

**BioS421 - (O10/D10; On-Site and Distance Education)  
Molecular Cell Biology 1  
(Spring 2015)**

**Tuesdays 4:10 pm – 7:00 pm (Iacocca Hall, IH-E301)**

**Course Site at:** <https://coursesite.lehigh.edu/course/view.php?id=64114>

<b>Instructor:</b>	<b>Prof. Matthias Falk</b>	D-218 Iacocca Hall
610-758-5896 (office)	Fax: 610-758-4004	mmf4@lehigh.edu

All classes will be held except if Campus is closed due to emergency or adverse weather conditions. Consult website or call 610-758-6397 to find out if campus closed.

This course is a discussion class that reviews current “hot topics” in Cell Biology and related areas. **You will need to attend all classes live.** It is designed (I) to give you a sense on current advances in selected aspects of Modern Molecular Cell Biology, (II) to read and understand research and review articles that have been published preferentially in the past year in leading international journals, and (III) to teach you how to critically comprehend, digest, present and discuss the research findings. Select topics were chosen under the aspect of structure & function, cellular dynamics, understanding the proteome, and the central role of cell biology for molecular medicine. Each day, 3 manuscripts will be discussed. Due to the large class size this year, only two paper-presentations/student will be given (= 50% of final grade). Thus, engaged participation in class discussions is very important (= 50% of final grade).

Each publication, will be presented in a PowerPoint presentation by an assigned student and its content will be discussed in class. **Thus, it is important that ALL students carefully read ALL papers that will be discussed on that day BEFORE class meets!**

We will discuss about 35 articles. PDF-files and/or internet-links of the articles (including News & Views sections, cover highlights and other timely comments) will be posted on the accompanying Course Site. Manuscripts will be assigned on the first day of class.

In addition, it is planned that each student presents a short summery (a few minutes each) of her/his work/field of expertise/work environment. These presentations will be given on the first course day after the Introductory Meeting. **Since this is a discussion course, lectures and exams will not be given. Your grade is entirely dependent upon your oral presentations AND lively participation in class discussions! Presence and active participation in ALL classes is required!**

**All students will have to send me their ready PP presentation no later than Tuesday, 12 noon, either by email, or Lehigh Drop Box!**

When preparing your presentation, keep in mind that each student has 45 minutes/presentation including discussion time. Thus, presentations should not be longer than 25-30 minutes. Make sure, that you give a brief, but clear introduction to the

principle topic area of the paper. To consult additional materials, such as the Internet, Google images, and Cell Biology Textbooks, is advisable. **Also, emphasis should be placed on the methods used. Even if a manuscript is not on the topic of one's own research, methods used by others might be very useful!** If you feel, the paper is too long to be presented in its entirety, you have to select and cut to be done in time. Make sure that you explain why sections/figures were chosen to either be presented, or to be eliminated. **For higher resolution images of figures, using the 'full text file' on the journal website (accessible via LTS e-journals) might be advisable, instead of copying figures from the provided relatively low-resolution PDF files.** All articles will be accessible through Lehigh's online library services. In previous classes, it was found to be advantageous when distance ed. students managed to come to class the day of their presentation. Remember, no one knows your presentation better than you do.

## **DETAILED CLASS SCHEDULE:**

### **Class 1, January 20:**

Introduction and Organizational Meeting

### **Class 2, January 27:**

#### ***LEARN TO KNOW EACH OTHERS EXPERTISE (Section I)***

All students will give a short summary (**about 9 min max. each including discussion**) of her/his work, field of expertise, a specific technique or techniques used, and their work environment. Please do not present protected or confidential material. **Please add a portrait picture of yourself as slide 1 to the presentation to help to know each other: and a slide giving bullets on your degree, when and where received, how long and where at work, and how long at Lehigh (how long in distance ed. program).**

#### **Presenters (not necessarily in order:**

- (1) Liam Bonnette
- (2) Elyse Ellsworth
- (3) Susanna Fox
- (4) Sonya Gunter
- (5) Elee Moussa
- (6) Alexandra Richardson
- (7) Catherine Snopkowski
- (8) Linden Watson

