Of all our existence, the 9 months we live inside the womb are the most eventful for our growth and development.

Cole, Cole & Lightfoot, p. 72
Duration of Prenatal Periods

1. Germinal period (single-cell zygote → morula → blastocyst)
   - Conception to attachment (8-10 days later)

2. Embryonic period (embryo)
   - Attachment to end of 8th week (when all major organs have taken primitive shape)

3. Fetal period (fetus)
   - 9th week (with first hardening of the bones) until birth

Germinal Period: Key Concepts

- **Cleavage:** Mitotic division of zygote into multiple cells
- **Heterochrony:** Different parts of the organism develop at different rates
- **Heterogeneity:** Variability in levels of development of different parts of the organism at a given time

Germinal Period: Key Concepts

- **Epigenetic Hypothesis:** Interactions between the cells and their environment generate the new cell forms and emergence of body organs
Germinal Period: Blastocyst

- The inner cell mass will eventually become the embryo, while the trophoblast will develop into membranes (e.g., amnion, chorion → placenta) that will protect and support the embryo.

Embryonic Period

- Begins with implantation and lasts for about 6 weeks
- Basic organs formed; sexual differentiation occurs
- Organism begins to respond to direct stimulation (e.g., will turn its head in response to a light touch around the mouth)
- Developmental patterns
  - Cephalocaudal: Proceeds from head down
  - Proximodistal: From middle of organism out to the periphery

Fetal Period

- Begins with skeletal ossification
- From week 8/9 until birth
- From 1¼ → 20 inches
- From 8 → 3250 grams

Fetus at approx. 9 weeks
Fetal Development

- **10th week**: Intestines in place; breathing and jaw-opening movements
- **12th week**: Sexual characteristics; well-defined neck; sucking and swallowing movements
- **16th week**: Head erect and lower limbs well-developed
- **5th month**: As many nerve cells as it will ever have
- **7th month**: Eyes open and lungs capable of breathing
- **8th month**: Many folds of the brain present
- **9th month**: Brain more convoluted
- Fetus doubles in weight in final weeks before birth

Fetal Sensory Capacities

- **Sensing motion**
  - Sense of balance at 5 months
- **Vision**
  - Responds to light (i.e., heart rate changes, increased movement) at 26 weeks
- **Sound**
  - Responds at 5-6 months
  - Can discriminate outside sounds, but hears mother’s voice best (i.e., changes in heart rate)

Fetal Learning

- Mothers read *The Cat in a Hat* by Dr. Seuss, 2x/day for last 1½ months of pregnancy
- **Method**: Changes in rate of sucking turned on or off a tape recorder of mother reading (half read that story, the other half another story)
- **Finding**: Infants modified their rates of sucking in the direction that produced the familiar story

DeCasper & Spence, 1986
Maternal Conditions: Attitudes & Stress

- Presence of a sympathetic mate and other supportive family members, adequate housing, and steady employment – factors that give a woman a **basic sense of security** – appear to enhance the prospects for a healthy baby (Thompson, 1990)

- **Czech study:** At birth, **unwanted children** weighed less and needed more medical help than children in the control group

- **Psychological stress** during pregnancy is associated with premature delivery and low birth weight (Hedegaard, 1993)

Maternal Conditions: SES

Maternal Conditions: Nutrition

- **Rotterdam, Holland:** Spontaneous abortions, stillbirths, malformations, and deaths at birth increased markedly.

Maternal Conditions: Teratogens

- Effect of agent orange, an environmental pollutant used during the Vietnam War
**Teratogens: Smoking**

- Increase in rate of spontaneous abortion, stillbirth, and neonatal death
- Nicotine results in abnormal growth of the placenta
- Similar effects from cigarette smoke of others

**Teratogens: Alcohol**

- **Fetal Alcohol Syndrome**
  - Abnormally small head, underdeveloped brain, eye abnormalities, congenital heart disease, joint anomalies, malformations of the face
  - Most serious damage from alcohol caused in first weeks of pregnancy

**Teratogens: Drugs**

- **Prescription**
  - Thalidomide (nausea), Valium (tranquilizer), Accutane (acne), streptomycin & tetracycline (antibiotics), artificial hormones
- **Caffeine**
  - Increased rate of spontaneous abortion and low birth weight
- **Marijuana**
  - Low birth weight, premature delivery; infants startle more readily, have tremors, and experience sleep cycle problems
- **Cocaine**
  - More likely to be stillborn or premature, have low birth weights, have strokes, have birth defects; infants more irritable, uncoordinated, slow learners
- **Methadone & Heroin**
  - Born addicted; likely to be premature, underweight, vulnerable to respiratory illness, tremors, irritable; infants have difficulty attending, poor motor control
Teratogens: Infections, etc.

