

2023-2024 MCB Area of Interest Course Information

Developmental Biology, Stem Cells & Aging

FOUNDATIONAL COURSES

Foundational Course One:

Course Number: CONJ 530

Course Title: Directing Stem Cells Toward Regenerative Medicine

Instructor (s): Hannele Ruohola-Baker

Location: SLU

Credits: 3.0

Quarter, Weeks, and Frequency course is offered: Winter, weeks 1-10, odd-numbered years, *will be offered in Winter 2025*

Attributes: lecture and literature review

Sub Area (if applicable): Stem Cells

Synopsis: In this class we will discuss three topics: the recent findings on adult and embryonic stem cell classes and their niches, on epigenetic control of stem cells and stem cells in human disease. **Learning objectives:** After this class, the students should have a solid foundation on stem cell biology, epigenetic analysis and regulation of stem cells and human diseases connected to stem cell biology.

Foundational Course Two:

Course Number: CONJ 542

Course Title: Cell Biology of Development

Instructor (s): Dave Raible, Phil Abitua

Location (e.g. UW, FH, SLU): UW

Credits: 3

Quarter, Weeks, and Frequency course is offered: Autumn, weeks 1-10, even-numbered years, *will be offered in Autumn 2024*

Attributes (e.g., graded, lecture-based): lecture and literature review

Sub Area (if applicable): Development

Synopsis: The goals of this course are:

- to introduce students to the cell biological mechanisms that mediate developmental processes
- to demonstrate the conservation of developmental processes across organisms and organ systems
- to encourage curiosity-driven questioning
- to enhance student skills required to analyze and interpret primary literature in cell and developmental biology, to develop presentation skills to communicate key ideas, and to write effective critiques of scientific literature

The course will focus on four topics that reveal how molecular processes within individual cells are coordinated across tissues to build structures. The instructors will introduce each topic through an explanatory lecture and then devote four sessions to the discussion of key papers in the field. The topics are:

1. how cytoskeletal and motor proteins create tensile forces that change cell shapes and alter tissue structures
2. how apical-basal polarity within cells contributes to the establishment and maintenance of tissue architecture
3. how cellular metabolism influences cell behaviors and differentiation

4. how these cell biological characteristics combine to influence collective cell migration
5. Students will read each paper, including the supplementary data, and be prepared to explain the logic, methods, results, and conclusions described therein. Students will participate in in-class discussions that will focus on novel findings within the papers and on questions that students propose based on their reading.

Foundational Course Three:

Course Number: MCB 522

Course Title: The Developmental Basis of Human Disease

Instructor (s): Cecilia Moens

Location: FH

Credits: 3.0

Quarter, Weeks, and Frequency course is offered: Winter, weeks 1-10, even-numbered years, *will be offered in Winter 2024*

Attributes: lecture and literature review

Sub Area (if applicable): Development

Synopsis: Rapid advances in human genetics have identified a host of new genes associated with rare human genetic disorders. In many cases, the functions of these genes have already been elucidated by developmental and cell biologists working in non-human model systems. This ten-week course will explore the intimate relationship between developmental biology and human disease, including both inherited genetic disorders and cancer. Each week we will choose a different human disorder whose underlying genetic cause has been discovered. We will then discuss how the causal gene or genetic pathway controls normal animal development. The second meeting of each week will be an opportunity for students to present papers from the literature to uncover specific mechanistic links between normal developmental gene functions and disease.

Foundational Course Four:

Course Number: PATH 517

Course Title: The Biology and Pathology of Aging

Instructor (s): Jonathan An and Alex Mendenhall

Location: UW

Credits: 3

Quarter, Weeks, and Frequency course is offered: Winter, weeks 1-10, *will be offered in Winter 2024*

Attributes: lecture and literature review

Sub Area (if applicable): Aging

Synopsis: The students focus on learning about aging, either centered around the hallmarks of aging or some contemporary topic in aging. Students attend or listen to prerecorded lectures, discuss the topic of the lecture in class, perform peer review of a related paper, and discuss the peer review in groups. The peer review model we use is the eLife peer review model.

