The stories are in every newspaper: cloning, stem cells, genetic engineering, in vitro fertilization, cancer therapies, organ regeneration, and protocols for prolonging our lifespan. In the past five years, developmental biology has usurped a place formerly occupied by science fiction... This ability to understand and even transform nature is revolutionary... Students taking developmental biology classes should be able to explain to their classmates (and parents) the science behind the news stories... I also believe that developmental biologists (both current and emergent) need to think about the implications of our research.
Scott Gilbert, 2003

Welcome to
Biology 376
Animal Development
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Each of us was once a single cell. What happened after that remains one of the most amazing processes in the universe.
Review of Syllabus, Course Mechanics

Text: Developmental Biology, Gilbert ©2003 (still using 7th edition)

Important reminders:

Lab begins today, Wednesday, Sept. 2
- lab manual and notebook available for purchase in lab today (bring cash)
- read first lab and background material
- other lab supplies needed by next week
- quiz on microscopy at end of lab
Office Hours

Mon  2 - 4 PM  
Tues  8:30 - 10:30 AM  
Thurs  11 - 12 PM  

Animal Development Course Organization
1. Phenomena of development  
   - what, when and where  
2. Mechanisms of development  
   - how  
3. Special topics  
   - in depth focus on specific areas  
   a. Nervous system development  
   b. Programmed cell death/apoptosis  
   c. Cancer biology  
   d. Evolution & development “Evo-devo”  
History - who - science is done by real people.

Developmental Biology  
- study of life history of organisms  

Embryology  
  Descriptive embryology  
  Comparative embryology  
  Experimental embryology
Questions of Developmental Biology
- Differentiation
- Morphogenesis
- Growth
- Reproduction
- Evolution
- Environmental Integration

Principle Features of Development
- Fertilization
- Cleavage
- Gastrulation
- Organogenesis (and Neurulation)
- Birth / Hatching
- Sexual maturation
- Gametogenesis
- Senescence / Death

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Embryogenesis

Post-Embryonic Development
Fig 2.1 Developmental history of the leopard frog, Rana pipiens.

Principle Features of Development

• Fertilization

Cleavage - rapid cell division without growth

Fig 2.2 Early development of the frog, Xenopus laevis.
Principle Features of Development

- Fertilization
- Cleavage
- Gastrulation - rearrangement of cells into layers - formation of “primary germ layers”

**Gastula**  
- Ectoderm
- Mesoderm
Principle Features of Development

- Fertilization
- Cleavage
- Gastrulation
- Ectoderm
- Mesoderm
- Endoderm

Fig 2.1 Developmental history of the leopard frog, Rana pipiens.

Principle Features of Development

- Fertilization
- Cleavage
- Gastrulation
- Organogenesis - in the vertebrates, this includes Neurulation
Fig 2.1 Developmental history of the leopard frog, *Rana pipiens*.

**Principle Features of Development**
- Fertilization
- Cleavage
- Gastrulation
- Organogenesis
- Birth / Hatching
- Maturation and Gametogenesis
- Aging / Senescence
Fig 2.1 Developmental history of the leopard frog, *Rana pipiens*.

**Germline**

- Separation between soma & germline
- Fertilization (via Germline)
- Death
- Gametes
- Soma: body cells
- Germline: gametes

**The process is repeated**

- Mortal
- Immortal
<table>
<thead>
<tr>
<th>The core concept of Development:</th>
<th>Differential Gene Regulation &amp; Genomic Equivalence</th>
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<tbody>
<tr>
<td>All cells have the same genes</td>
<td>(genomic equivalence), but each cell turns on a specific subset of those genes (differential gene regulation).</td>
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Levels of Gene Regulation:
- Transcription
- RNA processing, stability
- Translation
- Post-translational modification