvard Med. Sch. Two scientific sessions were held in conjunction with the other members of the Fed. Four independent sessions were held. The following papers and titles were presented at the independent sessions.

Scientific program. FIRST SESSION. MONDAY, Dec. 27, 2.00 p. m. *Walter Jones:* Presidential address, Methods in biochemistry.

W. R. Bloor: Assimilation of fat.—*V. H. Mottram:* Fat infiltration of cat kidney.—*R. F. Ruttan* and *M. J. Marshall:* Composition of adipocere.—*O. R. Kline, C. C. Fowler, M. E. Rehfuss* and *P. B. Hawk:* Cholesterol content of blood serum and its diagnostic significance.—*P. A. Levene* and *C. J. West:* Kephalin.—*A. B. Macallum:* Inorganic composition of cerebro-spinal fluid.—*A. B. Macallum* and *J. B. Collip:* Secretion of hydrochloric acid in the peptic tubules.—*L. J. Henderson:* On volume.—*G. H. A. Clowes:* Analogous antagonistic effects exerted by salts of sodium, potassium, calcium and magnesium on physical and biological systems.—*A. E. Taylor* and *C. W. Miller:* Bence-Jones protein.—*A. E. Austin:* Significance of the presence of bile in the fasting stomach.—*N. W. Janney:* Protein synthesis and metabolic diseases.

SECOND SESSION. TUESDAY, Dec. 28, 9.00 a. m. *P. A. Kober* and *S. S. Graves:* Proteins and their digestion: (I) Spontaneous digestion of casein and edestin.—*H. C. Bradley:* Mechanism controlling autolysis.—*Max Morse:* Hydrogen-ion concentration in autolysis.—*H. H. Bunzel:* Mode of action of oxidases.—*V. J. Harding* and *R. M. MacLean:* Estimation of the course of protein hydrolysis; a comparision of the Sörensen, Van Slyke and colorimetric methods.—*M. X. Sullivan* and *Carl Voegtlin:* Occurrence

in food of so-called vitamines and their isolation.—*E. C. Kendall:* Isolation in pure crystalline form of the active constituent of the thyroid; its chemical nature and physiological activity.—*H. C. Sherman* and *D. E. Neun:* Pancreatic amylase preparations.—*P. H. Mitchell:* Causes of certain color-producing diseases in shell-fish.—*E. W. Rockwood:* Diastase accelerators.—*E. D. Clark* and *F. M. Scales:* Enzymes of a cellulose-destroying fungus from the soil, *Penicillium pinophilum.*—*J. G. Mateer* and *E. K. Marshall, Jr.:* Urease content of certain beans, with special reference to the Jack bean.

THIRD SESSION. WEDNESDAY, Dec. 29, 9.00 a. m. *John Howland, F. H. Haessler* and *W. McK. Marriott:* Use of a new reagent for micro-colorimetric analysis, as applied to the determination of calcium and of inorganic phosphates in the blood serum.—*J. O. Halverson* and *Olaf Bergeim:* Determination of calcium in blood.—*F. P. Underhill:* Influence of alkali upon blood sugar-content.—*J. R. Murlin* and *B. Kramer:* Influence of alkali on the diabetes of partially and totally depancreatized dogs.—*A. I. Ringer:* Diabetes: (I) Influence of higher aldehydes on sugar elimination and acidoses; (II) Influence of acetaldehyde on the formation of aceto-acetic acid in the perfused livers of diabetic dogs.—*A. A. Epstein* and *George Baehr:* Influence of phloridzin on the formation of glycogen in the liver.—*C. M. Guion* and *S. R. Benedict:* Blood sugar in phloridzin glycosuria.—*Hugh McGuigan* and *E. L. Ross:* Liver circulation in relation to glycemia.—*I. S. Kleiner* and *S. J. Meltzer:* Hyperglycemia and glycosuria produced by intravenous injections of magnesium sulfate in dogs.—*A. W. Peters* and *Mary E. Turnbull:* Experimental and clinical studies on mental defectives: (II) Glycosuric reaction of institution inmates in relation to nutritional and pathological conditions.—*Louis Baumann:* Origin and estimation of creatin in muscle.—*Max Morse:* Creatin elimination in atrophy.—*C. F. Langworthy:* Respiration calorimeter for incubation experiments with poultry eggs.

FOURTH SESSION. WEDNESDAY, Dec. 29, 2.00 p. m. *P. A. Levene:* Sphingomyelin.—*R. S. Hubbard* and *P. A. Shaffer:* Determination of β-hydroxybutyric acid.—*E. G. Miller, Jr.* and *W. J. Gies:* Internal secretions in their relation to the development and

condition of the teeth: (4) Effects of parathyroidectomy.—*J. O. Halverson, Olaf Bergeim* and *P. B. Hawk:* Complete metabolism study of goitre with the effect of thyroid and thymus treatment.—*B. Kramer* and *J. Marker:* Is the sugar retained under the influence of sodium carbonate by depancreatized dogs stored as glycogen?—*H. H. Bunzel:* Relative oxidase activity of different organs of the same plant.—*Otto Folin* and *W. Denis:* Creatin and creatinin metabolism.—*R. T. Woodyatt:* Remarks on technique of phloridzination.—*W. A. Perlzweig* and *W. J. Gies:* Influence of deficient diets on dentition: (2) Nutritive factors in the development of teeth and bones, with special reference to the influence of hydrochloric acid and β-hydroxybutyric acid in the diet, and the effects of dietary deficiencies of calcium and phosphorus.—*I. J. Kligler* and *W. J. Gies:* Relations of oral micro-organisms to dental caries (2–4).—*L. A. Shephard* and *W. J. Gies:* Validity of Marshall's salivary coefficient as a means of diagnosis in dental caries.—*E. G. Miller, Jr.,* and *W. J. Gies:* Influence of food-acid media on natural extracted teeth.—*C. O. Johns* and *D. B. Jones:* Protein of the Jack bean, *Canavalia ensiformis.*—*G. A. Geiger, C. O. Johns* and *Arno Viehoever:* Cedrin, a glucoside from seeds of *Simaba cedron.*—*Arno Viehoever, L. H. Chernoff* and *C. O. Johns:* Distribution of quercimeritrin in the cotton plant, *Gossypium herbaceum;* Saponin from *Yucca angustifolia.*—*C. O. Johns, G. A. Geiger* and *Arno Viehoever:* Saponin from *Yucca radiosa.*—*I. K. Phelps* and *H. Q. Daubt:* Kjeldahl method for the determination of nitrogen.—*J. F. Brewster* and *C. L. Alsberg:* Distribution of nitrogen in wheat, Jack bean and cow-peas.—*C. F. Langworthy:* Digestibility of Kafir corn and Indian cornmeal prepared for the table in the usual ways.—*M. X. Sullivan* and *Carl Voegtlin:* Relation of lipoids to "vitamines."—*C. C. Fowler, M. E. Rehfuss* and *P. B. Hawk:* Influence of aqueous solutions of certain substances upon gastric secretion.

Papers read by title. *E. B. Hart* and *E. V. McCollum:* Growth on strictly vegetable diets.—*J. F. McClendon:* Hydrogen-ion concentration and "buffer" value of blood with new apparatus.—*Jacob Rosenbloom:* Influence of low and high purin intake on the excretion of uric acid and purins in gout.—*Helen I. Mattill* and *H. A. Mattill:* Metabolic effects of bathing in the Great Salt Lake.—

C. P. Williamson and *W. H. Welker:* Hemoglobin: (1) Optical constants.—*C. P. Williamson* and *Grover Tracy:* Nitrogen partition in gout.

Executive proceedings. CONSTITUTION. Three amendments to the constitution were proposed by the council of the society. Amendment I was intended to enable the society to meet at another time of the year, if in the future it should seem wise to do so.[1] The amendment was as follows: "The annual meeting shall be held at a time and place chosen by the Council in consultation with the Exec. Commit. of the Fed. of Amer. Soc. for Exp. Biology."

Amendment II was intended to bring the constitution into harmony with the conditions which have arisen since the formation of the Fed. These changes involved a formal distinction between executive meetings and scientific meetings not expressed in the constitution as it stands.

Amendment III related to the number of votes required for the adoption of an amendment to the constitution. It involved a change from "A three-fifths vote in the affirmative of the *entire membership* shall be required for the adoption of an amendment" to "Affirmative votes from three-fifths of the *members voting* shall be required for the adoption of an amendment." Those in favor of this amendment cite the opinion that it is practically impossible to effect a change in the constitution, no matter how essential it be, because a failure to vote is a negative vote and there are possibly some members of the society who take so small an interest in its affairs that they fail to vote through neglect. It is contended, on the other hand, that essential changes might be brought about by a very small minority of the members and that such changes could not be regarded as representative of the sentiment of the society; for that reason, if for no other, the proposed change should not be made.

The vote on the amendments to the constitution was as follows: Amendment I: 93 for, 2 against; II: 92 for, 1 against; III: 82 for, 16 against. There being 165 members in the society, 99 votes were necessary for the adoption of an amendment and the amendments were therefore lost.

[1] See comment on this subject by Auer: BIOCHEM. BULL., 1915, iv, p. 186 and *Ibid.*, 1916, v, p. 44, of this issue. [Ed.]

After general discussion it was unanimously agreed that the members present express their condemnation of the present situation according to which proposals with such large support fail of adoption; that the amendments be again introduced for action next year; and that the Secretary be directed to circularize the members and take another vote on the proposals.

NOMENCLATURE OF LIPOIDS. The Commit. appointed some years ago on the classification and nomenclature of lipoids having been unable to reach an agreement, and having failed to present a report, was discharged and the matter dropped for the present.

"BULLETIN 28." The Secretary was directed to request the Secretary of the U. S. Dep. of Agric. to revise and republish Bull. 28 on the "Chemical composition of American food materials."

PHYSIOLOGICAL ABSTRACTS. The society voted to extend its cooperation and moral support to the British Physiol. Soc. in the publication, by the British Soc., of the proposed *Physiological Abstracts.*

VOTE OF THANKS. The thanks of the society were expressed to the Harvard authorities and members of the Local Commit. for their generous hospitality during the meetings.

NEW MEMBERS: *R. J. Anderson,* N. Y. Agr. Exp. Sta.; *N. R. Blatherwick,* U. S. Dep't of Agric., Washington, D. C.; *M. H. Givens,* U. S. Treas. Dep't, Pellagra Hosp., Spartanburg, S. C.; *Samuel Goldschmidt,* Johns Hopkins Univ.; *V. J. Harding,* McGill Univ., Canada; *J. S. Hepburn,* U. S. Dep't of Agric., Phila.; *John Howland,* Johns Hopkins Univ.; *F. B. Kingsbury,* Univ. Minn.; *R. A. Kocher,* Univ. Calif.; *S. J. Meltzer,* Rockefeller Inst.; *H. O. Mosenthal, Geo. Peirce,* Johns Hopkins Univ.; *E. L. Scott,* Columbia Univ.; *H. Wastenеys,* Rockefeller Inst.; *Ruth Wheeler,* Univ. Ill.; *D. W. Wilson,* Johns Hopkins Univ.

OFFICERS-ELECT. President, *Walter Jones;* vice-president, *F. P. Underhill;* secretary, *S. R. Benedict;* treasurer, *D. D. Van Slyke;* additional members of the Council, *Otto Folin, A. B. Macallum, P. A. Shaffer;* Nominating Commit., *C. L. Alsberg, H. C. Bradley, W. J. Gies, Andrew Hunter, P. A. Levene, A. P. Mathews, L. B. Mendel, T. B. Osborne, A. E. Taylor.*

Comment. PRESENTATION OF PAPERS. In spite of the large

attendance at this meeting the success of the program was seriously interfered with, as it was last year, by the failure to appear of a number of the members who had announced papers for the sessions. The Secretary believes that members should refrain from offering papers unless they are reasonably sure to attend the meeting; and, if circumstances prevent their attendance, the Secretary should be notified as promptly as possible. Failure to do so on the part of some of the members has repeatedly caused confusion and inconvenience.

Attendance. J. J. Abel, H. M. Adler, Samuel Amberg, A. E. Austin, Louis Baumann, F. G. Benedict, S. R. Benedict, W. N. Berg, Olaf Bergeim, W. R. Bloor, T. M. Carpenter, G. H. A. Clowes, W. H. Eddy, K. G. Falk, C. H. Fiske, Otto Folin, Samuel Goldschmidt, Isidor Greenwald, V. J. Harding, R. A. Hatcher, P. B. Hawk, L. J. Henderson, J. S. Hepburn, A. D. Hirschfelder, P. E. Howe, W. H. Howell, Reid Hunt, N. W. Janney, Walter Jones, E. C. Kendall, F. B. Kingsbury, I. S. Kleiner, Benjamin Kramer, R. S. Lillie, Jacques Loeb, A. S. Loevenhart, A. P. Lothrop, Graham Lusk, A. B. Macallum, E. V. McCollum, F. H. McCrudden, J. J. R. Macleod, W. deB. MacNider, W. McK. Marriott, E. K. Marshall, Jr., S. J. Meltzer, L. B. Mendel, V. H. Mottram, J. R. Murlin, V. C. Myers, F. G. Novy, George Peirce, A. W. Peters, A. N. Richards, A. I. Ringer, E. W. Rockwood, R. F. Ruttan, E. L. Scott, F. H. Scott, P. A. Shaffer, Torald Sollmann, M. X. Sullivan, A. E. Taylor, F. P. Underhill, D. D. Van Slyke, Carl Voegtlin, H. G. Wells.

IV. AMER. SOC. FOR PHARMACOL. AND EXP. THERAP.: SEVENTH ANNUAL MEETING

John Auer, Secretary

The seventh annual session of the Pharmacol. Soc. was held in Boston, at the Harvard Med. Sch., on Dec. 27–29, 1915. Three independent sessions were held in addition to the two joint meetings with the other members of the Federation. At these sessions the following papers were read.

Scientific program. First session. Monday, Dec. 27, 2.00 p. m. *C. J. Wiggers:* Effects of drugs on auricular systole and their consequent effect on ventricular efficiency.—*J. H. Pratt* and *C. Wesselhoeft:* Potency of digitalis preparations.—*William Salant* and *A. E. Livingston:* Influence of iodine on the heart.—*J. D. Pilcher:* Effect of certain drugs on the excised uterus in guinea pigs.—*J. Auer* and *S. J. Meltzer:* Magnesium sulfate and reflex deglutition.—*L. B. Mendel* and *T. B. Osborne:* Stability of the growth-promoting substance in butter fat.—*W. H. Schultz:* Lipoids. —*S. Amberg, A. S. Loevenhart* and *W. B. McClure:* Mustard-oil inflammation.—*P. A. Lewis:* Distribution of trypan red to the tissues and vessels of the eye, as influenced by congestion and early inflammation.—*T. S. Githens* and *S. J. Meltzer:* Is the pupil dilatation from adrenalin following gangliectomy due to vasodilatation?—*William Salant* and *R. O. Bengis:* Absorption and elimination of different dyes.

Second session. Tuesday, Dec. 28, 9.00 a. m. *W. de B. MacNider:* Inhibition of the toxicity of anesthetics in the nephropathic kidney.—*D. E. Jackson:* Anesthesia and analgesia.—*G. H. Martin, C. H. Bunting* and *A. S. Loevenhart:* Morphological changes in the tissues of the rabbit as a result of reduced oxidations.—*E. Woodward* and *C. L. Alsberg:* Relation of the hemolytic power to the surface tension of saponin solutions.—*C. W. Edmunds* and *M. I. Smith:* Nicotin tolerance.—*G. B. Roth* and *Carl Voegtlin:* Effects of the prolonged feeding of aluminum.—*L. G. Rowntree* and *R. L. Levy:* Toxicity of various commercial preparations of emetin hydrochloride.—*R. J. Collins:* Clinical actions of veratrum.—*S. Amberg* and *H. F. Helmholtz:* Detoxifying action of sodium salts upon potassium salts after intravenous injection.—*B. H. Schlomowitz* and *C. S. Chase:* Influence of temperature on the onset of strychnine convulsions in the intact frog.

Third session. Wednesday, Dec. 29, 9.00 a. m. *R. W. Scott, T. W. Thoburn* and *P. J. Hanzlik:* Salicyl in blood and joint fluid of individuals receiving full therapeutic doses of salicylate; Excretion of salicyl in the urine of rheumatic and non-rheumatic individuals.—*K. G. Falk* and *K. Sugiura:* Elimination of hexamethylenetetramin (urotropin).—*H. G. Barbour, L. L. Maurer* and

W. C. v. Glahn: Paraoxyphenylethylamin as a morphin antagonist. —*H. G. Barbour:* Action of some derivatives of phenylethylamin. —*Worth Hale:* Comparative action of the chief alkaloids of cinchona.—*William Salant* and *L. E. Wise:* Fate of sodium citrate in the body.—*William Salant* and *A. E. Livingston:* Pharmacological action of oil of chenopodium.—*R. J. Collins* and *P. J. Hanzlik:* Colorimetric method for the estimation of free formaldehyde.—*P. J. Hanzlik:* Salicyluric acid.

PAPER READ BY TITLE. *R. Weil:* Anaphylatoxin theory of anaphylaxis.

Executive proceedings. PHYSIOLOGICAL ABSTRACTS. A unanimous acceptance was voted in response to the invitation of the British Physiol. Soc. to cooperate with it in the publication of a new journal of abstracts, by having the name of the society appear on the title-page of this journal as a co-operative society.

NEW MEMBERS: *R. J. Collins,* Western Reserve Univ. Med. Sch.; *J. F. Corbett,* Univ. of Minn.; *O. Folin,* Harvard Med. Sch.; *R. J. Hoskins,* Northwestern Univ. Med. Sch.; *Paul D. Lamson, R. L. Levy,* Johns Hopkins Med. Sch.; *C. C. Lieb,* Columbia Univ.; *E. K. Marshall, Jr., D. I. Macht,* Johns Hopkins Med. Sch.; *Louise Pearce,* Rockefeller Inst.; *Richard Weil,* Cornell Univ. Med. Sch.

OFFICERS-ELECT: President, *Reid Hunt;* secretary, *J. Auer;* treasurer, *W. de B. MacNider;* additional members of the Council, *A. D. Hirschfelder, G. B. Roth;* Membership Commit., *C. W. Edmunds* (term expires 1918), *Torald Sollmann* (term expires 1916).

General comment.[1] TIME OF MEETING. Considerable interest was shown this year in the time of meeting for, as usual, a number of the members were compelled to sacrifice at least a part of

[1] Before making any comments, the Secretary hastens to state that the following remarks have no official warrant for their existence, and are purely personal opinions. This fact should not discourage those who love to go gunning for secretaries, as the season is always open for them. Moreover all secretaries soon learn to endure a charge of verbal or written salt with a fine equanimity, for they all know Aesop's fable of the ass. Indeed, a course as secretary can be recommended to the sensitive as an excellent means of producing an astonishing integumental induration. (Should any thin-skinned individual wish to try this therapeutic measure, a *mild* initial course should be chosen, but not, for example, the secretaryship of the Biochemical Society.)

Christmas day itself in traveling; and for a still larger number the Holidays were seriously marred by the necessity of being away from home for several days. The dissatisfaction caused by this interference with the most intimate of our holidays is not the only reason why the advisability of changing the meeting time should be seriously considered. There are others, for example, the instability of the weather, with its combination of rain, sleet, and snow, during the December sessions, is a menace to the health not only of the elderly but of all who are dependent for the time upon hotel accommodations and the contents of a suitcase.

To remedy this condition radically is difficult, for it would mean a shifting of the meeting time to a more clement season. This, however, is forbidden by constitutional provisions in three of the societies, the time set being between Dec. 25 and Jan. 10.[2] A constitutional amendment of this clause is by no means a hopeless undertaking, and the venture has already been made by the Biochem. Soc. The negative result scored in this society must not, however, be taken as a condemnation of the proposed change, but must be ascribed to the especially great difficulty of fulfilling the requirements for a change in its constitution. The amendment proposed by the Biochemists seems a model which all the societies would do well to adopt; it is as follows:

"The annual meeting shall be held at a time and place chosen by the Council in consultation with the Exec. Commit. of the Fed. of Amer. Societies for Exp. Biology."

Palliative treatment of the Christmas-meeting evil has already been instituted. The secretary of the Fed. was instructed, at the last meeting of the Exec. Commit., to arrange that the scientific sessions begin on such a date that Christmas day would be spared to a majority of the members.

DINNERS. While all societies appreciate the hospitality of the university authorities who house the scientific sessions of the Fed., it is perhaps doubtful whether the labors of the Local Commit. are appraised at their full worth by the members who enjoy the results

[2] The Physiol. Soc. meets, according to the constitution, between Dec. 25 and Jan. 1; the Biochem. Soc. between Dec. 25 and Jan. 10; the Pharmacol. Soc. between Dec. 25 and Jan. 1. The Pathol. Soc., however, states in its constitution that it shall meet at the same time and place as the other societies in the Fed.

of this committee's work. However this may be, certainly no one wishes to add to their burdens and yet such an abuse may occur. In the arrangement of dinners and luncheons a certain sum of money must usually be guaranteed to the hotel or caterer. If the sale of luncheon or dinner tickets falls short of this sum, the deficit must be met by the Local Commit. This is manifestly unjust; the shortage ought to be borne by the societies or, if this is impossible (the Constitution!), by the councils of the various societies.

Another undemocratic practice has developed in connection with the dinner which usually terminates the meeting of the Exec. Commit. and to which all members of the various councils usually are invited. Heretofore the expenses of this always delightful occasion have apparently been defrayed by the local members of the council. It is hardly open to question that this privilege should be denied them; each member who has the honor of attending this dinner should pay for his cover, just as at the general subscription dinners.

Joint sessions. Only two joint sessions could be arranged this year on account of the large number of papers which were announced. If the influx of titles continues at the same rate of growth, joint sessions will become impossible in the future unless the sessions are increased in number. While there is apparently some diversity of opinion about the desirability of joint sessions, it seems fairly certain to the writer, at least, that their advantages more than compensate for their drawbacks.

Question of Privilege. A number of members of the Fed. have inquired whether they have the privilege of discussing papers in those societies of which they are not members. This point was raised too late to obtain a ruling from the societies, but should be taken under advisement as soon as possible; *a priori,* it would seem that no objection could be found against the granting of this privilege.

Attendance. The Boston sessions were very well attended; at the opening joint session the large amphitheatre of Building C was practically filled to capacity. The cross-circulation between the four societies was also well developed, and many members attended parts of sessions of all the societies. It would be desirable if some plan could be devised whereby each society could

be kept informed of the progress of the program in every other society. It will be remembered that this was attempted at the Washington Univ. meeting in 1914.

MEETING PLACE IN 1916. The Pharmacol. Society and the other three members of the Fed. will meet in 1916 in New York City with the Amer. Assoc. for the Adv. of Science. At this meeting not only the A. A. A. S. and the Fed., but in all likelihood every scientific society in the U. S. will be represented, and N. Y. City will probably see the greatest gathering of scientific men that has ever occurred on this continent.

VOTE OF THANKS. A motion was made, seconded and unanimously carried, that a vote of thanks be extended to the Harvard authorities and to the Local Commit. for their hospitable services, which contributed so largely to the success of the meetings.

(See p. 30 for additional general comment on the affairs of the Fed.)

V. AMERICAN SOCIETY FOR EXPERIMENTAL PATHOLOGY: THIRD ANNUAL MEETING

Peyton Rous, Secretary

The Pathol. Soc. held two independent scientific meetings in addition to participation in the joint meetings of the Fed.

Scientific program. FIRST SESSION. MONDAY, Dec. 27, 2.00 p. m. PRESIDING OFFICER: *S. J. Meltzer* (in the absence of the Pres. and vice-Pres.).

Hans Zinsser and *J. G. Hopkins:* Syphilis immunity.—*H. C. Schmeisser:* Spontaneous and experimental leukemia of the fowl.—*Theobald Smith:* Localization of the schizont in coccidiosis.—*Emil Goetsch:* Occurrence of gastric mucosa in Meckel's diverticulum.—*H. T. Karsner* and *J. E. Dwight, Jr.:* Experimental bland infarction of the myocardium; myocardial regeneration and cicatrization.—*P. D. Lamson:* Influence of the liver on polycythemia.—*L. H. Newburgh:* Respiratory mechanism is experimental pneumonia.—*B. S. Kline* and *S. J. Meltzer:* Production of typical pneumonic lesions by intrabronchial insufflation of unorganized substances.

SECOND SESSION. TUESDAY, Dec. 28, 9.00 a. m. PRESIDING OFFICER: *H. G. Wells* (vice-pres. elect).

C. W. Duval: Effects of desiccation of the virus of hog cholera and the use of this material in immunization.—*W. G. Smillie:* Streptococcus of Smith.—*P. A. Lewis* and *R. B. Krauss:* Influence of certain organic substances on the growth of the tubercle bacillus. —*M. J. Rosenau:* Experiments on poliomyelitis.—*E. C. Cutler:* Torula infections.—*David Marine:* Permanence of thyroid transplants in rabbits.—*Hideyo Noguchi:* Recently discovered spirochetosis prevalent in Japan.—*F. G. Novy* and *P. H. De Kruif:* Anaphylatoxin.—*A. E. Taft:* Cell reactions in the spinal cord in acute anterior poliomyelitis.

Executive proceedings. PHYSIOLOGICAL ABSTRACTS. The invitation of Dr. Bayliss, of the Physiol. Soc. (England), that the Amer. Soc. for Exp. Path. lend its name to the title page of the new English publication, *Physiological Abstracts,* as cooperating with it, was accepted.

OFFICERS-ELECT: President, *Simon Flexner;* vice-president, *H. G. Wells;* secretary-treasurer, *Peyton Rous;* councillor (through an oversight a new councillor to succeed David Marine was not elected).

NEW MEMBERS. No new members were elected.

MEMBERS PRESENT. Harvey Cushing, C. W. Duval, D. L. Edsall, H. T. Karsner, P. A. Lewis, Leo Loeb, W. G. MacCallum, W. H. Manwaring, David Marine, S. J. Meltzer, J. B. Murphy, H. Noguchi, F. G. Novy, M. J. Rosenau, E. C. Rosenow, Peyton Rous, Theobald Smith, G. N. Stewart, R. P. Strong, H. G. Wells, Hans Zinsser.

Laboratory of Biological Chemistry of Columbia University, College of Physicians and Surgeons, New York.

BIOCHEMICAL NEWS, NOTES AND COMMENT

Editorial sub-committee:

BENJAMIN HOROWITZ,

WILLIAM J. GIES, HATTIE L. HEFT, JOSEPH S. HEPBURN, PAUL E. HOWE, EDGAR G. MILLER, JR.

I. GENERAL

Necrology. *H. Debus,* prof. of chem., Royal Naval Coll., Greenwich; lect. on chem., Guy's Hosp.—*Eugene W. Hilgard,* prof. of agric., Univ. Cal. (1875–1904), distinguished for his contributions to agricultural chem.—*Raphael Meldola,* prof. of chem., Finsbury Coll., London.—*Charles V. Mapes,* industrial agric. chemist, N. Y. City.—*Isaac Ott,* prof. of physiol., Medico-Chi. Coll., Phila.—*Henry E. Roscoe,* chemist and emer. prof., Univ. Manchester.—*U. Rose,* instr. in internal med., Univ. of Strassburg.—*F. Tauszk,* privat-doc. of internal med., Univ. Budapest.—*Jules Ville,* prof. med. chem., Faculté de Montpellier.—*Anton Vorisek,* prof. of anal. chem., N. Y. Coll. of Pharm.—*Rudolf A. Witthaus,* prof. of chem. and toxicol., Cornell Univ. Med. Coll.

Retirement. Königsberg: Dr. *Albert Stutzer,* prof. of agric. chem., will retire from active service at the close of the present semester.

Appointments.[1] Boston Floating Hosp.: Dr. *Alfred W. Bosworth* (assoc. chem., N. Y. Agric. Exp. Sta.), chief dep't biol. chem.

[1] In this summary, institutions from which appointments were made are named in parenthesis. See also page 56.

Bromberg (Germany): Dr. *Hugo Fischer,* act. head, chem. and bacteriol. dep't, Kaiser Wilhelm Inst. for Agric.

Squibb and Sons (New Brunswick, N. J.): Dr. *John F. Anderson* (direc., Hygienic Lab., U. S. Public Health Service), direc., research and biolog. lab's.

Univ. of Minn., Med. Sch.: Dr. *Leonard Rowntree* (assoc. prof. of med., Johns Hopkins), prof. of med.

Washington Univ., Med. Sch.: Dr. *Leo Loeb,* prof. of comp. pathol.; Dr. *P. A. Shaffer* (prof. of physiol. chem.), dean.

Western Reserve Univ., Med. Sch. (Cleveland): *C. H. Fiske* (Harvard Univ.), assoc. in biochem.

Honors. HON. DEGREES. Dr. *Fritz Haber* (direc., Kaiser Wilhelm Inst. for Physiol.) and Dr. *Karl Bosch* (Baden Anilin Works), hon. doctorates, Karlsruhe Tech. Sch.

Prof. *W. A. Pearson* (Hahnemann Med. Coll., Phila.), hon. M.D., Hahnemann Med. Coll. of the Pacific.

FACULTY RESEARCH LECTURER. *Dr. F. P. Gay,* prof. of pathol., Univ. of Cal., has been chosen by his colleagues of the Univ. of Cal. as faculty research lecturer for 1916. He will give this annual public address on some of the results of his own research, at the Univ. of Cal. on the evening of Charter Day, Mar. 23, 1916. He was selected in recognition of his recent work in developing improved methods for the treatment of pneumonia, and for the treatment of typhoid fever by the use of sensitized vaccine; for his researches, in collaboration with Dr. Edith J. Claypole, in the field of immunization against typhoid; and for his development, in association with Dr. J. N. Force, of a skin test of immunity against typhoid.

COMPLIMENTARY DINNER. Harvard Club, N. Y. City, Jan. 12: By the Faculty of N. Y. Univ. and Bellevue Hosp. Med. Coll., to Prof. *V. C. Vaughan.*

HONORARY MEMBERSHIP. Dr. *P. A. Levene* has been elected an honorary member of Rega Societas Scientiarum Upsaliensis.

Lectures. ENDOWED LECTURES. Coll. of Phys., Phila.; Thirteenth *Rush Soc. Lect.,* Jan. 21: Dr. *F. M. Allen,* Investigative and scientific phases of the diabetic question, with their probable relations to practical problems of clinical medicine.

Royal Soc. (London); *Croonian Lect.,* Dec. 9, '15: Dr. *W. M.*

Fletcher and Prof. *F. G. Hopkins,* Respiratory process in muscle, and the nature of muscular action.

MISCELLANEOUS LECTURES. Amer. Assoc. Adv., Science (Columbus): General lect., Dr. *F. K. Cameron,* Fertilizer resources of the U. S.

Coll. City of New York; Dec. 22, '15: Dr. *K. G. Falk,* The electron conception of valence.

Prizes. LE CONTE PRIZE of the French Acad. of Sciences, $10,000: Sir *Almroth Wright,* for his share in the introduction of systematic vaccination against typhoid.—NOBEL PRIZE, Chem., 1915: *Richard Willstätter,* for his researches on chlorophyll.—NOBEL PRIZE, Chem., 1914: *T. W. Richards,* for his work on atomic weights.

In commemoration of the centennial of the independence of Argentina, 1816–1916, the Acad. de Med. offers a prize of 2,500 pesos for the best unpublished work on a med. subject presented at the Congr. of Social Sciences to be held at Tocyman, Argentina, July 9, 1916. This prize is open to any American member of the Congress.

Medals. COPLEY MEDAL, Royal Soc., London: *Ivan P. Pavlov,* For his investigations in the physiol. of digestion and secretion.—DAVY MEDAL, Royal Soc., London: *Paul Sabbatier,* for his work on catalysis and hydrogenation.—LEEUWENHOECK GOLD MEDAL, Royal Acad. of Sciences, Amsterdam (every ten years in recognition of the most important work done during the decade on the microscopical organisms first discovered by Leeuwenhoeck in 1675): Surgeon-General *Sir David Bruce.*—MOXON GOLD MEDAL, Royal Coll. of Physicians, London (every three years to the scientist whose observations and researches in clinical med. are deemed to render him most worthy of this distinction): Dr. *Dejerine* (prof. of diseases of the nervous system at the Faculté de med., Paris). This is the first time the medal has been awarded to any but an English clinician.—PERKIN MEDAL, Soc. Chem. Industry: Dr. *L. H. Backeland.*

Associations, societies, etc.: Officers-elect. AMER. ASSOC. CLINICAL RESEARCH. Pres., *Warren Coleman;* first vice-p., *Wm. B. Snow;* second vice-p., *L. T. Aschraft;* perm. sec. *James Kraus,*

AMER. PHYSIOL. SOC. See page 33.

AMER. PHYTOPATHOL. SOC. Pres., *Erwin F. Smith;* vice-p., *Mel. T. Cook;* sec.-treas., *C. L. Shear;* councillors, *F. D. Kern, E. C. Stakman* (vice Mel. T. Cook). Editor of *Phytopathology, W. A. Orton;* assoc. ed., *H. T. Gussow, C. W. Edgerton, E. C. Stakman, V. B. Stewart.*

AMER. SOC. FOR EXP. PATHOLOGY. See page 47.

AMER. SOC. OF BIOL. CHEMISTS. See page 37.

Amer. Soc. of Naturalists. Pres., *R. Pearl;* vice-p., *A. F. Blakeslee;* sec., *B. M. Davis;* treas., *J. A. Harris;* additional members, exec. commit., *E. M. East, H. V. Wilson, F. R. Lillie.*

AMER. SOC. PHARMACOL. EXP. THERAPEUTICS. See page 42.

FED. AMER. SOC. EXP. BIOL. See page 28.

N. Y. Acad. of Sciences, Sect. Astron., Phys. and Chem.: *E. E. Smith,* chairman.

ROYAL SOC., LONDON. Pres., Sir *J. J. Thomson;* treas., Sir *A. B. Kempe;* sec's, *A. Schuster, W. B. Hardy;* foreign sec., *D. H. Scott.*

SOC. AMER. BACTERIOLOGISTS. Pres., *T. J. Burrill.*

Members-elect. See page-references above.

Univ. of Penn. Chapt., Sigma Xi. Non-resident: *Henry Leffmann, C. B. Cochran* (chemist, Dairy and Food Commis., Penn.) Faculty: *L. A. Klein* (prof. of pharmacol., Dean of the Fac. of Vet. Med.)

Journalistic. The editorial offices of the *Jour. Amer. Pharmaceut. Assoc.* have been removed to the Bourse, Phila., Pa.

The *N. Y. Jour. of Pharmacy,* published by the Alumni Assoc., N. Y. Coll, of Pharm., lately began its 23d vol. in new form and dress, and with a new name: "C.U.C.P. Alumni Journal." Dr. C. P. Wimmer is succeeded, in the editorship, by Dr. Jeannot Hostmann. Drs. H. H. Rusby, G. C. Diekman and H. V. Arny are the "contributing editors."

Jour. Pharmacol. Exp. Therap. Beginning with Jan., 1916, the *Jour. Pharmacol.* and *Exp. Therap.* will be issued in monthly installments, instead of bi-monthly as heretofore. This change is made necessary by the increased number of papers offered to the editors for publication. The price of the Journal will be as heretofore, $5.00, post free, per volume of about six hundred pages.

For the present, it is planned that eight or nine numbers shall constitute a volume.

Miscellaneous items. ENDOWED PROFESSORSHIP AND FELLOWSHIP IN PHYSIOLOGY. Dr. Isaac Ott, prof. of physiol., Medico-Chi Coll. of Phila., died at Easton, Pa., Jan 1, 1916. He was a former president of the Amer. Neurol. Soc., and noted for his work on ductless glands and on the heat centers of the brain. By his death, under the will of his mother, a sum of money becomes available for the endowment of the Isaac Ott Prof. of Physiol. in the Medico-Chi. Coll. Under his own will, the Univ. of Penn. will ultimately receive an endowment for the foundation of the Isaac Ott Research Fellowship in Physiology.

FUNCTION OF MILK. The milks of different species are not readily interchangeable because the proteins have functions in helping to develop such radically different digestive apparatuses. From a nutritional standpoint milks do not differ very markedly, but in developmental quality they are far apart. This forms a very good additional reason why every human mother should, if possible, nurse her own infant. The higher mortality following artificial feeding is thus not the only reason in favor of maternal nursing. In the former case by using milk of another species—the cow—we put a hard-curdling milk into a stomach intended and adapted for a soft, flocculent curd. This is not only the cause of much indigestion, but such substitution fails adequately to carry out one of the functions that milk was intended (!) to perform in the scheme of evolution—namely, in each species specially to develop certain parts of the gastro-intestinal tract that must later perform most of the work of digestion. H. D. CHAPIN: *Scientific Monthly*, 1916, lxxvii, p. 2.

DR. C. W. ELIOT ON THE IMPORTANCE OF BIOLOGICAL CHEMISTRY. The fruits of the biological sciences—botany, zoology, physiology and **biochemistry,** applied to curative medicine and surgery and to preventive medicine and sanitation—have been *direct* contributions to human welfare; because they have provided defenses against disease, premature death, and individual and family distress and suffering. The beneficent applications of biological science, unlike most of the large results of applied chemistry and physics, take effect in the field of human affections and family experiences,

make life less anxious and more enjoyable for multitudes of human beings, mitigate or abolish ancient agonies and dreads of the race, and promise for it a happier future. *Science:* 1915, xlii, p. 920.

The progress of **biochemistry** and bacteriology has already enabled civilized governments to do much for the protection of their people from injury by foods not fit for consumption and by adulterated drugs. This is a branch of the public-health service which is capable of large extension hereafter. The efficiency of the methods now used will be greatly increased; and they will be used in new fields. *Science:* 1915, xlii, p. 923.

Biologists are now realizing that **biochemistry** *must furnish the fundamental knowledge of the processes which incessantly go on in the healthy body, and must also provide the exact knowledge of those changes in the normal processes which lead to disease and death.* The physician and the sanitarian have become accustomed to the beneficial use of remedies and defenses which chemistry at present can neither analyze nor synthesize; such, for example, as diphtheria antitoxin; but they are aware that this condition of their art is unsatisfactory and ought not to be permanent. The animal body consists of well-known chemical substances, and its functions depend on chemical reactions. Digestion is largely a chemical process. The animal body consists of innumerable cells in great variety, each of which acts under chemical and physical laws. Hence the belief of the biologist of today that chemistry—analytical, structural and physical—can and will come to the aid of the science and art of medicine in the large sense, and will ultimately enable biological science to comprehend the vital processes in health and disease, and to penetrate what are now the secrets of life and death. *Science:* 1915, xlii, p. 929.

Dr. C. W. Eliot on pure science and applied science. The *pure scientist* often feels, and not infrequently expresses, contempt for applications of science and for the men that make them. Sometimes the *seeker for valuable applications of scientific knowledge* feels no interest whatever in researches of which no industrial application seems feasible or probable, and confesses publicly this lack of interest. The facts seem to be that *all such feelings are narrow and irrational;* that no mortal can tell how soon a practical applica-

tion of a scientific truth, which seems pure in the sense that it has no present application, may be discovered; and that, on the other hand, innumerable applications are nowadays made of truths which five years or fifty years ago seemed as remote from all human interests as the observation attributed to Thales, that a bit of amber rubbed with a piece of silk would repel pith-balls suspended by fine filaments. Yet all magnetism and electricity with their infinite applications hark back to this experiment by Thales and to Galvani's observation of twitchings in a frog's legs. *Science:* 1915, xlii, p. 928.

II. WAR NOTES

Univ. item. About 1200 past and present students and members of the staff of the Imperial Coll. of Science and Tech., London, are serving with the forces.

Recovery of wounded soldiers and return to the ranks. The *Münch. med. Woch.* quotes a Russian daily to the effect that there is great complaint in Russia because only 18 percent of the wounded soldiers recover sufficiently to return to the ranks, while the Germans report that 60 percent are returned to the front. The Russians regard this ratio, 60 to 18, as testifying to the superior technical skill of the Germans in treating the wounded.

Miscellaneous items. A number of German physicians and pharmacists, taken prisoners by the British in Southwestern Africa, have been exchanged for a corresponding number of British medical men in German hands.

The landslide in the Panama canal has interfered with the export to England of sodium nitrate, from Chile, by prolonging the time of the voyage. English scientists urge the substitution of artificial calcium nitrate.

In an address on "Science and the War," before the Leeds Med. Sch., Sir William Osler said: "In the war my Lady Science is busy both ways. She employs artists in death and artists in life; she supplies them—so impartial are abstractions—with asphyxiating gases and with antiseptic dressings; she manufactures with equal mind high explosives and protective vaccines, submarines and motor-ambulances. What a thing it is to be an abstraction, a name for systematized thought; to have no morals, no likes or dislikes;

to be nothing but a Latin word for the best way of doing what is to be done."

III. COLUMBIA UNIVERSITY BIOCHEMICAL ASSOCIATION

1. General notes

Appointment.[2] Princeton Univ.: *E. Newton Harvey,* assis. prof. of physiol. (promotion).

Associations and societies. OFFICERS-ELECT. Dr. *C. L. Alsberg:* member, Nom. Commit., Amer. Soc. Biol. Chem.

Prof. *S. R. Benedict:* sec'y, Amer. Soc. Biol. Chem.

Dr. *C. Stuart Gager:* sec'y, Council, Amer. Assoc. Adv. Science.

Prof. *A. B. Macallum:* member, Council, Amer. Soc. Biol. Chem.

Prof. *L. B. Mendel:* member, Nom. Commit., Amer. Soc. Biol. Chem.

Prof. *A. N. Richards:* sec'y, Soc. of Normal and Path. Physiol. (Phila.)

MEMBERS-ELECT. Prof. *A. J. Goldfarb,* fellow, N. Y. Acad. of Sciences.

Dr. *Joseph S. Hepburn:* member, Amer. Soc. Biol. Chem.

Dr. *John Howland:* member, Amer. Soc. Biol. Chem.

Prof. *C. C. Lieb:* member, Amer. Soc. for Pharmacol. and Exp. Therap.

Dr. *S. J. Meltzer:* member, Amer. Soc. Biol. Chem.

Dr. *H. O. Mosenthal:* member, Amer. Soc. Biol. Chem.

Dr. *E. L. Scott:* member, Amer. Soc. Biol. Chem.

2. Proceedings of the Association

The 25th meeting will be held on Feb. 4.

The fifth annual dinner will be given at the Hotel Majestic, on Feb. 10, in honor of Prof. A. B. Macallum, Univ. of Toronto.

3. Columbia University Biochemical Department

Appointments. FROM THE STAFF. Columbia Univ. (Presbyterian Hosp.): *Katherine R. Coleman,* clinical chemist.

TO THE STAFF. Dr. *Walter M. Kraus* (Bellevue Hospital), instructor.

[2] See also page 49.

Sydney D. Kramer (American Mus. Natural Hist.), assistant.

Grace Sheets, assistant (Teachers College), vice Katherine R. Coleman (see note above).

Associations and societies. OFFICERS-ELECT. Prof. *Wm. J. Gies,* member, Nom. Commit., Amer. Soc. Biol. Chem.

Dr. *Victor E. Levine:* sec'y, N. Y. Acad. of Sciences, Sect. Astron., Physics and Chem.

MEMBERS-ELECT. Prof. *Wm. J. Gies,* non-resident member, Franklin Inst., Phila.

Dr. *Victor E. Levine,* fellow, N. Y. Acad. of Sciences.

Dr. *H. Wasteneys:* member, Amer. Soc. Biol. Chem.

New Doctor of Philosophy. *Edward Plaut* recently fulfilled the requirements for the Ph.D. degree. His major and minor subjects were organic, biological, and organic chemistry, respectively. *Dissertation:* The synthesis of certain substituted syringic acids.

Memorial Library. Dr. *Edward Plaut* has given, to Princeton Univ., $5000 for the establishment there of the Albert Plaut Memorial Library of Chemistry, in memory of his father.

Address. Prof. Gies was one of the speakers at the annual dinner of the First District Dental Society of the State of New York, at the Hotel Astor, Jan. 22.

EDITORIALS

WILLIAM J. GIES

Biochemical Bulletin: Past, present, future

Beginning with this issue, the BIOCHEMICAL BULLETIN becomes a monthly. Practically all the many mechanical obstacles in the way of prompt distribution of the numbers in preceding volumes have been due to the comparative infrequency, and the corresponding bulk, of quarterly publication. We anticipate not only regularity in monthly issuance of the BIOCHEMICAL BULLETIN, but also continued improvement in the quality of the numbers, and in the timeliness of the personal and professional "news items" that will remain one of the BULLETIN'S general features.

Coincident with this change in character, from a quarterly to a monthly journal, there has been an effective reorganization in the editorial office. A special and systematic effort will be made regularly to obtain "news items" from every biochemical laboratory in this country and abroad, in order that the BULLETIN may mirror biochemical events in the most complete and faithful manner, to the credit and advancement of biochemistry.

The difficulties which have persistently enforced delay in the distribution of the successive numbers of the BIOCHEMICAL BULLETIN made it impossible to publish the first issue of Vol. IV (March) before last June. The June and September numbers of Vol. IV are in press and will be issued together in the course of a few days; the December number is in type and will follow soon thereafter. Instead of permitting the excessive delay in the publication of these back numbers to embarrass our purpose to issue the BIOCHEMICAL BULLETIN monthly, beginning with Vol. V, we have adopted the unconventional plan of going ahead promptly with the new program and adjusting affairs on the old schedule as soon as possible.

Our subscribers will find that the delayed issues are among the most important in the series, and that the contained papers suffer little, if any, from the enforced postponement in their publication.

Each number of the BIOCHEMICAL BULLETIN will hereafter go to press on the 15th of the month and will be issued on or about the last day of the month. The time covered, in each issue by our section on "*News, notes and comment,*" will be, accordingly, the period from the middle of one month to the middle of the next.

The monthly plan of publication will not increase the subscription price of the BIOCHEMICAL BULLETIN. The Editorial Committee continues to pay all the executive expenses of publication, which, with the further contribution of free editorial labor, makes it possible to offer the BULLETIN to subscribers at a price below that of any other journal of its kind and size.

We propose to adhere to the policy of issuing but one volume a year. *There will not be an increasing expense to the subscribers, even if the annual volumes are enlarged.* Thus far we have received annually a larger number of papers than we have been able to publish. The influence of the **Kronecker Biochemical Prize** may add to our embarrassment in this regard, but the corresponding *qualitative* increase in the value of the BIOCHEMICAL BULLETIN will be a gratifying consequence for our subscribers.

The Columbia University Biochemical Association decided, some time ago, to endow the BIOCHEMICAL BULLETIN with a fund that will insure the permanent continuance of this journal, in the active service of biochemistry as a science and as a profession. Announcements of details in this connection will appear in succeeding issues.

Kronecker Biochemical Prize

One of the many who appreciate the career of Hugo Kronecker, and who honor his memory, has authorized us to publish the following statement anonymously:

"In response to your suggestion that the award of a cash prize of one hundred and fifty dollars ($150), to the author of the most meritorious biochemical paper in each successive volume of the BIOCHEMICAL BULLETIN, would serve 'cumulatively to encourage biochemical research and improve biochemical literature,' I wish to say that you may draw upon me for that amount ($150) for that purpose, for five years in succession.

"In accordance with your general suggestions the only conditions I attach to the expenditure of this fund are the following:

"1. The prize shall be designated, in all reference thereto in the BIOCHEMICAL BULLETIN, as the **Kronecker Biochemical Prize.**

"2. No one more than 40 years of age shall be eligible to receive the prize, but neither nationality, race, creed, sex, nor any other state or personal condition shall render an author ineligible to receive the prize.

"3. The prize-winning paper, article, or other contribution, may be of multiple authorship and of any biochemical character whatever, provided the paper or any part of it is not published elsewhere before the award is formally announced; but the prize may not be awarded to a paper that is more than 15 printed pages in extent, exclusive of diagrams, plates, tables, and other illustrative matter.

"4. The award of the prize shall be made annually by *vote of the subscribers for the* BIOCHEMICAL BULLETIN.

"5. The Managing Editor of the BIOCHEMICAL BULLETIN, with the advice of the members of the Executive Committee of the Columbia University Biochemical Association, shall have authority to announce that none of the papers in a given volume is sufficiently meritorious to warrant the award of the prize for that volume; but in any such event the prize for the succeeding volume, or volumes, shall be increased by the amount, or amounts, not previously awarded.

"6. The Managing Editor of the BIOCHEMICAL BULLETIN shall announce and execute all plans desirable or necessary for the attainment of my purpose in this matter, in accord with the conditions above expressed.

"If, in the judgment of the Executive Committee of the Columbia University Biochemical Association, by the time of the fifth award, the prize will have accomplished, to a reasonable degree, the purpose of its establishment, it will give me pleasure to consider the continuance and enlargement of the **Kronecker Biochemical Prize,** on the basis of an endowment to be placed under the management of the Columbia University Biochemical Association."

It will be impossible suitably to award the **Kronecker Biochemical Prize** before its existence is widely known. Plans for the execution of the donor's purpose will be developed at an early date and announced in the next few issues of the BIOCHEMICAL BULLETIN.

All due preparation will be made for the first award of the prize shortly after the completion of the next succeeding volume (VI) of this journal.

Development of the Medical Brotherhood: "F. M."

The *Medical Brotherhood* ("F. M.")—the organization and proceedings of which are discussed in Vol. IV (June-Sept.)—is steadily increasing in size and importance. As we go to press the number of members exceeds *eleven hundred* (1,100). The following quotation is pertinent, though unintended, comment on the opportunities of the Medical Brotherhood:

> The whole civilized world observes with delight that the profession of medicine, including surgery and the profession of public health and sanitation, stands out distinctly among all the intellectual callings as being steadily and universally devoted to curing the sanguinary ills of war, alleviating human sufferings from disease and folly, and extending for mankind the domain of health and happy life. These professions employ all the resources of physics, chemistry and biology for merciful ends both in peace and in war. The martial professions, on the other hand, employ many scientific discoveries and inventions, originally made for peaceful uses, as means of destruction and death. Biological science has great advantage in this respect over physical and chemical: It can not so frequently or easily be applied to evil ends. C. W. Eliot: *Science,* 1915, xlii, p. 928.

Objection to scientific meetings during the Christmas holidays

Do the members of the American Society of Biological Chemists continue to prefer the Christmas holidays, of all other days of the year, as the period in which to hold the annual meetings, or, do the members continue annually to meet submissively during that holiday season chiefly because "they started that way and don't know how to stop"? Has the Bochemical Society yoked up with the ox of custom and has custom been running away with the society? Is this case parallel with the classical: "We're here because we're here?"

There appears to be widespread dissatisfaction with the present plan of breaking into the Christmas vacation with serious scientific meetings, a dissatisfaction with which the writer heartily sympathizes and which the BIOCHEMICAL BULLETIN will attempt to measure and express. The members of the American Society of Biological Chemists, and of the other three societies that comprise the Federation of American Societies for Experimental Biology, will shortly receive a list of questions on this subject with the request that answers be returned for publication in this journal. The BIOCHEMICAL BULLETIN will endeavor, in this unconventional way, to serve the interests of all by showing that either there is, or is not, good reason to change the time for the annual meeting of the Federation and its constituent societies.

See page 44 for comment on this subject by Secretary Auer.

Books received

The BIOCHEMICAL BULLETIN promptly acknowledges here the receipt of publications presented to it. Reviews are matter-of-fact statements of the nature and contents of the publications referred to, and are intended *solely to guide possible purchasers.* The wishes or expectations of publishers or donors of volumes will be disregarded, if they are incompatible with our convictions regarding the interests of our colleagues. *The sizes of the printed pages are indicated, in inches, in the appended notices.*

Edema and nephritis: A critical, experimental and clinical study of the physiology and pathology of water absorption in the living organism. 2d ed. By Martin H. Fischer, Eichberg prof. of physiol., Univ. of Cincinnati. Pp. 695—4 x 6½; $5.00. John Wiley and Sons, New York, 1915. "These pages give in combined form the contents of the 1909 Hatfield prize essay of the Coll. of Phys., of Phila., and of the 1911 Cartwright prize essay of the Alumni Assoc. of the Coll. of Phys. and Surg., Columbia Univ., previously published as separate volumes bearing the titles 'Edema' and 'Nephritis.' The close association between the two made their appearance in combined form seem advisable. The chief changes which time has rendered necessary consist of additions to the general text embodying the results of later experimental and clinical observations in good part not readily accessible to English readers—*the main argument remains as before.*"

Among the changes in the treatment of these subjects is an added section on the relation of syneresis to the accumulation of fluid in body cavities in edema (pp. 240–2). Special attention is also given to the possible influences of enzymes as factors in the causation of edema (p. 220). Referring specifically to the rôle of acid, Fischer says: "I have never held an acid production and accumulation to constitute, of necessity, the only factor responsible for the increased hydration

which characterizes edema" (p. 229). "My constantly reiterated claim that certain changes in tissues are due to an 'increased acid content' *cannot at will be made to read an 'increased (hydrogen ion) acidity.'* The latter may under otherwise constant conditions become evidence of the former, but the reverse need not follow" (p. 633). Recent criticisms by Henderson and collaborators are considered on pages 633–4. This book deserves to be studied by every investigator of problems involving the biological relationships of water, for it presents effectively, and in a stimulating and interesting manner, from many points of view, the gist of our knowledge, theories, doubts and errors on this important general subject.

A review of the literature of phosphorus compounds in animal metabolism. By E. B. Forbes and M. Helen Keith, Wooster, Ohio. Pp. 748—4½ x 7¼. Ohio Agric. Exp. Sta'n Technical Series, Bull. No. 5. This comprehensive review is recommended unreservedly as the best work of reference on phosphorus in its relation to normal animal nutrition. The parts (pp. 13–588) are (1), Chem. of organic compounds of P; (2) P of foods; (3) P of animal bodies and products; (4) normal P metab.; (5) P metab. in disease. An unusually complete bibliography is appended (pp. 589–709), including the title of each paper mentioned; and a complete and detailed index is included (pp. 711–48). The spirit in which this splendid achievement was conceived and executed is indicated by the following quotation from the introduction (p. 11):

"Throughout the intricacies of these processes—in considering the relations of the animal to its food—let it be our point of view that inheritance has furnished the plans, the details and specifications which are to govern the whole course of metabolism; that food builds the structure and maintains its processes, in so far as made possible by the nature and amounts of its constituents; that variability in the composition and functions of the animal body, and excess of capacity in its structures, constitute a provision of safety, a means of adaptive response to changes in dietary conditions; that time lends to these adaptations such permanency, in the individual, as to constitute specific effects of foods on the life and structure of the animal; that these specific effects of foods are, in general, due rather to their limitations than to stimulation of supernormal function; that the nature and possible extent of these effects have been separately determined for each species by the particular conditions, and the *variability* of conditions of life to which, through the ages, they have become adapted; and that in relation to practical animal nutrition our interests are in the highest states of function rather than in irreducible physiological minima, since the whole range of success and profit lies close, and ever closer, to maximum possibilities."

