SHMS02A
Physical & Motor Development
Chapter 1

From conception through toddling
Prenatal Development

- Conception-birth
- 9 months
- Life in utero = 4 basic features:
  1. Cell division
  2. Differentiation
  3. Unification
  4. Integration
The Study of Prenatal Development

A model for the development of all subsequent periods (e.g., stage-like changes)

Understand how the developing organism can be affected by mother-to-be’s health, habits, and lifestyle
Prenatal Development

- Germinal Period
- Embryonic Period
- Fetal Period
Germinal period: 2 weeks

– Conception – Implantation of fertilized egg

– Cell division
Embryonic Stage

- Stage from 2-9 wks after conception
  - Organs begin to form and function
    - Develops heart, nervous system, stomach, esophagus, ovaries or testes
    - Develop eyes, ears, nose, jaw, mouth lips
    - By end have tiny arms w/ elbows, hands, fingers
    - Legs have knees, ankles, toes
EMBRYONIC STAGE
The zygote (sex cell) = 
  – result from the fusion of the sperm and egg.

The zygote has to then divide into many copies of the cell that will eventually lead to the formation of the human.

These cells are all the same with no difference.

Mitosis
  – is the process by which new cells are generated.

Meiosis is the process by which gametes/sex cells are generated for reproduction.
Fetal Stage

• 7 month period of prenatal development, spanning 9 weeks from conception to birth
  – Begins to look distinctly human
  – Organs grow and start to function
    • By 3 months: can kick, make fist, turn head, open mouth, swallow, frown
    • In 6th month: eyelids open, has tastebuds, well-developed grasp, can breathe regularly as long as 24 hrs. at a time
      – Could potentially survive premature birth by end of 6th month
    • Organ systems typically functional by end of 7th month
    • 8th & 9th month: respond to light & touch, hear outside sounds
      – Can also learn – respond differently to sound of mother (faster heartbeat) and stranger (slower heartbeat)
Embryonic period: 2\textsuperscript{nd} – 8\textsuperscript{th} week

- Implantation – embryo is recognizable as a human fetus
- Cell differentiation
- The zygote cell that has divided into many cells form a disk with 3 layers.
- Here the cells become different or specific according to their location in the disk to form an organized human
- Ectoderm (outer layer) - Nervous system & skin
- Mesoderm (middle layer) - bone, muscles, lymph glands, heart, blood vessels
- Endoderm (inner layer) - Digestion, breathing organs
16-day-old embryo (dorsal surface view)

Key:
- Blue = Ectoderm
- Red = Mesoderm
- Yellow = Endoderm

Muscle and connective tissue (mostly from mesoderm)
Nervous tissue (from ectoderm)

Epithelium

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Teratogens

• Disease
  • Can be born with AIDS or experience physical defects from other diseases like rubella

• Drugs (i.e. heroine, cocaine, crack)
  • Can be born addicted
  • “Crack babies”
    – premature, underweight, tense, fussy, delayed physical growth & motor development, behavior & learning problems
• Smoking/nicotine
  • Can cause respiratory problems, irritability, social/attention problems, greater risk for nicotine addiction later in life, can harm brain development
  • Can cause reduction of nutrients that can lead to premature and underweight birth, which can cause cognitive and behavioral problems
Teratogens

- Alcohol
  - Can kill fetal brain cells – depresses fetal nervous system, putting at risk for birth defects & mental retardation
  - Fetal Alcohol Syndrome (FAS)
    - Characterized by mental retardation, possible physical malformations
  - Behavioral and psychological problems also linked to mothers experiencing significant stress, depression, or flu in first 6 months
- Fortunately, vast majority of infants (>90% in western nations) are born without mental or physical problems
EMBRYONIC PERIOD

- 28 days
- 5mm in length
- Primitive heart
- Simple kidneys
- A liver
- A digestive tract
- Simple eyes, ears, nose
From 4 to 6 weeks...
Look at the difference!
Embryonic period (Cont)

- Vulnerable to viral diseases
  - Rubella
  - German measles
FETAL PERIOD: 8\textsuperscript{TH} WEEK - BIRTH

- End of 2\textsuperscript{nd} month
- 2.54cm in length
- 18.7 grams
– **Fetus**: has all essential features for recognition as a human
– Rapid, uniform, progressive growth
– Unification & integration of organs
Motor Behaviour Before Birth
6 Weeks

- reflex response of mouth
Motor Behaviour Before Birth

3 Months

- Movements of head, arms, legs, shoulders, elbows, fingers, toes
Motor Behaviour Before Birth
4 Months

- activity = increased
Motor Behaviour Before Birth
4 1/2 Months

- strength = increased →
  sharp kicks & pushes
Motor Behaviour Before Birth
5 Months

- Up & down, side to side, completely around (somersault) movements
Motor Behaviour Before Birth
8-9 Months

• Considerable weight gain makes space confined (completely stops moving at 2 weeks before birth)
Developmental Direction & Integration
Growth Pattern

• Cephalocaudal
  – Head – feet

• Proximodistal
  – Midline – fingertips
Which develops control first??

