

A general-practice laboratory

An initial six-year review

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THE main factor which started our group-practice laboratory in 1966 was the intermittent withdrawal of general-practitioner laboratory facilities by our local hospital through staffing difficulties. The hospital is ten miles away and is the nearest of three serving the practice.

We decided that a limited pathology service could be arranged within the practice and a small room was converted. The equipment we have gradually acquired was financed by work undertaken privately for local industry and also a research project carried out for a leading drug firm. In 1968, when the practice premises were expanded, the laboratory was moved upstairs into a larger room as shown in Figure 3.

Staffing

The laboratory was established by one of us with previous experience of laboratory procedures. The work has subsequently been carried out voluntarily on a part-time basis with the valuable assistance of a Danish friend who previously worked in a hospital laboratory in Copenhagen.

Equipment

The initial equipment was a monocular microscope, a Sahli haemoglobinometer, a haemocytometer (Neubauer), a bunsen burner and a home-made sedimentation rack, enabling us to undertake the following tests: haemoglobin, red and white cell counts, ESR, and urinalysis. As we developed, the range of investigations increased.

We gradually acquired the following:

- | | |
|--------------------------|-------------------------|
| 1. Centrifuge | 5. Incubator |
| 2. Grey-wedge photometer | 6. Refrigerator |
| 3. Hot air oven | 7. Stop watch |
| 4. Water bath | 8. EEL colorimeter |
| | 9. Binocular microscope |

This has extended the work to include:

1. Bleeding and clotting time
2. Blood sugar and glucose tolerance curve
3. Blood urea
4. Uric acid
5. Cholesterol
6. Bilirubin
7. Alkaline phosphatase
8. Serum glutamic pyruvate transaminase

9. Examination of vaginal swabs for *Trichomonas* and *Candida*
10. Cultures of urine and other swabs
11. Bacterial sensitivities
12. Identification of assorted parasites
13. Culture for dermatophytes

Ready-poured plates are purchased from Oxoid Ltd. for bacterial cultures and sensitivities, and request/report forms are printed locally and fit into the patients' record cards.

Analysis of laboratory workload

The total number of investigations carried out in the laboratory annually is shown in Figure 1.



Figure 1.

The total number of tests in 1966 was 1,455 and this rose to 3,481 in 1971. A significant change has also occurred during this period in the relative proportions of National Health Service and other investigations, the ratio changing from 0.8 : 1 in 1966 to 8 : 1 in 1971.

Initially the laboratory served a two-man practice of 3,400 patients, and at the end of the period under review the practice had increased to four partners with a list of 10,300. From 1968, work has also been undertaken for the other group practice in the town, serving a population of a further 7,500.

Parallel with this fivefold increase in population served, Figure 1 shows an eightfold increase in National Health Service investigations.

The investigations undertaken can be conveniently considered under three sub-groups, namely, haematology, biochemistry and bacteriology. We have illustrated the relative contributions of the three subgroups to the total workload in Figure 2.

The graph shows that during the six years there was a 74 per cent increase in haematological investigations, an increase of 187 per cent in biochemical investigations and