The chemistry of colloids and some technical applications. By W. W. Taylor, lect. in chem., Univ. of Edinburgh. Pp. 328—3½ x 6; $2.00. Longmans, Green & Co., London, 1915. "It is curious that although colloid chemistry owes its development in no small degree to British investigators, hitherto there has been not only no English text-book on the subject, but no text-book in English available, the foreign works that have been translated dealing with particular aspects of the subject only, or with its bearings on other sciences." This volume is based on the author's lectures on heterogeneous systems, delivered to advanced students in the Univ. of Edinburgh. It is a very useful text-book, and a valuable

work of reference for biological chemists. The four main parts deal with (1) general properties of colloids, (2) methods of preparation, (3) adsorption, (4) applications of colloid chem. (including biology, pp. 295–318).

A text-book of medical chemistry and toxicology. By James W. Holland, emeritus prof. of med. chem. and toxicol.; dean, Jefferson Med. Coll., Phila. 4th ed. Pp. 678—4 x 6¾; $3.00. W. B. Saunders Co., Phila. and London, 1915. This excellent volume continues to present in systematic form the essentials of chemistry as they are related to practical and scientific medicine. The book is primarily intended for students of medicine who are required to take, in medical schools, courses in inorganic, organic and physiol. chem., and in toxicology. In the revision successful effort was made to give a thoroly satisfactory presentation of the "aid now offered to diagnosis by the chem. laboratory." The author acknowledges his indebtedness to Prof. P. B. Hawk, and Messrs. M. A. Saylor and Olaf Bergeim, "for helpful suggestions in this revision."

Collected papers from the Physiological Laboratory of King's College, London. Ed. by W. D. Halliburton. Vol. XIII; 1915 (17 reprints).

Publications from the Jefferson Med. Coll. and Hospital, Phila. Vol. V; 1915 (27 reprints). Vol. VI; 1915 (pp. 190; 18 original papers, not published elsewhere).

Studies from the Department of Physiology, Cornell Univ. Med. Coll., including contributions from the Russell Sage Inst. of Pathology. Vol. IV; 1915 (24 reprints).

Studies from the Department of Physiology of Columbia Univ., at the Coll. of Physicians and Surgeons. Vol. V; 1910–12 (24 reprints). Vol. VI; 1913–1914 (23 reprints).

Studies from the Department of Pathology of the Coll. of Physicians and Surgeons, Columbia Univ. Vol. XIV; 1914 (30 reprints).

Studies from the Rockefeller Institute for Medical Research. Vol. XXI; 1915 (pp. 637; 64 reprints).

Collected papers from the Research Laboratory of Parke, Davis and Co., Detroit, Mich. Dr. E. M. Houghton, Director. Vol. III; 1915 (pp. 341; 22 reprints).

Hydrographic, plankton, and dredging records of the Scripps Institution for Biological Research of the Univ. of California, 1901 to 1912. Compiled and arranged, under the supervision of W. E. Ritter, by Ellis L. Michael and George F. McEwen. (No. 1, Vol. XV; Univ. of Cal. publications). 1915; pp. 206.

The Illinois Chemist. "A quarterly published in the interests of the Faculty, Alumni and Students of the Dep't of Chem. of the Univ. of Ill., under the auspices of the Univ. of Ill. Sect. of the Amer. Chem. Soc., the Chem. Club, Alpha Chapter of Phi Lambda Upsilon, and Zeta Chapter of Alpha Chi Sigma." Introductory number: June, 1915; pp. 44.

The list of members of the Columbia University Biochemical Association, which has been kept running on an insert in the quarterly issues, will be published hereafter, in revised form, semi-annually—in the June and December issues.

This space will be used, hereafter, for announcements pertaining to biochemical "positions vacant" and "positions wanted." Such announcements will be published free of charge.

CONTENTS

The BIOCHEMICAL BULLETIN is a monthly biochemical review. It publishes results of original investigations in biological chemistry, preliminary reports of researches, addresses, lectures, criticism, reviews, abstracts of papers, practical suggestions, biographical notes, historical summaries, bibliographies, quotations, questions, news items, proceedings of societies, personalia, views on current events in chemical biology, descriptions of new substances, methods and apparatus,—any and all suitable items of personal and professional interest to students, investigators and practitioners of biochemistry.

Subscription prices: Vol. I, $6.00; vol. II, $5.00; vol. III, $4.50; vol. IV, $3.50; vol. V, $2.75 ($3.00, foreign).

Address remittances, manuscripts and correspondence to the Managing Editor, William J. Gies, 437 West 59th St., New York.

Vol. V February–March, 1916 No. 18–19

Biochemical Bulletin

NEW YORK

Entered as second-class matter in the Post Office at Lancaster, Pa.

KRONECKER BIOCHEMICAL PRIZE

A prize of one hundred and fifty dollars ($150), to be known as the **Kronecker Biochemical Prize,** and intended "to encourage biochemical research and improve biochemical literature," will be awarded to the most meritorious paper, in each successive volume of the BIOCHEMICAL BULLETIN, under the following conditions:

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6. The contents of the second half of the present volume (V—July to December, 1916, inclusive) and of the whole of the succeeding volume (VI—1917) shall constitute the series of papers from which the most meritorious contribution will be selected for the *initial* bestowal of the **Kronecker Biochemical Prize.** Beginning with Volume VII (1918), this prize will be awarded *annually.*

7. The Managing Editor of the BIOCHEMICAL BULLETIN will announce and execute all plans desirable or necessary for the attainment of the donor's purpose in this matter, in accord with the conditions above expressed.

See page 59 (Jan.) and 127 (this number) of the BIOCHEMICAL BULLETIN.

BIOCHEMICAL BULLETIN

VOLUME V FEBRUARY–MARCH, 1916 No. 18–19

SCIENTIFIC TRUTH AND THE SCIENTIFIC SPIRIT[1]

A. B. MACALLUM, F.R.S.

In appearing before you this evening in my present rôle I cannot but recall an incident of fifty-five years ago, which often recurs to my mind when I think of the events of today.

The Trustees of the Smithsonian Institution in 1861 were preparing their programme for the year, and in this programme were courses of lectures to be given to the public on a series of selected topics. Their intention was announced and they were importuned to devote those lectures to what was at that time in everybody's mind. It was the first year of your great war of the Secession. I say *your* war, but I might with some justification have called it *our* war, for there fought in the ranks of the armies of the North 68,000 British citizens of whom 45,000 were Canadians, and of the latter 15,000 lost their lives. There were even then stop-the-war people, prototypes of the Fords, the Akeds, the Jane Addamses and the Lloyd Joneses of today, futile, mole-visioned and cloister-minded, who imagined that the great conflict could be prevented by talking and they wished to avail themselves of the opportunity the lectures might present of showing how it could be done.

The Trustees apparently wished to be neutral, perhaps they were uncertain what the upshot of the conflict was going to be, and this may have helped them to decide, as they did, that all War topics should be excluded from their programme. To secure that they invited Professor, afterwards Sir, Daniel Wilson of the University of Toronto, to give a course of lectures on Prehistoric Man. Pro-

[1] Address delivered at the Fifth Annual Dinner of the Columbia University Biochemical Association, February 10th, 1916. See page 123.

fessor Wilson was eminent for his attainments and achievements in many fields, but he was chiefly known at the time as a pathmaker in what were then the trackless wilds of the earliest history of our race, and, therefore, the selection of him as a lecturer on the subject could not have been more aptly made. It was a fortunate selection from another point of view. His subject could not be remotely associated with the war then begun, but, had it been otherwise, his habit of mind prevented him from alluding to it in his lectures, and not even once in his conversation during his stay in Washington did he indicate the slightest interest in the great struggle then begun. There were occasions when he could have referred to it. Frequently during the delivery of his lectures the boom of cannon, heard in the lecture room, coming from across the Potomac, punctuated his sentences. According to the late Dr. Otis T. Mason, who was my informant on this subject, he left as a memory of his visit a reputation for mental detachment that was Olympic in its character.

This evening I appear before you in a rôle which is in some respects parallel to that filled by Sir Daniel Wilson on that occasion, but there are in it contrasts also. Your country, your nation is now at peace and it is my country that is at war, engaged in a struggle unparallelled in history. Canada has already played a part and she is preparing to play a larger one. She is to increase her army of 200,000 men to half a million, that is, to train and arm five men out of every twelve of the male population between the ages of eighteen and forty-five. That will indicate the magnitude of the task we have undertaken. There can be no mistaking the seriousness with which we regard what is before us. Our young men are preparing to do their duty and to pay the toll that may be exacted. Daily through my laboratory windows comes the sound of the drilling of more than seventeen hundred men, which goes on from morning to night on our University lawn. We have already sent seven hundred of our students and young graduates overseas on active service and we have now a continually lengthening Roll of Honour with its sad yet noble memories of those whom Age shall not weary nor the Years condemn. The end may be far off and the future is dark and heavy with fate, but we are going for-

ward with the determination that, though life will never again be as it was in the joyous, care-free past, a new world shall come into being as a compensation for the sacrifices that we are making and are yet to make. We are certain above all things of one result, and it is that this war is forging on the anvil of Destiny, in the fierce furnace heat of the conflict, the scattered loosely-knit portions of our Anglo-Celtic Empire into an organization, an instrument that shall be a guarantee of happiness and liberty to countless millions yet unborn.

It is the thought of all these things crowding in on my mind, that prevents me from adopting the absolutely detached, Olympic mind that Sir Daniel Wilson displayed when your nation was being welded into one in the furnace heat of the great Civil War. I am not, however, going to allow these thoughts to crowd out those which it is my duty to express to you on this occasion. I must look forward, as you must also, to a time when the welter of baleful hatred and palæolithic fury of the hour will be past though not forgotten, to a time when men of science of all nationalities may, under better auspices, and in spite of the chauvinism that will be the result of this war, cultivate once more a camaraderie on the intellectual high-road of life. And in looking forward we must strive to strengthen those forces which, out of all the wreckage of today, remain to assist us in restoring what we, two years ago, were wont to believe could never be swept away.

What are those forces? They are *Scientific Truth and the Scientific Spirit,* both of them intangible entities or principles, but for all that destined to play a part in the restoration of the world to sanity.

It is upon these that I am to dwell this evening, and I have chosen them as the subject of my address in the hope that, in holding your attention for the moment, I may direct your thoughts to questions which are of enduring interest to all workers in science.

To workers in biochemistry these topics are of fundamental importance because our attitude toward them, our comprehension of their significance, determine our usefulness as scientific investigators. As students of the phenomena of living matter we are constantly in touch with problems which, to many, seem inscrutable,

inexplicable on the basis of our present knowledge. There is in the make-up of our personalities a tendency to classify the inexplicable as transcendental and to believe that in living matter there operate forces that can never be scrutinized and examined as we examine the forces of the ordinary physical world. That tendency of mind, from which I say few are wholly free, is, when unchecked, a negation of the Scientific Spirit, and to a mind more or less influenced by it there can be no Scientific Truth, for the latter is the product of the Scientific Spirit.

There may be some who will ask "What is Truth?" They ask the question not in the spirit and intent of the Procurator of Judæa, but because they are perplexed by the irreconcilable interpretations of the term, "Truth," as advanced in the discussions amongst the different schools of philosophical thought. The perplexity is to a certain extent natural, but it ought not to prevent us from finding an answer to the question which will meet the tests, not only of daily life, but also of the world of science, as a brief consideration of the doctrines of two diametrically opposed schools of thought may show.

Amongst the adherents of one of these schools, which I may, for the sake of brevity, call the Absolute School, Truth is a concept reached by processes of more or less rigid speculation and reasoning, in which, however, introspection plays a large part, explaining the world, reality and mind in terms which are wholly of dialectical coinage. The central doctrine of this system of thought is that reality and appearance are but manifestations of the activity of an entity freed or absolved from all limitations of time and capable of all that we can conceive and more, an entity that is, in consequence, denominated the Absolute. The Absolute is, in the language, some would say, in the jargon, of the School, but Truth itself because it is claimed to be the product of the final analysis of the phenomena of Mind and Reality.

This concept of Truth commends itself to minds of a rare type, chiefly those of the cloister or the study, but never to those representative of the world of action. I do not wish to be understood as deriding it or the processes by which it is reached, for I recognize that the human mind must explore its own depths and exploit its

own processes, whatever the result may be, yet I would point out that the world is not peopled wholly by Greens, Cairds, Bosanquets, Bradleys and Royces, and that the life and thought of the exoteric many can never but remotely be influenced by this doctrine of Truth.

The other school of philosophy is a proponent of a doctrine of Truth quite different from the product of pure intellectualism and which can be understood and applied by the many to daily life, and because it can be of service to them it can be absolved from the charge that "it bakes no bread." This school of philosophy holds, as its cardinal tenet, that Truth is a body of beliefs or generalizations that works when you apply it in your needs. The truth in a particular case is the generalization, great or small, that you find in accordance with the facts, and the facts themselves are isolated truths, the products of your experience, that you accept as satisfying your intellectual tests. Whatever works then in daily life is truth, and, if a generalization, or belief, cannot be so applied, it has no function or significance intellectually or practically, and cannot be truth as it is conceived by the disciples of this school.

This school of philosophy is known as the Pragmatic School and it is generally supposed to have been founded within our own time by the late C. S. Pierce and Professor William James of Harvard and Dr. F. C. S. Schiller of Oxford, and Professor John Dewey of Columbia, who still remain its leaders. The school, however, represents an attitude of mind that has influenced the race since its origin one or more millions of years ago. Ever since the middle of the Pliocene Age, or, perhaps, even since the end of the Miocene, man has had to struggle with his environment, and that very struggle postulated a system of beliefs and generalizations, which, if they served him, represented to him Truth. The beliefs and generalizations did not work, if he failed in the struggle and was exterminated. They were, of necessity, at first of the crudest, the most barbaric type and limited in their scope and application to the needs of the moment, but they were changed as they slowly underwent the test of experience, and the beliefs and generalizations of one age were discarded wholly or became the superstitions

of succeeding ages. Even today the vast majority of mankind regard their beliefs and generalizations as true because they work or give a satisfactory explanation of the scheme of things as it appears now.

That the pragmatic point determined what Truth was in the mind of prehistoric man may be gathered from the study of the beliefs and practices of those tribes which are still in the prehistoric stage of culture. Sir John G. Frazer, the author of "The Golden Bough," and one of the profoundest students of the history of human culture, in his work, "Psyche's Task," claims that the evolution of some of our most cherished convictions and principles, such as the sacredness of human life, sexual morality, the rights of property and our conception of social order, was promoted by the beliefs and generalizations of prehistoric races. These beliefs and generalizations now appear to us as superstition, and of the grossest character in some respects, but this very superstition in promoting those convictions and principles on which the whole fabric of society rests has rendered a great service to humanity. Sir John Frazer admits that superstition has been productive of evil in the history of the race, but this should not blind us to the benefit it has conferred, and he gives special point to all this by a dictum which for its brevity and concentrated wisdom is well worth remembering: "Once the harbour lights are passed and the ship is in port, it matters little whether the pilot steered by a Jack o'lantern or the stars."

The history of the human mind is then that of long ages of discipline in pragmatism. It is the pragmatic mind that has brought man along the road of progress through the million or more years of the prehistoric period to the stage of civilization of today. It is the pragmatic mind that will lead him, indeed force him, along the road of progress in the many, many millions of years during which the race will possess the earth. In all that time to come he will refine more and more the processes by which he arrives at what he will regard as Truth and he will subject it to ever rigider tests as the millennia pass. As a result, there will be many a discarded belief and generalization once looked upon as Truth, just as there

has been in the past a long series of beliefs and generalizations which for a time worked and then became superstitions. Truth then will have its palæontology just as life has, with its myriads of forms which have passed away.

To those who are inclined to accept the intellectualist's teachings, this view of Truth as earth-born rather than heaven-born, appears repellant and degrading. It does not seem possible for them to idealize it as they can idealize what Carlyle calls "The Eternal Verities." They, with Chaucer, may hold that "Truth is the highest thing a man may keep," and they are prone accordingly to sublimate it, as the intellectualist does, until it has no earthly affinities. They should remember that Truth of the Absolute School has had a repellent history. Men have in the past assumed that they were in the possession of Absolute Truth and they attempted to compel all others to accept it also. Not to receive the Absolute Truth, they held, was to murder the soul, and to prevent such murder the extremest cruelty was considered justifiable. Hence arose persecution, religious wars, death at the stake and on the scaffold, massacres of thousands and relapses into barbarism. Absolute Truth has then its palæontology to remind it that it, like the Truth of Pragmatism, is subject to growth, to evolution and that it may ripen only with the ages.

From all that I have said it follows that the long discussions on the nature of Truth as the pure intellectualist understands it have been but vain dallyings with illusory ideas. There is no Absolute Truth knowable to the human mind. All that passes for such can, at best, be but a remote approximation to what may, in the final cast of thought in the far-distant future, be a dim limning of the ultimate, the absolute, the fundamental significance of the relations of Reality and Mind.

Now what is the bearing of all this on Scientific Truth?

Its significance lies in the fact that the representatives of Science must always face the question of the validity of its position as an exponent of organized knowledge. There is in the popular mind a notion that the processes by which the facts and generalizations of Science are established are different from those which are employed outside of the laboratory or observatory to establish the

working hypotheses of daily life, or which were employed, more or less unconsciously, in the development of the most firmly founded principles on which our present social order rests. This has caused Science to be regarded as a thing apart, as the lore of an oracle whose pronouncements it is profanity to reject. One hears in popular speech such expressions as "Science says —" or, "according to Science" or "Science teaches . . ." and this indicates that in the mind of the average man there is a more or less developed cult of Science as an infallible entity, personality, or divinity, which, like Minerva, has no earthly or human origin. It is perhaps not the popular mind that is wholly to blame for this. When one reviews the discussions and polemics of the last fifty years, which have arisen from the conflict between conservative and advanced thought, and, especially, advanced thought based on direct observation and experiment, there has not been wanting a species of dogmatism in not a few of the representatives of Science, that suggests the claim of a degree of infallibility which the popular mind, superficial as it is, and because of the achievements of Science, has been and is inclined to accept. It is true, the clearest-minded amongst the representatives of Science never by speech or silence encouraged such a claim. Tyndall, Huxley, Kelvin, Helmholtz, Virchow and Pasteur have, in set terms, again and again insisted that Science is not infallible. Huxley, throughout his long crusade for the recognition of Science as a force making for progress, was specially insistent on the possibility of error in Science. He it was who defined Science as nothing but trained and organized common sense. a definition that ought to acquit it of the charge of claiming infallibility.

In spite of these disclaimers, the taint of a reputation for infallibility remains and it not infrequently draws from the superficial, as well as from some who ought to know better, the criticism that the judgments of Science are unstable and ought not to be regarded as having any validity when they are opposed to the established beliefs and the dogma of the day. Sometimes the exponents of the older learning denounce Science as falsely so-called, or term it Pseudo-Science. At one time that was the stock charge against Science, and it had its effect on the unthinking. It still

is launched against Science chiefly in the polemical publications of the orthodox theological school.

It is, however, when the criticism comes from the rank and file of the army of Science that it does the most mischief, and especially so when it is urged in defence, not of religious beliefs or dogmas of a philosophical school, but of dogmas like vitalism, the acceptance of which postulates a negation of the established methods of Science.

It is not difficult, though not fair, to charge Science with pretensions to infallibility, then to recall its mistakes, its discarded theories and generalizations and thereby to impugn its claims to speak with authority on matters with which it busies itself. That appeals occasionally to the man in the street and it gains a little, perhaps desired, notoriety for the critic, but does it help us in the final cast of things to question the hard-won achievements of the human mind and say that they are nought? By what other methods than those followed in scientific research can organized knowledge be gained? Is it by intuition, revelation or the dialectics and pipe-dreams of the intellectualists? It is, therefore, beside the mark for Von Uexküll to ask "Was ist eine wissenschaftliche Wahrheit?" and to answer "Ein Irrtum von heute." In a different spirit and with a world of difference in ultimate meaning is the observation of Huxley that "history warns us that it is the customary fate of new truths to begin as heresies and to end as superstitions."

Science, then, is not infallible and never can be. Equally lacking is the quality of infallibility in Scientific Truth. The essence of a truth in Science lies in its power to explain phenomena in a satisfactory way. If it does not do this, then it is not a truth. In a certain stage of the development of scientific knowledge a theory is found to explain or relate all the known facts in a particular range of phenomena. This is the source of the satisfaction it gives to the scientific mind and at that stage it is accepted as a Truth. But subsequently discovered facts in the same province may refuse to be so explained or related, and the previously accepted truth will, consequently, be discarded for one that will give this service.

An illustration is to be found in the history of the theories of light. Newton held that light emanated from its source in the

form of excessively minute particles or corpuscles, which were supposed to travel with enormous velocity. This "corpuscular" theory in his day and for a hundred years after seemed to explain all the then known phenomena of light. It was not only satisfactory in this respect but it stimulated further inquiry in the subject. This eventually led to the promulgation of the "undulatory" theory, according to which light is but a wave motion in the cosmic ether. For the last hundred years this has been accepted as a truth, but in its turn it is failing to explain all new facts as they are ascertained, and its acceptance in its original form as a truth may eventually terminate.

If this is Scientific Truth, what is there to prevent it from running riot, and confusing and misleading rather than guiding?

The only preventive force is the Scientific Spirit. It is a development of the quality or tendency of the mind which has compelled man in all the periods of his history to discard or to recast his truths because they do not work, and to accept new ones because they do work. That tendency in common life has operated crudely and slowly, it has caused countless mistakes and the temporary acceptance of countless errors, but it has brought us to our present stage of civilization. It is indeed nothing else than the pragmatic spirit. The Scientific Spirit is the pragmatic spirit trained in the strictest fashion to accept only what answers rigid tests and reinforced by an intense curiosity or desire to know. The very essence of this Spirit is manifested in the habit of unceasing, relentless criticism. Without such incessant criticism there would be chaos in Science. The Scientific Spirit, as thus understood, is an all-powerful factor in establishing Scientific Truth.

To some of you, perhaps to many of you, what I have said may appear as a restatement of a series of truisms, and I am prepared to admit that. I have, however, dwelt on these latters at length because they are of fundamental importance to men of science generally, and, amongst these, to biochemists, especially of the younger generation, who have now to meet an extraordinary situation in which these matters are involved.

A brief sketch of the history of biochemistry to the present date will demonstrate what this situation is.

It would be difficult to say when the history of biochemistry actually began, for all through the last century a number of contributions to chemistry were made which can now be regarded as contributions to biochemistry. The history of biochemistry, however, as a distinct department of knowledge, may be said to have begun with Hoppe-Seyler in 1867 in the work from his laboratory, which he subsequently published under the general title of "Medicinische-Chemische Untersuchungen." The number of publications from all sources, which appeared annually during the seventies, was small, and even in 1884 when I began to interest myself in the subject it did not, all told, exceed more than three hundred a year. It was possible for a biochemist then and for a few years thereafter to keep in touch with all advances in his subject, but eventually the number grew and in 1905 the year's output of biochemical publications of all kinds was estimated to be about three thousand five hundred papers. It did not cease to grow and the output of 1913 was more than six thousand.

The task of the Scientific Spirit in 1870, so far as the exercise of relentless criticism was concerned, was easy, for the dozen or more biochemists could supervise the whole field of production and pronounce judgment. That function was carefully and deliberately performed. It is on record that when Miescher, who had been for some time a student in Hoppe-Seyler's laboratory in Tübingen, offered his paper, now classical, on nuclein for publication in the "Medicinische-Chemische Untersuchungen," Hoppe-Seyler would not publish it till he himself had worked over the whole subject and verified all the observations of Miescher. The publication of the paper was, in consequence, delayed two years.

What could be done in 1870 cannot be done now, when the mass of literature being poured out in every department of biochemistry is so overwhelming. It is still possible for the head of a laboratory to censor its productions and a number of the leaders exercise that function, but what they do in this subject ameliorates the situation only to a slight extent. There is still, as anyone can see, too little criticism of value in the annual output. One gets the impression in reviewing the literature on a subject, that the contributors to it regard criticism as not within their province, and that

they are anxious to get their own views on record without going through the labour of preparing a critical review of that literature. There is in consequence an ever increasing dependence on Jahresberichte, Centralblätter and Ergebnisse. Even when the function of criticism is exercised the situation is not always thereby bettered, for the criticism not infrequently is slipshod or specious, and the result is only polemics, or it is completely ignored.

It may be urged that the criticism to be effective would increase the length of each contribution, which on the average is sufficiently long already. The answer to this is that effective criticism would in the end not only shorten the length of the papers, but also lessen their number.

The haste to publish and the tendency to multiply unnecessarily the number of papers are vices which should be curbed. The fact that they are so prevalent is due to the absence of effective criticism.

In claiming that criticism is the essence of the Scientific Spirit, I must not be understood as justifying criticism of the indiscriminating or reckless type. That is utterly senseless and is a graver fault than the absence of all criticism. Criticism, to be effective, must be pertinent, judicial, honest and, above all, courteous to the object of it. Criticism of that type no one can refuse or reject and it is extremely valuable to the individual who is subjected to it, as he will admit sooner or later if he is of the right sort. It is the only means of determining whether what he offers as a contribution is going to work.

To inculcate right standards of criticism there should be given in every University a course of lectures on Ethics for all those who propose to devote themselves to a scientific career. There might even be, I would suggest, a Brotherhood like the ancient Brotherhood of Hippocrates, the members of which would vow to devote themselves to the cause of Truth, to deal justly and courteously with one another and with all labourers for that cause and to keep the scientific record purged of what is false or mean.

Not to dwell further on this subject, I will now briefly emphasize the central points of this address:

The first is that Absolute Truth is not knowable, and that even to the end of time it will be so.

> The unfinished window in Aladdin's Tower
> Unfinished must remain.

The second point is that Scientific Truth of any age is that which works and consequently it may change and present a new aspect with each succeeding generation.

The third is that the Scientific Spirit is, when rigorously exercised, the only test of what works or what is Scientific Truth.

The last point is that Science is not and never can be infallible, and we should be thankful for that, for, if it assumed infallibility, the progress of the human mind on the path of Truth would cease.

Before I conclude finally I would call attention to a rendition of the ideal Scientific Spirit which is to be found in a passage of Tennyson's "Ulysses." The old hero is there represented as having, after ten long years before the walls of Troy and ten more years of peril and adventure on the sea, returned to Ithaca, his old home, and as now resolving to take up the life of change and discovery even though the gulfs should wash him down. The passage which I quote should be indelibly fixed in the memory of every scientific worker:

> I am a part of all that I have met;
> Yet all experience is an arch wherethro'
> Gleams that untravell'd world whose margin fades
> Forever and forever when I move.
> How dull it were to pause, to make an end,
> To rust unburnish'd, not to shine in use!
> As tho' to breathe were life! Life piled on life
> Were all too little, and of one to me
> Little remains, but every hour is saved
> From that eternal silence, something more,
> A bringer of new things, and vile it were
> For some three suns to store and hoard myself,
> And this gray spirit yearning in desire
> To follow knowledge, like a sinking star,
> Beyond the utmost bound of human thought.

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THE "RETROGRADE CIRCULATION OF CALCIUM" IN THE HUMAN BODY

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Introduction. Calcium is an essential element in the biochemical constitution of the human body, through which it circulates constantly. In various forms, calcium enters the organism with food and potable water, and leaves it in urine and feces. Other excretions normally contain traces of calcium but, under pathological conditions, may carry much larger quantities, *c. g.,* the sputum in pneumonia and pulmonary tuberculosis, as stated by Loeper and Béchamp (1). Ingested calcium is partly absorbed in the stomach and upper portion of the small intestine. Most of the ingested calcium usually passes *unabsorbed* along the intestinal tract and is eliminated in the feces. *Absorbed* calcium is excreted along two different channels, some being ejected by the kidney, some by the lower portions of the small intestine. The foregoing statements indicate the normal circulation of calcium in the human body, as established by the successive investigations of Forster, Voit, Müller, Neubauer, Bertram, Renvall, and others. The relative quantities of calcium involved in the different phases of this circulation vary considerably with the physiological state, the age, and peculiarities of the individual but, above all, with the quality and quantity of the food.

Calcium is eliminated in the urine in combination principally with phosphoric acid, also with sulfuric, carbonic, oxalic and uric acids; that is to say, with acids which form with it slightly soluble compounds (2). The daily quantities of urinary calcium vary from about 0.15 gm. to 0.50 gm., according to different authors. The fecal calcium, that is to say, the difference between the ingested and the urinary calcium, also varies greatly in quantity, under both normal and pathological condition.

In adults under ordinary conditions, the urinary calcium amounts to about 10 percent of the ingested total. Von Noorden (3) found that in five persons there were variations between 3.9 and 28.3 percent of that total. Blauberg (4) determined that in infants during the nursing period, on mother's milk, the relation between the amounts of urinary and fecal calcium was 76:24, that is to say, the relation for adults is reversed for infants. When infants were fed upon cow milk, however, this ratio was similar to that for adults, and varied from 45:55 to 22:78. In nursing infants the fecal reaction is normally acid; in adults and in infants fed upon cow milk, the fecal reaction is usually neutral or alkaline. When, in adults under certain pathological conditions, the fecal reaction becomes strongly acid, the calcium ratio is "inverted," as for nursing infants.

The relation between (a) the quantity of calcium that is excreted by the intestinal mucous membrane, after having traversed the intermediary nutritive cycle mentioned above, and (b) the residuary calcium, of ingested food, that passes along the digestive tract without being absorbed, cannot be estimated precisely, because of inadequacy of the methods for their determination. The method employed by Müller (5), Tigerstedt (6), Renvall (7) and Salomon and Wallace (8), was based upon analytic data pertaining to the feces of (a) fasting subjects (Cetti and Breithaupt) or of (b) subjects receiving a diet poor in nitrogen, phosphorus and salins, that is to say, a diet from which residuary food calcium was eliminated (practical fasting, in this connection). In such subjects fecal calcium is calcium *excreted* into the alimentary tract. Salomon and Wallace have found that, in two adults subjected to a diet consisting exclusively of sugar, 0.211 gm. and 0.189 gm. of calcium (expressed as CaO), were excreted respectively during 24 hours. On such a diet, fecal calcium arises almost entirely from the mucous membrane in the lower portions of the small intestine, according to Voit (9), whose experimental researches on the feces produced by an isolated intestinal loop permit of no doubt in this matter. The pancreatic and biliary secretions, as well as those produced by the large intestine, contain only very small quantities of calcium.

The method employed by Salkowski (10), later by Ury (11), is

based upon the assumption that the soluble mineral matters (among them salts of calcium) in watery extracts of feces, are excreted by the intestinal mucous membrane. Ury considers intestinal calcium an excretion that is complementary to the urinary elimination of calcium. This idea, of complementary intestinal and urinary function in the excretion of calcium, seemed to have been confirmed, in the pathological field, by Soetbeer (12), who described an anomaly of calcareous catabolism, named *calcariuria,* in which the quantities of urinary calcium increase, while those of fecal calcium decrease. Soetbeer found, for example, that in 24 hours a woman excreted, in the urine, 0.263 gm. of calcium (expressed as CaO) in excess of the corresponding quantity by another normal person on the same diet. On the contrary, she excreted 0.310 gm. less in the feces. The excess of urinary calcium in this case originated from absorbed alimentary calcium, which, in opposition to what happens normally, was not excreted by the intestinal mucous membrane, but by the kidneys. Soetbeer attributes the pathogeny of calcariuria to the existence of colitis, which, he believes, impedes the excretion of absorbed calcium through the diseased intestinal mucous membrane.

Nevertheless, I regard Ury's supposition as an undemonstrable hypothesis. In reality the phenomenon his assumption is intended to explain is of an entirely different character. I have termed *"retrograde circulation of calcium"* in the human body the (a) *putrefactive production* of *soluble* calcium (salts) in the feces, (b) the *reabsorption* of such soluble calcium into the blood, and finally its (c) *passage into the urine,* where it occurs in combination with volatile or inferior fatty acids primarily formed in the feces.

My object, in this paper, is the presentation of an abstract of the experimental data upon which my conclusions were established. Those who may be interested in the details of the subject can find a complete account of them in a book I have recently published, in French, on the "Tropical pathological chemistry of the Atlantic region" (13).

Experimental. If the quantities of soluble and total calcium, and also of volatile fatty acids, in feces, are determined by means of

reliable methods,[1] it is found that these substances present parallel variations, and that the proportions of soluble calcium and volatile fatty acids are greater in calcariuric patients than in normal persons. Similar variations, though greater, are observed in diabetics, who, I believe, suffer from calcariuria and lipaciduria, sometimes with the greatest intensity. In the urine of all these persons the quantities of calcium and volatile fatty acids show correlative variations. Some of the figures obtained in these connections, for normal and calcariuric persons, are appended.

Name		Normal individuals		
		Soluble calcium CaO gm.	Total calcium CaO gm.	Soluble calcium: percent of total Ca
B. de T...	100 gm. of feces contained.....	0.167	1.321	12.6
A. C.....	100 gm. of feces contained.....	0.146	1.705	8.6
		Volume cc.	Calcium CaO gm.	
B. de T...	24 hour urine.....	973	0.312	——
A. C.....	24 hour urine.....	1231	0.224	——
		Calcariuric patients		
		Soluble calcium CaO gm.	Total calcium CaO gm.	Soluble calcium: percent of total Ca
F. W.....	100 gm. of feces contained.....	0.2890	0.4767	60.6
L. C.....	100 gm. of feces contained.....	0.5340	1.0293	51.9
		Volume cc.	Calcium CaO gm.	
F. W.....	24 hour urine.....	3.202	0.576	——
L. C.....	24 hour urine.....	1.939	0.512	——

These analytic results are fundamentally opposed to Soetbeer's assumption that the diminished quantity of fecal calcium in such patients is due to special colitis, which impedes the excretion of absorbed calcium, the latter being eliminated compensatorily by the kidney. From the analytic data above, it may be observed that in the patients in which the total intestinal excretion of calcium ought to be impeded and least, the *proportion of fecal soluble-calcium is greatest.*

[1] Calcium was quantitatively estimated by the Neubauer-Huppert method (14), slightly modified, and volatile fatty acids by the Schmidt and Strasburger method (15).

Comparative determinations of the volatile fatty acids in 24 hour urines, from both kinds of individuals, reveal similar variations. The volatile fatty acids were quantitatively estimated, in this case, by the Strauss and Philippsohn method (16), and expressed in cc. of decinormal sol. of sodium hydroxid.

Name	Normal individnals cc.	Calcariuric patients cc.
F. W.		58.0
L. C.		49.2
B. de T.	28.1	
A. C.	21.3	

In a case of severe diabetes, which was studied extensively in these directions, the proportions of soluble calcium and volatile fatty acids in the feces and urine were very striking, and suggested passage of large proportions of both substances from the feces to the urine, as in the case of many other urinary substances of fecal origin. The following data, obtained in this interesting case, show an inverted relation between the fecal and the urinary calcium.

Urine:	Volume, in 24 hours,	12.950	c.c.
	Volatile fatty acids (*n*/10 NaOH sol.),	838.5	c.c.
	Calcium, as CaO,	2.226	gm.
Feces:	Soft evacuation, obtained with a drastic,	1239.0	gm.
	Soluble calcium, as CaO,	1.073	gm.
	Total calcium, as CaO,	1.121	gm.
	Soluble lime: percent of total Ca,	95.7	percent
	Volatile fatty acids (*n*/10 NaOH sol.),	1593.0	c.c.

These experimental premises being established, it is entirely rational to believe that the volatile fatty acids arising during the stagnation and putrefaction of fecal matter, may produce soluble calcium salts by attacking the carbonates and phosphates of calcium that occur abundantly in every feces. By reabsorption ("retrograde circulation"), such soluble calcium salts pass directly into the blood, where, unlike the alkali salts of the same acids, they are not destroyed by oxidation, but finally appear in the urine. The formation of such soluble calcium salts in the feces may be easily imagined to occur, considering the nature of the putrefactive and fermentative processes in the large intestine. As a matter of fact, the addition to feces of a few drops of volatile fatty acid increases

largely its content of soluble calcium, as the following experimental data among others, clearly show.

Three equal weights of a given specimen of feces were treated with equal volumes of distilled water. To one portion, 2 to 3 drops of acetic acid sol. were added; to another, 2 to 3 drops of ammonium hydroxid sol., and each mixture rendered homogeneous by thorough stirring. The extracts were then filtered and the quantities of calcium in the filtrates determined, with the following results:

	Calcium, CaO
200 c.c. of fecal extract with distilled water	0.0314 gm.
200 c.c. of fecal extract with dilute acetic acid	0.2170 gm.
200 c.c. of fecal extract with dilute ammonia	0.0225 gm.

In order further to test my general conclusion, I made direct experiments, on men, by means of rectal injections of solutions of ammoniacal and calcareous salts of volatile fatty acids. These experiments have shown that the ammoniacal salts cause strong polyuria, whereas the calcareous induce marked hypouria. The ammoniacal injections were prepared with ammonia (3.825 gm. of NH_3) neutralized with butyric acid in the presence of rosolic acid and made up to 100 cc. The calcareous injections were prepared with 5 cc. of pure acetic acid neutralized with carbonate of lime, filtered, washed, and made up to 100 cc. The daily quantity was diluted four or five times with water and fractionally injected, in each case. Below are recorded the results of an experiment on a given individual during four periods of several days each. Throughout the experiment the daily urine was collected and analyzed. Only the averages for each period are given below. (The daily data for this and similar experiments may be found in the book referred to above (13).)

	Volume, cc.	Calcium CaO, gm.	Volatile fatty acid (n/10 NaOH sol.), cc.
First period. *Normal conditions*			
Daily averages	1290.6	0.2426	24.51
Second period. *Polyuric effect of injected butyrate of ammonia*			
Daily averages	2248.0	0.2989	31.56
Third period. *Hypouric effect of injected acetate of calcium*			
Daily averages	1384.0	0.4503	68.7
Fourth period. *Polyuria provoked by ingested water; no injections*			
Daily averages	1769.2	0.2558	25.38

[2] This average does not show the full hypouric effect of calcium acetate, though its action was very strong. This period followed the period of polyuria but, notwithstanding this fact, the volume of urine in the latter part of the period was below normal.

These analytic results show that the proportions of calcium and volatile fatty acids are practically uniform in the urine of the same person, under normal conditions and during the polyuria produced by the drinking of an abundance of water. The rectal absorption of calcium salts of volatile fatty acids produces a simultaneous, rapid, and striking increase of both calcium and fatty acid in the urine. The small increase of volatile fatty acid in the urine above normal or above the *polyuria potatoria,* after rectal injection of ammonium butyrate, is not due to direct passage into the urine of the absorbed fatty acids in combination with ammonia. This small increase may be explained by a formation of calcium salts through the solvent action of the ammonium butyrate sol. on the carbonates and phosphates of calcium that occur abundantly in every feces, as a simple and direct experiment on feces shows (similar to the one mentioned before). An exact investigation of the nature of the volatile fatty acids in the urines of persons submitted to the action of rectal injections shows that butyric or acetic acid predominates in the urine when rectal injection of a salt of one or the other of these acids is used. Finally, by a suitable mixture of both kinds of salts (ammonium and calcium), it is possible to obtain simultaneously the polyuria, the calcariuria and the lipaciduria, as they occur in diabetes. The polyuria is induced by the salt that yields urea (17).

General deductions. The foregoing data show that calcium, and with it volatile fatty acids, describe a very interesting "retrograde circulation" in the human body, the biological mechanism of which has not hitherto been demonstrated. The calcium and volatile fatty acids in urine are generally considered final products or residues of tissue metabolism. These investigations demonstrate that the presence of most of each substance in the urine may be explained by the "retrograde circulation of the calcium," which is initiated by intestinal putrefaction.

Although in the present state of our knowledge of this subject, it is impossible to say that all the calcium and all the volatile fatty acids of the urine have the exclusive intestinal and bacterial origin above mentioned, nevertheless the data at hand warrant the conviction, already expressed, that most of each arises in the manner sug-

gested. It is also impossible to say, at present, whether the calcium that is *normally absorbed* from ingested food is excreted exclusively by the intestinal mucous membrane or whether a portion of it is also eliminated in the urine. Many reasons, and the results of numerous experiments which cannot be explained here, are entirely favorable to the first of these two possibilities.

Calcariuria and lipaciduria, which are very commonly observed in diabetes and other maladies, may be explained by the "retrograde circulation of calcium." This view, if verified by experiment, would modify very profoundly our conception of the nature of these diseases, which are considered today, perhaps too exclusively, "nutritional" disturbances.

The part which the calcium of "retrograde absorption" plays in the pathogeny of arteriosclerosis is a very important matter for consideration. Those who may be interested in this phase of the subject will find a description of an extensive study of it, in the book referred to above (13).

[The author of this paper is now in the United States and may be addressed in care of the BIOCHEMICAL BULLETIN. *Ed.*]

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A SIMPLE, EFFICIENT, AND ECONOMIC FILTER

Its application to the filtration of the yellow precipitate in phosphoric-acid estimations[1]

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INTRODUCTION. General considerations in connection with our work on the chestnut-blight disease led us to make phosphoric-acid determinations for the various barks, healthy and infected, in accordance with Neumann's[2] method. It was soon found by the senior author[3] that while Neumann's method is reliable and convenient, the calculation-factor, 0.554, is too low under certain conditions, a finding in full agreement with the work of Heubner.[4] Further investigation[5] revealed the fact that the amount of water used for washing the yellow precipitate has a certain influence on the calculation-factor. While the work according to Neumann's method was going on, we were impressed by the fact that the filtration of the ammonium-phosphomolybdate precipitate through a folded filter, as recommended by Neumann, is a tedious and time-consuming operation. A search for a better filtering medium finally led us to the paper-pulp filter.

New mechanical devices, like new chemical methods, are of more or less importance to science, which is true, *e. g.*, of the well-known Gooch crucible (as well as of the Munroe[6] crucible), the intro-

[1] Presented at the Second Pan-American Scientific Congress, Washington, D. C., January 4, 1915, and published by permission of the Secretary of Agriculture.

[2] Neumann: *Z. physiol. Chem.* **37**, 129 (1902–03); **43**, 35 (1904–05).

[3] Jodidi: *Journ. Amer. Chem. Soc.*, **37**, 1708 (1915).

[4] Heubner: *Biochem. Z.*, **64**, 393 (1914).

[5] Jodidi and Kellogg: *Jour. Franklin Institute*, **180**, 349 (1915).

[6] Munroe: *Chem. News*, **58**, 101 (1888); *Jour. Analyt. Chem.*, **2**, 241 (1888).

duction of which meant marked progress in analytical chemistry. The use of the Gooch crucible in connection with the asbestos filter enables one to save time and labor, and also to obtain very accurate results. A disadvantage, however, lies in the fact that the preparation of a good asbestos filter requires some skill and presumes the use of asbestos that is soft, long-fibred and cut into uniform, small pieces, etc. The paper-pulp filter, on the other hand, is exceedingly easy to prepare, being so efficient and economic that it seems worth while to describe it in some detail.

PREPARATION OF FILTER-PAPER PULP. When good filter paper is at hand, such as ashless filter paper washed with hydrochloric and hydrofluoric acids, Swedish or S. & S. filter paper, all that is necessary is to transfer some of it to a flask, to add a sufficient quantity of distilled water, and to shake the stoppered flask vigorously for a minute or two. The paper is now reduced to pulp (it appears to the naked eye to consist chiefly of separate or coherent fibers and of flake-like fragments), which is ready for immediate use. In case the pulp is too thin or too thick, it can easily be corrected by pouring off some of the supernatant liquid, on standing, or by adding more distilled water and shaking until a suspension of the desired consistency is obtained. We have found that by using a S. & S. filter, 12.5 cm. in diameter, 100–150 c.c. of distilled water is the proper amount to apply for the reduction of the paper to a suspension with which it is easy to make a good pulp-filter. In other words, one 1 sq. c. of filter paper of ordinary thickness requires about 1 c.c. of water for its reduction to a well filtering pulp.

If only common filter paper is at hand, and it is desirable to free it from some of its mineral constituents, it is first reduced to pulp with distilled water, whereupon mineral acid, usually hydrochloric or nitric, is added, to a conc. of from 2 to 10 percent. The acid-containing pulp is allowed to stand at room-temperature for an hour or more, depending on the conc. of the acid and the object sought. The pulp is now thrown on a large porcelain filter-plate, or, most conveniently, on a Buchner funnel, and washed free from acid with distilled water. The washed pulp is transferred to a flask where, on mixing with the necessary amount of distilled water, it is kept ready

for use. Unlike the asbestos filter, the paper pulp should in no case be heated with strong acid (or alkali) since, by such treatment, it is converted into a more or less sticky mass which is no longer fit as a filtering medium.

PREPARATION OF PAPER-PULP FILTERS. A pulp filter can be used either in connection with a perforated porcelain-plate in a funnel or with a Gooch crucible. While the pulp filter can be prepared in a variety of ways we have found the following convenient: The Gooch crucible is connected with a suction flask, by means of rubber tubing, funnel and rubber stopper, exactly in the same manner as in the case of an asbestos filter. Care should be taken that the bottom of the Gooch crucible is level. The crucible is now filled with paper pulp and suction is *gently* started until all of the water is filtered out, whereupon the suction valve is closed. The filling of the crucible with paper pulp, etc., is repeated once or twice. The filter, which is about 2 mm. thick, is now ready for use, namely, for the filtration of precipitates to be estimated acidimetrically, as in the case of the ammonium-phosphomolybdate precipitate. If it is desired to use the paper-pulp filter for gravimetric analysis, the pulp filter prepared as described above is washed with distilled water until paper fibers no longer run through.

EFFICIENCY OF THE PAPER-PULP FILTER. The pulp filter combines the rapidity of an asbestos filter with the accuracy of a good paper-filter. In fact, the pulp filter is superior to both of them in several respects. Tightly clinging, as it does, to the bottom and walls of the Gooch crucible, the pulp filter easily retains fine precipitates, such as that of ammonium-phosphomolybdate, despite rapid filtration. There is ample evidence in the literature that the filtration of the yellow precipitate caused considerable difficulties. Neumann[7] himself recommended that, prior to the filtration of the yellow precipitate, the filter be filled with ice-cold water, which causes the filter pores to contract and thus prevents the very fine precipitate in the warm solution from going through the filter. As a matter of fact, in spite of the frequent use of ice-cold water, the filtrate from the yellow precipitate is occasionally turbid, which makes a second and even a third refiltration imperative.

[7] Neumann: *Z. physiol. Chem.*, 37, 134 (1902–03).

Plimmer and Bayliss,[8] who made phosphoric-acid estimations according to Neumann's method, wrote as follows in this connection: "The greatest difficulty, however, occurred in the filtration of the precipitate of ammonium phosphomolybdate and the washing of it free from acid. This was found to be extremely slow. . . . We have obtained this (a more speedy method) by employing a special pattern of filtering tube." . . . Their apparatus, however, is far from being simple and easy to handle. Wardlaw[9] recently stated in this connection, that an attempt made by him to wash the precipitate by suction in the manner recommended by Plimmer and Bayliss, was unsuccessful since "in every case it was found impossible to prevent visible amounts of the precipitate from passing through the filter."

While the Gooch crucible in connection with the asbestos filter is of excellent service in analytical chemistry, the preparation of a good asbestos filter requires some experience and is not satisfactory in all cases. In our experience, for instance, the asbestos filter, unless prepared with the utmost care, permits small amounts of ammonium-phosphomolybdate precipitate to pass through. To be sure, the amount of yellow precipitate which may thus pass into the filtrate is usually slight, but in cases where only a small amount of phosphorus is involved the error is not quite negligible. The pulp filter, on the other hand, so completely retains the yellow precipitate, that out of ninety *consecutive* analyses, in which the phosphorus was precipitated as ammonium phosphomolybdate, all filtrates were absolutely water-clear, not showing the slightest turbidity or the faintest yellow color. By employing a few mgm. of phosphorus, in such tests, the available yellow precipitate can be separated by filtration and washed in about five minutes. This enables one to run conveniently three or four times as many phosphoric-acid estimations as is possible by the filtration of the yellow precipitate through a folded filter, which, by the way, is a very tedious operation. The work with the pulp filter has still another advantage in that the liquids to be titrated contain a considerably smaller amount of paper pulp, and further that, because of the rapid filtration and

[8] Plimmer and Bayliss: *Jour. of Physiol.*, 33, 441 (1905–06).
[9] Wardlaw: *Jour. Proc. Roy. Soc.* N. S. Wales, 48, 78 (1914).

washing, no bluish color (due to slight reduction) appears, so that the endpoint of the titration of the ammonium phosphomolybdate can be ascertained much more distinctly.

ECONOMY OF THE PAPER PULP FILTER. Ten S. & S. filters, 12.5 cm. in diameter, were shaken with about 1200 c.c. of distilled water, and the resultant pulp used for the filtration of yellow precipitates obtained in a definite way.[10] It was found that the pulp was sufficient for the filtration of 42 individual precipitates of ammonium phosphomolybdate. Another lot of ten filters, reduced to pulp, gave exactly the same result. In other words, ten filters which, when used as such, would suffice for ten analyses only, were, in the form of pulp, sufficient for 42 analyses—a reduction in the use of filter paper to 21.4 percent. The actual saving is greater, however, when we consider that filters, in order to be fit for use in quantitative analysis, must be faultless, which they sometimes are not. On the other hand, paper pulp, when used for volumetric analysis, may be made of any filter paper; for instance, of broken and faulty filters, of sheet filter-paper, of filter-paper waste, etc. Only when the paper pulp is to be employed for gravimetric analysis is it advantageous to prepare the pulp from ashless filter-paper.

When this paper was ready for publication we noticed an article by Raper,[11] who mentioned, in but three sentences, the employment of a pulp filter for the separation of the ammonium-phosphomolybdate precipitate.

Below are given the results of phosphoric-acid estimations showing how completely the ammonium-phosphomolybdate precipitate is retained by the pulp filter, despite the fact that the filtration of the yellow precipitate and its repeated washing on the pulp takes only about five minutes.

Ten grams of crystallized disodium hydrogen phosphate were dissolved in water and made up to 5 liters. Of this sol. four portions (250 c.c. each) were analyzed gravimetrically. They were found to yield 0.1756, 0.1754, 0.1757 and 0.1753, respectively, with a mean of 0.1755, gm. of magnesium pyro-phosphate, which is equivalent to 0.1955 mg. of phosphorus per c.c. of sol.

[10] Jodidi: *Jour. Amer. Chem. Soc.*, 37, 1709 (1915).
[11] Raper: *Biochem. Jour.*, 8, 652 (1914).

In eight portions of the same sol. (25 c.c. each) the phosphorus was precipitated as ammonium phosphomolybdate, which was filtered (and washed) on a 12.5 cm. folded filter in accordance with the directions given by Neumann. The results are recorded in the accompanying table (1).

TABLE I

Data pertaining to the comparative efficiency of the pulp filter and the folded filter. (See also Table 2)

No. of analysis	For neutralization of the yellow precipitate: *n*/2 NaOH sol., c.c.	No. of analysis	For neutralization of the yellow precipitate: *n*/2 NaOH sol., c.c.	Phosphorus found (calculation-factor: 0.554), mgm.
1	8.78	5	8.73	
2	8.72	6	8.72	
3	8.75	7	8.80	
4	8.75	8	8.81	
Average (1–8)...			8.76	4.853 = 99.3 percent.

In nineteen other portions of the same sol. (25 c.c. each) the yellow precipitate was filtered through a pulp filter prepared in the manner already described. (During filtration and the washing of the ammonium-phosphomolybdate precipitate, *gentle* suction must be maintained, otherwise the pulp filter would be packed down too tightly and filtration retarded.) Unlike filtration through a folded filter, where decantation takes place, practically all of the yellow precipitate was thrown on the pulp filter, whereupon the precipitation flask was washed with about 25 c.c. of distilled water, which was filtered through the pulp. This was repeated twice. The last washings were always found to be neutral. The further treatment of the washed yellow precipitate was exactly as outlined elsewhere,[12] with the only difference that no blanks were subtracted from the *n*/2 sodium hydroxid sol. used for the neutralization of the yellow precipitates referred to in the accompanying three tables. Table 2 presents our data in this connection.

A glance at Tables 1 and 2 shows that the work with the pulp filter gave results as accurate as those with the paper filter, and required considerably less labor and time.

Neumann[13] laid stress on the use of ice-cold water for washing

[12] Jodidi and Kellogg: *Jour. Frankl. Institute,* 180, 349 (1915).

[13] Neumann: *Z. physiol. Chem.,* 37, 132 (1902–03).

TABLE 2

Data pertaining to the comparative efficiency of the pulp filter and the folded filter. (See also Table 1)

No. of analysis	For neutralization of the yellow precipitate: *n*/2 NaOH sol., c.c.	No. of analysis	For neutralization of the yellow precipitate: *n*/2 NaOH sol., c.c.	Phosphorus found (calculation-factor: 0.554), mgm.
1	8.80	10	8.75	
2	8.69	11	8.70	
3	8.79	12	8.71	
4	8.71	13	8.73	
5	8.75	14	8.76	
6	8.70	15	8.82	
7	8.78	16	8.80	
8	8.71	17	8.77	
9	8.75	18	8.75	
		19	8.72	
Average (1–19)..			8.75	4.848 =99.2 percent.

the ammonium-phosphomolybdate precipitate, which is not absolutely insoluble in water. Inasmuch as the employment of the pulp filter enables one to accomplish both the isolation of the yellow precipitate, and its purification by washing with a small quantity of water, in but five minutes, it was reasonable to assume that the results would be the same whether the yellow precipitate is washed with ice-cold water or with water at room-temperature. Plimmer and Bayliss[14] expressed the opinion that, with rapid filtration of the yellow precipitate by means of a special pattern of filtering tube, it is unnecessary to wash the yellow precipitate with ice-cold water. They did not give any data confirming their viewpoint, however. Below are reported the results of a number of phosphoric-acid estimations in which the yellow precipitates were washed either with ice-cold water or with water at room-temperature. The phosphate sol. contained 15 gm. of disodium hydrogen phosphate in 5 liters of water. All of the yellow precipitates, prepared in the manner mentioned above, were, after filtration, washed with 25 c.c. of distilled water; the washing was repeated twice. The results are summarized in Table 3.

