REGIONAL MEETING
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MCMASTER UNIVERSITY, HAMILTON, ONTARIO

ABSTRACTS – POSTER PRESENTATIONS

SORTED BY LAST NAME

Is Dissection in Virtual Reality an Effective Learning Tool?

Akanksha Aggarwal[1], Sapriya K. Birk[1], Jaskaran S. Gill[1], Katrina S. Hass[1], Josh P. Mitchell[1], Barbara Fenesi[2], Bruce Wainman[1]; [1]Education Program in Anatomy, McMaster University, Hamilton, Ontario; [2]Faculty of Education, University of Western Ontario, London, ON

Three-dimensional (3D) visualization technology such as virtual reality (VR) has the ability to illustrate and replicate physical dissection, and its novelty has captured the interest of many educational institutions. Unfortunately, the testing of 3D technology lags behind development, and most research is confined to case studies. This study's objective is to (1) analyze the short-term and long-term efficacy of VR dissection technology compared to an interactive, physical dissection model, and (2) determine if other factors, such as spatial ability, impacts the effectiveness of learning anatomy from VR models. Based on previous research in our lab, physical models have been shown to improve memory retention, and thus would perform better in teaching anatomy. The interactive, physical model consists of a 3D-printed bony pelvis and fabric perineal structures to effectively display the dissections. The physical model was scanned to produce an identical VR replica which is displayed on an HTC Vive. This crossover study will use undergraduate McMaster University students (n = 75) with no formal anatomy education. Participants will be asked to learn anatomical structures from both physical and VR models and be tested on the knowledge from each model in two separate tests. After 48 hours, they will be tested to determine if either model exhibits better long term retention. Tests will include nominal, functional, and spatial questions to assess recognition, critical thinking, and spatial awareness. Data collection is underway and expected to yield results in December 2018. Understanding the impact of VR and physical dissection models on student learning could help guide and improve the development of future anatomy education programs.

Level of First Author: Undergraduate Student **Topic Category: Anatomy Education**
Presentation type: Poster
Poster Board #19

Regulation of Endoplasmic Reticulum Stress Sensitivity by TORC1 Signalling in Yeast

Khadija Ahmed, Patrick Lajoie; Anatomy and Cell Biology, Western University, London, Ontario

The endoplasmic reticulum (ER) is a specialized organelle responsible for the post-translational modification and folding of nascent polypeptides to form biologically active secretory proteins. Incorrect folding of secretory proteins in the ER results in an aberrant accumulation of misfolded proteins (ER stress) and activates a coping mechanism known as the unfolded protein response (UPR). Clinically, UPR activation is at the root of several neurodegenerative diseases such as Alzheimer's disease and Huntington's disease. While the mechanisms of UPR activation have been well established, how it integrates with other stress responses remains unclear. Given that TORC1 is an important regulator of cell growth during protein misfolding stress, I sought to investigate how TORC1 signalling acts in parallel with the UPR to regulate ER stress sensitivity. Our studies employ the budding yeast, Saccharomyces

cerevisiae, a genetically and biochemically traceable model organism that allows for rapid and extensive genetic manipulation. Our results indicate that yeast cells carrying a hyperactive allele of TORC1 (TOR1 L2134M) have increased sensitivity to canonical ER stressors and are inositol auxotrophs. Both phenotypes can be linked to a defective response to ER stress. Surprisingly, UPR activation and downregulation of ribosome biogenesis, two major consequences of ER stress, are equivalent between yeast cells carrying a wild-type and hyperactive TOR1 L2134M allele, suggesting that TORC1 controls other signalling events required to cope with secretory protein misfolding. Interestingly, ER stress tolerance in yeast depends on the activation of the cell wall integrity pathway, which is regulated by TORC1. Our results indicate that hyperactive TOR1 L2134M mutants are more sensitive to cell wall stressors and that the addition of sorbitol, a canonical cell wall stabilizer, rescues ER stress sensitivity in hyperactive TOR1 L2134M mutants. Our preliminary results also indicate that the calcium-calcineurin pathway may be downregulated in TOR1 L2134M mutants. Overall, our studies in yeast may uncover new paradigms by which the response to protein misfolding is regulated, and thus, have implications for several human disorders.
Support or Funding Information: Supported by NSERC Discovery Grant Funded by Alexander Graham Bell Canada Graduate Scholarship (CGS-M)
Level of First Author: Graduate/Medical Student **Topic Category: Cell and Molecular Biology**
Presentation type: Poster
Poster Board #25

AP-2β Transcription Factor is Required for Normal Development of the Anterior Segment of the Eye
Monica Akula[1], Vanessa Martino[1], Trevor Williams[2], Alexander Ball[1], Judith West-Mays[1]; [1]Pathology and Molecular Medicine, McMaster University, Hamilton, Ontario; [2]Craniofacial Biology, University of Colorado, Denver, Colorado

Previously, our lab showed that AP-2β transcription factor is highly expressed in the periocular mesenchyme (POM) of the developing eye. We further showed that conditional deletion of AP-2β in the POM (AP-2β NCC KO mice) resulted in anterior segment defects, including absence of a corneal endothelium, iridocorneal adhesions and outflow pathway defects that were accompanied by raised intraocular pressure (IOP). To better understand the cause of these defects this study purports to further examine the embryonic patterns and differentiation of the POM in AP-2β NCC KO mice. To carry this out, Wnt1Cre+/-/Tfap2b+/- mice were bred with Tfap2blox/lox mice to generate Wnt1Cre+/-/Tfap2b-/lox mice (AP-2β NCC KO) with Tfap2b, encoding AP-2β, deleted in the POM of the eye. Immunohistochemistry of paraffin embedded AP-2β NCC KO and control littermate eyes was done at embryonic day (E) 10.5, E15.5 and in postnatal mice using antibodies raised against phospho-histone H3, Pitx2, α-smooth muscle actin (α-SMA) and myocilin, the latter of which is an extracellular matrix component. Furthermore, plastic resin-embedded tissue sections of the trabecular meshwork region of the eye were stained with Uranyl acetate and placed on copper grids for transmission electron microscopy (TEM). Results demonstrated that at E10.5 and E18.5, proliferation and apoptotic changes remained the same in both KO and control mice. However, at E15.5 Pitx2 localization (a marker for POM) was increased in the posterior cornea of mutant mice, and the 2nd wave of newly migrated Pitx2 positive POM cells appeared adhered to the cornea in AP-2β NCC KO mice, which was not observed in controls. Furthermore, at P14, the number of beams was significantly reduced in the trabecular meshwork of early postnatal and adult mutant mice as compared to controls. In addition, mutant mice also showed a significant reduction in the number of α-SMA-positive trabecular and ciliary muscle cells, and a reduction in myocilin expression, both at early and late postnatal time points. The fact that the POM cells in the mutants appear adhered to the posterior endothelium early in embryogenesis (E15.5) suggests that the iridocorneal adhesions observed later in adult mice were likely initiated at this embryonic stage. Reduced expression of α-SMA and myocilin in the KO mice, as well as the reduction in the number of trabecular beams, further supports the idea that AP-2β expression in the POM is critical for appropriate differentiation into iridocorneal angle cell types when compared to control littermates.
Support or Funding Information: BrightFocus Foundation & National Institute of Health
Level of First Author: Graduate/Medical Student **Topic Category: Developmental Biology/Embryology**
Presentation type: Poster
Poster Board #30

Uncovering the Role of OVOL1 in Placental Stem Cell Differentiating Using Saccharomyces cerevisiae
Maram Albakri, Hazel Dhaliwal, Gargi Jaju, Stephen Renaud, Patrick Lajoie; Anatomy and Cell Biology, Western University, London, Ontario

The placenta is an important maternal-fetal barrier that ensures the exchange of nutrient, waste, and gas. When stem cells fail to adequately differentiate into the placenta, it can lead to serious complications that can harm both the mother and the baby. In the beginning stages of embryo implantation, a group of stem cells known as cytotrophoblasts are signaled to differentiate into syncytiotrophoblast. Syncytiotrophoblast will later help form the chorionic villi which interact with the maternal blood supply to support the growth of the baby. We previously identified OVOL1 as a regulator of cytotrophoblast stem cell differentiation. OVOL1 is a transcription factor involved in repressing genes that maintain cytotrophoblast progenitor population. However, how OVOL1 represses cytotrophoblast stem cell growth to trigger differentiation remains poorly understood. Our objective is to use the budding yeast Saccharomyces cerevisiae as a model, to uncover the mechanisms underlying OVOL1 regulation of cell proliferation. Our preliminary results indicate that, similarly to trophoblast cells, the expression of OVOL1 results in growth inhibition in yeast. This phenotype relies on the presence of histone deacetylases (HDAC), which are associated with gene silencing through deacetylation of histone proteins. Our results suggest that interaction between OVOL1 and HDACs could play a key role in regulating trophoblast stem cell differentiation in the human placenta. Our yeast discovery platform will enable us to understand the mechanisms regulating OVOL1 protein interactions, which can uncover potential therapeutic targets to address prevalent pregnancy complications associated with placental maldevelopment.
Support or Funding Information: NSERC Discovery Grant
Level of First Author: Graduate/Medical Student **Topic Category: Cell and Molecular Biology**
Presentation type: Poster
Poster Board #28

~~**Drawing on Students' Interests for Authentic Inquiry Learning in Undergraduate Anatomy**~~
~~**Lauren Anstey,** Centre for Teaching & Learning, Western University, London, Ontario~~

~~This presentation draws on findings from a doctoral dissertation that investigated students' experiences an inquiry project component to their undergraduate pre-medical gross anatomy course. Utilizing a case-study design with three groups of students (n = 18) and their facilitators (n = 3), methods of classroom observations, interviews, and artifact collection were utilized. Findings demonstrate how students engaged course material to inquire into and apply disciplinary considerations to their personal lives and the world around them. A theoretical model of authentic inquiry learning will be presented and discussed in guiding anatomy curriculum development.~~
~~**Level of First Author: Faculty** **Topic Category: Anatomy Education**~~
~~**Presentation type: Poster**~~
~~**Poster Board #**~~

The Evolution of MacAnatomy: A Portal to Anytime, Anyplace Anatomic Education
Ilana Bayer, Bruce Wainman; Pathology and Molecular Medicine, McMaster University, Hamilton, Ontario

Context/Setting: The expansion of McMaster University's Michael G. DeGroote School of Medicine into three regional campuses and growth in all Health Sciences programs necessitated the provision of a web-based content management system (CMS) to allow for anytime/anywhere access to anatomic educational materials only available in the main anatomy facility. Intervention: An online portal to the Education Program in Anatomy at McMaster University – MacAnatomy (https://macanatomy.mcmaster.ca) – was initially developed using Joomla! (an open source CMS). The MacAnatomy project involved digitization, labeling and generation of metadata for over 3,000 prosections as well as other learning objects such as models, illustrations, purpose-built HD anatomy videos, lecture captures and standalone e-learning modules. The site has approximately 6,000 pages and over 50 GB of material. The original project took 5 years and approximately 7,000 hours to complete. MacAnatomy has continued to evolve based upon feedback and evaluation of the site as well as changing technical requirements. Recently, the online portal was redeveloped using WordPress to facilitate editing and increase access for mobile devices. Observations: MacAnatomy is used as both a standalone resource as well as a resource used in conjunction with the physical

specimens in the anatomy lab. The site generates on average approximately 30,151 pageviews from 13, 000 visitors per month from various faculties including medicine, rehabilitation sciences, midwifery and nursing. Discussion: Effective clinical anatomy teaching involves integrating physical and digital resources in a meaningful way. This melding of educational materials is challenging in the face-to-face environment of the anatomy lab but expansion of programs to regional campuses creates unique demands for distributed resources. We will provide an overview of MacAnatomy, discuss team collaboration and technologies (e.g., Joomla!, WordPress) that were used to develop, implement and evaluate it as well as use of the site. We will also share the pedagogical and ethical challenges of displaying human anatomy on the web, the unique issues around multimedia retrieval and delivery we overcame while putting the lab "online", and the benefits and challenges of using WordPress to redevelop the online portal.

