Modern Human Anatomy Program

UNIVERSITY OF COLORADO
ANSCHUTZ MEDICAL CAMPUS

Capstone Project Poster Presentations

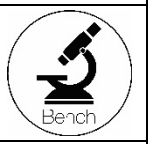
Monday, April 22, 2019

2019 Modern Human Anatomy Program
Capstone Poster Presentations
Agenda

April 22, 2019

8:30 AM – 9:00 AM	Breakfast available, students arrive
9:00 AM	Welcome and overview, Dr. John Thompson
9:05 AM – 10:30 AM	Presentation for Session I posters
10:30 AM – 12:00 PM	Presentations for Session II posters
12:00 PM – 1:00 PM	Lunch

Session I Poster Presenters
9:00 AM – 10:30 AM

Capstone Poster Presenter	Poster #	Abstract Page #	Poster Title	Category
Nathaniel Alzofon	**1**	6	Rare Tumors in a Unique Patient Population: A pheochromocytoma and paraganglioma pilot study with a focus on head and neck paraganglioma	
Mckenzie Hackmaster	**2**	7	Comparing flexible bronchoscopy landmarks to computed tomography imaging in pediatric tracheomalacia patients: A step towards a more objective diagnosis	
Chorong Hong	**3**	8	Anatomical Evidence for a Novel Circuit in Human Retina	
Natalie Hourigan	**4**	9	iBooks Learning Resource Increase Patient and Caregiver Understanding at the Blood Infusion Center	
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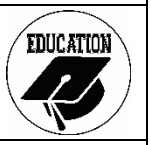
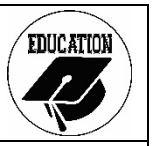
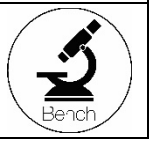
Debra Szuster	**9**	14	A novel approach to resolving the brachial index issue of A.L. 288-1 (“Lucy”) using 3D computer models of hominid forelimb bones	
Sydney Taylor	**10**	15	Undergraduate Education on Equine Cervical Vertebral Compressive Myelopathy	

Peter Thomsen	**11**	16	Assessing Post-Rehabilitation Quadriceps Strength and Movement Quality During a Step Down Task after Total Knee Arthroplasty	
Haylie Helms	**12***	17	Generation of Cardiac Organoids using Cardiomyocytes, Endothelial Cells, Epicardial Cells, and Cardiac Fibroblasts derived from Human Induced Pluripotent Stem Cells	

*e-Poster

Session II Poster Presenters
10:30 AM – 12:00 PM

Capstone Poster Presenter	Poster #	Abstract Page #	Poster Title	Category
Sara Beck-Pancer	**13**	18	Fiber-type transitions in skeletal muscle of the FUS^{R521C} mouse model of amyotrophic lateral sclerosis	
Christine Castillo	**14**	19	Visualizing Twin Connections: Creation and Usability of a 3D Parent Education Toolkit for Twin-Twin Transfusion Syndrome	
Athena Clemens	**15**	20	Impact of Deep Brain Stimulation of the Subthalamic Nucleus on Neuropsychological Outcomes and Voxel-Based-Morphometric-Analyses in Parkinson's Disease Patients	
Nathan Davis	**16**	21	Correlation between local field potential activity and myelin changes in the lenticular fasciculus and subthalamic nucleus using diffusion tensor imaging in Parkinson's disease patients	
Ritesh Kashyap	**17**	22	Sexual Dimorphism and the Scaling of Intrinsic Thumb Muscle Physiological Cross-Sectional Area and Trapeziometacarpal Joint Size	
Brian Kelly	**18***	23	Efficacy of Virtual Reality Training for Physical Therapy Students	
Mark Malham	**19**	24	Comparable CT segmented models used in preoperative surgical planning after minimizing the number of slices	

Daniel Marchetti	**20**	25	Quantitative and Qualitative Orthopaedic Shoulder Anatomy: An iBook Review Tool	
Leandra Nikont	**21**	26	Tackling the Most Prevalent Disease in the United States: Development and Assessment of an Educational Module to Emphasize the Similarities and Differences between Osteoarthritis and Rheumatoid Arthritis	
Natasha Rousseau	**22**	27	Investigating the Impact of the Voice-Activated Chatbot Application for Study Skills on Student Usability in Physical Therapy Anatomy Application	
Meredith Ware	**23**	28	Pancreatic fat is not related to PCOS status in obese adolescents but is related to prolonged hyperinsulinemia	
Yannick Dzowo	**24***	29	Quantification and Characterization of Taste Cells in Mice Circumvallate Taste Buds	

*e-Poster

Thank you to faculty serving on capstone committees, as these projects would not be possible without your commitment to the success of our students.

MSMHA Student	Capstone Committee Chair	Capstone Mentor	Committee Member	Committee Member
Alzofon, Nathaniel	Ernesto Salcedo, PhD	Lauren Fishbein, MD, PhD	Lindsey Hoffman, DO	
Beck-Pancer, Sara	John Caldwell, PhD	Roger Bannister, PhD	Ernesto Salcedo, PhD	
Castillo, Christine	Lisa Lee, PhD	Rony Marwan, MD	Nicholas Behrendt, MD	Allison Dempsey, PhD
Clemens, Athena	Maureen Stabio, PhD	John Thompson, PhD	Thomas Wodushek, PhD	
Davis, Nathan	Ernesto Salcedo, PhD	John Thompson, PhD	Drew Kern, MD	
Dzowo, Yannick	John Caldwell, PhD	Thomas Finger, PhD	Robert Lasher, PhD	
Hackmaster, Mckenzie	Norma Wagoner, PhD	Emily DeBoer, MD	Todd Wine, MD	
Helms, Haylie	John Caldwell, PhD	Jeffrey Jacot, PhD	Louis Stodieck, PhD	
Hong, Chorong	Thomas Finger, PhD	Maureen Stabio, PhD	Jordan Renna, PhD	
Hourigan, Natalie	Danielle Royer, PhD	Angela Falco, NP, MPH/MSPH, MS, RN	Lindsey Lyle, PA-C, MS	
Kashyap, Ritesh	John Thompson, PhD	Caley Orr, PhD	Jamie Hodgkins, PhD	
Kelly, Brian	Ernesto Salcedo, PhD	Janet Corral, PhD	Dana Judd, DPT, PhD	
Malham, Mark	John Thompson, PhD	Mark Erickson, MD	Jennifer Wagner, PhD	
Marchetti, Daniel	Caley Orr, PhD	Travis Turnbull, PhD	Charlie Lockwood, MD	
Matin, Nadira	Ernesto Salcedo, PhD	Todd Hankinson, MD	Emily DeBoer, MD	
Nikont, Leandra	Caley Orr, PhD	Karen King, PhD	Jennifer Stratford, PhD	
Plunkett, Cassidy	Ernie Salcedo, PhD	Lisa Lee, PhD	Jennifer Stratford, PhD	
Rosicke, Samantha	John Caldwell, PhD	Brianne Bettcher, PhD	John Thompson, PhD	
Rousseau, Natasha	Mike Pascoe, PhD	Janet Corral, PhD	Amy McDevitt, DPT	Dana Judd, DPT, PhD
Ruse, Riley	Mike Pascoe, PhD	Jennifer Stevens-Lapsley, PT, PhD	Julio Carballido-Gamio, PhD	
Szuster, Debra	Vic Spitzer, PhD	Caley Orr, PhD	Anna Warrener, PhD	
Taylor, Sydney	Caley Orr, PhD	Yvette Nout-Lomas, DVM, PhD	Ray Whalen, DVM, PhD	
Thomsen, Peter	Ernesto Salcedo, PhD	Jennifer Stevens-Lapsley, PT, PhD	Jesse Christensen, PT, PhD	
Ware, Meredith	John Caldwell, PhD	Jill Kaar, PhD	Melanie Cree-Green, MD, PhD	

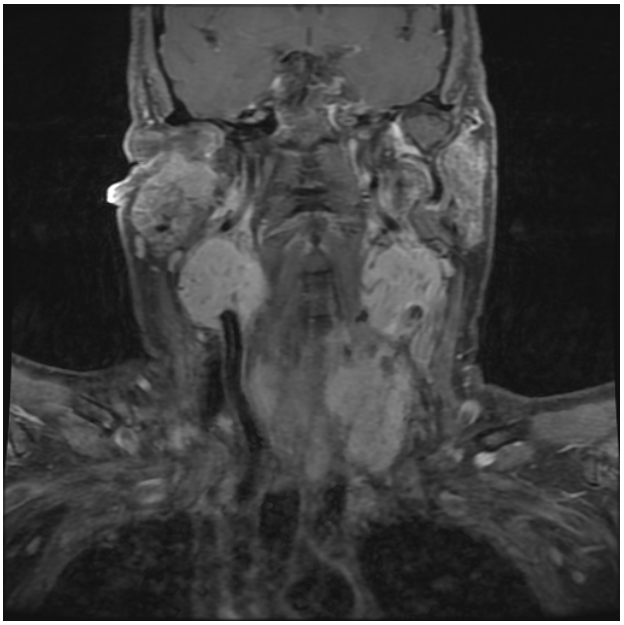
Session I: 9:00 AM – 10:30 AM

Poster #1 Nathaniel Alzofon

Rare Tumors in a Unique Patient Population:
A pheochromocytoma and paraganglioma pilot study with a focus on head and neck paraganglioma

Capstone Committee: Ernesto Salcedo (chair), Lauren Fishbein (mentor), Lindsey Hoffman

ABSTRACT:
Pheochromocytoma and paraganglioma (PCC/PGL) are rare tumors of the adrenal medulla and extra-adrenal paraganglia, respectively. Thirty-five to 40% are associated with a germline mutation in one of twelve known susceptibility genes. It has been suggested that altitude acts as a phenotypic modifier in some PCC/PGL susceptibility gene carriers. PGLs that form in the head and neck (HNPGLs) are associated with morbidity due to mass effect on cranial nerves and surgical complications. We performed a retrospective chart-review as a pilot study to describe a unique cohort of HNPGL patients with PCC/PGL susceptibility gene mutations. Our cohort differed from that described in the literature. In our cohort, the majority of affected PCC/PGL susceptibility gene carriers presented with HNPGL rather than adrenal pheochromocytoma or extra-adrenal paraganglioma. We found that PCC/PGL susceptibility mutation carriers trended towards presenting with smaller HNPGLs than patients who tested negative for PCC/PGL susceptibility gene mutations. Additionally, there was a higher frequency of metastatic disease in patients who tested negative for PCC/PGL susceptibility gene mutations. Taken together, the data suggests our patient population may have a unique clinical presentation compared to previously described cohorts and warrants further study into possible mechanisms of these differences.

