The future of medical laboratory science – a personal perspective of Dr Who

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The metamorphosis of the 1950's medical laboratory bacteriologist, the right hand man of the pathologist into the current modern medical laboratory scientist of 2008 has been one of evolution shaped by the ever changing laboratory environment and individual aspirations. It's unlikely the future will be driven any differently, however its doubtful if this process will evolve into medical laboratories stocked full of PhD's or clinical associates. The future role of the medical laboratory scientist will be one based on diversity and agility. It will be the survival of the fittest, a tailor made solution to fit the particular work space, science speciality and laboratory type.

But are we still caught in a time warp and need Dr Who's Tardis to get us out of the QTA, technologist and scientific officer's mind set? These roles, developed in laboratories during the 1960's and 70's, are anachronism. Unfortunately, I believe they still exist within the culture and structure of the profession, reinforced by collective agreements and a barrier to progress.

Our history will be our path to the future of what's going to happen in 20 years in medical laboratory science is not going to be too different to what's happened in the last 20 years. It will be driven by the science and the environment. This paper will explore the optional roles for the future, where the diversity lies and the change in mind set needed to facilitate this process.

The science
Technology driven
We are a technology driven science, what you could call science with a purpose. Very rarely do we develop the technology or discover the science, we are reliant on the in-vitro diagnostic industry to do that and certainly a great number of our fellow medical laboratory scientists work in that industry. But they provide the tools, rarely would the industry create a product that has no use, or the need for the laboratory to find a use. We would be unable to do a business case to buy the thing if we didn’t know what we were going to use it for.

We often do the research and method development for new tests, or prove the efficacy or usefulness or improvement in patient outcomes for new tests. We respond to clinical demand and provide information about a patient's physiological status or what bugs them, where so to speak. When we evaluate a new method or instrument we are more often than not doing validation. We confirm it will do the job or the patient information we produce or instrument we are more often than not doing validation. We bugs them, where so to speak. When we evaluate a new method provide information about a patient's physiological status or what outcomes for new tests. We respond to clinical demand and prove the efficacy or usefulness or improvement in patient

New sciences
It is in these laboratories the new science areas of DNA analysis in molecular genetics, infectious diseases, chromatography and flow cytometry are developing and where there is still research. Very often new methods are developed in a university research laboratory or during a medical laboratory research project.

If found to be clinically useful, the challenge is then to manage the transition from research method to routine medical laboratory method and that often requires skills outside that of the researcher. Too many of our senior scientists spend careers performing analysis which, when they retire, the laboratory is unable to produce the same information as the transition has not been well managed. Succession planning has been lacking or the sharing of information scant.

New sciences - pharmacoeconomics
However the new sciences within our profession are more around analysis of biological material to determine the suitability of a particular drug for treatment. Determining the sensitivity of a pathogen to an antibiotic was perhaps an early and till most commonly used analysis of this type.

We are now taking this a step further with chromosomal abnormality detection to determine the type of cancer and the most suitable treatment. These include such things as Her2 analysis by FISH to see if Herceptin is of use or not or FISH analysis of brain tumours to determine yes or no to radiotherapy or chemotherapy. Leukaemia diagnosis is made by flow cytometry and cytogenetics. Micro-array technology is being adopted more and more into the labs and will be the auto-analysers of the future. Microscopes will be rarely used in cytogenetics.

So tailor made analysis to provide specific information about a specific disease. Yet what of the traditional medical laboratory departments, haematology, chemical pathology, microbiology, immunology, anatomical pathology, transfusion sciences, phlebotomy, specimen services, forensic science, cytogenetics and virology?

Diagnostic genetics are emerging within haematology, cytogenetics, virology and microbiology and with the number of common processes in molecular analysis, the clinical interpretation / clinical inter-action still remains with those experts who have the competency to act as the information gatekeepers. Rapid PCR is now becoming a reality where almost black box technology is on the market for elegant simple infectious diseases screening including MRSA, VRE, viruses and STD's. This means most laboratories will have access to this type of analysis without the need of specialist reference laboratories.

