Neuroscience of Fear
Spring 2017
Days: Tuesday, Friday
Time: 11:40-13:00
Location: ST3-21

Instructor Information
Bettina Hornbøll
Founder of CogniCation; cognitive communication. PhD Candidate 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 from 2012.

Course Description
Humans share brain structures controlling the fear response with other mammals, birds, and reptiles. These structures have been evolutionarily preserved because fear helps protect us from danger, injury, and death. Although we are now further removed from the dangerous elements of nature, our primal fear instincts remain. We will examine the neurobiological, psychological as well as evolutionary aspects of the fear response, and consider how it ties into decision-making and our everyday lives. We will examine this set of issues from a multidisciplinary perspective, synthesizing recent work from the fields of biology, psychology, neuroscience and philosophy.

Prerequisites
One year of biology or one semester of Introduction to Neuroscience, Physiological Psychology or Biological Psychology at the university level.

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
Learning outcomes of the course
Upon completion of the course students will be able to:
• Explain functioning of the brain in general terms, in particular with respect to the fear system
• Describe several theories and concepts of emotion, especially fear
• Identify fear in an evolutionary, biological, philosophical and psychological sense
• Discuss the influence of fear in everyday life as well as how fear is a component of several common dysfunctional behaviors

Course Components
Field Study
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.

• Wednesday, February 22nd → 13:00-17:00, Please see course schedule for more details
• Wednesday, April 26th → 8:30-12:30, Please see course schedule for more details

Expectations of Students & Code of Conduct
• Laptops or other electronic devices are not allowed to be open, or used for note taking, in the classroom unless agreed upon for specified tasks.
• Reading must be done prior to the class session; as a huge part of the class is dependent on discussions in class, it is crucial for your learning to be prepared before each class.
• 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, as well as asking any questions you might have in regards to the material covered.

Policies
• Disability and Resource concerns: Any student who has a need for accommodation based on the impact of a disability should contact the Office of Academic Support 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 Office of Academic Support 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 rewrite or edit any written assignments after the deadline.

• 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.
### Assignments, Evaluation, and Grading

<table>
<thead>
<tr>
<th>Assignment</th>
<th>Weight</th>
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<tbody>
<tr>
<td>Engagement &amp; Participation</td>
<td>10%</td>
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<tr>
<td>Group presentation of research paper (Group grade)</td>
<td>15%</td>
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<tr>
<td>Research project: Written part</td>
<td>15%</td>
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<tr>
<td>Research project: Oral part</td>
<td>20%</td>
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<tr>
<td>Exams during the semester</td>
<td>15%</td>
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<tr>
<td>Exam #1: Tuesday, February 14 (10%)</td>
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<td>Exam #2: Friday, March 31 (10%)</td>
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<td>Exam #3: Friday, April 21 (20%)</td>
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<td><strong>Total</strong></td>
<td><strong>100%</strong></td>
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To be eligible for a passing grade in this class you must complete all of the assigned work.

### Approach to teaching

A big part of the class will be spend in small groups discussing the material. It is therefore crucial that students come prepared for class, in order to be able to contribute to both group debates, but also to class discussions. The students are expected to be engaged and participate in an interactive way, by contributing with questions, opinions, and explanations both in groups and in plenum.

### Engagement & Participation (10%)

You will need to be present and actively participating to receive full credit (see “Approach to teaching”). **Class engagement is to be understood as** critically evaluating: (a) the model/hypotheses suggested in readings, (b) asking relevant questions to get a broader knowledge of the material (c) being prepared for class and be ready to answer questions when asked (d) discussing implications as regards to practical application and/or future research considerations (e) hand in evaluations of reading material.

### Three exams throughout the semester (40%)

Throughout the semester there will be 3 exams, containing questions of multiple choice, short answer, and essay questions based on class readings, and discussions.

### Group presentation and discussion in class

The presentations should have a logical and clear structure, provide relevant background information, explain the methods used, present the original data in a clear and interesting way, briefly discuss the findings in relation to previous research, and state the conclusions and perspectives of the results. The background information should include a short introduction to fear in general and an overview of the research topic in question.

### Presentation (group grade – 15%)

Only to be made by the ONE group presenting

**Structure**
- Presentation in class
- Followed by a scientific discussion with the class after your presentation, where you will answer questions from the class related to your research paper

**Content**
- Present scientific article (see ‘course schedule’ to find the article you are presenting): Introduction, Background, Method, main findings/points of paper, conclusion.
- Implement your answers to questions from other group into the presentation.
- Why is this article important for this area of research?
- Relate the findings to the theme
- Why is this an important/interesting field of science?
- Manage scientific discussion.
Questions for presenting group (part of Presentation grade)
Each member of the group responsible for asking questions to the presenting group will upload a minimum of one question, **ONE WEEK in advance** of the group presentation. The questions should relate to the material presented by the group.

Debate group for group presentation (part of Presentation grade)
The debate group will be prepared to ask the presenting group questions about the presentation itself, about the paper being presented, or questions in general relating to the material being presented. It is important that the debate group is as prepared when they show up for class as the presenting group in order for a good discussion to be carried out.

