

PHYSICAL GROWTH, MATURATION, AND AGING

CHAPTER OBJECTIVES

- Describe the course of body growth and aging over the life span
- How the genes play a major role in the course of early:
 - physical
 - growth and
 - development
- Review the influence of extrinsic factors on growth and development and the increasing role of extrinsic factors as individuals proceed through the life span;
- Identify typical patterns of growth while recognising individual differences in the timing of growth, and
- Distinguish between growth and maturation.

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- ✘ Definitions of motor development and human development
 - ✘ Elements of developmental change
 - ✘ Concepts of development, maturation, and growth
 - ✘ Common terms in motor development
 - ✘ Age periods and stages of human development

INTRODUCTION

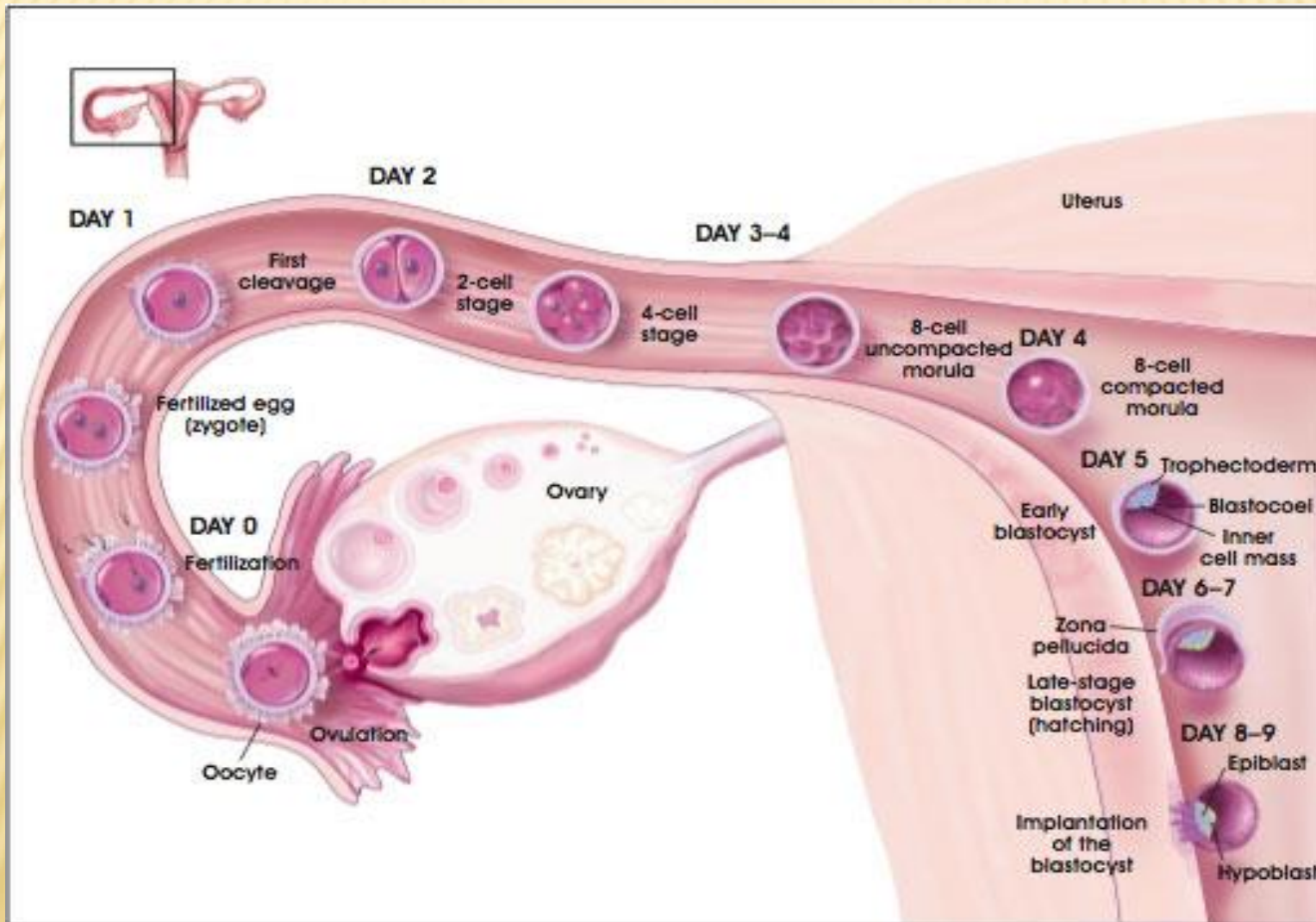
- Physical growth and aging are fascinating
- Humans are members of a species:
 - Experiencing many common steps
 - Processes in:
 - Growth & aging

PHYSICAL GROWTH, MATURATION, AND AGING

- **PRENATAL DEVELOPMENT**
 - Embryonic development
 - Fetal development
 - Fetal nourishment
 - Abnormal prenatal development

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- POSTNATAL DEVELOPMENT
 - Overall growth
 - Gender
 - Height
 - Weight
 - Physiological maturation
 - Extrinsic influences on postnatal growth

PRENATAL DEVELOPMENT



PRENATAL DEVELOPMENT

- Growth process begins:
 - Ovum & spermatozoon fuse in fertilization
- Genes determine:
 - the normal aspects of development
 - inherited abnormal development.
- Extrinsic factors:
 - environment (amniotic sac in the uterus)
 - nutrients (delivered to the fetus via the placenta)

PRENATAL GROWTH

- Prenatal growth is divided into 2 phase:
 - Embryonic phase:
 - Form conception to 8 weeks
 - Fetal growth:
 - From 8 weeks to birth

PRENATAL DEVELOPMENT

- × Germinal Period
- × Embryonic Period
- × Fetal Period

- Humans have 23 pairs of chromosomes = 46.
- Through a process called meiosis
- each sex cell divided into
 - + two 'daughter' sex cells and
 - + only one chromosome from each of the 23 pairs migrates to each daughter cell.
- When fertilization occurs:
 - both parents donates a set of 23 chromosomes
 - reestablishing the total of 46 chromosomes

GERMINAL PERIOD

- × Conception:
 - + Implantation of fertilized egg
- × Cell division

EMBRYONIC STAGE

- Stage from 2-9 wks after conception
 - Organs begin to form and function
 - Develops heart, nervous system, stomach, esophagus, ovaries or testes
 - Develop eyes, ears, nose, jaw, mouth lips
 - By end have tiny arms w/ elbows, hands, fingers
 - Legs have knees, ankles, toes

EMRYONIC PERIOD

EMBRYONIC STAGE



- ✘ The zygote (sex cell)=
 - + result from the fusion of the sperm and egg.
- ✘ The zygote has to then divide into many copies of the cell that will eventually lead to the formation of the human.
- ✘ These cells are all the same with no difference.
- ✘ Mitosis
 - + is the process by which new cells are generated.
- ✘ Meiosis is the process by which gametes/sex cells are generated for reproduction.

