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The History of the Public Analyst's Certificate, and Present Day Requirements

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A valid certificate of analysis is an important link in the chain of events leading to a successful prosecution under the Food and Drugs Act and even where no legal action is envisaged it is important that any objection taken to a sample under the Act must be set out clearly so that it is readily understood. As it is my long experience that an analyst new to this field of work frequently finds it difficult to have reliable information on the subject, I shall endeavour in this paper to set out the basic underlying requirements for a valid certificate. Some have urged over the years that the Association of Public Analysts prescribe a standard certificate, but such a format is already prescribed by law[1], and in view of the multifarious articles which are examined by Public Analysts every year and the number of possible irregularities it would be an impossibility to prepare a form of words which would cater for them all.

But first a little history.

The first Pure Food Act of 1860 required that an analyst receiving a sample taken under the provisions of the Act should issue a certificate of analysis. This was laid down in section IV which reads as follows:—

> IV. Any purchaser of an article of Food or Drink in any district, county, city or borough where an analyst is appointed under this Act shall be entitled, on payment to the Analyst of a sum of not less than two shillings and sixpence nor more than ten shillings and sixpence, to have such article analysed by the Analyst who may be appointed by such district, county, city or borough and to receive from such Analyst a certificate of the result of his analysis, specifying whether in his opinion such article is adulterated and also whether it is adulterated so as to be injurious to the health of people eating or drinking the same, and such certificate signed by the Analyst shall in the absence of any evidence to the contrary be sufficient evidence before the Justices or any Court of Justices of the matter certified therein.

No form of certificate or further guidance was given, and the Analyst was largely left to his own devices. He was, however, only specifically required to do two things:—

(i) to say if it was adulterated, and
(ii) to say if it was injurious to health.

Unfortunately, I have been unable to find any evidence of the form of certificate used by analysts in these formative years before the 1872 Act. The only reference to it is by Dr. Letheby, the Public Analyst for the City of London, who advised that certificates "*must be very clearly worded and state if the adulteration, if any, is injurious*". Even in these early days, however, certificates caused a good deal of controversy since they were regularly used for advertising purposes often for goods with which they had no connection. Hassall, a pioneer of food law enforcement, clearly suffered badly in this respect.

As is well known this Act became a "dead duck" within a very short time and it was not until 1872 that a second or really supplementary Act was placed on the Statute Book. The new Act again made no recommendation as to the form of certificate, nor gave any general guidelines on the subject. Although this Act was followed by a period of intense analytical activity and many prosecutions, the general judicial procedures adopted at the time left little opportunity for the defending lawyers to challenge certificates—let alone their format.

Unfortunately there are now very few copies of certificates issued under the 1872 Act still in existence. But one taken from the Appendix to the Report of the Select Committee[2] gives a general idea of the format used in those days. This reads much as follows:—

Chemical Laboratory and County Analyst's Office,
46, High Street, Sheffield.

In the Matter of an Act for the Prevention of Adulteration of Food & Drink and of Drugs (35 & 36 Vict. c 74). No. 1043:14 6 November, 1873. I hereby certify that in pursuance of the above-named Act of Parliament I have analysed a sample of tea, marked "*Finest Ping Suez Gunpowder*" received from Messrs. Davy Brothers, Sheffield Moor on 29th October.

The sample contained 59·05 per cent. of leaves and insoluble matter. The tannin amounted to 12 per cent., the ash, 7·34 per cent. The latter is more than a genuine tea contains, and I find that about one half per cent. of insoluble matter is present which may have been introduced accidentally.

The difference is not enough to condemn the tea, which I am of opinion is genuine.

William Baker,
Analyst for the Division of Upper Strafford and Tickhill in the West Riding of York.

This certificate relates to one of the disputed analyses which were the subject of some strong comments at the above enquiry, and from written comments on certificates of that time I would think it to be typical of the style and wording then used. It would be very ungenerous to comment much further on the wording of the certificate but I think it will be agreed that it shows very clearly how analysts were "feeling their way" not only in methods of analysis but also in framing and phrasing of such certificates.

In the Sale of Food and Drugs Act, 1875, a form of analyst's certificate was prescribed by law. The format was as follows:—

Schedule Sect. 18

Form of Certificate

To (*a*)

I, the undersigned, public analyst for the , do hereby certify that I received on the day of 18 from (*b*) , a sample of for analysis (which then weighed (*c*)), and have analysed the same, and declare the result of my analysis to be as follows:—

I am of opinion that the same is a sample of genuine

or

I am of opinion that the said sample contained the parts as under, or the percentages of foreign ingredients as under:

_____

_____

Observations (*d*)

_____

As witness my hand this day of

A.B.,

at

_____

(*a*) *Here insert the name of the person submitting the article for analysis.*

(*b*) *Here insert the name of the person delivering the sample.*

(*c*) *When the article cannot be conveniently weighed, this passage may be erased, or the blank may be left unfilled.*

(*d*) *Here the analyst may insert at his discretion his opinion as to whether the mixture (if any) was for the purpose of rendering the article portable or palatable, or of preserving it, or of improving the appearance, or was unavoidable, and may state whether in excess of what is ordinary, or otherwise, and whether the ingredients or materials mixed are or are not injurious to health.*

In the case of a certificate regarding milk, butter, or any article liable to decomposition, the analyst shall specially report whether any change had taken place in the constitution of the article that would interfere with the analysis.

The final version reproduced above is not very different from the one set out in the draft Bill which was criticised by the Society of Public Analysts[3], as follows:—

"The Bill contains, as a schedule, a proposed form of certificate which

document we reproduce below with the single remark that as a specimen of involved and impracticable absurdity it really is ingenious".

The Society was singularly successful in obtaining modifications of many of the provisions of the draft Bill and some of these are still the pillars of our present day legislation, but they were less successful in the matter of the form of certificate and had to be content with a slightly and only slightly, modified version. Defending lawyers were quick to realise that the presentation of a Public Analyst's certificate as given could be a valuable and indeed a powerful defence when all else failed. As a result, for at least seventy years a number of the cases which were referred to the High Court involved allegedly unsatisfactory analysis certificates. The form of the analyst's certificate is, therefore, of the utmost importance.

There is little point in enumerating all the different cases in which the substance of a certificate has been questioned, but one or two must be mentioned as they represent the basis of present day legislation. One of the earlier cases to be discussed in *The Analyst* was one involving A. W. Stokes who reported on a sample of fat-deficient milk as follows:—

> I am of opinion that the said sample contained the parts as under or the percentages of ingredients as under:—
>
> *Twenty five per cent. less than the normal amount of cream.*
>
> Observations
>
> *No change had taken place in the constitution of the Article that would interfere with the analysis.*

The Magistrate ruled that as the component parts of the milk were not given, the certificate was invalid. The local Government Board supported the Magistrate's ruling and a good deal of somewhat woolly discussion took place at one of the Society's meetings when the matter was raised. To my mind the very curious point which was not discussed was the use of the word "cream". At that time the Society had recommended a standard of 3 per cent. of butter fat for genuine milk and "cream" was a measure of that part of the milk which rose to the surface on standing, in the test designed by Sir J. Banks, and always contained a very variable amount of fat.

Following the form of the Official Certificate which required the "parts" present in the sample to be stated the following High Court judgment was given (*Fortune v. Hanson*, 1896).

The Public Analyst had reported:—

> "I am of opinion that the said sample contained the percentage of foreign ingredients as under:
>
> *5 per cent. of added water to the prejudice of the purchaser*":

It was held that this certificate was bad as evidence of adulteration, because it did not state the constituent parts of the sample analysed, and that in such a

case as this the constituent parts ought to be stated. In the course of his judgment, Hawkins, *J.*, commented:

> "If the analyst found in the milk some material substance which ought not to be found in milk at all, it would be sufficient for the certificate to state that the sample ..... contained so much per cent. of foreign ingredient, but when the magistrates have to decide whether the sample contained .....added water, the question becomes much more difficult, because water is to be found in milk in its most pure state.....I think the magistrates are entitled to inquire, and the Legislature intended they should have a statement in such a case as this, of the parts of which the sample was composed. Merely to say that a sample of milk contained five per cent. of added water is only to state the analyst's own opinion that water has been added. The magistrates have to exercise their own judgment on the question.....they ought to be informed.....what was the total percentage of water".

And Kennedy, *J.*, said:

> "Where the thing said to be added is one of the constituents of the article analysed.....the analyst.....must state the facts on which he has come to his conclusion sufficiently to enable the magistrates to come to a conclusion themselves".

To my mind the most far-reaching and most important judgment given in the High Court (*Lee* v. *Bent* and *Barlow* v. *Noblett*, 1901) was that of Lord Alverstone, *C.J.*, dealing with certificates of an analyst stating the opinions that

(*1*) *the beer contained arsenic.*
(*2*) *the beer contained a serious quantity of arsenic.*

His Lordship said:

> "We are all of opinion that the two certificates are not sufficient. It is very important that the practice should be uniform and we think it is clear that the certificate of the analyst must be a document in proper form and that the certificate ought to contain in it sufficient materials to enable the magistrates to form a judgment on those materials whether the offence charged has been committed".

Bearing in mind that the Act accepts the analyst's certificate as evidence of the alleged offence (without his appearance in court unless required by the defence), this pronouncement is really only very sound common sense.

Another judgment by Lord Alverstone was to the effect that an analyst is not permitted to add to his certificate in the witness box. He may obviously defend his certificate and the reasons for his opinions but he may not bring forward new evidence which could be prejudicial to the defendant. During the Second World War when we were fighting food substitutes I was on two occasions severely "taken to task" by leading Counsel—who obviously knew the law—when I tried to bring in additional condemnatory evidence in the

course of cross-examination and told in no uncertain terms that "I ought to know better".

Mention must also be made of a small point but one which is regarded by some lawyers as being of considerable importance. It arose as a result of a milk case where the High Court held "that the certificate was good but the existence of the Regulations of 1901 (Sale of Milk) does not do away with the necessity of stating the standard directly or implicitly in the certificate".

The Act of 1938

This form of certificate remained in force until the Food and Drugs Act of 1938, when a modified wording was introduced to take into account the changing nature of the work of the Public Analyst: a certificate requiring "parts as under" or "percentage of foreign ingredients" was completely unsuitable to report against a sample containing a few parts per million of, say, arsenic or lead.

The essential change was the introduction of the following wording:

"I further certify that I have analysed it, and as a result of my analysis I am of opinion that:—

it is a sample of

and/or

the constituents of the sample included the following substances in proportions as under:—

Observations (*a*)"

In regard to the last-section of the certificate (headed "observations") a footnote stated:

(*a*) *Here the analyst may insert at his discretion his opinion whether the analysis indicates any addition, abstraction, or deficiency of any kind and whether the addition, abstraction or deficiency (if any) was for the purpose of rendering the article portable or palatable, or of preserving it, or of improving the appearance, or was unavoidable. He may also state whether the addition, abstraction or deficiency is in excess of what is ordinary, or otherwise, and whether it is or is not, injurious to health, and add any other observations he may wish to make. Where a sample of milk is found to be deficient both in milk fat and in other milk solids the analyst should indicate how much, if any, of the milk fat deficiency he considers to be due to abstraction, allowance being made for the effect of added water. In the case of a certificate regarding milk, or any other article liable to decomposition, the analyst should specially report whether in his opinion any change had taken place in the constitution of the sample that would interfere with the analysis.*

Where the notes to the certificate are concerned it is interesting to observe that guidance is given in the case of a milk which is found to be deficient in both milk fat and of milk solids other than fat, and in certifying a fat deficiency which

may be due to abstraction allowances must be made for the effect of the added water. This is a point which is sometimes overlooked today. Furthermore, in enumerating the observations which the analyst may make on the inferences to be drawn from the results of his analysis, he is also entitled to "*add any other observations he may wish to make*". This very wide discretion was a new departure which was clearly necessary in view of Section 6 of the Act relating to misleading labels.

Those who can, will remember that this was the most valuable section of the Act in connection with the wartime food substitutes.

The Food and Drugs Act, 1955

One can now consider the present Act of 1955. The major change in the form of certificate was, of course, the provision of a "passing on" clause providing for the occasions when the analyst was unable to make an effective analysis. Slight alterations in the wording of other parts were made as follows:

> I further certify that the sample has been analysed by me, or under my direction, and as a result of the analysis I am of the opinion that:— (*a*)
>
> Observations (*b*)
>
> (*a*) *Here the analyst should specify the result of the analysis in the light of the Food and Drugs Act, 1955.*
>
> (*b*) *Here the analyst may insert at his discretion his opinion whether the analysis indicates any addition, abstraction, or deficiency or the presence of foreign matter or other defect and whether the nature, substance or quality is thereby affected; any physical, chemical or other properties bearing on the nature, substance or quality of the article; whether the article is injurious to to health or unfit for human consumption; whether and in what respect a label of description or any advertisement relating to the sample is incorrect or misleading; and he may add any other observations he may consider relevant.*

A further High Court judgment made in connectionw ith *Tolson* v. *Larcombes* (*Bellingham*), 1961, may usefully be included.

