DEPARTMENT OF NEUROSCIENCE

C4F6086, Stress Neurobiology: Molecular Insights and Translational Approaches, 1.5 credits (hec)

Stressneurobiologi: Molekylära insikter och translationella tillvägagångssätt, 1,5 högskolepoäng

Third-cycle level / Forskarnivå

Approval

This syllabus was approved by The Committee for Doctoral Education on 2025-09-10, and is valid from spring semester 2026.

Responsible department

Department of neuroscience, Faculty of Medicine

Prerequisite courses, or equivalent

Basic knowledge of neuroscience is recommended.

Purpose & Intended learning outcomes

Purpose

This doctoral-level course offers an integrative, mechanistically grounded exploration of stress neurobiology across the lifespan, with an emphasis on translational relevance. Combining molecular, circuit-level, and behavioral perspectives, it examines how stress shapes brain development, function, and behavior, contributing to risk and resilience for stress-related disorders. Students will engage with cutting-edge models and methodologies to address key challenges in psychiatric research. The curriculum also covers multi-scale data integration, advanced tools for biological and behavioral analysis, and ethical considerations, including stress/trauma modeling and broader societal implications.

Intended learning outcomes

By the end of the course, students will be able to:

1. Define the core biological systems involved in stress regulation.
2. Explain the mechanisms that contribute to individual differences in stress susceptibility

and resilience.
3. Demonstrate understanding of how stress exposure during critical developmental periods affects long-term outcomes.
4. Describe mechanisms underlying variability in treatment response for stress-related disorders.
5. Critically assess experimental models and translational strategies used in stress research.
6. Reflect on ethical and societal considerations in stress research, including trauma modeling, sex differences, and the implications of translational findings.

Course content

The course will explore the neurobiology of stress across four main modules:

Module 1: Foundations of Stress Neurobiology: Introduces the core neurobiological systems and organs involved in stress regulation, as well as the distinction between adaptive and maladaptive stress responses. Students will also discuss ethical considerations in stress research, including stress/trauma modeling, sex differences, and the societal impact of stress-related research. Different research model systems and paradigms will be introduced to facilitate critical comprehension of the subsequent modules.

Module 2: Susceptibility and Resilience: Explores biological and environmental factors shaping individual stress responses. This focuses on molecular and circuit-level mechanisms, including but not limited to gene-environment interactions, epigenetics, neuroendocrine, and neuroimmune pathways.

Module 3: Treatment Response: Examines variability in therapeutic outcomes from a biological and mechanistic perspective. Topics include behavioral, neuromodulatory, and pharmacological interventions, including novel rapid-acting antidepressants, and personalized treatments.

Module 4: Critical Periods: Analyzes how stress during sensitive developmental windows (e.g., prenatal, early life, adolescence, adulthood, aging) affects brain structure, function and long-term mental health risk. It emphasizes timing and plasticity in intervention strategies.

Forms of teaching and learning

The course will feature a series of lectures delivered by both local and international experts, each followed by interactive group discussions to deepen understanding and encourage critical engagement.

Language of instruction

The course is given in English

Grading scale

Pass (G) /Fail (U)

Compulsory components & forms of assessment

Compulsory components

All lectures and seminar presentations are compulsory. Absences must be compensated according to the course director's instructions.

Forms of assessment

Students must demonstrate achievement of each of the intended learning outcomes through written/oral presentations and during critical discussions of relevant topics within the course's neurobiology of stress scope.

Course literature

Recommended original research and review papers will be provided by the course organizers.