

# Neural Plasticity Syllabus - NSC 4371 Spring Semester 2026

---

## Professor Contact Information

Dr. Michael P. Kilgard, Teams Office hour: Friday 2-3 pm

E-mail address: [kilgard@utdallas.edu](mailto:kilgard@utdallas.edu), office phone 972-883-2339

Teaching assistant: Ethan Nguyen [Ethan.Nguyen3@UTDallas.edu](mailto:Ethan.Nguyen3@UTDallas.edu)

Class time: Tuesday and Thursday, 11:30am-12:45pm

Meeting location: [HH2.706 \(Hoblitzell Hall\)](#)

---

## Course Pre-requisites, Co-requisites, and/or Other Restrictions

NSC 3361, NSC 4352, CHEM 1311, CHEM 1312 and BIOL 2311.

---

## Course Description

This course will review the basic principles of neural plasticity with special emphasis on cortical plasticity related to development, recovery from injury and learning.

Lectures will provide students with the appropriate background for each topic, and discussions will explore classic and modern primary papers. Workload will consist of readings, class presentations, class participation, and weekly written critiques.

This first aim of the course is to provide a detailed and up-to-date understanding of the concepts and methods involved in a well-studied aspect of brain function: plasticity. The focused nature of this course will be a useful supplement to a general education of brain function based on surveys of many fields. Because similar plasticity principles apply throughout the brain the detailed description of cortical plasticity provided by this course will serve as a conceptual starting point for thinking about other brain regions.

An additional aim of this course is to relate the discussed concepts to clinically relevant issues. This course assumes a general understanding of basic neuroscience principles and will be useful to students interested in neuroscience, communication disorders, cognitive science, developmental psychology, biology, computer science, or neural networks.

---

## Student Learning Objectives/Outcomes

On completion of this course, students should be able to:

- Pick up a primary research article related to neural plasticity and understand the major new findings.
  - Place new findings within the historical context of previous experiments.
  - Critically evaluate the logic of experimental design.
  - Effectively use library and internet resources to answer their own questions and expand on material presented in the introduction of the paper.
  - Lead a coherent discussion of primary research articles.
- 