It ran as follows:—

> "Where the case is one of passing-off an imitation article for the genuine then it is sufficient if the Public Analyst, using the correct form of certificate, so certifies without giving full analytical composition details".

Present Day Certificates

The modern certificate of analysis, therefore, evolved as a result of High Court judgments, and in reality is the kind of statement which would be made if one were giving evidence in the witness box without a certificate.

The certificate, in my view, is divisible into three separate parts.

1. The results of analysis
2. Standards by which the results are judged
3. Conclusions

It will be realised, therefore, that there is no magic in this format which is only that which is commonly used in most scientific work of this nature.

It is pertinent at this point to discuss the amount of information required to be given in each section, bearing in mind all the time that the space available on the certificate is limited and, what is more important, that the Magistrate's require a clear and concise statement without any unnecessary padding. Taking the sections in order:

1. ANALYSIS. The amount of analytical detail to be given in the certificate has always been a subject of considerable controversy and readers may be interested to have the account of the discussion that took place at a meeting of the Society of Public Analysts in 1892[4]. The general theme of the discussion was—"Restrict analytical details to an absolute minimum"—mainly on the grounds that the more details given on the certificate the more points the defence have for cross-examination and the more "red herrings" that can be produced. These discussions took place before the High Court judgments given at the turn of the century, and these latter clearly killed for all time many of the very restricted views held by members of the Society of Public Analysts at the time.

The restricted information advocated by some Public Analysts at the meeting was clearly not in the interests of justice, and quite apart from the help which must be given to the Magistrates, the defendant also has the right to know the data on which the charge is based. My advice on this subject after many years' experience and from discussion with leading Counsel is—give sufficient information to establish conclusively the offence but omit information which will have no meaning to the lawyers, much less to the Magistrates.

As an example, let us consider sausages. The main statutory requirement here is meat content with the amplification of the proportion of fat included in it. With this in mind I would never advocate giving full analytical details on which the determination of meat content is based. Remember, two analysts rarely, if ever, get the same figures for moisture, protein, fat and ash in officially "divided" samples of sausages, but usually the meat contents agree very well.

In cross-examination the differences in, say, the protein can be magnified out of all proportion, with the sole intention of creating a doubt in the minds of the Magistrates.

Similarly, in fat analysis there is no point whatever in giving figures for the Reichert-Meisel or Polenske values since, usually, the bench is only concerned with the percentage of butter-fat. If such figures are given, arguments may well arise because the defending analyst finds slightly different ones, resulting in disagreement over the figures taken for normal butter.

This can only confuse the Magistrates, whereas if there is only a difference

in the amount of butter-fat to be considered then they can decide whose evidence they think should rightly be taken. Where certain items of analysis are specifically laid down in Regulations, then of course they must be given.

2. STANDARDS. The High Court judgments referred to earlier make it obligatory to quote the title of the relevant Regulations, or the Section in the Act and also the standard prescribed. Where no statutes exist then the analyst should state that, in his opinion, the article must contain x per cent. of the ingredient and give reasons for this opinion if possible. Remember that a "Code of Practice" should be referred to as "an opinion" since it is not legally binding.

Under this section reference would be made to claims as to composition or individual constituents made on the label or in advertisements distributed by the manufacturer or packer, or to any other information with which the composition of the article was to be compared.

3. CONCLUSIONS. Use of this section is more or less obvious. In it is set out the offence in quantitative terms, showing the percentage admixture, the deficiency from a prescribed standard, or the excess beyond a maximum allowable limit. If a percentage deficiency is given it should be made clear on what basis it is calculated, that is, on the whole sample or on the minimum requirement of the stated constituent.

It is clearly in this section that the Analyst should add an opinion on whether or not the label or the advertisement was misleading. The provision for a special section described as "Observations" is so unnecessary in a modern certificate that I never have it printed on my own official documents but only have it typed when it is required. I believe in any case that the footnotes (*a*) and (*b*) above could be worded much more precisely. Frankly this is not of great importance since High Court judgments have laid down very clearly what information the Analyst's certificate is required to contain.

Pork Sausages

As an illustration of the points discussed above a sample of pork sausages deficient in meat can be used as a simple example.

> ... and as a result of my analysis I am of opinion that the constituents of the sample contained the following substance in proportion as under:—
>
> Meat ..... 50 per cent.
>
> The Sausage and Other Meat Product Regulations, 1967 require that pork sausages shall have a meat content of not less than 65 per cent.
>
> The sample was therefore deficient in meat to the extent of 23 per cent. of the minimum amount proper to pork sausages.

Proprietary Medicine

Again, a proprietary medicine (tablets) found to be deficient in two of its

constituents can be used to illustrate cases which have been known to have caused uncertainty in the past when completing certificates.

... and as a result of my analysis I am of opinion that:—

these tablets had an average weight of 160 milligrammes

A tablet of average weight contained:—

Paracetamol	100 milligrammes
Ascorbic Acid	10 milligrammes
Phenylephrine Hydrochloride	3 milligrammes

The label on the bottle in which these tablets were sold stated that each tablet contained:—

Paracetamol	150 milligrammes
Ascorbic Acid	30 milligrammes
Phenylephrine Hydrochloride	3 milligrammes

The tablets were therefore deficient in paracetamol and ascorbic acid to the extent of 33 per cent. and 66 per cent. respectively of the quantities stated to be present on the label.

Milk

To illustrate the type of certificate used for an unsatisfactory milk consider the case of a milk which was originally deficient in fat before being watered. This example is instructive since, in my experience, the directions given in the notes to the 1938 certificate of analysis are frequently overlooked.

For years, even before the 1938 Act, I have reported in the following manner:

... and as a result of my analysis I am of opinion that the constituents of the sample included the following substances in proportions as under:—

Total Milk Solids	8·98 per cent.
Including	
Milk Fat	1·50 per cent.
Milk Solids other than Milk Fat	7·48 per cent.
Freezing Point	—0·466 °C (Hortvet)

and that it consisted of:—

Milk already deficient in Fat	43 per cent. not more than 88 per cent.
Added water	at least 12 per cent.

This opinion is based on the above results of analysis and on the Sale of Milk Regulations 1939 which presume minimum figures of 3·0 per cent. of fat and 8·5 per cent. of solids-not-fat for a genuine milk until the contrary is proved. The proportion of added water was confirmed by the freezing point of the sample.

Where unsatisfactory milks are concerned it has always been found better to reverse the order of items relating to standards and conclusions.

At this stage it must be admitted, immediately, that there are two schools of thought on the subject of the order in which the foregoing sections appear on the certificate; there are arguments for and against each of them and mercifully the matter has never been considered to be of sufficient importance to merit seeking the opinion of the High Court.

Sequence of Reporting

The sequence of reporting set out above, which I believe is the most logical, has been used for a lifetime, but not everyone would agree with it. There are some who prefer to present the conclusion as Section 1 and then proceed to explain how this opinion was reached. This school would certify, for example:

> . . . "as a result of my analysis I am of opinion that the sample of pork sausages was 23 per cent. deficient in meat"

and then give figures of analysis and official standards. It is argued that this form of certificate gives greater emphasis to the offence, which is immediately obvious and in the event of a "plea" the Magistrates need not read the whole certificate. This argument undoubtedly has points in its favour and in most cases it must be agreed that no serious objection can be taken to it. Personally, I regard this procedure as unscientific. Moreover, it can be definitely illogical in the case of a misleading label.

As an example, consider the report for a honey spread which makes a false claim for its content of Vitamin A and Vitamin C. The certificate would be framed somewhat as follows:—

> . . . and as a result of my analysis I am of opinion that the label on the jar in which this Honey Spread was sold was false and misleading.
>
> My examination of the sample showed that it consisted of a honey preparation containing:—
>
> Vitamin A . . . . . 10 international units per fluid ounce
>
> Vitamin C . . . . . 0·5 milligramme per fluid ounce
>
> The label on the jar in which this Honey Spread was sold stated "Rich in Vitamin A and Vitamin C".

The sample was merely described as "Honey Spread" and yet without any introduction whatever it is stated that the label was misleading. In my view, it is far better to give the results of analysis first then to describe the claims made on the label explaining why the vitamins were determined. This would be followed by an opinion as to the standard required to justify the claim of rich in vitamins and finally by an opinion as to the misleading claim.

Such a certificate would read as follows:—

. . . and as a result of my analysis I am of opinion that:—

it consisted of a honey based preparation containing:—

Vitamin A ..... 10 international units per fluid ounce
Vitamin C ..... 0·5 milligramme per fluid ounce

The label on the jar in which this Honey Spread was sold claimed it to be "Rich in Vitamins 'A' and 'C' ".

In my opinion in order to justify a claim for being rich in a vitamin the average daily intake of the foodstuff should provide at least half the average daily requirement of the vitamin. On the basis of the average daily intake of this spread being about two ounces the average daily intake of Vitamin 'A' would be 20 i.u. and of Vitamin 'C' 1·0 milligramme which amounts are far below half the average daily requirement.

I am therefore of the opinion that the claim "Rich in Vitamins 'A' and 'C' " is false and misleading.

The form of reporting that I am criticising apparently goes back to the early days in which the wording on the official certificate practically invited the analyst to say—"*This is a sample of pork sausages deficient in meat*". But the odd thing, however, is that the early editions of Bell's commentary, "*The Sale of Food and Drugs*", which include model certificates stated to be unobjectionable, gave examples largely based on the format that I have adopted.

For the benefit of the student and those in doubt I would only add that to more than a dozen of my certificates which have been considered by the High Court over the years no really valid objection has ever been taken.

Finally, where more than one offence is revealed by analysis each should be shown on the certificate. The existence of two deficiencies and/or, for example, the presence of non-permitted colour or preservative, are both part of the information revealed by analysis and must be shown in the results of the analysis; then, the facts having been revealed, the conclusion drawn from them must be given. If either of the facts or the conclusions are omitted the certificates can be claimed to be invalid in view of the judgment by Lord Alverstone previously referred to.

What is a sample?

I have been requested to include in my paper a few remarks on the important subject of "What is a sample?". I assume that this is prompted by the many "samples" which we all receive every year following consumer complaints. Let me say straight away that although everyone refers to them loosely as samples they are *not* samples which have been procured under the provisions of Section 91 of the Food and Drugs Act. This section describes a number of ways in which a true sample may either be purchased or taken from a bulk and such samples must be dealt with according to the provisions laid down in the appropriate part of the Seventh Schedule to the Act. They are also subject to some of the provisions of Section 108, such as the time limit after which no prosecution shall be commenced.

It should also be remembered that these special provisions also apply to private purchaser samples which are purchased from a bulk with the view to having an analysis made. Such samples are practically non-existent these days but the Act makes provisions for them.

That a sample submitted as a result of a consumer complaint is not subject to the provisions of these sections is supported by two High Court judgments, *Leach* v. *United Dairies* and *Breed* v. *Cricket Malherbie Limited.* It is regrettable that the latter case was not reported, particularly since the judgment made it clear that the use of the certificate of a Public Analyst in the prescribed form and reference to a "sample" in the Summons did not denote that strict sampling rules had been complied with. So much then on the subject of "what is a sample?" under the Act. Next comes the important question of how to report on them.

These *quasi* samples were referred to by one of our late Presidents, Mr. Donald Moir in his Presidential Address some years ago[5], and clearly he regarded them quite differently from myself. He recommended that the results of analysis should be given in the form of a letter to the inspector submitting the sample and not on an official certificate. This meant that the Analyst had to attend Court to support his certificate unless a "plea" was entered. I have always disagreed with this procedure and have taken the view that since proceedings are usually taken under Section (2) (1) of the Food and Drugs Act the certificate must be in the prescribed form; this of course has the additional advantage that the certificate is taken as evidence in subsequent proceedings.

The position with regard to certificates has changed to some extent with the Criminal Justice Act, 1967, which makes provision for a special Statement of Witness, thus avoiding the personal attendance of the Analyst unless specifically called. In spite of this, however, there are some solicitors who regard a certificate in the prescribed form of the Food and Drugs Act as a vital part of the case. Recent High Court rulings, however, would not support this view.

