



Excellence in Clinical Practice

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| Title of entry | Excellence in Clinical Practice: Histology Services, Hawke's Bay District Health Board |
| Synopsis of entry | <p>While we can recognise this service for its early commitment to building and achieving a service of high quality, it as an even greater achievement to maintain and, in this case, significantly add to that level of quality over a sustained period of time. This submission describes how a department within our laboratory that has achieved just that.</p> <p>We are not describing a project that has run for six months or even over a year – Histology Services has sustained achievements with a diverse team brought together and managed under two different organisations</p> |
| Name of organisation/s | <p><u>Hawke's Bay District Health Board:</u> Histology Laboratory and Office Staff</p> <p><u>Southern Community Laboratories Hawke's Bay:</u> Pathologists</p> |
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Our Organisation –an integrated Histology Service

In 2008, driven by, the new Community Laboratory Contract and partnership arrangement between Hawke’s Bay Hospital Laboratory and Southern Community Laboratories (SCL), the Histology Service took up the challenge and opportunity to develop a truly integrated service for the whole Hawke’s Bay District Health Board (DHB) region providing continuity of diagnosis, and improved clinical communication and responsiveness.

This was in marked contrast to the previously fragmented services delivered from three independently run laboratories. Histology services for all DHB patients is now located at the Hawke’s Bay Fallen Soldiers’ Memorial Hospital. The three histopathologists are employed by SCL and the technical (scientists and technicians), and office staff are employees of the DHB.

The team is a collaboration of:

- 3 pathologists (Dr Lesley Joblin as lead) from SCL and HBDHB staff
- 2.6 scientists (with Christine Gregory as Charge) and 5.4 technicians providing the necessary technical work; and
- 4 office staff (Sue Larkin as team leader) who register the accessions and type the final reports, together with their other clerical tasks.

Initially the three work groups had different reporting lines, with the clerical staff reporting separately to the DHB’s Administration Manager. Reporting lines have now changed with all technical staff and clerical staff reporting to the Laboratory Manager. The pathologists report to and work under the oversight of SCL. The technical and pathologist resourcing levels are considerably lower than Wellington and Christchurch hospital, despite the increasing throughput of work being managed by the team.

Excellence in Clinical Practice

Hawke’s Bay clinicians, both hospital and community based, are fully reliant upon a histological service that makes accurate, timely and cost effective diagnosis on patient tissue samples to enable them to provide the appropriate, and timely treatments (right treatment, right time, right place).

The histology department has now provided such a service over an impressively long period of time **with arguably the fastest turnaround times for histology specimens in New Zealand.**

The nationally driven “Faster Cancer Treatment” programme has greatly added to histological service demands throughout the country. The Hawke’s Bay histology department has absorbed these demands with what has seemed like relative ease, and with insignificant additional service costs, whilst maintaining their impressive level of quality services to the clinicians and patients of the region. The DHB is well placed, from a histological service aspect, to achieve the 62 day patient treatment target for Faster Cancer Treatment.

The histological diagnosis of a malignant tumour is the critical decision point in determining the clinical treatment that follows for the patient. Prior to 2008, a patient from HBDHB region could have had their histology reported from any one of three separate laboratories. The tissue from follow-up surgery could have been reported by a different laboratory. The integration of histology services onto the Hawke’s Bay Hospital site was a major advancement, ensuring improved continuity and speed of the final diagnosis and, as a result, earlier treatment leading to better patient outcomes. The demands of the Faster Cancer Treatment Key Performance Indicator of 62 days (from referral to the first treatment) requires for the histological reporting to very accurate and timely.

Determining the histology of a tissue sample within histology requires a number of steps that would surprise the non-technical observer. These are detailed under Appendix Two; a summary of key terms is provided below:

- Accession – patient event resulting in histology tissue samples (example – an endoscopy procedure may result in up to ten tissue samples)
- Cassette – holds tissue samples for processing (examples – a simple skin lesion requires one cassette, a breast sample up to 120). **The number of cassettes used by the laboratory is a basic indication of the complexity of the samples received.**
- Block – processed tissue sample placed into a wax block ready for slicing and mounting onto slides
- H&E – Haematoxylin and Eosin stains, 1 block = 2 H&E slides
- Immunohistochemistry – a specialist staining procedure to identify tumour type and treatment options.
- Frozen section - is done on fresh tissue directly from the patient upon the operating table. The tissue is hand delivered to the laboratory and a subsample is snap frozen into a block. Immediate testing is undertaken and results communicated to theatre surgeon.

