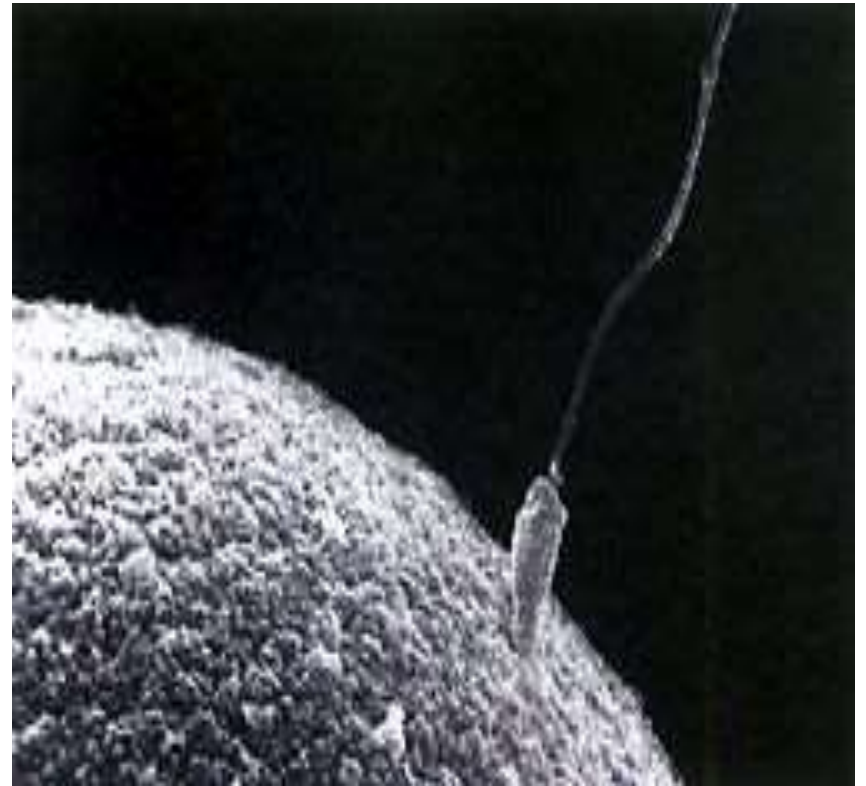


PRENATAL PEDIATRICS



Conception

- Once a month and ovum is released
 - Ovum- A female egg
- The Egg moves through the Fallopian Tube to the uterus
 - Uterus-Where the baby develops during pregnancy
- If not fertilized it disintegrates and is flushed away with menstruation



But . . .

- If it is fertilized in the Fallopian Tube by a sperm—Conception occurs
- This Union is what we call a zygote!

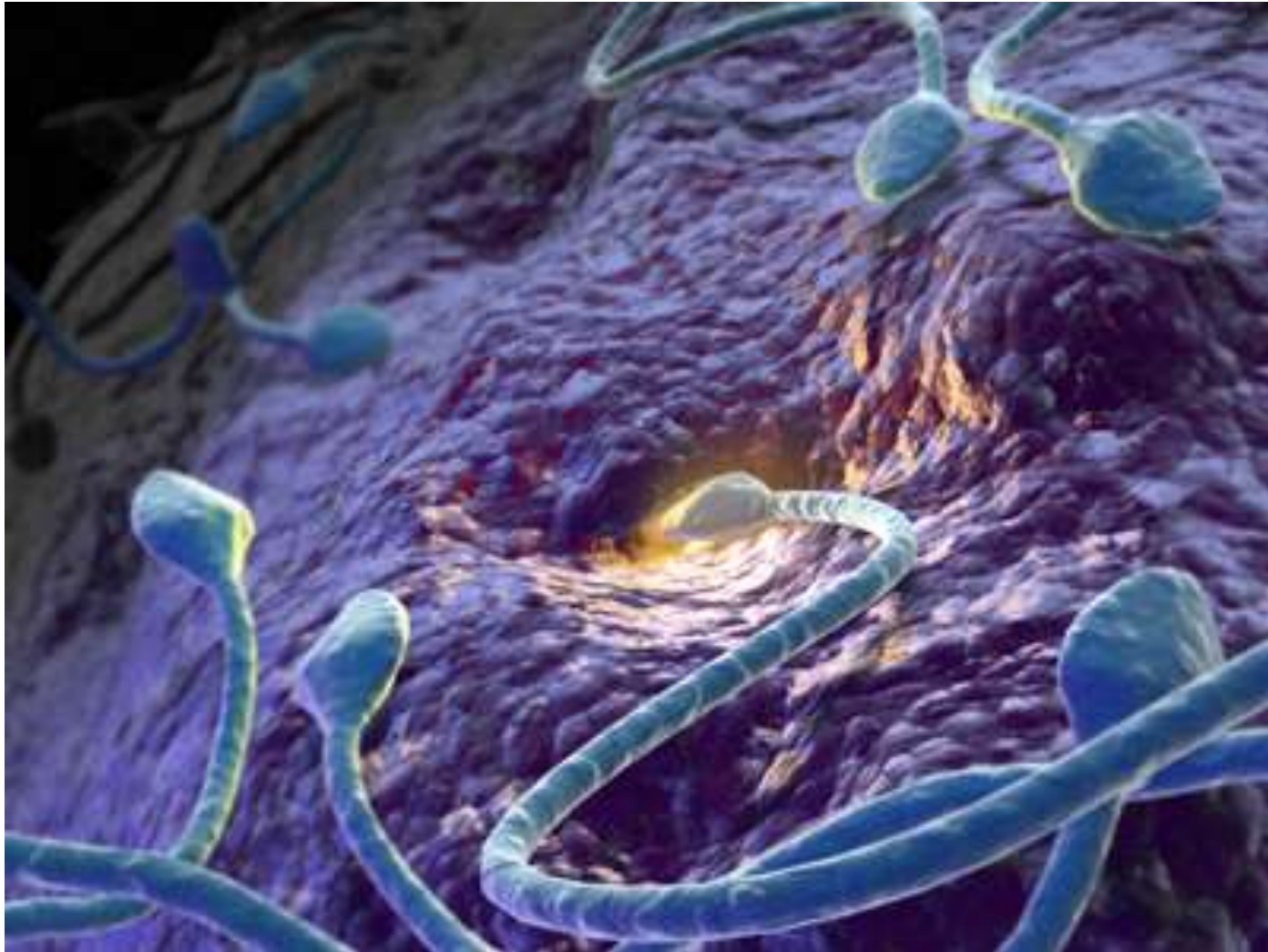


Fertilization: Four Major Steps

1. Sperm contacts the egg
2. Sperm or its nucleus enters the egg
3. Egg becomes activated and developmental changes begin
4. Sperm and egg nuclei fuse

- A sperm fertilizing an ovum. When semen is deposited in the vagina, the spermatozoa travel through the cervix and body of the uterus and into the Fallopian tubes.
- Fertilization of the ovum (egg cell) usually takes place in the Fallopian tube. Many sperm must cooperate to penetrate the thick protective shell-like barrier that surrounds the ovum.
- The first sperm that penetrates fully into the egg donates its genetic material (DNA). The egg then polarizes, repelling any additional sperm.
- The resulting combination is called a zygote, a new and genetically unique human organism.

