

Journal of the Society of Arts.

FRIDAY, FEBRUARY 1, 1861.

EXAMINATIONS.—LOCAL BOARDS.

Those Secretaries of Institutions who have not already forwarded Lists of their Local Educational Boards are requested to do so as soon as possible, not omitting to specify the Chairman and Secretary.

Copies of the Programme of Examinations for the present year may be obtained by members of any of these Boards on application to the Secretary of the Society of Arts. In this will be found full instructions for their guidance in making the necessary arrangements for co-operating with the Society of Arts.

EIGHTH ORDINARY MEETING.

WEDNESDAY, JANUARY 30, 1861.

The Eighth Ordinary Meeting of the One Hundred and Seventh Session, was held on Wednesday, the 30th inst., W. H. Bodkin, Esq., Assistant Judge for Middlesex, Vice-President, in the chair.

The following gentlemen were proposed for election as members of the Society :—

- Battam, John H. .... Gough-square, E.C.
- Cresswell, A. J. Baker . Cresswell, Morpeth.
- Dixon, James W. .... Cornish-place, Sheffield.
- Hartley, Bartholomew H. Red-hill-lodge, Red-hill, Surrey
- Ledger, George ..... { 5, Caroline-street, Bedford-square, W.C.
- Malcomson, William ... Milfort, Portlaw, Ireland.
- Murray, Andrew ..... 2, Old Palace-yard, S.W.
- Porter, John H. .... { Birmingham, and 10, Old Cannon-street, E.C.
- Rogers, Rev. William . 7, Charterhouse-square, E.C.
- Toase, Thomas ..... Kingston, Jamaica.

The following candidates were balloted for and duly elected members of the Society :—

- Aldridge, R. W. .... { The Avenue, Denmark-street, Cambervell, S.
- Allen, Thomas ..... Upton-cottage, Macclesfield.
- Beale, James ..... 11, Wellington-place, Cork
- Boden, Henry ..... Ednaston-lodge, near Derby.
- Borries, Christian .... Newcastle-on-Tyne.
- Breillat, E. .... { Murdoch-villa, Coburg-road, Montpelier, Bristol.
- Cammell, Charles ..... Norton-hall, near Sheffield.
- Chesterfield, Earl of ... { 3, Grosvenor-square, W., and Breyby-park, Burton-on-Trent.
- Clayton, Thomas ..... South Stainley, Ripley, Yorks.
- Cocker, Joseph R. .... { Belle-vue, Hathersage, vid Sheffield.
- Cooper, Major William { Toddington Manor, Dunstable, Beds.
- Cooper ..... { Holland-house, Vassall-road, Brixton, S.
- Dickinson, Peter ..... { 209, West George-street, Glasgow.
- Euing, William ..... {

- Hamilton, Edward Wm. } 32, Upper Brook-street, W.
- Terrick ..... {
- Harris, Henry ..... Heaton-hall, near Bradford.
- Heaps, John Knowles... Leeds.
- Henderson, John ..... { Hungerford Wharf, Strand, W.C.
- Higginbotham, Samuel Glasgow.
- Howard, Edward C. ... Brinnington-hall, Stockport.
- Hunt, Thomas ..... Bridge-street, Banbury.
- Kay, John Robinson ... { Walmesley-house, Summerseal, near Manchester.
- Lyons, M. .... 143, Suffolk-street, Birmingham.
- Mitchell, C. .... { Low Walker, near Newcastle-on-Tyne.
- Morrison, Robert ..... Ouseburn Engine Works, Newcastle-on-Tyne.
- Muspratt, Frederic ..... Woodend Chemical Works, Runcorn Gap, Warrington.
- Napier, Robert ..... West Shandon, Glasgow.
- Neville, Samuel ..... Ellison Flint Glass Works, Gateshead-on-Tyne.
- Oakes, John ..... Riddings-house, near Alfreton.
- Pierpoint, Benjamin.... St. Austin's, Warrington.
- Platt, John ..... Oldham.
- Radcliffe, John ..... Lower-house Mills, Oldham.
- Richardson, E. Junr. ... { 3, Lovaine-place, Newcastle-on-Tyne.
- Robb, Alexander ..... 79, St. Martin's-lane, W.C.
- Smith, Samuel ..... { 6, Upper Westbourne-terrace, Hyde-park, W.
- Sowerby, John ..... Ellison Flint Glass Works, Gateshead-on-Tyne.
- Straker, John ..... Willington-house, Durham.
- Turner, Robert ..... { 32, Grey-street, Newcastle-on-Tyne.
- Wotherspoon, William 46, Dunlop-street, Glasgow.
- Young, J. H. .... 64, Gordon-street, Glasgow.

The following Colonial Institution has been taken into Union since the last announcement :—

Corfu, Ionian Association for the Promotion of Science, Literature, and Art.

The Paper read was—

ON FOOD; ITS ADULTERATIONS, AND THE METHODS OF DETECTING THEM.

By WENTWORTH LASCELLES SCOTT.

It is with no little diffidence that I have undertaken to address you this evening upon the subject of our food and drink—its various impurities and sophistications; a subject of such ample scope and grave importance, that I feel quite incapable of doing justice to it in the brief hour allotted for the reading of this paper. Nevertheless, important nationally and individually as the subject is, it has not hitherto received a commensurate amount of attention from scientific men, the commercial world, or the general public; indeed, at the present moment, the latter are accused of apathy and indifference in the matter—but the charge is a false one, as I shall presently endeavour to show.

The practice of adulterating articles of food and drink, as well as those myriad non-alimentary substances so necessary to our comfort in various ways, is by no means of recent origin, as, according to Pliny, the wines of his period were largely adulterated; lead, either in the metallic form, or in that of acetate, being added, to work off the sourness of new or inferior varieties; while, if I am not mistaken, our Saxon Harold greatly distrusted the confectionary department (as well as the holy relics) of Duke William's palace, when on his memorable but decidedly uncomfortable visit to that crafty potentate. A history of the "rise and progress" of adulteration, however, although it might be interesting to some, is quite removed from my present purpose, which has to deal

exclusively with the evil propensities of our own time and our native country.

Adulteration, in the more comprehensive sense of the word, may be stated to signify, 1st., the dilution of any articles for sale as genuine with other substances of inferior commercial value or less marked properties, as instanced in the addition of water to wine or spirits, or of chicory, &c., to coffee. 2ndly, the heightening or simulation of their active principles, by the admixture of various matters foreign to their legitimate composition, of which examples may be found in the falsification of bread with alum, gin with capsicums, &c. 3rdly, The employment of various colours, essences, &c., for the purpose of rendering the articles more attractive to the eye, or to the senses of taste and smell. In this division may be placed bottled fruits and pickles, rendered green by cupreous salts; various syrups and light beverages, coloured and flavoured to a dangerous degree, and, in fact, confectionary *in toto*. Lastly, any combination may be made of these several kinds of adulteration in the fabrication, or getting up for the market, of any of those cheap food-preparations, so terribly abundant in poorer neighbourhoods, and but too frequently met with in fashionable localities.

Adulteration, however, is not quite confined to the types I have just indicated, for if a manufacturer of any one of the almost countless "foods, drinks, condiments, or narcotics," with which we are acquainted has an accident in the process of that manufacture, or if his consignment of a certain ingredient is of a very inferior quality, does he put aside for other purposes the deteriorated article, or explain its deficiencies, and sell it at a lower price? No; in the vast majority of instances he proceeds in the manufacture of that article as usual, adding thereto various colouring or flavouring adulterations (which may be poisonous, injurious, or harmless, as chance disposes), to simulate the physical qualities it ought to possess, or conceal their absence by heightening the tint, pungency, &c.

Again, I ask, in how many cases will the retail tradesman confess that an article which has been exposed in his shop window for a month or two, to the influences of sun, dust, and atmosphere, is injured in appearance and properties? I have here an illustrative specimen—some "crystallised" sugar, containing about 3 or 4 per cent. of dust, sold to me as the "same quality" as that which attracted admiring observers to the window, by its superior lustre and whiteness. Clearly this is adulteration, should be recognised as such, and should be punished as such. But perhaps the most heartless and pernicious species of adulteration, is that shown when persons make it their rule to manufacture nothing else but inferior, adulterated, and deleterious articles, buying up all sorts of injured produce, and refuse matter, for the compounding of their "pure and nutritious" or "health-giving" foods, as their advertisements would say;—relying upon an ambiguous but highflown testimonial from "the late Dr. Blank," or some other celebrity of the same moral calibre, and also upon the tendency of a too confiding public to purchase "cheap" things, to get rid of their vile, perhaps poisonous, mixture at an immense profit.

It must be readily seen that an intelligible and practical classification of this complex subject is somewhat difficult. I have attempted, however, to embody in the form of tables (see Tables I. and II.) a kind of general outline of adulteration and its effects, which, if in the hands of the people at large, might possibly guard them from some few impositions.

Having now made up our minds that the cause of adulteration is simply that fraudulent tradesmen wish to acquire, in an indolent manner, more money than the honest man can obtain by years of toil and application, we have to consider, in the first place, by what methods we can discover and tangibly demonstrate the presence of adulterants of any kind in articles sold as genuine, and find out in what proportion they have been added. Secondly, what measures, social, scientific, or legislative, require to be

taken for the suppression or diminution of this great and growing evil; and, lastly, what part in such measures this Society, known throughout the world by its beneficial influences upon all things tending to advance the knowledge or promote the welfare of our countrymen, seems to be called upon to perform.

The limits of my time to-night are, of course, far too narrow for me to enter upon a detailed account of the various analytical processes for the detection of food-adulterants known to modern chemists, or employed by myself, but, for the benefit of those persons (forming the greater portion of the public) who are unacquainted with any means of testing the purity of their food, and who are unprovided with the complicated and costly apparatus of the analyst's laboratory, I will briefly narrate what everyone might do, and, as I hold ought to do, with the various articles of his daily food and drink.

I will commence with what has been aptly and poetically denominated the "staff of life"—bread. Recent analytical experiences, however, show very forcibly that in most cases the "staff," as supplied in the form of "half-quarters," is but a very frail reed indeed for a working-man to lean upon. Bread is adulterated with a variety of substances not legitimately entering into its composition—some harmless, some injurious to health, but none, to my knowledge, of an actively poisonous nature.\* The general characters of pure bread are tolerably well-known to most people, and after Dr. Daughlish's able paper at this Society last session, † I should only be recapitulating were I to enumerate them. Of pure bread there are several specimens on the table, illustrating Dr. Daughlish's process, as carried out by Messrs. Peek and Frean, and the ordinary method, of which latter Mr. W. Salmon, of the King's-road, Chelsea, has furnished me with samples.

When bread is adulterated with other flours or starches the admixture is often somewhat difficult to detect without the aid of a good microscope, but some of the simpler and less expensive varieties of this valuable instrument will frequently answer the purpose. The presence of potatoes in bread imparts a peculiar crumbly texture, which a very casual inspection will enable us to recognise; while rice-flour causes a brittleness of structure not easy to mistake. Nitric acid affords a means of showing the presence of potato-starch when in large quantity, as it will give a colouration to wheat flour, while the other farina remains white. Maize or Indian corn flour may be detected (without a microscope), if a little care is taken, by roughly estimating the amount of fatty matter, as maize contains fully four times the quantity of fat that is usually found in wheat. The bread should be carefully and completely dried, powdered, weighed, and washed with (what is sold for) pure benzole or benzine, upon a filter, then dried perfectly and weighed again. The loss upon the former weighing will give the amount of fat or oil, extracted by the benzole.

Oatmeal also contains a comparatively large quantity of fat, but is seldom, if ever, used as an adulterant for bread or flour in this country. No instance has come under my own observation.

Chalk, or carbonate of lime, is shown to be present if the suspected bread effervesces strongly on the addition of an acid. If gypsum, or plaster of Paris, be looked for, boil the bread in water ‡ for a long time, till quite broken up and partly dissolved; then, after standing, pour off; wash the sediment (if any), and boil the latter in a solution of pure carbonate of soda; filter, or pour off the clear liquid, to which add some chloride of barium; if this gives a decided milkiness, and the washed sediment an effervescence with acids, the bread has been adulterated with plaster of Paris—a substance of great importance to

\* Sulphate of copper (*bluestone*) is used by Belgian and Austrian bakers, but not in this country.

† See *Journal*, Vol. viii., p. 414.

‡ The water should be distilled.

fraudulent tradesmen, who use it extensively in the manufacture of confectionary (when it goes under the name of "daft"), mustard, and many other articles.

I now come to speak of a substance—concerning which there has been a great deal of discussion in this room and elsewhere, both as to the best methods of detecting it, and also on the question of its presence being hurtful or the reverse—I refer to alum. This is about the most frequent adulterant of bread, very few samples being uncontaminated by this salt. I may here mention, as an act of simple justice, that the sample of fermented bread before you on the table, is from the shop of Mr. Salmon, who is almost the only baker in the district of Chelsea, so far as my knowledge extends, who sells perfectly pure and unadulterated bread. This may be considered a bold assertion, but it is my well-founded opinion, nevertheless.

Alum, when present in pretty considerable quantity, may be detected by soaking the bread in water for some time and adding a salt of barium to the clear extract, when a cloudiness, more or less marked, will occur, an experiment I think I may be able to show you. Another way is to char the bread, and burn it nearly to an ash, and boil the latter with diluted hydrochloric acid, to which a little nitric acid has been added; the addition of ammonia to the filtered liquid will precipitate various substances, including the alumina of the alum. This precipitate must then be boiled in potassa, when, after filtration, the liquid must be neutralised with hydrochloric acid, and the alumina may then be thrown down by ammonia.

Bone-dust is now but seldom found in bread; it may be detected very readily with the microscope. The preceding observations apply of course equally well to flour, which is very largely adulterated with inferior varieties of wheat and other meals in addition to alum and the adulterations before mentioned. My experiences show that on an average the bread in London is more or less adulterated to the amount of 87 per cent.—by which I mean to say that if I were to buy 100 loaves, as many different bakers in various parts of the metropolis, I should get about 13 of good and genuine bread. At this present time I should probably not get quite so many good loaves, as the late bad harvest has thrown large quantities of damaged corn on the market, which of course is adulterated proportionately.

The adulteration of cakes, biscuits, and similar articles are chiefly those of the several ingredients composing the same with but few special additions. Saffron, gamboge, chrome yellow, &c., are, however, frequently used in the manufacture of sponge cakes and bath buns, for the purpose of deluding the unfortunate school-boy whose weakness lies in that direction into the belief that no expense has been spared in the matter of eggs; gastric, and probably another kind of irritation often follows the experiment. Messrs. Huntley and Palmer have favoured me with some specimens of the various biscuits made by them, as regards which they say, "it is impossible to select the articles of our manufactures of better quality or of greater purity"—an assertion my own extended observations have fully borne out. I may also direct your attention to the pure biscuits of Messrs. Peek and Frean, to those of Messrs. Hill and Jones, and to some intended for the nursery made by Mr. Salmon. Samples of all these are on the table.

