Physiological Chemistry.

Effects of Alkalis and Acids on Respiration. By C. LEHMANN (*Landw. Versuchs-Stat.*, **31**, 169—171).—According to the author, the ashes of various cattle-foods have not been sufficiently studied from the point of view of their effect on the transformation of tissue in the respiratory organs. The general opinion is that the increase of alkalis in the circulation, causes increase of oxidation and consequent rapidity of tissue changes, whereas the preponderance of acids has a contrary effect. Experiments in this direction being very rare, the author undertook some researches with the view of deciding the question; the work of others is also noticed. The author's experiments were made on rabbits on which the operation of tracheotomy was performed after a fast of 18—24 hours; they were then placed in the respiration apparatus described in *Pflüger's Archiv*, 1884.

During spontaneous breathing of the animals after introduction of alkali into the stomach by the pump, there was an increase of oxygen consumption of more than 5 per cent., while after the introduction of acids there was a decrease of 8·3 per cent., the substances used being sodium carbonate and hydrochloric acid.

In order to obtain a more rapid action, the substances in a suitably dilute state were introduced directly into the veins (2 per cent. of Na_2CO_3—0·5 per cent. HCl), and in order better to observe the muscular contractions, the animals were curarised and artificial respiration employed; after 1—2 hours from the time of the injection of the alkali, the consumption of oxygen had increased 4—5 per cent. and the production of carbonic anhydride to 7—20 per cent.; the injection of the dilute acid on the contrary, reduced the consumption of oxygen about 5 per cent., and also that of the carbonic anhydride considerably. In another series of experiments, using the same alkali and acid, but adding 3 per cent. of grape-sugar to each, it was shown that the non-nitrogenous matters were rendered more readily oxidisable by alkalis and less so by acids; in one case the alkali caused an increase of oxygen consumed of 15 per cent. and of carbonic anhydride produced of about 24 per cent. In order to show that the injection of the solutions into the veins was not the cause of abnormal irritation, the author injected solutions of common salt into other animals under precisely similar conditions, but the functions of the organism continued to be carried on normally. J. F.

Digestive Ferments. By P. VIGIER (*Jour. Pharm.* [5], **9**, 398—402, 461—468; and **10**, 17—21).—1. *Pepsin.*—After many experi-

ments, the author proposes the following method for the estimation of pepsin:—Medicinal pepsin powder 0·5 gram; water 60; hydrochloric acid, officinal, 0·6; mutton, pork, or veal fibrin, washed and strained, 10 grams. Heat at 50° on water-bath for six hours, with frequent agitation until the fibrin is dissolved; this takes place very rapidly, then shake every hour; after six hours, 10 c.c. of the filtered liquor should give no turbidity on the successive addition of 30—40 drops of nitric acid; 0·2 gram of the pepsin extractive ought to give the same results. The aptitude of a pepsin to dissolve fibrin is a character of no value, for a good pepsin can dissolve three or four thousand times its weight of fibrin, if the amount of acidified water present is proportional to the amount of fibrin; the true test is the power to convert the fibrin into peptone. The author asserts that the only character which indicates in a precise manner that the digestion is complete, is the absence of all precipitation and turbidity on the addition of nitric acid. The fibrin employed should be obtained by vigorously stirring up warm blood with a bundle of twigs, washing in a large quantity of water until colourless, and then pressing in cloth. It may be preserved in glycerol, but the results are not so good as with fresh material. Results obtained by the author point to the fact that the accumulation of peptone in the solution tends to prevent further action of the pepsin, and that the action of the pepsin is considerably increased if the peptone produced be sufficiently diluted; hence the necessity of drinking sufficient fluid during a meal. These results appear to show that pepsin acts as a living ferment. J. T.

Behaviour of Carbonic Anhydride, Oxygen, and Ozone in the Human Stomach. By W. Jaworski (*Zeits. f. Biol.*, **20**, 234—254).—Whilst making experiments upon the behaviour of chloride of sodium solution in the human stomach, the author noticed that if the solution was saturated with carbonic anhydride it passed through much more rapidly than if no free carbonic anhydride were present. He accordingly made the following experiments, the results of which are briefly as follows:—

All the gases increase the quantity of secretion, although in varying proportions, a fact which proves that it is not from mechanical stimulation, but from the action of the gases themselves.

