



Suspicious minds

ANATOMICAL PATHOLOGISTS ARE MEDICINE'S PRIVATE DETECTIVES, WHOSE WORK INVOLVES PLENTY OF INTRIGUE AND DRAMA. LISA MITCHELL REPORTS.

It's a bit like doing 30 crossword puzzles a day, says Dr Rohan Lourie of the 4000–5000 medical cases he investigates annually.

As an anatomical pathologist, he and 680 other probing perfectionists around Australia and New Zealand spend up to five hours a day propped over their microscopes.

Tens of thousands of Australians turn to these doctors each year for answers when diagnosed with cancer. "Will my tumour kill me?" they want to know, and "how long have I got?"

Anatomical pathologists are behind a revolution in cancer therapy. They are categorising cancers so efficiently that drugs are now being developed to target specific malignant cells, eliminating the blanket destruction of healthy and harmful cells caused by chemotherapy.

Unlike their well-publicised forensic colleagues on *CSI: Crime Scene Investigation*, anatomical pathologists are 'the quiet achievers', often perceived as introverts huddling in basements with the lab mice, Dr Jeanne Tomlinson grumbles through a smile.

Bah humbug! There is intrigue aplenty in their work, she says.

"We see a lot of bread-and-butter stuff, but once or twice a day you get something that really interests you that's a bit difficult. You've got to be like a private investigator, ringing clinicians for more information, looking at texts, showing it to your colleagues. It's really very satisfying when you nail a case," says Dr Tomlinson, who works with Douglass Hanly Moir Pathology in Sydney.

Bizarre but true

Tell Dr Mary Miller she lives a cloistered life hunched over a microscope and she will tell you about the time she returned an arm to a murderer and thwarted the beating of an innocent man.

Dr Miller is an anatomical pathologist at Middlemore Hospital in Auckland, which specialises in bone tumour referrals. She is sometimes called upon to return limbs to patients. They like to bury them, she says, recalling the handover of one young man's frozen arm, which had been amputated below the elbow.

"A couple of years later, he was convicted of rape and murder," she says.

"As soon as they said a 'one-armed man' [on the news], I knew who it was...

I suppose losing his arm didn't prove any barrier to carrying out his activities."

Back-office medicos, eh? Hospitals would grind to a halt without them. Anatomical pathologists are essentially the diagnostic arm of medicine. They examine cells, tissues or organs which are prepared and placed on slides, then stained with various inks and dyes to reveal information upon examination under microscope. Larger specimens may also be viewed with the naked eye (grossly or macroscopically), before being sampled.

"I've had specimens such as a whole leg – mid thigh down to the foot – with a tumour around the knee," says Dr Andrew Laycock, an anatomical pathology registrar (trainee) at Western Diagnostic Pathology in Perth.

Samples are collected by biopsy. There is the incisional biopsy (cutting away a small piece of tumour), and the excisional biopsy (removing the entire tumour from a patient). The smallest biopsy available is fine-needle aspiration cytology, which involves inserting a fine needle to extract cells. And there is the core biopsy, which uses a larger needle to extract a larger sample.



PHOTO CREDIT: IAN BARNES

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Cutting to the truth

While the bulk of anatomical pathologists' work involves the scrutiny of tumours, they also view biopsies of bowels, livers, kidneys and other organs for various diseases – inflammatory (Crohn's disease), bacterial (tuberculosis), viral (hepatitis C) and metabolic (haemochromatosis, which causes cirrhosis of the liver).

In their laboratories you will find gleaming stainless steel benches, body

bits drowned in formalin, cutting machines, staining and labelling machines, microscopes, scalpels, knives, and dictaphones to record proceedings.

Biopsy specimens are fixed in formalin, placed in containers, then put into a machine that impregnates the tissue with wax. This produces a firm block that can be cut finely into sections that are only one cell – or even less than one cell – thick.

“Those slices are then put on a glass slide and stained with different stains to bring out different features in the tissue,” says Dr Tomlinson. Hundreds of stains are available to help categorise cells.

Thirty years ago, breast cancer was breast cancer, and mastectomies were the treatment tool of the day. Today, the ability of anatomical pathologists to categorise, diagnose and prognose cancers more efficiently is an enormous contribution to modern medicine. It has, however, doubled and even tripled the workloads of pathologists.

