

PHYSIOLOGY OF INFANCY

COMPETENCY No.PY 11.6

Date: 23/05/2020

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□ Neonate: first 28 days of newborn

□ Infant: upto one year age

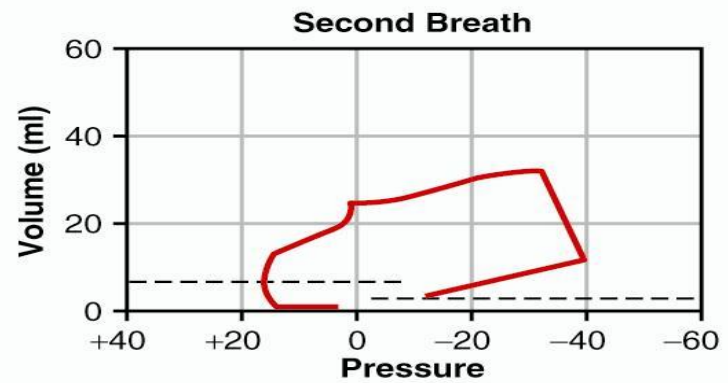
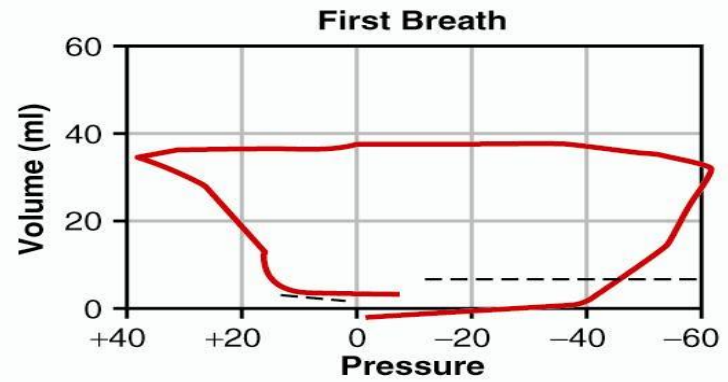
Adjustments of the Infant to Extrauterine Life

Cause of breathing:

- 1) a slightly asphyxiated state due to the birth process
- 2) sensory impulses that originate in the suddenly cooled skin.
- 3) Hypoxia and hypercapnia initiates breathing

Expansion of the Lungs at Birth.

- At birth, the walls of the alveoli are at first collapsed because of the surface tension of the viscid fluid that fills them.
- So more than 25 mm Hg of negative inspiratory pressure in the lungs is required for lung expansion



Pressure-volume curves for
the lungs of the neonate

Figure 83-3;
Guyton & Hall

- ❑ Deficiency of surfactant leads to Hyaline membrane disease
- ❑ Fetus secrete surfactant until the last 1 to 3 months of gestation. Therefore, many premature babies and a few full-term babies are born without the capability to secrete sufficient surfactant, which causes both a collapse tendency of the alveoli and development of pulmonary edema.

Changes in Circulation at Birth

1) Decreased Pulmonary and Increased Systemic Vascular Resistances at Birth.

- Systemic vascular resistance  that increases the aortic pressure, as well as the pressures in the left ventricle and left atrium.
- Pulmonary vascular resistance  because of expansion of lungs which reduces the pulmonary arterial pressure, right ventricular pressure, and right atrial pressure.

2) Closure of the Foramen Ovale.

