

**Prenatal  
Development,  
Learning, and  
Birth**



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**Outline**

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

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**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

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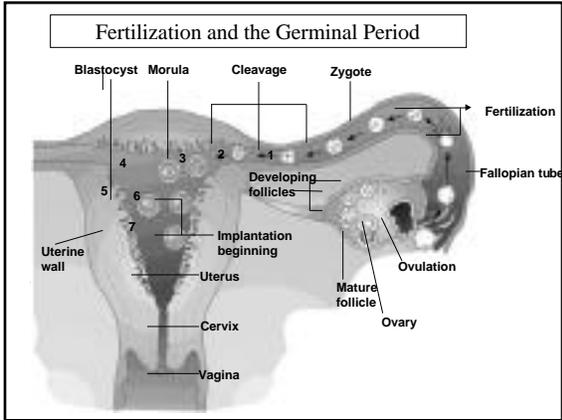
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### Assisted Reproduction Techniques

- **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.

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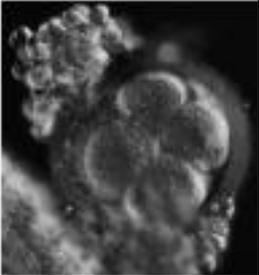
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### Germinal Stage

From Conception to Implantation  
(About 10 days)

Rapid cell replication and division  
 Heterochrony - cells divide at different rates  
 Heterogeniety - different levels of development for different parts




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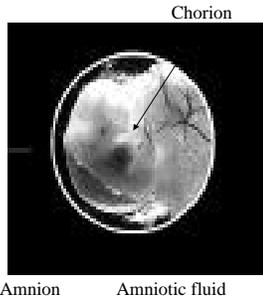
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### Embryonic Stage

- 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



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### 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



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### 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.

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### 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

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### 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



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### 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)

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## 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)

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## Factors affecting Prenatal Development

- **Maternal Conditions**
- **Teratogens**

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## 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 & cortisone that affect the fetus

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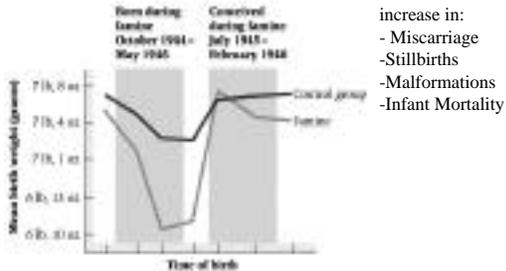
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## Nutritional influences on prenatal development

- Extreme malnutrition



- increase in:
- Miscarriage
  - Stillbirths
  - Malformations
  - Infant Mortality

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- Undernourishment and associated factors
  - **Low birth weight**
  - **Miscarriage**
  - **Delayed Effects**
    - Heart disease
    - Stroke

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- 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

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Nutritional Need Difference Between Non-pregnant and Pregnant Women (24 Years Old)				
Nutrient	Nonpregnant	Pregnant	Percent Increase	Dietary Sources
<b>Folic acid</b>	180 mcg	400 mcg	+122	Leafy vegetables, liver
<b>Vitamin D</b>	5 µg	10µg	+100	Fortified dairy products
<b>Iron</b>	15 mg	30 mg	+100	Meats, eggs, grains
Calcium	800 mg	1200 mg	+50	Dairy products
Phosphorus	1.6 mg	1200 mg	+50	Meats
Pyridoxine	1.1 mg	2.2 mg	+38	Meats, liver, enriched grains
Thiamin	12 mg	1.5 mg	+36	Enriched grains, pork
Zinc	1.3 mg	15 mg	+25	Meats, seafood, eggs
Riboflavin	50 g	1.6 mg	+23	Meats, liver, enriched grains
Protein	150 mcg	60 g	+20	Meats, fish, poultry, dairy
Iodine	60 mg	175 mcg	+17	Iodized salt, seafood
Vitamin C	2200 kcal	70 mg	+17	Citrus fruits, tomatoes
Energy	280 mg	2500 kcal	+14	Proteins, fats, carbohydrates
Magnesium	15 mg	320 mg	+14	Seafood, legumes, grains
Niacin	2.0mcg	17 mg	+13	Meats, nuts, legumes
Vitamin B-12	800µg	2.2 mcg	+10	Animal proteins
Vitamin A		800 µg	0	Dark green, yellow, or orange fruits and vegetables, liver