Fertilization

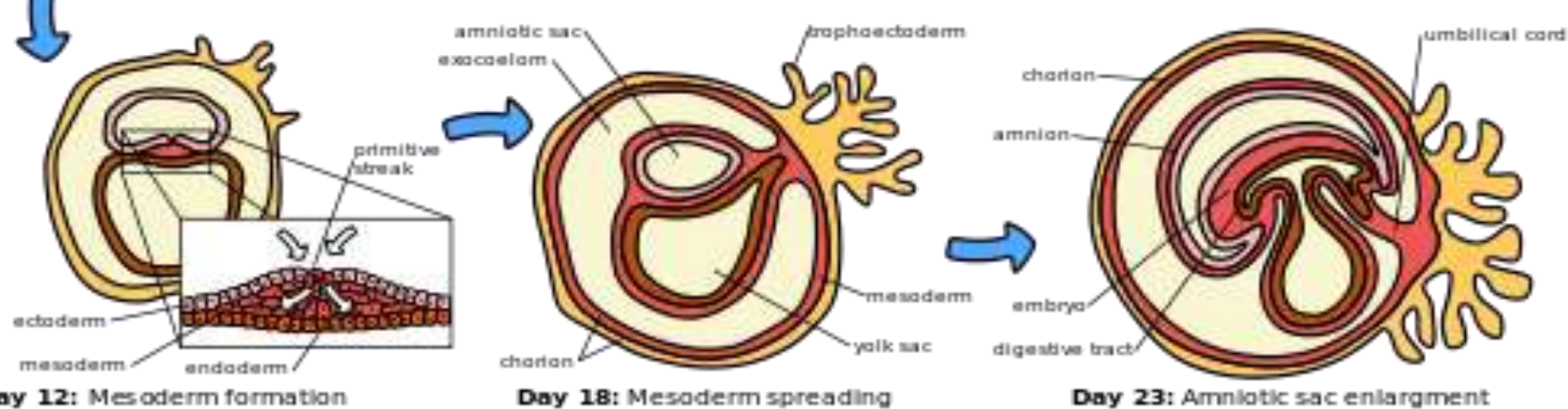
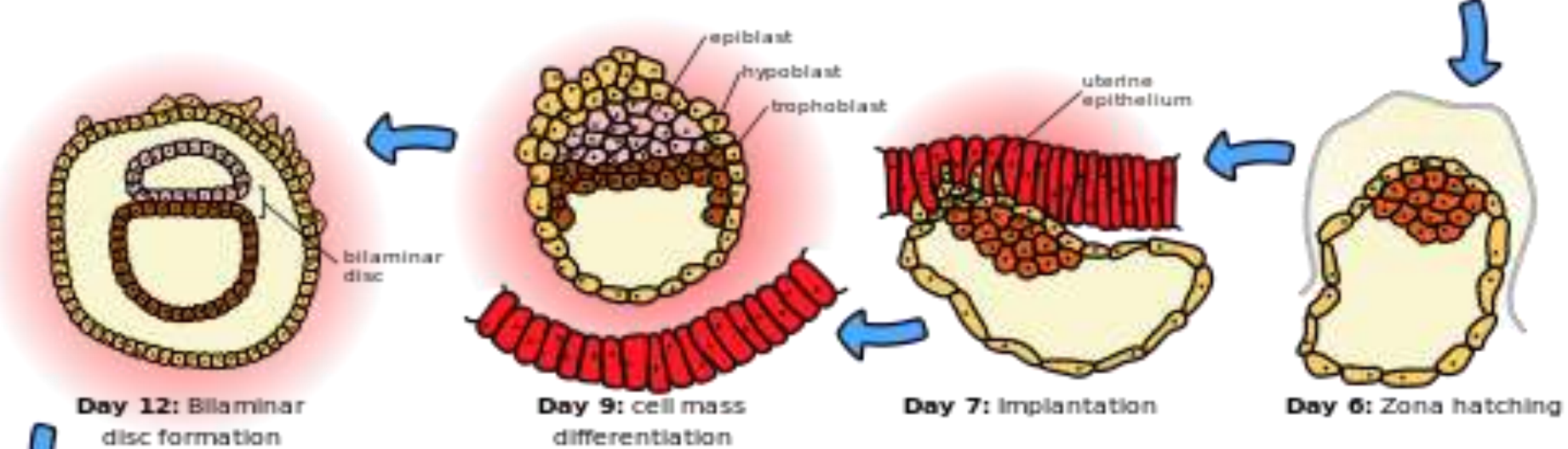
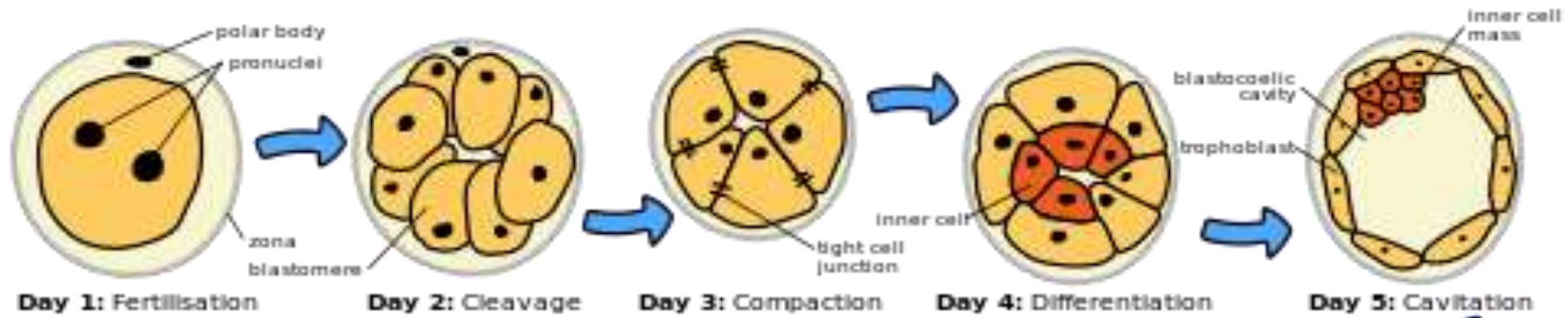


The total gestation period is divided
into four phases:

- Pre embryonic stage
- Germinal period
- Embryonic period
- Fetal period

Pre embryonic stage

- The fertilized egg travels from fimbriated part of the fallopian tube and implants or embeds itself into the lining of the body of the uterus. The period lasts from 12- 14 days after fertilization.