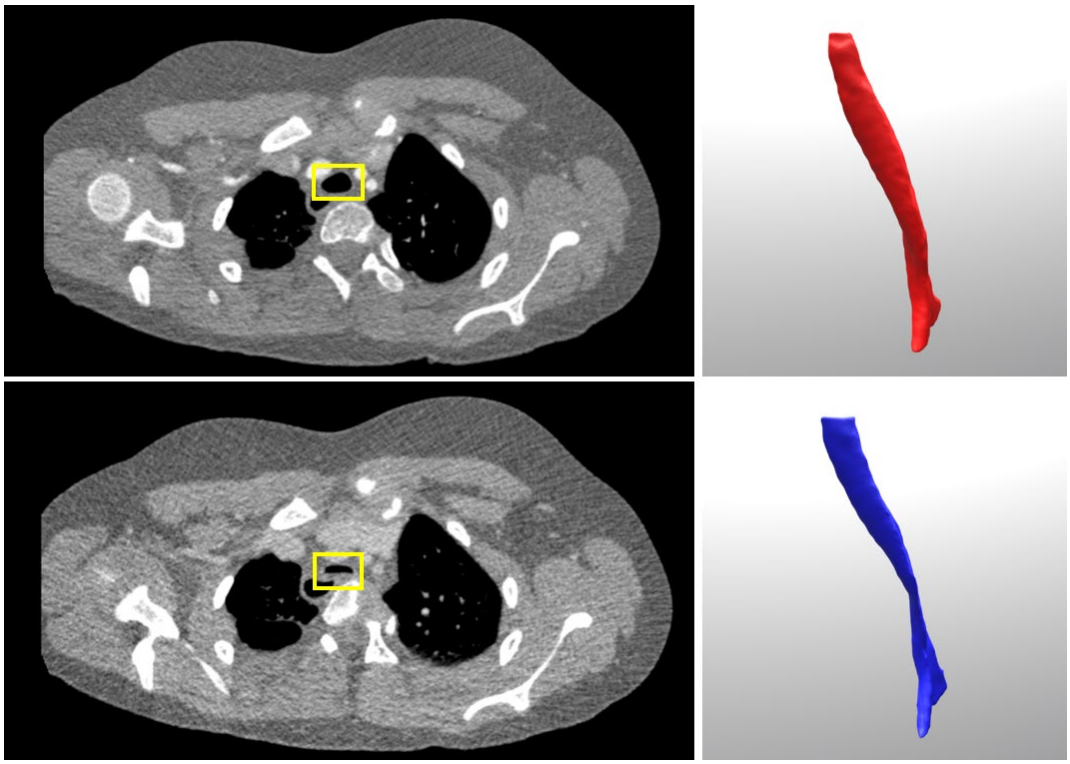


Poster #2 Mckenzie Hackmaster

Comparing flexible bronchoscopy landmarks to computed tomography imaging in pediatric tracheomalacia patients: A step towards a more objective diagnosis

Capstone Committee: Norma Wagoner (chair), Emily DeBoer (mentor), Todd Wine

ABSTRACT:
Flexible bronchoscopy is currently the gold standard for diagnosing pediatric tracheomalacia, but as technology advances, interest has grown in the diagnostic capabilities of chest computed tomography angiogram (CTA) analysis. Previous studies indicate that CT does validate the presence of tracheomalacia. However, none have gone further to analyze the ability of CT in characterizing this common airway disease. The primary aim of this study is to compare previously archived flexible bronchoscopy data to results obtained by quantitative CT analysis in regard to the severity, distribution, and directionality of airway collapse. The secondary aim was to characterize patterns of tracheomalacia presentation with the goal of supplementing bronchoscope and CT analysis of this disease. We hypothesized that CTA analysis validates flexible bronchoscopy findings in at least 75% of pediatric patients. To test this hypothesis, we segmented inspiratory and expiratory tracheas of 21 experimental and 9 control pediatric patients then analyzed the severity, directionality, and distribution of collapse using MATLAB. This data was compared to the visual description obtained via flexible bronchoscopy procedures previously performed on each patient. Our results indicate that CTA analysis validated the presence of pediatric tracheomalacia in 73% of patients, the severity in 14% of patients, the distribution in 7% of patients, and the directionality in 36% of patients.

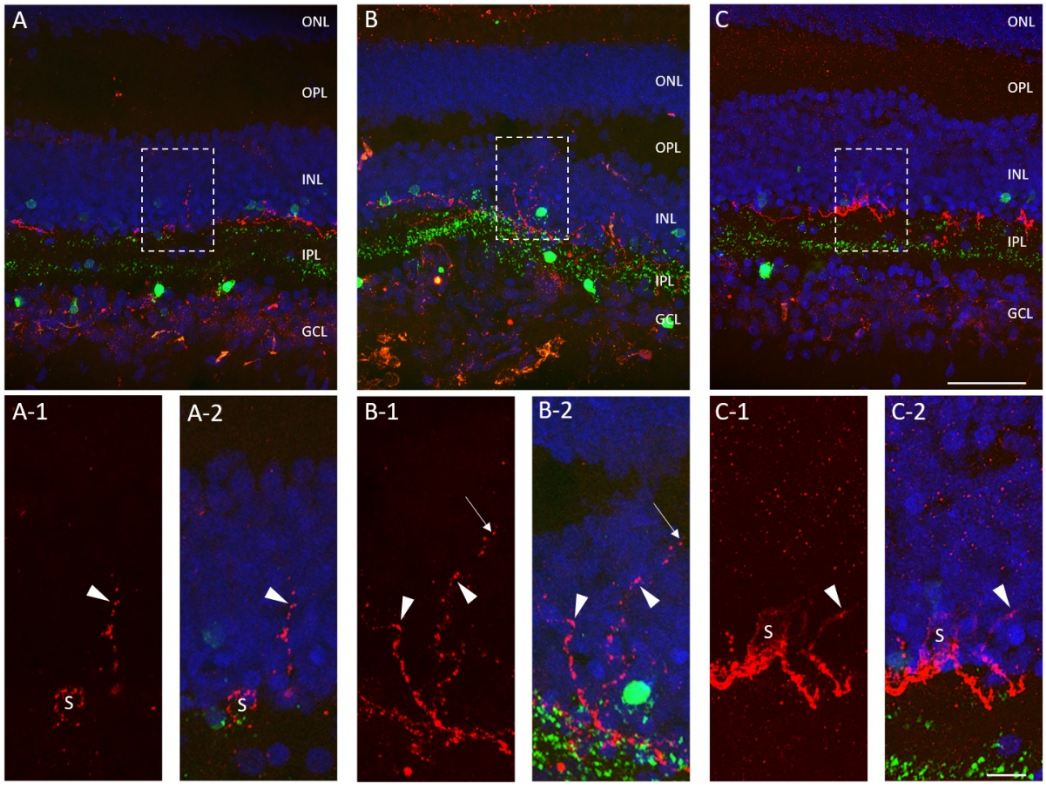


Poster #3 Chorong Hong

Anatomical Evidence for a Novel Circuit in Human Retina

Capstone Committee: Thomas Finger (chair), Maureen Stabio (mentor), Jordan Renna

ABSTRACT:
Melanopsin ganglion cells are intrinsically photosensitive and contribute to circadian entrainment as well as the pupillary light reflex. It has been recently discovered that, although the dendrites of the melanopsin ganglion cells ramified within the inner plexiform layer, some of the melanopsin ganglion cells in the mouse retina have outer retinal dendrites extending into the inner nuclear layer or the outer plexiform layer. In the human retina, however, the outer retinal dendrites of the melanopsin ganglion cells have not been found. This study aims to demonstrate the existence of the outer retinal dendrites in the human retina and compares cell morphologies of the outer retinal dendrites-positive melanopsin ganglion cells in mouse and human retinas. We performed immunohistochemistry with an antibody for melanopsin on the mouse and human retinas that were sectioned or flat mounted. The confocal microscopy was used for visualizing and analyzing the morphologies of the melanopsin ganglion cells with their outer retinal dendrites. The presence of outer retinal dendrites from melanopsin retinal ganglion cells have been confirmed in early postnatal and adult mice. In human retina, it has been found that some of the dendrites from the melanopsin retinal ganglion cells stratify within the inner nuclear layer vertically towards the outer plexiform layer. This founding is suggestive of the presence of outer retinal dendrites in human retina. Further studies in human retina with different ages may provide indisputable outer retinal dendrites structures similar to those discovered in mouse retina.



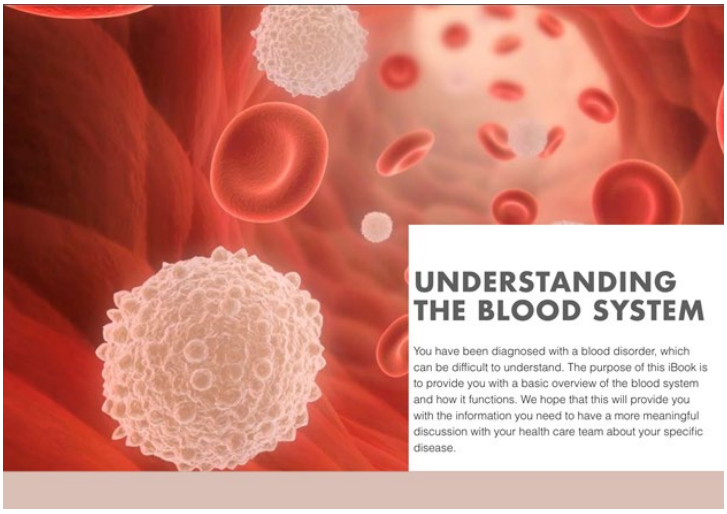
Poster #4 Natalie Hourigan

iBooks Learning Resource Increase Patient and Caregiver Understanding at the Blood Infusion Center

Capstone Committee: Danielle Royer (chair), Angela Falco (mentor), Lindsey Lyle

ABSTRACT:

PURPOSE
The prevalence of people diagnosed with blood cancer in the United States is high (170,000 in 2017). Notwithstanding the high occurrence of diagnoses, there is a lack of resources available to patients who have been diagnosed with a blood cancer. Since blood is a liquid organ, it is difficult for patients to conceptualize the development of blood cells and the anatomy involved in hematopoiesis. Our goal was to develop an accessible learning tool using iBooks to educate patients at the Blood Infusion Center at University of Colorado Hospital.
METHODS
We have designed and created an interactive learning tool with comprehensible descriptions and visually accurate images to help patients understand their circulatory and lymphatic systems. Healthcare providers were interviewed and asked to verbally evaluate the iBooks resource based on accuracy of terms and usability in the clinic. Patient data was collected using pre and post intervention assessing knowledge and anxiety towards treatment.
RESULTS
35 participants were enrolled in the study. Participants involved in the study had 1 of 12 different types of blood cancer with 81% being diagnosed with a lymphoma/leukemia, 18% being diagnosed with myeloma, and less than 1% being diagnosed with a different type of blood cancer. The resource significantly increased patient understanding of blood and immune cell production.
CONCLUSIONS
We created a digital learning resource using iBooks Author to educate patients on blood and immune cell production. We hope that this resource will become a useful tool to help teach patients and caregivers about the anatomy of their blood disorder and treatment. Future versions of this tool will likely contain more 3-Dimensional anatomy and be structured to help patients and caregivers understand their specific blood disorder.