Carbonic anhydride very markedly increased the activity in two cases, but only a little in a third case; the acid secretion peptonised albumin readily, and had moreover a strongly antiseptic action.

Oxygen caused in one case the secretion of an alkaline fluid, which dissolved, but did not peptonise.

Ozone produced in one case a less alkaline secretion than oxygen, in another case very little change; the largest increase in the secretion is, however, produced by ozone.

Carbonic anhydride, besides producing a pleasant effect, stimulated the appetite. J. P. L.

Formation of Fat from Carbohydrates in the Animal Organism. By S. Chaniewski (*Zeits. f. Biol.*, **20**, 179—192).—

Soxhlet's experiments on pigs and Schulze's on geese being inconclusive, the author made the present ones, in the hope of arriving at a more definite conclusion. For this purpose, three geese of nearly similar live weight were fed for 26 days on rice and barley, at the end of which period No. 1, weighing 3219 grams, was killed and used as the standard of comparison. No. 2 and No. 3 were then fed on a daily ration of 100 grams of a mixture of rice and barley, their respective weights before the commencement of the feeding, being No. 2, 3283 grams, No. 3, 3581 grams. After 18 days, No. 2 was killed, and weighed at that time 3816 grams. No. 3 was not killed till the 29th day; its weight had then increased to 4471 grams.

The total amount of proteïd and fat was determined in the dried flesh, bones, blood, feathers, &c., of each bird, and are compared in a table given in the original paper.

During the period of feeding, the intake and output of nitrogen balanced one another within the limits of experiment. The increase in proteïd in both birds was but a small percentage of the total.

Making every allowance for the fat assimilated from the food and that which was possibly due to the decomposed proteïd of the same, it is only necessary to subtract 75·37 grains for No. 2 and 136·52 for No. 3; a balance of 193·63 grams for No. 2 and 503·68 grams for No. 3 is still left, the origin of which apparently can only be from the carbohydrates.

A similar experiment made with two geese almost destitute of fat gave even a more striking result, 86·7 per cent. of the newly formed fat apparently being due to the carbohydrates. J. P. L.

Alimentary Value of Oats. By A. Muntz and C. Girard (*Ann. Agronomiques*, **10**, 524—526; from *Ann. de l'Institut Agronomique*, No. 8).—Three horses were fed each with three varieties of oats from Sweden, Russia, and the Beauce district respectively. The rations were weighed and analysed before ingestion, and the excreta of the animals were also weighed and analysed, in order to determine the coefficient of digestibility of each constituent in the three samples of oats examined. Taking the coefficient of digestibility of the starch (none of which was excreted) as 100, the authors arrive at the following conclusions:—

Nitrogenous Substances.—80 per cent. (mean) of the nitrogen contained in the Beauce sample, 77·3 of that in the Russian sample, and 75 per cent. of that in the Swedish sample, was digested.

Saccharifiable Cellulose.—56 per cent. of that in the Beauce oats, and about 34 per cent. of that in the other samples, was digested.

"*Indigestible fibre*" (the residue after successive treatment with acid and alkali).—45·2 per cent. of this was digested in the Beauce sample, 37·5 in the Swedish sample, and 18 5 only in the Russian sample.

The nutritive value of a sample of oats is greater the smaller the proportion of husk to kernel; in the cases cited, the Beauce oats contained much less husk than the Swedish.

The authors point out the erroneous results arrived at in estimating the nutritive value of a food such as oats, from an ordinary analysis.

They also mention that different samples of oats which they have examined, vary in the percentage of albuminoïds from 7·6 to 13·25.

J. M. H. M.

Digestibility of Substances used as Food for Horses. By A. Muntz and C. Girard (*Ann. Agronomiques*, **10**, 526—527; from *Ann. de l'Institut Agronomique*, No. 8).—Experiments made in the manner above described have yielded the following results:—

Horse-beans.—Horse No. 1 digested 67·64 per cent. of the nitrogenous matter, horse No. 3, 77·9 per cent.; crude fibre 46 (No. 1) and 81 (No. 3) per cent.; saccharifiable cellulose 73·6 (No. 1) and 88·3 (No. 3) per cent.