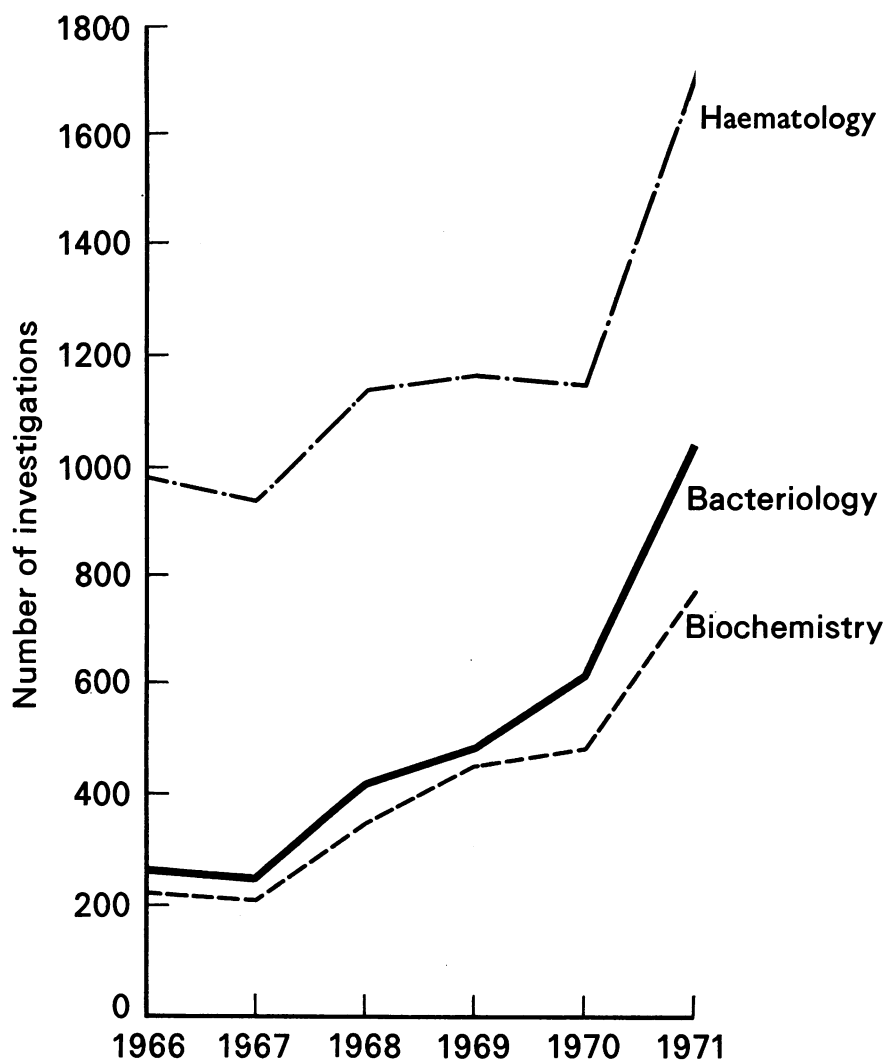


Figure 2.

an increase of 311 per cent in bacteriological investigations. The relatively smaller increase in haematology is in large part due to the fact that there was a marked decrease in the number of haematological screening tests done for local industry in 1971 compared with 1966.

An analysis of these three groups, on an average monthly basis, is shown in the following three tables:

TABLE 1
HAEMATOLOGY

	Average number of tests per month					
	1966	1967	1968	1969	1970	1971
Hb	22.1	22.8	30.8	30.1	31.8	49.7*
RBC	1.3	1.8	3.1	4.3	4.8	8.0
Total WBC	20.7	17.8	20.4	22.3	20.2	32.2
Differential WBC	20.2	16.6	18.1	19.8	16.5	18.6
ESR	12.3	16.6	18.6	18.1	17.3	25.5
Films	0.8	0.6	1.9	2.2	3.3	6.0
Others	4.0	2.4	1.2	0.8	1.0	1.3

Others include: platelet counts, bleeding time, clotting time, PCV and reticulocyte counts.

* As might be expected, haemoglobin estimation is the most commonly requested investigation. This reflects the stress laid by McAlpine *et al.* (1957) on the need to estimate haemoglobin to detect anaemia rather than to rely on clinical assessment. The routine screening of antenatal patients for grouping, antibodies, WR and anaemia is not done by the laboratory, but monitoring of the treatment of pregnancy anaemia is included.

TABLE 2
BIOCHEMISTRY

	Average number of tests per month					
	1966	1967	1968	1969	1970	1971
Urinalyses	17.1	17.4	24.7	29.4	31.2	53.0
Blood glucose	—	0.1	1.3	2.3	3.8	3.0
Blood urea	0.1	—	0.3	0.8	0.6	0.4
Serum uric acid	—	0.1	0.9	—	0.2	1.5
Serum cholesterol	—	—	1.5	3.4	2.8	1.4
Liver function tests	1.2	0.6	—	2.8	1.4	2.2
Occult blood	0.6	—	0.4	—	0.4	2.2

Liver function tests include: alkaline phosphatase, Van den Bergh, serum bilirubin, and serum glutamic pyruvate transaminase.

The routine screening of antenatal patients and the use of the dip-stick tests in the consulting room are not included in the above analysis but follow-up investigations of any abnormality are undertaken by the laboratory and are included in the above figures.

We realise that in hospital laboratories, urinalysis is usually the province of the bacteriologist, but we have classified it under biochemistry because from the general practitioner's point of view, especially those using the dip-stick method, urinalysis is purely a biochemical procedure.