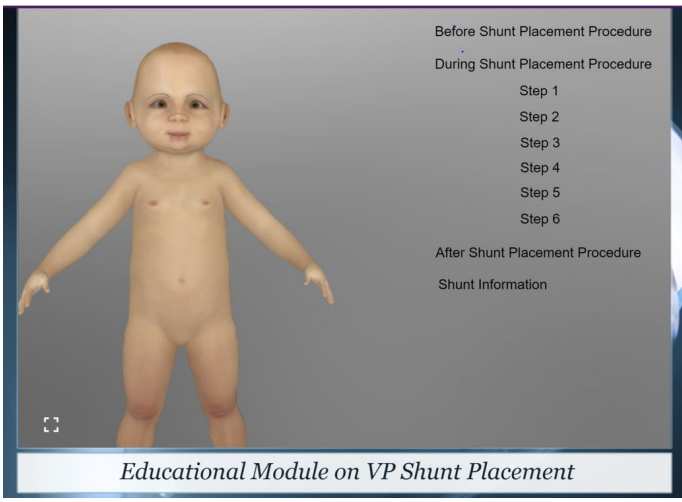


Poster #5 Nadira Matin

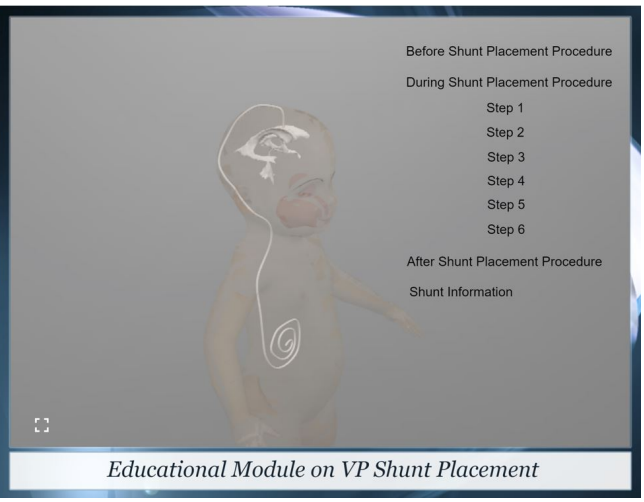
Interactive 3D Module Improves Parent Understanding of Shunt Placement for Hydrocephalus

Capstone Committee: Ernesto Salcedo (chair), Todd Hankinson (mentor), Emily DeBoer

ABSTRACT:
Available parent resources for hydrocephalus are limited to a 26-page booklet with one B&W image. The goals of this Capstone study were to: 1) create and implement an anatomy-based interactive digital module that would guide parent understanding of shunt placement for hydrocephalus and 2) assess the premise that parents will prefer learning through a three-dimensional (3D) module more than a B&W pamphlet. Various software programs were used to yield the final product. Slicer was used to scale a brain ventricle while MakeHuman was used to create the human 3D child. Blender was used to create the shunt and compile the various 3D objects into one scene. The module was hosted locally, using SimLab Composer. Parents of children with ventriculoperitoneal shunt placement completed a post-pre intervention survey after interaction with the module. Statistical analysis was performed, and a paired sample t-test showed a statistical significance that parents favored learning with digital modules after interacting with the educational resources. Qualitative data that was collected revealed that parents enjoyed the interactive component and the ability to visually see the shunt within the body. Overall, this module offers a more robust visual of shunt placement while providing shunt placement information for parents.



Educational Module on VP Shunt Placement



Educational Module on VP Shunt Placement

Poster #6 Cassidy Plunkett

Embryos in Gross Anatomy Laboratory? The Educational Impact of 3D Printed Embryo Model Integration in Medical Basic Sciences Education

Capstone Committee: Ernesto Salcedo (chair), Lisa Lee (mentor), Jennifer Stratford

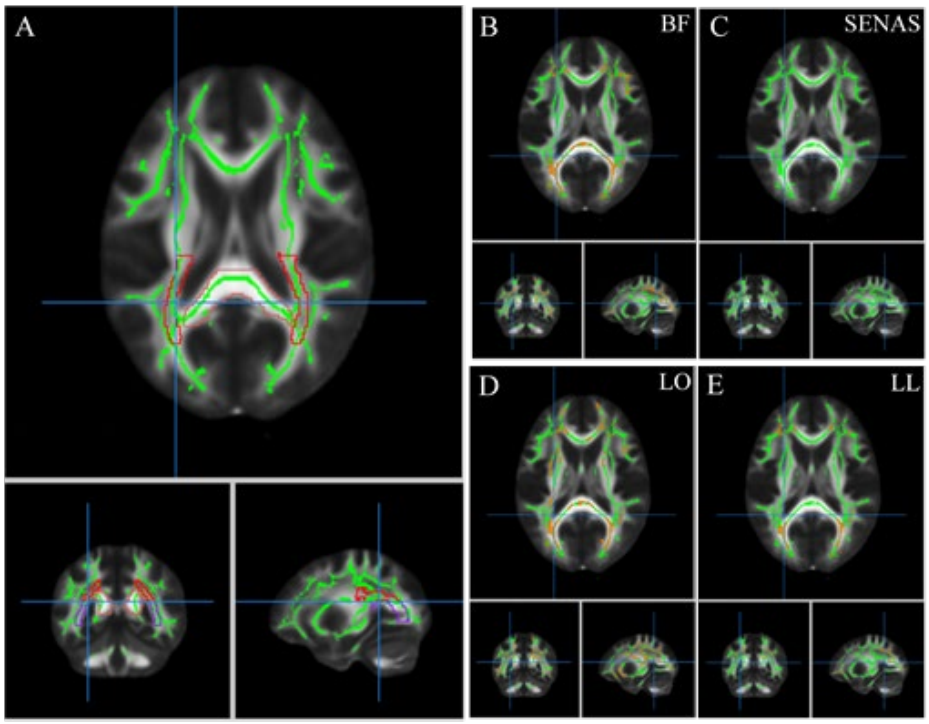
ABSTRACT:
Embryology, the study of embryonic development, lays foundation for gross anatomy, anatomical variations, and congenital conditions. Despite its evident applicability to other basic sciences subjects and clinical medicine, curricular hours devoted for embryology in medical education have been reduced to a minimum. As a result, and due to the multidimensional and rapid nature of development, embryology is often perceived as one of the most difficult subjects to learn and teach. To enhance embryology education, 3D virtual and 3D printed embryo models were developed by segmenting and rendering serial embryo tissue sections. Previous studies assessing the educational value of these resources with various student populations have shown positive learning outcomes. The aim of the current study was to assess the educational value of the 3D printed and 3D virtual embryo models in an integrated medical basic sciences curricular framework. In a Colorado Multiple Institutional Review Board exempt study (#18-1600), 160 first-year medical students were randomized into 4 groups, each receiving a different resource for integrating embryology, in a gross anatomy laboratory. All groups received a pamphlet with embryo figures. While Group A received no additional resource; Group B received 3D virtual models; Group C, 3D printed models; and Group D, an instructor-led tutorial of embryology on an adult cadaver. The educational impact of the resources was analyzed by comparison of quiz scores on embryonic anatomy before and after resource exposure. Perceived value of the assigned resources was assessed by survey analytics. The results show that Groups A and C improved post quiz scores on average by 8% and 13% respectively, while Groups B and D had modest increases of 5% and 2%. A Kruskal-Wallis test comparing combined scores of all four groups revealed that post-quiz score increase was statistically significant ($p= 0.046$) indicating that embryology resources had an overall positive effect on student performance. Dwass-Steel-Critchlow-Fligner pairwise comparisons showed that the difference in pre to post-quiz scores was only significant between Groups C and D ($p=0.004$) suggesting that interacting with 3D printed embryo models led to higher learning outcomes than instructor-led embryology tutorials on cadavers. In the survey, after students explored all four learning resources, majority ranked 3D printed embryo models to be the highest in educational value and easiest to use. In the current randomized study, 3D printed embryo model integration in gross anatomy laboratory appears to hold a high potential for improving students' interest in learning and mastery of embryology.

Poster #7 Samantha Rosicke

Association of White Matter Integrity and Visuospatial Function in Clinically Normal Adults vs. Adults with Mild Cognitive Impairment

Capstone Committee: John Caldwell (chair), Brianne Bettcher (mentor), John Thompson

ABSTRACT:
Mild Cognitive Impairment (MCI) is a disorder describing a mild deficit in cognitive functions including visuospatial function – the ability to locate visual stimuli in space. Performance in classic cognitive tests is analyzed to diagnose deficits in cognition. The primary goal of this study is to compare the association of white matter microstructure with visuospatial functioning between aging clinically normal adults and aging adults with MCI. We hypothesized that (1) white matter microstructure involved in visuospatial function would be localized around the parietal lobe across all subjects, and (2) aged adults with MCI would have stronger correlations of visuospatial function loss and white matter deficits than clinically normal aged adults. This was tested by analyzing diffusion tensor imaging data for fractional anisotropy values. Regions of interest and a whole brain analysis were studied for correlations between white matter deficits and visuospatial task performance. The effect of the diagnostic group on these correlations was also analyzed using general linear regression models. Though we saw two significant localizations of visuospatial function and two non-significant trends, our whole brain proxy and whole brain analysis demonstrated a lack of visuospatial function localization in suspected areas. Only non-significant trends were found when determining whether diagnosis plays a role in the correlations between cognitive task scores and fractional anisotropy values. This study helps further knowledge of anatomical changes in the aging brain, which is important because, as world populations grow older, it becomes imperative that we identify and treat MCI early.

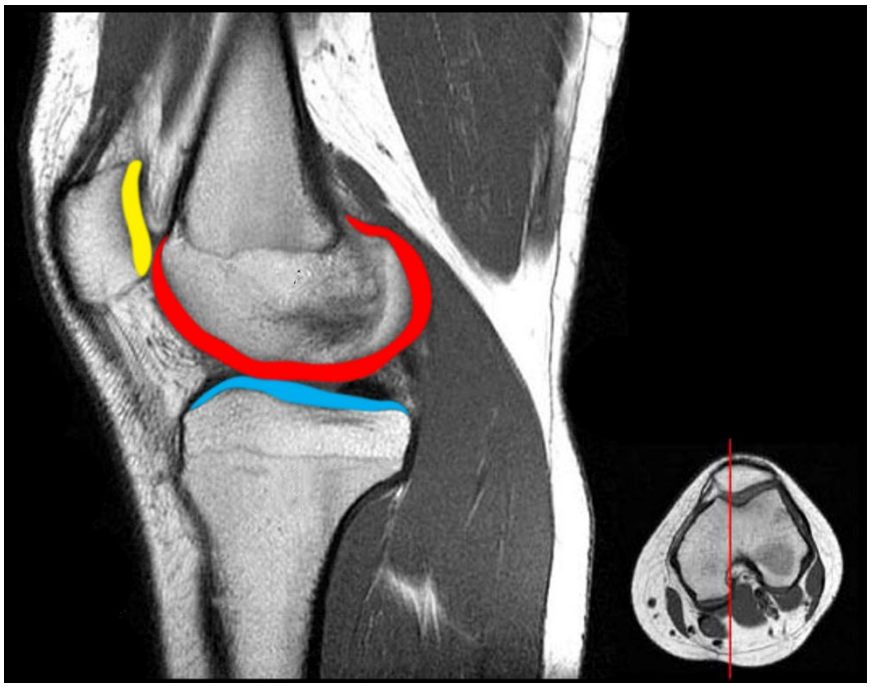


Poster #8 Riley Ruse

Reliability of an MR-based Knee Cartilage Semiautomatic Segmentation Protocol for Non-Clinicians

Capstone Committee: Mike Pascoe (chair), Jennifer Stevens-Lapsley (mentor), Julio Carballido-Gamio

ABSTRACT:
Evaluating knee osteoarthritis through semiautomatic segmentation of articular cartilage in magnetic resonance (MR) imaging relies on a strong understanding of the anatomy of the knee and can influence the reliability of quantitative measures in research trials. MR imaging offers researchers the ability to quantify volume, thickness and integrity of articular cartilage but is also limited by a low signal-to-noise ratio and spatial resolution. The situation is exaggerated in research subject's with extensive osteoarthritis which can make novel imaging procedures, like automatic segmentation, capable of filling this gap, unreliable. The purpose of this study was to develop and evaluate the reliability of a training manual and protocol geared towards refreshing and standardizing the level of anatomical knowledge necessary to semiautomatically segment the knee. MR images were acquired from 8 rehabilitation research subjects. Two raters segmented and measured volume and thickness of the femoral, medial tibial, lateral tibial, and patellar articular cartilage. Reliability was determined through calculating intra- and interrater correlation coefficients. Six of the computed ICC values were above 0.950 and almost all intrarater ICC values demonstrated excellent reliability of 0.900 or greater. Seventy-five percent of all ICC values fell between 0.750 and 0.900, indicating good reliability. Interrater reliability was lower with only two of the sixteen ICC values measuring over 0.950 and six ICC values fell into the range of moderate reliability, 0.500 to 0.750. These results indicate that to produce a protocol with high interrater reliability requires more training in segmentation practices and a clearer, more detailed set of instructions to standardize these procedures.



