

Chemistry 564

Receptor Biochemistry (Signal Transduction)

Course Information

Class days: Monday and Wednesday
Class times: 10:00-10:50 am
Class location: GMCS 314
Mode of delivery: Lecture/discussion

Instructor: Peter van der Geer
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Office location: CSL 322
Office hours: Mondays 12:30-2:00
Tuesdays 1:00-2:30

Learning objectives

- Describe various types of lipids and membrane proteins.
- Describe how lipids and proteins are involved in signal transduction.
- Discuss (in global terms) the importance of signal transduction, the need for communication between cells in multi-cellular organisms, sensing the environment, and role of receptors in sensing and communication.
- Detail the signal transduction cascades downstream of various membrane receptors with emphasis on signal transduction downstream of receptor protein-tyrosine kinases (RPTKs) and G protein-coupled receptors (GPCRs)
- Discuss receptor-mediated endocytosis.
- Discuss regulated intramembrane proteolysis.

Prerequisites

Chem 560:

Amino acids
Nucleotides

structures and basic chemical properties
structures, names and chemical
properties

Proteins

primary, secondary and tertiary structure;
forces involved in protein folding, basic
understanding of enzyme-mediated
catalysis

Lipids
Membranes

structure and function of common lipids
function and physical properties, types of
membrane proteins, synthesis of type 1
integral membrane proteins

Cell biology

basic organization and
compartmentalization of the cell

Course materials

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- Cell Signaling by John Hancock 3/4rd edition
 - We will use handouts that will be posted on Blackboard
Handouts are copies of articles from the scientific literature
 - You may find useful information in some of the following textbooks.
Biochemistry (Voet, Voet, and Pratt), Principles of Biochemistry (Lehninger),
Biochemistry (Garrett and Grisham), Cell and Molecular Biology (Karp), all
have chapters on membranes and membrane proteins and chapters on signal
transduction. Signal transduction (Gomperts, Kramer and Tatham) is a book
completely devoted to signal transduction.

Week	Date	Lecture	Topic	Pages
1	1/22	1	Introduction	
2	1/27	2	Introduction	CS Ch 1.1-14
	1/29	3	Membranes	Basic Biochemistry
3	2/3	4	Lipids	Basic Biochemistry CS Ch. 8.1-8.3; 8.5
	2/5	5	Integral and lipid-linked membrane proteins, secretory pathway	Basic Biochemistry
4	2/10	6	Peripheral membrane proteins and domains	Basic Biochemistry CS Ch. 1.7
	2/12	7	Palmitoylation	Research paper
5	2/17	8	Palmitoylation	Research paper
	2/19	9	Palmitoylation	Research paper
6	2/24	10	Extracellular messengers	CS Ch. 4.1-4.2, 4.4-4.7
	2/26	11	Extracellular messengers	
7	3/2	12	Ligand binding	Basic Biochemistry CS Ch 5.3
	3/4	13	Receptors	CS Ch 5.1-5.3
8	3/9	14	G-protein coupled receptors – the players	CS Ch. 7.1-7.5
	3/11	15	GPCR activation, Cyclic AMP a second messenger	GPCR review articles
9	3/16	16	Midterm	
	3/18	17	Visual system and desensitization	CS Ch. 7.6-7.7 CS Ch. 12.2
10	3/23	18	Receptor protein-tyrosine kinase - activation and signaling proteins	CS Ch. 6.3, Receptor protein-tyrosine kinase reviews
	3/25	19	Analyzing protein-protein interactions	
11			Spring break	
12	4/6	20	Ras-MAP kinase pathway	Ras reviews 1 and 2
	4/8	21	Ras activation	
13	4/13	22	Ras inactivation	Switching Ras on
	4/15	23	Raf-MEK-Erk	
14	4/20	24	Cholesterol transport	
	4/22	25	Receptor-mediated endocytosis	Basic Biochemistry (VVP pp660-664)
15	4/27	26	Regulated intramembrane proteolysis	Basic Biochemistry (VVP pp704-708)
	4/29	27	RIPping and regulation of gene transcription	
16	5/4	28	CSF-1 receptor ripping	
	5/6	29	CSF-1 receptor ripping	

Graded work

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- There will be regular quizzes (usually once a week). Quizzes are worth 10 points each, there will be 13 quizzes, the lowest quiz score will be dropped.
 - There will be one midterm exam worth 80 points (March 16).
 - There will be one final exam worth 150 points (May 8, 10:30-12:30).

Regular quizzes, 13 quizzes, 10 points each, lowest score is dropped	120 points
Midterm, March 16	80 points
Final, May 8 10:30-12:30	150 points
Total	350 points

The following percentage scores are guaranteed. It is possible that the percentages will be lowered, they will not be raised.

