Neuroscience Methodology: A Cellular Approach to Cognition
Fall 2016
Tuesdays and Fridays: 10:05-11:25
Classroom: N7-C25

Related Disciplines: Biology, Biomedicine, Neuroscience, Psychology, Premedicine
Pre-Requisites: One year of biology and one year of chemistry at the university level.
(Note: One semester of chemistry can be substituted with one semester of an Introductory Neuroscience Course)

Instructors

Bettina Hornbøll (BEH), MSc
Founder of CogniCation; cognitive communication. PhD-fellow in neurobiology doing imaging of the effect of serotonin during emotion processing in the brain, while challenging participant’s natural serotonergic levels. The project has been conducted at Danish Research Center for Magnetic Resonance (DRCMR) and Center for Integrated Molecular Brain Imaging (CIMBI). M.Sc. Neurobiology (University of Copenhagen, 2006). B.A. Biology (University of Copenhagen, 2004). With DIS since 2012.

Julian Macoveanu (JM), PhD
Senior Researcher at Mental Health Center Copenhagen. He has long experience with neuroscientific methods for imaging the brain’s structure and function and has conducted numerous neuroimaging studies in both healthy and depressed individuals using functional MRI. MSc in Biochemistry from Stockholm University 2002, PhD in Neuroscience from Karolinska Institute, Stockholm, 2006. With DIS since 2013.

DIS Contacts
Lisbeth Borbye, Program Director
Susana Dietrich, Assistant Program Director
Victoria Stepanova, Science & Health Program Assistant
Science and Health Programs Office: Vestergade 10-B12
**Course Description**

This course aims to provide students with an overview of the most commonly employed neuroscientific techniques to study cognitive processes in both animal and human brain. The course will have a particular focus in explaining functional neuroimaging methods like MRI and PET, two techniques that have received the most attention when studying cognitive processes in humans. Neuroscientific techniques will be introduced by providing a thorough theoretical background as well as by using practical examples from selected scientific studies.

Furthermore, the relationships between the use of animal and human models will be explored in order to understand how the use of animal models can affect the design of human models.

Through reviews of academic journal publications covering selected neuroscience methods, students will gain a comprehensive understanding of the significance that neuroscience techniques play in current and future research. Additional course discussion topics will include, but are not limited to: the principles of experimental design, statistical analysis and interpretation. An explorative lab field study will be included.

**Learning Objectives**

Upon completion of the course students will be able to:

- Explain how the brain functions in general terms, from neurons to brain systems
- Understand the background with hypothesis and choice of neuroscientific technique as well as results interpretation and validity for a neuroscience project
- Understand the methodological differences as well as advantages and disadvantages of the learned techniques.
- Evaluate scientific neuroscience literature, in regards to methods used

**Approach to Teaching**

The course will be taught with a dynamic where the students are expected to participate in an interactive way, by contributing with questions, opinions, and explanations.

**Course Components**

**Expectations of Students & Code of Conduct**

- Laptops are not allowed to be open in the classroom unless agreed upon for specified tasks such as article reading and or for discussion purposes (Tasks will be agreed upon in each class)
- Reading must be done prior to the class session
- Since class participation is a major component of the course, you will need to be present and participating to receive full credit. Your grade will be deducted for unexcused absences and lack of participation. And remember to be in class on time!
- Classroom etiquette includes being respectful of one another’s opinions, listening to others and entering a dialogue in a constructive manner

**Policies**

- **Disability and Resource concerns:** Any student who has a need for accommodation based on the impact of a disability should contact Sean Green to coordinate this. In order to receive accommodations, students should inform the instructor of approved DIS accommodations within the first two weeks of classes.

- **Attendance:** You are expected to attend all DIS classes when scheduled. If you miss multiple classes the Director of Teaching and Learning, and the Director of Student Affairs will be notified and they will follow-up with you to make sure that all is well. Absences will jeopardize your grade and your standing at DIS. Allowances will be made in cases of illness, but in the case of multiple absences you will need to provide a doctor’s note.

