

SIGNAL TRANSDUCTION (BioSci 964, VBMS 964)
Spring 2018
3 credits

Instructor: Rodrigo Franco-Cruz

Signal transduction is the process whereby cells sense information in their environment and transduce it to different physiological outcomes.

Generally, signal transduction starts with a receptor/sensor that recognizes a signaling molecule, the result of which is the induction of a cascade of events leading to specific changes in the cell physiology. There are many signaling pathways as well as many second messengers.

In this class we will examine the basic concepts of signal transduction and revise a broad range of signaling pathways. The primary goals of this class are: 1) for students to be able to understand what signal transduction means and its biological principles; 2) to appreciate the vast and increasing diversity of signaling mechanisms described to date (receptors, ligands, second messengers, adaptors, post-translational modifications, crosstalk, etc); 3) to understand the importance of signal transduction in human/animal/plant development, health and disease; 4) to be able to understand/read signal transduction literature; and 5) to apply this knowledge to their own research.

CLASS MEETS ON MONDAYS AND WEDNESDAYS: 8:45-10:45. The plan is to introduce a topic with a general lecture (45 min to 1 hr), and then a paper discussion will take place. This gives students a general idea of the topic and then the current state of research on every subject. Beware, this class requires quite a bit of reading and participation! Topics are likely to be outside your (and mine) area of expertise as this course is aimed at expanding your understanding of signal transduction and for you to appreciate the learning opportunities outside your field

ATTENDANCE: REQUIRED IF YOU EXPECT TO GET ANYTHING ABOVE A “C”. IF YOU ARE NOT GOING TO BE IN CLASS, LET ME KNOW IN ADVANCE, AND IT HAD BETTER BE A GOOD EXCUSE. ! DID NOT READ THE PAPERS IS NOT AN EXCUSE. IT IS COLD AND SNOWING IS ALSO NOT AN EXCUSE!

PRE-REQUISITES: None. However, students are strongly encouraged to have a general background on cell/molecular biology, biochemistry, physiology. It is not necessarily to be an expert in all the topics to be discussed, but to have an understanding of how a cell functions.

OFFICE HOURS:

Feel free to call or stop at my office to ask questions or get clarification(s). Email contact is preferable as I might not always be at my office.

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Grading Policy:

1. 50% on-class participation. Participation is evaluated on how much you contribute to the class and paper discussion. The correct use of the information and your willingness to extend the topic under discussion will be an important aspect of the evaluation. Come to class ready to discuss the paper you have read. The types of discussion will range from background material, a critical review of the methods used and of the interpretations(s) of the results, future directions, and relevance. This is not

an inclusive list. The best summary of what to know is to know as much as you can. It is important that you begin to integrate the information in a form that is usable to you. Learn to think in signal transduction terms. We are looking for thoughtful ideas, critical analysis, and **effort**. The goal of this class is to have an interactive discussion of everyone in the class. The interactions should become more dynamic with time. Initially you must take the plunge and not be reserved. We will develop together; do not take the attitude that you will just absorb the information! **Participation is NOT optional!!**

2. 25% Presentations: Final oral presentation and defense of the Mini-Grant Proposal (25 min each). There will be 3 small presentations (10 min each) before the final one that will also count for the score. In these small presentations the student will get feedback for the Mini-Grant Proposal and Final presentation
3. 25% Mini-Grant Proposal. A NIH R21-like proposal (2 specific aims, 6 pages + bibliography) based on a signaling process of your choice. The proposal has to focus on signal transduction. Evaluation will include clearness of the hypothesis and goals and methodology.

Grading: A+(>95%), A(95>90%), A-(90>85%), B+(85>80%), B(80>75%), B-(75>70%), C+(70>65%), C(65>60%), C-(60>55%), F (55%>)

REFERENCE MATERIAL:

- <http://csb.portlandpresspublishing.com/>
- Signal Transduction. 2014. Cold Spring Harbor Laboratory Press. Lewis Cantley, Tony Thunter, Richard Sever and Jeremy Thorner.
- Molecular Biology of the Cell. 2014. Garland Science. Bruce Alberts and Alexander Johnson
- Cellular Signaling Processing. 2008. Garland Science. Friedrich Marks, Ursula Klingmuller and Karin Muller-Decker.
- Biochemistry of Signal Transduction and Regulation. 2014. Wiley-VCH. Gerhard Krauss.
- Signal Transduction. 2015. Academic Press. Bastien D. Gomperts, Ijsbrand M. Kramer and Peter E. R. Tatham.

