Introduction of the AS-410M to Tallaght University Hospital- From challenge to change - a story of innovation in daily lab life

Presented by Laura-Anne Williamson

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Tallaght University Hospital

Dublin, Ireland

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Introduction

- Background to our Hospital and the struggles we have faced in recent years
- Introduction of the ASM and the positive impact it has had on our department
- Troubleshooting
- Plans for the future

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Challenges over recent years

- Tallaght University Hospital (TUH) is currently in an expansion phase with increasing capacity in dermatology, gynaecology, surgery and endoscopy. This has put extreme pressure on the demand for Cellular Pathology services.
- The cellular pathology lab has struggled in recent years to produce results in a timely manner resulting in failure of TATs in the face of sustained service expansion and chronic medical scientist staff shortages.
- The core issues we have encountered are:

1. Increase in workload
2. Increase in additional ancillary testing
3. Staffing

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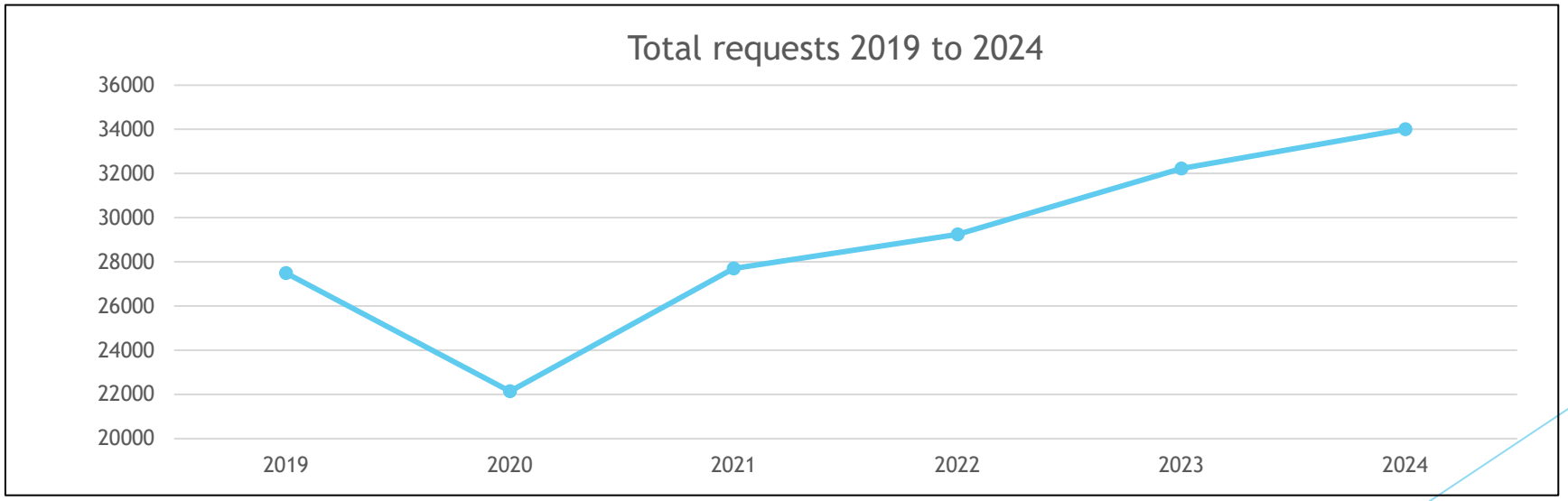
Increase in the number of histology requests

- In 2020 the Lab recorded 22,141 requests. By 2024 this had increased to 34,009. Approximately 10% increase annually
- Number of histology requests from 2023-2024 increased by 19%
- Processing approximately 65,000 histology samples a year.



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Increase in additional testing in 2024

- Samples for referral for molecular testing- increase of 13%
- Special stain requests ↑ 11%
- Frozen section requests ↑ 56%
- DNAX5 (B & T cell rearrangements) ↑ 5%
- Immunohistochemistry (IHC) testing has also seen a steady increase over the last few years of approximately 10% a year. However, in 2024 there was a slight decrease of 5%.
- Cytology experienced an increase in samples of 5% in 2024. This resulted in: ↑8% PAP, ↑48% MGG, ↑11% IHC, ↑95% specials, ↑23% cytology blocks

Staffing

- Vacancies unfilled since 2020.
- We are currently experiencing a 40% deficit.
- Engagement with staff during the year to improve rotas and processes but hard to keep up morale.
- Limited staffing means covering areas with most demand and of highest importance such as IHC. Staff burnout, low morale in the department, increase in non conformances, loss of experience due to retirements, time spent on training new staff.

Time for a change

- In 2023 we had experienced 3 years of increases in overall workload and no improvement in staffing levels.
- TATs in TUH have fallen significantly short of the National Histopathology QI programme targets.
- Solutions to maintain the service so far have been reliance on agency staff, overtime and outsourcing. However, these were unsustainable and increasing the cost of service. Not having enough of an impact.
- One of the major bottlenecks in the lab was blocks waiting for microtomy. It was one of the most labour intensive areas and relied on qualified medical scientists.
- Heard about the AS-410M
- Set a plan in place - funding, space within the department, liaising with staff

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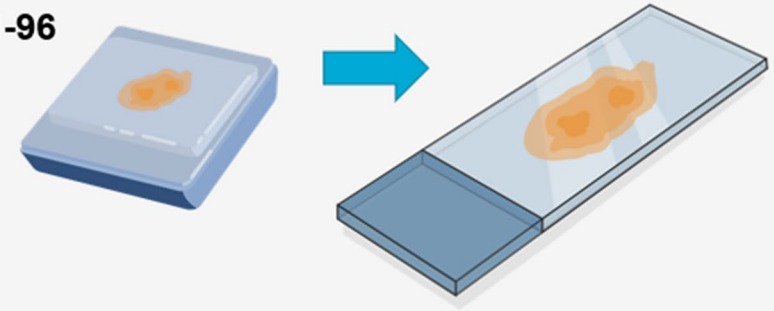
Capacity