- **Rubella** (German measles): Can cause a syndrome of congenital heart disease, cataracts, deafness, and mental retardation in more than half of all babies born to mothers who suffer from the disease during the first 12 weeks of pregnancy.
- **AIDS**: Approximately 30% of the babies born to mothers who test positive for the AIDS virus acquire this disease.
- Also Rh incompatibility, radiation, pollution.

Teratogenic Principles

1. The susceptibility of the organism depends on the stage of its development.
2. A teratogen's effects are likely to be specific to a particular organ.
3. Individual organisms vary in their susceptibility to teratogens.
4. The physiological state of the mother influences the impact of a teratogen.
5. The greater the concentration of a teratogenic agent, the greater the risk.
6. Teratogens that adversely affect the developing organism may affect the mother little or not at all.
Birth

- Compared to other apes, monkeys, and mammals in general, human birth is a relatively difficult process
  - Takes longer
  - More complex sequence (with potential hazards at each step)
  - Needs (benefits significantly from) the assistance of others
  - Has a relatively high rate of neonatal and maternal mortality (in pre-industrial societies, 20% neonatal death rates and 5% maternal death rates are common)

Anthropological Significance of Birth

- Anthropologists and others suggest the danger is due to the human evolution of:
  - Large heads
  - Upright ambulation
- These two features of our species work against each other: large heads favor a large pelvis for birth, while upright stature favors a small pelvis for bipedal ambulation and balance.

Birth: The First Bio-Social-Behavioral Shift

- Holding the fetus while upright
Birth and Culture?

- Although women can give birth alone, their survival is greatly enhanced by the assistance of others.
- This may be one of the origins of culture: the advantage of specialized assistance from others while giving birth.

Birth in other cultures

- Almost all cultures have rituals and support practices to assist birth. Tactics and practices vary, but family involvement, a birthing “team,” and celebration are almost universal.
- Birth practices in Japan

Parents often have well-formed expectations about the future behaviors of their newborn babies.

How might these expectations shape the child’s development?

Death Rates Post Delivery (USA)
Assessing Viability

**Physical condition:**
- Apgar Scale...

**Neurological condition:**
- Brazelton Neonatal Assessment Scale...

Good guides for determining necessity of medical intervention and normal development. Not so useful for predicting later intelligence or personality.

Apgar Scoring System

<table>
<thead>
<tr>
<th>Rating (at 1 &amp; 5 minutes after birth)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vital Sign</td>
</tr>
<tr>
<td>0</td>
</tr>
<tr>
<td>Heart rate</td>
</tr>
<tr>
<td>Absent</td>
</tr>
<tr>
<td>Slow (&lt;100)</td>
</tr>
<tr>
<td>Over 100</td>
</tr>
<tr>
<td>Respiratory effort</td>
</tr>
<tr>
<td>Absent</td>
</tr>
<tr>
<td>Slow, irregular</td>
</tr>
<tr>
<td>Good, crying</td>
</tr>
<tr>
<td>Muscle tone</td>
</tr>
<tr>
<td>Flaccid</td>
</tr>
<tr>
<td>Some flexion of extremities</td>
</tr>
<tr>
<td>Active motion</td>
</tr>
<tr>
<td>Reflex responsivity</td>
</tr>
<tr>
<td>No response</td>
</tr>
<tr>
<td>Grimace</td>
</tr>
<tr>
<td>Vigorous cry</td>
</tr>
<tr>
<td>Color</td>
</tr>
<tr>
<td>Blue, pale</td>
</tr>
<tr>
<td>Body pink, extremities blue</td>
</tr>
<tr>
<td>Completely pink</td>
</tr>
</tbody>
</table>