Automation – routine – time dependant – core laboratory
We have the Medical laboratory Science Board (MLSB) not recognising specimen services as part of the practice of medical
laboratory science, yet tell me where the boundary is going to be between specimen services and the total automation laboratory where pre-analytical processing is indistinguishable from analytical processing? This is where high throughput automation includes what was chemistry, haematology, coagulation and immunology including infectious diseases, all connected electronically to online ordering at the clinical / patient interface. Where does the technical and clinical responsibility start and finish? Do you need to have haematologist or biochemist branded on your forehead to put a tube in a rack that’s going to be processed by a lot of steel, software and reagent and a lot quicker and more accurately than the scientist doing it manually?

**Rapid response laboratory**

Time dependent analysis is fundamental to the rapid diagnosis and treatment of patients in the ED / APC / high dependency unit area. To admit or not to admit, to treat or not to treat, to monitor continually are the key question’s and there will be increasing need for laboratories to perform against time frames. If this is done in a core laboratory, a rapid response laboratory or whatever other laboratory label you may have, it is essential that our science is demand driven and must be responsive to the needs of the referrers.

Technology will drive this and manufacturers will develop technology that will facilitate this provided there is sufficient return financially to the supplier or developer. However, the answer is not necessarily in point of care testing because of the cost.

**POCT**

Some years ago with the advent of Point of Care Testing, the profession came out fighting what was thought to be the end of medical laboratory science as all analyses were perceived to be done by doctors and nurses beside the patient. It did not happen and the guidelines formulated by the NZILS in 1993 are still on our website and are a fair indication of what is happening in most hospitals today. The standard ISO 22890 point of care testing has become the norm with those hospitals and laboratories that have become the norm with those hospitals and laboratories that most hospitals today. The standard ISO 22890 point of care testing and the guidelines formulated by the NZIMLS in 1993 are still done by doctors and nurses beside the patient. It did not happen and the guidelines formulated by the NZILS in 1993 are still on our website and are a fair indication of what is happening in most hospitals today. The standard ISO 22890 point of care testing has become the norm with those hospitals and laboratories that manage this science. The science will drive the scientists, it is not controlled by the scientists but utilised and managed and adopted by them.

**The systems**

**Environmental**

And to maintain the integrity of the information we produce we have all sorts of systems around that. Systems such as accreditation, method standardisation, IT protocols, release of information protocols, how we get rid of the biological material and consent to retain it. All of these are interrelated and interational, the systems being a pot-pourri of environmental, political, social and clinical needs. The so called items and conditions of producing a lab result have changed markedly and have been embroiled in a multilayer of documents, regulations and governance.

**Quality**

Quality is an endless process of continual improvement with a significant number of different measurements. The drivers are varied, but accountability and performance are key elements and ensuring outcomes that are tangible and satisfies the need for which there are designed. Regardless of the quality frame-work, we are accountable and need to ensure information integrity and relevance.

**IT systems**

Laboratories are e-organisations and will increasingly become more and more dependent on information technology. The amount of data most laboratories process could not be processed manually nor would be same degree of accuracy be maintained. However, it is also one part of the post analytical process where laboratories are lacking both the skill set and the institutional knowledge. It will be the largest single ongoing investment over time for most laboratories.

**Occupational health and safety**

We are also obliged to ensure we have systems in place to protect our colleagues from bugs, chemical hazards, body fluid accidents, falling over things and things falling over them. In the world of ACC, regulation and requirement go hand in hand and become more arduous. Repetitive tasks leading to workplace injury will be a continual strain on resources and the need to move from a labour intensive process to more automated processing.

**Financial**

And who pays for this information we produce? Clearly everything else is financially driven, the recent pathology reforms in New Zealand were not necessarily about better patient outcomes but more about where money can be saved. Essentially cost shifting from one service to another without necessarily determining the long term effects, yet promoted in the name of better patient care. The flow-on effects will continue to be felt in the ensuring years as the profession becomes unattractive to new entrants because of the instability and volatility of the sector.

So we have systems around costs, plotting income versus expenses allocating all these to what sections or departments we happen to have organised our laboratory in. Cost of service is the biggest driver within pathology because too often it is easier to see the tangible than the intangible. We have systems designed to measure financial outcomes or costs, but not the right tools to measure clinical or improved patient outcomes. Driving down the cost of pathology will reduce access which will in time increase the long term cost of chronic diseases such as diabetes and cardiac disease. Clearly cost effective healthcare when funded by the state is more about value for money, provided the delivery is at the clinical / patient interface and not tied up with resources maintaining politically correct protocols such as the current interface. So what Pathology is allowed or funded to delivery in the future will always be driven by the funder and allocation of the dollars.