Level of First Author: Faculty **Topic Category: Anatomy Education**
Presentation type: Poster
Poster Board #13

Professionalism & Clinical Anatomy

Ethan Bazos, Tim Wilson; Anatomy and Cell Biology, University of Western Ontario, London, Ontario

Planned Happenstance Theory (PHT) is a career counselling model centered on the effects of unpredictable career-related events that occur throughout an individual's life. As these happenstance events occur, they have the capacity to become positive, neutral, or negative career developmental experiences for that individual. PHT consists of two core modalities: (i) By actively exploring career venues of interest, individuals increase happenstance event frequency, and (ii) The presence of five happenstance skills assist in permitting these individuals to take advantage of these events as they occur. In this study, we aim to investigate the significance of PHT and career satisfaction in a post-graduate student cohort (M.Sc. Clinical Anatomy graduates). This pilot study explored planned happenstance tendencies and career satisfaction in a cohort of post-graduate students (n=9) from the past 4 years. Using structured interview we qualitatively sampled for the presence of skills, happenstance events, and career success through phenomenological study. Individuals were quantitatively assessed for the presence of skills using the Planned Happenstance Career Inventory (PHCI), while career satisfaction was sampled for using the Career Satisfaction Scale (CSS). Preliminary data reveal mean PHCI skill scores: curiosity (4.4±0.59 on a 5-point scale), flexibility (3.3±0.86), persistence (4.5±0.58), optimism (4.2±0.55), and risk-taking (4.0±0.71). Mean CSS score is (3.95±1.2 on a 5-point scale). Post graduate students portray relatively high PHCI skills scores and reasonably strong career satisfaction scores. Further research in the undergraduate population would help educators and career counsellors to understand how curriculum affects student progression.

Level of First Author: Graduate/Medical Student **Topic Category: Anatomy Education**
Presentation type: Poster
Poster Board #5

Surgery Interest Group for Residency Preparation: A Proposed Model

Christina Chopra, Michael Balsz, Fauzia Nausheen, MD; School of Medicine, California University of Science and Medicine, San Bernardino, CA

Background: First- and second-year medical students are often overwhelmed by an intense academic curriculum, leaving them with little time for exploration of various medical specialties. By the time students begin their clinical rotations, many are still not equipped with knowledge and skills related to various surgical specialties. This perceived state of unpreparedness may negatively influence the residency program application process. This, combined with increasing competitiveness and high expectations from residency directors, informs our desire to propose an interest group model designed to increase preparedness for surgery rotations and residency programs. Purpose: To propose a surgery interest group model inclusive of an intensive anatomy curriculum designed to prepare medical students for rotations and residency in surgery. Methods: A literature review was conducted to collect data on effective practices in preparing students for residency programs. In addition, a survey was issued to all surgery interest group members to gather data on desired outcomes and basic competencies as they related to a surgical career path. Based on the data collected, five educational spheres of the interest group curriculum were developed, with specific objectives outlined for each sphere. Results: The surgery interest group curriculum at

CUSM-SOM is designed to target the main spheres of professional and academic development critical in helping students determine their specialty of interest and gain the knowledge, skills, and attitudes necessary to be successful in clinical rotations and enter their desired residency program. The spheres include: 1) Skills Workshops, 2) Mentorship & Professional Development, 3) Research, 4) Service & Shadowing, and 5) Specialist Presentations. The interest group has a 4-year longitudinal progression, with surgical specialties introduced in the first two years. This education will be supplemented by an intensive regional anatomy curriculum and skills workshops that coincide with the academic curriculum of the medical school. The focus in the last two years will be on mentorship, research, clinical exposure, and professional development. Conclusion: The CUSM-SOM surgery interest group curriculum will be delivered by the executive committee with the assistance of anatomy and clinical faculty. Assessments have been developed to determine students' proficiency levels in the desired competencies. Progress surveys will be issued to group members over the four years to quantify desired outcomes.

Level of First Author: Graduate/Medical Student **Topic Category: Anatomy Education**
Presentation type: Poster
Poster Board #4

Morphology of the Semispinalis Capitis Muscle in the Neck

Marco Ciavaglia, Adam Elturk, Ibrahim Aljerdi, Mary Tracy-Bee; Biology, University of Detroit Mercy, Dearborn Heights, MI

Objective: To determine the correct anatomical morphology of the semispinalis capitis muscle in order to determine if adjustments are required in anatomy textbooks. Methods and Results: Eight human cadavers from the University of Detroit Mercy College of Health Professions were investigated to examine the muscle in question. Dissections were done with an incision from the base of the skull down the midline keeping within the midsagittal plane. Cuts were made through the trapezius, splenius cervicis, and splenius capitis which were then reflected to both sides. Then, two incisions were made laterally along the skull and the underlying skin and muscles were reflected to expose semispinalis capitis. Images were then taken with a ruler as reference. The cadaver's muscles were grouped into categories based off the tendinous pattern: other form, one vertical and one curved band, two uniform vertical bands. The results showed 19% of them fit the other form, 27% fell into the one vertical and one curved, and 54% were in the two uniform bands category. Conclusions: There were in fact differences observed in length and continuity of the tendon between the cadavers and the given anatomy textbooks. There also were differences in width, coloration, and depth of the muscle between the bodies.

Level of First Author: Undergraduate Student **Topic Category: Gross Anatomy**
Presentation type: Poster
Poster Board #33

Palmaris Longus: Evolutionarily Vestigial Muscle or Proprioceptive Organ?

Edward Czarnecki, Mary E Craig; Biological Sciences, Oakland University, Rochester, MI

Introduction: The Palmaris Longus muscle has long been called vestigial. From a functional view, there are intrafusal fibers present in the muscle which have been shown to send proprioceptive information back to the Central Nervous System. There has been little research done to demonstrate how these signals affect biomechanics and locomotion. According to Radovanovic et al. it is believed that a better understanding of the sympathetic innervation of these intrafusal fibers will greatly aid our understanding of how the muscles function as proprioceptors and how they alter muscle action under stress, such as hyperextension; however, since native skeletal muscle fibers are present they may have begun to relay proprioceptive information back to the Central Nervous System without the need for intrafusal fibers. Aim: Quantification of native and intrafusal fibers in vestigial muscles to better understand the placement and evolutionary implications. Methods: General histology: tissues - sectioned, stained, quantified. Samples stored in 10% formalin was rinsed with a Phosphate Buffered Saline (PBS). Samples were either serially rinsed for 24 hours in 50, 70, 95, 100% alcohol or held in PBS for 24 hours. The latter, to perform frozen sectioning. Alcohol treated samples were embedded in wax prior to sectioning, frozen were not. All tissue was sectioned at 5 microns via Cryostat or Microtome. Tissue sections were mounted on slides and stained with Hematoxylin and Eosin to demonstrate cellular structures. Images and measurements were taken.

Select samples may receive Silver Stain to reveal neurological tissue. Results and Conclusion: Preliminary data is pending.
Support or Funding Information: Thanks to the Department of Biological Sciences at Oakland University for support. Special thanks to the Body Bequest Program at Wayne State University for permission to remove cadaveric tissue.
Level of First Author: Undergraduate Student **Topic Category: Histology**
Presentation type: Poster
Poster Board #35

A Master of Science in Anatomical Education
Ron Easteal, Leslie MacKenzie, Stephen Pang, Charles Graham; DBMS, Queen's University, Kingston, Ontario

In the early 2000s, it was predicted that there would be a shortfall in college and university Anatomy teachers. In 2006, Queen's University's Department of Anatomy and Cell Biology instituted a Master of Science programme designed to fulfill that shortfall. The 16-month curriculum was based on three pillars of competency. The first pillar is coursework in all anatomical subdisciplines including graduate courses in Histology, Gross Anatomy, Neuroanatomy, and Embryology. The second pillar consists of graduate, interactive courses in teaching and learning, which involve three semesters of coursework in the modern techniques of postsecondary education; these courses require maximum integration of instructors and students. The third and final pillar is a practicum in teaching and in anatomical preparation, including cadaveric dissection, histological and gross anatomical specimen preparation, as well as teaching assistantships and at least five lectures to undergraduate and graduate students in any of the four subdisciplines. So far, the programme has been very successful. 40% of our graduates go into Medicine, another 40% go on to do PhDs, and the other 20% are doing something useful with their lives.
Level of First Author: Faculty **Topic Category: Anatomy Education**
Presentation type: Poster
Poster Board #9

Research Design for the Evaluation of Two-Stage Collaborative Testing on Student Recall of Anatomical Material
James P Faul[1], Danielle C. Bentley[2]; [1]Department of Human BIology, University of Toronto, Toronto, Ontario; [2]Department of Surgery, University of Toronto, Toronto,Ontario

To overcome concerns regarding retention of anatomical information, previous cohort studies have successfully employed two-stage collaborative testing, an alternative to traditional 'independent testing', to increase final exam performance and improve retention of course material. A limitation of such cohort studies is the inability to explore direct effects of testing strategy on individual student learning outcomes. Therefore, using a randomized cross-over design with intra-individual comparisons, this research will determine the impact of two-stage collaborative testing on student recall and retention of anatomy knowledge within an undergraduate introductory course in gross anatomy. Secondarily, this study will investigate (1) how performance metrics compare between high and low performing students, (2) whether the effects of student retention dissipate with time, and (3) student perceptions regarding the two-stage collaborative testing structure. The experimental cohort are students (n=97) taking an introductory anatomy course for Medical Radiation Science at the University of Toronto / Michener Institute. Students have been block-randomized into approximately 30 groups of 2-4, controlling for the Michener program (Radiation Therapy, Radiological Technology, Nuclear Medicine, Molecular Imaging Technology). Following an initial term test where each group is acclimatized to the collaborative testing structure, groups will then randomly complete their second and third term tests either i) individually or ii) individually + collaboratively. This descriptive poster transparently presents the proposed project design elements, including general methodology, group allocation scheme, anticipated challenges, student consent processes, and planned statistics. It is hypothesized that the collaborative testing will (1) enhance recall of course material, assessed between group cohorts via the recall quiz, (2) enhance retention of course material, assessed within a student via segmented final examination scores, (3) equally benefit both high- and low- performing students, assessed between high and low cohorts via segmented final examination scores, and (4) be well-received by the students, assessed using the end-of-term Feedback Questionnaire.
Level of First Author: Undergraduate Student **Topic Category: Anatomy Education**