Buckwheat.—Supposing the grains to be perfectly masticated, which is never the case, the digestive coefficients are as follows:—fat 55·14, starch 100, saccharifiable cellulose 35·75, crude fibre 7·10, nitrogenous matter 69·06, undetermined constituents 51·15.

Carrots.—Digestive coefficients:—fat 56·3, sugar 100, saccharifiable cellulose 98·03, crude fibre 90·25, nitrogenous matter 89·28, pectic substances 100, undetermined constituents 90·88. J. M. H. M.

Composition and Methods of Analysis of Human Milk. By A. R. Leeds (*Chem. News*, **50**, 263—267; 280—281).—The author has examined 84 samples of human milk, and has tested experimentally the various methods employed for the analysis of human milk. In the present communication the various methods previously employed are reinvestigated, and numerous sources of error pointed out.

He commends highly the Gerber-Ritthausen method (Abstr., 1881, 657); it is the one employed in his analyses.

The 84 analyses of human milk are thus summarised. They had a uniformly alkaline reaction. Only normal milks were analysed after being submitted to a microscopical examination:—

	Average.	Minimum.	Maximum.
Specific gravity	1·0313	1·0260	1·0353
Albuminoïds	1·995	0·85	4·86
Sugar	6·936	5·40	7·92
Fat	4·131	2·11	6·89
Solids not fat	9·137	6·57	12·09
Ash	0·201	0·13	0·37
Total solids (by addition of constituents)	13·268	10·92	16·79
Total solids (by evaporation)	13·267	10·91	16·66
Water	86·732	83·21	89·08

These results agree fairly well with those of earlier investigators of this subject. The most variable constituent of human milk is the albuminoïd, the fat coming next, whilst the sugar is the least so.

The colour of the milk is no indication of its richness, the taste is usually more or less saline and somewhat disagreeable, whilst its consistency is much thinner and more watery than cow's milk. Although the amount of solids is greater in human than in cow's milk, nevertheless the specific gravities of the two classes of milk vary but

little one from the other, that of human milk being somewhat the greater. The milk from women under 20 years of age is richer in all respects than that from older women, and that of the first lustrum is richer in albuminoïds, and especially in sugar than that of those succeeding it. D. A. L.

Relation of Phosphoric Acid to Nitrogen in the Urine during Feeding with Brain. By G. Politis (*Zeits. f. Biol.*, **20**, 193—214).—Zülzer, Edlefsen, and others from their observations concluded that an increased excretion of phosphoric acid denoted an increased activity and decomposition of brain material. Voit, however, doubted the correctness of this conclusion, which is left in still greater doubt by the present experiments. A dog was fed for nine days on a meat diet consisting of 500 grams of cooked flesh, and the average relation of phosphoric acid to the nitrogen excreted was 1 to 6·7; on the 10th, 11th, and 12th days 50 grams of ox brain was included with the meat, its equivalent in meat being deducted, the relation however still remained the same. In another experiment the animal was fed on brain exclusively (518 grams per day); the urine during the day was analysed five times, at intervals of three hours, from 9 A.M. to 9 P.M., and not only did the average relation remain constant, but the relation was the same for the whole 24 hours. The reason of the varying relation during meat diet is owing to the fact that the phosphoric acid exists as inorganic salts (phosphates), which are easily absorbed and excreted; whilst in brain it exists in an organic combination, and consequently undergoes resolution concurrently with the proteïd.

Moreover it seems unnecessary to attribute the increase, even admitting its truth, to increased activity of the brain solely, as that organ only forms ½ to 2 per cent. of the body weight, whilst the muscles, which themselves experience great activity, constitute 45 per cent. J. P. L.

Action and Fate of Trichlorethyl Alcohol and Trichlorobutyl Alcohol in the Animal Organism. By E. Kulz (*Zeits. f. Biol.*, **20**, 157—164).—Liebreich incorrectly attributed the physiological action of chloral hydrate to the formation of chloroform in the organism, due to the alkalinity of the blood. Mering and Musculus found, however, a new body: "trichlorethylglycuronic acid," excreted in the urine after taking chloral hydrate; this substance is lævorotatory, and is decomposed into trichlorethyl alcohol and dextrorotatory glycuronic acid when treated with mineral acids. The author has been unable to obtain this acid from the urine of patients kept under chloroform for a long time during operation, or from the urine of a dog continuously chloroformed for five hours. He further states that the lævorotatory action of the urine from chloroformed patients is due to the presence of a similar substance, "phenylglycuronic acid." In the present paper, the author has given the results of experiments with trichlorethyl and trichlorobutyl alcohols; both produce a marked soporific effect and are excreted in the urine as their corresponding glycuronic acids. Both these latter compounds have still a very strong physiological action, producing a more prolonged sleep, although they take longer to produce

the effect than an equivalent dose of chloral hydrate, butyl-chloral hydrate, or trichlorethyl or trichlorbutyl alcohols. J. P. L.