FETAL STAGE

- 7 month period of prenatal development, spanning 9 weeks from conception to birth
 - Begins to look distinctly human
 - Organs grow and start to function
 - By 3 months: can kick, make fist, turn head, open mouth, swallow, frown

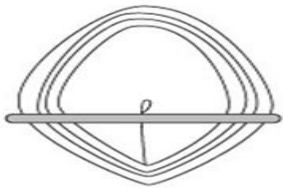


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- × In 6th month: eyelids open, has tastebuds, well-developed grasp, can breathe regularly as long as 24 hrs. at a time
 - Could potentially survive premature birth by end of 6th month
 - Organ systems typically functional by end of 7th month
 - 8th & 9th month: respond to light & touch, hear outside sounds
 - Can also learn – respond differently to sound of mother (faster heartbeat) and stranger (slower heartbeat)

EMBRYONIC PERIOD: 2ND – 8TH WEEK




- + *Implantation – embryo is recognizable as a human fetus*
- + *Cell differentiation*
- + *The zygote cell that has divided into many cells form a disk with 3 layers.*
- + *Here the cells become different or specific according to their location in the disk to form an organized human*

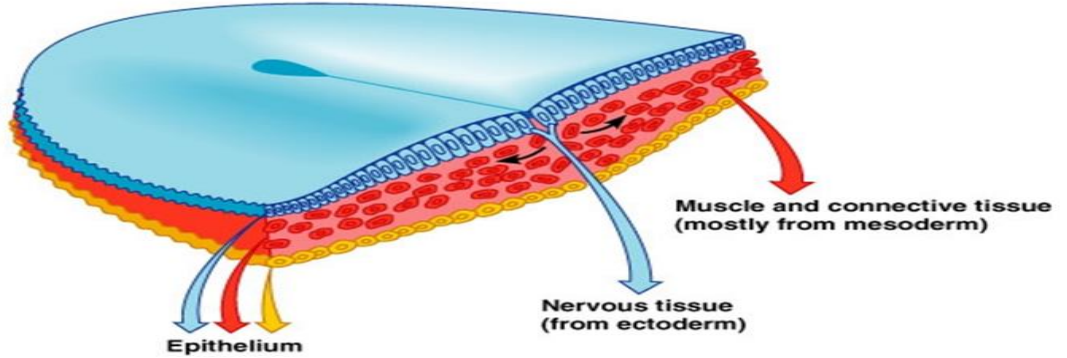
- ❖ Ectoderm (outer layer) - Nervous system & skin
- ❖ Mesoderm (middle layer) - bone, muscles, lymph glands, heart, blood vessels
- ❖ Endoderm (inner layer) - Digestion, breathing organs



16-day-old embryo
(dorsal surface view)

Key:

-  = Ectoderm
-  = Mesoderm
-  = Endoderm

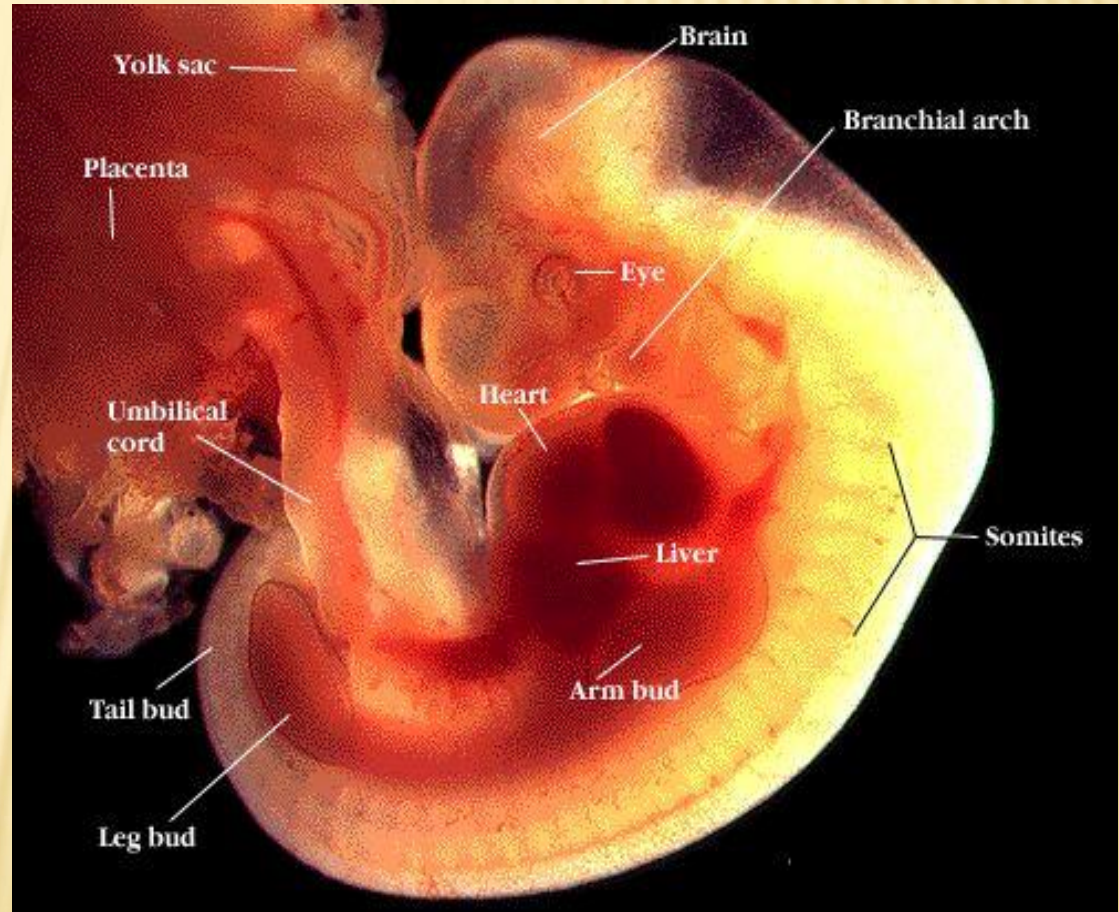


EMBRYONIC DEVELOPMENT

- Development begins with the fusion of an ovum and spermatozoan.
- Genetic information:
 - × hair
 - × eye color
 - × height,
 - × skeletal structure contained in the deoxyribonucleic acid (DNA).

EMBRYONIC PERIOD

- + 28 days
- + 5mm in length
- + Primitive heart
- + Simple kidneys
- + A liver
- + A digestive tract
- + Simple eyes, ears,
nose



FROM 4 TO 6 WEEKS... LOOK AT THE DIFFERENCE!