The changing workload

Since 2008, the histology laboratory has, in addition to the hospital work, received and processed all the community generated tissue samples (GPs and private specialist clinics). Over this time span, there have also been a significant increase in general hospital surgical volumes, specialist skin clinics established in the community, and specific cancer identification/treatment programs such as breast screening and bowel cancer initiatives.

Over the past five years, the actual volume of patient events requiring the Histology service has increased steadily – from 16,547 accessions in 2010 to 17,400 in 2014. When we compare our team’s performance with other DHB hospital laboratories we appear to be leading the field. Wellington does about 12,000 per year and Christchurch about 25,000 (we are mindful that these laboratories do not routinely do community generated work). Refer Table 1.

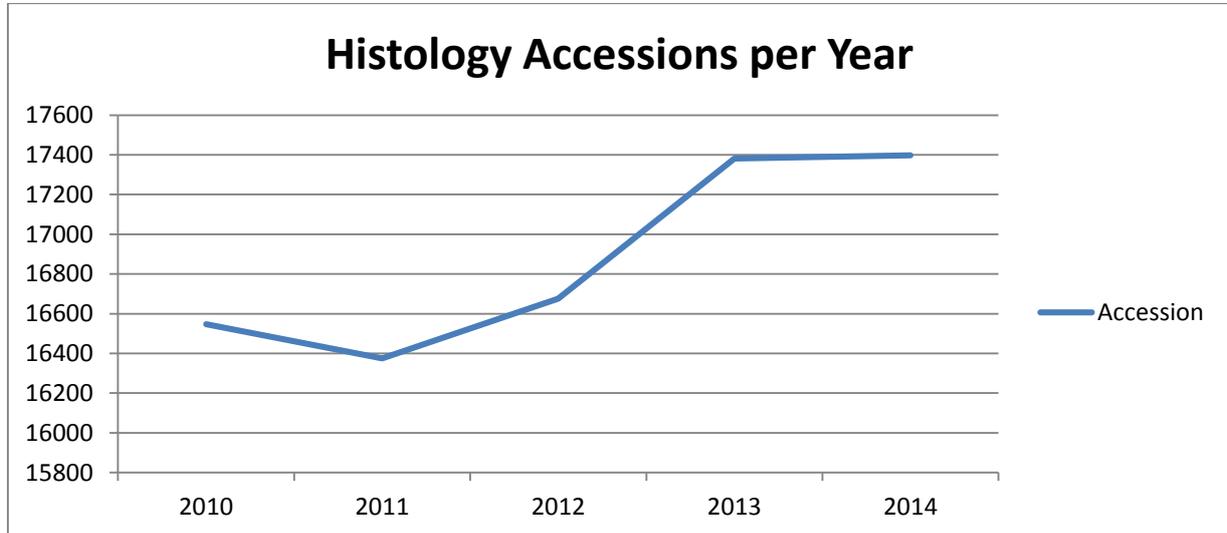


Table 1: Histology Accessions 2010 to 2014

The number of tissue blocks has risen dramatically over the five years (a 67% increase from 29,873 in 2010 to 50,075 in 2014). This reflects the increase in complexity of samples received. Complex samples would include bowel, breast, and other large organ resections. Refer Table 2.