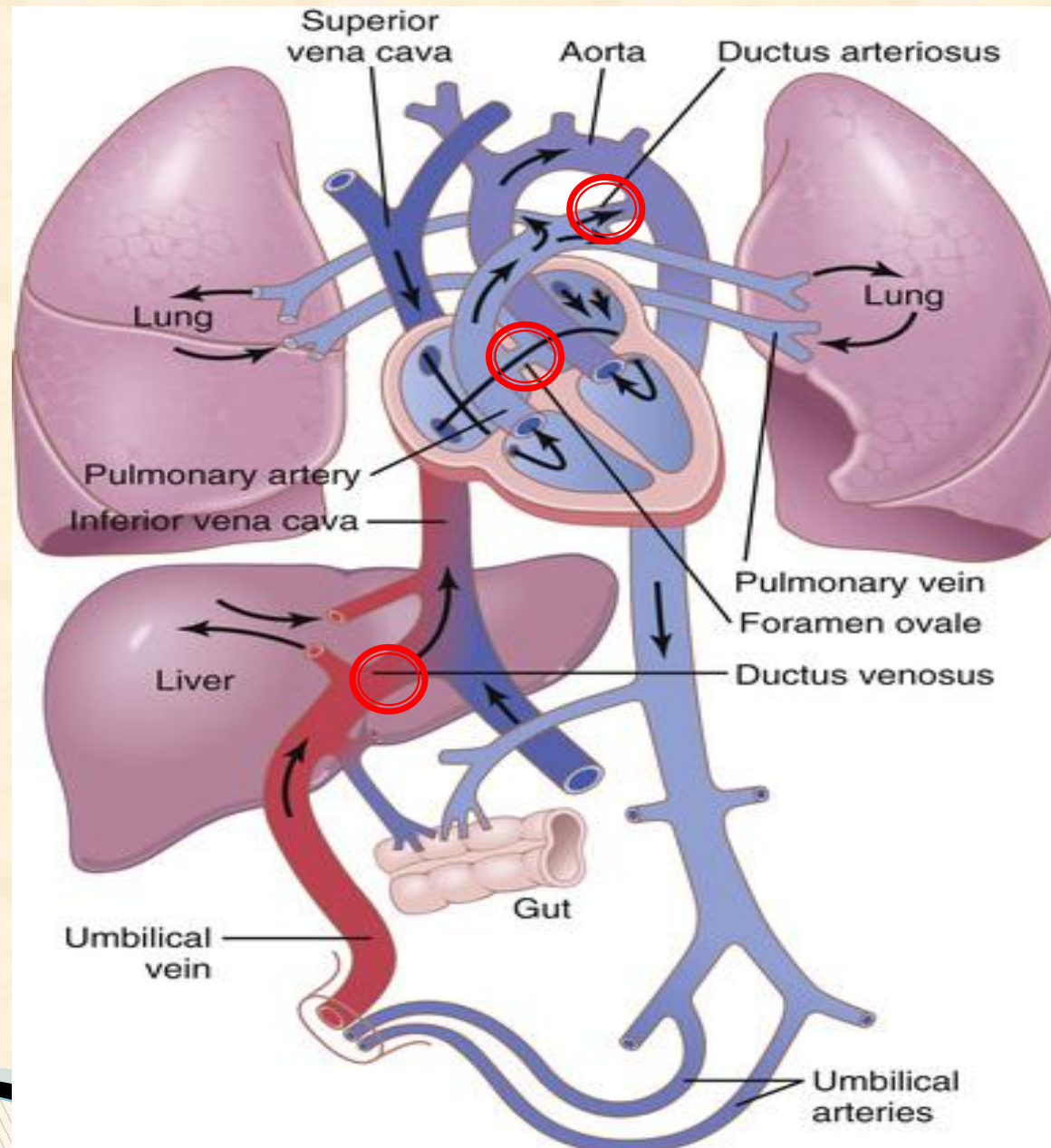
Low right atrial pressure and the high left atrial pressure closes the foramen ovale valve within few months to years

3) Closure of the Ductus Arteriosus

Functional closure of the ductus arteriosus occurs in 1-8 days. Then, during the next 1 to 4 months, the ductus arteriosus ordinarily becomes anatomically occluded by growth of fibrous tissue into its lumen.