I also regard as *quasi* samples the private purchaser complaints in which the local authority acts as agents and lawyers. Remember, the complainant must agree to a prosecution being taken and give evidence of the purchase and the nature of the complaint. Accordingly the certificate of analysis is made out in the name of the purchaser or complainant. In framing the certificate the judgment of Lord Alverstone is taken into account, that the certificate should be a complete document and should give the magistrates sufficient information for them to form their own opinion on the nature and seriousness of the offence.

In order to comply with this judgment we break our usual rule with regard to the sequence of reporting and give a brief description of the nature of the sample as received and of the nature of the complaint. We regard this as being of the greatest importance with samples of this nature since some inspectors leave the sample some days before submitting it for examination and in the case of perishable foods it has changed out of all recognition by the time the case eventually comes to Court. Good photographs of the foodstuff as received by

the inspector can help enormously but often they have to be explained to the Court.

The following is the form of certificate which I employ—it should be noted that the document is made out in the name of the person submitting the sample.

CERTIFICATE

TO: Mrs. J. Smith, 42 Woodstock Lane, Witham, Essex.

I, the undersigned, Public Analyst for the County of Essex, do hereby certify that on the 1st day of March, 1973 a sample marked F.C. 105. 27.2.73

~~and weighing (or measuring)~~ was

submitted to me by you per Mr. B. S. Cooper

~~sent to me by~~ ~~to whom it was submitted by you~~

as a sample of Bread for analysis.

I further certify that the sample has been analysed by me, or under my direction, and as a result of the analysis I am of the opinion that:—

this sample consisted of approximately half a large white loaf which was submitted for examination following a complaint that it contained foreign matter.

My examination of the Sample showed the presence of a blackish pellet embedded in the crumb of the cut surface of the loaf near the bottom crust.

Further examination showed that the pellet consisted of a rodent excretion and enzymic tests show it had been subjected to a heating process consistent with its having been baked in the loaf.

Over the years many thousands of such certificates have been issued, several of which have been considered by the High Court and the procedure has always been regarded as being sound.

DISCUSSION

C. H. MANLEY: Could Dr. Hamence comment further on the difference between the wording in the Public Analyst's Regulations made under the 1955 Act and that in the Regulations made under the 1875 and 1938 Food and Drugs Acts, referring to "... analysed by me or under my direction ..."?

Secondly, in a case at Leeds, some years ago, a sausage was reported to have the composition

Meat	25 per cent.
Soaked Rusk and Seasoning	75 per cent.
Meat Deficiency = 50 per cent.	

The lay magistrates held that the deficiency was only 25 per cent. Which procedure would be more acceptable?

DR. HAMENCE: (1) This is a good point made by Mr. Manley and the form of certificate made under the Act of 1955 differed from earlier ones in that it regularised the position that the analysis could be made under the Public Analyst's direction and need not be performed by him personally.

(2) In my view the magistrates in the case quoted were right in view of the form of wording used; the analyst should have stated the deficiency as being 50 per cent. of the minimum quantity of meat prescribed by the regulations.

G. B. THACKRAY said that he used the column marked "private" for the reporting of "complaint" samples in a quarterly report, having regard to the fact that there appeared to be no other use for this column. Presumably, therefore, it was intended for this purpose.

DR. HAMENCE: I think it is wrong to include complaint samples under the heading "private". "Private" samples in the official schedule refer to samples which have been taken by a private purchaser from a bulk for the purpose of analysis and should be dealt with in the same way as samples taken by inspectors.

Clearly a further column is now necessary for these complaint samples in the schedule. We usually include them (wrongly I admit) under informal samples.

R. G. MINOR: I agree with the three basic principles stated, and with the elimination of all matter irrelevant to the demonstration of the offence. I am concerned that the Food and Drugs certificate used for 'informal' and complaint samples would require proving by oral evidence from the Public Analyst—to my knowledge a legality not yet tested in court. The risk is obviated by the use of the Statement of Witness form, which, if accepted by the defence, is acceptable as evidence. The attestation by the witness merely affirms that what he has stated is true to the best of his knowledge and belief. He is not thereby to be held responsible for the correctness of his conclusions so long as he believed them to be true. So the protection provided by Sect. 128 of the Food and Drugs Act is not invalidated, and only if he knew the statement to be false would he be liable to prosecution.

The Food and Drugs Act does not define "sample", and uses the word both for the article purchased and for the part of it following division—a point which might yet cause legal trouble.

DR. HAMENCE: It is our experience that in the case of "complaint" samples a certificate by the Public Analyst on the prescribed form is always accepted as evidence. A number of our certificates in such cases have been considered by the High Court and no objection has been raised either by defending counsel or their Lordships.

I agree that the Food and Drugs Act does not define "sample" but it lays down in very precise terms how a sample shall be dealt with and moreover a sample must be drawn from a bulk.

DR. E. C. WOOD: In dealing with "complaint samples" of the "mouldy meat pie" type or "glass in the bun" type, it is better to use the sort of statement permitted by the Criminal Justices Act, and to begin with a detailed description of the 'Specimen' (not Sample) submitted rather than to try to fit the report into the framework of the Public Analyst's certificate. Moreover, examination of the specimen may not be 'analysis', and it must be remembered that the certificate says—"I have caused the sample to be analysed . . .". One certificate of mine was criticised as invalid for this reason by the defence, and the Magistrates accepted this and dismissed the case.

On another matter, I wonder whether other Public Analysts, when making the quarterly report to the Ministry, include "Complaint" samples as 'Formal' or 'Informal'.

DR. HAMENCE: I agree that a Criminal Justice Act statement can be useful in dealing with complaint samples. The point I make here is that we reported such samples on an official form in the manner shown long before the Criminal Justice Act was on the Statute Book.

I agree that the wording of the official certificate of analysis does not fit in too well with our method of reporting.

When the 1955 Act was considered we tried very hard to get an alternative wording which could be used in the case of these samples, but we ran into great difficulty with the official draughtsmen and the project was finally abandoned.

We report complaint samples on the official schedule as informal.

J. MARKLAND: I speak as the Chairman of the Examination Board for the Mastership of Chemical Analysis, and I feel that I would have the support of the Board in commenting on this subject. Three principles have been expounded by Dr. Hamence, and I think it is true to say that no candidate has been failed on the style of a certificate. If the three principles are obeyed, the certificate concerned would not be rejected.

DR. HAMENCE: I agree with Markland's observations always provided that the points laid down by the High Court are complied with and that the certificates are sound.

F. C. SHENTON: This most interesting paper on the Public Analyst's certificate by Dr. Hamence has shown the different approaches to writing certificates. In order to assist candidates sitting for the Mastership examination, I suggest that the Association adopts a 'recommended form' of reporting.

DR. HAMENCE: As I have pointed out in my paper a recommended form of certificate would be difficult owing to the very wide variety of samples with which we deal. My own feeling is that once candidates understand the basic requirements which have been prescribed by the High Court no really serious difficulties should arise. The real trouble in the past has been that some candidates have had no idea of the High Court rulings on this subject.

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New Labs for Old

PRINCIPLES IN THE DESIGN OF A MODERN PUBLIC ANALYST'S LABORATORY

by MRS. A. PEARCE

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Details are given in Part 1 of the planning principles and the design of the custom-built Public Analyst's Laboratory recently opened in Portsmouth. Time-saving systems and specially-designed equipment are described. Part II will outline the introduction of the punch-card system for the processing of samples through the Department and will describe certain aspects of office and laboratory administration introduced to streamline efficiency in the new premises.

PART I: PLANNING AND DESIGN OF THE LABORATORY

Portsmouth appointed its first Public Analyst in March, 1873. Almost throughout the history of the Department, records show that the premises have been of a makeshift character, with limitations of space and inadequate working conditions. In 1941, the building was totally destroyed by enemy action and the laboratory was re-established in 1942 in temporary accommodation in Trafalgar Place, Portsmouth, at a total cost of £701. Twenty-six years later the "temporary" accommodation, considerably modified over the years, was still in use, antiquated when compared with some technical colleges and school laboratories. In 1967 there was an upsurge in new legislation affecting the work of the Public Analyst and it became obvious that with the increase in statutory duties, together with the development of modern analytical techniques, there was a demand for a higher standard of laboratory accommodation than could be provided in the existing premises.

Accordingly, a year later, the Council of the City of Portsmouth agreed to the construction of a new laboratory for the Department of the Public Analyst and Scientific Adviser. A considerable amount of thought and planning was devoted to the project, and it is to be hoped that this article may prove of some value to those few who are contemplating building new premises and in addition that the descriptions of some of the systems incorporated into the design and organisation of the building may be useful to established laboratories.

The City Architect (Mr. W. D. Worden) undertook the planning of the new premises and a brief was prepared by Mr. G. B. Thackray the present Public Analyst for Portsmouth.

Consideration of the flow of work through the Department, as shown in Fig. 1, established that it would be desirable for all the major laboratory functions to be on one floor, with offices and ancillary services on the ground

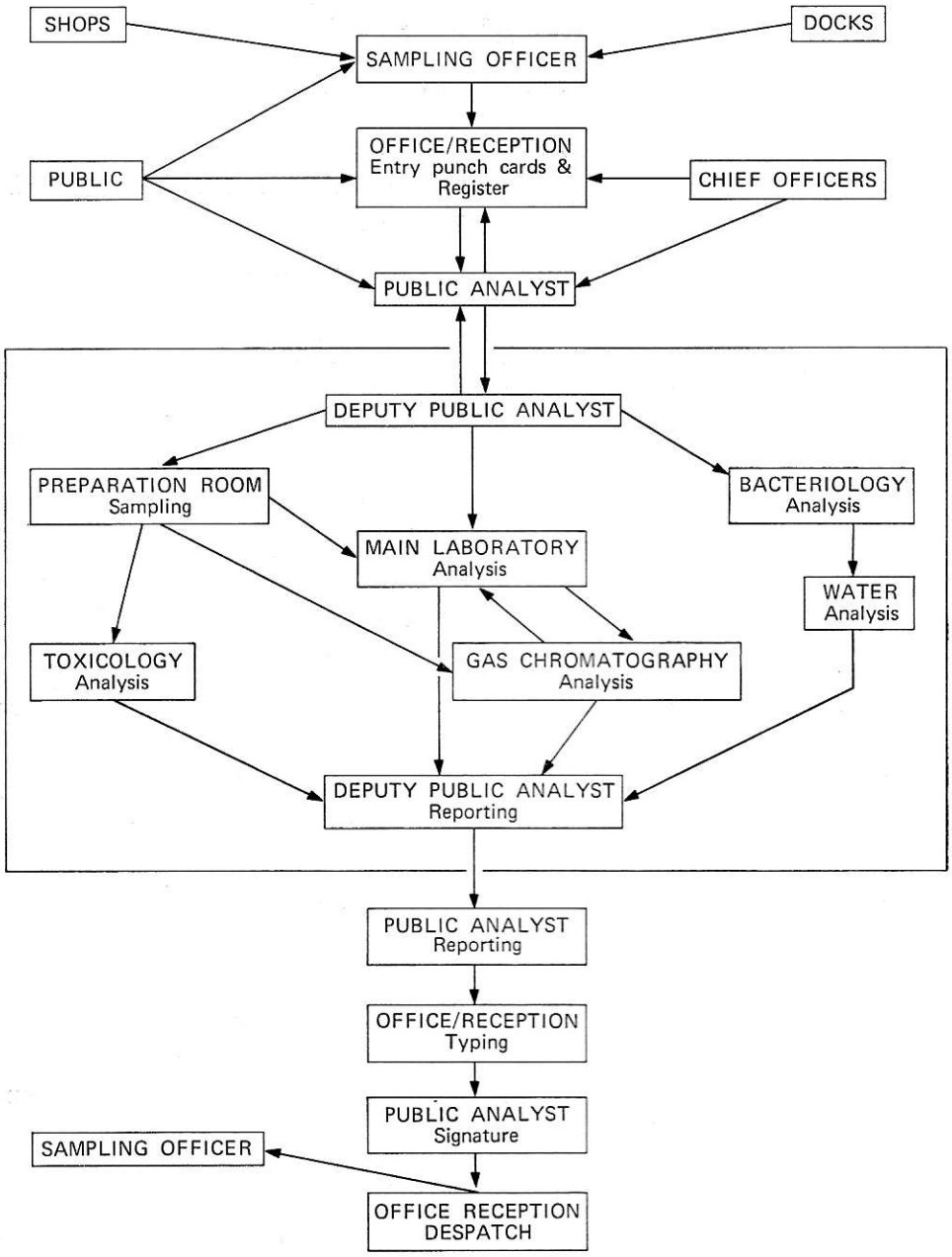

FIG. 1. Flow diagram of samples through the Department.