Corn is subject to a variety of diseases, which often greatly impair its quality, and even render it dangerous as food; of these perhaps the *ergot fungus* and the pepper-brand (*uredo foetida*) are the most disgusting in their effects, the former acting sometimes like an irritant poison, and the latter is said to have occasioned skin diseases. Corn or meal affected with the smut or pepper-brand is at once distinguished by the disagreeable odour it emits and thus may be bought up cheaply, which to my personal knowledge is often done for the purpose of making cheap, highly-flavoured cakes and puddings with the flour, which is also used for adulterating mustard, pepper, ginger, and other articles having a powerful odour of their own,

which conceals that emanating from the *uredo fungus*. Another variety of *uredo* (the *uredo segetum*) is known to growers by the name of *dust-brand*, *black-burn*, or *smut*, but though injurious and destructive to growing crops, it does not appear to deteriorate the flour to any very great extent. I have, however, noticed a deficiency of nitrogen in wheat affected by smut. Various insects, too, such as the *musca pumilionis*, *cecidomyia tritici*, &c., attack and injure corn. I may not, however, dilate upon them now, but will refer those interested in the subject to the able papers of Mr. E. Quekett and Professor Henslow. An inquiry into the causes of the cereal fungi and the means of preventing their occurrence, would be one of great scientific interest and practical value, and in my opinion would be accomplished without great difficulty, if this Society were to offer a prize for the research. While on the subject of corn, I may mention a notable instance of its adulteration, which came under my notice at Wakefield some few years back. A gentleman purchased a quantity of wheat grain at the market there, at a rather lower rate than ordinary, for the apparent quality. After-examination showed that the bulk of the sacks were filled in with shrivelled or diseased wheat and barley, the uppermost 12 or 14 inches being grain of fair quality. Certain circumstances which I need not relate, rendered redress impossible.

Barley and oatmeal are frequently adulterated with inferior samples of either, and our poor horses frequently get some five and twenty per cent. of brewers or distillers "grains" served out to them in their reputed measure of oats.\*

Peas, beans, lentils, and other *leguminosae*, all come in for a share of adulteration; albeit, they are used largely as adulterants themselves. I may here remark that, in the examination of all cereal and pulse flours, starches, prepared farinas, &c., I have found that the previous abstraction of the oil or fat, by means of benzole, greatly assists the investigation, especially for the microscope, where very slight differences of the form and structure of starch granules have to be observed. Generally speaking, the too liberal use of alcohol or ether, as recommended in many works, should be avoided, for those liquids will occasionally produce a slight alteration in some of the granules, by cracking or wrinkling the outer membrane, and, by making them appear more like other starches, render their true origin doubtful. I am, perhaps, a little prolix on this point, as I believe that the errors now and then said to be made by microscopists may be due to this cause. The starches afforded by various plants all differ in size, form, or character of surface when viewed under a good microscope, and may be thus distinguished from one another. Into these literally microscopic details we may not enter now, but I have arranged a series of the more important starches, which Mr. Baker's very excellent microscopes will enable you to compare. Unforeseen circumstances have prevented my appending to this paper some notes on the microscopy of starches, and a table of their micrometric measurements, which, however, may hereafter appear in the *Journal*, should the Council deem them worthy to be printed.

Arrowroot is a farina or starch of remarkable purity—that is, the genuine "Maranta" variety; but out of 100 samples bought promiscuously in London, about 48 only would be genuine, and all those even would not prove of first-rate quality, as many of the samples imported are contaminated with albuminous and ligneous matter, from having been carelessly prepared. The adulterants are, as might naturally be supposed, various other starches and farinas, those most in vogue being potato and wheat starches, and sago meal. It has been said, and generally with truth, that the adulteration of arrowroot is of comparatively little consequence since none of the adulterants are detrimental to health, and they all answer the intended purpose nearly as well as the genuine article; but I have

\* The rape cake given to horses and cows often contains a quantity of refuse mustard seed, which always proves dangerous, and sometimes fatal, to the former animal.

had a sample of "genuine Maranta arrowroot" containing a large quantity of barley starch of a bad colour, and a notable amount of *flake-white*—a carbonate of lead, and a substance not calculated to preserve one's health or invigorate the system.

Maranta arrowroot gives an opaque paste when mixed with about twice its volume of strong hydrochloric acid, while potato-starch, under similar circumstances, yields a translucent jelly.

There are various other arrowroots known to trade, such as "East India arrowroot," derived from the tubers of *Curcuma angustifolia*, that from Tahiti (from the *Tacca oceanica*); "Brazilian arrowroot" (the farina of the *Manihot utilissima*), and many others. They are not often to be bought pure at retail shops.

I must necessarily pass over a number of mixed or "prepared" farinas with high-sounding titles, and, if we are to believe the packet-labels, superlative powers of restoring health, happiness, and peace of mind, in cases "where many eminent physicians had failed to effect a cure;" they are, without exception, frauds of the worst description, and the selling of such articles should be distinctly known to the public as, in fact equivalent to, the grave offence of "obtaining money under false pretences." On this section of the subject, Dr. Hassall and the editor of the *Lancet* have done good service by exposing many of these wretched impostors.

More recently, however, various manufacturers, importers, and others, have evinced a laudable desire to supply the public with pure food, and these I hold ought to receive every encouragement, as they frequently labour under very great difficulties from the opposition against which they have to contend. To cite an instance, I will point to Brown and Polson's Patent Corn-flour—an article of which I have a very high opinion, as it professes to be nothing but what it is—the fecula of maize, very carefully prepared. Specimens of this starch, or flour, are on the table, and also of the gluten and husk, which, when mixed, form an excellent occasional food for horses, cattle, &c.

Even this prepared flour, however, apparently protected by the signature and trade-mark of the manufacturers, is sometimes adulterated. I met with an instance at Islington, where, with the "trade mark" slightly altered, some potato starch and barley flour, with but little of the maize, was sold to me for "Brown and Polson's patent farina." I am inclined to think that in this instance the "corn flour" was used to adulterate arrowroot, while the packets were refilled with the above mixture.

Passing from bread and farinas, we naturally come to meat, as the next staple component of our daily food. Here, again, we have ample scope for detective examination and remedial legislation, for not only is a great deal of that commonly sold not of the quality it should be, but of the meat disposed of at the London markets, nearly ten per cent. is more or less unfit for human consumption. It is well-known that butchers will adopt any means of making their meat appear better and fresher than it really is, and accordingly we not infrequently find that washes of vinegar and water are used to heighten the colour of some meats; weak alkaline leys to improve the appearance of others; and, when decomposition or disease renders more potent agents necessary, even arsenical solutions are employed without hesitation. With game and poultry this latter practice is, indeed, quite common, and I call upon you to-night, as a small but influential portion of the British public, to express unmistakably your opinion of such practices, and to do all in your power to suppress them.

Vegetables and fruits here follow most appropriately—their adulterations and deteriorations must be known to you all, and also the methods of detecting the same, but I may perhaps name a few points without being accused of tediousness.

The question has often been put to me—can fruit ever be adulterated? As often, my answer has been in the

affirmative. Without going into what might be called the natural and accidental adulterations—such as blight, mildew, insects, &c., I may mention that I have seen English apples, of rather inferior quality than otherwise, coloured superficially in imitation of the American Newtown Pippins, and sold as such at the rate of two and three shillings per dozen! Although we may admire the artistic genius thus displayed, we must still condemn the fraud. Old and inferior oranges, well boiled, with a little saffron added to assist nature when her shortcomings in the matter of external colouring are a little too obvious, may be purchased at many shops, as we all know. Melons and cucumbers, too, when looking pale and dejected from waiting so long to be eaten, have their rusty coats furnished up with a little acetate of copper, so that a "green old age" at least is accorded to them.

The mention of verdigris reminds us to turn to pickles, sauces, condiments, and other similar contrivances for manufacturing appetites for debilitated humanity. Here the field is so wide, as regards adulterants of all kinds and species, that a hasty glance at them is all we can afford to give.

Before considering the special adulterations of pickles, it will be well to note those practised with the several articles used in their manufacture. We will commence with vinegar, which is largely sophisticated with water and crude acetic acid,\* sulphuric acid, or oil of vitriol, together with burnt sugar, and other materials for colouring. The strength of vinegar (*i.e.*, the per centage of acetic acid therein) can only be accurately estimated by employing an alkalimeter, and discovering by such means how many grains of dry carbonate of soda are required to neutralise a given measure of the vinegar. A more simple, but less exact, method is to weigh carefully a small, dry, white lump of Carrara marble, and to place the same in a known weight or measure of the vinegar† until effervescence has entirely ceased. Then the marble may be rinsed, dried, and re-weighed, when a loss of five grains upon its original weight would show the presence of six grains of monohydrated acetic acid in the measure of vinegar taken for the experiment. The vinegar of commerce may be divided into two classes—fermented and distilled vinegar; the former derived from either sugar, malt, or wine, the latter obtained by the distillation of wood. According to the researches of Dr. Hassall, the per centage of acetic acid in ordinary vinegar varies from 2.38 to 5.66 per cent., a disparity sufficiently large to show how greatly standard strengths are required resembling those employed in determining the value of spirits. Very weak vinegars should always be discarded, as they are unable to prevent the decomposition of meat and vegetables, while the extremely pungent varieties are immediately open to suspicions of cayenne pepper and sulphuric acid. The latter is very readily detected by the addition of a barium salt, which throws down a white insoluble precipitate if the acid is present. Now, vinegar may often contain a small quantity of combined sulphuric acid, derived from the water with which it is made and diluted, and  $\frac{1}{1000}$ th part of pure acid is permitted to be added by law, although there is never any real occasion for this, as, if the vinegar itself is good, it will keep for any time. On this account vinegar will generally give a milkiness with chloride (or nitrate) of barium, but of course not to such an extent as when oil of vitriol is distinctly added as an adulteration. I have myself found as much as 7.4 grains of sulphuric acid in 1,000 of vinegar, I have also once detected oxalic, and in another sample formic acid (evidently having been purposely added),—facts which I believe have not been noticed heretofore. The onions and cauliflowers in pickles are generally slightly tinted with turmeric, but as this colouring matter is itself frequently adulterated with the poisonous chromate of lead, its employment is often

\* Derived from the destructive distillation of wood.

† After the sulphuric acid present (if any) has been separated by the addition of a little chloride of barium.

raught with danger to the consumer. On the other hand, with the cucumbers, girkins, and French beans, the custom is to render them considerably greener than they ever were by nature, by the addition of salts of copper. This may be accomplished in several ways—either by directly adding verdigris, oxide of copper, or sulphate of copper, (“bluestone”) to the pickle, or by leaving the vinegar in copper pans for some time so as to dissolve a portion of the metal. In relation to pickles, I must say that consumers are open to very great blame, for the too general rule with them is to buy those pickles which are of the deepest green, for no better reason, it would appear, than that they are considered prettier. It is quite time all such weaknesses were dissipated, and I hold that he who chooses to buy girkins where he can get them greenest is of the same intellectual tint personally, and, whenever he purchases a pickle, deserves also to get into one. For various specimens, and much valuable information on this subject, I am indebted to Messrs. Crosse and Blackwell, who certainly evince a great desire to deal fairly with the public—if the public will only allow them to do so, and not persist in asking for green pickles, bright yellow mustard, and intensely red cayenne pepper; I can conscientiously affirm that these dangerous articles cannot now be purchased in Soho-square.

I have here a bottle of pure pickles, and here an adulterated sample; the difference in tint, you see, is very apparent, and if I add to both a little solution of ammonia, the presence of a large quantity of copper in the one case, and its entire absence in the other, will be speedily shown. The properties of dissolved copper, as an active poison and powerful irritant, are very generally known; it is a great pity that people will not think of them a little oftener than they do. According to my calculation, about 91 per cent. of the pickles sold in London are more or less adulterated, and in Liverpool the proportion is often greater still.

I have now to exhibit what might justly be considered a very great curiosity—one, too, which it is probable that not many of those present have ever seen before—I refer to this specimen of genuine mustard, kindly procured by a friend, specially for me. Even this, however, is not absolutely pure, for the microscope detects traces of wheat-flour in the sample—looking rather as if the mill which ground it had indulged in bad habits so long that they could never be entirely eradicated. The chief adulterants of mustard are:—Plaster of Paris, chalk, clay, quick-lime, various flours and starches, cayenne and other peppers, annatto, turmeric, gamboge, and chromate of lead, all of which come in also for making “ground ginger.” I once bought a sample of mustard so largely adulterated with *fresh* plaster of Paris, that when mixed with water it “set” into a solid cake in the course of a few minutes.

I will mix a little of my genuine sample here and also some bought in a packet, which I know to be adulterated with flour and other matters. You will observe that the addition of ammonia causes no change in the good sample, while the adulterated is altered in colour to a reddish brown, thus proving the presence of turmeric. Ginger is falsified so much in the same manner that I need not again refer to it. Ginger is seldom to be met with pure, mustard *never*. The microscope furnishes the only reliable method of testing for flours and starches, in ground spices and condiments.

Turmeric is a usual and legitimate component of currie powder, which I am told cannot be made without it—a broad assertion I am greatly inclined to doubt. It is greatly falsified with various injurious and poisonous yellow colours, and as currie may contain almost every conceivable abomination, under cover of “peculiarity of the original receipt,” I do not see how its adulteration can be prevented unless by the adoption of standard recipes. The specimen of currie powder on the table is quite free from all injurious admixture.

The adulterations of pepper present a few points of interest, so they must not pass quite unnoticed, for in addi-

tion to the usual flours, meals, &c., we find lamp-black, black-lead, coal ashes, and even road dust in some samples. In New Orleans, Philadelphia, Liverpool, and occasionally in this metropolis, a “pepper” is sold consisting of old ships or dogs’ biscuits (such as those upon the table, but in a considerably worse condition); first soaked in an infusion of capsicums, then dried and ground finely with a little lime, and any other little additions in the way of colouring matter that might be required. This would be “nice and strong”—anyhow, “almost too genuine,” as I have heard some people say in their innocence, when commenting upon a sample more than usually adulterated.

Mace and nutmegs are chiefly adulterated with damaged and inferior specimens, and occasionally a portion of the aromatic oil is extracted before they are sold, thus diminishing their intrinsic value. According to Chevallier,\* nutmegs are frequently adulterated with worm-eaten varieties, the apertures being filled up with a paste made of nutmeg powder, flour and oil; the same composition is used to form imitation nutmegs. In the United States wooden nutmegs are now and then sold along with the purchaser.

Somewhat similar remarks will apply to cinnamon, cloves, cassia, and pimento; the first, however, is, I believe, imitated, but inferior and spent varieties of all are used as adulterants. Microscopical examination shows when the samples have been previously boiled, as the granules are then much altered in appearance and augmented in size. With ground spices, of course, adulteration flourishes vigorously to an average of about 60 per cent. in the larger towns of Britain, and a still higher figure in country villages.

For an illustrative collection of genuine spices, I am beholden to Messrs. Travers and Sons, of St. Swithin’s-lane; the specimens are now before you: I have here a pure sample of cayenne pepper, and also one adulterated with, among other things, red-lead; by sprinkling some of each upon the surface of some water they are readily distinguished, as the mineral poison will sink to the bottom whenever it is present.

The preservation of food-substances is a subject of no little importance, upon which a dozen papers might be written without fear of exhausting it; I can therefore only select a point or two here and there, for discussion to-night. Preserved fruits and vegetables are greatly sophisticated, a fact the more to be regretted, because it is evident the guilty parties must be the original manufacturers—not the retail tradesmen. A glance at the tables accompanying this paper will best convey information on this section; the observations concerning green pickles may be wholly applied to green preserves. Various colouring matters are employed in preparing the other varieties, but these are seldom of a deleterious nature, as body-colours are quite inadmissible. Gamboge, however, is a favourite addition for inferior marmalades; it requires to be carefully distinguished from turmeric, which it somewhat resembles; in testing for either colouring matter in preserves, strong alcohol should be used as the solvent.

