Biology of Reproduction
Spring 2008

- **Louis Guillette**
- Office: 528 Bartram Hall
- Office Hours:
  - Tuesday period 4 (10:40-11:25)
- Phone: 392-1098;
- Email: ljg@zoo.ufl.edu
- http://www.zoo.ufl.edu/ljg/Courses/index.htm

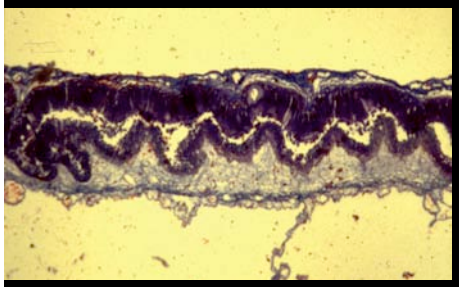
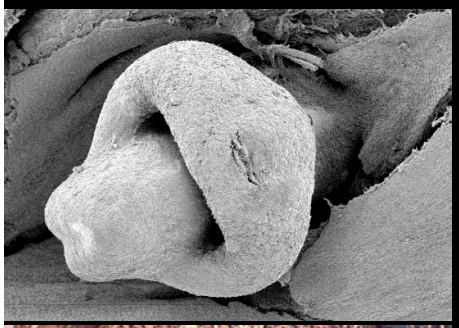
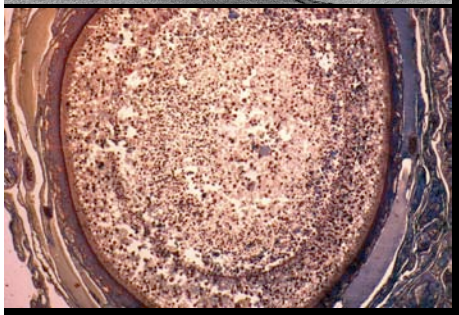
- **Ashley Boggs**
- Office 309 Carr Hall
- Office Hours: Thursday period 4 (10:40- 11:25)
- Email: boogsta@zoo.ufl.edu

Guillette laboratory

- 23rd year at UF
- Research focus on reproductive biology
- Teaching: general biology - graduate studies

My Research

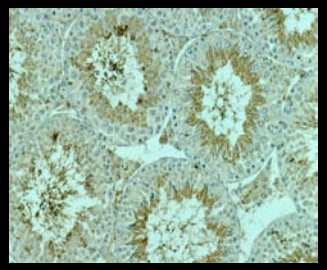
- **Perchlorate**: 70% of solid rocket fuel
- Effects on thyroid hormone and development of the reproductive system at NASA's Cape Canaveral, Florida


Laboratory Projects

- Evolution of the Reproductive System
  - Environmental sex determination
  - Maternal-fetal communication
  - Genitalia development
- Endocrine Disruption & Birth Defects
  - Phallic abnormalities
  - Ovarian follicle defects
    - FSH/Inhibin/activin abnormalities
    - Hypothyroidism
- Endangered Species Reproduction

The World of Reproductive Biology



Laboratory-based Studies

Molecular

↑ seconds

Cellular

↑ minutes

Tissue

↑ hours

Organ

Organism

Population

↑ decades

Community

↑ centuries

Ecosystem

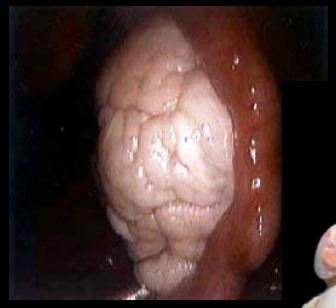
↑ eons

Biosphere

Field-based Studies

years

Lab or Field-based Studies



Thanks to John Moran and Rex Hess
for use of photos presented here.