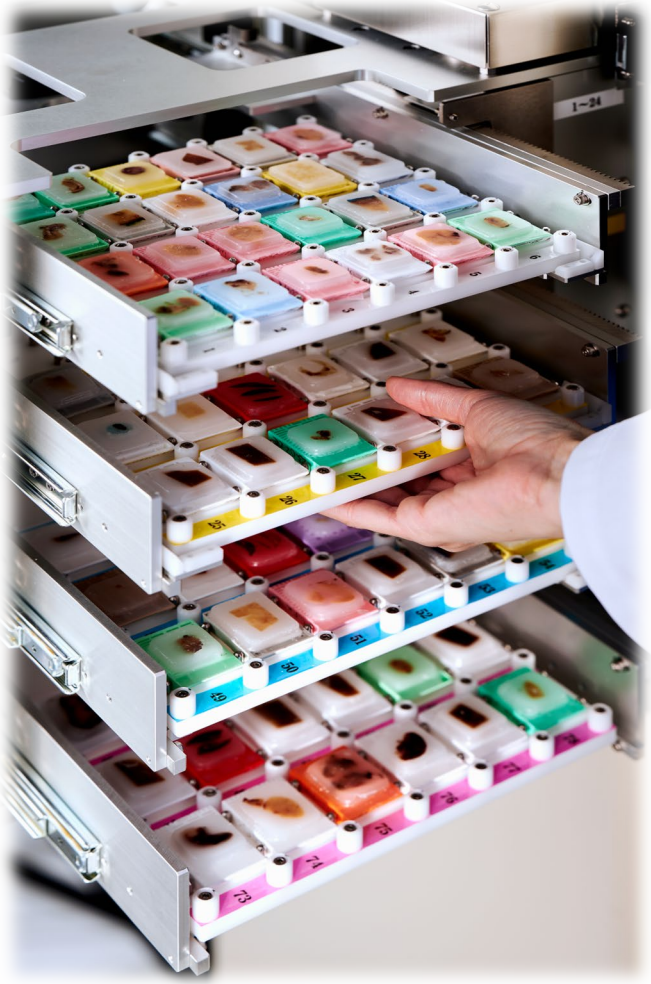
Routine process time:
1 block = approx. 2-2.5 min
24 blocks = approx. 48- 60 min
96 blocks = approx. 3.5 - 4 hours

1-96



Max. 400 slides

Control process time:
100 slides = approx.60 min
400 slides = approx. 4 hours



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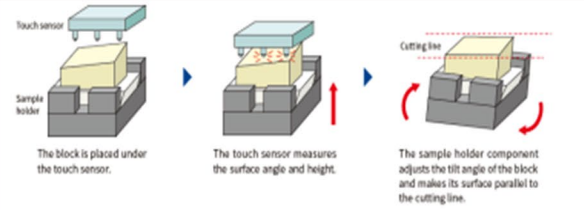
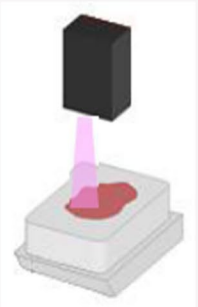
AS-410M Sectioning Process

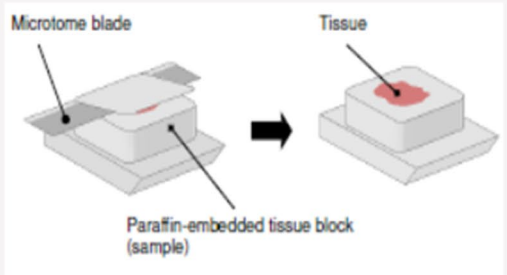
1) The QR/ or data matrix code is scanned.



2) The blocks' angle and height is detected by 4 spring sensors. And can be adjusted to meet a plan sectioning line. Tilting more the 6%= Block rejected



3) The temperature is measured. If the surface in above around 19°C it would hold back the sections.



4) The unit will preform a polish to align the block and the blade. Polish is built up on an algorithm and is a fixed quantity.

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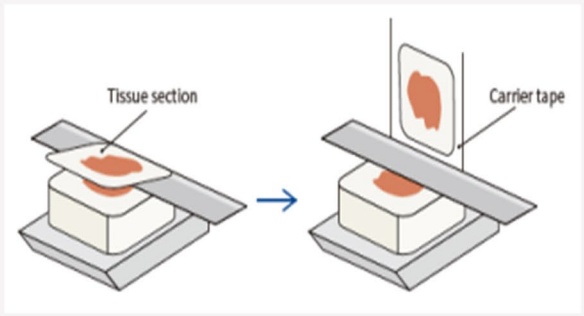
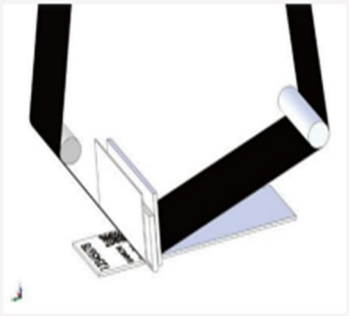
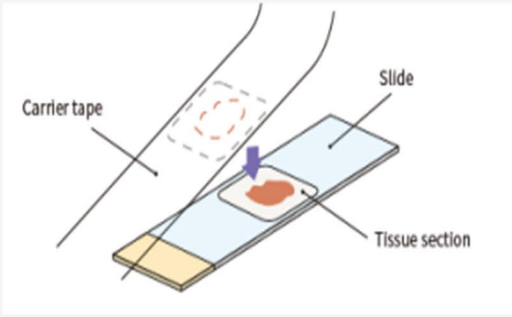
AS-410M Sectioning Process



4) The unit will make 4 pre section prior to the section that is mounted on the slide.



5) A corresponding print to the block will be printed on the frosted area.



6) The section is being transferred from the carrier tape on to the slide with the help form mounting medium.