## Required Textbooks and Materials

None

## Suggested Course Materials

Principles of Neural Science by Kandel, Schwartz, and Jessell

---

**Class Assignments** (Dates may be adjusted as needed for missed days)

- 1) 1/20 **Course Introduction and advice on how to read neuroscience papers**
- 2) 1/22 [Plasticity of ocular dominance columns in monkey striate cortex](#). 1977 (2211 citations)
- 3) 1/27 Plasticity of ocular dominance columns in monkey striate cortex. 1977 (2211 citations)
- 4) 1/29 [Topographic reorganization of somatosensory cortical areas 3b and 1 in adult monkeys following restricted deafferentation](#) 1983 (1402 citations)
- 5) 2/3 [Somatosensory cortical map changes following digit amputation in adult monkeys](#) 1984 (1804 citations) *Optional review article Plasticity of Sensory and Motor Maps in Adult Mammals 1991 (1980 citations)*
- 6) 2/5 Somatosensory cortical map changes following digit amputation in adult monkeys 1984 (1804 citations) *Optional review article Plasticity of Sensory and Motor Maps in Adult Mammals 1991 (1980 citations)*
- 7) 2/10 [Classical conditioning induces CS-specific receptive field plasticity in the auditory cortex of the guinea pig](#) 1990 (503 citations)
- 8) 2/12 Plasticity in the frequency representation of primary auditory cortex following discrimination training in adult owl monkeys 1993 (1715 citations)
- 9) 2/17 Dependence of cortical plasticity on correlated activity of single neurons and on behavioral context 1992 (541 citations) *Optional review article: Cortical plasticity: from synapses to maps 1998 (2990 citations)*
- 10) 2/19 Cortical Map Reorganization Enabled by Nucleus Basalis Activity 1998 (1636 citations)
- 11) 2/24 Cortical Map Reorganization Enabled by Nucleus Basalis Activity 1998 (1636 citations)
- 12) 2/26 Sleep Enhances Plasticity in the Developing Visual Cortex 2001 (629 citations)
- 13) 3/3 The Basal Forebrain Cholinergic System Is Essential for Cortical Plasticity and Functional Recovery 2005 (295 citations)
- 14) 3/5 A synaptic memory trace for cortical receptive field plasticity 2007 (739 citations)
- 15) 3/10 Neuromodulators Control the Polarity of Spike-Timing-Dependent Synaptic Plasticity 2007 (489 citations)
- 16) 3/12 The Antidepressant Fluoxetine Restores Plasticity in the Adult Visual Cortex 2008 (1146 citations)
- 17) 3/24 **Student Presentations** (2000-2010 papers)
- 18) 3/26 Cortical map plasticity improves learning but is not necessary for improved performance, 2011 (288 citations)
- 19) 3/31 Reversing Pathological Neural Activity Using Targeted Plasticity, 2011 (849 citations)
- 20) 4/2 Associative fear learning enhances sparse network coding in primary sensory cortex. 2012 (140 citations)
- 21) 4/7 Harnessing plasticity to understand learning and treat disease, 2012 (123 citations)
- 22) 4/9 Distinct Eligibility Traces for LTP and LTD in Cortical Synapses, 2015 (256 citations)
- 23) 4/14 **Student Presentations** (2010-2020 papers)
- 24) 4/16 **Student Presentations** (>2020 papers)
- 25) 4/21 [Vagus Nerve Stimulation Enhances Stable Plasticity and Generalization of Stroke Recovery, 2018.](#) (244 citations)
- 26) 4/23 [Closed-loop neuromodulation restores network connectivity and motor control after spinal cord injury, 2018.](#) (164 citations)
- 27) 4/28 [Enhancing plasticity in central networks improves motor and sensory recovery after nerve damage, 2019.](#) (112 citations)
- 28) 4/30 [Increased cortical plasticity leads to memory interference and enhanced hippocampal-cortical interactions, 2023.](#) (18 citations) **OR** [Motor learning refines thalamic influence on motor cortex, 2025.](#) (9 citations) – class vote to determine which paper.
- 29) 5/5 NEW PAPER NOT YET PUBLISHED!
- 30) 5/7 Group Discussion

All papers (unbolded assignments) can be found at [ncbi.nlm.nih.gov/pubmed](https://ncbi.nlm.nih.gov/pubmed) or [scholar.google.com](https://scholar.google.com)

---

## Grading Policy

All assigned readings must be completed before each class. Expectations for an A begin very easy, because everyone has limited experience. Expectations raise gradually as the class masters the important skill of reading a paper, understanding it, and explaining it to others in a clear manner.

### Individual class participation – 50% of final grade

- Raise questions about unfamiliar or interesting terms and concepts.
- Actively discuss readings, critiques, and scientific issues, in class.
- Students will be called on in a pseudorandom fashion to explain the introduction, methods, figures, and discussion section of each paper.
- Letter grades will be assigned for every explanation.
  1. A for a clear and complete explanation
  2. B for an adequate explanation (i.e. missing 1 or 2 minor issues)
  3. C for a poor explanation (i.e. missing the key concepts)
  4. D/F for a completely wrong explanation or unexcused absence

### Class preparation – 20% of final grade.

Efficient note taking is critical to understanding papers, explaining papers, and keeping up with the published literature. Turn in your personal notes by email before we discuss each paper in class. Your notes should be used during discussion. Carbon copy the TA and include 4371 in the subject line so that they are sent to the class homework folder.

Since this is a new skill, the notes from the first two papers will not be turned in.

### In class presentations – 20% of final grade.

Maximum of 10 minutes of presentation time followed by questions. Email the article as a pdf to the professor and class at least 24 hours before your presentation.

### Attendance – 10% of final grade

---

## Course & Instructor Policies

Discussion of papers and concepts with classmates outside of class is strongly encouraged.

Students who meet with a study group do better in the class and have more fun!

Contact the professor if you need assistance finding a study group.

Students must read and understand all online supplementary figures included in each paper.

---

## Comet Creed - "As a Comet, I pledge honesty, integrity, and service in all that I do."

---

*The descriptions and timelines contained in this syllabus are subject to change at the discretion of the Professor.*