RECEPTOR BIOLOGY

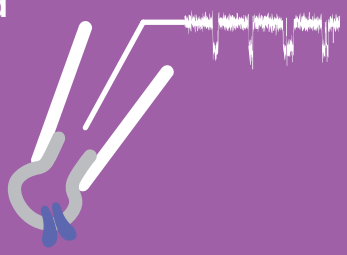
BIOL 333
Spring 2025
TR 9:45-11AM
MBH 148

COURSE OVERVIEW

>4% Over 4% of the protein-coding human genome encodes for a receptor

Receptors enable transmission of information into the cell and represent a major target in the pharmaceutical industry

We'll explore the world of receptors and the interdisciplinary methods used to understand their structure/function



After engaging with the primary literature, we'll emphasize discipline-specific writing and other forms of communication

INSTRUCTOR INFO

Professor: Greg Pask, Ph.D.
Please call me: Greg or Dr./Prof. Pask (he/him)
Ask me about: Anything related to the course, navigating your major, getting started in research, graduate school or other future plans, being a Division III athlete, outdoor spaces in VT, insects, board games, the Marvel Universe, cooking, and building/creating fun stuff.

Preferred Contact: Direct message through Slack
Office Hours: TW 1:30-3:00 or by appointment
Office: MBH 315
Email: gpask@middlebury.edu

COURSE MATERIALS

Slack Workspace: biol333s25.slack.com for all course-related materials

LEARNING OBJECTIVES

At the completion of this course, students will be able to:

Apply knowledge gained from the examined membrane receptor families to comprehend new and unfamiliar receptor types.

Integrate the principles of chemistry, biology, and pharmacology to comprehend ligand-receptor interactions and evaluate its utility in drug discovery and medical treatment.

Evaluate and interpret data from both classical and modern techniques in receptor biology and propose well-designed experiments to investigate receptor structure/function.

Explore the primary literature for significant advances in receptor biology and effectively communicate its merits to different audiences in both oral and written forms.

HOW YOU'LL PROGRESS TOWARD THESE GOALS:

Paper Discussion Reflections

Receptor Competency Problem Sets

CAPSTONE PROJECT

Digital Research Journal

Journal Club Discussions

Scientific Journalism Article

Review Article

HOW I WILL ASSESS YOUR PROGRESS

This course will use a labor-based grading approach that centers on feedback, improvement, integrative thinking, idea development, and effective communication. I strongly believe that traditional assessment practices focus too much on "the grade" and can increase stress and/or decrease risk-taking. Instead, your grade will be based on all the work (learning) you'll be doing this semester.

If you put in significant effort into an assignment and submit it on time, you get full credit for your work.

Critical feedback is given frequently with a focus on self-improvement.

Larger assignments will involve multiple stages of work spread throughout the semester, and all this effort counts!

I reserve the right to deem any work unacceptable. If the amount of effort is insufficient or it is submitted late, you will not receive any credit for doing it. We will then work to figure out the best practices to optimize your labor-based learning.

EXPECTATIONS

BE ENGAGED

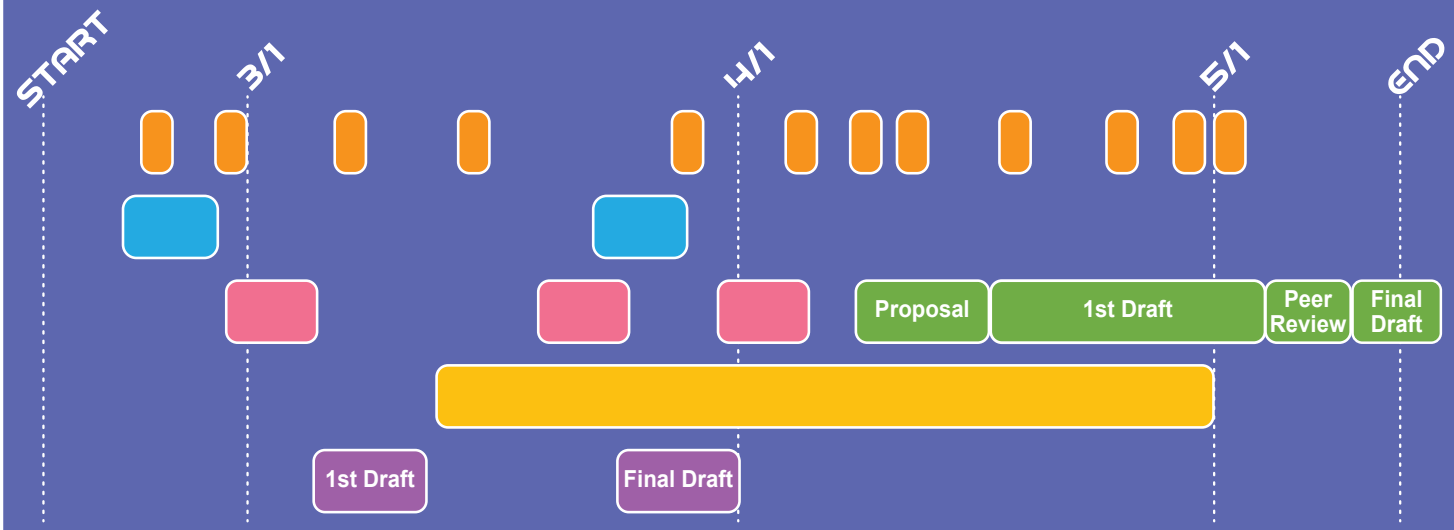
BE CURIOUS

WORK HARD

ACADEMIC INTEGRITY

I believe that Academic Honesty and Integrity is of the utmost importance, so the language from the Honor Code in the Middlebury Handbook (section B.1.a.) resonates with my values. Please include the Honor Code Pledge ("I have neither given nor received unauthorized aid on this assignment.") on all assignments for this course. If you are unsure of whether a specific action in this course would violate the Academic Honesty Policy in this course, I urge you to check with me beforehand. Any suspected instances of the Academic Honesty Policy will be brought to the attention of the judicial affairs officer.