Germinal period

- From the 1st to 3rd week of development, germinal period begins at conception.
- It includes
 - cleavage division of zygote,
 - formation of morula,
 - blastocyst and its implantation,
 - differentiation of trophoblast and chorion;
 - appearance of bilaminar and trilaminar disc.

Embryonic period

- From 3rd week to 8th week; it denotes by the changes of shape and external appearance of embryo.
- Three germ layers undergoes individual differentiation and majority of tissues and body organs formed.

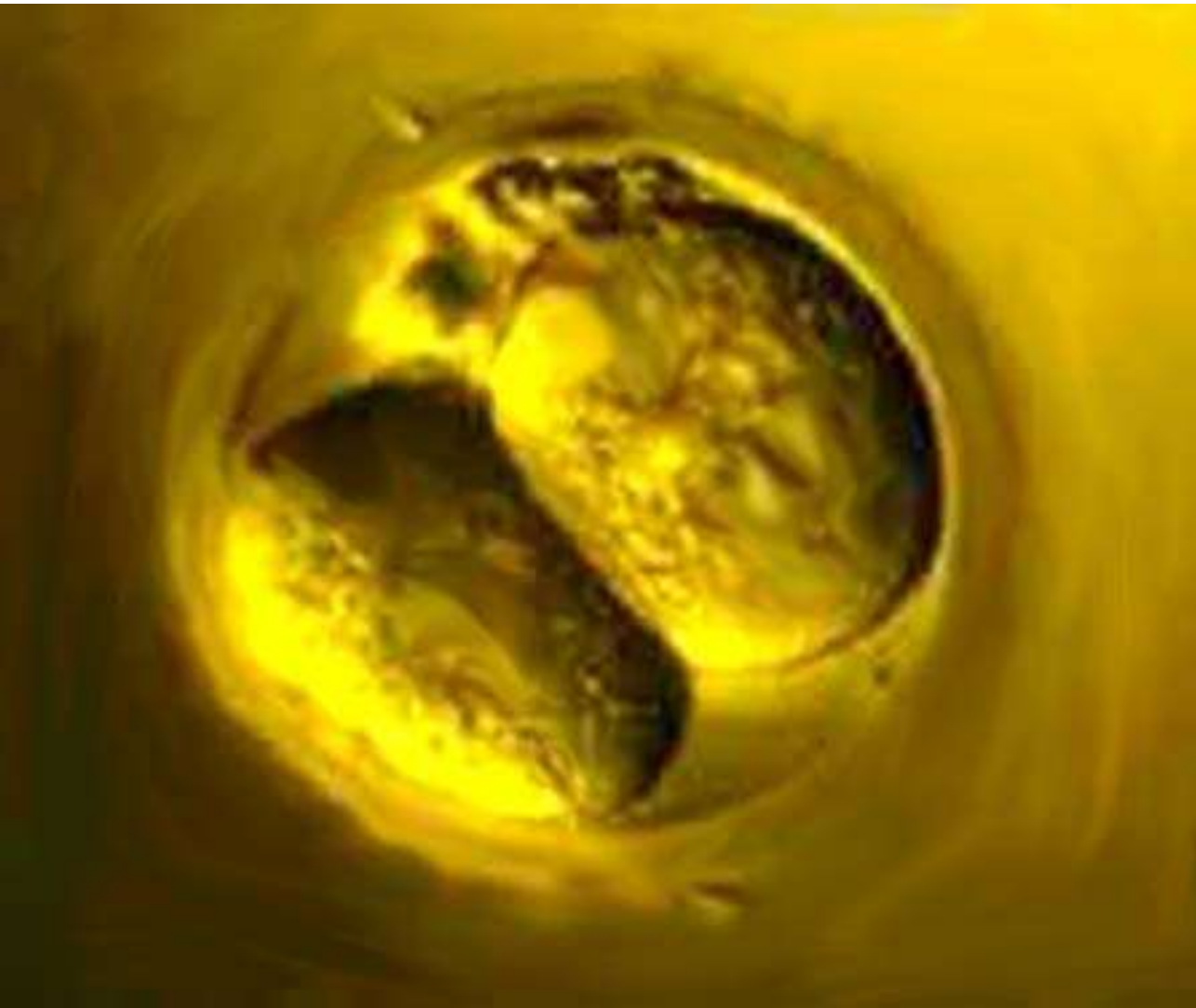
Fetal period

- From 3rd month upto the termination of pregnancy, it is characterized by rapid growth of fetus, placenta development and tissue differentiation.

Determination of Sex chromosome

- Sperms contains 'X' and 'Y' chromosomes.
- Each mature ovum contains an X- chromosome, when an X bearing spermatozoa fertilizes an ovum, the zygote contains 2X chromosomes + autosomes; resulting into female child.
- If the ovum is fertilized by Y bearing spermatozoa, the sex of the zygote will be male containing XY chromosome + 44 autosomes.
- Therefore the father decides the chromosomal sex of the offspring.