A glance at Table 3 shows that the yellow precipitates washed with ice-cold water required for their neutralization 5.03 c.c. of *n*/2 sodium hydroxid sol. (total average), while the yellow precipitates

[14] Plimmer and Bayliss: *Loc. cit.*

TABLE 3

Data pertaining to the solubility of ammonium phosphomolybdate in ice-cold water and in water at room-temperature

No. of analysis	Yellow precipitate washed with		No. of analysis	Yellow precipitate washed with		No. of analysis	Yellow precipitate washed with	
	Ice-cold water	Water at room-temperature		Ice-cold water	Water at room-temperature		Ice-cold water	Water at room-temperature
	For neutralization of the washed yellow precipitates *n*/2 NaOH sol. was used							
	C.c.	C.c.		C.c.	C.c.		C.c.	C.c.
1	5.07	—	11	5.04	—	21	4.99	—
2	5.05	—	12	5.05	—	22	4.98	—
3	5.04	—	13	5.00	—	23	5.00	—
4	5.01	—	14	5.00	—	24	4.98	—
5	5.19	—	15	5.05	—	25	5.04	—
Ave.	**5.07**			**5.03**			**5.00**	
6	—	5.19	16	—	5.02	26	—	5.02
7	—	5.03	17	—	5.01	27	—	5.01
8	—	5.05	18	—	5.00	28	—	5.00
9	—	5.07	19	—	5.01	29	—	5.02
10	—	5.16	20	—	5.10	30	—	5.09
Ave.	..	**5.10**		..	**5.03**	..	—	**5.03**

washed with water at room temperature required 5.05 c.c. The difference is so small as to be negligible.

SUMMARY OF GENERAL CONCLUSIONS. The paper-pulp filter, its preparation and use, are described in detail.

The efficiency of the pulp filter is shown. This filter not only combines the accuracy of the best paper-filters with the rapidity of the asbestos filter, but even surpasses both of them in some respects.

The great economy of the pulp filter is demonstrated, its employment effecting a reduction in the use of filter paper to less than 25 percent.

The advantageous application of the pulp filter to the filtration of the ammonium-phosphomolybdate precipitate is shown.

STUDIES ON THE RELATION OF CEMENT DUST TO CITRUS VEGETATION

1. The effect on photosynthesis

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INTRODUCTION. The effect of the dust arising from the rotary kilns, in the manufacture of Portland cement, on the surrounding vegetation has been the basis of considerable investigation. In Southern California it has become a problem of importance because of several characteristic factors. There are here some rather large cement-plants in the heart of a prosperous citrus district. As this is naturally a semi-arid climate and dependent on irrigation, there are no frequent rains to wash the dust from the leaves and, since the trees are not deciduous, the leaves with their dust-coating are not dropped annually. Because of the great value of the interests involved, the effect of the dust on the trees has recently been the subject of a great deal of litigation.

In this connection the possible interference of the dust with photosynthesis, by excluding the light, was considered. Peirce[1] found that orange leaves showed, in halves which had been freed from dust in the morning, "four or five times as many grains of starch as those in the covered and shaded half." As this would mean a very serious interference with photosynthesis, an investigation was undertaken to see whether or not it held true generally on dusty leaves.

* The author wishes to express his indebtedness to the Riverside Portland Cement Company, Riverside, California, which defrayed the expenses of this investigation, and to Professor R. E. Smith, University of California, for his many helpful suggestions.

[1] Peirce: "An effect of cement dust on orange leaves," *Plant World*, 1910, 13, p. 283.

Composition of dust from orange leaves. In order that there might be no doubt that the coating found on the leaves was actually composed of dust from cement-stacks, samples were collected and analyzed. In Table 1 are given the percentages of silica, ferric and aluminum oxides, and calcium oxide, for a sample of the "raw mixture" (the material fed into the kiln at the base of the stack), and of three samples of dust-coatings from leaves. These three samples were taken from trees approximately a half mile, a mile, and a mile and a half, respectively, from the plant of the Riverside Portland Cement Co.

TABLE I

Data pertaining to the composition of dust from stack and from orange leaves

Sample	SiO_2	Fe_2O_3 and Al_2O_3	CaO
	%	%	%
Raw mixture	15.58	5.74	43.22
Dust No. 1	16.45	5.51	43.52
Dust No. 2	18.00	5.78	41.90
Dust No. 3	10.71	7.30	42.94

The figures in Table 1 agree closely enough to establish the fact that the dust on the leaves consisted chiefly of material from the kiln-stacks.

Amount of dust on leaves. The amount of dust on the leaves varies greatly, of course. As has already been pointed out, there is little or no rain here from April to November, a condition that allows the dust to accumulate to a much greater extent than would be the case in a humid region. To determine the maximum amount deposited, a sample of 51 leaves was picked from trees quite close to the cement-plant in November, 1910. The total green-weight of the leaves was 29.96 gm. when picked; the total area was 1178.87 cm. The amount of dust was 4.04 gm. or 0.079 gm. per leaf.

Av. wgt. of leaf	Av. area	Av. amount of dust	Av. amount of dust per sq. cm.
590 mgm.	23.11 sq. cm.	79.0 mgm.	3.4 mgm.

Percent of light excluded from the leaf by the dust. Since the primary object of this investigation was to determine the effect of the dust on photosynthesis, the amount of light excluded

was first studied. Clear glass plates about 2″ x 3″ were placed in a tray and covered with water having cement-dust in suspension. After allowing the dust to settle for 24 hr., the plates were carefully removed and dried. Measurements were taken, with a Lummer-Brodhun photometer, of the amount of light excluded. The plates were then cleaned and the dust weighed. The data in this connection are summarized in Table 2.

TABLE 2

Data pertaining to the amount of light cut off by a given amount of cement-dust on glass-plates

No.	Wgt. of dust, per sq. cm. of plates	Amt. of light excluded	No.	Wgt. of dust, per sq. cm. of plates	Amt. of light excluded
	mgm.	%		*mgm.*	%
1	2.54	93.8	7	3.45	92.8
2	4.18	92.2	8	3.45	91.2
3	16.00	95.5	9	2.36	86.2
4	7.45	95.0	10	5.09	86.6
5	4.18	95.3	11	4.00	83.8
6	7.09	96.0	12	1.63	83.3

From the figures previously given it will be seen that numbers 7 and 8 (in Table 2) have almost exactly the same weight of dust, per sq. cm., as the more heavily covered leaves. It is very probable, however, that the amount of light excluded by the dust-covered glass-plates is somwhat in excess of the amount excluded by the dust-covering of the leaves in the field, since the dust deposited from suspension in water is probably more coherent than that deposited in a natural way. The degree of exclusion of light by the natural dust-coating is very difficult to determine directly, since the opacity of the leaf itself and its coloration interfere. Considerable practice in such determinations, however, minimizes the importance of these sources of error.

A series of determinations, using the leaves themselves, was made. A number of rather large, very heavily coated, leaves were taken, and the percent of light transmitted, before and after cleaning was determined, the difference being the amount of exclusion due to the dust. See Table 3.

Effect of shading on carbohydrate synthesis. Carbohydrate synthesis in the leaf seemed to offer the easiest measure of

TABLE 3

Data pertaining to the amount of light cut off by cement-dust on orange leaves

No.	Percent of light excluded by dust	No.	Percent of light excluded by dust
1	80.6	6	68.0
2	82.2	7	82.4
3	79.4	8	90.6
4	75.2	9	67.3
5	70.2	10	86.9

any injury that might be caused by the presence of cement-dust. Investigation showed that approximately 90 percent of the stomata were on the under side of the leaf, which remained free from dust. Very little interference could, therefore, occur in the gaseous interchange between the leaf and the air. If, however, dust excludes so much light from the leaf that photosynthesis is impaired, it should be possible to ascertain the extent of this injury by determining the difference between the total amounts of carbohydrates formed.

Some preliminary work was done on the starch content, by the well known Sachs method. Leaves which, in the morning, had been freed from dust on one side of the midrib, were cut off in the evening, and the halves treated separately. The amount of starch was so great in each half that no satisfactory conclusion could be drawn as to any possible difference, either macroscopically or microscopically.

After a number of attempts this method was discarded in favor of chemical ones. After cleaning the leaves as before, they were examined according to the methods used by Brown and Morris[2] in their study of the chemistry of leaves. A composite of 25 or 30 leaves was taken, the midrib having been discarded. The leaves were thoroughly dried the same evening they were cut, ground to pass through a 0.25 mm. sieve and extracted with ether. The sugars were extracted with alcohol and determined gravimetrically by the Fehling method. The residue from the alcoholic extract was "inverted" by saliva and determined in the same way. Table 4 shows the results obtained, as expressed in percentage of absolute dry weight.

While the figures show great irregularities, the averages are in

[2] Brown and Morris: The chemistry and physiology of foliage leaves. *Journal Chemical Society*, 1893, 63, 604–677.

TABLE 4

Data pertaining to carbohydrates in cleaned and uncleaned halves of dusty leaves. (See also Table 5)

Date, 1910	Total hexose-sugars		Starch		Total carbohydrates	
	Cleaned	Uncleaned	Cleaned	Uncleaned	Cleaned	Uncleaned
Nov.	%	%	%	%	%	%
8	4.25	3.29	3.23	3.68	7.48	6.97
9	3.77	3.78	2.83	2.31	6.60	6.09
10	3.69	3.80	1.03	1.01	4.72	4.81
11	3.63	5.50	1.02	0.92	4.65	6.42
14	5.49	5.13	2.59	4.04	8.08	9.17
15	3.01	4.75	3.80	2.54	6.81	7.29
16	4.12	5.48	5.27	3.11	9.39	8.59
17	5.36	5.86	5.36	2.52	10.72	8.38
21	3.29	3.11	0.55	0.80	3.84	3.91
22	2.97	3.71	0.91	0.73	3.88	4.44
28	2.99	4.62	1.13	1.15	4.12	5.77
29	5.34	4.06	1.10	1.63	6.44	5.69
30	3.43	3.81	1.15	2.16	4.58	5.97
Dec.						
2	3.31	2.92	1.22	0.87	4.53	3.79
3	2.48	3.49	0.83	1.11	3.31	4.60
4	3.45	2.38	1.22	1.31	4.67	3.69
Average	3.78	4.10	2.07	1.87	5.85	5.97

quite close agreement. The cleaned half-leaf samples seem to contain a little more starch and a little less sugar than the dusty samples, the total carbohydrate being the same within the limit of error. The difference between the relative amounts of starch and sugar may possibly be accounted for by a greater activity of the diastase of translocation in the less intense light in the shaded half of the leaf.

Repetition of the tests. This work was repeated the following year with two points in view: to determine whether the differences might not be greater at a more actively growing season; and to determine the relative activity of old and new leaves. On the orange trees there are always leaves of various ages, from a few days, possibly, to several years. A comparison of the activities of leaves a few weeks old with those of a year old would seem to determine whether any permanent injury to the leaf had taken place, since the dust does not adhere to the surface of new leaves.

The figures in Table 5 show a much greater formation of carbohydrates than those in Table 4. In Table 5 the difference between the cleaned and uncleaned samples, as regards starch and sugar, has disappeared.

TABLE 5

Data pertaining to further determinations of carbohydrates in fresh new leaves, and cleaned and dusty halves of older leaves, from the same tree.
(See also Table 4)

Date, 1911, May	Total hexose-sugars			Starch			Total carbohydrate		
	New	Old		New	Old		New	Old	
		Clean	Uncleaned		Clean	Uncleaned		Clean	Uncleaned
	%	%	%	%	%	%	%	%	%
1.....	3.31	3.78	3.59	5.55	5.50	4.30	8.86	9.28	7.89
2.....	3.74	3.23	2.98	4.96	3.63	4.60	8.70	6.86	7.58
3.....	3.53	3.42	3.39	4.65	3.90	3.10	8.18	7.32	6.49
4.....	2.95	2.82	3.48	5.17	4.39	4.79	8.12	7.21	8.27
5.....	3.39	4.28	4.27	5.51	4.45	5.80	8.90	8.73	10.07
6.....	2.97	4.22	2.95	2.20	1.90	1.42	5.17	6.12	4.37
Average...	3.31	3.62	3.44	4.67	3.96	4.00	7.98	7.58	7.44

As might be expected, the new leaves showed a slightly greater activity; but this was not enough to imply an injury to the older leaves.

SUMMARY OF GENERAL CONCLUSIONS. The coating of dust on orange leaves, adjacent to cement plants, corresponds very closely in composition to the "raw mixture" from which cement is made.

The amount of dust on such leaves is often as much as 0.0034 gm. per sq. cm.

This amount of dust may shut out as much as 80 percent of light from the upper surface of the leaf.

The exclusion of light from the upper surface of the leaf, by such dust, does not interfere with carbohydrate synthesis.

The metabolic activity of new leaves was only very slightly greater than that of old leaves.

Leaves analyzed in May contained nearly one-third more total carbohydrate than those analyzed in November and December.

ASSOCIATIONS AND SOCIETIES

Proceedings and items of interest to biochemists

PAUL E. HOWE

PREPARED CHIEFLY FROM REPORTS BY SECRETARIES

CONTENTS

I. SOCIETY OF PUBLIC ANALYSTS AND OTHER ANALYTICAL CHEMISTS

E. RICHARDS BOLTON, SECRETARY

A. The Annual General Meeting of the Society of Public Analysts and other Analytical Chemists was held at the Chem. Soc. Rooms, Burlington House, on Wed. evening, 2nd Feb. 1916, when the Pres't, Mr. *A. Chaston Chapman,* delivered his Annual Address.

President's Address. Mr. Chapman said: Once again it is my lot to review the activities of our Society during a period of such intense and universal stress and strain as finds no parallel in the world's history. Since my last Annual Address was delivered, the deadly struggle has continued without intermission, and if that struggle has brought untold suffering and misery to millions of our fellow-beings, there is, happily, some good to be placed to the other side of the terrible account.

As a nation we have in the past shown a neglect of Science which has very nearly been our undoing, and although from time to time grave warnings have been uttered and powerful appeals have been made, these have for the most part fallen upon deaf ears. Now, as a result of the inflexible logic of events, the nation is beginning to realise the error of its ways, and never again can Chemistry and the

other experimental sciences consent to be relegated to the humble position they have so long occupied in the national esteem.

For the successful prosecution of the war, and still more for the general development and industrial protection of the country during the very difficult period which must follow the cessation of hostilities, all our best scientific brains will be needed, and all the energy and scientific organisation of which we are capable.

Among the many lessons which we are learning as the result of the war, not the least important is the fact that Experimental Science in general, and Chemistry in particular, is not merely an interesting intellectual occupation, but one of the foundation-stones on which national progress rests, and that its continued neglect could only lead to disaster, and end in our complete defeat by more progressive and far-seeing nations.

The ignorance of the value of scientific knowledge shown by our people is very great, and, unfortunately, many of our rulers are little, if at all, better informed. As a consequence, much inertia still remains to be overcome, and a great deal of leeway has to be made up. Happily, signs are not wanting that we are at last directing our footsteps on the right path, and those of us who know, and who have the real interests of their country truly at heart, will earnestly pray that our progress along that path may be certain and rapid.

I must now pass on to a matter which has very closely concerned many of our members during the past year. I refer to the recruiting of chemists for active military service. One of the penalties which a country has to pay for unpreparedness for war—a penalty which is greatly increased by adherence to the voluntary system—is an immense waste both of human material and of treasure. Men who, by their training and experience, are absolutely necessary in their civil occupations for the welfare of the country—both in war and in peace—offer themselves, and are accepted for military work which could in many cases be at least equally well performed by men who could be more readily spared.

At the outbreak of war, the authorities were seemingly unaware of the vast and multifarious services rendered to the State by professional chemists, and of the extent to which the welfare of the nation depended upon the adequate utilisation of their services. As

a result, many hundreds of highly-trained chemists were to a great extent wasted by being put to military duties which could easily have been performed by men whose normal activities were of no special value to a nation at war.

This state of affairs lasted until a few months ago, when the authorities apparently began to appreciate the facts of the situation, and the Board of Trade issued a circular of instructions to local tribunals under Lord Derby's Scheme, together with a "list of occupations (reserved occupations) of cardinal importance for the maintenance of some other branches of trade and industry." Since then the Board of Trade has issued a further schedule of "reserved occupations," in which occurs the following important paragraph: "Chemists: Analytical, Consulting Research Chemists (not to be accepted for immediate enlistment or called up for service with the Colours without the consent of the Royal Society); Chemical Laboratories: Head Laboratory Attendants."

It will have been noticed that chemists are not only not to be enlisted, but are not allowed to enlist without the express permission of a recognised body, the only other persons in the schedule who are treated similarly being "licensed pilots, officers, and crews of vessels belonging to the General Lighthouse Authorities, and lighthouse-keepers"—that is to say, men whose services are absolutely essential for the public safety.

This is one of the signs of public recognition to which I referred at the commencement of my remarks, and there are indications that others will be forthcoming. It only remains in this connection to say that the President of the Royal Society has appointed a committee to assist the Royal Society in connection with matters relating to recruiting, and that, as President of this Society, I have been invited to serve on that body.

During the past eighteen months the columns of the technical and of the general press have been inundated with letters and with articles bewailing the neglect of chemical science in this country, and deploring the want of appreciation of the services of chemists so often shown by manufacturers.

That we have shamefully neglected the claims of science is a fact of which many of us have been painfully aware for a good

many years, and one which through the stern teaching of the war is gradually being brought home to the bulk of the nation. This, however, is a matter which is intimately bound up with our whole system of education, and until that system has been thoroughly reformed it is hopeless to expect that chemistry and the other experimental sciences will take their proper position.

So far as our colleges are concerned, I feel very strongly that a more thorough training in analytical chemistry is desirable, and I would, in addition, venture to suggest that the present curriculum of those chemical students who intend to become professional chemists should, whenever possible, be amplified so as to include a further year of study.

During this post-graduate year, the student should be trained by thoroughly competent and specially-selected teachers under conditions approximating more to those of the technical than to those of the academic laboratory.

During his academic course of practical work the student is very properly taught that accuracy is the first consideration, and the factor time, which is so important in the works laboratory, scarcely enters into his calculations. Again, he has been taught to work on a small scale, has little or no knowledge of the disturbing influence of mass, and has never learned to think in terms of large scale operations. He has not, moreover, acquired even the most elementary knowledge of engineering, and does not know how to construct or to interpret even the simplest drawings of plant.

During this additional year of study I am far from suggesting that the student should attempt to familiarise himself with any one special branch of applied chemistry; but I feel convinced that, under the working conditions I have in mind, he would acquire a new mental attitude and a new way of looking at chemical problems which would do much to bridge over the gap which exists at present between his academic studies and his work in the factory. Even with this additional knowledge the young chemist must, if disappointment is to be avoided, realise that he has much to learn, and that a good deal of his further technical training will have to be done at the expense of his employer.

Whilst words fail to express the indignation which one some-

times feels at the miserable wages (the word "salary" would be out of place) offered to men who have devoted several years and a not inconsiderable sum of money to their training, yet, on the other hand, the young chemist seeking a position should remember that his future lies very largely in his own hands. The chemical manufacturer is not a philanthropist, neither is he a fool. Whilst he is obviously disinclined to pay a big salary or to make a binding agreement until he knows something of the capabilities of the man he is engaging, he will be equally anxious not to lose that man's services should he prove himself thoroughly capable and useful.

Again, the manufacturer on his side must understand that in engaging the services of a young chemist from one of our Universities he is getting the partly-manufactured material, and not the finished product. He should be told that his future employee is merely a well-trained apprentice who knows how to use the tools of his craft, but who will have to be given time in which to find his feet and to learn something of the new conditions under which he will have to work. It is here that our University Professors can do much to prevent misunderstanding and disappointment by pointing out to manufacturers the limitations of the men whom they may be recommending.

A good many manufacturers (I am not, of course, referring to the heads of large concerns where many chemists are employed, and where their functions are thoroughly well understood and appreciated) do not always know very clearly what they want. They have a vague idea that some sort of chemical assistance is necessary in a modern factory, and they consequently go to one of our colleges and state that they want "a chemist." As one of the objects of our colleges is very properly to find employment for the men they have trained, he is offered the services of a man who has perhaps just finished his chemical course, but who knows little or nothing of the nature of industrial chemistry or the requirements of the factory. He has done his work industriously and well, and perhaps with distinction, and his Professor is obviously justified on general grounds in recommending him highly.

It is at this point, however, that the trouble to which I have alluded commences for the young man in question is offered to the

manufacturer labelled "chemist" without any qualification at all. As a very general rule no intimation is given to the manufacturer that his prospective employee is little more than a senior student, and, in the absence of any statement to the contrary, there is some justification for regarding him as thoroughly competent not only to carry out the routine work of the factory, but also to undertake industrial research, to cheapen production, and to effect improvements in the manufacuring processes concerned. At the end of the year, in many cases, nothing very definite had resulted, no additional profit had been made; and there is no obvious improvement in the factory working; and the manufacturer is very apt to give emphatic expression to his disappointment, and to inveigh against science in general and chemistry in particular.

I need scarcely say that I do not overlook the very numerous cases in which young chemists fresh from our college laboratories have entered factories, and have most thoroughly justified themselves in every possible way, nor do I desire to exaggerate in the slightest degree the extent of the difficulty to which I have referred. I have merely called attention to a state of affairs which does, unhappily, exist, and which, owing to its unfortunate consequences, is one for which the chemical profession should urgently seek a remedy.

I wish it to be understood, moreover, that my remarks apply especially to the general works chemists, to whom is entrusted the testing of the raw materials and finished products, and the exercise of a general scientific supervision. With the more important question of industrial chemical research it is quite impossible to deal within the limits—which, I fear, have already been overstepped—of an Annual Address. I would only say that chemists competent to initiate and to carry through to a successful issue the kind of investigations which are of importance to manufacturers are, comparatively speaking, few in number, and that the chemical investigator, like the poet, must be born. He may be shaped, but he certainly cannot be made, and it would save not a little disappointment if it were recognised more generally on the industrial side that men possessing all the special qualities of intellect and of character which go to make a successful chemical investigator are not very fre-

quently combined in any one man, and that the chances of obtaining the services of such a man in a more or less haphazard way, and at a salary which would be rejected with scorn by many an artisan, are not very great.

Summarising the points on which I have briefly touched in this address, I would appeal for—

1. Greater sympathy, freer intercourse, and closer co-operation between the two great branches of the chemical profession—the teachers and the practitioners.

2. The establishment of Chairs of Analytical Chemistry in our Universities and Colleges as a practical step towards securing the more adequate treatment of that important branch of our science.

3. The more general provision in our Universities and Colleges of post-graduate facilities for acquiring a good general knowledge of certain subjects which form an indispensable part of the professional equipment of every technical chemist.

Officers and council for 1916. The following were elected the officers and council for the ensuing year:—

PRESIDENT: *George Embrey.*

PAST-PRESIDENTS Serving on the Council (Limited by the Society's Articles of Association to 8 in number): Leonard Archbutt, Edward J. Bevan, *A. Chaston Chapman,* Bernard Dyer, Otto Hehner, R. R. Tatlock, E. W. Voelcker, J. Augustus Voelcker.

VICE-PRESIDENTS: *H. G. Colman,* J. H. B. Jenkins, R. T. Thomson.

HON. TREASURER: Edward Hinks.

HON. SECRETARIES: P. A. Ellis Richards, E. Richards Bolton.

OTHER MEMBERS OF THE COUNCIL: *W. T. Burgess,* J. A. Dewhirst, *J. T. Dunn,* P. V. Dupré, R. G. Grimwood, *H. G. Harrison,* E. M. Hawkins, *A. W. Knapp, Stevenson J. C. G. Macadam, William Macnab, H. L. Smith,* W. Collingwood Williams.

Schedule of meetings for 1915–1916. November 3, December 1, February 2, March 1, April 5, May 3, June 7.

B. Ordinary Meeting, 2nd Feb., 1916. Mr. George Embrey, President, in the Chair.

Messrs. *Thomas Featherstone Harvey, Cyril Hubert Manley, Caryl Cameron Roberts,* and *Frank Thomas Shutt* were elected

members of the society. A certificate was read for the first time in favour of Mr. *Frank Theodore Alpe,* "Bracondale," Wymondham, Norfolk. Certificates were read for the second time in favour of Messrs. *Thomas John Hitchcock,* and *Nelson Trafalgar Foley.*

Abstracts of the papers that were read are appended.

Note on human milk: *G. D. Elsdon,* B.Sc., F.I.C. Results of analysis, including data for the fatty portion, were given for two samples of milk taken on two successive days from the same source. A table of figures was included for 146 samples of human milk, 67 of which were fully analysed, and 79 partially.

Notes on common processes used in water analysis: *W. T. Burgess,* F.I.C. The author called attention to the several details in ordinary processes, neglect of which causes unexpected errors in the determinations; he also dealt with the care of laboratory glass apparatus.

He stated that the green growths in condensers, which so often disfigure our laboratory benches, could be almost entirely prevented by the simple expedient of inserting a long helix of fine and bright copper wire in the water-jacket, the trace of copper taken up by the water being sufficient to inhibit the development of the algæ.

The author said that he had reasons for believing that the "nitrometer" method of estimating nitrogen was not in such general use as its excellence warranted, and exhibited a slightly modified apparatus in which the determinations could be made with expedition. The ordinary measuring tube with single-bore stopcock, is fitted with a large rubber "cork," of a size sufficient to take a short length of wide glass tubing which can, when required, be slipped over the stopcock and the graduated part of the tube. The pressure tube is carefully selected so that its internal diameter is exactly the same as that of the measuring tube. The NO is liberated in the usual way, and when the action is completed the pressure tube is clamped so that the level of the mercury is about 40 mm. below that in the measuring tube. A few drops of distilled water are then allowed to enter the measuring tube; this water remains on the top of the turbid, acid, mixture and permits the meniscus to be seen clearly. The wide glass tube is then slipped on the cork and filled with water, and after a few minutes the volume of gas

and the temperature of the water-jacket are recorded. A glass or celluloid millimeter scale is afterwards placed against the pressure-tube so that its zero coincides with the level of the mercury; the stopcock is then opened and the rise of the mercury in the pressure-tube noted, and as the two tubes are of equal diameter, this number multiplied by two gives the reduced pressure under which the gas was measured. The height of the barometer is also taken and the weight of nitrogen may be calculated in the usual way, or preferably by the aid of the tables, etc., given in Sutton's volumetric analysis.

Poli oil: a new adulterant of Ghee. *J. H. Barnes,* B.Sc., F.I.C. and *Arjan Singh.* The authors deal with the edible seed of *Carthamus oxyacantha N. O. Compositæ,* one of the Safflowers, which is found as a persistent thorny weed, growing with and alongside the wheat crop in India, from Umballa in the South to Peshawar in the North, and is difficult to eradicate.

The seeds produce Poli oil, which they describe as an adulterant of Ghee (the clarified butter-fat of India). The authors give the chemical and physical constants which they have determined for a genuine sample of the fresh oil, and state that the analyst will have little difficulty in recognising the adulterant when found in conjunction with Ghee.

46, Stamford Brook Road, W., London.

II. THE BIOCHEMICAL SOCIETY, ENGLAND

R. H. A. Plimmer, Secretary

February 14. Inst. of Physiol., Univ. College, London, W.C. (5.30 P.M.)[1]

W. M. Bayliss: Effect of temperature on inhibition of enzyme action.

R. H. A. Plimmer: Analysis of proteins. I. Estimation of arginine by decomposition with alkali.

W. W. Reeve: Note on the preparation of cholesterol.

At the meeting on Dec. 13 the following nominees for membership were elected: *F. Camp, Bernard F. Davis, Ingvar Jorgensen,*

[1] The last two preceding meetings were held on Nov. 8 and Dec. 13. See Biochemical Bulletin, 1916, v, p. 26.

H. King, J. Mellanby, Hon. H. Onslow, Theodore Rettie, W. W. Reeve, S. S. Zilva.

In a recent letter to the BIOCHEMICAL BULLETIN Dr. Plimmer makes the following statement of general interest to biol. chemists: "Our interest in Biochemistry in this country still remains, but the output of work is sadly diminished. Most of the scientific workers are engaged in war-work, either as combatants or indirectly, so that our future meetings will not be large either in the way of attendance or of communications. It is right that every one should work in some capacity to bring the war to a successful conclusion and as speedily as possible." [Ed.]

University College, London.

III. PAPERS OF BIOCHEMICAL INTEREST (TITLES) IN THE PROCEEDINGS OF SEVERAL SOCIETIES

Amer. Chem. Soc., Minn. Sect., Jan. 21: *R. A. Gortner:* Ammal pigments.—*J. F. McClendon:* Physiological and biochemical significance of hydrogen ion concentration.

Amer. Soc. Animal Production: Annual meeting, Kansas State Agric. Coll., Manhattan, Kansas; Dec. 22–23, 1915.—*J. A. Burns:* Cotton-seed meal as feed for hogs.—*R. E. Caldwell:* Milk substitutes for calf feeding.—*E. B. Hart* and *E. V. McCollum:* Influence of strictly vegetable diets on the growth and reproduction of swine.—*H. J. Waters, W. A. Cochel* and *C. M. Vestal:* Use of food by swine.—*H. S. Grindley* and *M. E. Slater:* Study of the amino-acid contents of feeding stuffs.—*J. A. Fries:* Weak places in the methods used in animal nutrition investigations.—*Sleeter Bull:* Study of the effect of amount of ration consumed upon the rate and efficiency of the gains by fattening steers.—*E. B. Forbes:* Mineral metabolism of the milch cow.—*W. A. Cochel:* Use of grain sorghums in meat production.—*J. C. Ross* and *H. S. Grindley:* Swine feeding experiments to determine the nutritive value of the amino acids of feeding stuffs.—*C. B. Lee:* Measurements of steers in experimental work.—*C. R. Moulton:* Relations between blood, protoplasmic tissue, and surface area of beef cattle.—*H. H. Mitchell* and

R. A. Nelson: Preparation of protein-free milk for use in feeding experiments on the nutritive value of proteins and amino acids.

Amer. Soc. of Zoologists:[2] In joint session with Section F, Amer. Assoc. Adv. Sci. and the Amer. Soc. Naturalists, Ohio State Univ., Columbus, Ohio; Dec. 28–30, 1915.—*W. C. Allee:* Effect of certain ions on rheotaxis in *Asellus.*—*E. J. Lund:* Differentiation and dedifferentiation in *Bursaria* and its significance. —*W. J. Crozier:* Loss of cell pigment as an index of permeability changes.—*Chas. Zeleny:* Rate of regeneration from new tissues compared with that from old tissues.—*O. C. Glaser:* Distribution of water in the embryonic nervous system.—*V. E. Shelford:* Comparative resistance of marine animals from different depths to adverse conditions.—*W. J. Crozier:* Physiology of chemoreceptors; Cell penetration by acids: Effects of anesthetics and of stimulation by induction shocks.—*D. D. Whitney:* Sex controlled in rotifers by food.—*A. F. Shull* and *S. Ladoff:* Male-production in *Hydatina* favored by oxygen.—*M. M. Wells:* Resistance of starved and normal fishes to low oxygen and the effect upon this resistance of acids, alkalies, salts, etc.

Botan. Soc. of Amer.:[3] Tenth annual meeting, Columbus, Ohio, Dec. 27–31, 1915.—*E. T. Reichert:* Specificity of proteins and starches in relation to genera, species and varieties.—*T. F. Manns:* Rapid methods for quantitative and qualitative studies of soil flora; Media for quantitative and qualitative studies on azotobacter and nitrifiers.—*C. O. Applemann:* Relation of catalase and oxidase to respiration in potato tubers.—*G. H. Coons:* Lipolytic action in germinating teliospores of *Gymnosporangium juniperivirginianæ*—*K. F. Kellerman* and *R. C. Wright:* Action upon soil nitrogen of certain crops.—*F. E. Denny:* Permeability of certain non-living plant membranes to water.—*C. A. Shull:* Influence of temperature on the moisture intake of seeds.—*C. H. Farr:* Experiments on galvanotropism.—*I. W. Bailey:* Structure of the bordered pits in conifers and its bearing upon the tension hypothesis of the ascent of sap in plants.—*A. H. Chivers:* Injurious effect of "Tarvia" fumes on vegetation.—*P. J. O'Gara:* New methods and apparatus

[2] Proceedings in full: *Science,* 1916, xliii, p. 139 and p. 176.

[3] Proceedings in full: *Science,* 1916, xliii, p. 285, 323 and 360.

for determining, qualitatively and quantitatively, the effects of sulfur dioxid on plants.

Ill. Acad. Science: Ninth annual meeting; Univ. of Ill., Feb. 18–19.—*H. S. Grindley:* Rôle of proteins in the nutrition of animals.—*Sleeter Bull:* Conservation of nitrogen in feeding farm animals.

Nat'l Canners' Assoc. and Allied Industries: Ninth Annual Convent.; Louisville, Ky., Feb. 7–11, 1916.—*H. E. Barnard:* Food officials boosters, not knockers.—*Wm. Frear:* Principles of standardization.—*W. D. Bigelow:* Laboratories of the Nat'l Canners' Assoc. —*J. R. Baines:* Canned-foods labels should describe quality clearly and frankly.—*H. E. Otting:* Method of determining solids and fats (in milk) as approved by the Assoc. of Offic. Agric. Chem.—*A. E. Slessmann:* Standardization of sauer kraut, both in cans and in bulk. —*L. A. Round:* Fermentation of sauer kraut. (Reported by *J. S. Hepburn.*)

N. Y. Acad. Sci., Sect. of Biol., Mar. 13.—*G. G. Scott:* Oxygen utilization of fishes.—*F. H. Pike:* Significance of certain internal factors in organic evolution.

IV. REFERENCES TO SOCIETY PROCEEDINGS

Amer. Assoc. Adv. Sci.: Columbus meeting, Dec. 27–Jan. 1. SECT. C. (CHEM.): *Science,* 1916, xliii, p. 112.—SECT. M. (AGRIC.): *Science,* 1916, xliii, p. 356.

Amer. Physiol. Soc.: Twenty-eighth annual meeting. BIOCHEM. BULL., 1916, v, p. 33; *Science,* 1916, xliii, p. 254; (in full) *Amer. Jour. Physiol.,* 1916, xl, p. 126 (Mar.).

Amer. Soc. Biol. Chem.: Tenth annual meeting. BIOCHEM. BULL., 1916, v, p. 37; (in full) *Jour. Biol. Chem.,* 1916, xxiv (Mar.).

Amer. Soc. for Pharmacol. and Exp. Therap.: Seventh annual meeting, Boston, Dec. 27–29. BIOCHEM. BULL., 1916, v, p. 42; *Science,* 1916, xliii, p. 252; (in full) *Jour. Pharmacol. and Exp. Therap.,* 1916, viii, p. 109 (Feb.).

Fed. Amer. Soc. Exp. Biol.: Third annual meeting, Boston, Dec. 27–29. BIOCHEM. BULL., 1916, v, p. 28; *Science,* 1916, xliii, p. 251.

V. OFFICERS-ELECT OF VARIOUS SOCIETIES[4]

Amer. Assoc. Adv. Science. Pres., *C. R. Van Hise.*—Sect. C (Chem.), vice-p., *Julius Stieglitz.*—Sect. F (Zool.), vice-p., *G. H. Parker.*—Sect. G (Bot.), vice-p., *T. J. Burrill.*—Sect. H (Anthrop. —Psychol.), vice-p., *F. W. Hodge.*—Sect. K (Physiol.—Exp. Med.), *E. O. Jordan.*—Sect. L (Educ.), vice-p., *L. P. Ayres.*—Sect. M. (Agric.), vice-p., *W. H. Jordan;* perm. sec., *L. O. Howard;* gen. sec., *W. E. Henderson;* sec. of council, *C. S. Gager.*

Amer. Chem. Soc. Pres., *C. H. Herty;* directors (1916–'19), *W. R. Whitney, W. D. Bigelow;* council.-at-large, *G. D. Rosengarten, W. D. Bigelow, B. C. Hesse, G. N. Lewis.*—Div. Pharmaceut. Chem.: Ch'r'n, *J. H. Long;* vice-ch., *H. V. Arny;* sec., *G. D. Beal;* exec. commit., *F. R. Eldred, C. W. Johnson*—Agric. and Food Div. Ch'r'n, *L. M. Tolman;* sec'y, *G. F. Mason;* members of exec. commit., *H. A. Huston, A. V. H. Mory, E. R. Smith.*—N. Y. Sect. At the annual meeting for the election of the ch'r'n of the N. Y. Sect., Mar. 10, Drs. *K. G. Falk* and *J. M. Matthews* each received 78 votes. The tie was formally broken in behalf of Dr. Matthews by the vote of the chair.—Va. Sect. Vice-p., *E. C. L. Miller.*

Amer. Med. Assoc. The ranking vice-p., *Albert Vander Veer* succeeds pres. *W. L. Rodman,* deceased.

Amer. Soc. Animal Production. Pres., *W. A. Cochel;* vice-p., *J. M. Evvard;* sec.-treas., *F. B. Morrison.*

Amer. Soc. Naturalists. Treas., *J. A. Harris.*

Assoc. Offic. Agric. Chem. Hon. pres., *H. W. Wiley;* pres., *F. N. Brackett;* vice-p., *J. K. Haywood;* sec.-treas., *C. L. Alsberg;* addit. members of the ex. commit., *W. J. Jones, Jr., E. B. Holland.*

Referees. Phosphoric acid, *W. J. Jones, Jr.*—Nitrogen determination, *H. D. Haskins;* separation of nitrogenous substances, *L. L. Van Slyke.*—Potash, *E. E. Vanatta.*—Soils, *J. W. Ames.*—Dairy products, *Harry Klueter.*—Feeds and feeding stuffs, *A. C. Summers.*—Food adulteration, *Julius Hortvet.*—Sugar, *C. A. Browne.*—Insecticides, *R. C. Roark.*—Inorganic plant constituents, *A. J. Patten.*—Medicinal plants and drugs, *W. O. Emery.*—Water, *W. W. Skinner.*—Water in foods and feeding stuffs, *W. J. McGee.*

[4] See p. 51 for recent items in this connection.

—Testing chemical reagents, *C. O. Ewing.*—Organic and inorganic phosphorus in foods, feeding stuffs and drugs, *E. B. Forbes.*—Lime requirements of soils, *B. L. Hartwell.*

ASSOCIATE REFEREES. Phosphoric acid, *C. S. Lykes.*—Nitrogen determination, *R. B. Deemer;* special study of Kjeldahl method, *I. K. Phelps;* separations of nitrogenous substances; milk and cheese, *L. S. Palmer;* meat products, *P. F. Trowbridge.*—Potash, determination, *T. D. Jarrell.*—Soils, nitrogenous compounds, *C. B. Lipman.*—Dairy products, *J. T. Keister.*—Feeds and feeding stuffs, *P. H. Smith;* feed adulteration, *Carleton Cutler;* crude fiber, *C. K. Francis.*—Food adulteration; colors, *W. E. Mathewson;* saccharine products, *F. L. Shannon;* fruit products, *P. B. Dunbar;* wine, *B. G. Hartmann;* beer, *H. S. Paine;* distilled liquors, *A. B. Adams;* vinegar, *E. H. Goodnow;* flavoring extracts, *A. E. Paul;* spices, *H. E. Sindall;* baking powder, *H. E. Patten;* meat and fish, *E. D. Clark;* fats and oils, *R. H. Kerr;* dairy products, *Julius Hortvet;* cereal products, *J. A. LeClerc;* vegetables, *W. D. Bigelow;* cocoa and cocoa products, *E. Bloomberg;* tea and coffee, *H. M. Loomis;* preservatives, *A. F. Seeker;* metals in foods, *David Klein.*—Sugar, *M. N. Straughn.*—Insecticides, *C. B. Winter.*—Inorganic plant constituents, *R. W. Thatcher.*—Medicinal plants and drugs; synthetic products, *W. O. Emery;* medicated soft drinks, *J. O. Schlotterbeck;* medicinal plants, *A. Viehoever;* alkaloids, *H. C. Fuller;* balsams and gum resins, *E. C. Merrill;* pepsin and papain, *V. K. Chesnut.*—Water, *H. P. Corson.*—Lime requirements, *W. H. McIntire.*

COMMITTEES. Cooperation with other Committees on Food Adulteration, *William Frear, Julius Hortvet, J. P. Street.*

Board of Editors. Ch'r'n, *C. L. Alsberg; L. L. Van Slyke, E. F. Ladd, J. P. Street, R. E. Doolittle.*

Editing methods of analysis. Ch'r'n, *R. E. Doolittle, W. A. Withers, J. P. Street, A. F. Seeker, G. W. Hoover, B. L. Hartwell.*

N. Y. Assoc. Improv. Condition of Poor.—Bur. of Food Supply: *Graham Lusk, H. C. Sherman.*—N. Y. School Lunch Commit.: *W. J. Gies.*—Ventilation Commis.: *C. E.-A. Winslow, F. S. Lee.*

Biochemical Laboratory,
Columbia School of Medicine.

BIOCHEMICAL NEWS, NOTES AND COMMENT

Editorial sub-committee:

BENJAMIN HOROWITZ,

WILLIAM J. GIES, HATTIE L. HEFT, JOSEPH S. HEPBURN, PAUL E. HOWE, EDGAR G. MILLER, JR., W. A. PERLZWEIG

I. GENERAL

Necrology. *W. A. Borger,* assis. direct., Pasteur Inst. and vaccination service in Java.—*Rodolphe Engel,* prof. of chem., Montpellier Sch. of Med.—*Georg Grübler,* Dresden, distinguished for physiol. and bacteriol. study of proteins, enzymes and stains.—*Edmond Heckel,* prof. of materia med., Marseilles.—*F. W. Hewitt,* eminent English anesthetist.

Appointments.[1] British Dyes, L'td.: Dr. *W. H. Perkin* (prof. of chem., Univ. of Oxford), head, research dep't; also chairman, Advis. Council, vice *Raphael Meldola,* deceased.

Cornell Univ.: The title of Dr. *E. M. Chamot* has been changed from prof. of sanitary chem. and toxicol. to prof. of chem. microscopy and sanitary chem.

Lady Hardinge Med. Coll. and Hosp. (Delhi): Miss *A. M. Bane,* prof. of chem.

Leland Stanford Jr. Med. Sch.: Prof. *A. H. Hewlett* (prof. of med., Univ. Mich.), prof. of med.

Marine Biol. Lab., Woods Hole, Mass.; Summer session, 1916: Dr. *A. P. Mathews* (Chicago), Dr. *H. C. Bradley* (Wisconsin), Dr. *Shiro Tashiro* (Chicago), Dr. *W. E. Garrey* (Washington

[1] In this summary, institutions from which appointments were made are named in parenthesis. See also pages 121 and 126.

Univ.), Dr. *A. R. Moore* (Bryn Mawr), and others; officers in the dep't of physiol.

Univ. of Colo.: Dr. *Robert C. Lewis* (assis. biochem. U. S. Pellagra Hosp., Spartanburg, S. C.), prof. of physiol.

Univ. of Utah: Dr. *J. A. Widtsoe* (pres., Utah Agric. Coll.), pres.

Washington Agric. Exp. Sta'n: Dr. *J. S. Caldwell* (prof. of bot., Ala. Polyt. Inst. and Agric. Exp. Sta'n), "by-products specialist."

Honors. Among the New Year Honors conferred upon British men of science was a "C.B." on Dr. *A. W. MacFadden,* chief inspec. of food, Local Gov. Board.

A bust of *von Behring* has been erected in the Marburg Inst. for Hygiene, in memory of the 25th anniv. of v. Behring's publication of his first work on serum therapy.

The fifth annual dinner of the Columbia Univ. Biochem. Assoc. was given in honor of Prof. A. B. Macallum, Feb. 10 (see p. 123).

Lectures and addresses. ENDOWED LECT'S. Physical Soc. (London); Imperial Coll. of Science, *Guthrie Lect.,* Jan. 28: Dr. *W. B. Hardy,* Some problems of living matter.

Univ. and Bell. Hosp. Med. Coll., *Herter Lect.,* Jan. 10–14: Dr. *V. C. Vaughan,* Course of five lects. on poisonous proteins.

MISCELLANEOUS ITEMS. Amer. Chem. Soc., N. Y. Sect., Mar. 10: Dr. *C. S. Hudson,* Acetyl derivatives of the sugars; Dr. *C. L. Alsberg,* Development of the U. S. Bureau of Chemistry.

Franklin Inst.; Feb 9: Dr. *G. E. de Schweinitz,* Drug and occupational amblyopias; Feb. 10: Dr. *Charles Baskerville,* Refining of animal and vegetable oils; Mar. 9: Prof. *G. C. Whipple,* The element of chance in sanitation.

Harvard Univ.; Five public lect's: Prof. *L. J. Henderson,* Teleology and natural science.

Harvey (Society) Lect.; N. Y. Acad. Med., Jan. 15: Dr. *D. D. Van Slyke,* Present significance of the amino acids in physiology and pathology; Feb. 26: Prof. *W. T. Longcope,* Susceptibility of man to foreign proteins; Mar. 11: Prof. *H. A. Christian,* Some phases of the nephritis problem; Mar. 25: Dr. *R. T. Woodyatt,* Intermediate carbohydrate metabolism.

Phi Lambda Upsilon Lect.; Columbia Univ., Feb. 17: Dr. *A. C. Grehore,* Atoms, molecules, and crystal structure.

Princeton Univ., Chem. Club; Feb. 18: Dr. *Ira Remsen,* Reminiscences of Liebig and Wöhler.

Washington Acad. Sciences; Jan. 13: Dr. *C. L. Alsberg,* Chemical analysis of animal nutrition.

Grants. Amer. Acad. Arts and Sciences, WARREN FUND: *James F. Norris,* $500; study of factors which influence the valency of carbon.

Nat. Acad. Sciences, BACHE FUND: *E. J. Werber,* $230; assistance in experimental studies aiming at the control of defective and monstrous development; (1) effect of toxic products of metabolism on the developing teleost egg; (2) effect of experimentally produced diseases of parental metabolism on the offspring in mammals.

Paris Acad. Sciences, BONAPARTE FUND: *Henry Devaux,* 3,000 francs; continuation of his researches on the cultivation of plants in arid or semi-desert regions.—LOUTREUIL FUND (francs):—*M. Müntz,* 2,400; direc. lab., vegetable chem., Meudon.—*Jules Amar,* 6,000; improving his equipment for the study of the muscular forces of man at work by the graphic and chronophotographic methods.

Prizes. Paris Acad. Sciences, JECKER PRIZE: *G. Bertrand,* for his work in organic and biol. chem.; a special prize of 2,500 francs: *F. Maignon,* for his researches on the toxicity of albuminoid material.

Journalistic. *Jour. of Cancer Research.* (Official organ, Amer. Assoc. for Cancer Research.) Ed. commit.; *J. C. Bloodgood, Leo Loeb, E. E. Tyzzer, Richard Weil* (man. ed.), *H. G. Wells, W. H. Woglom.*

Jour. of Immunology. (Official public., Amer. Assoc. of Immunologists, and the N. Y. Soc. of Serol. and Hematol.) B'd of Ed.: *J. F. Anderson, John Auer, A. Breinl, J. J. Bronfenbrenner, Carl Browning, A. F. Coca* (ed. in chief), *R. I. Cole, William Elser, L. W. Famulener, J. G. Fitzgerald, W. W. Ford, F. P. Gay, J. W. Jobling, Preston Kyes, J. A. Kolmer, P. A. Lewis, W. H. Manwaring, J. McIntosh, C. J. Martin, Hideyo Noguchi, R. M. Pearce, M. J. Rosenau, R. P. Strong, J. C. Torrey, Richard Weil, H. G. Wells, Hans Zinsser.*

German and Austrian scientific men, to the number of 246, have appealed to the public not to cease to subscribe to scientific periodicals, as the latter are indispensable to scientific progress.

Miscellaneous items. PERSONALIA. In a fire which destroyed the Cornell Univ. chem. lab., Prof. *W. D. Bancroft's* working library was ruined, together with the records and files of the *Jour. of Physical Chem.*, of which Dr. Bancroft is editor.

Prof. *H. V. Tartar*, head Oregon Exper. Sta. Dep't. Chem., has been granted a two-year leave of absence, to pursue research work at some of the leading eastern universities.

Miss *Gwendolyn Stewart*, formerly instr. physiol. chem., at Santa Barbara Normal Sch. of Manual Arts and Home Econom., is spending the year in the physiol. dep't. of Stanford Univ.

PHARMACOLOGICAL. *Salvarsan "made in America."* The dermatol. lab's. of the Phila. Polyclinic are now preparing arsenobenzol (salvarsan).

Food-and-drugs act constitutional. The U. S. Supreme Court recently rendered a decision in the case of "Eckman's Alternative," a nostrum sold as a tuberculosis "cure," in which the constitutionality of the amended food-and-drugs act was upheld.

N. Y. Dep't. of Health labels patent medicines. The "Goldwater Registry Law," requiring that all packages of patent med. bear a proper declaration-label, or that the seller declare the nature of the contents to the B'd. of Health, went into effect on Jan. 1, 1916. Several days before that date, 300 inspectors, from three bureaus of the Dep't. of Health, began to canvass 2,494 drug stores in Greater N. Y., and place labels on 5,000,000 packages of patent med. Druggists generally have facilitated enforcement of the law.

Present drug situation. The great outstanding need of the hour is the immediate foundation of an effective inst'n. for chemotherapeutic research. With the problems awaiting solution and the opportunities for developing information of unlimited importance to the science of med., there is no way in which philanthropy could do more for humanity than to make possible the establishment of such an inst'n. Ehrlich is dead and the great research inst'n. of which he was the head and moving spirit, by this misfortune and other conditions, will be unable for a long time to go on serving

med. science as it has in the past. There never was a more auspicious time for the development of a great inst'n. to take up the study of chem. in relation to the treatment of disease, and carry forward this great work that contains such wonderful possibilities for the relief of human suffering. It is to be hoped that some wealthy man can be shown the enormous benefits to be derived from such an inst'n., and how, by making its foundation possible, he can meet the most urgent need in connection with scientific med. today, *the need for taking advantage of the unlimited resources of chem.* EDITORIAL: *Amer. Med.*, 1916, xxii, p. 13.

NEW COURSES. Lewis Inst., Chicago, has added physiol. chem., food analysis, and advanced work in nutrition, to its regular four year curriculum in domestic science.

FELLOWSHIP. The Woman's Med. Assoc. of N. Y. City offers the *Mary Putnam Jacobi Fellowship* of $800, available for post-graduate study to any woman physician *for work in any of the med. sciences* (including biol. chem.). The fellowship will be awarded upon proof of ability and promise of success in the chosen line of work. Applications for 1916–'17 must be in the hands of the Commit. on Award by Apr. 1, 1916, and should be addressed to Dr. Annie S. Daniel, 26 Gramercy Park, N. Y. City.

INST. F. VOLKSERNÄHRUNG. A Vienna manufacturer has given $100,000 to found an inst'n. to study the technical side of nutrition for the people, by correlating the findings of organic chem., biol., physiol., etc. It is to be called the Inst. für Volksernährung.

DYESTUFF SITUATION IN THE U. S. AT THE CLOSE OF 1915. Before the advent of this deplorable war we imported annually about 2,500 short tons of anilin oil and anilin salts. In 1916 over 11,000 tons will be manufactured on Amer. soil, from Amer. coal-tar "crudes." In 1913 our Amer. color-works produced 3,300 short tons of coal-tar colors, made chiefly from German "intermediates." We imported 25,700 tons of artificial dyes, 22,000 tons coming from Germany. Today we are making over 15,000 tons of these colors, all from Amer. coal tar. Are the nation's color-chemists too optimistic in confidently looking forward to the year 1917 as a date when the great bulk of artificial dyes consumed in this country will be made in Amer. works, from Amer. raw material, by Amer.

labor? (T. H. NORTON: *Jour. Industr. and Eng. Chem.,* 1916, viii, p. 172.)

AMMONIA FROM CYANIMID. The large number of installations operating with perfect success in various parts of the world for a number of years has demonstrated the commercial possibility of making ammonia from lime-nitrogen. The plant in its present highly developed state is extremely certain in its action and simple to operate. The efficiency in the transformation of lime-nitrogen into ammonia gas is upwards of 98 percent, or almost quantitative. The consumption of reagents is remarkably small, and they are cheap and easy to obtain in almost all parts of the world. The quality of the ammonia produced by this process is not surpassed by any in the U. S. It is chemically pure as produced and requires no further costly and tedious purification to render it available for the highest grade chem. products, or for the production of liquefied anhydrous product. The actual cost of production of this high-grade pure ammonia on a considerable scale, which enables one to take advantage of the lower prices at which lime-nitrogen is offered, brings high-grade cyanimid-ammonia into the market almost as cheaply as the more impure forms already found there, and very much cheaper than it is possible to obtain an equal quality of ammonia from gas-house liquor, the coke ovens, etc. (W. S. LANDIS: *Jour. Industr. and Eng. Chem.,* 1916, viii, p. 160.)

II. WAR NOTES

Necrology. The *Press Medicale* gives an illustration of the large tablet to be erected under the arcade of the great staircase of the med. dep't of the Univ. of Paris. In Oct. the design, already in place, contained the names of six members of the faculty, victims of the war (Galland, Legrand, Moog, Pelissier, Schrameck and Reymond—the latter the aviator). There are also inscribed the names of 47 students, and of 26 former graduates of the institution.

Fat and ammunition. Sir W. Ramsay, in a letter to the London *Times,* claims that in spite of the blockade, Germany is making up for a shortage of fat by importing fats and oil-containing seeds from neutral countries. Ramsay contends that from linseed oil alone the British Gov. has furnished "the enemy" with no fewer than 18,000 tons of gun ammunition.

Univ. items. More than 600 students and alumni of the Univ. of Penn. are either fighting or doing med. work in the war zone.

The British Gov. has decided that all med. students, except those in the last two years of professional study, shall relinquish their work and become combatant members of the Army.

Prof. Hertwig, Berlin, who has just celebrated his 81st birthday, is now on active service with the troops at the front. This is his fourth military campaign—he also served in 1864, 1866 and 1870.