EMBRYONIC PERIOD

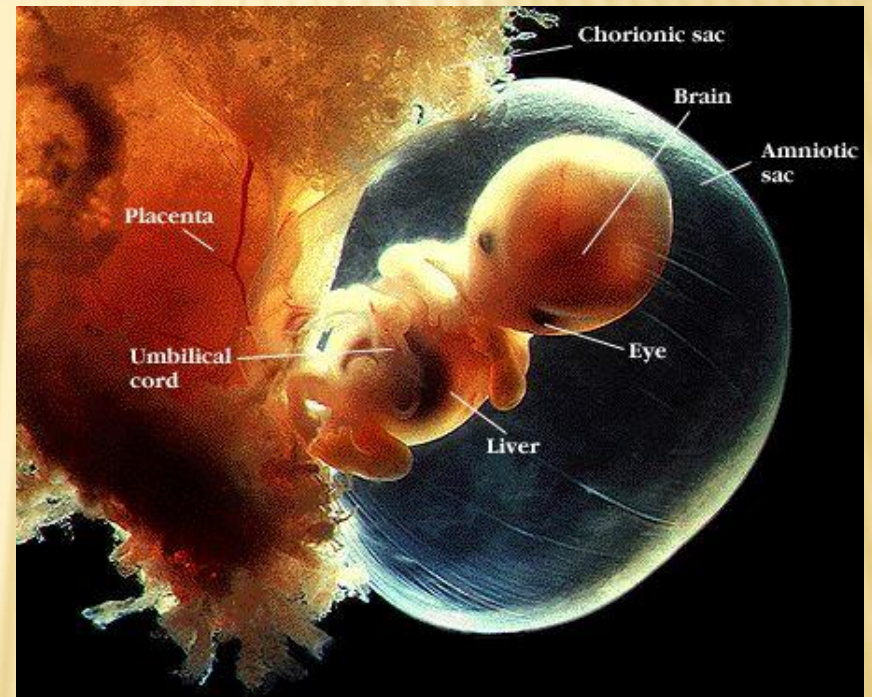
+ Vulnerable to viral diseases

× Rubella

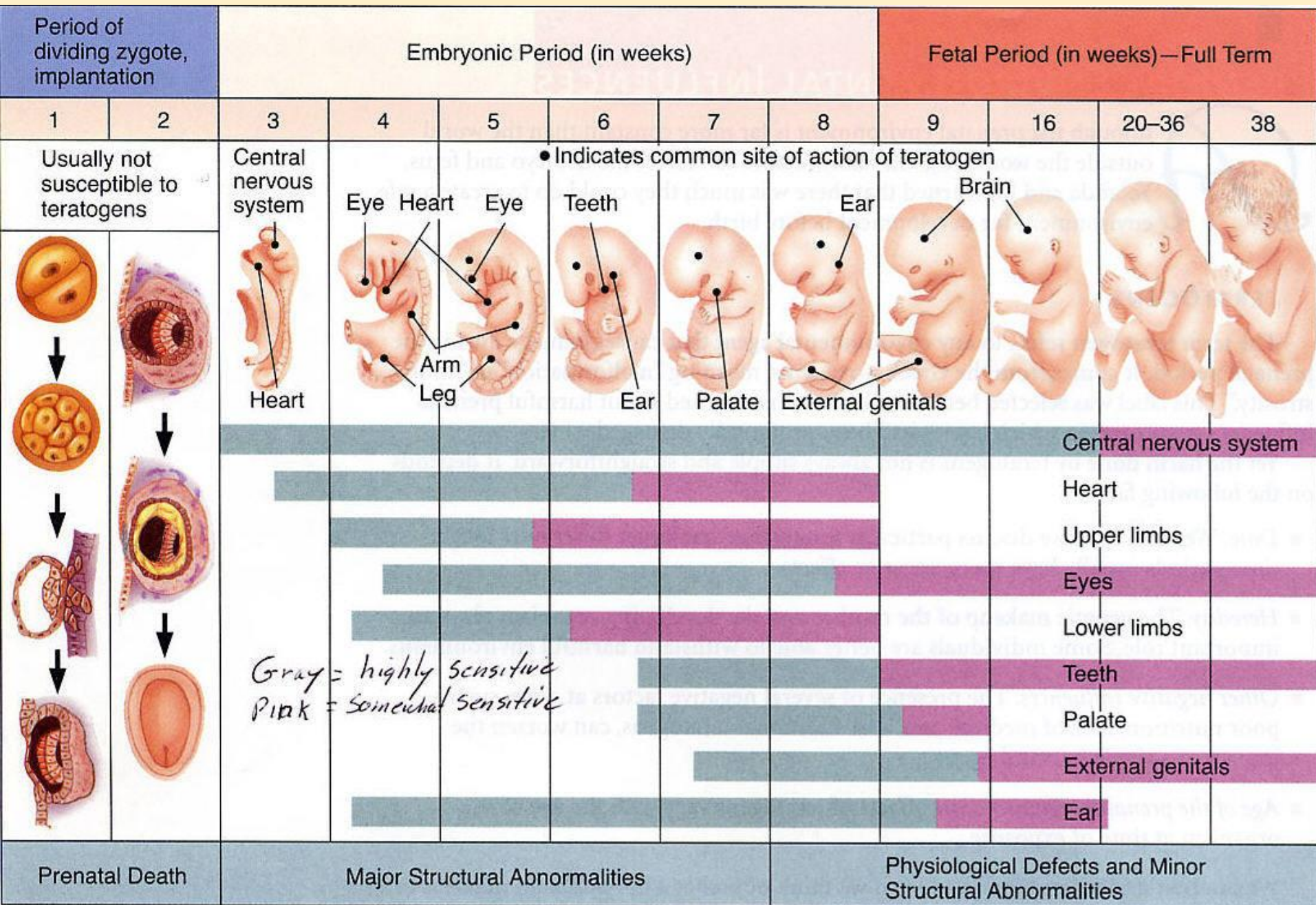
× German measles

FETAL PERIOD: 8TH WEEK - BIRTH

- ✘ End of 2nd month
- ✘ 2.54cm in length
- ✘ 18.7 grams



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- + **Fetus:** has all essential features for recognition as a human
 - + Rapid, uniform, progressive growth
 - + **Unification & integration of organs**