Cleavage (divide via mitosis) forms
the 2 cell stage



30 hrs after
fertilization

They split again to form the 4 cell stage



40 hrs after fertilization

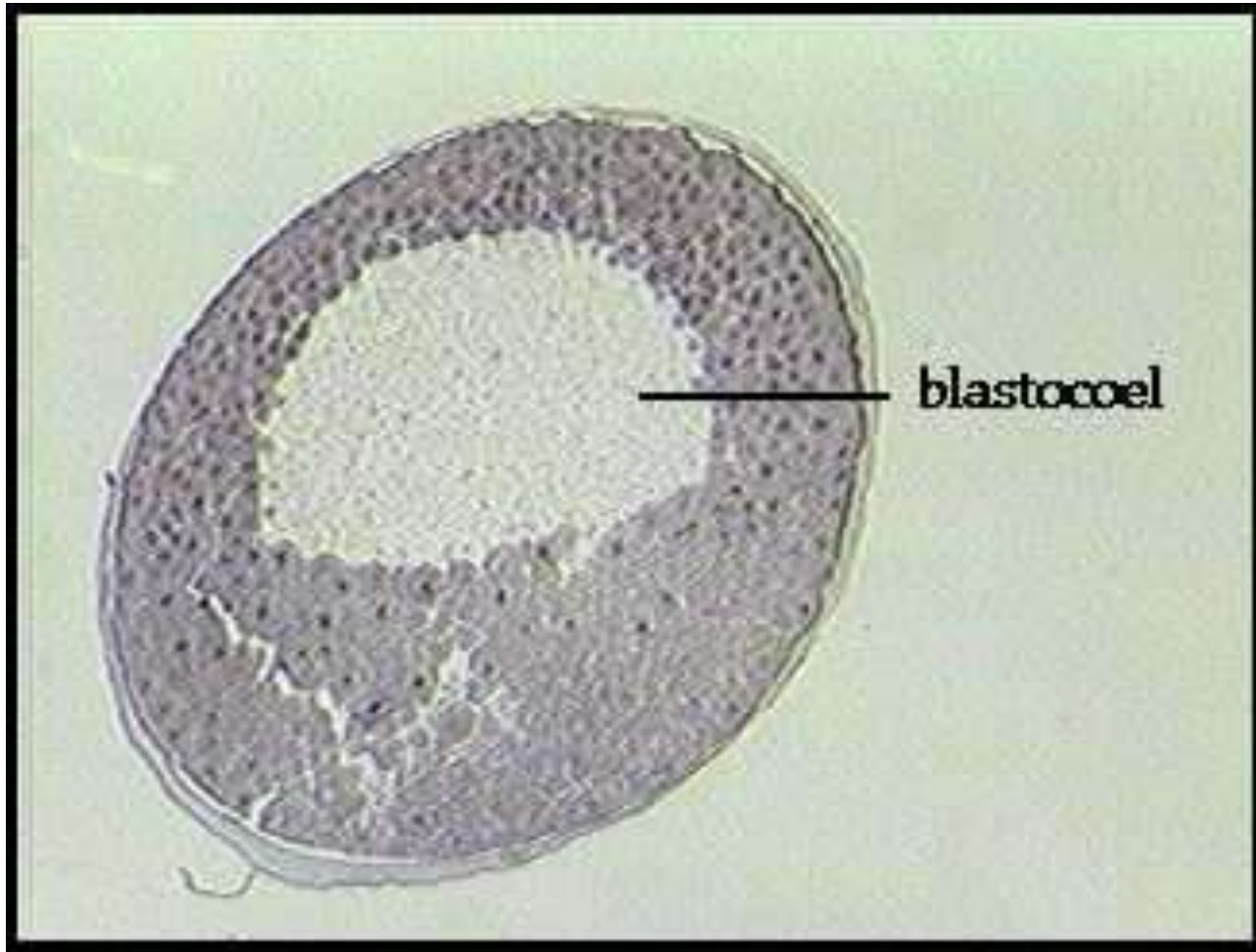
And again to form the 8 cell stage...



And eventually form a Morula



Next it becomes a blastula



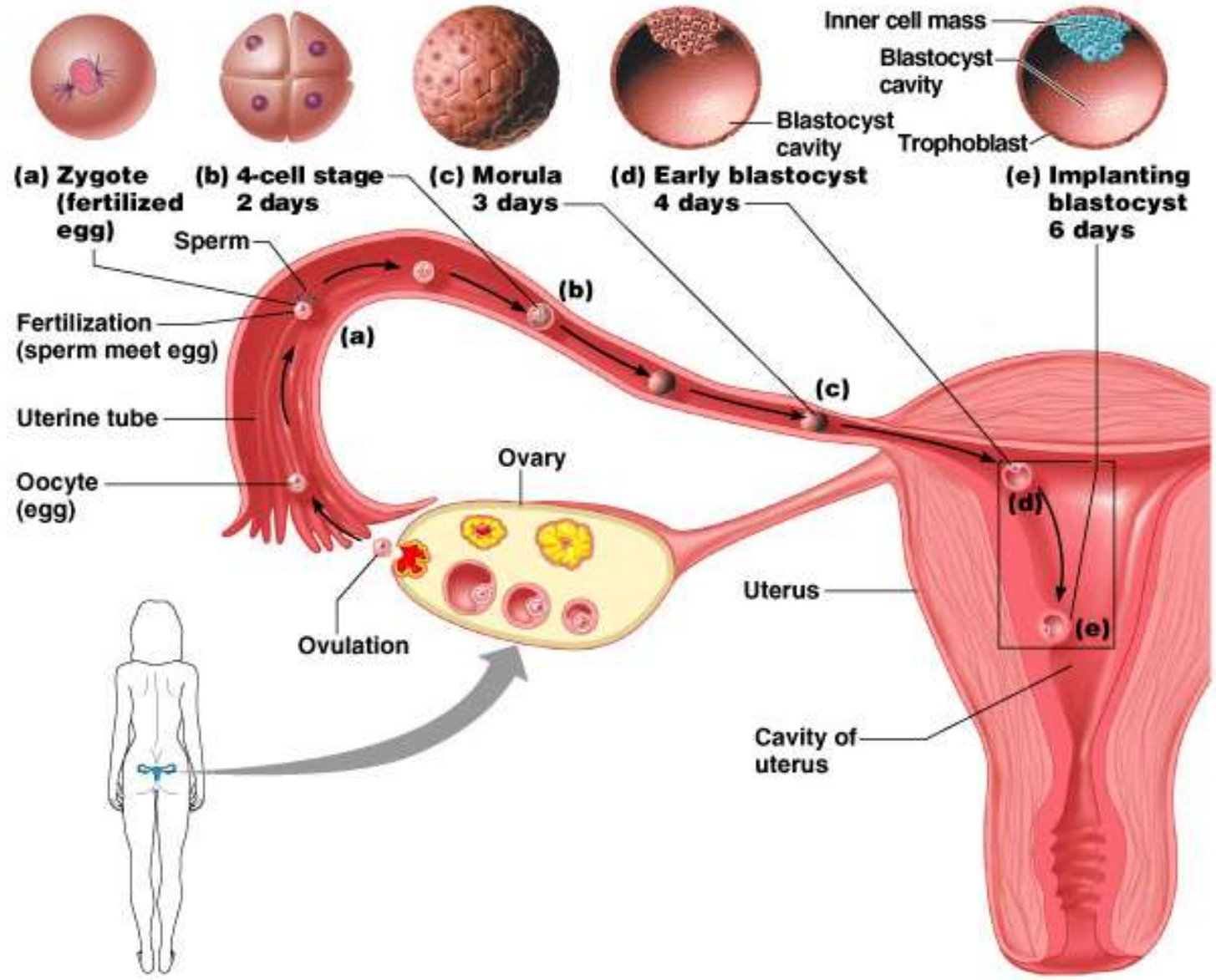
And next, a gastrula



- After 3 days of fertilization cells of compacted embryo divide again to form a 16 cells morula.
- Inner cells of morula constitute inner cell mass surrounded by outer cell mass.
- Inner cells gives rise to tissues of the embryo proper and outer cell mass forms the trophoblast, which contributes to the placenta.
- About the time of morula enters into the uterine cavity, fluid begins to penetrate through the zona pellucida into the intercellular spaces of the inner cell mass.

