

STTARR Innovation Core: Spatio-Temporal Targeting and Amplification of Radiation Response (STTARR) at PMCRT

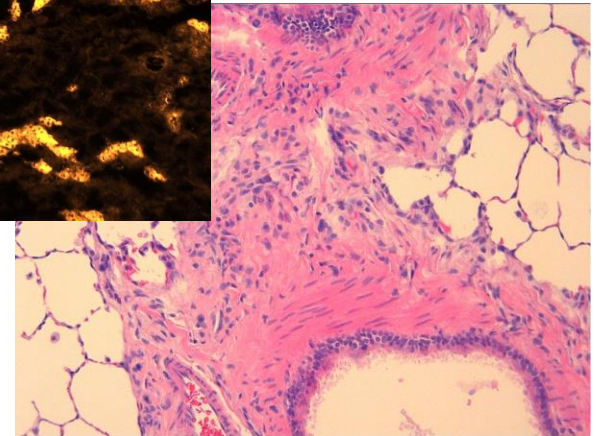
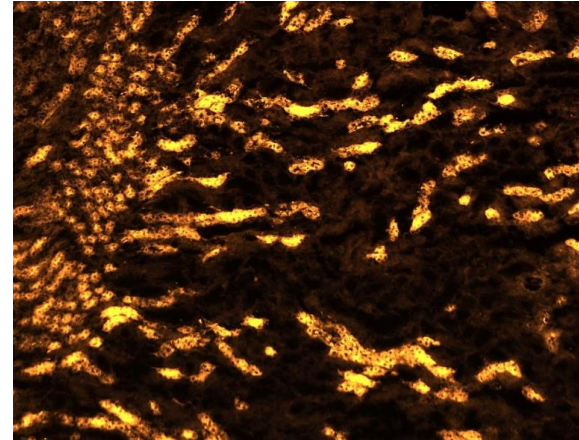
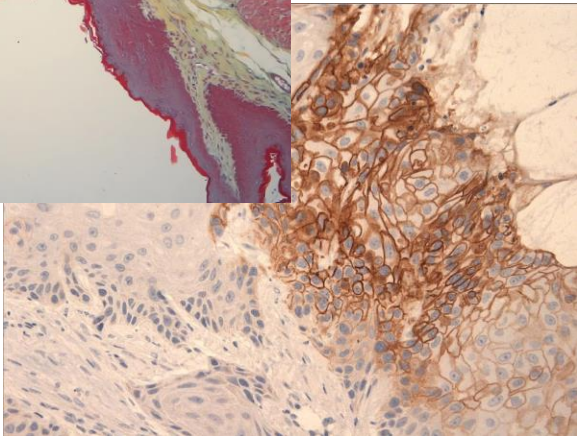
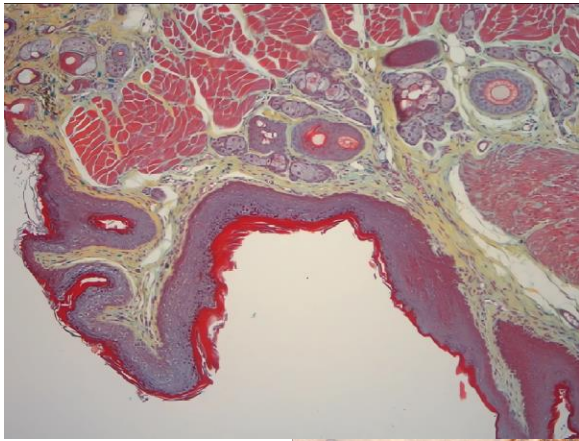
STTARR HISTOPATHOLOGY

Naz Chaudary

Napoleon Law

KDT Lunch and Learn

June 26th 2025



Agenda

Opening: [Naz Chaudary](#), *Manager of STTARR Innovation Centre*

- Welcome remarks
- Introducing the STTARR Histopathology team and outline of core services

Scope of services: [Napoleon Law](#), *Lead of the STTARR Histopathology Team*

- Review Histology and Pathology
- Scope of research projects that STTARR Histopathology team is servicing
- How histology is used as tools to assess pathological changes in tissue
- Overview of the histology services

Question session:

- Specific histology requirements

STTARR Innovation Core: Spatio-Temporal Targeting and Amplification of Radiation Response



- ❑ Founded in 2007 at University Health Network/Princess Margaret Cancer Research Tower
- ❑ State-of-the-art facility that enable investigators and scientists to access instruments, technologies and services to support their research studies in preclinical imaging and histopathology
- ❑ 700+ Projects; 1800+ researchers working with STTARR: industry and academic collaborations

STTARR's Histopathology Core Mission:

To provide comprehensive, state-of-the-art histological services, including tissue processing, staining, and antibody optimization to facilitate impactful research across diverse disciplines.

STTARR Innovation Core: Histopathology Team



Meet the Team!

Left to Right (front row): Feryal Sarraf, Napoleon Law, Naz Chaudary (Manager)
(back row): Simon Zhou, Jordi Ros Rodriguez

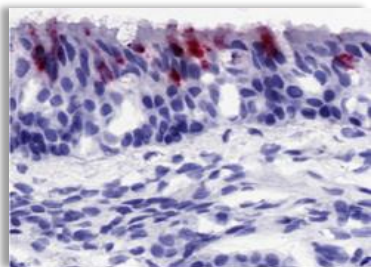
Homepage: www.sttarr.ca

Twitter: [@CoresUhn](https://twitter.com/CoresUhn) / X

LinkedIn: <https://www.linkedin.com/in/sttarr-innovation-centre>

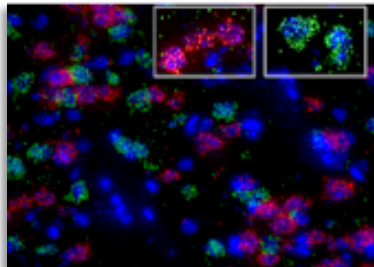
Phone: (+1) 416-581-7771

Email: sttarr.general@uhn.ca



Multiplex RNAscope V2 assay; mouse brain samples- detect up to 3 probes simultaneously.

- Formalin fixed paraffin+ frozen embedded tissue
- Immunohistochemistry/ immunofluorescence



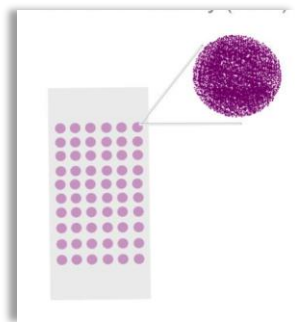
Respiratory mucosa stained with RNAscope 2.5HD assay for viral detection. Red stain: single copy mRNA molecule.

- ***UHN Transplant organ team- pig model antibody optimization**
- **Full necropsy (mouse, rat, guinea pig)**

** Unique service only provided by STARR*

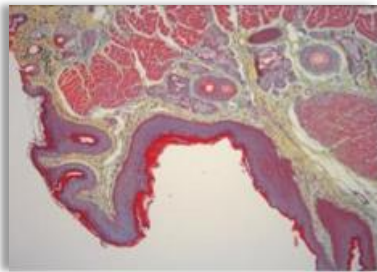
Histopathology Services

- **Fluorescent in situ hybridization with X and Y chromosome**
- **TUNEL Assay**
- **Human X-Y chromosome assays**



- ***Autoradiography**
- **Tissue microarray construction**
- **Cell pellet agar embedding**

- **Special Stains**
- **Enzyme Histochemistry**



Skin tissue stained with Movat's pentachrome

**localize radiolabeled proteins, to visualize and quantify proteins or DNA using histology*

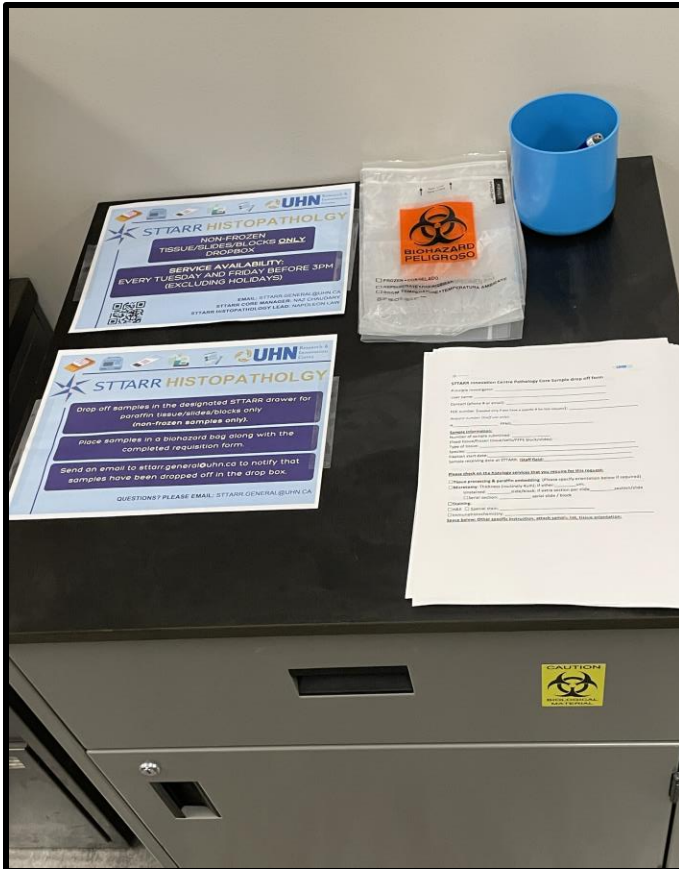
STTARR histopathology hosts University of Western Undergraduate Pathology Alliance



NEW: STTARR-KDT Drop-off service

Located outside the Krembil Research Institute
Directorate office: 4th floor: 4KD-478

Email: sttarr.general@uhn.ca



STTARR Histopathology provides services to:

University Health Network: TGH, PMH, TWH

Mount Sinai Hospital

SickKids

University of Toronto

Ontario Institute for Cancer Research (OICR)

St. Michael's Hospital

Industry partners located in the MaRS discovery towers and around Toronto region



**Mount Sinai
Hospital**



SickKids®





STTARR Histopathology Core: Scope of Services

- Napoleon Law, Lead of the STTARR Histopathology Core, HTL Board certified Histopathologist, American Society of Clinical Pathology (ASCP) Member of the National Society of Histotechnology (NSH)

Topics cover today:

- What is the difference between Histology and Pathology?
- Histology as a tool on research projects
- Overview of all services offered at STTARR Histopathology

