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Basic Prenatal Development

Pregnancy – 280 days from LMP (266 from conception)

Conception / Fertilization = Zygote then Blastocyst

5-10 days to implantation (avg. 6-8)

8-12 cells at implantation

Implantation about 4 weeks

Placental formation (placental membrane selectively permeable)

Rudimentary circulation

Umbilical Cord

Amnion & Chorion

Embryonic Development (weeks 3-8)

Cephalocaudal

Proximodistal

Differentiation of cells into organs and systems begins

Most vulnerable period to insults from external sources

Week 6

Neural tube closes by day 42 after LMP

Forebrain development

Upper limb buds develop

Otic pits (ears) begin

Week 7

Disproportionately large head

Differentiation of upper limbs

Elbow and hand plates with digital buds develop

Week 8

Rapid upper limb growth

Ear canals develop

Fetal Development (weeks 9-40)

Week 9

Herniation at umbilicus

Further limb development and refinement

Optic nerve connection to brain

Notches in hand rays develop

Week 10

Notches in foot rays

“Tail” still noted

Eyes open and fuse shut

Sex differentiation begins

Week 11-14

- Head is half crown rump length
- CRL doubles by end of week 14
- Primary ossification of bones
- Intestines close into abdomen by 13 weeks
- Urine formation noted
- Waste exchanged via placenta

Week 15-18

- Rapid Growth
- Limb movement present but not felt
- Myelination of nervous system begins about 16 weeks
- Active skeletal ossification
- Eye movements noted by 16 weeks
- Ovaries in females differentiate by 18 weeks

Week 18-20

- Quickening
- Brown fat development
- Capillaries penetrate linings of tubules in lungs

Week 22-27

- Viability about 23-24 weeks (depending on region)
- Further weight gain
- Skin Maturation
- Beginning of surfactant development
- Fingernails form

Week 28-31

- Improved survival
- Lungs able to ventilate but often collapse without lubricating surfactant
- CNS system maturation begins to complete
(incomplete until long after birth)
- Eyes reopen at 26 weeks
- Auricular cartilage formation completing

Week 32-36

- Growth and weight gain (limbs “chubby”)
- Pupillary light reflex noted
- Suck reflex may begin

Week 37-40

- Reflex grasp & Suck noted
- Orientation to light
- Slow lengthening, weight gain continues
- Birth usually occurs at “full term” gestation at this time.

Critical Periods of Development

Organogenesis week 4-7

From week 11-on fetus develops increasing relative resistance to harmful influences.

Positive influences on Prenatal Development

Adequate Nutrition
Folic Acid (?? Prenatal Vitamins)
Iron
Genetics

Negative Influences

Genetic disorders (fetal and maternal)
Teratogens
Random Mutation or Malfunction
Nutritional intake

Causes of human malformation

20%	Known Genetic Transmission
5%	Chromosomal Abnormalities
10%	Environmental Factors
	<1% Irradiation
	2-3 % Viral Infections
	1-2% Maternal Disorders
	4-5% Drugs and chemicals
65%	Multifactorial/unknown
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100%	Total

(from Iams, JD & Rayburn, WF (1980). Drug use during pregnancy: Part 2, Drug effects on the fetus. Perinatal Press, 4, 131.)

Genetic disorders

Single gene abnormalities- caused by mutation or abnormality on a single gene segment (or allele) in chromosome.

Chromosomal abnormalities- excess or deficiency of the genes contained in a whole chromosome or chromosome segment.

Multi-factorial abnormalities- caused by small genetic mutations combined with environmental influences.

Teratogen- an agent that produces or raises the incidence of congenital malformations.

Drugs, Chemicals, Medications, Herbs, “remedies”
Environmental “toxins”

FACTORS of teratogenicity

Most effect CNS development as it is very vulnerable

- Type of exposre
- Time of exposure to teratogen
- Dosage
- Fetal Genotype
- Maternal Genotype

Nutritional Intake

- Quality and Quantity of Food intake
- Weight gain (32-35# desired avg.)
- Vitamin and or Mineral deficiency
 - Folic Acid
 - Iron
 - Prenatal Vitamins???

Conclusion

- Variable Maternal and Fetal response is not reliably predictable.
- There are many more influences (positive and negative) on prenatal development than one can quantify.
- “Miracle Factor”