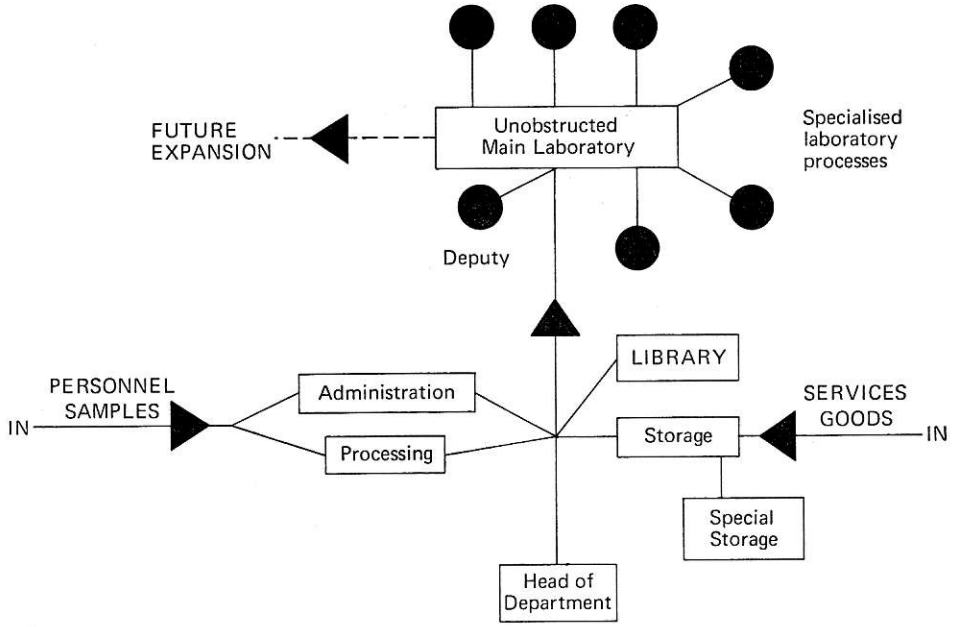

FIG. 2. Schematic layout of administration, laboratory functions and ancillary services.

floor. This is shown schematically in Fig. 2. A site analysis (see Fig. 3) to a large extent dictated the shape of the building with the service road to the north and the location of the front entrance at the south-west corner. The ground floor plan allowed a logical progression from either point of entry (see Fig. 4). The requirements for a natural sequence of operation, coupled with the desirability for maximum ease of communication between rooms, dictated the layout of the first floor. This is shown diagramatically on Fig. 5. There was also a need for a library/conference room in close association with the Office of the Head of the Department and which was also easily accessible from the Main Laboratory.

One important factor to be considered at the planning stage was that provision should be made for future expansion of the premises if the need for it arose. This has been achieved by arranging that the Main Laboratory and immediate ancillary rooms can be extended, on pillars, westwards over the car park area at first floor level allowing for an additional area of 3,000 sq. ft. Adequate provision has been made for services and, with some small additions, the air conditioning and heating plants are capable of dealing with the enlarged area.

The Public Analyst's brief specified the areas required for each of the rooms, and Table I details the final areas allotted. The brief contained a list of all the requirements for the benching, services and fittings. Sketch plans were drawn by the job architect (Mr. J. H. Wilson) and the Public Analyst was fortunate in

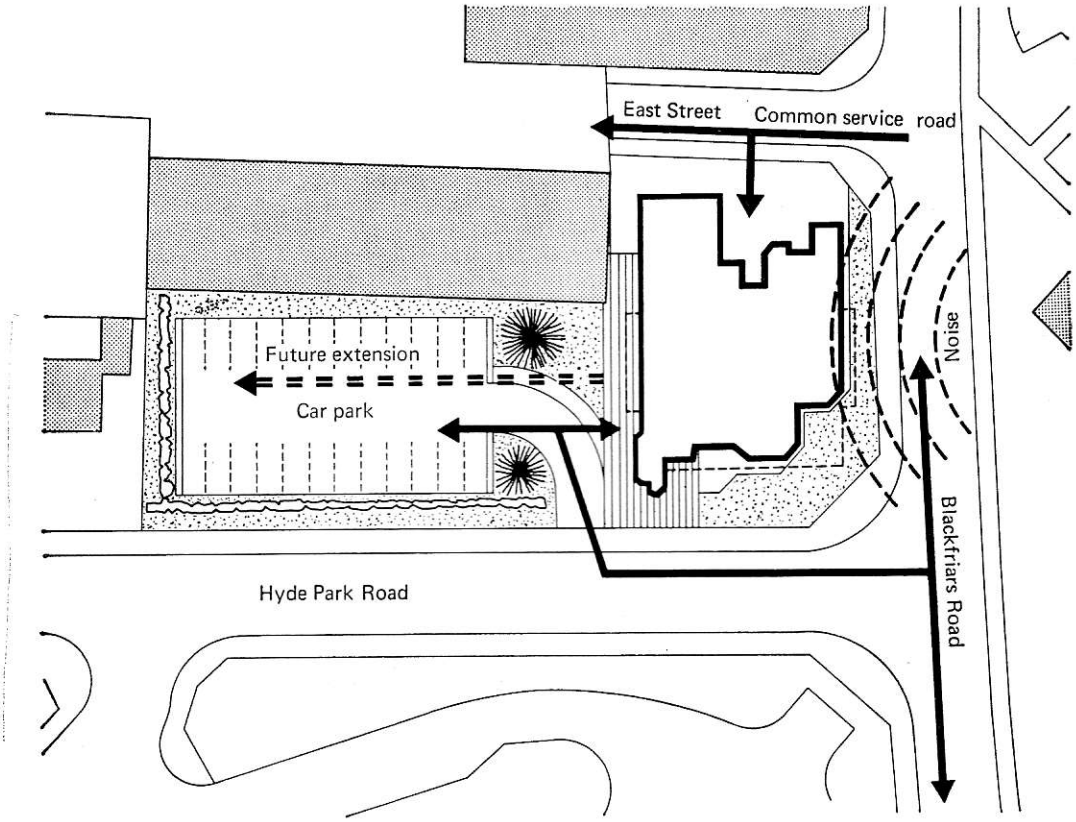

FIG. 3. Site analysis plan of building.

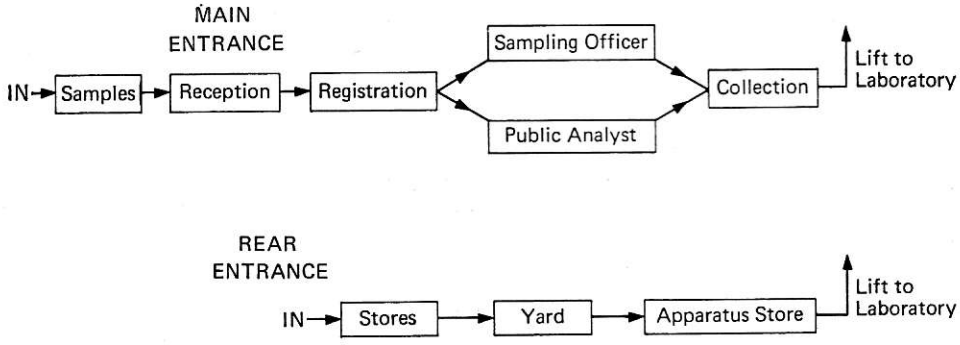

FIG. 4. Sequence of ground floor operations from either point of entry.

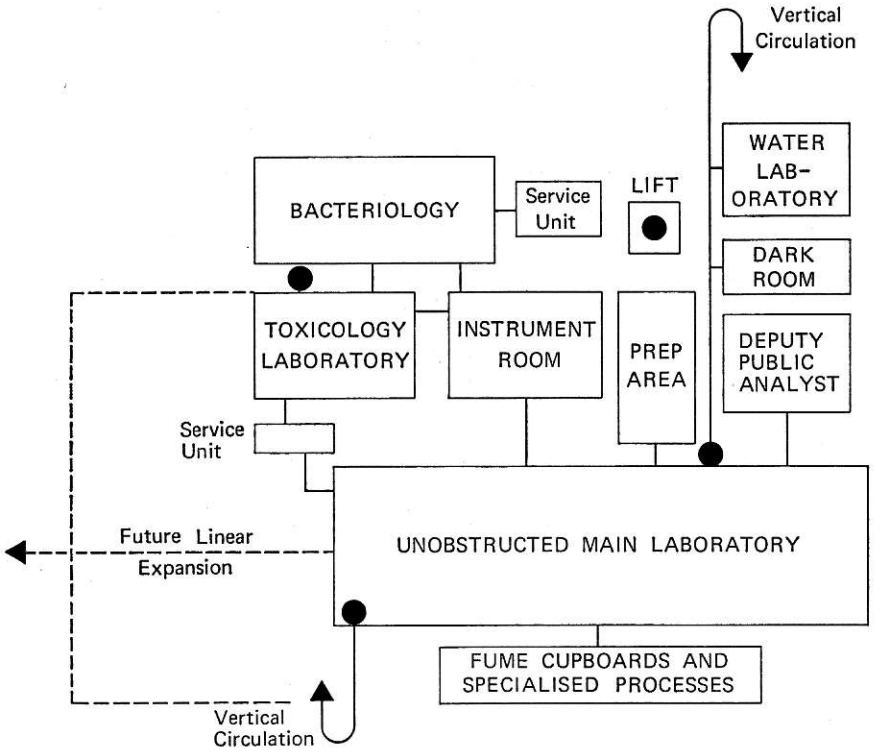

FIG. 5. Disposition of rooms on first floor with main circulation points.

that a very close liaison between the architect and the client existed at this early stage. The layout of the interior of each room was drawn to scale, to the nearest inch, by the then Deputy Public Analyst (Mr. A. J. Harrison) and the Author and included benching, sinks, fume cupboards, wall cupboards, under units, the siting of each electric socket, gas point, hot and cold water, vacuum and pressure points. Over the period of a year, working in close liaison with the architect, these two members of the staff produced floor plans and elevations for every laboratory, office and store room. The value of such close liaison with the architect at this critical stage of the planning cannot be too strongly emphasised. So often the client does not know exactly what he requires and it is left for the architect to interpret the brief in his own way. Since the experience of Local Authority architects is almost invariably associated with the design of school and college laboratories, the result would almost certainly have been a laboratory more suitable for teaching than for the specialised work of a Public Analyst. The members of the staff were able to specify precisely the content of each room and the siting of every item, having mentally operated in each laboratory, and bearing in mind the flow patterns of work and the principles of time and motion studies.

TABLE I

AREAS FINALLY ALLOTTED TO OFFICES, LABORATORIES AND STORES

Ground floor	sq. ft.	First floor	sq. ft.
Reception	200	Deputy Public Analyst	270
General office	470	Electrical switchgear	20
Public Analyst	300	Main Laboratory	1700
Sampling Officer	210	Wash-up	100
Library/Conference	540	Bacteriology laboratory	390
Servery	50	Sterilising room	140
Gas chromatography	300	Water laboratory	270
Apparatus store	250	Preparation area	340
Sick room	70	Dark room	90
Utility room	60	Instrument room	380
Stationery store	50	Toxicology laboratory	290
Ladies toilet	120	Plant room	500
Gents toilet	140	Circulation	100
Boiler room	200		
Solvent store	70		
Acid store	45		
Gas store 1	35		
Gas store 2	35		
Electrical switchgear	35		
Gas meter room	70		
Fan chamber	100		
Circulation	350		

As invariably happens in the planning of such a complex project, the quantity surveyor's job is extremely difficult. Many cuts had to be made at this stage in the re-planning of some areas, and many hours of discussion with the architect in order to achieve the original objectives. Finally, plans and estimates completed and Ministry approval granted*, the project was given the go-ahead by the City Council. Tenders were invited for the building work and for the laboratory furniture and fittings contracts. Messrs. Jno. Croad Limited, of Waterlooville, obtained the contract for the building at a cost of £162,000 and Messrs. Cygnet Joinery Limited, Bolton, were engaged to supply the laboratory furniture and fittings for a figure of £28,000. A sum of £8,000 was included in the overall estimate for the purchase, by the Public Analyst, of office equipment and furniture, and laboratory equipment. The building was completed in January 1973, at a total cost of £191,000 (including the price of the land).

The premises were officially opened on the 20th March, 1973, by the Chief Scientific Adviser (Food), Ministry of Agriculture, Fisheries and Food, Dr. G. A. H. Elton. The Lord Mayor of Portsmouth (Alderman Miss P. Lowe, M.B.E.) planted a tree to commemorate the 100th anniversary of the appointment of a Public Analyst in Portsmouth, celebrated in the same week.

The Laboratory is sited close to the Guildhall complex re-development area, the business heart of the city, and close to the main railway station and the Law Courts. Specifically designed for 20 analysts and support staff, the building shown in Plate 1, is of modern design, with car parking space for 24 cars.

