## Affective Neuroscience: Emotions, Cognition, and Behavior

**Draft syllabus.**

<table>
<thead>
<tr>
<th>Semester &amp; Location:</th>
<th>Summer 2019 - DIS Stockholm</th>
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<tbody>
<tr>
<td>Type &amp; Credits:</td>
<td>Summer Course - 3 credits</td>
</tr>
<tr>
<td>Core Course Study Tours:</td>
<td>Paris, France</td>
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<tr>
<td>Major Disciplines:</td>
<td>Neuroscience, Psychology</td>
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<tr>
<td>Faculty Members:</td>
<td>Élodie Cauvet</td>
</tr>
<tr>
<td>Program Director:</td>
<td>Carla Caetano - <a href="mailto:cca@dis.dk">cca@dis.dk</a></td>
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### Time & Place

TBA

### Description of Course

**Prerequisite:** One semester of neuroscience, physiological psychology, or biological psychology at university level

How do we understand the interplay of human emotions and their neural networks? This course applies findings from the interdisciplinary field of neuroscience and the psychological study of cognition, emotion, and personality. Basic, complex, and social emotions are explored from the perspective of, for example, the subjective experience...
of emotion, non-conscious processes, how emotions are interpreted, expressed, or regulated. Affective systems, neural networks, and their relationship to cognitive processes such as attention, learning, memory, and decision making are addressed. Where relevant, human brain imaging findings, pathological conditions, treatment and cultural perspectives are considered.

Learning Objectives
By the end of this course, students should be able to:

- Discuss the main theoretical perspectives in affective neuroscience Critically analyze the impact of emotions on cognitive processes, including - but not only - higher order functions
- Integrate the different levels of emotion processing (cognitive, psychological and neurological) and their interplay within multimodal models
- Compare and discuss the alterations of affect and its regulation in terms of cognitive and neural processes from typical and pathological perspective
- Reflect upon the developmental milestones of emotions and their regulation in terms of behavior and neurological process
- Explore emotions and the social context from an evolutionary perspective
- Present, discuss and criticize scientific papers
- Critically evaluate research methods used in the affective neuroscience field

The following topics will be covered during the course:

Theme 1: Key elements in neurobiology of emotion and neuroscience methods
- Neuroanatomy and cerebral organization of emotion systems
- Neuroimaging
- Autonomic nervous systems and the relation to hormonal systems
- Physiological and psychological measures

Theme 2: Basics and introductory theory in cognitive psychology
- Overview of cognitive functions
- Cognitive and psychological theories of emotion: the role of neuroscience
- Interplay of emotion and cognitive domains

Theme 3: Emotions: from basics to complex, their evolutionary perspective
- Positive emotions: excitement, pleasure, desire and their relation to happiness
- Negative emotions: Anger, disgust, fear and sadness
- Social emotions: moral, empathy

Theme 4: External antecedents of emotions: selected topics
- Emotion and the body: from touch to olfaction
- Emotion and audition: from music to language

Theme 5: Emotion and cognition
- Emotion and attention: bias and top down effects
- Emotion and memory
- Emotion regulation, executive functioning, reward and the prefrontal cortex

Theme 6: Variability in emotion
- Sex differences
- Aging
- Cultural differences
Faculty

Élodie Cauvet obtained her PhD in Cognitive Neuroscience, from Pierre & Marie Curie University in Paris (France). Her research interest started with language acquisition in infants leading to the study of the cerebral processing of language and music in adults. She became interested in neurodevelopmental disorders starting with developmental dyslexia then expanding into autism spectrum disorders as well as ADHD. She is using techniques from psychology as well as neuroimaging in her research; this includes MRI (anatomical and functional) as well as EEG and eye tracking. She has been conducting her latest research at Karolinska Institutet Center for Neurodevelopmental Disorders (KIND). Her interests include social cognitive skills, empathy and emotion processing within the whole spectrum of functioning from typicality to disorders such as ASD. With DIS since 2016.

