

# GROWTH AND MATURITY, METAMORPHOSIS OR EXTINCTION?

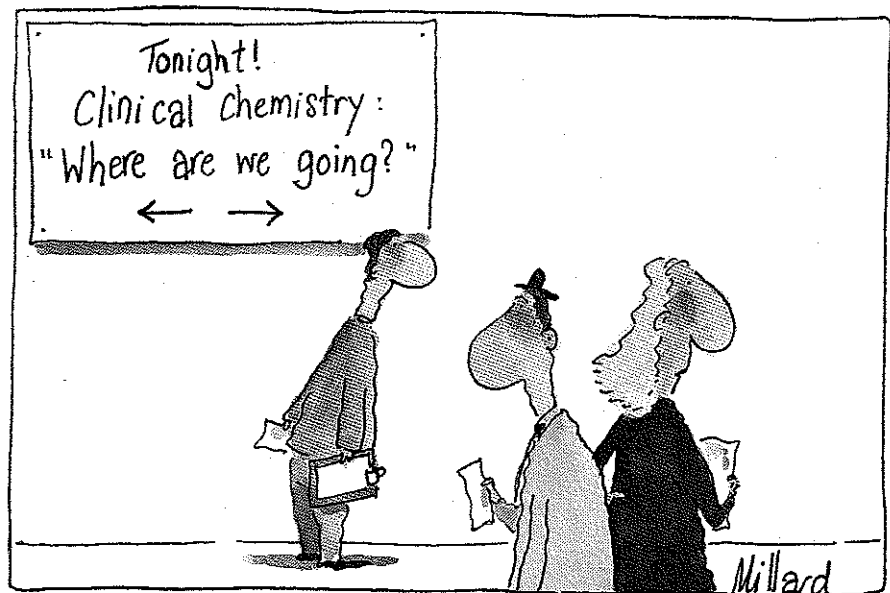
*Clinical chemistry is suffering a 'mid-life crisis', says one commentator, where its identity and meaning are under scrutiny.*

BY JOHN B WHITFIELD

**B**udget restraint in the healthcare system, removing layers of middle management, and amalgamating traditionally different laboratory areas, has led to an unsettling period for clinical chemistry, like other disciplines. On the one hand, there are opportunities for clinical chemistry to expand and, on the other, there is the threat of downsizing to purely routine activities that need fewer skills than before.

However, clinical chemistry has *always* been changing. The difference is that previously this change was against a background of expansion and was seen as an achievement, not a threat. For example, the records of Royal Prince Alfred Hospital in Sydney (see box on p30), show that even before 1930, there were a number of continuing themes emerging, including:

- the appointment of a specialist in biochemistry, and the subsequent administrative separation of a Department of Biochemistry from other parts of pathology;
- growth in the number of tests performed a year;
- employment of both medical and science graduates in biochemistry;
- a change in the pattern of tests performed, reflecting both a clinical imperative and the availability of suitable methods; and
- an indication that clinical outcomes could be influenced by laboratory testing or in-vivo testing in a laboratory-based department. This is shown both by an explicit comment about thyroid disease,



and implicitly by the growth of glucose testing soon after the discovery of insulin in 1921.

Many of these themes are with us today and are still likely to influence our future.

## The past: growth and prosperity

Between 1920 and 1980, there was a phenomenal growth in biochemical testing (Figure 1). Graphs like this can be produced by almost any clinical chemistry department in teaching hospitals of Australia, Europe and the US, and this growth was driven by developments both in knowledge of the causes of disease, and in ana-

lytical methods. Examples include the introduction of flame photometry and spectrophotometric methods, electrode technology applied to blood gas measurement, continuous-flow mechanisation of chemical analysis, chromatography and radioimmunoassay. We take for granted the enormous benefits to patients that resulted from understanding and treating electrolyte and acid-base abnormalities, and the ability to measure hormones and metabolites in endocrine disease and inborn errors of metabolism.

During this period of growth, employment in clinical chemistry naturally grew rapidly, even with productivity increases

associated with automation; societies were founded, and journals and books proliferated. Similar changes and growth occurred in other parts of pathology, such as haematology and microbiology. Meanwhile, in anatomical pathology, attention turned from post-mortem examinations to work on surgical or needle biopsies that could help the living patient. All these clinical laboratories moved towards maturity and (to a fair degree) prosperity; and also towards the inevitable mid-life crisis where identity and meaning come into question.

## Back in time...

Knowledge of chemical changes occurring in, or causing, human disease accumulated over the 19th century but clinical chemistry didn't emerge as a discipline in hospitals until the first two decades of the 20th.

For example, Royal Prince Alfred Hospital was founded in 1883 and by 1886 an honorary pathologist had been appointed. This pathologist also held a position as honorary physician in the hospital. A 'pathological chemist' was appointed in 1908, but only five chemical examinations were recorded for 1909. By 1913, a 'chemical pathologist' had been added, and the number of tests each year was around 100. Most of these were on urine or ascitic and pleural fluids.

