ANSC/FSTC 607
Biochemistry and Physiology of Muscle as a Food
EMBRYONIC GROWTH AND MYOGENESIS

I. Definitions

A. Hyperplasia

1. Increase in cell number.
2. Presumes divisions of cells (mitotic for most cell types).
   a. Proliferative
   b. Quantal (terminal)
3. Can occur prenatally or postnatally.

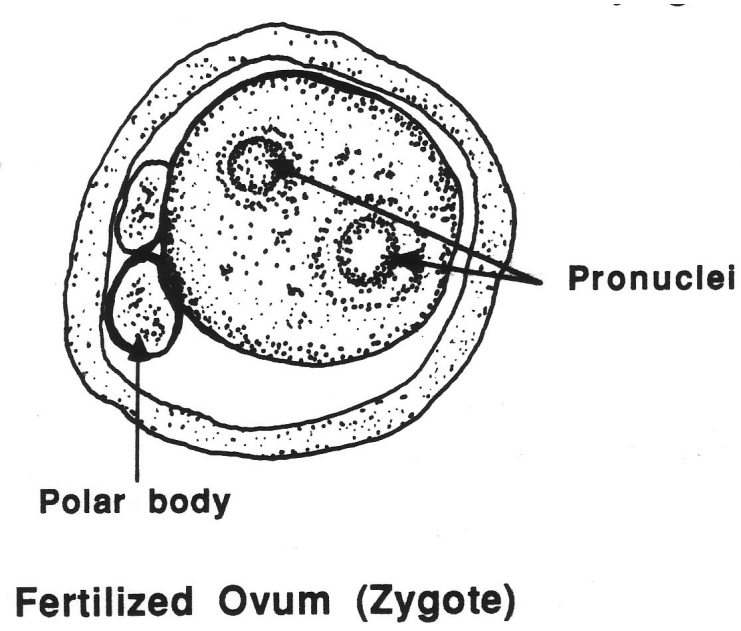
B. Hypertrophy

1. Increase in cell size
2. Implies that biosynthetic processes proceed at faster rate than degradative processes.
3. Occurs primarily postnatally.

II. Embryonic development

A. Zygote

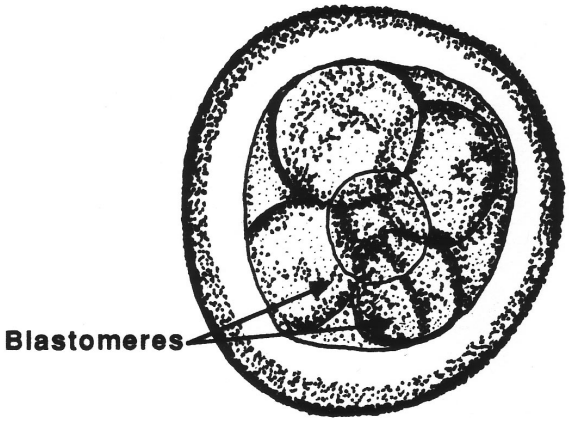
1. Fertilization → two pronuclei.
2. Reorganization/repair of nuclei.
3. Period of susceptibility to gene insertion.



Fertilized Ovum (Zygote)

B. Morula

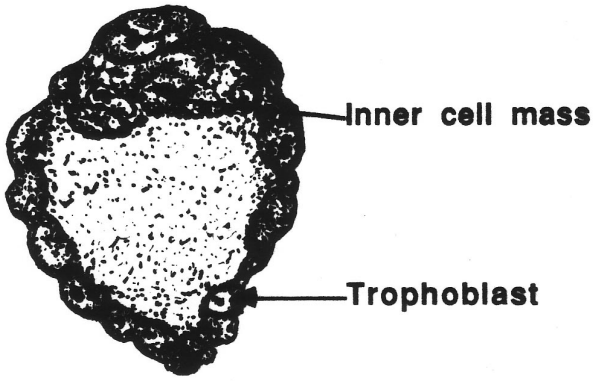
1. Division into blastomeres (nondifferentiated initially).
2. Stage that scientists use for embryo splitting.



Morula

C. Blastocyst

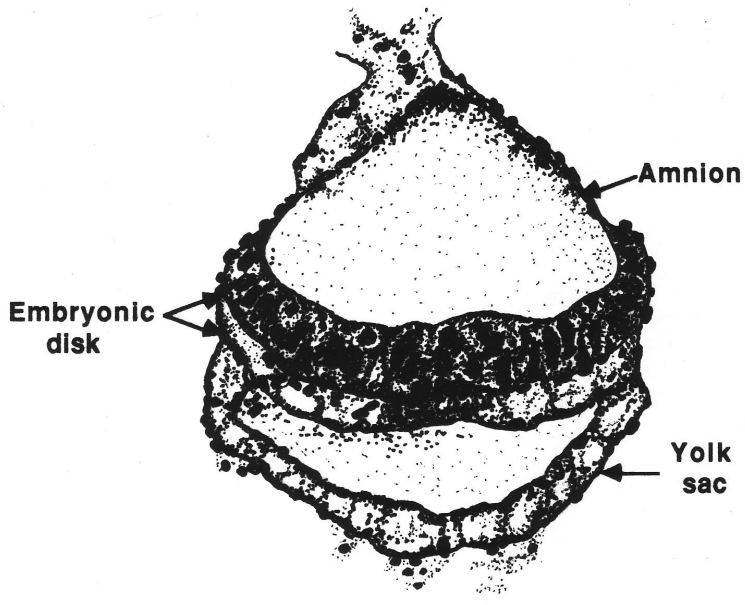
1. Hollow sphere: cavity = blastocoele.
2. Trophoblast = outer layer of cells (development of plancental tissues)
3. Inner cell mass
   a. Lowermost = endoderm.
   b. Uppermost = epiblast.