Examples of Readings:

Selected readings from the textbook:


Other Books: (selected chapters)

Kandel (2013): Principles of Neural Science, 5th edition,
Psychology Press: New York

Articles:


Field Studies

Dates to be arranged
Possible visits include:

Fotografiska Museum - Exploring how emotions are expressed in photographic images
Psychiatric facility with focus on emotional disorder and internet based treatment
Research facility with focus on emotional processing especially during aging processes.

Study Tour: Paris

Eliciting, appraising and reappraising emotions
Study tour is an integral part of the class. We aim to experience first-hand different settings related to the class
content: including high-end research lab and facilities, and clinical context. Especially in the summer session, we will inquire how emotions are elicited in different sensorial contexts, their subjective individual experience and the importance of current mood via induction and regulation strategies.

For instance, the group assignment presentations on the external antecedent of emotions will draw from the content of visits such as Dinner in the dark, olfacto-therapy workshop, deprivation tank experience or music therapy workshop. Another example of our experiential learning approach is evidenced in the group presentations assignments studying the relationship between emotion and cognition. The assigned groups will draw from a group activity which will explore the importance of mood in experiencing and memorizing content. Prior to a museum visit (looking at emotions in art through the different periods and mediums), each group of students will be assigned to a specific mood which will be induced prior to the visit. The mood induction might include happiness, sadness, or compassion and might consist in reading a short story or listening to a music piece in order to evoke the assigned emotion. After the visit, students will reflect upon their emotions regarding the different pieces of art and discuss how their induced mood might have affected their experience, memory of the events. This discussion will also serve as a pretext to discuss the affective disorders and their specific psychological and neural correlates. Importantly, we will use and discuss scientific objective tools to describe and reflect upon the neural correlates and mechanisms.

Visits might include:
- **Improvisation workshop**: expressing, recognizing and receiving emotions. Practical experience.
- **Music therapy**: experience music therapy as delivered to patients suffering from various affective disorders and discuss with therapists to understand the theories and application behind the practice.
- **Sensory deprivation tanks**: experience a moment without sensory stimulation, how does it affect your emotional well-being. Reflect upon therapeutic possibility behind this experience.
- **Dinner in the dark**: Experience a dinner completely in the dark. Taste without seeing what you eat, rely not anymore on vision but on all other sensory input. Reflect about the importance of visual inputs in your perception and emotions. Which cerebral networks have taken over? What happens in terms of emotion perception for blind people? Talk about cerebral plasticity.
- **Olfacto-therapy**: Olfaction has a specific place in emotional processing. Discuss this specificity in terms of neural processing and experience treatment of different affective disorders through the smell. Discuss with therapists the theories and application behind their treatment.
- **Fear of Height**: experience the height of being on top of trees for parkour, or standing on the 3rd floor of the Eiffel Tower. Discuss the fear psychological and neural mechanisms, as well as their implication in terms of disorders and higher cognitive functions.
- **Museum visit and mood induction**: Visit a museum with and/or without a guide (such as the Louvre, Orsay Museum) after being subjected to mood induction. Reflect upon the effect of mood in perception of the visit, emotions felt, but also pieces of art best memorized, detailed paid upon. Discuss the importance of emotion in memory and attentional processes.

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**Guest Lecturers**

**Dates TBA**

**Possible Speakers:**
**Monica Siquieros** is a psychologist and a PhD student at the Center for Neurodevelopmental Disorders at Karolinska Institutet. In her PhD research, she aims to investigate the contribution of genetic and environmental factors to individual differences in cognitive measures associated to Autism Spectrum Disorders and Attention Deficit and Hyperactivity Disorder in children and infants combining eye-tracking, EEG and a twin design.