- Head
- Legs
- Trunk
- Hands
Developmental Direction & Integration

- Movement becomes more rhythmical & synchronous = sign of maturation & integration within the nervous system
- Myelinization = NB aspect of neurological maturation
Myelinization

- Fatty substance that coats the nerve
- Serves as insulation
- Allows for:
  - increased speed
  - increased strength
  - more precise movements
Prenatal Movement Education

- Movement Ed should start during prenatal environment

- Establish a utero environment conducive to development

- Fetus is subject to internal & external stimuli
Prenatal Movement Education

• Prenatal development can be adversely affected by:
  – Unhealthy living habits of mother (smoking, alcohol, drugs)
  – Excessive stress
  – Excessive physical activity
  – Fear
  – Rage
  – Emotional distress
Reflexes

- Involuntary response to a stimulus that is specific, purposeful and adaptive

- 2 Reflex Categories:
  - Survival
    - Nutrition
    - Protection
  - Posturing
    - Body awareness
    - Understanding 2 Sides of body
Reflexes

- http://www.youtube.com/watch?v=_JVINnp7NZ0
## Rooting

| Stimulus /Response | S: touch of lips  
<table>
<thead>
<tr>
<th></th>
<th>R: move head in that direction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Concerns</td>
<td>No reflex problematic for nutrition</td>
</tr>
</tbody>
</table>
## Moro/Startle

| Stimulus / Response | S: Loud noise is made/support is taken away  
| R: Arms move out to sides & upward, legs extend downward |

![Image of Moro/Startle response](image-url)
**Palmar Grasp**

| Stimulus / Response | S: Pressure is applied to the palm  
|                     | R: Grasps & holds on tight |
| Stimulus / Response | S: Placing newborn on abdomen/back  
R: Whole body curls (flexor tonus)  
Whole body extends (extensor tonus) |
# Asymmetric Tonic Neck

| Stimulus / Response | S: Back-lying position, turn head to one side  
R: Limbs on same side straighten, bend on other side |
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Other</td>
<td>Also called ‘fencer’s’ position</td>
</tr>
</tbody>
</table>

**ATNR- Fencing Position Reflex**
## Symmetric Tonic Neck

<table>
<thead>
<tr>
<th>Stimulus / Response</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>S: Back-lying position and head is pushed backward</td>
<td>R: arms straighten, hands open, legs elevates</td>
</tr>
<tr>
<td>S: Front-lying position and head is pushed downward</td>
<td>R: knees &amp; elbows flex, hands closed, buttocks elevates</td>
</tr>
</tbody>
</table>

*Artist: Karin ILOVSKY*
Stepping/Placing

| Stimulus /Response | S: Infant upright with feet touching surface  
|                    | R: Step is performed |

![Stepping/Placing Image](image-url)
Infancy: Not Moving Independently

- Posture control & mobility
- Arm & hand control
- Vocalization
- Sensory awareness & perception
- Socialization & play
Posture Control & Mobility/Gross Motor Behaviour

• Events leading to mobility in the upright position:
  – Sitting with support
  – Sitting alone
  – Crawling
  – Creeping
  – Walking with support
  – Walking alone
• Between 1-3 months
  • Lift head while lying on abdomen
  • Turn & twist
  • Roll to side
Head Control

Newborn

Age 6 months
3 MONTHS

- Turn over from back to front
- Sit without support
- Push chest off the floor with arms
- **Crawling**

  Pulling with the arms and then pushing with legs while the abdomen is in contact with surface
4-5 MONTHS

- Keeps head steady when sitting
8-9 MONTHS

- Creeping
- Moving on hands and knees
15 MONTHS

- Bipedal locomotion progress from
- Tries to pull himself up on the side of the crib,
- Moving around the room holding onto furniture,
- Walking free of support,
- Walking with feet spread and arms raised
Bipedal locomotion progress
18 MONTHS

• At 18 months, the infant can:
  – Walk fast, effort getting started, once going, finds it hard to stop