Presentation type: Poster
Poster Board #8

Activating Endogenous Neural Precursor Cells in the Mammalian Spinal Cord with Metformin
Emily Gilbert, Wenjun XU, Cindi Morshead; Surgery, University of Toronto, Toronto, Ontario

Spinal cord injuries (SCI) result in devastating functional deficits with minimal treatment options. Endogenous neural precursor cells (NPCs) exist within the spinal cord and are located in the periventricular region lining the central canal. While normally relatively quiescent and non-neurogenic, these NPCs are activated in response to injury. Enhancing and harnessing the potential of resident NPCs may improve structural and functional outcomes following SCI. The FDA-approved drug metformin (MET) has demonstrated efficacy in promoting neural repair in the injured brain where it expands the size of the NPC pool and promotes both oligogenesis and neurogenesis from NPCs. Here, we seek to determine whether it has a similar effect on NPCs within the spinal cord. Using the in vitro colony forming assay (neurosphere assay) we examined the size of the neural stem cell pool in the spinal cord following 7 days of in vivo MET treatment. Females demonstrated a three-fold increase neural stem cells, while males did not show any expansion in response to MET treatment. Interestingly, the sex dependent expansion of the neural stem cell pool was not coincident with the effects of MET on the differentiation profile the neural stem cell progeny. Neurospheres were plated in the presence of differentiation media, and then stained for markers of mature neural cell phenotypes. We found neurons (-III-tubulin), oligodendrocytes (O4) and astrocytes (GFAP) within the spheres, and determined that in both sexes, MET increases oligogenesis compared to vehicle-treated controls. Our data reveal that MET has differential effects on spinal cord NPCs of males and females. By expanding the NPC pool in females, and augmenting oligogenesis in both sexes, MET treatment represents a viable therapeutic strategy for enhancing neural repair post spinal cord injury.
Support or Funding Information: American Association of Anatomists Fellowship to EG Ontario Institute for Regenerative Medicine Krembil Foundation
Level of First Author: Postdoc **Topic Category: Neurobiology**
Presentation type: Poster
Poster Board #39

Does Familiarization with Virtual Reality Improve Learning in a Virtual Reality Environment?
Jaskaran Gill[1], Akanksha Aggarwal[1], Sapriya Birk[1], Katrina Hass[1], Josh Mitchell[1], Barbara Fenesi[2], Bruce Wainman[1]; [1]Education Program in Anatomy, McMaster University, Hamilton, Ontario; [2]Faculty of Education, University of Western Ontario, London, ON

Despite a scarcity in substantive evidence, virtual reality (VR) is heralded as the future of anatomy education. Recent research in our lab suggests that VR headsets are substantially inferior to traditional plastic models as educational tools. This effect appears to be mediated by the VR headsets' inability to create convincing stereopsis. Our study aims to investigate if familiarization with the VR environment improves performance. When presented with a new learning environment (e.g., a room in VR), one may encounter a "novelty effect" where the new environment demands focus and distracts from learning. An introduction to the VR environment prior to learning would minimize this novelty effect. Therefore, we hypothesize that familiarization will improve test scores. Undergraduate participants with no prior formal anatomy education (n=50) will be randomized to a familiarization or non-familiarization group. The former group is allowed to orient themselves with a VR car engine model, ad libitum. Then, both groups will undergo a learning phase with a VR pelvis model. Participants will be tested on nominal, spatial, and functional knowledge immediately and 48 hours after learning. Data collection and analysis is anticipated to be completed in December 2018. Gaining an understanding of which factors influence VR learning allows it to become a more effective, evidence-based tool for anatomy education.
Level of First Author: Undergraduate Student **Topic Category: Anatomy Education**
Presentation type: Poster
Poster Board #17

Decorin Production during Decidualization of Human Endometrial Stromal Cells

Chidambra Halari, Pinki Nandi, P.K.Lala; Anatomy and Cell Biology, University of Western Ontario, London, Ontario

Background: Decidualization process involves transformation of endometrial Stromal cells (ESC) into specialized secretory cells that provide a nutritive and immunoprivileged matrix essential for successful embryo implantation and placental development. In the human, a minor cyclic decidualization occurs during the second half of the menstrual cycle, and it can be induced in hormone primed-rodents artificially. Decidua-derived factors provide immune-protection of the allogeneic conceptus and prevent over-invasion of the uterus by the placental trophoblast. Our lab discovered that "decorin" (DCN), a leucine-rich proteoglycan produced by decidual cells restrains trophoblast proliferation, migration, invasiveness, endovascular differentiation of the trophoblast by binding to VEGFR2, as well as renewal and differentiation of "Stem" trophoblast cells into invasive extra-villous trophoblast (EVT) and hormone-producing syncytiotrophoblast. Furthermore DCN overproduction by the decidua was associated with a trophoblast-hypo-invasive disorder preeclampsia (PE) in the mother, and elevated DCN levels in the maternal plasma during the second trimester was a biomarker for PE. Rationale: Presently it is unknown whether (a) DCN production changes during the process of decidualization of ESC and (b) DCN itself is essential for maintenance of decidualization in vitro or in vivo. Hypothesis: Decidualization of human ESC is associated with an increase in DCN production Methods: We used an immortalized (transformed) human endometrial stromal cell line (T-HESC) for decidualization in vitro in the presence of cAMP and medoxy-progestin. The degree of decidual response was evaluated by the production insulin-like growth factor binding protein (IGF-BP1) and the hormone prolactin (PRL). DCN was quantified at the mRNA level by qPCR and protein level by ELISA of cell culture supernatants Results: On decidualization treatment, light microscopy revealed clear phenotypic differences between undecidualized THESCs and decidualized THESCs. Decidualization was also confirmed at the molecular level through a qRT-PCR for IGFBP1 and PRL which showed an increase at day 6 followed by downregulation on treatment withdrawal. DCN expression showed upregulation in experimental THESC at day 6 at mRNA (qRT PCR) and protein (ELISA) level followed by downregulation on treatment withdrawal. Conclusion: DCN production by HESC increases during decidualization in vitro. Ongoing studies includes isolating pHESC from pregnant 1st trimester decidua and measuring DCN production at different time points.

Level of First Author: Graduate/Medical Student **Topic Category: Cell and Molecular Biology**
Presentation type: Poster
Poster Board #27

An Open Education Physical Model for Teaching Female Pelvic Anatomy

Katrina Hass, Bruce Wainman; Education Program in Anatomy, McMaster University, Hamilton, Ontario

The anatomy of the pelvic floor is very complex and often a challenge for students to learn. Traditionally, cadavers and plastic models have been utilized as anatomy teaching tools to help students identify structures and visualize the spatial relationships between these structures. However, these types of tools each come with their own shortcomings that limit the student learning experience. Cadavers are expensive and face many ethical and cultural difficulties. The fragility, lack of availability, and lack of uniformity of cadaveric specimens has made them difficult for large groups of students to learn from. Additionally, it is hard to see many pelvic structures because the layers are thin, adherent, and difficult to isolate. Pelvic plastic models on the other hand, often lack a way to show each individual layer without obscuring other structures and are generally far too robust compared to the real pelvis. A novel educational tool was developed in order to better teach female pelvic anatomy: a fabric pelvis dissection model. This model is a combination of a three-dimensional (3D) printed bony pelvis attached to a wooden board and soft pelvic structures made of textile. The various fabric types and colours distinguish each structure's tissue type. Black stitchwork depict the muscle architecture while white paint depicts the tendinous fibers. Elastic loops, hooks, and button clips allow each structure to be removable, giving the student a unique way to "dissect" the female pelvis while handling the model. Kinesthetic manipulation helps to reduce the high cognitive load placed on the learner while allowing the user to view structures from different angles. This new fabric and 3D-printed model offers a unique learning experience to the students that would otherwise be hard to obtain. To facilitate mass production of this learning object, the 3D print files and fabric patterns are offered as an open education resource.

Level of First Author: Undergraduate Student **Topic Category: Anatomy Education**

Presentation type: Poster
Poster Board #18

Size Matters? Evaluating the Effect of Size on Anatomy Learning

Alexandra Hildebrand[1], Barbara Fenesi[2], Danielle Brewer-Deluce[3], Bruce Wainman[1], Angela Dong[1], Jim Xie[1], Jack Yang[1]; [1]Pathology and Molecular Medicine, McMaster University, Hamilton, Ontario; [2]Education, Western University, London,Ontario; [3]Kinesiology, McMaster University, Hamilton,Ontario

Until recently the size of an anatomical structure for learning was simply its natural size. Now, with increasing accessibility of 3D scanning and printing, a highly accurate model of virtually any size can be produced. But the question remains, what is the best size for learning? To investigate the effect of object size on learning, 3D models were printed from surface scans of bones using a structured light 3D scanner. A human thoracic vertebra and a human hemipelvis were chosen both for their variation in size and the fact that bones lend themselves well to 3D printing. The bones were each printed in polylactic acid (PLA) filament at 50%, 100%, and 400% scale. Undergraduate students from McMaster University (n=120) with no prior knowledge of anatomy were randomized into six groups according to 1) which size of model they would learn from and 2) which bone they would learn first. Each participant was asked to learn nominal anatomy from both a hemipelvis and a vertebra model of the same size. After the learning stage, participants were immediately tested on a real bony specimen. The learning and testing stages were then repeated with the other bone. Participants also completed a short qualitative survey about their opinions on the size, labelling, colour, and handling of the 3D printed models. Data collection is underway. Insight into how model size affects anatomy learning will provide useful information for educators looking at printed 3D and virtual reality models used for educational purposes.

Support or Funding Information: This study is self-funded by the Education Program in Anatomy. There are no external sponsors providing funding.