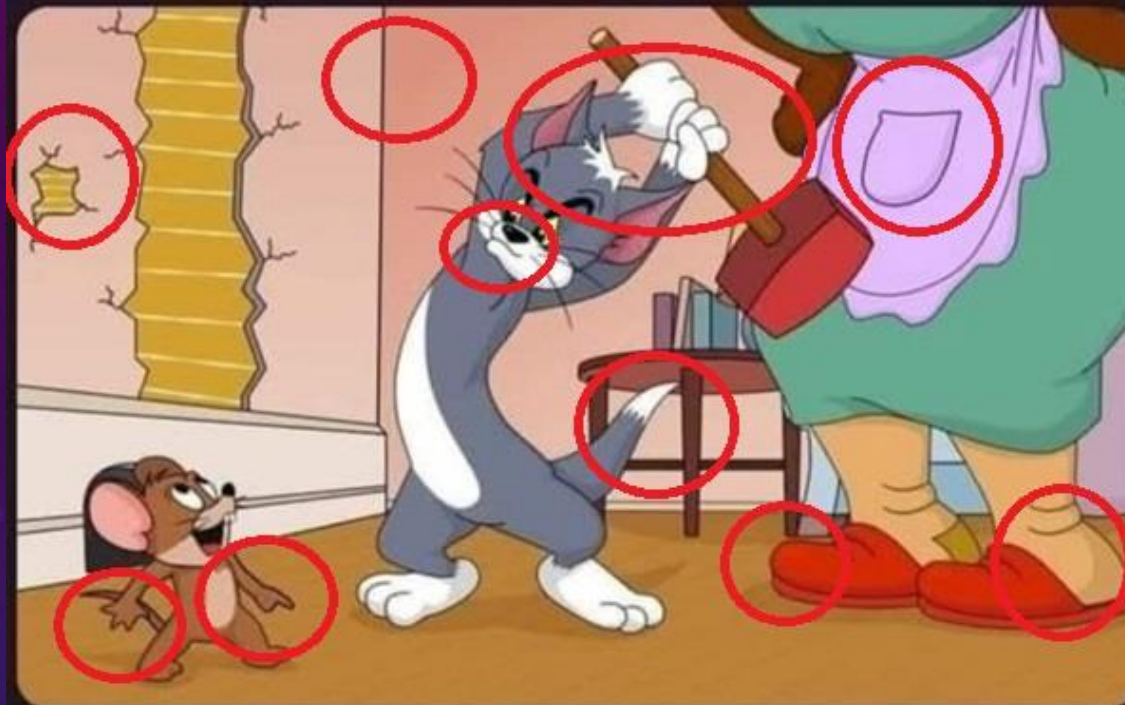




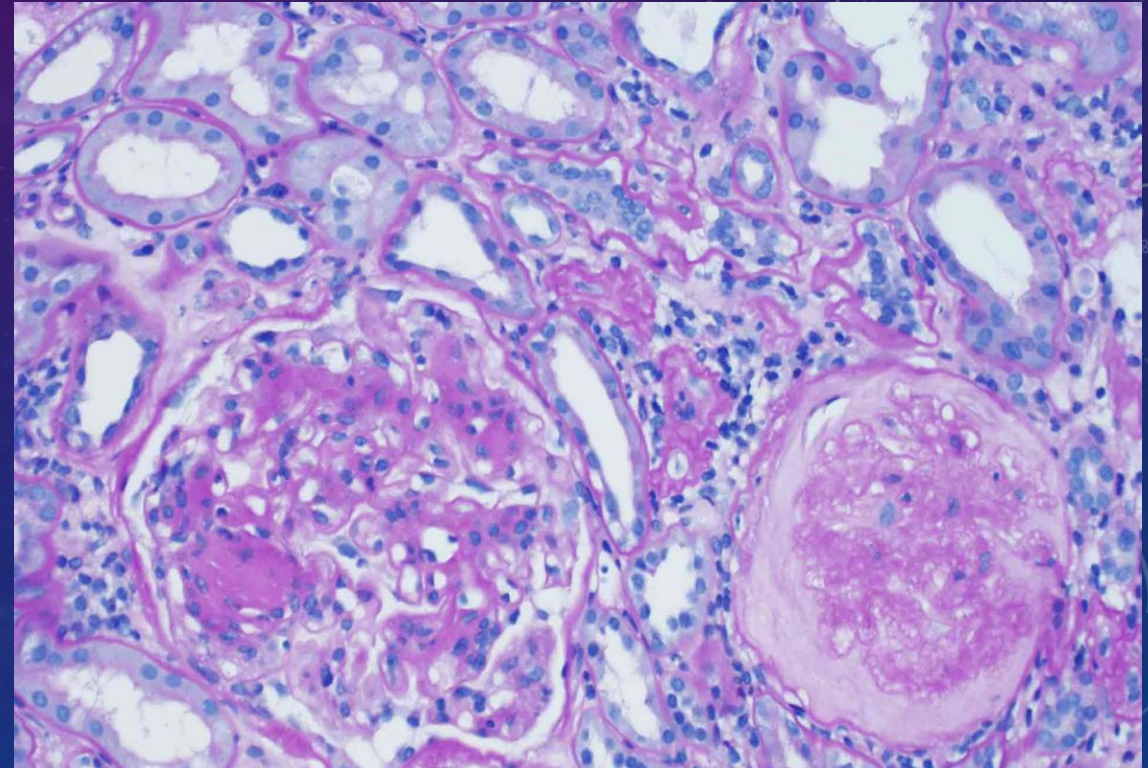
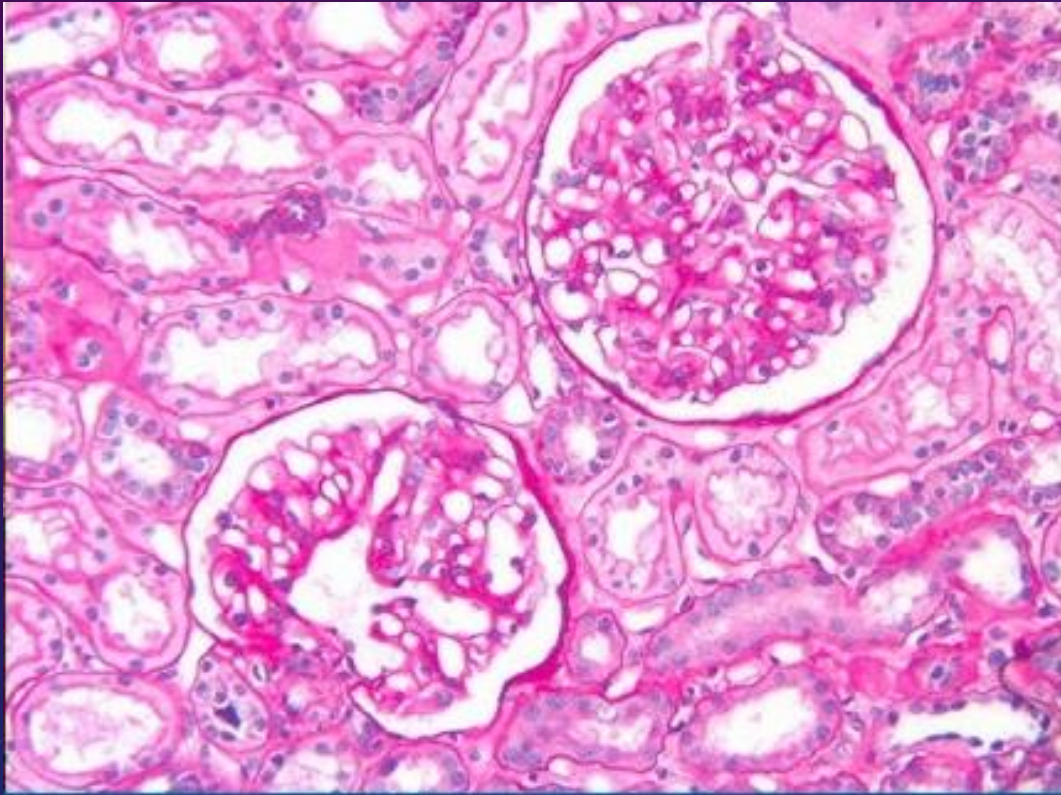
UHN