4) Closure of the Ductus Venosus

Immediately after birth, blood flow through the umbilical vein ceases, within 1 to 3 hours the muscle wall of the ductus venosus contracts strongly, the portal venous pressure rises from 0 → 6 to 10 mm Hg



Neonate

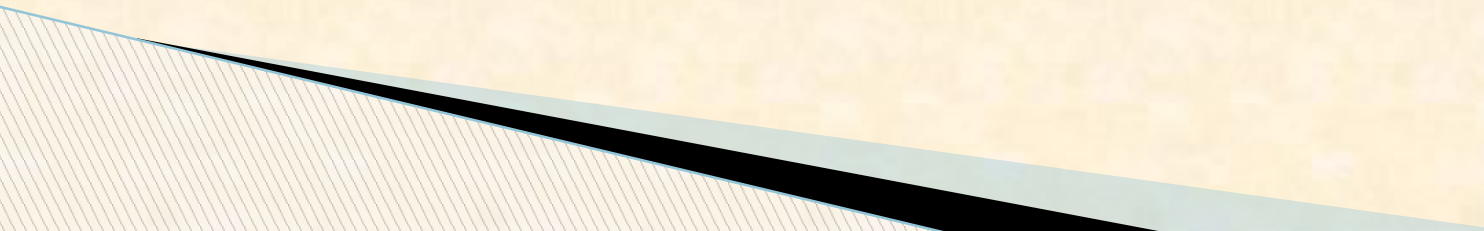
Typically pinkish and covered in vernix

Cardiac output, respiratory and heart rates are high

BP: 55/30, then 80/50 (after few months, 90/60) mmHg

Normal sinus rhythm

Respiratory rate 35-45/min



Special Functional Problems in the Neonate

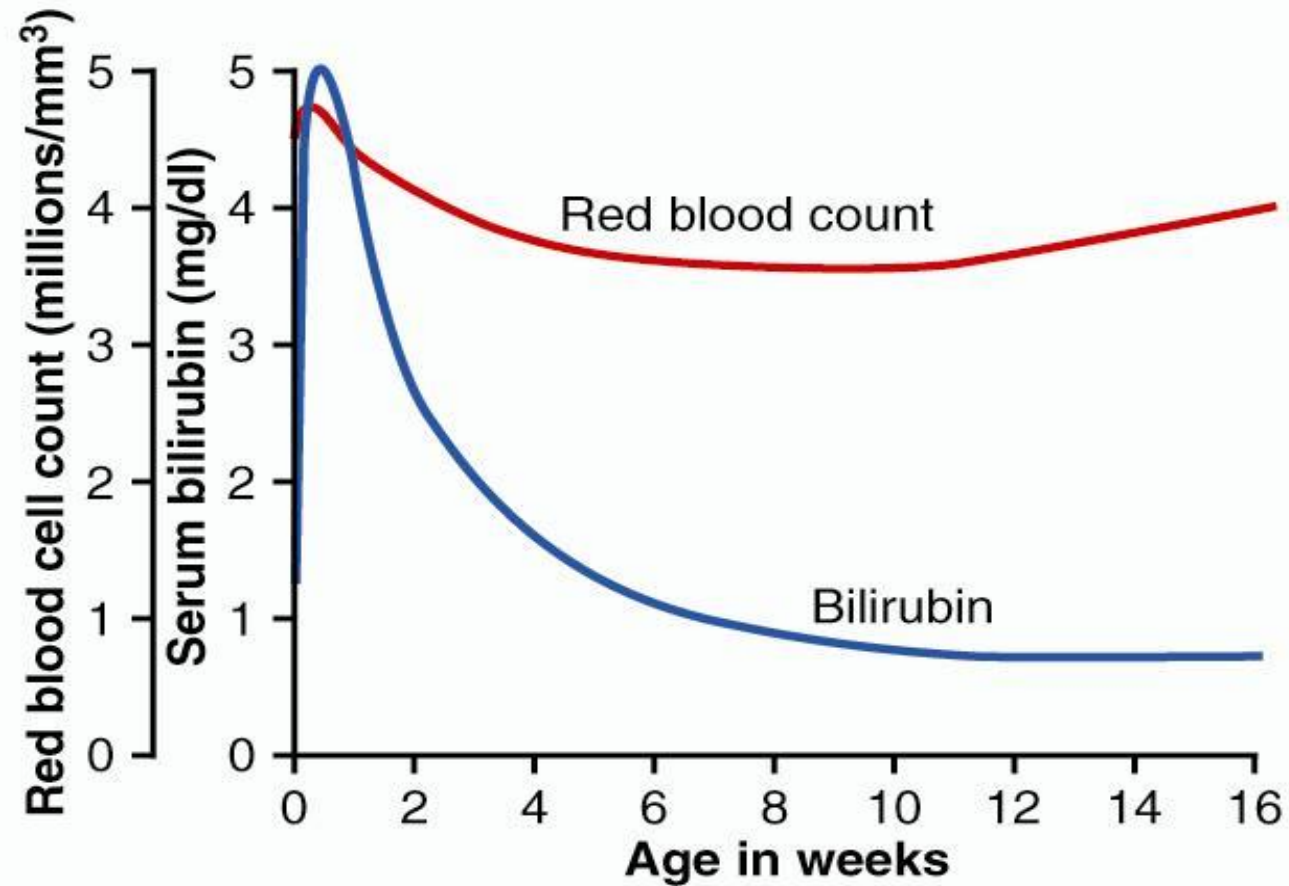
- RR-40/min, tidal air with each breath averages 16 milliliters. Total minute respiratory volume of 640 ml/min, which is about twice as great in relation to the body weight as that of an adult.
- *The functional residual capacity of the infant's lungs is only one half that of an adult in relation to body weight.*
- This difference causes excessive cyclical increase and decrease in the newborn baby's blood gas concentrations