Guillette - UF

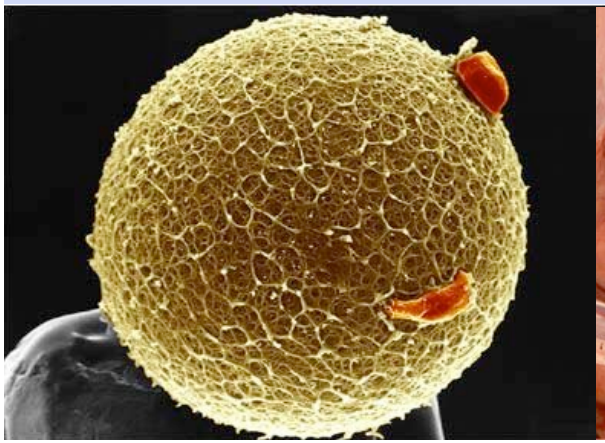
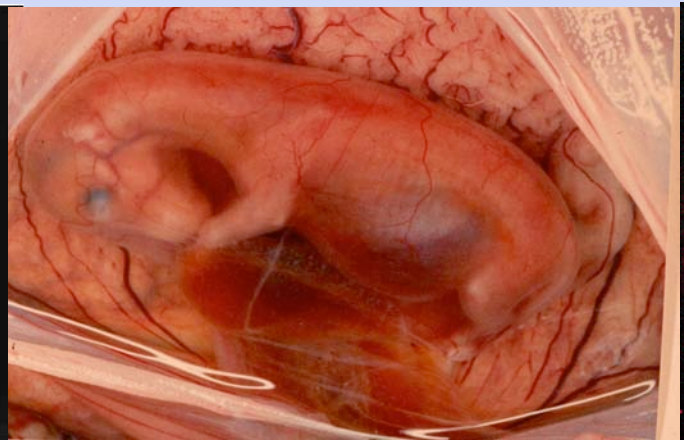
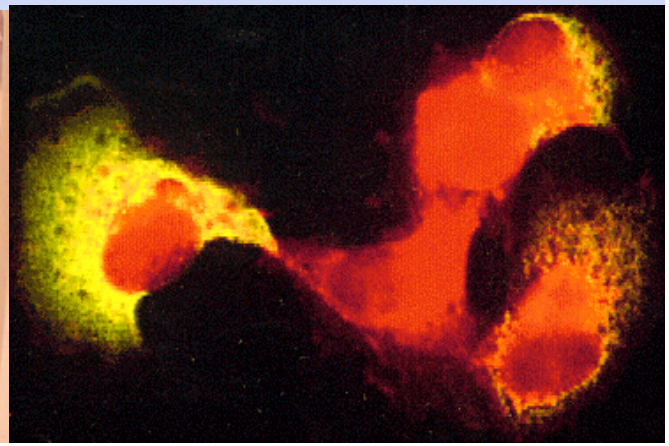
Evolution: Darwin's main ideas

1) Natural selection is "**differential success in reproduction**"

   a) Unequal ability of individuals to survive and reproduce

Reproduction

- central to biology and evolution
  - "differential reproduction"
- involves production, growth and differentiation of new individuals
- interdisciplinary in scope

Evolution: Darwin's main ideas

2) interaction between the **environment** and the **variability** inherent among individuals making up a population

Genes AND Environment

Phytoestrogen: genestein

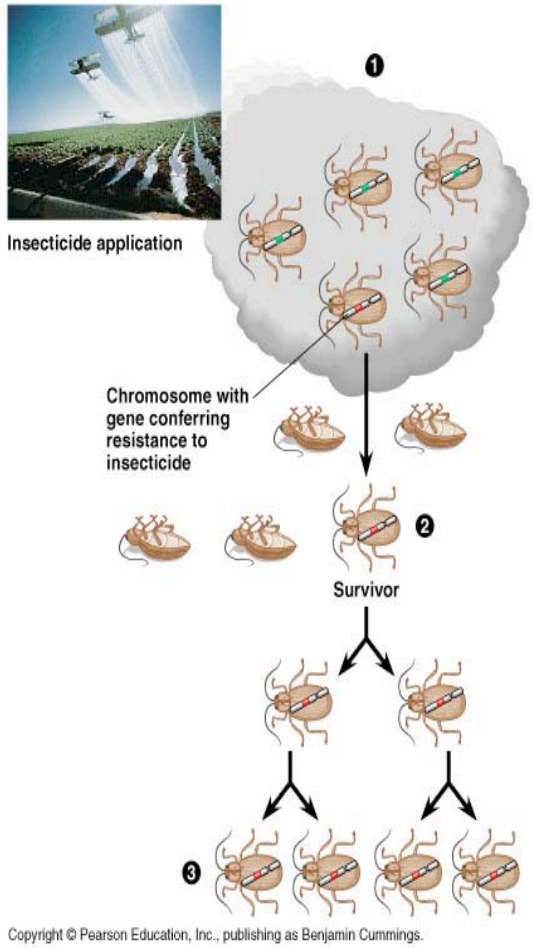
Evolution: Darwin's main ideas

3) adaptation of populations of organisms to their environment

insecticide resistance in insects

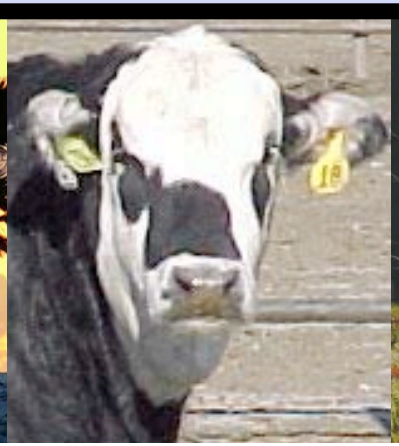
Insects with chromosome for resistance differentially reproduce

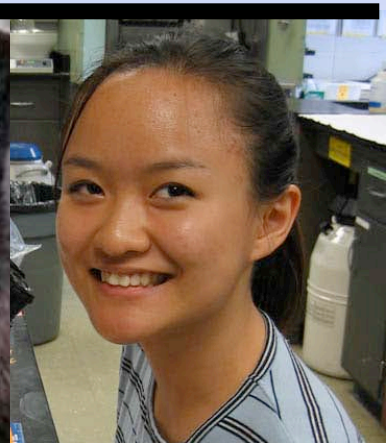
Figure 22.12 Evolution of insecticide resistance in insect populations