Research

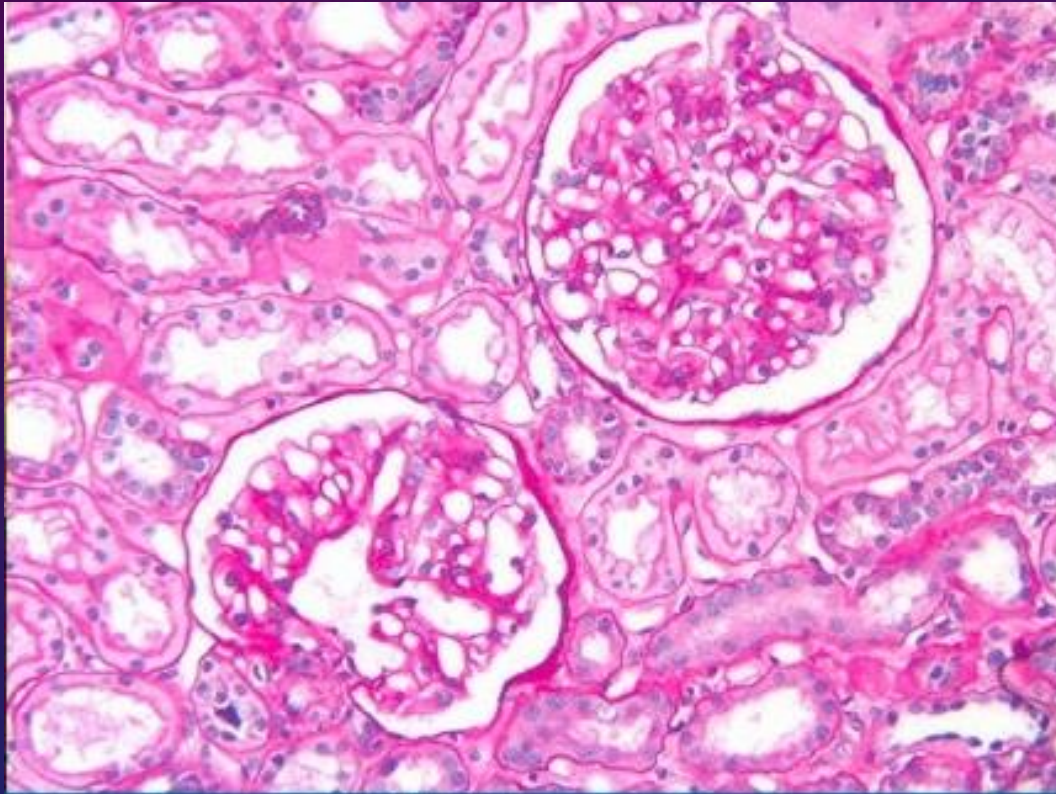




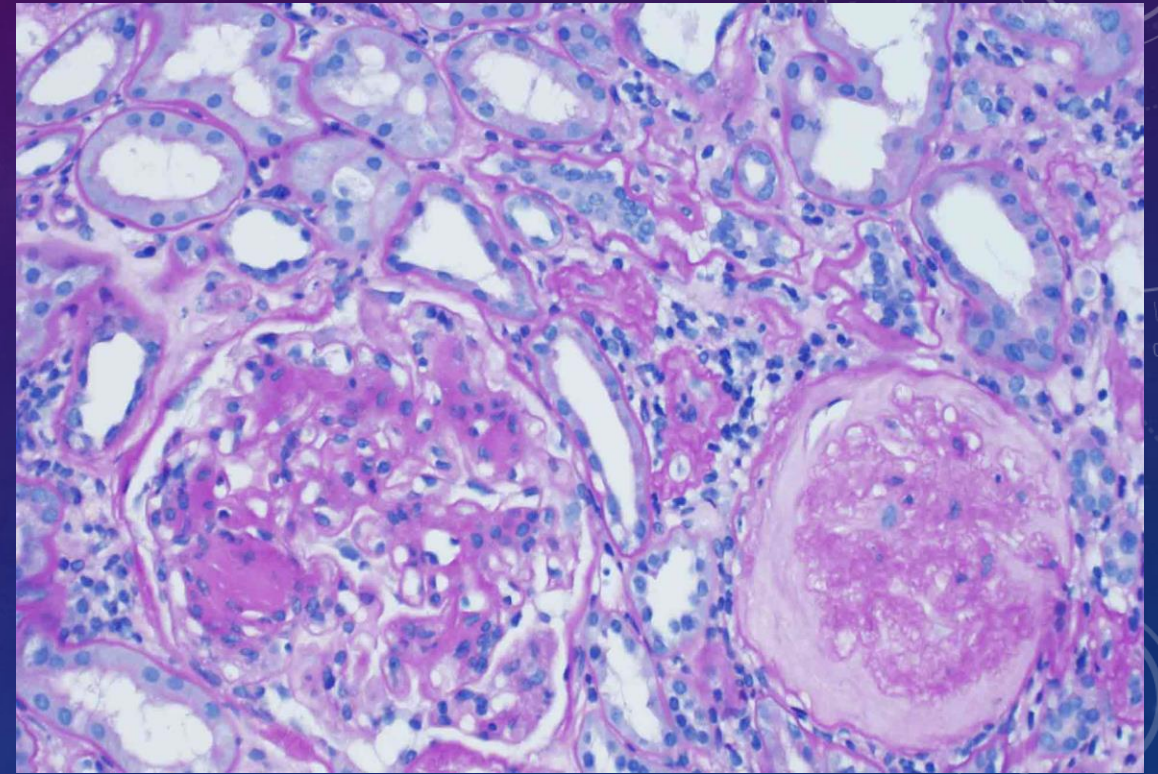
What is the difference between: histology and pathology?



What is the difference between: histology and pathology?



Histology: The study of microscopic anatomy of cells and tissue



Pathology: A medical specialty concerned with the diagnosis of disease



UHN Research

Histology as a tool in different research fields

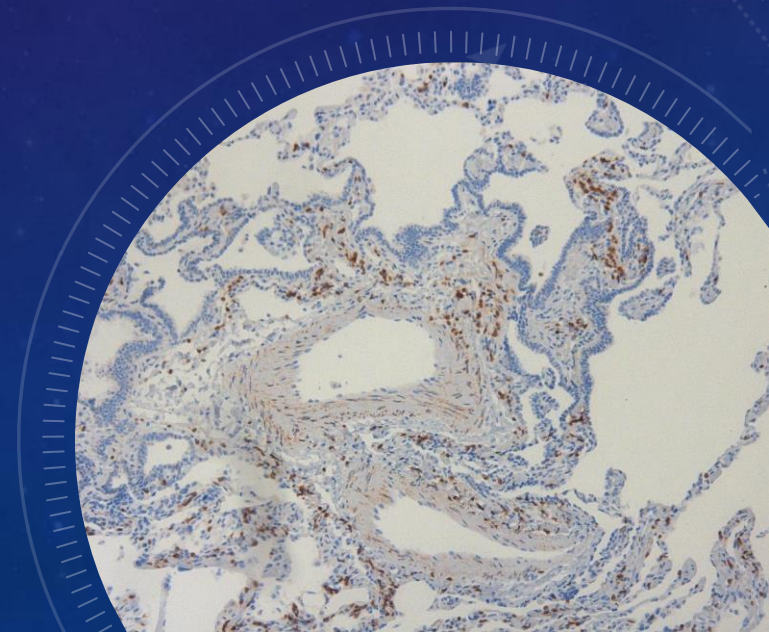
- Organ transplant
- Regenerative medicine
- Immunotherapy
- Neuroscience
- Osteology
- Joint / arthritis
- Cancer Research



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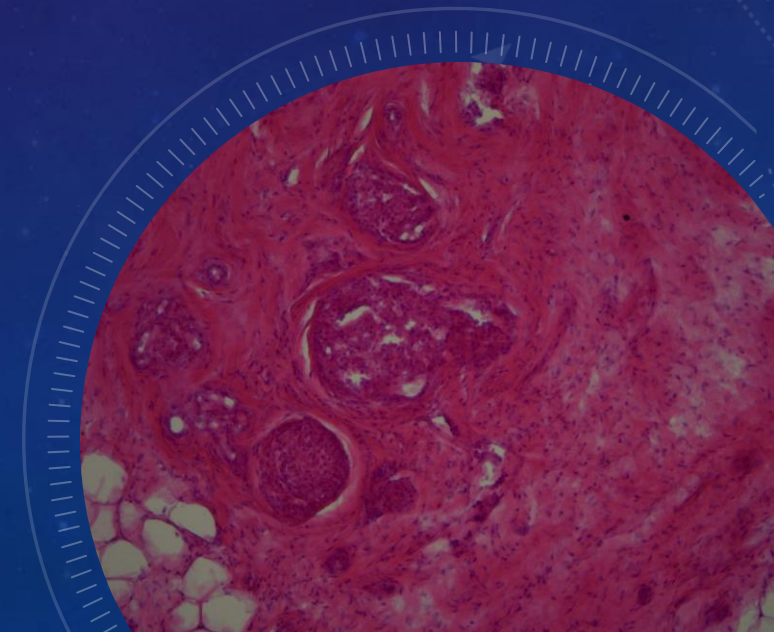
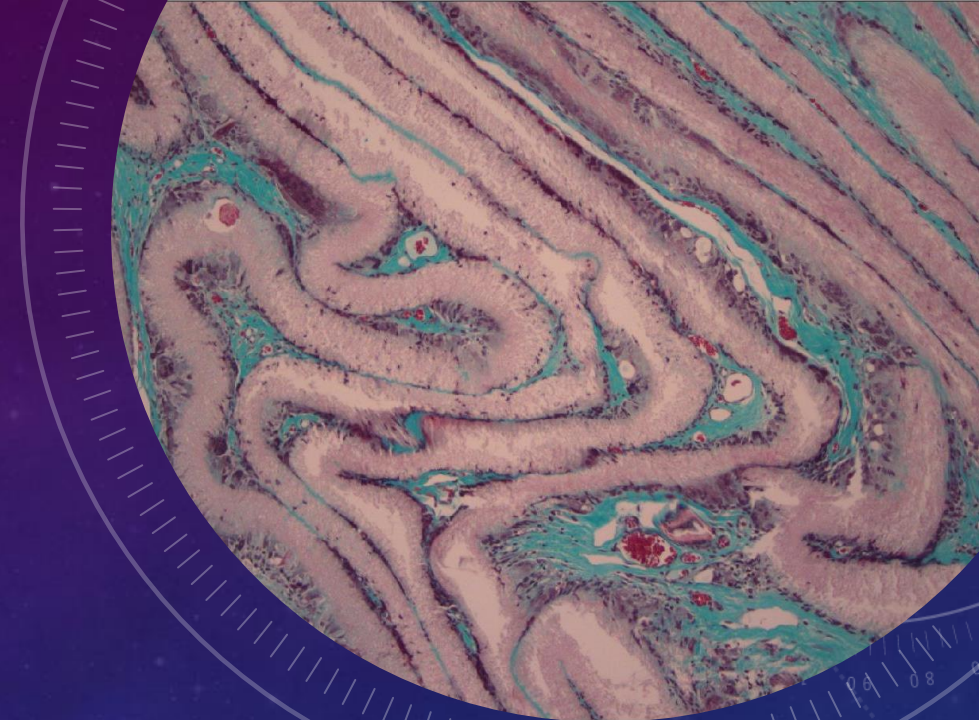
Histology as a tool in ***Organ transplant***

- UHN's inventions: insulin, pacemaker, ex vivo lung perfusion
- Lung, liver and kidney transplant
- Looking for immune responses, tissue damages due to rejections
- Lung transplant (Epstein-Barr-virus)



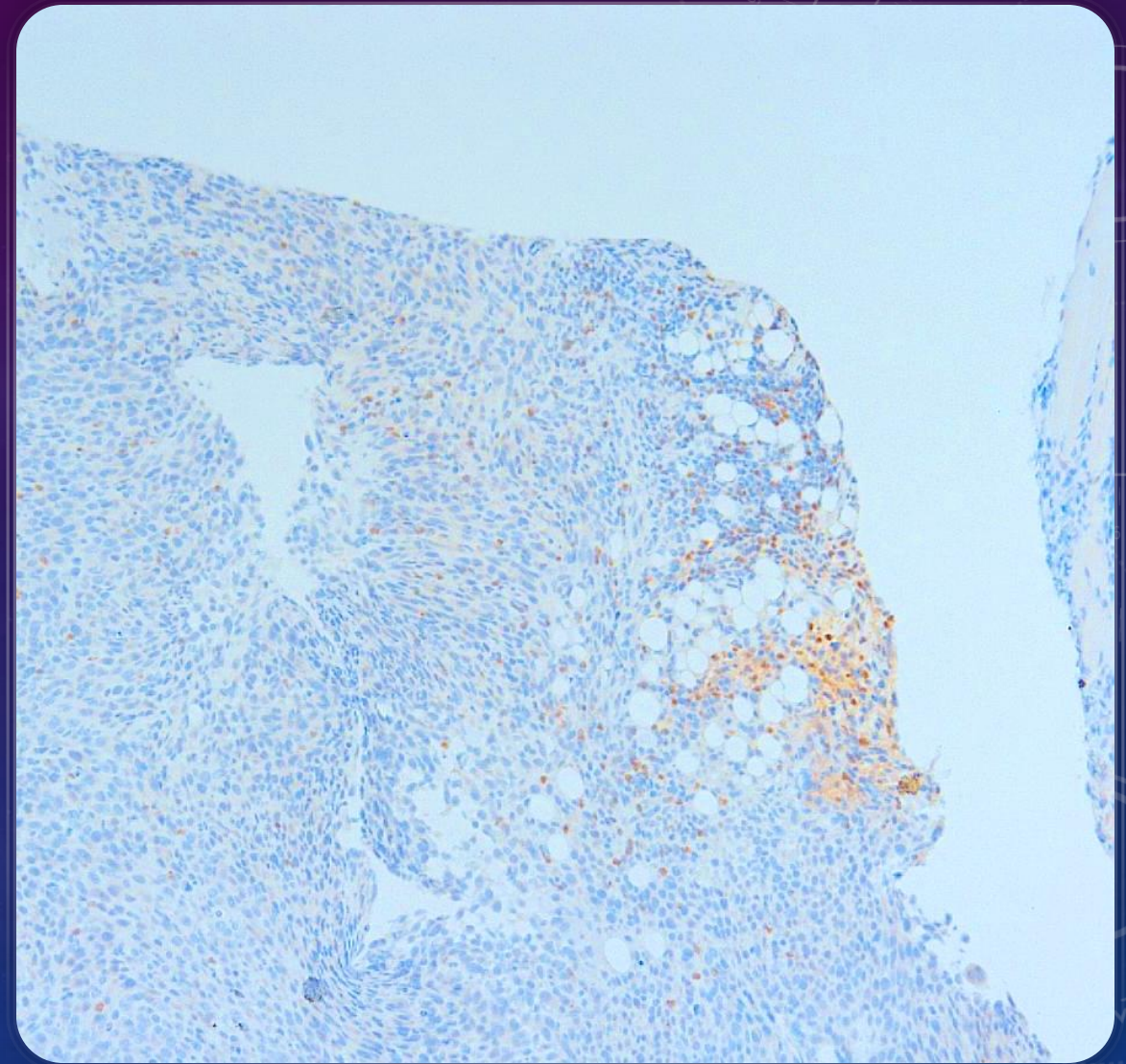
Histology as a tool in ***Regenerative Medicine***