Level of First Author: Undergraduate Student **Topic Category: Anatomy Education**
Presentation type: Poster
Poster Board #15

In Vivo Modulation of Microglial Activity using Chemogenetics

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Microglia, the immune cells of the central nervous system, survey their surroundings and respond to external stimuli to maintain homeostasis in the brain. To do this, microglia express an array of receptors that allow them to receive and respond to signals from neighboring cells. Many of these receptors are G-protein coupled receptors, which regulate a variety of microglial functions through different signalling pathways. Gi receptors have been shown, for example, to modulate microglial phagocytosis and chemotaxis. We have generated mice expressing either Gq (hM3Dq) or Gi (hM4Di) Designer Receptors Exclusively Activated by Designer Drugs (DREADDs) selectively in microglia. These mutated muscarinic receptors no longer respond to their endogenous ligand acetylcholine, but they can be activated by low doses of clozapine-N-oxide (CNO) or clozapine, which at these doses are inert at other receptors. In hM4Di mice, the recombinant receptor is expressed selectively in microglia, but not in neurons or astrocytes. Remarkably, activation of Gi signalling, by intraperitoneal injection of CNO, did not cause any major modification in mouse locomotion, sociability, depressive-like, or anxiety-like behaviour, implying that activation of this signalling pathway does not affect baseline behavior. We are currently further validating this new mouse line and determining whether activation of microglial Gi signalling can regulate neuroinflammation in the LPS model and in mouse models of neurodegeneration.

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Level of First Author: Graduate/Medical Student **Topic Category: Neurobiology**

Presentation type: Poster
Poster Board #40

When Students Choose E-learning Resources - The Importance of Ease and Convenience
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Electronic learning resources are popular with today's students. How students choose their favorite e-learning tools has not been investigated in detail and therefore is not well understood. The popular SecondLook™ (SL) Histology e-learning self-review tool was offered in three different formats to students participating in two different histology courses at the University of Michigan (CDB450/550 and DENT510). The SL formats included downloadable PowerPoint files, an interactive online website, and a mobile smartphone and computer tablet application (app). Identical in content, each format had specific advantages and disadvantages with respect to the types of compatible devices, user features, and access limitations. Upon the conclusion of their courses, students were surveyed about their format choices and reasons for their selection, as well as usage patterns. Only 3 out of 213 participating students (91.4% participation rate) reported not having used the SL resource. Many students (46% CDB450/550, 64% DENT510) tried only one resource format, with PowerPoint being the most popular final choice (56% CBD450/550, 64% DENT510). Although the interactive website and mobile app offered several user-friendly features not available within the PowerPoint files, they each only garnered approximately 20% final popularity in both courses. "Convenience," "larger screen," and "easy to use" were given most often as reasons for students' PowerPoint software format choice. The flexibility of time and place to use the resource and availability of features were also named as factors in the format selection. The access to a mobile learning tool enticed some students to use this resource in distractive environments. It also encouraged some students to forgo other learning resources, specifically textbooks, and the course website. These results suggest that today's students are in fact less motivated to actively seek out novel, high-tech learning resources than commonly believed and instead often select easy to use and convenient review tools with which they are familiar.

Level of First Author: Faculty **Topic Category: Anatomy Education**
Presentation type: Poster
Poster Board #2

The Virtual Anatomy Lab: A Pilot Project
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While cadaver dissection remains the gold standard for learning human anatomy, the learning experience can be supplemented through virtual reality technology. Virtual reality may provide students with a more efficient method of review, as the time necessary to commute to and from campus and the need to bathe after visiting the lab serve as obstacles to visiting the lab outside of scheduled dissection time. A virtual review of human anatomy may also be a preferred form of review prior to tests, as crowded laboratories in the days leading up to an exam can be distractive and create anxiety for some students. The cost involved with maintaining an anatomy lab is also restrictive for many institutions, and a virtual cadaver laboratory experience may be a more permissive means of learning anatomy. Educational specialists at UB are partnering with digital media companies to develop a virtual anatomy learning experience as a pilot project to explore the feasibility of this learning experience in a classroom setting.
Support or Funding Information: Funding from SUNY Innovative Instruction Technology Grant (IITG grant).
Level of First Author: Faculty **Topic Category: Anatomy Education**
Presentation type: Poster
Poster Board #7

A Preliminary Investigation of Cardiac Cell Proliferation Following a Puncture Injury to the Heart of the Leopard Gecko (Eublepharis macularius)
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A hallmark feature of cardiac self-repair is an increase in cell proliferation associated with both the wound site (local) and across the entire organ (global). Among species capable of cardiac regeneration, including zebrafish and salamanders, injuries to the heart initiate a surge in cardiomyocyte proliferation. In contrast, among species that repair cardiac injuries with a scar, rates of spontaneous cardiomyocyte proliferation are essentially unaltered in response to a lesion. Hence, cardiomyocyte proliferation in response to injury may provide an index of regenerative-competence. Here, we characterize cell proliferation following a cardiac puncture in a representative reptile, the leopard gecko (Eublepharis macularius, hereafter 'gecko'). Cardiac punctures (cardiocentesis) are a procedure used in veterinary clinics to collect blood from small lizards and snakes. Geckos readily tolerate this injury, but little is known about the structural and cellular changes that take place to repair the heart. To investigate cardiac cell proliferation, we performed double immunofluorescence with the DNA synthesis marker proliferating cell nuclear antigen (PCNA), with each of myosin heavy chain (MHC; a cardiomyocyte marker) and Vimentin (Vim; a marker of fibroblasts and endocardial cells). Prior to injury, we observed proliferating populations of both cardiomyocytes (MHC+/PCNA+) and non-cardiomyocytes (Vim+/PCNA+). One day post-cardiac puncture (dpc), the wound site is characterized by the formation of a blood clot capping the puncture, and the localized loss of MHC+ cardiomyocytes within the wound site. At 5 and 10 dpc, there is an increase in Vim+ expression within the wound site, while increasing numbers of proliferating cardiomyocytes are observed along the border of the lesion. By 14 dpc, MHC+ cardiomyocytes repopulate the wound site, restoring the original trabeculated architecture of the myocardium. Taken together, these data demonstrate that cardiac self-repair in the gecko heart is characterized by an increase in cardiomyocyte proliferation. Our findings reveal that gecko heart repair closely follows the regenerative trajectory observed in species such as zebrafish, and is distinct from the fibrotic response of mammals.
Support or Funding Information: Natural Sciences and Engineering Research Council of Canada (NSERC) Discovery Grants 400358 to MKV and the Ontario Veterinary College (OVC) scholarship to KJ.
Level of First Author: Graduate/Medical Student **Topic Category: Histology**
Presentation type: Poster
Poster Board #34

Syndecan-4 Regulates Extravillous Trophoblast Migration by Coordinating Protein Kinase C Activation
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Extravillous trophoblast (EVT) invasion is an essential component of human placentation. Poor EVT invasion is associated with obstetrical complications including preeclampsia. Integration of cues from the extracellular environment is required for directional EVT invasion, but how EVTs coordinate responses to these cues is not well understood. Syndecan-4 (SDC4) is a transmembrane heparan sulfate proteoglycan that binds to, and modulates the activity of, many extracellular proteins implicated in placental development. Therefore, we sought to determine the functional importance of SDC4 for EVT invasion. We found that SDC4 is expressed by a first trimester EVT line (HTR8), and in EVTs of 6, 14, and 39-week placentas throughout pregnancy, with higher expression during early pregnancy than at term (63% decrease in expression between 6-week and 39-week placentas, $p<0.05$). Higher expression was also observed in placentas from preeclampsia compared to normotensive pregnancies (4.3-fold higher expression than placentas from control pregnancies, $p<0.05$). Using a lentivirus-shRNA strategy, we successfully knocked down SDC4 expression in HTR8 EVTs by 90% ($p<0.05$). SDC4-deficient HTR8 EVTs exhibited reduced migration and Matrigel-based invasion, both under basal conditions (approximately 40% and 60% decreases, respectively, $p<0.05$) and following exposure to basic fibroblast growth factor and heparin-binding epidermal growth factor. SDC4-deficient HTR8 EVTs also showed reduced protein kinase C-alpha (PKCα) and AKT phosphorylation. Concordant with the importance of SDC4 for EVT motility, we show via co-immunoprecipitation that SDC4 directly bound to activated PKCα in EVTs, and inhibition of PKCα decreased EVT invasion and migration (approximately 70% and 60% decreases, respectively, $p<0.05$). Our findings reveal an essential role of SDC4 as a regulator of EVT motility, in part through coordination of PKCα activation.
Support or Funding Information: Children's Health Research Institute Natural Sciences and Engineering Research Council Schulich School of Medicine and Dentistry
Level of First Author: Graduate/Medical Student **Topic Category: Cell and Molecular Biology**

Presentation type: Poster
Poster Board #26

Using Educational Escape Room Activities to Teach Teamwork Skills and Build Effective Teams
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Teamwork involves a set of skills used by a group of people who are working together towards a common goal. It is one of the most important skillsets for many careers; however, students report that opportunities to develop teamwork skills are limited in undergraduate programs. In response to the students' feedback, we have collaborated with a local escape room design team to develop a novel educational escape room activity (escape activity) for the classroom. Briefly, the activity requires students to work in teams and consists of various types of thematic challenges, such as visual and numerical puzzles. It requires collaboration amongst team members, each with their own strengths and perspectives, to solve a series of challenges within a limited amount of time. Ultimately, the goal is to "break-in" to the box. The study was split into two components, which were completed in third and fourth year Interdisciplinary Medical Sciences laboratory courses. Each component required students to complete a series of surveys before and after the escape activity. The study with the third-year students investigated the effectiveness of the escape activity to positively influence student perceptions of teamwork skills. This was compared to the effectiveness of a conventional scenario-based activity, which has been used in the lab course in previous offerings. The study with the fourth-year students investigated the effectiveness of the escape activity to develop teamwork skills by engaging students in a low-stakes problem-based activity and self-reflection. The study also investigated the effectiveness of using a self-perceptions of teamwork skills survey post escape activity to form diverse teams. An additional survey on self and peer evaluations of teamwork behaviours will also be administered at the end of the semester to evaluate the effectiveness of these teams. The escape activity is generalizable to any course or discipline. Thereby, validation of the escape activity as an effective pedagogical tool to teach teamwork skills could provide educators with an innovative opportunity to address the lack of opportunities for teamwork development in the undergraduate curriculum.
Support or Funding Information: Western University - Centre for Teaching and Learning
Level of First Author: Graduate/Medical Student **Topic Category: Anatomy Education**
Presentation type: Poster
Poster Board #11