- ❑ **Cardiac Output-** The cardiac output of the neonate averages 500ml/min, which, like respiration and body metabolism, is about twice as much in relation to body weight as in the adult.
- ❑ **Arterial Pressure.** 70 /50 mm Hg this increases slowly during the next several months to about 90/60mmHg. Then there is a much slower rise during the subsequent years until the adult blood pressure is attained at adolescence

Blood

- The red blood cell count in the neonate averages about 4 million per cubic millimeter.
- 0.5 to 0.75 million from umbilical cord during the first few hours of life, giving a red blood cell count of about 4.75 million per cubic millimeter .
- Few new red blood cells are formed in the infant during the first few weeks of life, presumably because the hypoxic stimulus of fetal life is no longer present to stimulate red cell production

- ❑ Immediately after birth, the white blood cell count of the neonate is about 45,000 per cubic millimeter, which is about five times as great as that of the normal adult
- ❑ Also conjugating ability of newborn is less. So the plasma bilirubin concentration rises to an average of 5 mg/dl during the first 3 days of life and then gradually falls back to normal as the liver becomes functional.
- ❑ This effect, called *physiologic hyperbilirubinemia*, and it is associated with mild *jaundice (yellowness) of the* infant's skin and especially of the sclerae of its eyes for a week or two.
- ❑ Pathological jaundice-Erythroblastosis fetalis

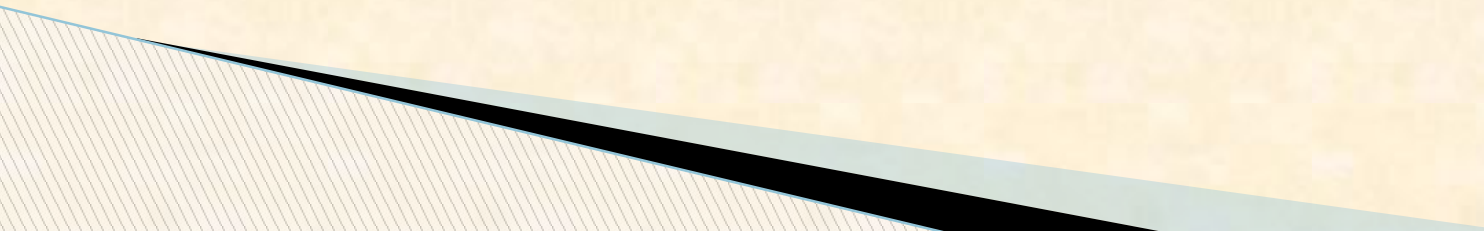


Changes in RBC
count and serum
bilirubin in the
first 16 weeks
of life

KIDNEYS

- Rate of metabolism is fast as compared to adults
- Functional development of the kidneys is not complete until the end of about the first month of life.
- The most important problems of infancy are acidosis, dehydration, and, rarely, overhydration
 - Metabolism 2x adult
 - Acid production 2x normal
 - Kidneys can only concentrate 1.5x osmolality of plasma (normal adult: 3-4x)