DATE	TOPIC	NOTES
January 01/08	Introduction to the class	
General Principles of Signal Transduction		
01/10	Signal Transduction Mechanisms: Signals and Sensors	
01/15	<i>Martin Luther King Day</i>	No Class
01/17	Signal Transduction Mechanisms: Second Messengers and Protein Modifications	
Signaling Pathways		
01/22	G Protein Coupled Receptor Signaling	Sci Signal 10:eaal3395
01/24	Receptor and Non-Receptor Tyrosine Kinases	Science. 356: 617
01/29	Serine / Threonine Kinase Coupled Receptors	Nat Commun 7: 13817
01/31	Mitogen-Activated Protein Kinases	Mol Cell 64:875
February 02/05	<i>Specific Aims and Objectives due and presentations</i>	<i>10 min each</i>
02/07	Phospholipid Mediated Signaling	Mol Cell 68: 566
02/12	Nuclear Receptors	PloS Biol15:e2000094
02/14	Redox Signaling	Mol Cell 63: 553
Signaling Processes		
02/19	Gene Transcription and Regulation	Nature 543:72
02/21	Cell Cycle and Proliferation	Mol Cell 65: 393
02/26	Protein translation and non-coding RNAs	Mol Cell Biol 36: 2360
02/28	Proteostasis and Protein Degradation Pathways	EMBO J 36:2790
March 03/05	<i>Experimental Approaches due and presentations</i>	<i>10 min each</i>
03/07	Cell Death Signaling	Cell 165:421
03/08 (Thursday)	Sensing and communication in Bacteria (Greg Somerville, SVMBS)	Nat Microbiol 2017 2:17080
03/12-03/14	<i>No lectures scheduled</i>	
03/19-03/21	<i>Spring Break</i>	
03/26	DNA damage response and repair (Aimin Peng, UNMC)	PLoS Biol14:e1002543
03/28	Metabolism and Signaling	Mol Cell 62: 359
Signal Transduction in Health and Disease		
April 04/02	<i>Expected Outcomes and Alternative Approaches due and presentations</i>	<i>10 min each</i>
04/03 (Tuesday)	Signal Transduction in Plants (Lirong Zeng, Plant Pathology)	Cell Host Microb 23:1
04/04	Diabetes and Obesity	Cell Metab 24: 118
04/09	Neurodegeneration	EMBO J 36: 3120
04/11	NPOD Annual Retreat https://cehs.unl.edu/npod/2018-spring-retreat/	Sheldon Museum of Art
04/16	Inflammation and Immune Response	Cell 164: 896
04/18	MMOD Annual Symposium https://mmod.unl.edu/mmod-annual-symposium	UNL's Champions Club
04/23	<i>R21 proposal due and presentations</i>	<i>25 min each</i>

04/25	<i>Presentations Cont.....</i>	<i>25 min each</i>
April-May 04/30-05/02	<i>Presentations Cont..... (If necessary)</i>	<i>25 min each</i>

ACADEMIC INTEGRITY

We support and enforce the UNL academic dishonesty policy published in the Student Code of Conduct and Disciplinary Procedures (Student Code) which may be found the UNL Student Affairs website at: <http://stuafs.unl.edu/ja/code/three.shtml>

Any instances of academic dishonesty such as cheating, fabrication or falsification, plagiarism, abuse of academic materials, falsifying reports of grades, and misrepresentation to avoid academic work won't be tolerated. When evidence is discovered of such instances, the circumstances will be investigated and action taken as specified in Sections 4.2.b through 4.2.e of the Student Code

All of us are members of the UNL academic community and none of us should tolerate academic dishonesty. Please bring instances of such dishonesty to our attention; do not assume we already know about it. We will protect your identity as best we can.

COURSE DOCUMENTS AND RECORDS

I will use **CANVAS** to post course materials and your grades, and to help communicate with you outside of class. All course documents and lecture slides will be posted to that site. The slides I use in class may not exactly match what appears on CANVAS because I reserve the right to revise slides, right up to class time.

You may access the course CANVAS site 24/7 at <http://my.unl.edu/webapps/portal/frameset.jsp>. If you have not used CANVAS before, please learn how to use it. If you need assistance, contact the UNL Information Technology Support Help Desk at 402-472-3970 (866-472-3970, toll free).

We may use some illustrations from textbooks during class presentations under fair use provisions of US copyright law. One criterion for such use is that it be for academic purposes only. We ask that you use such illustrations for THIS CLASS ONLY.

STUDENTS WITH DISABILITIES

It is the policy of the University of Nebraska-Lincoln to provide flexible and individualized accommodation to students with documented disabilities that may affect their ability to fully participate in course activities or to meet course requirements and we support that policy. Students with disabilities are encouraged to contact me for a confidential discussion of their individual needs for academic accommodation. To receive accommodation services, students must be registered with the Services for Students with Disabilities (SSD) office, 132 Canfield Administration, 472-3737 voice or TTY.

