

Chemistry of Vegetable Physiology and Agriculture.

Reduction of Silver Salts by Living Protoplasm. By T. BOKORNY (*Ann. Agronom.*, **13**, 239—240).—The blackening of argentic nitrate by the protoplasm of living cells, discovered some years ago by the author and Lœw, has been attributed by Beaumann and Hoppe-Seyler to the action of hydrogen peroxide. The author finds, firstly, that hydrogen peroxide cannot be detected in the living cells of *Spirogyra* by any test, secondly, that dead cells of *Spirogyra* even after imbibing a 10 per cent. solution of hydrogen peroxide, will not effect the reduction.

J. M. H. M.

Changes in the Proteïds of Seeds during Germination. By J. R. GREEN (*Proc. Roy. Soc.*, **41**, 466—469).—Gorup-Besanez (*Ber.*, 1874, 1478) stated that the changes in the reserve proteïd materials during germination are probably due to the action of a proteolytic ferment. This was disputed by Krauch (*Abstr.*, 1878, 996). The present experiments demonstrate in the case of the seeds of the *Lupinus hirsutus*, the correctness of Gorup-Besanez' view. The seeds were allowed to germinate for about a week; they then gave an acid reaction to test-paper; the cotyledons were ground, extracted with glycerol, and the extract dialysed until no trace of any crystalline substances which had formed during the germination could be detected in the dialysate. No trace of peptone passed the dialyser even after a week's exposure. The extract was then acidified with hydrochloric acid to the extent of 0·2 per cent., put into a fresh dialyser, some swollen-up boiled fibrin added, and the dialyser surrounded with 0·2 per cent. hydrochloric acid, and exposed to a temperature of 40°. Control experiments with acid only, or with boiled digestive extract, were carried out side by side. Digestion was slow, but after some time the dialysate contained peptone and leucine, while in the control experiments there were no such substances. The proteïds of the seeds are changed by this ferment in the same way as fibrin is. The ferment exists in the resting seed as a zymogen,

which is easily convertible into the ferment: the resting seeds have moreover a neutral reaction. The ferment acts best in a slightly acid medium; its activity is hindered by neutral salts and destroyed by alkalis, and is most active at a temperature of 40°. The process of germination is started or accompanied by a transformation of the zymogen into ferment on the absorption of water, and the development of vegetable acids in the cells of the seed: the ferment so developed converts the proteïds of the resting seed into acid albumin or para-peptone, peptone, and crystalline amides. The nitrogen travels from the cells of the seed to the growing points in the form of amides, not in that of peptones or other proteïds.

W. D. H.

Molecular Respiration of Plants. By N. W. DIAKONOFF (*Ann. Agronom.*, **13**, 229—233).—Experiments with the higher plants lead the author to the following generalisations which amplify those formerly arrived at from a study of intramolecular respiration amongst the moulds. The intensity of disengagement of carbonic anhydride by vegetable cells in the absence of the oxygen of the air is determined by the activity of the fermentative processes which take place in the cells. As soon as oxygen ceases to be supplied in quantities sufficient for normal respiration, fermentation sets in; with a renewed supply of pure oxygen, normal respiration again becomes possible. Without the chemical action of pure oxygen, or as alternative some process of fermentative change (which constitutes the sole means of satisfying the requirements of a living cell in a medium deprived of oxygen), there is no disengagement of carbonic anhydride, that is to say, there is no life.

J. M. H. M.

Exhalation of Oxygen by Fleshy-leaved Plants in Absence of Carbonic Anhydride. By A. MAYER (*Landw. Versuchs-Stat.*, **34**, 127—143).—Former researches by the author (*Abstr.*, 1876, i, 95; *Landw. Versuchs-Stat.*, **21**, 277; **30**, 217) have shown that under certain conditions oxygen is exhaled by the leaves of some plants in absence of carbonic anhydride. This is more especially the case with the Crassulaceæ, and it was found that *Bryophyllum calycinum* leaves which contain malates, after a period of darkness (during night) react acid, but this reaction during the day time becomes much less. Comments are here made on the author's own experiments, and on those of others (de Vries and Sachs) who have combated his conclusions. His experiments made since 1883 show that "acid leaves," during insolation in an atmosphere free from carbonic anhydride, yield more oxygen the richer they are in free acid; moreover the older leaves being more acid, yield more gas than younger leaves, which are more nearly neutral; also those Crassulaceæ which emit most oxygen, are more acid in the morning than other plants (compare *Bryophyllum calycinum* with *C. arborescens*), and when the elimination of oxygen has ceased, it is found that the leaves are nearly neutral in reaction. The acid present is a malic acid which differs in some respects from ordinary malic acid, but the calcium salt is a true malate; this acid and the calcium salt diminish during insolation, just as if the whole consisted of free acid, the products produced