Digestion, Absorption, and Metabolism of Energy Foods; and Nutrition

- ❑ The gluconeogenesis function of the liver is particularly deficient
 - ❑ The liver of the neonate usually also forms too little of the blood factors needed for normal blood coagulation.
 - ❑ Secretion of pancreatic amylase in the neonate is deficient, absorption of fats from the gastrointestinal tract is somewhat less than that in the older child.
 - ❑ Neonate is especially capable of synthesizing and storing proteins
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- The body surface area is large in relation to body mass, heat is readily lost from the body. As a result, the body temperature of the neonate, particularly of premature infants, falls easily.

Immunity

The neonate does not form antibodies of its own to a significant extent

- The neonate inherits much immunity from the mother because many protein antibodies diffuse from the mother's blood through the placenta into the fetus.

Development of Neonate

Nutritional needs:

- Ca^{++} - bone growth
- Fe - from mother, stored in liver for 4-6 months., then need supplements
- Vit C - not stored, need supplements
- Immune system: from mother
- IgA - begins about 3 months of age
- low glycogen stores

Child of Diabetic Mother

- High glucose crosses the placenta –
transient hypoglycemia 1-4 hr after birth,
_plasma insulin normalizes 12-24 hr after
neonate large for gestational age
- diabetic vascular disease in mother – IUGR
Can have respiratory distress syndrome

Physical growth & development during infancy



GROWTH MEANS INCREASE IN SIZE DUE TO..

- Increased number of cells
- Increase in their size
- Increase in intercellular substances

The increase can be seen and measured accurately

ASSESSMENT OF GROWTH DONE BY

- Anthropometry
 - Includes – weight, height, measurement of head, chest, abdomen, pelvis etc.
- Tissue growth
 - Skin fold thickness – measuring subcutaneous fat and measuring muscle mass
- Radiography - appearance and fusion of various epiphyseal centres
- Biochemical & histological examination
- Dental age

NEONATAL PERIOD

- Mature Newborn Weight (Wt) more than 2.5 Kg
 - Average 2.75 – 3.25kg
 - Low Birth Wt < 2.5kg
 - Loss of wt during first week and regained by 10 days of life
- Length : 50 - 52 Cm
- Head circumference: 33 - 35 Cm

Physical growth during infancy

AGE (in months)	WEIGHT (in grams/day)	LENGTH (in cms/month)	HEAD CIRCUMFERENCE (in cms/month)
0 – 3	25 – 30	3.5	2
3 – 6	20	2	1
6 – 9	15	1.5	0.5
9 – 12	12	1.2	0.5

Physical growth during infancy

▣ Weight

- End of 6 months - **DOUBLE** the birth wt.
- End of 1 year - **TRIPLE** the birth wt.