There are now about 1,700 Toronto Univ. men in active service. Of the univ. staff, 73 are serving as officers and 8 are in the ranks. Graduates numbering 746 are officers and 171 hold other ranks. There are 284 undergraduates serving as officers and 381 in the ranks.

III. COLUMBIA UNIVERSITY BIOCHEMICAL ASSOCIATION

1. General Notes

Appointments.[2] Marine Biol. Lab., Woods Hole, Mass.; Summer session, 1916: *Charles Packard,* instr., embryol.

N. Y. Univ. and Bell. Hosp. Med. Coll.: Dr. *M. G. Herzfeld,* assis. in pathology.

Officers-elect. SOCIETIES. Dr. *G. D. Beal*: sec'y, Div. of Pharmaceut. Chem., Amer. Chem. Soc.; vice-p., Phi Lambda Upsilon.

Prof. *R. H. Chittenden*: member, Council, Amer. Philosoph. Soc.; Ch'm'n, Finance Commit., National Commit. for Mental Hygiene.

Dr. *W. H. Eddy:* a director, Nat'l Educators Conservation Soc.; also ch'r'n, Commit. on Wild Life Protection and Increase.

Dr. *H. L. Fisher:* pres., Phi Lambda Upsilon.

Dr. *C. S. Gager:* a director, Nat'l Educators Conservation Soc.

Prof. *A. J. Goldfarb:* a director, Nat'l Educators Conservation Soc.

Dr. *I. J. Kligler:* member, Amer. Soc. Naturalists.

Dr. *Jacques Loeb:* trustee, Marine Biol. Lab., Woods Hole, Mass. (to serve until 1919).

[2] See also pages 115 and 126.

Prof. *C. R. Stockard,* sec'y, Amer. Assoc. Anat.

JOURNALS. Dr. *J. J. Bronfenbrenner:* board of ed., *Jour. of Immunology.*

Mr. *G. E. Cullen:* ed.-in-chief, *Register of Phi Lambda Upsilon.*

Dr. *W. H. Woglom:* ed. commit., *Jour. Cancer Research.*

Prof. *Hans Zinsser:* board of ed., *Jour. of Immunology.*

Lectures and addresses. Associated School Physicians, Pittsburgh, Mar. 4: Dr. *Jacob Rosenbloom,* Metabolism studies in a case of Diabetes insipidus.

Chem. Teachers' Club, N. Y. City; Columbia Sch. of Med., Feb. 19: Dr. *B. G. Feinberg,* The pure food law in operation.

Univ. of Ill., Feb. 10, 11, 12: Prof. *L. B. Mendel,* Some features of growth.—Agric. Coll.: Changes in the food supply and their relation to nutrition.

Lab. for determination of mental deficiency. A lab. for the purpose of examining prisoners to determine which are mentally deficient, has been established at the N. Y. police headquarters. Dr. *L. E. Bisch,* who conducted the preliminary exper. work, is the director of the laboratory.

2. Proceedings of the Association

EDGAR G. MILLER, JR., Secretary

Twenty-fifth meeting. The 25th meeting of the Assoc. was held, Feb. 4, in the Biochem. Seminar Room at the Columbia Med. Sch.

Prof's. A. B. Macallum (Toronto) and Leon Asher (Bern) were elected *honorary members.* Prof's. R. F. Ruttan (McGill), Teodoro Muhm (Chile), and E. Winterstein (Zürich) were elected *corresponding members.* Miss Hattie L. Heft, Dr. F. G. Goodridge and Prof. Gies were elected *life members.*

It was voted to transfer all contributions on account of life membership to the endowment fund of the BIOCHEMICAL BULLETIN.

The scientific proceedings of this meeting will be published in the next issue of the BIOCHEMICAL BULLETIN. The next regular scientific meeting (27) of the Assoc. will be held Apr. 7.

Fifth annual dinner (26th meeting). The fifth annual dinner of the Biochem. Assoc. was given, Feb. 10, 1916, at 7.30 p. m., at the Hotel Majestic. Preceding the dinner, at 6.30, an informal reception was held in the rooms adjoining the banquet hall. Prof. A. B. Macallum (Toronto) was the guest of honor. The attendance—260—was the largest in the history of the dinners given by the Assoc.

The president of the Assoc., Dr. Nellis B. Foster, was the toastmaster. The speakers who preceded Dr. Macallum on the informal program were Drs. L. H. Baekeland, M. T. Bogert, R. H. Chittenden, Graham Lusk and S. J. Meltzer. Prof. Macallum delivered the formal address of the evening on *Scientific truth and the scientific spirit*. This scholarly and impressive address is published in full at page 65.

The members of the Assoc. were highly honored by the presence of Prof. Macallum and the many others of their friends and colleagues in New York and nearby cities. The hope that the annual dinners of the Assoc. may help to advance the status of biochem. and foster *inter-institutional amity* in New York was encouraged by the large attendance and by the gracious interest of all the guests in the social success of the occasion. There was ample justification for the delight of the members in the evident success of the dinner, which it afforded them great pleasure to give in personal and professional honor of their distinguished friend and colleague from the Univ. of Toronto.

The names of those in attendance and the table groupings, are indicated below:

SPEAKERS' TABLE

Guest of honor: A. B. Macallum
Toastmaster: Nellis B. Foster

L. H. Baekeland	Ross G. Harrison	F. H. McCrudden
Marston T. Bogert	Holmes C. Jackson	John Marshall
R. H. Chittenden	Jacques Loeb	S. J. Meltzer
Charles B. Davenport	Graham Lusk	

TABLES 2–28

H. V. Arny
John Auer
W. A. Bastedo
T. S. Githens
R. A. Hatcher
D. S. D. Jessup
A. I. Ringer

Wm. N. Berg
Harlow Brooks
Rufus Cole
W. J. MacNeal
Wm. H. Park
Theobald Smith
A. B. Wadsworth

Isaac Adler
J. McK. Cattell
J. H. Larkin
Isaac Levin
G. M. Meyer
J. R. Murlin
Peyton Rous
Richard Weil

S. R. Benedict
W. B. Cannon
J. A. Fordyce
R. A. Harper
Yandell Henderson
P. A. Levene
R. T. Morris
F. P. Underhill

Warren Coleman
Haven Emerson
James Ewing
J. A. Hartwell
F. S. Meara
Walter Mendelson
B. T. Terry
F. C. Wood

J. P. Atkinson
M. A. Bigelow
T. B. Freas
C. S. Gager
Grace Langford
Grace MacLeod
Margaret E. Maltby
W. A. Murrill
Mary A. Nutting
G. B. Pegram
A. B. Stout
H. T. Vulté
J. F. Woodhull

C. D. Carpenter
Mrs. P. E. Howe
I. S. Kleiner
Mrs. M. Manchester
A. R. Rose
Mrs. M. D. S. Rose
Sadie B. Vanderbilt
Jennie A. Walker

H. L. Fisher
Helen Gavin
A. J. Goldfarb
Mrs. A. J. Goldfarb
F. W. Hartwell
C. A. Mathewson
Mrs. C. A. Mathewson
F. H. Pike
Mrs. F. H. Pike
Helene M. Pope
F. M. Wheat
Mrs. F. M. Wheat

Louise Berg
Robert Bersohn
Isabel Greenberg
J. S. Hepburn
Benjamin Horowitz
J. A. Killian
J. F. McDonald
Sergius Morgulis
Arthur Mutscheller
W. A. Perlzweig
C. P. Sherwin

Thos. H. Cherry
Wm. B. Dunning
Mrs. Wm. B. Dunning
Mrs. Wm. J. Gies
Hattie L. Heft
Mrs. J. C. Pennie
H. H. Rusby
Mrs. H. H. Rusby

C. A. Doremus
M. S. Fine
I. F. Harris
P. A. Kober
V. C. Myers
G. D. Palacios
H. D. Pease
E. E. Smith

C. F. Ash
H. S. Dunning
J. M. Levy
A. H. Merritt
J. H. Reed, Jr.
M. L. Rhein
H. S. Vaughan
L. M. Waugh

H. W. Banks, 3d
L. J. Curtman
Sarah S. Graves
Isidor Greenwald
Mathilda Koch
J. T. W. Marshall
Adelaide Spohn
Ethel Wickwire

W. H. Eddy
L. W. Fetzer
Samuel Gitlow
Karl Goldmark
W. A. Jacobs
N. W. Janney
O. M. Schloss
Matthew Steel
Sydney Steiner
R. G. Stillman
J. C. Torrey
William Weinberger
C. J. Wiggers

A. O. Gettler
Charles Irish
Charles Larkin
Mrs. R. M. Murphy
D. E. Roelkey
John Rumells
Sara Sellers
Miss A. Staudenmayer

William Carr
H. C. Ferris
N. S. Jenkins
C. C. Linton
W. S. Russell
A. L. Swift
D. M. Ward
H. L. Wheeler

Viola M. Bell
Grace Brinton
Margaret Hessler
Laura Lattin
Irma Latzer
Minerva Lawrence
Madeline Libert
Day Monroe
Frances Quilliard
Emily C. Seaman

George Bernheim
Mrs. G. Bernheim
K. G. Falk
Mrs. K. G. Falk
Casimir Funk
A. F. Hess
Myron Schafer
Mrs. Myron Schafer
Kanematsu Sugiura

A. K. Balls
Ruby Dexter
Abraham Gross
Edythe Hershey
Genevieve Howell
E. F. Howell
J. H. Mueller
Margaret O'Leary
Lucy Purefoy
Alice Walton

A. C. Neish
Mrs. A. C. Neish
J. M. Nelson
Mrs. J. M. Nelson
A. H. Rahe
Mrs. Jessie M. Rahe
A. W. Thomas
Mrs. A. W. Thomas

C. H. Allen
G. E. Cullen
W. M. Kraus
J. H. Northrup
Carl Ten Broeck
D. D. Van Slyke
Hardolf Wasteneys
Harry Weiss
C. J. West
E. A. Wildman

Blanche Frazier
Tula L. Harkey
Frances R. Lee
Marguerite T. Lee
C. W. Rubsam
Mrs. C. W. Rubsam
Mrs. M. L. Schapiro
Frances Weidner

Bertha N. Baldwin
Lucy H. Gillette
Beatrix H. Gross
Paul Gross
V. E. Levine
Mary G. McCormick
Mathilda McKeown
Miriam E. Mirsky
G. J. Rosenthal

L. H. Almy	Bess Heflin	Lucy Cooper
Juanita Darrah	W. F. Hume	Herbert Eastlack
Pritchett Harrison	Richard Leonardo	Ethel Epstean
Priscilla Jones	Sterne Morse	Harriet Jacobson
Marian Lord	Mrs. Sterne Morse	I. J. Kligler
Ida Millen	Joseph Muzante	S. D. Kramer
Grover Tracy	Grace Sheets	Helen McClure
Gertrude York	Annie Smead	A. V. Salomon

Helen C. Coombs	Esther A. Bullard
Katherine Fisher	Lenna Cooper
Nita Jadwin	Eleanor Diehl
Ann Kuttner	Annie S. Dix
E. G. Miller, Jr.	Wm. J. Gies
Mabel Ritti	Paul E. Howe
E. L. Scott	Helen Hubbell
Gertrude Warren	Elizabeth Jones

DINNER COMMITTEE: Drs. Benjamin Horowitz (chair.), Edgar G. Miller, Jr. (sec'y) and Paul E. Howe (treas.).

3. Columbia University Biochemical Department

Appointment. FROM THE STAFF. Beth Israel Hospital (N. Y. City): Dr. W. A. Perlzweig, director of the chem. laboratory.

Resignation. Mr. Grover Tracy recently resigned his assistantship in biochem. at the Med. Sch. of the Univ. of Ill. to resume Ph.D. work in this dep't.

Lectures and addresses. Dr. Gies recently delivered the lectures and addresses indicated below: Chem. Teachers' Club of N. Y. City, Columbia Med. Sch., Feb. 19; Digestion, absorption and assimilation of proteins.—Iota (Columbia) Chapt., Nu Sigma Nu Med. Frat., Feb. 25: Progress in dental science.—Fifth Ann. Conf. on Independent Journalism in Dentistry, Hotel Vendome, Boston, Feb. 26: Professional freedom, self-respect and efficiency are incompatible with subserviency to trade journalism.—New Brunswick (N. J.) Scientific Soc., Rutgers Coll., Feb. 28: Digestion and utilization of food.—King's Co. (N. Y.) Dental Society, Masonic Temple, Brooklyn, Mar. 9: Prevention of dental caries.

EDITORIALS

WILLIAM J. GIES

Kronecker Biochemical Prize

The January issue of the BIOCHEMICAL BULLETIN presented, at page 59, the first announcement of the **Kronecker Biochemical Prize** for the "encouragement of biochemical research and the improvement of biochemical literature." In that announcement it was stated that "it will be impossible suitably to award the **Kronecker Biochemical Prize** before its existence is widely known"; also that "plans for the execution of the donor's purpose will be developed at an early date and announced in the next few issues of the BIOCHEMICAL BULLETIN."

In order that the first award of the **Kronecker Biochemical Prize** may be made under appropriate circumstances, it has been decided that the contents of the second half of the present volume (V—July to December, 1916, inclusive) and of the whole of the succeeding volume (VI—1917) shall constitute the series of papers from which the most meritorious contribution will be selected for the initial bestowal of the prize; but that, beginning with volume VII (1918), the prize shall be awarded annually to the author of the most meritorious contribution in each successive volume of the BIOCHEMICAL BULLETIN, in accord with the conditions of the gift.

The method by which all subscribers for the BIOCHEMICAL BULLETIN may participate in the selection of the contributions to which the successive prizes shall be awarded will be published, in the near future, in the editorial section of this journal. The details of this method will also be more formally announced, by letter, to each and all directly concerned in the execution of the plan.

Two new features in our editorial policy

Beginning with this issue, items of biochemical interest pertaining to various scientific societies will be regularly assembled in a separate section, under the general heading: "*Associations and societies.*" It is believed that this plan of coördinated presentation will greatly facilitate reference to the main facts of biochemical interest in the proceedings of the scientific societies to be included in the plan. A

systematic effort will be made to obtain promptly all the important facts of biochemical interest in the public affairs of the leading scientific societies; and it is our hope that all the secretaries to whom our requests for information may be forwarded, will coöperate with us in the execution of this purpose.

Beginning with this issue we shall reserve the space on the inside of the back cover of each number of the BIOCHEMICAL BULLETIN for the publication there of personal and professional items relative to biochemical "*positions wanted*," "*positions vacant*," and "*new positions*." Items of this character will be received from any and all who may be interested, and will be published free of charge. The founders of the BIOCHEMICAL BULLETIN intended to make this journal an active factor in the advancement of the knowledge and practice of biochemistry. The BIOCHEMICAL BULLETIN aims not only to promote the science and art of biological chemistry, but also to "give aid and comfort" to those who devote themselves to biochemistry as a profession. In pursuance of these purposes the BIOCHEMICAL BULLETIN would cheerfully help to bring to realization the hopes of all who seek professional opportunities in biochemistry or who desire the services of biological chemists.

Books received

The BIOCHEMICAL BULLETIN promptly acknowledges here the receipt of publications presented to it. Reviews are matter-of-fact statements of the nature and contents of the publications referred to, and are intended *solely to guide possible purchasers*. The wishes or expectations of publishers or donors of volumes will be disregarded, if they are incompatible with our convictions regarding the interests of our colleagues. *The sizes of the printed pages are indicated, in inches, in the appended notices.*

Harvey's views on the use of the circulation of the blood. By John G. Curtis (*Posthumous publication*). Based on a lecture delivered, in 1907, before the Johns Hopkins Hospital Historical Club, at Baltimore. Edited by Prof. F. S. Lee, "with affection for Dr. Curtis's memory and with appreciation of his scholarly attainments." Pp. 194; 6 x 3¾. Columbia Univ. Press, 1915. "Dr. Curtis's work represents a more profound study of Harvey's ideas and comparison of them with those of the most important of Harvey's predecessors than has heretofore appeared."

Nutritional physiology: 2d ed. By Percy G. Stiles, instr. in physiol., Harvard Univ. Pp. 287—6 x 3½; $1.25 net. W. B. Saunders Co., Phila., 1915. First ed. issued in 1912. Our references to the first ed., as an "admirable treatment of nutrition" and a "very valuable addition to the growing supply of text books in biol. chem. for beginners," apply with even greater pertinence to this edition. The hygienic aspects of nutrition are given special consideration.

PROFESSIONAL OPPORTUNITIES FOR BIOCHEMISTS

The founders of the BIOCHEMICAL BULLETIN intended to make it an active factor in the advancement of the knowledge and practice of biochemistry. The BIOCHEMICAL BULLETIN aims not only to promote the science and art of biological chemistry, but also to give "aid and comfort" to those who devote themselves to biochemistry as a profession.

Hereafter, in pursuance of these purposes, this page will be reserved for the publication of personal and professional items relative to biochemical "*positions wanted*," "*positions vacant*," and "*new positions*." Items of this character will be received from any and all who may be interested, and will be published free of charge.

Address communications in this connection to William J. Gies, 437 West 59th St., New York City, by whom all details will be regarded confidentially, whether that attitude is formally requested or not; and by whom correspondents will be put directly in touch with each other.

New positions

1. Pathological chemist wanted by two physicians. Salary $150 per month. State qualifications.

2. Bacteriological chemist wanted to coöperate in dental and oral research. Salary to accord with training and ability. State qualifications.

3. Director of research on nature and effects of "food poisons" in a university laboratory desires collaboration of bacteriologists, biochemists and pharmacologists (pair of each). Full time appointments; no teaching duties. Research to continue for at least three years. State qualifications and salary desired.

13. "Oil chemist" wanted in industrial laboratory. Good salary for man thoroly trained, with wide experience.

Positions vacant

4. Two assistantships in biochemical department of large western university will be vacant at end of present academic year. New appointees will receive $500 each, free tuition, and "half-time" for Ph.D. work.

Positions wanted

5. Biochemist, Ph.D., with special experience and interest in research on enzymes, desires a permanent position in this kind of work.

6. Biochemist with special experience in research on lipins desires teaching position that would enable him to complete Ph.D. training.

7. Biochemist, Ph.D., long training and experience in agricult. chem., desires position of greater opportunity for research in same field. Salary desired, $2500.

8. Biochemist, Ph.D., with thorough training and extended experience in nutrition, desires more advanced opportunity in research in nutrition or an allied field. Prefers position without teaching duties. Salary desired, $2500.

9. Instructor in bacteriology, Ph.D., now teaching (a) general bacteriology, (b) water, milk and food bacteriology, and (c) bacteriological chemistry, seeks more advanced position, combining opportunity in research with teaching.

10. Bacteriologist, Ph.D., with chemical training and extended experience in bacteriology, desires position in research involving activity in bacteriochemistry. Salary desired, $2500.

11. Biochemist, M.S., now a candidate for Ph.D. in western univ., who has specialized in food and bacteriological chem., and is teaching chem., desires a teaching or research position in any of these fields.

12. Seven biochemists, who expect to receive the Ph.D. degree in June, desire "good positions."

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Vol. V April–May, 1916 No. 20–21

Biochemical Bulletin

LANCASTER AND NEW YORK

Entered as second-class matter in the Post Office at Lancaster, Pa.

KRONECKER BIOCHEMICAL PRIZE

A prize of one hundred and fifty dollars ($150), to be known as the **Kronecker Biochemical Prize**, and intended "to encourage biochemical research and improve biochemical literature," will be awarded to the most meritorious paper, in each successive volume of the BIOCHEMICAL BULLETIN, under the following conditions:

1. The prize shall be designated, in all references thereto in the BIOCHEMICAL BULLETIN, as the **Kronecker Biochemical Prize.**

2. No one more than 40 years of age shall be eligible to receive the prize, but neither nationality, race, creed, sex, nor any other state or personal condition shall render an author ineligible to receive the prize.

3. The prize-winning paper, article, or other contribution, may be of multiple authorship and of any biochemical character whatever, provided the paper or any part of it is not published elsewhere before the award is formally announced; but the prize may not be awarded to a paper that is more than 15 printed pages in extent, exclusive of diagrams, plates, tables, and other illustrative matter.

4. The awards of the prize shall be made annually by *vote of the subscribers for the* BIOCHEMICAL BULLETIN.

5. The Managing Editor of the BIOCHEMICAL BULLETIN, with the advice of the members of the Executive Committee of the Columbia University Biochemical Association, shall have authority to announce that none of the papers in a given volume is sufficiently meritorious to warrant the award of the prize for that volume; but in any such event the prize for the succeeding volume, or volumes, shall be increased by the amount, or amounts, not previously awarded.

6. The contents of the second half of the present volume (V—July to December, 1916, inclusive) and of the whole of the succeeding volume (VI—1917) shall constitute the series of papers from which the most meritorious contribution will be selected for the *initial* bestowal of the **Kronecker Biochemical Prize.** Beginning with Volume VII (1918), this prize will be awarded *annually.*

7. The Managing Editor of the BIOCHEMICAL BULLETIN will announce and execute all plans desirable or necessary for the attainment of the donor's purpose in this matter, in accord with the conditions above expressed.

See pages 59 (Jan.) and 127 (Feb.–Mar.) of this volume of the BIOCHEMICAL BULLETIN.

BIOCHEMICAL BULLETIN

VOLUME V APRIL–MAY, 1916 NO. 20–21

MEDICAL BROTHERHOOD FOR THE FURTHERANCE OF INTERNATIONAL MORALITY

Fraternitas medicorum

F. M.

A REPORT AND A DISCUSSION BY THE PRESIDENT,

S. J. MELTZER

In the issue of the BIOCHEMICAL BULLETIN for June–September, 1915 (p. 292),[1] an "Appeal to the Men and Women Engaged in Medical Practice and the Advancement of Medical Sciences" was published, asking them to join the organization of the *Medical Brotherhood for the Furtherance of International Morality*. It was signed by about one hundred and fifty members of high standing in the profession of this country, many of whom enjoy an international reputation. Soon after its publication, we began sending out the Appeal and an enrollment card to members of the medical profession. We wish now to give an account of the results thus far attained, and to discuss the nature of this venture and its merits.

REPORT. To this date (April 15) about fourteen thousand American physicians have enrolled as members of the Medical Brotherhood, the greatest part of whom are either members of medical societies of good standing or of societies which cultivate medical sciences. The Appeal was also sent to some leading members of the profession of other neutral countries. Here again we obtained very encouraging results. We received, and continue to receive, requests

[1] See page 249.

from members of the medical profession of these countries to be enrolled as members of the Brotherhood of our country. Among our correspondents are such well-known men as Theodor Kocher, Einthoven, Thalma, Rovsing, Thunberg, Von Monakow, Zwaardemaker, de Quervain, Jacquet, Marsden and others of similar standing. The Appeal was published in some of the medical and scientific journals of these countries, and we have the encouraging information that organizations similar to ours were started there. Quite recently the Nederlandsche Vereenigung voor Heelkunde (Holland) requested to be enrolled as a member of the Medical Brotherhood of this country. *We did not approach members of the profession in any of the belligerent countries;* nevertheless, we received requests to be enrolled from medical men in Finland (Russia) who probably read the Appeal in Swedish medical journals.

The fourteen thousand members of the medical profession of this country who have enrolled as members of the Brotherhood represent about 15 per cent. of the number of physicians to whom the Appeal was sent. We have, therefore, good reasons to consider henceforth the *Fraternitas Medicorum* as an established organization.

Analysis of objections. While it is idle to speculate as to the real attitude of those who did not respond to the Appeal, certain instructive facts, capable of shedding some light upon this question, may be learned, nevertheless, from an analysis of part of the correspondence we have had. We shall not include in the discussion the numerous letters in which the writers unreservedly and enthusiastically approved our movement. But we have to mention that among the enrolled members are some who originally looked upon the enterprise with misgivings. We shall mention further the instructive fact that a number of physicians asked for enrollment cards months after the Appeal was sent to them, stating frankly that they threw away the Appeal without even having read it, because they were bothered with too many war and peace circulars.

However, we received about twenty-seven letters, the contents of which were unmistakably adverse to our movement. Nine of these communications were anonymous; they contained offensive remarks, assuming that the Medical Brotherhood was a part of an

organized German propaganda and that the expenses were met by the German Kaiser.

Among those who signed the adverse letters are several from men who are of high standing in the profession, and are personally known to us. Several of our correspondents, some of whom were, during the present war, for short periods in France, stated that there is not a neutral fiber in them.

Two correspondents objected to the idea that physicians have a higher claim to international morality than other people. Several of our correspondents said that they either could not see the object of the movement or, as one expressed it, he could not see where "the uplift comes in"; or, on the contrary, that the aim of the Brotherhood is too Utopian for them. Finally, several writers approved the idea in general, but thought that the organization of a Medical Brotherhood should be postponed until after the war.

The objections to the organization of the Medical Brotherhood, so far as could be ascertained from this small number of adverse manifestations, may be summarized as follows: (1) That it is a part of a German propaganda, or, at least (2) a veiled pro-German movement; that (3) it is meant to be a neutral body which, therefore, ought not to be supported because the paramount duties of American physicians ought to be to help the Allies; that (4) physicians have no higher claim than other people to international morality; that (5) there is no object (no uplift) in this organization; that (6), on the contrary, the object is too Utopian, and finally, (7) that the movement is premature.

Financial resources. Small as the number of our critics is, their adverse points of view merit public discussion. In so doing we shall deal in the first place with the most objectionable interpretation given to the aims of the Medical Brotherhood, namely, that it is part of a pro-Teutonic propaganda and that it is financially supported by the German government. In the Appeal, as well as in a letter published in the *Journal of the American Medical Association* (1916, lxv, p. 971), it was expressly stated that the Brotherhood is neither a pro-Teutonic nor a pro-Allies movement. Such assurances probably do not reach the type of men who are capable of writing anonymous letters. But we owe it to the medical profession at large to

make the following statement regarding the financial resources of the Medical Brotherhood, which is as follows: Private contributions, to the amount of $660, were made, in smaller and larger sums, by some of the enrolled members. *The main financial support comes, however, from the Carnegie Endowment for International Peace.* The Executive Committee of this body granted us a liberal fund for the purpose of developing our organization. The Executive Committee is made up of such men as President Butler, President Pritchett, ex-Senator Elihu Root, and others of similar high standing. It is quite safe to say that no individual with normal judgment could think for a moment that these foremost American citizens would consent to support a pro-Teutonic organization. But ought such a question to have been raised at all by any fair-minded member of the profession in the face of the standing of the members of the committee which signed the Appeal? Would, for intance, the Surgeon-Generals of the Army, of the Navy, and of the Public-Health Service consent to be honorary presidents, if the Medical Brotherhood had some ulterior, pro-Teutonic or other un-American, tendencies?

General discussion. As to the other criticisms, they can be best met, we believe, by discussing the fundamental considerations underlying this movement. The term "brotherhood," it is true, recalls to mind a state in which all men shall treat one another like brothers—like good brothers. This is an ideal which probably will never be attained. The specter of the unattainable drives practical men away from such ideals. But it should be remembered that even the ideal is of great educational value, if utilized merely to indicate the *direction* which our practical activities ought to take. However, the Medical Brotherhood addresses the Appeal only to the medical fraternity, and does not intend to deal with unattainable objects. The medical profession has a training which is scientific in character and method, and which has, in modern times, among its precepts the following maxims: (1) That the development of a new view must be started on the basis of an assured fact, and not from mere desire or by the impulse of an untamed phantasy; (2) that one need not be afraid to assume, or to work for, something which has not received the approval of that great

authority, the practically wise man; (3) that one should not work for the demonstration of the correctness of the new assumption, or for the realization of the new aim, in the manner of the practical man, that is, by violent activities and in the expectation of attaining completely the desired end in a month or a year (perhaps to lose it again in a shorter time), but, on the contrary, must work patiently, trying to attain the end, or even only small parts of it, by steps which may appear to be very small but which offer the greatest chance for permanency; (4) that one should not be discouraged by some failures; and finally, (5) that one should care more for progress in the right direction, than for attainment of the goal.

Now, the development of our organization was started on the basis of the following indisputable facts: The ethical relations between separate nations are far behind the state of morals governing the relations of individuals of the same nation. International morality progresses at best in waves, positive and negative, making perhaps three steps forward and two and sometimes four or five steps backward. However, during the normal state of the world's affairs, ethical men of all countries are ready to be guided by the two great moral principles: patriotism and humanity. The present world-wide catastrophe has demonstrated, however, that even the most idealistic citizen is incapable, and, in fact, is not in a position to serve both ethical principles at the same time, while his country, right or wrong, is at war with another country. Physicians, however, are in an exceptional position; they are permitted and even required to observe both ethical demands even during war. In war the physician's services to his country are as necessary, as great, as that of the warrior, but he is in the fortunate position to be able to treat his compatriot and his country's foe alike. That standard of morality is upheld not only by the medical profession itself, but is practically demanded by the regulations agreed upon by the various international conventions, regulations which have been rarely broken even in the present most brutal war. Even in the present state of frightful confusion of judgment, practically no sane individual exists who would not consider this standard of morality desirable to obtain in all domains of human endeavor—if it were attainable. These are safe facts. Now the Medical Brotherhood was organized primarily

to bring these instructive facts to the consciousness of the members of the medical profession, to tell them of their ethically privileged status. This message is not sent to non-medical men; neither do we mean to say to the non-medical man that we physicians are holier than thou. We wish only to convey to physicians the message that their profession permits them to remain at all times simultaneously patriotic and humane, and that they should train their character properly so that they could be fit to exercise this high privilege. The nearest and simplest end to be gained from such information is the consciousness of a sense of higher duties which comes from the knowledge of one's higher moral dignity.

There is no doubt that the medical profession is a noble calling. Do medical men represent a noble class? They ought to. There are two good reasons for such an expectation. "A medical man whose ethical standard is not above that of the average man is morally below him." His activities are of a most serious nature; they concern life; and, furthermore, they can not, as in other callings, be controlled by anybody or anything else but the physician's own conscience; that conscience therefore must be of a higher type. Then, the physician has constantly to deal with suffering, that of the patient and of those to whom the patient is dear; sympathy, therefore, ought to be an integral part of the make-up of the desirable physician. It is true that the medical calling is at the same time the physician's business by which he makes his livelihood; it is therefore often afflicted with many of the moral shortcomings which frequently go with money-making occupations. The Medical Brotherhood, however, does not deal, and does not have to deal, with this side of the physician's life. It deals with the physician in his relation to his country, when he acts and has to act as a patriot; or when other countries are at war with one another, when the physician of a neutral country has to act as a humanitarian. Here every physician can afford to exercise his noble profession in a noble spirit. It is that for which the Medical Brotherhood appeals to all physicians of our country. That alone seems to us to be an object worth while looking for.

The fact that within only about nine months and without agitation and publicity, about fourteen thousand members of the med-

ical profession of the United States alone should have joined the Medical Brotherhood shows that we struck the right chord. This group of medical men and women, the vast majority of whom surely have more or less idealism, represent about 10 per cent. of the medical profession of this country. Moreover, there can be no doubt that the Appeal issued by the committee exerted a morally favorable influence upon many members of the profession who did not join the Medical Brotherhood; and there is great probability that a good many will join it when the war approaches its end.

In this connection we may call attention to the most encouraging fact that the medical journals of our country act in a most exemplary manner with relation to the war. None of the journals, at least none known to us, has indulged in offensive discussions of the various belligerent nations or made disparaging comments on the behavior of the medical members of these nations. The subject of the present war has been handled by the medical journals with rare good sense and tact. In a general way, the same may be claimed for the utterances of the members of the medical profession when made in lay gatherings or publications, although here the unavoidable small fraction of exceptions has not been lacking. The Medical Brotherhood has had occasion to remonstrate in two instances, in one with complete and in the other with partial success.

From the point of view of the scientific investigator, who is not afraid of Utopian ideals which may give him the direction for his work, but who works for his goal by small and practicable steps, we may claim for the movement of the Medical Brotherhood that it has a definite object, "an uplift," that it is not Utopian in its direction, that it was undertaken at the right time—when the medical mind was in a state of fermentation, *in statu nascendi*—and, best of all, that the movement has already attained a gratifying success: it has aroused the moral, humane, spirit in a great many members of the profession in this country as well as in other neutral countries.

We have no quarrel with those of our colleagues who do not wish to join the Brotherhood, because, as they say, they can not remain neutral in this war. No matter with which party one sides, and what his wishes may be, we do not question the moral nature of his motives. But we wish to make the following two remarks:

First, the Medical Brotherhood does not aim for mere neutrality. A neutral occupies, with reference to war, the same moral level as the belligerents, with the mere difference, that he is not in it, or not yet in it. The Medical Brotherhood wishes to occupy a position above this level. War represents a very backward phase in the development of human ethics. The various belligerent nations are simply products of the same moral phase, the same developmental period. The medical profession is fortunate to be able to occupy an advanced ethical position. Its members should be aware of it, and should adhere to it.

Second, the Medical Brotherhood is concerned only with the medical part of its members. As private individuals the members are at liberty to sympathize chiefly or exclusively with one side or the other of the warring parties. What we expect of members of the Medical Brotherhood is that they should commit no public act which is not in harmony with the advanced moral standing of the medical profession. *One who does not feel that he can bind himself to this simple obligation, or one who does not believe, or does not want to assume, that the medical profession occupies an advanced moral position, should, of course, not join the Medical Brotherhood.* This organization must consist of medical men and women who believe in the advanced ethical position of the medical profession and are willing to live up to this belief. It is as certain as day that only good and no harm can come from such a belief.

We shall not risk the presentation of a list of the problems which we may be called upon to try to solve now or later; "each bridge will be crossed when we get to it." One thing we may state definitely: *we do not intend to meddle with problems which deal with the termination of the present war.* The exertion of our energies will be limited to that which is attainable by us. On the other hand, we contemplate dealing definitely with this one problem. After the termination of the war, or even at the mere sight of this termination, an attempt should be made to unite the medical men of all the neutral countries for the purpose of arranging an early international meeting of the medical profession, to which meeting some members of the profession in the belligerent countries, who are, or may then be, in harmony with our ideals, may be invited. We shall thus

perhaps be in a position to accelerate an early rapprochement and fraternal reconciliation of the members of the medical profession of all the civilized nations. Here again we shall attempt to do our duty as we see it without being too sanguine as to an early and complete success.

HIPPOCRATIC OATH. A few of our sympathizing correspondents wished to know whether the aims of the Medical Brotherhood are not already covered by the Hippocratic oath. No; that oath covers only the relations of the physician to the individual as his private patient or pupil. As we all know, the influence of this oath leaves plenty of room for the ethical activities of the American Medical Association, the newly created College of Surgeons, etc. The Medical Brotherhood does not intend to deal with any part of this phase of medical affairs; *it has in view exclusively the relations of the physician to his country as a patriot and to other countries as a humanitarian.*

PATRIOTISM AND MEDICAL PREPAREDNESS. We have stated that medical men are in a position to be patriots and humanitarians at the same time. We have so far dealt exclusively with the international side of the Brotherhood. In fact, in the Appeal it was expressly stated "*For the Furtherance of International Morality.*" However, it would not be out of place to add a few remarks regarding patriotism and the relations of the physician to it. The present war, while presenting a frightful picture of the bloody struggle between the nations, has revealed, on the other hand, a most remarkable ethical side of the relations of the individual to the State in each and every one of the belligerent countries. The readiness of the individual to be helpful to, and sacrifice himself for, the State stands out as a shining light in the midst of the extreme darkness of the war. But here we wish to speak especially of the relations of our physicians to our country. Preparedness is a subject which at present agitates profoundly the minds of all of our citizens. It is none of our concern here to discuss this subject from the general point of view as citizens. As physicians, however, there can not be the slightest doubt that it is the duty of every member of the profession, who is in a position to do so, to offer his assistance to the medical department of the military organization of our country. We do not know when

the country will be called upon to defend itself. It may come suddenly, like a bolt from the skies, which are surely not clear at the present time. Physicians who are not devoid of a sense of duty should, therefore, prepare themselves with the necessary knowledge and skill, and should in large numbers inform the military medical department of their willingness to serve in case of need. The hygienist, bacteriologist, internist, etc., can be of just as much service as the surgeon in the incidents of war. The medical man who marches with the scouts ahead of the army to select camps, to test the drinking water, etc., is as important as those who work behind the lines. And the medical man whose daily work brings him in contact with infectious and contagious diseases is trained in courage as high as the veteran of many battles; bacteria are as deadly as bullets; and in his daily work the physician, like the man on the firing line, never knows when they may strike him.

On the other hand, the practitioner knows now quite well what importance is to be attached to sympathetic psychical treatment of patients who are in need of it. A training to preserve humaneness in the midst of passion and hatred ought to be a part of medical preparedness. After furious battles the poor injured prisoner of war needs often this mode of treatment as much as the surgical one.

The Medical Brotherhood of this country wishes to gather into its union those members of the medical profession who have a vein of idealism in them and who are willing to serve their country as patriots and humanitarians. It appeals further to the inspired ones to spread this gospel, wherever they find the proper opportunity, with impressiveness combined with patience and tolerance.

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THE EXTRACTION OF SAP FROM PLANT TISSUES BY PRESSURE

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(WITH PLATE 1)

(Received for publication, June 8, 1915).

In a paper of great importance to those engaged in the study of the properties of vegetable saps, Dixon and Atkins[1] have shown that a sample of sap obtained by pressing untreated tissues cannot be regarded as typical of that contained in the tissue-mass, but that fractions extracted successively differ essentially in their electrical conductivity and depression of the freezing point. Dixon and Atkins have, furthermore, provided a method of obtaining typical samples of sap by rendering tissues permeable by freezing in liquid air, and have extended the application of this method to the extraction of zymase from yeast.[2]

In the course of our work on the properties of vegetable saps we have had occasion to repeat these studies of Dixon and Atkins on an extensive scale.

Dixon and Atkins contented themselves with methods which were qualitative rather than quantitative so far as the squeezings are concerned. Such methods were, of course, quite sufficient for their purposes.

Our primary purpose has been to determine something concerning the nature, amount, and regularity, of the change in the

[1] Dixon and Atkins: Osmotic pressures in plants. 1. Methods of extracting sap from plant organs. *Sci. Proc. Roy. Dublin Soc.* (n. s.), 13: 422–433, 1913. Also, *Notes from Bot. Sch. Trinity Coll. Dublin*, 2: 154–172, 1913.

[2] Dixon and Atkins: The extraction of zymase by means of liquid air. *Sci. Proc. Roy. Dublin Soc.* (n. s.), 14: 1–8, 1914. Also, *Notes from Bot. Sch. Trinity Coll. Dublin*, 2: 177–184, 1914.

concentration of the sap extracted from a mass of tissue under continuous pressure.

At first we hoped to secure apparatus suitable for determining, in the case of various tissues, the amount of pressure required for the extraction of given volumes of sap and the concentration of the sap thus secured. This proved unfeasible, at least in preliminary studies; and we limited ourselves to a consideration of the concentration of successive samples of equal volumes obtained under approximately continuous pressure.

In extracting the sap, the tissue was carefully packed, in masses of about 200 grams, in a heavily tinned hemispherical bowl and forced down by means of a plunger of similar nature, which fitted closely into the bowl when empty. Numerous small perforations in the bowl permitted the escape of the extracted sap without disturbing the press. The plunger was forced down by a screw which was very slightly turned every few minutes to maintain a constant dropping of juice. Shallow smooth corrugations on the inner surface of the bowl and on that of the plunger prevented any grinding action between the plunger, sample, and bowl, before the applied pressure became sufficient to hold the mass rigid. The press was capable of exerting pressures of from 80 to 100 atmospheres, continually, until all the available sap was extracted.

As a basis for comparison, the sap was extracted also from a comparable mass of *frozen* tissue.[3] This will be designated as the "original frozen sample." After the process of sap-extraction had been carried as far as possible by direct pressing, the residue generally contained sufficient water for an ample extraction of sap after being frozen. This residual part of the tissue will be referred to as the "frozen residue."

The concentrations (osmotic pressures) of all the saps were measured in terms of the depression of the freezing point, as estimated by the well known Beckmann method.

The results of a rather large series of experiments can be stated very tersely, and with illustrative cases instead of with a full series of observational data.

[3] For methods see Gortner and Harris: *Plant World,* 17: 49–53, 1914.

In no instance did a first sample of sap, pressed from unfrozen tissue, give a depression of the freezing point as great as that from the "original frozen sample." Generally, all the fractions extracted by pressing alone show less depression of the freezing point than does the juice extracted from the "original frozen tissue." In some cases, however, the later samples of a series are as concentrated as, or more concentrated than, the sap of the "original frozen sample." *Diagram 1* (Plate 1) gives an illustration of this case.

Dixon and Atkins, in referring to the results of their own work and to the evidence obtained incidentally by others, mention only higher concentrations of the later samples. In general it is true that successive samples become more concentrated. The regularity of this increase in concentration is admirably shown by *Diagram 1 or 2* (Plate 1). Such is, however, not always the case. In some instances the fluid extracted by continuous pressing, without rearrangement of the tissue-mass, may become less and less concentrated. This is seen, for example, in the series of extractions from cabbage leaves shown in *Diagram 3* (Plate 1). In other instances all of the fractions may be of about the same concentration, as is shown in *Diagram 4* (Plate 1).

The juice obtained from the "frozen residue" always, so far as our experience goes, shows a greater osmotic pressure than that for any of the samples extracted by direct pressing or for the juice from the "original frozen sample." Both of these conditions are to be expected from the fact that the individual fractions of sap obtained by pressure of the tissue-mass are almost invariably less concentrated than that from the "original frozen sample," and on the average are always so. We are not convinced, however, that the high values for the depression of the freezing point of the sap from the "frozen residue" may not be due, in part, to chemical changes occurring during the process of pressing.

Thus, the results secured fully substantiate the conclusions of Dixon and Atkins, that samples of sap pressed from unfrozen tissues cannot be taken as typical of the original concentration of the juices in the tissues. While the entire credit for this advance in the study of vegetable saps must, with the exceptions noted in their

review of the literature in the papers cited above, be given to Dixon and Atkins, it will be noted that our results somewhat extend theirs; in some minor regards, only, our results are not in full accord with theirs.

EXPLANATION OF PLATE 1

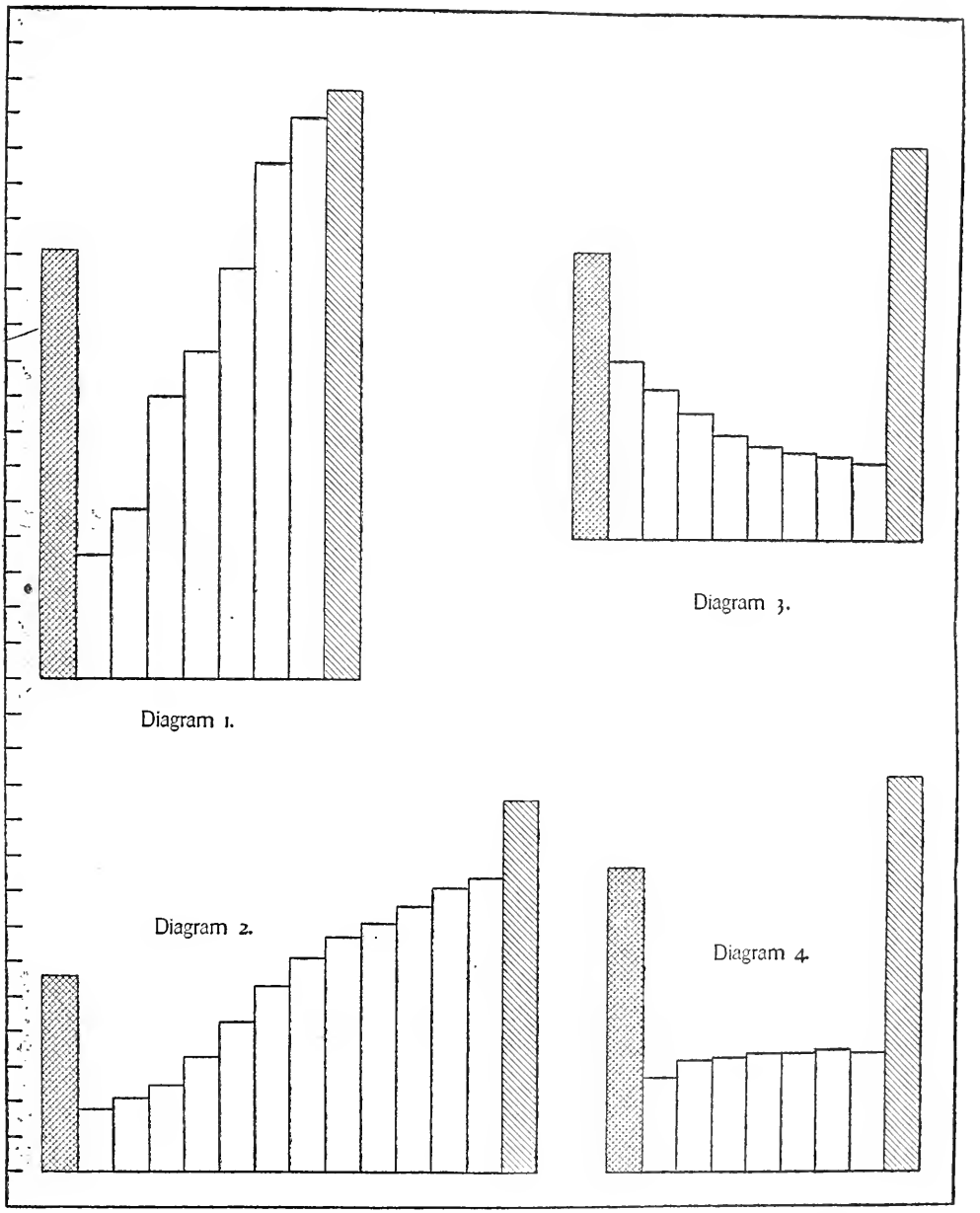
In all the Diagrams in Plate 1 the heights of the bars indicate the amounts of the lowering of the freezing-point, as shown on the scale to the left (1 unit = 0.1°). The cross-hatched bar to the left shows the concentration of the sap from the "original frozen sample." The lined column to the right shows that of the "frozen residue." The concentrations of the successive fractions extracted by pressure are shown (in order, left to right) by the unshaded bars.

Diagram 1. Sap from leaves from flowering plant of *Syringa vulgaris.*

Diagram 2. Sap from leaves of a greenhouse culture of seedlings of several dwarf varieties of *Pisum sativum.*

Diagram 3. Sap from inner leaves of Cabbage; determinations made in January.

Diagram 4. Sap from leaves, probably not quite mature, of *Symplocarpus fœtidus.*



GORTNER, LAWRENCE AND HARRIS: EXTRACTION OF SAP FROM PLANT TISSUES BY PRESSURE.

OXYGEN RELATIONS IN AUTOLYSIS

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(Received for publication, November 9, 1915).

The assumption has long been held[1] that autolysis is more or less intimately associated with oxidation. This association is suggested, in the first place, by the fact shown by Jacoby,[2] that liver lobes whose blood supply is interrupted, undergo autolysis. I have determined, in similar manner, that muscle, isolated from its nerve center, autolyzes[3] *in situ*. In the second place, the appearance of products of incomplete combustion, such as lactic acid,[4] suggests that oxygen may play a rôle in autolysis. Indeed, that oxygen supplied in optimum amounts may be the factor which inhibits the action of autolyzing enzyme in the normal condition of the tissue, is not an improbable hypothesis. It is the hypothesis which the present set of experiments was designed to meet, pro or con.

In the beginning it may be stated that, so far as these experiments *in vitro* were capable of throwing light, any relation of oxygen to autolysis could not be demonstrated. It is quite possible that such experiments *in vitro* do not represent the processes going on in a normally functioning tissue; but, until methods are available for more definitely following the metabolism of tissue *in vivo*, such attempts to study the rôle of the several factors involved in the present investigation must be our reliance.

The method of preparation of the digests was the same as that

[1] Hoppe-Seyler: Tübingen med.-chem. Untersuchungen, 1871, iv, p. 499.

[2] Jacoby: Ueber die fermentative Eiweissspaltung und Ammoniakbildung in der Leber; *Zeitschr. f. physiol. Chem.*, 1900, xxx, p. 170.

[3] Morse: Autolysis and involution; *Amer. Jour. of Physiol.*, 1915, xxxvi, p. 147.

[4] Magnus-Levy: Ueber die Säurebildung bei der Autolyse der Leber; *Beitr. z. chem. Physiol. u. Path.*, 1902, ii, p. 261.

previously used.[5, 6] The oxygen-compounds enumerated below were introduced into the digests as they rested in a Hearson incubator. Oxygen was introduced into duplicate jars of the digest as they stood in the incubator, the tube from a commercial cylinder, with reducer, leading through the thermometer-aperture in the top of the incubator, the thermometer having been removed. It was not found possible to estimate the amount of oxygen passed into the digests from the cylinder, but the bubbles were released at about a rate of two per second. The digests were shaken daily, sometimes several times a day.

It is conceivable that the application of oxygen immediately after its release from a pressure of 150 atmospheres and directed into the digest might have acted so that inhibition resulted, either from oxidation and consequent modification of the substrate, or by similar effects upon the enzyme. J. J. Thomson (Phil. Mag. 1903) has shown the condensation power of oxygen ions in cases of sudden release of pressure, but the ionization is low. No such inhibition is exhibited by the results in the present case.

It is conceivable, too, that the compounds and gas used here did not afford oxygen in a form available for use in the tissue. If the liver contains catalase, which seems to be the case,[7] peroxides, especially H_2O_2, would be rendered available; and, if the modern theory of oxidation is correct, such oxygen would be as normal a constituent as we could desire. Oxygen is principally molecular[8] under the conditions of these experiments. The case may be different for the peroxides used, since it is certain from the work of Loew,[9] Lepinois[10] and others that catalysis differs in different tissues and organisms, as judged by the guaiacum reaction.

[5] Bradley and Morse: *Jour. Biol. Chem.*, 1915, xxi, p. 209.

[6] Morse: The rôle of halogens as accelerators of tissue-enzyme action; *Ibid.*, 1915, xxii, p. 125.

[7] Dzierzgowiski: *Arch. des. Sc. biol. St. Petersburg*, 1909, xiv, p. 147.

[8] Ionization of $O_2 = 10^{-12} = 1/22$ mol. per liter, water being 1.1×10^{-7}.

[9] Loew: Catalase, a new enzyme of general occurrence; *Report No. 68, U. S. Dept. Agric.*, Washington, 1901.

[10] Lepinois: Sur les ferments solubles décomposant l'eau oxygénée; *Compt. rend. soc. biol.*, 1899, li, p. 401.

The following substances were used:

1. Oxygen gas, as described above.
2. Hydrogen peroxide, used in 10 percent sol. in the digest, *i. e.* approximately 25 cc. to 250 cc. of brei. The liquid was used from a small, hitherto unopened bottle, purchased locally.
3. Sodium peroxide, 5 percent sol.
4. Benzoyl peroxide synthesized in the laboratory from benzoyl chlorid and hydrogen peroxide by the Schotten-Baumann procedure[11, 12] of benzoylating; 5 percent sol.
5. Potassium permanganate, 1 percent sol. with the digest.

The results for autolysis are given below,[13] as cc. of $n/5$ ammonium hydroxid sol.

Condition	Beginning	24 hrs.	10 days
Control	10.9	11.6	12.1
Benzoyl peroxide	10.9	11.0	12.4
Sodium peroxide	10.9	11.5	11.8
Hydrogen peroxide	10.9	11.8	12.0
Potassium permanganate	10.9	11.8	12.0
Control for oxygen gas	11.4	12.3	14.0
Experiment with oxygen gas	11.4	12.8	15.6

[11] Schotten: *Ber. d. d. chem. Ges.*, 1890, xvii, p. 2545.

[12] Baumann: *Ibid.*, 1886, xix, p. 3218.

[13] Average of duplicate results.

ELECTRIC APPARATUS FOR THE AUTOMATIC CONTROL OF THE FLOW OF GAS[1]

SERGIUS MORGULIS

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(WITH PLATE 2)

(Received for publication, May 1, 1916)

There are many occasions in laboratory procedures when the automatic regulation of a gas current is highly desirable. This is particularly true of metabolism experiments where, for instance, oxygen must be supplied as rapidly as it is being used up by the organism. To insure a continuous and sufficient supply of oxygen in experiments of long duration, the attention of a special assistant is not infrequently required.

Being engaged, at present, in the construction of a respiration apparatus for the study of the gaseous metabolism of aquatic animals, attempts have been made to introduce, wherever possible, automatic regulators as time saving, as well as trouble saving, devices. In this note I wish to describe briefly an electrically controlled apparatus by means of which the admission of oxygen from a cylinder is effected automatically; and, while this has been designed for a special purpose, it is believed that the apparatus may be easily adapted to other laboratory uses.

The apparatus consists of three essential parts: a "pinch-cock," electromagnets and contact-makers (Plate 2). These will be described separately.[2]

A side view and top view of the first two parts are shown in

[1] Published by permission of the Commissioner of Fisheries.

[2] The apparatus has been made from the writer's sketches, but it is a pleasure to acknowledge that the refinement in the mechanical construction of the apparatus is due to the excellent workmanship of Mr. J. Becker, the mechanic in the Pharmacological Laboratory, who made it for me.

