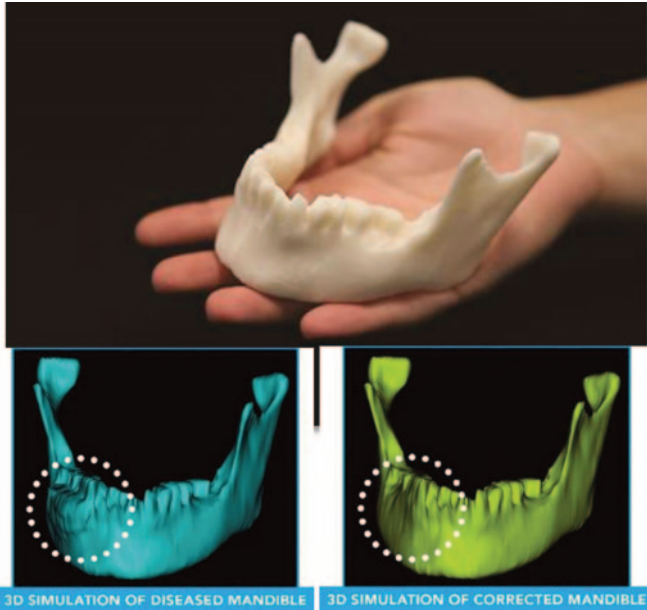


Head and Neck Surgery



Guided Therapeutics (GTx) Research

Jonathan Irish, David Goldstein, Michael Daly

GTx Program Manager/Scientist: Dr Jason Townson

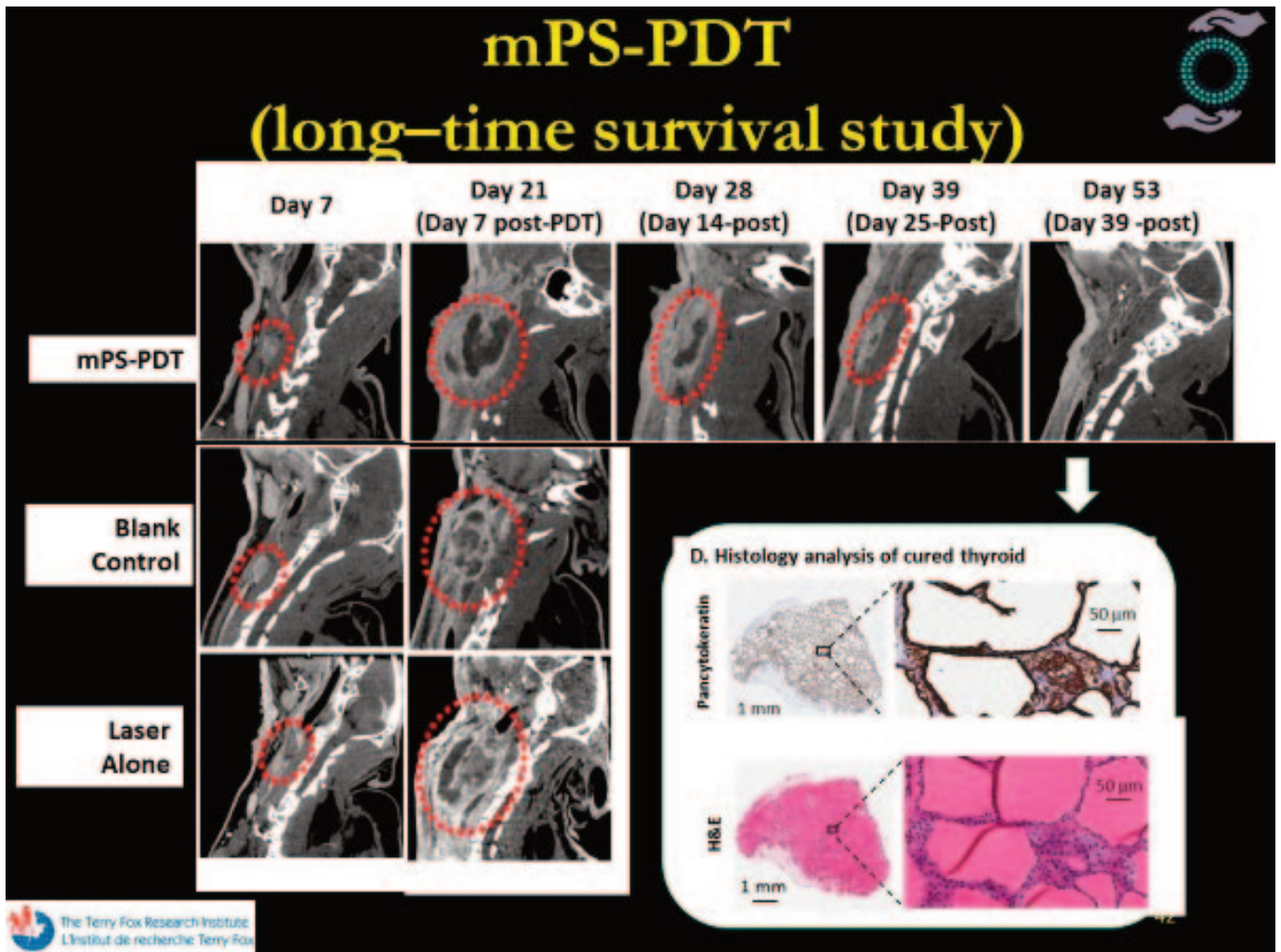
The GTx Research Program, part of UHN's TECHNA Institute, continues to lead and support research and development activities in head and neck, skull base, thoracic and sarcoma cancer surgery, as well as translational clinical trials, in all four clinical areas. This research is completed by our multidisciplinary team, composed of surgeons, radiation physicists, engineers, programmers, chemists, cancer biologists, and imaging specialists, using the key GTx infrastructure consisting of the GTx Operating Room (GTx-OR at the Toronto General Hospital) and the GTx-Lab (at Princess Margaret Cancer Research Tower). During the past year, the GTx Program focused on translational research and development of a broad range of new and continuing research projects:

- Adapting and assessing GTx surgical navigation tools in mandibular and maxillary surgeries;
- Improving reconstruction through new 3D modelling and printing capabilities;
- Developing fluorescent nanoparticles to guide surgery;
- Developing therapeutic nanoparticles to open the door for first-in-human nano-surgery;
- Quantification of circulating tumour cells (CTCs) in thyroid cancer patient blood (liquid biopsies);
- Developing GTx technologies for other types of cancer;
- Applying intraoperative dual energy CT scanning capability in the operating room to increase the sensitivity of non-invasive imaging;
- Refining intraoperative cone-beam CT scan imaging;
- Developing endoscopic navigation for better mapping of brachytherapy;
- Initiating a new collaboration with the National Optics Institute (INO) in order to evaluate sample adequacy using spectroscopic methods for point-of-care testing for thyroid fine needle aspiration (FNA) samples;
- Initiating a new collaboration with University of Guelph faculty to explore the potential benefits of improved size scale relevancy and natural tumour progression characteristics using canine models for late stage cancer therapeutics;
- Developing augmented reality (AR) and virtual reality (VR) technologies for surgical applications;
- Developing mobile phone applications to allow patients to perform the Epley maneuver at home with VR guidance;
- Continuing co-ordination of GTxOR research activities while increasing clinical service time to accommodate additional clinical and research programs;
- Training of undergraduate and graduate students and clinical fellows, and;
- Continuing collaboration with Drs. Wunder and Ferguson in order to translate GTx surgical

navigation technology to Mount Sinai ORs for osteosarcoma surgeries. Prior research from this collaboration was recently published in The Journal of Bone and Joint Surgery (Sternheim et al, May 2018).

The GTx Program was the recipient of a \$7M 5-year Terry Fox New Frontiers Program Project Grant for “Porphysome Nanoparticle-Enabled Image-Guided Cancer Interventions” which was announced in September of 2017. The Project leaders are Gang Zheng, Brian Wilson and Jonathan Irish. This grant will support the GTx Program’s continued research and development of porphysome nanoparticles (developed by and in collaboration with Dr. Gang Zheng) as an imaging and therapeutic (theranostic) agent for thyroid and oral cavity cancers. As part of the Terry Fox Research Institute funded project, the GTx program continues to play a significant role in development and translation of

porphysome nanoparticles for application in thyroid and mucosal head and neck cancers. During the last year the primary focus was on determining the safety, efficacy and specificity of a porphysome subtype, the miniporphysome, for photodynamic therapy (PDT) of thyroid cancer. In mouse and rabbit models it was observed the porphysome mediated PDT led to highly specific and effective apoptosis only in tumour tissue. Additionally, longitudinal studies revealed that porphysome mediated PDT was sufficient to eradicate thyroid tumour in rabbits without damaging proximal tissues including healthy thyroid, the recurrent laryngeal nerve or trachea. These promising results are consistent with previous porphysome results observed by the GTx lab in other head and neck models, and continues to assist in paving the way to first in human clinical trials in coming years.



GTx Program: At a glance

PATIENT OUTCOMES AND EXPERIENCE



- 9 cancer related clinical trials
- 3 non-cancer related clinical trials (26 patients)
- >200 cases in the GTx OR

KNOWLEDGE GENERATION



- 60 refereed papers
- 96 published abstracts and presentations
- 4 licensable technologies

KNOWLEDGE TRANSFER



- 40+ GTx OR open houses and tours
- 1 GTx Surgery Program Website
- 5 site-group specific GTx Fellowships
- 5 Undergraduate medicine and engineering summer students

- >18 multi-disciplinary team members involved
- **GTx Research & Operational Oversight Committee**; reporting to **GTx Governance Committee and Innovation OR Committee**

- **GTx Lab (TMDT)**, the **GTx OR (TGH)**, and the **Research MR Suite (TGH)** as key infrastructure
- 4 site group users to date
- **GTxOR** now mixed clinical and research use

PEOPLE



INFRASTRUCTURE, OPERATIONS AND INTEGRATION



Facial Plastic & Reconstructive Surgical Research

Peter Adamson

The following research papers were completed over the past academic year:

“Current Practice Patterns Among Rhinoplasty Surgeons: How Closely Do They Reflect Clinical Practice Guidelines”, by Carniol E, Adamson PA.

"Impact of Cosmetic Procedures on Social Media Posting"

Retrospective study examining the frequency of selfie posting prior to and following cosmetic procedures (injectable fillers and rhinoplasty) by Taki NH, Asaria J.

"Trends in Rhinoplasty 2012-2016: Incidence, Risk Factors, and Thirty-Day Complication Rates" by Roskies MG, Asaria J, Fritz M.

“Retrospective Review of the Use of a Miniplate in Septal Reconstruction” by Abou Sheleib W, Smith O.