Measuring blood sugar was first mentioned in 1921, and this represents a significant turning-point in the clinical application of chemical analysis because the introduction of insulin led to a need to monitor treatment by measuring glucose levels. By 1925, there was a biochemical department separate from pathology, with a medically qualified head and two BSc chemists. They did over 5000 tests in 1928, 53% of which were sugar or ketone measurements.

Another aspect of biochemistry in those days was measuring basal metabolic rate, and in 1927 the following comment was made: "Definite evidence is accumulating that patients suffering from thyroid disorders, whose treatment has been controlled by basal metabolic estimations, have done better than those who have not been so controlled."

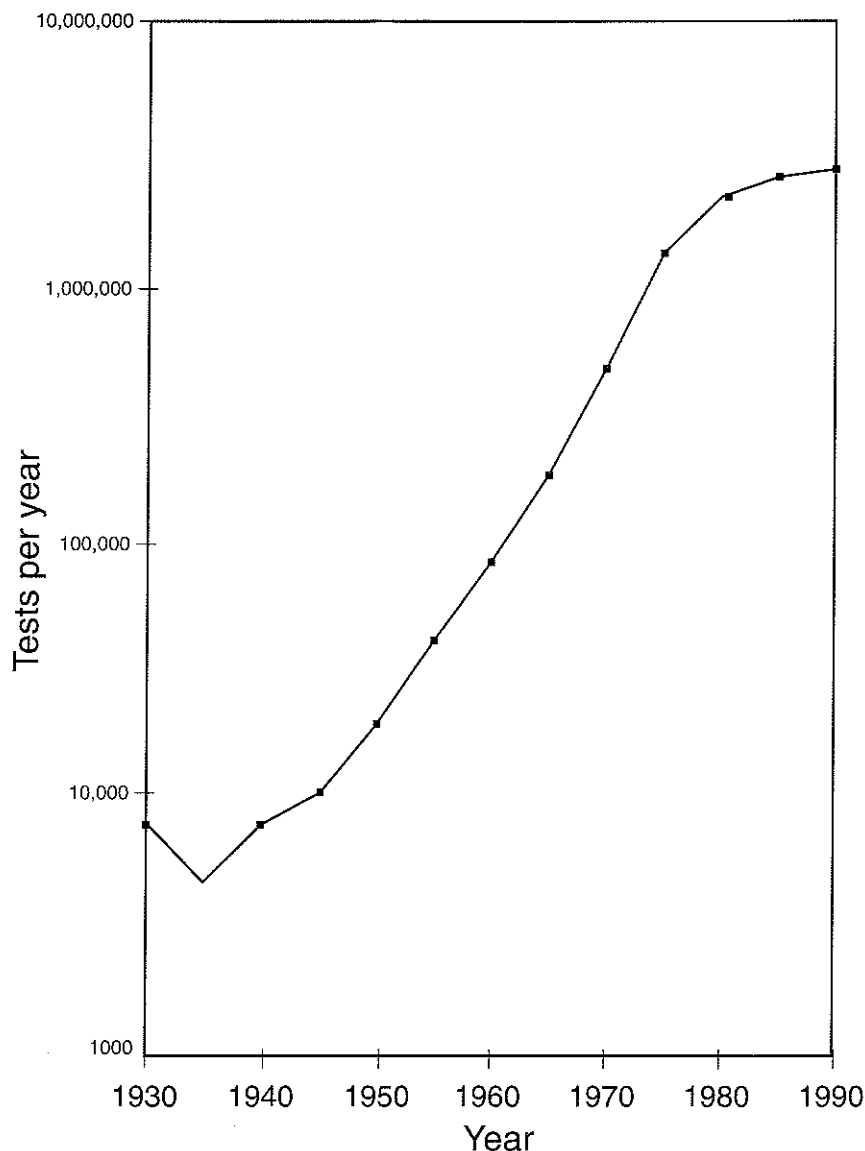


Figure 1. Growth of testing activity in the Biochemistry Department of Royal Prince Alfred Hospital, Sydney (1930-1990). Note the logarithmic scale. Exponential growth lasted about 40 years but has now ended.

## The present: stagnation and change

The last 10 or 15 years have seen a slowing of growth, at least in the major teaching hospitals; and a change from a mainly hospital-based activity to a more community-based one.

The trend towards ambulatory care, wherever possible, reduces hospitalisation costs and is likely to continue. Pathology testing in the community (servicing general practitioners or specialists in their offices) has been dominated by privately owned pathology organisations — initially partnerships but increasingly companies, some now quoted on the stock exchange.

Publicly quoted companies have access to capital that's increasingly hard to obtain in the public sector; they have economies of scale which were previously only available in large hospitals; and the range of tests they can offer is equal to that in all but a few public hospitals.

There has been a change in the role of the diagnostics industry. Previously, new tests and methods were developed by scientists working in hospitals or universities and published in journals so that anyone could use them. Laboratories made almost all their own reagents. Recently, a different pattern of innovation has developed; researchers who develop a method

or reagent make their first stop at the patent office and their next with an industry partner, and the introduction of new tests is increasingly via the commercial sector. This has both good and bad effects; the reagents should have been tested and validated before commercial release and there is standardisation of materials, calibrators and reference ranges across laboratories. In most, but not all cases, cross-licensing agreements allows the new method to be used on a range of common analyzers. However, particularly in molecular biology, there are restrictions on the clinical (but not usually research) use of certain methods or knowledge. There are also instances of delayed or partial disclosure of scientific discoveries.