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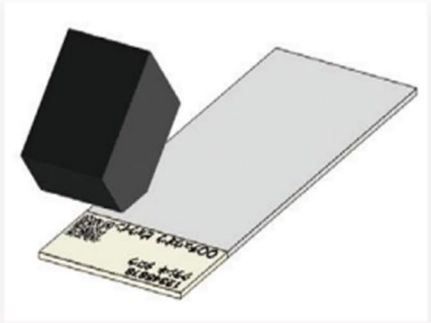
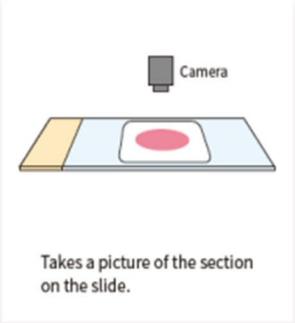
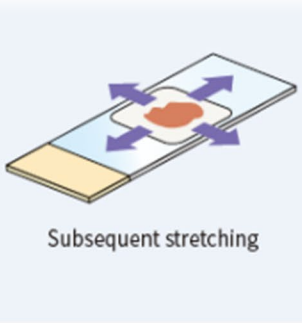
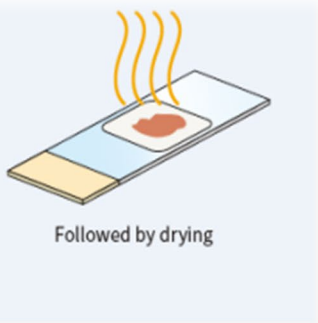
AS-410M Sectioning Process









7) The barcode is check and verified = no patient mix up
And the quality of the sections is being captured in images.

8) The section is stretch on a heating plate.

9) Then transferred to the dry chamber and ready for unloading.

Thermoregulator (drying unit)

Thermoregulator (stretching unit)

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Installation Timeline

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March 2025

- Backlog of over 2,500 blocks waiting to be cut for an initial H&E stain.
- No staff on a microtomy rota- 1 agency staff member on site Monday to Wednesday. Therefore only urgent samples cut on Thursday and Fridays- no routine microtomy.
- TUH was due to commence the BowelScreen in 2025 and was allocated funding by the programme to purchase the AS-410M
- The AS-410M would allow for automated microtomy. This was one of the major pit falls in the lab due to how time consuming it is and the reliance on qualified medical scientists.
- The objectives of the introduction of the ASM: improve TATs, quality of sections being produced, standardise processes as much as possible in preparation for digital pathology in the future.

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Preparation for Delivery

A lot of planning went in before accepting delivery of the AS-410M to ensure processes were as optimal as possible and to select a team to receive initial training and conduct the validation.

- Identified and freed up space in the lab.
- Validation team was selected: 1 Senior Medical Scientist, 2 Medical Scientists and 2 Medical Laboratory Aides.
- Validation plan was established which took into consideration the AS-410M requirements

Installation and Training

- Installation and initial set up took place at the end of March 2025.
- The Syntec and Axlab applications teams provided one-on-one training: demonstrations of the changing of consumables such as the carrier tape, ink ribbon and daily maintenance to be carried out.
- The applications teams set up protocols which enabled the running of different tissue types on the AS-410M.

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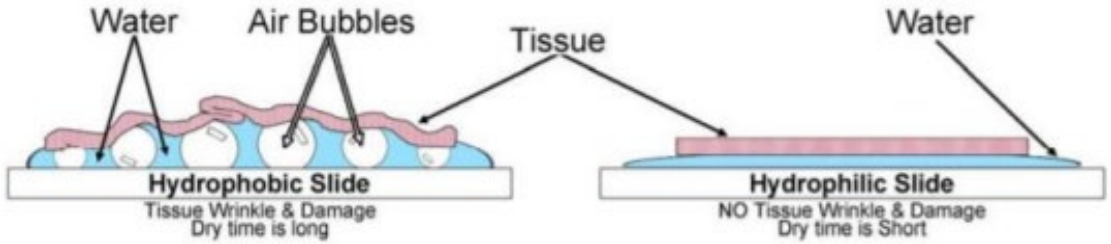
Preparation for Validation

- Prior to installation, a variety of tissue samples were chosen. These included standard resections, e.g. kidney, tougher tissue, e.g. hysterectomy samples and fatty tissue, e.g. lipoma samples. We also included tissue that would be typically cut thinner at 3um instead of the standard 4um, such as lymph nodes.
- AS-410M requirements: Grossing / cut up, Processing, Embedding, Paraffin, Pre trimming, consumables



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Initial Validation Workflow

- Step-by-step process documented.
- 2022 Archive material for initial testing for parameters and thickness.
- Parameters were set-up accordingly.
- Ran a range of different tissues on thickness of 3µm, 4µm, 5µm, 6µm.
- Ran on different parameter settings to discover optimal parameter for each tissue.
- Enhanced parameters and made alterations.
- Slides stained and given to consultants for review.
- Preferred thickness, preferred parameter and comments documented.
- Skins, Lymph nodes, Bone marrows and GI biopsies ran after 3 days.

ASM Parameter Cheat Sheet

Parameter Number	Tissue type
2	Default
3	Control Sections (bottom of slide
4	Hard Tissue
5	Fatty Tissue
6	Multi-well/Small

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Validation

- 2023 Archive material for final validation, 5µm preferred thickness for all tissue exempting bone marrow 4µm preferred thickness.
- Sections were cut, stained and compared to the original H&E sections which were produced originally by manual microtomy.
- The slides were scored by Dr Kevin O'Hare, Consultant Histopathologist. Preferred thickness, preferred parameter and comments documented.

Validation Feedback and Observations

Parameter DEFAULT60 (2)		
Case Number	Tissue Type	Comparable with original H&E
23H868 A1	PNS	Improved.
23H443 A2	CORH	"
23H1005 B4	SB	"
23H604 A1	RE	"
23H740 A1	APP	"
23H809 A1	APP	"
23H731 B2	SO	"
23H627 A1	KID	"
23H745 A1	VULX	"
23H1375 A6	OES	"

Parameter FATTY (5)		
Case Number	Tissue Type	Comparable with original H&E
23H2982 A1	LIPO	Improved.
22H25612 A1	LIPO	Improved. – cell boarders are very defined
23H443 A16	LN	Improved.
23H443 A15	LN	Improved
23H508 B1	SKXE	Not as good.
23H1196 B3	LN	Comparable.
23H3036 A26	LN	Improved.
23H508 B5	SKXE	Not as good.
23H1196 C1	LN	Comparable.

Parameter MULTIWELL (6)		
Case Number	Tissue Type	Comparable with original H&E
23H536 E1	DTX	Comparable.
23H541 A1	RECP	Not polished enough.
23H467 A1	SKPX	Improved - Original had thick & thin Section.
23H739 A1	SKXE	Comparable.
23H1453 A1	CXB	Improved.
23H489 A4	LETZ	Comparable.
23H507 A1	SKXE	Comparable.
23H522 A1	GFX	Improved.
23H522 C1	ANTX	Fold on ATOM Section.
23H2058 F1	URE	Comparable.

