Prenatal Development, Learning, and Birth

Outline

• Prenatal Periods
• Fetal Sensory Capacities
• Factors affecting Prenatal Development
• Principles of Prenatal Development
• Birth
• Parent-Child Relationship

The Periods of Prenatal Development

The Germinal Period
• The first cells of life
• The emergence of new forms
• Implantation

The Embryonic Period
• Sources of nutrition and protection
• The growth of the embryo
• The emergence of embryonic movement

The Fetal Period
• Fetal activity
• Functions of fetal activity
Fertilization and the Germinal Period

- Blastocyst
- Morula
- Cleavage
- Zygote
- Fertilization
- Fallopian tube
- Uterine wall
- Ovary
- Uterus
- Cervix
- Vagina

Assisted Reproduction Techniques

- Artificial insemination by donor: sperm from donor provided to woman during ovulation.
- Egg donation: egg from donor is inserted in another woman’s uterus.
- Fertility drugs: drugs given to stimulate the development and release of eggs from the ovary.
- Gamete intrafallopian transfer (GIFT): surgical insertion of sperm and egg in the Fallopian tube where fertilization occurs.
- In Vitro Fertilization (IVF): eggs harvested from ovaries and fertilized in petri dish for subsequent implantation.
- Surrogacy: woman carries fetus from her own egg and donated sperm or zygote from in vitro fertilization.

Germinal Stage

From Conception to Implantation

(About 10 days)

Rapid cell replication and division
- Heterochrony - cells divide at different rates
- Heterogeneity - different levels of development for different parts
Embryonic Stage
- From Implantation to 6 weeks
- Cell differentiation
  - Ectoderm - outer skin, nails, teeth, lens, inner ear, nervous system
  - Endoderm - digestive system, lungs
  - Mesoderm - muscles, bones, circulatory system, inner skin layers
- Emergence of movement
- Sources of nutrition

Fetal Period
- 8-9 week - birth
- Increase in size
- Increase in weight
- Organ systems increase in complexity
- Parts migrate to final location
- Convolutions in the cortex develop
- Coordinated movement

Function of Fetal Activity
- General Movement
  - Believed to play important role in the “pruning” of neuronal connections
  - Example: Chick fetuses denied movement failed to develop proper limb movement
- Breathing
  - Prenatal practice necessary to develop muscles needed for respiration.
The Fetus’s Sensory Capacities

- **Sensing Motion**
  – By 5 months can sense change in orientation & right itself

- **Vision**
  – Respond to light around 26 weeks

- **Sound**
  – By 5-6 months can detect external sounds
    • change in heart rate to mother’s voice

Fetal Learning

- **Contingent Sucking Paradigm** (operant conditioning procedure)
  • Infants given a non-nutritive pacifier
  • Sucking is rewarded with a recording
  • Thus discriminant increase in sucking is indicative of a preference

Fetal Learning

- **Contingent Sucking Paradigm** found that infants:
  – Prefer to hear mother’s voice over another female voice.
  – Prefer mother’s voice muffled like in utero over normal voice (Fife & Moon, 1995)
  – Prefer native language over other languages
  – Prefer familiar prenatally-read story over unfamiliar story (DeCasper & Spence, 1986)
Fetal Learning (cont)

- In utero testing
  - 6 weeks before due date
    • 4 weeks- mothers read a story aloud 3 times a day
    • 2 weeks before due date
      – Played familiar vs unfamiliar story over mothers’ stomachs
  • Fetuses heart rates dropped when familiar story played. (DeCasper et al, 1994)

Factors affecting Prenatal Development

- Maternal Conditions
- Teratogens

Maternal Conditions & Prenatal Development

- The effects of maternal attitudes and psychological stress
  - Negative Attitudes to pregnancy
    • Low birth weight, more medical problems
  - Stress
    • Low birth weight, prematurity
  - Why?
    • Under stress mother produces adrenaline & cortisol that affect the fetus
Nutritional influences on prenatal development

• Extreme malnutrition
  - Increase in:
    - Miscarriage
    - Stillbirths
    - Malformations
    - Infant Mortality

• Undernourishment and associated factors
  – Low birth weight
  – Miscarriage
  – Delayed Effects
    • Heart disease
    • Stroke

• Maternal Age (Over 40 or under 18)
  • Older - prematurity, mortality, labor difficulties
  • Younger - low birth weight, less healthy overall

• Low SES
  – Lack of nutrition, prenatal care, stress

• Lack of Prenatal Care
### Nutritional Need Difference Between Non-pregnant and Pregnant Women (24 Years Old)