CLASSROOM EMERGENCY PREPAREDNESS AND RESPONSE

UNL Alert provides free notification by various means during an emergency. More information about UNL Alert may be found on the UNL Emergency Planning and Preparedness website at <http://emergency.unl.edu/>.

If you receive a UNL Alert notification during a class period, please tell us immediately.

Shelter-in-place

It may be necessary to stay in the classroom if evacuation is not possible, such as a hazardous material release or hostile intruder.

If evacuation is not possible, secure the room and its occupants as much as possible and stay in it. Do not try to go to emergency responders, let them come to you. Turn off room lights and seek cover or concealment as much as possible. Silence cell phones. Remain calm and quiet. Do not answer the door and stay put if you do not recognize a voice outside of the room.

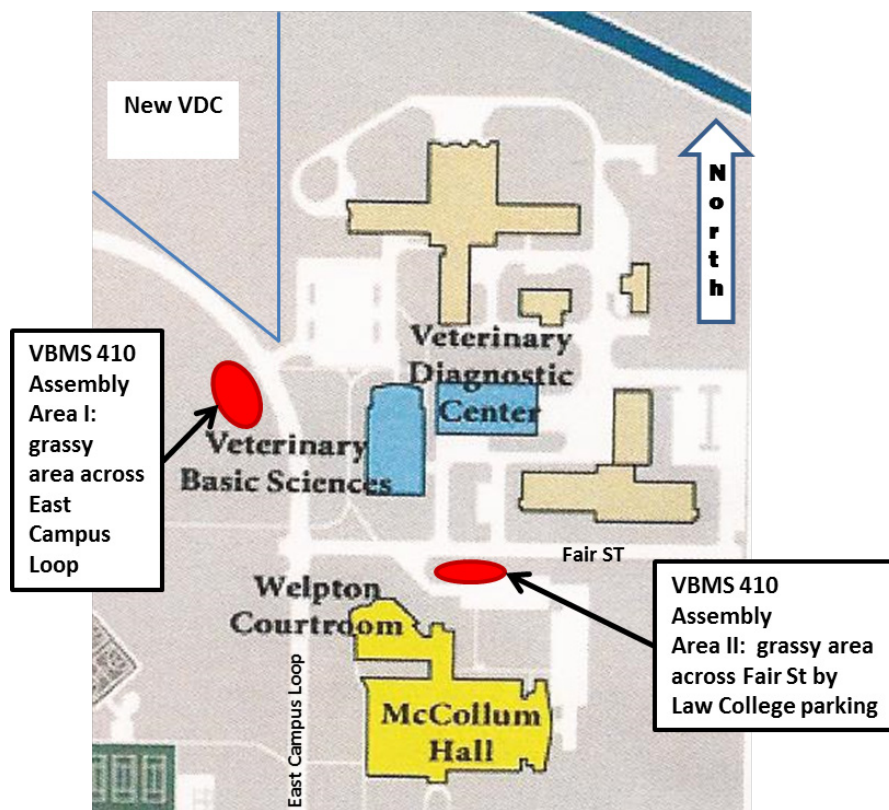
The person seated closest to each door moves to the doors and ensures that it is closed. In the event of a hostile intruder, the doors may be locked.

Emergency evacuation of classroom

There is one exit doors in the back of the room that connects to the hallway in VBS DO NOT obstruct this route. Once outside the building, follow the procedures listed below.

Once outside the building: move to the nearest assembly area. Assembly areas are designated on the map on the next page. **REMAIN IN THE ASSEMBLY AREA UNTIL AUTHORIZED TO LEAVE BY AN APPROPRIATE AUTHORITY.** A class roll must be obtained so emergency response personnel know if someone might still be inside the building. If I am at the assembly area, I will list class members present there and then move to the other assembly area to get a list of class members present there. If I am not at the assembly, then someone there must list class members present and await my arrival. If I do not arrive at the assembly area, stay there. Be ready to give the list to emergency response personnel or other people in authority, such as an emergency responder or a SVMBS staff member. Remember, do not leave the assembly area until authorized to do so by an appropriate authority.

Building Evacuation Assembly Areas for VBMS 410 Students



Severe weather/tornado shelter:

Move to (or stay in) 124 VBS, the large conference room at the south side first floor of the building.

Winter weather closure

Decisions to close UNL made during business hours will be communicated to the University community via UNL Alert, campus e-mail and the UNL website.

Decisions to close UNL made outside of business hours will be communicated usually by 6:00 AM via local broadcast media and various other means.

The effects such closures might have on the course depend upon too many variables to predict. I will announce necessary changes in the course syllabus and class schedule as necessary.