Poster #9 Debra Szuster

A novel approach to resolving the brachial index issue of A.L. 288-1 ("Lucy") using 3D computer models of hominid forelimb bones

Capstone Committee: Vic Spitzer (chair), Caley Orr (mentor), Anna Warrener

ABSTRACT:
Paleoanthropologists have difficulty calculating the brachial index (radius length / humerus length X 100) of Australopithecus afarensis A.L. 288-1, commonly known as "Lucy," because bilateral segments of radial and ulnar diaphyses are missing. Conventional approaches to reconstruction have produced upper limb models ranging from "ape-like" to "human-like." The aim of this study was to quantitatively estimate the brachial index of A. afarensis by warping a 3D model of a complete ulna from a larger male A. afarensis (A.L. 438) to 404 homologous landmarks on the proximal ulna of female A.L. 288-1 using a thin plate spline transformation (Viewbox 4 software: dHAL, Kifissia, Greece). Potential effects of allometry were tested by simulating female ulnar reconstructions in a sample of modern adult hominids exhibiting varying degrees of sexual dimorphism (Gorilla gorilla n=13, Pan troglodytes n=17, and Homo sapien n=20). Transformed hominid ulnae models had a maximum 16% error in bone length. Lucy's maximum radius length, 209 mm, was derived by virtually aligning radius articular surfaces with the transformed ulna of A.L. 438. With an established humerus length of 237 mm, Lucy's brachial index was estimated to be 88 with a range of 74-102 at a 95% confidence level. Results are sufficiently constrained to indicate that Lucy's brachial index was probably unlike that of humans; rather, she likely had a relatively long forearm given a brachial index intermediate between chimpanzees and gorillas. This result has important implications for furthering discussion regarding A. afarensis locomotion and habitat use in the context of hominin evolution.

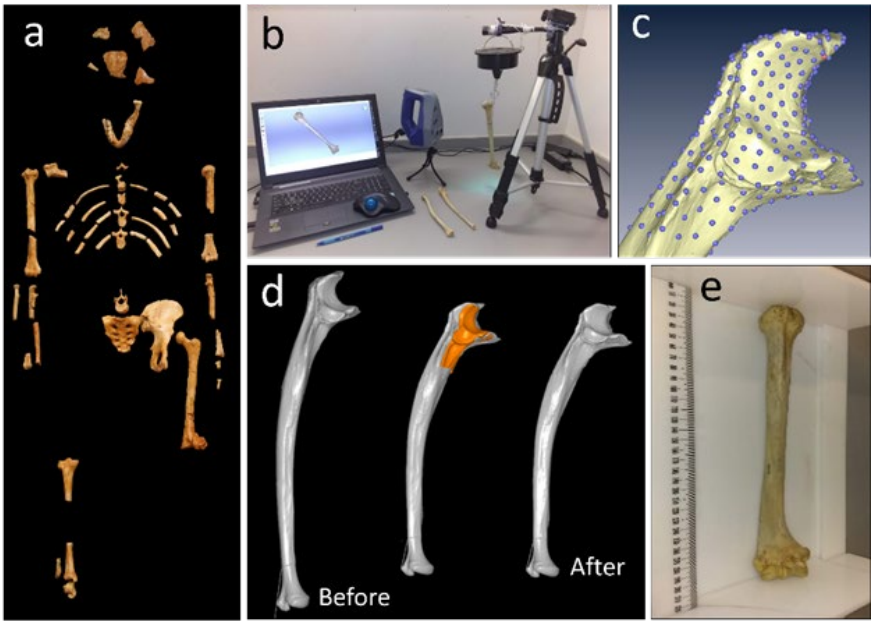


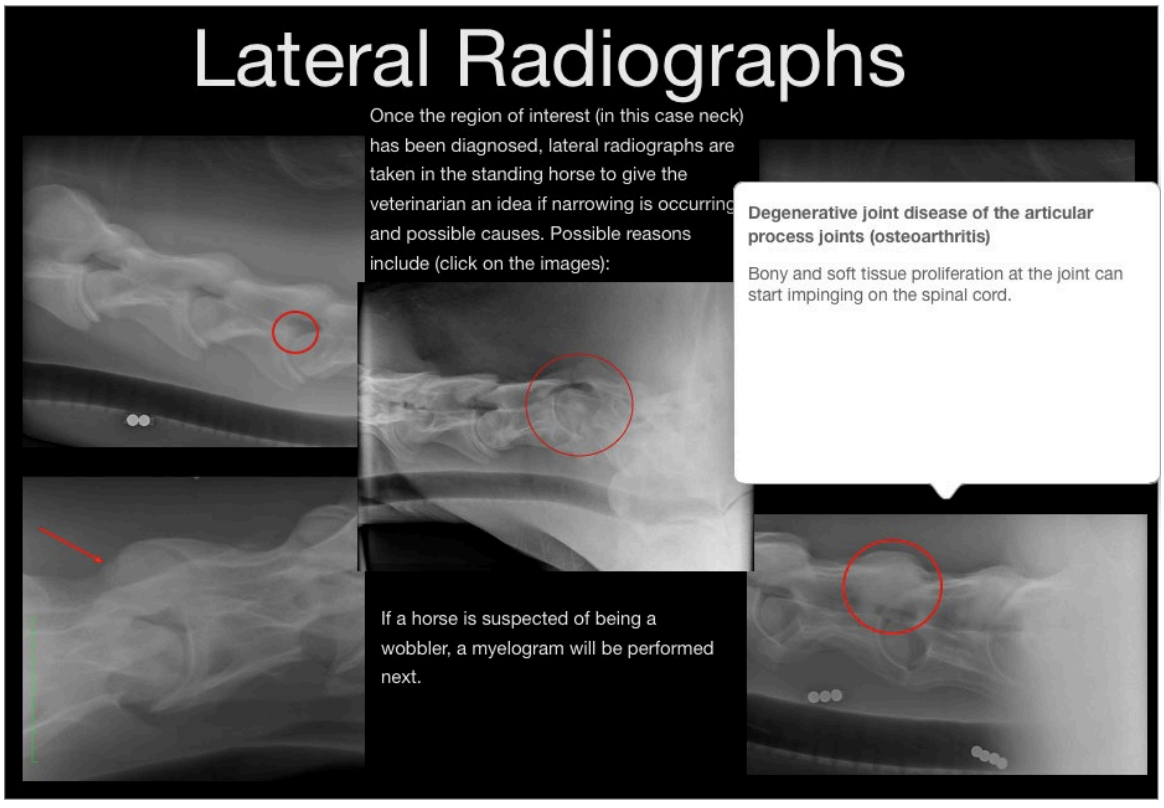
Figure 1: Reconstructing Lucy's fragmented ulna by morphing a 3D computer model of a complete ulna from AL 438. a) Lucy's skeleton, including missing forelimb diaphyses (*Museum national d'histoire naturelle*, Paris). b) Surface scanning original hominid bones using an Artec Space Spider scanner. c) Landmark placement on 3D models of the proximal head of ulnae. d) Morphing the complete male ulna to match the (orange) topography of the proximal female ulna. E) Traditional osteometric board measurements used to derive percent error of reconstructed bone length using experimental method.

Poster #10 Sydney Taylor

Undergraduate Education on Equine Cervical Vertebral Compressive Myelopathy

Capstone Committee: Caley Orr (chair), Yvette Nout-Lomas (mentor), Ray Whalen

ABSTRACT:
To provide a resource for horse owners to learn about the anatomy and clinical implications, and pathology associated with Equine Cervical Vertebral Compressive Myelopathy (CVCM) we developed an interactive iBook teaching tool. This iBook is intended to provide the user with a baseline understanding of the associated anatomy and the initial clinical signs of the disorder. Furthermore, the user follows a veterinary diagnostic process by being able to compare normal to abnormal and is provided with available treatments for CVCM. The efficacy of this iBook was assessed by comparing mean quiz scores between a control and experimental group composed of the Domestic Animal Anatomy students at Colorado State University. Students in the control group were given a paper by Nout-Lomas et al. 2003, and students in the experimental group were given the interactive iBook. Students from the experimental group performed significantly better than the control group on the post quiz scores ($p = 0.015$). While both groups said they felt more comfortable with their understanding of CVCM, more people in the experimental group said they would recommend the interactive iBook learning module to a friend ($p < 0.0000001$). The results suggest that an interactive iBook is a preferred method of learning about a condition like CVCM compared to reading an article, and that this appears to be a useful resource for horse owners and possibly veterinary students and veterinarians.



Poster #11 Peter Thomsen

Assessing Post-Rehabilitation Quadriceps Strength and Movement Quality During a Step Down Task after Total Knee Arthroplasty

Capstone Committee: Ernesto Salcedo (chair), Jennifer Stevens-Lapsley (mentor), Jesse Christensen

ABSTRACT:
Following total knee arthroplasty (TKA), patients demonstrate persistent quadriceps deficits that may be linked to poor functional outcomes and asymmetrical joint loading behaviors in both limbs, particularly during high-demand tasks such as stair negotiation. The aims of this study were to assess the following characteristics of a high-demand step down task in patients following a 10 week rehabilitation post-TKA: 1) the relationship between quadriceps strength and surgical support limb knee loading, 2) the relationship between quadriceps strength and non-surgical landing limb loading, and 3) interlimb joint moment and total support moment symmetries. A standardized 10 week physical therapy protocol was performed on all participants (n = 20). Motion analysis was performed during a step down task and peak isometric knee extension torque was obtained as a measure of quadriceps strength. Quadriceps strength was compared with knee extension moment and landing limb loading variables using Pearson's r bivariate correlations. Joint moment and total support moment symmetries were compared using paired sample t-tests. Quadriceps strength correlated strongly with surgical limb knee extension moment ($r = 0.6959$, $p = 0.0009$) but showed no significant correlations with either landing limb loading variable. The surgical limb generated a lower total support moment when compared to the non-surgical limb ($p < 0.0001$), including decreased ankle ($p < 0.0001$) and knee ($p < 0.0001$) moments in the surgical limb. These findings suggest that loading asymmetries are present immediately following rehabilitation and decreased quadriceps strength is associated with decreased functional capacity of the surgical knee in high-demand tasks.