TABLE 3
BACTERIOLOGY

	Average number of tests per month					
	1966	1967	1968	1969	1970	1971
Urine microscopy	17.8	18.1	25.8	27.8	28.9	48.6
Vaginal films	—	—	0.4	2.6	2.5	4.5
Other films	0.1	—	—	0.7	0.8	0.3
Urine cultures	2.4	1.8	7.7	4.5	12.1	20.0
Vaginal swab cultures	—	—	0.4	1.2	1.5	3.3
Other cultures	—	—	0.8	1.1	2.6	3.4
Sensitivities	0.3	—	—	1.1	1.8	4.5

'Other' refers to faeces; sputum; aural, pharyngeal, throat, conjunctival, urethral, dermal, nasal, rectal and wound swabs; cultures of skin scrapings, hair and nails for dermatophytes and identification of assorted parasites.

We have observed that one of the bacteriological advantages of the laboratory is the avoidance of the deterioration of specimens in transit, which as MacNaughton, *et al.* (1965) point out, may involve swabs drying, contaminants multiplying, and pathogenic organisms perishing. The figures for the three months following the period under review show a further increase of about 29 per cent in the specimens cultured.



Figure 3. The laboratory

Advantages of the integrated laboratory

We believe that there have been considerable benefits in having a laboratory within the practice unit which we summarise as follows:

1. To the doctors

- (a) We can confirm with confidence previous observations (Hunt, 1951; MacNaughton *et al.* 1965; and Knox, 1966) that the laboratory has heightened clinical interest—it has been revealing for instance to observe the effects, sometimes striking, on the white cell pattern of a variety of self-limiting and sometimes obscure viral infections.
- (b) The ability to obtain results rapidly—as for example with vaginal swabs, or a white cell count in a pneumonia or a possible appendicitis in a young patient.
- (c) A degree of independence from hospital-laboratory difficulties and hours.
- (d) More complete and comprehensive clinical control of diseases such as diabetes and rheumatoid arthritis has been made easier.
- (e) There are advantages to a teaching practice. The laboratory was of noticeable interest to trainee applicants when interviewed and has been a valuable adjunct to the

training programme during the past five years. As stated in the Royal College of General Practitioners' Reports from General Practice No. 13 *Present State and Future Needs* (1970) "To train doctors in the methods of modern medicine and then to deny them the simple tools of their trade is absurd. The general practitioner requires on-the-spot facilities for haemoglobinometry, urinalysis, cardiography, simple tests of respiratory function and under some circumstances certain bacteriological techniques." It is our experience that the laboratory has been an aid to trainees in adapting their hospital experience to the needs of the general practice.

(f) Research possibilities. Some research work has been done, but the potential for research offered by the laboratory is not, as yet, fully explored. This is due in part to coping with the inevitable problems of a rapidly expanding practice and also because we have concentrated our interest on widening the range of investigations.

(g) The cementing of inter-practice co-operation. This has been a pleasing by-product.

2. *To the patients*

Some of these are implicit in what has been stated above; other advantages are:

(a) Earlier and more accurate treatment is often received.

(b) Some patients show overt anxiety at the prospect of a visit to hospital, whatever the reason, and in many others this fear is unvoiced. Having the laboratory housed within a familiar environment helps to alleviate the apprehension patients feel while awaiting tests or results. These observations amplify those of Knox (1966).

(c) Patients are more likely to receive appropriate investigations because doctors are less concerned about the possibility of inconveniencing them.

(d) There is considerable saving of patients' time, and indeed money, particularly in rural areas with inadequate public transport. Often the taking of a specimen or attendance at the hospital laboratory entails at least half a day lost from work.

3. *Advantages to the hospital service*

(a) Relief of work load to hospital laboratories. Some idea of the extent of this relief may be gauged from the fact that over 3,000 National Health Service tests were performed by the practice laboratory in 1971.

(b) Good and easily obtained facilities for investigating patients reduces the hospital outpatient referral rate (Darmady, 1964).

Discussion

We are aware that there will always be certain limitations with a laboratory such as we have described. To attain its full potential it is essential to have cordial relations and close co-operation with local hospitals. It is invaluable to have support in checking standard solutions, to be able to discuss methods and equipment, verify unexpected results and, on occasions, receive advice on interpretation of results.

It is inevitable that many of the more complicated and expensive investigations will continue to be performed by specialist laboratories but we are of the opinion that the majority of the tests most often needed in general practice could be carried out within the practice itself. This is supported by the observations of Eimerl (1962) that nearly 90 per cent of practitioners' requests are for simple investigations like haemoglobin estimation and urine microscopy. Often these requests are made simply because they do not possess a grey-wedge photometer or even a microscope as their counterparts do in other countries. The 1971 Liverpool study by the London School of Hygiene and Tropical Medicine showed that over half the general practitioners in England and Wales do not own a microscope and only 31 per cent have a haemoglobinometer.