**The market**

The environment in which pathology operates is all part of the systems and very much a key component in determining the future of our science. I believe we will be soon looking at a pathology renaissance, assuming of course that we have been through a dark age recently.

If 60 – 70% of medical treatment and diagnosis is reliant on some form of pathology information, then access is a key component. That has clearly been damaged recently and access to reliant and sustainable information from laboratories is not always guaranteed. So a key determination to the future of medical laboratory science is the market, the systems, the funding. In other words, the environment in which pathology is expected to operate.

**Professional governance**

The Health Practitioner’s Competency Assurance Act is the state ensuring those who are working in the healthcare profession have the competency and ongoing education to do so. Because we do not have medico-legal litigation, then there needs to be safety nets and assurances for the users of the services.

**Professional relationships**

And what of the political environment of the professional relationships, doctor to doctor and that of the pathologist and the scientists. The future of the science is very much determined by those relationships as much as what, where and how.

**Patients**

Politics play a part with professional governance and on-going education and competency. The public has a right to ensure those providing their healthcare are registered and competent to
and deliver safe healthcare. We must respect their privacy, ensure they consent to whatever we are doing to their biological material and understand their different cultural needs.

Will this lessen? I doubt it because as a society we are becoming more complex and the relationship between clinician and patient will have a direct effect of the relationship we have with the clinician. I believe our relationship will become more interactive with the patient/client and referrer and access to patient information by the patient more readily accessible.

The staff
A qualification says you are able to do the job, but it does not say how good you are at it. Therefore are all laboratory scientists and technicians created equal? Someone once said unless you are producing the information on the bench by doing the analysis, you are there to help.

The biggest variable in predicting the future and probably the most demanding is the scientific staff that populate our laboratories. What the future holds for us is very much outside our control because the key drivers will always be the science and the systems. Adaptation to one’s environment will ensure survival of our species because essentially it is out of our control. Unless we can adapt or create situations where there is flexibility and agility, we will indeed be exterminated.

We can talk about baby boomers, generation X and generation Y, but all that will be meaning less because unless each generation can adapt to our environment, our labels will not matter. That does not mean we ignore those characteristics, however, what comes first, the needs of the job or the needs of the scientist?

But we are a confused lot and if you look at the number of different job titles in medical laboratories, regardless of what generation you come from, you really would wonder about it all.

Laboratory manager
Practice manager
Technical head
Section leader
Scientific officer
Team leader
Technical specialist
Scientific leader
Scientific director
Director
Medical laboratory scientist
Phlebotomist
Mortuary technician
Forensic technician
Cytotechnologist
Medical laboratory technologist
Laboratory assistant
Charge medical laboratory scientist
Senior medical laboratory scientist
Laboratory scientist
Supervising medical laboratory technician
Medical laboratory technician
Medical laboratory assistant
Charge phlebotomist
Trainee medical laboratory technician
Intern medical laboratory scientist
Charge mortuary technician
Student, cadet, GAP student,

And yet we have only two scopes of practice!

Much of this is in the terms and conditions the various awards throughout the country, many of which have historical connections to the days when all there was in a lab was:

A Principal Technologist
Charge Technologists
Graded Medical Laboratory Technologists also known as Graded Officers!
Medical Laboratory Technologists
Trainee Medical Laboratory Technologists
QTA’s, QTO’s and Lab Assistants.
With a smattering of Scientific Officers...
And life was good...or was it?

However while we remain in historical time warps wither through MECA's or re-enforcement of status by whoever, we will never move forward. Many of the baby boomer generation still refer to some Med Lab Scientists as Technologists, lab assistants and the like.

Unfortunately many senior staff in status or decisional positions are the barrier’s to professional advancement and quite often guilty of disempowering colleagues. They are often there not because of their ability to manage colleagues, but more likely because they have been around the longest or have academic qualifications not necessarily suited to management.

The inter-action for example between the Scientific Officer and the Medical Laboratory Scientist (Technologist) has historically been difficult where differentiation was always made on qualification rather than ability and lead to a perception of elitism within the scientific officer community.

Yet the same applies to the relationship between Scientist and Technician although many technicians these days in the specialist areas are those non-BMLS science graduates who can't get registration as a medical scientist.