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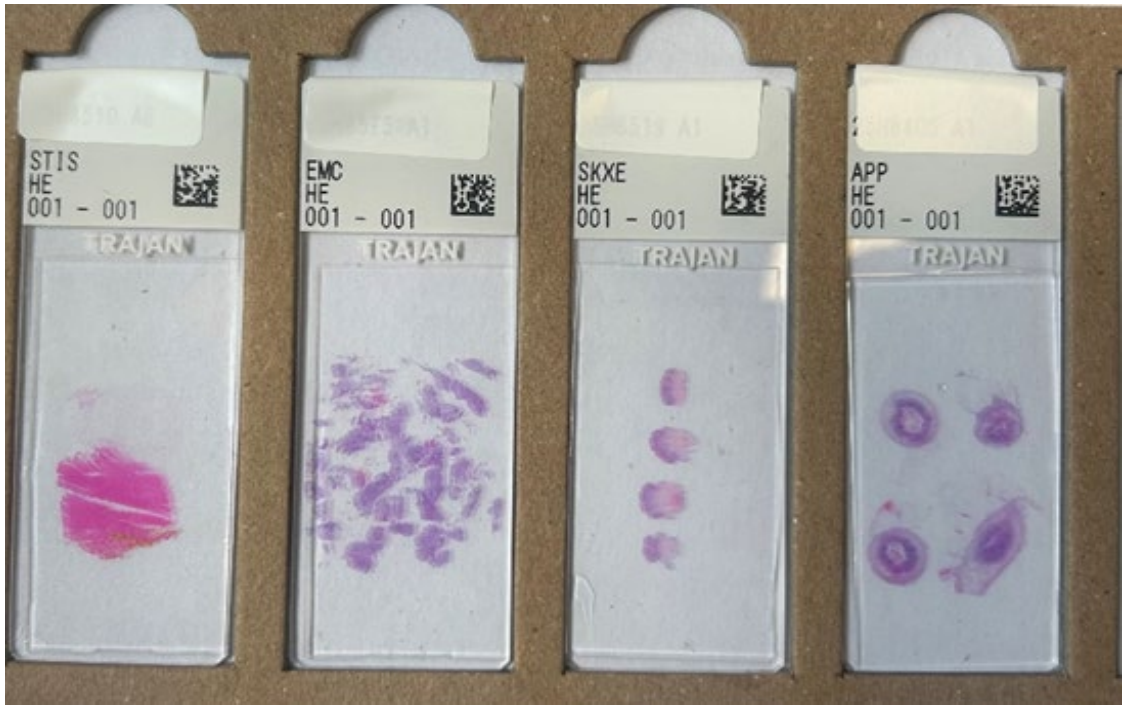
Validation

- It was found that the quality of the majority of sections were greatly improved when cut on the AS-410M.
- This was due to the fact that the AS-410M eliminates carry over and squamous cells that would typically be seen with the use of a water bath at manual microtomy.



A = Soft tissue (muscle)	B = Endometrium Curettage	C = Skin Excision	D = Appendix

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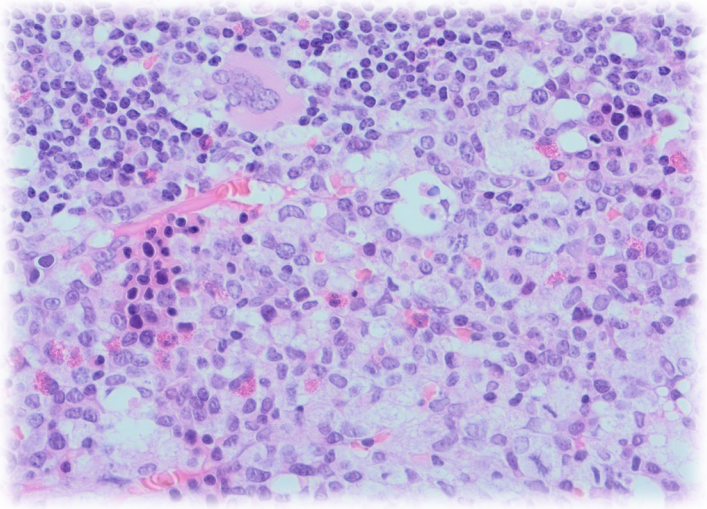
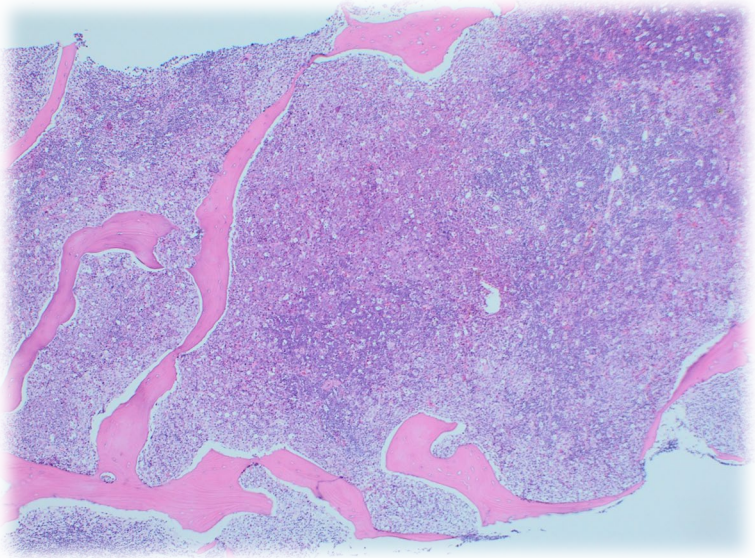
Bone Marrow Sections



4 µm × 400 magnification



4 µm × 40 magnification

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Validation of GI Biopsies

- Require 3 Levels (L1-3) on all GI biopsies
- Consultant carried out an audit on over >1000 GI blocks to assess the diagnostic significance of the third level. (513 cases representing 1055 tissue blocks)
- Data collected at case review for sign out, with initial level 1 and 2 examined, diagnosis formulated if appropriate, then level 3 examined.
- Findings: the diagnosis was adequately made on the first 2 levels provided from slides produced from 1013 (98.9%) tissue blocks. Level 3 contributed to the diagnosis in slides produced from 11 (1.1%) tissue blocks.
- As a result it was decided to move to 2 levels and run all GI biopsies on the ASM.