Clinical Implications for Variations Observed of the Internal Iliac artery
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Understanding the anatomic variation of the internal iliac artery (IIA) is of great interest to the medical community because vascular compromise of this region can lead to pathologies like IIA occlusive disease, IIA stenosis, and lower extremity arterial disease. Anatomic variation can lead to confusion in surgeries such as embolization and angioplasty or can lead to lingering symptoms after surgery. We studied variations in the internal iliac artery, which contains the inferior gluteal, internal pudendal, middle rectal, obturator, umbilical, superior vesical, inferior vesical, uterine, superior gluteal, lumbosacral, and iliolumbar arteries. 25 cadavers were studied and, for each individual, branching patterns of 10 arteries from both the anterior and posterior divisions of the internal iliac artery were observed. Our most interesting observations were of a muscular artery entering the psoas muscle, because it has never been reported before. We found this branch in 13/25 of the cadavers studied, where the majority of them were coming off the superior gluteal artery. Another interesting observation was of the uterine artery, where 4 of them originated from the common trunk of the superior vesical and umbilical arteries. We also found significant variation in the obturator artery, but this has been previously well studied. These studies suggest that compromise of vessels that are not normally considered high risk for pathologies such as gait issues or severe bladder dysfunction should be assessed properly in the treatment plan of a patient. Significant variation exists in the pelvic region, and if not appropriately evaluated, can lead to unforeseen end organ damage.
Support or Funding Information: NYIT Anatomy Department
Level of First Author: Graduate/Medical Student **Topic Category: Gross Anatomy**

Presentation type: Poster
Poster Board #32

Characterization of the Role of Shroom3 in Nephron Formation

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During kidney development the proper formation of the nephron, the functional unit of the kidney, is essential for normal kidney function. The first stage of nephrogenesis begins when the metanephric mesenchyme cells begin to migrate and cluster together to form mesenchymal aggregates. These tightly clustered cell aggregates then change their cell shape and undergo mesenchymal-to-epithelial transition to form the renal vesicle. These renal vesicles will undergo cell growth, cell proliferation, elongation, and further cell shape changes to eventually form the mature nephron. These cell shape changes are essential for the proper development of the nephron and for proper nephron function. Shroom3 is an actin-binding protein that regulates epithelial cell shape. By binding to actin, Shroom3 helps localize actin to the apical portion of the cell resulting in the formation of "pie" shaped cells, a process that is essential for tubule formation. Kidneys from Shroom3 null mice have numerous abnormal nephrons with collapsing glomeruli at embryonic day E18.5, supporting a role for shroom3 in nephron formation. We hypothesize that Shroom3 is required for mesenchyme cells to cluster and form cell aggregates, pretubular aggregates, and renal vesicles. To support a role for Shroom3 in nephrogenesis we first localized shroom3 expression. Shroom3 was highly expressed in the aggregating mesenchyme, renal vesicle, and parietal and visceral epithelial cells of the developing glomeruli. In contrast to wild-type Shroom3 mice, E13.5 kidney histology of Shroom3 mutants demonstrated the mesenchymal aggregates lacked organization, demonstrated increased spacing between mesenchyme cells, and an increased distance of mesenchymal cells from the neighbouring ureteric bud tip cells. These abnormalities were confirmed by immunofluorescence (IF) using Six2 and Pax2, specific markers of the mesenchyme aggregates. The IF also demonstrated several Six2 and Pax2 positive cells in the center of the kidney, which is rarely observed in wild-type kidneys. The analysis for renal vesicles in Shroom3 mutants at E13.5 and E18.5 demonstrated abnormally forming renal vesicles that were few in number when compared to wild-type. Taken together, our findings establish, for the first time, that Shroom3 is essential for the early stages of nephron formation and suggest these early changes lead to the abnormal nephrons observed in null mice.
Support or Funding Information: NSERC, CIHR, KFOC
Level of First Author: Graduate/Medical Student Topic Category: Developmental Biology/Embryology
Presentation type: Poster
Poster Board #31

Manipulating Acetylcholine and Glutamate Secreted by Cholinergic Interneurons to Investigate Their Roles in Behaviour

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Cholinergic interneurons (CINs) are neurons thought to be critical for information processing and modulation of the striatum. CINs co-express the vesicular acetylcholine transporter (VAChT) and vesicular glutamate transporter 3 (VGLUT3) and thus can store and release acetylcholine (ACh) and glutamate (Glu). Recent studies suggest that the balance between ACh and Glu is critical for controlling striatal-dependent behaviour. We hypothesize that CIN-secreted ACh and Glu differentially regulate striatal function. We selectively eliminated VAChT or VGLUT3 in CINs that expressed an excitatory DREADD (hM3Dq) to generate mice with an altered striatal balance of ACh and Glu release that could be remotely manipulated. Initial characterization indicated that using a VGLUT3-Cre driver led to hM3Dq expression in CINs, but we also found substantially ectopic expression of this DREADD in the mouse models. Global activation of VGLUT3-positive DREADD neurons caused a substantial decrease in locomotion, allowing this mouse line to serve as a pharmacological reporter for agonists of hM3Dq in vivo. We specifically investigated pharmacological consequences arising from systemic administration of clozapine, clozapine-N-oxide, compound 21

and perlapine. To selectively target CINs, we bilaterally implanted cannulas in the dorsal striatum of our mouse models. Preliminary experiments indicate that, in contrast to global activation of VGLUT3 expressing neurons, selectively activating only the release of ACh from CINs appears to favour increased locomotion. Our approach allows for exquisite flexibility to test novel DREADD agonists and antagonists and to examine the contribution of CINs to striatal-associated behaviours.
Support or Funding Information: Supported by CIHR, OGS, Brain Canada, Jonathan & Joshua Memorial Scholarship
Level of First Author: Graduate/Medical Student **Topic Category: Neurobiology**
Presentation type: Poster
Poster Board #41

Cognitive Integration of Basic Science and its Effect on Diagnostic Reasoning in Allied Health Students
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Introduction: Integration of basic and clinical science knowledge is increasingly being recognized as important for practice in the health professions. The concept of 'cognitive integration' places emphasis on role of basic science in providing critical connections to clinical signs and symptoms while accounting for the fact that clinicians may not explicitly articulate their use of basic science knowledge in clinical reasoning. In this study, we aimed to extend previous work on cognitive integration using new learning materials teaching musculoskeletal pathologies with allied health students. In addition, we aimed to further our understanding of cognitive integration and conceptual coherence by using a diagnostic justification task to investigate the impact of integrated basic science instruction on novices' diagnostic reasoning process. Methods: Massage therapy students (N = 43) from Humber College were allocated to an integrated basic science (BaSci) or clinical science (CS) training group. The BaSci group was taught the clinical features along with the underlying causal mechanisms of four musculoskeletal pathologies while the CS group was taught only the clinical features. Participants completed a diagnostic accuracy and memory test immediately after learning and 1-week later. A diagnostic justification test was also completed 1-week after initial learning. Results: Novices who learned the integrated causal mechanisms had superior diagnostic accuracy ($p<0.01$) and a better understanding of the relative importance of key clinical features ($p<0.01$). While participants from both groups identified correct features on the justification test, those in the BaSci group identified key diagnostic features rather than features that were common across disease categories. Conclusion: This study demonstrates the positive impact of integrating basic anatomical education and clinical science instruction on students' diagnostic reasoning. These findings also further our understanding of conceptual coherence by providing explicit evidence of the advantage learners have when basic science knowledge is cognitively integrated.
Support or Funding Information: Funding for this project was provided by Humber College
Level of First Author: Faculty **Topic Category: Anatomy Education**
Presentation type: Poster
Poster Board #6

Streamlining Knowledge Translation at the PhD: The Development of an Animation Video on Exercise and the Muscle-Bone Unit in Children
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Background: Knowledge translation is essential, however it can become challenging when research involves complex physiological processes, such as the case with studying the physiological response to exercise. Objectives: The purpose of this study is to develop a knowledge translation video for children that explains the systemic effects of exercise on muscle and bone regulators. Methods: Our lab has recently investigated the systemic effects of exercise on muscle and bone regulators in girls and women. These findings (not published) will be summarized and used to create a short animation video targeted towards children between the ages of 8-10 years old. The first stage of video creation will be composed of designing illustrations on commercially available drawing applications (ie. Procreate and Adobe Draw). The second stage will be composed of animating the illustrations on raw animation

platforms (ie. Rough Animator). In the last stage, recorded voice overs will be added to the animation to add an interactive component. The knowledge translation video will then be showcased to children in the target age range, after which they will be asked to evaluate the video based on their level of engagement and understanding of the content. The results of this project will be used as a thesis chapter for a PhD project and will be made available for public access. Results: NA Conclusion/Implications: This knowledge translation initiative will communicate current research findings to the public that explains the benefits of exercise on musculoskeletal health while highlighting the importance of pursuing knowledge translation projects at a graduate research level.
Support or Funding Information: This project is funded by the Natural Sciences and Engineering Research Council of Canada.
Level of First Author: Graduate/Medical Student **Topic Category: Anatomy Education**
Presentation type: Poster
Poster Board #12

Raiders of the Lost Atlas: Reviving the Bassett Collection Using Google Cardboard
Josh Mitchell, Anthony Saraco, Alexander Ball, Bruce Wainman; Education Program in Anatomy, McMaster University, Hamilton, Ontario

Objective: Gross anatomy is visualized in 3D space in the dissection lab, however 3D is not a parameter that is represented in traditional atlases or online resources. Furthermore, a benefit of stereoscopic images on learning anatomy has recently been demonstrated (Remmele et al, 2018; Cui et al, 2017). In 1962 Dr. David L. Bassett published an extensive stereoscopic atlas of more than 1,550 3D images of outstanding dissections in collaboration with William B. Gruber, inventor of the View-Master. Although the resource was purchased by many anatomy departments for instruction at the time, its widespread use was hampered by the effort required to organize and find a series of images, the inconvenience of wearing polarized glasses for large numbers of students, and the inability to point to specific structures in the 3D space. The objective of our study was to develop an inexpensive and easily accessible phone app to utilize the Bassett stereoscopic dissections in teaching anatomy. Our first app was a self-test Objective Structured Practical Exam (OSPE) that we termed a Virtual Reality Bell Ringer (VRBR). Methods: Bassett dissection images were used through a Creative Commons license http://lane.stanford.edu/biomed-resources/bassett/index.html. Adobe After Effects was used to place digital pins into high resolution stereo pair images so that specific structures could be referenced in 3D space. An application was developed for iOS and Android smartphones using the Unity development platform. This allowed students to download the labeled images onto their own phones. The app used at least 5 labeled images in each of 12 labs of a second year undergraduate Anatomy and Physiology course. The ability to move to the next image, back to the main menu, and zoom were features enabled using simple movements of the device. Questions regarding the labeled images were provided through the online course management system, Avenue to Learn. A custom Google Cardboard VR headset (I AM Cardboard V2; $8/unit) for viewing the app was made available to 975 students. Results: We created 67 OSPE practice questions using 3D images from the Bassett atlas collection. We also created 5 health and lab safety questions based on stereoscopic photographs taken in-house. Usage of the app was tracked using the Avenue course management system. Conclusion: The implementation of a 3D app in an undergraduate course allows students to study anatomical structures in an environment that closely resembles the dissection lab. Our future studies will determine if the app improves exam scores and if stereopsis plays an important role in anatomical education.=
Level of First Author: Undergraduate Student **Topic Category: Anatomy Education**
Presentation type: Poster
Poster Board #20

An Overview of the First Year Undergraduate Medical Students Feedback on the Point of Care Ultrasound Curriculum
Vian Mohialdin, Ari Shali, Bruce Wainman; Pathology and Molecular Medicine, McMaster University, Hamilton, Ontario

With the technological progress of different types of portable Ultrasound machines, there is a growing demand by all health care providers to perform bedside Ultrasonography, also known as Point of Care Ultrasound (POCUS). This technique is becoming extremely useful as part of the Clinical Skills/Anatomy teaching in the undergraduate Medical School Curriculum. Teaching/training health care providers how to use these portable Ultrasound machines can complement their physical examination findings and help in a more accurate diagnosis, which leads to a faster and better improvement in patient outcomes. In addition, using portable Ultrasound machines can add more safety measurements to every therapeutic/diagnostic procedure when it is done under an Ultrasound guide. It is also considered as an extra tool in teaching Clinical Anatomy to Medical students. Using an Ultrasound is one of the different imaging modalities that health care providers depend on to reach their diagnosis, while also being the least invasive method. We thought investing in training the undergraduate Medical students on the basic Ultrasound scanning skills as part of their first year curriculum will help build up the foundation for their future career. The research we report in this manuscript is a preliminary qualitative study. And provides the template for future model for teaching a hand on Ultrasound for all health care providers in different learning institutions. A questionnaire was handed to the first year medical students to evaluate their hands on ultrasound session experience. Answers were collected and data was analyzed into multiple graphs.