Many of the finest practitioners of medical laboratory science have been those whose origins were on the bench being trained under the old technologist programme. Of course we now have a four year degree and only those without his degree, but who have specialist knowledge or skills in the molecular sciences or chromatography have a place in the modern medical laboratory at Masters or PhD level.

However we still live in an anachronistic world and many of the structures still in place are those created in historical times. Those old hierarchical systems and attitudes still exist in some laboratories where egalitarianism and collegiality are not often displayed.

However the future needs of the laboratory workforce will be far more diverse. The increasing demands of the science, systems and environment will determine the future type of scientist, and they will be far more diverse.

However the skill’s needed are in managing the science, the systems and the staff. Specialist knowledge is needed in managing automation as systems rather than boxes, managing electronic connectivity, quality systems, processes and how to manage a diverse work-force. But as we need specialists, we will also need generalists, diversity and agility being the key.

The biggest challenge for anyone working in a laboratory is, and will continue to be, managing fellow scientists. Yet managing will not be elemental to success but more leadership and the evolution to self managed teams based on decentralised processes and quality frame-works. The level of emotional intelligent within an individual rather than their IQ will determine their place in a lab.

We over use the team word in our labs, work groups are more acceptable and certainly more realistic. Often those with the team leader title don’t know the difference in definition between a team and a work group and lack the leadership skills to create a team.
We are excellent at managing and maintaining instruments or scientific process; however the most valuable component of any laboratory, the scientist or the technician, we maintain and manage miserably.

There is no point talking about whatever whizz bang technology that's about to revolutionise our playgrounds until we learn to manage interpersonal relationships between ourselves and our science and our environment.

**Fig. 1 Baby Boomers**

In most of the senior positions in the Lab

**Key characteristics (1946-1955):** experimental, individualism, free spirited, social cause oriented,

**Work Values:** quality of life, nonconforming, seeks autonomy, loyalty to self

**Key characteristics (1955 – 1964):** less optimistic, distrust of government, general cynicism,

**Work values:** loyalty to career, success, achievement, ambition, hard work; loyalty to career

We Baby Boomers' (Fig 1.) populate by far the senior management and scientific positions within most Laboratories in New Zealand and we have our own characteristics'.

What will make our science attractive will be the ability to create flexibility, job satisfaction, and a balanced lifestyle with workplace loyalty to fellow scientists. Those are the needs for Generation X (fig 2), those born from approx 1964 – 1980 and who are now sitting in middle management positions waiting to talk over from us baby boomers and some of us aren't ready yet.

**Fig. 2 Generation X**

Currently in middle management positions in labs waiting to take over from the BB's.

**Key Characteristics (1965 – 1981):** described as “don’t believe in God, dislike the Queen and don’t respect parents”. Reject the values of the baby boomers and have a hazy sense of their own identity.

**Work values:** Flexibility, job satisfaction, balanced lifestyle, loyalty to relationships.

So the question is this? Do the next generation of scientists, so called generation Y (Fig 3) compatible with the values and practice of a Medical Laboratory. They have been described as being techno-savy, are especially tuned to their own value in the market, have limited loyalty to any particular employer and insist on working in a stimulating job environment.

**Fig. 3. Generation Y**

Are they suitable for the current lab environment, especially those from western culture.

Who will be suitable for the strict lab environment?


**Work Values:** Tuned to their own value in the job market, have limited loyalty to any particular employer and insist on working in a stimulating job environment.

Yet our adherence to process, quality frameworks, the often and precise work we do is more in conflict to that required by our younger scientists who are looking for diversity, flexibility and not staying in one place for very long.

Are the scientists from the more traditional cultures seen in the East more suitable to work in our laboratory environment than those from a Western culture? Will the ethnic and social background pre-determine who will be coming into our profession?

But what about scientific and clinical leadership? I fully endorse the role extension proposals and training for Medical Laboratory Scientists who wish to become more involved in the clinical interface between laboratory and referrer; however will the system allow it?

We have midwives and nurse practitioners using the laboratory service and quite ably. Who do they go to for clinical advice?

There will probably be little choice as clinical leadership, especially with the decline in numbers of Clinical Pathologists in Chemical Pathology, Haematology and Microbiology needs to be managed some how.

But this pathway is very limited and arduous and quite frankly may not be preferable to doing a medical degree and without clinical endorsement and governance, of little use. Acceptability at master's level may be sufficient for endorsement of clinical competency and role extension.