ASSIGNMENT TIMELINE



Please see the most recent Course Schedule on our Slack Workspace for exact due dates.
All work must be submitted before or on the due date.

YOU'VE RECEIVED 3 FLEXIBILITY TOKENS!

You can spend one of these to:

- receive a 48-hour extension on an assignment
- resubmit an assignment that did not earn credit

COURSE ASSIGNMENTS AND GRADE EARNED

Review Article
120 pts

proposal 10 pts
1st draft 50 pts
peer review 10 pts
final draft 50 pts

Paper Discussion Reflections
60 pts

12 reflections @ 5 pts each

Digital Research Journals
60 pts

3 checks @ 20 pts each

Scientific Journalism Article
60 pts

1st draft 30 pts
final draft 30 pts

Receptor Competency Problem Sets
50 pts

2 problem sets @ 25 pts each

Journal Club Discussion
50 pts

TOTAL POINTS	GRADE
372-400	A
360-371	A-
348-359	B+
332-347	B
320-331	B-
308-319	C+
292-307	C
280-291	C-
240-279	D
≤239	F

DISABILITY ACCESS/ACCOMODATION

Students who have Letters of Accommodation in this class are encouraged to contact me as early in the semester as possible to ensure that such accommodations are implemented in a timely fashion. For those without Letters of Accommodation, assistance is available to eligible students through the Disability Resource Center (formerly called Student Accessibility Services). Please contact the ADA Coordinators Jodi Litchfield (litchfie@middlebury.edu, 802-443-5936) or Peter Ploegman (pploegman@middlebury.edu, 802-443-2382) for more information. All discussions will remain confidential.

Many thanks to my former students for helpful suggestions on how to improve this course and David Aja's Hawkeye for graphical inspiration.

Course Schedule

Date		Topic	Paper Discussion	Assignment Due
2/11	T	Course intro and overview of receptor/channel families		**Listen to "Making the Grade" Podcast** **Join Slack Workspace**
2/13	R	Receptor Basics *Biological Membrane Physiology*		**Prepare for Receptor Draft!**
2/18	T	Receptor Basics *Ionotropic vs. Metabotropic receptors*		
2/20	R	Receptor Basics *Ligand-Receptor Interactions*	Sato-Akuhara et al. "Ligand Specificity and Evolution of Mammalian Musk Odor Receptors: Effect of Single Receptor Deletion on Odor Detection" *Journal of Neuroscience* 2016	**Paper Discussion Reflection #1 due 2/21**
2/25	T	Methods in receptor research *Expression and Molecular Techniques* and *Writing to non-experts workshop*		**Problem Set #1**
2/27	R	Methods in receptor research *Expression and Molecular Techniques II*	Bohlen et al. "A Bivalent Tarantula Toxin Activates the Capsaicin Receptor, TRPV1, by Targeting the Outer Pore Domain" *Cell* 2010	**Paper Discussion Reflection #2 due 2/28**
3/4	T	Methods in receptor research *Ligand binding/efficacy assays*		**Digital Research Journal Check #1**
3/6	R	Leading a Journal Club Workshop	Caterina et al. "The capsaicin receptor: a heat-activated ion channel in the pain pathway" *Nature* 1997	**Paper Discussion Reflection #3 due 3/7**
3/11	T	Methods in receptor research *Electrophysiology*		**Scientific Journalism Article First Draft**
3/13	R	Journal Club 1	Read Journal Club Papers	**Paper Discussion Reflection #4 due 3/14**
3/17-3/21		***Spring Break – no class***		
3/25	T	Methods in receptor research *Structural Biology*		**Digital Research Journal Check #2**
3/27	R	Journal Club 2	Read Journal Club Papers	**Paper Discussion Reflection #5 due 3/28** **Problem Set #2**
4/1	T	Review Article Discussion and Workshop	Carli et al. "Dopamine D2 Receptors Dimers: How can we Pharmacologically Target Them?" *Current Neuropharmacology* 2018	**Scientific Journalism Article Final Draft**

4/3	R	Journal Club 3	Read Journal Club Papers	**Digital Research Journal Check #3** **Paper Discussion Reflection #6 due 4/4**
4/8	T	Methods in receptor research *Structural Biology II*	Rasmussen et al. "Crystal structure of the β2 adrenergic receptor-Gs protein complex." *Nature* 2011	**Paper Discussion Reflection #7 due 4/9**
4/10	R	Journal Club 4	Read Journal Club Papers	**Paper Discussion Reflection #8 due 4/11**
4/15	T	Neurotransmitter receptors		**Review Article Proposal Meeting deadline**
4/17	R	Journal Club 5	Read Journal Club Papers	**Paper Discussion Reflection #9 due 4/18**
4/22	T	Sensory Receptors		
4/24	R	Journal Club 6	Read Journal Club Papers	**Paper Discussion Reflection #10 due 4/25**
4/29	T	Journal Club 7	Read Journal Club Papers	**Paper Discussion Reflection #11 due 4/30**
5/1	R	Journal Club 8	Read Journal Club Papers	**Paper Discussion Reflection #12 due 5/2**
5/6	T	*Peer Review Groups* *Review Article*	**Read and comment on group member's review articles**	**Review Article 1st Draft due in class**
5/8	R	Course Wrap-Up		
5/16	F			**Review Article Final Draft**