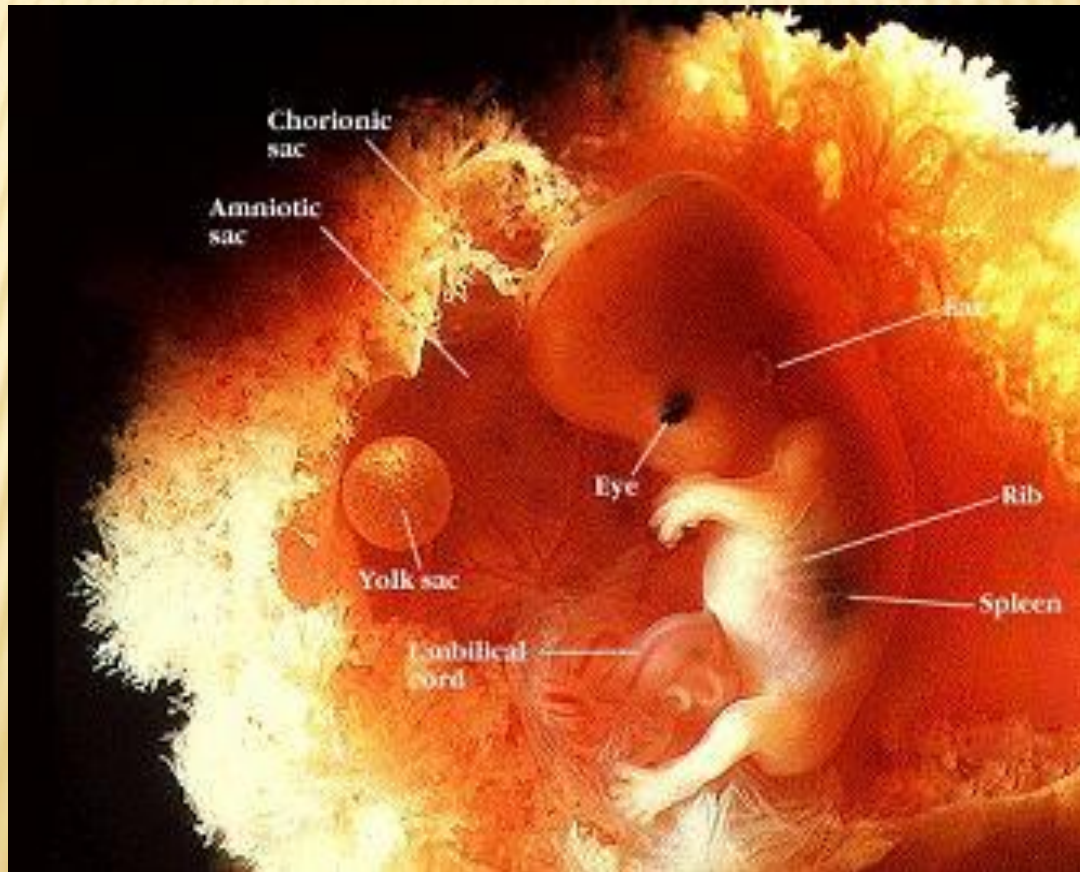
MOTOR BEHAVIOUR BEFORE BIRTH 6 WEEKS

- ✗ reflex response of mouth



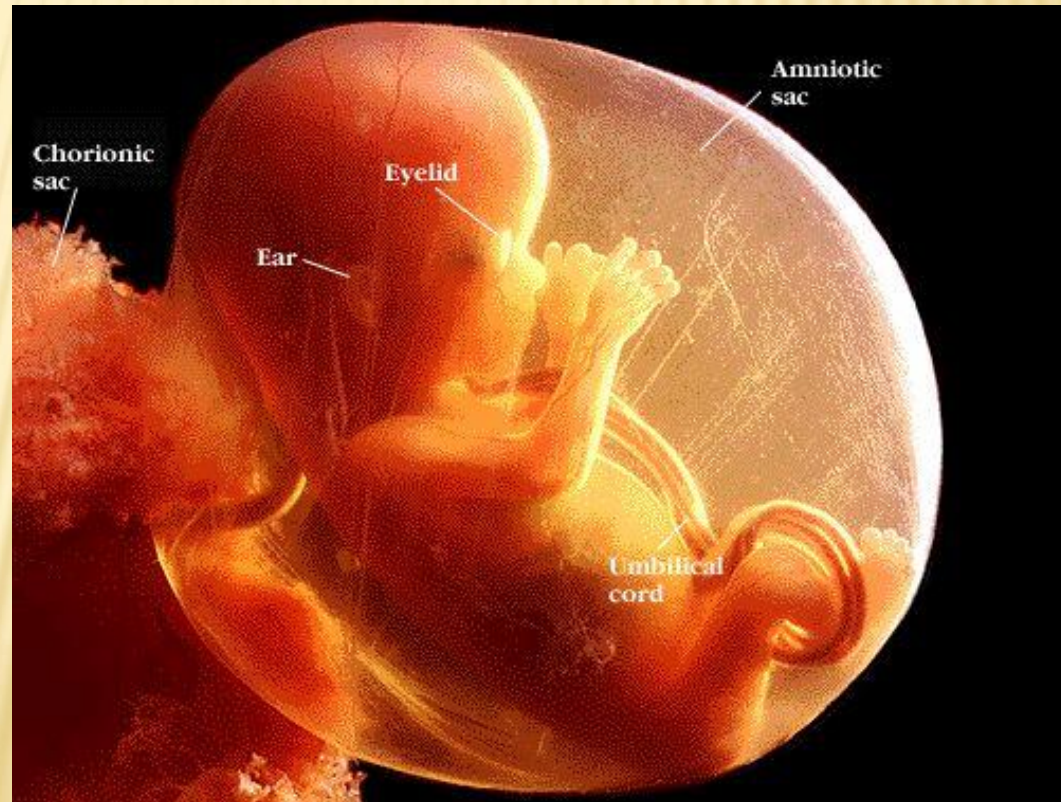
MOTOR BEHAVIOUR BEFORE BIRTH 3 MONTHS

- ✘ Movements of head, arms, legs, shoulders, elbows, fingers, toes



MOTOR BEHAVIOUR BEFORE BIRTH 4 MONTHS

✗ activity = increased



MOTOR BEHAVIOUR BEFORE BIRTH

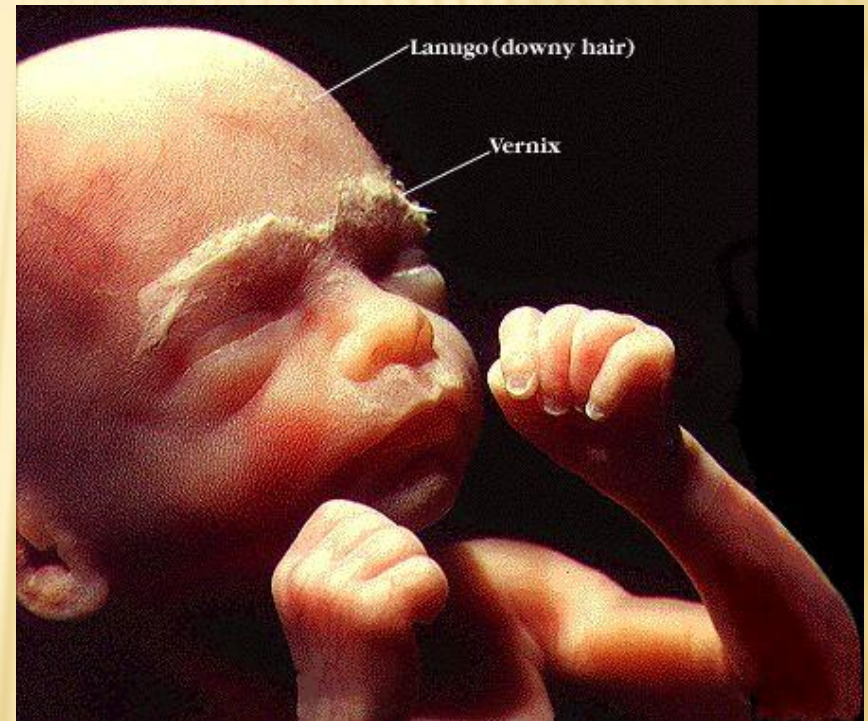
4 1/2 MONTHS

- ✘ strength = increased
- ✘ sharp kicks & pushes



MOTOR BEHAVIOUR BEFORE BIRTH 5 MONTHS

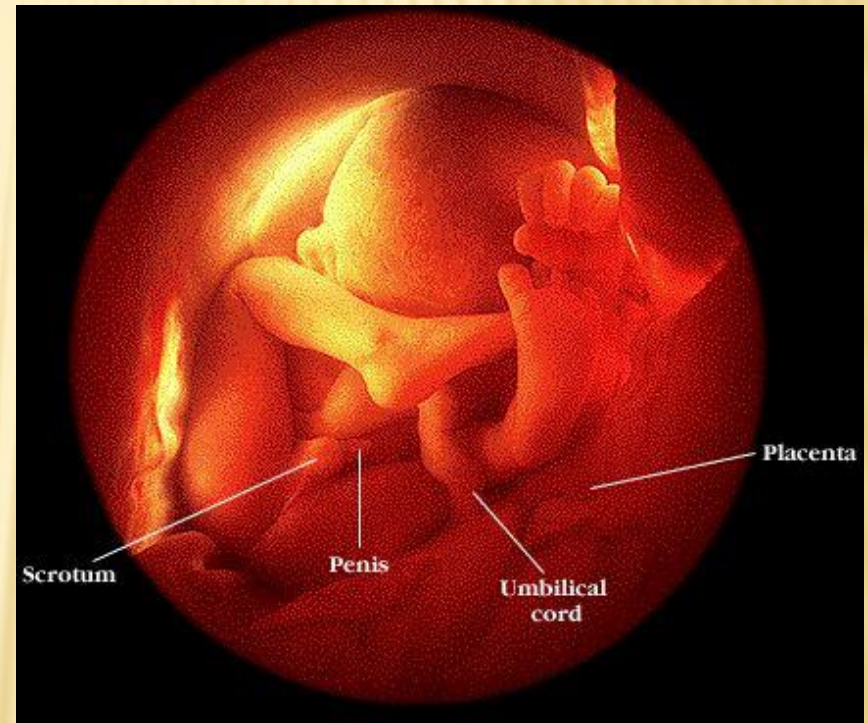
- ✘ Up & down,
- ✘ side to side,
- ✘ completely around
(somersault)
movements



MOTOR BEHAVIOUR BEFORE BIRTH

8-9 MONTHS

- ✘ Considerable weight gain makes space confined (completely stops moving at 2 weeks before birth)



WHICH DEVELOPS CONTROL FIRST??

Head

Hands

Legs

Trunk

FETAL DEVELOPMENT