Where anatomical pathologists practise

- **Public sector** – government-run laboratories servicing public hospitals
- **Private sector** – boutique or large multidisciplinary laboratories
- Working as **specialists** in paediatrics, women's health, forensics or neuropathology, or in hospitals with centres of cancer expertise
- Working as **academics** within universities

Just another day in the office

On a typical day at Douglass Hanly Moir Pathology, around 500 cases are divided between 15 colleagues. Some cases might require 30 or 40 slides each. They might end up with 2000 tissue blocks that need to be stained and examined by attentive eyes.

“Before staining and labelling machines came in about 20 years ago, it was all done by hand. So there has been some automation,” Dr Tomlinson says.

But cutting of samples is still performed by manually operated machines.

This is certainly no profession for slackers. Anatomical pathologists earn their whites over 13 years. The first six years are spent acquiring a medical degree, followed by a year as an intern,

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- Dr Jeanne Tomlinson

another as a resident, and another five years as a trainee pathologist in either a public or private-run laboratory.

“You need to have good visual skills and attention to detail, an urge to complete things,” suggests Dr Lourie, who works at Mater Pathology Services in Queensland.

“To have 100 slides and to know that you must look at each carefully and with the same level of detail... it takes a certain personality.”

Anatomical pathologists may gain expertise within certain areas, such as kidney, bone or lung pathology, by working in hospitals that have developed a centre of expertise. Some sit specific exams to specialise in paediatrics, women’s health, neuropathology, or the CSI specialty, forensics.

The new era for anatomical pathology is taking examinations from a cellular level to a molecular level, and using microarray technology (still largely research-based) to conduct rapid analysis of large amounts of genetic material.

“What we’re doing now is trying to figure out at the molecular and genetic level what the abnormalities are, and specifically making treatments targeting those abnormalities,” Dr Laycock says.

Recently, he used polymerase chain reaction (PCR) to amplify specific regions of a DNA strand as part of his investigation into a lump on the salivary gland of a young boy. Fine-needle aspiration cytology revealed some inflammatory cells, while staining revealed fungal elements, but PCR confirmed and identified the fungus.

“If that had not been confirmed, it might have festered and spread to the central nervous system and brain and caused all sorts of problems”.

Common conditions diagnosed by anatomical pathologists

- **Skin disorders** – solar damage-related disorders, such as basal cell cancer, squamous cell cancer, actinic keratoses (pre-cancerous skin damage), skin rashes
- Small **gastrointestinal** biopsies with gastritis, colitis, polyps
- **Common tumours** – colon, breast, lung and prostate cancer
- **Less common tumours** – lymphoma, melanoma, bone lesions, salivary gland and thyroid lumps, brain tumours

Says Dr Tomlinson: “Before, we would just divide lymphoma into small-cell lymphoma, which was good, or large-cell lymphoma, which was bad. Now we know lymphomas have a specific genetic ‘fingerprint’ that allows us to make a specific diagnosis. There are now over 30 different types of lymphoma, each with its own unique behaviour and treatment.”

And while drug companies are developing specific drugs to treat refined categories, those drugs are also tremendously expensive.

“You want to know that the patient is going to respond before you put them on a drug that costs \$50,000,” Dr Lourie says.

At least one anatomical pathologist has emerged from the shadows of his colourful television counterparts on CSI. In 2005, Dr Robin Warren, a senior pathologist at the Royal Perth Hospital, (now retired) and his colleague, Professor Barry Marshall from the Microbiology and Immunology Department at the University of Western Australia, took the Nobel Prize for Medicine for their investigative work on peptic and gastric ulcers, which led to a cure via antibiotics. Seventy thousand

Australians can now rejoice instead of belly aching.

“The general public don’t know what we do, and we are often undervalued by our colleagues,” says Dr Tomlinson, whose recent handiwork had a 37-year-old woman rushed to hospital for treatment of a rare fungal infection that had otherwise been tagged as an aggressive lung cancer destined to kill her.

“She’ll never know that I did it, or that I was the person who put her on the right path.”

Nor did the chap about to be ‘beaten up’ by his wife’s family ever know that Dr Miller proffered the vital piece of information that whisked vengeance from their minds:...

“A woman who had an ectopic pregnancy thought her partner had caused her to lose the baby because he had beaten her up the night before,” Dr Miller says. “I explained to her that she’d had a miscarriage because the baby was implanted in the wrong place... people are interesting!” 🔥