- **Extensions:** There will be no extensions. Any exceptions must be accompanied by prior agreement with me. Late work will not be accepted. It will not be possible to make a do-over of any written assignments.
• **Academic Honesty: Plagiarism and Violating the Rules of an Assignment**

DIS expects that students abide by the highest standards of intellectual honesty in all academic work. DIS assumes that all students do their own work and credit all work or thought taken from others. Academic dishonesty will result in a final course grade of 'F' and can result in dismissal. The students' home universities will be notified. DIS reserves the right to request that written student assignments be turned in electronic form for submission to plagiarism detection software. See the Academic Handbook for more information, or ask your instructor if you have questions.

**Field Studies:**
Field studies serve to complement your course work by placing you in other contexts than class in order to compare, extend and rethink what has been (or will be) read and discussed in class.

**Field Study Dates:**
- **Wednesday, October 5th,** 8:30 – 12:30 See course schedule for more information
- **Wednesday, November 30th,** 13:00 – 17:00 See course schedule for more information

**Evaluations**

**Attendance & Participation**
Since class participation is a major component of the course, you will need to be present and actively participating to receive full credit.

**Group presentations**
Once during the semester each group will present one scientific article, employing a neuroscientific technique (see course schedule for literature), supply specific questions for another presenting group, and be opponent for a presenting group.

**Scientific methods paper**
Each student will write a 4-5 page review project, where methods, subjects, theory, and results are explained and supported through use of scientific literature.

**Exams**
There will be a midterm exam that covers all the theory up until that date. At the end of the semester there will be a cumulative final exam, covering the entire semester.

<table>
<thead>
<tr>
<th>Evaluation</th>
<th>Percentage</th>
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<tbody>
<tr>
<td>Attendance &amp; Participation</td>
<td>5%</td>
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<tr>
<td>Group presentation of research paper (Group grade)</td>
<td>10%</td>
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<td>Questions for group presentations</td>
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<td>Debate group for group presentation</td>
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<tr>
<td>Scientific methods paper</td>
<td>25%</td>
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<td>Written exams #1: October 21</td>
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<td>Written exams #2: December 2</td>
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<td>Oral Exam</td>
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<td><strong>Total</strong></td>
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To be eligible for a passing grade in this class you must complete all of the assigned work.
Required Texts
There will be readings from the following textbook: Ward, J. (2010). *The Student’s Guide to Cognitive Neuroscience 2nd Edition*, as well as peer reviewed scientific articles, all relating to the neuroscience methods covered in the course.

Canvas
Canvas is a web-based system that allows you to access course resources and communicate with your classmates and faculty. To access Canvas, you can go to the DIS homepage and click the ‘Canvas’ link on the bottom of the website, or go to: https://canvas.disabroad.org/login/canvas. You can also download the Canvas App (By: Instructure) on iPhone and Android mobile smart phones.

Recommended material
a) The app “iSurf Brainview Desktop” which can be downloaded for free from the apple app store has a general reference for brain structures and functions. Apple app store http://itunes.apple.com/us/genre/ios/id36?mt=8

b) http://www.thehumanbrain.info is a web page in relation to a book of the same name, and contains all kinds of interesting and useful information about the human brain.

Course schedule
Note: Schedule is subject to change if necessary with as much notice as possible.

<table>
<thead>
<tr>
<th>Day</th>
<th>Date</th>
<th>Lecturer</th>
<th>Topic</th>
<th>Reading</th>
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<tbody>
<tr>
<td>Class 1</td>
<td>Friday August 26</td>
<td>BEH + JM</td>
<td>Introduction to the class</td>
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<td>Groups for group presentation:</td>
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<td><strong>Group1:</strong> Cholinergic interneurons control local circuit activity and cocaine conditioning.</td>
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<td><strong>Group2:</strong> Epileptogenesis after cortical photothrombotic brain lesion in rats</td>
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<td><strong>Group3:</strong> Panic disorder and a possible treatment approach by means of high-frequency rTMS: a case report.</td>
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<td><strong>Group4:</strong> Frontolimbic Serotonin 2A Receptor Binding in Healthy Subjects Is Associated with Personality Risk Factors for Affective Disorder.</td>
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<td><strong>Group5:</strong> A neural marker of perceptual consciousness in infants</td>
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<td>Introduction to research paper</td>
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<td>Introduction to group presentations.</td>
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<tr>
<td>Class 5</td>
<td>Friday September 9</td>
<td>JM</td>
<td>Optogenetics</td>
<td>Fenno et al. The Development and Application of Optogenetics, Annual Reviews 2011 p384-412 Science Compendium #7, p. 75-98</td>
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</tbody>
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**Core Course Week September 12-17**


