Periods of Prenatal Development

<table>
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<tr>
<th>Period</th>
<th>Length</th>
<th>Key Events</th>
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| Zygote | 2 weeks | • Fertilization  
• Implantation  
• Start of placenta |
| Embryo | 6 weeks | • Arms, legs, face, organs, muscles all develop  
• Heart begins beating |
| Fetus  | 30 weeks | “Growth and finishing” |

Prenatal Development

Teratogens
- Any environmental agents which cause malformations during prenatal period. Agents tend to affect early prenatal period, first three months, when organs first developing.
  - German Measles - Rubella
  - Drugs - Thalidomide disaster

Phocomelia - stunted development of arms or legs
- Days 21 – born without ears
- Days 25-27 deformed arms or no arms
- Days 28-36 deformed legs or no legs
- After 40 days no effect

60% of women take at least 1 drug during pregnancy, and such “mild” drugs as aspirin and ibuprofen can cause problems.

Fetal Alcohol Syndrome
- Widely spaced eyes, underdeveloped upper lip, flat nose, or midface.
- Leads to low intelligence and behavior problems
- May occur in one bout of binge drinking.
- Appears to disrupt synaptogenesis, decreases oxygen available, constricts umbilical arteries.

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Sensitive Periods in Prenatal Development

Other complications
- Anoxia-oxygen deprivation. Can occur during birthing if cord becomes kinked. More dangerous in breech births. Short time window, approximately 4-10 minutes
- Erythroblastosis, oxygen deprived because of destruction of red blood cells.
  - Occurs when mother is missing rh factor and is carrying an infant who is rh positive.
  - Usually first infant ok, but birthing may mix blood or antigens may cross over to mother so she makes antibodies to kill them.
  - Mother can be inoculated with rhogam to prevent reaction.
Premature Infant

Prematurity

In the U.S.
- Approximately 12% of infants preterm (under 5 lbs.)

Causes include maternal Smoking, poor prenatal care, drug use, illness or disease.
- Cigarettes per day

<table>
<thead>
<tr>
<th>Cigarettes per day</th>
<th>Percentage of premature births</th>
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<tbody>
<tr>
<td>0</td>
<td>6%</td>
</tr>
<tr>
<td>15</td>
<td>12%</td>
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<tr>
<td>30+</td>
<td>33%</td>
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- Susceptible to respiratory problems, may have long-term effects on attention and intelligence.

Hospitalization
- Average about 3 weeks at $1,000 to $2,500 per day, rate of prematurity has not declined in last 20 years.

Treatment
- Stimulation programs, such as body massage.
  - Greater weight gain and earlier hospital discharge between 3 and 6 days (Tiffany Field, 2004)

Low Birth Weight and Disabilities

Maternal Malnutrition
- Instructions about weight gain around 25 lbs.
- May create deficiencies in some vitamins and nutrients.
- Folic acid important to prevent Spina bifida which creates malformed spinal cord development.

Maternal Obesity
- 5'4" woman, 174 = BMI of 30.
  - In 2004, 1/3 of women 15 yrs up obese
  - Greater incidence of birth defects, complications, and death of mother

Age of Mother
- Better for mother and child if mother between 19-29, your book says 16-35, but recent evidence finds older mothers do very well, still problem of greater chromosomal abnormalities with age.

Stress

Maternal stress
- Stress leads to secretion of stress hormones.
  - May disrupt flow of oxygen and nutrients to fetus
- Women who are stressed may not eat well, use alcohol, tobacco, drugs which affects fetus.
- Problems do not end at birth. Child may be "difficult" infant who is unresponsive to mother, and causes mother to give less satisfactory care.
- Stress more likely when women ambivalent about their marriages and when they do not have support from friends and family.
- Difficult to sort out stress factor from the poor environments these women in that may be responsible for problems

Maternal Bonding and the Birth Process

Klaus and Kennel 1976
- Experimental Group - Mothers given close bodily contact with their infant immediately after birth, and allowed to keep their child in their rooms.
- Control Group - Usual hospital routine of separating mother and child shortly after birth, and child brought to mother during feeding times.
- Results: Experimental mothers showed more affection, greater eye contact, stayed closer to their infants and soothed them, seemed more knowledgeable.

Problem: It doesn’t replicate. A later study by these same investigators failed to find any evidence of it, and reversed their position to say the early weeks after birth are important for bonding. It also does not line up with what we know about adoptive parents.
In 1960, the US was 12th in the world in infant mortality, we continue to drop and we are now ranked 29th tied with Poland and Slovakia. The main problem seems to be that we are not very good at preventative care.

Problems in pregnancy associated toxemias, infections, prematurity, anoxia, etc. 3–4 times more frequent in lower class. Estimate that 47% of infant deaths in lower class preventable.

Physical Growth and Development

Why are infants more immature than other primates at birth?

- Period of gestation proportionately shorter
- Human brain 25% of adult at birth, primates 40–60%
- Problem of bipedal mother and giving birth
- Fontanel-infants are soft in the head

First year is a period of Rapid growth of brain
- 25% at birth
- 66% at one year
- 76% at 2½
- 90% at 5

- Two types of brain cells
  - Glia cells – provide support of neurons and myelinization
  - Neurons

Growth and Development

Brain growth spurt from birth to two years.

- Rapid growth in the brain not the result of neuronal reproduction but glia cells, which nourish the neurons, provide guiding function, and encase them in myelin, and the addition of synaptic connections between neurons.

Stages of Brain Development

- **Cell proliferation.** Production of brain cells, neurons, begin one month after conception, ends approximately at end of 2nd trimester at 100–200 billion neurons.
  - New evidence suggests neurons continue to proliferated after birth in hippocampal area.

- **Cell migration.** Shortly after formation neurons in the neural tube of the embryo, they are guided to their eventual locations within brain. They will take on the function of the part of the brain they end up in. Alcohol and mercury can interfere with migration and cause retardation.

Stages of Brain Growth

- **Cell differentiation.** Neuronal cells form connections and live or die based on stimulation.
  - Experience organizes the structure of the brain, there is no specific genetic blueprint to do this. With only 30,000 genes not enough.
  - Synaptogenesis, the forming of synaptic connections after birth occurs rapidly. Average infant has twice as many as adult.
  - Synaptic pruning, about 40% of the synapses pruned based on stimulation and about half the cells produced in early life die.
  - Neurons and connections that successfully connect and respond to stimulation live. This last stage suggests experience very important for brains to develop properly.

Synaptic Pruning
Experience and the Brain

Austin Riesen’s chimps
- Chimps raised in the dark lost visual function, atrophy in retina and optic nerve.

Greenough and Rosenweig’s enriched environments
- Rats given enriched experience have heavier brains and differences in chemical composition

Myelination - waxy sheath that forms over neuron. Speeds transmission.
- Continues into adolescence for frontal areas (planning and foresight) and reticular formation (focusing attention.)

Growth and Development

General principles
- Greater plasticity before adolescence, better recovery from brain damage
- Sensory and motor areas develop before the others
- Cephalo-caudal and proximo-distal patterns of myelination
- Cerebral lateralization - evidence before birth and in child’s postural positions

Catchup Growth
- Purpose is to maintain growth trajectory based on heredity
  - Birth height unrelated to later height, but predictive at 2 years
  - Differences in twins that share placenta
- Growth disorders based on psychological environment
  - Failure to thrive, 0 – 2 years
  - Deprivation dwarfism, 2 – up

Nutritional diseases
- Marasmus - insufficient protein and too few calories
- Kwashiorkor - little or no protein but enough calories

Catchup Growth