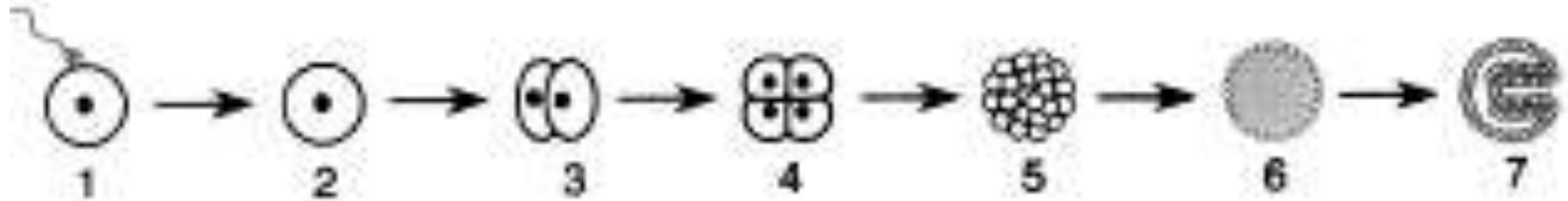
- Gradually, the intercellular spaces become confluent and finally blastocoele, cavity forms.
- At this time, the embryo is a blastocyst, cells of the inner cell mass called the embryoblast area at one pole & those of the outer cell mass or trophoblast ; flatten & form the epithelial wall of the blastocyst.
- The zona pellucida has disappeared, allowing implantation to begin.
- It takes place on the 6th or 7th day after fertilization.

Fertilization and the Events of the First 6 Days of Development



- The trophoblastic cells over the embryoblast pole begin to penetrate between the epithelial cells of the uterine mucosa about the 6th day.
- Attachment & invasion of the trophoblast involves integrins, its receptors promotes attachments while fibronectin receptors stimulate migration.
- These molecules interact along signal transduction pathways to regulate trophoblast differentiation so that implantation is the result of mutual trophoblastic and endometrial action.
- Hence, by the end of the 1st week of development, the zygote has passed through the morula & blastocyst stages and has begun implantation in the uterine muscle.

The Regents Diagram...



1. Sperm and ovum
2. Zygote (fertilized ovum)
3. 2-cell stage
4. 4-cell stage
5. Morula
6. Blastula
7. Gastrula

Embryology

- **Embryology** – study of the origin and development of single individual
- Prenatal period
 - **Embryonic** period – first 8 weeks
 - **Fetal** period – remaining 30 weeks

The Embryonic Period

- Week 1 – from zygote to blastocyst
 - **Conception** – in lateral third of uterine tube
 - **Zygote** (fertilized oocyte) moves toward the uterus
 - **Blastomeres** – daughter cells formed from zygote
 - **Morula** – cluster of 12–16 blastomeres
 - **Blastocyst** – fluid-filled structure – about 60 cells