Brazelton Scale

- Includes tests of infant reflexes, motor capacities, muscle tone, capacity for responding to objects and people, capacity to control own behavior, attention
  - Orientation to animate objects (visual/auditory)
  - Pull-to-sit (e.g., try to right his head)
  - Cuddliness (e.g., resist, passive, tries to cuddle)
  - Defensive movements (e.g., try to remove cloth from face)
  - Self-quieting activity (e.g., suck thumb, look around)

Premature Birth

- Born before 37th week
- More likely in twins, very young mothers, women who smoke or are undernourished
Premature Birth: Nutritional Intake

Consequences of Premature Birth

- Immaturity of the lungs (leading cause of death among preterm infants), as well as of their digestive and immune systems
- Premature babies who are of normal size for their gestational age stand a good chance of catching up with full-term babies
- However, some children born prematurely have problems with maintaining attention and with visual-motor coordination when they are school age

Low Birth Weight

- Typical weight at birth: 7 to 7½ lbs.
- Causes of fetal growth retardation
  - Multiple births; intrauterine infections; placenta abnormalities; maternal smoking, use of narcotics, or malnutrition
- Developmental consequences
  - Two-thirds of deaths that occur in the period immediately following birth are among low-birth-weight infants
  - 3x more likely to have neurologically-based developmental handicaps
  - Decrease in intellectual capacities in childhood
  - However, babies who are raised in good SES circumstance with an intact family and a mother with good education are less likely to suffer negative effects from their condition at birth than children raised without these benefits

Parent-Child Relationship

- Babyness: Prominent forehead; large eyes below horizontal midline of face; round, full cheeks
- “Babyness” seems to appeal to adults (shift for women between ages of 12 and 14, for men between the ages of 14 and 16)
Birth (Stage 1)

- Vanessa is in the first stage of labor, which usually lasts between 12 to 24 hours. Her cervix has begun to dilate but has opened to only about 3 centimeters. It will need to open to 10 centimeters to let the baby’s head and shoulders emerge. In this clip, Vanessa describes her contractions; at this early stage, contractions last anywhere from 15 to 60 seconds, and they are spaced about 15 to 20 minutes apart. Later, they will grow progressively stronger, last longer, and occur at shorter intervals, until they are only 2 to 5 minutes apart by the end of the first stage of labor.

Birth (Transition)

- The first stage of labor ends when the cervix has dilated to 4 inches. At this point, there is a transition between the first stage of the birth process and the second, when the baby’s head moves through the cervix and into the birth canal and, ultimately, the child emerges from the mother’s body. During the transition between stages 1 and 2, hormonal changes in the mother’s body may cause nausea, shivering, shaking in the outer limbs, and hot flashes or cold flushes. This mother, Veronica, is showing the stress that is normal during this period.

Birth (Stage 2)

- Still in stage 2 labor, Vanessa is now having fairly constant contractions, spaced about 1 minute apart and lasting about 1 minute. Stage 2 labor averages about 90 minutes, and during this critical time the mother must bear down and help to push the baby outside of her body and into the world. Just before the actual birth, the baby’s head crowns, or shows at the opening of the vagina. Vanessa has her first glimpse of her baby’s head, and she seems to gain energy from this sight.

Birth

- Vanessa had three good pushes and the baby arrived, ending stage 2. Jaclyn lay on her mother’s belly as her father, following instructions from the physician, cut her umbilical cord. A nurse then put Jaclyn in the “warming tray,” wiped her off, and clamped the cord. After a few minutes in the warming unit and some tests to ensure that she was doing well, Jaclyn was returned to her mother and welcomed into the world by other family members and friends.
Birth (Delivery of the Placenta)

- In the final stage of labor, the mother’s uterine contractions continue, expelling the various structures that supported the child before birth. Vanessa’s doctor shows the new parents the placenta, which connected Jaclyn to Vanessa and enabled nourishment and waste disposal; the sac which held Jaclyn and the amniotic fluid that protected her; and the remainder of the umbilical cord, which the father had severed after Jaclyn was born.

Conclusion:

- Birth is a difficult and risky process for mother and child
- Humans have developed elaborate assistance strategies for birth that may be related to the evolution of culture, group behavior, transmission of skills, and gender support
- Later mental and psychological difficulties (of the child) are associated with prenatal and birth complications.