However, the need for post-graduate study is essential to learn new skills and provide an academic foundation for new roles. In addition to higher level learning in the traditional medical laboratory sciences, alternatives such as quality management, information technology, education, human resources, accountancy and organisational behaviour are subjects more in line with the future needs of med lab science.

These can be sought through tertiary institutions and don’t forget NZIMLS fellowship.

Not everyone would want to or can be a Lab Manager, a technical head, do a MBA or a business diploma, however strong leadership skills in the workplace will be essential for future section leaders and supervisors where inter-action and integration of various types of scientists is fundamental to success.

How much effectiveness and efficiency are we loosing now because those who are currently providing the leadership in Laboratories are unable to create an ideal work environment to maximise the human potential for which they are responsible? Is the decline in numbers within the lab due to retention issues more a reflection of current management skills than workplace drivers?

Scientists will continue to evolve as technology replaces labour in the routine processing of human biological material. Skill sets will expand into management of processes, broader generalist labour skills over a number of disciplines, as well as specialist systems and science skills within regulatory and organisational parameters.

**Conclusion**

So the future of Medical Laboratory Science will be determined by two major influences, the science and the environmental systems.

The science will be driven by clinical need and financial necessity, the systems and processes within the environment by regulation and social need.

We as scientists have an obligation to create pathways by which our younger colleagues can adapt and evolve in this ever changing environment.

The pathways must be flexible, but maintain duty of care responsibilities and professional standards.

But as the Tardis lands in 20 years time, glucoses will continue to...
be a glucose, a creatinine a creatinine and urines, full blood counts, swabs and bits of tissue will still be there.

You may not recognise the scientists or the technology, however I think you will recognize the lack of funds, lack of good staff, pathology reviews and current restructures.

Our history is the pathway to our future, our continual evolution the pathway to our survival.

Ross Hewett,
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In this issue

Each year the NZIMLS Council honours a prominent medical laboratory scientist to deliver the TH Pullar Memorial Address at its Annual Scientific Meeting. The recipient this year was Kevin Taylor from Canterbury Health Laboratories who’s Address is in this issue. In his Address, Kevin draws on his sporting activities experiences to give some pertinent points on how we can learn from the coast to coast endurance race in to decipher how we can find the Rumplestiltskin of medical laboratory science. In other words how the world of medical laboratory science replicates the increasing impossible tasks represented in the rooms of straw of this fairy tale.

Ross Hewett, Laboratory Manager of LabPLUS Auckland gives his personal perspective of the future of medical laboratory science in the viewpoint article in this issue. To quote Ross, ‘The future role of the medical laboratory scientist will be one based on diversity and agility. It will be the survival of the fittest, a tailor made solution to fit the particular work space, science speciality and laboratory type’.

Jaine Duncan from Canterbury Health Laboratories presents a retrospective review of homozygous haemoglobin E patients. Jane originally presented this data as a poster presentation at the 2007 Annual Scientific Meeting and was the winner of the Hugh Bloor Memorial Prize for the best poster presentation. She reviewed the Canterbury Health Laboratory thalassaemia patient database and found 43 patients who had been diagnosed as homozygous Hb E. However, seven of these patients had equivocal results. She stresses the importance of reviewing the blood count, blood film and clinical findings of patients with equivocal results.

Yeu-Sheuan Khor, a 4th year medical laboratory science student evaluated the immature reticulocyte fraction as an early indicator for bone marrow engraftment in seven patients who had undergone a bone marrow or stem cell transplantation in Auckland Hospital. He found that the immature reticulocyte fraction may be an early sign of haematological recovery, and thus may reduce the use of growth factors in patients undergoing bone marrow or stem cell transplantation.

Two prominent members of our profession recently passed away. In this issue is an obituary on Rod Kennedy who worked in Auckland Hospital and served on the Institute’s Council from 1963 to 1975, first as Council Member and then as Secretary. The other member of our profession who recently passed away was Barry Edwards from Canterbury Health Laboratories. His obituary will appear in the April 2009 issue of the Journal.

Abstract of oral and poster presentations at the NZIMLS Annual Scientific Meeting in Dunedin in August 2008 are in this issue. Only abstracts that are informative to the reader are included. Any abstract which stated that results will be presented or that results will be discussed, have been excluded.

At this year’s Annual Scientific Meeting, Olympus sponsored a photography competition. Seventeen photos were submitted and all are reproduced in this issue.