#### **BREAK**

- (9) Trista Barthol
- (10) Tiffany Cummings
- (11) Dan Marad
- (12) Mike McLaughlin
- (13) Kate Oliver
- (14) Tim Yeh
- (15) Chao Zhang
- (16) Caitlin Zuilkoski

## ***SELECTED TOPICS IN CELL BIOLOGY (Section II)***

### **Class 3, February 3:**

**Topic 1:** The 2012 Nobel Prize in Medicine, Shinya Yamanaka and John Gurdon: Induced Pluripotent Stem (iPS) Cells; also embryonic stem (ES) cells

**Paper 1A:** The original paper on human iPS cells

*Takahashi et al.*, Cell 2007

(Presenter: Sonya Gunter d/e)

**Paper 1B:** Stimulus triggered pluripotent cells (**falsified data**)

*Obokata et al.*, Nature 2014 (**retracted**)

(Presenter: Tiffany Cummings o/s)

**Paper 1C:** ES cell differentiation into functional human insulin-producing  $\beta$ -cells

*Doug Melton et al.*, Cell 2014

(Presenter: Catherine Snopkowski d/e)

### **Class 4, February 10:**

**Topic 2:** The 2013 Nobel Prize in Medicine, James Rothman, Randy Schekman, Tom Südhof; Intracellular Protein Trafficking

**Paper 2A:** SNARE proteins

*Rothman et al.*, eLIFE 2014

(Presenter: Caitlin Zuilkoski o/s)

**Paper 2B:** COPII coat structure

*Schekman et al.*, eLIFE 2013

(Presenter: Liam Bonnette d/e)

**Paper 2C:** SNARE-formation in neuronal cells

*Südhof et al.*, PNAS 2014

(Presenter: Elyse Ellsworth d/e)

### **Class 5, February 17:**

**Topic 3:** Cell-Extracellular Matrix Interactions

**Paper 3A:** Matrix elasticity and stem cell fate (the original paper by Dennis Discher)

*Discher et al.*, Cell 2006

(Presenter: Kate Oliver o/s)

**Paper 3B:** Fluorescence speckle microscopy to investigate actin dynamics

*Waterman et al.*, Science 2007

(Presenter: Trista Bartol o/s)

**Paper 3C:** The nucleus is part of the cell tension-sensing machinery

*Burridge et al.*, Nature Cell Biology 2014

(Presenter: Tim Yeh o/s)

### **Class 6, February 24:**

**Topic 4:** The classic pathways of Intercellular communication: Gap Junctions

**Paper 4A:** Sudden infant death syndrome (SIDS) is caused by a mutation in Connexin43

*Willecke et al.*, Circ. Cardiovasc. Genetics 2014

(Presenter: Elee Moussa d/e)

**Paper 4B:** Connexin43 membrane targeting and desmosomal disease

*Kathleen Green et al.*, J. Cell Biol., 2014

(Presenter: Chao Zhang o/s)

**Paper 4C:** Connexin43 is required for trophoblast cell fusion

*Tasken et al.*, J. Cell Sci. 2014

(Presenter: Mike McLaughlin o/s)

### **Class 7, March 3:**

**Topic 5:** New pathways for intercellular communication: Nanotubes, Cytonemes, Exosomes

**Paper 5A:** Tunneling nanotubes (TNTs)

*Zurzolo et al.*, J Cell Sci. 2013

(Presenter: Dan Marad o/s)

**Paper 5B:** Cytonemes

*Guerrero et al.*, Nature Cell Biol. 2013

(Presenter: Alexandra Richardson d/e)

**Paper 5C:** Exosomes

*Fedele et al.*, J. Biol. Chem. 2015

(Presenter: Susanna Fox d/e)

### **March 9-13: SPRING BREAK (no class)**

### **Class 8, March 17:**

**Topic 6:** The 2014 Noble Prize in Chemistry, Eric Betzig, Stefan Hell, William Moerner; Superresolution fluorescence light microscopy

**Paper 6A:** Imaging proteins to embryos at high resolution over time

*Betzig et al.*, Science 2014

(Presenter: Linden Watson d/e)