* The Department of the Environment was the relevant Government Department. They sought the advice of the Ministry of Agriculture, Fisheries and Food, who, in turn, consulted the Government Chemist.

The surrounding areas have been attractively landscaped by the Parks Department. Natural lighting in the laboratory areas has been deliberately restricted in order to minimise heat loss during the winter and solar heat gain during the summer, glazing being of solar reflecting glass. All laboratory areas have colour-match fluorescent lighting.

Ground Floor

The floor finish to the ground floor administrative area and the library is of 100 per cent. non-woven, nylon carpet affixed to the floor screed and turned up 9 in. on wall faces to form a skirting. Wall finishes in these areas are of emulsion paint or vinyl wall paper on plaster, with some walls in red facing brick with recessed pointing. Ceilings are self-finish mineral tiles laid in a concealed suspended system to give a fire resistance and low flame spread classification. Services to the first floor laboratory are suspended below the first floor slab in the ground floor ceiling void.

Windows extend from floor to ceiling, and are double glazed, each with vertical sun blinds. Colour plays an important part in the furnishing of the ground floor offices. All woodwork is of mahogany and therefore, with red brick walls, inclined to be dark. Apricot and gold/brown tweed mixtures were chosen for all chairs in offices and the library, and the carpets vary in colour from room to room ranging from blue/green mixtures to blue/black and red/bronze.

OFFICES

The General Office, which is adjacent to a large reception area, is on an open plan and is designed for three office staff. All visitors to the Department report to the receptionist/typist. Contact between the ground floor staff and the first floor staff is maintained by the installation of a "direct speech, hands-free" intercommunication system. In all, nine stations are sited throughout the laboratory enabling direct communication to be made between members of the staff from all points. This instrument, supplied by Plessey Limited, is entirely electronic and controlled by the caller, using a press button. The person called need only direct his reply toward the instrument from the point where he is working. This was an important feature which governed the selection of this particular instrument. It is so designed that should a member of the staff be engaged when called, operation of a cut-out button informs the caller of this fact with an audible signal.

An office was allotted to the Sampling Officer but during the period of construction of the laboratory, he was transferred to offices within the Health Department and his room therefore became vacant. At the present time this office is used for the compilation of technical information, filing, cataloguing and general scientific support services to the laboratory.

THE PUBLIC ANALYST'S OFFICE

The Public Analyst's room is ideally sited and has pleasing architectural features. Incorporated into the design are wall cupboards with dividing

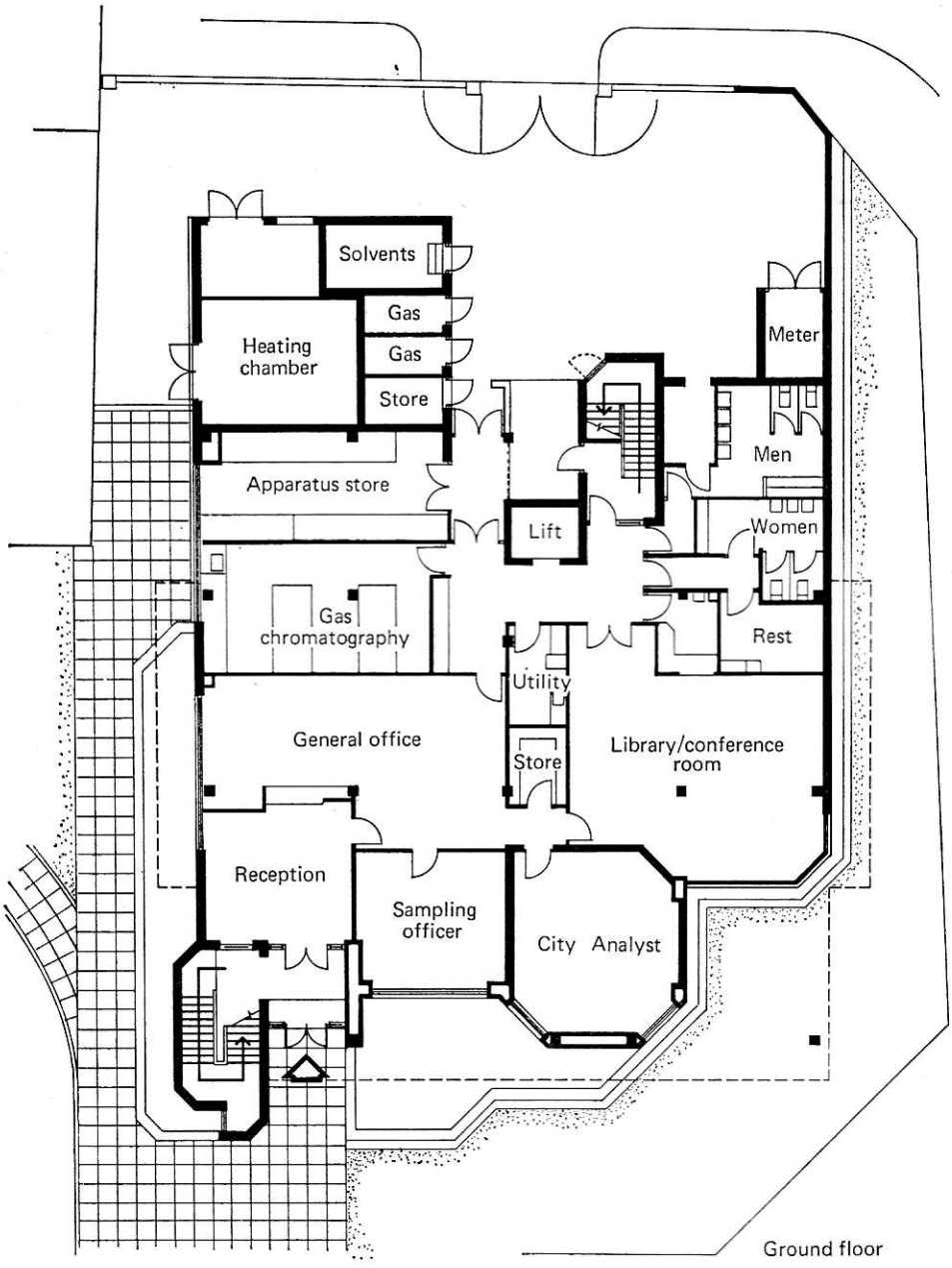

FIG. 6. Plan of ground floor.

shelves for the storage of criticised samples under the headings of separate authorities and quarters of the year.

THE LIBRARY AND CONFERENCE ROOM

The Library/Conference room (see Plate 2) has been designed to cover a variety of uses. Primarily intended as a library, with tables and chairs for literature research facilities for all members of the staff, it is also capable of seating up to 40 people for lectures. A large white "Magiboard" sited on one wall functions as a lecture "blackboard" or as a screen for slide and film projection. The small servery adjoining the room is completely self-contained, with a wash hand basin, and fitted under the formica-topped counter is a stainless steel sink and drainer unit. Facilities are available for serving light refreshments to staff and visitors to the laboratory.

STORES

At the rear entrance, all deliveries of stores, chemicals and apparatus are easily distributed to the various storage units. A metal roller shutter, adjacent to a small unloading bay, enables large cartons to be transferred easily to the unpacking area in the apparatus store or into the hydraulic lift (capable of holding seven persons) for transport to the first floor laboratory.

A large apparatus store, with deep, floor to ceiling cupboards, some with roller shutters and under-units containing plastic storage trays, allows stock glassware to be kept in ideal conditions for stock control. The storage trays are similar to those in the laboratory and are used to hold small items of ground-glass apparatus, corks, rubber tubing, etc. A small work bench, with storage facilities for tools, is also incorporated into the design in order that repair work on instruments and glassware can be carried out efficiently.

Stock bottles of acids are kept in a specially-designed store on the exterior of the building near the unloading bay. This room has a sloping, sunken floor and a cold water supply with drainage facilities for flushing down any accidental spillage of acid. Two small stores are provided to house spare gas cylinders, one for inflammables and the other non-inflammables. A third store is especially designed to contain all the highly inflammable solvents.

WASHING AND TOILET FACILITIES

In addition to the usual toilet facilities, a small sick room for ladies, with a divan bed, a wash hand basin and first aid facilities have also been provided. A utility room, with a stainless steel sink and double drainer, a sluice and a waste disposal unit, serves also as a store room for all cleaning materials and is sited opposite the lift for easy access to the first floor laboratory.

GAS CHROMATOGRAPHY ROOM

This is the only laboratory sited on the ground floor. In the original specification, gas supplies to the gas chromatography room and the toxicology laboratory on the first floor, were to be piped direct from cylinders in the outside

stores to the bench consoles for connection to the instruments. This dictated the positions of the gas chromatography room and the toxicology room. However, at the costing stage, this plumbing item was deleted from the estimates; subsequent information on the gas piping systems as envisaged has indicated that they would have been difficult to maintain and operate. It was nevertheless decided to leave the location of the rooms as originally planned, there being often obvious advantages in having the gas chromatography instruments separate from the laboratory. However, during the building programme, the work load for pesticide analyses of fruit and vegetables from the Port increased considerably and the function of the room changed from that originally conceived. Fortunately, the benching had not been fitted at this time and by rotating one bench through 90° analytical work as well as the preparation and extraction procedures for pesticides, could be easily accommodated.

The peninsular benches are 3 ft. 6 in. wide with a service console running along the back edge. Electric points, vacuum and pressure lines and gas points for cylinders are placed along the facia of the console. The wider bench allows for the GLC apparatus to be permanently set up with every facility for the supply of gas lines and for servicing the instruments from the rear. A small wood-framed fume cupboard is fitted at one corner of the room for solvent extractions, adjacent to a small work bench with a large sink and drainage area.

The pipelines from the gas cylinders are secured to a wooden batten fixed on the wall above the cylinders. They run along the wall, down to beneath the bench top, and along a duct to the console. At set points on the console, the one-eighth-inch copper piping emerges from the wood facia, held securely in place by small rubber grommets, and is easily connected to the instruments. The piping on the wooden facia on the wall are all covered with wooden strips to give a neat finish. Whilst the appearance of the room is perhaps somewhat marred by the presence of cylinders strapped to a batten on the wall, the system works efficiently and is easy to service.

First Floor

The wall and floor finishes to the laboratories are flexible P.V.C. with continuous welded joints, the exceptions being to wall areas adjacent to apparatus with a high heat output. The P.V.C. flooring is reinforced with a layer of woven fibre-glass and sponge backing to reduce sound impact transmission and to reduce fatigue. All P.V.C. walls are white with a grey fleck and floor coverings are grey/white, orange/white, green/white or blue/white. This variation in the colour of floor finishes was chosen to give the staff a feeling of change of environment in view of the all-white walls in each laboratory. The ceilings, as for the ground floor, include removable panels to facilitate access to the ducting and services located in the ceiling void.

SERVICES

The services are numerous and can be divided into three basic sections: supply, disposal and environmental control.