by the change being starch, sugar, &c., and the amount of oxygen which should be separated by the produced carbohydrates, agrees well with the quantity of oxygen found to be set free by insolation. From all these facts, the author has drawn the conclusion that the changes which occur as above are part and parcel of the regular assimilation in the plant, that is processes of reduction which take place in the green portions of the plant, and that the malic acid of the Crassulaceæ is to be considered as an intermediate product. Further results have also been obtained, for it was found that the acid in dead leaves was not altered by light, nor did oxalic acid suffer any reduction nor give off oxygen. As regards the formation of malic acid in the dark, it is evidently the result of decomposition. The remainder of the article is occupied by a defence of his own theory against the arguments and experiments of de Vries, Kraus, and Warburg.

E. W. P.

Relations between Inorganic Salts containing Nitrogen and Plants. By H. MOLISCH (*Monatsh. Chem.*, 8, 237—259).—The most important conclusions arrived at by the author are the following:—

Nitrates are generally distributed in the vegetable kingdom; they usually occur to a much greater extent in herbaceous than in woody growths.

Nitrites could not be found in any of the plants examined (which amounted to about 100) in spite of their frequent presence in the ground. Former statements on the so-called presence of nitrites in different plants are based on errors and incorrect interpretation of results.

Plants possess the power of reducing nitrites with surprising quickness as soon as assimilated, and this is evidently the reason why they are never found in plants. Nitrates, however, will remain for weeks or even months in the vegetable cells before they are destroyed.

In contrast to the nitrates, nitrites act injuriously on certain plants even when employed in comparatively dilute solutions (0.1—0.01 per cent.).

Plants, to which the nitrogen is offered not in the form of nitrates, but in the form of nitrites or ammonia, never contain nitrates. It, therefore, follows that neither nitrous acid or ammonia undergo oxidation to nitric acid in the vegetable organism.

Contrary to the statement of Berthelot and André, plants, with perhaps the exception of bacteria, have not the power of producing nitrates from nitrogenous compounds. All nitrates in plants originate from outside, and when they exceed the amount contained in the substratum in the plant, the excess can be simply explained by the storing up of the salt. E. Schulze's experiments with lupines (this vol., p. 859) afford additional evidence in favour of this view.

Diphenylamine dissolved in sulphuric acid serves very conveniently for the detection of nitrates under the microscope. In those cases, however, in which humin substances are quickly formed by the action of the sulphuric acid, the reaction is more or less checked.

The paper also contains some observations on the localised appearance of substances which turn guaiacum emulsion and potassium iodide and starch-paste blue.

G. H. M.

The Proteïds of the Seeds of Jequrity. By S. H. C. MARTIN (*Proc. Roy. Soc.*, 331—334).—Warden and Waddell ("Non-bacillar Nature of Abrus Poison," Calcutta, 1884) have given the name "abrin" to the poisonous principle of jequirity (*Abrus precatorius*). They showed also that abrin was closely allied to "plant albumin", but did not enter into any details as to whether it consisted of one or more proteïds. The present examination relates to the kinds of proteïds present in the seed, and is preliminary to an investigation of their physiological action. The red cuticle was first removed by shaking the seeds with chloroform; the outicle sinks in that liquid, and the yellow kernel powder is readily removed and dried by allowing the chloroform to evaporate. The powder was then extracted with 15 per cent. sodium chloride solution and filtered. The proteïds in the filtrate were separated: (1) by saturation with ammonium sulphate; (2) by saturation with sodium chloride and the subsequent addition of glacial acetic acid.