Specimens of various bottled fruits, of Messrs. Crosse and Blackwell’s manufacture, are on the table; they are prepared by a process as simple as it is efficient; the carefully-picked fruit, with the addition of a small quantity of water, is introduced into wide-mouthed bottles, which are placed up to their necks in large cisterns, or water-baths, heated to a temperature of 200 degrees, where they remain for about twenty-four hours; they are then taken out and stowed away in cellars until required. Some kinds of vegetables, such as green peas, are treated in a similar manner, cylindrical tin cases being substituted for bottles. I learn from an inspection of the works of the firm in question that no less than 9,370 tins of green peas were sealed at their works in 1860, while of the fruits 51,000 dozen

\* Dictionnaires des Altérations et Falsifications des Substances Alimentaires.

bottles, and of preserves, or, as they are more popularly called, jams, nearly 250 tons were prepared within the same year. I merely mention these statistics to show that if I describe any process or practice of Messrs. Crosse and Blackwell, I quote from no mean authority.

A point here occurs to me that is, I consider, too important to omit. There are a great number of varieties of tropical and other fruits which are seldom seen in this country, owing to the very great difficulty of transporting them safely; if, however they were carefully suspended in metallic cases of peculiar construction, provided either with small tubes containing phosphorus or an alkaline solution of pyrogallic acid, or else with fragments of charcoal soaked in chloroform, I am fully convinced that the form, colour, and flavour of the banana, mango, mangosteen, alligator pear, plantain, and many other luscious and delicious fruits, might be known in this country, almost as perfectly as in their own.

Fruit and wine essences and syrups next claim our attention; in this department, a variety of sophistications are apparent, as the result of careless manipulation, the use of impure sugars and of a host of injurious colouring matters, or flavoring principles. Thus the liquid generally known as fusel-oil has a colour and flavour of a very disagreeable kind, and in many cases, acts injuriously on the animal economy\* but treated with various chemical reagents, it at once becomes the source of several fruit ethers or flowering essences. Treated with bichromate of potassa and sulphuric acid, it yields by distilling the mixture, a volatile fluid, the *valerianate of amyle*, which is employed by confectioners as an essence of apples. The *acetate of amyle*, better known as essence of jargonelle pears, is the result of the distillation of fusel oil with acetate of potassa and sulphuric acid. Melon-essence (*coccinate of ethyle*) is also artificially prepared from ordinary, or wine ethers; coconut-oil, the essence of quinces (*pelargonie ether*) by distilling together oil of rue and nitric acid, and that of pine-apples (*butyrate of ethyle*) by saponifying butter and distilling the resulting soap with sulphuric acid and alcohol. Benzole, too, under the influence of concentrated nitric acid, yields a very good imitation, in point of flavour, of essence of almonds, and, accordingly, is largely employed for the purpose. All these artificial essences, and a great many others, would probably effect their intended object much better than the natural ones, if due care were exercised in their preparation, which, unfortunately, is not very often the case; we are, as yet, greatly in the dark upon the subject, which presents a wide field for future investigation. Many of the compound ethers, I believe to be injurious to health, even in small quantities; fusel oil, for instance, a very common impurity in essences, wines, and spirits, seems to have a powerfully narcotic effect upon some people, producing headache, nausea, and a tendency to vomit; while with others it is apparently harmless.

Sugar shall be our next article of food—a rather prominent one, if we consider the quantity annually consumed in the United Kingdom, which, in 1859, amounted to no less than 8,641,927 cwt. of the raw variety (or about 32½ lbs. per head of the population); and of refined sugar and sugar candy, 242,379 cwt., or, between 13 and 14 oz. per head.

Raw, moist, or brown sugar, as imported, is much contaminated with dust, fragments of cane, molasses, and some minute insects of the *acari* genus—the *acarus sacchari* of Hassall, to whom the honour of their first discovery is due. Retail grocers, however, add to their sugars, for purposes of adulteration, inferior kinds—fine sand, saw-dust, salt, water, flour, potato, and other starches. The best way of examining a sample of brown sugar is in my opinion to determine, in the first place, the per centage of moisture, by carefully drying, at a temperature not exceeding 120 deg., a known weight of the sugar; the loss sus-

tained will give the water contained in the same. The dried powder should then be placed upon a filter, and washed with cold distilled water until the washings are no longer perceptibly sweet, when the albuminous matters, if present, may be precipitated by boiling the solution.\*

The insoluble matter, together with the filter, may now be dried and weighed, after which the starch granules, if any be present, can be recognised under the microscope with great facility; also *acari* and spores of *fungi*, when they occur. Crystallised sugar is a much more wholesome, and also economical variety, especially that made by the centrifugal process, as it is nearly always tolerably free from imported impurities. It is, however, constantly adulterated with the inferior kinds, so that purchasers should be particular in their selection. Loaf sugar may contain a few of the ordinary impurities, if not carefully and thoroughly refined; also traces of pipe-clay, albumen, &c. Broken lump sugar has been adulterated with fragments of white marble, but this is, of course, quite exceptional.

It is greatly to be regretted that the sale of the impure brown sugars of commerce should be permitted at all, as the amount of injury their use inflicts upon the public health can be by no means slight. I hold, therefore, that remedial measures are urgently needed here. The common practice of selecting the very coarsest and darkest-coloured sugars (popularly known as *foots*) for the preparation of cakes, puddings, &c., is one which I cannot too strongly reprehend; if it be required to "make a cake look rich"—the usual pretext—why not employ a pure white sugar for the purpose of sweetening, and supply the place of the deficient dirt and colouring matter by a little wholesome burnt sugar, which will answer a great deal better. As to the finance part of the question—a delicate point with housekeepers—it will always be found cheaper to employ a fine white, or at least a light-coloured sugar, than to use a dark brown variety of a lower price.

The uses of sugar as a preservative agent are well known, and in the department of confectionary proper it holds the first place. Unluckily we insist upon having our bon-bons and conserves made, not only to please the palate, but also to attract the eye; thus has been called into existence the most universal and pernicious system of adulteration with which we are acquainted. It is easy to understand that in this department very large profits are to be made, if, as a rule, as much China clay, plaster of Paris, and flour, as possible are added to the various saccharine abominations manufactured, which are then ornamented with a variety of poisonous colours, and flavoured with some crude essence, to conceal more effectually their intrinsic inferiority. We will take the simple, diluent adulterants first; the readiest methods of testing for these have already been given when speaking of the adulterations of bread, and therefore need not be repeated here. In all cases the suspected *bon-bon*, sugar-plum, or other article, should be immersed for some time in distilled water, when the insoluble matter is then presented in a convenient form for examination. In some instances it may be found desirable to burn away all the organic matters, thus leaving the ash alone for analysis. Next, proceeding to the colouring ingredients, it should be carefully noted whether these are soluble or not in the water, alcohol, or ether; if only one tint is apparent the entire substance of the article may be taken for experiment, if several they must be carefully separated by means of a small sharp knife. In the second Table accompanying this paper I have condensed some general information relating to the chief colouring matters used for purposes of (what might be called) ornamental adulteration, amounting to upwards of sixty in number, of which twelve or thirteen are active and powerful poisons—a like number are harmless, except in special cases of disease or morbid debility—while the remainder are either

\* The real properties of fusel oil, or "*potato-spirit*" in this respect are as yet but very imperfectly known.

\* These may, of course, be dried, and the weight ascertained if desirable.

more or less injurious to health, or we know too little about their effects upon the animal economy to venture a decided opinion either way. I beg here to record that my friend Dr. Benjamin W. Richardson has kindly brought his large experience to my assistance in this section of the subject, and that to him my best thanks are due, and are most gratefully proffered. Some pure confectionary of Messrs. Hill and Jones's manufacture is on the table before you.

It would absorb too much of our time to-night to narrate at length the method of testing for each colour, so—with some reluctance—I dismiss those points in a very few words. If a colour be soluble in water, it is far less likely to be an injurious mineral pigment than if it remain undissolved; it should be remembered, too, that alkalis will deepen into purples, most of the animal and vegetable red colours, while acids will heighten them, and increase their brilliancy. Indigo may be recognised by mixing it with plaster of Paris, drying the cake thus formed, and cautiously heating the same in a glass tube until the indigo (if present) sublimes in minute crystals. Blue litmus is changed to red by addition of an acid, ammonia or any alkali restoring the original tint; by this latter addition the colour of Prussian blue is destroyed. The greens derived from copper or arsenic are readily detected by the various well-known tests for these metals, while the red and yellow lead colours are quickly identified by their deportment with sulphide of ammonium, which turns them black. Specimens of coloured confectionary are so familiar to the eye of almost every person, that I have considered it unnecessary to exhibit many to-night—shop-windows furnish examples without number daily.

Reverting for a time to the animal kingdom, we have there still four articles which claim our attention, viz., milk, butter, cheese, and lard. The two first are rarely to be met with pure in this metropolis, for the simple reason that they are very easily adulterated.

Water is the usual adulterant of milk, as the dairyman who has only 40 gallons of pure milk at his disposal, while he requires 50 or 60, finds the "cow with the iron tail" ever ready to aid him in making up the deficiency. I have myself found the quantity of extraneous water in London milk to vary from about 8 to 61 per cent, while out of 100 promiscuous samples, from all parts of this city, I believe the number, more or less adulterated, in one way or another, would be about 74. Large additions of water not only impart a bluish tint to milk, but also decrease its specific gravity; some yellow colouring matter is therefore added, generally annatto, turmeric, or gamboge; and the liquid may be thickened with various starches, mucilage, or rarely with the brains of some animal. This latter is best detected by the microscope. Starch is shown to be present if the milk after separating the curd give a blue colour with tincture of iodine. Improper feeding and housing of the cows, too, are fruitful sources of bad milk, which when derived from diseased animals, certainly is injurious. Caution must always be exercised in determining the density of milk, as cream will diminish this very powerfully. The lactoscope of M. Donné is useful in determining the richness of milk, but a simpler, and perhaps a better instrument, was described some time since in the *Dublin Medical Press*, consisting of a thin hollow wedge of glass, graduated on one side, into which milk can be introduced, and its opacity discovered by ascertaining at what thickness of the wedge the graduations can no longer be seen through. The instrument has also been described in the *Chemical News*.

Butter, too, is one of those articles which affords a striking proof of the extent to which adulteration is carried in this country, both the "salt" and "fresh" varieties being sophisticated very largely. According to Hassall, the amount of water in the fresh butters examined by the "Lancet Analytical Commission," varied from 4.18 to 15.43 per cent., while the quantity of salt averaged from 0.30 to 2.91 per cent. In the salt butters, the extremes

of water were 8.48 and 28.60 per cent., and those of salt, 1.53 to 8.24 per cent. My own more recent results show a wider difference, and I have found as much as 49 per cent. of water in some samples of salt butter. From a little pamphlet on adulteration, by Mr. John Postgate, of Birmingham, I learn that, in 1857, butter was sold in Liverpool to the poor, which contained only 48 per cent. of that article, 24 pounds of a mucilage (probably a kind of lichen), and 28 lbs. of water making up the remainder of this delightful compound. Butter is also adulterated with flour and other substances, and one instance has come under my notice in which the silicate of soda, or soluble glass, was the adulterant employed. Butter should be examined by melting a weighed quantity, in a graduated tube or jar, when the relative proportions of fatty matter and water can be roughly estimated.

Lard is adulterated in much the same manner as butter, and is itself sometimes used as an adulterant of butter.

Cheese is not generally adulterated, although instances have come to my knowledge. Some very fine samples of this article, and also of butter, have been kindly contributed by Mr. Osborne, of Ludgate-hill. I recommend these specimens to your notice.

Infused beverages must be our next consideration, commencing with tea as the most important. Here, I feel that I am treading upon rather delicate ground; after the able paper read in this room last week by Mr. Leonard Wray, it would be presumption in me to say very much upon the subject. I have to thank Messrs. Phillips for a small but interesting collection of genuine teas—I mean genuine as imported, for of the 21 samples here exhibited, from India, China, Java, and Japan, three have been coloured at Canton. Specimens of the Assam Tea Company's importations are also exhibited here. Some of these specimens are very fine, as may be readily perceived, and I am indebted to Messrs. Phillips no less for their kindly-accorded information on many points than for the standard samples now presented to your notice. That tea is very largely adulterated in the Chinese ports before shipment, and during the first preparation of the leaves also, I think the evidence is very convincing, but as to the proportional amount of adulterated tea imported into this country, we have little or no data to go upon. Taking the average of the black teas sold retail in London, I believe that out of 100 samples about 61 would be found more or less impure or adulterated, while of green teas the per centage of adulterated samples would be approximately 78. Teas are adulterated with a variety of substances, but the list is too long to enumerate. A good way of examining teas is to sift them over a white, smooth sheet of paper, when the colours, or "facing" will be presented in a convenient form for analysis. When burnt, tea should leave a white ash—a coloured one indicating mineral adulteration. To detect the presence of other leaves in tea, hot water should be poured upon a small portion, and the unfolded leaves can then be inspected under a small lens, and compared with standard specimens of teas, and the leaves of other plants. Here again, however, the microscope presents the only accurate method of determining the true nature of broken leaves. Diagram 1 is a rough outline representation of the leaf of the ordinary variety of tea (*Thea viridis*); No. 2 being the kind grown in Assam, or, perhaps, more properly Assam. Paraguay tea is shown in the next diagram (No. 3); and the leaf of coffee-plant, used in Sumatra and elsewhere as a substitute for tea, and sometimes imported into this country as an adulterant, is sketched in diagram No. 4. The leaf of the *Gaultheria procumbens*\* (figured in diagram No. 5) is employed in North America as an infused tea; it is there called Mountain Tea. In this country I have once detected it as an adulterant. For the actual leaf specimens from which these diagrams were drawn, I am indebted to Mr. J. de C. Sowerby, of the Royal Botanic Society. Some

\* The plant from which "oil of winter-green" is obtained.

TABLE II.  
Showing the Chief Colouring Matters of Commerce used as Adulterants (Class IV. and V.), and their Effects upon the Animal Economy.