<table>
<thead>
<tr>
<th>Presentation date</th>
<th>Presenting group</th>
<th>Question group</th>
<th>Debate group</th>
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<tbody>
<tr>
<td>Friday, February 24th</td>
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<tr>
<td>Tuesday, March 28th</td>
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<td>Tuesday, April 4th</td>
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<td>4</td>
<td>5</td>
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<td>Tuesday, April 11th</td>
<td>4</td>
<td>5</td>
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<tr>
<td>Tuesday, April 18th</td>
<td>5</td>
<td>1</td>
<td>2</td>
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**Research project**
The purpose of the research project is to give you experience and practice in doing research on a scientific concept/mechanism/disorder (mental/neurological) related to “Neuroscience of Fear” and communicating the information to a general audience (like yourselves). You have to find the appropriate literature and make scientific conclusions based on results of research projects. In a field of research it is important to not only being able to find valuable information, but also to communicate the findings. Therefore this project will combine these two challenges, by consisting of a written and an oral part.

**Written part (20%)**: Each student is to make a **review paper**, based on scientific articles on a topic, drawn from the **primary literature** (i.e., not review articles, Wikipedia, etc.).

**Oral part (15%)**: Based on the experience from group presentations in class during the semester, each student will present the main finding of their own research project in class.

**Required Texts**
We will primarily be using scientific articles combined with book chapters when appropriate. Most of the texts will be in the compendium all additional reading material will be made available on Canvas prior to class.

**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](https://canvas.disabroad.org/login/canvas). You can also download the Canvas App (By: Instructure) on iPhone and Android mobile smart phones.

**Recommended material**:
- **b)** [http://www.thehumanbrain.info](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 January 20</td>
<td>BEH</td>
<td><strong>Introduction to each other and the course</strong></td>
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<td><strong>Introduction to Research paper</strong></td>
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<td><strong>Introduction to group presentations</strong></td>
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<td><strong>Group 1</strong>: Neural correlates of using distancing to regulate emotional responses to social situations</td>
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<td><strong>Group 2</strong>: A Neural Biomarker of Psychological Vulnerability to Future Life Stress.</td>
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<td><strong>Group 3</strong>: A longitudinal investigation of posttraumatic stress and depressive symptoms over the course of the year following medical-surgical intensive care unit admission</td>
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<td><strong>Group 4</strong>: Some animal specific fears are more specific than others: Evidence from attention and emotion measures</td>
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<td><strong>Group 5</strong>: Acute pharmacologically induced shifts in serotonin availability abolish emotion-selective responses to negative face emotions in distinct brain networks.</td>
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<tr>
<td>Class</td>
<td>Date</td>
<td>BEH</td>
<td>Topic</td>
<td>Reading</td>
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**Core Course Week**
February 06-11
<table>
<thead>
<tr>
<th>Class 6</th>
<th>Tuesday</th>
<th>BEH</th>
<th>Exam #1: 30 min</th>
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<tbody>
<tr>
<td></td>
<td>February</td>
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<tr>
<td>14</td>
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<td>Emotional memory formation</td>
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<td>- Fear conditioning</td>
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<td>- Fear extinction</td>
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<td>- Startle response</td>
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<td>Introduction to part two of Research Paper</td>
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<td>Final definition of three sub-topics with choice of literature and introduction due TBA.</td>
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<td>Covering classes 1-5</td>
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<td>Recommended reading:</td>
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<tr>
<td>Class 7</td>
<td>Friday</td>
<td>BEH</td>
<td>Cellular and Molecular Neuroscience</td>
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<td></td>
<td>February</td>
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<td>- Introduction to methods of neuroscience.</td>
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<td>17</td>
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<td>- Neuroanatomy of fear</td>
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<td></td>
<td>Neuropsychopharmacology</td>
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<tr>
<td>Class 8</td>
<td>Tuesday</td>
<td>BEH</td>
<td>Regulation. Neuropsychopharmacology : Official Publication of the American College of</td>
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<tr>
<td>Field</td>
<td>Wednesday</td>
<td>BEH</td>
<td>TBA</td>
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<td>study</td>
<td>February</td>
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<td>13:00-17:00</td>
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| Class 9 | Friday February 24 | BEH | **Neuropsychology of Human Fear**  
- Emotion regulation  
  