Human Blastocyst (approx. 5 d)

D. Embryo – early

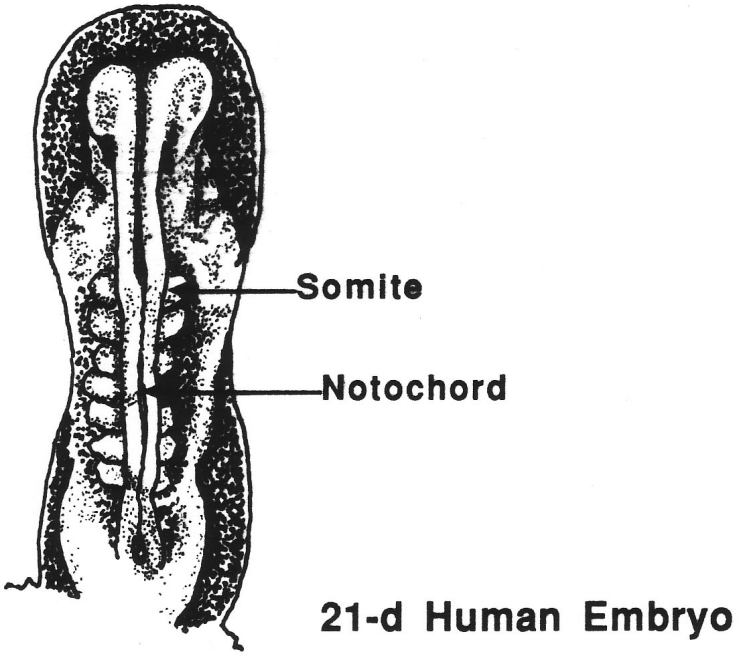
1. Amnion
2. Yolk sack, surrounded by endoderm.
3. Embryonic disk
   a. From epiblast.
   b. Bilaminar.
      1) Dorsal = ectoderm.
      2) Ventral = endoderm.
   c. Primitive streak
      1) Mesodermal cells migrate into central region.
      2) Source of connective tissues and muscle.



16-d Human Embryo

E. Embryo – late

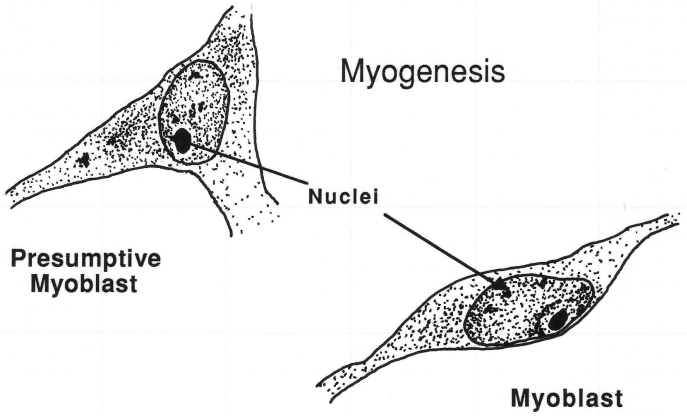
1. Notochord now is visible.
2. Somites develop.
   a. Dermatome → source of dermis (skin).
   b. Sclerotome → source of connective tissues.
      1) Precursors of vertebrae.
      2) Mesenchymal cells
         a) Adipose tissue
         b) Other connective tissues
   c. Myotome → muscle



III. Myogenesis

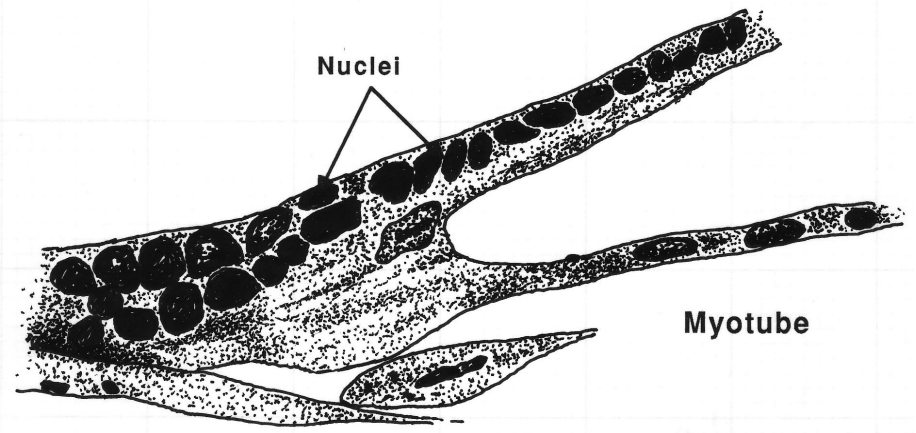
A. Myoblast

1. Presumptive myoblasts undergo proliferative divisions.
2. Synthesis of myofibrillar protein is barely detectable at this stage.



B. Myotubes

1. Final (quantal) division of myoblast elicits differentiation; cells acquire new characteristics.
2. Myoblasts now fuse.
3. Fusion initiates a high rate of myofibrillar protein gene expression.
4. Myotube becomes multinucleated.



D. Fusion of myoblasts → myotubes

1. Multinucleated, each nucleus encoding for a domain of protein
2. Large increase in transcription, translation for myofibrillar proteins
3. Later migration of myofibrillar proteins (e.g., desmin) to Z-lines
4. Cytoplasm and nuclei in core of myotube.
5. Aggregation of Z-line material (α-actinin) around filaments
6. Synthesis of myofilaments, no apparent development of sarcomeres
7. Exclusion of sarcoplasm and nuclei from core -- nuclei → subsarcolemma