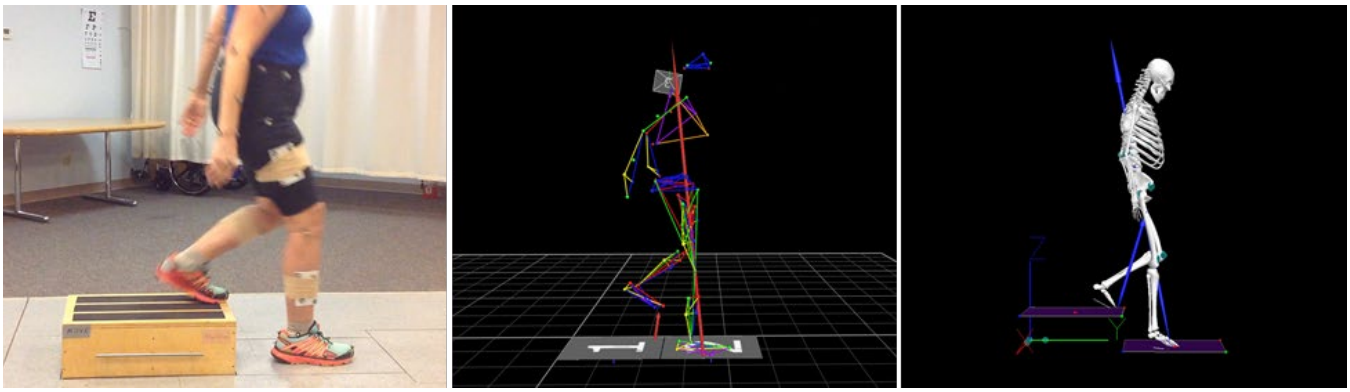


Figure: Progression of motion data collection and processing. Representative participant performing step down task (left), marker trajectory and analog force data (center), and trajectory-based segment reconstructions for biomechanical variable computation (right).

Poster #12 Haylie Helms

Generation of Cardiac Organoids using Cardiomyocytes, Endothelial Cells, Epicardial Cells, and Cardiac Fibroblasts derived from Human Induced Pluripotent Stem Cells

Capstone Committee: John Caldwell (chair), Jeffrey Jacot (mentor), Louis Stodieck

ABSTRACT:
Two-dimensional (2D) cell culture models fail to recapitulate the complex tissue architectures, extracellular matrices, and cellular crosstalk that occur in vivo. Three-dimensional models (3D), including scaffold-free organoids, derived from a single human induced pluripotent stem cell (hiPSC) cell source can more accurately model cell-cell and cell-matrix interactions to study specific genetic and organ-level diseases that are difficulty to study in vitro. Additionally, 3D culture methods utilizing suspension culture or simulated microgravity environments have been shown to improve (iPSC)-derived cardiomyocyte (CM) maturity, differentiation efficiency, and function, while promoting self-organization in models that include multiple cardiac cell types. However, current published models have incorporated only one or two of the four predominate cardiac cell types or have used cells from a mixture of primary and hiPSC-derived sources, primarily due to inefficient hiPSC differentiation protocols, especially for epicardial cells (epiC) and cardiac fibroblasts (CF). This study aims to generate organoids consisting of all four predominant cardiac cell types (CM, epiC, CF, and endothelial cells) differentiated from a single hiPSC source using two 3D culture techniques. hiPSCs were differentiated into cardiomyocytes, endothelial cells (EC), epiC, and CF. All cells were singularized with Accutase, mixed at a 5:2:2:1 ratio (CM:epiC:CF:EC) as proposed by the developing cardiac model, and cultured in a non-adherent spheroid plate (Aggrewell, StemCell Tech) for two days. The spheroids were then cultured for seven days in static culture (culture plate) or suspension culture (spinner flask) environment. After seven days the organoids were analyzed via motion contraction velocities, quantitative real-time polymerase chain reaction (RT-PCR), and immunofluorescence. Cardiac organoids containing all four predominate cell types were compact and viable (beating) following seven days of culture in both static and suspension culture. However, suspension culture resulted in higher expression of the gene gap junction alpha 1 (GJA1), suggesting suspension culture generates more mature organoids than static culture. Organoid formation was further supported by the positive staining of cardiac troponin T (cTnT), connexin 43 (Cx-43), alpha-smooth muscle actin (α-SMA), vimentin, and proliferation marker Ki67. Therefore, this study demonstrates a method of generating cardiac organoids containing all four cardiac cell types, derived from the same hiPSCs, which is a promising model for future patient specific disease modeling, therapy testing, or tissue engineering.

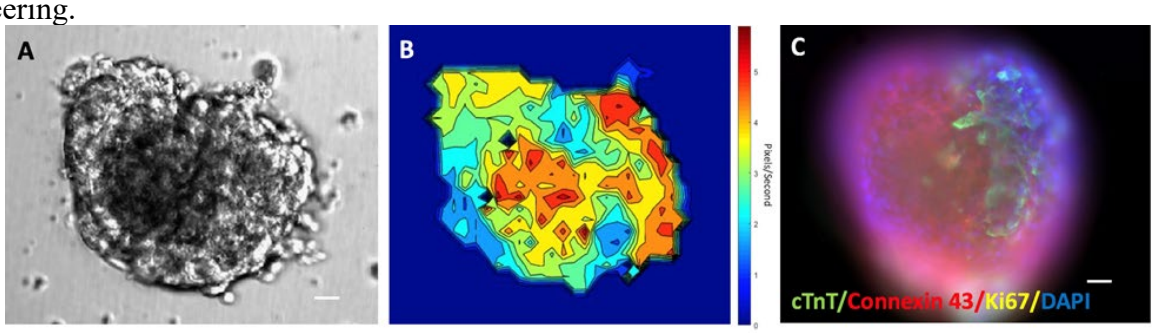


Figure 1 Organoid Characterization After 7 Days of Culture. (A) Bright field microscopy. (B) Mean contraction heat map. (Red being most contraction) (C) Immunofluorescence imaging. (Scale bar 50 μm)

Session II: 10:30 AM – 12:00 PM

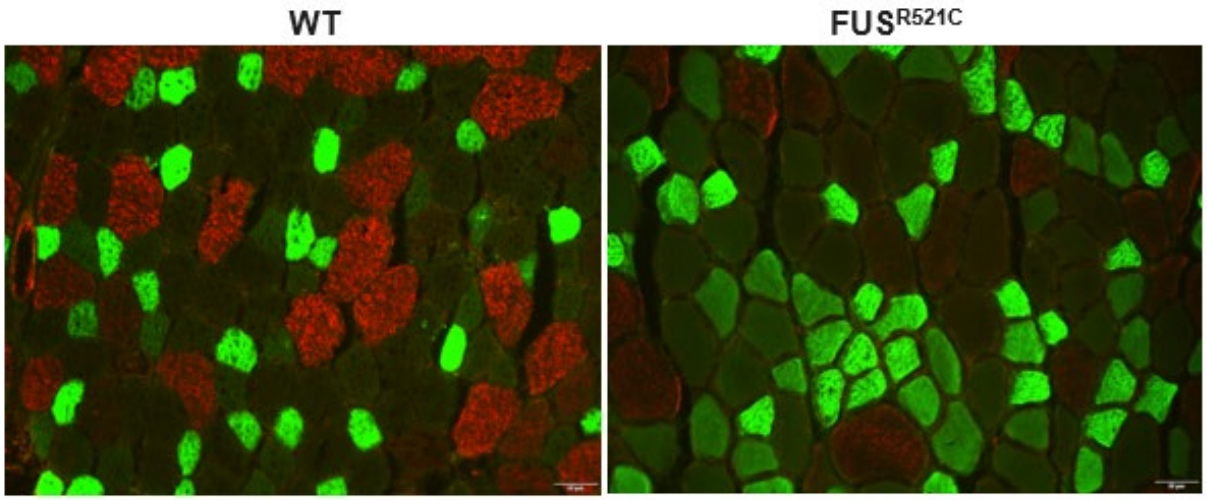
Poster #13 Sara Beck-Pancer

Bench

Fiber-type transitions in skeletal muscle of the FUS^{R521C} mouse model of amyotrophic lateral sclerosis

Capstone Committee: John Caldwell (chair), Roger Bannister (mentor), Ernesto Salcedo

ABSTRACT:
Amyotrophic lateral sclerosis (ALS) is increasingly recognized as a multi-system disease involving not only motor neurons, but also neuroglia, neuromuscular junctions, and skeletal muscle. Here, we focus on changes occurring in skeletal muscle during the course of ALS. Preferential loss of fast-fatigable motor units along with transitions from type IIB to type IIA fibers is well-established in the SOD1G93A mouse model of ALS. However, fiber-type transitions in the FUSR521C ALS mouse have yet to be studied. Using immunofluorescence, we examined fiber-type transitions in fast-twitch (tibialis anterior, extensor digitorum longus) and slow-twitch (soleus) muscles in pre-symptomatic FUSR521C mice. We found that in tibialis anterior there was a significant difference in the distribution of fiber types compared to wild-type counterparts; the proportion of type IIB fibers decreased, while the proportion of type IIA fibers increased. From a therapeutic standpoint, maintaining the type IIA fibers may help preserve motor function when used in ALS in combination with other therapies designed to preserve motor neurons.



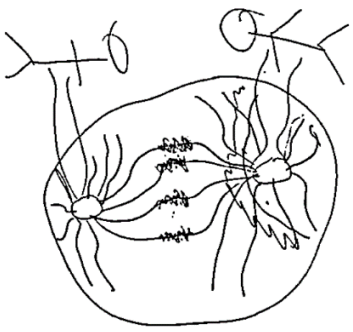
Tibialis anterior muscles from a wild-type mouse (left) and a FUS^{R521C} mouse (right) differ in muscle fiber-type composition, as indicated by immunofluorescence staining. Type IIB fibers (red), type IIA fibers (bright green), type IIX fibers (dark green).