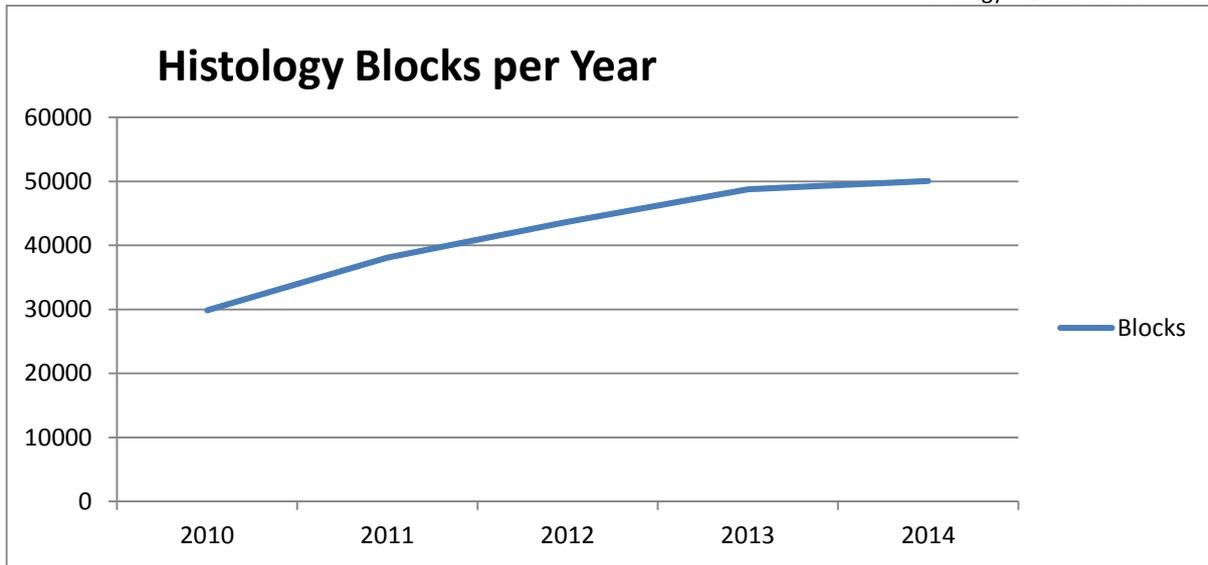


Table 2: Histology Blocks 2010 to 2014

The immunohistochemistry slides done per year have increased 74.5% from 3,379 in 2010 to 5,897 in 2014. The increase mirrors the increase in blocks (more complex samples) but also indicates the increased pathology (increased cancer identified) on those samples. Refer Table 3.

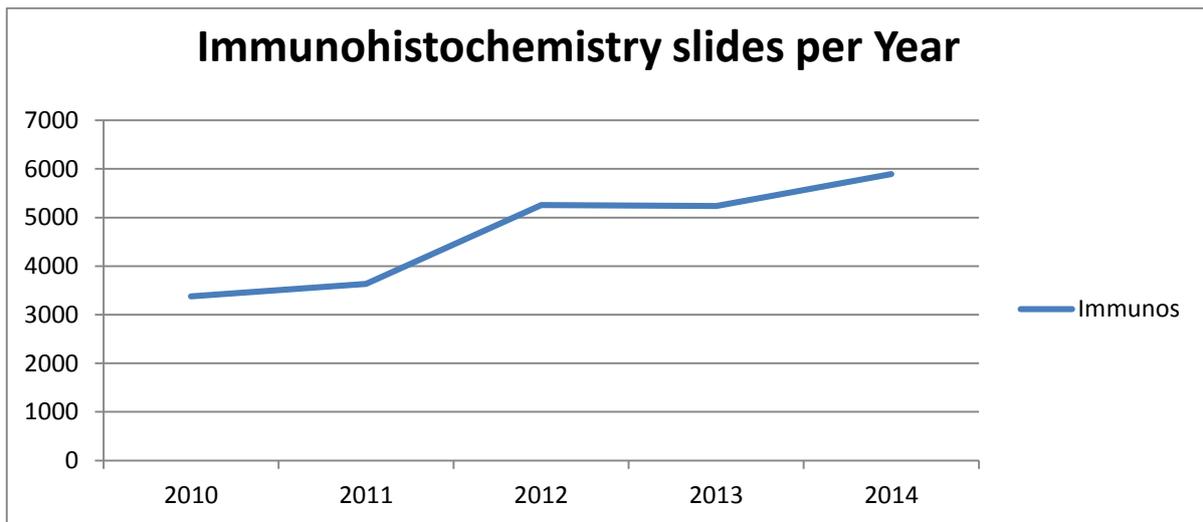


Table 3: Immunohistochemistry 2010 to 2014

Our Technical Staff

Over the 2010 to 2014 period, the technical staffing levels increased by 1.0 FTE technician. The first technical part of processing tissue is the “cut-up” (refer Appendix One). The technical staff at our laboratory – scientists and technicians - are responsible for over 95% of the “cut-up”. Technical staff completing this volume of processing is unique to Hawke’s Bay. In contrast for example, Christchurch and Wellington hospitals employ registrars for this role with a selected few senior scientists doing simple skin samples. The model adopted in Hawke’s Bay has reduced the cost of operating the technical part of the histology laboratory and increased the technical efficiencies.