Researchers and or clinicians from the field of affective neuroscience. For instance, they would give an introduction into genetic factors affecting NDDs and the techniques used to study them; or a lecture on the use of emotional strategies to remediate traumatic disorders (such as PTSD).
**Approach to teaching**

I am an enthusiastic teacher whose goal is to develop your curiosity, sense of questioning and critical thinking. As such, I encourage asking questions whether for clarification or for deeper understanding. There is no such things as bad questions: what appears trivial might actually turn into the most interesting and insightful questions. Each class include both lectures by the teacher and discussions led by the students. We will develop and reflect upon the emotions, mood and their typical and atypical correlates from different descriptive scales: physiological, psychological, cognitive and neural. Classes’ content relies on the readings. Content of the readings is expected to nourish the discussions and will not be developed in details during the class. However, any unclear areas, pointed out by students’ questions, will be reviewed in class.

**Expectations of the students**

Students are expected to be involved in their studies and are responsible for them. In addition to being present in class, having read the required readings and handing in assignments at the due time (all mandatory), students are expected to participate actively in class and to create a lively and positive learning environment. This includes (but is not restricted to) participating in the discussions and asking questions to both the teacher and peers.

Students are responsible for their learning. This implies taking notes from the lecture and summarizing the content of both lectures and discussions. Slide presentations include graphs, pictures and illustrations necessary to understand the class. Students are expected to take notes complementing and explaining the slides. The slides are a support and should be treated as such and not as the main source of information for assignments. Class content delivered orally by the teacher need to be written down individually by the students. Main discussions must be summarized by the students and transcribed on white board. A picture of these will be available on Canvas after the respective classes.

**Workload**

This course is intensive course. In just three weeks, you will cover an extensive content and receive three credits. In order to merit this you should expect a high workload and intensive preparation for classes on a daily basis.

**Evaluation**

The course consists of lectures, discussions and assignments at home and in class as well as field studies, core course week and long study tour. Students’ attendance of the classes, visits, tours and their active participation in the discussions are mandatory and taken into account in the evaluation. In discussions and assignments (in class or in tours), students are required to demonstrate that they read and understood the required literature. They should be able to integrate their knowledge to discuss in depth research questions and topics. Showing independent and critical thinking is expected.
Assignments Can Include

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<thead>
<tr>
<th>Assignment</th>
<th>Percent</th>
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<tbody>
<tr>
<td>Active Class Participation</td>
<td>15%</td>
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<tr>
<td>Study Tour Pre-assignment: presentation of the visits</td>
<td>10%</td>
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<tr>
<td>Study Tour Assignment: Mood diary and emotion regulation</td>
<td>15 %</td>
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<tr>
<td>Test</td>
<td>15 %</td>
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<tr>
<td>Oral presentation on assigned theme</td>
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<tr>
<td>Group oral presentation</td>
<td>15%</td>
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<tr>
<td>Review of others</td>
<td>10%</td>
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<tr>
<td>Assessors - summarizing</td>
<td>5%</td>
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<tr>
<td>Final Project</td>
<td>15%</td>
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<tr>
<td>Total</td>
<td>100%</td>
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Detailed assignment description and rubrics will be available via Canvas and in-class

Active class participation (15%):
The student is active in discussions and group work. Active participation and engagement includes asking questions related to readings and material presented in the class and taking part in discussions as well as being active during field trips, study tours and guest lectures. Active participation also means taking the initiative. The grade is split into active participation in class, active participation in field studies and active participation in study tour. Class attendance is mandatory and will be reflected in this assignment grade, each unattended class will result in a 7% decrease of the grade. See Canvas for class participation grading.

Ass1: Study Tour pre-assignment: Group presentation of the different visits: 10%

Date: TBA

Groups of 2 to 3 students get assigned to one visit so that all visits are covered. They make a short summary of the info they can find on their assigned visit, write a short paragraph on how this visit relates to the content of the class and add a few critical questions that will be used as an inspiration to the discussion with our guests. Each group will thus produce max 1 page that will be bound together into a booklet. This booklet (on top of the one provided by the teacher) will be used during the study tour. Each group will briefly (5min) present the results of their search to the rest of the class on the Friday prior to the departure.