- Regenerating damaged organs with stem cells
- Stem cell research: islet, cardiac muscle, bone tissue regeneration
- Stem cell markers such as Ku80 are used in IHC



Histology as a tool in *Immunotherapy*

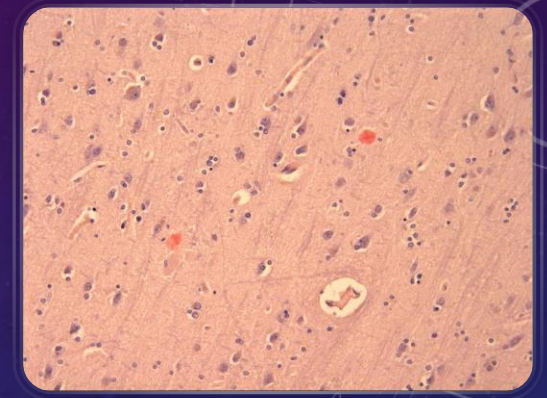
- Reprogram T-cell and B-cell for targeted immune response on cancer
- IgG antigen binding region modification to target cancer and amyloid
- B-cell re-programming to produce specific antibodies
- Immune cells infiltration into the cancer



CD8 IHC staining: Infiltration of cytotoxic T cells on human tumor cells derived mouse xenograft

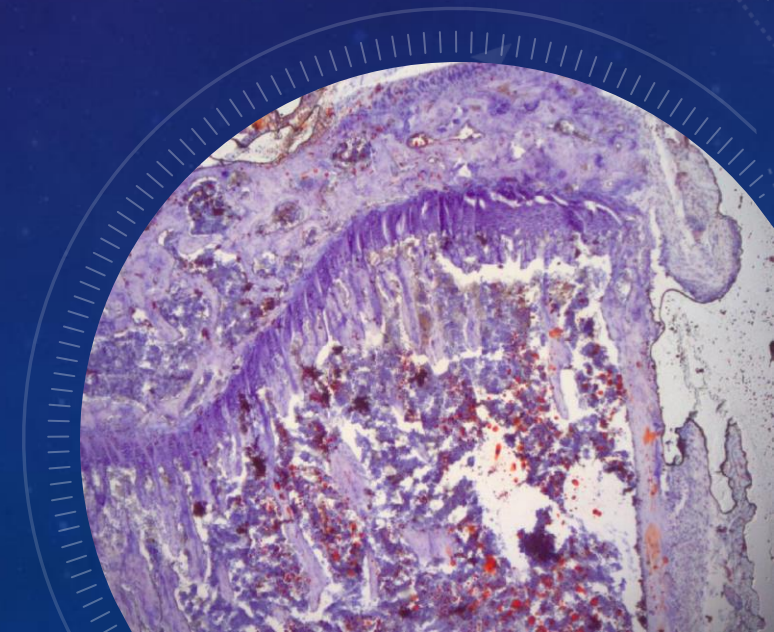
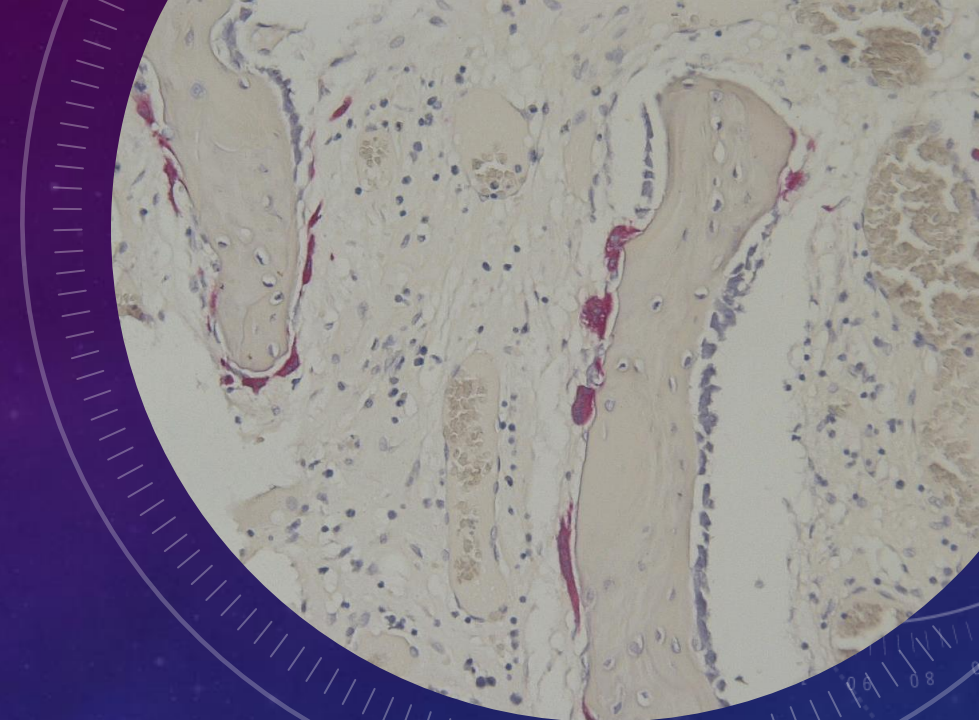
Histology as a tool in *Neuroscience & Eye Research*

- Brain development in neonatal age (brain sectioning on E9.5-E18 mouse embryo)
- Alzheimer: amyloid deposit in the brain
- Special stains (Congo Red, Cresyl violet, Luxol blue)
- Whole eye microsectioning



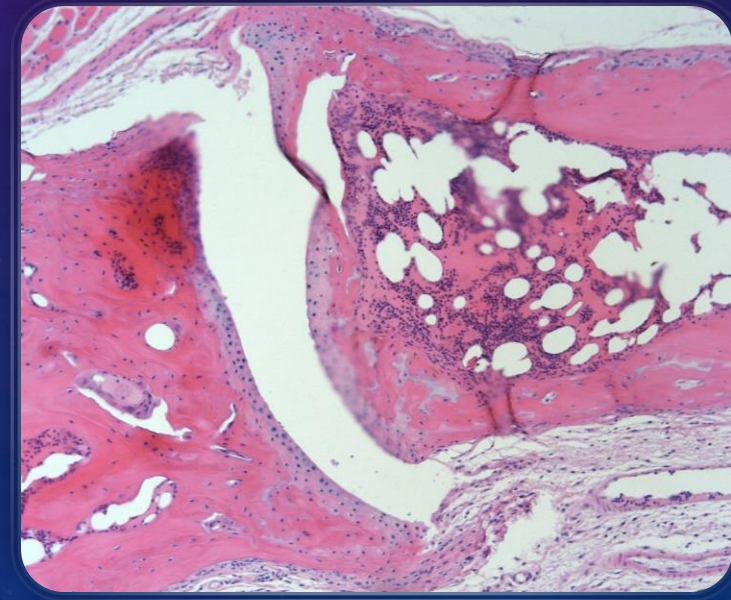
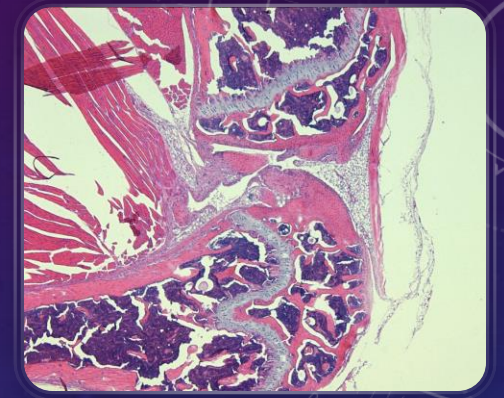
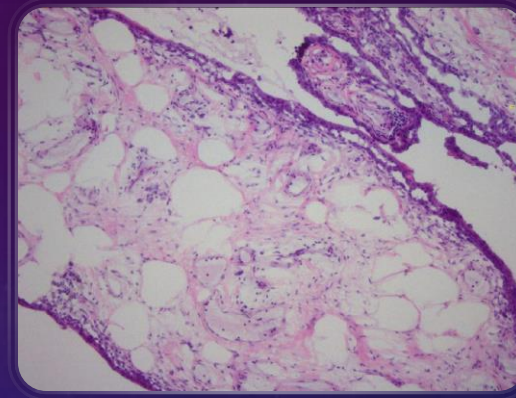
Histology as a tool in ***Osteology***

- Bone development
- Obesity, age: fat deposit in bone marrow
- Bone cancer research (study of bone marrow tumor cells migration into the nervous system)