Implantation of the Blastocyst

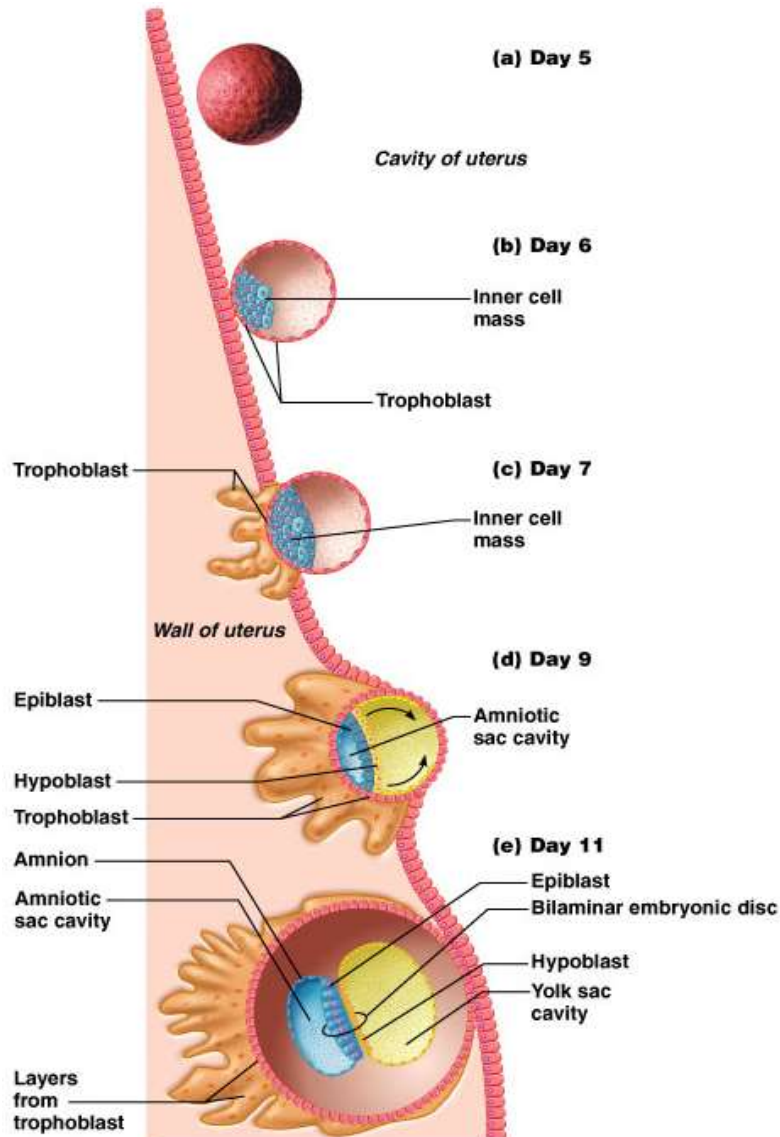


Figure 3.4

Week 3 – The Three-Layered Embryo

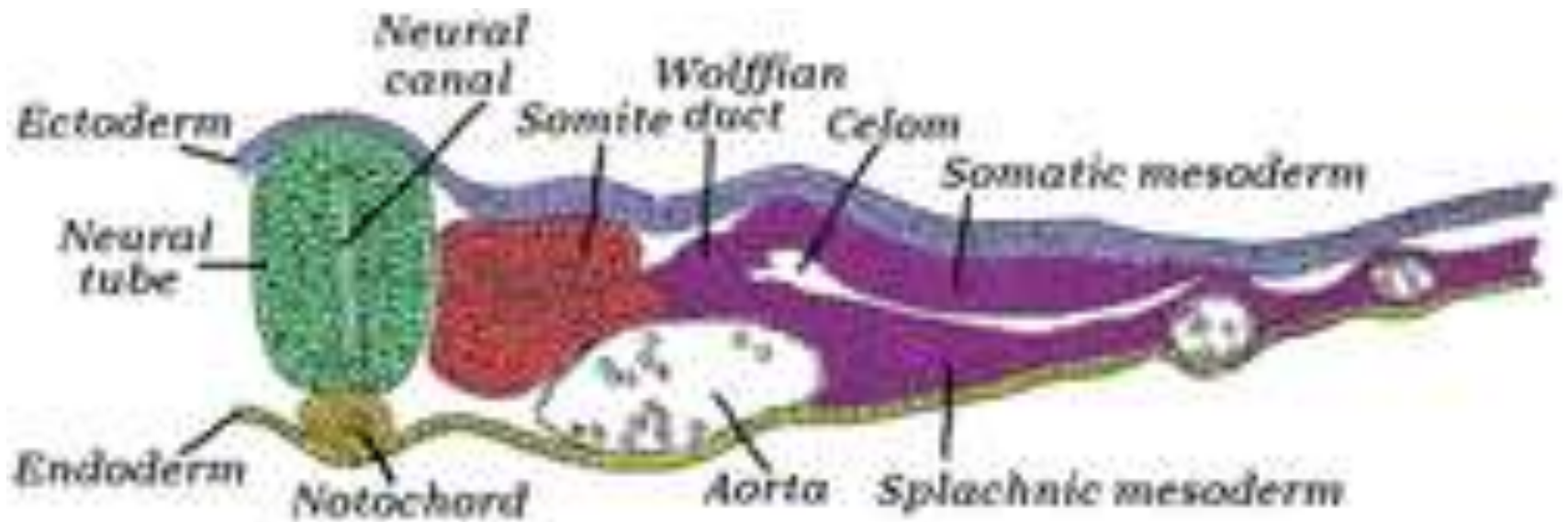
- **Primitive streak** – raised groove on the dorsal surface of the epiblast
- **Gastrulation** – a process of invagination of epiblast cells
- **Endoderm** – formed from migrating cells that replace the hypoblast
- **Mesoderm** – formed between epiblast and endoderm
- **Ectoderm** – formed from epiblast cells that stay on dorsal surface

The Notochord

- Primitive node – a swelling at one end of primitive streak
- Notochord – defines body axis
 - Is the site of the future vertebral column

The **notochord** is a flexible rod-shaped body found in embryos of all chordates. It is composed of cells derived from the mesoderm and defines the primitive axis of the embryo.

Notochord



Neurulation

- Neurulation – **ectoderm** starts forming brain and spinal cord
 - Neural plate – ectoderm in the dorsal midline thickens
 - Neural groove – ectoderm folds inward
 - Neural tube – a hollow tube pinches off into the body
 - Cranial part of the neural tube becomes the brain
- Neural crest – forms sensory nerve cells, ganglia, and melanocytes

Week 4 – The Body Takes Shape

- Derivatives of the germ layers
 - **Ectoderm** – forms brain, spinal cord, and epidermis
 - **Endoderm**
 - Forms inner epithelial lining of the gut tube
 - Forms respiratory tubes, digestive organs, and urinary bladder

Week 4 – The Body Takes Shape

- **Notochord** – gives rise to nucleus pulposus within intervertebral discs
- **Mesoderm** – forms muscle, bone, dermis, and connective tissues
 - ***Somites*** divides into **sclerotome (vertebrae and ribs)**, **dermatome (dermis of skin in dorsal part of body)**, and **myotome (trunk and limb muscles)**
 - ***Intermediate mesoderm*** – forms kidneys and gonads

Week 4 – The Body Takes Shape

- **Mesoderm**

- **Splanchnic** mesoderm

- Forms musculature, connective tissues, and serosa of the digestive and respiratory structures
 - Forms heart and most blood vessels

- **Somatic** mesoderm – forms dermis of skin, bones, and ligaments

Week 5-8 – The Second Month of Embryonic Development

- Limb buds form
- Embryo first looks recognizably human
- Head is disproportionately large
- All major organs are in place