Level of First Author: Faculty Topic Category: Imaging
Presentation type: Poster
Poster Board #37

Effects of Altered Connexin-43 Function on Mandibular Morphology in Newborn Mice

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Background: Mutations in connexin-43 (Cx43) can result in the human disease oculodentodigital dysplasia (ODDD), which has a strong craniofacial phenotype, including micropthalmia, a narrowed nose, and an increased incidence of cleft palate. The literature on the human condition of ODDD documents a mandibular phenotype including macrognathia and widened alveolar ridges; however, the mandibular phenotype has yet to be studied in detail in mouse models of ODDD. Therefore, the purpose of this project is to determine the effects of reduced Cx43 function on mandibular morphology.
Methods: We used one mouse model with a mutation in the gene encoding for Cx43 (Cx43G60S/+) which have a severe craniofacial phenotype that mimics the human disease ODDD. Homologous landmark data was collected from microCT images of newborn hemimandibles and analyzed with geometric morphometric analyses to quantify and visualize mandibular shape changes between mutants and wildtype littermates.
Preliminary Results: Cx43G60S/+ mice display alterations to mandibular shape and size when compared to their wildtype littermates. The regions with the largest shape alterations are the alveolar processes and coronoid process.
Significance & Future Directions: This preliminary work confirms the presence of an ODDD mandibular phenotype within Cx43G60S/+ mice at birth and shows involvement of the coronoid process in the mandibular phenotype of this mouse model. Future studies will assess the mandibular phenotypic effects of a separate Cx43 mutant mouse which displays a moderate ODDD phenotype. We will also examine differentiation of mandibular chondrocytes, osteoblasts, and osteocytes.
Support or Funding Information: Funding for this project was supplied by NSERC.

Level of First Author: Graduate/Medical Student Topic Category: Cell and Molecular Biology
Presentation type: Poster
Poster Board #29

High salt diet induces renal lesions and oxidative stress in Wistar Kyoto Rats

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Background: Several studies have shown detrimental effects of excessive sodium consumption on renal homeostasis, such as proteinuria, albuminuria, renal interstitial fibrosis, decreased glomerular filtration rate, renal

and cardiac hypertrophy, and endothelium dysfunction [1-3]. Nevertheless, the effects of short-term high salt consumption on renal histology, oxidative stress, and the dependency of these effects on blood pressure in normotensive versus hypertensive animal models have never been investigated. We hypothesized that high salt diet induces blood pressure dependent renal damage to both Wistar Kyoto (WKY) and Spontaneously Hypertensive Rats (SHR). Methods: Twelve-weeks old SHR (N=10) and WKY (N=10) male rats were given either high salt (HS, %8 NaCl) or normal salt (NS, %0.4 NaCl) for 4 weeks. After 4 weeks, blood pressure was measured using tail cuff plethysmography, kidneys were collected, and the animals were sacrificed. Kidneys were evaluated for lesions, interstitial fibrosis, and oxidative stress levels through Periodic acid–Schiff (PAS) staining, Masson's trichrome staining, and immunohistochemistry (IHC) respectively. Results: Four weeks of HS consumption did not change systolic or diastolic blood pressures in either WKY or SHR rats. SHR rats had higher baseline systolic and diastolic blood pressure regardless of salt diet compared to WKY rats. WKY-HS rats suffered from abnormal protein depositions in their glomeruli, tubular dilation in outer medulla (OM), and cellular damage in inner medulla (IM), whereas WKY-NS rats showed normal renal histology. Masson's trichrome stained the abnormal depositions in the WKY-HS glomeruli red, which suggests that these depositions were proteins. WKY-NS, SHR-LS, and SHR-HS showed normal renal interstitial fibrosis. Consistently, 3-Nitrotyrosine (3-NT) IHC staining showed that HS diet increased glomeruli oxidative stress in WKY rats, but decreased in the SHR rats. Moreover, SHR glomeruli showed significantly less oxidative stress compared to WKY of the same diet. Conclusions: Four weeks of HS consumption induced renal damage in WKY but not SHR rats. The observed pathologies were independent of blood pressure, as HS diet did not change blood pressure in either WKY or SHR rats. References 1. Berger, R.C., et al., Renal Effects and Underlying Molecular Mechanisms of Long-Term Salt Content Diets in Spontaneously Hypertensive Rats. PLoS One, 2015. 10(10): p. e0141288. 2. Henry, C., et al., Salt induces myocardial and renal fibrosis in normotensive and hypertensive rats. Circulation, 1998. 98(23): p. 2621-2628. 3. Farquhar, W.B., et al., Dietary sodium and health: more than just blood pressure. J Am Coll Cardiol, 2015. 65(10): p. 1042-50.
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Level of First Author: Graduate/Medical Student **Topic Category: Histology**
Presentation type: Poster
Poster Board #36

A Virtual Reality Brachial Plexus on a Smartphone: Bridging the Gap between Study and Student
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Introduction: Stereoscopic imagery has garnered much interest as a method of simulating three-dimensional (3D) environments. Its potential for immersive experiences is extended through the use of stereoscopic virtual reality (VR) technology. This has led to increasing interest in the application of VR technologies to medical education, particularly in anatomy. However, studies assessing VR education often use costly VR equipment not easily accessible to students and faculties, hindering the translation of these innovations to the classroom. Hence, we describe a protocol for a rapidly implementable and financially accessible 3D VR production system, based on mobile phone cameras, free/open-source production software, and low-cost Google Cardboard headsets as the viewing modality. These methods remain flexible enough to manipulate key aspects of the VR experience for research purposes, such as the degree of stereopsis. Objective: Develop efficient and cost-effective methods of producing student-accessible VR resources to improve anatomy education. Results: Stereoscopic images of the brachial plexus were created in a single step using a short video pan of a specimen. Different angles of the specimen from the video are processed into a single left-right stereoscopic 3D image. Sequences of 3D specimens can be viewed in the Google Cardboard headset using any 3D-image viewing app of choice. Stereoscopic videos were recorded using two mobile phone cameras, with their lenses separated by a variable distance dependent on the desired degree of stereopsis. Videos are then synchronized in both timing and stereoscopic alignment using open-source video editing software. Using the Google Cardboard VR headset, users were thus able to view a VR

video teaching brachial plexus anatomy. All methods described use tools already available to many university students and faculties, allowing it to be rapidly implemented with numerous anatomical specimens. Conclusion: We have demonstrated that it is possible to develop VR anatomy teaching tools in a financially- and technologically-accessible manner. To further investigate the use of accessible VR in anatomy learning, a teaching tool created through this process will be assessed in an upcoming randomized control trial. This project provides insight regarding the design and use of VR in anatomy and physiology education.
Support or Funding Information: This work was financially supported by the McMaster University Michael G. DeGroote School of Medicine Waterloo Regional Campus Research Department.
Level of First Author: Graduate/Medical Student **Topic Category: Anatomy Education**
Presentation type: Poster
Poster Board #22

Learning through the Eyes of the Beholder: A Study Design for Using Eye Tracking to Understand How Novices Learn Neuroanatomy
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Neuroanatomy's high degree of difficulty is thought to contribute to neurophobia (the fear of neural sciences). The source of the difficulty is unknown. We previously demonstrated that increased contrast between gray and white matter on brain slices improved learning in students with low-working memory capacity, indicating that a lack of contrast between structures in the CNS is not a significant contributor to the difficulty of the subject matter in only certain students. In the current study, we propose to use eye tracking technology to investigate where attention is distributed and how that relates to neuroanatomy learning. The experiments will 1) observe understand how students learn neuroanatomy, 2) assess the differences in viewing patterns when observing stained vs unstained brain slices, 3) measure how viewing patterns differ between students with low and high working memory, and 4) evaluate the differences in viewing patterns between novices and experts in neuroanatomy. Students with no previous anatomical education (n=120) will learn and be tested on 12 neuroanatomical structures from two sets of brain slices (transverse stained, coronal unstained or coronal stained, and transverse unstained). Participants will also complete the Automated Operation Span Task working memory test (OSPAN) to deal with the confounding effect of working memory on learning. Eye tracking data will be collected for all learning and testing periods to evaluate participants' viewing patterns, to be compared against performance and working memory scores. By better understanding how students learn neuroanatomy, we will gain insight into factors that contribute to the difficulty of the subject. Additionally, these insights will support further research into the best methods to teach neuroanatomy, in hopes of mitigating neurophobia and improving anatomy learning in all systems.
Level of First Author: Undergraduate Student **Topic Category: Anatomy Education**
Presentation type: Poster
Poster Board #16

Assessment of Third-Year Medical Students' Basic Science Knowledge vs. Clerkship Directors' Expectations
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PURPOSE Basic sciences are essential for clinical practice; however, research demonstrates that medical students' basic science knowledge is not well retained, which may lead to clinical incompetence. Furthermore, the curriculum in which basic sciences are delivered varies widely among institutions, and as a result, it is unclear if students learn and retain the most relevant basic science concepts during pre-clerkship. Thus, the aims of this study are to 1) determine clerkship directors' expectations of students entering clerkship, and 2) assess clerks' basic science knowledge level prior to and at the completion of each rotation. METHODS 1) Interviews were conducted with six clerkship directors (family med., psych., paeds., OB/GYN, surgery, internal med.), and recording transcripts were coded according to which basic science concepts clerkship directors deem necessary for their rotation. 2) Using interview data as a guide, a basic science assessment comprised of clinical vignette MCQ's was created for each

rotation. Assessments were distributed as a pre- and post-test for each rotation to assess clerks' knowledge retention and learning. RESULTS 1) Pharmacology was the most prevalent basic science overall (30%), and in family med., psych., surgery, and internal med. The most prevalent basic science in paeds. and OB/GYN was anatomy and physiology, respectively. 2) Data revealed that clerks achieved an average passing grade (>60%) on each pre-test. There was a significant increase between pre- and post-test scores for all rotations ($p<0.05$); the greatest improvement (10%) was identified for clerks completing paeds ($p=0.0001$). CONCLUSIONS 1) Students are expected to know common drugs for every rotation, which supports the high prevalence of pharmacology. With paeds. heavily relying on embryology, identified anatomy concepts were normal development and malformation. OB/GYN directors deemed the physiology of ovulation, conception, and parturition necessary for students to know. 2) Assessment results indicate that clerks, on average, have a passing level of basic science knowledge prior to each rotation, and continued to learn concepts during clerkship. Paed's large increase may reflect the high-volume of in-class instruction during that rotation. Using the identified concepts and assessment scores as a guide, results will inform the re-integration of basic sciences as Schulich deploys a competency-based education model at the undergraduate level. With annual implementation of the assessments, the influence of curricular changes on knowledge retention can be monitored.