Ass2: Study Tour Assignment: Mood Diary and emotion regulation strategies (15%)

Date: TBA

Conduct a mood diary on yourself during the length of the study tour and analyze it.

Mood diary is a powerful tool used by psychiatrists, psychologists, researchers but also everyday people to get record over time emotional status. After each visits, you will record your mood, emotions and noticeable events that might have triggered these emotions, add any additional info that you deem necessary to the understanding and analysis of your emotions.

You can rate your mood on a scale; name the different emotions you felt, add your energy level and the hours of sleep you got since they might influence emotional processing. Login the elements in the visits (or outside if you would like to share). In the end of the week, you will shortly summarize the week objectively and analyze your diary with a focus on emotion regulation with reappraisal strategies (or expressive suppression) that you used or might have wanted to use in light of reading available on canvas. This assignment will be discussed and used during the session 15 on Emotion regulation.
Ass3: Test (15%)

Date: TBA

Short answered questions (between 7 and 10) and two short essays. Short answer questions will be a combination of information recall and explanation of concepts and theory. Short essays will summarize knowledge on a specific topic covered in class and will require integration of class content. This can include describing emotional processing at neural level in a concrete everyday life situation, or proposing an experiment to answer a research question and the expected results.

Ass4: Class Topic presentation – group presentation (15%) + peer review and debate (10%) + Assessor (5%)

Date: TBA

Students will be grouped in two’s or three’s and will be assigned to one of the themes on external antecedents of emotion or the interaction between cognitive function and emotions. Students will have to prepare an oral presentation on this topic (20-30minutes) including a discussion theme with their fellow students. The oral presentation will be graded as a group and the goal is to present the state of the art on this topic as well as the current burning research questions. One other group of students will be assigned to the peer review of the topic. They will be responsible to ask questions to the presenting group. One last group will be assigned to take notes and eventually ask clarification questions. Presentation dates and topics will be assigned randomly during class at the beginning of the course. After the presentation, the slides will be handed in through canvas. Group grades will take into account the slides (quality and readability), the oral presentation, the information presented (quality of the topic search and organization) for the presenting group. The Peer Review Group will be graded on the lead of the following discussion and question. Finally, the assessor group, will get assessed on the quality of their notes which will be made available as a summary of the content to be used for midterm assessment.

Ass5: Final Project: (15%)

Date: TBA

This course will run from June 12th to July 1st
Topics will be distributed between these days

Course Summary:

<table>
<thead>
<tr>
<th>Date</th>
<th>Details</th>
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<tbody>
<tr>
<td></td>
<td>Below are examples of possible topics to be included in the course</td>
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</table>

Field Study: Emotion in arts: from elicitation to physiological, cognitive and neural correlates

Fotografiska Museum Stockholm and walk back to DIS for presentation of the class content and assignments. Group creation for the diverse assignments.

Topics to be covered:

- Define the different emotions
- Assess individual knowledge in terms of: emotion psychological constructs, psychological and cognitive models, neural representations
- Build up collectively a reflection on affective neuroscience based on art observation starting from individual knowledge
- Introduce the class content
- Discuss about the class expectations
- Ice-breaker: meet fellow students and teacher in a cozy location
<table>
<thead>
<tr>
<th>Topic 1: Classification of emotions: Basic emotions and valence based classification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Positive emotions and their relation to happiness</td>
</tr>
<tr>
<td>Negative emotions: Anger, disgust, fear and sadness</td>
</tr>
</tbody>
</table>

**Learning objectives:**
Describe and discuss the link between some of the positive emotions discussed during this class, especially how they relate to happiness. Describe and discuss the relationship between negative emotions

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**THEME 1: Key elements in neurobiology of emotion**

**Session 2: Emotion systems: Neuroanatomy and cerebral organization**

Assess neuroanatomical knowledge and play with 3D brain model, learn to locate the key regions of the emotional system.