Grading scale

85% and above	298 and above	A
80-84%	280-297	A-
75-79%	263-279	B+
70-74%	245-262	B
65-69%	228-244	B-
60-64%	210-227	C+
55-59%	193-209	C
50-54%	175-192	C-
45-49%	158-174	D+
40-44%	140-157	D
35-39%	123-139	D-
below 35%	below 123	F

University policies

Accommodations: If you are a student with a disability and are in need of accommodations for this class, please contact Student Ability Success Center at (619) 594-6473 as soon as possible. Please know accommodations are not retroactive, and I cannot provide accommodations based upon disability until I have received an accommodation letter from Student Ability Success Center.

Student Privacy and Intellectual Property: The [Family Educational Rights and Privacy Act](#) (FERPA) mandates the protection of student information, including contact information, grades, and graded assignments. I will use Blackboard] to communicate with you, and I will not post grades or leave graded assignments in public places. Students will be notified at the time of an assignment if copies of student work will be retained beyond the end of the semester or used as examples for future students or the wider public. Students maintain intellectual property rights to work products they create as part of this course unless they are formally notified otherwise.

Religious observances: According to the University Policy File, students should notify the instructors of affected courses of planned absences for religious observances by the end of the second week of classes.

Academic Honesty: The University adheres to a strict [policy prohibiting cheating and plagiarism](#). Examples of academic dishonesty include but are not limited to:

- copying, in part or in whole, from another's test or other examination;
- obtaining copies of a test, an examination, or other course material without the permission of the instructor;
- collaborating with another or others in work to be presented without the permission of the instructor;
- falsifying records, laboratory work, or other course data;
- submitting work previously presented in another course, if contrary to the rules of the course;
- altering or interfering with grading procedures;
- assisting another student in any of the above;
- using sources verbatim or paraphrasing without giving proper attribution (this can include phrases, sentences, paragraphs and/or pages of work);
- copying and pasting work from an online or offline source directly and calling it your own;
- using information you find from an online or offline source without giving the author credit;
- replacing words or phrases from another source and inserting your own words or phrases.

The California State University system requires instructors to report all instances of academic misconduct to the Center for Student Rights and Responsibilities. Academic dishonesty will result in disciplinary review by the University and may lead to probation, suspension, or expulsion. Instructors may also, at their discretion, penalize student grades on any assignment or assessment discovered to have been produced in an academically dishonest manner.

Resources for students: A complete list of all academic support services--including [Writing Center](#) and [Math Learning Center](#)--is available on the Student Affairs' [Academic Success](#) website. [Counseling and Psychological Services](#) (619-594-5220) offers confidential counseling services by licensed therapists; you can Live Chat with a counselor at http://go.sdsu.edu/student_affairs/cps/therapist-consultation.aspx between 4:00pm and 10:00pm, or call San Diego Access and Crisis 24-hour Hotline at (888) 724-7240.

Classroom Conduct Standards: SDSU students are expected to abide by the terms of the Student Conduct Code in classrooms and other instructional settings.

Prohibited conduct includes:

- Willful, material and substantial disruption or obstruction of a University-related activity, or any on-campus activity.
- Participating in an activity that substantially and materially disrupts the normal operations of the University, or infringes on the rights of members of the University community.
- Unauthorized recording, dissemination, or publication (including on websites or social media) of lectures or other course materials.
- Conduct that threatens or endangers the health or safety of any person within or related to the University community, including
 1. physical abuse, threats, intimidation, or harassment.
 2. sexual misconduct.

Violation of these standards will result in referral to appropriate campus authorities.

Medical-related absences: Students are instructed to contact their professor/instructor/coach in the event they need to miss class, etc. due to an illness, injury or emergency. All decisions about the impact of an absence, as well as any arrangements for making up work, rest with the instructors. [Student Health Services](#) (SHS) does not provide medical excuses for short-term absences due to illness or injury. When a medical-related absence persists beyond five days, SHS will work with students to provide appropriate documentation. When a student is hospitalized or has a serious, ongoing illness or injury, SHS will, at the student's request and with the student's consent, communicate with the student's instructors via the Vice President for Student Affairs and may communicate with the student's Assistant Dean and/or the [Student Ability Success Center](#).

SDSU Economic Crisis Response Team: If you or a friend are experiencing food or housing insecurity, or any unforeseen financial crisis, visit sdsu.edu/ecrt, email

ecrt@sdsu.edu, or walk-in to Well-being & Health Promotion on the 3rd floor of Calpulli Center.