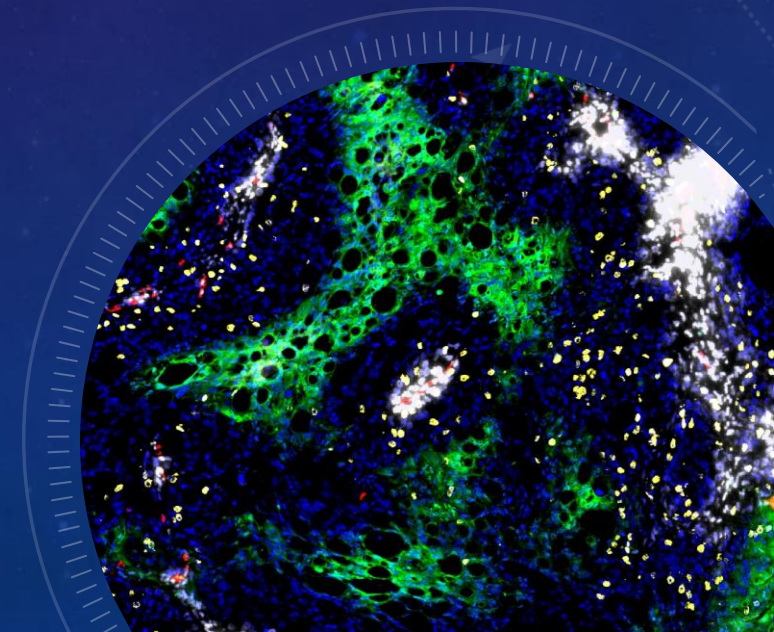
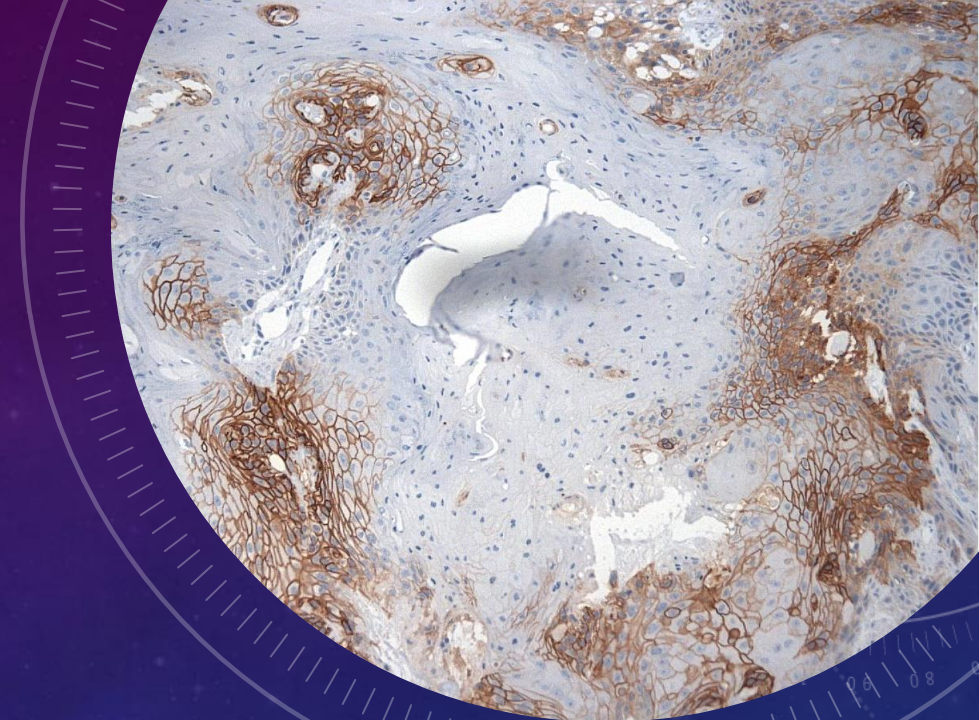
Histology as a tool in *Joints / Arthritis Research*

- Trim tissue block to specific joint region
- Synovium tissue sectioning
- H&E to demonstrate morphologic changes observation
- IHC can also be used to identify inflammation and any immunological responses



Histology as a tool in *Cancer Research*

- Treatment effectiveness
- Radiation therapy
- Hypoxia research (more hypoxic, less responsive to radiation treatment)
- Evaluation of hypoxia in cancer (pimonidazole, CAIX)



Histology services at STTARR histopathology core

- Tissue fixation, process and paraffin embedding
- Bone tissue process
- Paraffin embedding and cryosectioning
- H&E staining
- Special stains
- Immunohistochemistry
- In situ-hybridization
- Cell pellet embedding
- Tissue microarray construction
- Project Consultation

PMCRT 7th floor room 901



UHN

Research

Histology services at STTARR

Tissue fixation, process and paraffin embedding

Fixative (Most important: over fix rather under fix)

- 10% neutral buffered formalin
- Bouin :picric acid, formaldehyde, acetic acid
- 70% ethanol for long term storage

Tissue processing includes:

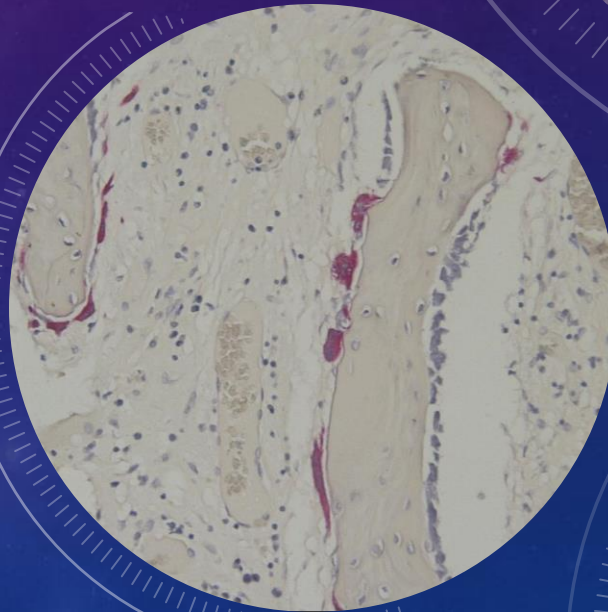
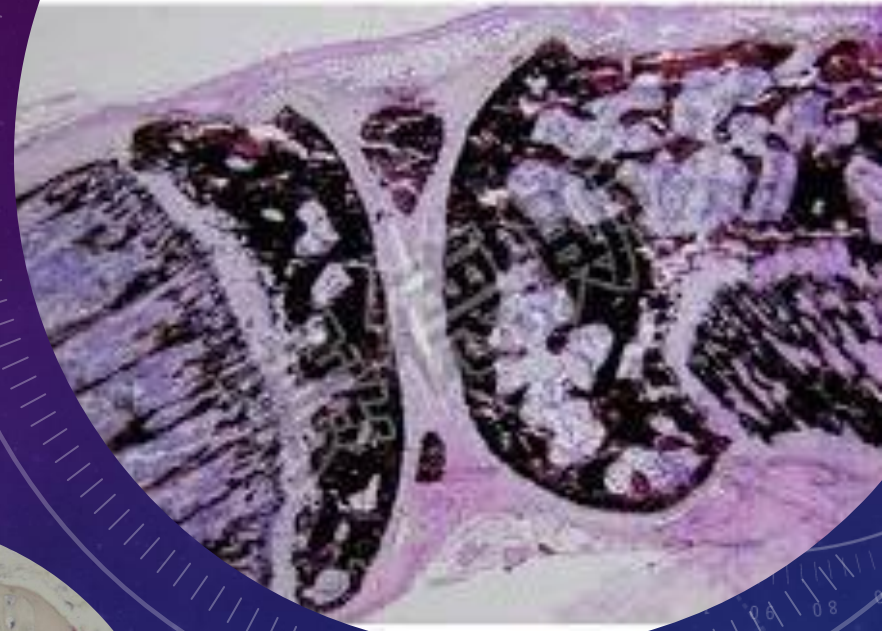
Dehydrate, paraffin infiltration



Histology services at STTARR

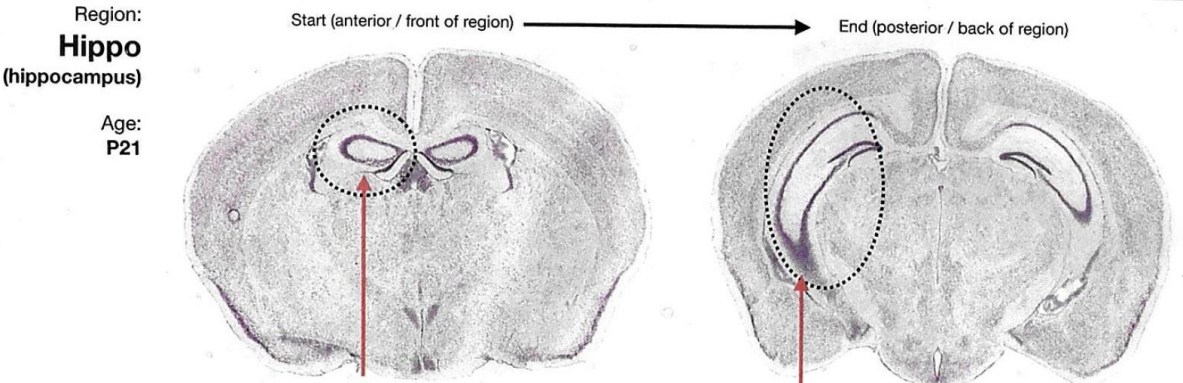
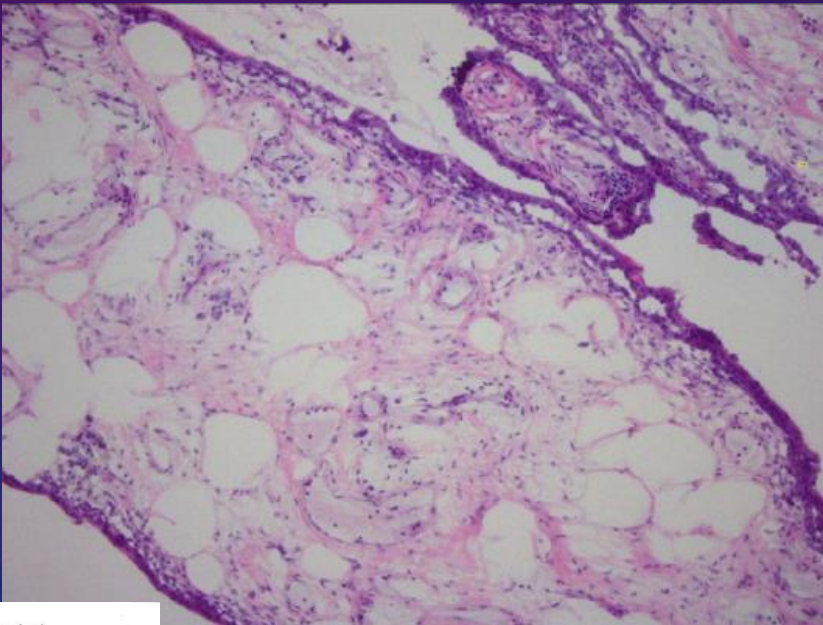
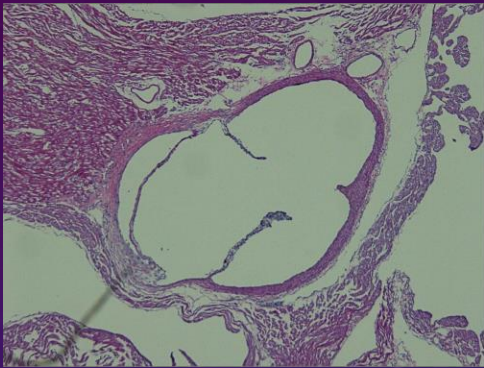
Bone tissue processing

- decalcification (formic acid / EDTA)
- paraffin and cryosectioning (non-
- Tartrate-Resistant Acid Phosphatase (TRAP) for osteoclasts
- von Kossa (calcium), safranin O (cartilage)



