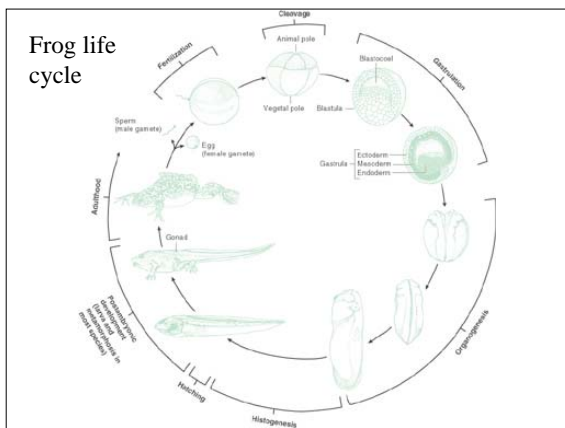


Chapter 5

Image PowerPoint

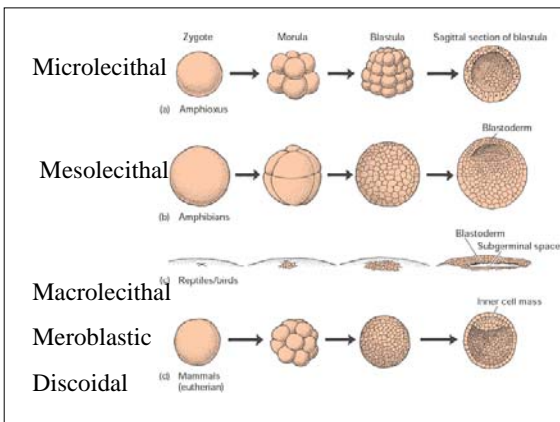


- **Embryonic development** (= ontogeny) – fertilization – birth or hatching
 - Single, fertilized cell becomes millions
 - Develops basic structural organization of an individual
- **Maturation** – birth to sexual maturity
 - Growth in size
 - Acquisition of learned skills
 - Acquisition of secondary sexual characteristics
- Abrupt body form change = metamorphosis
- **Immatures** = juveniles

Embryologic development

- **Zygote** undergoes division, or cleavage
- Cell types differentiate into three major germ layers
 - **Ectoderm**
 - **Mesoderm**
 - **Endoderm**
- Zygote passes through stages:
 - **Morula** – solid ball of cells
 - **Blastula** – division continues to form a hollow ball of cells

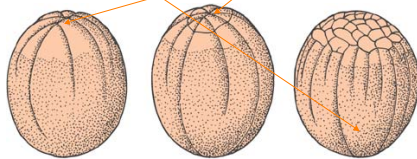
- **Gastrula** – hollow ball of cells that has invaginated at one end
- **Neurula** – elongated version of a gastrula
- **Embryonic area** – area that will become living embryo
- **Extraembryonic area** – area that will form membranes that nourish the embryo
- **Egg types differ** in yolk amount & cleavage pattern
 - Depends on the amount of yolk present
- **Learn animal egg types and amounts of yolk and yolk distribution in each. (Table 5.1)**



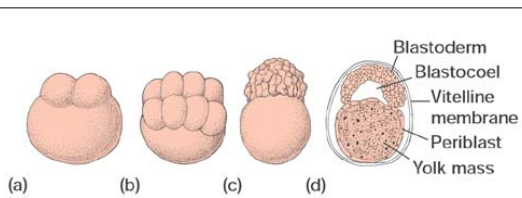
Holoblastic (= complete) cleavage (bowfin, *Amia*)

Cells of different sizes result from different amounts of yolk in each

Little or no yolk at the **animal pole**; more yolk toward the **vegetal pole**



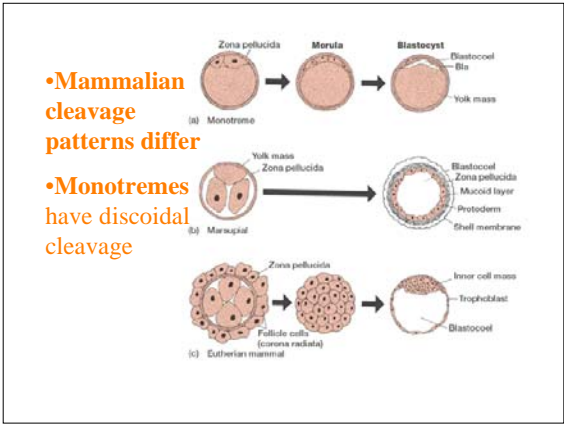
- **Cleavage direction** and order stereotyped
- **First cleavage** may not be complete prior to the second starting
- Cleavages continue at increasing pace
- **Blastula** hollow ball of cells does not change mass greatly but many additional cells (= blastomeres) present



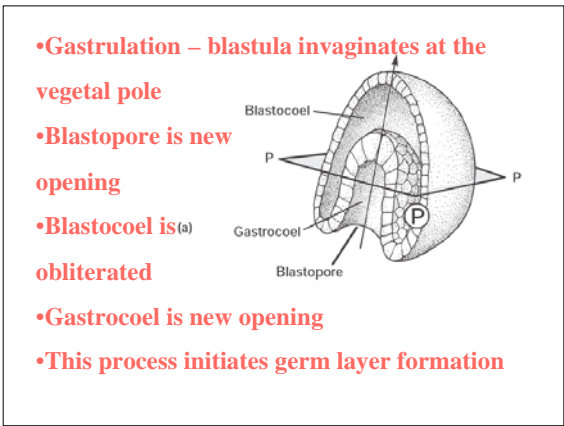
Macrolecithal egg of a teleost

Cleavage forms a **blastodisc** (= blastoderm)