ELECTIVE COURSES

Elective Course One:

Course Number: BIOL 416

Course Title: Molecular Genetics of Plant Development

Instructor(s): Takato Imaizumi

Location: UW

Credits: 3.0

Quarter, Weeks, and Frequency course is offered: Autumn, weeks 1-10, *will be offered in Autumn 2024*

Attributes: Lecture and Literature Review

Sub Area (if applicable): Course includes upper-level undergraduates

Synopsis: The major goal of this class is to convey the excitement and challenges of doing research in the dynamic field of plant developmental biology. This class will not be a complete survey of plant development, but rather we will take an in-depth look at a few selected areas of current research. **Note:** Students must obtain approval from the MCB Co-Directors for this 400-level class to count toward their 18-graded credits.

Elective Course Two:

Course Number: BIOL 519

Course Title: Data Science for Biologists

Instructor(s): Bing Brunton

Location: UW

Credits: 4.0

Quarter, Weeks and frequency: Winter, weeks 1-10, *not offered in 2024.*

Attributes:

Sub Area (if applicable):

Synopsis: Explores, analyzes, and visualizes biological data sets using scientific computing software. Focuses on the foundations of data wrangling, data analysis, and statistics, particularly the development of automated techniques that are reproducible and scalable to large data sets. Automated techniques are useful for image analysis because cells/tissues change shape during development; e.g., morphometric analysis.

Elective Course Three:

Course Number: BIOL/FHL 536

Course Title: Evolutionary Development of Marine Invertebrates

Instructor(s): Andreas Heyland

Location: UW/Friday Harbor Labs

Credits: 5.0

Quarter, Weeks, and Frequency course is offered: Summer, weeks 1-10, *will be offered in Summer 2024*

Attributes: Practical course, Literature and Methods

Sub Area (if applicable):

Synopsis: Evolutionary Development of Marine Invertebrates will use hands-on lab experience to introduce students to the great diversity of developmental modes and processes found among marine invertebrates. The course will bridge cell and molecular approaches with ecological and evolutionary approaches to provide an integrated view of animal development. The course is intended to serve both biologists who wish to understand diversity in modes of development for ecological and evolutionary studies, and cell and developmental biologists who wish to broaden their knowledge of embryos beyond the standard model systems.

Elective Course Four:

Course Number: CONJ 544

Course Title: Protein Structure, Modification and Regulation

Instructor(s): Stoddard, Campbell, Bradley

Location: FH

Credits: 1.5

Quarter, Weeks, and Frequency course is offered: Winter, weeks 1-5, odd-numbered years, *will be offered in Winter 2025*

Attributes: Lecture, Lit review and methods

Sub Area (if applicable):

Synopsis: Overview of general principles of protein structure, including forces that contribute to folding and stabilization (in week 1), followed by comparative presentation of the primary means by which protein structure and function are studied (NMR, Crystallography, CryoEM and Computational Structure Prediction and modeling) in weeks 2 through 5. The course is intended for molecular and cellular biology students without a background or ongoing research training or experience in structural analyses. The course will introduce students to the basic principles, differences and similarities between different approaches to structural analyses, and will use examples from the recent literature to learn how to evaluate and exploit such studies. Grading is based on participation, questions and answers, and a final writing assignment.

Elective Course Five:

Course Number: MCB 539

Course Title: Biological Basis of Neoplasia

Instructor(s): David MacPherson and Bob Eisenman

Location: FH

Credits: 3.0

Quarter, Weeks, and Frequency course is offered: Spring, weeks 1-10, *will be offered in Spring 2024*

Attributes: Lecture and Literature Review

Sub Area (if applicable):

Synopsis: Introduces the major themes in research in the biology of neoplastic change. Covers principle molecular mechanisms responsible for tumor initiation and progression, with a specific emphasis on intracellular signaling, DNA repair, cell cycle checkpoints, and loss of normal tissue homeostasis. The latest state of the art research in Cancer Biology will be presented by invited scientists, experts in their relevant field. The discussion meetings will concentrate on selected major papers in cancer biology and be presented and discussed by the students with help and guidance of the instructors.

Elective Course Six:

Course Number: PATH 511

Course Title: Topics in Experimental Pathology: The Biology of Aging

Instructor(s): Jonathan An and Alex Mendenhall

Location: UW

Credits: 1.0

Quarter, Weeks, and Frequency course is offered: Spring, weeks 1-10

Attributes: Seminar and Discussion

Sub Area (if applicable):

Synopsis: Students listen to invited speaker lectures on aging research and review and discuss related papers. Class sessions alternate between a lecture and a literature review.