FETAL DEVELOPMENT

- × Fetal stage:
 - + 8 weeks to birth
- × Characterized by:
 - + Further growth
 - + Cell differentiation
 - + Leading to functional capacity
- × Continued growth of organs & tissue occurs in 2 ways:
 - + Hyperplasia & hypertrophy

✘ Hyperplasia:

- + An increase in absolute number of cells

✘ Hypertrophy:

- + Increase in relative size of individual cell

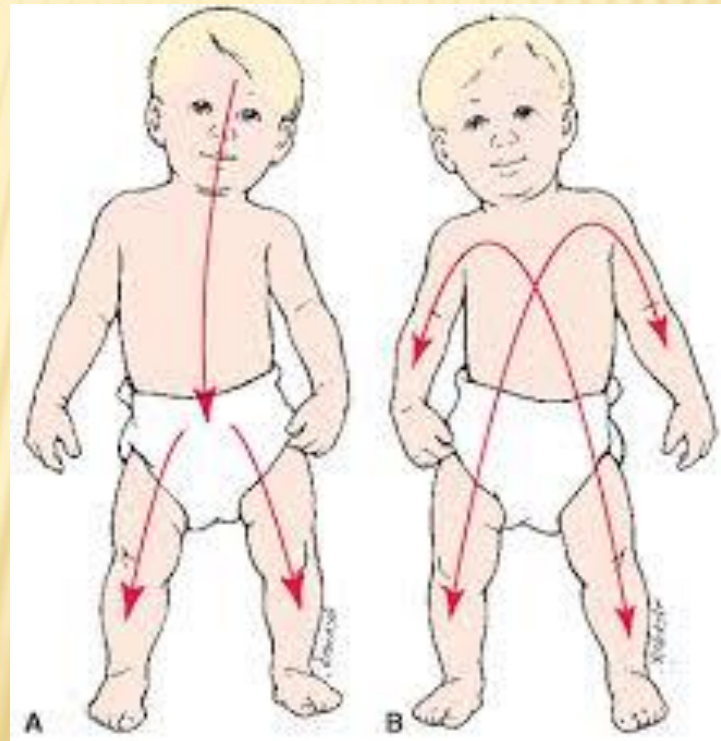
✘ Growth tends to proceed in 2 directions:

- + Cephalocaudal

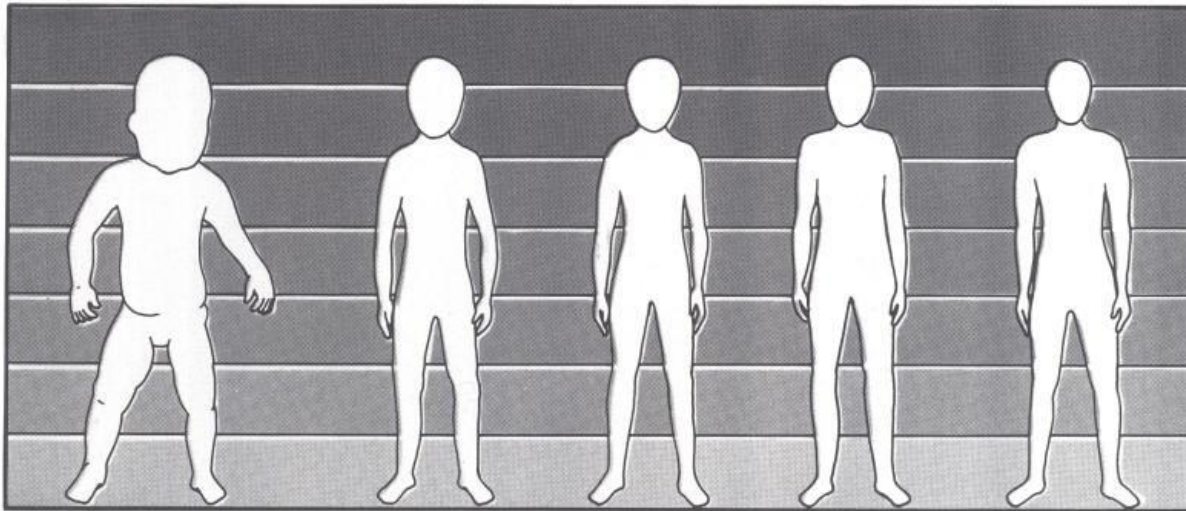
- + Proximodistal

✘ Cephalocaudal:

- + head and facial structures grow the fastest
- + then the upper body
- + followed by the slow growing lower body.



- × From head to tail (i.e. head to feet)
- × Growth – E.g. Head size of infant relative to body.
- × Movement Ability – E.g. Toddler learning to walk.