There has been a proliferation of specialised laboratories. Through the late '60s and early '70s, a range of radioimmunoassays for hormones and, later, other proteins were described in the literature. Adapting these methods often needed laboratories to purify proteins or raise and charac-

terise antibodies. These were not methods that could readily be implemented in clinical chemistry laboratories. To meet the clinical demand research groups, often associated with medical rather than pathology departments, began to offer tests that had been developed for research purposes. Policies on payment for such tests, and on retention of fees by the laboratories or their senior staff, provided a strong economic incentive for developing small laboratories outside the administrative structure of 'pathology'. Innovation was accomplished at some cost in duplicating services.

Financial pressures, and emphasis on managerial issues such as marketing and quality improvement, have become important. This is a common experience, not only in the health sector, and has two sets of effects: pressure to do more with less, and staff spending more time on non-bench activities. This is not to say that a focus on costs, budgets, customers and quality improvement is wrong, but it does redirect resources.

There has been a more widespread use of chemical methods. Photometric and immunoassay methods, and more recently molecular biology, have spread into haematology and microbiology. There are now many tests that cross traditional departmental boundaries and one consequence has been duplicating equipment and staff, together with occasional demarcation disputes.

In response to many of these changes and pressures, many centres have implemented core or general automated laboratories. These perform tests drawn from chemistry, haematology, endocrinology, and immunology and may produce faster results at lower cost. However, in the process of learning new generalist skills, many staff are likely to lose their specialist skills and, perhaps, their job satisfaction.

### Prospects for the future

After a period of growth, clinical chemistry has pupated; outwardly its evolution may seem to have stopped but extensive remodelling is occurring inside. Will a but-

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terfly or a moth emerge? Will there still be an identifiable subject called clinical chemistry (or biochemistry or chemical pathology) and where will its boundaries lie? Will new technology take tests out of the laboratory and into the clinic or surgery? How will we be able to show beneficial effects of testing on patient outcomes, in a time of evidence-based approaches to medical practice?

If we accept (with minor modification) the definition adopted by the International Federation of Clinical Chemistry (IFCC), then the subject can and will keep expanding. Clinical chemistry is 'the application of chemical (and) molecular... concepts and methods to the understanding and the evaluation of human health and disease'. This definition deliberately sets very wide boundaries.

Activities in pathology may soon fall into two broad groups, one based on measuring concentrations of analytes in biological tissues or fluids, while the other is concerned with image analysis and pattern recognition. The former is very close to the quoted definition of clinical chemistry. Such a division would simplify our organisations and eliminate many of the problems that have arisen because technologies and instruments no longer conform to the traditional divisions in pathology departments.

Whatever the organisational structure, reconciliation of the needs for efficiency and expertise is central to the future development of clinical laboratories. The com-

mon answer is to build larger organisations and to centralise the specialised work while automating the rest. In many organisations, the physical and emotional walls between departments are vanishing, and instruments are shared between departments even if the staffing and administrative divisions remain.

However, it is essential that steps are taken to keep specialist expertise among scientists, and indeed among pathologists. Otherwise all services will be reduced to the lowest acceptable level, and there will be little critical evaluation of tests, or methods, or instruments or even of ways of delivering services.

Some intellectual component is as necessary for clinical laboratories as it is for engineering, or for literature, or even (dare one say) for economics, and the people who can supply it must be encouraged and retained. How far this need for expertise is recognised will have major implications for career prospects for scientists in laboratory medicine. Perceptions of the prospects for promotion and recognition will change people's career decisions — to take a scientific higher degree, to do an MBA, or to leave and try something else.

I think clinical chemistry will survive and prosper despite the changes occurring, and it will do so in a form that will still be recognisable. Opportunities will arise, as they always have, from the impact of biological and technological discoveries, and the need to implement new tests and methods for disease diagnosis.

*John Whitfield is deputy head of the Biochemistry Department at Royal Prince Alfred Hospital, Sydney. He has been secretary and president of the Australasian Association of Clinical Biochemists, and is currently chairman of the Hospital Scientists Branch of the Public Service Association of NSW, and secretary of the IFCC. The views expressed in this article are the author's own.*

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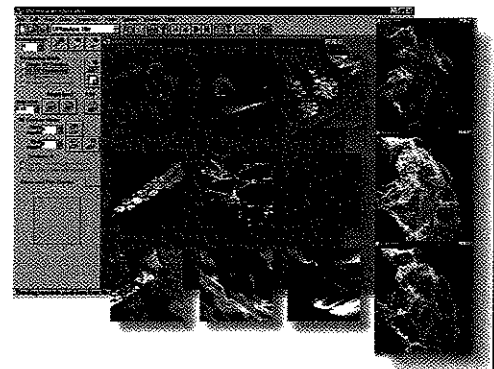
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