Support or Funding Information: Ontario Graduate Scholarship AAA Educational Research Scholarship

Level of First Author: Graduate/Medical Student **Topic Category: Anatomy Education**
Presentation type: Poster
Poster Board #3

~~**The Hepatocystic Quadrangle of Ozobia**~~ **Withdrawn**

~~**Nathan Ozobia,** Surgery, University Medical Center of Southern NV, Las Vegas, NV~~

~~For decades, the incidence of biliary tract injuries has remained at 0.3-0.5% since the first Cholecystectomy by Langenbuck in 1882. While each cholecystectomy is unique in its simplicity or complexity, knowledge of the triangle of Calot, the Critical View of Safety and now the Hepatocystic Quadrangle of Ozobia, will greatly help in significantly reducing the rate of biliary tract injuries. The missing link in reducing the frequency of biliary tract injuries to near zero% is in knowing about the Hepatocystic Quadrangle and its contents. Early on during cholecystectomy, religiously outlining the Triangle of Calot and the Critical View of Safety as currently practiced is crucial before applying aggressive surgical interventions. WHAT IS THE HEPATOCYSTIC QUADRANGLE This never before described anatomic oddity is a quadrangular or rectangular space under the right lobe of the liver spanning the space between the gallbladder, the hepato-duodenal ligament with the gallbladder in the surgical position with appropriately placed retractors and traction forces in place. It can be further subdivided into "Quadlets" [Q1,Q2,Q3.Q4] with the Q1 Quadlet in the territory of the Calots Triangle. WHAT IS THE IMPORTANCE OF THE HEPATOCYSTIC QUADRANGLE Knowledge of the quadrangle and strict adherence to dissections in Quadlet 1 and lower border of Q2 will help reduce the incidence of biliary tract injuries to near zero % by avoiding Q2,3,4 where more vital structures exist. WHAT ARE THE BOUNDARIES OF THE QUADRANGLE SUPERIORLY: undersurface of the right lobe of the liver INFERIORLY: Imaginary line from the neck of the gallbladder to the hepatoduodenal ligament LATERALLY: From the neck of the gallbladder up to the undersurface of the right lobe of the liver MEDIALLY: The entire length of he hepatoduodenal ligament The QUADLETS can be obtained by visually bisecting the quadrangle vertically and horizontally. Q1 starts at the cystic duct gallbladder neck junction, then Q2, Q3 Q4 are outlined clockwise WHAT ARE THE CONTENTS OF THE HEPATOCYSTIC QUADRANGLE Q1: cystic artery, cystic lymph node lymphatics Q2: right hepatic duct, right hepatic artery, medial end of cystic artery and the right portal vein Q3: Porta hépatis, confluence of the right and left hepatic ducts, right and left hepatic arteries, division of the portal vein Q4: common bile duct, cystic duct, hepatic artery portal vein CONCLUSION Even for the most experienced biliary tract surgeons, cholecystectomy, laparoscopic or open, remains one of the most difficult procedures for the general surgeon but I believe that knowledge of the Triangle of Calot, the Critical View of Safety and the Hepatocystic Quadrangle of Ozobia will go a long way in reducing the injury rate to near zero %.~~

~~**Level of First Author: Postdoc** **Topic Category: Anatomy Education**~~
~~**Presentation type: Poster**~~
~~**Poster Board #21**~~

Axial Kinematics and Vertebral Morphology in Jackson's Chameleon

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Chameleons are the only lizard species to perform true arboreal locomotion, and many have an entirely arboreal lifestyle. All living chameleons share physical features associated with arborealism, such as zygodactylous feet and prehensile tails. Previous studies of Chamaeleo calyptratus have shown a unique pattern of locomotion in chameleons, including semi-erect limb posture and restricted lateral undulation that occurs mainly in the caudal region of the trunk. We wanted to test whether the same pattern of movement was present in other chameleon species, and whether the specialized kinematics of the chameleon spine are associated with morphological specializations of the vertebrae. We chose to study Jackson's Chameleon (Trioceros jacksonii) because it is highly arboreal and represents a genus whose kinematics had not been previously studied. Sixteen evenly spaced dots of white acrylic paint were applied to the spine between the head and the pelvis in order to facilitate tracking. The animals walked at their own paces on substrates ranging from ¼" to 2" in diameter and were recorded using four synchronized high speed video cameras set up at different angles. Kinematics software was used to track the spine points and calculate their three-dimensional coordinates, which were then analyzed in MATLAB to determine the amount of mediolateral undulation in different portions of the spine during a stride. Morphometric measurements were taken from two specimens of T. jacksonii and compared with previously acquired measurements from a non-chameleon lizard. Our analysis confirms that the caudal region of the spine is responsible for the majority of the movement of the spine as a whole, whereas the rostral region of the spine only contributes a small amount. Moreover, this difference in kinematic function corresponds to specific changes in vertebral structure. Morphometric measurements associated with mediolateral flexibility, such as horizontally oriented zygapophyses, were more pronounced in the caudal region of the spine in the Jackson's Chameleon than in the cranial region, but less pronounced than in any region of the spine of the non-chameleon lizard. Examining the structure-function relationships that underlie adaptation of chameleons for an arboreal lifestyle can help us to better understand how other species were able to adapt to novel environments. Future studies involving greater sample sizes and more species will be used to determine whether this pattern of morphology and movement is shared throughout the family Chamaeleonidae.

Support or Funding Information: Julia Molnar Startup Grant

Level of First Author: Graduate/Medical Student Topic Category: Rehabilitation Sciences & Biomechanics
Presentation type: Poster
Poster Board #44

Anatomy in Medical Education: A Canadian Context

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Background: Anatomical science has always been regarded as an essential element to medical education. In Canada, methodology and time dedicated to anatomy teaching is unknown. Methods: To gather a comprehensive view of the anatomical education for medical students in Canada, two surveys were administered to program directors and anatomy faculty from all medical schools in Canada. The same twelve schools responded to both surveys. The initial survey addressed the first year of medical school while the follow-up was directed at the entire program. The surveys posed questions about gross anatomy, histology and embryology. Data was collected on total course hours, large and small group hours as well as laboratory hours. Results: A small increase in hours is seen; an average increase of 10.16 hours for gross anatomy, 3.72 hours for histology, and 1.37 hours for embryology. Interpretation: This shift toward a more integrated curriculum is also prevalent in the United States of America. The major difference however, between Canada and the US can be seen in the total hours of gross anatomical education. In the US the average total hours of gross anatomy for a medical program is 129 hours, whereas in Canada the total course hours are 35.96 hours on average. The reasons for the difference between Canadian and US schools is not known. Possible reasons include the steering effects of the CanMEDS framework in Canada and the USMLE Step 1 examination. The CanMEDS framework used in Canada uses six core competencies to ensure that physicians to have more of a comprehensive foundation as a medical expert and puts less emphasis on basic

sciences. By contrast the USMLE Step 1 focuses on the basic sciences of medical practice, including anatomy, and student performance on the USMLE drives curriculum standards. Further investigation is required to determine if the substantially lower amount of anatomical science education received in Canada affects students in clerkship and residency.

Level of First Author: Graduate/Medical Student **Topic Category: Anatomy Education**
Presentation type: Poster
Poster Board #10

Investigating Anti-fibrotic Inhibitors on Trabecular Meshwork Cells in Open Angle Glaucoma

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Increased levels of actomyosin contraction due to reorganization of cytoskeletal architecture in human trabecular meshwork (HTM) cells, has been considered a causality for heightened intraocular pressure (IOP) and lowered aqueous humour (AH) outflow. Nuclear translocation of myocardin-related transcription factors (MRTFs) is believed to regulate stress fiber formation in other cellular systems including the lens. The connection, however, between cytoskeletal reorganization and MRTF translocation in HTM cells is not well understood, and may provide a unique perspective on decreased AH drainage and increased IOP in open angle glaucoma. By using a range of cytoskeletal inhibitors, we investigated their effects on MRTF-A as well as general HTM cell morphology under set conditions. We performed immunocytochemistry on HTM cells treated with dexamethasone (Dex), a corticosteroid which has been linked to increased IOP and steroid-induced open angle glaucoma in humans, in the presence and absence of either a novel MRTF-A inhibitor (CCG-203971), or a Rho kinase inhibitor (Y-27632). Immunofluorescence analyses of HTM cells revealed that, unlike controls, cells incubated with Dex exhibited nuclear translocation of MRTF-A. Importantly, this Dex-induced nuclear translocation of MRTF-A was inhibited in the presence of CCG-203971. Our western blot analysis for α-smooth muscle actin (α-SMA), a well-recognized marker for myofibroblast transformation, showed a 2.4-fold increase in expression of α-SMA in HTM cells incubated with Dex when compared to untreated HTM cells. This Dex-induced increase in α-SMA expression in HTM cells was further prevented in the presence of either Y-27632 or CCG-203971. Overall our findings demonstrate the ability of the cytoskeletal inhibitors such as CCG-203971 and Y-27632, to prevent Dex-induced myofibroblast transformation of HTM cells. Since transformation of HTM cells has been associated with trabecular meshwork fibrosis and subsequent blockage of aqueous humor outflow, these inhibitors may be important therapeutics in managing elevated IOP.