The former method is the best; it takes shorter time, and precipitates the proteïds more completely. The precipitated proteïds were redissolved in distilled water, and the solution dialysed; this caused a copious precipitate, which was collected, washed with boiled distilled water, and dried over sulphuric acid. The residue consisted of dark-brown scales, which consisted of globulin and colouring matter. All the globulin is not, however, precipitable by dialysis. Alcohol was therefore added to the liquid, which had been in the dialyser for seven days, to precipitate the remaining proteïds. After six to eight weeks, the globulin was rendered insoluble by this means; the precipitate was collected, dried, and treated with distilled water, which dissolved out a proteïd which was an albumose. There are thus two proteïds present; a globulin and an albumose. The globulin is coagulated by heat at 75—80° in a 10 per cent. magnesium sulphate solution, at 66—73° in a 10 per cent. sodium chloride solution. It does not become insoluble when the latter solution is placed in an incubator at 35—40° like vegetable myosins; it belongs to the class of vegetable paraglobulins (this vol., p. 507).

The albumose is soluble in cold or boiling distilled water. It is not precipitated by saturation with sodium chloride unless a large amount of glacial acetic or phosphoric acid is added also. It is readily precipitated by saturation with neutral ammonium sulphate. It is not precipitated by nitric acid unless its solution be nearly saturated with sodium chloride. It gives the biuret reaction. This phytalbumose is seen to be closely allied to Kühne and Chittenden's deutero-albumose, and is identical with the α -phytalbumose of papaw-juice (*Abstr.*, 1886, 642).

W. D. H.

Safrole. By — FLÜCKIGER (*J. Pharm. Trans.* [3], 17, 989—990).—Safrole exists not only in the essential oil of sassafras root, but probably in other plants belonging to the natural order of *Lauraceæ*. In Germany, safrole is now extracted on a large scale from the oil of the camphor tree, *Cinnamomum camphora*. An odour resembling that of sassafras is noted in *C. Parthenoxylon*, *C. glanduliferum*, and in *Beilschmiedia obtusifolia*. Safrole is associated with eugenole in the

fruit of *Illicium religiosum*, and in *Illicium anisatum* it is replaced by anethole. The empirical formulæ of these three highly aromatic substances, $C_{10}H_{10}O_2$, $C_{10}H_{12}O_2$, and $C_{10}H_{12}O$, suggests that probably they are capable of being converted one into another. R. R.

Strophanthus. By W. ELBORNE (*Pharm. J. Trans.* [3], 17, 743—747).—The seeds of *Strophanthus kombé* yield 20·8 per cent. of fixed oil when extracted with light petroleum; 0·9 per cent. of chlorophyll and fat when extracted with ether; 1·5 per cent. of a bitter glucoside to absolute alcohol; and an additional 2·9 per cent. of bitter glucoside to water. These solvents were made to act successively on the dried and powdered seeds. It is remarked that when the alcoholic solution is evaporated to dryness at a low temperature, and the residue dissolved in water and set aside for a few days, the product becomes far more toxic. The cause of this change has not yet been investigated, but in the method adopted by the natives of Eastern Africa in preparing their arrow-poison from the plant, advantage appears to be taken of this fact. Bitter principles from *Strophanthus* have been already described by Fraser, and by Hardy and Gallois under the names of “*strophanthin*,” “*strophanthin*,” and “*strophanthidin*.” The author was unable to extract any alkaloid from the comose hair of the seeds. R. R.

Poisoning of Plants by Lithium Salts. By J. GAUNERSDORFER (*Landw. Versuchs-Stat.*, 34, 171—206).—Experiments have previously shown that lithium is a constant compound of the ash of some plants, and that it is stored in their leaves, but not in their roots, and they even collect it when the presence of lithium in the soil is scarcely to be detected. Various experimenters are here referred to, also the results obtained by them. The author records the results of experiments made by him on various plants, *Cicer arietinum*, *Vicia faba*, &c., with solutions of lithium chloride of different strengths, 1·1—0·066 per mille; the descriptions are given in full detail, and the following conclusions are drawn: lithium is a fairly constant but not essential constituent of certain plants, but for most plants, in relatively small quantities it is a poison, and produces evident disturbances in the plants. Lithium is deposited in the *fully grown* leaves, whilst the young leaves, buds, and reproductive organs, failing as they do in hardened fibre, are exempt from the action of lithium, which does not reach them. It is the action of transpiration which carries lithium upwards, but this element can move sideways through the hardened cell-walls. Those plants which do not naturally contain lithium will live healthily in a soil which contains but a small portion of lithium, but finally the whole of the lithium is carried into the leaves which, dropping off, denude the soil of the element referred to.

E. W. P.

Composition of some Leguminous Seeds. By R. WAAGE (*Bied. Centr.*, 1887, 394—395).