Our Office Staff

These staff members are integral to the histological service – they register the accession into the computer, type both the macroscopic reports from cut-up and the final microscopic reports as dictated by the pathologist/s. The team also files the slides and tissue blocks, and arranges for the slides and other relevant information to be available for the pathologist to present to the multi discipline meeting.

Pathologist/Clinician Meetings – Multi-Discipline Meetings (MDM)

The MDM sessions are attended by the relevant diagnostic and treatment cancer teams – oncologists, surgeons, radiologists, other clinical staff and teams, and pathologists. The increase in immunohistochemistry undertaken by the team has resulted in a corresponding increase in hours spent attending, and the pre and post preparation time, the MDM sessions. Pathologists attend 25 MDM sessions monthly (33 hours per month) with an estimated additional hour spent pre and post by office and/or technical staff per MDM.

Turnaround Times for Histological Specimens.

A fast and accurate histological report results in reduced patient anxiety, and provides a platform for earlier treatment interventions as appropriate. The tissue for routine histological examination is required to be fixed in buffered formalin. For most samples the fixation takes several hours. Larger samples such as uterus, breast or bowel samples are required to be “opened up” by a pathologist, to allow for full formalin penetration into the tissue to prevent autolysis of the cells to be examined, and can therefore add a day to the technical work.

The turnaround times delivered by the Hawke’s Bay Histology service are the best in New Zealand.

| Histology Turnaround Time - Days to Report a Result | | | | | | | | | | |
|--|--------------|--------------|--------------|--------------|--------------|-------------|-------------|-------------|-------------|-------------|
| (Data average for 1 July 2014 – 30 June 2015) | | | | | | | | | | |
| | 0-1 days | 2 days | 3 days | 4 days | 5 days | 6 days | 7 days | 8 days | 9 days | 10 + days |
| Hawke’s Bay Hospital Laboratory | | | | | | | | | | |
| % reported | 53.5% | 31.5% | 10.2% | 3.0% | 0.8% | 0.3% | 0.2% | 0.1% | 0.1% | 0.4% |
| Milestones | | 85.0% | 95.2% | 98.2% | 99.0% | | | | | |
| Other Laboratories from within New Zealand | | | | | | | | | | |
| Lab A | | | 58% | | 82% | | | | | |
| Lab B | | | | | 82% | | | | | |
| Lab C | | | | | 90% | | | | | |
| Lab D | | | | | 80% | | | | | 98% |
| Lab E | | | | | 82% | | | | | 99% |
| Lab F | | | | | | | | | | 80% |

Table 4: Histology Turnaround Time 2014/2015 year

The turnaround data shown in Table 4 above has been consistent over recent years despite the significant increase in technical work required and MDM session commitments.

When our data has been compared to a number of other laboratories within New Zealand, it consistently outperforms all other laboratories. The data in the table above was gathered by the Laboratory Quality Assurance Group and is listed from Lab A to F. For example, 85% of samples received into our laboratory are reported in two days; Laboratories A, B, D, E, and F have not achieved this within five days. Our laboratory achieves reporting of 99% of samples in five

days – with the unreported samples almost invariably awaiting a second opinion from a reference laboratory, usually from outside New Zealand. Laboratories D and F have not achieved this even after ten days.

The Breast Screening programme requires a quick diagnosis leading onto the appropriate treatment. The histology laboratory provides a histological service for not only the HBDHB region but also for the Gisborne Breast Screening patients. Breast core samples are collected on Monday to Wednesday afternoon and almost without exception, a diagnosis is available for the Breast MDM session by Thursday lunchtime. It is quite conceivable for a patient to have a breast core sample on the Wednesday afternoon and find out their diagnosis within 24 hours.

This speedy service is considered best in class compared to anywhere else in New Zealand.