Model Systems

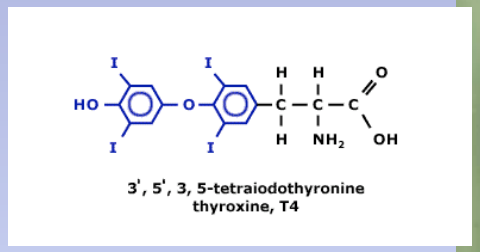
- 90% of the recent research in mammals is focused on 10 species
  - 0.02% of present day vertebrate species!
- these 'models' have "pointed the way" but do not clearly represent the diversity present

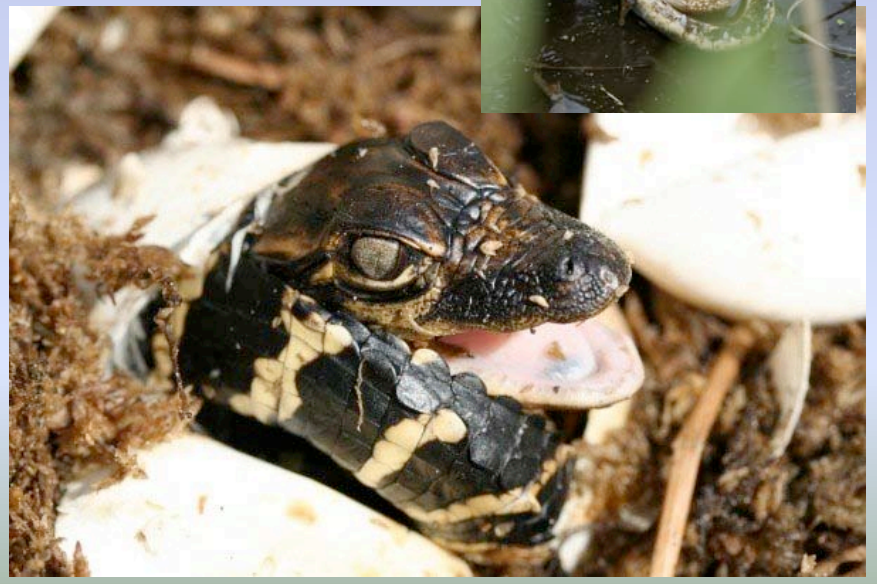



Alligators for Water Quality Research

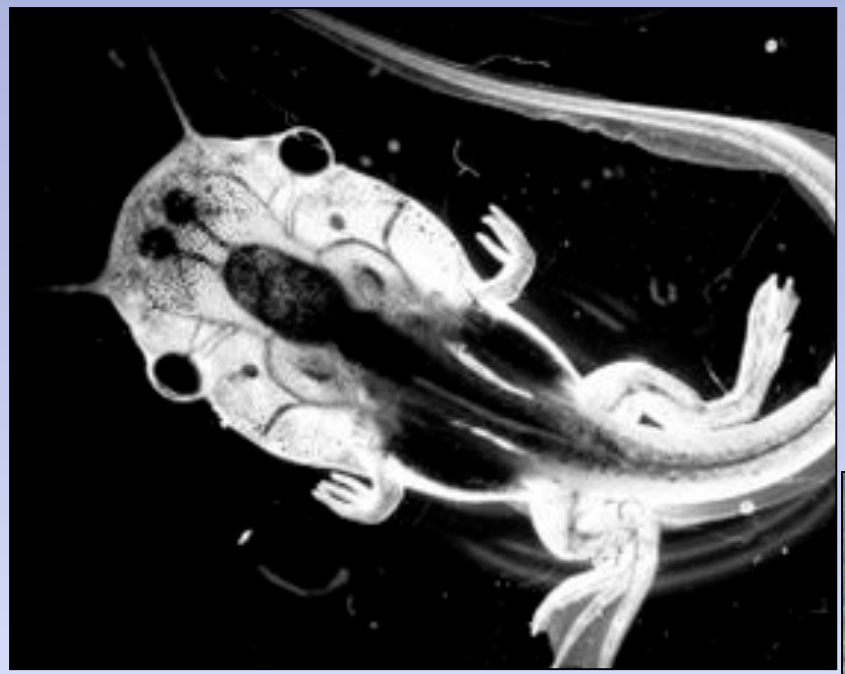
- Aquatic
- Long lived
- Top predator of the food chain
- Thyroid hormone is chemically identical
- Thyroid gland morphology is similar to human
- Egg is permeable



3', 5', 3, 5-tetraiodothyronine
thyroxine, T4



Xenopus laevis Model System?



- Fully aquatic throughout life
- Easy to breed in captivity
- Egg development easy to see

- Tetraploidy: 4 chromosomes
- Molecular model???

