

Advanced Cell Biology

Topics covered: History and theory of cell biology; microscopy and other techniques to study cells and organelles; membranes; organelles; protein import; cell signaling; cytoskeleton; polarity; cell cycle; stem cells; pattern formation; cancer biology.

Advanced topics in: Membrane function and transport across membranes; cell signaling; cell polarity; stem cell biology; molecular patterning; cancer; cell biology techniques.

Instructor: Dr. Michael Freitag
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Class Hours: 9:00 – 9:50, Monday – Wednesday – Friday
ALS 2018 (BB classroom)

Office Hours: Michael Freitag Mo and We 11 am – noon (or by appointment)

Resources: **Reviews and primary papers on CANVAS (required reading)**
Molecular Biology of the Cell, 2015, Sixth Edition, Alberts *et al.* (not required)

Evaluation: Examinations 2, non-cumulative, each 100 points; 200 points total).
Class presentations 2, 50 points each; 100 points total – group score).
Homework 8 10 points each; 80 points total).
Quizzes 20 points total.
Research proposal: 1, 100 points (group score).
Being prepared and participating in class is necessary and required. It will lift or sink you grade to the nearest next grade (e.g. from B+ to A-). If it's truly horrible I will ask for a meeting with the student.

Graduate students (BB560) are required to write a term paper (100 points total).

Learning aids: - Lecture notes are posted on CANVAS site
(there may be some changes **after** each lecture has been given).
- Problem sets and study guides will be available on CANVAS by week 2.
- Links to student exercises will be available on CANVAS.
- Recommended (indicated as “not required”) materials will also be on CANVAS.

BB560 Graduate Student Term Paper. The paper assignment entails a critical analysis of a **recent, full-length, primary** research publication, dealing with any topic covered this term. The appropriateness of the article should be discussed with the instructor prior to May zth. The paper should take the form of a written “Journal Club” presentation, in which the student presents a clear summary and critical analysis of the paper. For example, the following questions should be considered: Is the paper a significant contribution to knowledge? If so, why? Are experimental methods clearly described? Do the authors adequately consider alternative models? Are the experiments convincing? Are the conclusions drawn justified based on the reported results? What are the most important future directions for the work? *Please make sure to substantiate your opinions by citing from the literature.*
Recommended length: <10 pages.

Research proposal and Graduate Student term paper due date:
Monday, November 27th (earlier submission is strongly encouraged).

University Policies on Disability Access Services:

Accommodations for students with disabilities are determined and approved by Disability Access Services (DAS). If you, as a student, believe you are eligible for accommodations but have not obtained approval please contact DAS immediately at 541-737-4098 or at <http://ds.oregonstate.edu>. DAS notifies students and faculty members of approved academic accommodations and coordinates implementation of those accommodations. While not required, students and faculty members are encouraged to discuss details of the implementation of individual accommodations.

Reminder of some additional university policies:

The University rules on civility and honesty can be found at: <http://oregonstate.edu/admin/stucon/regs.html>

Cheating or plagiarism by students is subject to the disciplinary process outlined in the Student Conduct Regulations. Students are expected to be honest and ethical in their academic work. Academic dishonesty is defined as an intentional act of deception in one of the following areas:

- ◆ Cheating-use or attempted use of unauthorized materials, information or study aids
- ◆ Fabrication-falsification or invention of any information
- ◆ Assisting-helping another commit an act of academic dishonesty
- ◆ Tampering-altering or interfering with evaluation instruments and documents
- ◆ Plagiarism-representing the words or ideas of another person as one's own

Behaviors disruptive to the learning environment will not be tolerated and will be referred to the Office of Student Conduct for disciplinary action.

Use of cellular phones is not permitted in the classroom during lectures or exams.

"The goal of Oregon State University is to provide students with the knowledge, skill and wisdom they need to contribute to society. Our rules are formulated to guarantee each student's freedom to learn and to protect the fundamental rights of others. People must treat each other with dignity and respect in order for scholarship to thrive. Behaviors that are disruptive to teaching and learning will not be tolerated, and will be referred to the Student Conduct Program for disciplinary action. Behaviors that create a hostile, offensive or intimidating environment based on gender, race, ethnicity, color, religion, age, disability, marital status or sexual orientation will be referred to the Affirmative Action Office."

Prerequisites and Co-requisites

PREREQUISITES: BB 314 or BB451 or BB492

Learner Outcomes

- Understand and explain functions of major cell compartments, including membranes.
- Acquire working knowledge of the cellular biology of stem cells, cell signaling, the cytoskeleton, the cell (nuclear) cycle, cell death and cell junctions.
- Gain an understanding of how cellular processes are regulated at the level of protein complexes.
- Demonstrate measurable ability to explain and chose from appropriate methods to carry out cell biology investigations.
- Display a measurable understanding of key concepts relevant to cell biology via performance on written examinations, quizzes and homework assignments as outlined above in "Evaluation".