TINT PRODUCED.	ORD. NAME.	COLORING PRINCIPLE.	PREPARED FROM	WHENCE OBTAINED.	USED IN ADULTERATING	EFFECTS UPON THE ANIMAL ECONOMY.	REMARKS.
White ...	Chinese White.	Hyd. Oxide of Zinc.	Nat. Minerals, Calamine, &c.	(See Flake White.)	Confectionary, tea, etc.	Not definitely known. Insoluble and probably inert.	
	Cotiant "	Sulphate of Barium.	Native Witherite, &c.	Scotland, Derbyshire, &c.	" "	Poisonous. Gastric irritation. Colic. Muscular paralysis.	
Purple ...	Flako "	Hydrated Oxide and Carbonate of Lead.	Metallic Lead, by various processes.	Derbyshire, Northumberland, Cornwall, Devon.	" "	" "	(e) Made by diluting Prussian Blue with chalk or other whites.
	Aniline Purple: Mauve. Blue-Violetta. Antwerp Blue. (d)	Aniline Purple. Aniline Blue. (See Prussian Blue.)	Aniline, by oxidation, &c. Prussian Blue and various Whites.	(See Prussian Blue.)	" "	" "	
Blue .....	Indigo.	Indigo.	Leaves of <i>Indigofera</i> (various species).	Indi, China, West Indies.	" Gelatine.	(Indifferently known. In large doses causes vomiting in some occasional spasms. Is sometimes found in fluid excretions.)	
	Litmus (b).	Various coloured acids.	<i>Roccella tinctoria</i> and other lichens.	Canaries, Cape Verd I., Levant, &c.	" "	Inert.	(b) Sometimes adulterated with Arsenic and Mercury.
	Prussian Blue.	Ferrocyanide of Iron (c).	Horn, Bone, &c. by roasting with salts, and iron filings.	" "	Tea.	Not poisonous, but should be used only in small quantities.	(c) Chemical compound somewhat doubtful.
	Small.	Silicates (and Phosphates) of Cobalt. Lazulite.	Zaffre and other ores, by calcination with sand, &c. Native Mineral by calcination, &c. and artificially.	Norway, Germany, Holland, China, Thibet, Badakshan.	" "	Indifferently known. Mechanical irritant.	
	Ultramarine.	Carbonate of Copper.	Soluble Copper Salts, by precipitation.	Usual sources of Copper ores.	" Tea, pickles.	Poisonous. In small doses, a gastric irritant.	
	Verditer.	" "	Leaves of <i>Taraxiacin</i> .	Various parts of Europe.	" Dried fruits, preserved green fruits.	Indifferently known.	
	Brunswick Green (d).	Oxychloride of Copper.	Metallic Copper and Hydrochloric Acid.	(See Verditer.)	" "	Actively poisonous. Powerful gastric irritant.	(d) False Brunswick Green, composed of Chromate of Lead and Prussian Blue, is very generally used.
	Chlorophyll.	Chlorophyll Chromatite	Sap of various grasses.	Shetland, Isles, Sweden, &c., &c.	" Tea.	Probably inert. Indifferently known.	
	Chromes Green.	Sesquioxide of Chromium	Native Minerals or by precipitation.	(See Gamboge and Prussian Blue.)	" Gelatine.	Not distinctly known. Salts of Chromium are poisonous irritants.	
	Prussian "	Gamboge Acid and Ferricyanide of Iron.	Gamboge and Prussian Blue, in various proportions.	(See Gamboge and Prussian Blue.)	" "	Not poisonous, but should not be largely used.	
Green ...	Sap "	Rhamnian (?)	Juice of <i>Rhamnus catharticus</i> .	France, Britain, China, &c.	" "	Indifferently known. Not apparently injurious.	
	Scheele's "	Arsenite of Copper.	Soluble Copper Salts, by precipitation.	(See Verditer.)	" (Pickles, preserved green fruits)	Actively poisonous. Powerful gastric irritant.	
	Verdigris.	Acetate of Copper.	Metallic Copper, by solution in Acetic Acid.	(See Verditer.)	" Pickles, preserved fruits, jams, jellies.	Actively poisonous. Gastric irritant.	
	Annatto (e).	Orellanic Acid (?)	Berries of <i>Bixa orellana</i> .	South America, West Indies.	" Milk, butter, cheese, Bath marmalade.	Not known as deleterious.	(e) Often adulterated with injurious colours.
Yellow and	Cadmium Yellow.	Sulphide of Cadmium.	Chloride or Sulphate of Cadmium, by precipitation.	Accompanying zinc ores.	" Bath buns, tea, (cheese?) currie, and custards.	Indifferently known. Injurious in large quantity.	
	Chrome "	Chromate of Lead.	Lead Salts and Bichromate of Potassa.	(See Chrome green and Flake White.)	" Bath buns, apricot jam, marmalade.	Poisonous. Gastric irritant. Produces colic and muscular paralysis.	
Orange.	Fustic.	Morine.	Wood of <i>Morus tinctoria</i> .	Brazil, West Indies, &c.	" Bath buns, tea, jams, jellies, milk.	Active purgative properties. Gastric irritant.	
	Gamboge.	Gambogic Acid.	Exudation from <i>Garcinia cochinchinensis</i> .	Siam, Ava, Birmah, Ceylon, &c.	" Confectionary.	Not known. Probably inert.	
Orange.	Gallsone.	Extranthate of Magnesia.	Biliary calculus of ox.	Unknown.	" "	Actively poisonous. Gastric irritant.	
	Indian Yellow. King's "	Bisulphide of Arsenic.	" Native Mineral.	Various countries.	" Currie powder, mustard.	Poisonous. Produces lead-colic, muscular paralysis, &c.	
	Massicot. Myrabolans.	Oxide of Lead.	Metallic Lead, by oxidizing when fused. Fruit of various trees (Bot. name uncertain).	(See Flake White.) India, Turkey.	" "	Not known. Probably astringent.	



Showing the Principal Foods, Drinks, Condiments, and Narcotics of Br

FOODS, DRINKS, CONDIMENTS, AND NARCOTICS.	Per Cent. of Adult-rated Samples.	ANALYST.	CLASS I.			
Acids:—Acetic, Vinegar . . . . .	57.0	W. L. Scott . . . . .	Wood spirit, tarry matters, &c. . . . .			
" Citric, "Lemon-juice," "Lime-juice," &c. . . . .	. . . . .	. . . . .	} { <i>Microscopic fungi</i> and <i>decaying matter</i> . . . . .			
" Tartaric, "Effervescing-powders," drinks, &c. . . . .	. . . . .	. . . . .				
Beer:—Ale, "Scotch," and other sweet varieties . . . . .	15	" " . . . . .	Results of imperfect manufacture . . . . .			
" " "Bitter," "India," &c. . . . .	26	" " . . . . .	_____ . . . . .			
" Porter and Stout . . . . .	24	" " . . . . .	_____ . . . . .			
" Articles used in manufacturing—Hops . . . . .	. . . . .	. . . . .	Effects of damp, over-sulphur, &c. . . . .			
Malt . . . . .	. . . . .	. . . . .	Results of imperfect manufacture . . . . .			
Biscuits:—(See also <i>Flour, Bread, Butter, Sugar, &amp;c.</i> ) . . . . .	. . . . .	. . . . .	<i>Micro. fungi, animalcules, lactic acid, &amp;c.</i>			
Bread:—Ordinary . . . . .	87.0	" " . . . . .	<i>Fungi, &amp;c., lactic acid</i> . . . . .			
" "Fancy" (See also <i>Butter, Sugar, &amp;c.</i> ) . . . . .	. . . . .	. . . . .	_____ . . . . .			
Butter:—Fresh "Devonshire," "Epping," &c. . . . .	65.0	" " . . . . .	<i>Butter-milk, curd, butyric, and lact. aci</i>			
" Salt "Dorset," &c. . . . .	77.0	" " . . . . .	_____ . . . . .			
Cheese . . . . .	. . . . .	. . . . .	<i>Fungi, animal, lact. and valerian, acids</i>			
Chicory . . . . .	. . . . .	. . . . .	Results of over-roasting . . . . .			
Chocolate . . . . .	} 90.0	W. L. S. & L. A. C.	{ Results of over-heating, imperfect			
Cocoa . . . . .				} 92.0	W. L. Scott.	{ mentation, &c. . . . .
Coffee . . . . .						
Condiments and Spices:—Allspice, &c. (powder) . . . . .	} 79.0	L. A. C.	{ Results of improper preparation,			
" " Cassia . . . . .				} 72.0	" " . . . . .	{ ing, or of exposure to atmospheric
" " Cloves . . . . .						
" " Curriepowder . . . . .	} 56.0	" " . . . . .	{ _____ . . . . .			
" " Ginger . . . . .				} 85.0	" " . . . . .	{ Results, of improper drying, &c.
" " Mace and Nutmegs . . . . .						
" " Mustard . . . . .	} 4.0	" " . . . . .	{ Cellulose, &c., from insuf. washing, &			
" " Pepper . . . . .				} 29.0	" " . . . . .	{ <i>Dust, sand (from millstones), bran, &amp;c.</i>
" " Cayenne . . . . .						
" " Vanilla . . . . .	} 29.0	" " . . . . .	{ Dusts, husks, &c. . . . .			
Eggs . . . . .				} 29.0	" " . . . . .	{ _____ . . . . .
Farinaceous Foods:—Arrowroot . . . . .						
" Flour . . . . .	} 29.0	" " . . . . .	{ Husks, dust, shrivelled and inf. grain			
" " Barley, Oatmeal, &c.. . . . .				} 29.0	" " . . . . .	{ Results of improper packing, &c.
" Maccaroni . . . . .						
" Millet . . . . .	} 29.0	" " . . . . .	{ Decomposition from rancid oil, &c.			
" Peas, Beans, Lentils, &c. . . . .				} 29.0	" " . . . . .	{ _____ . . . . .
" Sago, Tapioca, &c. . . . .						
" Wheat (grain) . . . . .	} 29.0	" " . . . . .	{ <i>collecting</i>			
Fish (fresh). . . . .				} 29.0	" " . . . . .	{ <i>Products of ferm., &amp;c., fr. use of damp</i>
" (preserved) Anchovies . . . . .						
" " Sardines and other varieties . . . . .	} 29.0	" " . . . . .	{ _____ . . . . .			
Fruit (fresh) large varieties Apples, Pears, Oranges, Melons . . . . .				} 29.0	" " . . . . .	{ _____ . . . . .
" " small varieties, Strawberries, Currants, &c. . . . .						
" (preserved) Jams, Jellies, &c. . . . .	} 29.0	" " . . . . .	{ _____ . . . . .			
" " Marmalade . . . . .				} 29.0	" " . . . . .	{ _____ . . . . .



Approximate Per-centage of Adulterated or Sophisticated Samples (RETAIL).

ING THEM.

	CLASS IV.	CLASS V.	CLASS VI.	REMARKS.
.	Sulphuric acid, brown sugar, &c. (a)			<p>a Rarely with oxalic acid, probably from leaves of <i>orvalis acetosella</i>.</p> <p>b Some "<i>citronade algerienne</i>" examined by me contained <i>no citric acid at all!</i> Lemonade is said to be sometimes adulterated with mineral acids.</p> <p>c Also THORNAPPLE, wormwood, bitter ash wood, "<i>grains of paradise</i>," <i>salicine</i>, and even pure STRYCHNINE. Some kinds of gum may be added to Scotch ale to give richness.</p>
.	Tartaric acid, tartar, sugar, &c. (b)			
.	Tartar.			
.	Sugar, chamomile flowers, salt, &c.			
.	COCCULUS INDICUS, NUX VOMICA, QUASSIA, &c. (c)			
.	—Sulph. acid, liquorice, br. sugar, logwood, salt, &c.			
.	Syrup washes, &c.			
§c.	Salt, alum, various starches, &c.	<p>Various colouring matters, §c., such as saffron, CHR. YEL., &amp;c.</p>		
&c.	Potato, and other starches, alum, salt, borax, §c.			
.	—Carb. ammonia, gum, &c.			
.	Fats, annatto, saffron, nitre, §c.			
.	Annatto.			
ots, dog-	Coffee-grounds, burnt sugar, salt, olive, Venetian red, &c.			
d, }	{ Var. fats, RED LEAD, Venetian red, red ochres, clays, sugar, salt, &c.			
. (e)	Burnt sugar.			
sweepings	Inferior spices, essences, &c.			
.	Syrup, &c.			Elm buds (f)
.	Burnt sugar, oil of cloves, &c.		Sp. clo. and im. do.	
.	Cayenne pepper, &c.		Imitation ginger.	
.	Oil of nutmegs			
eed, oat-	Turmeric, gamb. annatto, Cay. pep. §c.		Betel-nuts, wooden nutmegs, &c.	
&c.	Capsicums, long pepper, lime, &c.			
os, §c.	Long pepper, &c.			
.	Treacle, essences, benzoin, &c.		Other bean-pods.	
neal, &c.	Dextrine.*		White eggs coloured like the rarer kinds (?)	
Paris, §c.	Salt, alum.		French	
.	Salt, sugar.			
.	Alum			
&c.	Gum, dextrine.			
.	Steam (to swell the grains).			
.	Salt, chloride of lime, §c.			
.	RED LEAD, bole, Venetian red, §c.		Sprats and oth. fish	
.	Alkaline and acid washes.*			
.	Solution of tartaric acid		False specimens.	
.	Various essences, colours, §c.			
.	Gamboge, silicine, and various bitters.	Various colouring		

a Rarely with oxalic acid, probably from leaves of *orvalis acetosella*.

b Some "*citronade algerienne*" examined by me contained *no citric acid at all!* Lemonade is said to be sometimes adulterated with mineral acids.

c Also THORNAPPLE, wormwood, bitter ash wood, "*grains of paradise*," *salicine*, and even pure STRYCHNINE. Some kinds of gum may be added to Scotch ale to give richness.

d Some time ago butter was adulterated with soluble glass at certain large provincial towns.

e Acorns, parsnips, etc. roasted, are occasionally added.

f One instance of this adulteration has come under my notice.

\*The addition of myrtle-buds is doubtful (in my opinion).

g Corn is often injured by the *wredo frumenti puccinia graminis*, and other fungi, also by insects such as the *musca pumilionis cecidomyia tritica*, etc.

\*Doubtful, Some "best Bermuda arrow-root" in my possession exhibits, under the microscope, when moistened with dist. water, some living animalcules about one-eighth of the size of the starch granules.

h Sometimes poisonous.

A common adulteration, or rather substitution.

\* (Doubtful)

i Generally organic, and not often very

	Sago, Tapioca, &c.				Results of over heating, &c.
	Wheat (grain)				Husks, dust, shrivelled and inf. grain
Fish (fresh).					Results of improper packing, &c.
" (preserved) Anchovies .		38	W. L. Scott.		Results of improper preparation, &c.
" " Sardines and other varieties		29-0	" "		Decomposition from rancid oil, &c.
Fruit (fresh) large varieties Apples, Pears, Oranges, Melons					{ Results of improper packing, handling
" " small varieties, Strawberries, Currants, &c.					collecting
" (preserved) Jams, Jellies, &c.					{ Products of ferm., &c., fr. use of damp
" " Marmalade					unclarified sugar, imperf. prep., &
" " Various dried kinds					Results of imperfect preparation, &c.
" " " Raisins," Currants, &c..					Dust, twigs, &c.
Gelatine:—Isinglass .		63-0	L. A. C.		{ Fungoid growths from being stored
" Gelatine .					damp, &c.
Lard .		52-0	W. L. Scott.		Results of decomposition . . .
Liqueurs:—Curaçoa .		31-0	" "		Decomposed syrup from over-heating,
" (various) .					Products of fermentation
Meat (various) .		9-5	" "		{ Products of decomposition, &c. .
" Pork, &c. .					—
" Tongue (ox) .					Imperfect curing . . .
" Various cooked and preserved varieties					Congestion from method of killing
" Poultry, Game, &c.		74-0	" "		paring, &c.
Milk .					Results of bad feeding, &c.
Nuts (various) .					Results of damp, time, &c.
Opium .					Woody matter, gum, &c. . .
Oils:—Olive, Florence, Lucca, &c.					Fungoid growths, &c., from exposure to
Pickles:—"Mixed," "Piccalilly," &c. (See also <i>Vegetables,</i>					
<i>Condiments, and Vinegar</i> ).		91-0	" "		(See Vinegar, &c.) . . .
Spirits:—Brandy .					Fusel-oil, wood spirit, &c. . .
" Gin .		67-0			Fusel-oil, &c.
" Other varieties .					— Acetic, butyric, valerianic acids.
Sugars:—Loaf .					Native colouring matter, &c.
" Brown .		95-0	W. L. S. & L. A. C.		— Various insects, fungi, &c., mold
" Honey .		22-0	" "		Dust, products of fermentation, &c.
Sugarplums (various articles of confectionary)					Results of imperfect manipulation .
Tea:—Black .		61-0	W. L. Scott.		{ Old and over-dried leaves, defectiv
" Green .		78-0	" "		nipulation . . . . .
Tobacco:—"Bird's-eye," "Cavendish")					—
" Cigars .					—
" Snuff .					Dust, inferior varieties . . .
Vegetables:—Fresh ordinary varieties .					{ Diseased and blighted specimens,
" " Horseradish .					veloped and decaying specimens.
" " Parsley .					{ insects, &c. . . . .
" " Watercresses .					—
" " Mushrooms .					—
" Dried or preserved varieties (See <i>Pickles and</i>					Results of imperfect manipulation .
<i>Sugarplums</i> ) .					— Veg. acids, fungi, &c.
Wines:—Ginger, Raspberry, &c.		64-0	W. L. Scott.		Results of <i>Oidium</i> , tartar, &c. . .
" Foreign, Port, Claret, &c.		73-0	" "		Results of <i>Oidium</i> , &c., in the vine
" " Sherry, Madeira, &c.					—
" " Champagne, and allied wines .					Results of bad fruit, imperf. manip., &c
" Allied beverages—Cider, Perry, &c.					—

NOTE.—The names of adulterants more or less injurious to health are printed in *italics*.