| FIELD STUDY | Wednesday October 5th 8:30-12:30 | BEH | TBA | |
| Long Study Tour / Break I October 8-16 | | | | |
| Class 12 | Tuesday October 18 | BEH + JM | Presentation of research paper
Work in class on paper
Q/A for midterm exam | Class rep. meeting
Covering classes 2-11 (Green classes)

Class 14 | Tuesday October 25 | BEH | Lesion studies |
<table>
<thead>
<tr>
<th>Class</th>
<th>Date</th>
<th>Topic</th>
<th>Method applied:</th>
<th>To be presented by group:</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>October 28</td>
<td></td>
<td></td>
<td><strong>Compendium #4, p. 53-63</strong></td>
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<td><strong>Group2</strong>: Presenting</td>
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<td><strong>Group3</strong>: Supply questions for presenting group to implement one week in advance</td>
<td><strong>Recommended readings:</strong></td>
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<td><strong>Compendium #5, p. 64-68</strong></td>
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<td>The rest of class will bring questions for presenting group.</td>
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<td>Long Study Tour/ Break II</td>
<td>October 29- November 6</td>
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<td>Class 16</td>
<td>Tuesday November 8</td>
<td>TMS Theory and application</td>
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<td>Class 17</td>
<td>Friday November 11</td>
<td>TMS Theory and application</td>
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**Recommended readings:**
**Compendium #2, p. 23-30**  
**Compendium #9, p. 107-113**  
**Compendium #10, p. 114-119**
### Class 18

**Tuesday November 15**

**BEH**

**Method applied:**

**PET (and SPECT)**

**Recommended reading:**


**Compendium #18, p. 201-209**

**Recommended reading:**


**Compendium #19, p. 210-234**

### Class 19

**Friday November 18**

**BEH**

**Method applied:**

**PET**

**Group4:** Presenting

**Group5:** Supply questions for presenting group to implement **one week in advance**

**Group1:** Opponents in class

The rest of class will bring questions for presenting group.

**To be presented by group:**


**Compendium #20, p. 235-242**

**Recommended readings:**


### Class 20

**Tuesday November 22**

**JM**

**EEG and MEG**

**To be presented by group:**


**Compendium #23, p. 305-310**

**Recommended readings:**


**Compendium #22, p. 292-304**

### Break III

**November 23-27**

### Class 21

**Tuesday November 29**

**JM + BEH**

**Method applied:**

**EEG and MEG**

**Group5:** Presenting

**Group1:** Supply questions for presenting group to implement **one week in advance**

**Group2:** Opponents in class

The rest of class will bring questions for presenting group.

**Wrap-up and Q/A for final exam**

**To be presented by group:**


**Compendium #23, p. 305-310**

**Recommended readings:**


**Compendium #22, p. 292-304**
<table>
<thead>
<tr>
<th>FIELD STUDY</th>
<th>Wednesday November 30th 13:00-17:00</th>
<th>JM</th>
<th>TBA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Class 22</td>
<td>Friday December 2</td>
<td>JM</td>
<td>Exam #2</td>
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<td>Covering classes 14-21 (Blue classes)</td>
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<tr>
<td>Class 23</td>
<td>Tuesday December 6</td>
<td>Elise</td>
<td>Ethics in research</td>
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<td>BEH + JM</td>
<td>Become familiar with the ethical theories on the following webpage: <a href="http://humanethics.prod2.imcms.net/">http://humanethics.prod2.imcms.net/</a></td>
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<td></td>
<td>TBA</td>
<td>JM+BEH</td>
<td>Final Oral Exam</td>
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<td>More information TBA</td>
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</table>

### Reference list

**BEH**


**JM**