The changes in proportions from birth to adult

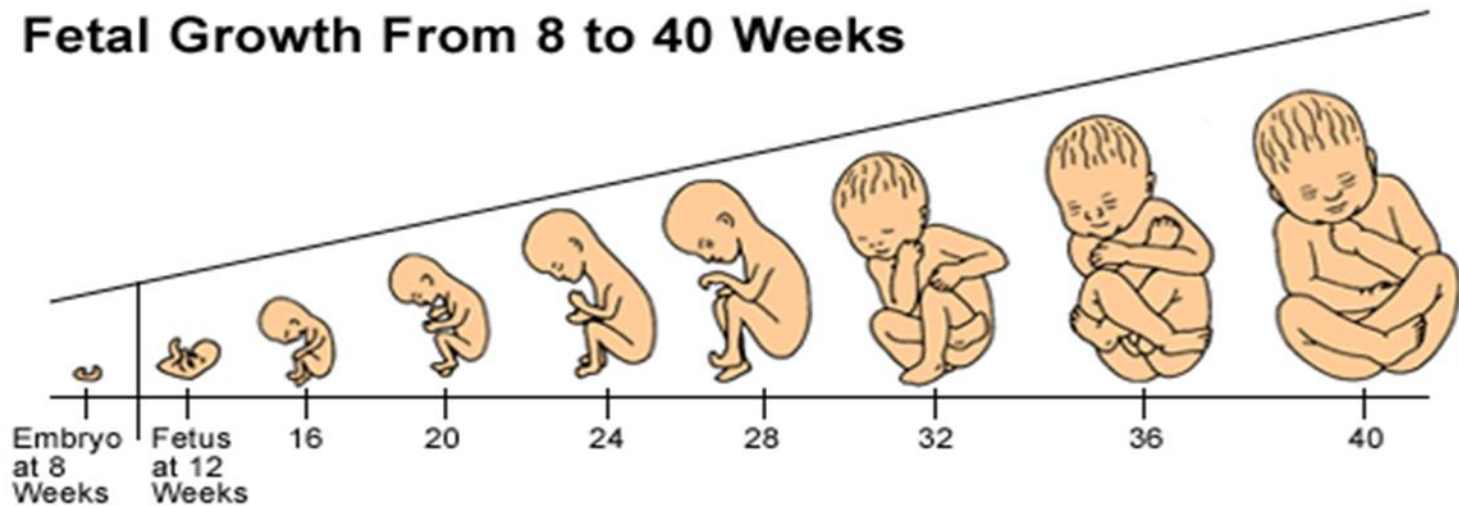
- Proximodistal:
 - the trunk tends to advance,
 - then the nearest parts of the limbs
 - finally the distal parts of the limbs.



- *Proximodistal*

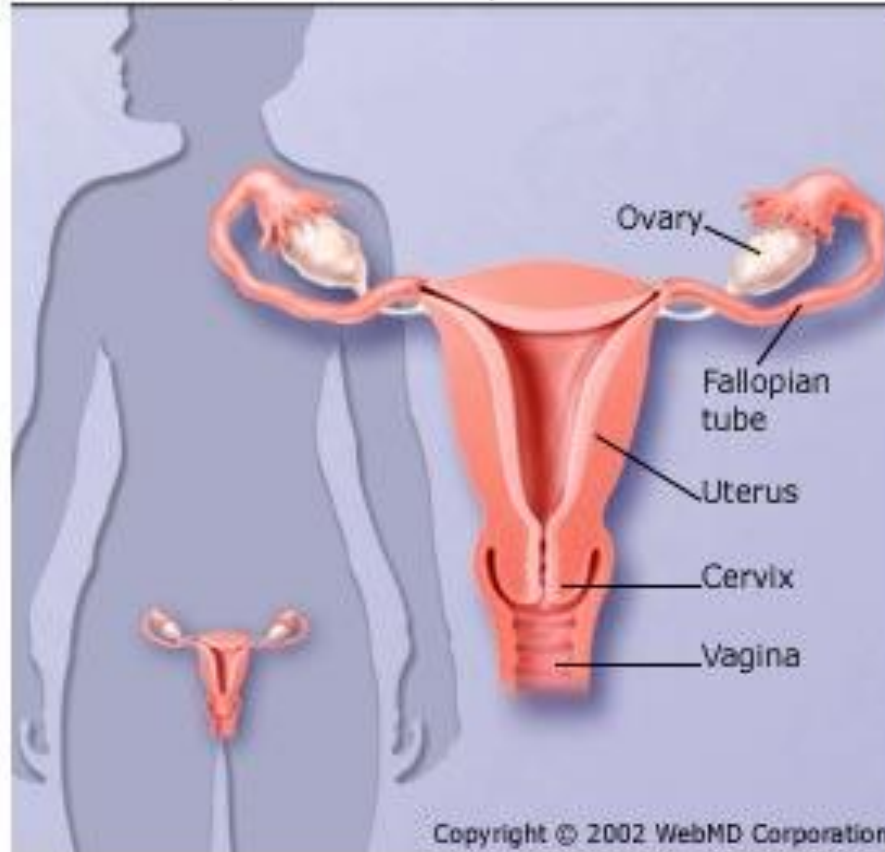
- From those points close to the body's center to those points close to the periphery
- Growth – E.g. Prenatal growth
- Movement Ability – E.g. Infant acquiring motor skill