In the above table the adulterants are thus classified:—

Class I. Results of imperfect purification or preparation, or of improper packing or storing, etc. (*fraudulent, or from negligence*).

Class II. (In articles sold in natural state, or nearly so.) Results of natural decomposition, organic disease, certain parasitical

plants and ins  
from negligenc  
Class III. A  
Class IV. A

teating, &c.		Inferior and damaged varieties	
ivelled and inf. grains, &c.	<i>Smutted and mildewed grains, &amp;c. (h)</i>	See 1st and 2nd Classes. Water, &c.	Steam (to
per packing, &c.	<i>Partly decomposed specimens</i>	Inferior varieties	Salt, chlor
per preparation, &c.		Sprats and other inferior varieties	RED LEAD,
rom rancid oil, &c.			
roper packing, handling, or	{ <i>Undeveloped or decaying specimens, va-</i> <i>rious insects, fungi, dust, &amp;c.</i>	<i>Washed, boiled, and false specimens</i>	<i>Alkaline an</i>
m., &c., fr. use of damp fruit,		Inferior kinds, <i>wild fruits, berries, &amp;c.</i>	<i>Solutio of</i>
sugar, imperf. prep., &c.		Starch, gelatine, gum, &c.	<i>Various ess</i>
ect preparation, &c.		Starch, &c., ord. oranges, turnips, &c.	<i>Gamboge, s</i>
	Damaged specimens	<i>Inferior and damaged varieties</i>	<i>Various ess</i>
ths from being stored when		— water twigs, &c.	Treacle of
osition		Gelatine of various qualities	Isinglass (c
		<i>Glue, gelatinised paper, &amp;c.</i>	
up from over-heating, &c.		Water, potato, and other , mutton fat,	<i>Alum, salt</i>
entation		pipe-clay, &c.	
composition, &c.	<i>Results of organic disease, &amp;c.</i>	Water, syrup, molasses	Sugar, cap
	<i>Entozoa, &amp;c. PECULIAR POISON, &amp;c. (j)</i>	Water, gin, &c.	Sugar, salt
ing		<i>Inferior portions of animal</i>	Salt, A3SE
om method of killing, pre-			
feeding, &c.	<i>Results of various diseases</i>	<i>Old and diseased specimens</i>	Nitre, salt
time, &c.	<i>Taken at wrong periods</i>	<i>Diseased and inferior portions</i>	Pepper, sal
gum, &c.	<i>Unripe or decayed specimens, &amp;c.</i>	<i>Damaged and inferior varieties, &amp;c.</i>	(W
&c., from exposure to air	Inferior specimens, &c.	Water, butter-milk, skim-milk	Annatto, c
	Colouring matter, &c.	Damaged and inferior varieties	
		— clay, resin, &c.	
		Various animal oils, &c.	
		<i>Inferior vegetables, spices, &amp;c.</i>	VERDIGRIS
		Water, gin, &c.	Pepper, cay
		Water	SUL
		Water, inferior varieties, &c.	Van
		Chalk,* clay,* beet-root sugar. (m) &c.	
		— Sand, salt, starches, &c.	Spicules, d
	Wax, peculiar flavouring principles, &c.	Water, flour, potato-starch, &c.	Sugar, var
		Chalk, plaster of Paris (n) clay, flour, star. &c.	Dextrine, ;
	Old and inferior leaves, twigs, &c.	{ "Lie tea," leaves of ash, beech, buckthorn,	Black-lead,
	Old and inferior leaves, &c.	{ oak, poplar, sloe, willow, (o) spent tea	Salts of irc
		{ leaves, &c.	
		{ Leaves of rhubarb, dock, horse-chesnut	
		<i>Old and damaged specimens</i>	Salt, carb
	<i>Decaying or unseasonable</i>		
	ROOT OF ACONITUM NAPELLUS (q)		
	ÆTHUSA CYNAPIUM (q)		
	HELOSCLADUM NODIFLORUM (q)		
	Var. species of poison, fungi, &c. (q)		
		<i>Inferior varieties, water, &amp;c.</i>	
		Water, damaged preserves, &c.	Pepper, tan
		Water, cider, elder wine, extract of logwood, &c.	Brandy, ca
		Water, ginger-wine,* &c.	Brandy, ca
		Water, cider, gooseberry-juice, &c.	Tartaric ac
		Water, vinegar, &c.	

Health are printed in *italics*, *poisonous substances* in small capitals. A dash rule — in any column represents *all the substances* in the line immediately adjacent to it.

igence) | plants and insects, or various injurious specimens, apparently resembling the true ones for which they are sold (*fraudulent*, or | Class V.  
arastical | from negligence.) | injurious | Class VI.  
| Class III. Adulterants employed as diluents (*fraudulent*.) | they are so  
| Class IV. Adulterants used for imparting fictitious "strength," flavour, or colour, etc. (*fraudulent*.)

	Steam (to swell the grains). Salt, <i>chloride of lime</i> , &c. RED LEAD, <i>bole</i> , <i>Venetian red</i> , &c.				water, some living animalcules about one-eighth of the size of the starch granules. k Sometimes poisonous. A common adulteration, or rather substitution.
	<i>Alkaline and acid washes</i> . <i>Solution of tartaric acid</i> <i>Various essences, colours</i> , &c. <i>Gamboge, silicine, and various bitters</i> . <i>Various essences and colours</i> . Treacle of sugar, &c. Isinglass (externally applied)			Sprats and oth. fish False specimens.	* (Doubtful)
	Alum, salt, carb. of soda, <i>lime</i> , &c.	<i>Various colouring matters</i> . (i)		Gelatine. Glue.	Generally organic, and not often very injurious.
utton fat,	Sugar, <i>capsicums</i> , <i>pepper</i> . Sugar, salt, <i>nitro-benzole</i> , <i>var. ess.</i> &c. Salt, <i>ARSENIC</i> , <i>chloride of lime</i> , &c.	<i>Various colouring matters</i> . (i)			
	Nitre, salt, &c. Pepper, salt, and various spices. —— (When dres.) <i>ARSENIC</i> , &c. (k) Annatto, <i>cerebral matter</i> , <i>chalk</i> , &c.			Horses and cows tongues.	j Far more common in Germany and parts of Switzerland than in this country, although specimens of German sausage, etc. affected with it are occasionally met with here, even when of British manufacture. k Solutions of ARSENIUS ACID or ARSENITE OF POTASSIUM are constantly employed by poultryers and others for washing over poultry, game, etc., with the view of keeping them (superficially) fresh. The practice is a dangerous one, and cannot be too strongly reprehended. l BLUE-STONE (sulphate of copper) is sometimes added to pickles to improve their colour; sometimes metallic copper is dropped in. m Doubtful, no authenticated instance has come to my knowledge. n Beet-root sugar is probably derived from abroad.
	VERDIGRIS, <i>COPPERAS</i> (l) <i>capsic.</i> &c. <i>Pepper, capsicums</i> , molasses, salt, &c. —— <i>SULPHURIC ACID</i> , <i>turpentine</i> , &c. —— <i>Various flavours</i> , &c.	Var. green colouring matters. SCHEELE'S GR. VERD. gamb. VERMIL. CHR. YEL. and GR. and other cols. poison. or inju. Var. ess. mirbane, OIL OF ALMONDS, fus. oil, ess. &c. and various narcotics. (p)		Carrara marble.	
cc.	Spicules, &c. of mica (?) Sugar, various kinds, &c. Dextrine, molasses, &c. <i>Black-lead</i> , lamp-bl., salt, <i>Trus. bl.</i> &c. <i>Salts of iron</i> , COP, and LEAD, <i>turm.</i> &c.			"Lie-tea" containing no tea at all but made up of sweepings, etc., coloured and "faced."	n Universally in the icing of twelfth and other cakes. o Tea is also (exceptionally) adulterated with logwood, rice in husks, spent tea r-dried, <i>felspar</i> , <i>soapstone</i> , and with various clays and colouring matters.
star. &c. uckthorn, spent tea	Salt, carbonate of soda, &c.				p ORPIMENT (sulphate of arsenic) is (rarely) found in confectionary, probably by being mistaken for some other yellow colour. In various cough lozenges narcotic poisons are often added with dangerous liberality. q Poisonous, generally mistaken for the true vegetables.
snut					
	<i>Pepper, tart. acid, various flavours</i> , &c. Brandy, <i>capsicums</i> , <i>catechu</i> , &c. Brandy, <i>capsicums</i> , <i>var. essences</i> , &c. Tartaric acid, bicarbonate of soda, &c.	<i>Various colours and essences</i> .		{ False champagne from gooseberries, rhubarb, &c.	* Doubtful. It is probable that more than half the "best champagne" is spurious.

in the line immediately above it. L. A. C. signifies *Lancet Analytical Commissioners*.

adulterant, or Class V. Substances not employed as adulterants proper, but for the purpose of additional ornamentation or flavouring (*highly injurious to health, but not legally speaking fraudulent*).  
Class VI. Substances not employed as adulterants proper, being *substitutions* for or *imitations* of the true articles for which they are sold (*distinctly fraudulent*).

	Ochre.	Ferruginous earth.	Native Mineral.	Super-oolite bed, almost universally.	Confectionary, cocoa, chocolate, spices.	Inert, except in large quantities; then a mechanical irritant.
	Orange Chrome.	Subchromate of Lead.	Soluble Lead salts, by precipitation.	(See <i>Flake White</i> .)	Mustard, currie.	(See <i>Chrome Yellow</i> .)
	Orpiment.	Tersulphide of Arsenic.	Native Mineral.	Various countries.	" Bath buns.	Actively poisonous. Gastric irritant.
	Picric or Carbazotic Acid.	Picric or Carbazotic Acid.	Indigo, by oxidation with nitric acid.	(See <i>Indigo</i> .)	" ( " ?), Marmalade.	Indifferently known. Probably injurious.
YELLOW	Safflower.	Carthamine.	Petals of flowers of <i>Carthamus tinctorius</i> .	Egypt, Asia, Levant, Turkey, India.	" Gelatine, marmalade, etc.	Indifferently known. Probably inert.
and	Saffron (S).	Polychroite.	Stigmata of <i>Crocus sativa</i> .	Spain, Portugal, Italy, Sicily.	" butter, etc. " milk, etc.	Not active, but, long taken, stains the tissues yellow.
ORANGE.	Sumach.	" " " " " "	Stem and root of <i>Rhus coriaria</i> and <i>R. cotinus</i> .	China, Java, India, Madagascar.	" Currie, opium, mustard, ginger, milk, cayenne.	In small doses, causes dyspepsia and prostration in large, vomiting and stupor.
	Turmeric.	Curcumin.	Root of <i>Curcuma longa</i> .	Lancash. South of France, Italy, Germany, &c.	" Marmalade, mustard.	Mild aromatic stimulant. Harmless.
	Weld.	Luteoline and Luteoline.	Leaves and stem of <i>Reseda luteola</i> .	America. (Australasia)	" Jellies, preserves, bottled fruits, wines, etc.	Not known.
	Quercitron.	Quercitrine.	Bark of <i>Quercus tinctoria</i> .	South of France, Levant, &c.	" Jellies, preserves, bottled fruits, wines, etc.	Indifferently known. Astringent.
	Alkanet Root.	Anchusine (I).	Root of <i>Anchusa tinctoria</i> .	" " " " " "	" Jellies, pres. curraunts.	Inert.
	Aniline Red—Magenta.	Aniline Red.	Aniline, by oxidation, &c.	Armenia, Italy, France, Great Britain, &c.	" Anchoyies, new sauces, and potted meats; cocoa, coffee, chicory, etc.	Not poisonous. Tonic in medicinal doses.
	Armenian Bole.	Ferruginous earth.	Native Minerals, by levigation.	South America, East and West Indies.	" Jellies, pres. and bottled fruits, syrups, port, claret, gelatine, etc.	Those of peroxide of iron. Inert in moderate quantity.
	Brazil-wood.	Braziléine.	Wool of <i>Cesalpinia cristata</i> .	Mexico, South Carolina, West Indies.	" Jellies, pres. and bottled fruits, port, claret, gelatine, etc.	Not known.
	Carmine.	Carmine.	<i>Coccus cacti</i> insect, by infusion, &c.	Campeachy, Honduras, Jamaica.	" Jellies, pres. and bottled fruits, port, gelatine, etc.	Inert.
	Indian Red.	" " " " " "	Wood of <i>Hæmatoxylin campechianum</i> .	Canaries, Cape Verd Isles, Levant, &c.	" Jellies, pres. and bottled fruits, port, gelatine, etc.	Indifferently known. Inert.
	Logwood.	" " " " " "	<i>Rocella tinctoria</i> and other lichens.	Italy, Levant, South of France, Holland, &c.	" Jellies, pres. and bottled fruits, port, gelatine, etc.	Indifferently known. Inert.
	Litmus.	" " " " " "	Root of <i>Rubia tinctorum</i> .	Africa, Mexico, Peru, &c.	" Jellies.	Not known.
	Madder.	" " " " " "	Guano, by oxidation of Uric acid, &c.	Various countries.	" Cayenne pepper (potted meats)	Actively poisonous. Arsenical gastric irritation.
	Murexide.	Murexide, or Purpurate of Ammonia.	Native Mineral, and artificial.	Derbyshire, Northumb., Cumb., Devon, &c.	" Cayenne pepper, potted meats, anchovies, etc.	Poisonous. Gastric irritation. Colic. Muscular paralysis.
	Realgar.	Bisulphide of Arsenic.	Metallic Lead, by oxidizing when fused.	(See <i>Litmus</i> .)	" Jellies, pres. and bottled fruits, port, claret, etc.	(See <i>Litmus</i> .)
	Red Lead.	" " " " " "	" " " " " "	" " " " " "	" Cocoa, chocolate, coffee, chicory, etc.	Slightly injurious, in large quantities. Otherwise inert.
	Turnsole.	" " " " " "	" " " " " "	" " " " " "	" Confectionary, essence of pepper.	Poisonous. Gastric irritation. Mercurial ptyalism.
	Venetian Red.	Sequoioxide of Iron.	" " " " " "	" " " " " "	" Confectionary.	Not known. Probably inert.
	Vermillion.	Sulphide of Mercury.	Native Cinnabar.	Mexico, California, Peru, Almaden, &c.	" Cocoa, chocolate, coffee, etc.	Injurious in large quantities, as mechanical irritants. Otherwise inert.
	Sepia.	Sepia.	Ink-bag of <i>Sepia officinalis</i> .	Seacoasts of temperate countries.	" Cocoa, chocolate, coffee, etc.	Probably inert.
	Sienna ("raw" and "burnt").	Ferruginous earth.	Native Mineral.	Tuscany, various parts of Germany.	" Tea, pepper.	Inert.
	Umber ("raw" and "burnt").	" " " " " "	Native Mineral.	Isle of Cyprus.	" " " " " "	"
BROWN	Vandyke Brown.	" " " " " "	" " " " " "	" " " " " "	" " " " " "	"
	Black Lead.	Carbon.	Native Graphite, and artificial, by calcination in nearly close vessels.	Cumberland.	" " " " " "	Probably inert.
	Ivory Black.	" " " " " "	Resin, &c., by burning and deposition of smoke.	" " " " " "	" " " " " "	Inert.
	Lamp Black.	" " " " " "	Cork, by burning without access of air.	" " " " " "	" " " " " "	"
	Spanish Black.	" " " " " "	" " " " " "	" " " " " "	" " " " " "	Nearly inert. Slightly astringent.