Support or Funding Information: Glaucoma Research Society of Canada

Level of First Author: Undergraduate Student **Topic Category: Cell and Molecular Biology**
Presentation type: Poster
Poster Board #24

Knock-out Anatomy: Using Martial Arts as a Platform to Discuss Human Anatomy with the General Public

Maureen Schaefer[1], John Faett[2]; [1]Radiology, Michigan State University, Okemos, MI; [2]Victory Martial Arts, Okemos, MI

Public knowledge of the structure and function of the human body is remarkably lacking (Ramanayake, 2014; Taylor, 2018). The initiation of many excellent outreach programs within school systems are attempting to combat this deficiency (Burns 2002). However, fewer widespread efforts have been enacted to educate adult populations. While the "Body Worlds" exhibits have reignited interest in the anatomical sciences, much like that accomplished through the public dissections held by Italian physicians and anatomists in the late middle ages, there is much controversy surrounding these events (Myser, 2017; Tanassi, 2007). Tickets to this commercial enterprise are also expensive and thus the exhibit is not accessible to all individuals of the public. Without the visual stimulus of cadaveric material, how else can one spark the interest of children and adults alike who do not require this knowledge for their professional lives? As part of the 2018 Michigan State University Science Festival, the Division of Human Anatomy and Victory Martial Arts joined forces to introduce "Knock-out Anatomy". This dynamic session blended medical science with martial arts by discussing the anatomy involved in four pressure points commonly

utilized in self-defense maneuvers. Attendees then had the opportunity to practice the techniques themselves. Thirty-seven individuals, spanning multiple generations, participated in the event. Verbal feedback revealed that attendees enjoyed the session and found the anatomical discussions fascinating. This session demonstrates that utilizing physical activity as a springboard to launch anatomical discussions is an effective mechanism to spark public interest in the human body. References Burns E. 2002. Anatomy of a successful K-12 educational outreach program in the health sciences: Eleven years experience at one medical sciences campus. Anat Rec 269:181-193. Myser C. 2017. Taking public education seriously: BODY WORLDS, the science museum, and democratizing bioethics education. AM J Bioeth 7:34-36. Ramanayake B, Liyanagoda N, Dahanayake P. 2014. Do patients understand medical communication? Patients' knowledge on anatomical location of organs in human body. Sci Res J 2:12-16. Tanassi, L. 2007. Responsibility and provenance of human remains. AM J Bioeth 7:36-38. Taylor A, Diggle P, Wessels Q. 2018. What do the public know about anatomy? Anatomy education to the public and the implications. Anat Sci Educ 11:117-123.

Level of First Author: Faculty **Topic Category: Anatomy Education**
Presentation type: Poster
Poster Board #1

Attitudes and Perceptions of Health Care Students in an Inter-Professional Cadaveric Dissection Elective

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Introduction: Inter-professional education (IPE) within healthcare programs has been associated with improved collaborative behavior, patient care and satisfaction, reduced clinical error, and diminished negative professional stereotypes. An inter-professional gross anatomy dissection course was created to facilitate IPE. The investigation sought to determine whether the course changed students' attitudes and perceptions towards inter-professional (IP) practice and readiness for IP learning and whether there are differences between professional groups. Methods: Two IPE scales were administered and data was collected from eight cohorts over eight years to determine the influence of this IPE format on the attitudes and perceptions of students towards other health professions. Each year, 28-35 students from the medicine, midwifery, nursing, physician's assistant, physiotherapy, and occupational therapy programs are randomly assigned into inter-professional teams for 10 weeks; a recent addition to the teams is the speech-language pathology program. A before/after design measured changes in attitudes and perceptions amongst all the students and within each professional subgroup. Results: The course resulted in significantly reduced negative professional identity towards other professions. It also led to majority of professional groups experiencing a significant improvement in positive professional identity towards other professions. However, for few IPE domains, majority of professional groups didn't improve. For example, with perceived need for cooperation, only midwifery students experienced a significant improvement. Conclusion: Overall, the course led to a general improvement in attitudes and perceptions of students towards IPE and other health professions. Some health professional groups experienced a greater improvement in certain IPE domains compared to other professional groups. Next steps include utilizing other IPE scales to assess effectiveness of the dissection course, and implementing course modifications to improve IPE learning experience based on IPE domains with minimal effect size.

Level of First Author: Undergraduate Student **Topic Category: Anatomy Education**
Presentation type: Poster
Poster Board #14

Impact of Esophageal Protective Devices on the Anatomy of the Posterior Mediastinum

Akmal Shahzad, Charys Martin, Michele Barbeau; Anatomy & Cell Biology, University of Western Ontario, London, Ontario

Atrial fibrillation (AF) is the most common cardiac arrhythmia in North America and is a major risk factor for stroke and congestive heart failure. The current treatment regime is focused on cardiac rhythm and rate control which can be achieved with radiofrequency catheter ablation (RFA), a minimally invasive procedure that utilizes a small

energy-emitting probe to burn cardiac tissue that is responsible for producing the fibrillations. Most notably, the pulmonary veins (PVs) of the left atrium (LA) have been shown to trigger AF in over 90% of cases. First-time RFA procedures have a high success rate and are effective at long-term restoration of normal sinus rhythm and heart rate. However, a deadly complication called an atrial-esophageal fistula (AEF) may occur in rare cases due to inadvertent thermal damage to the esophagus during ablation. Esophageal protective devices can be utilized to minimize the risk of thermal damage to the esophagus during ablation, however, their effects on the anatomy within the posterior mediastinum are unknown. Our study seeks to investigate the changes that occur in the left atrium and esophagus upon insertion of an esophageal protective device. Using 15 fresh, frozen cadaveric torsos we performed pre- and post-computed tomography (CT) scans with and without the device respectively. Using digital calipers, we measured the distance from the centerline of the esophagus to the left atrium's pericardium, the width of the esophagus, and the distance from the adjacent spinous process to the pericardium through a fixed point on the vertebral body. With this data, we hope to provide information that will be useful in the design and implementation of a novel esophageal protective device. A device well-informed to the anatomy of the posterior mediastinum and how it may change upon its insertion will serve its purpose effectively and minimize the risk of patients developing an AEF post-ablation.

Support or Funding Information: Our project is funded by our close collaborators, Baylis Medical.

Level of First Author: Graduate/Medical Student **Topic Category: Imaging**
Presentation type: Poster
Poster Board #38

Flow-Mediated Dilation Stimulated By Handgrip Exercise Is Determined by the Magnitude, not the Rate, of Increase in Shear Stress

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Background: Arteries are lined by a thin layer of cells called the endothelium, which responds to changes in blood flow-associated shear stress. The endothelium releases vasoactive molecules to produce subsequent flow-mediated dilation. There is evidence that the endothelium is responsive to both the rate and magnitude of increases in shear stress. However, whether flow-mediated dilation stimulated by sustained increases in shear stress (SS-FMD) is rate-sensitive in humans is unknown. Purpose: The purpose of this investigation was to test whether ramp (gradual) and step (instantaneous) increases in shear stress elicit disparate SS-FMD. Methods: Young, healthy men (n = 18, age = 22 ± 2 years, body mass index = 25 ± 3 kg/m2) performed two 11-minute bouts of rhythmic handgrip exercise in counter-balanced order; one with a 5.5-minute ramp-increase in shear stress and one with an immediate step-increase in shear stress. Ramp-increases in shear stress were achieved through incremental increases in handgrip exercise intensity (increases of 4% maximum voluntary contraction [MVC] every 30 seconds for 5.5 minutes, ending at 44% MVC) and step-increases in shear stress were achieved through a combination of arterial compression and commencing handgrip exercise at 44% MVC. Results: Shear rate was greater in the step versus ramp protocol in minutes 1 - 6, but not different thereafter. Similarly, SS-FMD was greater in the step versus ramp protocol during minutes 2 - 6, but similar in minutes 7 - 11 (minute 11: ramp, 8.7 ± 4.6%; step, 9.4 ± 3.6%; p = 0.343). SS-FMD continued to increase over time with maintenance of a steady shear stress stimulus (step, minutes 2 - 11: 0.51 ± 0.36 % min-1; ramp, minutes 7 - 11: 0.64 ± 0.57 % min-1; p = 0.259). Conclusions: These findings indicate that in the brachial artery of humans the magnitude of SS-FMD is determined by the magnitude and duration, but not the rate, of increases in shear stress

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Level of First Author: Graduate/Medical Student **Topic Category: Physiology**
Presentation type: Poster
Poster Board #43

The Convergent Evolution of a Sabertooth Upper Canine Replacement Mechanism

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Although many studies have examined the functional implications of sabertooth carnivore anatomy, relatively few studies have investigated how these predators developed their upper canine dentition. This study examines juvenile sabertooth carnivore fossil material from the American Museum of Natural History and University of California Museum of Paleontology. The analysis of juvenile specimens demonstrates that taxa from the Nimravidae and Barbourofelidae have anatomical and developmental characteristics that are similar to those of felid sabertooth taxa. The results suggest that at least three separate evolutionary lineages of sabertooth carnivores converged on a similar deciduous upper canine anatomy and upper canine replacement mechanism.

Level of First Author: Graduate/Medical Student **Topic Category: Paleontology**
Presentation type: Poster
Poster Board #42

Expert Perception of the Importance, Error Frequency and Severity of Procedural Steps in Cerebral Angiography: A Delphi Study

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Introduction and Aims: Interventional cerebral angiography is an endovascular procedure that requires extensive hands-on clinical training. Within the scope of an angiography fellowship, trainees are required to learn and reproduce complex steps and phases learned in literature and observed in the Angio Suite. Currently, their training and judged expertise relies on subjective assessments of performance and clinical exposure frequency. In order to advance training in this field, subjective methods of assessments need to be created, validated and applied to available training systems of protocols. Establishing assessment instruments will also allow for the introduction and transfer of simulation as a complementary training method. In order to begin assembling a representative schema of the procedure, there needs to be an assessment of the current angiography practices seen Angio Suites across the country. Methods: We distributed a Delphi method-based assessment to interventional experts across Canada in order to achieve a consensus on the importance, frequency, and severity of core steps in cerebral angiography and aneurysm coiling. A total of 85 interventional experts were contacted to participate in the online survey. After the data collection of the first phase, questions with a degree of disagreement would be reformatted and resubmitted to the experts for clarification. Once an agreement is achieved across the entire questionnaire, the collection of data is completed and analyzed. Results and Discussion: A total of 21 experts replied to the survey, with 13 completing the survey in full. There was a high degree of agreement on the importance of core clinical steps, such as palpation of the femoral pulse, advancement of diagnostic catheter from the descending aorta to the aortic arch, and safely advancing micro-catheter into the aneurysm. Experts also identified the most common errors observed in the Angio Suite, including failure to perform a single-wall puncture, failure to flush catheter in descending aorta, improper use of closure device at puncture site. Clinical severity of errors was also judged by the experts, with highest scores given to inappropriate advancement of micro-catheter to aneurysm, unsafe micro-wire advancement, incorrect coil placement and coil deployment. The study is currently in its second phase, which includes a recirculation of questions to the participating members for further input. This data will be essential in shaping the expectations and goals of a simulation-assisted training model in interventional angiography.
Support or Funding Information: CIHR

Level of First Author: Graduate/Medical Student **Topic Category: Anatomy Education**
Presentation type: Poster
Poster Board #23