Fetal Growth From 8 to 40 Weeks

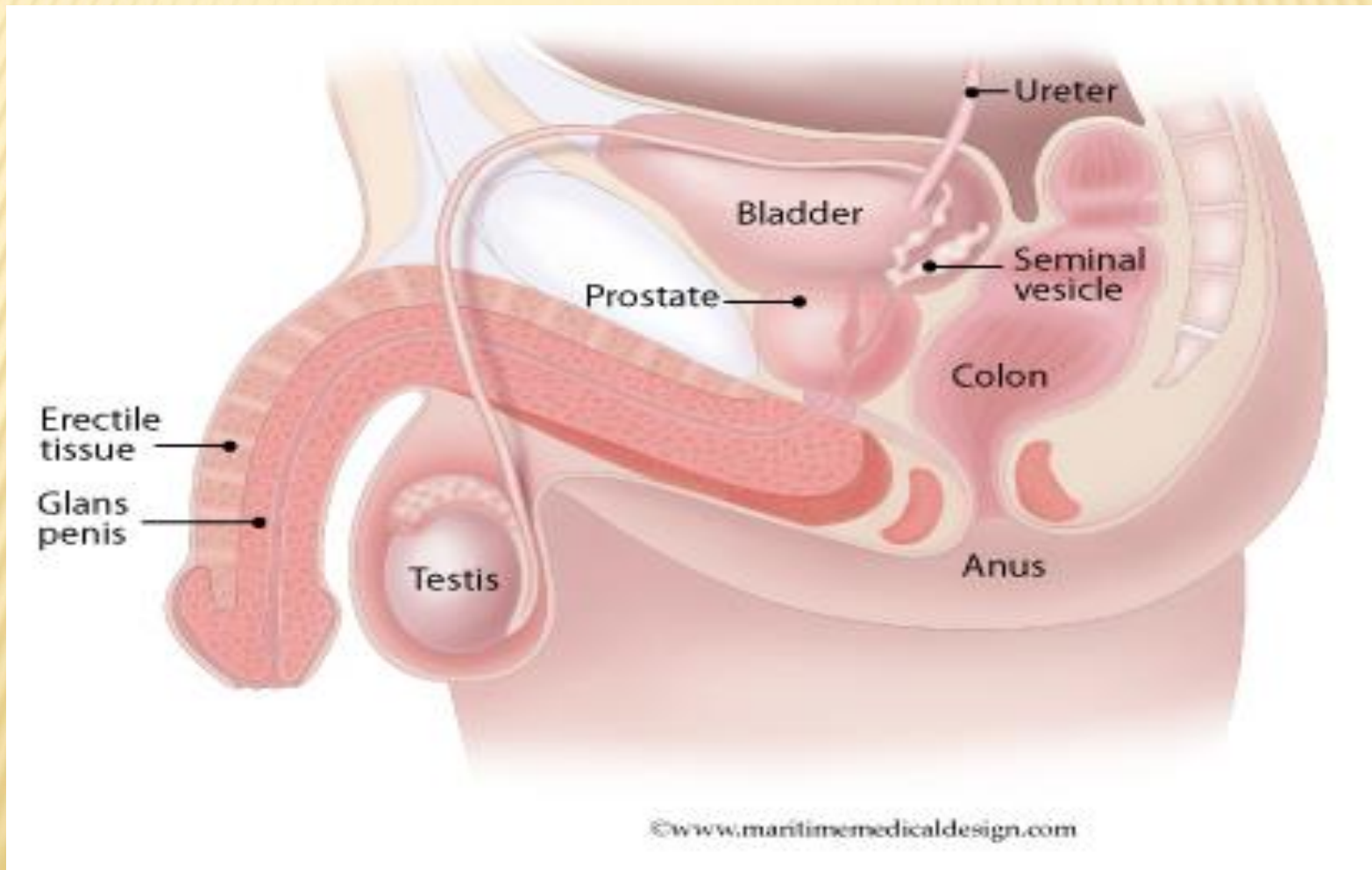


FEMALE REPRODUCTIVE SYSTEM

Female Reproductive System



MALE REPRODUCTIVE SYSTEM



FETAL NOURISHMENT

- ✘ Many characteristics of fetal environment have potential to affect growth
 - + Negatively or Positively
- ✘ Nourishment is the extrinsic factor that has the most impact on fetal development.

-
- × Fetus is nourished by:
 - + the diffusion of oxygen
 - + nutrients between fetal blood
 - + maternal blood in the placenta

✘ Fetus needs:

+ energy

+ nutrients

+ oxygen.

✘ Good conditions very important in meeting the need of the fetus.

✘ Less risk of illnesses and infections!

MOVEMENT DIFFERENTIATION AND INTEGRATION

+ *Differentiation*

- × Progression from gross, immature movement to well-controlled, intentional, precise movement
- × E.g. Toddler learning to walk



+ *Integration*

- × Motor systems are able to function together as ability progresses
- × E.g. See next slide

How does the child in this picture demonstrate the concept of integration?



OTHER PRENATAL EXTRINSIC FACTORS

× *Gross and Fine Movement*

+ *Gross movement*

- × Movement controlled by the large muscles or muscle groups (e.g. legs)

+ *Fine movement*

- × Movement controlled by the small muscles or muscle groups (e.g. hands)



FINE MOTOR SKILL

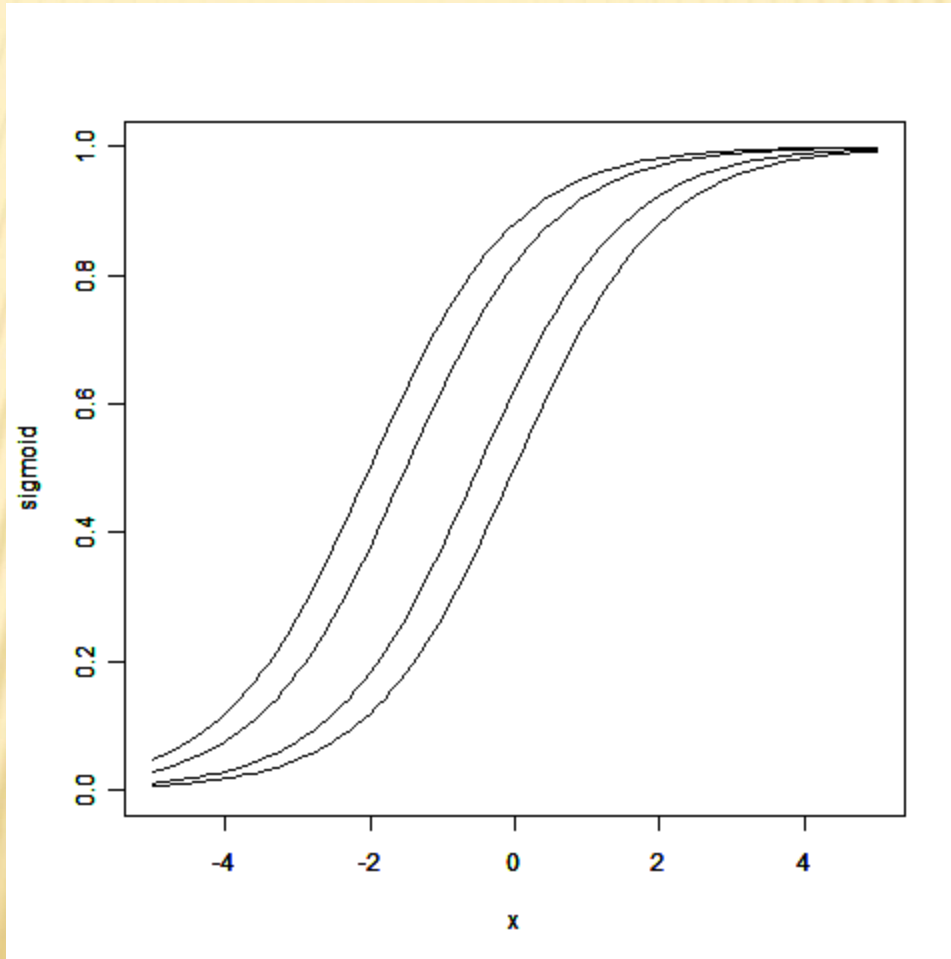


GROSS MOTOR SKILLS

POSTNATAL DEVELOPMENT

- ✘ Body growth after birth is continuation of prenatal growth.
- ✘ The growth pattern is predictable and consistent but not linear
- ✘ There is a rapid growth after birth followed by gradual but steady growth during childhood, rapid growth during adolescence and then leveling off.
- ✘ The growth patterns follow an S-shaped curve.
- ✘ Sigmoid curve after the Greek letter s.

SIGMOID CURVE



POSTNATAL DEVELOPMENT

- ✘ The timing of individual's spurts and steady growth periods is likely to vary from average.
- ✘ This is called the **universality** and **specificity** principles.

GENDER

- × Gender differences are minimal in childhood.
- × Boys slightly taller than girls.
- × Girls tend to mature at a faster pace than boys throughout childhood.
- × Girls begin their growth spurts when they are about 9 years old.
- × **Age at takeoff.**
- × Boys begin their growth spurt at about 11 years.
- × One third will initiate it even earlier or later.

HEIGHT

- ✗ Follows sigmoid pattern of growth.
- ✗ On average, girls reach peak height velocity at 11.5-12.0.
- ✗ Boys reach their peak height velocity at 13-5-14.0.
- ✗ Boys taller than girls.

WEIGHT

- ✘ Follows sigmoid pattern of growth.
- ✘ Susceptible to extrinsic factors.
- ✘ Growing 'up' first and then filling 'out'.