(S) Many other vegetable yellows are employed, such as saffron, turmeric, etc. (See "Litmus" and "Indigo" in the adulteration of Tea, &c.), but are of no special importance.

interesting specimens of "brick-teas," "tea-lozenges," and other curiosities, lent by the Council of the Royal Asiatic Society, are contained in the glass-case before you.

Coffee is not often very injuriously adulterated, but it is painful to reflect how people, especially poor people, are at once defrauded of their money and robbed of their health by the vendors of ground coffee, both in London and the provinces, for, out of every 100 samples obtained from retail dealers, I do not believe that more than eight will be genuine unsophisticated coffee of the quality inquired for.

Coffee, in all its varieties and conditions, may be distinguished from chicory, or any other roasted roots and beans, with the aid of the microscope. The pure article should leave a white ash when burnt, and should not immediately impart a colouration to cold water, as a "mixture of chicory and coffee" will do. Chicory, in its turn, is adulterated with inferior roots, brickdust, and Venetian red.

The cocoas and chocolates of commerce are adulterated to an extent which I must simply term frightful,—at this moment I hardly know a wholesale or retail establishment selling the pure ground nuts. On this account, I have not accepted specimens of cocoa from anyone,—for I need hardly tell you that the samples of food-products before you have been kindly contributed by various manufacturers and importers of whose high character and general respectability I had previously assured myself.

Time will not permit me to describe at length the adulterations of wines, spirits, and beer; their detection, too, is often so laborious a task that a non-scientific man would utterly fail in attempting it; so he had much better, before "ordering in a quantity," take Dr. Lankester's advice of last week, and hand the sample over, with a fee, to a professional chemist.

On one point relating to beer I will make a single observation, viz., that I have actually detected strychnine in two samples of bitter beer. Specimens of porter, double stout, and pale ale, from the brewery of Messrs. Gas-thorne and Co., of Westminster, are on the table; I can bear testimony to their remarkable purity.

I have thus briefly and imperfectly laid before you a few of the leading facts connected with the heartless system of adulteration practised with our daily food, and I beg to apologise for the incomplete nature of my illustrative specimens in some sections, arising from circumstances over which I had no control. The provisions of the recent Act for preventing adulteration are so well and so generally known that I need not enumerate them here. Two remarks, however, may not be out of place. The people of this country, I hold, are *not* indifferent to the subject, as is constantly asserted by interested parties, but do not know in what way to act, or how to obtain redress for their wrongs; deeply and cruelly do the people feel how hard it is that their daily bread, for which they all work, for which, too, let us hope they all pray, should be falsified and deteriorated with impunity, knowing too that as long as the monster adulteration exist, so long will it bring death and disease to them and those dearest to them, and pour a golden stream into the purses of its worshippers.

Still, the difficulty may be mastered in one way, and to the possibility of that way being opened up, thousands of our countrymen are now looking forward in anxious expectation. Need I say that what science unaided cannot do, what legislature as it stands cannot attain, may be accomplished through the instrumentality of the "Society for the Encouragement of Arts, Manufactures, and Commerce."

I do not hesitate to assert, and I entreat the Council of this Society to give this suggestion of mine their best and most earnest attention, that if a Special Committee were appointed on the adulteration of food and drink, the evil might be greatly lessened in three years, and almost annihilated within six or seven.

Among the members of such a committee, trade and manufactures, commerce and law, chemistry and medicine

should be well represented; and among the more important of their duties would be—

1st. The adoption of a series of standards of those goods whose legitimate composition is at present indefinite, such as vinegar, cocoa, currie powder, &c.

2ndly. The consideration of what colouring-matters should be permitted to be used by confectioners and others, and of those which should be prohibited altogether.

3rdly. The extension and improvement of detective analysis in points where it is now deficient.

4thly. The consideration of the best steps to be taken to prevent the importation of adulterated articles. And,

5thly. To give all possible aid to William Scholefield, or any other man, who will endeavour to introduce a more stringent measure for the suppression of adulteration than is now in existence.

In conclusion, I have most gratefully to acknowledge the kind assistance accorded to me by Dr. Forbes Watson and Sir Emerson Tennent, in furnishing me with certain statistical information; by Mr. W. Neal, of the Royal Asiatic Society; and by my brother, Mr. C. A. Scott; to these, and several other gentlemen, I beg to tender my best thanks.

#### DISCUSSION.

Mr. LEONARD WRAY said the paper they had just heard read mentioned the adulteration of tea, and thus afforded him an opportunity of referring to some assertions that he made at the last meeting on that particular point. In the paper which he had the honour of reading on that evening, he stated that seven-eighths of all the tea imported from China to the United Kingdom, of the last crop, was adulterated; and he gave, as his authority, the minutes of a meeting of tea merchants, held at Canton, on the 18th of April last. He had not, however, at that time the pamphlet containing those "minutes," but was speaking from the letter of a gentleman who had been for upwards of 20 years connected with the wholesale tea trade of London, and who, by referring to those "minutes," led him (Mr. Wray) to believe that the statement, as to the amount of adulteration, emanated from that meeting. He had since obtained the pamphlet, and although he certainly was in error in this one particular, yet it appeared from the testimony of this gentleman, that there really was no exaggeration in the statement that seven-eighths of the last crop of tea imported into the United Kingdom was more or less adulterated. In the *Morning Star and Dial* of Monday, the 28th inst., that gentleman, Mr. William Green, of Forest-hill, wrote as follows:—

"The Society of Arts, through the assistance of Mr. Wray, has done a great public service, in making known the extent of adulteration of tea in China, when intended for the English market. A correspondent of the *Star and Dial*, of Friday, doubts the correctness of the statement that seven-eighths of the tea imported here is adulterated. That, I believe, is rather below the fact; and that a gentleman of practical experience for 22 years should be startled by the announcement, surprises me. The character of the last five years' importation, however, powerfully sustains the averments in Mr. Wray's paper. The initiated, as well as the general public, will permit me to say that the adulteration—for convenience—may be described as of two classes, the positively spurious and the sophisticated. The former is known in the trade as Taysan Congou; it also represents most of the pekoes, capers, and Canton greens. In their manufacture is employed exhausted leaf; also leaves from three plants, *Gynura auriculata*, *Ardisia erispa*, and a common species of mint. These teas are mostly from Canton and its locality, and their quality for the most part is execrable. Those which I have denominated as "sophisticated" are from Foo-choo-foo; and for purity they rank higher than the former. The adulteration has, however, gradually extended and increased for the last five years. The new crop of this class has just arrived. It is nearly all refined and re-manipulated, having had large quantities of old and common leaf incorporated, though imported and sold as new and fine tea, &c., &c."

Now, if this testimony had emanated from an inexperienced



man, he (Mr. Wray) should certainly not bring it before the meeting; but Mr. Green had had very great practical experience; he was in one of the largest wholesale tea warehouses in London, and, for the last twenty years of his life, had had daily experience in the article of tea. He could have no hesitation, then, in giving him as an authority. Mr. Green had promised to attend there to-night, if possible, in order to support in person the assertions which he had not shrunk from publishing to the world through the newspapers. The main point, then, in that part of his (Mr. Wray's) paper, which treated of the enormous amount of adulteration practised by the Chinese on the teas they sold to our merchants, remained as he had stated it be. They must all, however, be glad to know that our highest merchants in Canton had pledged themselves not to purchase any teas which they knew to be adulterated; although the British Consul, Mr. Winchester, distinctly told them that success could scarcely be hoped for so long as the foreign buyers continued, in the hope of gain, to purchase these adulterated articles of the Chinese. The object of this Society must be to elicit and to disseminate truth, so that whatever subject it had in hand might be presented to the public in the clearest possible light, and free from all suspicion of incorrectness. Let this question of tea, then, be thoroughly and impartially investigated.

Mr. W. J. BLAND wished sincerely that the same fairness which characterised this Society was displayed also by the members of the public press, who had chosen to insert the views of one side of the question, but utterly refused to publish the other side of the case. His letter to the *Star* newspaper, in reply to the strong assertions of Mr. Green, had been denied publication in that journal. If an opportunity were afforded him, he was prepared entirely to disprove the statements which had gone before the public in the *Journal* of this Society. He would take upon himself to say, from the past history of the tea trade, that, so far from seven-eighths of the tea which came over to this country being adulterated, not one-eighth of our annual imports of that article was adulterated. As an old member of the Society, he had in former years brought forward facts upon this subject in the presence of Mr. Twining, Mr. Gibbs, and other leading members of the tea trade; and now, looking to the statements put forth in this room at the last meeting, he asked that the gentlemen who had made those assertions as to the alleged amount of adulteration of tea should bring forward evidence in support of them. If, as was alleged at the last meeting, seven-eighths of the tea now in our bonded warehouses was adulterated in the manner described, let them bring samples here, and he would undertake to prove that it was not adulterated or sophisticated. He claimed that this should be done, because the last speaker had urged upon the meeting to give an opportunity for candid investigation into the question, and, as he had previously stated, he was ready at any moment to come forward with proofs in support of what he had stated—and he would add that at no time within his own recollection were the public ever so safe upon the subject of tea as they were at the present time, for they now had teas of better character than was the case under the former *regime* of the East India Company. He unhesitatingly made these statements, and would be prepared to substantiate them.

Mr. Wm. HAWES confessed that he could not commence his observations upon this paper by characterising it, as it was generally in his power to do, as an able and useful one. He thought when charges of adulteration of food were dealt out in the wholesale manner in which they had been that evening, much more was required than the simple statement, before such charges would be received by an assembly such as he now saw before them. To say that 87 per cent. of the bread they ate was adulterated, if not entirely false, was, in his opinion, a gross misrepresentation. To say that seven-eighths of the thousands of tons of teas in our warehouses was adulterated to the ex-

tent alleged, was in his opinion a misrepresentation. What did adulteration mean? Did it mean that seven-eighths of the article so called was not tea? or did it mean that some processes were employed by which a different character was given to it (let them call it adulteration if they would), but which did not affect either the wholesomeness or the quality of the tea? If it was intended to take refuge under that statement, he would say that the assertion that this was practised to the extent of seven-eighths of the total quantity of tea imported into this country was a misrepresentation. If seven-eighths was not tea at all, then it was but fair that the promulgators of such a statement should describe what the article really was. When it was alleged that the dealers in corn were guilty of such gross fraud that they put 12 inches of good corn on the top of the sacks, and 20 inches of bad corn at the bottom, it ought to be proved by bringing a sack of corn bought in Mark-lane into that room. In his opinion, the great mass of traders in this country were not so thoroughly dishonest as this paper would lead them to believe. That there were fraudulent merchants and traders they all knew; but, when they went through the whole list of articles forming the chief ailments of the population, and asserted that not one-half of the things they bought were pure—not half were the articles they were represented to be, he repeated that very much more proof than had been given by one individual, was required before they would consider those charges substantiated. The fashion of dealing in these assertions was too common. They had a recent act of Parliament to protect them against adulteration of food. This was in his opinion a part of that paternal system of legislation which he thought had in this country passed away for ever, and it did virtually pass away when the House of Commons gave up the assize of bread, and testing for the purity of a variety of other articles of food. The public would generally take care of itself in such matters as these, and the less Parliament interfered with those petty details of life the more secure the public would be. What were the effects of the excise laws, to preserve them from adulteration? None whatever. Let them legislate upon this subject as much as they would, all that legislation did was to show what the dishonest trader must avoid, and to drive him to some other means of arriving at the same end. Legislation on such a matter was all thrown away. The paper summed up the long list of grievances by telling them the means by which the evils complained of could be remedied. What were those means? The Society of Arts was to appoint a Committee from its own body, which in three years was to lessen adulteration very considerably, and in six years to destroy it altogether. The whole world had been trying in vain to effect this object; but the Society of Arts, by a Committee appointed by itself, with no public responsibility whatever, was to drive out this great bugbear of adulteration, and in six years! Was it possible that if seven-eighths of their tea was adulterated; that if twelve inches of good corn would conceal twenty inches of bad corn; that if pickles were adulterated with copper; if that deleterious admixture were compounded with our pepper and mustard; and, indeed, every article sold by the butcher, baker, grocer, fruiterer, and greengrocer were sophisticated or adulterated, that all this could be remedied in six years, by a committee of this Society—a committee of traders, chemists, and *dilettanti* members—men appointed by this Society! He could never conceal his opinion upon such questions as these. He believed legislation upon them acted perniciously. He believed this microscopic examination of food—though very beautiful, perhaps, in itself—was of little practical service to the public, and worse than useless if it led to such statements as had been made that evening. He disagreed with the author of the paper in many of the points brought forward. He believed the results arrived at were exaggerated, and the remedies suggested were of the most futile kind.

Dr. LANKESTER confessed he had not expected to hear such a speech as that he had just listened to. He was surprised that a member of the Council should turn into ridicule the application of science to the practical arts of life; and he felt that, even supposing some indiscretions had been committed by Mr. Wentworth Scott, nothing could warrant the severe remarks which they had just heard. He wished this subject could be discussed without any unpleasant feeling, and he would endeavour to bring back the meeting to look at the scientific facts which the paper had brought before them. Were they to believe Mr. Scott's assertions as an honest man, or not? Were they to credit his statement that 60 per cent. of the bread he had tested was adulterated with alum or not? Mr. Scott was prepared to stake his reputation upon the matter, and on that ground he (Dr. Lankester) believed him. This was not the first time they had had this subject before them. They all recollected the analyses of food which were given in the *Lancet*, and yet he never heard it said that Dr. Hassall had given publicity to that which was untrue, or that he had unduly libelled the tradesmen of the country. He (Dr. Lankester) did not for a moment pretend to say that all persons who sold adulterated goods were aware of the extent to which the adulteration existed; but let them not encourage men to believe that they might put deleterious substances into food, and as long as this could not be detected, they were to go free. Mr. Scott, by the aid of chemistry, had shown the public what they were taking, and had warned them what they ought not to take. He had shown that the public required more scientific knowledge upon these subjects. He had brought before them a series of facts which showed the necessity, not only of the community being instructed in the elementary details of science, but also that tradesmen who wished to deal in an honest article should know something of the nature and scientific character of the products which they sold, and something of the laws by which human life was regulated. If a tradesman received a chemical education, he would be able to detect many of these adulterations. There, for instance, was a bottle of pickles which was manifestly adulterated, and which stood side by side with an unadulterated article. The vendor of that article knew it was not genuine—he knew the West Indian pickle was adulterated, and anyone who ate freely of it at supper would find this out in the course of the night too. Such a thing should be put down, and if they were unable to effect this through the medium of the ordinary influences which operated upon society, they might fairly ask for the help of the legislature in the matter. He was surprised therefore to hear a gentleman, whom he knew advocated the amendment of the laws of this country, condemn legislation upon this subject. With equal reason they might condemn legislation for the criminal who robbed his employer, as for those who systematically sold bad articles of food over the counter. Surely the legislature, which was effective in the one case, would be effective also in the other case; and he contended that the hon. member for Birmingham, who carried that bill through the house was right in endeavouring to set legislation in motion on such a subject. What he complained of was that, like too many acts of Parliament, it was insufficient, and could not be practically worked. The fee that was fixed for the analysis was too small to insure a proper investigation by the chemist; it would not pay him for the time that was occupied by it. In the next place, the person who sold the goods must be proved to have a knowledge that he was selling an adulterated article, and, unless they brought that guilty knowledge home to him, he could not be convicted. He hoped that further legislation would be really effective. The existing act had, however, been the means of calling attention to the fact that there was something like legislation going on, and that there were means by which these practices could be prevented. With regard to the question of tea, it was one which could be answered by the analytical chemist alone. Let them not permit any