Validation of GI Biopsies

- The initial validation involved assessing the appropriate level of polishing on the biopsy and multiwell blocks.
- Various intervals were run to establish the appropriate level of trimming between levels.
- KOH reviewed the slides and agreed on these parameters.

Biopsy Runs
Interval Layer: 2

Parameter 6 &7

	Polish	Interval
Normal Size	150	100
Thin/Scant	120	80

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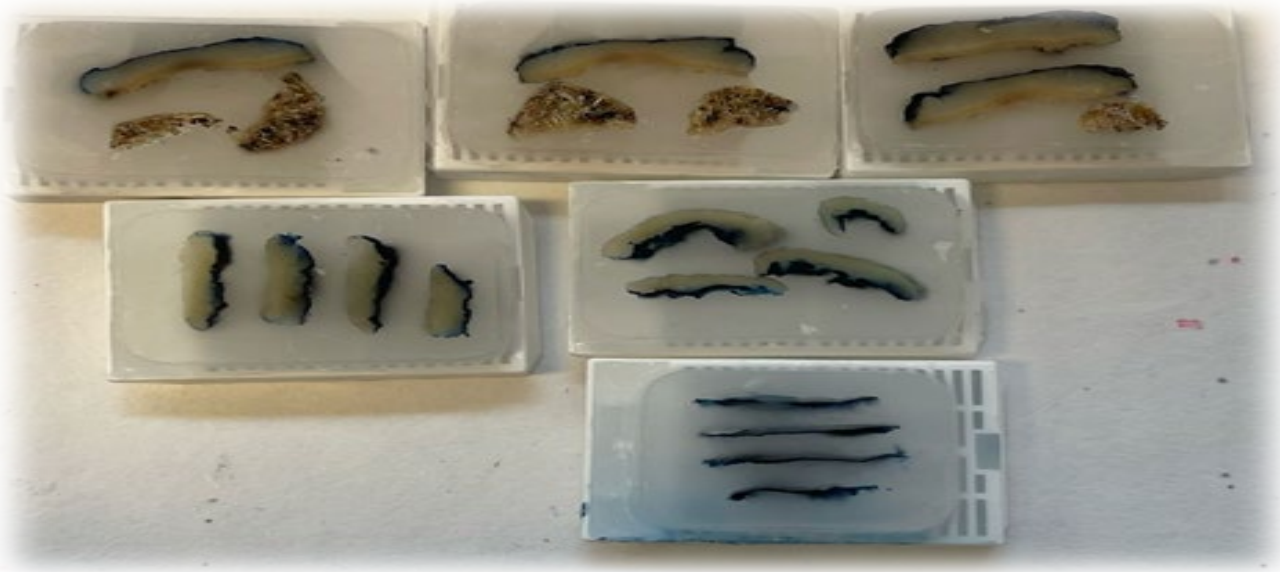
Initial Troubleshooting

- Requirements such as clipped corner slides- trialled a variety of clipped corner slides from different brands.
- The impact that cut up and embedding had on the quality of the tissue sections.

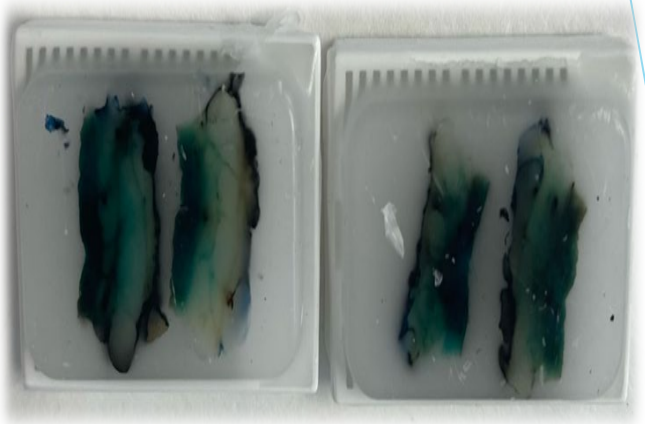


Skin sample exceeds optimal cassette capacity. Orientation of Skins

Initial Troubleshooting

Not enough paraffin

Cracks in block – Paraffin



No 2mm wax border

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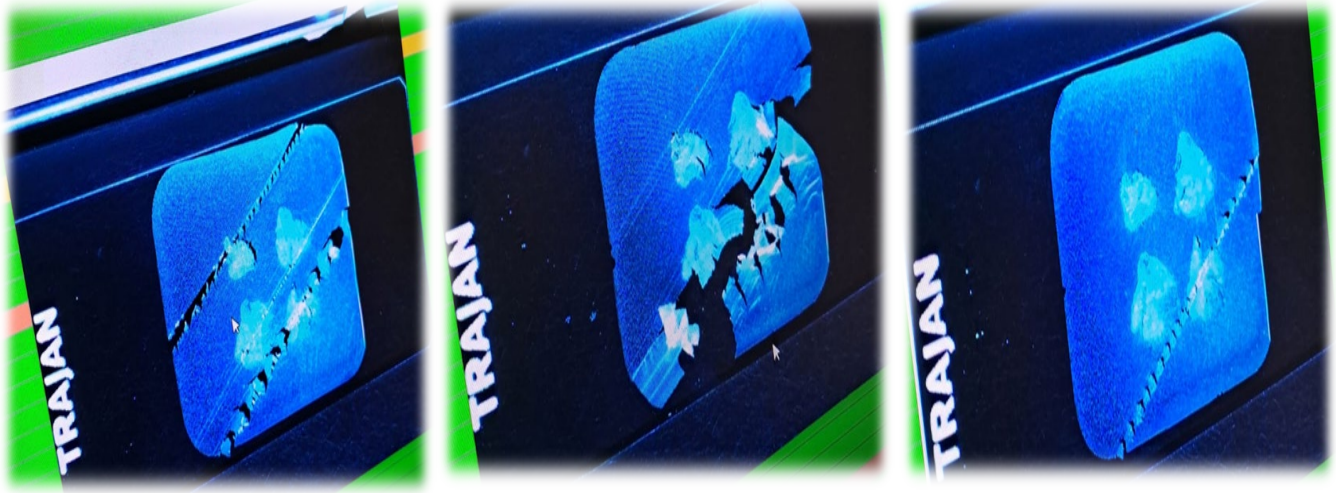
A Valuable lesson

- Skin sample that repeatedly failed the QC check on the ASM regardless of what parameter it was run on.
- Discovered that this was because too much tissue was placed in the block at specimen dissection.

