Course Number & Title: BIOL-U26 Developmental Biology

Instructor(s): Dr. Lionel Christiaen; Dr. Kenneth Birnbaum

Course Description:

The course covers the fundamentals of developmental biology in plants and animals with an emphasis on developmental genetics approaches that have connected specific genetic pathways to developmental traits. The first part of the course develops basic principles of developmental biology, including cell-cell signaling, cell identity, pluripotency, and differentiation. These are taught through examples of early development in plants and animals. The emphasis is on the concepts that connect animal and plant development, such as signaling mechanisms that maintain stem cell niches and the factors that determine the developmental potential of a cell. The second part of the course focuses primarily on animal development, such as gastrulation, limb and heart development.

Pre-requisites: BIOL-UA 21 Molecular & Cell Biology

Textbook(s) (if any):


Grading Information: Course grades will be based on the following:

<table>
<thead>
<tr>
<th>Component</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Midterm1</td>
<td>30%</td>
</tr>
<tr>
<td>Midterm2</td>
<td>30 %</td>
</tr>
<tr>
<td>Final Exam</td>
<td>30 %</td>
</tr>
<tr>
<td>Class Participation</td>
<td>10 %</td>
</tr>
</tbody>
</table>

Lecture Topics and Readings

Introduction, Concepts
In Developmental Biology

Mechanisms of differentiation
Induction, asymmetric division
morphogens

Cell-cell signaling

Polarity and the organizer
Fertilization in Animals and Plants

Introduction to Plant Development

Hormone regulation in plants

Root development

Developmental Plasticity and Symbiosis

**MIDTERM #1**

Discussion of Carlsbecker et al.

Shoot development

Cellular Plasticity in Plants

Induced Pluripotent Cells (iPS)

Following cells in development

Early development in invertebrates

macho-1 in ascidian

Early *Drosophila* development

Patterning the *Drosophila* embryo

Segmentation in *Drosophila*

Early amphibian development

Comparison with amniotes

Neurulation,

Neural tube patterning

**Midterm II**

Neural crest

Axonal guidance, target specificity

Segmentation in vertebrates

Myogenesis
Vertebrate limb development

Heart development
Gut development

Sex determination in mammals
Sex determination in *Drosophila*

Germ cells specification and migration

Evolutionary Developmental Biology

Evolutionary Developmental Biology II

Paper discussion (TBD)