▣ Length

- Increases by approximately 25 cms
- AT 1 YEAR = 72-75 cm

▣ Head Circumference

- 33-35 cm AT BIRTH,
- 1 YEAR = 44-46 cm

▣ Chest Circumference

- At birth 3 cms less than head circumference
- Same as head by 1 year

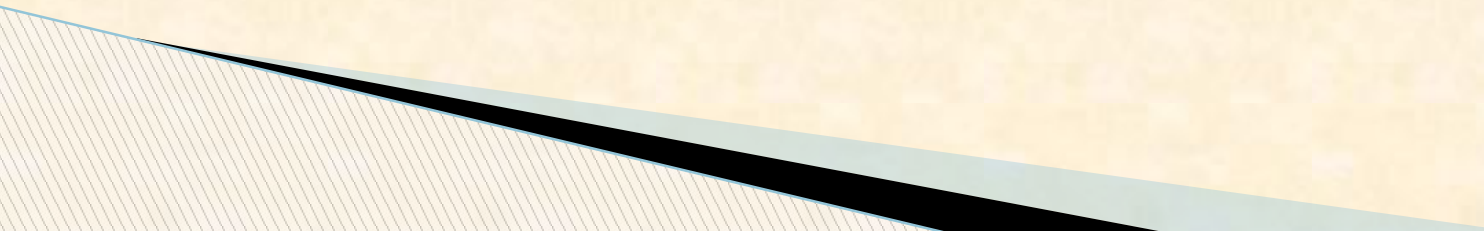
DEVELOPMENT

- ▣ Development means maturation of functions, especially of nervous system.
- ▣ It is a continuous process.
- ▣ Development delay means failure to reach desired level of milestone at a particular given age.
- ▣ Detection of delay at the earliest age is important.

GROSS MOTOR

- ▣ Head control - 2 to 3 months
- ▣ Turning over - 3 to 4 months
- ▣ Sitting up (when made to) - 5 to 6 months
- ▣ Sitting up by self - 6 to 7 months
- ▣ Standing up holding objects - 7 to 9 months
- ▣ Standing up by self - 10 to 12 months
- ▣ Walking - 12 to 15 months
- ▣ Climbing up the staircase – 15 months
- ▣ Climbing down the staircase - 18 to 24 months
- ▣ Kicking a ball - 2 to 3 years
- ▣ Standing on one foot - 3 to 4 years
- ▣ Hopping - 5 to 6 years
- ▣ Skipping a rope - 7 to 8 years

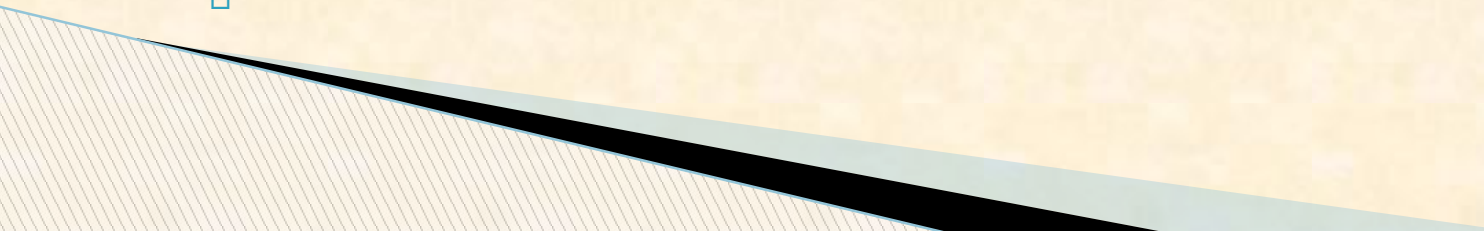
FINE MOTOR ACTIVITY

- ❑ Pincer grasp - picking up objects with apposition of thumb and fingers - 10 months
 - ❑ Holding a pen - 2 years
 - ❑ Writing - 2 years onwards
 - ❑ Painting - 3 to 5 years
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ADAPTIVE OR COGNITIVE BEHAVIOUR

- Means adaptation of motor activity to surrounding environmental objects
- Show torch light –
 - At 1 month will just focus and look at it
 - At 3 months follows light – eyes and head are moving
 - At 6 months tries to catch and hold it
 - At 1 year holds and bangs it
 - At 2 to 3 years wants to experiment

□



LANGUAGE

- First two years of a child's life are spent in hearing and understanding the language spoken by the family.
- In 2nd year the child tries to reproduce some syllables and speaks 1 – 3 words.
- After 2 years, proper speech is developed and child learns to speak sentences.

PERSONAL SOCIAL DEVELOPMENT

- Reaction of child towards persons and its social activities
- 1 month old child will recognize mother's voice and will become quiet if crying
- 2 to 3 months old will recognize mother
- 6 to 7 months old recognizes strangers.

THANKYOU