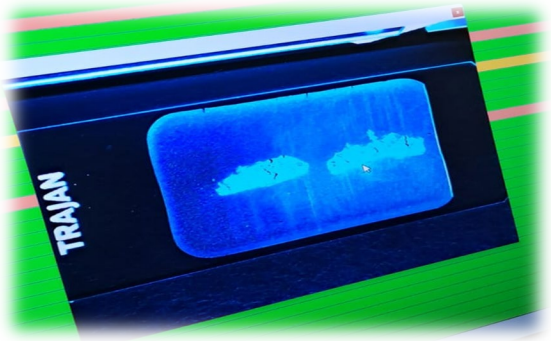
Ran this block on multiple different parameters



Although this block is quite keratotic this is not the underlying issue…

A Valuable lesson

Block from the same patient



Clearly evident tweaking of grossing & embedding practices can fast track a patients diagnosis

- Grossing practices are instrumental in the total efficiency and workflow of the lab as a whole.
- If blocks are too full after processing suggest adding additional cassettes at embedding stages.
- The more tissue inside one block, the more risk of obstacles.

Manual Input

- Currently we don't have sample tracking or barcodes on cassettes, this is a work in progress and when implemented will allow us to process more blocks per day and reduce the risk of errors further.
- At present, we are manually entering the sectioning information for the ASM using the LK400 system.
- Introduction of barcoding will mean more staff can be trained to operate the ASM. Currently it's a very small group of 5 who were given full training
- We recently sourced a cassette printer which will allow for barcodes to be implemented into the department.

More Unusual Troubleshooting

- Alterations of blade mark check and expansion plate time
- Jamming of the drying chamber door
- Unplanned amendments to parameters/settings
- Sections lifting (this was a really bizarre one)- thought it was the humidifier, then tape speed, then cut speed….
- Patient identifier not printing on slides
- Most recent error was one Air Pressure

Benefits of the AS-410M

- High standardized quality throughout.
- Automation brings consistency, speed, and reduces staff strain.
- Placed on the same position on the slide.
- Consistent thickness through out (due to a stabilized environment).
- Relives the workflow for repetitive work loads.
- Reduction in repetitive strain injuries for staff.
- Less risk of cross contamination as no water bath improving patient safety.
- Has the ability do perform overnight runs.

Benefits We Have Experienced

- Time saving allows redeployment of staff to other tasks.
- Huge morale boost to staff.
- Can visibly see the backlog of blocks decreasing daily.
- Improvement in TATs

	Target	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Histology	80% by Day 20	80	51	23	37	78	73	41	58	54			
	Day histology TAT achieved	20	23	24	25	21	21	23	22	22			

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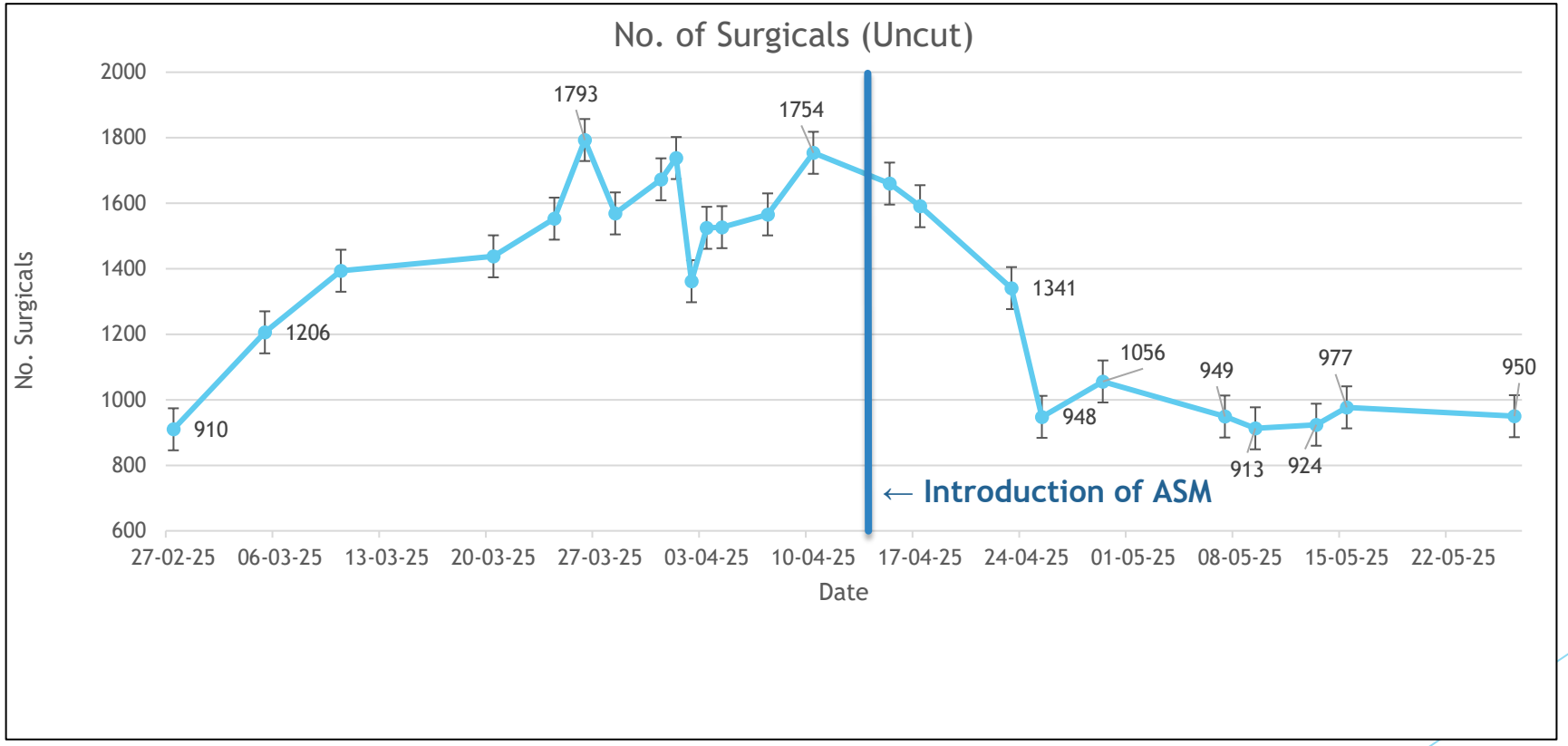
Immediate Results