Group presentation and class discussion:  
**Group 1:** Presenting  
**Group 2:** Supply questions for presenting group to implement one week in advance  
**Group 3:** Discussion in class  
The presentation will be graded according to the scientific content of the presentation, as well as the content of the scientific debate with the class after the presentation  
Compendium #16, p. 175-184 |
|---|---|---|---|
| Class 10 | Tuesday March 07 | BEH | Last information about, and work on “Research Project”  
Please bring a laptop to class |
| Class 11 | Friday March 10 | BEH | Work on “Research Project”  
Final paper due midnight March 31  
Please bring a laptop to class |
| Class 12 | Tuesday March 14 | TBA | **Neurobiological mechanisms of threat-related behavior**  
- Introduction to functional neuroimaging (fMRI & PET)  
- Linking neuroimaging measures with behavior  
- Neuroimaging and imaging genetics  
Compendium #12, p. 98-120 |
| Class 13 | Friday March 17 | TBA | **Genetic and environmental factors that shape threat-related behavior**  
- Imaging genetics  
- Gene-x-Environment interactions  
- Epigenetics and epigenetics mechanisms that shape brain function and behavior  
**Multi-modal-pharmaco-neuro-imaging-genetics of inter-individual variability**  
- Pharmaco-neuroimaging  
- Multi-modal neuroimaging  
- Measuring endogenous neurotransmission *in vivo*  
Compendium #1, p. 1-4  
Caspri supl. material on Canvas  
Compendium #8, p. 58-67 |
<table>
<thead>
<tr>
<th>Class</th>
<th>Date</th>
<th>Time</th>
<th>Main Topic</th>
<th>Presenting Group</th>
<th>Notes</th>
</tr>
</thead>
</table>
| 14    | Tuesday March 28 | TBA & BEH | Genetic Sensitivity to the environment | **Group 2**: Presenting | Group presentation and class discussion:  
**Group 2**: Presenting  
**Group 3**: Supply questions for presenting group to implement one week in advance  
**Group 4**: Discussion in class  
The presentation will be graded according to the scientific content of the presentation, as well as the content of the scientific debate with the class after the presentation  
Q/A for Exam #2  
| 15    | Friday March 31 | BEH | Exam #2: 45 min PTSD | **Group 3**: Presenting | Covering classes 6-14  
| 16    | Tuesday April 04 | BEH | Pathology  
- PTSD  
- Treatments | **Group 3**: Presenting  
**Group 4**: Supply questions for presenting group to implement one week in advance  
**Group 5**: Discussion in class  
The presentation will be graded according to the scientific content of the presentation, as well as the content of the scientific debate with the class after the presentation | To be presented by group: Davydow, D. S., Zatzick, D., Hough, C. L., & Katon, W. J. (2013). A longitudinal investigation of posttraumatic stress and depressive symptoms over the course of the year following medical-surgical intensive care unit admission. General Hospital Psychiatry, 35(3), 226–232. Compendium #4, p.23-29  
| 17    | Friday April 07 | BEH | Phobia | **Group 3**: Presenting  
**Group 4**: Supply questions for presenting group to implement one week in advance  
**Group 5**: Discussion in class  
The presentation will be graded according to the scientific content of the presentation, as well as the content of the scientific debate with the class after the presentation | Ipser, J.C., Singh, L. & Stein, D.J., 2013. Meta-analysis of functional brain imaging in specific phobia. Psychiatry and Clinical Neurosciences, 67(5), pp.311–322.  
| Class 18 | Tuesday April 11 | BEH | **Neuropsychology of Human Fear**  
- Social Learning of Fear  
- Primary and secondary fear  

Group presentation and class discussion:  
**Group 4:** Presenting  
**Group 5:** Supply questions for presenting group to implement one week in advance  
**Group 1:** Discussion in class  
The presentation will be graded according to the scientific content of the presentation, as well as the content of the scientific debate with the class after the presentation  

**To be presented by group:** Soares, S. C., Esteves, F., Lundqvist, D., & Öhman, A. (2009). Some animal specific fears are more specific than others: Evidence from attention and emotion measures. *Behaviour Research and Therapy, 47*(12), 1032–1042.  
**Compendium #29, p. 325-335**


| Long Study Tour 2 / Break  
April 12-17 |
| --- |

| Class 19 | Tuesday April 18 | BEH | **Pathology**  
How can basic research help?  

Group presentation and class discussion:  
**Group 5:** Presenting  
**Group 1:** Supply questions for presenting group to implement one week in advance  
**Group 2:** Discussion in class  
The presentation will be graded according to the scientific content of the presentation, as well as the content of the scientific debate with the class after the presentation  

Q/A for Exam #3  

**Compendium #11, p. 87-97**

**Compendium #31, 346-358**

**Recommended readings**  
**Compendium #24, p. 256-269**

| Class 20 | Friday April 21 | BEH | **Wrap up and Exam #3**  
Covering classes 15-19 |
<table>
<thead>
<tr>
<th>Class 21</th>
<th>Tuesday April 25</th>
<th>BEH</th>
<th>Oral presentations of research paper</th>
</tr>
</thead>
<tbody>
<tr>
<td>Field study</td>
<td>Wednesday April 26 8:30-12:30</td>
<td>BEH</td>
<td>MOVIE: We will watch the movie “Broderskab” with Thure Lindhardt (Angels and Demons). The movie is about a gay-couple within a neo-Nazi environment. And taps into human fear in various ways.</td>
</tr>
<tr>
<td>Class 22</td>
<td>Friday April 28</td>
<td>BEH</td>
<td>Oral presentations of research paper</td>
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<tr>
<td>Class 23</td>
<td>Tuesday May 02</td>
<td>BEH</td>
<td>Oral presentations of research paper - and goodbye…</td>
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</tbody>
</table>

**Reading List**