A comparison with blue and yellow lupines shows that the white and blue are nearly of equal value, whilst the yellow contains more nitrogenous and less carbonaceous matter.

	Whole lupins.	Red Sanderbsen.	Peluschken.
Water	16·52	15·38	15·8
Ash	2·89	2·96	3·06
Sand	0·09	0·13	0·05
Crude fat	5·42	0·15	1·13
„ fibre	12·71	5·31	5·35
Non-nitrogenous extract	39·96	51·96	52·50
Crude albumin	22·41	22·24	22·02
Albumen.....	20·84	19·63	21·09
Digestible albumin	95·63	94·90	88·80
Soluble legumin.....	12·84	11·42	10·89
Nutrient ratio	2·94	2·21	2·35

The effect of steeping in water to remove the bitter portion of the lupines is to remove a large portion of the ash, some of the non-nitrogenous and some of the albuminous matter.

The total loss of valuable material amounts to 7·65 per cent., of which 1·86 is albumin and 5·8 is non-nitrogenous. E. W. P.

Experiments on Potatoes at Harelaw in 1886. By AITKEN (*Trans. Highland and Agric. Soc.*, 1887 [4], 19, 215—237).—The general results of the Harelaw experiments are summed up by the author as follows:—

Unmanured Section, Residual Fertility.—Insoluble phosphates have left a larger available residue than soluble phosphates; the largest has been left by bone-meal. The phosphates which produce the greatest result during the previous rotation have left the least residue. Nitrate of soda alone exhausts the land very much, with other manures it exhausts it more than other nitrogenous manures. Sulphate of ammonia has left considerable residue, or at any rate has not exhausted the land so much as nitrate of soda. Horn-dust and dried blood have left no more for the potato crop than sulphate of ammonia; rape-dust has left more residue than the other nitrogenous manures. Both potassium sulphate and chloride have left a residue for the potato crop, but the chloride has left rather more than the sulphate. Peruvian guano has left the land in better condition for the growth of potatoes than either Ichaboe or fish guano. Low class superphosphate has left more residue than high class.

Manured Section, Immediate Fertility.—The manure applied to potato plots in 1886 gave the following results:—Mineral phosphates found to pass through a sieve of 120 wires per linear inch produced nearly as good results as dissolved phosphates; they were more active than bone-meal or pure dissolved bones. Sulphate of ammonia did better than nitrate of soda when no dung was used. Horn-dust and dried blood are not sufficiently active for potatoes when applied with the seed. Potassium salts are of great importance to potatoes, and there

is little difference between the sulphate and chloride. Ordinary superphosphate, 28 per cent. soluble, is better than richer ones. When the potato crop is insufficiently manured, not only is the produce less, but the proportion of small tubers is greater; potash is the most important ingredient for the production of large tubers. A well-balanced manure for raising a potato crop without dung should contain about equal parts potash, ammonia, and phosphoric acid. When applied with dung, half the potash may be used. Manure for potatoes should be within easy reach of the roots, but may be slow acting; dung appears to be the most appropriate manure, producing a crop with a large proportion of large tubers. With dung, nitrate of soda is better than sulphate of ammonia; without it, the sulphate of ammonia is best. Where much dung is used, potash salts may not be required.

J. M. H. M.

Production of Nitrates in Arable Soil. By P. P. DEHÉRAIN (*Ann. Agronom.*, 13, 241—261).—The present series of experiments was undertaken to determine the conditions under which different substances acting as manures nitrify in the soil. They were made with the nitrogenous black matter of soil, ammoniacal salts, oil-cakes, farmyard manure, and the black matter of farmyard manure, under varying conditions of moisture and for different periods of time; in some instances, the proportion of manure to soil, and the temperature, both varied. The quantities of nitrate formed in the various mixtures from time to time were determined as follows:—100 grams of the mixture were introduced into a litre flask, the quantity of water required to make it up to the mark measured into it, left in contact for several hours, and repeatedly shaken; then 700 to 800 c.c. were withdrawn and evaporated down to about 10 c.c., and the nitric oxide determined according to Schloesing's method by measurement of the gas.

