Virtual Neuroanatomy (86-713)
Tuesdays & Thursdays, 3-4:20pm
Baker Hall 332P

Instructor
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Office Hours: Thursday 2pm or by appt. (email to schedule), Baker Hall 340U.

Course Website: http://www.cmu.edu/blackboard (listed as course 86-713).

Text & Reading Materials

- An atlas of the human brain. A set of these are available to check out as part of the course. Limited to 1 week check out per student. A list of recommended atlases is presented below for those students wishing to purchase their own.
- Supplemental readings will be provided via the course blackboard site throughout the semester.

Recommended Textbooks

- The Human Central Nervous System: A Synopsis and Atlas. Rudolf Nieuwenhuys , Jan Voogd, Christiaan van Huijzen. Steinkopff; 4th edition (November 13, 2007)
- The Brain Atlas: A Visual Guide to the Human Central Nervous System. Thomas A. Woolsey, Joseph Hanaway, Mokhtar H. Gado. Wiley-Liss; 3 edition (December 10, 2007)
- Atlas of Human Brain Connections. Marco Catani, Michel Thiebaut de Schotten. Oxford University Press; 1 edition (September 7, 2012)
- The Human Brain: An Introduction to Its Functional Anatomy. John Nolte. Mosby; 5 edition (January 15, 2002)

Required Software

- DSIStudio: http://dsi-studio.labsolver.org/

Recommended Software

- Some exposure to Matlab may be necessary for certain assignments but proficiency in Matlab is not required

Course Overview:
This course will explore the macroscopic organization of the human brain by combining "virtual dissections" of white matter pathways (fiber tractography on diffusion weighted imaging data) with meta-analytic databases of brain-behavior relationships (e.g., www.neurosynth.org) and reviews of functional neuroanatomy texts. Through hands-on data analysis and literature reviews, students will acquire the necessary skills for exploring neuroanatomical connectivity *in vivo*, using diffusion weighted imaging, as well as learn basic principles of functional organization in the brain.

Learning Objectives:
This course is primarily designed to introduce basic neuroanatomy of the macroscopic human brain (primarily white matter pathways) and provide you with an in-depth exposure to fiber tractography using diffusion weighted imaging.

Successfully meeting the objectives of this course will allow you to:

1) Gain a fundamental understanding of the macroscopic organization of the human brain.
2) Have a working knowledge of how specific white matter pathways and gray matter structures are associated with specific cognitive functions.
3) Know the basic physical and physiological principles behind diffusion weighted imaging.
4) Know how to perform fiber tractography as a "virtual dissection" on white matter pathways.

Requirements:
Prerequisite Knowledge: An introductory course in neuroscience or a basic understanding of the human brain (e.g., knowing what neurons are, knowing basic neuroanatomical directions, knowing what sulci & gyri are). Existing knowledge of neuroanatomy is not required.

Readings: Readings will be a mixture of original articles and chapters from the neuroanatomy textbooks. Since such a large part of the grade will be based on in-class discussions it is important that you keep up with the readings.

Grading: Your final grade will be based on the assessments listed below. Percentages show the contribution of each evaluation step to the final grade.

> Attendance & Participation (25%): A large part of this course will involve in-class assignments and discussions. You will be graded on your participation in class activities and discussions, as well as attendance. *Baring exceptional circumstances that are discussed with me in person*, missing more than 3 classes will result in a 0% grade for Attendance & Participation.
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> Homework (25%): Throughout the course there will be brief homework assignments. These can vary from short reports (<300 words) to project-oriented tractography assignments. These assignments are designed to take no more than one hour to complete.
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> Final Presentation (50%): Each student will be required to present on one neuroanatomical system as part of the class. This will either be done individually or as part of a team depending on class size. This presentation will take place across two back-to-back classes. In the first class you will provide a formal presentation on the organization and function of the pathway of interest (Overview class). In the second class, you walk the class through tracking the sections and sub-sections of your pathway using one of the diffusion weighted imaging templates provided by the instructor (Tractography class). As the presenter you will be asked to submit your best tractography examples in order to the instructor as part of this assignment.

Code of Conduct: By enrolling this course, you agree to abide by the following codes of conduct.

Cheating & Plagiarism: Cheating and plagiarism are defined in the CMU Student Handbook, and include (1) submitting work that is not your own for papers, assignments, or exams; (2) copying ideas, words, or graphics from a published or unpublished source without appropriate citation; (3) submitting or using falsified data; and (4) submitting the same work for credit in two courses without prior consent of both instructors. Any student who is found cheating or plagiarizing on any work for this course will receive a failing grade for that work. Further action may be taken, including a report to the dean.

Human Participant Protection. The CMU Institutional Review Board requires everyone who conducts research with human participants to complete the NIH on-line training course entitled, "Human participant protections education for research teams" (http://cme.nci.nih.gov/). You must complete the course prior to collecting data from anyone besides yourself. The online "course" will take approximately 30 – 45 minutes to complete. After you have successfully completed the course, print one certificate for your files and hand in a second one during class. This must be completed no later than the second week of class.

Equal Opportunity Accommodations. All efforts will be made to minimize conflict with students' religious schedules (e.g., holidays, prayer services, etc.) and/or any disabilities. Students should consult with the Equal Opportunity Services (EOS) office *at the beginning of the semester* in order to setup any necessary accommodations for the class.

Course Schedule: The proposed schedule of the course topics is listed on the following page. This is schedule subject to change at any time throughout the course. The class will be notified changes at least 24hrs before the affected class

Class #	Date	Topic
1	**8/26/14**	Introduction to Virtually Navigating the Human Brain
2	**8/28/14**	Physics & Physiology of Diffusion Weighted Imaging
3	**9/2/14**	From K-space and Q-space to Brain-Space
4	**9/4/14**	Basic Principles of Fiber Tractography
5	**9/9/14**	Applied Tractography (part 1)
6	**9/11/14**	Applied Tractography (part 2)
7	**9/16/14**	Applied Tractography (part 3)
8	**9/18/14**	Applied Tractography (part 4)
9	**9/23/14**	Basic Assembly of a Human Brain Atlas
10	**9/25/14**	Corticostriatal Pathways: Overview (Tim)
11	**9/30/14**	Corticostriatal Pathways: Tractography (Tim)
12	**10/2/14**	Corona Radiata: Overview (Sarah)
13	**10/7/14**	Corona Radiata: Tractography (Sarah)
14	**10/9/14**	***No Class***
15	**10/14/14**	Cerebellar Peduncles: Overview (Travis)
16	**10/16/14**	Cerebellar Peduncles: Tractography (Travis)
17	**10/21/14**	Fornix & Stria Terminalis: Overview (Layla)
18	**10/23/14**	Fornix & Stria Terminalis: Tractography (Layla)
19	**10/28/14**	Arcuate Fasiculus: Overview (Lauren)
20	**10/30/14**	Arcuate Fasiculus: Tractography (Lauren)
21	**11/4/14**	Uncinate fasiculus: Overview (Jessica)
22	**11/6/14**	Uncinate fasiculus: Tractography (Jessica)
23	**11/11/14**	IFOF: Overview (Manon)
24	**11/13/14**	IFOF: Tractography (Manon)
25	**11/18/14**	***No Class (SFN Conference)***
26	**11/20/14**	ILF: Overview (Charlie)
27	**11/25/14**	ILF: Tractography (Charlie)
28	**11/27/14**	***No Class (Thanksgiving Break)***
29	**12/2/14**	Cingulum: Overview (Ruben)
30	**12/4/14**	Cingulum: Tractography (Ruben)