Histology services at STTARR

Paraffin and Cryosectioning



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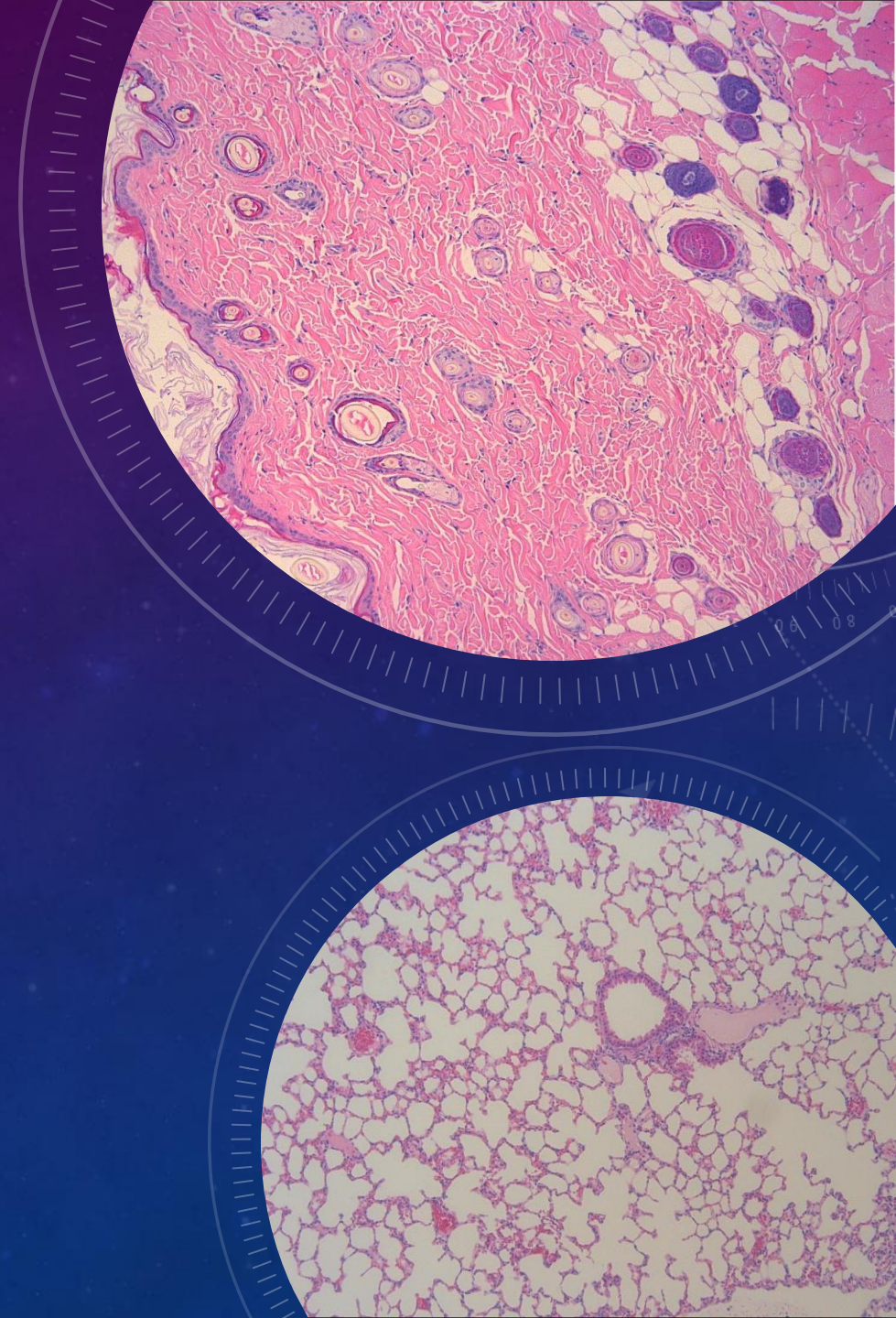
Research

Histology services at STTARR
H&E staining (nuclear and
cytoplasmic stain)

For general structure and cellular
morphology

Standard stain used by pathologist
to interpret make diagnosis

Good H&E staining has 3 different
tones of red



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Research

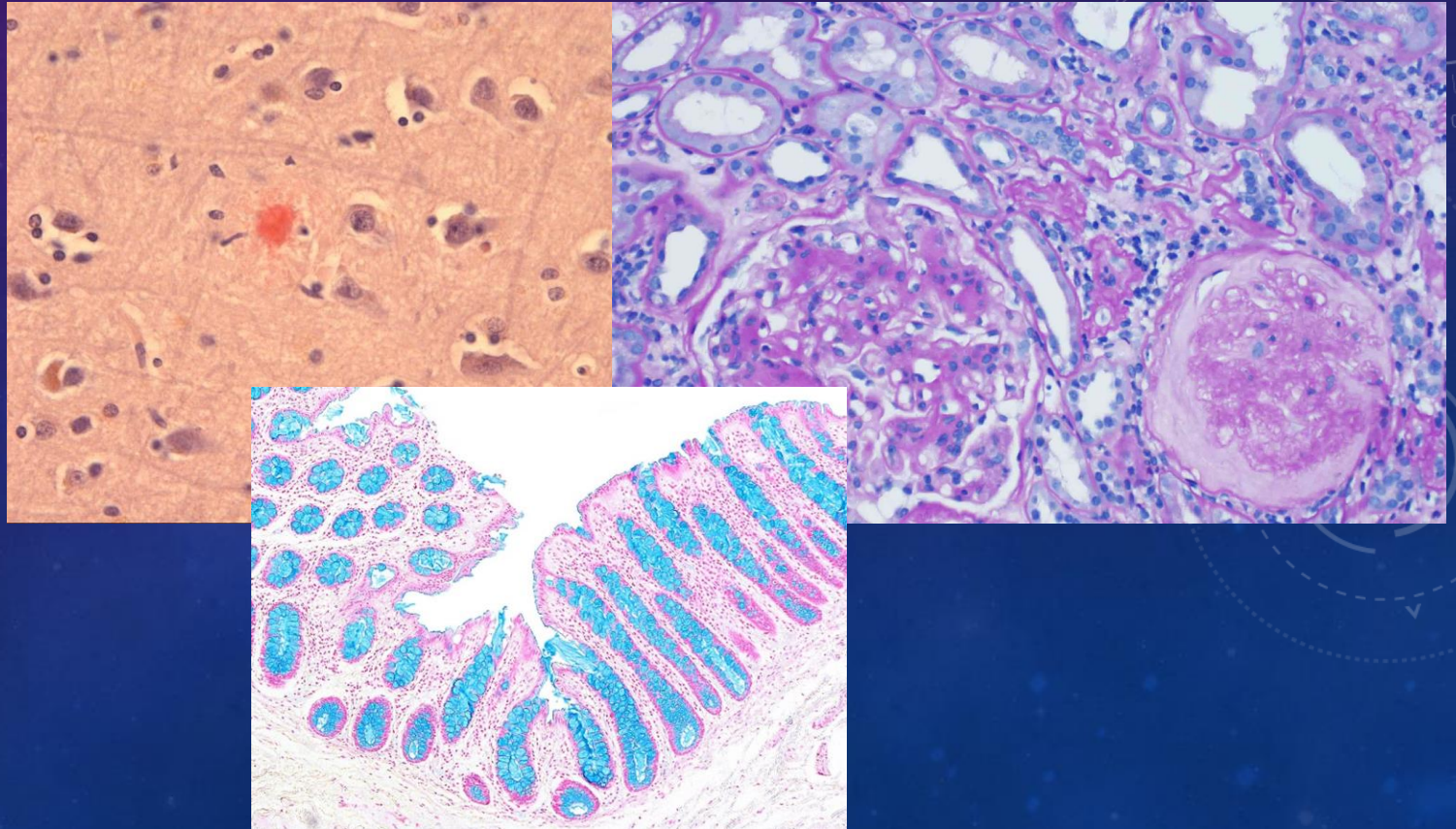
Histology services at STTARR: Special Stains

Carbohydrate (glycoprotein) and amyloid

Congo Red

Periodic acid Schiff

Alcine blue



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Research

Histology services at STTARR: Special Stains

Connective & muscle tissue

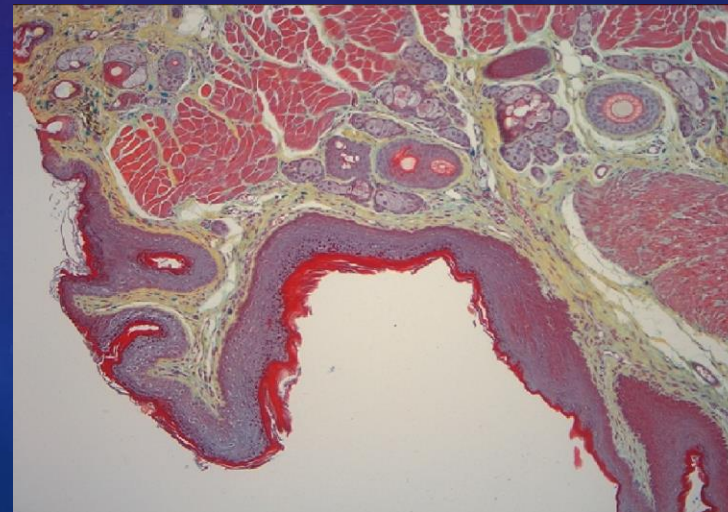
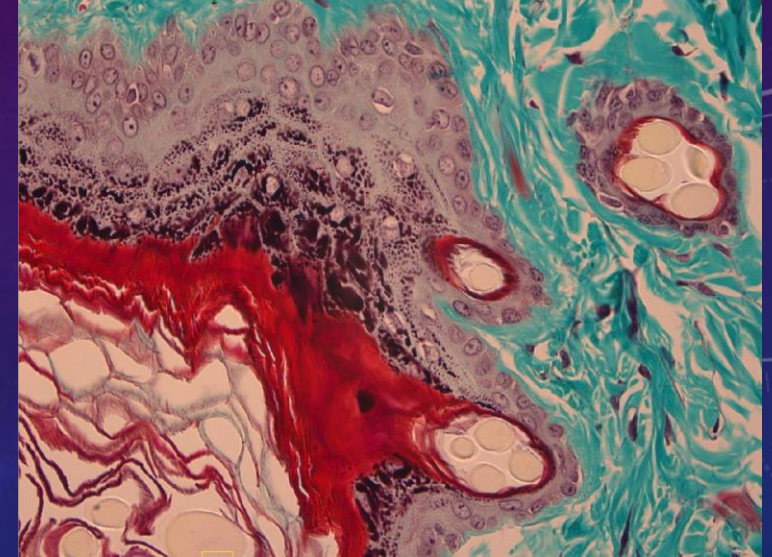
Masson trichrome