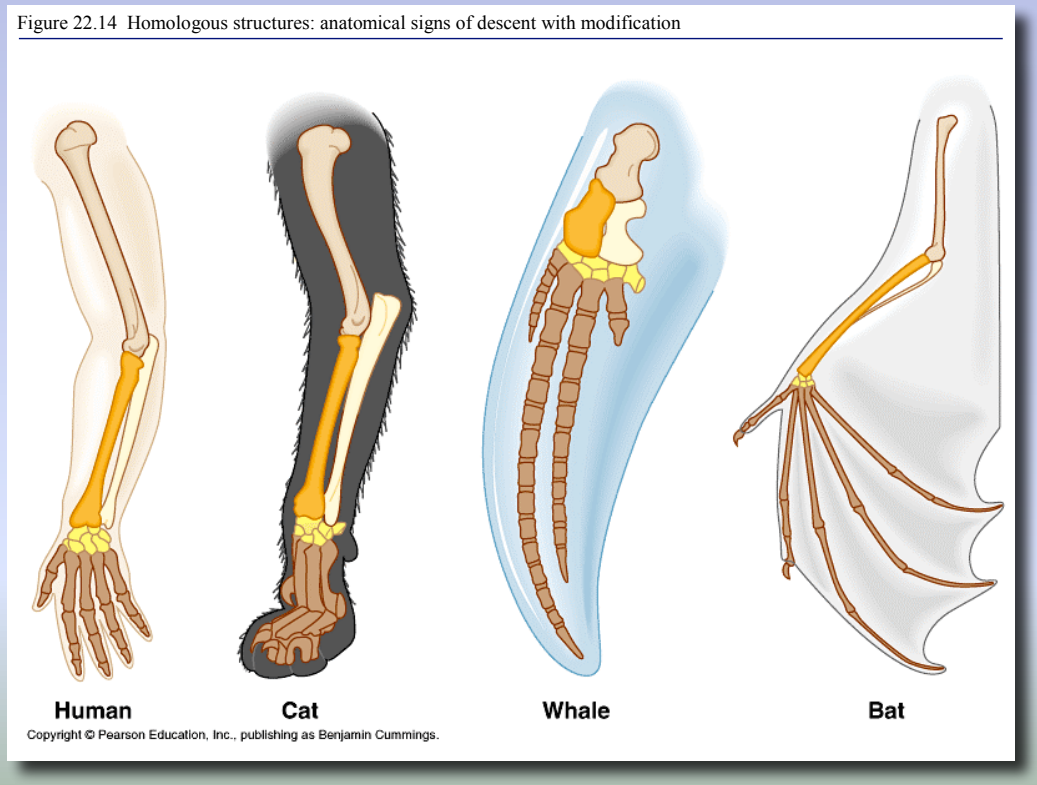
Terms You Should Know

- **PLESIOMORPHIC** - primitive
- **APOMORPHIC** - derived

- **HOMOLOGY**- characters share similar design and common evolutionary origin
- **ANALOGY** - independent evolutionary origin of structures that have similar form or function

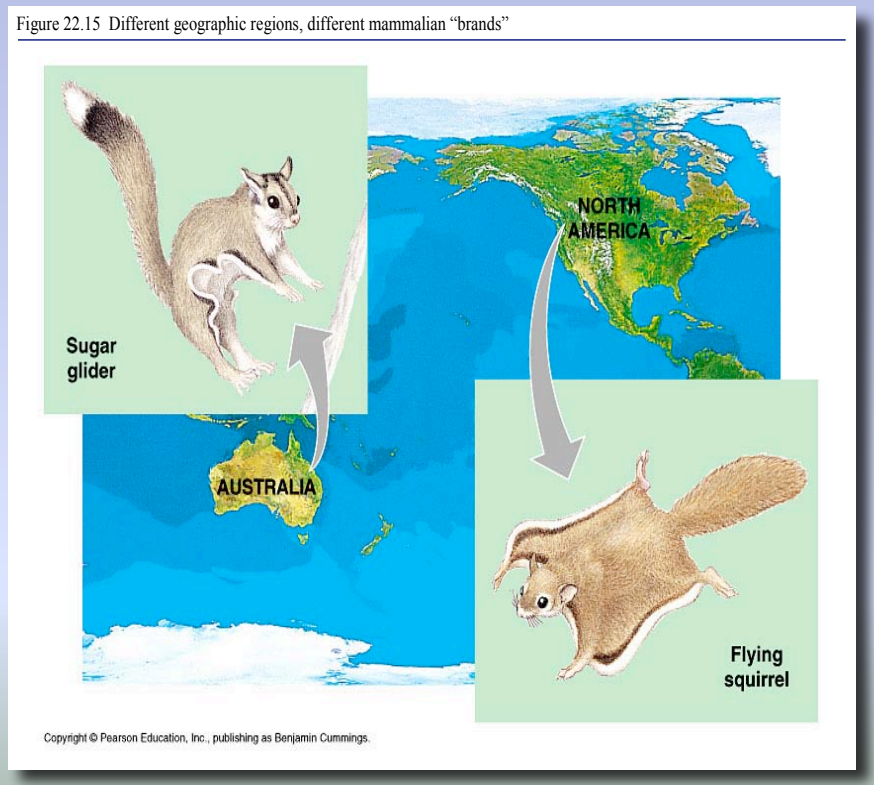
Homology

- **characters share similar design and common evolutionary origin**
  - bird wing and mammal limb
  - sexual homologies - mammalian external genitalia