A New Lævorotatory Substance (Pseudohydroxybutyric Acid). By. E KULZ (*Zeit. f. Biol.*, **20**, 165—178).—In the urine of diabetic patients taking chloral hydrate, after the sugar had been removed by fermentation, the author observed that the lævorotatory action of the urine in some cases exceeded that due to the trichlorethylglycuronic acid, and concluded that a second lævorotatory substance was present, which was incapable of precipitation either by lead acetate, basic acetate, or even basic acetate and ammonia. Neither was it identical with the lævorotatory body Haas has described as existing in normal human urine. In order to isolate this substance, one of the two following methods was adopted:—1st. After fermentation, the urine is concentrated and then precipitated with normal lead acetate, basic acetate, and basic acetate and ammonia; the filtrate freed from lead is evaporated to dryness, the residue dissolved in a little strong alcohol, and then absolute alcohol added until no more precipitate is formed. After remaining 24 hours, it is filtered and mixed with 5 times its volume of ether, whereupon the acid separates out as a light yellow syrupy mass. 2nd method. After fermentation, the acid liquid is concentrated to a syrup, and a large volume of ether added at once to separate the acid.

The purified acid was converted into its barium salt, and from this the potassium, magnesium, copper, cadmium, zinc, and silver salts were obtained; the last named crystallises in beautiful stellate needles, the elementary analysis of which agrees with the formula $C_4H_7AgO_3$, its specific rotatory power (using a Jellet-Cornu polarimeter) is $[\alpha]_j = -8{\cdot}637$. The acid obtained by decomposing the silver salt with sulphuretted hydrogen forms a colourless syrup. Analyses of the acid and its silver salt gave numbers agreeing with the formula for a hydroxybutyric acid.

As however it does not agree in any of its properties with any of the four hydroxy-acids already known, the author has assigned to it the name of pseudohydroxybutyric acid; it gives no colour reaction with ferric chloride, and is not volatile with the vapour of steam.

In 52 cases under observation, the acid occurred only in the urine of the most severe, and of those which at the same time gave the ferric chloride reaction. It is besides of great clinical interest, for in one of the cases above mentioned, over 200 grams were eliminated in 24 hours; it may possibly too account for the lower percentages of sugar sometimes obtained by the polarimetric, than by the tetrimetric method of estimation. J. P. L.

Putrefaction of Albumin in the Alimentary Canal of Herbivora. By L. BÖHM and O. SCHWENK (*Zeit. f. Biol.*, **20**, 215—233).—The authors consider the negative results of both Brieger and Munk in their researches on oxen and horses, to be entirely due to the fact that they used too small a quantity to determine the presence of the volatile aromatic compounds of sepsis. They have therefore repeated the experiments, observing at the same time the same division

of the alimentary canal as Tappeiner did in his recent experiments on intestinal gases. The results, which are entirely of a positive character, are as follows:—Phenol is present in every section of the alimentary canal of both horse and ox; in the paunch and colon of oxen in sufficient quantity to be weighed as tribromophenol; indole in the small intestine of horses and oxen, in the cæcum of horses and in the cæcum and colon of oxen; skatole in the paunch of oxen and colon of horses. There can, too, be no doubt that they owe their origin to the sepsis of albuminous bodies in the intestine. About 10 per cent. of the proteïd of the food may approximately be considered as lost through putrefaction. In the horse, putrefaction begins earlier, as traces of phenol are evident in the stomach; in the colon it is more active than in any part of oxen; this is in agreement with the observations of Munk, namely, that more phenol was contained in horse's urine than in that of oxen. They do not consider the variation in behaviour of phenol when given to dogs and horses to be due to the greater power of oxidation in the blood of the latter, but to the fact that it is more slowly absorbed. J. P. L.