Figs. 1 and 2. The "pinch-cock" consists of a movable frame *e, f, g, h,* supported by two uprights, *c* and *d,* and two brass bars, *a* and *b.* The former is permanently fixed to the parallel rods, *g* and *h,* by means of pins. The latter, *b,* can be shifted freely over the rods, *g* and *h,* and is attached to *j,* which can be moved either way in a horizontal plane by means of the set screws *k* and *l.* A rubber tube, held in position by two supports, *n* and *o,* as can be seen in Fig. 2, passes between the bars *a* and *b,* the inner faces of which

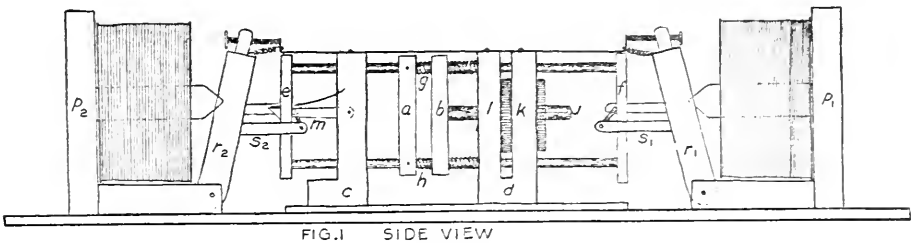


FIG.1 SIDE VIEW

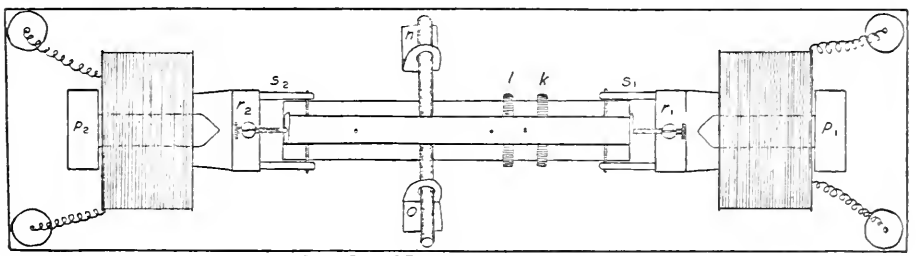


FIG.2 TOP VIEW

are rounded off so as not to injure the rubber tube. The lumen of the tube may be left entirely open, or it may be entirely closed, by varying the distance between the bars, *a* and *b,* with the set screws. In this way a permanent flow of gas at any desired rate can be secured. A further increase in the rate of delivery, or a complete shutting off of the current, is effected by shifting the frame, *e, f, g, h,* to the right or left. These movements are controlled by oppositely-placed powerful electromagnets. When the opening between the horizontal bars, *a* and *b,* has been once adjusted, it remains unchanged because on the one hand the set screws hold bar *b* securely fixed, while bar *a,* which is attached to the frame, is maintained in a fixed position by the catch *m.* By lifting that catch,

the entire frame shifts to the left, owing to the elasticity of the springs that extend between *a* and *d*; and a decompression of the lumen of the tube is thus effected. By pulling the frame from the opposite side, *a* and *b* are brought temporarily close together, compressing the lumen of the tube. This compression lasts only so long, however, as the pull is exerted upon the frame at *f*; for, as soon as the pull is released, the frame strikes back to its former position by the action of the springs, until it is checked by the catch *m*.

It is clear, from this description, that a current of gas under a pressure of, say, 2 to 4 lb. may be made to flow at a minimum rate, regulating this with the set screws; and, if necessary, the flow may be temporarily increased to its maximum capacity or temporarily cut off. It is also clear, of course, that if the set screws are adjusted so as to close off the lumen of the tube only two possibilities will be open; namely, the maximum delivery of gas, alternating with complete cessation of the flow. According to the special requirements of the case, either the three-phase or the two-phase regulation may be employed.

The electromagnets which control the movements of the frame, *e, f, g, h,* are mounted, together with the "pinch-cock," on a brass plate, as may be seen from Fig. 1 and 2. The construction of these electromagnets is somewhat peculiar and is calculated to obtain a maximum efficiency. The magnet consists of an L-shaped iron base, *p,* to which a ⅜ inch plate, *r,* also of iron, is pivoted so that it describes an arc in moving from the vertical to the horizontal position. A stout iron axis tapering at one end is firmly fixed to the vertical part of the base, and on this axis is set a spool bearing numerous windings of fine wire. The free tapering end of the axis fits into a pit of similar shape drilled into the movable iron plate. When an electric current is sent through the spool, the plate is very powerfully attracted to the axis and, owing to the fact that the pointed end protrudes into the plate, a strong pull is exerted from the start. The position of the movable plates from the frame, *e, f, g, h,* the amplitude of the pull, as well as the return to the original position when the electric current is discontinued, are secured by means of screws and springs, as is shown in Fig. 1 and 2. Each of the iron plates, *r,* bears upon its free surface a yoke-like structure, *s,* by means of

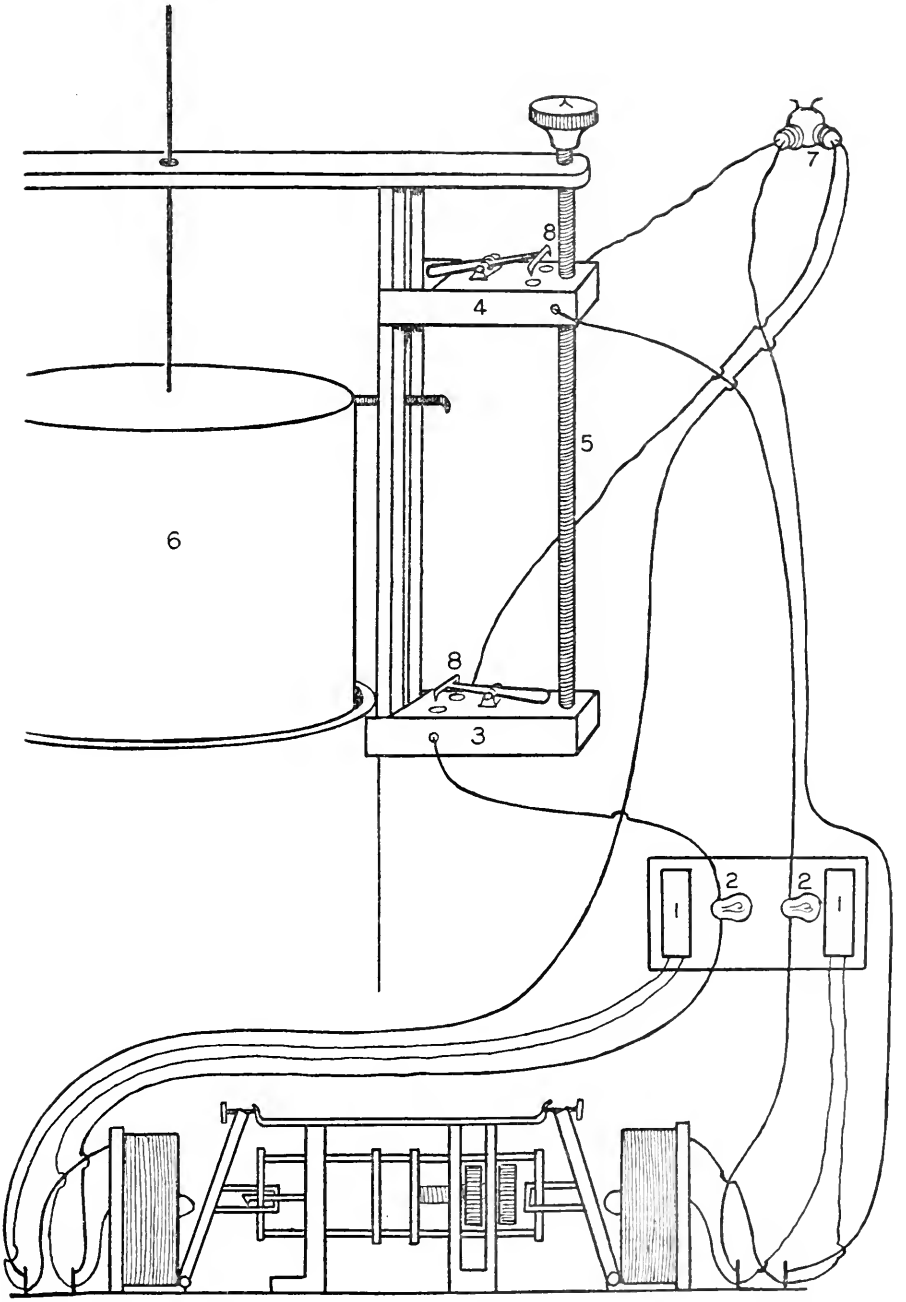
which it is interlocked with the frame, *e, f, g, h.* When the plate, r_2, is attracted, the yoke, s_2, moving upwards opens the catch, *m,* held down firmly by a spring. This causes the frame to shift to the left, as already explained, allowing an increased delivery of gas. This side movement of the frame brings bar *f* close to the cross piece of the yoke, *s,* of the opposite electromagnet. When this magnet is activated and attracted to the iron axis, it pulls strongly on the frame, shifting it back to the right and the catch, *m,* again clutches the bar, *e,* preventing the frame from striking back.

We have yet to consider the contact-makers, which, according to circumstances, bring into play either one or the other electromagnet. In the respiration apparatus I utilize, for this purpose, the spirometer, which is a light aluminum bell floating in a water-jacket formed by two concentric metal pipes. The bell, being exactly counterpoised, responds very quickly to changes in the volume of the air, dropping when the volume is diminished by the using up of oxygen, for instance, and rising when the volume increases. A small metal rod is soldered to the edge of the top of the bell, as will be seen from Plate 2, which passes through a narrow slit in the frame upon which the spirometer bell (6) is suspended. Two hard rubber blocks are attached to the frame: one (3) very near the base is fixed permanently, while the other (4) can be moved the entire length of the frame by means of a continuous screw (5). In this way any distance may be set between these two blocks. On the top of each block there are two little holes filled with mercury which is in contact with binding posts for the electric wires on either side of the block. The contact is effected by a small metal fork (8) with platinum teeth, which moves on a fulcrum set in the middle of the block. One end of the fork is made sufficiently heavy so that the part bearing the platinum points is always raised. When the spirometer bell, moving downwards, reaches a very low level, it presses with its hook-like projection upon the fork and causes its platinum points to dip into the mercury cups, thus closing the contact and sending the current through the left electromagnet. This releases the catch, *m,* and the tube is decompressed. The oxygen flows, now, at a maximum rate and the spirometer bell fills up rapidly, rising to the level at which the moveable contact-block has been set. As soon as it reaches this

point, the projection lifts the fork until the platinum points dip into the mercury, when a new contact is made and the current is sent through the opposite electromagnet. This now pulls the frame and shuts off the gas-flow. As soon as this contact is broken, the minimum oxygen delivery (which has been originally adjusted) is once more established. It will be observed that very little electric power is wasted in this process, as the current passes only at the time of the contact, which, in either case, is immediately broken.

In Plate 2 the entire apparatus is shown with the electrical connections. I use the street current directly and, by the use of a telephone condenser of 2 micro-farads (1) across the binding posts of each magnet and one ordinary lamp (2) in series, the contacts are made without any sparking. As the circuits are used alternately, the two magnets are supplied from the same socket (7).

While the apparatus here described has a definite purpose, it is evident that it may be employed with advantage for other functions. It would be an easy matter, for instance, to utilize the expansion of mercury for making the contacts and thus regulating the flow of lighting gas for the heating of incubators or drying ovens.



MORGULIS: ELECTRIC APPARATUS FOR THE AUTOMATIC CONTROL OF THE FLOW OF GAS

SANITARY STUDIES OF BAKING POWDERS

1. Is aluminium absorbable from bread, and similar food products, made with alum baking powder?

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(Received for publication, April 1, 1916)

Five years ago I published a paper, entitled "Some objections to the use of alum baking powder,"[1] from which the introductory paragraph is quoted below:

"During a period of about seven years I have occasionally conducted experiments on the effects of aluminium salts. These studies have convinced me that the use, in food, of alum or any other aluminium compound is a dangerous practice. That the aluminium ion is very toxic is well known. That 'aluminized' food yields soluble aluminium compounds to gastric juice (and stomach contents) has been demonstrated. That such soluble aluminium is in part absorbed and carried to all parts of the body by the blood can no longer be doubted. That the organism can 'tolerate' such treatment without suffering harmful consequences has not been shown. It is believed that the facts in this paper will give emphasis to my conviction that aluminium should be excluded from food."

Among the experiments above referred to, as having been conducted "during a period of about seven years," were those with House,[2] on *seedlings,* and with Steel,[3] and with Kahn,[4] on *dogs.*

[1] Gies: *Jour. Amer. Med. Assoc.,* 1911, lvii, p. 816.

[2] House and Gies: *Amer. Jour. Physiol.,* 1906, xv; Proc. Amer. Physiol. Soc., 1905, p. xix. (See a recent paper, on this subject, by Miyake: *Jour. Biol. Chem.,* 1916, xxv, p. 23.)

[3] Steel: *Amer. Jour. Physiol.,* 1911, xxviii, p. 94.

[4] Kahn: BIOCHEMICAL BULLETIN, 1911, i, p. 235.

The gist of our conclusions, from the results of these experiments, is indicated by the following four quotations:

I. "Compounds of aluminium, such as the chlorid, even when present in very minute proportions, are strong protoplasmic poisons and very toxic to growing plants" (*House*).

II. "When alum was administered in aluminium-free food to dogs, or when dogs ingested biscuits baked with alum baking powder, aluminium in comparatively large amounts promptly passed into the blood. . . . When aluminium chlorid was administered intravenously, from 5.55 percent to 11.11 percent of the aluminium passed from the blood into the feces during the three days immediately after the injection" (*Steel*).

III. "When biscuits baked with alum baking powder are fed in a mixed diet to dogs, aluminium passes in considerable amounts into the blood. Such absorbed aluminium circulates freely and, although it does not show a tendency to increase proportionately in the blood, it accumulates to some extent in various parts of the body. The bile contains a particularly large amount of aluminium. . . . Under the conditions of these (feeding) experiments, aluminium is absorbed in part and is excreted, to some extent, in both the bile and urine" (*Kahn*).

IV. "Two objections might be raised against this conclusion regarding the absorption of aluminium from the gastro-intestinal tract into the blood. It might be assumed that our analytic method was inaccurate. Such an assumption is always in order in the consideration of any method, for none is perfect. Our preliminary work with the analytic method employed and the checks against error that were instituted, give us complete confidence, however, in the *practical* accuracy of the process. If slight and unavoidable errors occurred, *we believe that, from the general nature of the method, they must have caused loss of aluminium and consequent diminution of the numerical result, rather than the reverse.*[5]

"It might also be urged that our figures representing the amounts of aluminium which passed into the blood are too small to mean anything. It might be thought that the proportions are too minute for the causation of deleterious effects. It might even be suggested that such small proportions of aluminium are beneficial because of the possible 'stimulating' action which traces of poisons frequently induce. But

[5] For further facts in this connection see Gies: Biochemical Bulletin, 1916, v, p. 189.

none of these assumptions could be shown to accord with the whole truth in the matter. The amount of aluminium in the blood at any moment, after the ingestion of aluminized food, is but a fraction of the quantity that may occur in the blood of the individual during a given hour or a given day—larger quantities circulate throughout the body meanwhile, under such conditions. Excretion seems to occur continuously in cases of this kind. If the aluminium which is thus carried into the blood were of any value to the organism, it is improbable that the absorption of a minute proportion of aluminium would be promptly followed by the elimination of much of it. The prompt excretion of aluminium under such circumstances implies a decided physiologic repugnance.

"We found, further, that absorbed aluminium circulated freely, but, as it did not show any pronounced tendency to accumulate in the blood, it is obvious that its full effects must have been registered outside of the circulation. The organism 'tolerates' a great amount of injury, but it has not been shown that the development of tolerance for aluminium is either a common achievement or a desirable attainment.

"It should not be forgotten that the influence of a given substance must be considered, in its practical aspects, from the standpoints of actual conditions attending its introduction into an organism. What are its effects on individuals, for example, who are temporarily ill or permanently diseased? Again, what effects are registered in a perfectly healthy individual, who takes a small quantity of the substance under consideration with similarly small quantities of equally toxic or even more noxious materials? What, for instance, may be said of the effect of aluminium from bread made with an alum baking powder, when the bread is eaten with butter colored by a 'coal-tar' dye; with jam sweetened by saccharin; with soup made from 'stock' preserved by sodium salicylate or salicylic acid; with peas greened by copper sulfate; with vegetables kept from spoiling by sodium benzoate or benzoic acid, in one case, by borax or boric acid in another; to say nothing of other deleterious substances, such as formaldehyd, sulfurous acid, sodium sulfite, 'ether flavors,' and the like, in various portions of an ordinary meal as it may happen to be served. Even if it may be reasonably urged that the effects of any one of these 'foreign' substances 'in the quantities eaten' are negligible, who can say that their *collective* action after such a meal is of no physiologic consequence? We frequently hear it said with assurance that 'people go on eating all these things without ever knowing it, and yet where is the case of

damage done by any of these products?' But may it not be asked in turn: Are not many cases of illness probably due to the effects of such substances in food, quite unknown to those who ascribe the sickness in any instance to a different cause? It is easy to understand that relatively very slight absorption of aluminium, day after day, may ultimately (as in chronic auto-intoxications) develop biochemical incoordinations leading to perverted function, defective structure, decreased resistance to disease, or other undesirable modifications of one or more qualities or parts of the body. How many people have been obviously injured by saccharin, for example? Perhaps millions have eaten it without noting any hurtful result. Nevertheless, saccharin has recently been officially declared a dangerous sweetening agent because it does exert injurious influences, and its use as a sweetener will soon be prohibited by law. Yet, if this decision had depended on authentic reports of cases of sickness arising from the ordinary use of saccharin as a sweetening substance, its prohibition would probably never have been announced. So it is with aluminium. Alum baking power may be injuring thousands without affording any obvious sign of damage. While doubt remains, its use should be avoided" (*Gies*).

The applicability, to people, of the foregoing inferences from the results of our experiments was rendered doubtful, two years ago, by a brief *preliminary* report, on this general subject, by the Referee Board of Consulting Scientific Experts of the U. S. Dep't of Agriculture.[6] In that report the Referee Board stated that *aluminium was not found in the blood* of four men who served as subjects in the Board's experiments.[7] The Referee Board concluded, also, that "alum baking powders are no more harmful than *any* (!) other

[6] Bulletin 103: U. S. Dep't of Agric., Apr. 29, 1914. A more complete report has not been published.

[7] The statement on this point in the Referee Board's report reads: "Following these experiments (*length of interval not indicated*) four men took 1 gm. of aluminum a day each for several days (*whether in aluminized food or otherwise is not indicated*)—corresponding to approximately 10 level teaspoonfuls of alum baking powder—and then their blood was tested to detect any aluminum that might be present in it. (*Amount of blood taken and method of estimation not stated.*) *No aluminum was found in the blood.*" (*Nothing stated about tests for aluminium in the urine.*) This quoted statement appears in the part of the report that summarizes the share of the work done by Prof. A. E. Taylor, from whose laboratory Schmidt and Hoagland published the method referred to (as theirs) in the succeeding papers (2–7) of this series, in this issue. (Schmidt and Hoagland: *Jour. Biol. Chem.*, 1912, xi, p. 387.)

baking powders," although the report presents no evidence that this opinion was based on the results of comparative experiments by the Referee Board, or by any investigator.

The disagreement between the Referee Board's negative results for absorption of aluminium into the blood (in *men*), and our own positive findings (for *dogs*), appears to be an important discordance. If our results in this connection are entirely wrong and the Referee Board's are wholly right, my deductions (quoted above) regarding the possible dangers attending the use of alum baking powder in food for people (based *mainly* on the toxicity of *absorbed* aluminium) are obviously unreliable.

In reflecting on the possible reasons for the discrepancy between our results and the findings of the Referee Board, I assumed that the negative data for absorption of aluminium, in the experiments by the Referee Board (on *men*), and our own positive results (on *dogs*), were correct observations within the limits of accuracy of the procedure followed for each group of experiments. I feared, however, that our own analytic method for aluminium was less efficient than that used by the Referee Board.[8] On the other hand, it seemed possible that the Referee Board did not take sufficient quantities of blood, in the individual tests, for the detection of small amounts of contained aluminium. I supposed, besides, that dogs might differ from people both in tendency and in ability to absorb aluminium under the conditions of the experiments now in review.

After concluding to conduct a further study of the facts in the case, I aimed to project the research along the following three main lines (*A–C*):

A. Ascertain, with the *independent* coöperation of several colleagues, the efficiency of the aluminium analytic procedure followed by Steel, and by Kahn, in comparison with the method that may now be the "best" for the quantitative determination of aluminium.

B. Determine the facts pertaining to absorption of aluminium into the blood, and its excretion into the urine, of *human* subjects, (*a*) through the agency of the aluminium analytic method found (*A*) to be the "best," (*b*) in both small and large volumes of blood and urine, and (*c*) with the *independent* collaboration of several colleagues.

[8] See foot-note 5.

C. Repeat, in at least one series of tests, the essential features of the experiments by Kahn (and Steel), on *dogs,* but use the aluminium analytic method newly adjudged to be the "best" (*A*).

In order to make this investigation comprehensive and particularly reliable, and completely to forestall any possible suspicion of prejudice on my part in favor of our previous findings, in case they were correct and would be confirmed, I planned to put each section of this research in charge of individuals or groups of workers ("units") that would be geographically, psychologically and professionally independent. I proposed, to each individual or group of workers involved, the solution of specific problems *without consultation with, or guidance from, me,* and without my divulging to any "unit" the name or names of, or the results obtained by, those in the other "units," while the work was in progress. It was aimed, in short, to make the work of all the "units" *coördinated but not concerted.*

A copy of my requests of, and suggestions to, one of the groups of workers involved, is published below. It *illustrates* the method of procedure referred to above, as applied to all the groups of workers concerned.

"*My proposal is, in general,* that you join a group of biological chemists in an investigation of certain aspects of the 'baking powder question' and that you coöperate in a study of the comparative values of the best of the available methods for the biochemical determination of aluminium. *This proposed study would involve the following conditions:*

"1. That it be conducted by you (and any assistants you would have) with entire independence of the other workers on the subject, you to be kept in ignorance of their names and results, and *vice versa,* until the joint completion of the work.

"2. Your report to me to be in the form of a finished paper for the Biochem. Bull.; to be printed in that journal after your approval of both galley and page proofs; and to be published nowhere else, *prior* to its appearance in the Biochem. Bull.

"It is intended to make this research far-reaching in scope, accurate in conduct, useful in public service, and creditable profession-

ally. The *independence* of each worker is calculated to facilitate chemical accuracy and to insure scientific reliability beyond question. Freedom to report separately each independent part of the research will assure every other desirable consideration.

"In this study of the comparative values of available methods for the determination of aluminium, you would be asked to ascertain *particularly* whether the method used by Steel (*Amer. Jour. Physiol.*, 1911, xxviii, p. 96), and by Kahn (BIOCHEM. BULL., 1911, i, p. 237), was as good as, better than, or inferior to, the method used by Schmidt and Hoagland (*Jour. Biol. Chem.*, 1912, xi, p. 387). This would involve comparisons of determinations of aluminium in standard aqueous solutions and in blood containing known proportions of added aluminium.

"In this memorandum I am suggesting merely the most general outlines of the proposed research. You would be free to ascertain the essential facts in your own way as to details. *If you endeavor to do the work with every purpose to make an earnest, faithful, and reliable, scientific contribution to this important symposium, you would meet every expectation I could entertain.*"

This particular phase of the general investigation was begun early in 1915 and has been in continuous progress, in one phase or another, ever since. The original plan has been extended to include a study of several types of baking powders.

The four succeeding papers of this series (2–5), in this issue, present the results obtained for section A of the research on the foregoing program, with supplementary comment, in a fifth (6), and a sixth (7), on the method found to be the "best" for the determination of aluminium in biological materials.[9] The four comparative papers (2–5) are published "in the original," in the order of their presentation, without revision of content or adjustment of form.[10]

[9] (2) Howe: BIOCHEM. BULL., 1916, v, p. 158; (3) Curtman and Gross: *Ibid.*, p. 165; (4) Steel: *Ibid.*, p. 173; (5) Smith and Hawk: *Ibid.*, p. 183; (6) Gies: *Ibid.*, p. 189; (7) Balls: *Ibid.*, p. 195.

[10] Some of the conventional revisions, on a typographical basis, to which manuscripts for the BIOCHEMICAL BULLETIN are usually subjected, were also withheld.

SANITARY STUDIES OF BAKING POWDERS

2. A comparison of the method proposed by the Association of Official Agricultural Chemists as modified by Steel, with that described by Schmidt and Hoagland, for the determination of aluminum in organic material.

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(Received for publication, July 10, 1915)

Introduction. The method used by Steel[1] and Kahn,[2] for the determination of aluminum in organic material, was compared with that described by Schmidt and Hoagland[3] for the same purpose. Steel, after examining various methods for the determination of aluminum in the presence of iron and phosphates, selected the one proposed by the Assoc. of Official Agric. Chem.[4] as the most accurate He modified this in that the iron was determined in an aliquot portion of the sol. to be analyzed, instead of in the combined, ignited, precipitate of aluminum and iron phosphates. Schmidt and Hoagland studied the conditions under which the Peters method for the precipitation of aluminum in the presence of iron could be used in accurate work.

I. The method used by Steel, as described by Kahn, was as follows: *Preliminary oxidation of organic material:* "The weighed tissue was placed in a Kjeldahl flask and conc. nitric acid sol. added to it. The flask was heated slowly at first and then more vigorously until the sol. became clear, when a moderate excess of nitric acid sol. was added and the liquid boiled down to a small volume. The fluid

[1] Steel: *Amer. Jour. Physiol.*, 1911, xxviii, p. 94.
[2] Kahn: BIOCHEM. BULL., 1911, i, p. 235.
[3] Schmidt and Hoagland: *Jour. Biol. Chem.*, 1912, xi, p. 387.
[4] Bull. 107, U. S. Dep't of Agric., 1907, p. 177.

was then treated with a fairly large vol. of conc. sulfuric acid sol. for the expulsion of the nitric acid and for the complete oxidation of any residual organic matter. The sulfuric acid mixture was boiled for at least 2 hr. after it became colorless, in order to eliminate NO_2. The residue was then dissolved in water, made up to vol., and the iron and aluminium determined.

Determination of iron and aluminum: "Obtain an aliquot portion of the available acid sol. and remove any contained silica. Mix the liquid with sodium phosphate sol. in excess of what is required to form normal aluminium phosphate. Add sufficient ammonium hydroxid sol. to effect complete precipitation of the aluminium phosphate after thorough stirring. Then add hydrochloric acid sol., drop by drop, until the precipitate completely dissolves. Heat the liquid to about 50° C. and mix with it, at that temp., a considerable excess of 50 percent ammonium acetate sol. and also 4 cc. of 80 percent acetic acid sol. As soon as the precipitate of aluminium phosphate (mixed with iron phosphate) has sedimented, collect it on an ashless filter, wash it with hot water, ignite it and then weigh the residue.

"In an aliquot portion of the original liquid determine the amount of iron by the Zimmerman-Rheinhardt[5] method. The calculated amount of $FePO_4$ is then subtracted from the weight of the mixed $AlPO_4$ and $FePO_4$."

In the analyses with this method the above procedure was followed exactly as described. It was necessary, however, occasionally to heat the filtrate to boiling in order to obtain a complete precipitation of the phosphates.

II. Schmidt and Hoagland give the following description of their method: An aliquot portion of the sol. obtained after the oxidation of the tissues according to the method described by Kahn[6] (see above) is measured into a beaker, the silica dehydrated and filtered off. The filtrate obtained is diluted to "about 300 cc. and should contain approximately 2.5 cc. of conc. hydrochloric acid. Tin is precipitated from the hot sol. by hydrogen sulfid and filtered off. Di-ammonium hydrogen phosphate is added to the sol.—0.5 gm. for each 100 mg. of aluminum phosphate present. The sol. is heated and, while hot, 5 gm.

[5] Mixer and DuBois: *Jour. Amer. Chem. Soc.*, 1895, xvii, p. 405.

[6] Schmidt and Hoagland obtained their sol. for analysis by ashing the tissues and then dissolving the residue.

of ammonium thiosulfate (in sol.) and, after several minutes, 6 to 8 gm. of ammonium acetate (in sol.) and 4 cc. of strong acetic acid are added. Heating is continued for about half an hour to expel SO_2, the precipitate allowed to settle, filtered and washed once by decantation. The precipitate is redissolved in 2 to 2.5 cc. of conc. hydrochloric acid, the sol. diluted to about 300 cc., 0.5 gm. of ammonium phosphate added for each 100 mg. of aluminum phosphate present and the aluminum precipitated as described above. The precipitate is filtered and washed several times with hot water to remove chlorides, and ignited in a transparent silica crucible until constant weight is reached to remove excess of P_2O_5."

Experimental. As a preliminary procedure, blank determinations were carried out with both methods on dist. water, using the quantities of solutions and reagents required for the precipitation of approximately 10 mg. of aluminum phosphate. The accompanying results were obtained (Table 1):

TABLE I

Comparative data pertaining to the weights of material obtained in blank determinations

A. O. A. C. (Steel) Method Milligram	Schmidt-Hoagland Method Milligram
1.0	0.7
0.6	0.6
0.8	0.6
0.8	0.6
0.9	0.5

Sol. of pure aluminum sulfate and ferric chlorid were used in comparing the two methods under investigation. Quantities of aluminum sulfate sol. were weighed out such that the weight of aluminum phosphate obtained upon precipitation would be approximately 10 mg. When ferric chlorid was added it was in amounts which gave approximately 20 mg. of the phosphate.

ALUMINUM SULFATE. Analysis of the aluminum sulfate sol. gave the results in Table 2:

TABLE 2

Comparative data pertaining to the weights of $AlPO_4$, in milligrams, obtained upon analysis of pure solutions of $Al_2(SO_4)_3$

A. O. A. C. (Steel) Method		Schmidt-Hoagland Method	
Found Milligrams	Theoretical Milligrams	Found Milligrams	Theoretical Milligrams
13.0	13.0	13.0	13.0
12.9		12.9	
12.7		13.0	
12.8		13.2	

ALUMINUM SULFATE AND FERRIC CHLORID. Analyses of mixtures of aluminum sulfate and ferric chlorid in dist. water gave the results in Table 3:

TABLE 3*

Comparative data pertaining to the weights of $AlPO_4$, in milligrams, obtained upon analysis of pure solutions of $Al_2(SO_4)_3$ and Fe_2Cl_6

A. O. A. C. (Steel) Method		Schmidt-Hoagland Method	
Found Milligrams	Theoretical Milligrams	Found Milligrams	Theoretical Milligrams
12.8	13.1	13.4	13.9
14.0	14.1	16.1	16.4
16.7	16.5	16.8	17.4
14.6	14.6	13.8	13.7

* In one set of determinations by the Schmidt-Hoagland method, the ammonium acetate added was not sufficient to reduce the acidity to the point where the aluminum would precipitate. In these cases the ignited residues obtained were equal to those found in the blank determinations reported above.

ANALYSIS OF BLOOD. *Dog blood.* Two dogs were bled completely, under local cocain anesthesia. The blood was drawn, according to the procedure of Steel, into weighed flasks. Five gm. of ammonium oxalate were placed in the bottom of each flask to prevent the clotting of the blood. To one sample a weighed portion of the standard aluminum sulfate sol. was added, the other portion was analyzed as such. The digestion was carried out with nitric and sulfuric acids. It was found more convenient to add the blood to the hot nitric acid in small portions, heating after each addition until the liquid was clear, than to add the nitric acid to the total quantity of blood as proposed by Steel. The analytic results in Table 4 were obtained.

TABLE 4

Comparative results of the analysis of fresh dog blood, as such and after the addition of $Al_2(SO_4)_3$, expressed as milligrams of $AlPO_4$

A. O. A. C. (Steel) Method		Schmidt-Hoagland Method	
Found	Theoretical	Found	Theoretical
Dog I. Blood (Blank)			
Milligram		Milligram	
1.2		1.2	
0.6		0.8	
0.7		0.8	
0.3		0.8	
Dog II. Blood + $Al_2(SO_4)_3$			
Milligrams	Milligrams	Milligrams	Milligrams
8.4, 8.0, 7.7, 8.0	9.0	9.0, 8.7, 8.7, 9.0	9.0

TABLE 5*

Comparative data pertaining to the weights of $AlPO_4$, in milligrams, obtained from dried goat blood to which $Al_2(SO_4)_3$ had been added

A. O. A. C. (Steel) Method			Schmidt-Hoagland Method	
Found	Theoretical		Found	Theoretical
Goat Blood (I)				
Milligrams	Milligrams		Milligrams	Milligrams
10.4, 10.3, 9.6, 10.3	8.8		11.0, 11.2, 10.8, 11.1	8.8
Goat Blood (II)				
Milligrams	Milligrams		Milligrams	Milligrams
8.8, 8.7, 8.3, 8.5	8.9		9.6, 9.9, 9.2, 9.6	8.9

* The large discrepancy between the amount of aluminum added and that found indicates the presence of aluminum in the original sample of blood. A smaller sample of blood was used in the case of the second set of determinations. A second sample of dried goat blood was obtained from the same dealer and analyzed for aluminum according to the method of Schmidt and Hoagland. The following results were obtained (percent of aluminum, as phosphate): 0.056, 0.057, 0.062, 0.051, 0.056, 0.058 (average 0.055). This sample, like the one used in studying the methods of analysis, had been specially ground. Extraneous material obtained from the powder, by passing it through a 100-mesh sieve, suggests that the aluminum found resulted from contamination.

Goat blood. Samples of dry, pulverized goat blood, obtained in the market and of doubtful purity, were oxidized as above, after the addition of weighed amounts of the aluminum sulfate sol. The analytic results in Table 5 were obtained.

Discussion and conclusions. Data have been presented showing the comparative results obtained with two methods for the determination of aluminum in the presence of iron; the method proposed by the Assoc. of Official Agric. Chemists as modified by Steel, and that described by Schmidt and Hoagland. The comparison is on the basis of small amounts of aluminum (equivalent, approximately to 10 mg. of aluminum phosphate or 4 mg. of aluminum oxide), such as would probably be determined in the analysis of tissues.[7, 8]

The results of the experiments show an agreement between the two methods when aluminum is determined in sol. containing a pure aluminum salt and in sol. containing mixtures of pure aluminum and iron salts. The analysis of blood to which aluminum sulfate had been added gave results which were slightly lower in the case of the method proposed by the Assoc. of Official Agric. Chemists as modified by Steel.

Considering the two methods from the point of view of manipulation, the method of Schmidt and Hoagland commends itself particularly. The combined precipitate of sulfur and of aluminum phosphate is readily filtered off and washed. We experienced some difficulty at the beginning of our experiments with regard to the amount of ammonium acetate required for precipitation of the aluminum. Not enough ammonium acetate was added to obtain a precipitate (the presence or absence of small precipitates of aluminum phosphate would be masked by the sulfur) because of the acidity of the sol. This difficulty disappeared as soon as the proper conditions were once established.

The method proposed by the Assoc. of Official Agric. Chemists, as modified by Steel, presented considerable difficulty in the matter of manipulation. Following the directions as given, we did not always obtain complete precipitation at 50° C. It was necessary to heat the filtrate to boiling to obtain the final traces of the phosphates.

[7] Steel: *Loc. cit.*

[8] Kahn: *Loc. cit.*

The data recorded for the pure sol. of aluminum and iron are those obtained after a number of attempts in which the results did not approach the accuracy finally attained. With the small amounts of aluminum and iron phosphates we did not experience the usual trouble in washing the precipitate on the filter.

From the data reported it is concluded that, for small amounts of aluminum in the presence of iron and phosphates, the method proposed by the Assoc. of Official Agric. Chemists, as modified by Steel, gives values which are essentially the same in the case of solutions of pure salts of aluminum, but slightly lower when applied to blood to which aluminum sulfate has been added, when compared with the results obtained with the method of Schmidt and Hoagland and with the quantities of aluminum known to be present.

SANITARY STUDIES OF BAKING POWDERS

3. A study of the methods for the quantitative determination of aluminum in blood

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The object of this investigation was a comparative study of the best of the available methods for the quantitative determination of aluminum in biological material. To this end it was desirable first to experiment with known mixtures of standard solutions of aluminum and iron.

Preparation and standardization of sol's. ALUMINUM SOL. Sixty-two gm. of $Al_2(SO_4)_3 \cdot 18H_2O$ (Kahlbaum) were dissolved in 5 l. of dist. water containing 50 cc. of H_2SO_4 (1 : 1). This gave a sol. with an aluminum value of approximately 1 cc. = 1 mg. The sol. was then standardized; the results are given in Table 1.

TABLE 1

Data pertaining to the standard aluminum solution

Test No.	Solution taken Cc.	Al found Milligrams
1	50	55.5
2	50	55.5
3	50	55.6
4	50	55.5
5	50	55.4
6	50	55.5
7	50	55.4
8	50	55.6
9	50	55.5

Mean value: 1 cc. = 1.11 mg. of Al

I. In Det'ns 1, 2, 3 (Table 1), definite volumes of the sol. were evaporated to dryness in a weighed platinum dish, heated in an oven,

ignited to Al_2O_3 over a blast and weighed as such. After digestion with HCl and water, the precipitate gave only a very faint test for sulfate, showing that the decomposition to Al_2O_3 was complete.

II. In Det'ns 4, 5, 6, 7, 8, and 9 (Table 1), the aluminum in each case was precipitated by NH_4OH as $Al(OH)_3$ in the presence of NH_4Cl, ignited and weighed as Al_2O_3. In Det'ns 4, 5, 6, 7, the ignitions were made in porcelain; in 8 and 9, platinum was used. The precipitates in Det'ns 5, 6, and 9, were not washed completely free of chlorides, as were the others, but no noticeable variation occurred on this account.

SOL. FOR THE TITRATION OF IRON BY THE MODIFIED ZIMMERMAN-RHEINHARDT METHOD.[1]

A.—$KMnO_4$: *n*/50.

B.—HCl: 1 part of water to 1 part of HCl (sp. gr., 1.2).

C.—$SnCl_2$: 450 gm. of the salt in 450 gm. of HCl (sp. gr., 1.2), and diluted to 2 l.

D.—$HgCl_2$: saturated solution.

E.—Preventative sol.: 160 gm. of $MnSO_4 \cdot 4H_2O$ dissolved in 1,750 cc. of water, plus 330 cc. of H_3PO_4 (sp. gr., 1.7) and 320 cc. of H_2SO_4 (sp. gr., 1.84).

The Zimmerman-Rheinhardt method is conducted as follows: Heat the HCl sol. of iron (which should not be greater than 50 cc. in vol.) to boiling. While hot add $SnCl_2$, drop by drop, till colorless, then one drop in excess. Add 10 cc. of $HgCl_2$ sol., dilute to 500 cc. and add 6–8 cc. of preventative sol. Titrate with $KMnO_4$ to first appearance of pink that lasts for 20 seconds.

$KMnO_4$ sol. (*n*/50). This sol., used in the above method, was standardized as follows.

(*a*) Against standard iron wire by sol. in HCl (1–1), reduction and titration by the above method. (*b*) Against Mohr salt (Kahlbaum) by sol. in water and titration in the presence of H_2SO_4. (*c*) Against $Na_2C_2O_4$ (Bureau-of-Standards Sample No. 40), titrated hot in the presence of H_2SO_4 to first lasting appearance of pink.

Concordant results were obtained by these methods. Since the work described in this paper covered a period of several months, the

[1] Mixer and DuBois: *Jour. Amer. Chem. Soc.*, 1895, xvii, p. 405.

iron titer of the sol. changed slightly. This was corrected by re-standardizing the sol. at the time it was used for the determination of the iron value of the blood.

$FeCl_3$ sol. Five l. of a sol., 1 cc. = 1 mg. of Fe (approximately) containing 1 percent of HCl (sp. gr., 1.2) was standardized as follows:

(*a*) Fifty cc. were evaporated in a porcelain dish with 5 cc. of H_2SO_4 (sp. gr., 1.84) until SO_3 fumes were produced, then transferred to a weighed platinum dish, evaporated to dryness and ignited to Fe_2O_3 at a low red heat.

(*b*) Titration of 10 portions (5 of 25 cc., 5 of 50 cc.) against the standard $KMnO_4$ sol. by the modified Zimmerman-Rheinhardt method.

The results of these 11 determinations did not vary by more than 0.01 mg. for the value of 1 cc. in terms of iron. The mean of these 11 experiments gave a value of 1 cc. = 1.098 mg. for the iron sol.

Comparison of methods. Of the methods proposed for the determination of aluminum in biological material, two deserve consideration; they are the method of Steel[2] and that of Schmidt and Hoagland.[3]

STEEL'S METHOD.[4] "Obtain an aliquot portion of the available acid sol. (after oxidation) and remove any contained silica. Mix the liquid with sodium phosphate sol. in excess of what is required to form normal aluminum phosphate. Add sufficient ammonium hydroxide to effect complete precipitation of the aluminum phosphate after thorough stirring. Then add hydrochloric acid sol., drop by drop, until the precipitate completely dissolves. Heat the liquid to about 50° C. and mix with it, at that temperature, a considerable excess of 50 percent ammonium acetate sol. and also 4 cc. of 80 percent acetic acid sol.

[2] Steel: *Amer. Jour. of Physiol.*, 1911, xxviii, p. 96.

[3] Schmidt and Hoagland: *Jour. Biol. Chem.*, 1912, xi, p. 387.

[4] The method proposed by Steel, although a modification of the official method (U. S. Dept. of Agric., Bull. 107, p. 177), contains a sufficient number of novel features to warrant its consideration as a separate method. We have, therefore, designated it throughout this article as Steel's method. Compared with the official method, the procedure used by Steel is decidedly shorter and as its shortcomings are not apparent, our experimental study was confined to a comparison of the Schmidt-Hoagland method with that of Steel, instead of with the official method.

As soon as the precipitated aluminum phosphate (mixed with iron phosphate) has sedimented, collect it on an ashless filter, wash it with hot water, ignite it and then weigh the residue. In an aliquot portion of the original acid liquid determine the amount of iron by the Zimmerman-Rheinhardt method.[5] The calculated amount of $FePO_4$ is then subtracted from the weight of the mixed $AlPO_4$ and $FePO_4$."

This method was followed with but one exception. Enough sodium phosphate was added to form an excess over that required to form *both* $AlPO_4$ and $FePO_4$. This is a necessary correction probably accidentally omitted from Steel's description.

The results obtained by this method, with mixtures of $FeCl_3$ and $Al_2(SO_4)_3$, are given in Table 2.

TABLE 2

Data pertaining to results obtained with Steel's method

No.	Taken		Theory			Found	Loss, milligrams
	Fe, milligrams	Al, milligrams	$AlPO_4$, milligrams	$FePO_4$, milligrams	Sum: $AlPO_4 + FePO_4$, milligrams	Sum: $AlPO_4 + FePO_4$, milligrams	
*a*1	54.9	27.7	125.1	148.3	274.3	248.3	26.0
*a*2	54.9	27.7	125.1	148.3	274.3	258.2	16.1
*a*3	54.9	27.7	125.1	148.3	274.3	251.9	22.4
*b*4	54.9	27.7	125.1	148.3	274.3	254.2	20.1
*a*5	54.9	12.2	55.0	148.3	203.3	176.4	26.9
*c*6	54.9	16.6	75.0	148.3	223.3	188.4	34.9

(*a*) Ignited in porcelain. (*b*) Ignited in platinum. (*c*) Ignited in transparent silica.

The precipitations were made in a vol. of 300–400 cc. The precipitates were washed free of chlorides only, no attempt being made to wash free of phosphates since this would have resulted in effecting the hydrolysis of the $AlPO_4$ and $FePO_4$.[6] The wash-water contained a small amount of sodium acetate to prevent as much as possible such hydrolysis. In Det'ns 3 and 4 (Table 2), the washing was not completed, the runnings giving a decided test. This was done to determine whether the losses as shown in Det'ns 1 and 2 were due to hydrolysis during the process of washing free from

[5] Mixer and DuBois: *Loc. cit.*

[6] Caven: *Jour. Soc. Chem. Ind.*, 1896, xv, p. 17; Cameron and Hurst: *Jour. Amer. Chem. Soc.*, 1904, xxvi, p. 885.

chlorides. The results obtained indicate that some other error was responsible for the loss, in addition to the possibility of hydrolysis. Careful qualitative tests for both iron and aluminum, in the filtrates after each precipitation, were negative.

The effect of ignition as a possible source of error was next considered. The known stability of $AlPO_4$, even at very high temp., caused attention to be turned to the effect of ignition on $FePO_4$. Nothing could be found in the literature on this subject. The experiments in Table 3 were made with sol. of pure $FeCl_3$.

TABLE 3

Data pertaining to the instability of $FePO_4$ at high temperatures

No.	Taken: Fe, milligrams	Theory: $FePO_4$, milligrams	Found: $FePO_4$, milligrams	Recovered: fusion and titration: Fe, milligrams
1	54.9	148.3	132.0	—
2	54.9	148.3	136.5	55.3
3	54.9	148.3	133.1	55.2

The procedure was identical with that employed for the mixtures (Table 2). The results of these experiments clearly show that the observed losses were due to the instability of the $FePO_4$.

Fusion of the ignited precipitates with Na_2CO_3, followed by sol. of the melt in HCl and titration of the iron after reduction, showed (Det'ns 2 and 3, Table 3) that all the iron was in the precipitate. Phosphoric acid must therefore be lost, either by hydrolysis or on ignition, or in both processes.

The results of the above determinations (Tables 2 and 3) require the rejection of the method of Steel on purely theoretical grounds.

It was thought necessary, however, before passing final judgment on the inaccuracy of Steel's method, to run a number of determinations with blood to which definite amounts of aluminum had been added, in order to discover if any compensating errors occurred in the entire process which might cause a correct result to be obtained. The method followed in oxidizing the blood was that given by Steel.[7] The blanks were of necessity run by the method of Schmidt

[7] Steel: *Loc. cit.*

and Hoagland[8] (see later) and showed no aluminum in the dog or ox blood used in this work. The results are given in Table 4.

TABLE 4

Data pertaining to the determination of aluminum in blood by Steel's method

Animal	Blood, grams	Al taken, milligrams	Iron present by titration, milligrams	Theory: $AlPO_4 + FePO_4$, milligrams	Found: $AlPO_4 + FePO_4$, milligrams
Dog.....	360	22.2	110.2	397.9	328.2
Ox.....	600	4.4	171.7	484.0	412.7

The low results shown in the above table conclusively prove the unreliability of the method.

METHOD OF SCHMIDT AND HOAGLAND.[9] "The vol. at this point should be about 300 cc. and contain about 2.5 cc. of conc. HCl. Diammonium hydrogen phosphate is added to the sol.—0.5 gm. for each 100 mg. of $AlPO_4$ present. The sol. is heated, and while hot 5 gm. of $(NH_4)_2S_2O_3$ (in sol.) and after several minutes 6–8 gm. of $NH_4C_2H_3O_2$ (in sol.) and 4 cc. of strong acetic acid are added. Heating is continued for about ½ hr. to expel SO_2, the precipitate allowed to settle, filtered, and washed once by decantation. The precipitate is redissolved in 2–2.5 cc. of conc. HCl, the sol. diluted to 300 cc., 0.5 gm. of $(NH_4)_2HPO_4$ added for each 100 mg. of $AlPO_4$ present and the aluminium again precipitated as described above. The precipitate is filtered and washed several times with hot water to remove chlorides and ignited in a transparent silica crucible, until constant weight is reached, to remove excess of P_2O_5."

The above method was followed exactly. Silica crucibles were used for the ignition of the $AlPO_4$. The results obtained with pure mixtures of iron and aluminum are given in Table 5 and leave nothing to be desired.

The filtrations are extremely rapid and the ignitions proceed very smoothly, requiring no special precautions.

[8] Schmidt and Hoagland: *Loc. cit.*

[9] Schmidt and Hoagland: *Loc. cit.*

TABLE 5

Data pertaining to the determination of aluminum by the Schmidt-Hoagland method

No.	Taken		Theory	Found
	Fe, milligrams	Al, milligrams	$AlPO_4$, milligrams	$AlPO_4$, milligrams
1	54.9	27.7	125.1	125.2
2	54.9	27.7	125.1	125.2
3	54.9	27.7	125.1	125.3
4	54.9	11.1	50.0	50.2
5	54.9	5.5	25.0	25.1

In Table 6 are given the results obtained, with this method, with dog and ox bloods[10] to which definite quantities of aluminum had been added.

TABLE 6

Data pertaining to the determination of aluminum in blood by the Schmidt-Hoagland method

Animal	Taken		Theory	Found	
	Blood, grams	Al, milligrams	$AlPO_4$, milligrams	$AlPO_4$, milligrams	Al, milligrams
Dog.....	360	11.1	50.0	49.5	11.0
Ox.....	987	4.4	20.0	19.4	4.3

It was not thought necessary to investigate the method of the Dep't of Agric., for the reason that, even if it did yield as accurate results as those obtained above by the method of Schmidt and Hoagland, the longer time and the number of different operations required, as compared with the method of Schmidt and Hoagland, would cause its rejection. In the method of Schmidt and Hoagland a direct gravimetric estimation of aluminum is made by a procedure involving two precipitations and one ignition. The official method, on the other hand, requires a precipitation of the iron and aluminum as phosphate, fusion of the precipitate, and an estimation of the contained P_2O_5; finally a volumetric determination of the iron in a separate portion calling for a standard sol. of $KMnO_4$. This procedure necessitates at least three precipitations, two ignitions and weighings, and one titration. It is evident, therefore, that all the objections to Steel's method on the score of technique apply here

[10] The blood was oxidized by the method of Steel: *Loc. cit.*

with greater force, although the method has a correct theoretical basis.

Conclusions. I. The method of Steel has been shown to be unreliable, due to the instability of $FePO_4$. For the determination of small quantities of aluminum in the presence of relatively large amounts of iron, the method is unsatisfactory owing to the increasing error occasioned by the latter.

II. Accurate results were obtained by the method of Schmidt and Hoagland both in pure sol. and in blood.

III. From the point of view of technique, the method of Schmidt and Hoagland is superior to that of Steel for the following reasons:

(*a*) A direct gravimetric determination of aluminum is effected. No volumetric sol. or operations are required and the aluminum is *not* found by difference (thus taking the sum of the errors).

(*b*) The determination is made on the entire sample, not on an aliquot portion of the sol. as in Steel's method and, as a consequence, the error in dealing with small amounts is thus materially decreased.

(*c*) The tedium of washing the precipitates is to a great extent avoided without any sacrifice of accuracy.

SANITARY STUDIES OF BAKING POWDERS

4. The determination of aluminum in the presence of iron and organic matter

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Contents

I. Introduction. A few years ago the author (1), at the suggestion of Dr. Gies, undertook a study of the absorption of aluminum from aluminized foods. In the course of this research it became necessary to make a careful comparative study of the best methods for the estimation of aluminum. The details of this study of the methods were not published in connection with the data on absorption of aluminum, but the following statements were made: "After several trials of all the standard methods had been com-

pleted, the method adopted by the Assoc. of Official Agric. Chemists (2), with a slight modification, was chosen. . . . This method was followed precisely with one exception: instead of fusing the combined phosphates (after ignition) with sodium carbonate, the iron was determined by the Zimmerman-Rheinhardt method (3) in an aliquot portion of the original acid sol. The calculated amount of $FePO_4$ was subtracted from the combined weights of $AlPO_4$ and $FePO_4$. *Many determinations were made by this method on mixtures of pure solutions of ferric chlorid and alum, and perfectly accurate results were obtained.*"

Later Dr. Max Kahn (4), while working on a similar problem, re-verified the accuracy of the method chosen by Steel (5).

The principal objection to the method is the length of time required to perform it. This factor has led other analysts to seek a shorter but equally accurate method. In 1912, Schmidt and Hoagland (6) published a method which they claimed to be comparatively quick and accurate.

II. Experimental work. 1. REAGENTS AND APPARATUS EMPLOYED. The reagents used in this work were selected with the greatest care and tests were made to verify their purity. The potassium permanganate sol. used was an old sample of good quality. The sodium oxalate used in standardizing the potassium permanganate sol. was a "Bureau-of-Standards standard sample No. 40." All the pipettes, burettes, and volumetric flasks used were standardized before using.

The following reagents were made up before starting the analytical experiments:

A.—Potassium permanganate solution: $n/40$.

B.—Stannous chlorid: 50 gm. of the pure crystallized salt were dissolved in 100 cc. of hot conc. hydrochloric acid and made up to 1 l. with dist. water.

C.—Mercuric chlorid: A cold saturated solution.

D.—Preventive sol.: (*a*) 100 gm. of manganese sulfate were dissolved in 500 cc. of water; (*b*) 200 cc. of H_2SO_4 were poured into 300 cc. of water and 500 cc. of syrupy phosphoric acid (1.3 sp. gr.) added; then (*a*) and (*b*) were mixed.

E.—Ferric chlorid: 5 gm. of $FeCl_3$ were dissolved in dist. water in a 500 cc. flask and made up to volume.

F.—Sodium alum: 20 gm. of sodium alum were dissolved in dist. water and made up to a liter.

G.—Standard blank sol.: 25 gm. of sodium phosphate, 15 gm. of potassium chlorid, 11 gm. of calcium chlorid, and 11 gm. of magnesium chlorid, were mixed with 800 cc. of dist. water and just enough hydrochloric acid to effect sol. The mixture was then made up to 1 l.

2. Standardization of the $KMnO_4$ sol. The potassium permanganate used for all of this work was an old, approximately $n/40$, sol., which had been made up over a year previously. A portion of this sample was filtered and diluted to $n/40$ strength for use. The diluted permanganate sol. was standardized against a $n/40$ sol. of oxalic acid, and against weighed portions of sodium oxalate.

A. Standardizing with oxalic acid. In preparing the $n/40$ oxalic acid sol., 0.7878 gm. of oxalic acid were dissolved in 500 cc. of water.

(*a*)	20 cc. of the $n/40$ oxalic acid						required	20.80 cc. of the $KMnO_4$.					
(*b*)	20	"	"	"	"	"	"	"	20.75	"	"	"	"
(*c*)	20	"	"	"	"	"	"	"	20.80	"	"	"	"

B. Standardizing with sodium oxalate. In standardizing the permanganate sol. with sodium oxalate, the conditions outlined in the "U. S. Bur. of Standards' Circular No. 40" (7) were followed.

(*a*)	0.0335 gm. of sodium oxalate						required	20.80 cc. of the $KMnO_4$.					
(*b*)	"	"	"	"	"	"	"	20.85	"	"	"	"	
(*c*)	"	"	"	"	"	"	"	20.80	"	"	"	"	

The average of the six tests equals 20.8. A "blank" on the reagents used in the above tests indicated absence of all oxidizable substances. Therefore, 1 cc. of the $KMnO_4$ sol. had a value of 1.93 mg. of Fe_2O_3.

3. Estimation of the iron in the standard $FeCl_3$ sol. The iron was determined in the standard sol. first by the Mixer and DuBois (8) modification of the Zimmerman-Rheinhardt method, and second, by Jones and Jeffrey's (9) modification of the Zimmerman-Rheinhardt method. The following results were obtained:

First method: 10 cc. of the $FeCl_3$ sol. required 17.70 cc. of the $KMnO_4$
" " " " " " " " 17.75 " " " "
Second " " " " " " " " 17.75 " " " "
" " " " " " " " 17.70 " " " "
Average 17.72

Therefore, 1 cc. of the $FeCl_3$ sol. is equivalent to 3.42 mg. of Fe_2O_3.