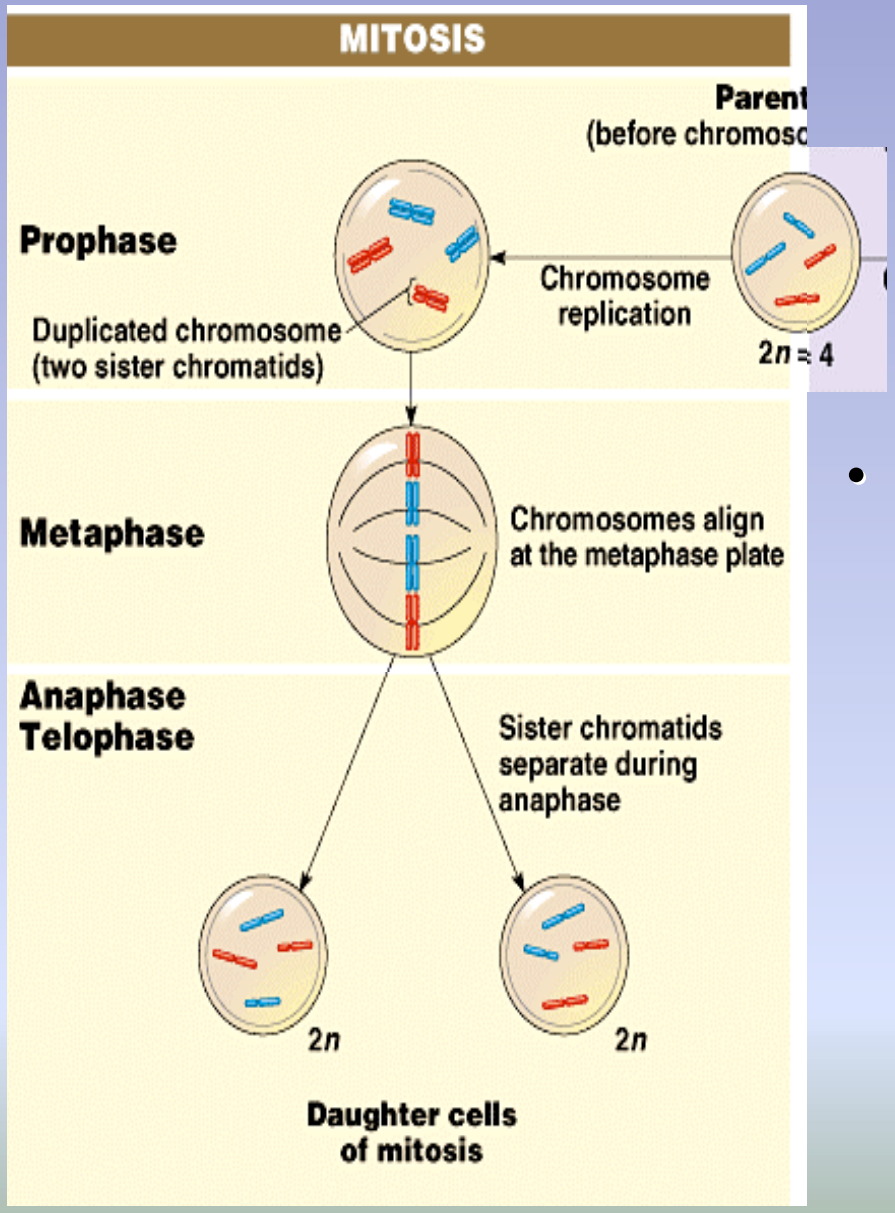


Analogy

- **Independent evolutionary origin of structures that have similar form or function**
  - wings of birds and bees
  - convergent evolution