van Gieson

Elastic trichrome,

Gomori reticulin fibre stain

Movat pentachrome

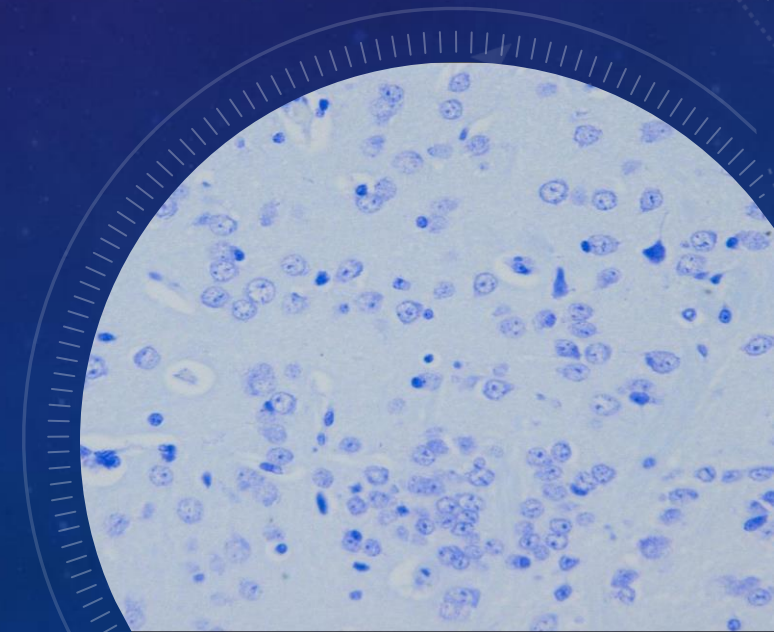
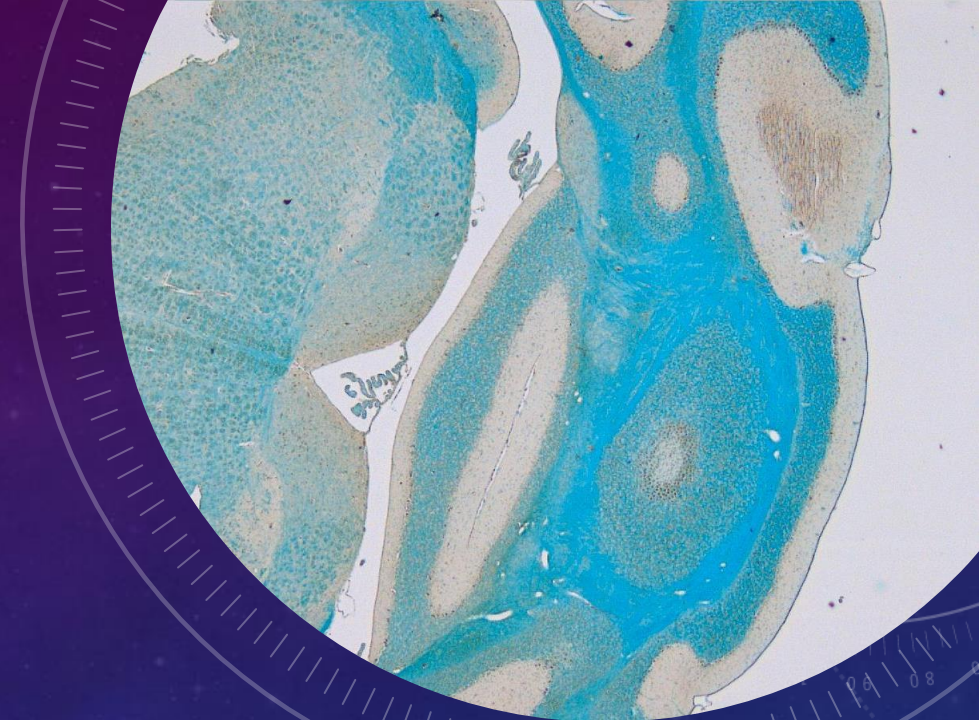


Histology services at STTARR: Special Stains

Nerve

Cresyl echt violet (Nissl substance)

Luxol fast blue (Myelin)



Histology services at STTARR: Special Stains

Microorganism

Acid fast bacteria

Gram stain

Giemsa (also for blood smear)

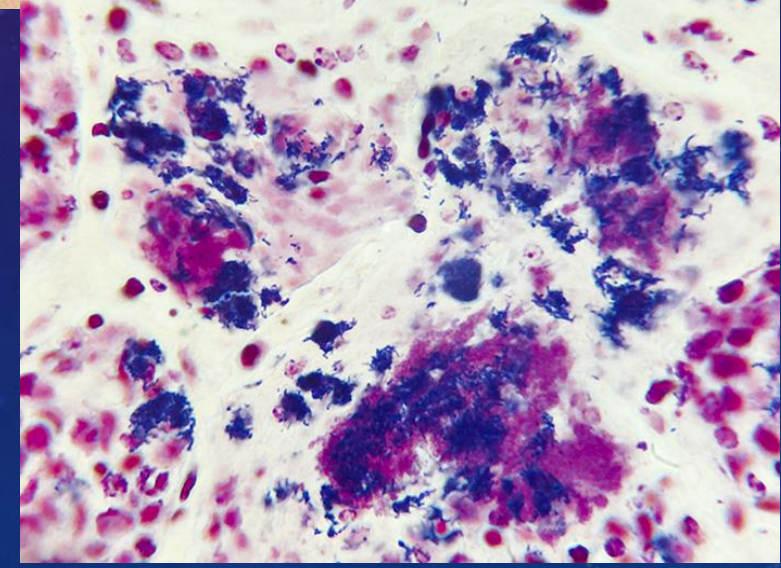
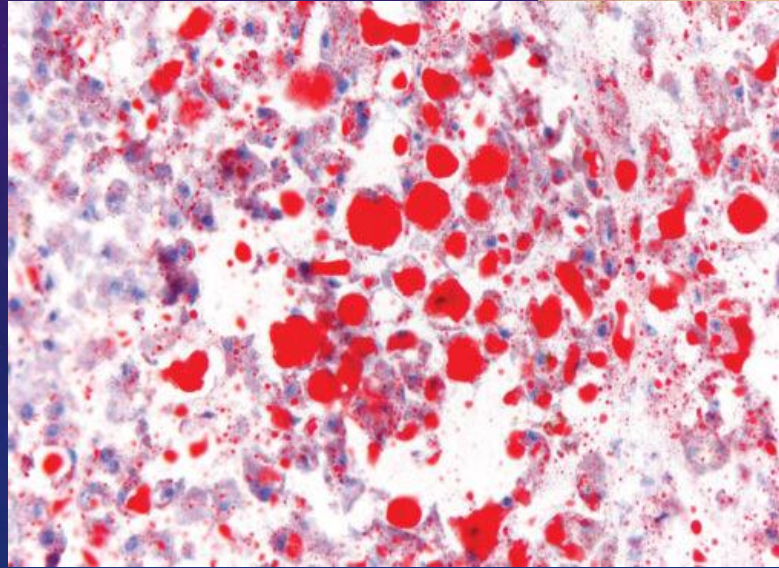
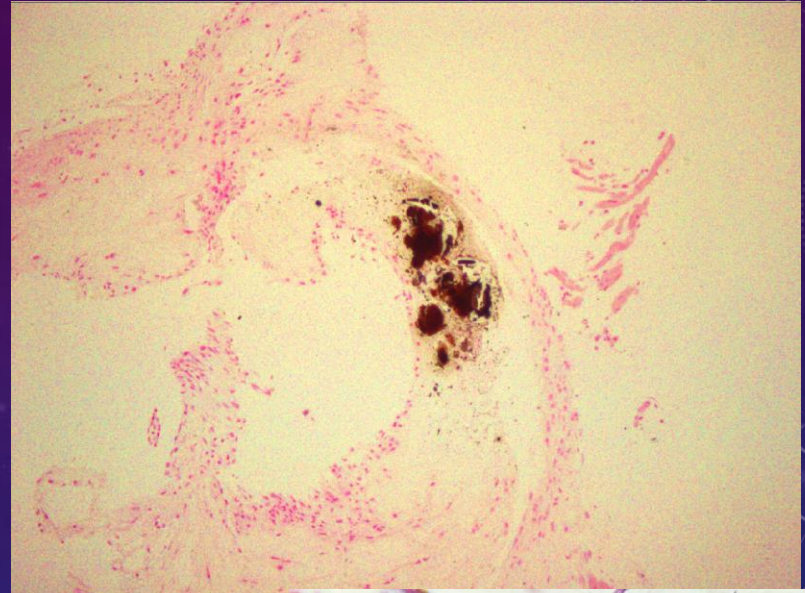
Pigments

Prussian blue (iron)

Fontana-Masson (melanin)

Von Kossa (calcium)

Oil red O (adipose)

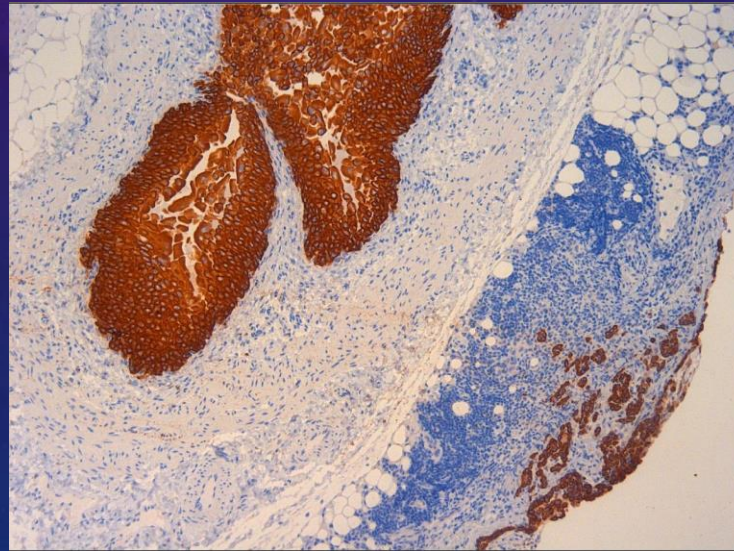


Histology services at STTARR

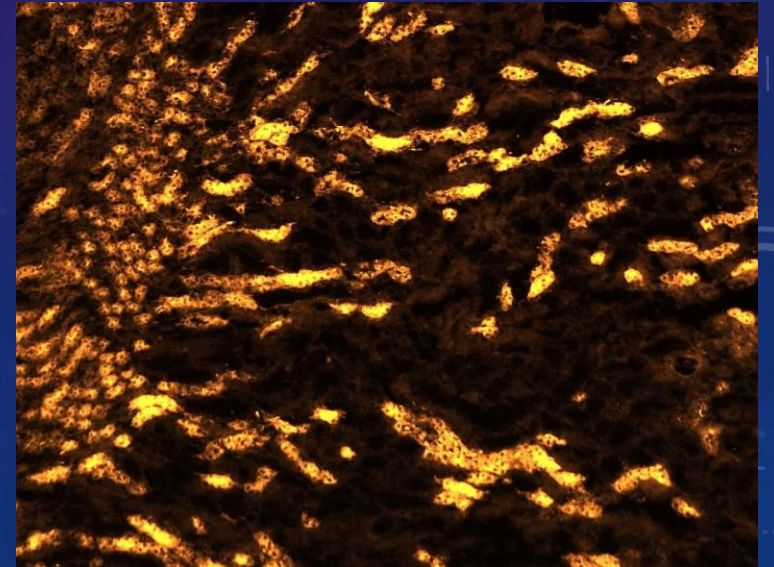
Immunohistochemistry and Immunofluorescence