4. ESTIMATION OF THE IRON IN THE STANDARD $FeCl_3$ SOL. IN THE PRESENCE OF SODIUM ALUM. 10 cc. of the $FeCl_3$ sol. were mixed with 10 cc. of the 2 per cent. sol. of sodium alum; then the mixture was analyzed according to Jones and Jeffrey's (10) modification of the Zimmerman-Rheinhardt method, with the following results:

(*a*) 17.70 cc. of $KMnO_4$ sol. were required.
(*b*) 17.75 " " " " " "

These results show that the method is absolutely accurate in the presence of aluminum.

5. ESTIMATION OF IRON IN THE STANDARD $FeCl_3$ SOL. BY THE UNMODIFIED A.O.A.C. METHOD. The only advantage of the modified method (Steel's) over the original A.O.A.C. method lies in the greater facility in estimating the iron. That equally accurate results can be obtained by both methods can be seen by a glance at Table 1.

TABLE 1*

Data pertaining to the estimation of iron by the A.O.A.C. method and Steel's method

No. of Exp.	Weight of $AlPO_4+FePO_4$, milligrams	Weight of $FePO_4$ calculated from the $KMnO_4$ det'n, milligrams	Equivalent in Fe_2O_3, milligrams	Weight of $FePO_4$ as det'd by the A.O.A.C. method, milligrams	Equivalent in Fe_2O_3, milligrams
1	90.3	64.6	17.1	64.8	17.1
2	90.9	64.6	17.1	65.0	17.2
3	90.1	64.6	17.1	64.4	17.0

* 10 cc. of the standard ferric chlorid sol. plus 5 cc. of the standard alum sol. were used in each of these experiments.

6. ESTIMATION OF ALUMINUM BY THE MODIFIED A.O.A.C. METHOD (Steel's). The estimation of aluminum by this method

consists in determining the weight of the combined iron and aluminum phosphates according to the technique of the A.O.A.C. method, then determining the iron content by the Mixer and DuBois (11) modification of the Zimmerman-Rheinhardt permanganate method in an aliquot portion of the original acid sol. A "blank" is made on the reagents used in the method and the "weight of the blank" is added to the amount of $FePO_4$; this weight is then subtracted from the combined weights of $AlPO_4$ and $FePO_4$. See Table 2.

TABLE 2

Data pertaining to the estimation of aluminum by Steel's method

No. of Exp.	Amts. of the standard sol. used in each exp., cc.	Wt. of $AlPO_4$ + $FePO_4$, milligrams	Wt. of $FePO_4$, calculated from the $KMnO_4$, milligrams	"Blank" on the reagents used, milligrams	Wt. of $AlPO_4$, milligrams	Equivalent wt. of Al_2O_3, milligrams
1	5 of alum sol. 10 of iron sol.	90.3	64.6	0.6	25.1	10.50
2	5 of alum sol. 10 of iron sol.	91.2	64.6	0.6	26.0	10.88
3	5 of alum sol. 10 of iron sol.	90.1	64.6	0.6	24.9	10.44
4	2 of alum sol. 5 of iron sol.	43.0	32.3	0.5	10.2	4.27
5	2 of alum sol. 5 of iron sol.	42.9	32.3	0.5	10.1	4.23

7. ESTIMATION OF IRON AND ALUMINUM BY THE GOVERNMENT RESEARCH COMMITTEE METHOD (12). This method is very similar to the modified A.O.A.C. method used by Steel (13). However, there are a few minor differences which are worthy of note, the most important of which are the following:

A.—The use of ammonium phosphate instead of sodium phosphate.

B.—Performing the acid digestion of the iron and aluminum phosphates in flasks made of glass containing little alumina, such as "Kavalier" or "F–Z resistant glass."*

* This committee was estimating the iron and aluminum content of phosphate rock, which contained more or less fluorin. They condemn the use of glass containing a relatively high percentage of alumina on account of the solvent action of the fluorin. This precaution is of little moment in the estimation of aluminum in animal tissues or foodstuffs, as fluorin is rarely if ever present in these substances.

C.—The use of methyl orange as the indicator to control the acidity on adding the ammonium acetate.

D.—Redissolving the phosphate precipitate in dilute HCl sol. and performing a second precipitation with ammonium acetate.

E.—The use of a "Meker" burner instead of a blast lamp.

F.—Using the Jones and Jeffrey modification of the Zimmerman-Rheinhardt method (14) for the estimation of iron instead of the Mixer and DuBois (15) modification of the same method used by Steel (16).

TABLE 3

Data pertaining to the estimation of iron and aluminum by the method proposed by the Government Research Committee

Exp. no.	Amts. of the standard sol. used in each exp., cc.	Wt. of $AlPO_4 + FePO_4$, milligrams	Wt. of $FePO_4$, calculated from the $KMnO_4$ det., milligrams	"Blank" on the sol. used, milligrams	Wt. of $AlPO_4$, milligrams	Equivalent wt. of Al_2O_3, milligrams
1	5 of alum sol. 10 of iron sol.	91.0	64.6	0.8	25.6	10.71
2	5 of alum sol. 10 of iron sol.	90.4	64.6	0.8	25.0	10.46
3	5 of alum sol. 10 of iron sol.	90.7	64.6	0.8	25.3	10.58
4	10 of alum sol. 20 of iron sol.	181.8	129.2	1.1	51.5	21.54
5	10 of alum sol. 20 of iron sol.	181.3	129.2	1.1	51.0	21.34
6	2 of alum sol. 4 of iron sol.	36.2	25.8	0.4	10.0	4.18
7	2 of alum sol. 4 of iron sol.	36.4	25.8	0.4	10.2	4.27

8. ESTIMATION OF ALUMINUM IN THE STANDARD ALUM SOL. BY THE SCHMIDT AND HOAGLAND METHOD (17). In aqueous sol. this method is comparatively simple. The technique is essentially as follows:

To the acid sol. one adds 0.5 gm. of ammonium phosphate for each 100 mg. of $AlPO_4$ known to be present. The sol. is then heated and, while hot, 5 gm. of ammonium thiosulphate (in sol.) are introduced; the sol. is allowed to stand awhile, then 6 to 8 gm. of ammonium acetate (in sol.) and 4 cc. of strong acetic acid are added. The mixture is

heated for 30 minutes to expel the SO_2, the precipitate is allowed to settle, filtered and washed once by decantation. The precipitate is redissolved in 2 to 2.5 cc. of conc. hydrochloric acid, diluted to about 300 cc. with water, and the aluminum reprecipitated as described above. The precipitate is filtered and washed several times with hot water to remove chlorides, and ignited in a transparent silica crucible in a Meker furnace to constant weight.

In the following experiments the same relative amounts of the standard iron sol. that were used in the other experiments were admixed with the alum sol. to keep the conditions identical. In some of the experiments there were added 50 cc. of the following standard "blank" sol.: 25 gm. of sodium phosphate, 15 gm. of potassium chlorid, 11 gm. of calcium chlorid, and 11 gm. of magnesium chlorid mixed with 800 cc. of dist. water and just enough HCl to effect sol.; then made up to 1 l. It was assumed that a mixture of sodium alum, ferric chlorid, and the ingredients of the above standard "blank"

TABLE 4

Data pertaining to the estimation of aluminum in a standard alum sol. by the Schmidt and Hoagland method

No. of Exp.	Amounts of the standard sol. used in each exp., cc.	Wt. of $AlPO_4$, milligrams	"Blank" on the reagents used, milligrams	Equivalent wt. of Al_2O_3, milligrams
1	5 of the alum sol. 10 of the iron sol.	24.8	0.2	10.29
2	5 of the alum sol. 10 of the iron sol.	24.6	0.2	10.21
3	10 of the alum sol. 20 of the iron sol.	50.2	0.2	20.92
4	10 of the alum sol. 20 of the iron sol.	49.8	0.2	20.75
5	10 of the alum sol. 20 of the iron sol. 50 of the standard blank sol.	50.0	0.4	20.75
6	10 of the alum sol. 20 of the iron sol. 50 of the standard blank sol.	49.6	0.4	20.59
7	5 of the alum sol. 10 of the iron sol. 50 of the standard blank sol.	25.2	0.4	10.46
8	5 of the alum sol. 10 of the iron sol. 50 of the standard blank sol.	24.9	0.4	10.25
9	5 of the alum sol. 10 of the iron sol. 50 of the standard blank sol.	24.9	0.4	10.25

sol. would embrace all the analytical difficulties usually encountered in determining aluminum in the presence of large amounts of organic matter (after incineration). The results of these analyses are recorded in Table 4.

9. ESTIMATION OF ALUMINUM IN THE PRESENCE OF ORGANIC MATTER BY EACH OF THE THREE METHODS NOTED IN SUB-SECTIONS 6, 7 AND 8.

Oxidation of the organic matter: 25 gm. of hashed lean beef and 30 cc. of H_2SO_4 were placed into each of 4 Kjeldahl flasks marked *A, B, C,* and *D.* To each of flasks *A* and *B,* 30 cc. of the standard alum sol., 60 cc. of the standard iron sol., and 10 cc. of conc. HNO_3 were added. To each of flasks *C* and *D,* 60 cc. of the standard alum sol., 120 cc. of the standard iron sol., and 10 cc. of conc. HNO_3 were added. The mixtures were digested until the sol. became colorless. When necessary, small quantities of ammonium nitrate were added from time to time to facilitate the oxidation process.

On cooling, 20 cc. of conc. HCl and 100 cc. of water were introduced, and this mixture was heated to boiling and filtered into a 300 cc. flask. After washing the residue with water, it was washed into a beaker with water and 10 cc. of conc. HCl were added. This was boiled, diluted with water and filtered into the flask containing the first filtrate. If any residue remained, which rarely occurred, it was treated in the same manner and the filtrate was again added to the flask. On cooling to room temp., each flask was made up to vol. Aliquot portions of these sol. were used for estimating the iron and aluminum contents. Since the volumetric flasks contained 300 cc., in flasks *A* and *B* 50 cc. portions were equivalent to 5 cc. of the standard alum sol., and 10 cc. of the standard iron sol. In flasks *C* and *D,* 50 cc. portions were equivalent to 10 cc. of the alum sol. and 20 cc. of the iron sol.

The iron content was estimated on samples from each flask and the results, which were remarkably concordant, were but a fraction of a milligram higher than the average of the results obtained on equivalent portions of the original standard ferric chlorid sol. This slight increase may be attributed to the iron content of the beef. There was no increase in aluminum. The results obtained by all three methods are recorded in Table 5.

TABLE 5

Data pertaining to the comparative efficiency of the three methods (Steel's, Gov. Research Committee's, and Schmidt and Hoagland's)

Method used	Found					Calculated
	No. of exp.	Wt. of $AlPO_4$ $+FePO_4$, milligrams	Wt. of $FePO_4$, calculated from the $KMnO_4$ det'n, milligrams	Wt. of $AlPO_4$, milligrams	Equivalent wt. of Al_2O_3, milligrams	From the average of the det'n in the aqueous sol., milligrams
Modified A. O. A. C. method (Steel)	1	90.8	65.2	25.6	10.71	10.48
	2	89.8	65.2	24.6	10.21	10.48
	3	180.4	130.4	50.0	20.92	20.96
	4	27.0	14.5	12.5	5.23	5.24
	5	26.8	14.5	12.3	5.16	5.24
	6	10.6	5.8	4.8	2.01	2.09
	7	10.5	5.8	4.7	2.00	2.09
Government Research Committee method	8	90.4	65.2	25.2	10.54	10.48
	9	90.1	65.2	24.9	10.42	10.48
	10	181.4	130.4	51.0	21.33	20.96
	11	27.1	14.5	12.6	5.27	5.24
	12	26.9	14.5	12.4	5.19	5.24
	13	10.7	5.8	4.9	2.05	2.09
	14	10.9	5.8	5.1	2.12	2.09
Schmidt-Hoagland method	15			25.0	10.46	10.48
	16			24.7	10.34	10.48
	17			50.1	20.96	20.96
	18			12.3	5.16	5.24
	19			12.4	5.19	5.24
	20			4.8	2.01	2.09
	21			5.0	2.09	2.09

III. Discussion of the relative merits of the three methods: accuracy and precision attainable in aqueous sol. and in the presence of large amounts of organic matter. The accuracy of the results obtained by the phosphate methods is affected (a) by varying conc. of mineral acids at the time of precipitation of the iron and aluminum as phosphates, (b) by the presence of aluminum in appreciable quantities in the glassware used, (c) by variations in the relative proportions of iron to aluminum (the best results are obtained when the proportion of iron to aluminum is about 2 to 1), (d) by the quantities of iron and aluminum contained in the portion used for analysis (*the most accurate results are obtained when the combined iron and aluminum phosphates do not weigh over 100 mg.*) and (e) *by the temp. to which the crucibles are heated* (either the blast lamp, the muffle furnace, or the Meker burner may be used to effect this incineration with equal accuracy, but *the author prefers the Meker burner*).*

* Italics were inserted by the editor of the BIOCHEM. BULL. See page 169.

When all these precautions are observed the phosphate methods, as outlined in this paper, may be relied upon to yield accurate results for aluminum, both in aqueous sol. and when derived from organic matter, even when only a few milligrams of aluminum are present in the sample analyzed.

The Schmidt and Hoagland method yields equally accurate results and has the advantage over the other methods of being simpler.

IV. **Conclusions.** 1. The method used by Steel in his work on the "Absorption of aluminum from aluminized food" yields accurate results for aluminum when care is taken in the technique.

2. The method proposed by the U. S. Government Committee on Research and Analytical Methods is very similar to the method used by Steel. This method yields accurate results for aluminum, both in aqueous sol. and in the presence of large amounts of organic matter.

3. The Schmidt and Hoagland method is as accurate as the other two methods, and has the advantage over them of involving fewer manipulations.

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16. Steel: *Loc. cit.* (1).
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SANITARY STUDIES OF BAKING POWDERS

5. The determination of aluminium in biological material: a comparison of the method of Steel (modified by Kahn) with the method of Schmidt and Hoagland

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Introduction. As a preliminary to work concerning the absorption of aluminium, we compared the two methods which are most used for the quantitative estimation of aluminium. These two methods are the one proposed by Steel[1] and modified by Kahn[2]; and the method of Schmidt and Hoagland.[3]

Aluminium was determined by each method in (1) a water sol. containing a known amount of alum, (2) a water sol. containing a known amount of alum and different amounts of ferric chlorid, (3) human gastric juice to which a known amount of a standard sol. of alum had been added (determination made directly without evaporation and ashing), (4) human gastric juice evaporated and ashed after the addition of a known amount of standard alum sol., and (5) beef blood to which a known amount of standard alum sol. had been added.

We hoped to obtain a standard sol. of an aluminium salt from the U. S. Bureau of Standards, but this was found to be unavailable. A pure preparation of alum (crystallized potassium aluminium sulfate) was made by twice recrystallizing Baker's analyzed potassium aluminium sulfate. In making the "standard sol. of alum" used throughout the experiment, 9.2863 gm. of the pure crystallized alum were dissolved in dist. water and diluted to 500 cc. This sol. con-

[1] Steel, M.: *Amer. Jour. Physiol.*, 1911, xxviii, p. 100.

[2] Kahn, Max: BIOCHEM. BULL., 1911, i, p. 237.

[3] Schmidt, C. L. A., and Hoagland, D. R.: *Jour. Biol. Chem.*, 1912, xi, p. 437.

tained 0.002 gm. of Al_2O_3 per cc., and was added in known amounts to the blood and gastric juice to be analyzed for aluminium. It was used also for analysis directly and after being mixed with ferric chlorid sol.

Preliminary treatment of gastric juice. Clear gastric juice was obtained by mixing and filtering several samples of juice obtained from different subjects after ingestion of Ewald or other test meals. These subjects were used in experiments not connected with this investigation, and in no case did the meal ingested contain any bread made with alum baking powder. Known amounts of the standard alum sol. were added to this clear juice, and the juice was then analyzed, either directly or after ashing, in the following manner:

To 50 cc. portions of this clear gastric juice, 10 cc. portions of the standard alum sol. (equivalent to 20 mg. of Al_2O_3) were added, and the aluminium determined in the resulting mixtures by each method. To another portion of the clear gastric juice (approximately 200 cc.), 25 cc. of the standard alum sol. (containing the equivalent of 50 mg. of Al_2O_3) were added, and the mixture evaporated to dryness in a silica dish on a water-bath. When nearly dry, the residue was ashed over a free flame with the aid of conc. nitric acid. The ash was taken up with hydrochloric acid, dehydrated to remove silica, again taken up with a little hydrochloric acid and water, filtered into a 250 cc. vol. flask, and diluted to the mark with dist. water. Fifty cc. portions of this sol. (containing the equivalent of 10 mg. of added Al_2O_3) were then analyzed for aluminium by each method.

Preliminary treatment of the beef blood. Twenty cc. of the standard alum sol. (equivalent to 40 mg. of Al_2O_3) were added to approximately 500 cc. of oxalated[4] beef blood. Another portion of approximately 500 cc. was used as a check and received no addition of alum sol. The two portions of blood were then placed in 2-liter round-bottomed Jena flasks, and oxidized by heating with conc. nitric and sulfuric acids, using small amounts of potassium permanganate to complete the oxidation. The process of oxidation was

[4] Some clotting occurred due to faulty shaking during the collection of the blood.

exceedingly long and tedious. After the oxidation was completed each portion was transferred to a 500 cc. vol. flask and diluted to the mark with dist. water. Aluminium was then determined, by each method, in 200 cc. portions of these sol. A 200 cc. portion of the sol. obtained from the blood to which alum sol. had been added, contained the equivalent of 8 mg. of Al_2O_3, while a 200 cc. portion of the other sol. contained no added alum.

The standard alum sol. was used directly for the determination of aluminium by each method, and was also mixed with ferric chlorid sol. in different amounts and analyzed by each method.

The method proposed by Steel[5] and modified by Kahn[6] depends upon the precipitation and weighing of the iron and aluminium as the phosphate. Iron is determined in the original sol. by the Zimmerman-Reinhardt permanganate titration method, which is described by Mixer and DuBois,[7] and ferric phosphate is calculated from this value. The weight of ferric phosphate is subtracted from the weight of precipitated ferric and aluminium phosphates to obtain the weight of aluminium phosphate. Each cc. of the permanganate sol. used was equivalent to 7.15 mg. of ferric phosphate.

The precipitation is carried out in the following manner: Mix the acid sol. in which the aluminium is to be determined, after the removal of silica, with sodium phosphate sol. in excess of the amount needed to form normal aluminium phosphate with the aluminium present. Add sufficient ammonium hydroxid sol. to effect the complete precipitation of the aluminium phosphate after thorough stirring, then add hydrochloric acid, drop by drop, until the precipitate completely dissolves. Heat the liquid to about 50° C. and mix with it, at that temp., a considerable excess of ammonium acetate sol. (50 percent) and also 4 cc. of 80 percent acetic acid sol. As soon as the precipitate of aluminium phosphate (mixed with iron phosphate) has sedimented, collect it on an ashless filter, wash with hot water, ignite and weigh the residue of $AlPO_4$ which is mixed with $FePO_4$.

The method used by Schmidt and Hoagland[8] for the determination of aluminium in feces depends upon the precipitation and weighing of aluminium as the phosphate, the iron present being kept in sol. in the

[5] Steel, M.: *Loc. cit.*

[6] Kahn, M.: *Loc. cit.*

[7] Mixer, C. T., and DuBois, H. W.: *Jour. Amer. Chem. Soc.*, 1895, xvii, p. 405.

[8] Schmidt and Hoagland: *Loc. cit.*

presence of ammonium acetate and acetic acid after reduction by thiosulfate.

The method is carried out in the following manner: The solution in which the aluminium is to be determined should be, after the removal of silica, about 300 cc. in vol. and contain about 2.5 cc. of conc. hydrochloric acid. Add di-ammonium hydrogen phosphate to the sol. (0.5 gm. for each 100 mg. of aluminium phosphate present), heat and add, while hot, 5 gm. of ammonium thiosulfate[9] in sol., and after several minutes, 6 to 8 gm. of ammonium acetate in sol., and 4 cc. of strong acetic acid sol. (80 percent was used). Continue heating the sol. for about 30 min. completely to expel sulfur dioxid, allow the precipitate to settle, filter, and wash once by decantation. Dissolve the precipitate in 2 to 2.5 cc. of conc. hydrochloric acid, dilute the sol. to about 300 cc., add 0.5 gm. of ammonium phosphate for each 100 mg. of aluminium phosphate present, and again precipitate the aluminium as described above. Filter and wash several times with hot water to remove chlorides, dry and ignite in a transparent silica crucible until constant weight is obtained.

The authors found it necessary, when there were large amounts of iron present in the sol. containing the aluminium, to resort to a third or even fourth precipitation of the aluminium phosphate, in order to obtain a precipitate free from iron. This process may be avoided by using larger amounts of thiosulfate and heating for longer periods of time.

Analytic results. The analytic data are recorded in the accompanying tables (1 and 2).

Discussion. An examination of the results obtained by the method of Steel (and Kahn), as summarized in Table 1, shows, with the exception of Det'ns 25 and 26, aluminium values uniformly lower than the theoretical amounts added. In the case of Det'ns 38, 41, and 42, the amounts of ferric phosphate alone, calculated from the permanganate titration values, are greater than the respective amounts of ferric phosphate plus aluminium phosphate, as obtained gravimetrically. In Det'n 37 the total weight of ferric phosphate

[9] Owing to the impossibility of obtaining *ammonium* thiosulfate, the authors used *sodium* thiosulfate in these investigations. This necessitates a little more care in the final washing of the precipitate of aluminium phosphate than when the ammonium salt is used, as any excess of the latter can be readily removed during ignition.

and aluminium phosphate is but very little (1.3 mg.) larger than the calculated weight of the ferric phosphate alone. These findings indicate a failure of complete precipitation of either the iron or the aluminium, or both. The exact reason for this failure was not determined. It would seem probable that it was due to the addition of an insufficient quantity of sodium phosphate, although the amounts added were considerably larger than the amounts called for in the method. The explanation for the high values noted in Det'ns 25 and 26 is not apparent.

TABLE I

Results obtained with the method of Steel (and Kahn), expressed in milligrams

Det'n no.	Material analyzed	Determined		Calculated		Theoretical
		$AlPO_4 + FePO_4$	$FePO_4$	$AlPO_4$	Al_2O_3	Al_2O_3
15	Standard solution.	43.1		43.1	18.0	20.0
16	Duplicate of 15.	43.8		43.8	18.3	20.0
25	Standard sol. + ferric chlorid sol.	310.7	247.9	62.8	26.3	20.0
26	Duplicate of 25.	316.2	247.9	68.3	28.5	20.0
27	Gastric juice + stand. sol.; not ashed.	53.3	8.2	45.1	18.9	20.0
28	Duplicate of 27.	52.7	8.2	44.5	18.6	20.0
33	Gastric juice + stand. sol.; ashed.	24.8	14.3	10.5	4.6	10.0
34	Duplicate of 33.	25.1	14.3	10.8	4.6	10.0
37	Beef blood + stand. sol.	144.3	143.0	1.3	0.5	8.0
38	Duplicate of 37.	139.9	143.0	...	...	8.0
41	Beef blood. "Check."	118.7	132.3	...	...	0.0
42	Duplicate of 41.	117.7	132.3	...	...	0.0

TABLE 2

Results obtained with the method of Schmidt and Hoagland, expressed in milligrams

Det'n no.	Material analyzed	Determined	Calculated	Theoretical
		$AlPO_4$	Al_2O_3	Al_2O_3
17	Standard solution.	46.5	19.5	20.0
18	Duplicate of 17.	46.8	19.6	20.0
29	Standard sol. + ferric chlorid sol.	49.0	20.5	20.0
30	Duplicate of 29.	47.2	19.7	20.0
31	Gastric juice + stand. sol.; not ashed.	51.5	21.5	20.0
32	Duplicate of 31.	51.4	21.5	20.0
35	Gastric juice + stand. sol.; ashed.	25.3	10.6	10.0
36	Duplicate of 35.	25.9	10.8	10.0
39	Beef blood + stand. sol.	20.5	8.7	8.0
40	Duplicate of 39.	21.6	9.0	8.0
43	Beef blood. "Check."	1.0	0.4	0.0
44	Duplicate of 43.	0.4	0.2	0.0

The method of Schmidt and Hoagland gave more satisfactory results as may be seen by an examination of Table 2. There seems to be a tendency for the results to be slightly higher than the theoretical, which is particularly noticeable in Det'ns 31 and 32. These determinations were made upon samples of gastric juice to which a known amount of the standard sol. of alum had been added, and, as the material was not ashed previous to the analysis, there was more or less organic matter present, which may explain the high values obtained; although the results of Det'ns 35 and 36, which were carried out upon ashed gastric juice to which a known amount of the standard alum sol. had been added, are nearly as high proportionately as those from the unashed juice. The absolute error in Det'ns 35 and 36 is, however, much lower than the error in Det'ns 31 and 32.

The determination in blood is not as accurate as is to be desired, yet the values obtained in Det'ns 39, 40, 43, and 44, are in much closer agreement with the theoretical than those obtained by the method of Steel (and Kahn).

General conclusions. 1. In our hands the method of Schmidt and Hoagland proved more satisfactory than the method of Steel (modified by Kahn), for the determination of aluminium in blood and gastric juice, to which known amounts of aluminium had been added.

2. It is not feasible to determine aluminium (by the Schmidt-Hoagland method) in gastric juice, without first ashing the material.

SANITARY STUDIES OF BAKING POWDERS

6. Comment on the data in the preceding papers (2–5) on the best available method for the quantitative determination of aluminium in biological materials[1]

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(Received for publication, May 31, 1916)

An examination of the data in the four preceding papers shows that Howe, Curtman and Gross, and Smith and Hawk, agree in the general conclusion that the Schmidt-Hoagland method is somewhat more accurate and serviceable than the Steel method for the estimation of aluminium in biological materials, and that the Steel method gives *low* results. Steel finds that the Schmidt-Hoagland method is more convenient but not more accurate than his own.

Curtman and Gross attribute the observed losses, by the Steel method, to the decomposition of ferric phosphate in the precipitated mixture of aluminium and ferric phosphates (page 169).

These findings suggest that possibly the results for aluminium, in the earlier experiments by Steel[2] and Kahn[3] (*with Steel's method*), were *low* and that *more aluminium was absorbed from the aluminized bread, in those experiments, than the data reported by Steel, and by Kahn, indicated.*[4]

After the authors of the four preceding papers (2–5) had corrected and returned to me the corresponding proofs, I forwarded to each author a copy of the first paragraph above with a copy of the

[1] (2) Howe: Biochemical Bulletin, 1916, v, p. 158; (3) Curtman and Gross: *Ibid.*, p. 165; (4) Steel: *Ibid.*, p. 173; (5) Smith and Hawk: *Ibid.*, p. 183.

[2] Steel: *Amer. Jour. Physiol.*, 1911, xxviii, p. 94.

[3] Kahn: Biochemical Bulletin, 1911, i, p. 235.

[4] Gies: *Ibid.*, 1916, v, p. 152.

corrected proofs of the four preceding papers (2–5); and suggested that such further comment as any of the authors might wish to publish be forwarded to me for inclusion here. I wrote to each as follows:

"I am sending you herewith a corrected copy of the proofs of four papers on our aluminium research, pertaining to relative efficiency of analytic methods, and, accordingly, make known to you the names of your associates, in the first phase of the work, and the results obtained by each. I am also forwarding to you a copy of the opening paragraph of my comment, on the general outcome of this part of the work, to appear in a note following your four papers in the BIOCHEMICAL BULLETIN. Please read each paper *critically* and forward to me, at once if possible, such further comment as you may wish to publish on this subject, for inclusion, over your signature, in the body of my concluding remarks in this relation. If you have nothing to add, please let me know. A copy of this letter goes with this mail to each of your associates."

In reply to these suggestions, Howe, and Hawk (for Smith and Hawk), stated that they had nothing to add. Further comment was offered by Steel, and Curtman and Gross, as follows:[5]

DISCUSSION BY MATTHEW STEEL. Smith and Hawk, and Howe, obtained results with Steel's modified A. O. A. C. method that were slightly lower than the results they obtained with the Schmidt-Hoagland method, but their results do not depart farther from the theoretical than one might expect for two different analysts. Messrs. Curtman and Gross, however, obtained results with Steel's method that were low enough to require special discussion.

The low results obtained by these investigators may have been due to the following causes:

1. *The large quantity used for analysis.* Experience has shown that the most accurate results are obtained when the combined phosphates do not weigh much more than 100 mg., whereas Curtman and Gross used three or four times this quantity.

2. *The temp. of ignition may have been too high.* The author recommends the following technique: The moist filter paper containing the precipitate should be carefully folded and put in a tared, fused, silica crucible and placed, without cover, on an asbestos-centered wire-

[5] The authors affected have not been made aware of the nature of this comment.

gauze over a very low flame until all the moisture is driven off. The crucible should then be placed in a large platinum dish and heated to a high temp. over a Bunsen flame. Most of the filter paper is burned off at this stage. The crucible should be finally heated to constant weight over a free flame with a Meker burner. During the final ignition the crucible should be nearly covered with a crucible lid.

3. *An insufficient quantity of ammonium chlorid in the sol.* A large quantity of ammonium chlorid would increase the solubility of calcium phosphate and decrease the solubility of iron and aluminum phosphates. I happened not to mention this fact in my original paper. The ammonium chlorid was introduced as follows: After digesting the organic matter with nitric and sulfuric acids, the mixture was boiled nearly to dryness to drive off all the NO_2 and the excess of sulfuric acid. This procedure always resulted in the production of a sediment which would not dissolve in water. It was found necessary to treat this sediment two or three times with hot hydrochloric acid to effect complete solution. This sediment always contained more or less iron, as could be observed from the color of the sol. after boiling with hydrochloric acid. In view of the fact that so much acid was used in dissolving this sediment, it was deemed advisable to nearly neutralize the portions taken for analysis with ammonium hydroxid prior to starting with the A. O. A. C. method. When working with pure salt solutions, I have always added large quantities of a sat. ammonium chlorid solution.

I tested my modified A. O. A. C. method with regard to its efficiency when *large* quantities of iron and aluminium are used. The bulky precipitates were cumbersome to wash, but my results (submitted below) show that the method is reliable even when the combined phosphates weigh as much as 400 milligrams.

No. of test	Weight of $FePO_4 + AlPO_4$	Weight of $FePO_4$, calculated from the $KMnO_4$ titration values	Weight of $AlPO_4$	Weight of Al_2O_3	
				Calculated from $AlPO_4$ found	Calculated from the average results for small amounts in aqueous solution
	mg.	mg.	mg.	mg.	mg.
1	194.1	145.0	49.1	20.52	20.96
2	243.4	145.0	98.4	41.36	41.92
3	390.0	290.0	100.0	41.84	41.92
4	390.8	290.0	100.8	42.16	41.92

These results, coupled with my previous findings, convince me that the method is absolutely reliable, *if followed with care.*

Discussion by L. J. Curtman and P. Gross. In the A.O.A.C. method (unmodified by Steel) the weighed precipitate may be regarded as consisting of $Al_2O_3 \cdot Fe_2O_3 \cdot xP_2O_5$. The precipitate is analyzed for Fe_2O_3 and P_2O_5. The difference between the total weight of the precipitate, and the sum of the Fe_2O_3 and P_2O_5 separately determined, will give the Al_2O_3 in the weighed precipitate regardless of whether the $AlPO_4$ or $FePO_4$ was partially decomposed in the process of washing or ignition. Barring the errors inherent in the separate determinations of the Fe_2O_3 and P_2O_5, this method will give a correct value for the Al_2O_3 in the precipitate.

Steel's method can be valid, from purely theoretical considerations, only on the assumption that the P_2O_5 in the weighed precipitate is just sufficient to form the normal phosphates with the Al and Fe present; in other words, that the precipitate consists of a mixture of pure $FePO_4$ and $AlPO_4$. The results given in our Tables 2 and 3 (pages 168–9) show conclusively, however, that the above assumption (tacitly made by Steel), as to the composition of the precipitate, is unwarranted. It is quite conceivable that the error in Steel's method, as noted in our Table 2, is unduly magnified by the relatively large amounts of Fe and Al involved, and that with smaller quantities (such as were used by Howe and by Steel) the error would be less apparent. Experiment, only, can decide this point. We feel, however, that the method of Steel, if reliable, should show a better agreement with the theory than found. The addition of insufficient sodium phosphate cannot be held responsible for the results in Table 2 (page 168), for the reason that in these, as in *all* our determinations, special care was taken to add a quantity of phosphate in excess of that required to combine with all the Al and Fe present.

It is regretable that neither Howe nor Steel deemed it necessary to standardize their aluminum sol's by methods other than those in which the Al is precipitated as phosphate. Since the object of this investigation was the comparison of methods finally depending upon the precipitation of Al as phosphate, it would seem imperative that the standardization of the aluminum sol. be based on a principle other than one used in the comparison of the methods. Equally regretable is the failure of Howe to supply details as to the manner in which he standardized his iron sol. This is a serious omission in view of the important rôle which the iron plays in Steel's method.

An interesting confirmation of our results is to be found in some of

the figures given by Smith and Hawk, in Table 1 (page 187). Commenting on these results, Smith and Hawk state: "In the case of Det'ns 38, 41 and 42, the amounts of ferric phosphate alone, calculated from the permanganate titration values, are greater than the respective amounts of ferric phosphate plus aluminum phosphate, as obtained gravimetrically. In Det'n 37 the total weight of ferric phosphate and aluminum phosphate is but very little (1.3 mg.) larger than the calculated weight of the ferric phosphate alone. These findings indicate a failure of complete precipitation of either the iron or the aluminum, or both. The exact reason for this failure was not determined."

These anomalous results of Smith and Hawk are in accord with some of our findings. Thus (page 170) in our Table 4 (ox) the weight of the $FePO_4$, calculated from the "iron by titration" (463.9), exceeds the weight of the sum of the $AlPO_4$ and $FePO_4$ found, giving a *negative* value for the weight of $AlPO_4$. These results, considered in conjunction with the values given in Tables 2 and 3 (pages 168–9), point not to a failure to secure complete precipitation of the iron and aluminum or both, but rather to a decomposition of the ferric phosphate either in washing or in igniting, or in both, as the most probable cause of these irregularities.

After receiving the foregoing comment by Curtman and Gross, I requested Dr. Howe to give me, for publication here, the "details as to the manner in which he standardized his iron sol." His reply is appended.

Addendum by Paul E. Howe. Approximately 2 gm. of iron (piano wire) were dissolved in hydrochloric acid and this sol. diluted to 2000 cc. with dist. water. Portions of this sol., approximately 10 gm., were *weighed* out and the iron determined according to the Zimmerman-Rheinhardt method. The average of five determinations of the iron sol. was 0.931 mg. for each gm. of sol.; the greatest deviation from the mean was 0.01 mg.

The facts in the foregoing discussion do not require revision of the general conclusion, stated in the opening paragraph of this paper, that the Schmidt-Hoagland process is apparently somewhat more *accurate,* and more *convenient* of execution, than any other of the available methods for the quantitative determination of

aluminium in biological materials, as these methods are currently conducted. The disparity between the results reported by Steel, and by Curtman and Gross, for Steel's method, may be due (as Steel suggests) to differences in the degrees of heat applied during the ignition of the precipitates.[6]

As soon as the general outcome of the studies published in the four preceding papers (2–5) was apparent, the work on the second and third phases of the research—on the absorption of aluminium from aluminized bread, in men and dogs—was begun, and the Schmidt-Hoagland method adopted thruout as the best of the available ones for the determination of aluminium in biological materials. The reports on these parts of the investigation were completed, and in my possession, before the corrected proofs of the four preceding papers (2–5) went to the authors.

The succeeding paper, by Balls, throws further light on the question of the *accuracy* of our "best" method. Balls' findings seem to indicate that the Schmidt-Hoagland method may fail to recover the full amount of aluminium involved. There is special need for a new method that would overcome all the objections against the best of the processes that are now available for the estimation of aluminium in biological materials.

The remaining papers in this series—on the absorption of aluminium—will be published in the next issue of the BIOCHEMICAL BULLETIN.

[6] See the succeeding paper, by Balls, for further intimations regarding the discordant influences of different temperatures and periods of ignition.

SANITARY STUDIES OF BAKING POWDERS

7. A direct test of the degree of accuracy of the Schmidt-Hoagland method for the quantitative determination of aluminium

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(Received for publication, December 1, 1915)

Prior to the inauguration of a study of the absorption of aluminium from aluminized foods, we tested directly the accuracy of the Schmidt-Hoagland[1] method for the determination of aluminium —the method we expected to use in the investigation.[2] This method is conducted, in principle, as follows: The organic matter is destroyed, silica dehydrated and removed, and ammonium phosphate added to the aluminium-containing sol., which is acid with hydrochloric acid. The sol. is then neutralized with an excess of ammonium thiosulfate, followed by the addition of ammonium acetate and acetic acid. The aluminium is precipitated as the phosphate, accompanied by large proportions of sulfur; while any iron that may be present, being in the ferrous condition, remains in solution. The phosphate thus obtained is purified by re-precipitation according to the original plan, and then is ignited to constant weight in a silica dish.[3] The advantages of this method, in the analysis of biological materials, arise from the facts that iron is conveniently excluded, that phosphates do not interfere, and that a direct determination of the aluminium is possible.

[1] Schmidt and Hoagland: *Jour. Biol. Chem.*, 1912, xi, p. 387.

[2] Gies: BIOCHEMICAL BULLETIN, 1916, v, pp. 151 and 189.

[3] Silica dishes, even of the "clear" variety, last but a short time, repeated ignitions causing them to "scale off" on the exterior. In these tests ordinary crucibles of German porcelain were used with entire satisfaction; they withstood, without loss of weight, the temp's of ignition to which the precipitates were subjected.

In order to ascertain whether correct results were obtainable by this procedure, a sol. of a very pure potassium alum was prepared and standardized. This sol. was found to be free from phosphate and to contain a negligible trace of iron. The standardization of the sol. was effected by precipitating the aluminium as hydroxid, in the presence of ammonium chlorid, with a current of ammonia gas and removing almost all the ammonia by boiling. The hydroxid was filtered off, washed, re-dissolved in a little hydrochloric acid sol., then re-precipitated as before, and finally ignited and weighed as Al_2O_3. The analytic data are appended.

Volume of solution taken.	Weight of Al_2O_3.	
	Found.	Per cc.
cc.	mg.	mg.
50	194.3	3.89
25	97.5	3.90

The Schmidt-Hoagland method was then applied to portions of the same sol., with the results summarized below:

Volume of solution taken	$AlPO_4$ precipitated	Al_2O_3		
		Calculated	Per cc.	Loss
cc.	mg.	mg.	mg.	%
25	230.7	96.5	3.86	0.9
25	221.9	92.9	3.71	4.6
25	218.6	91.5	3.66	6.0
25	228.5	95.6	3.82	1.7
10	86.1	36.0	3.60	7.4
10	87.3	36.5	3.65	6.2
10	88.6	37.1	3.71	4.8
10	90.0	37.7	3.77	3.3
5	44.3	18.5	3.70	4.8

From these figures it is evident that the Schmidt-Hoagland method may give results involving a loss of as much as 7 percent of the available aluminium. The average error was about 4 percent. In determinations of very small amounts of aluminium, say less than 3 mg., a loss of 7 percent might fall within the range of error of an ordinary analytical balance, and would be insignificant.

Altho the indicated error is relatively unimportant, in determinations of small amounts of aluminium in biological materials, we endeavored, nevertheless, to ascertain its cause.

In the determinations referred to above, the precipitates were ignited at high temp's, for several hours at a time, in an electric muffle and cooled in the *covered* crucibles over sulfuric acid. It had been observed that, in practically all cases, the ignited products were hygroscopic. After exposure to the open air, for 10 min., a precipitate weighing 86.3 mg. increased in weight to 89.1 mg. Re-ignition reduced the weight of this mass to 86.1 mg. Aluminium phosphate is not hygroscopic but aluminium oxid has that property. The conditions of precipitation in the Schmidt-Hoagland method make it extremely unlikely that oxid of aluminium is separated, at that point, with the phosphate. It was inferred, therefore, that either oxid, or a basic phosphate, was produced during the ignition. This opinion was confirmed by the results of analysis of several of these precipitates, which were found to contain less P_2O_5 than the amounts required by the formula for the corresponding quantities of ortho-phosphate.

The precipitates of $AlPO_4$, as obtained by the Schmidt-Hoagland process, contain *large* proportions of sulfur, resulting from the decomposition of ammonium thiosulfate by the acid in the sol. This fact suggested that, during the ignition of the precipitate, P_2O_5 is replaced by oxides of sulfur, and that the resultant $Al_2(SO_4)_3$ is converted into Al_2O_3, at least to some degree. The ignited precipitate of $AlPO_4$ referred to above, weighing 86.1 mg., was mixed with about its own bulk of pure flowers-of-sulfur, and re-ignited. The weight became constant in 6 hr., and the precipitate was found to have lost 1.7 mg.

Similar losses, indicating an influence of associated sulfur, in accord with the foregoing opinion, were obtained in three analogous tests. (See contradictory data on page 198.)

After adding a small crystal of ammonium phosphate to the ignited mass just referred to (84.4 mg.), moistening it with a drop of water, and re-igniting, the precipitate increased in weight to 89.6 mg. A second ignited mass of $AlPO_4$, weighing 87.6 mg., was treated in a similar manner with ammonium phosphate. Its weight increased to 90.8 mg., and the product was no longer hygroscopic. Re-ignition with ammonium phosphate increased the weight of this precipitate to 92.8 mg., in practical agreement with the standardiza-

tion value (92.9 mg.). There was apparently a re-conversion of Al_2O_3 to $AlPO_4$.

From these findings it might be supposed that a correct result could be obtained by adding ammonium phosphate to a precipitate of $AlPO_4$, before ignition and weighing, but experience has shown that, unless repeated additions of very small amounts are made, this cannot be accomplished; for, if a quantity of ammonium phosphate sufficient to effect the change is added all at once, it is extremely difficult to volatilize the excess of P_2O_5. In the cases cited above, it required 12 and 15 hrs. of ignition, respectively, at nearly white heat in the muffle, to remove the excess of P_2O_5, yet in neither case was sufficient phosphate added the first time to convert all the oxid to phosphate. In an attempt to make a single addition suffice, it was found, after 17 hrs. of ignition, that at least 70 hrs. would be required for complete removal of the excess of P_2O_5, obviously an impossible condition for ordinary work.

In two repetitions of the foregoing tests—6 and 7 in the accompanying Table (1)—conducted some time after the earlier ones, it was found that ignition with sulfur did not produce a significant loss in the weights of the ignited precipitates. The addition, however, of ammonium phosphate always caused perceptible increases in the weights of such precipitates. There was evidently production of oxid, or a modified phosphate, as a result of the first ignition, independently of any influence of the sulfur. Ignition with ammonium phosphate re-converted the resultant product, wholly or in part, into normal phosphate.

It is impossible to say, under the circumstances, that the conversion of phosphate into oxid was dependent, in any of the foregoing tests, on the intermediate action of the associated sulfur. It is possible that temperature differences, and other unknown factors, were influential in effecting the observed variations in the results with sulfur. The influence of impurities seems to have been excluded.[4]

[4] $AlPO_4$, made by the Schmidt-Hoagland method, and precipitated only once (not re-precipitated as they direct), contained traces of potassium, chlorin and sulfate. When precipitated twice, it was free from these materials.

That sulfate was not produced as an intermediate product, in any of the tests of the influence of sulfur, is suggested by the fact that none of the ignited precipitates contained detectible quantities of sulfate; although it is possible that sulfate, after its production, was *completely* converted to oxid.

The data pertaining to the foregoing tests are summarized below:

TABLE I

Data pertaining to the effects, on the weights of $AlPO_4$ precipitates, of ignition with sulfur or ammonium phosphate

	1	2	3	4	5	6	7
A. Standardization value	232.3	232.3	....	92.9	92.9*	92.9	92.9
B. Constant weight (method of Schmidt-Hoagland)	221.9	228.5	20.5	86.1*	87.6*	88.6	90.0
C. Exposure for 10 minutes to the open air.....	224.7	230.3	21.4	89.1*	88.7	90.6	91.3
D. Constant weight after ignition with sulfur (compare with *B*)..	221.3	227.9	19.5	84.4*	....	88.4	89.9
E. Constant weight after ignition with ammonium phosphate (compare with *A*)	229.0	231.1	22.4	89.6*	90.8*	90.9	93.0
F. Constant weight after a second ignition with ammonium phosphate (compare with *A*).....	....	....	....	....	92.8*		

* Referred to in the text.

The weight of "aluminium phosphate," obtained by the Schmidt-Hoagland method, varies somewhat according to the temp. of ignition. Precipitates, after ignition to constant weight at a low temp. in an electric muffle, lost weight from exposure to a higher temp., and again became constant in weight at the new temp. level. In this way, as many points of constant weight were obtained as there were different "levels" of temp. involved. It was observed, however, that ignition at even comparatively low temp's failed to give results for phosphate that were equivalent to our standardization values. The losses in weight are illustrated by the data in Table 2.

The ignited precipitates, obtained by the Schmidt-Hoagland method, are not, as claimed, the *normal* phosphate; but are either basic phosphate, or normal phosphate contaminated with alumina. Some of these precipitates, ignited to constant weight at white heat in an electric muffle, contained approx. 2 percent less P_2O_5 than

TABLE 2

Data showing successive losses in weight of Schmidt-Hoagland precipitates at successive temperature-levels

		I				II			
		Weight of $AlPO_4$	Period of ignition necessary to obtain a constant mass	Loss calculated from first constant weight of $AlPO_4$		Weight of $AlPO_4$	Period of ignition necessary to obtain a constant mass	Loss calculated from first constant weight of $AlPO_4$	
		mg.	hr.	mg.	%	mg.	hr.	mg.	%
1	Standardization value, calculated to $AlPO_4$*	232.3	....	....	....	232.3	....	....	....
2	Constant weight at dull red heat. (Compare with 1.)	224.9	10	....	....	222.8	10	....	....
3	Constant weight at bright red heat	224.1	6	0.8	0.36	221.9	6	0.9	0.40
4	Constant weight at white heat ..	222.7	3	2.2	0.98	220.3	3	2.5	1.12

* Standardized by the method described on p. 196.

TABLE 3

Data pertaining to the composition of aluminium phosphate obtained, by the Schmidt-Hoagland method, from definite volumes of a standard aluminium solution

			I		II		III		IV		V	
			mg.	%	mg.	%	mg.	%	mg.	%	mg.	%
Standardization values.	1	Al_2O_3	97.3	....	97.3	....	97.3	....	97.3	....	19.5	....
	2	Calculated as $AlPO_4$.....	232.3	....	232.3	....	232.3	....	232.3	....	46.6	....
	3	Equivalent amount of P_2O_5	135.0	....	135.0	....	135.0	....	135.0	....	27.1	....
	4	Theoretical composition of aluminium ortho-phosphate ($AlPO_4$) — Al_2O_3 (compare with 7)	....	41.85	....	41.85	....	41.85	....	41.85	....	41.85
		Theoretical composition of aluminium ortho-phosphate ($AlPO_4$) — P_2O_5 (compare with 6)	....	58.15	....	58.15	....	58.15	....	58.15	....	58.15
Values found.	5	Precipitate, by Schmidt-Hoagland method	216.1	....	215.6	....	220.3	....	222.7	....	44.8	....
	6	P_2O_5 found in precipitate 5 (compare with 3 and 4) ..	120.8	55.90	121.8	56.44	123.5	56.06	126.1	56.60	25.3	56.48
	7	Al_2O_3 found by A. O. A. C. method in precipitate 5 (compare with 1 and 4) ..	95.3	44.10	93.8	43.56	96.8	43.94	96.6	43.40	19.5	43.52

that required for the equivalent amounts of $AlPO_4$.[5] The data in Table 3 show that, if the quantities of aluminium oxid in such precipitates are determined in the usual way[6] (by subtracting the P_2O_5 found from the total weight of Al_2O_3 plus P_2O_5), the results for Al_2O_3 are low, indicating incomplete precipitation of aluminium as phosphate. In view of the solubility of aluminium phosphate, as shown by Carnot,[7] such loss is quite possible, especially since the precipitate, obtained by the Schmidt-Hoagland method, is washed with an abundance of dist. water.

Precipitates of aluminium phosphate, prepared by the method under investigation, were ignited, in coarsely granular condition, in an electric muffle to constant weights at different high-temp. levels. They were then very finely pulverized in an agate mortar, and the powders heated for 5 min. to dull redness, to expel atmospheric moisture, and weighed. The powders were then re-ignited at the corresponding temp's used previously to obtain constancy of mass, and invariably lost weight. Illustrative data are given in Table 4.[8]

TABLE 4

Data pertaining to further losses in weight of ignited, granular, precipitates of $AlPO_4$, after thorough pulverization, desiccation and re-ignition.

	Nature of ignited precipitate	Individual tests				
		I	II	III	IV	V
		mg.	mg.	mg.	mg.	mg.
1	Weight after grinding and re-drying..	372.4	216.0	223.3	220.3	215.7
2	Weight after ignition subsequent to grinding and re-drying..	368.5	214.0	222.4	219.6	214.9
3	Loss (1 minus 2)....	3.9	2.0	0.9	0.7	0.8
4	Approximate temperature of ignition	White heat.	Bright red heat.	Bright red heat.	White heat.	White heat.

[5] See Gmelin-Kraut: Handbuch der anorg. Chem., 1909 (vol. ii, pt. 2), p. 639, for comment on the great variety of basic phosphates.

[6] Bull. 107, U. S. Dep't of Agric., Bur. of Chemistry, 1912, p. 177.

[7] Carnot: *Compt. rend.*, 1881, xciii, p. 155.

[8] These, and the previously mentioned, precipitates of $AlPO_4$ were prepared from potassium alum (p. 196). $AlPO_4$, made from $AlCl_3$ and $(NH_4)_2HPO_4$, washed free from chlorides and dried to constant weight at 110° C., also very readily lost weight during strong ignition.

The fact that the masses of phosphate could be ignited to *constant weight,* after a preliminary production of oxid, suggests that a "surface layer" of the oxid protected the remaining phosphate from further decomposition.

Conclusions. The Schmidt-Hoagland method for the determination of aluminium gave results which involved a loss of as much as 7 percent of the available aluminium, but which was usually about 4 percent.

The losses appear to have been due, in the main, to the formation of Al_2O_3 from $AlPO_4$, in the precipitate of the latter during ignition, but also partly to the solubility of $AlPO_4$ in the reagents and washings.

The material, as finally weighed, is not wholly *normal* ortho-phosphate of aluminium, but contains less phosphoric anhydrid than does the same weight of ortho-phosphate.

The indicated error might invalidate the method for accurate determinations of relatively large amounts of aluminium. For comparatively small quantities, however, the error appears to be negligible.

ASSOCIATIONS AND SOCIETIES

Proceedings and items of interest to biochemists

PAUL E. HOWE

PREPARED CHIEFLY FROM REPORTS BY SECRETARIES

CONTENTS

I. SOCIETY OF PUBLIC ANALYSTS
and Other Analytical Chemists

P. A. ELLIS RICHARDS AND E. RICHARDS BOLTON, SECRETARIES

I. Ordinary Meeting, *1st March,* 1916.[1] Held at the Chem. Soc. Rooms, Burlington House, London. Mr. George Embrey, President, in the Chair.

Messrs. *Thomas John Hitchcock,* and *Nelson Trafalgar Foley* were elected members of the society. A certificate was read for the first time in favour of Mr. *Maurice S. Salamon.* A certificate was read for the second time in favour of Mr. *Frank Theodore Alpe.*

The papers abstracted below were read and discussed:

Manufacture of English chemical filter paper. *E. J. Bevan,* F.I.C. and *W. Bacon,* B.Sc., F.I.C. The introduction dealt with the manufacture of filter paper at the commencement of the war, with an approximation of the total consumption yearly. The manufacture of this paper, as carried out at the present time, is practically in the hands of four firms and, from examinations that we have

[1] The last preceding meeting was held 2d Feb., 1916. See BIOCHEMICAL BULLETIN, 1916, v, p. 107.

made from time to time, such papers can be looked upon as being well up to the standard of the German makes, and in certain respects, superior. The papers are classified according to their physical characteristics, in which the main question dealt with is that of bulk. Experiments were illustrated showing the relation of this factor to the rate of filtration and absorbency tests.

The chemical side of the question, with regard to choice of material, was next dealt with, and showed the common impurities found and the methods of removing same. Organic impurities were also described and an actual determination of such an impurity as oil, was outlined.

The application of filter paper for use in milk analyses and other work was also described.

Pink colour on the surface of margarine. *A. W. Knapp*, B.Sc., F.I.C. Beakers of margarine left about in the lab. often become pink on the surface. This colour is due to mineral acid vapours in the air of the lab. acting upon the azo-colour in the margarine. As butters do not give the colour, it can be used as a sorting test as follows. The filtered fat solidified in small beakers is placed in a crystallising dish, on the bottom of which is a filter paper soaked in strong hydrochloric acid. The dish is covered, and the fats examined after 2 hr. A pink colour indicates that the sample is probably margarine. The hydrochloric acid was found to diffuse ½ in. into the fat in 10 days.

A rapid method for the estimation of fat in powders. *S. B. Phillips.* The method was invented for the estimation of fat in cocoa, and is applicable to any substance which can be finely divided. The process consists of extracting the fat, from a known quantity of the substance, with trichlorethylene, and of determining the fat in an aliquot part of the sol. Such a quantity of the substance as is likely to contain 1.5 to 3.5 gm. of fat, is weighed by difference into a 6 oz., wide-mouthed, stoppered bottle (about 3.5 in. high to the shoulder), 100 cc. of solvent at room temp. is added from a pipette, and the mixture thoroughly shaken. The filter used is made by folding 2 filter papers (9 cm. diam.) together into the shape of a Soxhlet thimble and tying them into a small perforated cork (hole about 8 mm.) which is then fixed on the end of a 20 cc. pipette. Filtra-

tion is hastened by pressure applied to the bottle by means of a tube passed through a bung, which also carries the pipette. In this way 20 cc. of clear sol. is removed. The fat in it is determined after evaporation of the solvent. The total weight of fat in the substance taken is determined by multiplying by a factor, which varies according to the weight of fat obtained. Thus, if 0.3 gm. is obtained, the factor is 5.04; if 0.5 gm., 5.11; if 0.7 gm., 5.165.