Clinical Viewpoint on the Histology Service

The feedback received from clinicians regarding service performance is consistently positive and informs critical treatment decisions. The impact that the quick turnaround time, and the advice given to clinical staff, has on patients is best assessed by asking the clinicians, from both the hospital and the community, who are responsible for investigating and treating the patients.

The service we get here from the histopathology dept is admirable and excellent. The turnaround time is superb, and the reports are almost always of considerable help. Interaction with the pathologists is excellent and of very high quality.

Dr Malcolm Arnold, Medical Director of Acute and Medicine and Gastroenterologist.

I'm blown away by the rapid turnaround time of histology specimens sent from colonoscopy. I've never worked anywhere that has even come close. Thanks for providing an amazingly efficient service!

Dr Tom Boswell, Gastroenterologist.

I think the pathology service and the pathologist offer a wonderful service. The pathologists are very approachable and always willing to discuss cases. They do a wonderful job explaining their logic, and are always happy to review a case when there is new or conflicting clinical data. They are also very open to getting outside opinions on difficult or unusual cases.

Dr Jody Jordan, Oncologist

As a dermatologist, I submit in excess of 500 skin cancer specimens for histological examination each year. Over the past 8 years I have felt privileged to be partnered in my practice by such a competent and efficient service. A few years ago, my principal nurse and I spent a day at the lab and followed specimens right through reception, cutting, block fixing, sectioning, staining, mounting and finally examining. We were made welcome and treated extremely well by everyone and learned a great deal which has helped us interact better with the lab ever since. I cannot think of a department in the DHB that deserves recognition for a job well done more than the Histological Service and recommend them unreservedly for an award (Excerpt from letter attached in Appendix Three)

Dr Hugh Findlay, Dermatologist, City Medical

The histology team takes pride in such comments and it helps them appreciate the positive impact they are making upon the patient diagnosis and treatments – for the entire HBDHB regions community and hospital services. The clinical feedback embraces the whole team – office, technical, and pathology staff. None of the above could be achieved with isolated work practices.

Future Plans

The histology laboratory is currently upgrading the computer software used (Delphic AP version 9 with the Single Piece Workflow and Tissue Management Modules) to record and report the patient's histological accession. When this upgrade is completed by the end of 2015, we will be the first laboratory in New Zealand to have this latest version.

The recently announced planned build of new Endoscopy suites for 2017; the planned National Bowel Screening Program; and improving Faster Cancer Treatment Targets will add increased specimen volumes and new quality requirements. These will present new challenges for the histological service and indeed the entire DHB laboratory. The full interdepartmental engagement of the laboratory, clinical teams, and management will be vital to ensure resourcing allows for the current "routine" service quality to be maintained and even enhanced for the future. Some recent changes in the management structure within Health Services allows for better linkages between senior laboratory management and clinical services management to allow for the required engagement.

Appendix One

Tissue Sample Processing



Sample Receipt and Registration

Samples for histological examination arrive into the laboratory with individual specimen bags and forms, as pictured here. Each specimen is carefully checked to ensure the patient details match exactly and that there is clinically relevant information on the laboratory request form. Each form – which may have multiple specimens - has a unique laboratory episode number added to the form and associated specimen(s). This unique number is used to register the patient event into the Delphic AP computer software that is used to process the sample and eventually issue a report

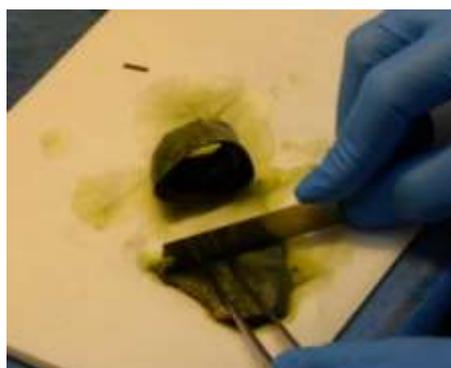


Cut-up

Samples have cassettes fully labelled with the patient and episode number details plus the unique cassette number. Pictured here is a patient sample at the cut-up bench with three labelled cassettes. The bench has special air extraction – down and from the back - to reduce the staff member's exposure to the hazardous formalin that the tissue was placed in to preserve the cellular structure.



This picture shows a gall bladder that has been preserved in formalin. The technical person (or pathologist) doing the cut-up records, via the Winscribe dictation system, the macroscopic appearance of the tissue. This will include the length, diameter, colour, shape, and any other relevant information about the sample.