In Australia (Geyman, 1971; Royal College of General Practitioners, 1970) and Canada (Royal College of General Practitioners, 1970; Mowat, 1972) 'It is common for the groups working in country areas to have their own pathological laboratories with the aid of laboratory technicians'. In the United States of America many single-handed practitioners undertake a more comprehensive range of tests than performed in our own laboratory (Eimerl, 1962; Geyman, 1971). The only European country which we know where laboratory facilities exist in primary medical units is Sweden—and there, only in certain rural areas (Smith, 1971).

Relying, as we have done, on voluntary expertise, it has been possible, even without financial aid, to provide the range of investigations described. The provision of a more comprehensive service to include, for example, screening for infectious mononucleosis, pregnancy tests and more routine bacteriology, has been limited only by financial considerations.

However, to enable the concept of the practice laboratory to develop in this country two requirements must be met. The first is the provision of adequate finance and the second is the availability of trained staff. Economic reasons are usually put forward for the central provision of diagnostic facilities. We believe that there are equally convincing economic grounds for financing practice laboratories, particularly in rural areas. In our experience the practice laboratory has reduced the number of emergency admissions, outpatient referrals and the need for transport of patients and specimens. Possibly however, the most significant saving is the reduction in the number of working hours lost for patients. We therefore feel there is much to be said for the comment in a report of the Royal College of General Practitioners that "While it may be cheaper to treat more patients centrally in larger specialist hospitals, it may be cheaper still, and more conducive to preserving health, when fewer patients are treated in hospital anywhere because family doctors have been provided with more and better diagnostic and treatment centres."

For staffing the laboratory the trend has been to encourage married women doctors, nurses and health visitors to return to part-time work. A similar untapped reservoir of married laboratory technicians must surely exist and could be used. Much can also be done by a suitably trained nurse or receptionist.

The view that health-centre laboratory facilities are grossly under-used (Thompson, 1971) is not supported by the experience of the Darbshire House Health Centre in Manchester, where the use of their laboratory and x-ray equipment has enabled the centre to reduce their referral rate to 30 per cent below that of the country as a whole (Honigsbaum, 1972). The under-use of the laboratories described by Thompson is probably due to the fact that, in contrast to the Darbshire House Health Centre, there was no technician on the premises.

The future trend in many areas of the country seems to be towards large health centres with laboratory facilities serving populations of 80,000 and over. The Royal College of General Practitioners in its report *Present State and Future Needs of General Practice* (second edition) states that it is uneconomical to provide these services for populations under 50,000. We disagree with this, and feel that our six-year experience of serving a 3,000–17,000 population shows that laboratories of the size and scope described are both feasible and desirable.

Summary

This paper reports investigations in a general-practice laboratory and the advantages to both doctors and patients.

An analysis of the laboratory work load is presented but no attempt has been made to assess the clinical information obtained from this work; we hope to do this later.

We hope our experience will stimulate discussion as to whether financial provision should be made to develop and run practice laboratories in health centres and group practices. In particular, we believe this is worth consideration in rural areas where hospitals are distant and communications and transport may be difficult.

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SCREENING PROGRAMME FOR PREVENTION OF DOWN'S SYNDROME

The feasibility of a preventive programme for Down's syndrome is analysed. Whereas estimates show the incidence of the condition to be declining because of demographic factors relating to maternal age, prevalence is rising strikingly because of increasing survival. *It is the predominant single cause of severe mental subnormality.*

Strategies for prevention are considered. Prevention of conception could prevent a third of cases at best, but it is most unlikely to achieve as much. Intervention after conception by prenatal diagnostic screening is made possible by amniocentesis and karyotyping. Almost total prevention of Down's syndrome could be achieved by screening all pregnant women. Five aspects of a prenatal diagnostic screening programme are reviewed; amniocentesis, laboratory screening by culture and karyotype, induced abortion of affected fetuses, the development of a comprehensive service, and evaluation of efficacy and ethics.

It is concluded that a preventive prenatal diagnostic screening programme is feasible. The ethical constraints are the same as those on elective abortion in general, and depend on the laws and values of the society considering the programme. An outline is given of a proposed programme for New York City.

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