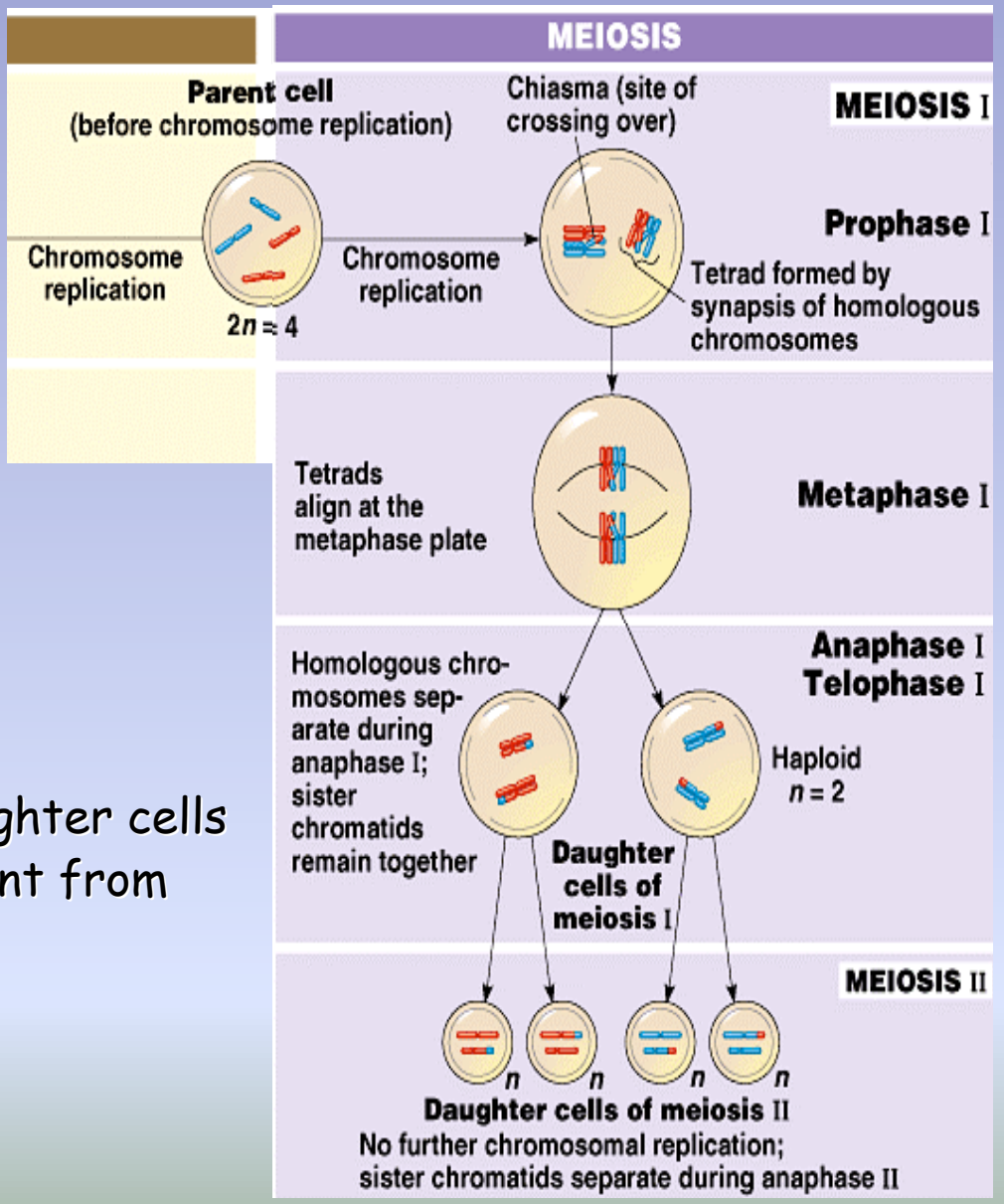
Mitosis and Meiosis



- Mitosis
  - 2 daughter cells/division
  - Equal chromosomal separation - diploid daughter cells
  - Daughter cells identical to parent cell