Nitrogenous Black Matter of Soil.—The soil employed contained 0.160 per cent. organic nitrogen and 0.015 per cent. nitric acid (N_2O_5 ?). Quantities of 100 grams of this soil were placed in glass beakers and moistened with 5, 10, 15, 20, and 25 c.c. of water respectively, and all the beakers were placed together under a bell-glass, and the nitric acid formed determined after several periods up to 90 days. With the 5 per cent. of added water, there was no nitrification at the end of 56 days, but all the other mixtures had commenced to nitrify at the end of the first period. After 90 days, the quantity of nitrate formed in a tonne (1000 kilos.) of soil was 250 grams in that moistened with 5 per cent. of added water; 16 grams with 10 per cent. water; 270 grams with 15 per cent. water; 290 grams with 20 per cent. water; and 370 grams with 25 per cent. water—the nitric acid formed thus attaining a maximum in the most humid mixture. The greatest rate of nitrification observed was 1 gram nitrogen nitrified per day per tonne of soil. Supposing this rate to be maintained during the active life of a cereal crop, say 100 days, the nitrogen nitrified would amount to 300 to 400 kilos. per hectare, a quantity greatly in excess of the requirements of the crop.

Ammoniacal Salts.—Quantities of soil watered with various propor-

tions of ammonium sulphate were placed in identical conditions with plain soil freely exposed to the air.

Sulphate of ammonia in quantities equivalent to 0.030 gram and 0.010 gram nitrogen per 20 grams of soil far from increasing the quantity of nitrate formed greatly hindered the nitrification in the soil. In a saturated atmosphere, however, with the soil freely supplied with water, doses of sulphate of ammonia up to 0.100 gram nitrogen per 100 grams soil did not prevent nitrification, although the larger the doses employed the less nitrates were formed.

A series of experiments with sulphate of ammonia equivalent to 0.010 gram nitrogen per 100 grams soil, moistened with 5, 10, 15, 20, and 25 grams water, showed that with the smaller proportions of water nitrification was less than in the parallel experiments with plain soil; with the larger proportions of water, more nitrogen was nitrified, that of the ammoniacal salt undergoing oxidation as well as that of the organic matter of the soil, and at a much faster rate, so that, for example, the addition of 0.010 gram nitrogen as ammoniacal salt to 100 grams soil containing 0.160 gram organic nitrogen doubled the quantity of nitrate formed during the course of the experiments. Frequently as much as one-hundredth of the nitrogen added as ammoniacal salt was nitrified per diem, whilst the nitrogenous matter of the soil scarcely gave rise to one-thousandth of its weight of nitric acid in the same time. The whole of the sulphate of ammonia added as manure is probably nitrified in the course of a few months. Some of the nitrates at first formed disappear afterwards, more especially in the most humid mixtures, and this is attributed by the author to the slow growth of moulds.

Maize Cake.—The nitrogen of maize cake is nitrified more quickly than that of the organic matter of soil, more slowly than that of ammonium sulphate, so that if a mixture of the two is used as manure, when the action of the latter is exhausted that of the former still continues. The influence of humidity is the same as in the preceding cases.

Farmyard Manure.—2 per cent. of farmyard manure was added to the soil, corresponding to a dressing of 72 tonnes per hectare. Even with 5 per cent. of added water some degree of nitrification occurred, whereas with plain soil of the same humidity there was none. With the largest proportions of water, nitrification was very irregular, no more nitrate being formed after 90 days than after 26, and in some cases the nitrate formed was less than with plain soil. These irregularities are doubtless due to the growth of moulds, &c., of which the spores and mycelia abound in farmyard manure. In point of rapidity of nitrification, farmyard manure comes next to ammonium sulphate, and before maize cake and plain soil.

Black Matter of Farmyard Manure.—This was obtained by extracting decomposed farmyard manure with water, filtering, and evaporating the filtrate to dryness by exposure to air alone. It contained 3.5 per cent. of nitrogen, and was added to the soil in the proportion of 0.3 per cent., thus introducing the same quantity of nitrogen as that contained in the 0.050 gram ammonium sulphate used in a former series of experiments. With these mixtures, nitrification occurred

exactly as with plain soil, that is to say, the nitrogen of the black matter appeared to undergo no change. It appears to lose the capacity of being nitrified by the act of drying, since in trials with the *undried* extract of farmyard manure the nitrogen of the extract was nitrified in sensible quantities. J. M. H. M.