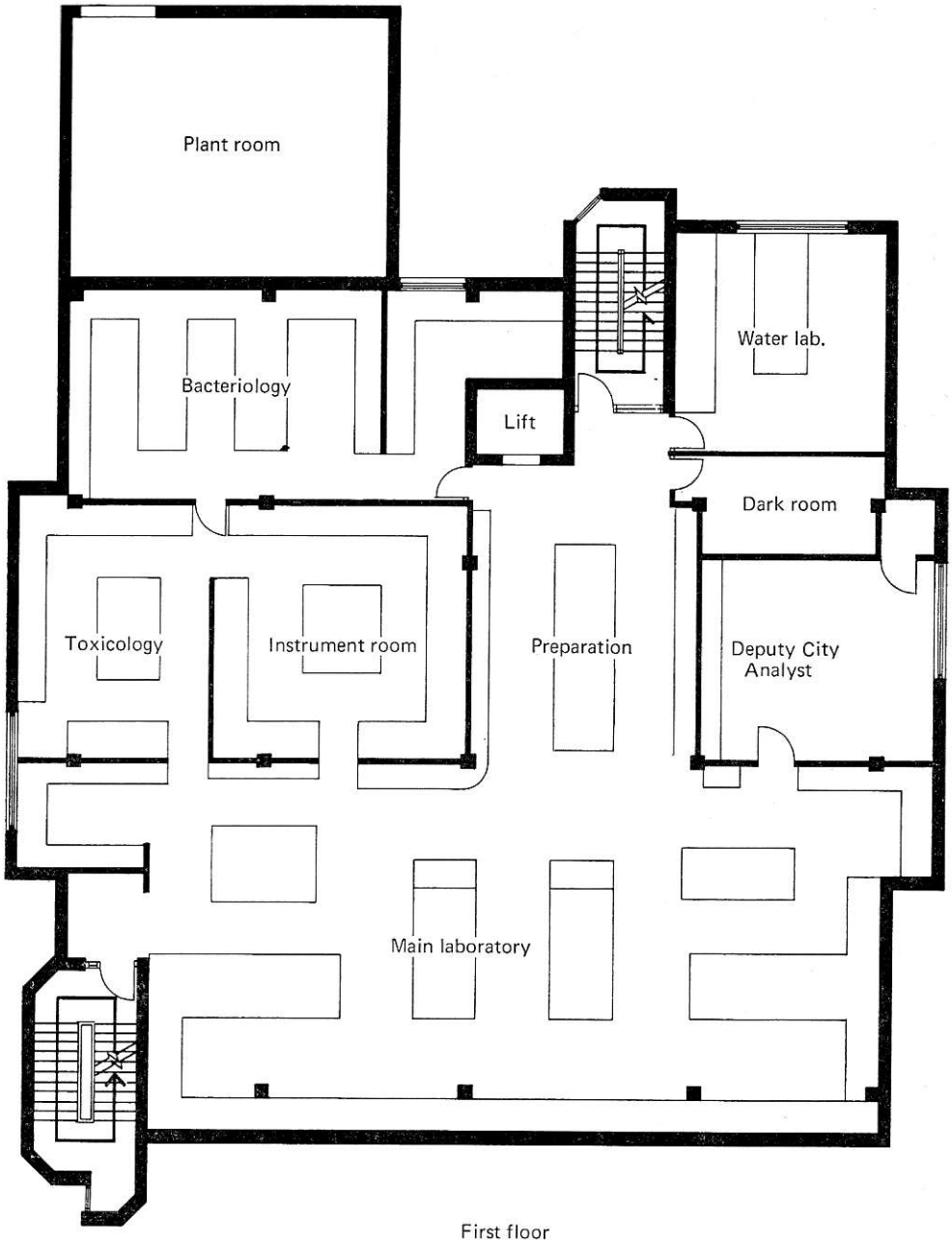

FIG. 7. Plan of first floor.

1. *Supply*

These are the services which are required by the staff and which are necessary for the functioning of the laboratories, and they include hot and cold water, electricity, together with various gases, compressed air and vacuum. In the laboratories alone, provision has been made for 160 double 13-amp socket outlets and 110 natural gas points excluding services to fume cupboards. This large number of points may at first sound excessive. It nevertheless enables the analyst to use electrical and gas equipment at any point on the working bench length without the hazard of trailing electric leads and gas tubing, and adds significantly to the efficiency of his operations.

2. *Disposal*

Drainage and waste disposal includes removal of general laboratory waste, soil waste and rain water. The last two are the normal requirements of any building and have been dealt with in the conventional manner. The laboratory drainage and waste disposal presents a special problem due to the corrosive nature and other deleterious effects of the materials conveyed. Copolymer polypropylene waste and fittings have been used throughout the laboratory, being a material which has the characteristic of excellent resistance to both organic and inorganic substances. Some difficulty has been encountered with these waste pipes which were welded on site. Unless the welding is carried out under strictly controlled conditions, the joints contract and leakage occurs. The effective repair of such joints is a problem which has not been finally resolved at this present stage. Screwed joints were originally specified but were deleted during the final cuts in the estimates. With the troubles already encountered this action now appears to have been a false economy. As it is not acceptable to discharge laboratory wastes directly into the sewer system, all waste from laboratory sinks and other such fittings is first led into one gallon glass dilution pots before being released into the main drainage system. There is also a requirement for disposal of solid waste matter from the laboratories and this has been achieved by the installation of the electric waste disposal unit in the utility room on the ground floor, to handle material which can be dealt with in this way.

3. *Internal Environmental Control*

Because of the nature of the processes carried out within the laboratory and the effect of the many heat-producing appliances, together with the need to produce stable and, in some areas, aseptic conditions, a full air-conditioning system has been installed. This not only has the ability to heat the air supply to the laboratories in cold conditions but will also cool the air in hot weather. Fume cupboards are provided with independent means of foul air disposal and are designed so that there is no draught or back-draught effect on the staff using them. The most difficult problem has been the accommodation of the services which require a large amount of space but need to be concealed for

FIG. 8. Storage tray under-units.

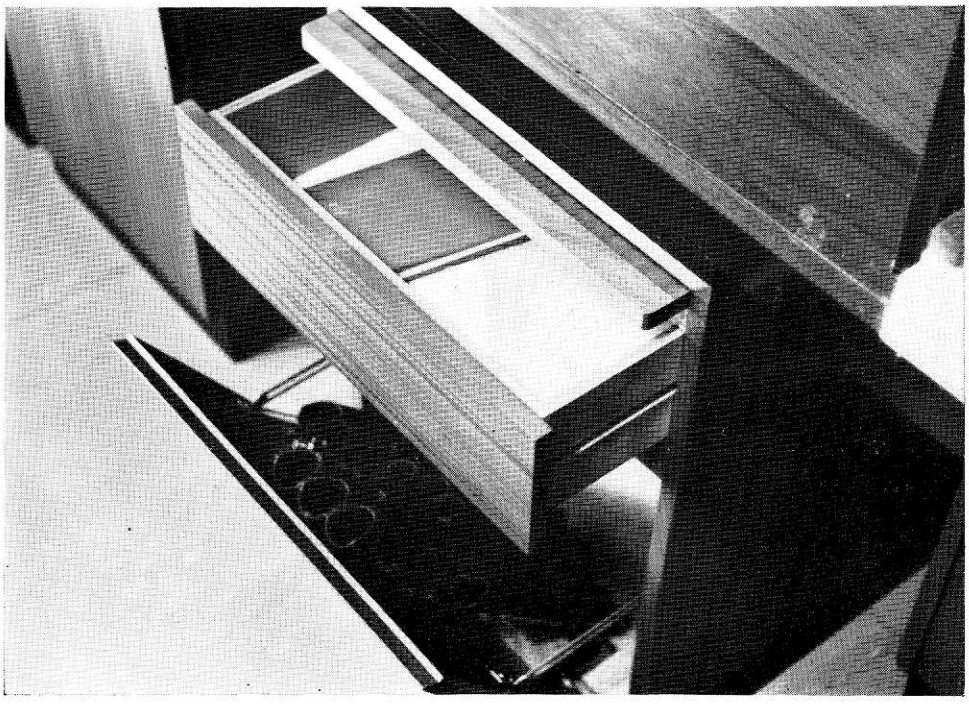

FIG. 9. Pipette units.

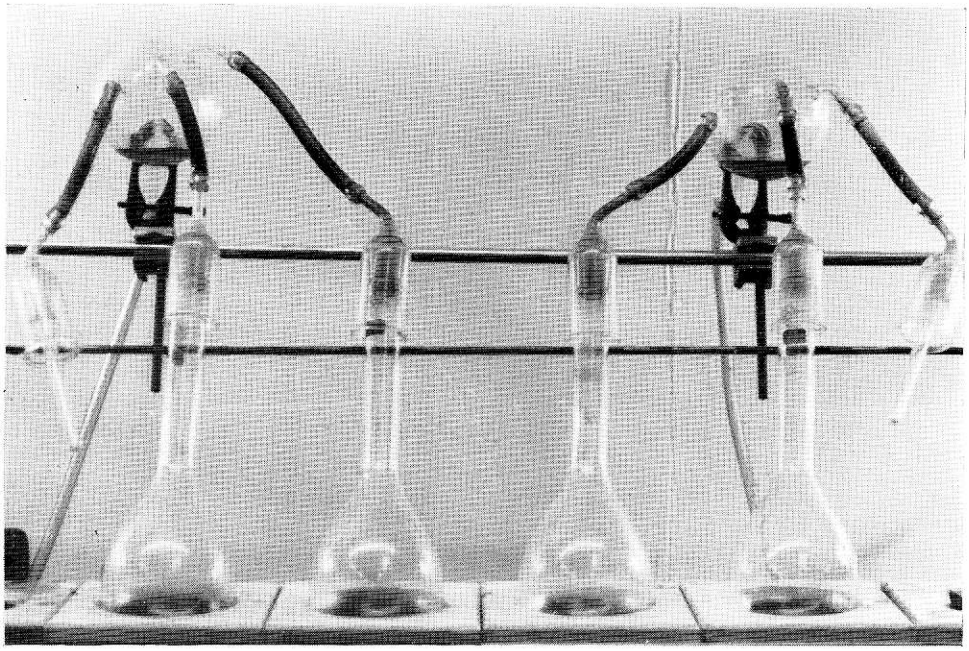

FIG. 10. Extraction assembly for Kjeldahl digestion unit.

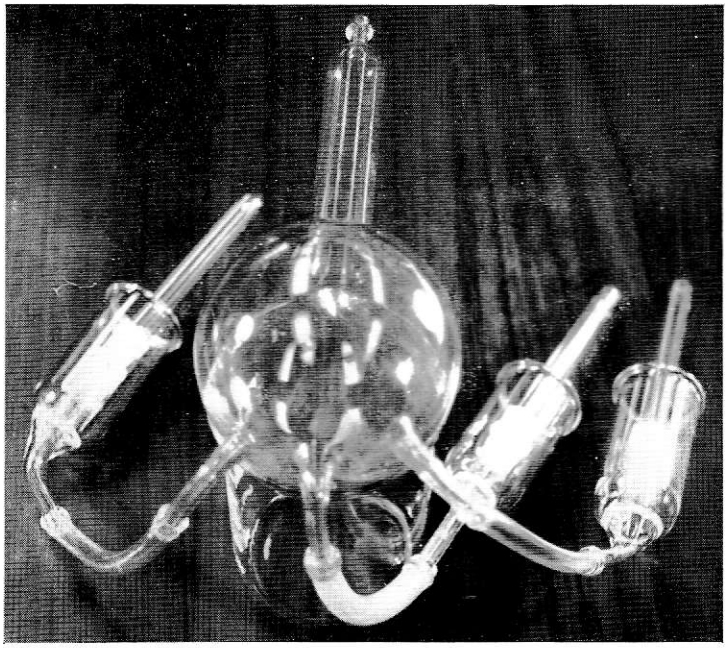

FIG. 11. Close-up of glass extraction assembly.

PLATE 1. Exterior view of New Laboratory.

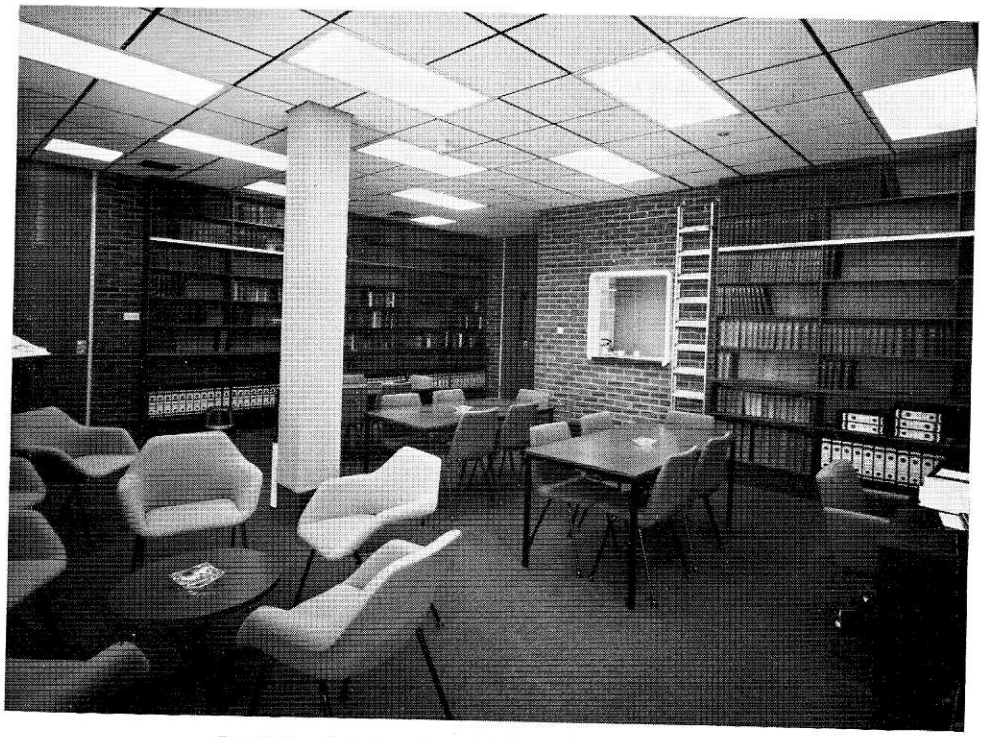

PLATE 2. Interior view of Library/Conference room.