gentleman who was only a dealer in tea, and knew nothing of chemistry, to say that tea was not adulterated; but it should be put into the hands of the botanist to say whether there were other leaves with it than those of the tea plant; and into the hands of the chemist to say whether there was anything besides the natural product. He would not take the opinion of a man who had dealt in tea for 25 years, if he knew not how to distinguish between the leaf of tea and the leaf of any other plant. Let them not, upon such evidence as that, decide that tea dealers were too honest to sell bad tea. Passing over the subjects of the paper, he would say that he thought Mr. Wentworth Scott had brought before them a number of practical hints by which persons with a limited knowledge of chemistry might assist themselves in judging whether an article was adulterated. With regard to bread Mr. Scott's process for detecting alum was, perhaps, too complicated for general application, for alum was not easily detected, and he warned persons against concluding from such evidence as Mr. Scott had brought forward as to the presence of alum in bread. He (Dr. Lankester) thought the test of the blow-pipe was more satisfactory in that case. Mr. Scott had spoken of the adulteration of meat. There was an astounding thing! In the newspapers of that day there was an account of hundreds of pounds of meat having been seized a few days ago by the sanitary authorities of the City. There was the fact of the unwholesome meat being exposed for sale in the market. He knew how common it was to bring into the markets of London mearled pork, which, once seen and known, would always be recognised as diseased; which, when eaten by human beings, resulted in the production in the stomach or bowels of a worm, which was the pest of life ever after. Ought the public to be protected from such things as these? That pork, if not sold in joints to the public, found its way to the sausage-makers; and were they not to interfere between her Majesty's subjects and the horrible tapeworm? Mr. Scott had also referred to the adulteration of pepper and other spices. There was always more or less difficulty in detecting adulteration in powders. These ginger, pepper, and mustard powders might contain almost anything, for what the public knew, and it was not easy for them to ascertain what they really were. Upon this part of the subject he need only refer them to the great Liverpool pepper case, which occurred within the last twelve months. They saw from that, how very difficult it was to detect the adulteration of those spices. It was frequently to the interest of tradesmen to adulterate even only to the extent of 5 or 10 per cent., to enable them to undersell their neighbours to that extent; so that there seemed to be good reason why the government should be alive even on this matter. Even in cases where there was no Excise duty to be protected, there was an equivalent of value which no government ought to overlook. Human life was money value. A slave in America would be worth from £100 to £200, and surely the life and labour of a human being in this country was worth that amount. Therefore, as a mere money question, it behoved the government to see that the most stringent measures were carried out to detect the adulteration of food.

Dr. KIRNS wished to mention the fact, that whilst staying with a friend in Derby, last summer, he had the most convincing proofs afforded him that plaster of Paris was used by tons for the adulteration of mustard. It was sent in very large quantities to some of the largest mustard manufacturers in the kingdom.

Mr. WM. GREEN had attended solely for the purpose of confirming the statements he had made in print, as alluded to by Mr. Leonard Wray, upon the subject of the adulteration of tea, which had occupied a large share of his attention during the last five years. His experience in one of the largest houses in the kingdom for twenty years had been, that teas were very largely adulterated; and he was prepared to stake his reputation upon the statement he made, that of the tea which had been imported into

this country during the last three years seven-eighths was adulterated. Startling as that statement was, he might, perhaps, add an explanation, which would, in some measure, qualify it. Mr. Wray had correctly stated, he believed, the extent to which the tea was adulterated in putting it at seven-eighths, and that only one-eighth was absolutely pure. Out of the whole quantity one-eighth might be regarded as a spurious material altogether; that left three-fourths of the stock to be more or less adulterated or sophisticated. That three-fourths might be taken to be adulterated to an extent varying from 1 to 50 per cent.; and if Mr. Bland (who might be looked upon as one of the fathers of the tea trade) could convince him that no adulteration took place, he should be happy to acknowledge himself mistaken. He felt it was impossible, whatever a man's knowledge of tea might be, to detect adulteration in it when carried to a comparatively small extent. He would say that of the entire crop of Foo-choo-foo tea which had just arrived, he believed there were but few lots that were absolutely pure. He had obtained some lots of that tea, and he found that although it was only three months old, it had already deteriorated in commercial value to the amount of 6d. per lb. Then with regard to the black tea of Congou, the orange pekoe, and other varieties, he believed the assertion that seven-eighths was adulterated was borne out by the facts. He believed the quantity of tea exported from this country amounted to about 10,000,000 lbs. annually, shipped principally to northern ports, and it was some consolation to know that the tea so exported consisted chiefly of the most inferior qualities. He had waited anxiously to hear some suggestion by which this confessedly great evil might be remedied or overcome; and it appeared to him that, as long as they carried on a war with China, as long as they exacted compensation for such a war, and as long as they taxed the produce of that country at home, it was in vain to expect they could get a true and genuine article in tea. He would urge upon those who were anxious to be delivered from this evil, that they should direct their attention to the obtaining of teas direct from the grounds where they were grown.

Dr. NORMANDY could not state what was done with the tea in China, but he could, as an eye-witness, give them some information as to the treatment it received in this country, at the hands of large and so-called respectable dealers. They were aware that the tea came to this country in cubical boxes, enclosed in a thin sheet of lead, which was soldered in a manner so exquisitely beautiful, that no European plumber could imitate it. In the event, therefore, of that metallic sheet being ruptured, it could not be re-soldered without immediate detection. The practice, therefore, was to cut a hole in the metallic sheet sufficiently large to admit the introduction of the hand to take from the chest a sample from which the dealer decided as to his purchase. The tea having been delivered in the chests to the purchaser, then came his own process of sophistication. If the seam in the metallic sheet could be imitated or reproduced, the task would be an easy one, but as that could not be done, the chests were emptied of their contents through the hole to which he had alluded, and the tea was poured out in a room appropriated to the purpose, the floor of which was kept very smooth and clean. A mixture of various descriptions of tea was then made in a heap, turned over with wooden shovels, and the chests were refilled through the same hole; the compression of the tea in the chest being effected by the hand in the first instance, and afterwards by the foot. In that manner the chests were repacked with a different article from that which they originally contained, and they were then ready for sale by the dealer. He begged to state that he had seen the process carried on in one of the largest tea houses of London, and he would therefore vouch for the correctness of his statement. With respect to bread, he was in the habit of analysing many hundred samples every year, and he could say that, at one time

he never met with bread entirely free from alum. It was not his purpose now to discuss the question whether alum so administered was injurious to the human system or not. The question was whether alum was actually present in bread or not. He had been instrumental in convicting about a hundred bakers for adulteration of bread, and he might state that, of the cases so brought forward, the largest proportion pleaded guilty to the charge. He was happy to say that his experiments in this matter showed that a decided improvement had lately taken place in the general quality of the bread submitted to him, inasmuch as out of twenty-three samples of bread sent to him, at the instance of the magistrates of Wandsworth, only nine were found to contain alum, so that it would be seen that they were improving, and it was to be hoped that legislation had done something towards mitigating the evil.

Mr. T. A. MALONE wished to set himself right with respect to what he had stated at the last meeting as to the adulteration of tea with the substance known as *Valonia*. Professor Bentley having questioned that assertion, he (Mr. Malone) would now state that a piece of *valonia* was put into his hand by the son of a large tea merchant, who told him that it was a substance used in the sophistication of tea; and it was upon that authority (which he considered a good one) he made the statement at the last meeting. At the same time, he laid no claim to having discovered any ready means by which the presence of that substance in tea could be detected. He had been told by a gentleman present, acquainted with the subject, that *valonia* could be used in such a manner as to deceive the most experienced judges of tea; in fact, he was inclined to doubt whether chemical appliances were sufficient to detect that kind of sophistication. It had been said that there was equal difficulty in detecting some methods of adulterating tobacco; and he had heard it said of an eminent analyst that he was able to adulterate tobacco in such a perfect manner that he could not afterwards detect his own work; and he believed that remark applied in a great measure to the sophistication of tea. The injurious effects of tea upon some constitutions were attributed to the astringent properties it contained. He believed those properties could be modified by the use of gelatine; and, in his own experience, he had rendered tea more agreeable to his palate by the introduction of a few strips of isinglass into the infusion. The general opinion, he believed, was that the principle in tea which was known as *Theine* acted unfavourably upon the nervous system of some persons, and the amount of that principle (which could be detected by treatment with benzole), might form some test of its action upon the human system.

Dr. RIDDELL remarked that the question of tea had been more or less discussed during the last ten years. His own experience had been principally confined to such articles as pickles and sauces. Soy was an article which contained very nutritious properties. It contained a larger quantity of nitrogen than any other kind of food used by the Chinese, and it appeared they had discovered that to be case, and therefore used it in large quantities. People frequently now would see, in the shop-windows of London, a peculiar-shaped jar, labelled "Japanese Soy," but that jar contained a cork, and if the article was what it purported to be, the wonder was how the cork got into the bottle, considering the Japanese did not use corks. A very favourite condiment in this country was mushroom ketchup, and when they purchased it, the shopkeeper could do no more than tell them that he bought it for genuine, and he hoped it was so. Very good "mushroom" ketchup was, however, said to be made from horse's liver; and a lady in India had told him she always made her "mushroom" ketchup from calves' liver. Some remarks had been made with regard to curry powder, and it was stated that it could be made without turmeric. He believed he could put his hand upon 400 different receipts for making curry powder, written in Persian, so that it would be difficult to make a universal curry powder. With regard to pickles, he believed very little East Indian pickle was sent

to this country. Girkins certainly would not be found in India. The West Indian pickles consisted chiefly of mangoes. With regard to cayenne pepper, the public taste was in favour of a red-coloured article, although it was difficult to conceive how a genuine pepper of that colour could be furnished from a dark-brown or yellow chilli.

The CHAIRMAN said he had listened with satisfaction both to the paper and to the discussion upon it. It had been truly stated that the object of this Society was, upon every subject that it touched—as far as human means could do so—to promote and elicit truth; but it would be quite understood that the Society did not hold itself responsible for the views that were advanced in the papers brought before these meetings, or for the facts therein stated. It was hardly possible to conceive that a subject of this kind, arraying on the one side charges against the commercial classes of the country, and on the other side persons who naturally desired to screen themselves from the imputation of supplying unwholesome food—that a discussion of this kind would not call forth a little temper; he was glad to see it had not been carried further. The probability was that on one side there might be an exaggeration of facts, and on the other side an over anxious zeal to defend interests of which these persons were in some degree the representatives. Under these circumstances, perhaps they might look for the truth between the two extremes. There was one subject to which he would more particularly allude. With regard to the public health, he thought the statistical returns showed that to whatever degree the adulteration of food was indulged in, the value of human life had in modern times greatly increased. That was a strong fact, but there were other circumstances to be regarded, which, he thought, would not afford equally satisfactory results. During the last year he had been a visitor of one of the largest lunatic asylums in the world, where there were now 1,800 and 1,900 lunatics in one building, and the great increase of lunacy in this country had attracted the attention of everyone who had considered the subject. It was undoubtedly the opinion of the most eminent physiologists, and men conversant with the human frame, and the action of food upon it, that some extent, if not a considerable portion of the increase of this malady, might be traced to the effects upon the nervous system of deleterious substances, which it was to be feared were but too commonly mixed with articles of food supplied more especially to the poorer classes of the community. He thought, with respect to the paper, nothing had transpired which ought to deprive the author of it of the usual compliment which was paid upon these occasions. He would therefore take the sense of the meeting upon the proposition that a vote of thanks be given to Mr. Wentworth Scott for his paper.

A vote of thanks was then passed to Mr. Scott.

The Paper was illustrated by specimens of unadulterated food, kindly lent by various persons therein named, as well as by a collection of articles lent by Mr. T. Twining from his Economic Museum, intended to illustrate the adulteration of flour and bread. The microscopic detection of adulteration was illustrated by several microscopes contributed by Mr. Baker. The thanks of the Society are tendered for these contributions.

The Secretary announced that on Wednesday evening next, the 6th inst., a paper by Mr George R. Burnell, C.E., F.G.S., F.S.A., "On the Condition of the Water Supply of London," would be read.

Mr. JOHN POSTGATE writes:—I think that some expression of opinion by the Society of Arts would tend

materially to remove a misconception which prevails respecting the provisions of the recent Act of Parliament for the prevention of the adulteration of food or drink. The first clause of that Act makes two offences; one, that of selling knowingly articles adulterated with substances injurious to health, and would require proof of such knowledge before conviction; but the other goes to the root of the mischief, and places a remedy in the hands of the public—for it expressly states, "every person who shall sell, as pure or unadulterated, any article of food or drink which is adulterated or not pure, shall, for every such offence," &c., forfeit and pay a penalty not exceeding £5, with costs; and for a second offence the name and residence of the offender may be advertised at his expense in the newspapers. It is, therefore, perfectly clear under this Act, that purchasers have only to ask for the pure article and request the seller to label it as such—and equally clear is it that impure and adulterated articles of food or drink must be sold as such; but, even these may bring the seller under the law, should they contain any material hurtful to health, as the magistrates may refuse to admit a plea of want of knowledge of his business by the seller, or that no means of knowing (an analyst being appointed in his district) existed within his reach. Respecting the public analysts appointed, it is of the highest importance that they should be, not only well skilled in chemistry and the use of the microscope, but also persons of well-established reputation for integrity and honourable conduct, otherwise the power placed by this act in their hands may be used for very bad purposes; and, I think, in all cases where analysts are appointed by local authorities, the inspectors of meat and markets should be ordered by those bodies to make purchases, submit them to the analyst, and initiate the proceedings before the magistrates; a work quite within their duties, and one that may be carried on under this act of parliament. It now rests with corporations to protect the community against the great evil of adulteration, and avert such calamities as occurred at Bradford and other places. I am glad to find, as the originator and worker of this question for several years, that the Society of Arts has taken this important matter up.

Edgbaston, Birmingham.

#### WOOL AND SHODDY.

Messrs. Littledales, Liverpool, in their circular say:—

"The position of the woollen and worsted trades throughout the manufacturing world is such as to bespeak grave reflections, and ought to command an active sympathy—they are not extending in the same ratio as other branches of industry, and are precluded from doing so for want of adequate supplies of the raw material. The cry of scarcity which has been sounded for the last eight or nine years has produced no practical effect, the small increase of growth having been absorbed without any relief. In England, economising expedients have been resorted to on an enlarged scale. The use of cotton in woollen and worsted fabrics has been vastly augmented; and the manufacture of rag-wool (which consists of old worn-out woollens, torn or ground up) has been developed into quite an important branch of business, under the name of "Shoddy" or "Mungo," being utilised to the extent of 38,880,000 lbs. annually (equal to about a fourth of our yearly importations of colonial and foreign wools), for the purpose of mixing with or adulterating wool in its manufacture; and yet, with these enormous aids, the prices of wool when not checked by adverse extraneous influence, ever gravitate to an extreme range, such, in fact, as effectually to limit the consumption. We have latterly congratulated ourselves on the achievement of the French Treaty, as likely to create a new outlet for our manufactures, woollens and worsteds amongst the rest; more recently we have felicitated ourselves on the opening of a market in China capable of swallowing such goods to an

indefinite extent. Pray where are they to come from? Our present customers are evidently taking all that we have the raw materials to make; and as the high prices of 1853, 1857, 1859, and 1860 have palpably failed to influence any thing like a proportionate increase of supply, the present scarcity must for all practical purposes be considered absolute; ergo, all business in woollen and worsted goods to new customers must necessarily be so much abstracted from all the old ones! This is a most unwelcome conclusion to arrive at. To men of the world, having the word *progression* eternally on their lips, it sounds incredible, but who can gainsay it? Better ask, Where can we look for help? What we want is *more wool*, for which we can give a good price—fifty per cent. above what was considered profitable to grow it ten years ago! We might point to Canada as especially capable of assisting our growth of English, to South Africa for an increase of fine colonial, and to India for a larger supply of low wools; but if the stimulus for excessive price has proved insufficient to effect the desired purpose, we are at a loss for a stronger inducement."