• At 2 years:
  – Walk backwards
  – Cross-lateral use of arms
Arm & Hand Control/ Fine Motor Behaviour

- Reaching
- Grasping
- Letting go of an object

Aspects Using the Arms & Hands in Coordination
• Newborn
  – Grasping reflex
  – Arms kept out to side of body
  – Holds hands fisted
4 MONTHS

- Undirected reaching
- When reaching entire body gets involved
Arm & Hand Control/ Fine Motor

Behaviour

• 5 Months
  – Arms move to midline of body

• 6 Months
  – Coordinate process of
    • seeing an object,
    • reaching for the object &
    • grasping the object
  – Grasp object with entire hand
6 ½ MONTHS

- Radial Palmar grasp
8 MONTHS

- Pincer grasp
9 MONTHS

- Grasp without palm
- Thumb used in a rudimentary way
15 MONTHS

• Place 1 block on another
16 MONTHS

- Thumb opposition apparent
18 MONTHS

- Build tower of 4 blocks
2 YEARS

- Perform a mature thumb opposition
Vocalization

Communication
Transferring of info by some symbolic form from 1 person to another

Language
Method of communication: spoken, written, gesture
Vocalization

- Birth
- Undifferentiated crying
- 3 Months
- Differentiated crying/vital crying
- response to discomfort: pain, cold, hunger
6 MONTHS

- Meaningful sounds:
  - Speech sounds
  - Phonemes, babbling, lallation
• 7 Months:
  – echo speech sounds

• 20 Months:
  – name objects

• 4 Years:
  – simple sentences
Sensory Awareness & Perception

- Sensory receptors respond to specific stimuli
  - Light
  - Heat/cold
  - Stretching of muscle fibers
  - Pressure on joints
  - Vibrations
  - Chemical stimulants
Perceptual Process

- Gives meaning to the stimuli coming to the brain by way of the sense organs
- Sensory awareness = composed of 4 factors:
  - Reception
  - Perception
  - Conceptualization
  - Expression
Vision

• Comprehension of info that is gathered in the brain through the eyes and reconstruction of this info into conceptual images that have meaning

• It involves:
  – Sight
  – Perception
  – Integration
  – Conception
## Visual Perception

<table>
<thead>
<tr>
<th>Age</th>
<th>Ability</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 Weeks</td>
<td>Follow object with eyes</td>
</tr>
<tr>
<td>3 Months</td>
<td>Perceive an outline</td>
</tr>
<tr>
<td>8 Months</td>
<td>Figure ground perception</td>
</tr>
<tr>
<td>1 ½ Years</td>
<td>Coordinated focusing of eyes</td>
</tr>
</tbody>
</table>
Outline That Infants See

The Newborn Baby’s Limited Focusing Ability

Newborn View

Adult View
Figure-Ground Perception

- -

are distinct.

Candlestick
Visual Perception

• 2 Years
  – Differentiate unlike objects
4 YEARS

– Differentiate among shapes, sizes, varied symbols
Audition (Hearing)

• Birth
  – Respond to noise with moro reflex

• 3 Months
  – Respond to threatening sounds
  – Able to focus on specific sounds

• 4-5 Months
  – Locate sound by turning the head in direction of the stimulus
Tactility (Touching & Feeling)

• A system for gaining info from the cutaneous surfaces of the body by means contact

• Tactile abilities enable children to discriminate familiar objects

• Haptic sense
  – Combination of feeling and movement
Tactility (Touching & Feeling)

• At Birth
  – Skin reflexes examples??

• 5 Months
  – Differentiate & react to sensations that can affect survival (pain, wetness, temperature)

• 13 Months
  – Discriminate non-pain stimuli (roughness or smoothness)
• 16 Months
  – Becomes aware of third dimension (not everything is flat)

• 2 Years
  – Differentiate in shapes of objects

• 4 Years
  – Accurately identify features of objects by touch alone
Social & Play
Recognition

• Birth
  – Respond to sounds of parent

• 1 Month
  – Differentiate between object & person

• 6 Months
  – Recognize family members

• 7 Months
  – Suspicious of strangers
Smiling

• 2 Months
  – Smiles in response to adults

• 4 Months
  – Instigate socialization by smiling first

• 5 Months
  – Smiles in mirror
  – Smiles @ a smile
Playing

- 3 Months
  - Spontaneous play
- 7 Months
  - Peek-a-boo games
- 15 Months
  - Solitary play
- 18 Months
  - Play next to other children
  - Seldom interacts
  - Seeks social approval
1 YEAR

• Express complex emotions
  – Anger, affection, jealousy, sympathy