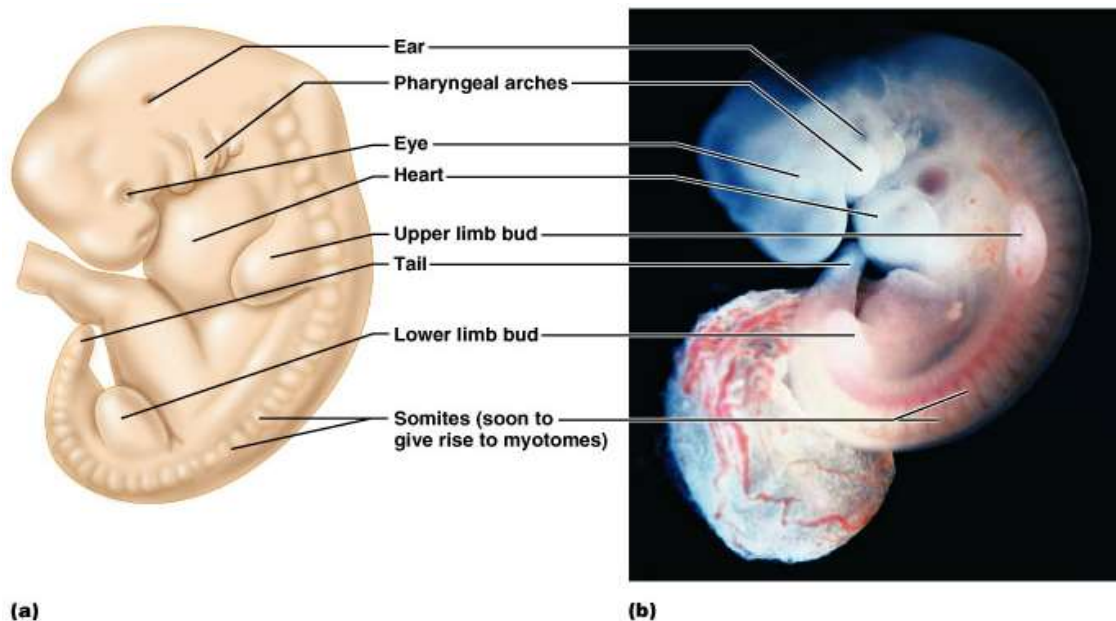
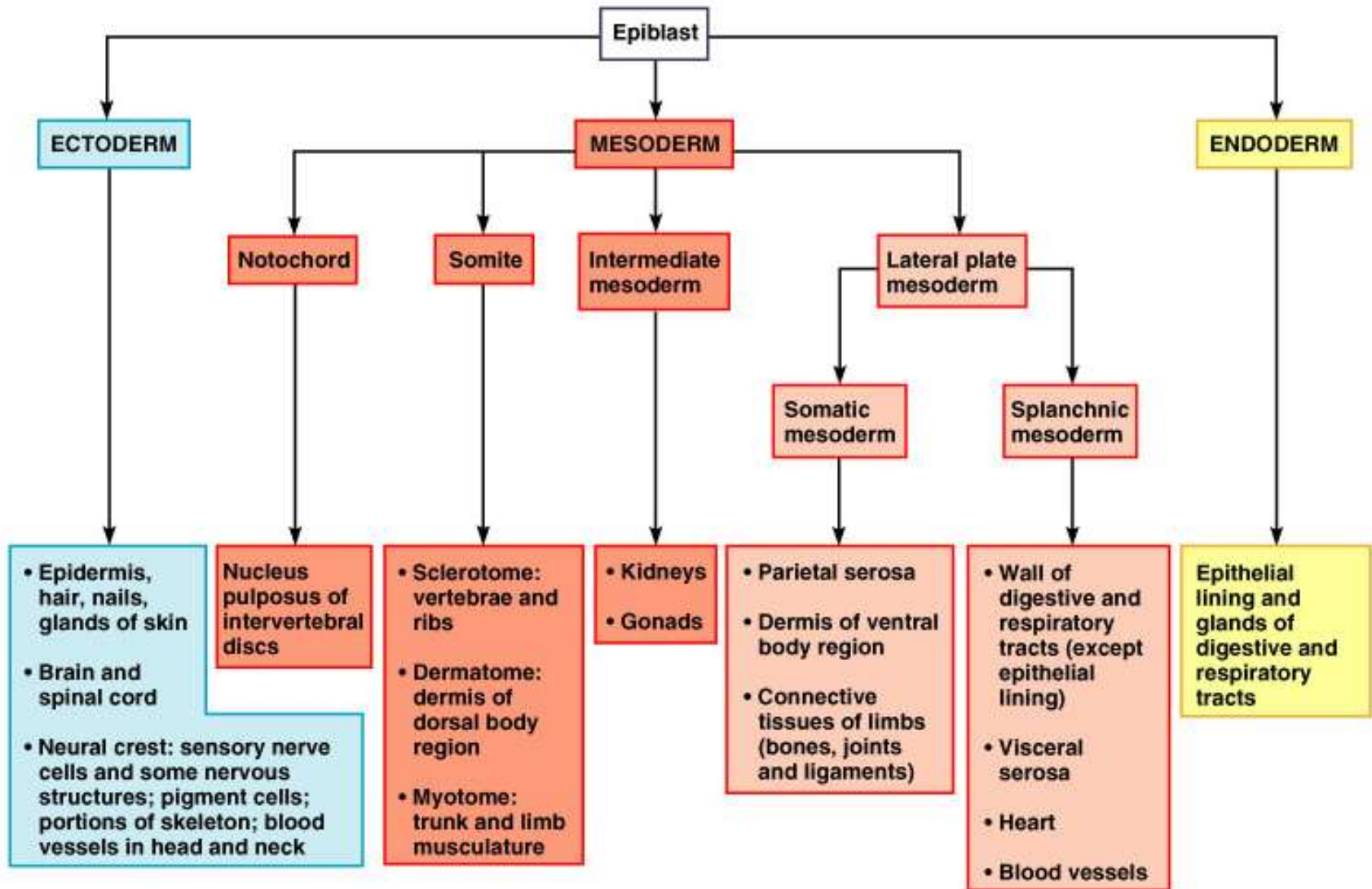


Figure 3.11

Differentiation of Primary Germ Layers (from the gastrula)

Ectoderm	Mesoderm	Endoderm
Nervous system	Skeleton	Digestive tract
Epidermis of skin	Muscles	Respiratory system
	Circulatory system	Liver, pancreas
	Gonads	Bladder

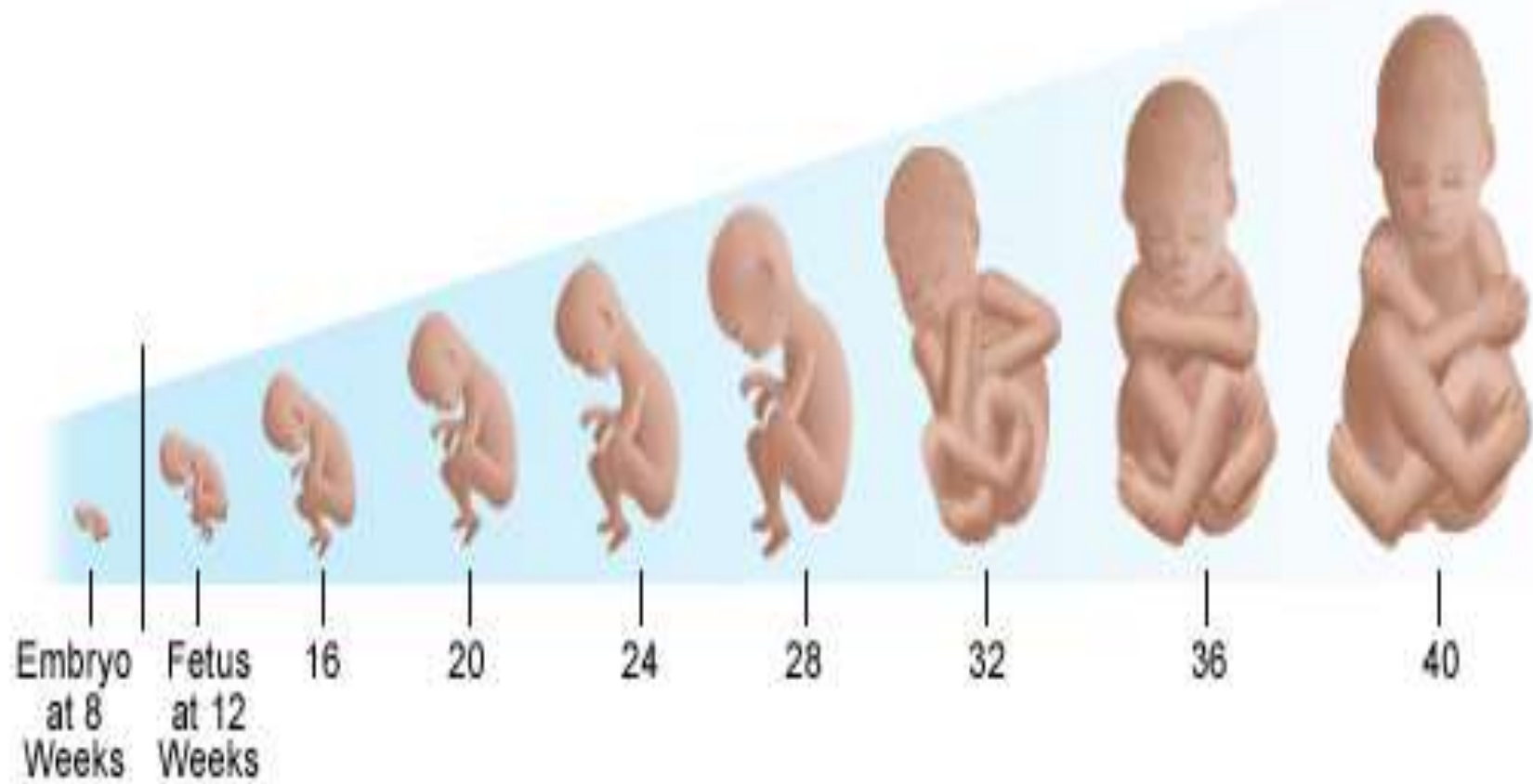
Major derivatives of the embryonic germ layers