Anæsthetic Action of Cocaïne. By J. GRASSET (*Compt. rend.*, **99**, 983—984).—When a 1 per cent. solution of cocaïne hydrochloride is injected under the skin of dogs or monkeys, it produces complete cutaneous anæsthesia after some minutes, and this anæsthesia includes those muscles which lie nearer the surface, but there is a limit to the depth to which the effect extends below the skin. C. H. B.

Physiological Action of Dichloromethane compared with that of Chloroform. By J. REGNAULD and VILLEJEAN (*Jour. Pharm.* [5], **9**, 384—389). — The researches of the authors show (1) that the methylene chloride usually supplied to surgeons is simply a mixture, owing its anæsthetic properties to chloroform; (2) that the physiological action of dichloromethane is different from that of chloroform, and only resembles the latter in producing insensibility; (3) the symptoms produced by dichloromethane are constant, and of such a nature as to preclude the employment of this agent in surgery. J. T.

Analysis of the Contents of a Cyst formed under the Tongue. By GUINOCHET (*Jour. Pharm.* [5], **9**, 475—479). — The cyst was about 18 years growing, and weighed about 30 grams. Details of the method of analysis are given; its composition was found to be as follows:—

Soluble in ether..	water.....		21·20
	cholesterin	69·80	74·73
	fatty matter.....	4·93	
Insoluble in ether	mineral salts.....	0·97	4·07
	blood, *débris*.....	3·08	
	albuminoïd matter		
			100·00

The large amount of cholesterin is very remarkable. J. T.

Occurrence of Xanthine, Guanine, and Hypoxanthine. By A. Baginsky (*Zeits. Physiol. Chem.*, **8**, 395—403).—The researches of Fischer (Abstr., 1883, 354) having shown the close relation of xanthine to caffeïne and theobromine, it appeared probable that it might occur in tea. The author, therefore, examined several samples of tea, and found not only xanthine, but also hypoxanthine.

A considerable quantity of the pancreas of the ox was divided into two portions. The first portion, examined whilst quite fresh, contained guanine 0·2797 per cent., xanthine 0·1145 per cent., hypoxanthine 0·128 per cent. The second portion was allowed to putrefy for three weeks, and then yielded guanine 0·0069 per cent., xanthine 0·0455 per cent., and hypoxanthine 0·0810. An experiment in which in the course of three days 4·28 grams of hypoxanthine was administered to a dog, showed that no increase was thereby caused in the amount of hypoxanthine excreted in the urine. In cases of acute inflammation of the kidneys in children, the urine contained quantities of xanthine varying between 0·0113 and 0·0285 gram per 100 c.c. of urine, whilst normal urine (of children) contains only 0·0028—0·003. A. J. G.

Guanine. By A. Kossel (*Zeits. Physiol. Chem.*, **8**, 404—410).—The separation of guanine from hypoxanthine can only be effected by ammonia (in which guanine is sparingly, hypoxanthine readily soluble) in the absence of peptonous substances and many other compounds. It is therefore better to precipitate both substances together by means of ammoniacal silver nitrate, recrystallise the mixed silver salts from hot nitric acid in the presence of carbamide, and then, after removal of the silver, to effect a separation by ammonia. A loss of about 5·5 per cent. of the guanine is met with in this process, due to the solubility of guanine silver nitrate in the nitric acid employed. The amounts of guanine, hypoxanthine, and xanthine, in several animal tissues, &c., were determined with the following results, per 100 parts of the dry organ :—

	Guanine.	Hypoxanthine.	Xanthine.
Leuchæmic blood	0·201	0·072	Not determined.
Sarcoma of the peritoneum of a cow	0·283	0·272	,,
Sarcoma of the skin of the upper arm	0·196	0·137	,,
Embryonal muscle (ox)	0·412	0·359	0·111
Muscle of adult animal (ox)	0·020	0·230	0·053
Muscle of adult animal (dog)	trace	0·222	0·093
Pancreas (ox I)	0·241	0·411	0·844
Pancreas (ox II)	0·746	0·364	0·130
Spleen (ox)	0·270	0·281	0·152
Liver (ox)	0·197	0·134	0·121

A. J. G.