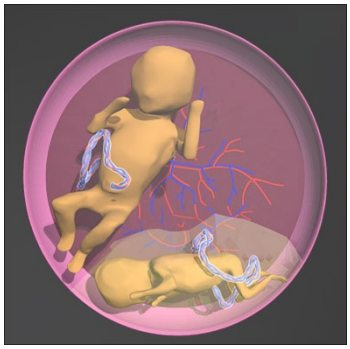
Poster #14 Christine Castillo

Visualizing Twin Connections: Creation and Usability of a 3D Parent Education Toolkit for Twin-Twin Transfusion Syndrome

Capstone Committee: Lisa Lee (chair), Rony Marwan (mentor), Nicholas Behrend, Allison Dempsey

ABSTRACT:
Twin-twin transfusion syndrome (TTTS) is a complication occurring in 10-20% of monochorionic diamniotic multiple pregnancies characterized by unequal circulation due to placental anastomoses. These pathologic vascular connections result in a smaller "donor" twin with oligohydramnios (insufficient amniotic fluid) and a larger recipient twin with polyhydramnios (excessive amniotic fluid). Untreated chronic TTTS has an 80-100% mortality rate, with complications affecting cardiovascular, neurological and renal systems in surviving infants. Prognosis is improved by timely diagnosis and intervention, with selective fetoscopic laser photocoagulation seen as the front-line treatment. TTTS announcement is considered a traumatic event for expectant parents, thus adequate support from their providers is essential. Parents rely on receiving ample information for satisfactory care, and while antenatal multidisciplinary consultations at fetal centers provide space for parent education, parents often have difficulty understanding the anatomy involved. Currently, supplemental resources at the Colorado Fetal Care Center (CFCC) include 2D images and literature intended for a scientific audience. Needs assessment at the CFCC revealed that visuals were the most helpful for providers to explain the pathology and for parents to receive information. The primary objective of this project was to develop a 3D parent education toolkit for use during antenatal consultations consisting of virtual and physical models of TTTS. The 3D model was created based on fetal MRI data (COMIRB Secondary Use #18-1955), which was segmented on 3D Slicer then imported onto Blender for further modeling. The model was published onto the virtual interface Sketchfab, and 3D-printed using the Formlabs Form 2 SLA printer. The secondary aim of this study was to assess usability of the resource among providers at the CFCC. Physician needs, behaviors, and attitudes surrounding the toolkit were identified through video-recorded interviews and counseling simulations (COMIRB Exempt #19-0188). Inductive thematic analysis of their responses revealed that while both the virtual and 3D-printed models increased provider efficiency, contained relevant anatomy, and could potentially convey information to parents, the virtual model had higher perceived usability due to ease of integration into usual practice. The TTTS toolkit has the potential to improve parents' experience by increasing knowledge and engaging them in the intervention planning required to optimize fetal outcomes. Further investigation is planned to determine the efficacy of the toolkit as an educational resource.



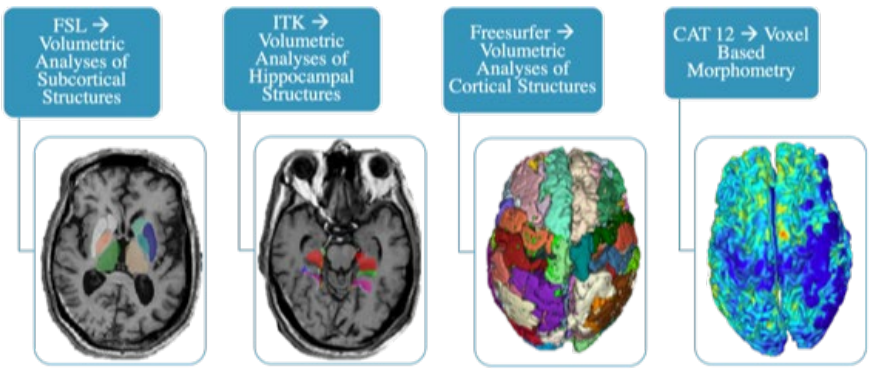


Poster #15 Athena Clemens

Impact of Deep Brain Stimulation of the Subthalamic Nucleus on Neuropsychological Outcomes and Voxel-Based-Morphometric-Analyses in Parkinson's Disease Patients

Capstone Committee: Maureen Stabio (chair), John Thompson (mentor), Thomas Wodushek

ABSTRACT:
Parkinson's Disease (PD) is a movement disorder that is characterized by tremor, rigidity, and bradykinesia, due to significant cell-death of the dopaminergic neurons in the substantia nigra (Jankovic, 2008). Deep brain stimulation (DBS) is a surgical intervention used to treat PD patients in which stimulating electrodes are placed bilaterally, most often in the subthalamic nucleus (STN) (Volkmann, 2004). This procedure can alleviate some of the motor symptoms associated with PD (Anderson, Beecher, & Ba, 2017; Tröster, 2017). Historically, the majority of clinical research on STN-DBS has focused on motor outcomes; fewer studies have explored its effect on post-surgical cognitive and memory outcomes (A Funkiewiez, C Ardouin, E Caputo, P Krack, V Fraix, H Klinger, S Chabardes, K Foote, A-L Benabid, 2004; Geevarghese et al., 2016). Moreover, the relationship between cognitive outcomes and neuroanatomical changes in PD patients with STN-DBS is unknown. The goal of this study was to correlate pre- and post-surgical memory and cognitive neuropsychological outcomes with volumes of relevant neuroanatomical structures before and after DBS intervention. Ten patients met inclusion criteria for this Colorado Multiple Institutional Review Board (COMIRB) approved study (COMIRB 16-1060). Voxel-based-morphometry and segmentations of T1-weighted MR were used to assess whether volumes of cortical and subcortical structures correlated with post-surgical changes in performance on standard neuropsychological exams including: California Verbal Learning Test 2nd edition (CVLT-II); Brief Visuospatial Memory Test – Revised (BVMT-R); Controlled Oral Word Association Test (COWA); and Animal Naming Test (ANT). The present analyses found significant post-surgical decreases in raw scores for ANT, CVLT-II List Learning Total Free Recall (Learning Trials 1-5), and CVLT-II List Learning Delayed Free Recall. Strong correlations were observed between percent change in these neuropsychological measures and several pre-surgical structure volumes. This study better characterizes neuroanatomical and neurofunctional changes that occur with STN-DBS in a small cohort. The clinical relevance of this study lies in its potential to impact clinical care and outcomes via enhanced screening and patient advising. Future studies on larger samples may lead to strong predictive measures which allow physicians to better screen for patients who will benefit most from STN-DBS surgery based on both neuropsychological and neuroanatomical pre-testing.

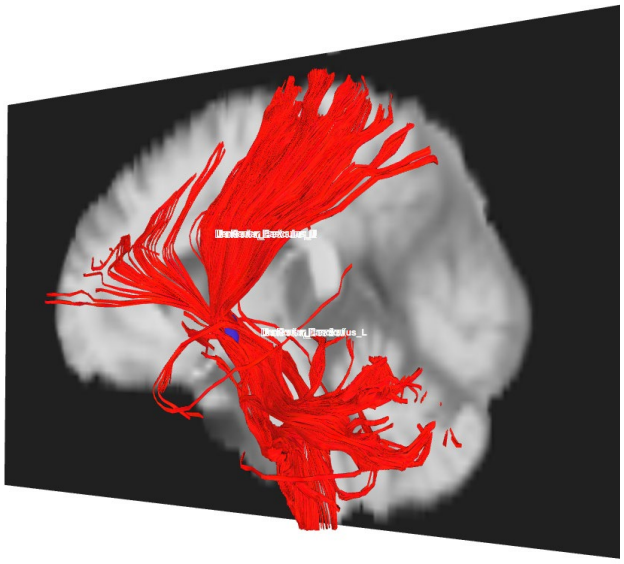


Poster #16 Nathan Davis

Correlation between local field potential activity and myelin changes in the lenticular fasciculus and subthalamic nucleus using diffusion tensor imaging in Parkinson's disease patients

Capstone Committee: Ernesto Salcedo (chair), John Thompson (mentor), Drew Kern

ABSTRACT:
Parkinson's disease (PD) is a neurodegenerative disease characterized by motor impairments. Abnormal oscillatory patterns in the beta frequency recorded from the basal ganglia have recently been linked to pathophysiology of patients with Parkinson's disease1–3. Additionally, patients with PD have increased myelin compared to age matched controls4 and the level of myelin pathology correlates with disease severity4. However, there has been no research examining the relationship between the changes in oscillations and myelin seen in patients with PD. The objective of the current study is to use Diffusion Tensor Imaging (DTI) to investigate whether there is a correlation in the change in oscillations seen in PD patients with the observed myelin pathologies. We hypothesized that the underlying myelin pathology damages the circuit and leads to the increased oscillatory power. This increased beta oscillatory power in areas of the STN would be correlated with regions that show myelin pathology characteristic of PD. Additionally, we predicted that an increase in myelin pathology would correlate with an increase in disease severity. Patients (n=8) with deep brain stimulation (DBS) electrodes implanted had pre-operative DTI imaging performed. Using DSI studio, white matter tracts intersecting with the LF and STN were extracted and saved along with their parameters. Local field potentials (LFPs) were measured during implantation of the electrode. MATLAB was used to analyze the fractional anisotropy (FA) and axial diffusivity (AD) of each tract, graph a representation of each tract, compare to other tracks and, correlate parameter measures with LFPs. The results of this study showed that FA and AD parameters were significantly different between hemispheres. We also show that FA values correlate with both Low and High Beta wave oscillations significantly for the left STNs of all patients combined. Additionally, we observed the High Beta waves significantly correlated with AD values for the right STNs of all patients combined.



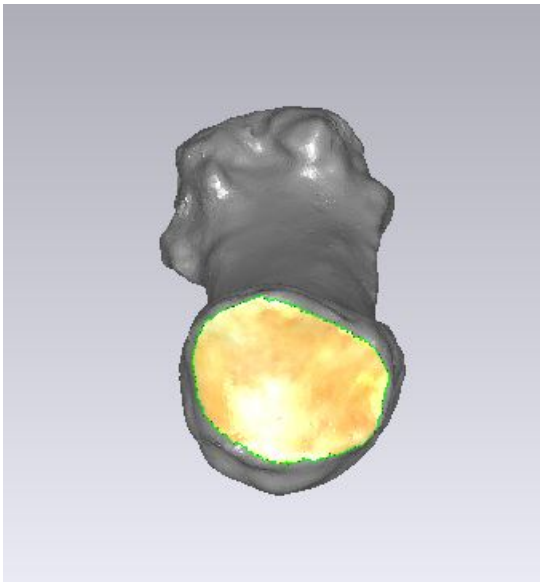
Poster #17 Ritesh Kashyap

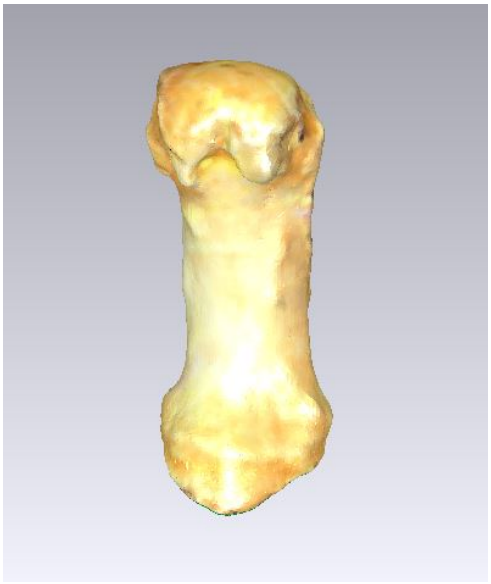
Clinical

Sexual Dimorphism and the Scaling of Intrinsic Thumb Muscle Physiological Cross-Sectional Area and Trapeziometacarpal Joint Size

Capstone Committee: John Thompson (chair), Caley Orr (mentor), Jamie Hodgkins

ABSTRACT:
The thumb is a common site for the development of osteoarthritis (OA) and studies show that there is greater prevalence of OA of the thumb joint in women. While a number of explanations have been proposed, the mechanism underlying the sex distribution of OA remains unknown. One possible contributing factor is the generally smaller size of females. Given constraints on size at the trapeziometacarpal (TMC) joint (which is locked into the wrist complex), it is possible that stress (force per unit area) tends to be greater in smaller individuals. This may lead to quicker progression of the degenerative processes characteristic of OA. However, increased stress requires a similar muscle force acting on a relatively smaller joint, and this might be the case if females must maintain a minimum level of grip strength for day-to-day function. Thus, we hypothesize that females have higher TMC joint stress due to scaling constraints (small joint surfaces with relatively large muscles). To test this hypothesis, cadaveric samples from the University of Colorado School of Medicine were used to measure the physiological cross-sectional area (PCSA) of intrinsic thumb muscles and scaled against the surface area of the TMC joint. Data from this study shows that females tend to have lower total intrinsic thumb muscle PCSA compared to males, and a smaller overall area of the TMC joint surface. Most importantly, the proxy for maximal potential stress (PCSA/mm2) was in fact lower in females than males, which does not support the hypothesis. This suggests factors other than biomechanical stress as a majority factor in the prevalence of OA in females. This study may provide a foundation for future research into methods of preventing OA.