Free Phosphoric Acid and Superphosphates. By M. WEIL-ANDT (*Landw. Versuchs-Stat.*, **34**, 207—215).—Ritthausen has previously found that a solution of superphosphate and calcium carbonate produces dicalcium phosphate, and generally in the crystallised condition. The author has now studied the results of the reactions of a 10 per cent. solution of orthophosphoric acid on several alkaline carbonates. Pure barium and strontium carbonates produced 65.2 and 45.7 per cent. respectively of the insoluble phosphate, but when carbonic anhydride was passed in rather less of the bibasic and more of the monobasic phosphate and free acid were produced, as also many crystals. When, however, the concentration of the solution was raised, the results were reversed, but when the time of action was lengthened there was rather less of the bibasic salt produced, but in the filtrate was found a large conversion of the free acid into the monobasic salt. It would appear, then, that the crystallised phosphoric acid acts somewhat differently from the superphosphate.

The author, therefore, prepared a superphosphate from Mejillones guano and phosphoric acid, and with the solutions thus obtained he experimented on marble and other forms of carbonate, of which marl appeared to react most energetically. From the results obtained, it is evident that if superphosphate is applied to a well marled soil none will be lost by passing through unabsorbed in the monocalcium form, but all (98 per cent.) of the acid will be retained at the surface. As was to be expected, the more crystalline compounds are least readily acted on, whilst marl, which is readily decomposed, and in which the calcium carbonate is finely dispersed, becomes coated with the bibasic compound and prevents any further reaction. E. W. P.

Basic Cinder and other Finely-ground Insoluble Phosphates as Manures. By AITKEN (*Trans. Highland and Agr. Soc.*, 1887 [4], **19**, 245—253).—The phosphates tried were Curaçoa phosphate with 87 per cent., Canadian phosphate with 59 per cent., Carolina phosphate with 57 per cent., Belgian phosphate with 40 per cent., and basic cinder with 40 per cent. of phosphate of lime. These were tried against each other and superphosphate of 28 per cent. at four different stations on turnips. It was found that only 40 to 50 per cent. of the ground Curaçoa, Carolina, Canadian, and Belgian phosphates would pass through a sieve of 120 wires per linear inch, whereas all the basic cinder passed through this sieve. A large sieve of this gauge was therefore made, and sufficient quantities of the mineral phosphates passed through it to try the sifted against the unsifted portions. Sulphate of ammonia and sulphate of potash were added in all cases to make a general manure, and quantities of the phosphates containing equal weights of phosphoric acid were employed. In almost all cases, the sifted phos-

phates produced a larger crop than the unsifted phosphates, amounting on an average to a gain of 1 to $1\frac{1}{2}$ tons of roots per acre, and it seems reasonable to suppose that this increase would pay for the extra fineness of grinding. The superphosphate proved little if any superior to the sifted phosphates or the basic cinder, and this last phosphate appears to be at present the most finely ground as well as the cheapest in the market. The nature of the mineral phosphate used appears to be of much less importance than the fineness to which it is ground.

J. M. H. M.

Note by Abstractor.—The author says of basic cinder, "I do not doubt that its efficacy as a phosphatic manure is in the main to be attributed to the extraordinary fineness to which it is ground." No doubt fineness of grinding is extremely desirable, but the basic cinder appears to possess a distinct advantage over the mineral phosphates in the great relative solubility of the phosphate of lime contained in it. On some soils this tells very much; in the Downton experiments, conducted in 1885 by the Abstractor and another (this vol., p. 176), the coprolites were much more finely ground than the basic cinder employed, yet the latter produced far better crops than the former.

J. M. H. M.

Ground Felspar as a Potash Manure. By AITKEN (*Trans. Highland and Agr. Soc.*, 1887 [4], 19, 223—255).—The result of two small experiments, made at Pumphuston on turnips and at Boon on peas, is that felspar when ground so as to pass through a sieve of 120 meshes per linear inch undoubtedly acts as a potash manure. On the turnips, the felspar did better than an equivalent quantity of sulphate of potash, on the peas not so well.

J. M. H. M.

Butter from various Districts. By E. DUCLAUX (*Compt. rend.*, 104, 1727—1730).—The author has determined the proportion of volatile acids in various butters by the methods previously described. The butters examined were obtained from Isigny, Gournay, Brittany, and Cantal.

The ratio of butyric acid to caproic acid is practically constant in butter from the same district, but varies considerably from one district to another. In butter from Gournay, it is 1.6, Brittany 1.9, Isigny 2.1, Cantal 2.4. The total quantity of the two acids varies in different samples even from the same district. The production of butter of fine flavour and good quality is not simply a question of the method of preparation.

C. H. B.