PLATE 3. Interior view of Main Laboratory with part of Preparation area on the right and the Fume cupboard complex on the left.

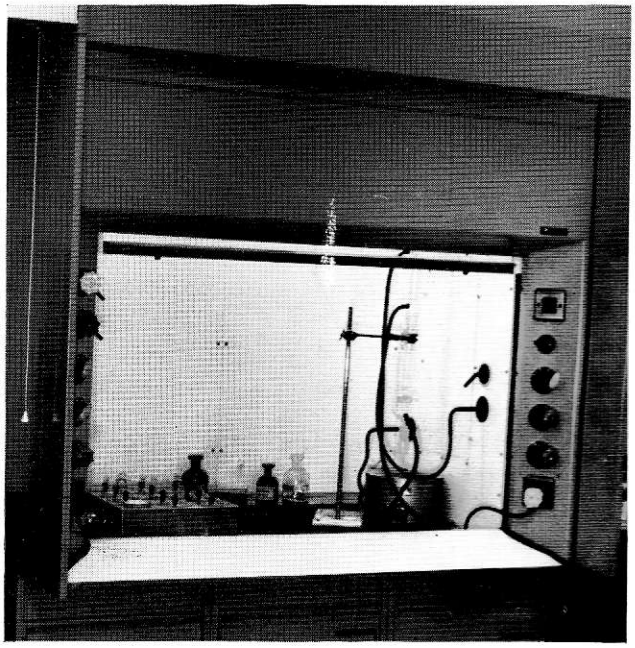

PLATE 4. "Airistocrat" fume cupboard.

aesthetic reasons, yet demanding easy access for repair purposes. This has been overcome in two ways. Firstly, all main runs are located in the voids above suspended ceilings and at ground floor level in floor ducts. Secondly, secondary service runs to outlet points on benches are taken from floor level along the wall behind benches in voids especially incorporated in the design of the bench fittings. Frequent access points are provided for maintenance purposes.

In a building of this nature there is a high degree of fire risk and the Chief Fire Officer and the insurers have insisted upon an efficient standard of fire detection. Accordingly, a system incorporating both heat and smoke detectors with a direct automatic call line to the fire station has been installed. Similarly, a burglar alarm system with a direct call line to the Police Station has also been incorporated into the building.

LABORATORY FURNITURE

The fitted benches are designed with fixed bench tops and module-type interchangeable under-bench units. A service console is fixed along the back of the bench top abutting the wall face with an inclined facia upon which are located the various service outlets. The bench tops generally are of hardwood (iroko teak) except where conditions of excessive heat or dampness occur, and in such places vitreous tile tops have been used. The under-units are 20 in. $\times$ 20 in. and 40 in. $\times$ 40 in., sapele mahogany wood, coated with polyurethane. All shelves are fully adjustable in all cupboards. Many of the cupboards contain plastic storage trays (see Fig. 8) for the storage of ground-jointed glassware and assemblies. This enables an analyst to place the trays on the bench when searching for specific pieces of glassware. Waste bins are standard throughout the laboratory, and have removable galvanised bins for ease of disposal of their contents. Units were designed by the staff to serve as storage for pipettes and also to provide a pull out flap (for writing purposes) and a personal drawer for each analyst. Pipettes are held in an upright position in polythene tubing of various sizes resting on a nylon mesh to allow the pipettes to drain (see Fig. 9). These units, when delivered on site, were not entirely to our specification but appear to serve the purpose adequately. All shelving throughout the laboratory is in black formica, being easy to keep clean.

THE MAIN LABORATORY

Totalling some 1700 sq. ft., the Main Laboratory is designed to accommodate 10 analysts in such a way that there is a minimum walking distance from any working bench to support services such as chemical stores, fume cupboards, ovens, balances and other facilities. The centralising of these items and the construction of the preparation area and instrument room enables all work benches in the main laboratory to be free from ancillary equipment, thus allowing each analyst the maximum amount of working bench, *i.e.* 12–14 ft. Throughout the laboratory, spaces between benches have been kept to the maximum and vary from 3 ft. in areas where there is little movement of staff,

to 4 ft. where the flow of work dictates continual use of gangways by the staff using service areas, stores and fume cupboards.

Each island and peninsular bench has a large sink unit with drainage area, with hot and cold water dispensed by a mixer tap, a cold water swan-neck tap for rinsing burettes, and a distilled water reservoir. The sink units have a cupboard under and a waste bin built into each side. Incorporated into the service console, which is either abutting the wall or along the centre of each bench, are small tun dishes with multi-outlet cold water taps. Each analyst has facilities for storing a basic set of glassware in under-bench units and a complete set of basic reagents on the shelves above the console. Surplus glassware is stored in units under benches in the Preparation Area.

Ovens, vacuum ovens, a muffle, together with a table top multipurpose centrifuge are located on a stainless-steel-topped bench at the western end of the laboratory adjacent to the balance bench and the instrument room.

On the south wall of the laboratory are two Morgan & Grundy* Airistocrat metal fume cupboards in coral and white finish. These have Klingenberg, acid-resistant, tiled bases and contain all services and lighting. A small pump is provided in one of the cupboards below, and is connected to vacuum and pressure points in the fume cupboard. Each fume cupboard has a remote-control fire extinguisher built into the side wall. Merely by pulling a handle, any fire in the fume cupboard is immediately extinguished by a blanket of bromotrifluoromethane vapour.

Between the two fume cupboards is the specially-designed Kjeldahl digestion fumehood and Argand bench for ashing samples. The Kjeldahl unit is of unique design and in practice has proved completely satisfactory. The hood has two small extractor fans and an auxiliary flow of air from vents in the front of the bench top. One of the three digestion racks and assemblies in use is shown in Fig. 10, the extraction assembly being held in place by laboratory scaffolding. After the initial stages of acid digestion are complete, the cap is placed over the top of the flask and suction applied by a glass water pump. Any caps not in use are plugged with specially designed polypropylene stoppers. Fumes are drawn along polythene tubing to the trap where the vapours or condensate are drawn off by the glass water pump. Metal pumps are obviously useless where these concentrations of acid are involved. The glassware was specially developed by Mr. Harrison and the Author to solve the problems of extraction of sulphur dioxide fumes. The prototypes were made by local firms†.

The Argand bench has one small extractor fan and auxiliary air flow via a vent in the back of the bench. It is specifically designed for the ashing of foods and accommodates Argand burners and a muffle furnace. All food samples after initial charring on Argand burners are placed into this first muffle so that any smoke emitted will be carried away by the extraction system. A muffle

* Morgan & Grundy, Ltd., High Street, Cowley, Uxbridge, Middlesex.

† R. J. Porter, T. W. Wingent (Scientific) Ltd., Portswood Road, Southampton; or M.W. Scientific Ltd., Broom Road, Parkstone, Poole, Dorset.

sited on the central west-end bench is only used for the final stages of ashing, because of the possibility of activating the smoke detectors.

At the eastern end of the laboratory an island bench contains all the facilities for Kjeldahl distillation and Soxhlet extraction. All apparatus for these determinations is stored in cupboards under the bench. Directly opposite this bench is one of two fully automatic titration benches as manufactured by Messrs. A. Gallenkamp Limited. A second titration bench is situated at the west end of the laboratory for general purposes. Also at the eastern end, a small area has been set aside for senior analysts to write reports. Facilities are provided for filing personal notes in a suspended filing drawer. This area is adjacent to the Deputy Public Analyst's office thus enabling contact between senior staff and the deputy at all times.

Situated at the western end of the laboratory is a wash-up service unit. This contains a stainless steel double sink unit with hot and cold water and a large drying cupboard of 32 cu. ft. capacity, with glass doors. Glassware requiring washing is placed, by the analyst, in nylon-coated-wire baskets on the sink units at the end of each work bench. The baskets, each marked with the name of the owner, are collected on a purpose-built trolley by the attendant and the contents washed, rinsed and placed in the same basket for drying in the cupboard. The dried glassware and basket are returned to the respective analysts who return their own glassware to store. Glassware taken from the reserve stock cupboard is marked with a black spot and sorted separately and returned to the respective cupboards in the preparation area by the attendant. The Main Laboratory contains one large refrigerator and two deep freeze units. An emergency shower is provided in case of serious laboratory accidents.

PREPARATION AREA

This area, being central to the first floor and directly opposite the lift, comprises the main servicing area for the whole laboratory. The senior technician and his assistant operate from this area providing a complete service to all the staff.

Inorganic and organic chemicals are stored in the wall units which have fully-adjustable shelves and roller shutters. The units below them contain stock acids, solvents and ancillary glassware. One end of the large island preparation bench is topped with black formica for sampling procedures, and the other end has the standard sink unit. Portable vacuum pumps mounted on small trolleys are stored under this section. They can be wheeled to any bench requiring vacuum or pressure and are easily fitted to piping under any bench to provide the service required via vacuum or pressure points on the console.

INSTRUMENT ROOM

This room, adjacent to the preparation area, contains extra wide benching around all walls. There is no console on these benches, the 25 double 13-amp

sockets are mounted in the wall, above bench level, allowing adequate space for all instruments to be accommodated in this room with ease.

One corner of the room is reserved for microscopy and two wall cupboards with glass sliding doors accommodate all reference specimens for the use of the microscopist. Many of the under-bench units contain filing drawers in order that manuals and standard reference curves can be readily to hand for each instrument.

The atomic absorption spectrophotometer has its own ventilating hood and a panel set into the wall is designed as a terminus for gases from the cylinders sited in the bacteriological laboratory. This is not an ideal situation but one which arose from the withdrawal of the gas piping system already mentioned. Fortunately, the modification works satisfactorily, but does produce areas in the bacteriological laboratory which attract dust and special care has to be taken to keep the cylinders clean.

TOXICOLOGY LABORATORY

As large numbers of toxicological analyses are carried out in the Portsmouth laboratory it was considered necessary to incorporate provision for this specific function. It is a self-contained laboratory with its own Airistocrat fume cupboard (similar to those in the Main Laboratory), a refrigerator, and a large wall cupboard with lockable roller shutters for the storage of reference drug specimens. One bench is of similar design to those in the Gas Chromatography room on the ground floor, one gas chromatograph being used for the detection of alcohol in Road Traffic Act specimens and another for the detection of drugs in biological material. Gas cylinders for these instruments are also held in the Bacteriological Laboratory and the piping arrangements are identical with those in the gas chromatography room.

The laboratory has an island bench with a central console but the sink unit is built into one of the side benches for convenience. The laboratory has direct access to the instrument room and for this reason the ultra-violet and infra-red spectrophotometers are sited adjacent to the connecting doorway.

BACTERIOLOGY AND STERILISING ROOMS

The Bacteriological Laboratory has a special filtered air system and is designed to accommodate milk analyses, bacteriological and chemical, and the bacteriological examinations of drinking waters, sea waters, swimming pool waters and ice cream. The room has two deep peninsular benches designed for bacteriology in that they have no central service console. One has gas taps only and the other gas and electricity. The wall unit has a full console and is equipped for the chemical analysis of milks. Prepared media are stored in the spacious units beneath the benches. Constant-temperature water baths are sited on specially framed units with suitably controllable multi-outlet taps and independent drainage facilities. The framed units are so designed that shelves act as temporary resting places for racks of media bottles or for tubes to

be placed in, or removed from, the water baths. All washing-up of media bottles and the preparation and sterilisation of media and ancillary equipment take place in the Sterilising Room immediately adjacent to the Bacteriological Laboratory. A stainless steel double sink unit with drainer provides excellent washing up facilities. An electric oven/steriliser and electric autoclave are positioned along one wall under an extraction hood and distilled water provided by a "Fistreem" still and deioniser is also maintained in this section.

DARK ROOM

Designed to serve two purposes, as a dark room for photography and also as a general purpose laboratory for analytical procedures requiring dim light, this room has no windows. It contains two benches, one for photographic processing, with a large sink and drainer unit, and the other a working bench with full console and under-bench units as for the Main Laboratory.

WATER LABORATORY

Specifically designed for water and effluent analysis, the laboratory has a filtered air supply similar to that of the bacteriological area. It is a self-contained laboratory with a stainless steel acid resistant Airistocrat fume cupboard with wash down facilities and all services. All benching and under-bench units are the same as those in the Main Laboratory. One bench, however, has no console and electric points are sited above bench level in order that ovens and incubators can be easily accommodated.

THE DEPUTY PUBLIC ANALYST'S OFFICE

The only office on the first floor, the D.P.A.'s room is tastefully decorated with green nylon carpet and vinyl papered walls. Besides the usual office furniture, a specially-designed storage unit for incoming samples is built along one wall with one end division designed to act as a bookcase. The decision to locate this office on the first floor was prompted by the need for a close working liaison between the Deputy and analytical staff at all items.