*Topics to be covered today:*
Basics in neuroanatomy with the goal of being able to locate and name the main cerebral components within the emotion systems.
- Cortical regions and networks mediating emotions
- Limbic system
- Subcortical regions: Amygdala, hypothalamus, nucleus accumbens brain stem

*Required Readings: Chap 48, Kendall*

**Topic 3: Introduction to neuroimaging techniques: from structure to function**

Topics to be covered today:
List known techniques.
Presentation of the main neuroimaging techniques: what is measured and how, advantages and disadvantages
MRI, EEG, MEG, PET, NIRS

Objective: Knowing the main neuroimaging techniques used in affective neuroscience: their names, and explain what they measure and how, their advantages and disadvantages.

*Required Readings: Chapter 4, 5 and 6 of the textbook*

**Topic 4: Physiological response to emotion: hormonal and autonomic system**

Topics to be covered today:
Basics of the autonomic, musculoskeletal hormonal systems
How they are involved in emotion processing, signaling

*Required Readings: Chapter 3 from textbook, chapter 47 from Kendall*
Topic 5: Physiological and psychological measures of emotion
Topics to be covered today:
Objective measures: heart rate, autonomic nerve stimulation, skin conductance, temperature etc.
Subjective measures: questionnaires, interviews
Discuss the reliability of the different measures, their pro, cons and combination.

Learning objectives:
Knowing which physiological correlates of emotions are accessible and how.
Integrate this with the knowledge on the hormonal, musculoskeletal and autonomic nervous system from class 2.

Required Readings: chapter 2 from textbook

Goal of theme 1: Be able to name and detail the cerebral emotion systems. Explain how the brain regions and networks are interfaced with the autonomic system toward the effector cells. Be able to name these effector cells and explain how they are involved in the emotional responses. Propose a global schema that integrate all the aforementioned structures.

Preparation to Study Tour: short presentation from students

STUDY TOUR  Dates TBA
Eliciting, appraising and regulating emotions

THEME 2: Basics and introductory theory in cognitive psychology

Topic 6: Theories of Emotion
Topics to be covered today:
Main theories of emotions:
  cognitive theories
  neuroscience approach

Learning objective: Be able to discuss the main theories of emotion, their advantages, disadvantages, their differences, and resemblance.

Required Readings: Chapter 1 from textbook,
### Topic 7: Interplay between cognition, emotions and behavior: the role of neuroscience

Topics to be covered today:
- Overview of the cognitive functions and their main neural correlates
- List cognitive functions that are altered by emotions and their behavioral correlates (link to the session 2)
- How the neuroscience approach put to test the theories of emotions

Learning Objectives:
Knowing which brain structures and networks underlie the cognitive functions listed in class. Discuss how the neuroscience approach can shed light on the theories of emotion.

### THEME 3: Emotions: from basics to complex, their evolutionary perspective

### Topic 8: Social emotions: moral, and empathy

Topics to be covered today:
Description of social emotions: psychological constructs and neural correlates
Social emotions: their role in society
Integration within the theoretical framework
Pathologies associated

**Integration and discussion up to know (preparation to midterm)**
Learning objectives:
Be able to describe the social emotions from a multilevel perspective (psychology, cognitive and neural)
How can social emotions be integrated in the theoretical framework
Detail at least 2 disorders of social emotions and their pathological neural networks

**Required Readings:** chap 21, 22 and 23 of textbook

Additional objectives by the end of this arch:
Discuss disorders affecting positive emotions in terms of neurological disorders.
Integrate the positive emotions within the theoretical framework.
Explain and describe at least 2 disorders involving negative emotions in terms of neural structure and networks.
Be able to describe at least 2 paradigms to test the neural correlates of negative emotions.