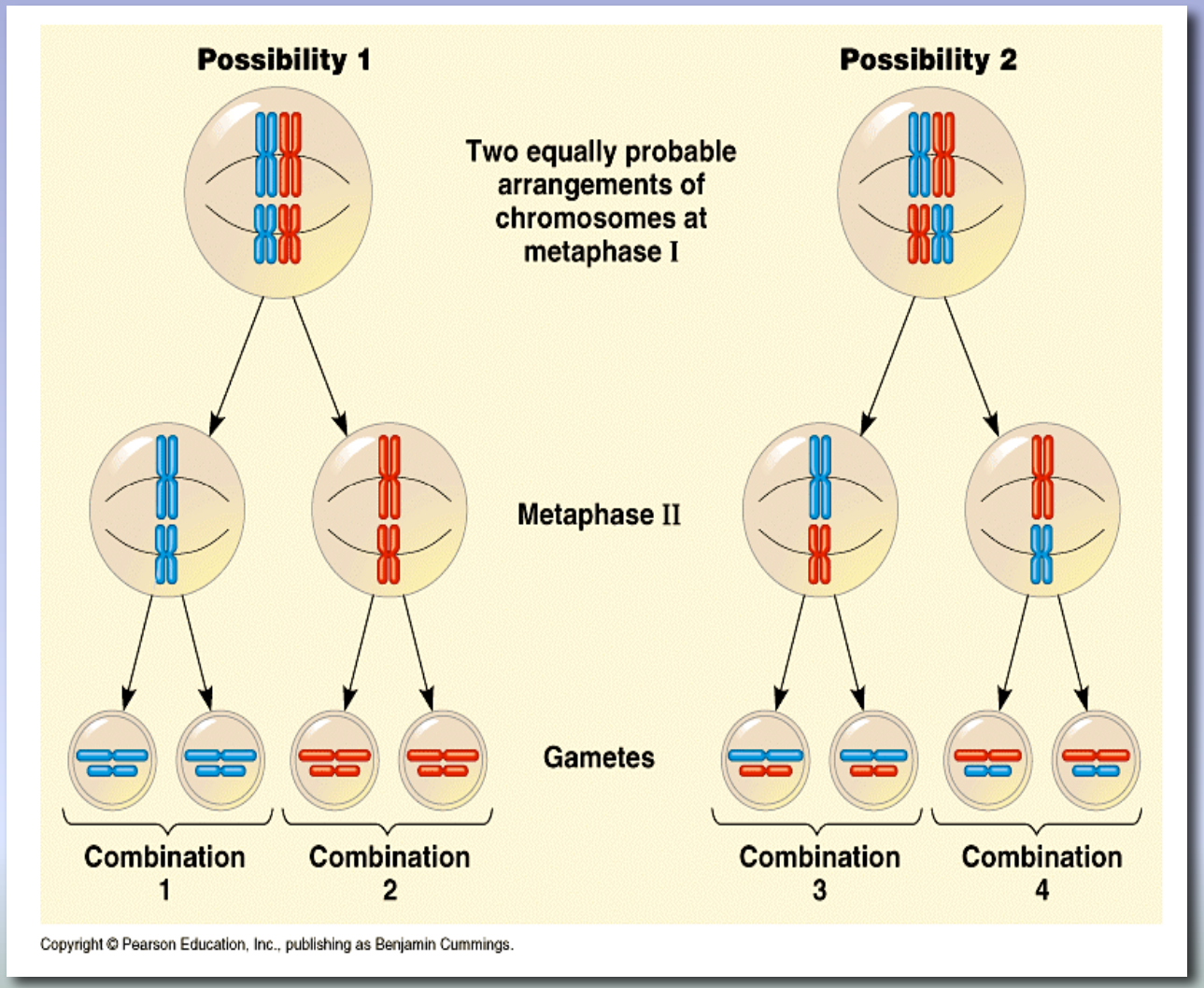
Mitosis and Meiosis

- Meiosis
  - Male 4 cells/division
  - Female 1 cell/division
    - 2 polar bodies
  - Unequal division - haploid daughter cells
  - Daughter cells can be different from parent cell