Graph 1: The number of surgical blocks waiting to be cut over a period of time including pre and post the introduction of ASM



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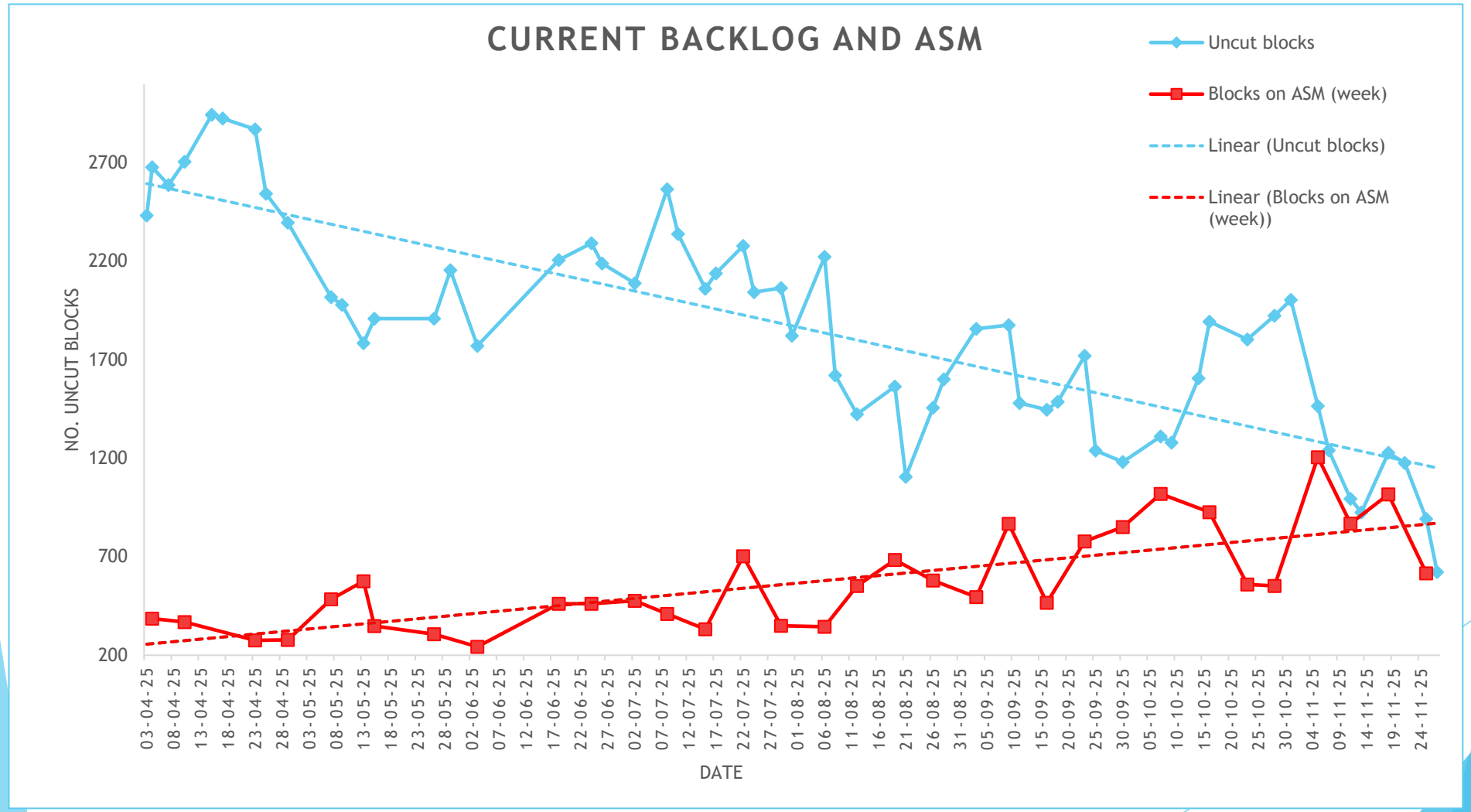
8 Month Progress Report

Graph 2: Overview of the current backlog in TUH.



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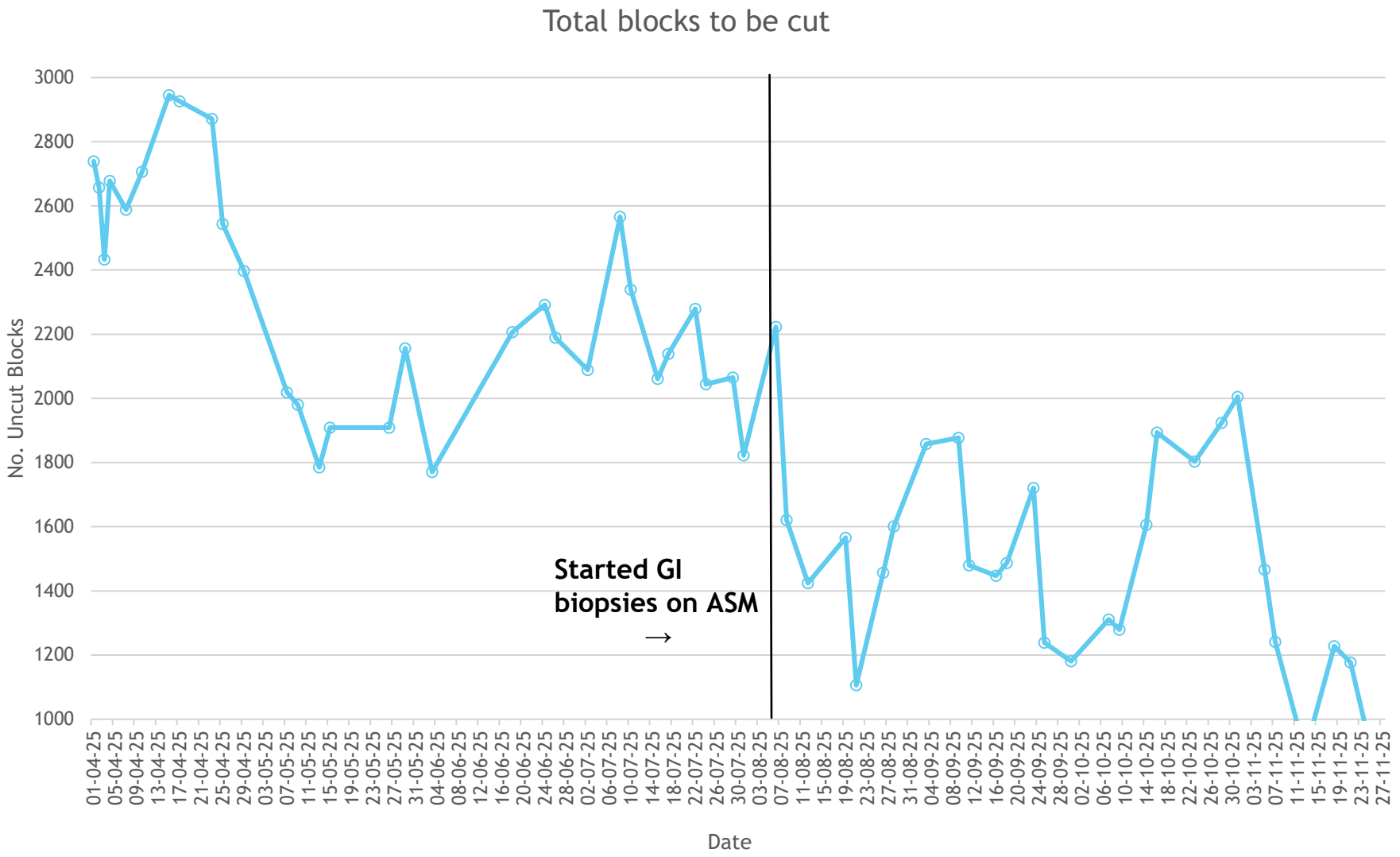
8 Month Progress Report