Poster #18 Brian Kelly

Efficacy of Virtual Reality Training for Physical Therapy Students

Capstone Committee: Ernesto Salcedo (chair), Janet Corral (mentor), Dana Judd

ABSTRACT:
The goal of this project was to develop a virtual reality (VR) training simulation for physical therapy (PT) students to gain foundational movement analysis skills before interacting with role-playing scenarios with medical actors (also called standardized patients (SPs)). Reference videos of physical therapy faculty performing several common sit-to-stand transfer errors were recorded and sent to a 3D artist. The artist recreated these movements as animations with a realistic human model. A VR scene was created, utilizing a realistic gymnasium asset that was found online which the human model was implemented into. This way, the PT student would have exposure to working in a PT-style clinic. The VR training module was designed so that the PT student could select each sit-to-stand animation from a menu and apply it to three different styles of models: a fully clothed female, a male wearing boxer—briefs, and a male with no skin showing all the underlying musculature. Initially, the goal of this study was to test PT students with a standardized assessment using either the VR training module or a role-playing exercise with PT faculty. Due to time constraints, the VR training module was demonstrated to graduate anatomy students and staffed, who took a pre-VR and post-VR survey. Results from the survey showed that students and faculty transitioned from an initial impression that VR would not be beneficial in PT curriculum to a final impression that VR would be very beneficial in PT curriculum.

Poster #19 Mark Malham

Comparable CT segmented models used in preoperative surgical planning after minimizing the number of slices

Capstone Committee: John Thompson (chair), Mark Erickson (mentor), Jennifer Wagner

ABSTRACT:
Computed tomography (CT) imaging and 3D modeling is often used to plan orthopedic surgeries due to the high contrast of bony structure, ease of segmentation and speed of image acquisition. However, there is a persisting concern regarding the potential long-term effects of ionizing radiation from CT scans, particularly when repeated imaging is required in infants and young children. This retrospective study aims to assess the potential to model a spinal column using additive manufacturing after increasing the pitch (slice spacing) in CT imaging in patients that underwent corrective surgery for scoliosis at Children's Hospital Colorado. CT DICOM files were loaded into MATLAB to increase pitch by eliminating every other acquisition (Low-resolution, LR). LR DICOM files, as well as the original full-sample DICOM files (High-resolution, HR), were then loaded into 3D Slicer, an open source software platform for medical image processing. HR and LR spinal models were generated and analyzed for volume and surface area. SPSS was subsequently used to compare these values using paired samples t-tests. No significant difference was observed between HR and LR for volume ($p = 0.66$) and surface area ($p = 0.64$). Future studies should investigate whether these down-sampled LR models are statistically similar to real-time down-sampling of CT data sets in order to limit the exposure to radiation for this pediatric population.

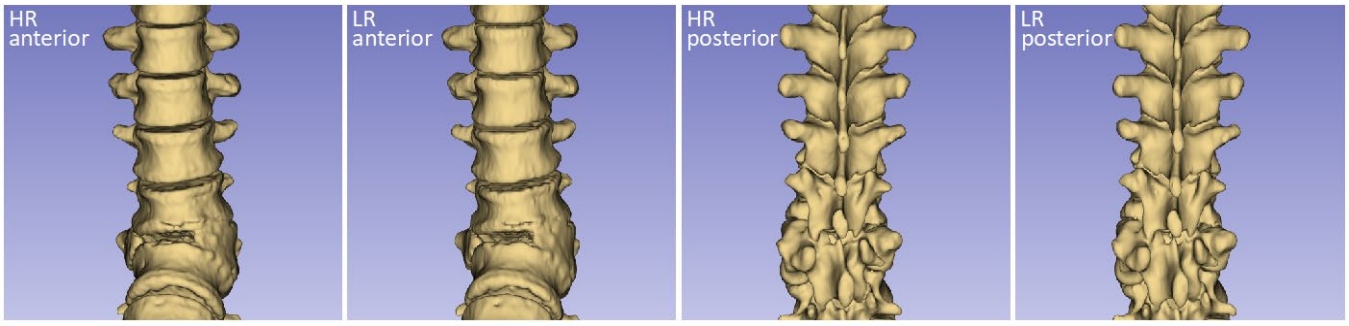


Figure 1. Comparison of High-resolution to Low-resolution models of one participant's spinal column (T9 – L1)

Poster #20 Daniel Marchetti

Quantitative and Qualitative Orthopaedic Shoulder Anatomy: An iBook Review Tool

Capstone Committee: Caley Orr (chair), Travis Turnbull (mentor), Charlie Lockwood

ABSTRACT:

BACKGROUND: In a technologically advancing and ever-changing medical field, new and improved methods of learning and reviewing anatomy is necessary. An iBook anatomical resource may prove to be an efficient and beneficial tool for orthopaedic residents during preoperative planning. Ultimately, a better understanding of the shoulder's anatomy by orthopedic residents may lead to superior surgical outcomes and establish a stronger anatomical foundation that will be utilized throughout their career.

METHODS: Ten nonpaired fresh-frozen human cadaveric shoulders (mean age 52 years, range 33-64 years) were included. A 3-dimensional coordinate measuring device was used to quantify the location of pertinent bony landmarks and soft tissue attachment areas. Coordinates of points along the perimeters of attachment sites were used to calculate areas, whereas coordinates of center points were used to determine distances between surgically relevant attachment sites and pertinent bony landmarks. Apple Books/iBook (Apple Inc., Cupertino, CA) was used as the platform to create a digital anatomical resource. Information was presented in four different sections: bony anatomy/osteology, static stabilizers, dynamic stabilizers, and neurovascular structures. The Shoulder Anatomy iBook was distributed, along with a follow-up survey, to orthopaedic residents around the country. The survey aimed to understand the degree to which orthopaedic residents found the iBook favorable, engaging, and relevant to their duties

RESULTS: ShapeConsistent, quantifiable measurements and 3-D relationships of ligaments, tendons, nerves, and bony landmarks of the shoulder were observed. The iBook was successfully created incorporating processed data and photographic images taken during dissection and Romer Arm data collection. A total of 27 participants (including 9 residents) reviewed the Shoulder Anatomy iBook and responded to the accompanying survey. For all 12 Likert-scale questions, "strongly agree" was always the most common answer choice (48-89%), whereas "disagree" or "strongly disagree" were never chosen (0%). All residents (n=9) found the iBook relevant to their duties and surgically useful. Reported strengths by residents included "images of gross anatomical dissections, video of rotator cuff motion, simplicity, ease of access, and rapid reference to detailed anatomical information".

CONCLUSIONS: Consistent relations and quantifiable measurements were observed across all cadaveric specimens. The iBook was perceived as favorable, engaging, and a relevant way to review orthopaedic shoulder anatomy according to participant feedback. All residents (n=9) stated that they would consult the Shoulder Anatomy iBook during preoperative planning.

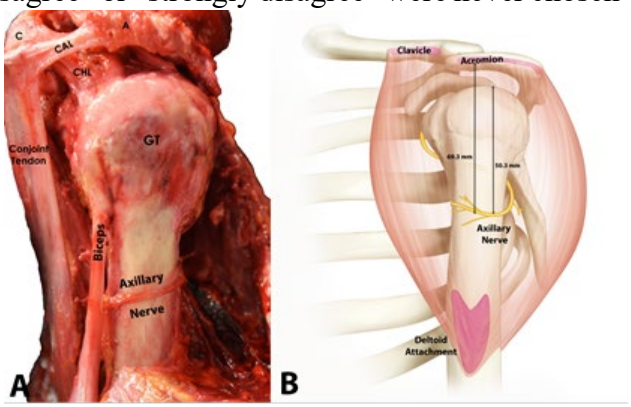


Figure 2. A) Dissected left cadaveric shoulder and **B)** graphic illustration of the axillary nerve in relation to other important landmarks. (A, acromion; C, coracoid; CAL, coracoacromial ligament; CHL, coracohumeral ligament; GT, greater tubercle. The axillary nerve was found to be 69.3 mm inferior to the lateral aspect of the acromion.

Poster #21 Leandra Nikont

Tackling the Most Prevalent Disease in the United States: Development and Assessment of an Educational Module to Emphasize the Similarities and Differences between Osteoarthritis and Rheumatoid Arthritis

Capstone Committee: Caley Orr (chair), Karen King (mentor), Jennifer Stratford

ABSTRACT:
The aim of this project is to increase awareness of differences between rheumatoid arthritis and osteoarthritis from an anatomical standpoint. The most prevalent disabilities affecting middle-aged and older adults cause mobility impairments—mainly due to arthritis1,2. At a symposium on arthritis held by the American Journal of Nursing, it was concluded that the top barrier in the limitation of arthritis understanding was patients and providers needing access to educational tools to spread awareness of the disease and target misconceptions3. To increase awareness of anatomical effects of arthritis, educational modules were created in Articulate Storyline 360 describing Knee Anatomy, Effects of Osteoarthritis, and Effects of Rheumatoid Arthritis. It was hypothesized that an interactive 3D model of the anatomical structures rather than a 2D picture would emphasize the understanding of the information. The model was based on the picture and constructed with Meshmixer and Sketchfab. Multiple-choice quizzes were created to measure efficiency of the educational modules and ANOVA analyses provided evidence that the quizzes were equally difficult and effectively tested participants' knowledge before and after using the modules. Pre-quiz scores were directly proportional to participants' level of science education while neither age nor overall education level affected pre- or post-quiz scores. Participants who used the module including the picture produced significantly better post-quiz results. It may be possible that the model was an unnecessary distraction—future studies utilizing these methods to educate individuals on other disorders would aid in the understanding of how interactive models inhibit or benefit the learning process.