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**Teratogens: Environmental Sources of Birth Defects**

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

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Effects of Agent Orange on limb development




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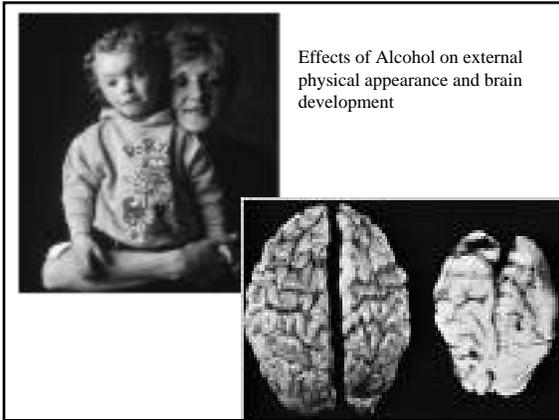
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Effects of Alcohol on external physical appearance and brain development

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**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.”

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**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

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## 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

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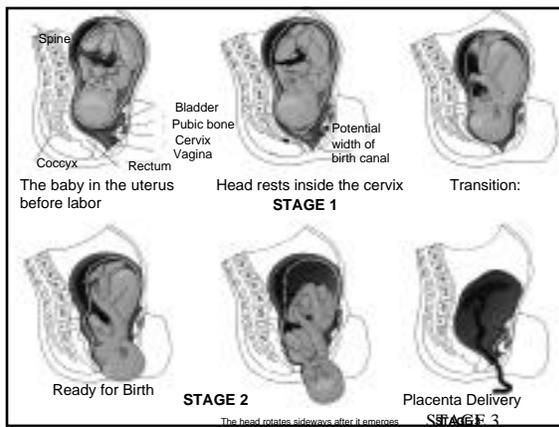
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## Cultural Variations in Childbirth

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

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## **Childbirth in the United States**

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

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## **Medical Interventions**

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

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## **The Newborn's Condition**

- **Assessing the Baby's Viability**
  - Physical condition (Apgar)
  - Behavioral condition (Brazelton)

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### Apgar Scoring System

Vital Sign	Ratings		
	0	1	2
Heart rate	Absent	Slow (below 100)	Over 100
Respiratory effort	Absent	Slow, irregular	Good, crying
Muscle tone	Flaccid	Some flexion of extremities	Active motion
Reflex responsiveness	No response	Grimace	Vigorous cry
Color	Blue, pale	Body pink, extremities blue	Completely pink

Source: Adapted from Apgar, 1953. From V. Apgar, "A Proposal for a New Method of Evaluation of the Newborn Infant," *Anesthesia and Analgesia: Current Research*, 31, 260-267. Copyright © 1953. Used by permission of Lippincott Williams & Wilkins. Visit our website at [www.ama-assn.org](http://www.ama-assn.org).

Assessing infant's physical condition

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### Brazelton Neonatal Assessment Scale

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

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### Problems and Complications

- Prematurity
- Low birth weight
- Developmental consequences

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Neonatal Intensive Care Unit (NICU) for premature or at-risk infants

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Premature infant with "breathing teddybear"

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### State of Arousal in Infants

State	Behavior of Infants
Non-REM sleep	Complete rest
REM sleep	Occasional twitches; irregular eye movements
Drowsiness	Occasional movements, but fewer than in REM sleep; eyes open and close; glazed look
Alert inactivity	Eyes open and scanning; body relatively still
Alert activity	Eyes open, but not attending or scanning; frequent, diffuse bodily movements; vocalizations
Distress	Whimpering or crying; vigorous movements; facial grimaces; skin flushed

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**Beginning the Parent-Child  
Relationship**

**The Baby's Appearance**

**Social Expectations**

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