

Pathology 2025: Imagining the future

Never has medicine been as challenging as it is in the 21st century; and never have the opportunities been so great. Pathology, as the very foundation of medicine, is at the forefront of the revolution and new diagnostic tools and knowledge are taking pathologists into broader roles of research and correlating diagnoses for clinicians.

Yet, despite the challenges and opportunities, there remains a shortage of pathologists which adds to the pressures to this crucial branch of medicine. So, what does the future hold for pathology in 2025? *PathWay* asked five leading pathologists from across the globe to share their vision for the future, with some fascinating and surprising results.

Dr Puay Hoon Tan Singapore

Q. How will the role of pathology change over the next two decades?

A. In many institutions with a research arm, anatomical pathologists are already serving as the bridge between basic science and clinical medicine, and are therefore poised to become effective leaders in the research arena. I believe pathology will be increasingly called upon to take a leadership or at least a prominent supportive role in research in the coming years.

It is hard to clearly imagine what advances in information and other technology will have exploded into our lives by 2025. It is difficult to use pathology of 20 years ago as historical comparison with pathology today, and extrapolate the advances over the past 20 years to the future two decades, as the pace of development and change will be distinctly more rapid in the future. Hopefully, pathologists in 2025 will not be merely “tissue samplers. Pathologists need to keep pace with current

technological advances and be fully involved in and direct new developments, since it is only appropriate that pathologists be the ones to control the use of novel technology in our discipline to improve patient care.

Q. What is your wishlist for pathology over the next 20 years?

A. I hope for sufficient pathologists to perform the closely integrated duties of diagnostic service, teaching and research. Pathology is the foundation of medicine, and is by nature an academic discipline. It is sad that pathologists have been sometimes relegated to a less important role in the medical profession. The goal as an anatomical pathologist is to provide as best a diagnosis on submitted tissues, and to be an effective member of the managing team of clinicians in solving the problems of patients. In order to achieve these aims, pathologists should constantly add value to their work by actively participating in teaching and research, as these are efficient means of learning, understanding and self-improvement. This wish can only be realised when there are enough pathologists on board.

I truly hope that pathology can be re-established as the basis of all medical disciplines, and regain the respect, relevance and profile within the medical community. It is also important that more young medical professionals should consider pathology as a viable career option, as that will be the start of alleviating the current shortage of pathologists. There is a great need for pathologists with passion for the discipline.

Technological advances should be harnessed to continually improve the discipline, with the pathologist in charge.

Q. Where would you like to see research focused over the next 20 years?

A. I would like to see research focused on cancer prognostic markers and cancer cures via targeted therapies. Advances in molecular taxonomy will be an important adjunct to histologic diagnoses. Development of dedicated tissue banks, construction of tissue microarrays, standardization of processing protocols so that paraffinised archival tissue can be effectively harnessed for immunohistochemical and molecular research, all occurring within an established ethical framework that ensures moral standards, will be in the future of research pathology.

Q. If the current shortage of pathologists continues, how will the profession and the community be affected?

A. The profession will not be able to pull itself out of the monotony of service work, and will not find time to participate in value added activities such as cutting edge research, which will be taken over by non-pathologist scientists. The discipline will be unable to improve and advance. There will be a pervasive low morale which may cascade into a vicious cycle with diminishing numbers of young doctors being interested in the discipline. It will continue to slip in professional standing in relation to other more glamorous and dynamic medical disciplines.

Dr Puay Hoon Tan is the Senior Consultant and Head of Histopathology at Singapore General Hospital and Adjunct Associate Professor Departments of Pathology and Anatomy, National University of Singapore.

Sir James Underwood

United Kingdom

Q. Which scientific/technological/medical developments will have the most impact on pathology in the coming years?

A. Advances in genetics, information technology and digital imaging are already transforming histopathology and many other pathology specialties. This will continue. In histopathology, for example, I predict that much interpretive reporting will be done from flat screens rather than through microscope eyepieces.

In my specialty of histopathology, I forecast that molecular pathology will develop alongside diagnostic macroscopy and microscopy and as an adjunct, rather than as a substitute.

Q. How will the role of pathology change over the next two decades?

A. Pathology will always to be the scientific basis for medical practice, but it will continue to struggle to get this message across to curriculum planners and to health service managers.

The migration of some pathology 'tests' from laboratories to the point-of-care will continue, but hopefully with concerns about training, health and safety, quality assurance, and results interpretation fully addressed. This will be best achieved by point-of-care testing being part of a locally managed pathology network.