**Paper 6B:** The fine-structure of focal adhesions (see Topic 3)

*Waterman et al.*, Nature 2010

(no Presenter assigned)

**Paper 6C:** Single cilium formation (see Topic 8)

*Stearns et al.*, Mol. Biol. Cell 2014

(Presenter: Catherine Snopkowski d/e)

### **Class 9, March 24:**

**Topic 7:** Postranslational modifications to regulate protein function: Ubiquitination (Ub)

**Paper 7A:** Ubiquitin and mitochondria function

*Kane et al.*, J. Cell Biol. 2014

(Presenter: Mike McLaughlin o/s)

**Paper 7B:** Ubiquitin and chromatin function

*Kalb et al.*, Cell Reports 2014

(Presenter: Caitlin Zuilkoski o/s)

**Paper 7C:** Ubiquitin and transport vesicle size regulation (see Topic 2)  
*Jin et al.*, Nature 2012 (Presenter: Chao Zhang o/s)

**Class 10, March 31:**

**Topic 8: Primary Cilia: Structure/Function and Disease**

**Paper 8A:** Cilium tip organization  
*Anderson et al.*, Nature Cell Biol. 2014 (Presenter: Elee Moussa d/e)

**Paper 8B:** Cilia base pore complex (similarity to nuclear pore complexes and trafficking)  
*Verhey et al.*, Nature Cell Biol. 2012 (Presenter: Dan Marad o/s)

**Paper 8C:** Trafficking of proteins via Golgi into cilia  
*Qian et al.*, Nature Communications 2014 (Presenter: Tiffany Cummings o/s)

**Class 11, April 7:**

**Topic 9: Endocytosis: clathrin-mediated or clathrin-independent?**

**Paper 9A:** Endocytosis is mostly clathrin driven  
*Bitsikas et al.*, eLIFE 2015 (Presenter: Liam Bonnette d/e)

**Paper 9B:** Epsin and actin function in clathrin-mediated endocytosis  
*Messa et al.*, eLIFE 2014 (Presenter: Tim Yeh o/s)

**Paper 9C:** Endophilin and novel CME-independent endocytosis  
*McMahon et al.*, Nature 2014 (Presenter: Sonya Gunter d/e)

**Class 12, April 14:**

**Topic 10: Pathogen Invasion**

**Paper 10A:** Pathogens bind to the tip of filopodia (see Topic 5)  
*Romero et al.*, J. Cell Sci. 2012 (Presenter: Kate Oliver o/s)

**Paper 10B:** Rabies virus uptake via clathrin (see Topic 9)  
*Kirchhausen et al.*, J. Virol. 2013 (Presenter: Elyse Ellsworth d/e)

**Paper 10C:** Bacterial (*Listeria spec.*) uptake mechanisms  
*Cossart et al.*, J. Cell Biol. 2011 (Presenter: Susanna Fox d/e)

**Class 13, April 21:**

**Topic 11: The ESCRT Machinery and Membrane Dynamics**

**Paper 11A:** Plasma membrane repair and ESCRT machinery

*Perez et al.*, Science 2014

(Presenter: Alexandra Richardson d/e)

**Paper 11B:** ESCRT and HIV1 budding

*Sandy Simon et al.*, PNAS 2014

(Presenter: Trista Bartol o/s)

**\*Paper 11C:** ESCRT and how HIV1 becomes an RNA virus

*Mougel et al.*, Nucleic Acids Res. 2014

(Presenter: Linden Watson d/e)

**Class 14, (Last Class) April 28:**

**Topic 12: CRISPR-Cas9 (or buffer day)**

**Paper 12A:** to be determined

(3rd paper, Presenter: )

**Paper 12B:** to be determined

(3rd paper, Presenter: )

**\*Paper 12C:** to be determined

(3rd paper, Presenter: )

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**Accommodations for Students with Disabilities:** If you have a disability for which you are or may be requesting accommodations, please contact both your instructor and the Office of Academic Support Services, University Center 212 (610-758-4152) as early as possible in the semester. You must have documentation from the Academic Support Services office before accommodations can be granted.

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