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The Future, the Dream

- The potential is there to cut blocks for immunohistochemistry, to pre-cut batches of control slides for Daily H&E QC, to pre-cut control slides for IHC and special stains and to section patient samples onto the pre-cut control slides.
- Planning to cut core biopsies straight from embedding on the ASM.
- Planning to cut auto-embedded tissue from our Milestone Magnus Tissue Processor- no trimming
- Utilising the ASM when implementing Digital Pathology

Acknowledgments

Implementation of new equipment into any Laboratory needs the complete collaboration of each and every member of the staff within the department. Whether it was working within the Validation team or covering the extra work on the routine benches day to day by staff members.

The speedy and hugely successful validation and introduction of the ASM into routine use into the Cellular Pathology Department in TUH is a testament to the dedication and amazing team work of all the staff within this department.

Pictured from left to right are Laura-Anne Williamson, Senior Medical Scientist; Christopher Owens, Medical Laboratory Aide; Andrea Byrne, Medical Scientist; Caoimhe Gibbons (seated), Medical Scientist; Dannie Loayon, Medical Laboratory Aide, and Sarah Delaney, Chief Medical Scientist.

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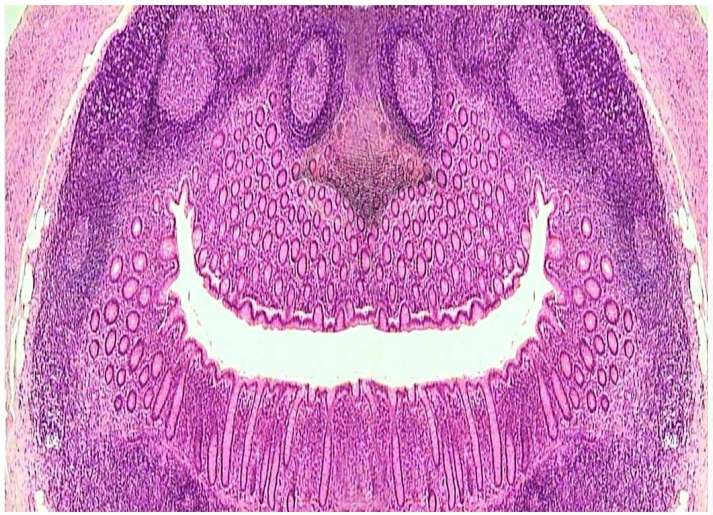
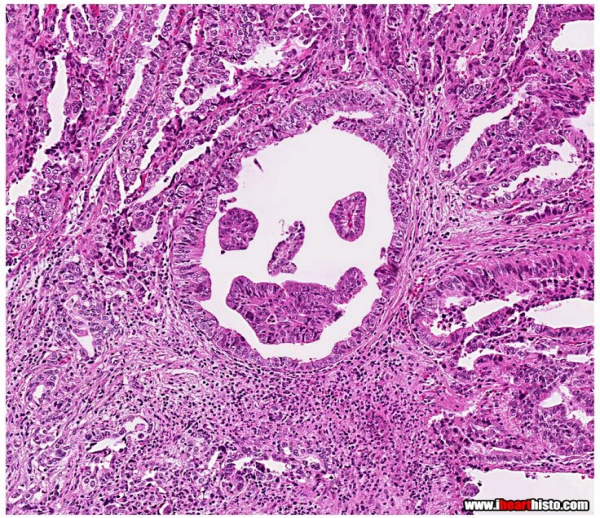
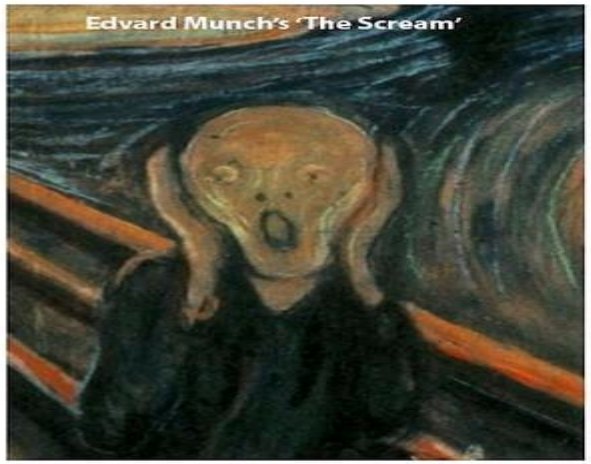
Thank you for listening

- All questions welcome I will answer to the best of my abilities.







Histology's 'Placental villi'

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