Classification of Eggs and Types of Cleavage

Animal Pole

Less Yolk

Vegetal Pole

More Yolk

Classification of Eggs and Types of Cleavage

Classification by yolk content

Isolecithal - little yolk, evenly distributed
Mesolecithal - moderate yolk
Telolecithal - large amounts of yolk

Yolk content affects how cells divide

Holoblastic cleavage - complete division
Meroelastic cleavage - incomplete division
Last classification: Cleavage symmetry

1. Holoblastic Cleavage
   A. Isolecithal
   3. Radial cleavage
      Echinoderms, amphioxus

Echinoderms: radial cleavage

Fig. 8.7 Cleavage in the Sea Urchin

Animal pole

Vegetal pole

ectoderm

endoderm

Animal half

Mesomeres

Macromeres

Vegetal half

Micromeres

Fig. 8.8 Cleavage in Live Embryos of the Sea Urchin

(A) (B) (C)

(D) (E) Micromeres

(F) Blastula Blastocoel

Fig. 8.4(1) Patterns of Cleavage
Figure 8.4(2) Summary of the Main Patterns of Cleavage

1. HOLOBLASTIC CLEAVAGE
   a. Megasphaeral
      Displaced radial cleavage
      Amphibians

Figure 10.1 Cleavage of a Frog Egg

Figure 10.2 Scanning Electron Micrographs of Cleavage of Frog Egg
It is not birth, marriage, or death, but gastrulation which is truly the most important time in your life.

Lewis Wolpert

Figure 8.5 Types of Cell Movements During Gastrulation

- Invagination
- Involution
- Ingression
- Delamination
- Epiboly

Important factors:
- Individual cell shape change
- Cell Adhesion
- Cell rearrangement

Convergent Extension
Figure 8.16(1) Entire Sequence of Gastrulation in Lytechinus variegatus

9 hrs. 9.5 hrs. 10 hrs.

10.5 hrs. 11 hrs. 11.5 hrs.

Figure 8.15(1) Normal Sea Urchin Development, Following the Fate of the Cellular Layers of the Blastula

Figure 8.18 Ingression of Primary Mesenchyme Cells

(A) Extracellular matrix/ fibril
(B) Basal lamina
(C) Primary mesenchyme cell
(D) Hyaline layer
Figure 8.20(1) Invagination of the Vegetal Plate

(A)

Figure 8.20(2) Invagination of the Vegetal Plate

(B) Blastocoel interior
Vegetal plate cells

(C) Vegetal plate cells

Secretory vesicles with chondroitin sulfate proteoglycan
CSPG secreted into the inner lamina absorbs water, causing swelling

Figure 8.24 Mid-Gastrula Stage of Lytechinus pictus

(A) (B)
Theories come and theories go.
The frog remains.
Jean Rostand
Figure 8.4(2) Summary of the Main Patterns of Cleavage

I. HOLOBLASTIC CLEAVAGE
   A. Mesolecithal
      Displayed radial cleavage
      Amphibians

Figure 10.1 Cleavage of a Frog Egg

Figure 7.33 Reorganization of Cytoplasm in the Newly Fertilized Frog Egg
Figure 10.8 Surface View of An Early Dorsal Blastopore Lip of Xenopus

Figure 10.9(1) Epiboly of the Ectoderm

Internal Gastrulation Movie
(morph of sections at successive stages)
Simplified Fate Map of Frog Blastula
(some frogs)

Figure 10.5 Fate Maps of the Blastula of the Frog *Xenopus laevis*

(A) EXTERIOR
(B) INTERIOR

Figure 10.5 Fate Maps of the Blastula of the Frog *Xenopus laevis*
Frog Neural Plate to Neural Tube

- Notochord
- Neural plate
- Neural tube
- Neural crest
- Somite

Frog Embryo – Neurula (Neural Tube stage)

Major Derivatives of the Ectoderm

- Skin ectoderm
- Neural tube
- Neural crest cells
Figure 12.1 (mod)  Major Derivatives of the Ectoderm

Ectoderm

Surface ectoderm

Neural crest

Neural tube

Figure 12.1 (4)  Major Derivatives of the Ectoderm Germ Layer

Ectoderm

Brain

Neural pituitary

Spinal cord

Motor neurons

Retina

Figure 12.9  Early Human Brain Development

3 Primary vesicles

Telencephalon

Hippocampus

Corpus

Retic

Epithelum

Thalamus

Hypothalamus

Mammill

Midbrain

Cerebell

Pons

Spinal cord

5 Secondary vesicles

Mesencephalon

Myelencephalon

Medulla
4mm frog embryo cross section at heart level

Endoderm formation - Human embryo