The gall bladder is cut with three sections being placed into their individual cassette for the tissue processing cycle that runs over night.



Tissue Processing

The cassettes are placed into the tissue processor with multiple racks of cassettes stacked on each other. This processor chamber can hold up to 300 cassettes and the other processor 400. The processing cycle is programmed to start in the evening so the tissue is available for the next step at 0730 in the morning.



The tissue processor step prepares the tissue for examination. There are three main phases in the tissue processing step. The first step is to dehydrate the tissue of all water. The cassette chamber is flooded with increasing strengths of alcohol (ethanol) to remove the water from the tissue with the final step using 100% alcohol. The next step is the “clearing” cycle where the cassette chamber with the tissue is filled with increasing concentrations of xylene that replaces the alcohol in and around the tissue. The tissue becomes transparent and clear. The last step is where molten wax that infiltrates the tissue and helps maintain the cellular structure.



Embedding

After the tissue processing cycle the tissue sample is embedded in molten wax (temperature = 60 degrees C). The tissue section is carefully placed in a metal mould to ensure the correct “face” is aligned so the appropriate thin sections can be cut from the solid wax/tissue block. The wax is dispensed into the mould and allowed to set on a cold plate. As the wax/tissue block sets, in some instances the tissue may need to be held to ensure the correct orientation within the block. The plastic cassette is placed on top of the wax/tissue mould.



The block is placed on a cold plate (temperature = 4 degrees C) to set fully. The different coloured cassettes are used to readily the different type of tissue. White = general tissue; purple = Dr Lesley Joblin; and green = Skins In this picture you can see the plastic cassette sitting on top of the metal mould which after the wax has set is removed exposing the tissue facing that is cut for thin sections.



Sectioning

The cassette is placed into the holder on a microtome. The holder with cassette can be moved across a very sharp knife blade to produce very thin slices of the tissue embedded in wax facing. This picture shows slivers of wax/tissue around the knife edge. The tissue can be seen embedded in the wax within the green cassette. The head of the cassette holder can be set to advance towards the knife edge by 3 μm at a time. A μm is one millionth of a metre



A cut wax/tissue section is gently lifted off the face of the microtome knife edge and floated on top of a water bath. Here three sections from the tissue block can be seen floating on the water (temperature = 50 degrees C)



The appropriate wax/tissue section floating on the water bath is gently separated using tweezers and a microscope slide is brought up underneath and the tissue floated onto the slide.



A slide with two wax/tissue sections placed upon the glass surface. There are at least two distinct pieces of tissue in each section.

The slide is then placed onto a hot plate to fix the tissue firmly on the slide. After the heat fixing the slide is stained with the routine histological stain – Haematoxylin and Eosin (commonly called H&E). After the staining a thin glass coverslip is mounted over the stained tissue surface.

In 2014, the histology laboratory used over 125,000 slides



Collation

This is another important final check before the H&E slides are taken through for pathologist examination. Here the wax/tissue block is matched against the H&E slide – both by name and episode number but also by a physical match. Here you can see the block at the bottom with the matching H&E slide above.



Immunohistochemistry

In addition to the H&E slide, the histology laboratory now does specialised staining using specific monoclonal antibodies to detect “markers” on or within the tumour cell. The “markers” can assist with further defining the diagnosis and/or give direction on the most appropriate treatment. This picture shows four H&E slides and ten immunohistochemistry stained slides. All immunohistochemistry slides are examined under the microscope by the pathologist.

What Happens to the Slides and Tissue Blocks?

- Every slide and tissue block is filed in the episode number sequence. Therefore in 2014, we filed over 125,000 slides and 50,075 tissue blocks. Accuracy in filing is critical as we may need to refer back to the slide and/or block
- We store every slide, tissue block, and request form for 25 years. The histology laboratory has literally millions of slides stored in the basement and at the Crown Storage facility in Hastings
- When a patient sample presents to the histology laboratory, we check to see if there has been any relevant samples received previously – over the past 25 years! If required we can retrieve the relevant slides and tissue block and re-examine the old tissue using the most up to date immunohistochemistry staining that may not have existed at the time. The pathologist can use the previous specimen to assist with diagnosis on the current specimen. A tumour identified many years previously can resurface as a secondary tumour in another site of the body. Immunohistochemistry can link the two events.