Learner Outcome

- Display a measurable ability to design novel cell biology research in form of a research proposal.

Learner Expectations

- Student will come prepared for lectures by studying the assigned texts, handouts or lecture notes prior to class.
- Significant time is required for studying the assigned readings, lectures and notes throughout the term. *Studying for exams at the last minute will likely result in a poor grade.*
- **The instructor is here to help you!** In turn, you are expected to arrange to come to office hours if help is needed. **DO NOT WAIT UNTIL THE LAST WEEK BEFORE EXAMS!**
- Graduate students: significant time and effort will be spent on preparing term papers. Grades will be assigned relative to the scientific rigor evident in the final product.

<u>Date</u>	<u>Discussion</u>	<u>Topic</u>
9/20	1	Course Overview: Definition of life and cell, history of cell theory
9/22	2	Isolation of cells and cellular compartments
Week of guest lectures by Dr. Weihong Qiu, Physics/BB, OSU		
9/25	3	Microscopy: Light microscopy
9/27	4	<i>Paper discussion: Following gene expression from DNA to import into organelle</i>
9/29	5	Microscopy: Super-resolution and electron microscopy
10/2	6	Membrane structure
10/4	7	Organelles and their function
10/6	8	Protein sorting to different organelles
10/9	9	<i>Paper discussion: Photosynthesis, ATPases or sorting (varies by year)</i>
10/11	10	Cell signaling: Principles and G-coupled receptors
10/13	11	Enzyme-coupled receptors and signaling in gene regulation
10/16	12	<i>Paper discussion: Smell, Ras, Wnt, notch or NFk B paper (varies by year)</i>
10/18	13	Cytoskeleton: actin and microtubules, intermediate filaments
10/20	14	Polarity
10/23	15	<i>Paper discussion: cytoskeleton (animals), polarity (plant or fungi)</i>
10/25		First EXAM (covers discussions 1 to 14)
10/27	16	Nuclear organization: DNA, chromatin, chromosomes.
10/30	17	Nuclear cycle (aka "cell cycle"): The control system.
11/1	18	<i>Paper discussion: Yeast cell cycle (classic genetic approach) or modern paper.</i>
11/3	19	Mitosis, meiosis and cytokinesis.
11/6	20	Cell death (apoptosis)
11/8	21	Cell junctions, adhesion
11/10		<i>Veterans Day (no class)</i>
11/13	22	Stem Cells
11/15	23	<i>Paper discussion: Unequal division..</i>
11/17	24	Mechanisms of pattern formation: <i>hox</i> genes, morphogenesis, cell migration
11/20	25	<i>Paper discussion: Fly or human development, flower development</i>
11/22	26	Dysregulation of cellular processes: "Cancer"
11/24		<i>Thanksgiving holidays (no class)</i>
11/27	27	Genetic and epigenetic roots of cancer
11/29	28	<i>Paper discussion: Cancer development and prevention</i>
12/1	29	Summary and review and conclusion
12/7	Thursday	Second EXAM (2 PM; covers discussions 15 to 28)

Reading for BB460 – Fall 2017

1. All background reading is posted on Canvas in the folder for each week. This includes reviews and copies of textbook chapters that complement the lectures and discussions. Highly recommended reading, which is can be found labelled as “Dx_AuthorYearJournal_Topic”).

2. Papers for discussions (absolutely required reading for all students):

- Group 1** *Paper discussion: From Silencing to Gene Expression: Real-Time Analysis in Single Cells*
P1_Janicki2004Cell_ExpressYourself
- Group 2** *Paper discussion: Protein sorting into the nucleus: The nuclear pore*
P2_Gu2016Cell_NucleoporinAndPlantImmunity
- Group 3** *Paper discussion: Connecting endocytosis and receptor-mediated signaling*
P3_Vinyoles2014MolCell_WntEndosomes
- Group 4** *Paper discussion: Planar polarity*
P4_Aw2016CurrBio_MouseSkinPCP
- Group 1** *Paper discussion: Deciphering the cell cycle – all worked out?*
P5_Kovacs2012MolCell_TxnNetworkCyclinCDKs
- Group 2** *Paper discussion: Asymmetric divisions and Hippos*
P6_Keder2015CurBiol_HippoAsymDivision
- Group 3** *Paper discussion: Body plan development – Hox genes in flies*
P7_Cobeta2017CurrBiol_HoxNeuralStemCellProlif
- Group 4** *Paper discussion: Epigenetics and cancer*
P8_Hochedlinger2004GenDev_CancerReprogramming