PowerLecture:
Chapter 43
Principles of Animal Reproduction and Development
Section 43.0: Weblinks and InfoTrac
See the latest Weblinks and InfoTrac articles for this chapter online
Impacts, Issues: **Sex and the Mammalian Heritage**
- Lioness gives birth to cubs less than 4 months after mating
- Cubs depend on mother about 16 months
- 80% die before 16 months, usually from starvation

Impacts, Issues: **Sex and the Mammalian Heritage**
- Males are larger, compete for dominance of females
- When new male assumes power, he kills all cubs he can catch
- Females collectively ovulate, get pregnant, bear and defend cubs

Impacts, Issues: **Sex and the Mammalian Heritage**
- In nature, the main function of sex is to perpetuate one's genes

- Perpetuation of life includes reproduction and development

Section 43.1: Weblinks and InfoTrac
See the latest Weblinks and InfoTrac articles for this chapter online
Modes of Reproduction
- Sexual reproduction
  - Meiosis, gamete formation, and fertilization
  - Offspring show genetic variation
- Asexual reproduction
  - Single parent produces offspring
  - Offspring are genetically identical

Cost of Sexual Reproduction
- Specialized cells and structures must be formed
- Special courtship, and parental behaviors can be costly
- Nurturing developing offspring, either in egg or body, requires resources from mother

Cost of Sexual Reproduction

Early Development
Where embryos develop
Section 43.2: Weblinks and InfoTrac
See the latest Weblinks and InfoTrac articles for this chapter online
Stages of Development
Gamete formation
Fertilization
Cleavage
Gastrulation
Organ formation
Growth, tissue specialization

Stepped Art
Life Cycle of a Leopard Frog
Leopard frog life cycle
Life Cycle of a Leopard Frog
Stages of development

Section 43.3: Weblinks and InfoTrac
See the latest Weblinks and InfoTrac articles for this chapter online
Maternal Instructions
- The egg cytoplasm contains enzymes, mRNA transcripts, etc.
- These materials are not randomly distributed throughout the egg
- The egg also contains yolk, which influences cleavage patterns

Experimental Evidence of
Localized Differences

Experimental Evidence of
Localized Differences
Cytoplasmic localization
Cleavage Patterns Vary
- Complete or incomplete
- Radial or rotational

Section 43.4: Weblinks and InfoTrac

See the latest Weblinks and InfoTrac articles for this chapter online

Gastrulation

- Blastula is ball of cells
- During gastrulation, some cells move inward
- Produces a three-layered embryo
  - Ectoderm
  - Mesdoderm
  - Endoderm

Gastrulation

Gastrulation

Cell Differentiation

- Certain groups of genes are activated in some cells but not in others
- Genes are not lost, just inactivated
- Gurdon showed frog intestinal cell still had all the genes needed to make a new individual

Morphogenesis

- Orderly changes result in specialized tissues and early organs
- Cells migrate
- Whole sheets of cells expand and fold
- Programmed cell death sculpts body parts

Morphogenesis

Neural tube formation

Section 43.5: Weblinks and InfoTrac

See the latest Weblinks and InfoTrac articles for this chapter online

Cytoplasmic Localization

- Development fate of embryonic cell lineages changes upon exposure to gene products from adjacent tissues
- Cells behave as if they have positional memory
- Demonstrated experimentally by transplanting embryonic cells

Signal Transduction Pathways

Dorsal Lip Transplant

Dorsal Lip Transplant

Embryonic induction

Morphogens

- Dorsal lip (embryonic signaling center)
- Influences other cells by producing a morphogen

- Diffusion of morphogen creates gradient that influences differentiation; influences which genes are turned on or off

AER Transplant
AER transplant
Pattern Formation
- Starts with cytoplasmic localization
- Classes of master genes activated in sequence
- Interactions among master genes are guided by regulatory proteins
- Gene products are spatially organized in the embryo

Similar Master Genes
- Diverse animals use similar or the same master genes to govern development
- May help explain why there are so few body plans
- The relatively small number of master genes constrains variation

To Know a Fly
- *Drosophila* used to study development
- Fate map
- Egg is polar
- Gradients of gene products influence expression of other genes

Section 43.6: Weblinks and InfoTrac
See the latest Weblinks and InfoTrac articles for this chapter online
Videos: CNN
Ask your Thomson Sales Representative for these volumes on CD or VHS

- Genetics, 2003, Vol. 1, *Fountain of Youth* (1:32)

- Biology, 2004, Vol. 8, *Is Aging Treatable?* (2:25)

Why Do Animals Age?

- Programmed life span hypothesis

- Cumulative assaults hypothesis

Gray Crescent
Formation of gray crescent
Blastomere
Blastomere separation I
Blastomere
Blastomere separation II
Section 43.7: Weblinks and InfoTrac
See the latest Weblinks and InfoTrac articles for this chapter online
Dying in the Open
- *Everything in the world dies, but we only know about it as a kind of abstraction*
- *Animals seem to have an instinct for performing death alone, hidden*
- *If…all the dying were done in the open, with the dead there to be looked at, we would never have it out of our minds*
- *…we take [deaths] to be unnatural events, anomalies, outrages*

- *We will have to give up the notion that death is a catastrophe, or detestable, or avoidable, or even strange*
- *Everything that comes alive seems to be in trade for everything that dies… There might be comfort in the recognition of synchrony, in the information that we all go down together, in the best of company*

- Lewis Thomas, 1973

Leading cancer specialist before his own death from cancer

Coral Spawning
Salamander
Salmon Upstream
Tadpoles