RELATIVE GROWTH

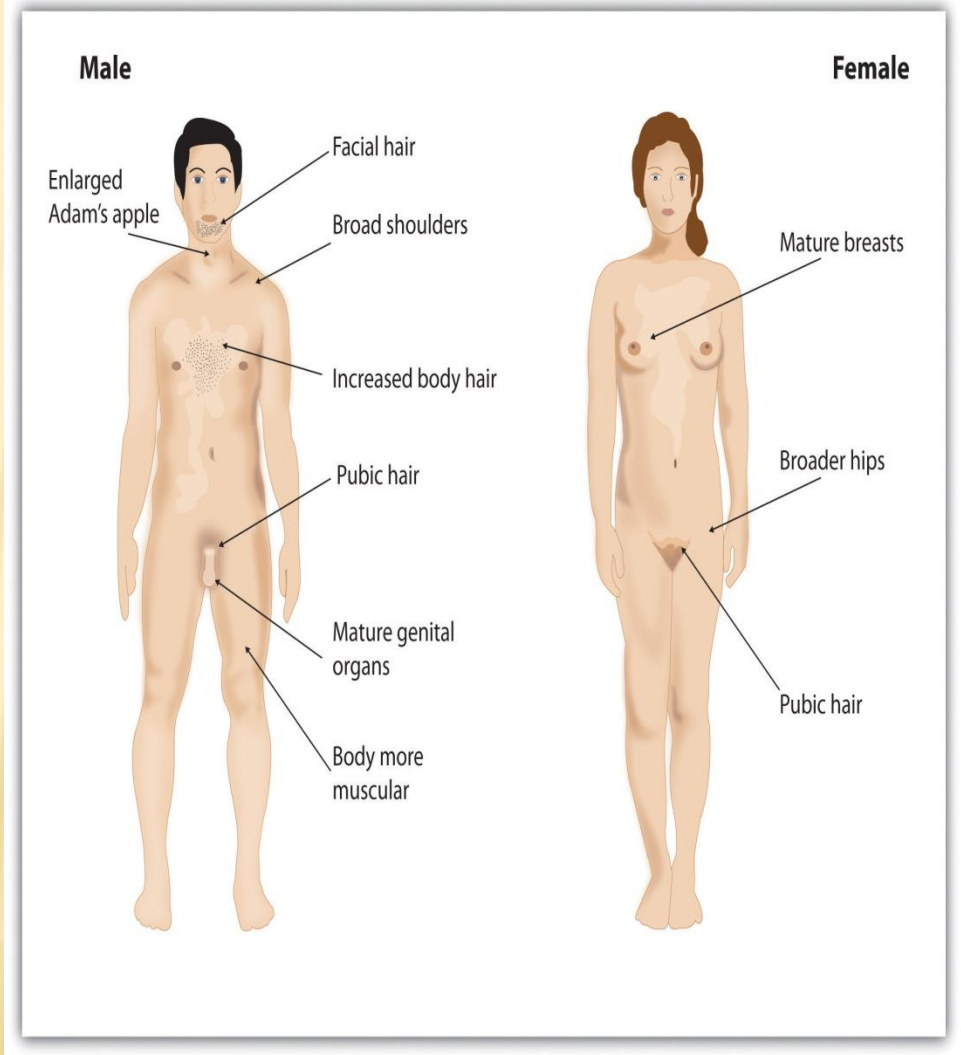
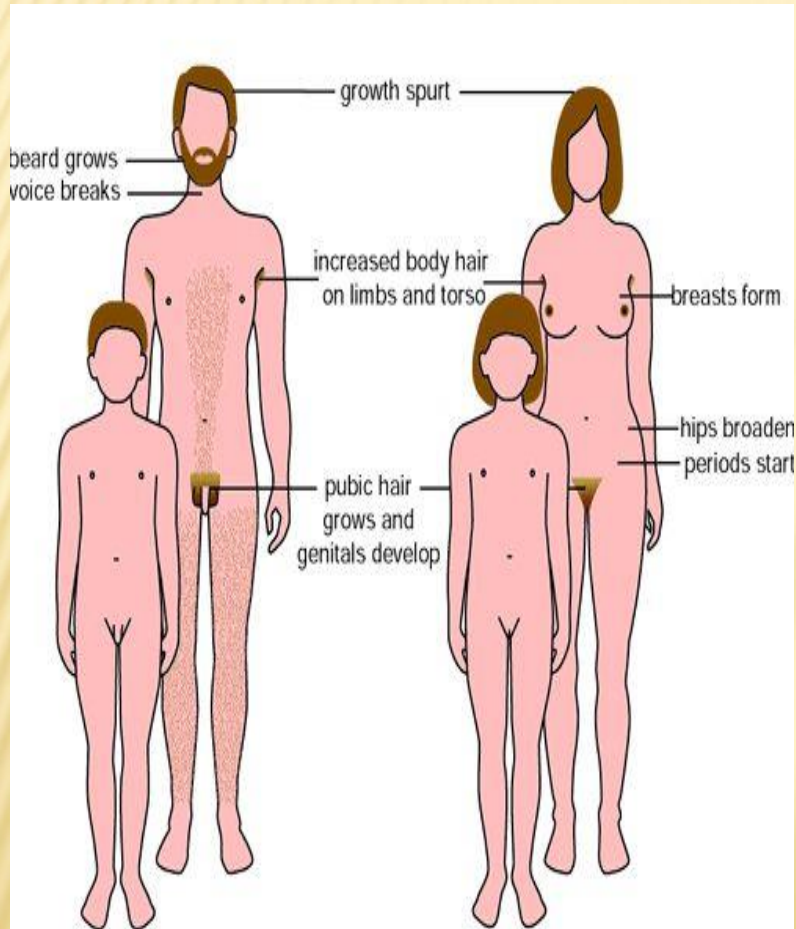
- ✘ Follows sigmoid pattern of growth.
- ✘ Specific body parts, tissues and organs have differential rates of growth
- ✘ Proportions changes throughout life.
- ✘ Body proportions at birth reflect the cephalocaudal and proximodistal direction of prenatal growth.
- ✘ Newborn has a form quite different from that of an adult.
- ✘ Boys and girls have similar proportions in childhood.

- ✘ In girls, shoulder and hip breadth increase at about the same rate.
- ✘ Boys increase shoulder breadth in relation to hip.
- ✘ This has implications for skill performance: balance.
- ✘ Tissues and organs grow differently.
- ✘ 80% of the brain weight is achieved by 4 yrs.

PHYSIOLOGICAL MATURATION

- ✘ Tissues grow without an increase in size.
- ✘ **Physiological maturation**: developmental process leading to a state of full function.
- ✘ Chronological age, growth in body size and physiological maturation are related.
- ✘ However, they can proceed with their own timing.
- ✘ **Secondary sex characteristics**: aspects of form or structure appropriate to male or females, often used to assess physiological maturity in adolescents.

SECONDARY SEX CHARACTERISTICS



- ✘ Secondary sex characteristics appear at a younger age in girls and boys who are early maturers.
- ✘ Girls mature earlier than boys.
- ✘ The breasts enlarge, pubic hair appears, menarche and a first menstrual cycle appear.
- ✘ Average age of menarche is 12.5-13.0.
- ✘ In boys, testes and scrotum grow in size, and pubic hair appears.
- ✘ More mature individuals likely to be stronger and more coordinated than those who are less mature at the same chronological age.