**Field Study 2: TBA**

### Topic 9: Midterm
**Topic 10: Genetics of Affective Disorders**

**THEME 4: External antecedents of emotions: selected topics**

**Topic 11: Emotion and the body: from touch to olfaction**
Topics to be covered today:
The assigned group will present their designated theme covering the interaction between emotion and touch and olfaction.
The teacher will complement the group presentation by discussing how visual cues (face perception for instance) also elicit emotions and discuss the case of blind people.

Learning objectives:
- Discuss how olfaction and touch can mediate emotion (physiological, neural levels) and its link to social emotions.
- Discuss the importance of visual cues in emotion elicitation and how blind people deal without it.
- Be able to integrate touch, olfaction, and visual stimuli within the theoretical framework.

Required Readings: Chap 10 and 8

Cf. Assignment 4

**Topic 12: Emotion and audition: from music to language**
Topics to be covered today:
The assigned group will present their designated theme covering how auditory stimuli such as music or emotional voices convey emotions on the different description levels.
The teacher will complement the presentation by discussing how language in general elicit emotions at the different descriptive levels.

Learning objectives:
- Discuss what emotions can be elicited by music and language.
- Understand and be able to explain how emotional cerebral networks and music and language networks interact one with another.
- Discuss how some affective disorders can be remediated through music (how music therapy works).

Required Readings:
Chapter 11, 12 and 13 from textbook
Cf. Assignment 4

**THEME 6: Emotion and cognition**

**Topic 13: Emotion and attention: bias and top down effects**
Topics to be covered today:
The assigned group will present their designated theme covering the effect of attention on emotion processing and vice versa (how emotion affect attentional processes). They will use all descriptive levels mentioned since the beginning of the class.
The teacher will complement the presentation by discussing how attentional biases can be manipulated in everyday life to enhance wellbeing, both for healthy and affected individuals.

Learning objectives:
Explain at least 2 attentional biases in attention and perception and how emotions are responsible for these.
Detail and discuss how attentional cerebral networks interact with emotional ones
Give examples on how to use these biases to remediate disorders (help everyday life)

Required Readings: Chapter 14 and 15 of the textbook
Cf. Assignment 4

Topic 14: Emotion and memory
Topics to be covered today:
The assigned group will present their designated theme covering how emotions modify the memory processes (within different memory type) detailing the different description levels.
They will touch upon memory deficits and how emotions interacts with these pathologies.
The teacher will complement the student presentation by discussing reward learning processes and its societal links. She will integrate all descriptive levels to understand how reward learning contribute to learning.

Learning objectives:
Discuss memory processes on a cellular and cerebral levels and how emotions modify them.
Detail reward cerebral networks and how they mediate emotions

Required Readings: chap 19 and 20
Cf. Assignment 4

Topic 15: Emotion regulation and the prefrontal cortex
Topics to be covered today:
The assigned group will present their designated theme covering emotion regulation from a cognitive and cerebral perspective (with special attention toward the prefrontal cortex).
They will detail how an inadequate emotion regulation result in pathologies or disorders.
The teacher will complement the students’ presentation by detailing the development of emotional regulation from infancy to adulthood.

Learning objectives:
Detail the mechanisms regulating emotions at a cerebral level.
Discuss how the prefrontal cortex is involved in emotion regulation.
Be able to use the example of lesions, and/or affective disorders to illustrate inadequate emotional regulation.

Required Readings: chap 16 and 27
Topic 16: Sex, age and cultural invariants and differences in emotion processing
Topics to be covered today:
Sex difference on the cerebral processing of emotion and link with sexual hormones. 
Variation in the emotional processing (different descriptive levels) with aging. 
Compare different cultures on their perception of emotion: cultural variants and invariants

Learning objectives:
Discuss how sex differences affect emotion in relation to hormonal status on the psychological and neural networks.
Detail how age modifies emotions and their regulations (development cf. class 15 and aging), and how the brain matures.
Discuss how culture affects emotion perception and processing.

Required Readings: chap 25, 26, and 28

Wrap up

Presentation of the final project