Over 150+ antibodies optimized for IHC staining targeted on different species

Cytokeratin staining on mouse lymph node



IF staining on injured mouse kidney tubules



Histology services at STTARR

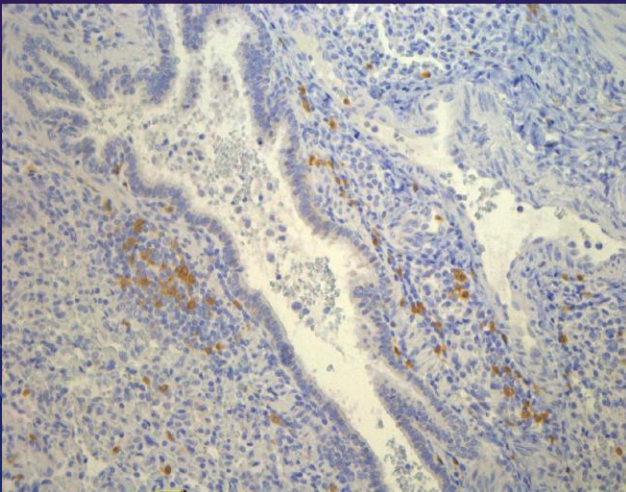
Immunohistochemistry and Immunofluorescence

We also specialized on pig tissue samples

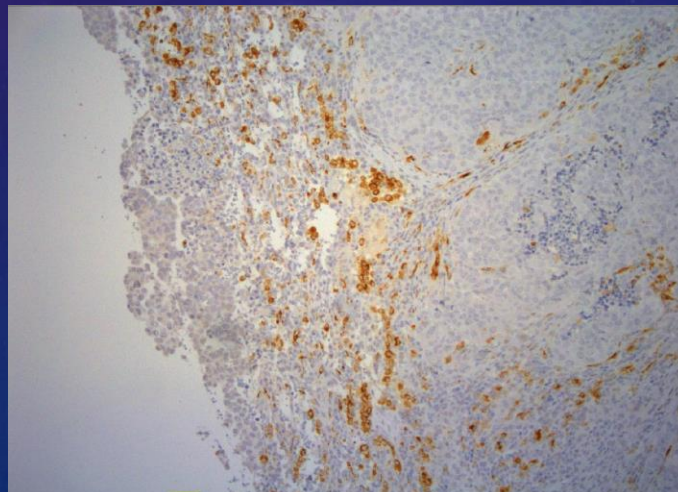
List of antibodies targeted on pig tissue:

Scan our QR code ---->

CD4 on porcine lung



CD68 on porcine lymph node



Antibodies for porcine tissue

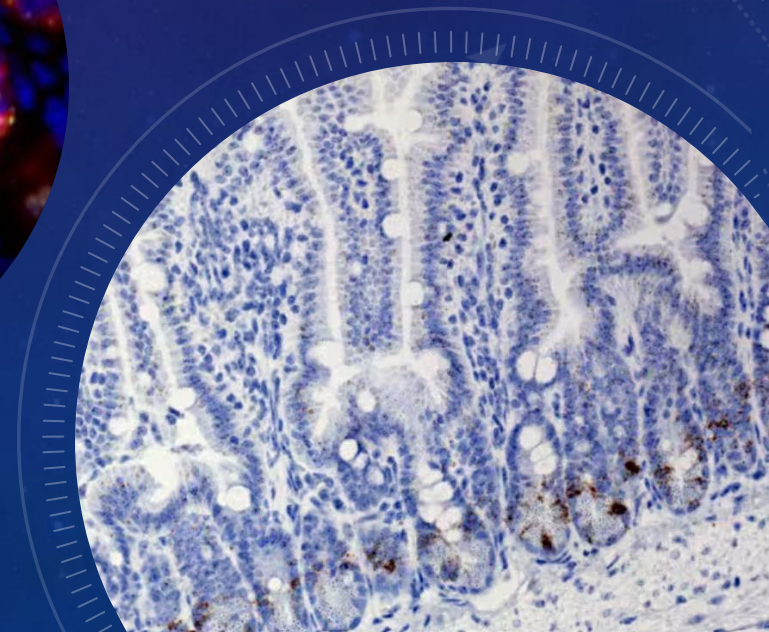
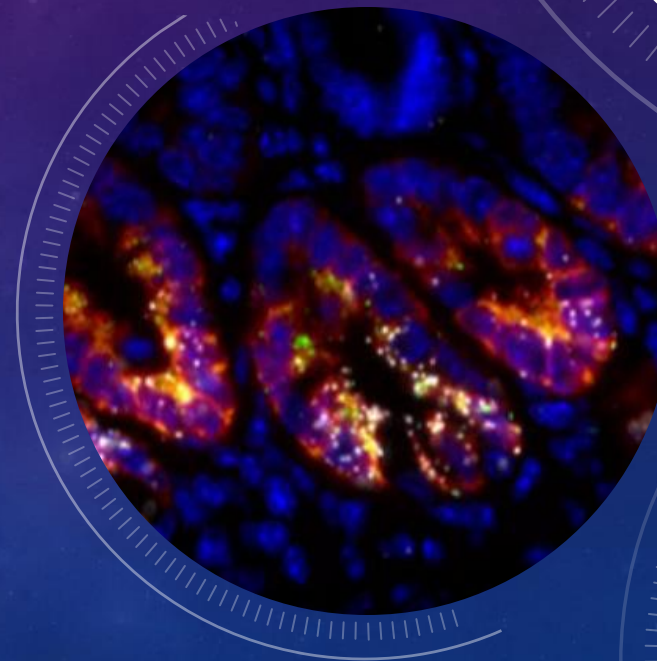
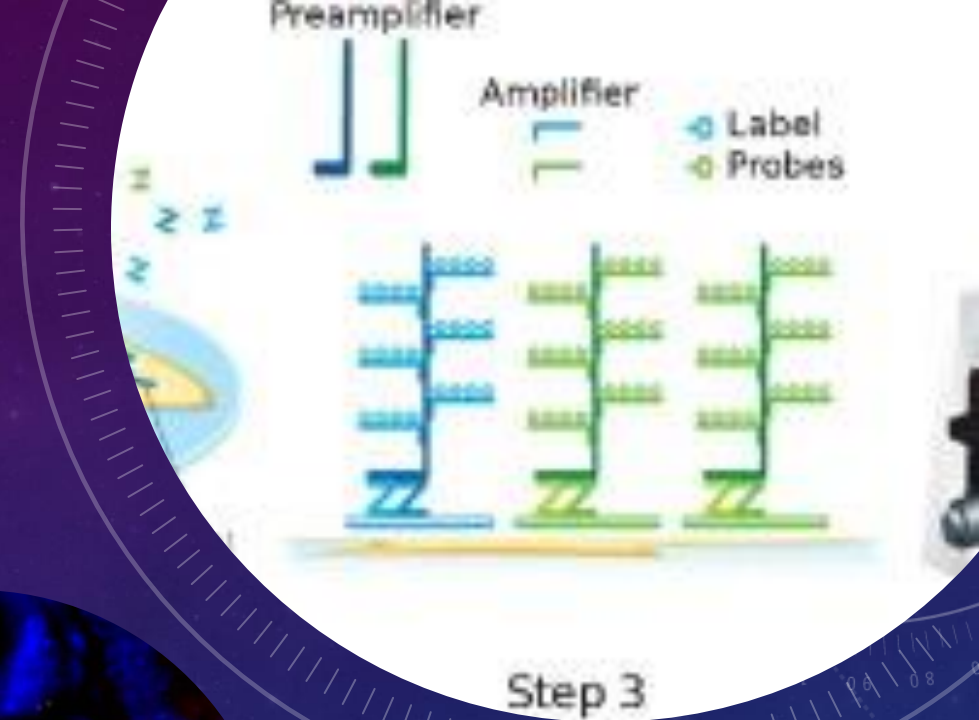


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Research

Histology services at STTARR: In situ hybridization - RNAscope (Advanced Cell Diagnostics)

- mRNA as target using probes to detect the sequence of interest
- One step before translation into protein expression



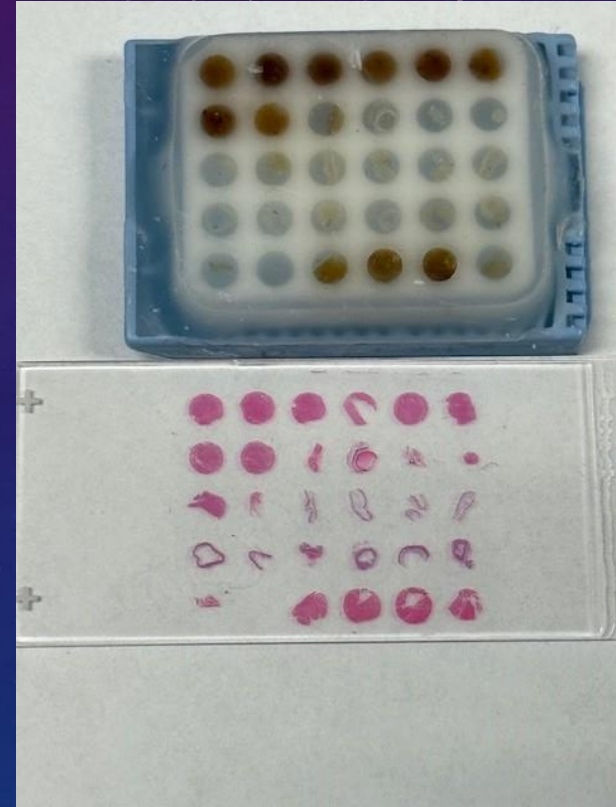
Histology services at STTARR: Cell Pellet Embedding

- embedding loose cells or
- organoids in paraffin



Histology services at STTARR: Tissue Microarray

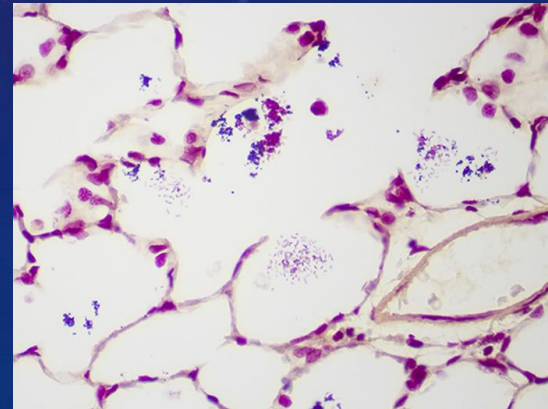
- Combine multiple blocks into 1 paraffin block
- Rapid IHC test in 1 IHC test
- Used commonly in cancer research
- Sizes: 2mm, 3mm, 5mm cores



Histology services at STTARR

Project Consultation

- Understanding the goal of the study
- What kind of questions are you trying to answer
- Is the histology stain going to demonstrate the interested component well (e.g. Gram stain)
- Any technical challenges in looking for microscopic structures from tissue section (embedding, microtomy)
- Positive and negative controls
- Suitable antibody for IHC / IF staining



AOMF SLIDES SCANNING AND IMAGE ANALYSIS SERVICES



- Brightfield 20x and 40x full slide scan

Leica Aperio AT2 brightfield scanner

- Fluorescence 20x 40x full slide scan

Zeiss Axioscan fluorescence scanner

HALO whole slide analysis software

Seamless transfer to AOMF upon request



Questions

STTARR Histopathology

Homepage: www.sttarr.ca

Twitter: [UHN Research & Innovation Cores \(@CoresUhn\) / X](https://twitter.com/CoresUhn)

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