A new colour reaction for aloes. *C. E. Stacy.* A pink colouration sufficiently delicate to detect one part of Barbadoes aloes in 10,000 is produced by the addition of a freshly-prepared sol. of potassium ferricyanide to the cold aqueous sol. of the aloes, under the conditions named. By the difference in colour of the reaction the author claims to be able to distinguish certain different varieties of aloes used in medicine, from each other and from commercial aloin in med. preparations.

II. Ordinary Meeting, *5th April, 1916.* Held at the Chem. Soc. Rooms, Burlington House, London. Mr. George Embrey, President, in the Chair.

Mr. *Frank Theodore Alpe* was elected a member of the society. A certificate was read for the second time in favour of Mr. *Maurice S. Salamon.*

The papers abstracted below were read and discussed:

On the alkalimetric estimation of certain bivalent metals in the form of tertiary phosphates, with especial reference to the volumetric determination of cobalt and nickel. *W. R. Schoeller,* Ph.D. and *A. R. Powell.* Stolba's alkalimetric method for the estimation of phosphoric acid in magnesium ammonium phosphate is also used for the determination of magnesium, and has been extended to that of zinc in zinc ammonium phosphate. The authors have demonstrated the applicability of the process to cadmium, manganese, and cobalt. On dissolving cobalt ammonium phosphate in a measured volume of $n/5$ acid and titrating back the excess of the latter, the intense colour of the sol. rendered most indicators useless. Results obtained with cochineal were always 0.5–2 mg. high, due to the action of cobalt on the indicator. By suspending cobalt ammonium phosphate in water and adding $n/5$ acid until the precipitate just disappeared, satisfactory results were obtained. It is shown

that the nickel in the filtrate from cobalt ammonium phosphate can be titrated by cyanide without further manipulations; hence the phosphate process for separating nickel and cobalt allows a separate volumetric estimation to be made of the two metals.

Note on a specimen of Russian oak. *P. A. Ellis Richards,* F.I.C. The author gives the results of his examination of specimens of oak that have been buried for many centuries in the sandy bed of the river Moksha in Russia. The chemical analysis shows that by the prolonged solvent action of water in the presence of a soil rich in iron, the sodium and potassium salts originally present have almost entirely disappeared whilst the percentages of iron and calcium compounds have greatly increased. The oak itself still retains its woody character although the colour has changed to a dark grey or black.

The estimation of potassium in presence of other substances. *A. H. Bennett.* The author describes a method based on a combination of the cobaltinitrite and perchlorate processes, which can be successfully used for the estimation of potassium in the presence of even considerable quantities of other substances, ammonium salts being the only substances of common occurrence capable of interfering with the results. The method is particularly applicable in the case of wine lees, argols, tartars, and in the liquors of tartaric acid works, where potassium occurs with free tartaric acid, sulphuric and phosphoric acids, iron, alumina and organic matter. Precautions to be observed when phosphates of iron and aluminium are constituents of the mixtures analysed are given, together with results obtained by the use of the process under varying conditions.

Royal Dental Hospital, W. C., and
46 Stamford Brook Road, W., London.

II. THE BIOCHEMICAL SOCIETY, ENGLAND

R. H. A. Plimmer, Secretary

March 20. Botany B'd'g, Imperial Coll. of Science and Tech., South Kensington, London, S. W. (5.30 P. M.)[2]

S. B. Schryver and (Miss) D. Haynes: Preparation and properties of plant pectins.

[2] The last preceding meeting was held on February 14. See Biochemical Bulletin, 1916, v, p. 109.

S. B. Schryver and (Miss) M. Hewlett: Diphasic action of salts on the cholate gel.

I. Jorgensen: Differences between natural chlorophyll and so-called artificial chlorophyll.

S. G. Paine: On the supposed origin of life in solutions of colloidal silica.

W. Brown: Demonstration of dialysis with differential collodion membranes.

V. H. Blackman: Demonstration of an electric growth recorder.

MEMBERS ELECTED: *David Burns, Dorothy Haynes, Enid S. Moore, Max Morse, H. Raistrick, G. Totani.*

OFFICERS ELECTED: Hon. Treas., *J. A. Gardner;* Hon. Sec., *R. H. A. Plimmer;* Ordinary members (new) of the Commit., *C. Crowther, F. G. Hopkins, O. Rosenheim.*

University College, London.

III. PAPERS (TITLES) AND TRANSACTIONS OF BIOCHEMICAL INTEREST IN THE PROCEEDINGS OF SEVERAL SOCIETIES

Amer. Chem. Soc.: Spring meeting, Urbana, Ill.; Apr. 18–21. GENERAL PROGRAM. *L. H. Smith:* Composition of corn as affected by 19 generations of seed selection.—*G. H. A. Clowes:* Influence exerted by electrolytes on the equilibrium of emulsions, jellies and living cells.—*C. F. Burnam:* Use of radium in the treatment of cancer.

DIV. OF AGR. AND FOOD CHEM. *Symposium:* The chemist in food control; Manufacturing standpoint.—*C. S. Miner:* Cattle foods. —*A. P. Bryant:* Starch and glucose.—*W. D. Bigelow:* Canning.—*J. R. Powell:* Gelatin.—*Harry Snider:* Flour.—*W. W. Skinner:* Salt purification.—*George Lloyd:* Flavoring extracts.—*W. M. Hoskins:* General.

Food investigations.—Arnold Wahl: Preventing the staling of bread by cooling in a predetermined atmosphere.—*W. B. Smith:* Use of picric acid in meat sugar sol.—*J. F. Snell:* Analysis of maple products.—*L. M. Tolman* and *J. G. Riley:* Study of Amer. beers to show the effects on their composition of various raw materials used

in their production.—*C. C. Wong* and *Katherine Blunt:* Chinese preserved eggs. Pidan.

Agri. Chem.—H. A. Huston: Effects of plant foods upon the amount and quality of substances used for foods, particularly fruits and vegetables.—*G. D. Beal* and *D. T. Englis:* Studies on liquid fertilizer.—*H. J. Wichman:* Detection of lime used as a neutralizer in dairy products.

Div. of Biological Chem.—*G. H. A. Clowes:* Formation of soap jellies and the process of blood coag.—*W. D. Bancroft:* So-called caseinates; Action of rennin on casein.—*G. H. A. Clowes:* Electrolyte antagonisms in physical and biol. systems; Anesthesia.—*C. L. Alsberg* and *H. E. Woodward:* Surface tension of saponin sol.—*A. Vichoever* and *C. O. Ewing:* Relative sensitivity of some commercial litmus papers.—*R. S. Potter* and *R. S. Snyder:* Aeration method for total nitrogen determ.—*B. S. Davisson:* Titrimetric determ. of nitrite-N; Determ. of ammonia by aeration.—*I. K. Phelps* and *H. W. Daudt:* Investigation of the Kjeldahl method for determ. nitrogen; New aeration apparatus.—*M. H. Fischer:* Physical and biol. chem. of fat.—*C. R. Smith:* Mutarotation of gelatin and its significance in gelation.—*A. D. Hirschfelder:* Effects of acids on the swelling of certain colloids; Brain lipoid as a hemostatic.—*R. A. Hall* and *R. E. Morris:* Pharmacol. action of citrates.—*R. A. Hall* and *E. D. Brown:* Fate of methylene disalicylic acid and derivatives in the body.—*H. B. Lewis:* Rôle of cystin in the maintenance of nitrogenous equilib. in dogs on a low protein diet.—*H. B. Lewis* and *W. G. Karr:* Excretion of uric acid after ingestion of sodium benzoate in man.—*W. G. Karr* and *H. B. Lewis:* Comparative study of the urea content of the blood and tissues of some vertebrates.—*H. A. Shonle* and *H. H. Mitchell:* Esterification of amino acids.—*E. M. K. Geiling* and *H. H. Mitchell:* Feeding exper. on the nutritive value of casein.—*H. H. Mitchell* and *H. S. Grindley:* Determ. of the digestibility of the constituents of a mixed diet.—*W. M. Clark* and *H. A. Lubs:* Hydrogen electropotentials of phthalate, phosphate, and borate buffer mixtures.—*E. J. Piper, C. J. Humphrey* and *S. F. Acree:* Chem. studies on the decomposition of red oak by *Fomes applanatus* and of red spruce by *Trametes pini var. abietis.*—*F. W. Tanner:* Bacterial metabolism of sulfur compounds.—*V. C. Myers:*

Colorimetric method of estim. amylolytic activity.—*V. C. Myers* and *A. R. Rose:* Colorimetric determ. of glucose, sucrose, dextrin, and starch in food stuffs.—*J. N. Currie:* Citric acid production of *Aspergillus niger.*—*O. Kamm:* Equation of fermentation of glucose by *B. coli communis.*—*R. Bengis* and *A. R. Rose:* Liberation of ammonia from ammonium salts by *B. coli communis.*—*A. Knudson* and *A. R. Rose:* Change in urinary constituents following the feeding of *B. coli communis.*—*J. Rosenbloom:* Ethereal sulfates of the urine in certain chronic diseases.—*J. Rosenbloom* and *Jena Miltan:* Ammonia content of human gastric juice.—*E. W. Rockwood:* Some auxoamylases. —*C. C. Fowler, M. Levine* and *S. B. More:* Chemical and bacteriol. study of some non-pathol. gastric residuums.—*C. C. Fowler* and *Z. Zentmire:* Study of 80 samples of gastric residuums obtained from apparently normal women.—*A. W. Bosworth:* Prep. of a synthetic milk for use in infant metabolism studies.—*R. J. Anderson* and *A. W. Bosworth:* Utilization of inosite in the animal organism: Effect of inosite upon the metabolism of man.—*R. J. Anderson:* Utilization of inosite in the animal organism: In the dog.—*G. O. Higley:* Analysis of urine as a part of the physical exam. of the college man.—*H. S. Grindley* and *H. C. Eckstein:* Non-protein constituents of foods and feeding stuffs.—*J. C. Ross:* Swine feeding exper. to determ. the nutritive value of amino acids.—*L. J. Desha:* Chem. methods in diagnosis: (I) Renal function; Contributions of the chemist to the science and art of medicine.—*J. H. Long* and *F. Fenger:* Reaction of the pancreas and other organs.—*H. A. Spoehr:* Chem. aspect of photosynthesis in plants.—*G. D. Buckner* and *J. H. Kastle:* Growth of isolated plant embryos.—*R. W. Thatcher:* Plant immuno-chem.—*E. H. Walters:* Presence and origin of volatile fatty acids in soils.—*R. S. Potter* and *T. H. Benton:* Organic phosphorus of soil.—*R. S. Potter* and *R. S. Snyder:* Changes in the amino-acid nitrogen and "soluble non-protein nitrogen" in heated soils.—*M. L. Foster:* Distrib. of nitrogen in egg lecithin.—*C. L. Alsberg* and *F. Brewster:* Nitrogen distrib. in certain seeds.—*A. Viehoever* and *J. F. Clevinger:* Oxalic acid and its salts in foods and spices.—*C. O. Johns* and *D. B. Jones:* Some proteins from the Jack bean, *Canavalia ensiformis;* Alcohol-soluble protein from Kafir corn, *Andropogon sorghum.*—*D. E. Worrall* and *M. K. McNamara:* Synthesis of tetracarbonimid.

Special biochemical program for Home Economics.—E. E. Butterfield: Diet in its relation to the treatment of diabetes.—*Ruth Wheeler:* Carbohydrates as milk modifiers.—*Louise Stanley:* Occurrence of creatin in the urine of children.—*Amy L. Daniels:* Relation of a diet high in calcium to the calcium content of the tissues.—*M. Louise Foster:* Phospholipins, lecithin, cephalin, and similar substances.—*Grace MacLeod:* Digest of data on mineral substances in the diet.—*Alice F. Blood* and *Viola Anderson:* Relation between the total nitrogen and the non-protein nitrogen in certain fruits and vegetables.—*Emily C. Seaman:* Report of a survey of the food conditions at Sing Sing prison; The relation of biol. chem. to problems of the community.—*Edwin Lefevre:* Bacteriol. study of hamburger steak.—*R. D. Milner:* Temp. of potatoes while cooking and a method of measuring temp. during cooking and canning.—*W. D. Bancroft:* Washing and cleaning; Whipped cream, etc.; Mayonnaise.—*H. L. Lang* and *C. F. Walton, Jr.:* Cleaning silver by contact with aluminum in alkaline sol.—*H. L. Lang* and *Anna H. Whittelsey:* Iron rust and its removal—new methods.—*Elizabeth W. Miller:* Solution of antimony from some enameled cooking utensils.

Div. Ind. Chem. and Chem. Eng.—*H. A. Kohman:* Use of certain yeast nutrients in bread making.

Div. Org. Chem.—*T. B. Johnson:* Researches on pyrimidin-nucleotides: new developments.—*E. C. White, H. A. Lubs* and *S. F. Acree:* Phenolsulphonephthalein dyes and the quinone theory of indicators.—*H. A. Lewis* and *S. F. Acree:* Use of viscose as a dialysis membrane.—*R. W. Schorger* and *D. F. Smith:* Galactan of *Larix occidentalis.*—*B. H. Nicolet:* Partial hydrogenation of cottonseed oil; Anomalies in the solidification points of fats.—*C. S. Hudson* and *D. H. Brauns:* Crystalline β-methyl fructoside and its tetracetates.—*C. S. Hudson* and *J. M. Johnson:* A fourth crystalline pentacetate of galactose and some related compounds.—*C. S. Hudson* and *J. K. Dale:* Isomeric pentacetate of glucosamine and of chondrosamine.—*C. S. Hudson* and *E. Yanovsky:* Indirect measurement of the rotatory powers of some of the alpha and beta forms of the sugars by means of solubility measurements.—*C. S. Hudson:* Numerical relations among the rotatory powers of the compound sugars.

DIV. OF WATER, SEWAGE AND SANITATION.—*F. W. Bruckmiller:* Modification of ammonia distillation in water; Modification of the Whipple method for direct nesslerization.—*John Johnston:* Determ. of carbonic acid, combined and free, in water.—*E. B. Phelps* and *W. F. Wells:* Numerical treatment of *B. coli* values in water analysis.—*F. N. Crawford* and *Edw. Bartow:* Composition of the effluent air from an activated sludge tank.

DIV. PHARM. CHEM.—*L. E. Sayre:* Toxicity of the volatile principles of coffee, with comments on coffee substitutes.—*J. H. Long:* Pancreatin tests of the pharmacopoeia.—*H. T. Graber:* Rennett: a note and a correction; Pepsin: a résumé of tests.—*R. A. Hall, E. L. Newcomb* and *R. E. Morris:* Relative toxicity of different species of digitalis.—*Norbert Mueller* and *Edw. Kremers:* Apparent and real ash content of digitalis.—*H. F. Lewis* and *G. D. Beal:* Alkaloidal assay by immiscible solvents.—*F. O. Taylor:* Prep. and characteristics of emetin; Unexpected reactions in pharmaceut. mixtures.—*H. A. Langenhan* and *Edw. Kremers:* Strength of fluid extracts.—*Ruth E. Okey* and *G. D. Beal:* Identification of emodin-containing drugs.—*E. Mallinckrodt, Jr.:* Determination of small amounts of water and alcohol in ether for anesthesia.—*C. H. Briggs* and *W. L. Irwin:* Detection of minute quantities of unsaturated hydrocarbons in liquid petrolatum.

SECTIONAL MEETINGS. CHICAGO SECT., Feb. 18.—*H. G. Wells:* Chem. and metabolism of nucleic acids. KANSAS CITY SECT., Nov. 13.—*P. A. Shaffer:* Fate of food protein in the animal body. LEXINGTON SECT., Mar. 9.—*W. S. Anderson:* Abderhalden test for pregnancy. LOUISIANA SECT., Mar. 17.—*W. L. Owen:* Influence of phosphates on alcoholic ferm.—*M. A. Schneller:* Determ. of diastatic power in wheat flour.—*F. W. Liepsner:* Discussion of by-products of rice milling. MINN. SECT., Mar. 24.—*J. J. Willaman:* Factors influencing the occurrence of hydrocyanic acid in plants. MISSOURI SECT., Feb. 18.—*C. W. Greene:* New physiol. aspects of fat metabolism. NASHVILLE SECT., Feb. 18.—*E. A. Ruddiman:* Estimation of extract of beef. N. Y. SECT., Apr. 7.—*W. H. Nichols:* University and industry; Discussion (among others) by *M. T. Bogert, P. A. Levene.* OREGON SECT., Apr. 1.—*H. V. Tartar:* Sulfur and soil acidity, two important factors in the fertility of

soils. RHODE ISLAND SECT., Mar. 23.—*F. P. Gorham:* Bacterial treatment of textile fibers. ROCHESTER SECT., Mar. 20.—*A. P. Sy:* Character, cost and adulteration of foods. ST. LOUIS SECT., Mar. 6.—*E. Bartow:* Activated sludge. SYRACUSE SECT.—Mar. 24.—*G. W. Cavanaugh:* Problems in agric. chem. WASHINGTON SECT., Mar. 9.—*H. H. Curtis:* Isolation of vitamines from brewer's yeast.—*A. Seidell:* Chem. nature of vitamines.

Amer. Philosoph. Soc.: Annual general meeting, Phila., Pa.; Apr. 13–15.—*R. F. Bacon:* Work of the Mellon Inst. in its relation to the industries and to the universities.—*J. W. Harshberger:* Origin and vegetation of salt marsh pools.—*W. J. V. Osterhout:* Dynamics of antagonism.—*J. J. Stephenson:* Coal formation.—*G. Scatchard* and *M. T. Bogert:* New and very sensitive indicator for alkalimetry and acidimetry.—*W. J. Gies* and collab.: Bacteriochem. studies of decay of the teeth.—*M. E. Rehfuss:* Human gastric secretion.—*F. W. Clarke:* Inorganic constituents of marine invertebrates.—*Raymond Pearl:* Effects of continued administration of certain poisons to the domestic fowl, with special reference to the progeny. (Contributed by *J. S. Hepburn.*)

Botan. Soc. Wash. *C. O. Appleman:* Relation of catalase and oxidases to respiration in plants.

Harvey Soc. Supper at Sherry's in honor of *W. H. Welch,* Apr. 29; speakers, *Abraham Jacobi, W. M. Polk, H. M. Biggs, S. W. Lambert, W. B. James, Simon Flexner.*

Nat'l Acad. Sciences:[3] Annual meeting, Apr. 17–19.—*S. J. Meltzer:* Permeability of endothelia.—*I. S. Kleiner* and *S. J. Meltzer:* Infl. of morphin upon the elim. of intraven. injected dextrose.—*Simon Flexner:* Finer mechanisms of protection from infection.—*V. C. Vaughan:* Protein poison.—*C. R. Stockard:* Heredity transmission of defects resulting from alcoholism.—*W. B. Cannon:* Recent observations on the activity of some glands of internal secretion.—*H. H. Donaldson:* Water content of the nervous system.—*C. L. Alsberg:* Relation of investigational work to the enforcement of the Food-and-Drugs Act.

Soc. Exp. Biol. and Med. *Mar. 15.—R. Ottenberg:* Effect of sodium citrate on blood coag. in hemophilia.—*S. J. Meltzer* and

[3] Abstracts of the proceedings: *Science,* 1916, xliii, p. 538.

John Auer: Effect of intraven. injections of magnesium sulfate upon conductivity in the center of deglutition.—*F. P. Underhill:* (a) Control of acidosis and its relation to impaired sugar metabolism in human diabetes; (b) Relationships between acidosis and creatine elim.—*G. M. Mackenzie:* Effect of exercise on blood sugar in depancreatized dogs.—*G. H. A. Clowes:* Production of soap jellies, and the physical conditions under which jelly formation takes place. *April 19.—A. F. Hess:* Separation of serum into coagulatin and anticoagulative fractions.—*M. S. Fine* and *V. C. Myers:* Comparative distrib. of urea, creatinin, creatin and uric acid in blood and spinal fluid.—*I. S. Kleiner* and *S. J. Meltzer:* Infl. of morphin upon the elim. of intraven. injected dextrose.—*Cary Eggleston:* Antagonism between atropin and certain central emetics.—*H. R. Miller* and *Hans Zinsser:* Complement fixation in tuberculosis.—*E. V. McCollum, Nina Simmonds* and *Walter Pitz:* Distrib. of the fat-soluble A, the growth-promoting substance of butter-fat in the naturally occurring foodstuffs.

IV. OFFICERS- AND MEMBERS-ELECT OF VARIOUS SOCIETIES

Acad. Nat. Sciences. Pres., *S. G. Dixon.*

Amer. Assoc. Anat.[4] Pres., *H. H. Donaldson;* vice-p., *C. M. Jackson;* sec., *C. R. Stockard;* members of exec. commit., *E. R. Clark, R. M. Strong.*

Amer. Assoc. Univ. Prof's. Pres., *J. H. Wigmore;* vice-p., *E. R. A. Seligman;* sec., *H. W. Tyler;* treas., *J. C. Rolfe.*

Amer. Pharmaceut. Soc. Pres., *F. J. Wulling.*

Amer. Soc. of Zool. Pres., *D. H. Tennent;* vice-p., *Chas. Zeleny;* sec., *Caswell Grave.*

Botan. Soc. of Amer. Pres., *R. A. Harper;* vice-p., *G. T. Moore;* sec., *H. H. Bartlett;* treas., *Arthur Hollick;* councillors, *David Fairchild, W. F. Ganong, B. E. Livingston.*

Phi Lambda Upsilon. Pres., *H. L. Fisher;* vice-p., *G. D. Beal;* sec., *L. C. Johnson;* treas., *B. S. Hull;* registrar, *S. C. Langdon;* editor-in-chief, *G. E. Cullen.*

Sigma Xi. Pres., *C. S. Howe;* sec., *H. B. Ward;* treas., *J. F. Kemp;* ex. commit., *J. McK. Cattell, J. Stieglitz, D. S. Kimball, E. Orton, C. E. McClung.*

[4] Proceedings in full; *Anatom. Record,* 1915, x, p. 132.

Soc. of Biol. Research, Univ. of Pittsb. Pres., *W. C. White;* sec.-treas., *W. W. G. Maclachlan;* addit. members of exec. council, *W. W. Blair, R. E. Sheldon.*

Soc. Exp. Biol. and Med. Pres., *Jacques Loeb;* vice-p., *W. J. Gies;* sec.-treas., *H. C. Jackson;* addit. members exec. commit., *J. Auer, E. F. DuBois.*

Washington Acad. of Sciences. Vice-p., *R. H. True.*

Amer. Philosoph. Soc. *F. R. Lillie, D. T. MacDougal, L. B. Mendel, E. F. Smith, W. L. Johannsen* (Univ. Copenhagen), *J. D. van der Waals* (Univ. Amsterdam).

Nat'l Acad. Sci. *M. T. Bogert, Otto Folin, P. A. T. Levene, A. G. Mayer, Raymond Pearl.*

Nat'l Inst. of Social Sciences. *L. P. Brown, Haven Emerson, W. J. Gies.*

Royal Swedish Acad. of Sci. Foreign members, *E. B. Poulton, R. Willstätter.*

Soc. Exp. Biol. and Med.—Jan. 19: *H. Amoss, A. A. Epstein, N. W. Janney, F. W. Peabody, Louise Peirce.*—Feb. 16: *Casimir Funk.*—Mar. 15: *Carl Ten Broeck, Edw. Uhlenhuth.*—April 19 (none).

Zoolog. Soc. (London). Foreign member, *Elie Metchnikoff.*

Biochemical Laboratory,
Columbia School of Medicine.

BIOCHEMICAL NEWS, NOTES, AND COMMENT

BENJAMIN HOROWITZ,

WM. J. GIES, HATTIE L. HEFT, PAUL E. HOWE AND W. A. PERLZWEIG

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EDGAR G. MILLER, JR., *New York City,*

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I. GENERAL

Necrology. *Béla Alexander,* direc. Radiologic Inst., Budapest Royal Hungarian Univ.—*W. P. Bolles,* prof. mater. med. and botany, Mass. Coll. of Pharm. (1874–'84); instr. mater. med. and therap., Harvard Med. Sch. (1880–'84).—*Elton Fulmer,* Wash. state chem.; sr. member and dean of faculty, Wash. State Coll.—*H. C. Jones,* prof. physic. chem., Johns Hopkins Univ.—*Ivan Lewinstein,* noted chemist who developed the aniline industry in England.—*Walter Loeb,* head chem. dept, Rudolf Virchow Hosp., Berlin.—Foreign papers announce the death of *E. W. Pavlov,* the Russian surgeon. It is possible that the published announcements of the death of *I. P. Pavlov,* the distinguished Russian physiologist, were due to

confusion of his name with that of his colleague.—*F. Schenck,* direc. Physiol. Inst., Marburg.—*J. F. Schmid,* chief Nat'l Public Health Service, Switzerland.—*V. A. Tichomirov,* prof. pharm. and mater. med., Moscow Univ., Russian Councillor.—*Francis Wyatt* (N. Y. City), authority on fermentation and brewing.

Resolution in memory of R. A. Witthaus. The faculty of the Cornell Univ. Med. Coll. has adopted the following memorial on the death of Prof. Witthaus, one of its members, written by Drs. Warren Coleman, W. G. Thompson and W. M. Polk:

In the death of Dr. R. A. Witthaus, emer. prof. of chem. (Dec. 19, 1915), after a long illness, the med. fac. of Cornell Univ. sustained the loss of one of its most famous men.

Dr. Witthaus was graduated from Columbia Univ. in 1867 and received the A.M. degree in 1870. He continued his studies at the Sorbonne and the Coll. of France. In 1875 he obtained the degree of M.D. from the Univ. Med. Coll. (N. Y. Univ.). He occupied chairs of chem. and toxicol., chem. and physiol., and chem. and physics, in the univ's of Vermont, Buffalo, and the Univ. Med. Coll. (N. Y. Univ.). In 1898 he was called to the chair of chem. and toxicol. in Cornell Univ. Med. Coll. and occupied this position until his retirement, for age, in 1911. Since 1911, he had been emer. prof. of chem. in Cornell Univ. Med. Coll.

Dr. Witthaus's career was most notable perhaps for two circumstances: the eminence to which he rose and for the fact that the subject in which he acquired fame was, in his youth, the plaything of a dilettante. His interest in chem. dated back to his college days, when he converted a room in his father's stable into a lab. where he amused himself with the study of chem. problems. Reverses in fortune soon compelled him to seek a livelihood in what had been his hobby.

In his riper years he was without a peer as a medico-legal expert. His services were often sought by the state in criminal trials involving toxicol. questions and his testimony was always an important, if not the leading factor, in the verdicts of the juries. He made what is probably the most complete catalog of reported cases of poisoning in existence.

Dr. Witthaus was a prolific, as well as a convincing, writer. His text books, "Essentials of Chem.," "General Med. Chem.," "Manual of Chem." and "Lab. Guide in Urine Anal. and Toxicol.," were much

in demand and passed through numerous editions. He contributed articles on toxicol. subjects to Wood's "Handb. of the Med. Sciences," and edited "Witthaus and Becker's Med. Jurisprudence," the fourth volume of which he wrote.

He was a Fellow of the Amer. Assoc. for the Adv. of Science, of the N. Y. Acad. of Med. and other scientific bodies, including chem. societies in Paris and Berlin.

Dr. Witthaus was a man of broad culture and had many interests outside of his profession. He was an ardent disciple of Izaak Walton. His love of books amounted to a passion. At several different periods of his life he collected libraries of first and other rare editions. During his last years his chief interest lay in the collection and cataloging of books and original manuscripts.

His fortune and med. library were bequeathed to the N. Y. Acad. of Med.

Resignation. *Dr. S. P. Sadtler,* prof. of chem., Phila. Sch. of Pharm.

Appointments.[1] Boston Floating Hosp.: Mr. *A. W. Bosworth* (N. Y. Agric. Exp. Sta.), biol. chemist.

British Dyes, L'td.: Dr. *J. C. Cain,* chief chemist.

Cambridge Univ.: Dr. *A. V. Hill* (lect. in physiol. chem.), fellow of King's Coll.

Chicago: Dr. *W. W. Armstrong* (head of food bureau), supervision field-officer (transfer).

Columbia Univ.: Dr. *W. A. Bastedo,* assis. prof., clin. med. (promotion); Dr. *A. T. Martin,* lect., pharmacol.; Dr. *F. H. Pike,* assoc. prof., physiol. (promotion); Dr. *W. M. Rhett,* instr., pharmacol.

General Educ. Board: Prof. *R. M. Pearce,* ch'r'n commit. to study the condition of med. educ. in Brazil.

Harvard Med. Sch.: Dr. *G. R. Minot,* assis. in chem.

N. Y. Conserv. Commis.: *Mr. Francis Harper,* to make detailed study of the fishing waters of Oneida Co., N. Y., as a basis for scientific working plans for fish stocking and protection.

N. D. Agric. Coll.: Prof. *E. F. Ladd,* dean of chem. dep't, pres't.

Rutgers Coll. (New Brunswick, N. J.): Dr. *A. R. Moore* (Bryn

[1] In this summary institutions *from* which appointments were made are named in parentheses. See also page 245.

Mawr Coll.), prof. of physiol.; head of newly created dep't of physiol.

Univ. of Berlin, Rudolf-Virchow Hosp.: Prof. *Julius Wohlgemuth* (assis., Path. Inst.), direc., Chem.-physiol. Div.

Univ. of Cal., Med. Sch.: Dr. *T. B. Robertson,* prof. of biochem.; head of newly created dep't of biochem. and pharmacol.

Univ. of Cambridge: Dr. *S. W. Cole* (Trinity Coll.), univ. lect., med. chem.

Univ. of Chicago: Dr. *E. O. Jordan,* ch'r'n, commit. on sanitation and hygiene.

Utah Agric. Coll.: Dr. *E. G. Peterson,* pres't.

Lectures and addresses. ENDOWED. *Harrington Lects.,* Univ. of Buffalo Med. Sch.; May 30, 31: Dr. *M. J. Rosenau,* Anaphylaxis.

Harvard Med. Sch.; *Cutter Lect.,* Apr. 26: Dr. *Simon Flexner,* Finer adjustments of immunity reactions to recovery from infection.

Jerome Cochran Lect., Ala. Med. Assoc., Mobile; Apr. 18: Dr. *H. A. Kelly,* Radium therapy in the treatment of disease.

Royal Inst'n: The day lectures after Easter included Prof. *C. S. Sherrington,* Harvey and Pavlov; Dr. *T. M. Lowry,* Optical research and chem. progress; Prof. *W. H. Bragg,* X-rays and crystals (Tyndall lect.); Prof. *C. G. Barkla,* X-rays.

MISCELLANEOUS. Amer. Chem. Soc., N. Y. Sect. Dr. *P. A. Levene* was one of the speakers in the formal discussion of "Univ. and Industry," at a meeting in the Chem. Club, Apr. 7.

Annual Congress in Med. Educ., Chicago, Feb. 7: Prof. *F. S. Lee,* Relation of the laboratory courses to the work of the clinical years.

Chem. Soc. (London), Feb. 3: Dr. *W. H. Bragg,* Recent work on X-rays and crystals, and its bearing on chemistry.

Coll. of the City of N. Y.; May 12: Dr. *J. P. Atkinson,* Food poisons.

Columbia Univ.; *Phi Lambda Upsilon Lect.,* Apr. 5: Dr. *Virgil Coblentz,* Influence of the war on our supply of drugs and medicinal chemicals.

Franklin Inst.; May 17: Prof. *T. W. Richards,* Fundamental properties of the elements.

Marquette Univ., Mar. 16: Dr. *A. S. Loevenhart,* Biological aspects of oxidation.—Apr. 19: Dr. *W. J. Meek,* Physiology of adrenalin.

Menominee, Mich.; Apr. 10: Dr. *V. C. Vaughan,* Influence of disease on civilization.

New England Assoc. of Chem. Teachers, 55th meeting; Harvard Univ., Feb. 12: *G. L. Wendt,* Radium and its contribution to chem.

N. Y. Acad. of Med.: *Symposium on alcohol,* Apr. 6.—Dr. *F. G. Benedict,* Influence of alc. on man, with special reference to psychol. effects.—Dr. *R. C. Cabot,* Relation of alc. to personal efficiency. *Discussion:* By Drs. *Haven Emerson, F. S. Lee, B. Sachs, C. R. Stockard, C.-E. A. Winslow.*

N. Y. Acad. of Sci.; Sect. of Biol., May 8: Dr. *W. C. Clark,* Some phases of bone growth in the adult.

Racine Co. Med. Soc., Ill.; Mar. 30: Dr. *F. E. Simpson,* Radium and its uses in the treatment of cancer and other skin diseases.

School lunch problem: Second Inter-municipal conf.; Boston, Mass., May 5 and 6.—*Sarah L. Arnold:* Popular education as to diet.—*P. G. Stiles:* Application of dietary standards to the needs of the normal child.—*W. E. Brown:* Public health and food education.

Univ. of Neb., *Sigma Xi;* Feb. 12: Dr. *H. L. Shantz,* Water as a factor in plant growth.

Univ. of Wis., Mar. 16: Dr. *L. M. Warfield,* Essentials of diagnosis in internal medicine.

Wash. Acad. of Sci.; Mar. 23: Dr. *L. H. Backeland,* Chem. in relation to war.—Dr. *E. F. DuBois,* Basal food requirement of man.—Apr. 14: Prof. *Graham Lusk,* Nutrition and food economics. —Apr. 21: Dr. *E. B. Forbes,* Mineral metabolism of animals.—Apr. 28: Dr. *Carl Voegtlin,* Relation of vitamines to nutrition in health and disease.

Washington Irving High Sch. (N. Y. City); Mar. 24: Dr. *H. W. Wiley,* Relation of dental hygiene to public health.

Wellesley Coll.; Mar. 14: Dr. *F. G. Benedict,* Living without food for 31 days.

Winnebago Co. Med. Soc., Rockford, Ill.; Apr. 11: Dr. *E. H. Ochsner,* Biochem. of topical applications.

Yale Univ., *Sigma Xi;* Mar. 1: *Prof. C. R. Stockard,* Experimental studies on the influence of alcohol in development and inheritance.—Mar. 18: Prof. *J. McK. Cattell,* Scientific research as a profession.

Prizes. ADAMACHI PRIZE, Roumanian Acad. of Sci.: Drs. *A. Babes* and *V. Busila* (Bucharest), for a comprehensive report on pellagra in Roumania.

ELLEN RICHARDS RESEARCH PRIZE. The Naples Table Assoc. for Promoting Lab. Research by Women announces the offer of an 8th prize of $1,000 for the best thesis written by a woman, on a scientific subject. This thesis must embody new observations and new conclusions based on independent lab. research in biol. (including psychol.), chem. or phys. science. The theses offered must be in the hands of the ch'r'n of the commit. on the prize, Dr. *Lilian Welsh,* Goucher Coll., Balt., Md., *before Feb. 25, 1917.* The title page of each manuscript must bear an assumed name; and the writer must send with her manuscript, a sealed envelope containing her application blank and superscribed with her assumed name. The B'd of Examiners, for 1916–17, are Drs. *W. H. Howell* (J. Hopkins Med. Sch.), *E. P. Kohler* (Harvard Univ.), and *Henry Crew,* (Northw. Univ.). In April, 1911, the prize was named the Ellen Richards Research Prize, in recognition of the devoted service of Mrs. Richards as ch'r'n of the commit. on the prize from its establishment in 1900.

Paris Acad. of Sci. Proposed prizes for 1917: *Chem.*—JECKER PR. (10,000 f.), for work leading to progress in org. chem.; CAHOURS PR. (3,000 f.), for encouragement of young chemists who have already published good work; MONTYON PR. (2,500 f.), for a means of rendering an art or calling less unhealthy; HOUZEAU PR. (700 f.), to reward a promising young chemist; BERTHELOT PR. (500 f.), for researches in chem. synthesis. *Med. and surg.*—MONTYON PR. (2,500 f.), for work most useful in the art of healing; BARBIER PR. (2,000 f.), for a valuable discovery in surg., med., or pharmaceut. science, or in botany in relation to med.; BREAUT PR. (100,000 f.), for a radical cure for Asiatic cholera. *Physiol.*—

MONTYON PR. (750 f.), for work in exper. physiol.; POURAT PR. (1,000 f.), for work on the relation between combined sugar and protein of the blood.

RAYMOND HORTON-SMITH PRIZE (Cambridge): *Dr. E. Mellanby,* for a thesis on Cause and treatment of diarrhea and vomiting in children.

The 20th Cent. Club, Detroit, Mich., offers three prizes of $20, $10, and $5, resp., for the best three stories, containing between 2,000 and 5,000 words, on the effects of cigaret smoking. The stories will furnish material for a volume of anti-cigaret literature for use in school libraries. All stories in competition must be sent to the ch'r'n of the Anti-Cigaret Commit., Mrs. *O. E. Angstman,* 277 Putnam Ave., Detroit, Mich., by June 15, 1916.

Medal. NICHOLS MEDAL, Amer. Chem. Soc., N. Y. Sect.: Dr. *C. S. Hudson,* in recognition of his work on carbohydrates.

Journalistic. NEW JOURNALS. *Jour. of Bacteriology:* Official organ, Soc. of Amer. Bacteriologists. Ed.-in-ch., *C.-E. A. Winslow;* man'g ed., *A. P. Hitchens;* with 22 "advis. editors" and 31 "abstr. editors." Bi-monthly: subscr. price, $5.00 per vol.

The Phila. Sect. of the Amer. Chem. Soc. is publishing a monthly paper, "*The Catalyst.*"

Soil Science: "Devoted to problems in soil physics, soil chem., and soil biology." Ed.-in-ch., Dr. *J. G. Lipman.* Among the group of internat. collab. are Drs. F. J. Alway, H. J. Conn, E. J. Russell and Oswald Schreiner. Monthly: subscr. price, $3.00 per vol.

PHYSIOLOGICAL ABSTRACTS. See page 252.

JOUR. BIOL. CHEM. Dr. *C. J. West* has been elected a member of the b'd of ed. of the *Jour. of Biol. Chem.* His service began with the Feb. issue.

Fellowships. Columbia Univ.: A gift of $2,400, from Mrs. *F. S. Coolidge,* for the maintenance of research fellowships in med.

Harvard Med. Sch.: Drs. *W. R. Ohler, E. F. Walsh, J. A. Wentworth,* fellows in chem.

The *Mary Putnam Jacobi Fellowship* has been awarded to Dr. *Mildred Clark* (Johns Hopkins, 1914), who will use the fell. for research in med. bacteriol. in Dr. T. C. Janeway's dep't at Johns Hopkins Hosp.

Mellon Inst., Univ. of Pittsburgh, *Indust. fellowships* in operation Jan. 1, 1916:

28: FERTILIZER.—$2,500 a yr. for 3 yr.; bonus, $5,000. Fellow, *E. S. Bishop,* M.A., Univ. of Neb. (Jan. 5, '14.)

34: FATTY OILS.—$2,100 a yr. for 2 yr. Fellow, *L. M. Liddle,* Ph.D., Yale. (July 1, '14.)

48: BREAD.—$6,500 a yr. for 2 yr.; bonus, $10,000. Fellows: *H. A. Kohman,* Ph.D., Univ. of Kan., senior fellow; *T. M. Godfrey,* B.S., Univ. of Kan., and *L. H. Ashe,* B.S., Univ. of Pittsb. (Mar. 1, '15.)

49: CANDY.—$1,800 for 1 yr. Fellow, *C. A. Neusbaum,* A.B., Wabash Coll. (July 1, '15.)

51: YEAST.—$2,800 a yr. for 2 yr. Fellow, *Ruth Glasgow,* M.S., Univ of Ill.; scholar, *T. A. Frazier,* Univ. of Pittsb. (Sept. 1, '15.)

55: PHARMACEUTICAL PRODUCTS.—$13,000 for 1 yr. Fellows: *J. R. Watson,* B.Sc., London Univ.; *R. A. Dunphy,* Ph.D., Univ. of Pittsb.; *H. W. Huntley,* M.A., Univ. of Wis.; *J. B. Churchill,* B.S., Harvard; *R. N. Mullikin,* Ph.D., Johns Hopk.; *E. P. Wightman,* Ph.D., Johns Hopk.; *R. W. Harris.* M.S., Ohio State Univ. (July 7, '15.)

56: SOAP.—$2,000 for 1 yr. Fellow, *B. H. Nicolet,* Ph.D., Yale. (June 26, '15.)

57: GLUE.—$1,800 for 1 yr. Fellow, *R. C. Schuey,* B.S., Univ. of Kan. (July 1, '15.)

63: PEAS.—$1,200 for 1 yr. Fellow, *E. H. Taylor,* M.S., Univ. of Ill. (Nov. 1, '15.)

64: Petroleum.—$10,000 for 1 yr.; bonus, $10,000. Fellows: *B. T. Brooks,* Ph.D., Univ. of Gött., sr. fellow; *I. W. Humphrey,* B.S., Univ. of Kan.; *Harry Essex,* Ph.D., Univ. of Gött.; *D. F. Smith,* M.S., Univ. of Wis. (Sept. 1, '15.)

65: COMPOUND FATS.—$2,800 for 1 yr. Fellow, *E. O. Rhodes,* M.S., Univ. of Kan.; scholar, *R. L. Wharton,* Univ. of Pittsb. (Oct. 1, '15.)

66: GLYCERO-PHOSPHATES.—$1,500 for 1 yr.; bonus, 10 percent of profits. Fellow, *F. F. Rupert,* Ph.D., Mass. Inst. Tech. (Oct. 1, '15.)

Miscellaneous items. PERSONALIA. A demonstration of admiration and affection was rendered to Prof. *H. A. Hare,* Apr. 11, by the faculty and students of Jeff. Med. Coll. in commemoration of his 25th anniv. as a member of the coll. fac. A reception, which was attended by several hundred students, members of the fac., and professional friends, was held in the hosp. amphitheater. Dr. *F. X. Dercum,* prof. of nerv. and ment. diseases, acted as ch'r'n, and a beautiful bronze statue of Mercury, by Pigalle, was presented by the students. The presentation address was made by Dr. *J. C. Da Costa,* prof. of clin. surg., and a memorable address of appreciation and acceptance was made by Dr. Hare.

The students in pharmacy, Univ. of Pittsb. Coll. of Pharm., recently gave a dinner in honor of Prof. *J. A. Koch,* on the 25th anniv. of his appointment as dean of the college.

Dr. *Mary E. Pennington* is the only member of the Amer. Soc. of Biol. Chemists to be included among the "advisory editors" of the recently founded *Jour. of Bacteriology.*

Prof. *Elie Metchnikoff* has been seriously ill at the Inst. Pasteur. Sir Ray Lankester wrote to *Nature,* under date of Feb. 26, that Metchnikoff's med. attendants believed the pleurisy would soon disappear and that the pulmonary congestion had already vanished.

RADIUM CLINIC. The Radium Inst'n of N. Y. has established a weekly clinic at 205 West 70th St., and extends a general invitation to med. men to be present any Saturday afternoon.

ALCOHOL AND ITS EFFECTS. Dr. *Kraepelin,* an eminent investigator, has written an entirely new chapter on this subject. Working with instruments of precision that measure the rapidity of transmission of nerve impulses and mental operations, he found that as small a quantity as ¼ oz. of alc. produced paralyzing influences that could be detected for hours afterwards by such instruments. These experiments demonstrated that it frequently takes a man under the influence of alc. seven times as long to hear, feel, taste, or receive an impression of any sort as a normal person. Such a man, called upon to act in an emergency—an engineer, for instance, would require at least seven times as long to make up his mind what he ought to do as a healthy person would require. DAVID PAULSON: *Med. Rev. of Rev.,* 1916, xxii, p. 284.

Work and alc. do not belong together, especially when work demands wideawakeness, attention, exactness and endurance. QUENSEL: The alc. question from a med. viewpoint—Studies in the pathol. of alcoholism; *Year Book, U. S. Brewer's Assoc.*, 1914, p. 168.

TRIBUTE TO FAVILL. Members of the Nat. Dairy Council, repr. every branch of that industry, held a memorial meeting at the Hotel Sherman, Chicago, Feb. 28, to pay tribute to their late pres't, Dr. *H. B. Favill.*

MANITOU WATERS. The El Paso Co. Med. Soc. (Tex.) has appointed a commit. of ten, known as the Manitou Mineral-Waters Commis. of the El Paso Med. Soc. This commit. intends to secure the services of a physiol. chemist, to thoroly test the effects of the waters, and will provide a fully equipped lab. for exper. purposes.

"PHILA. THE HOME OF DENTISTRY." An exhibition illustrating the progress of dentistry was held at the Hotel Adelphia Roof Garden, Phila., under the auspices of the dental manufacturers and dealers of Phila., April 25 to 28, inclusive.

DERMATOLOGISTS SEEK CHARTER. A petition for a charter was filed, Mar. 1, in the Common Pleas Court, of Phila., by Drs. *J. F. Schamberg, J. M. Kolmer, David Riesman* and *A. D. Ferguson,* for the incorporation of a Dermatol. Research Lab., the object as stated being "for the promotion of scientific research into the cause and cure of skin diseases and every other disease of cognate character."

ACIDOSIS. Much remains to be learned regarding acidosis. The presence of abnormal acids explains the origin of some forms, but there are others that are in nowise understood. Are there abnormal acids whose presence has not been detected? Are normal acids formed in excess? Are bases lost? Does the kidney fail to excrete sufficient acid? These are a few of the questions at present unanswered that must be answered before our knowledge of acidosis can be considered in any way complete. JOHN HOWLAND and W. MCK. MARRIOTT: *Bull. Johns Hopk. Hosp.*, 1916, xxvii, p. 63.

SPRAGUE MEMOR. INST.: Officers and workers, 1915. *Director,* H. G. Wells. *Members,* R. T. Woodyatt, Samuel Amberg, Lydia M. DeWitt, E. A. Graham, H. F. Helmholz, Maud Slye, H. J. Corper, E. J. Witzemann, Harriet F. Holmes. *Voluntary investi-*

gators, Frank Billings, Linton Gerdine, W. H. O. Hoffmann. *Fellows,* W. B. McClure, L. W. Sauer, A. B. Schwartz, L. D. Minsk, G. H. Coleman, Kaethe W. Dewey, H. B. Culver, Frank Nuzum. *Assistants,* R. M. Wilder, W. D. Sansum, J. H. Lewis, Hope Sherman, Mary B. Maver, Edith Farrar, G. L. Huber, G. T. Caldwell, S. M. Cadwell, C. H. Christman, J. J. Moore.

Lowest body temp. The lowest recorded body temp. in a human being who survived was 75° F. The patient was a man, aged 34, who, while intoxicated, had been exposed to a temp. of 34° F. over night. This case was reported by Reineke (*Deut. Archiv. für klin. Med.,* xvi, 15). A temp. as low as 71.6° F. is said to have been observed in one case. The authority in the latter case, however, does not seem entirely dependable. Answer to query: *Jour. Amer. Med. Assoc.,* 1916, lxvi, p. 978.

Apparatus. Long experience has taught that however much we may owe to the great minds that evolve basic generalizations and hypotheses, real progress in science ultimately rests on the establishment of facts. Our reasoning faculties, by themselves, are unable to cope with the complexity of the phys. world, and are sure to stray from reality unless they are continually guided by observation and experiment. Galileo with his exper. methods contributed more to science than did all the generations preceding him. . . . *The greater the advancement in any branch of science, the greater must be the development of the apparatus that is employed. The two are necessarily interdependent.* The instrument is to a great extent an index of the state of the science. The greater the precision with which we can make our observations and measurements, the surer we are of keeping on the right path in our interpretation of the phenomena concerned. Anthony Zeleny: *Science,* 1916, xliii, p. 185.

Methods. *Preparation of collodion membranes.* Collodion thimbles of regularly increasing degree of permeability may be prepared by soaking air-dried thimbles in alcohol-water mixtures of increasing alc. content. The diffusive capacity of any substance through collodion may be specified in terms of the alc. strength required to produce the membrane which just prevents its passage. This may be termed the "alcohol index" of the substance. W. Brown: *Biochem. Jour.,* 1915, ix, p. 617.

Comparison of methods for the determination of casein in milk. Though the official nitrogen method is the standard of accuracy for the determ. of casein in milk, the results show that, for all ordinary work, the Hart method with electric centrifuge is dependable, checking very closely the official method, and is far superior to the volumetric method. As to the time required by the three methods, the official is longest in total time, with about the same time required in personal attention as the Van Slyke method. The Hart method requires, however, but a small fraction of the time of the other methods and has the added advantage of requiring neither exactly standard solutions nor final calculation of results. C. B. HERSEY: *Jour. Ind. and Eng. Chem.*, 1916, viii, p. 336.

Use of paper pulp in quantitative analysis. The application of the pulp filter to the quant. estim. of barium and sulfuric acid as barium sulfate, of silver and hydrochloric acid as silver chlorid, and of potassium and ammonium as chlorplatinates, has been shown to give results as accurate as those obtained with standard filter paper. It is convenient and easy to handle, when applied to the quant. determ. of the above acids and bases, and enables one to save considerable time and labor. S. L. JODIDI and H. E. KELLOGG: *Jour. Ind. and Eng. Chem.*, 1916, viii, p. 319. (See also BIOCHEM. BULL., 1916, v, p. 87.)

Electrical treatment of water. The gases produced (by electr. action on water) kill a large number of microorganisms, but to kill them all the conditions of the exper. must be such as to bring all the organisms into contact with the gas. I should think it possible that some scheme might be devised whereby efficient treatment could be imparted without relying upon the action of sedimentation. This settling action is undoubtedly an important factor to be dealt with, and if it is feasible to combine the effects of the gases and the effects of sedimentation into a working scheme, the results could be absolutely relied upon. The action of electr. pure and simple is useless. T. A. STARKEY: *Amer. Med.*, 1916, xxii, p. 187.

Manufacture of gasoline and benzene-toluene from petroleum and other hydrocarbons. The large-scale exper. have fully confirmed the lab. exper. and established the fact that the conversion into gasoline can be even more satisfactorily accomplished in a tube of

greatly enlarged diam. and increased length than in the electr. heated 1½ in. tube. The conditions favorable for gasoline produc. are shown to be the same in the larger tubes as in the small tube, namely, a temp. of approx. 500 to 575°C. and a pressure of 250 to 300 lb. per sq. in. The gasoline process, therefore, can justly be considered as a success so far as conversion in the large tubes is concerned. The adaptation of the unit to refinery conditions is a matter of mechan. detail involving no inherent difficulties. In view of the continuous operation of the benzene-toluene process by the Aetna Explosives Co., over a period of nearly one yr., as well as the results of the large-scale operations, there can exist little doubt as to the success of the benzene-toluene process on a commer. operative scale. It has been proved that benzene and toluene can be produced in large quantities by this process. These products have been shown to be capable of being worked into the nitro-compounds desired for making explosives. Furthermore, these nitro-compounds, or the derivatives thereof, are equally suitable for use in producing dyestuffs.

The claims which were made for the process at the outset have thus been fully verified by commer. results, and its future is dependent alone upon the perfection of the mechan. apparatus and the consequent reduction in labor and operating costs. W. F. RITTMAN, C. B. DUTTON and E. W. DEAN: *Jour. Ind. and Eng. Chem.*, 1916, viii, p. 361.

UNSUSPECTED SYPHILIS. Many years ago Sir William Osler used to emphasize the importance of obscure syphilis and admonished his students in no uncertain terms to remember the frequency and diversity of the manifestations of this protean disease; and only the other day his successor in Balt., Dr. *L. F. Barker,* speaking before the N. Y. Acad. of Med., said: "The more my experience grows, the more I am inclined to take as a diagnostic aphorism, 'When in doubt have a Wassermann test made; when not in doubt still have a Wassermann test made.'" EDITORIAL: *Amer. Med.*, 1916, xxii, p. 152.

BILE PIGMENT METABOLISM. The curve of bile pigm. secretion can be depressed below normal by a meat diet, and can be raised much above normal by a diet rich in carbohydrates. . . .

This observ. must dispose of the commonly accepted belief concerning the origin of bile pigm.; namely, that they can be formed only by the breaking down of red blood cells. Can one assume, that a carbohy. diet will cause the dissolution of a small army of red bl.-cells, to explain the fact that the output of bile pigm. may be almost doubled in a sharp transition from a meat diet to a diet rich in carbohy.? C. W. HOOPER and G. H. WHIPPLE: *Amer. Jour. of Physiol.,* 1916, xl, p. 349.

CONSCIENCE OF THE EXPERT. For two cent. there has been growing up in the exper. lab. an ideal of exactness and a reverence for tested fact. . . . The standing of a univ. as a research inst'n is determined by its lab's. The buildings of a modern med. sch. consist almost entirely of lab's. Nowadays the first thing wise men do when they are face-to-face with a grave problem, relating, say, to food values, or ventilation, or juvenile delinquency, or whether animals reason, or the harmfulness of adulterants, is to equip a research lab. for working it out. We have realized that the old-fashioned reflection and discussion are but a poor method of finding truth. The spirit of the lab. is a sense of the all-importance of fact, a nervousness as to error, a willingness to take infinite pains in measuring and verifying. Formerly only chemists and engineers went out into their life-work with this spirit. But of late, lab's have so multiplied in the univ's, in the research bureaus of gov't, and in the big indust. concerns, that you will find this spirit in many groups of social servants, such as physicians, psychiatrists, criminologists, statisticians, sanitarians, charity agents, social workers, factory inspectors and probation officers. The lawyers and the preachers have scarcely caught it, but in the school of journalism, with "Accuracy Always" a wall motto and a daily prayer, the students are getting it. Whether the conditions of newspaper employment will permit them to act upon it remains to be seen. . . . E. A. ROSS: *School and Society,* 1916, iii, p. 522.

NEW INSTITUTES. *Indus. Research Inst.* The Univ. of Wash. has established a Bur. of Indus. Research similar to the Mellon Inst. of the Univ. of Pittsb. The plans for the Bur., which were developed by members of the fac. and business men of the northwest, met with the approval of the board of regents of the univ. at its

last meeting, and *Henry K. Benson,* prof. of industrial chem., was appointed director. The Bur. will coordinate the research activities already undertaken by the univ., in order fully to utilize the resources of Washington. Contributions have already been assured to initiate the plan and the univ. will lend all its facilities for the furtherance of the work of the bureau.