Most of vegetal pole with most of the yolk does not divide and becomes the **periblast**, a layer of cytoplasm adhering to the undivided yolk mass



- **Marsupials** have no morula stage
 - Cells spread inside zona pellucida and form protoderm
- **Eutherian** mammals pass from a morula to a blastocyst
 - Inner cell mass cells become embryo
 - Outer cells become trophoblast that forms membranes
 - Little yolk present



Gastrulation – formation of endodermal tube of early gut

Space within gut is **archenteron** (= gastrocoel)

Outer layer is **ectoderm**

Layer that moves between is the **mesoderm**, with three regions:

- Mesomere
- Epimere
- Hypomere

Cross sections at right come from plane "P" in drawing at left

Gastrulation in amphioxus (microlecithal, isolecithal egg type)

- Colors for different germ layers remain the same
- Mesodermal outpocketings form somites
- Endoderm forms gut lining

Lamprey early development through neurulation

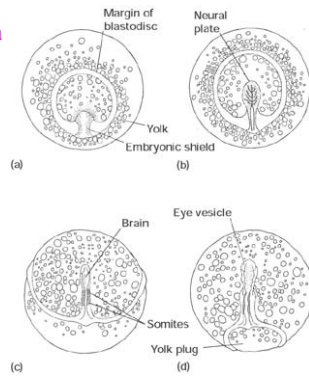
Holoblastic cleavage

Mesolecithal egg

•Differentiation in a teleost fish

•Meroblastic cleavage pattern

•Macrolecithal egg type



•Amphibian gastrulation and neurulation

•Holoblastic cleavage

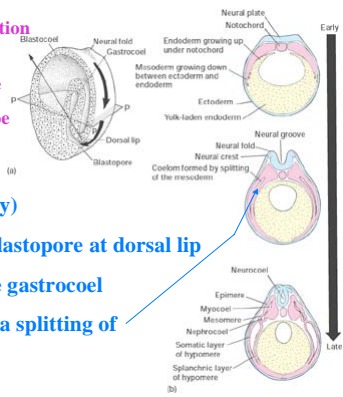
•Mesolecithal egg type

•Cells move along the surface (epiboly)

•Turn inward at blastopore at dorsal lip

•Form and enlarge gastrocoel

•Coelom forms by a splitting of mesoderm



•Anuran development.

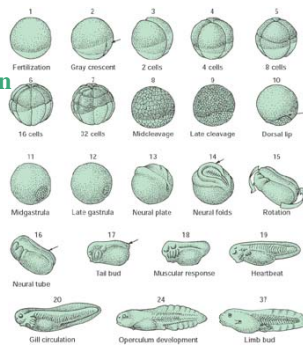
•1-2 = fertilization

•3 - 5 early cleavages

•6 - 8 morula

•9-10 blastula

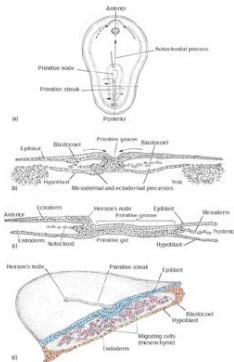
•11-12 gastrula



- 13 – 16 neurula
- 17 tail bud forms
- 18 Muscular twitches begin
- 19 heartbeat starts
- 20 functional early gills develop and blood circulates through the caudal fin
- 24 operculum appears
- 37 Hindlimbs and then forelimbs appear

Bird gastrulation

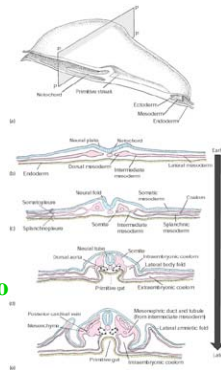
- Macrolecithal egg type
- Discoidal cleavage
- Primitive streak serves as does dorsal lip of blastopore
- Cells move inward and differentiate into different germ tissues
- Separate stream of cells move anteriorly to form notochord



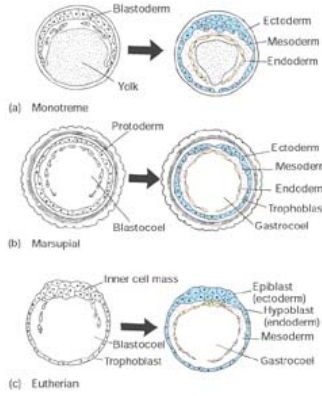
Later stage of bird gastrulation and also neurulation

Beginning of formation of tissues that will give rise to organs

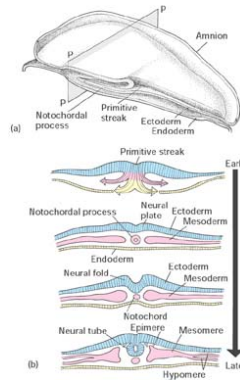
Cells move toward locations from which they will differentiate into organs.



- Mammalian gastrulation
- Egg has little yolk
- But shows complex pattern of cell movement as does a bird
- Primitive streak is location where cells move into center of embryo



Mammalian gastrulation and neurulation



Organogenesis

Structures from three germ layers divided according to colors of layers and structures formed