At the time of writing this article, the laboratory has been fully operational for four months, and already there has been a marked increase in efficiency and the turnover of work. Regular staff meetings are held in the library and these enable new ideas, methods of analysis and other information to be exchanged freely, resulting in a close-knit, enthusiastic working team.

The Author thanks Mr. G. B. Thackray, Public Analyst and Scientific Adviser for his help and encouragement and permission to publish this article.

Entry into the E.E.C. and its Effect on Official Methods of Analysis

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Based on a lecture given by the author at a meeting of the Association of Public Analysts at Heskin Hall, Eccleston, on 9th March, 1973

The Institutions of the EEC, and their working methods, are reviewed. Progress to date in the harmonization of technical standards with special reference to food is considered, and possible future developments are discussed.

The United Kingdom became a full member of the European Economic Community (EEC) on 1st January, 1973. However, in the preceding months UK delegates had frequently attended, as observers, meetings of working parties and expert groups and had been able to make important contributions to the business of the meeting. Many useful contacts have been established and a preliminary interchange of views regarding matters and methods of analysis has already taken place in a number of areas.

I was sent along with a number of United Kingdom, Irish and Danish Civil Servants on special attachment to the Commission of the EEC for a period of 3 weeks during January. The course consisted of a few days of semi-formal lectures and discussions on topics such as "Economic and Monetary Union", "The Common Agricultural Policy", "Foreign and Trade Relations", and "Regional Policy". This was followed by a period of about 2 weeks in which individuals were attached to Directorate(s)-General dealing with subjects of particular interest to the trainee. This enabled one to obtain a more detailed knowledge of the Commission and of its working methods. In this note I hope to give some information about the Institutions of the EEC, their working methods, and to speculate about possible future developments in areas which are of particular interest to food analysts.

EEC Institutions

These comprise:—

The Council of Ministers
The Commission
The Economic and Social Committee
The Parliament
The European Investment Bank
The Court of Justices

The first two of these institutions are of prime importance in the present context. The last four do not impinge greatly in areas of interest to us today,

except that the Economic & Social Committee and the Parliament have a right of consultation regarding certain aspects of policy written into the Treaty of Rome.

THE COUNCIL consists of Ministers of member states. Normally the Secretary of State for Foreign Affairs would represent his country except when the business of the meeting related, for example to agriculture or transport, when the appropriate minister responsible would speak on behalf of his government. The Council is the most important of the EEC institutions since it is the only body which is empowered to take decisions. Naturally, the administration of such a community is immense, and so the Council of Ministers has to delegate much of the detailed work of preparation of papers and policy formulation to the Committee of Permanent Representatives, who are ambassadors of member governments permanently resident in Brussels. Their main interest and competence is in the political sphere, so that technical matters are normally referred to specialist working groups. For example a standing committee *Denrées Alimentaires* meets twice a week to discuss problems associated with food. The topics under review vary from week to week and from day to day; similarly the make-up of the delegations is equally varied.

THE COMMISSION can be considered as a European Civil Service. Its function is to formulate proposals for approval by the Council. It consists of 13 Commissioners, each appointed for a four years term of office by member governments. Once elected, Commissioners are pledged to be independent of national interests. Each Commissioner is responsible for the co-ordination of work in a particular area but the Commission can only act collectively. The Commissioners are supported by a team of international civil servants divided into Departments known as Directorates-General (*D-G*). Responsibility in the food area is split between two Directorates-General, namely *DG III* Industrial, Technological & Scientific Affairs and *DG VI* Agriculture*. In the programme of work approved by the Council in 1969, *DG III* was made responsible for the following commodities: ice cream, sugar confectionery, chocolate confectionery, biscuits, casein, beer, mineral waters, extracts of tea and coffee, malt and tapioca. On the other hand, *DG VI* is concerned with butter, meat, cocoa, sugar, wine, milk, honey, vinegar, oils and fats, margarine and so on. The dividing line is not always clear to an outsider but in general, *DG VI* is concerned with prime agricultural products whilst *DG III* is involved with manufactured goods.

The Commission acts by means of REGULATIONS which are community laws and are legally binding on member countries, and by DIRECTIVES which are equally binding as to what has to be achieved but leave the national government free to decide on the means of attaining the required objective.

The *Treaty of Rome* can be considered as the rules of EEC club membership. It is concerned primarily with the broad objectives which the community should seek to achieve, leaving the details of implementation to decisions taken by

* Since this talk was prepared the *DGs* have been reorganised.

Council on proposals made by the Commission. Progress has been rapid in some areas but rather slow in others. One significant achievement was the 'common market' or customs union in which tariffs and quantitative restrictions on trade between Member Countries were removed in 1968. Since that time it has been realised that tariffs are not the sole barrier to trade. Varying standards from country to country can impose restrictions on trade just as much, and by creating conditions of unequal competition can indirectly affect the operation of a common market. Hence the Council has adopted a programme for the harmonization of technical standards in a number of different fields.

EEC Food Standards

Secondary legislation relating to food, which has already been enacted will now be discussed. The first directive[1] issued by Council on 23rd October, 1962 had, as its objective, the establishment of a single list of permitted colours for use in foodstuffs for human consumption. The requirements for acceptability, as in most countries, are that the colour must not be prejudicial to health and that its use must be economically desirable. Both general and specific purity tests were written into the order. For example the pure colour should not contain more than 5 mg of arsenic per kg or 20 mg of lead per kg. Limits for other mineral constituents such as antimony, copper, chromium, zinc and barium sulphate were fixed at 100 mg per kg with a limit of 200 mg per kg for whole list taken together. Cadmium, mercury, selenium, tellurium, thallium and uranium should be absent. Specific purity requirements included tests for aromatic amines and polycyclic aromatic hydrocarbons. Natural colouring matters, and those used for colouring the exterior parts of foods not normally consumed, are excluded. Subsequent amendments have been made to the permitted list, to the time scale of implementation, and for the establishment of agreed methods of sampling and analysis.

Similar restraints on the use in foods of preservatives (5th November, 1963) (with amendments) and antioxidants (13th July, 1970) have been promulgated. The list of permitted preservatives includes sorbic acid and its salts, benzoic acid and benzoates, and ethyl and propyl esters of *p*-hydroxy-benzoic acid and their salts. Vinegar, sodium chloride, ethyl alcohol, edible oils and sugars, nisin and certain other products are exempt. A supplementary list contains other compounds in which the preservative action is a secondary effect. Examples include sodium nitrite, sodium and potassium nitrate for use in conjunction with sodium chloride, and acetic acid and its salts, lactic acid and its salts, propionic acid and carbonic acid. The growing concern regarding the use of nitrites especially in infant foods is not reflected at present in the EEC Regulations. In the case of antioxidants, the permitted list includes ascorbates, tocopherols, gallates, butylhydroxyanisole and butylhydroxytoluene. The supplementary list includes sulphur dioxide, bisulphites, sulphites and lecithin. A further list of synergistic products details lactic acid and lactates, citric acid and citrates, tartaric acid and its salts, and orthophosphates. A fourth list of permitted solvents and diluents is included.

The Effect of U.K. Accession

As a consequence of our entry into Europe, we will have to adopt agreed community legislation. Under the Treaty of Accession changes will be introduced during the transitional 5-year period. There is a commitment to introduce legislation operative from 1st July, 1974 to replace the present Colouring Matter in Food Regulations, 1966[2] as amended 1970[3]. This will allow the use in food of certain coal-tar dyes not at present permitted in the U.K. A joint examination by experts will be carried out to determine whether any of the colours permitted in this country, but not at present under EEC rules, can be added to the list. It is hoped that this study will have been completed before the end of the 5-year period.

Progress to Date and the Immediate Future

As can be seen from the above, progress has been limited to areas in which relatively small numbers of compounds are involved. Agreement will be more difficult to obtain in discussions on emulsifiers and stabilisers, and on flavouring agents. Progress is likely to continue at a fairly slow rate partly as a result of the complex nature of the subject under discussion, and also because of the lengthy procedure required to achieve unanimity agreement at the final stage. Where unanimity is not required under the Treaty obligations, current practice is nevertheless to seek a solution acceptable to all member states.

Existing U.K. legislation will undoubtedly be modified over the years as a result of EEC entry and one possible development is the inclusion of approved methods of sampling and of analysis in new regulations, similar to the situation under the present Fertilisers and Feeding Stuffs Acts. Standards of purity for additives will also be specified. In most cases these 'official' methods of analysis are likely to be very similar to existing methods approved by International Expert Working Parties set up under the auspices of bodies such as Codex Alimentarius, the International Standards Organisation, and the Association of Official Analytical Chemists (of America). Such methods, however, can be time-consuming and great care is required in their specification. Further difficulties can arise through translation differences and it is important that they should be thoroughly tested *in toto* prior to adoption. Britain and the other entrant states have much to offer Europe in the formulation of new directives to prevent adulteration, fraud and injury to the consumer. We have a long history of enlightened concern both in the administration and the enforcement of food regulations, and in the application of science and technology to manufacturing processes and to analytical methods.

The Author thanks the Government Chemist for permission to publish this paper.

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2. "Colouring Matter in Food Regulations, S.I. 1966, No. 1203". H.M.S.O., London, 1966.
3. "Colouring Matter in Food (Amendment) Regulations, S.I. 1970, No. 1102". H.M.S.O., London, 1970.

Book Review

LABORATORY TECHNIQUES IN FOOD ANALYSIS. By D. PEARSON. Pp. 315. London: Butterworth and Co. Ltd. 1973. Price £6·50.

According to the author's preface, the principal aim of this book is to assist the technician in carrying out the routine analysis of foods, and it appears admirably suited to fulfil not only this, but also the secondary objective of providing a practical manual for students of food science and technology. Its primary concern is with practical methods of analysis intended for the quality control laboratory, but it can hardly escape comparison with the same author's *Chemical Analysis of Foods*. Both books deal with much the same subject matter, so that there is inevitably some duplication of material, and the arrangement is similar, but the emphasis is different; they are, in fact, complementary and seem to stand in an almost tweedledum-tweedledee relationship.

The first chapter is an admirable exposition of the principles of quality control and sets the tone for the book—the maintenance of standards and the avoidance of variation in the product. The rest of the chapter headings are virtually the same as those in the earlier book, but more attention is given to practical detail and rather less to discussion, some consideration being afforded to the assessment of certain raw materials and the control of products during manufacture. The shift in emphasis is well illustrated by a comparison of the length of similarly headed chapters in the two books. The chapter on 'General Methods' occupies 50 pages, as against 22 in the *Chemical Analysis of Foods*, and most of this increase is taken up with more practical detail. On the other hand, the chapters devoted to 'Food Additives and Trace Elements' have been reduced from 84 pages to 41.

Basic chemical methods are given adequate coverage, but instrumental techniques, such as gas-liquid chromatography and atomic absorption spectrophotometry, which are now becoming commonplace, are not dealt with. At the end of the book there are some useful appendices and, of course, a set of logarithmic tables.

There is little of which one could seriously disapprove in this book, but two minor points that attracted the reviewer's attention were as follows:—

(*i*) On page 115, it would have been helpful to have had the saturated solution of thiourea listed among the special reagents in the quercetin method for the determination of tin, and

(*ii*) On page 227, Method 8.8 is headed 'Estimation of Thiamine in Flour', but thereafter, vitamin B_1 is referred to as aneurine throughout the method. It would have been preferable, and less confusing, to have adhered to one name or the other.

One minor irritation in the very early part of the book is the use of the adverb 'also' as the initial word in a sentence. In the first 24 pages, this occurs no less than thirteen times (once, even, as the first word in a paragraph), a stylistic idiosyncrasy which not only suggests that the sentences in question were afterthoughts, but tends to distract the reader's attention and turn him into a compulsive 'also' hunter. Fortunately, the remainder of the book seems relatively free from this blemish. There were, too, occasional instances where awkward constructions tended to jar, as on page 53 where one is exhorted to 'Avoid the material clinging to the neck of the flask'—an instruction which is mildly ambiguous.

In general, proof reading seems to have been well done, only three errors having been noted. On page 175, in the first sentence, 'place' appears instead of 'plaice', while in the last paragraph of page 256, the word 'sauces' in the second sentence should surely be replaced by 'pickles'. In the first paragraph on page 208, something appears to have gone wrong with the typesetting of the third sentence.

The book is well-produced, clearly printed and the arrangement logical and uncluttered. The instructions are clear and moderately easy to follow, but they could have been made more so by the use of shorter paragraphs; this, however, would have added marginally to the expense of production. References seem to be adequate and are tidily collected at the end of each chapter.

S. J. BUSH.