Medical graduates (as opposed to science graduates) working in pathology services will continue to develop a much more patient-centred approach to their specialty, with increasing involvement in clinical decisions as members of multidisciplinary teams.

Q. What is your wishlist for pathology over the next 20 years?

A. Pathology should be restored to its rightful place in the medical undergraduate curriculum before widespread ignorance and misunderstanding imperils patients, if it has not done so already.

Television drama producers should realise that cancer diagnosis can be just

as exciting as forensic death investigations.

Research in pathology should be valued by its benefit to human health and welfare rather than by the size of the research grant or the impact factor of the journal in which it is published.

When given death certificates, bereaved relatives should ask certifying doctors how they can be so confident about the cause of death when research shows that up to 30% of certificates are significantly wrong or incomplete? How about an autopsy?

Pathology services should cease to be regarded as a 'cost' or 'overhead' in healthcare organisations.

Pathology investigations should be evidence-based in order to reduce unnecessary tests and iatrogenic anaemia (resulting from excessive haematological and biochemical investigations).

Q. Where would you like to see research focused over the next 20 years?

A. Rather than suggest topics for research, I would argue for a cultural shift in how pathology research is designed, conducted and published. Too many papers report small series with numerous variables, such that the study is incapable of advancing knowledge with sufficient reliability. To give pathology research the status it deserves, we should encourage studies that are robust, powerful and demonstrate clinical effectiveness. For example, a new classification or grading of a particular disease should be researched as a clinical intervention in order to determine the effect on patient outcomes. A new monoclonal antibody for identifying histogenetic or predictive markers should be evaluated for its actual clinical utility.

Sir James Underwood is Professor of Pathology at the University of Sheffield, UK, and consultant histopathologist to the Sheffield Teaching Hospitals. In 2002, he was elected President of the Royal College of Pathologists. He was recently knighted for his services to medicine.

Dr Lee Hilborne

USA

Q. Which scientific/technological/ medical developments will have the most impact on pathology in the coming years?

A. Molecular diagnostics, genomics and proteomics will probably have the biggest impact because they will continue to redefine disease at the molecular level. Some of the challenges we face today in terms of discriminating disease will be eliminated ie: uncertainty will be decreased and accuracy will be increased. The further development of nanotechnologies will also drive change and expedite diagnoses. The other change will be increased automation - more things can be done with greater consistency, less time, and less cost.

Q. Where would you like to see research focused over the next 20 years?

A. I think research should focus on new diagnostic tests, getting those tests with promise to market, and work on modifying some diagnostic tests that are only available in large clinical laboratories because of the testing complexity. Highly complex testing restricts applications to developed countries and those with resources. Moving to new paradigms for some diagnostics, particularly for such conditions as acute infectious diseases, HIV, diarrheal diseases, acute respiratory illnesses, can help move those diagnostic services to under-served areas of the world. Of course, the development of new diagnostics will require the availability of therapeutic techniques for treatment once the diagnoses have been made. Of course, I would hope that by the next 20 years we would have the answer regarding how to effectively attack both malignancies and retroviral infections.

Q. If the current shortage of pathologists continues, how will the profession and the community be affected?

A. I guess that depends on the other issues. I think the demand for traditional surgical pathologists may decrease if molecular diagnostics take over. Many will argue (and I agree) that people have been

saying this for years and it won't happen over the next 20 years. I am not sure how fast change will occur. Of course, if the demand for pathologists rises and the shortage increases, the laws of supply and demand will necessitate that the cost of professional pathology services will increase and more individuals will be encouraged to enter the profession. Current trends have been in the opposite direction, but shortages will force a reversal of this trend.

Dr Lee Hilborne MD, MPH, DLM (ASCP) is Professor of Pathology and Laboratory Medicine at the David Geffen School of Medicine at UCLA and Deputy Director of Global Health for the RAND Corporation in Santa Monica, California.

Dr Anthony Landgren

Australia

Q. Which scientific/technological/ medical developments will have the most impact on pathology in the coming years?

A. Further development of molecular diagnostic tools and point of care pathology testing.

Q. How will the role of pathology change over the next two decades?

A. Increased focus on disease prevention and early diagnosis.

Q. What is your wish list for pathology over the next 20 years?

A. Short to medium term issues, particularly work force shortages tend to overwhelm consideration of where to in the next 20 years. Improved training opportunities, facility and technology investment, improved risk management and error reduction are my current priorities.