Prophylactic Inst. Under this title an association has been formed in Paris whose object is to conduct a campaign for the gradual extinction of syphilis. Besides the direct treatment of patients, it will undertake scien. researches, and bring continuous action to bear on the admin. authorities. Among the members are Dr. *Roux,* Direc. Pasteur Inst., Dr. *Ladouzy,* Dean Paris Fac. of Med., M. *Painlevé,* Min. of Instr. and of Invent. affecting Nat'l Defence, and M. *Brieux,* author of Les Avaries. Mr. *F. J. Gould* has sent 250,000 f. to the Foundation Commit. of the new Inst.

Curriculum in Public Health. The Univ. of Cal. offers, besides the work usual to a med. sch., a "Curric. in Pub. Health," in which the grad. degree of "Grad. in Pub. Health" may be earned by those who specialize in med., chem., bacteriol., or san. engin., and who plan a career in prevent. med., san. science, and pub. hygiene.

Warning regarding treatment of "hay fever." The authors feel it incumbent upon them to warn the med. profession against "hay fever" vaccines which contain a mixture of a large number of pollen extr., such mixture being given both for spring and fall cases. No diagnostic means are employed to determine which pollen or pollens are operative in a given case. Under these conditions many a patient who is suffering from the spring variety of pollinosis, being already a fit subject for further sensitization, is placed in danger of becoming sensitized to those pollens which are active during the fall. It may also be stated that pollen extracts in large doses are extremely dangerous, and with the dosage not properly controlled by experienced workers in this particular field, a calamity from mishandling may cast a shadow upon a very valuable proposition. S. Oppenheimer and M. J. Gottlieb: *Med. Rec.,* 1916, lxxxix, p. 508.

Viruses, serums, toxins and analogous products for use in the treatment of domestic animals to be better super-

VISED. A comprehensive bill to regulate commerce in, and importation of, viruses, serums, toxins, and analogous products, for use in the treatment of domes. animals has been introduced into Congr. by Repr. Steele of Iowa. If enacted in its present form, domes. animals will have better legal protection against danger from the class of remedies named than will human beings, unless in the meantime there should be similar legislation for the protection of the humans. The execution and enforcement of the law will be under direction of the Sec'y of Agric. *Jour. Amer. Med. Assoc.*, 1916, lxvi, p. 967.

The U. S. Supr. Court's decision, upholding the constitutionality of the Food-and-Drugs Act, brings to mind the fact that all biol. products, such as serums, vaccines, and similar therapeutic agents intended for veterinary use, can be manufac. only in establishments having a license from the Bur. of Animal Ind. This license is good for one yr. and is issued only to establishments, which, on inspection, are seen to be fit, from the san. point of view, for the manufac. of material for which a license is asked. The Pathol. Div. of the Bur. of Animal Ind. examines the various products to ascertain whether the claims made are correct; their decision is final. This is a recent law and was enacted at the urgent request of many stockmen, who suffered severely from the worthless preparations sold to them. Sometimes worthless antitoxic serums were sold by houses of great reputation. As an instance, the firm of ——— sold a serum for the treatment of anthrax in horses, which was worthless. Not a word of protest from this firm was heard when the Bureau revoked the firm's license for making anthrax serum. The other products marketed by this firm are good.

PHARMACEUTICAL. *New Sch. of Pharm.* The Univ. of Ill. has purchased, for its Sch. of Pharm., a new site located at Wood and Flournoy St's, Chicago, immediately opposite the new Cook Co. Hosp., and affording a frontage of 201 ft. on Wood St. and 128 ft. on Flournoy St. The purchase includes two substantial brick b'ld's erected for the Chicago Homeopathic Med. Coll. and Hosp. some years ago. These b'ld's will be remodeled. It is expected that the Sch. will remove to its new quarters immediately after the close of the present academic yr. The new location is in the great med. center of Chicago and only a short distance from the med. and dent.

coll. of the univ., which will bring its three Chicago dep'ts into much closer relations.

The man who made quinin cheap. Sir *Clement Markham* died at the age of 85, from burns due to a fire caused by reading in bed by candlelight. He entered the navy in 1844, and served in the Franklin search expedition in the arctic regions. He was a great traveler and writer on geog. subjects. In 1852 he made his first visit to Peru, mainly to inquire into the remains of the Incas. When the gov't of India perceived the value of quinin in malaria, it determined to introduce the cinchona plant into that country from Peru. Markham was entrusted with the task, which he carried out most successfully, with the result that the price of quinin was reduced from many shillings to a few pence per ounce. The service thus rendered by him to humanity has been everywhere recognized. LONDON LETTER: *Jour. Amer. Med. Assoc.,* 1916, lxvi, p. 753.

II. WAR NOTES

Personalia. The Univ. of Tor. has granted Dr. *V. E. Henderson,* assoc. prof. pharm. and pharmacol., leave of absence on his appoint. as major in Can. overseas exped. force.

Dr. *A. E. Taylor,* Univ. of Penn., recently went to Ger. as an attaché of the Amer. Embas. at Berlin. He will study food conditions in Ger. His colleague, Dr. *D. J. McCarty,* will perform similar service in Gr. Br.

The decision of the Derby Educ. Commit., to dispense with the services of Dr. *P. E. Bowles,* as assis. lect. in chem. at the Tech. Coll., led Dr. *A. J. Walker,* head of the chem. dep't, to tender his resig., to take effect Mar. 31. In his letter to the commit. he ascribes his action to their "unfair and unjust treatment" of his colleague, the impossibility of carrying on the work single-handed, and a determination not to be associated with anything lacking in efficiency. He points out that Dr. Bowles was attested under Lord Derby's scheme after receiving the promise that, if called to active service, he would be paid his salary, less War Office allowance, and would have his appointment kept open. He also argues that any type of retrenchment calculated to diminish the output of chem. experts from the training establishments of the country is a fatal form of war economy.

University items. Of past and present students of the Univ. of Birm., 500 have joined the services. Of these, 10 percent have already lost their lives.

Of the 18,100 students in seven Ger. univ's during the present semester, 13,629 are absent in the army, *i. e.*, about 75 percent.

Among the 11,000 members of Cambr. Univ. in the land, sea, and air services, 1,723 casualties have been reported; 627 have been killed and 892 wounded. The Victoria Cross has been awarded to 3 men, the D.S.O. to 52, and the Mil. Cross to 103. The services of 714 of the Univ. have been recognized.

The number of students in residence at Oxf. Univ., this term, is 550. This number compares with 1,087 in res. at this time last yr. and with 3,097 in 1914. A decree has been passed by convocation recording the thanks of the univ. to all officials, professors, readers, examiners, and others who by contributing voluntarily, since the beginning of the war, by renunciation of stipend or otherwise, to the funds of the univ., have come to its help in a time of severe financial stress. The sums received by the curators of the univ. chest from these sources amounted, in 1915, to £5,750.

The report of the mil. educ. commit. of London Univ., for 1915, has been presented to the Senate. It states that the number of members of the Univ. of London O.T.C. [officers' training corps], during the training year ended Sep. 30, was 2,209, of whom 1,068 proceeded to commissions during the year. Up to the end of 1915, 2,228 cadets or ex-cadets of the contingent had been granted commissions. Of these, 86 had fallen in the war, and the honors and distinctions gained were 1 V. C., 25 military crosses, 63 mentions in dispatches (4 mentioned twice), and 1 Medaille Militaire. In addition, 273 commissions had been granted to graduates and students (other than cadets or ex-cadets), and these officers had gained 4 mil. crosses and 10 mentions in dispatches.

Education, science, politics. THE STATE AND CHEM. INDUSTRY. State-aided chem. indus. runs like a vein of gold through the statecraft of Ger., and if ever we learn what Kultur means, we shall find that Ger. chem. indus. is its vital part. EDITORIAL: *Nature,* 1916, xcvi, p. 598.

A SACRIFICE TO A "WOODEN" POLITICAL SYSTEM. The late

Prof. *Meldola* was twice offered a decoration of the Legion of Honor—in 1900 and again in 1907. On both occasions the Foreign Off. forbade him to accept it. It could not be supposed that either Lord Salisbury or Sir Edward Grey wished to behave in so rude a manner to a friendly nation and to a distinguished man. The cause was to be found in the *wooden system* erected by some jack-in-office of the permanent service in order to magnify his own petty tyranny. Then came the war and, in the utter confusion caused by our policy, the country was in serious difficulty, with many important industries under enemy control and quite inaccessible. So Prof. Meldola, with his unrivaled knowledge of the relations between science and industry, was asked to preside over some committees and to serve on others. He was too patriotic to refuse, but the strain was too great for one who was far from strong, and he died after a few months of overwork. The character of the examination for civil-service posts, and for the army, must be changed, and science must be given a far more important place. That change would at once react on our public schools and the old univ's, and would bring the members of future parliaments under the influence of science. LONDON LETTER: *Jour. Amer. Med. Assoc.,* 1916, lxvi, p. 971.

SCIENCE VS. LATIN AND GREEK. The French, in 1871, frankly acknowledged that they had been beaten "by the Pruss. schoolmaster," and accordingly they set themselves to reform their educ. system. The English, although still confident of victory, are beginning to recognize that their educ. system is in large part responsible for their inability to cope with the crisis. Prof. *H. E. Armstrong,* one of the foremost chemists of Eng., uses strong language on this point: "This country is governed primarily by and from Oxford. If the lessons of the war do not cause Oxf. to reform, we shall be forced to confess that there is no health in us and, like the snark, our industry will 'softly and silently steal away.'" Since war has become a branch of applied chem., the Br. are now paying the penalty for permitting Ger. to oust Eng. from that leadership in the chem. indus. which she held a half-cent. ago. Prof. Armstrong calls the Oxf. degree in chem. 'worthless for pract. purposes,' and urges that Greek and Latin have no right to monop. the field as they have done hitherto. It will be remembered that 5 yr. ago the neces-

sity of reforming Oxf. was generally recognized by those in charge of the univ. as well as by outsiders. The resident staff favored the abolition of compulsory Greek, but the alumni of the univ., especially the country clergy, voted repeatedly against any modification of the ancient régime." INDEPENDENT: *School and Society,* 1916, iii, p. 353.

SCIENCE IN THE PUBLIC SCHOOLS AND THE CIVIL SERVICE. From the welter of the billows which have recently beaten about the place of science in educ., in the columns of the periodical Press, two main points stand out, namely, those of the dominance of classical and literary teaching in our great Pub. Sch., and its influence upon the older univ's and the Public Services. Our polit. leaders and adminis. of State dep'ts are in the main trained in these schools, where vested interests preserve the prime places in the curriculum for ancient learning, and scient. subjects are discouraged for students who hope to obtain univ. scholarships or appointments in the highest ranks of the Civil Service. . . . We want to see a . . . recognition of the need of scient. knowledge on the part of the humanists of today, in the place of that attitude of obscurantism which they present to it. We want to make science the keynote of our Pub. Sch. and Univ. system, as Humboldt and others did in Prussia at the beginning of the 19th cent. when Ger. was under the heel of Napoleon; for to it are due the position and power gained by that country since then. . . . Are we to await like defeat before taking the necessary steps to ensure that our legislators, gov. officials, and others who exert the highest influence in the State, receive the scient. educ. which modern life demands? EDITORIAL: *Nature,* 1916, xcvi, p. 671.

ENGLISH NEGLECT OF SCIENCE. No unofficial war document thus far published can compare in importance with the manifesto issued yesterday on the subject of our national neglect of science. The signatories include many of the foremost scient. names of the day. The arguments are crushing in their conclusiveness. Best of all, if it is permissible so to speak, the manifesto is issued at a time when we are face to face with the most lurid of object lessons. The bulk of our failures in the war have been a consequence of our neglect of that scient. energy, strenuousness, and organization, of

which the Germans make so much. We believe their achievements in this field are exaggerated. At the same time, they are far too obvious for us to remain undisturbed by them unless we mean to resign our ancient place in the world. . . . About the peremptory necessity of better scient. organiz. on nat'l lines there can be no two opinions. It is not only a question of our prosperity, but of our existence. The law of the survival of the fittest works just as inexorably among nations as it does among individuals. We can be the fittest if we like. Unless we *do* like we shall not survive. But if we are to tackle seriously this problem of scient. reorg., we shall have to scrap the whole of our *rotten and antiquated political machinery*. The scient. mind and temper can not possibly flourish in an atmosphere of polit. trickery, nepotism, and plunder, such as that which has surrounded us for the last few centuries. . . . True science and politics are incompatible. They can not exist together any more than the eagle and the squid can share the same apartment. Science has at this moment the most magnificent opportunity that it has ever enjoyed of seizing the steersmanship of human destiny. Every man who wants to see his country great, progressive and prosperous, marching as a standard-bearer at the head of the advancing legions of mankind, should back the scientists with every ounce of energy that he possesses. If, otherwise, he wishes to see her mean, petty, retrogressive, squalid and contemptible, let him support a return to our debasing party strifes, with their concomitant triumph of the political schemer and all the host of parasites whom he enriches out of public money. London Financial News: *Science,* 1916, xliii, p. 350.

British Civil Serv. Estimates. The estimates of civil services, for the year ending Mar. 31, 1917, are being issued as parliamentary papers. The grant in aid of scient. and indust. research has been increased from £25,000 to £40,000.

Food and nutrition. Nutrition of children. Dr. *Hepner* has published observations made in regard to the state of nutrition of the children of Mannheim who are just entering on school life. Comparing 500 children who entered school at Easter, 1914, with a similar number for 1915, he found that the average weight for 1915 was exactly the same as for 1914. Berlin letter: *Jour. Amer. Med. Assoc.,* 1916, lxvi, p. 754.

PRICES OF FOODS IN GERMANY. The Commandant at Berlin and Mark Brandenburg, Feb. 1, issued an order which set the prices of flour per pound as follows: rye fl., 22 pf. (about 6 cents); wheat fl., 24 pf.; pure wheat fl., 30 pf. The so-called Ger. black bread (rye bread) is whiter than in peace times, because of the considerable addition of wheat fl.; and the Ger. "bun" (semmel), which formerly was very dark in color, has now just about the same appearance as it had in normal times.

According to the last official report from Berlin, the price has been reduced considerably for beef, veal and mutton, as well as for spinach and many other vegetables. According to its quality, meat costs per pound: beef, 1 m., 66 pf. to 1 m., 82 pf. (40 to 45 cents); veal, 1 m., 80 pf. to 1 m., 89 pf.; mutton, 1 m., 73 pf. to 1 m., 93 pf.; pork, 1 m., 40 pf. Butter costs 2 m., 68 pf. a lb.; 10 lb. of potatoes 40 pf.; 1 egg, 24 pf. BERLIN LETTER: *Jour. Amer. Med. Assoc.*, 1916, lxvi, p. 1039.

AUTHORIZATION OF THE SALE OF SKIMMED MILK. Milk is constantly becoming scarcer. The permanent commit. of agric., which discussed this problem at its last meeting, has therefore concluded that it would be desirable to allow skim. milk to be sold in commerce for the use of adults on condition that it contains not less than 1.5 percent of fat (up to the present a minimum fat content of about 3.3 percent has been required). The commit. has indicated that this skim. milk ought not to be given to infants and that whenever such milk is sold, not directly to consumers from the producers, but through middlemen, it should be pasteurized. To avoid confusion of skim. milk with unskim. milk and the frauds which might thus arise, the commit. has advised that this product should be sold only in containers bearing in conspicuous letters the words "skimmed milk" and the directions, "not to be fed to infants." Professors Chauveau and Mossu assert that skimmed milk has a caloric value equal to more than one-half that of unskim. milk. PARIS LETTER: *Jour. Amer. Med. Assoc.*, 1916, lxvi, p. 1212.

GERMAN PRISON CAMPS. Typhus fever is a sure index of san. insufficiency and underfeeding, and the fact that outbreaks of the disease have occurred in most if not all Ger. prison camps is not denied. Quite probably the sufferings of the prisoners are in many

instances rather due to the breakdown of the Ger. organiz. than to deliberate malice . . . there is evidence that efforts are being made, in some camps at least, to improve matters. Reports by members of the staff of the Amer. Embas. at Berlin, published early in Mar., indicate that the conditions at the prisoners-of-war camps at Limburg, Giessen, Darmstadt, Mannheim, and Heidelberg are now satisfactory. The camp at Mannheim, where there are sixty Br. prisoners, is described as a "good example of the specially and scient. constructed camps, and general conditions are of the best." Much of this improvement is due to the courage and persistency of the Amer. Embassy. EDITORIAL: *Brit. Med. Jour.,* March 18, 1916, p. 422.

GERMAN "FOOD-PROBLEM." There has to be some restriction in the use of fat and butter. It goes without saying that every one must practice econ. and exercise good judgment, and even suffer some restriction in the use of all kinds of provisions; and there naturally must be a slight incr. in their price. That starv. is still a *remote* problem is shown, further, by the *food given to prisoners of war.* The daily rations, provided for some time ago, have remained unchanged. Every person receives daily 90 gm. of albumin (formerly 85), 30 gm. of fat (formerly 40), 500 gm. of carbohydrates (formerly 475), and 10 percent is added for persons who are working, or such as are poorly nourished. The gov't purchases the more essential food products and staples outright through the Min. of War, so that each prison camp is placed on the same basis, so far as food is concerned, and there is no misuse of anything sent to them. Ger. is now taking care of about 1,500,000 prisoners of war, and to feed these there are required daily about 600 head of cattle, 900 hundredweights of bread, and 30,000 hundredweights of potatoes. The letters sent home by prisoners of war show that very few of them have lost in weight since their capture. BERLIN LETTER: *Jour. Amer. Med. Assoc.,* 1916, lxvi, p. 754.

Trade war. CAPTURE OF THE WORLD'S TRADE. "Amer. chemists have not talked to anything like the same extent as we (British) have done about "capturing Ger. trade." Nevertheless, as recent discussions in the Amer. Sect. of the Soc. of Chem. Indus. unmistakably indicate, aided by their elastic fiscal policy, they have quietly

and deliberately set themselves to do it. And, curiously enough, the "hyphenated" Amer. has not been the slowest to move. *Nature,* 1916, cxvii, p. 60.

MED. AND SCIENTIFIC COMMIT. OF ECONOMIC EXPANSION. A med. and scientific commit. for the econ. expan. of France and her allies has just been founded at Paris. The first meeting was held at the Fac. de méd. under the chairmanship of the dean, Prof. *Landouzy*. . . . Similar commit. are being formed in Gr. Br. and in Italy. Russia and Japan have been invited to take part in the organiz. The purpose of all these commit. is to oppose Ger. indus. in all the allied countries. Before the outbreak of war, physicians and scientists paid a heavy tribute to Ger. indus. Not only chem. and pharmaceut. products, but also all instruments used by the med. profession, almost all optical and lab. instr., and lenses of almost every kind, came from Ger. The attempt now being made is to encourage the allies to produce at home, or, at any rate, to obtain from one another, such supplies as they need in med. and scient. work. The action of the med. and scient. commit. of the allied countries will be threefold: (1) They will endeavor to induce the purchaser (the practitioner or lab. man) to ask the origin of the objects that he buys. (2) They will carry on an assiduous propaganda among manufac. to persuade them to produce all the articles necessary for the use of lab's and in the prac. of med. (3) The commit. will keep in communication with each other so that all necessary data, especially catalogs printed in several languages, may be exchanged to keep purchasers informed with regard to production and the firms which are able to supply articles which hitherto have come from Ger. PARIS LETTER: *Jour. Amer. Med. Assoc.,* 1916, lxvi, p. 1125.

Sanitation, disinfection. SANITATION OF BATTLEFIELDS. The solution of this problem is occupying the attention of many men. Cremation, which has been suggested, is distasteful to many persons in France. Dr. *F. Bordas* advises, instead, accel. decomp. of corpses, which will permit the ultimate removal of the bones without danger to the living. In the "Study of Putrefaction," which Dr. Bordas pub. in 1892, he noted the extreme variability of the time required for decomp. Almost every cemetery has its own peculiarities due

to its geol. characteristics. In some cem., like the Campo Santo of Pisa, bodies decomp. rapidly, a fact which is attrib. to the alkal. of the soil. In others, like that of St. Nazaire, the soil of which is compact clay formed from disint. mica schists, which retains the water permanently, decomp. is so slow that bodies have been found intact 5 yr. after burial. In dry, sandy soils, on the other hand, the corpse mummifies as it does in the dry cold air of St. Bernard. The endeavor, then, should be to realize the conditions which favor decomp. Bordas describes some interesting exper., in the *Revue d'hygiène*. Using bodies of animals, he ascertained that the germs and ferments of manure act rapidly and powerfully to produce decomp. Obviously, however, manure cannot be used to accel. the decomp. of the human body. Bordas therefore made an anal. study of the principal species of bacteria occurring in manure, and found that one group of ferments of manure has particularly powerful action—that of the ferment of urea. Bordas placed the body of a horse in a trench on a bed of straw and covered it with straw sprinkled with a culture of urea ferment. In 21 days nothing remained of the body except the bones. This transf. would have required 3 or 4 yr. in earth under ord. conditions. To apply these exper. data to human bodies, Bordas says it would be necessary to place in a trench a layer of straw or leaves, to lay the bodies on this bed of straw, and to cover them with a layer of straw or leaves moistened with the approp. bact. culture. Earth should not be laid on top of the straw; it would disturb the processes of decomp., and it is not necessary, for no malodorous gases are disengaged during decomp. under these conditions. In a few weeks or months, at the most, nothing but bones would remain and burial might be made without the least danger to the living. PARIS LETTER: *Jour. Amer. Med. Assoc.*, 1916, lxvi, p. 828.

ANTISEPTICS FROM SEA WATER. The electr. decomposition of sea water yields sodium hypochlorite, which is a powerful antisep., at a very small cost. This fact has been turned to account in the disinf. of hosp. ships, which are so largely used by us in the war, by means of an appar. recently installed in the Aquitania under the supervision of *Dr. H. D. Dakin,* and at the instance of the med. research commit. of the Nat'l Insurance Act. The appar. consists of

an electr. cell, a reversing switch capable of carrying 100 amperes, and some ordinary insul. electr. cable. The cost is about $250. The cell stands on a rubber mat to insul. it, and is raised on a low table to enable its contents to be poured out easily. It is filled with cold sea water, and if a current of from 60 to 75 amperes at 110 volts is then turned on, a sol. containing 2 parts of sodium hypochlorite or available chlorin to 1,000 parts will be obtained in 5 min. The cost of this sol. works out at 6 cents per hundred gal. The sol. is also excellent as a sterilizer of drinking water (1 part chlorin to 1,000,000 parts), and as an antiseptic for wounds (used undiluted as produced by the electrolyzer, that is, 2 parts sodium hypochlorite to 1,000 parts). Further, in the butcher's dep't its value was soon evident, and also in the laundry for soaking undyed cotton and linen goods. It was added to the water in the swimming bath of the ship in the proportion of 1:2,000,000, with the result that bacteria present to the number of 2,000 per cc. were reduced to 200. The econ. in replacing expensive coal-tar disinf., such as phenol, by electr. hypochlorite will approximately pay for the cost of the cell in the course of a single trip of three weeks. LONDON LETTER: *Jour. Amer. Med. Assoc.*, 1916, lxvi, p. 827.

DISINFECTION AND IMMEDIATE OR EARLY UNION OF RECENT WOUNDS. The use of Dakin's fluid in the treat. of wounds, about which so much has been said of late, continues to be much discussed in med. soc. At a recent meeting of the Soc. de chir., *Dr. Cunéo* showed that, in order to disinf. a recent wound and obtain immed. or early union, there is no need to employ almost continuous lavage, lasting possibly several days, with Dakin's fluid. Whenever Cunéo had to treat wounds several hours old, he disinf. and reunited them successfully in the following simple manner: In the case of a seton wound amenable to immed. disinf., by means of a pair of long forceps he passed through the wound a gauze compress, soaked in any suitable disinf., such as hydrogen peroxid, undil. or dil., tincture of iodin, 1:20, etc. Holding the two ends of this compress, he rubbed it vigorously back and forth through the wound, removing the debris of clothing and other foreign matter. This procedure was repeated 2–3 times. Nine times out of ten the patient developed no complications. If the wound became infec., Cunéo laid it open. In

this way he or his assistants treated hundreds of wounds. In cases of tortuous wounds, the technic was a little more complex. The wound, made larger if necessary, was held open by traction forceps. Then some tepid sol. was poured in until all of the recesses were washed out. The wound, having been well cleaned, was then closed without drainage.

In the case of head injuries, Cunéo carried out the following procedure early on the day that the wounded arrived: He outlined, around the cutaneous wound, a large flap with the convexity uppermost; the wound was circumscribed by an incision and immed. sutured. The site of the fracture was then cleaned, the splinters removed, etc., and the generally abundant hemor. was arrested with tampons. Two or three days afterward, if the patient was doing well, the tampon was removed and the flap was sutured without draining. Wounds treated in this way gave a greater percentage of cures than that obtained by Cunéo with his old technic (cruciform incision, cleaning of the site of fracture, and prolonged tamponing).

Cunéo disclaimed the credit for originating the procedure described, which is in general use at the front. He believed that the recent circular addressed to the mil. physicians on the initiative of Dr. Tuffier, extoling the use of Dakin's fluid, was, at least, futile.

Dr. Tuffier replied that, although several hr. after the wound has been made, a mechan. disinf., consisting of opening up, the removal of foreign material, and the excision of mortified parts, was alone sufficient to insure secondary reunion of a wound of war, such a procedure is no longer sufficient after several days have passed. At that time he believes a chem. disinf. necessary. Such a disinf. is Dakin's fluid which, therefore, ought to be considered an excellent topical application.

Dr. Quénu believes that this statement of Tuffier's throws considerable light on the question of dressing with Dakin's fluid. Tuffier admits, in fact, that early primary reunion will take place without any chem. applic. whatever, provided the wound is cleaned during the first hours after it has been received, and is freed from contused parts and splinters.

Dr. Broca stated that for a long time all surgeons have been aware of primo-second. reunion of wounds, that is to say, reunion

of wounds at the stage of granulation. Why, then, has this "new" method created such a sensation? Does it not seem as if Dr. Carrel, who is a physiol. but not a surgeon, finding himself confronted by facts that heretofore were unknown to him, believed his practice new because surgeons had passed over in silence observations which to them were not unusual?

Prof. Monprofit of Angers believes that it is unwise to speak too much, at present, of immed. or second. reunion in surgery at the front, where even now there may be seen at times unsatisf. results from immed. reunions; it is to be feared that inexperienced persons may be induced by such reports to attempt to produce reunions that will not be favorable to the wounded. Monprofit believes that it is best to hold to the classic rules of surgery—incision, opening up, cleaning the wound, and drainage—the nature of the antisep. used being of less importance.

Dr. Hartmann concluded (1) that, according to the consensus of opinion, disinf. of wounds of war is easier the sooner the treatment is begun after the wounds have been received; (2) that this disinf. may be effected by different means, Tuffier himself having described a series of complicated fractures of the thigh, the humerus, and the pelvis that were reunited immed. without complications after disinf. by agents other than Dakin's fluid, thereby showing that this liquid, and, consequently also, the circular he prepared, is useless; (3) that the treat. of wounds described in this circular is even dangerous, since it is practiced by physicians who have only recently had any surg. experience. On the other hand, according to Monprofit, physicians in general should realize the utility of opening up and draining. PARIS LETTER: *Jour. Amer. Med. Assoc.*, 1916, lxvi, p. 969.

LECTURES ON ASPHYXIATING GASES. The administration of the med. service has organized, in all the regiments of the entrenched camp at Paris, lect. on the asphyx. gases employed by the enemy. These lectures are given by an *aide-major,* who is a prof. of chem. and toxicol. The lecturer, after showing the composition of the asphyx. gases used by the Germans, explained that a humid alkal. barrier is sufficient for defense. Improvised devices are not to be despised. In default of appropriate masks the nose may be plugged

with a damp handkerchief on which soap has been rubbed. Exper. followed the lecture. The lecturer shut himself and his auditors up in a room where they underwent the effects of a whole series of asphyx. gases. Each one made use of protective appar., the efficacy of which was thus clearly demonstrated. PARIS LETTER: *Jour. Amer. Med. Assoc.*, 1916, lxvi, p. 905.

Preparedness. . . . We plan a greater navy and a larger army, but we apparently have no assurance that either could be of use in time of war. We are not only failing to keep our powder dry, but we are not even surely planning to have any powder. *It is not generally realized that no useful explosive for any mil. use whatever can be made without nitric acid.* From black powder and smokeless, through fulminates, nitroglycerin, dynamite, gun-cotton, picric acid, to trinitrotoluene and the latest more complex benzol derivatives, not a pound can be made without nitrates. *These are now obtained from Chili exclusively.* In the event of any interference with that supply, we should have to revert to the pea shooter, the sling, or the air gun. Can we be sure that Chili will always be willing and able to supply us, and also shall we be able to transport it in face of foreign opposition of conceivable kinds? These are points which chemists in particular should consider. EDITORIAL: *Jour. Ind. and Eng. Chem.*, 1916, viii, p. 298.

Chemical items. AMMONIUM SULFATE. On the recommend. of the Fertilisers' Commit., and with the approval of the pres't of the B'd of Agric. and Fisheries and the pres't of the B'd of Trade, the Br. authorities have decided to suspend for the present the issue of licenses for the export of ammonium sulfate.

PHILADELPHIA'S PHENOL PRODUCTION. As a result of the war, the production of phenol in the U. S. has grown from less than 2,000 tons to about 12,000 tons a year. One firm in Philadelphia is producing at least a fourth of the total output, an average of 10 tons a day.

SYNTHETIC DYES. In a recent issue of the *Revue Scientif.* (Jan. 8) Dr. *Wahl,* direc. of the lab. of the Porrier works, claims that, first, among the scient. causes of Ger. predominance in the manuf. of synthetic dyes must be placed the rapid growth in the middle of the 19th cent. of the study of pract. organic chem. and, secondly,

the evolution of large tech. lab's having a scient. organiz. of the highest order. Under the leadership of Bernthsen, Bohn, Duisberg, Sandmeyer, and others, continuity of effort, organiz. of research, orderly arrangement of references and bibliog., produced a sum total of intimate practical knowledge of the subject which could not have been gained in any other less methodical way. This coörd. of effort in the Ger. color indus. gives rise to 300 patent applications per annum.

SANAPHOS AGAIN. The proprietors of *sanaphos* are still endeavoring to exploit the strong anti-Ger. feeling of the country for the benefit of their nostrum, so that it may take the place of the Ger. *sanatogen.* The sale of the latter is still permitted under the condition that none of the profit be sent to Ger. The sanaphos people, in a quarter page advert. in the *Times,* are asking the public to petition Parliament for the passage of an Act to forbid firms trading which are mainly owned by Germans, for the reasons that "(1) Sanatogen is not 'necessary' now because (2) it is not the best article of its kind now available; (3) it is surpassed by the later, more highly perfected and wholly Br.-owned product, sanaphos." This "petition" is accompanied by some dozens of anonymous testim. alleged to be from physicians, and by a few from former users of sanatogen, who declare that sanaphos is a much better article. It is evident that the methods of nostrum venders, whether Ger. or Br., do not differ and may be summed up in one word—bluff! LONDON LETTER: *Jour. Amer. Med. Assoc.,* 1916, lxvi, p. 971.

MISCELLANEOUS. Prof. *Leo Vignon,* of Lyons, has compared the number of chemists in Switzerland, Germany, France, and England, in proportion to their respective populations. The relative numbers are: Switzerland, 300; Germany, 250; France, 7; England, 6.

Nature announces that, on account of the restrictions imposed by the British Gov't on the importation of wood-pulp and other materials used in paper manufacture, it, in common with other periodicals, will be forced to reduce its size.

In an article on "Chem. organisation in Germany during the war" (*Nature:* 1916, xcvii, p. 82), Dr. *F. G. Donnan* discusses the development of various chem. industries in that country since the

beginning of the present conflict. Among these may be mentioned the production of ammonia, nitrates, sulfuric acid, nutritive substitutes for wheat and rye, zinc, hydrochloric acid, acetic acid, fats and oils, hydrogen, alcohol, and chlorin.

III. COLUMBIA UNIVERSITY BIOCHEMICAL ASSOCIATION

1. General Notes

Prizes. Accademia dei Lincei, Rome; King's prize for human physiol., £400: Dr. *Filippo Bottazzi,* prof. of physiol., Univ. of Naples.

A prize of $1,000, given by the Metropol. Life Ins. Co., through the Amer. Soc. Hyg. Assoc., for the best pamphlet on social hygiene for boys and girls, has been awarded to Dr. and Mrs. *D. B. Armstrong* of Stapleton, S. I. Dr. Armstrong is director of the Social Welfare Dep't, N. Y. Assoc. for Improv. Cond. the Poor; Mrs. Armstrong is actively interested in social and philan. work. Nearly 500 essays were entered in competition from all parts of the U. S., Canada, Europe and So. Amer., and the task given the judges to compare and pass on these manuscripts was exacting. The judges were Mrs. Martha P. Falkner, sup't, Sleighton farms, State Training Sch. for Girls (Darlington, Pa.); L. K. Frankel, 6th vice-p., Metropol. Life Ins. Co. (N. Y.); Dr. L. H. Gulick, pres't, Campfire Girls of Amer.; Julia C. Lathrop, chief, Children's Bur., U. S. Dep't of Labor; Dr. M. J. Rosenau, Harvard Med. Sch.; Dr. V. C. Vaughan, Univ. of Mich.; and Mrs. Ella F. Young, formerly sup't of schools, Chicago. Dr. and Mrs. Armstrong's essay will be published in the *Quart. Magazine* of the Amer. Soc. Hyg. Assoc.

Appointments. Bradley Polytech. Inst. (Peoria, Ill.): *Isabel Collins,* instr., home econ. and sup. of pract. teaching.

Clark Co. High Sch. (Las Vegas, Nev.): *Margaret M. Johnson,* direc., househ. econ.

Columbia Univ. (Teachers' Coll.): *Helene M. Pope,* instr., dietetics (promotion).

Ind. State Normal Sch. (Terre Haute): *Minnie L. Irons,* assis. prof., dom. econ.

Jewish Hosp. (Cincinnati, O.): *Elsa Maurer,* instr., dietetics.

Kan. Agric. Coll. (Manhattan): *Helen H. Hahn,* assis. prof., educ.; direct., pract. teaching in home econ.

Mechanics' Inst. (Rochester, N. Y.): *Bertha N. Baldwin,* instr., dietetics.

Nelson Morris Memor. Inst. for Med. Research (Chicago): Prof. *Max Morse* (Univ. of Nebr. Coll. of Med.): member of the Inst. in charge of chem.; also consult. chem. pathologist, Michael Reese Hosp. and Sarah Morris Hosp. for Children.

N. Y. City Coll.: Dr. *D. B. Armstrong* (direc. Dep't of Social Welfare, N. Y. Assoc. for Improv. Cond. Poor), appointed to conduct a course in "community medicine."

N. C. State Normal and Indus. Sch. (Greensboro): *Gladys H. Smith,* instr., food and househ. chem.

Oregon State Agric. Coll. (Corvallis): *Laura J. Cheney,* instr., dom. science.

San Antonio High Sch. (Tex.); *Kittie R. Carlisle,* teacher, dietetics.

Springfield Tech. High Sch. (Mass.): *Mabel M. Lutes,* direct., househ. science.

Trenton Public Sch. (N. J.): *Jean P. Case,* supervis., dom. art and science.

Tyrone High Sch. (Pa.): *Zada E. Herrick,* teacher, househ. arts.

U. S. Pub.-Health Serv.: Dr. *Charles Weisman* (Cornell Univ. Med. Coll.), transf. to Pittsburgh, in the new headquarters of the Serv. for work on industrial hygiene.

Univ. of Michigan: Dr. *N. B. Foster* (Cornell Univ. Med. Sch.), prof. of med.

Univ. of Minn.: *Lucile Wheeler,* assis. prof., home econ.

Associations and societies. OFFICERS. Dr. *C. L. Alsberg*: member, b'd of managers, Wash. Acad. of Sciences.

Dr. *E. F. DuBois,* member of the council, Soc. Exp. Biol. and Med.

Prof. *B. E. Livingston:* councillor, Bot. Soc. of Amer.

MEMBERS. Dr. *Louis Hussakof,* member, Amer. Soc. of Ichthyologists and Herpetologists.

Prof. *Max Morse:* member, Biochemical Society, England.

Miss *Jennie A. Walker,* member, Columbia chapt., Sigma Xi.

The following members of the Assoc. are members of the Chem. Teachers' Club of N. Y. City: *Robert Bersohn, C. D. Carpenter, B. G. Feinberg, W. J. Gies, Alexander Smith, C. H. Vosburgh.*

Lectures and addresses. Amer. Home Econ. Assoc., Detroit; Feb. 25: Prof. *Josephine Berry,* How the noonday lunch may be used in teaching home economics.—Prof. *Isabel Bevier,* Opportunities and obligations of home economics; also Report of commit. on terminol.

Cleveland Acad. of Med., May 12: Dr. *L. B. Mendel,* Abnormalities of growth.

Harvey Soc., N. Y. Acad. of Med., Apr. 8: Prof. *S. R. Benedict,* Uric acid in its relations to metabolism.

Prof. *C. R. Stockard* was one of the speakers in the symposium on alcohol at the N. Y. Acad. of Med., Apr. 6. He also delivered a lecture, before the Yale chapter of Sigma Xi, Mar. 1, on the influence of alcohol in development and inheritance.

Univ. of Pittsb., Sch. of Chem.; Apr. 12: Dr. *J. Rosenbloom,* Evolution of biochemistry.

Wash. Acad. of Sci., New Nat'l Museum, Apr. 7: Dr. *E. F. DuBois,* Basal food requirement of man.

Expedition to Japan. Prof. *E. N. Harvey* is a member of an expedition, for the study of echinoderms and siphonophores, that recently started for Japan under the auspices of the dep't of biol. of the Carnegie Inst. of Washington.

Journalistic. Dr. *Hans Zinsser* is one of the "advis. ed.," and Dr. *I. J. Kligler* one of the "abstr. ed.," of the recently founded *Jour. of Bacteriol.*

Prof. *W. D. Halliburton* is the editor of Physiological Abstracts. See page 252.

Personalia. Dr. *J. L. Kantor* has equipped an office, at 44 W. 96th St., N. Y. City, for the study and treatment of disorders of digestion.

Drs. *Philip Van Ingen* and *H. B. Wilcox* are members of the exec. commit. of the Huddleston Memorial Commit., organized to develop, in N. Y. City, the work of caring for "cardiac children."

2. Proceedings of the Association

The proceedings of the third quart. meeting for the year (Apr. 7) will be published with those of the second (Feb. 4) in the next issue of the BIOCHEMICAL BULLETIN.

At the meeting on Apr. 7, Miss *Hattie L. Heft,* Dr. *F. G. Goodridge* and Dr. *Gies* (all life members) were appointed trustees of the endowment fund for the BIOCHEMICAL BULLETIN.

3. Columbia University Biochemical Department

At the suggestion of the Med. Faculty, the trustees of Columbia Univ. have decided to admit women to all the med. courses to be given in the proposed new med. school. Women were first admitted to "grad. courses" in the Columbia Med. School, in 1908, in the Biochem. Dep't.

Dr. *Gies* is one of the two American abstractors for *Physiological Abstracts.* He was recently elected a member of the Chem. Teachers' Club of N. Y. City and of the Nat'l Inst. of Social Sci.; also vice-pres't of the Soc. for Exp. Biol. and Med. He was a delegate to the World Court Congress, held in Carnegie Hall, New York, May 2–4, where he represented Gettysburg College, of which he is a Trustee.

The Trust. of Columbia Univ. have approved the suggestion that, provided sufficient funds for the purpose can be obtained, a Sch. of Dentistry be included in the proposed new med. center to be created in N. Y. under Columbia auspices. Dr. *Gies* is a member of the commit. of the Med. Fac. appointed to further the plans for the Sch. of Dentistry.

At a recent meeting of the Columbia Chapter of Sigma Xi, Messrs *J. C. Baker, O. C. Bowes, E. G. Miller, Jr., L. H. Almy,* and *C. P. Harris* were elected members.

Orlando C. Bowes has been appointed to a Cutting Traveling Fellowship for 1916–'17.

Prof. *Gies* addressed the annual meeting of the Dental Society of the State of New York, in Albany, May 12, on the results of researches on the relation of internal secretions to dentition, conducted by him, during the past year, in collaboration with Miss *Hattie L. Heft* and Drs. *Edgar G. Miller,* Jr., and *W. A. Perlzweig.*

EDITORIALS

WILLIAM J. GIES

Further changes in our editorial policy

In our last issue we announced two changes in our editorial policy: (a) the creation of a new department, "*associations and societies,*" and (b) the reservation of the space on the inside of the back cover of each issue for notices pertaining to "*professional opportunities for biochemists.*" In this issue we give relatively more space than ever to "*biochemical news, notes, and comment.*" We are happy to announce that, with the special help of colleagues in various parts of the country, we expect to make this department of the BIOCHEMICAL BULLETIN increasingly more interesting and valuable. The names of our colleagues, who have already accepted our invitations to assist in this work, are printed at the head of the department (page 215), as "*sectional contributing editors.*" In succeeding issues we hope to add the names of others of our colleagues who will actively cooperate with us in making our "news" department both professionally and personally of particular service to biochemistry and of special value to biochemists.

Growth of the Medical Brotherhood

We publish, at page 129, a timely and interesting report on the status of the Medical Brotherhood, by its president, Dr. Meltzer. In this report, Dr. Meltzer emphasizes the following important facts among others:

(*a*) The Medical Brotherhood, as an organization and as a moral influence, is a *growing* success, in this country and abroad.

(*b*) The Medical Brotherhood is not an organization of the "peace-at-any-price" variety; nor is it an "anti-preparedness society." It was founded solely for the "*furtherance of international morality.*"

(*c*) The Medical Brotherhood is not "a veiled pro-German movement." If it is, then such eminent and astute Americans as President Nicholas Murray Butler and ex-Senator Elihu Root, of the Executive Committee of the Carnegie Endowment for International Peace (both advocates of *preparedness for defence*), have been grossly deceived, and the whole Executive Committee of the Medi-

cal Brotherhood has been hoodwinked, by Dr. S. J. Meltzer. We don't believe he would or could do either.

(*d*) The financial resources of the Medical Brotherhood have consisted, in the main thus far, of liberal appropriations from the Carnegie Endowment for International Peace. It may safely be assumed that the Executive Committee of the Carnegie Endowment believes, with the officers of the Medical Brotherhood, that the most perfect development of international *morality* would afford the most substantial and enduring basis for international *peace.*

(*e*) The Medical Brotherhood has not attempted, and *does not intend, to "meddle with problems which deal with the termination of the present war."* But the Brotherhood may be expected to do its utmost (at the earliest opportunity, in facing the problems that will remain, and arise, at the close of the war) to further a spirit of conciliation, and to facilitate the restoration of personal and professional good-will, among the medical men of the countries directly involved in the war.

(*f*) "The Medical Brotherhood of this country wishes to gather into its union those members of the medical profession, and those workers in the medical sciences, who have a vein of idealism in them, and who are willing to serve their country as patriots and humanitarians. It appeals, further, to the inspired ones to spread this gospel, wherever they find the proper opportunity, with impressiveness combined with patience and tolerance."

We have given space to the Medical Brotherhood, and will continue to do so, because a number of biochemists are members of the Brotherhood, because all biochemists are invited to affiliate with it, and because biochemists, as workers in medical sciences, are not only personally but also *professionally* interested directly in the furtherance of international morality and in the maintenance of "good-will among men."

Biochemists who have not already affiliated with the Medical Brotherhood, but who may desire to do so, are invited to communicate on this subject with the managing editor of the BIOCHEMICAL BULLETIN, who would facilitate attention to all correspondence in this relation.

The BIOCHEMICAL BULLETIN promptly acknowledges here the receipt of publications presented to it. Reviews are matter-of-fact statements of the nature and contents of the publications referred to, and are intended *solely to guide possible purchasers.* The wishes or expectations of publishers or donors of volumes will be disregarded, if they are incompatible with our convictions regarding the interests of our colleagues. *The sizes of the printed pages are indicated, in inches, in the appended notices.*

Books received

Handbook of colloid-chemistry. The recognition of colloids, the theory of colloids, and their general physico-chemical properties. By Wolfgang Ostwald, privatdoz., Univ. of Leipzig. *First English ed.;* translated from the 3d German ed., by *M. H. Fischer,* prof. of physiol., Univ. of Cin., with the assistance of Drs. *R. E. Oesper,* instr. in chem., N. Y. Univ.; and *Louis Berman,* staff physician, Mt. Sinai Hosp., N. Y. City. Pp. 278—7¼ x 4⅛; $3.00. P. Blakiston's Son & Co., Phila., 1916.—Most valuable and reliable book in English on this important subject. Of particular interest to, and significance for, biochemists because of the eminent position, as a colloid-chem. investigator, of its biochem. translator. The successive chapters deal with (1) general constitution of colloid systems, (2) relations between the physical state and the general properties of colloid systems, (3) general energetics of the dispersoids, (4) distribution of the colloid state and the concept of colloid chemistry, and (5, 6) mechanical properties of colloid systems (59 illustr.).

Translator's preface. "The day is past when the importance of colloid-chem. to the worker in the abstract or applied branches of science needs emphasis. The endeavor of the 'pure' chemist to reduce all substances to crystalloid form and from the knowledge of their behavior to re-synthesize the phenomena of nature has been a good one, but the limitations of such a point of view have grown daily more apparent. It happens that nature has chosen the colloid form in which to show her face. Crystalloid behavior is the exception, colloid behavior the rule, in the cosmos. Whether we deal with the regions above the earth, as the color of sky, the formation of fogs, the precipitation of rain and snow, or with the earth itself in its muddied streams, its minerals and its soils, or with the molten materials that lie under the earth, the problems of colloid-chem. are more to the fore than have ever been the crystalloid ones.

"To the abstract thinker in science colloid-chem. therefore, because of its universality, represents the larger field. But the practical worker knows, too, that in a better knowledge of the properties of those very materials which the orthodox chemist has too often cast aside in his jellies, pastes and glues, is found the explanation of so much that interests him. Is it any wonder, then, that colloid-chem. appeals to the agriculturalist, the metallurgist, the dealer in precious stones, the tanner of skins, the manufacturer of wood pulps and paper, the dyer, the histologist, the steel worker, the weaver of textiles, the smelter, the manufacturer of paints?

"Not only the inorganic world but the organic also has chosen the colloid realm in which to manifest itself. Living matter, whether of plants or animals, and under normal or pathol. conditions, is chem. in a colloid matrix; whence colloid-chem. comes to concern every botanist and zoologist, the physiologist, the pathologist and the practical man in medicine and surgery.

"Under the circumstances, does this volume, known the world over as the authoritative and classical text, need an introduction to any of our people who

think in the day's work? It can only seem somewhat strange that three large German editions and seven years were required before its first issue in the tongue of Thomas Graham and the brilliant modern group of English-speaking colloid-chemists. Wolfgang Ostwald's writings represent in colloid-chem. what those of Charles Gerhart represent in organic, Justus Liebig in agricultural, and Wilhelm Ostwald in physical chemistry."

Physiological Abstracts. Issued by the Physiol. Soc. (Gr. Britain and Ireland), with the co-operation of the Amer. Physiol. Soc.; also of the Amer. Soc. for Exper. Pathol., Amer. Pharmacol. Soc., Amer. Soc. of Biol. Chemists, Biologisk Selskab of Copenhagen, Carnegie Inst'n of Washington, Chem. Soc. (Gr. Britain and Ireland), Russian Biol. Soc.; also of *Archiv. di Fisiol.* (Prof. Fano), Archiv. Italiennes de Physiol. (Prof. Aducco), Jour. de Physiol. (Prof. Dastre); also of Prof's Arthus (Switz.), Boldyreff (Russia), Hamburger (Holland), Krogh (Denmark), Overton (Sweden), Torup (Norway), Zwaardemaker (Holland). **Abstractors:** W. M. Bayliss, *F. G. Benedict,* T. G. Brown, R. Brinkman, G. A. Buckmaster, F. J. J. Buytendijk, H. W. Bywaters, Mrs. G. D. Cathcart, *Wm. J. Gies,* T. Lewis, Keith Lucas, W. Mair, E. Mellanby, Mrs. E. Mellanby, Otto Rosenheim, C. S. Sherrington, S. B. Schryver, W. L. Symes, S. Tait, W. H. Thompson, G. S. Walpole. **Edited by W. D. Halliburton,** prof. of physiol., King's Coll., London. H. K. Lewis & Co., Ltd., London, W. C. *Monthly:* Three shillings net; annual subscrip., 25s. net, post free. Vol. I, No. 1 (April), pp. 36.—A publication that promises to do for physiol., among English-speaking physiologists, what *Chemical Abstracts* has accomplished for chem. among chemists whose mother tongue is English. The term "physiological," in the title, is "used in its wide sense, and will include the important papers in allied sciences which have physiol. bearings." The abstracts in the first number are grouped under the following headings: general, physical and chem., muscle and nerve, respiration, circulation, aliment. canal, inter. secretions, metabolism, devel. and growth, special senses, psychol., pharmacol. and toxicol., pathol. "The literature reviewed will be that published after Jan. 1, '16." Of the 68 abstracts in the first number, 25 pertain to papers published in the U. S. *Subscriptions and abstracts sent to the* BIOCHEMICAL BULLETIN *will be forwarded promptly to Prof. Halliburton.*

Practical physiological chemistry. By P. B. Hawk, prof. of physiol. chem. and toxicol., Jeff. Med. Coll., Phila. *Fifth ed.,* revised and enlarged; with numerous illustr. Pp. 638—7¾ x 4½; $2.50 net.—Continues to hold its unchallenged position as the best of the manuals *"designed for use in courses in practical physiol. chem. in schools of med. and of science."* This edition has been thoroly revised and in part rewritten. There are *five new chapters:* On nucleic acids and nucleoproteins, gastric analysis, intestinal digestion, blood analysis, metabolism. The sections on quantitative procedures have been extended and brought up-to-date.

Addisonia. Vol. I, No. 1: Mar., 1916. Pp. 20; colored plates 10. Published quarterly by the N. Y. Botanical Garden, from the proceeds of the Addison Brown Fund—a bequest by the late Judge Addison Brown. Preparation and publication in charge of Dr. J. H. Barnhart, bibliog., and G. V. Nash, head gardener. Subscrip. price, $10.00 per vol.—Colored illustrations and popular descriptions of plants.

PROFESSIONAL OPPORTUNITIES FOR BIOCHEMISTS

This page will be reserved for the publication of personal and professional items relative to biochemical "*positions wanted*," "*positions vacant*," and "*new positions*." Items of this character will be received from any and all who may be interested, and *will be published free of charge*.

Address communications in this connection to William J. Gies, 437 West 59th St., New York City, by whom all details will be regarded confidentially, whether that attitude is formally requested or not; and by whom correspondents will be promptly put directly in touch with each other, unless he is requested to act as confidential intermediary.

New positions

1. Pathological chemist wanted by two physicians. Salary $150 per month. State qualifications.

2. Bacteriological chemist wanted to coöperate in dental and oral research. Salary to accord with training and ability. State qualifications.

13. "Oil chemist" wanted in industrial laboratory. Good salary for man thoroly trained, with wide experience.

16. An agric. coll. proposes to ascertain "what constitutes food value in milk"; will employ a trained biochemist to conduct the work. Salary, $2,000.

24. Services of a biochemist desired, in a hospital, in research on a nutritional disease. Salary, $1,500.

25. Two important technical lab's want services of several well trained biochemists at good salaries.

26. Bacteriol. chemist wanted to assist, in a univ. lab., in research on the nature and chem. properties of fecal enzymes.

Positions vacant

15. Southern coll. wants new prof. of "chem. and biology." State qualifications and salary desired.

17. Agric. coll. wants a new prof. of chem., to give instruction in food chem., physiol. chem., and toxicol. Opportunity for research. Salary, $1,500.

20. Western sch. of med. wants new instr. in chem., to give instruction in org. chem. and physiol. chem. Opportunity for research. State qualifications and salary desired.

22. Western univ. wants new instr. and new assist. in biochem. State qualifications and salary desired.

Positions wanted

5. Biochemist, Ph.D., with special experience and interest in research on enzymes, desires a permanent position in this kind of work.

7. Biochemist, Ph.D., long training and experience in agricult. chem., desires position of greater opportunity for research in same field. Salary desired, $2,500.

9. Instructor in bacteriology, Ph.D., now teaching (a) general bacteriology, (b) water, milk and food bacteriology, and (c) bacteriological chemistry, seeks more advanced position, combining opportunity in research with teaching.

11. Biochemist, M.S., now a candidate for Ph.D. in western univ., who has specialized in food and bacteriological chem., and is teaching chem., desires a teaching or research position in any of these fields.

14. Expert entomologist, who recently has taken courses in biochem., desires an opportunity to conduct biochem. research in entomology, as a Ph.D. student, under suitable financial conditions.

18. Graduate of Austrian and German univ's; an investigator at Pasteur Inst. (Paris); a teacher, in an Amer. univ., of pathol. and bacteriol.; recently investigator in chem. biology; desires "good position" involving either teaching or research, or both, in biochem.

19. Amer. biochem., specially trained also in Germany, recently an instr. in Amer. univ., now in the gov't service, desires position combining teaching duties and research opportunity.

21. Teacher of biochem. in woman's med. coll. desires larger opportunity for teaching and research in biochemistry.

23. Nine biochemists, who recently completed Ph.D. work, desire "good positions."

Positions 3, 4, 6, 8 and 10, referred to on this page in the last previous issue, have been filled.

CONTENTS

The BIOCHEMICAL BULLETIN is a monthly biochemical review. It publishes results of original investigations in biological chemistry, preliminary reports of researches, addresses, lectures, criticism, reviews, abstracts of papers, practical suggestions, biographical notes, historical summaries, bibliographies, quotations, questions, news items, proceedings of societies, personalia, views on current events in chemical biology, descriptions of new substances, methods and apparatus—any and all suitable items of personal and professional interest to students, investigators and practitioners of biochemistry.

Subscription prices: Vol. I, $6.00; vol. II, $5.00; vol. III, $4.50; vol. IV, $3.50; vol. V, $2.75 ($3.00, foreign).

Address remittances to the Biochemical Bulletin, 41 North Queen St., Lancaster, Pa., or 437 West 59th St., New York; manuscripts and miscellaneous correspondence to the Managing Editor, William J. Gies, 437 West 59th St., New York.