### Home Correspondence.

#### USES OF TEA.

SIR,—A single practical observation on tea-drinking may not be out of place. For twenty years I was in the habit of drinking black tea, at 3s. 8d. and 4s. the lb., but last year I thought I would try 5s. tea, and I have been delighted with the change. There seems to me to be no just comparison between the two teas. The 4s. tea appears to me to be a very uninteresting and suspicious kind of drug; the 5s. tea is a fine aromatic beverage. Moreover, practically, tea at 5s. is cheaper than tea at 4s., as three teaspoonfuls of the higher-priced will make a stronger and finer infusion than four teaspoonfuls of the lower-priced.

Very few of the large advertising tea-dealers keep 5s. tea; their best is usually 4s. 4d., a miserable article, compared with the 5s. tea. This good tea is to be had in some of the small, unpretending, old-fashioned shops.

I am certain that many will thank me for this hint if they will only make a trial. I see only one disadvantage, viz., that if all come to know that the high-priced teas are not only immeasurably the best, but actually the cheapest, the demand for them would become greater than the supply, and inferior teas would be offered as rare teas. It is therefore important to ascertain if an unlimited supply of the higher-priced teas could be imported.

I am, &c.,

GEORGE WYLD, M.D.

### To Correspondents.

In the last number of the *Journal*, p. 147, col. 2, line 5, before "the malt-tax," insert "the repeal of."

#### MEETINGS FOR THE ENSUING WEEK.

- MON. ...Royal Inst. General Meeting.  
 Entomological, 8.  
 Brit. Architect, 8.  
 Medical, 8½. Clinical Discussion.
- TUES. ...Royal Inst., 3. Prof. Owen, "On Fishes."  
 Civil Engineers, 8. Continued discussion upon Mr. Braithwaite's paper "On the River Wandle."  
 Pathological, 8.  
 Photographic, 8. Anniversary.
- WED. ...Society of Arts, 8. Mr. George R. Burnell, "On the Condition of the Water Supply of London."  
 Geological, 8. Sir R. I. Murchison, F.R.S., and Mr. A. Geikie, "On the Altered Rocks of the Western and Central Highlands of Scotland."  
 Pharmaceutical, 8½.  
 Ethnological, 8½.

- THURS. ...Royal Inst., 3. Professor Tyndall, "On Electricity."  
 Zoological, 4.  
 Royal Soc. Club, 6.  
 Linnæan, 8. Mr. A. G. More, "On the Occurrence of *Festuca ambigua* in the Isle of Wight."  
 Chemical, 8. Prof. Field, "On the Carbonates of Copper, Nickel, and Cobalt."  
 Artists and Amateurs, 8.  
 Royal, 8½.  
 Antiquaries, 8½.
- FRI. ....Astronomical, 3. Anniversary.  
 Royal Inst., 8. Professor T. H. Huxley, "On the Nature of the Earliest Stages of the Development of Animals."
- SAT. ....Royal Inst., 3. Dr. E. Frankland, "On Inorganic Chemistry."  
 Royal Botanic, 3½.

### PATENT LAW AMENDMENT ACT.

#### APPLICATIONS FOR PATENTS AND PROTECTION ALLOWED.

[From Gazette, January 18th, 1861.]

- Dated 7th January, 1861.
41. W. Taylor, Nursling, near Southampton—A portable horticultural and arboricultural fruit, flower, and plant protector.
43. W. Bagley and W. Mincher, Birmingham—Certain imp. in coating metals and alloys of metal.
- Dated 8th January, 1861.
45. W. Clark, 53, Chancery-lane—Imp. in filters. (A com.)
47. H. Hirsch, Bridge-road, Lambeth, Surrey—Imp. in insulating the conducting wires used for telegraphic purposes.
49. G. Hallett, 52, Broadwall, Lambeth, and J. Stenhouse, 17, Rodney-street, Pentonville—Imp. in the manufacture of pigments for coating surfaces.

- Dated 9th January, 1861.
51. E. Lord and R. Whitaker, Todmorden, Yorkshire—Certain imp. in machinery for preparing, spinning, and doubling cotton and other fibrous substances.
57. C. S. Dawson, Thames Ditton, Surrey—Imp. in rotary engines, applicable to be worked by water, steam, or other fluids, also to be used as a means of raising and forcing fluids. (A com.)
59. W. E. Gedge, 11, Wellington-street, Strand—An improved buckle. (A com.)

[From Gazette, January 25th, 1861.]

- Dated 13th November, 1860.
2784. L. Saccardo, Schio, Venetia—An improved apparatus and arrangement of paper for the substitution of this latter instead of the cards of Jacquard looms.
2786. W. Clark, 53, Chancery-lane—Imp. in looms. (A com.)
- Dated 21st November, 1860.
2850. W. Clark, 53, Chancery-lane—Imp. in journal or axle boxes, for railway carriages, whereby to effect the better lubrication of the frictional surfaces. (A com.)

- Dated 24th November, 1860.
2880. P. C. H. Charbol and A. Berson, 51, Rue de Malte, Paris—Imp. in the making of cages and aviaries for birds.
- Dated 26th November, 1860.
2894. G. F. Train, Liverpool—Imp. applicable to street railway carriages, part of which are suitable for other purposes. (A com.)

- Dated 3rd December, 1860.
2958. R. E. Keen, 15, Old Change, London—Imp. in cocks, taps, valves, and other apparatus for stopping and regulating the flow of liquids, steam, and gas.

- Dated 18th December, 1860.
3104. C. Stevens, 1b, Welbeck-street, Cavendish-square—A new mode of obtaining an article resembling honey, and to be used as a substitute therefor. (A com.)
3108. W. Scholes, High Town, near Leeds, Yorkshire—Imp. in wire card-covering for carding wool, silk, flax, tow, cotton, jute, or other fibrous substances.

- Dated 21st December, 1860.
3136. D. A. Morris, Pittsburgh, Pennsylvania, U.S.—Imp. in the manufacture of sheet iron.

- Dated 24th December, 1860.
3154. P. Spence, Newton Heath, near Manchester—Imp. in separating copper from its ores.

- Dated 29th December, 1860.
3188. J. L. St. Cyr, A. J. Grignon, and P. Rome, Paris—Imp. in manufacturing fibrous materials, tissues, or other fabrics.
3190. L. C. M. J. Vilcoq, Courbevoie, France—Imp. in apparatus or machinery for triturating textile bodies and other substances.
3192. H. Chamberlain, Wareham, Dorsetshire—Imp. in the preparation of clay for pottery purposes, which improvements are also applicable to filtering or cleansing liquids.

*Dated 2nd January, 1861.*

6. W. Cooke, Charing-cross—Imp. in apparatus for ventilating.

*Dated 3rd January, 1861.*

16. H. Doffegnies, Brussels—Imp. in the process for obtaining pulp for the manufacture of paper from Indian corn and other similar plants.

*Dated 4th January, 1861.*

22. P. Pimont, 55, Imperial-street, Rouen, France—Imp. in apparatus for dyeing fabrics and other articles.  
24. J. Crocker, Liverpool—Improved apparatus for indicating the number of persons, vehicles, or articles passing, or being made to pass, any place or part of a machine, especially applicable to omnibuses.  
26. J. R. A. Douglas, Hounslow, Middlesex—An improved mode of roughing the shoes of horses and other animals, to prevent them from slipping in frosty weather.

*Dated 5th January, 1861.*

30. A. Gilbee, 4, South-street, Finsbury—Imp. in sewing machines. (A com.)  
32. G. Sloper, Hackney, Middlesex—An improved method of, and machinery for amalgamating, and for effecting the separation of gold from earthy and other matters containing the same.  
34. L. D. Owen, 481, New Oxford-street—Imp. in bustles or skirt supporters. (A com.)  
40. W. Luck, Mabledon-place, Burton-crescent, Middlesex—An improved table, or article of furniture.

*Dated 7th January, 1861.*

42. G. D. Mease, South Shields—Imp. in the manufacture of sulphuric acid, and also in separating copper and silver from their ores.  
44. W. Bagley and W. Mincher, Birmingham—Certain imp. in coating metals and alloys of metals.

*Dated 8th January, 1861.*

50. J. J. Welch, Cheapside—Imp. in scarfs and cravats.

*Dated 9th January, 1861.*

52. D. Adamson, Newton Moor, Chester—Imp. in steam engines.  
56. E. C. Shepard, Victoria-street, Westminster—An improved apparatus for carburating gas for gas lighting.

*Dated 10th January, 1861.*

62. S. Moulton, Bradford—Imp. in the manufacture of india-rubber, applicable to springs, valves for machinery, and other purposes.  
63. R. A. Broom, 166, Fleet-street—Treating lava and other volcanic substances, in order to fit them for employment in certain arts and manufactures. (A com.)  
64. C. Newsome, Coventry—Imp. in looms for weaving ribbons and other fabrics.  
65. J. H. Johnson, 47, Lincoln's-inn-fields—Imp. in tanning hides and skins. (A com.)  
66. J. Conry, Manchester—Imp. in apparatus for communicating between the passengers and guard and guard and engine-driver on railways.  
67. C. H. G. Williams, 39, Regent-square, Gray's-inn-road—Imp. in the manufacture of dyes and colouring matters.  
68. W. Longmaid, Inver, Galway, Ireland—Imp. in hardening the surfaces of the rails of railways, and the surfaces of the tyres of railway wheels, and in charring the surfaces of timber to be used for railway sleepers and other purposes.

*Dated 11th January, 1861.*

71. W. C. Corsan, Sheffield—Imp. in stoves, grates, or fire-places.  
73. T. Bromwich, Bridgnorth—A combined apparatus for combing and cutting the hair of the human head.  
75. W. H. Muntz, Millbrook, Hants—Improved means of signalling or communicating with the guard or engine-driver in railway trains.  
77. W. E. Gedge, 11, Wellington-street, Strand—Imp. in weighing machines. (A com.)  
79. T. T. Chellingworth, 12, Buckingham-street, Adelphi, and J. Thurlow, 37, Belvidere-road, Lambeth—Imp. in traction engines.  
81. H. Pawsen, 117, Leadenhall-street—Imp. in scale beams and weighing machines.  
83. N. Ager, 77, Upper Ebury-street, Pimlico—Imp. in stoves and ranges.  
85. W. G. Woodcock, West Bromwich, Staffordshire—Imp. in wrought iron beams or girders and columns.  
87. M. A. Muir, and J. Melville, Glasgow—Imp. in looms for weaving.

*Dated 12th January, 1861.*

89. G. Whight, Ipswich—Imp. in sewing machines. (A com.)  
91. J. Charlton, Manchester—Imp. in the method of directing the streams of water employed in extinguishing conflagrations, and in apparatus connected therewith.  
95. E. F. Prentiss, Birkenhead—Improved apparatus for regulating the flow of gas, part of which is applicable to the valves of steam engines. (A com.)  
97. C. A. Girard, 17, Boulevard du Temple, Paris—Imp. in preparing colouring matters for dyeing and printing. (Partly a com.)

*Dated 14th January, 1861.*

101. V. Hall, Oxford-street—Imp. in obtaining colouring matters.  
103. H. Clifford, Greenwich—Imp. in apparatus to be employed in coiling and laying out electric telegraph cables. (Partly a com.)  
105. H. Weaver, New Maldon, Surrey—An imp. in window fastenings.  
107. J. H. Johnson, 47, Lincoln's-inn-fields—Imp. in machinery or apparatus for obtaining motive power. (A com.)

*Dated 15th January, 1861.*

109. J. Sidebottom, Harewood, near Mottram, Cheshire—Certain imp. in fire arms and ordnance.  
111. J. F. Spencer, Newcastle-upon-Tyne—Imp. in steam engines, and the machinery and apparatus connected therewith.  
113. C. B. Walker, 1a, Southampton-street, Strand—A novel mode of advertising, signalling, giving notices, or other communications.  
115. G. Davis, 1, Serle-street, Lincoln's-inn—Imp. in the manufacture of blades for knives, razors, swords, bayonets, and other similar articles, and in apparatus to be used in such manufacture. (A com.)  
117. M. Courmion, Libourne, France—Manufacturing tallow candles supporting a heat of 28 degrees, without greasing or adhering, and extracting from the moulds whatever may be the atmosphere every two hours.  
119. L. A. Bigelow, High Holborn—Imp. in the construction of certain kinds of passenger carriages. (A com.)  
121. E. Stevens, 5, 6, and 7, Cambridge-road, Bethnal-green—Imp. in machinery for preparing dough and paste.

*Dated 16th January, 1861.*

123. W. Coulter, 143, Everton-road, Chorlton-upon-Medlock, Manchester—An invention for the use of joiners, cabinet makers, and others, called a "bench hook."  
125. J. Reading, Birmingham—Imp. in swivels or fastenings for connecting watches to watch chains, for fastening articles of jewellery, and for other like purposes.  
127. J. Batley, Leeds—An improved manufacture of belting. (A com.)

#### PATENTS SEALED.

[From Gazette, January 25th, 1861.]

January 25th.	1896. T. Webb.
1813. J. Thompson.	1910. C. Stevens.
1825. R. A. Brooman.	1911. C. Stevens.
1841. J. H. Pape.	1926. G. H. Newton and A. Wild.
1843. L. Rome.	1998. J. Garnett.
1852. A. V. Donnet.	2098. C. J. B. Renault.
1854. A. Dixon.	2173. P. Richards.
1856. J. Goucher.	2191. D. Nicoll.
1859. F. H. Trevithick and R. Jones.	2351. W. A. Martin & J. Purdie.
1860. J. Willcock.	2524. W. Ramsell.
1872. J. C. Haddan.	2621. E. Sparkhall.
1873. J. T. Pitman.	2848. G. H. Cail.
1874. B. Arnold.	2886. J. H. Johnson.
1875. J. T. Pitman.	2973. W. T. Walter and C. Henij.
1880. S. S. Skipton.	

[From Gazette, January 29th, 1861.]

January 26th.	1999. R. Tempest and J. Tomlinson.
1829. J. Jeyes.	
January 29th.	2025. J. Newhouse.
1865. A. Ripley.	2105. J. H. Johnson.
1867. E. Partridge.	2553. J. Jack and D. Rollo.
1877. E. Billington.	

#### PATENTS ON WHICH THE STAMP DUTY OF £50 HAS BEEN PAID.

[From Gazette, January 25th, 1861.]

January 21st.	January 22nd.
122. W. Weild.	127. J. Gordon.
333. F. M. Baudoin.	

[From Gazette, January 29th, 1860.]

January 21th.	January 25th.
135. G. E. Dering.	136. J. Garnett.
149. J. W. Midgley.	152. P. Busi.

#### PATENTS ON WHICH THE STAMP DUTY OF £100 HAS BEEN PAID.

[From Gazette, January 25th, 1861.]

January 21st.  
162. J. Lockhart, Jun.

[From Gazette, January 29th, 1860.]

January 25th.	January 26th.
241. P. J. Meeus.	212. J. L. Clark.