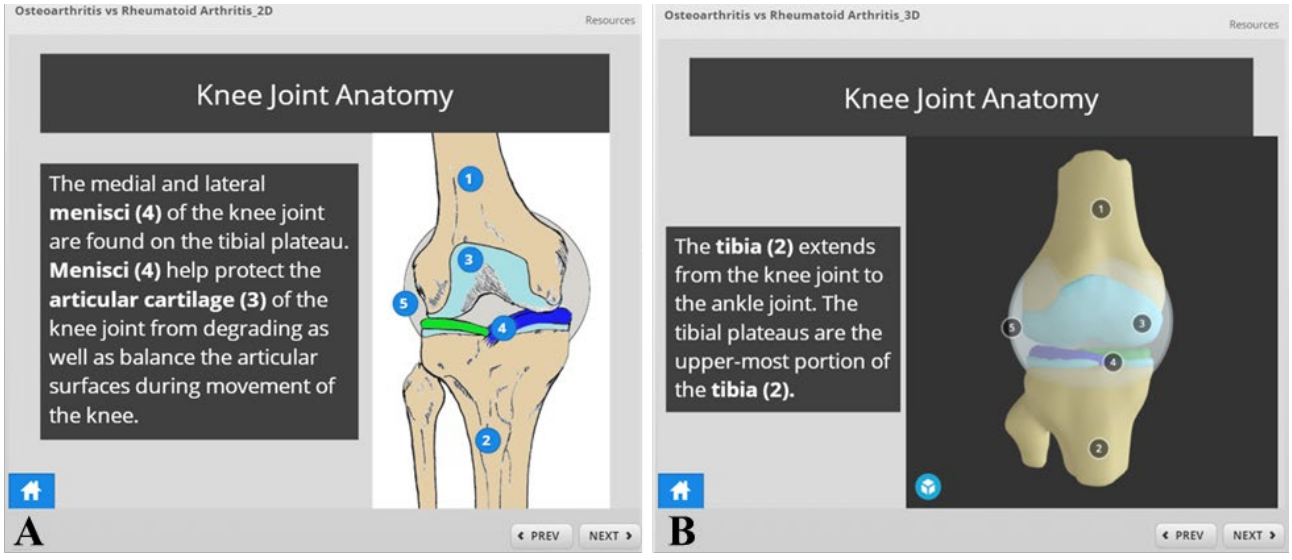


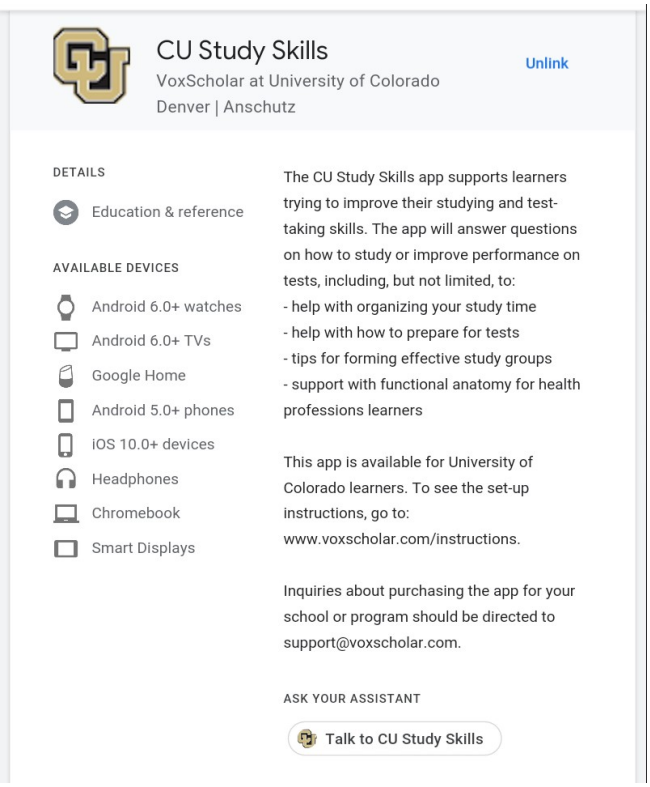
Figure 1: Example slides from the educational modules. **(A)** Experimental version including the 2D picture. **(B)** Experimental version including the 3D model.

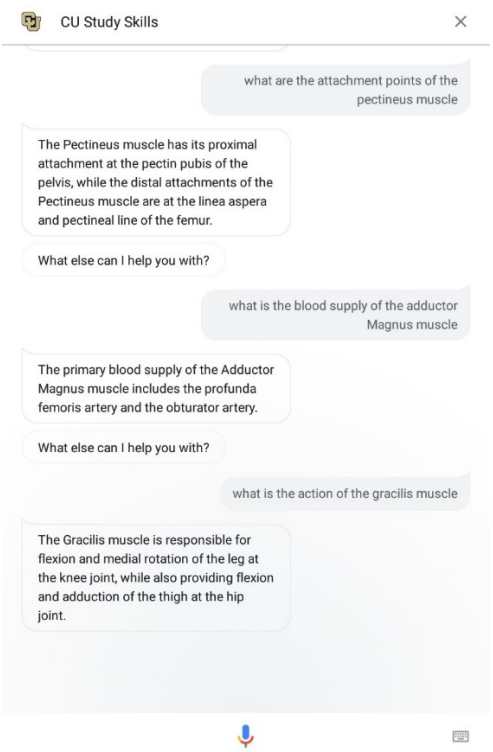
Poster #22 Natasha Rousseau

Investigating the Impact of the Voice-Activated Chatbot Application for Study Skills on Student Usability in Physical Therapy Anatomy Application

Capstone Committee: Mike Pascoe (chair), Janet Corral (mentor), Amy McDevitt, Dana Judd

ABSTRACT:
The purpose of this investigation was to determine students' usage of an educational chatbot to study anatomy and physical therapy examination skills in their courses compared to a traditional method of study in the form of a paper-based review guide. Chatbots are computer-based programs that dialogue with users to answer basic questions. As many students are immersed in technology through personal use or through their education program, the hypothesis was that a chatbot with the capability to dynamically respond to specific questions would be a preferred method over a static PDF review guide. The chatbot content developed for this study included anatomy and physical therapy-specific content; the same material was delivered as a review guide for the comparison group of students. Usage was measured through the use of surveys. Survey data demonstrated a statistical significance in the respondents' answers between the learning modalities in the areas of relevance and detail of study skills and anatomy content. While the review guide was reported as providing more relevant study skills and anatomy content, the chatbot was reported as requiring frequent rephrasing of the user questions to obtain similar relevant content. These results demonstrated the following: users be taught how to best utilize the chatbot through training, the quality of the chatbot content should be expanded, and the natural language processing ability of the chatbot assessed further. A significant implication of this study is that educators should consider human centered design when developing educational innovations for student use.





Poster #23 Meredith Ware

Clinical

Pancreatic fat is not related to PCOS status in obese adolescents but is related to prolonged hyperinsulinemia

Capstone Committee: John Caldwell (chair), Jill Karr (mentor), Melanie Cree-Green

ABSTRACT:
Background: Obese adolescent girls with polycystic ovarian syndrome (PCOS) have increased cardiometabolic disease including insulin resistance (IR), dysglycemia, and hepatic steatosis. Excess pancreatic fat (PF) is hypothesized to disturb pancreatic hormone secretion and contribute to the development of dysglycemia, and may relate to excess hepatic fat (HF). The association between PF and IR, dysglycemia, or HF has not been measured in adolescents with PCOS.

Methods: Secondary analysis included data from 65 sedentary adolescent girls (15.3 ± 1.9 years of age) with and without PCOS and BMI ≥ 90th percentile, who were enrolled in 3 different cross-sectional studies. Participants underwent fasting laboratory tests, a 2-hour 75-gram oral glucose tolerance test (OGTT), and an abdominal MRI to quantify PF and HF via proton density fat fraction six-echo Dixon methodology. Participants were categorized by PF, either above or below the median PF of 3.1% [High PF, n = 32, 4.4(3.9,5.1) and Low PF, n = 33, 2.2(1.7,2.7)]. Group differences and associations between PF and HF and glucose dynamic were performed.

Results: PF did not differ by PCOS diagnosis ($p = 0.36$) and there was no relationship between PF and serum androgens ($r = 0.13$, $p = 0.29$). Whereas the High PF group had significantly more HF [6.1(3.5,10)% High vs 3.9(2.6,4.9)% Low, $p < 0.01$], individual PF and HF did not correlate ($r = 0.23$, $p = 0.07$). During fasting, there was no difference in insulin sensitivity (HOMA-IR, $p = 0.11$), although there was more impaired fasting glucose in the High PF group (14% vs 0%; $p = 0.04$). High PF had higher insulin concentrations at 2 hours post-OGTT ($p = 0.02$).

Conclusions: Neither PCOS status nor androgens relate to higher PF. Similar to other at-risk populations, excess PF is associated with dysglycemia and IR. Future studies should be directed toward identifying methods to reduce PF in obese adolescents to prevent the progression of dysglycemia in this population.

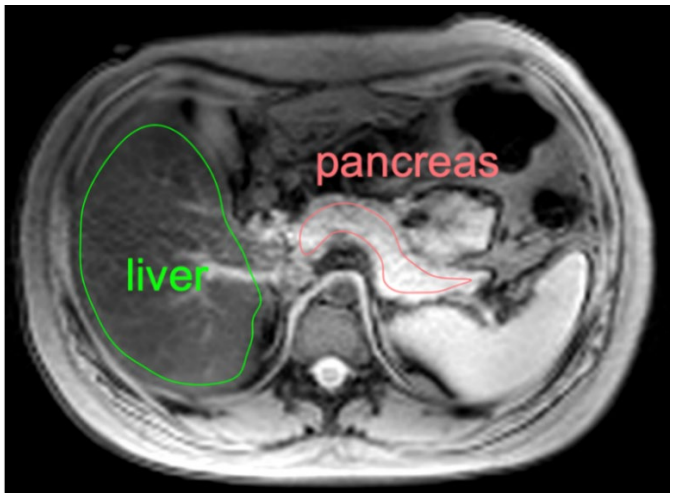


Figure 1. Proton density fat fraction Dixon method to measure fat content in the liver and pancreas.

Poster #24 Yannick Dzowo

Quantification and Characterization of Taste Cells in Mice Circumvallate Taste Buds

Capstone Committee: John Caldwell (chair), Thomas Finger (mentor), Robert Lasher

ABSTRACT:
Taste buds in mice encompass four types of taste cells: 3 elongate types: type I, type II, type III; and basally-situated post-mitotic cells (type IV). The bud is surrounded by edge and non-taste epithelial cells while progenitor cells lie outside of the taste bud along the basement membrane. Taste cells have several characteristics which are used to divide them into different types. Type I cells are characterized by an indented and elongated nucleus with invaginations, folded membrane, and distinctive apical microvilli (short and tall) in the taste pore. Type II cells are spindle-shaped and characterized by a large round or oval nucleus, a single apical microvillus, which extends through the taste pore, and specialized "atypical" mitochondria at functional points of contact with nerve fibers. Type III cells are slender and characterized by a single apical microvillus extending through the taste pore, an elongate, indented nucleus and synaptic vesicles gathered at points of contact with nerve fibers. Type IV cells (non-proliferative "basal cells") have a nucleus in the lower third of the taste bud, do not extend to the taste pore, and although irregularly shaped, are elongated in the axis of the taste bud, with a foot processes extending to the basement membrane. Based on these characteristics, we used the series images of taste buds created by serial block-face SEM to quantify the percentage of the different cell types in 4 taste buds. Type I cells represent just over 50% of the overall cell counts, whereas type II, type III, and basal cells represent 19%, 15%, and 13% respectively. In summary, use of 3D Reconstruct software to analyze these serial images has allowed us to attain accurate quantifications and morphological descriptions of taste cell types in circumvallate taste buds.