Q. Where would you like to see research focused over the next 20 years?

A. Development of molecular diagnostic tools.

Q. If the current shortage of pathologists continues, how will the profession and the community be affected?

A. Pathologists, laboratories and diagnostic activities will be predominantly located in major population centres with point of care testing, courier transfer of specimens and electronic communication of results. This has already happened with many regional communities no longer served by a locally based pathologist.

Anthony J Landgren, FRCPA, FACLM, MRACMA, Barrister and Solicitor. Tony Landgren is Chairman of the Department of Anatomical Pathology at the Royal Melbourne Hospital and a Biotechnology Lawyer.

Dr D Sean O'Briain

Ireland

Q. Which scientific/technological/ medical developments will have the most impact on pathology in the coming years?

A. Medicine is pathology, and as new technology steadily changes medicine, pathology will change gradually with it. A sudden quantum change in medicine, rather than gradual change, is less likely to occur but there are two possible circumstances of rapid profound change. One is the finding of a silver bullet, a magic cure for a major disease, such as a cure for cancer, that would profoundly change much of medicine including pathology; but this is unlikely to be achieved by 2025. The second is the emergence of a devastating new disease. We worried about this with SARS a few years ago, and within the past two decades we've seen AIDS change the face of medicine in many poorer regions of the world.

Extreme regional poverty, overpopulation and local conflicts with ensuing malnutrition and infectious diseases including gastroenteritis, AIDS and tuberculosis, will continue to be the major problems in world health but, as now, will only have a significant effect on medicine of the developed world if the situation also acts as a pressure cooker for the emergence of new global pandemics. Developed countries may heave a quiet collective sigh of relief if 2025 dawns without such a pandemic, but, as now, are unlikely to take effective action to end the threat.

In the developed world, pathology will still use many of the current techniques but these will be enhanced due to developments predominantly in molecular pathology, information technology and imaging techniques and will be driven by commercialisation of new techniques and better instrumentation.

Q. How will the role of pathology change over the next two decades?

A. The pathologist will continue as diagnostician, but as there will be a wider range of technologies to support and to augment the diagnosis, will take on a larger role in correlating the diagnosis for the clinician. A major challenge to the pathologist will be to master the new technologies and to incorporate them into the pathology diagnosis. The current division of the pathology laboratory into traditional well-defined subsections may be a barrier to change; with expanded dynamic imaging and point of care testing much of current laboratory work will occur at the bedside while the laboratory will offer a new profile of tests that may require a realignment of diagnostic disciplines and subspecialties.

Enhanced decision support programmes will be a major component of clinical care and the pathologist will format results to feed laboratory information into these hospital systems. This will simplify the diagnosis and care of well-defined diseases and will allow the pathologist to focus on diseases where the diagnosis is obscure. These will be the subject of hospital multidisciplinary conferences where the pathologist will have a major role in defining the implications of complex laboratory results.

New therapies will change the profile of diseases, and some now-fatal diseases will be curable; but just as infectious diseases did not go away when antibiotics were developed, diseases such as cancer will develop new forms of resistance to therapy and complications from the new treatments. New laboratory-based approaches to these problems will continue to emerge.

Q. What is your wishlist for pathology over the next 20 years?

A. The role of the pathology laboratory is to use blood, fluid or tissue to provide accurate, timely and relevant information

useful in making diagnoses, and to guide and monitor therapy. A general wishlist includes more rapid access to the specimen, increasingly better tests and prompt communication of the results to the clinician. These will be achieved by a variety of developments in test ordering, point of care testing, specimen transport, with enhanced laboratory information systems connecting with more developed electronic patient records, and new instrumentation providing better, faster tests.

Q. Where would you like to see research focused over the next 20 years?

A. Research should be focused where it is likely to do most good, either on diseases causing widespread morbidity or where a breakthrough seems intuitively likely. The major areas include infectious diseases that involve the developing world, cancer, cardiovascular disease and degenerative cerebral disease. We are likely to see a huge return on money invested in research on infectious disease and cancer, based on application of

molecular biology. But the causes of cardiovascular and degenerative cerebral disease remain tantalisingly out of reach and will require a substantial research effort at a more basic level.

Q. If the current shortage of pathologists continues, how will the profession and the community be affected?

A. Pathology, like any other occupation, follows the law of supply and demand. Shortages are likely to be temporary and regional. Medical graduates are unusually mobile and will move to the areas of opportunity. Pathologists will improve the profile of the discipline and present it more attractively to medical students who will respond to the increased career opportunities by filling any vacancies.

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