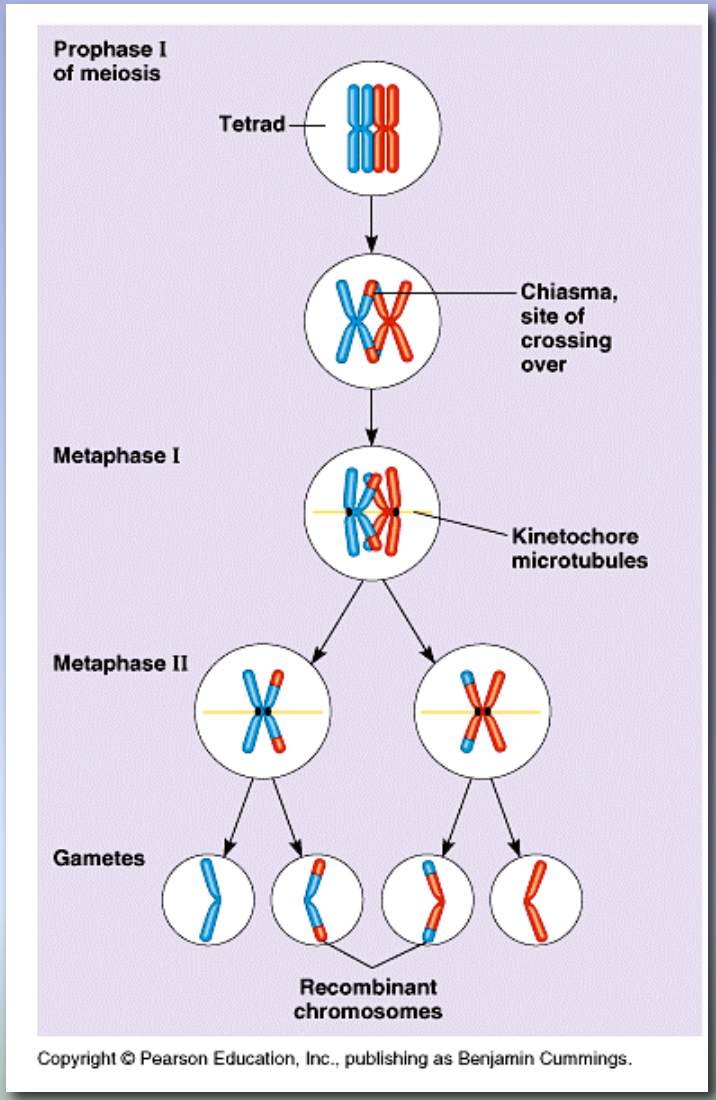
Meiosis generates variability

alternative arrangements of homologous chromosome pairs

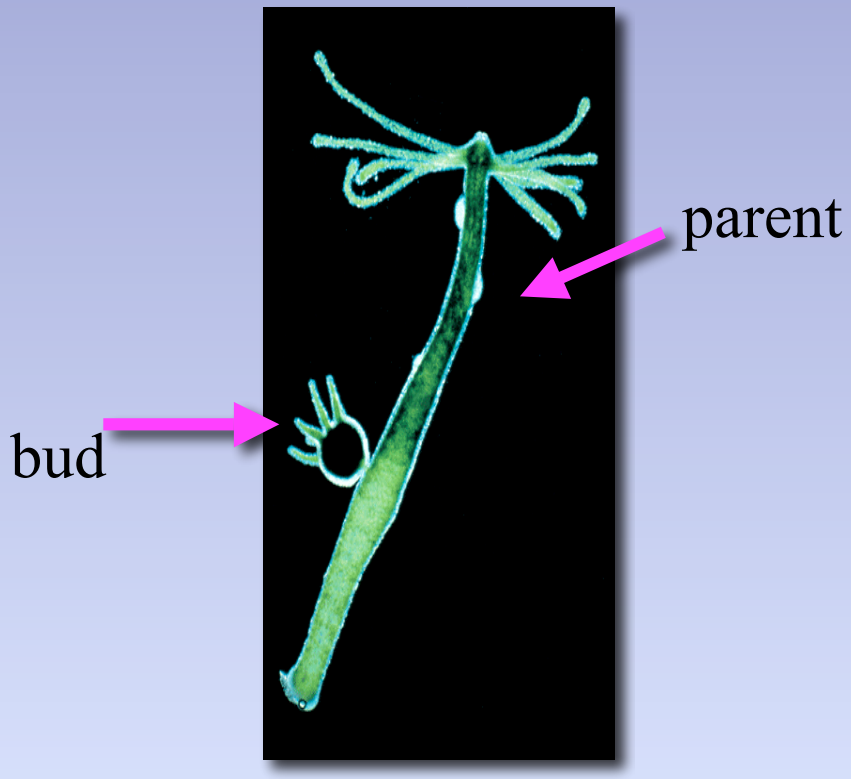


Meiosis generates variability

As a result of crossing over



Asexual Reproduction

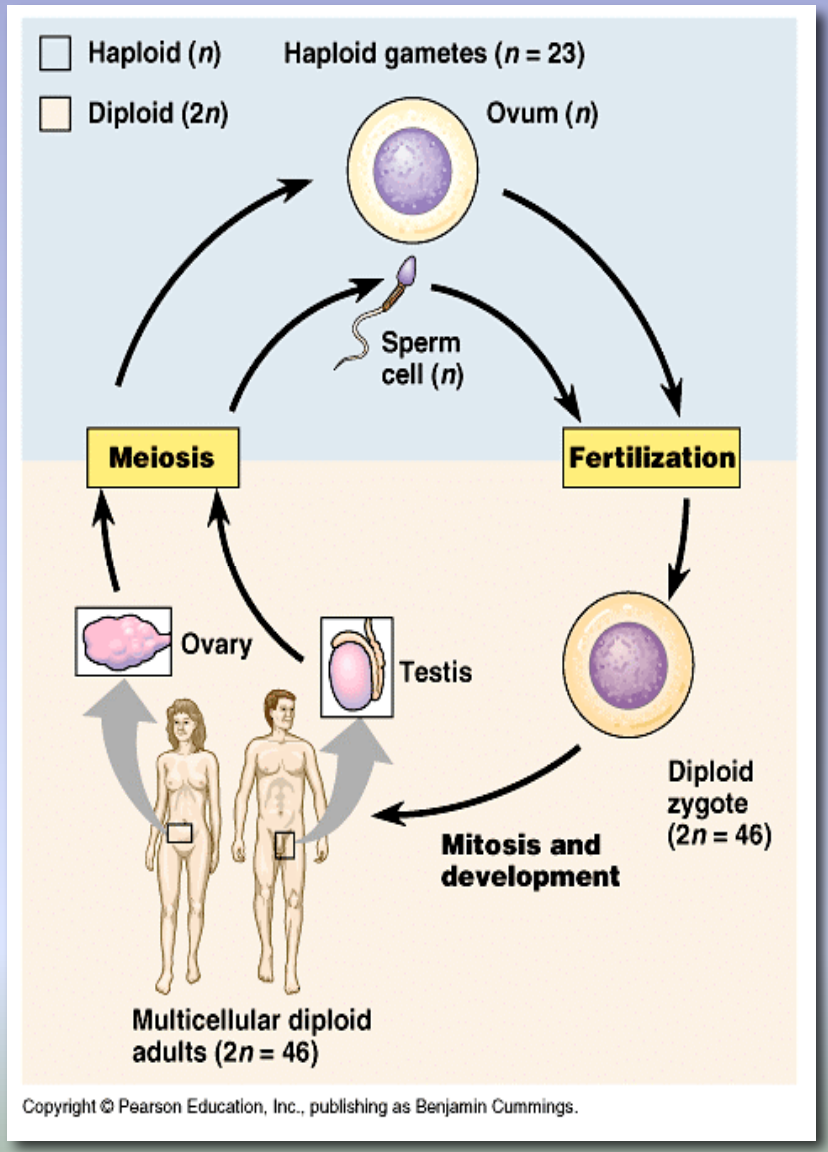


- all genes from one parent
- **fission** - a separation of a parent into two or more individuals of about equal size (mitosis)
- **budding** - new individuals split off parent


Crown of Thorns Starfish

Sexual Reproduction

- genes from two parent
- fusion of haploid gametes = diploid zygote
- male gamete = sperm
  - usually smaller than oocyte
- female gamete = ovum
  - egg/oocyte
  - usually larger than sperm
- gamete also called germ cell



External Fertilization

- requires shedding of eggs and sperm
- usually in moist environment
  - prevent egg desiccation
  - allow sperm transport
- environmental factors can initiate release
  - temperature, rainfall, salinity, lunar cycle, pheromones, behavior

Internal Fertilization

- cooperative mating
- behavior important
  - courtship
  - mate choice

Sex Ratio

- **Primary** - male:female at fertilization
  - only those with genetic basis for sex determination
- **Secondary** - at end of parental/incubation period
- **Tertiary** - male: female adults in population