<table>
<thead>
<tr>
<th>Nutrient</th>
<th>Nonpregnant</th>
<th>Pregnant</th>
<th>Percent Increase</th>
<th>Dietary Sources</th>
</tr>
</thead>
<tbody>
<tr>
<td>Folic acid</td>
<td>180 mcg</td>
<td>400 mcg</td>
<td>+122</td>
<td>Leafy vegetables, liver</td>
</tr>
<tr>
<td>Vitamin D</td>
<td>5 µg</td>
<td>10 µg</td>
<td>+100</td>
<td>Fortified dairy products</td>
</tr>
<tr>
<td>Iron</td>
<td>15 mg</td>
<td>30 mg</td>
<td>+100</td>
<td>Meats, eggs, grains</td>
</tr>
<tr>
<td>Calcium</td>
<td>800 mg</td>
<td>1200 mg</td>
<td>+50</td>
<td>Dairy products</td>
</tr>
<tr>
<td>Phosphorus</td>
<td>1.6 mg</td>
<td>2.2 mg</td>
<td>+50</td>
<td>Meats</td>
</tr>
<tr>
<td>Pyridoxine</td>
<td>1.1 mg</td>
<td>2.2 mg</td>
<td>+38</td>
<td>Meats, liver, enriched grains</td>
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<tr>
<td>Thiamin</td>
<td>1.2 mg</td>
<td>1.5 mg</td>
<td>+36</td>
<td>Enriched grains, pork</td>
</tr>
<tr>
<td>Zinc</td>
<td>1.3 mg</td>
<td>1.5 mg</td>
<td>+26</td>
<td>Meats, seafood, eggs</td>
</tr>
<tr>
<td>Riboflavin</td>
<td>50 g</td>
<td>1.6 mg</td>
<td>+23</td>
<td>Meats, liver, enriched grains</td>
</tr>
<tr>
<td>Protein</td>
<td>150 mcg</td>
<td>60 g</td>
<td>+26</td>
<td>Meats, fish, poultry, dairy</td>
</tr>
<tr>
<td>Iodine</td>
<td>60 mg</td>
<td>70 mg</td>
<td>+17</td>
<td>Iodized salt, seafood</td>
</tr>
<tr>
<td>Vitamin C</td>
<td>2200 kcal</td>
<td>2300 kcal</td>
<td>+14</td>
<td>Citrus fruits, tomatoes</td>
</tr>
<tr>
<td>Energy</td>
<td>280 mg</td>
<td>300 mg</td>
<td>+14</td>
<td>Proteins, fats, carbohydrates</td>
</tr>
<tr>
<td>Magnesium</td>
<td>15 mg</td>
<td>30 mg</td>
<td>+14</td>
<td>Seafood, legumes, grains</td>
</tr>
<tr>
<td>Niacin</td>
<td>2.0 mcg</td>
<td>17 mg</td>
<td>+13</td>
<td>Meats, nuts, legumes</td>
</tr>
<tr>
<td>Vitamin B-12</td>
<td>800 µg</td>
<td>2.2 mcg</td>
<td>+10</td>
<td>Animal proteins</td>
</tr>
<tr>
<td>Vitamin A</td>
<td>800 µg</td>
<td>800 µg</td>
<td>0</td>
<td>Dark green, yellow, or orange fruits and vegetables, liver</td>
</tr>
</tbody>
</table>

### Teratogens: Environmental Sources of Birth Defects

- **Drugs**
- **Infections and other conditions**
- **Principles of teratogenic effects**

**Effects of Agent Orange on limb development**
Effects of Alcohol on external physical appearance and brain development

Principles of Teratology
- Individuals and species differ in susceptibility.
- Effects depend on stage of development of exposure.
- Accessibility to fetus or embryo influences extent of damage.
- Amount of exposure influences its effects.
- Do not show the same effects uniformly on prenatal development.
- Interfere with differentiation, migration, and other basic functions of cells.
- Some delay development temporarily, others may have "sleeper effects."

Principles of Development & Prenatal Development
- Sequence is fundamental
- Timing is important - sensitive periods
- Development consists of differentiation & integration
- Development change is stagelike
- Development is uneven
  - cephalocaudal-proximodistal.
- Development marked by apparent regressions
Birth: The First Bio-Social-Behavioral Shift

- The Stages of Labor
- Cultural Variations in Childbirth
- Childbirth in the United States
  - Childbirth pain and its medication
  - Medical interventions during childbirth

Cultural Variations in Childbirth

- Attitudes and Expectations
- Home vs Hospital
- Role of the Father
- Medicalization of Childbirth

The baby in the uterus before labor

The baby rests inside the cervix

Transition:

Potential width of birth canal

STAGE 1

STAGE 2

STAGE 3

Placenta Delivery
Childbirth in the United States

- Childbirth pain and its medication
  - Anesthetics: Epidural, Spinal Block
  - Sedatives: Nubain
  - Analgesics:

Medical Interventions

- Medical interventions during childbirth
  - Monitoring - fetal monitoring
  - Inducing labor - pitocin, rupturing membranes
  - Cesarean Section - surgical removal
  - Helping Delivery
    - Forceps
    - Vacuum

The Newborn’s Condition

- Assessing the Baby’s Viability
  - Physical condition (Apgar)
  - Behavioral condition (Brazelton)
Apgar Scoring System

Assessing infant’s physical condition

Brazelton Neonatal Assessment Scale

- Orientation to animate objects - visual & auditory
- Pull-to-sit
- Cuddliness
- Defensive Movements
- Self-quieting Activity

Problems and Complications

- Prematurity
- Low birth weight
- Developmental consequences
Neonatal Intensive Care Unit (NICU) for premature or at-risk infants

Premature infant with “breathing teddybear”

<table>
<thead>
<tr>
<th>State of Arousal in Infants</th>
<th>Behavior of Infants</th>
</tr>
</thead>
<tbody>
<tr>
<td>Non-REM sleep</td>
<td>Complete rest</td>
</tr>
<tr>
<td>REM sleep</td>
<td>Occasional twitches; irregular eye movements</td>
</tr>
<tr>
<td>Drowsiness</td>
<td>Occasional movements, but fewer than in REM sleep; eyes open and close; glazed look</td>
</tr>
<tr>
<td>Alert inactivity</td>
<td>Eyes open and scanning; body relatively still</td>
</tr>
<tr>
<td>Alert activity</td>
<td>Eyes open, but not attending or scanning; frequent, diffuse bodily movements; vocalizations</td>
</tr>
<tr>
<td>Distress</td>
<td>Whimpering or crying; vigorous movements; facial grimaces; skin flushed</td>
</tr>
</tbody>
</table>
## Beginning the Parent-Child Relationship

<table>
<thead>
<tr>
<th>The Baby’s Appearance</th>
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<tr>
<th>Social Expectations</th>
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