Appendix Two

Technical Terminology

Accession – each patient event that leads to tissue being sent to the histology laboratory is called an accession. While an endoscopy procedure could result in up to ten different tissue samples being sent it is still called one accession. Before 2008, the hospital histology laboratory processed approximately 4500 accessions – last year (2014) they processed 17,400. In 2011 the laboratory, in conjunction with the endoscopy team, introduced the technology to add up to eight biopsies onto a “Millipore” strip which reduced the number of cassettes, blocks, and slides used. About 50% of endoscopy work is received now on these Millipore strips.

Cassette – tissue samples from the patient are placed into these 3.5cm x 3cm plastic cassettes for the tissue processing step which is generally an overnight procedure. A small skin lesion would require one cassette whilst a breast sample recently required 102 cassettes. **The number of cassettes used by the laboratory is a basic indication of the complexity of the samples received.**

Block – after the overnight tissue processing step the tissue is embedded into a wax block. Sections of the embedded tissue are cut off and mounted onto slides for staining and examination under the microscope by the pathologist.

Haematoxylin and Eosin (H&E) – this is the basic histological stain used for every patient tissue block. Every block has two H&E slides done. The pathologist identifies suspicious or actual tumour cells using this stained slide.

Immunohistochemistry – this is a specialist staining procedure using monoclonal antibodies, on tissue cut from the block and fixed onto a slide, to identify specific markers in or on the tumour cell. The immunohistochemistry follows the H&E slide and is used to help define the type of tumour and what treatment options could be best for the patient. **The volume of immunohistochemistry slides done is a basic indication of the number of positive malignancy cases received.** The monoclonal antibodies used can be very expensive with 1ml of monoclonal costing \$1900. The histology laboratory has a profile of approximately eighty different monoclonals in use

Frozen Sections – is done on fresh tissue directly from the patient upon the operating table. The tissue is hand delivered to the laboratory and a subsample is snap frozen into a block. Sections are then cut in a specialist microtome that is mounted in a refrigerated unit (called a cryostat) at -20 degrees C. The slides are immediately stained and examined by a pathologist. The pathologist phones the presumptive diagnosis to surgeon who has remained with the patient in theatre. If required, this enables immediate surgical intervention within the single theatre visit, and is now commonplace in breast and prostatic surgery where the removal of additional lymph nodes may be required. The frozen section procedure is very labour intensive (typically takes an hour of technical time), with the histology scientist and pathologist working in synergy to achieve the rapid reporting. The tissue still undergoes routine processing as well.

Appendix Three

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Mr Ash Fitchett
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12 th August 2015

Dear Ash

Thank you for the opportunity to support your nomination of the HBDHB Histological Service for an Excellence in Health Award this year.

As a dermatologist, I submit in excess of 500 skin cancer specimens for histological examination each year. Over the past 8 years I have felt privileged to be partnered in my practice by such a competent and efficient service.

I can rely on histopathology reports being available a week after submission, which fits conveniently with my patients' return visits for review and removal of sutures. I am able then to discuss the histology with them and usually reassure them that all is well. On occasions when the reports are not to hand in that time frame, I have found the reception staff very helpful in tracking progress of the specimens and putting me through to the pathologist should I like to discuss the case with them.

I always find the pathologists approachable and happy to discuss cases and consider further sectioning or tests. On the rare occasions that I have felt uneasy with a histological diagnosis, I have always felt comfortable discussing this and feel that they support a team approach to the benefit of the patient.

A few years ago, my principal nurse and I spent a day at the lab and followed specimens right through reception, cutting, block fixing, sectioning, staining, mounting and finally examining. We were made welcome and treated extremely well by everyone and learned a great deal which has helped us interact better with the lab ever since.

I would also like to commend the pathologist's (particularly Lesley Joblin's) enthusiasm to engage with the team of Primary Care Skin Lesion Providers, attend after hours meetings and offer support and advice to the doctors. We know that this goes above the call of duty and really appreciate it.

I cannot think of a department in the DHB that deserves recognition for a job well done more than the Histological Service and recommend them unreservedly for an award.

Yours sincerely

Dr Hugh Findlay
 Dermatologist