The Fetal Period

- A time of maturation and rapid growth
- Cells are differentiating during the first half of the fetal period
- Normal births occur 38 weeks after conception
- Premature birth is one that occurs before 38 weeks

Fetal Growth From 8 to 40 Weeks



Weeks 10–12

- Gestational age: 9 weeks and 0 days until 11 weeks and 6 days old.
- Embryonic age: Weeks nr 8–10. 7–9 weeks old.
- Embryo measures 30–80 mm (1.2–3.2 inches) in length.
- Ventral and dorsal [pancreatic buds](#) fuse during the 8th week
- [Intestines](#) rotate.
- Facial features continue to develop.
- The [eyelids](#) are more developed.
- The external features of the ear begin to take their final shape.
- The head comprises nearly half of the fetus' size.
- The face is well formed
- The eyelids close and will not reopen until about the 28th week.
- [Tooth](#) buds, which will form the baby teeth, appear.
- The [limbs](#) are long and thin.
- The fetus can make a fist with its fingers.
- Genitals appear well differentiated.
- [Red blood cells](#) are produced in the [liver](#).

- **Weeks 13 to 16**
- Gestational age: 12 weeks and 0 days until 15 weeks and 6 days old.
- Embryonic age: Weeks nr 11–14. 10–13 weeks old.
- The fetus reaches a length of about 15 cm (6 inches).
- A fine hair called [lanugo](#) develops on the head.
- Fetal [skin](#) is almost transparent.
- More muscle tissue and bones have developed, and the bones become harder.
- The fetus makes active movements.
- Sucking motions are made with the mouth.
- [Meconium](#) is made in the intestinal tract.
- The liver and [pancreas](#) produce fluid secretions.
- From week 13, [sex prediction](#) by [obstetric ultrasonography](#) is almost 100% accurate. ^[13]
- At week 15, main development of external genitalia is finished

Week 19

- Gestational age: 18 weeks old.
- Embryonic age: Week nr 17. 16 weeks old.
- The fetus reaches a length of 20 cm (8 inches).
- [Lanugo](#) covers the entire body.
- Eyebrows and eyelashes appear.
- Nails appear on fingers and toes.
- The fetus is more active with increased muscle development.
- "[Quickening](#)" usually occurs (the mother and others can feel the fetus moving).
- The fetal heartbeat can be heard with a [stethoscope](#)

Week 23

- Gestational age: 22 weeks old.
- Embryonic age: Week nr 21. 20 weeks old.
- The fetus reaches a length of 28 cm (11.2 inches).
- The fetus weighs about 925g.
- Eyebrows and eyelashes are well formed.
- All of the eye components are developed.
- The fetus has a hand and [startle reflex](#).
- [Footprints](#) and [fingerprints](#) continue forming.
- [Alveoli](#) (air sacs) are forming in lungs.

Week 27

- Gestational age: 26 weeks old.
- Embryonic age: Week nr 25. 24 weeks old.
- The fetus reaches a length of 38 cm (15 inches).
- The fetus weighs about 1.2 kg (2 lb 11 oz).
- The brain develops rapidly.
- The [nervous system](#) develops enough to control some body functions.
- The eyelids open and close.
- The [cochleae](#) are now developed, though the [myelin sheaths](#) in neural portion of the auditory system will continue to develop until 18 months after birth.
- The respiratory system, while immature, has developed to the point where gas exchange is possible.

Week 31

- Gestational age: 30 weeks old.
- Embryonic age: Week nr 29. 28 weeks old.
- The fetus reaches a length of about 38–43 cm (15–17 inches).
- The fetus weighs about 1.5 kg (3 lb 0 oz).
- The amount of body fat rapidly increases.
- Rhythmic breathing movements occur, but lungs are not fully mature.
- Thalamic brain connections, which mediate sensory input, form.
- Bones are fully developed, but are still soft and pliable.
- The fetus begins storing a lot of iron, calcium and phosphorus.

Week 35

- Gestational age: 34 weeks old.
- Embryonic age: Week nr 33. 32 weeks old.
- The fetus reaches a length of about 40–48 cm (16–19 inches).
- The fetus weighs about 2.5 to 3 kg (5 lb 12 oz to 6 lb 12 oz).
- Lanugo begins to disappear.
- Body fat increases.
- Fingernails reach the end of the fingertips.
- A baby born at 36 weeks has a high chance of survival, but may require medical interventions.

Weeks 36 to 40

- Gestational age: 35 and 0 days until 39 weeks and 6 days old.
- Embryonic age: Weeks nr 34–38. 33–37 weeks old.
- The fetus is considered full-term at the end of the 39th week of gestational age.
- It may be 48 to 53 cm (19 to 21 inches) in length.
- The lanugo is gone except on the upper arms and shoulders.
- Fingernails extend beyond fingertips.
- Small [breast buds](#) are present on both sexes.
- Head hair is now coarse and thickest.