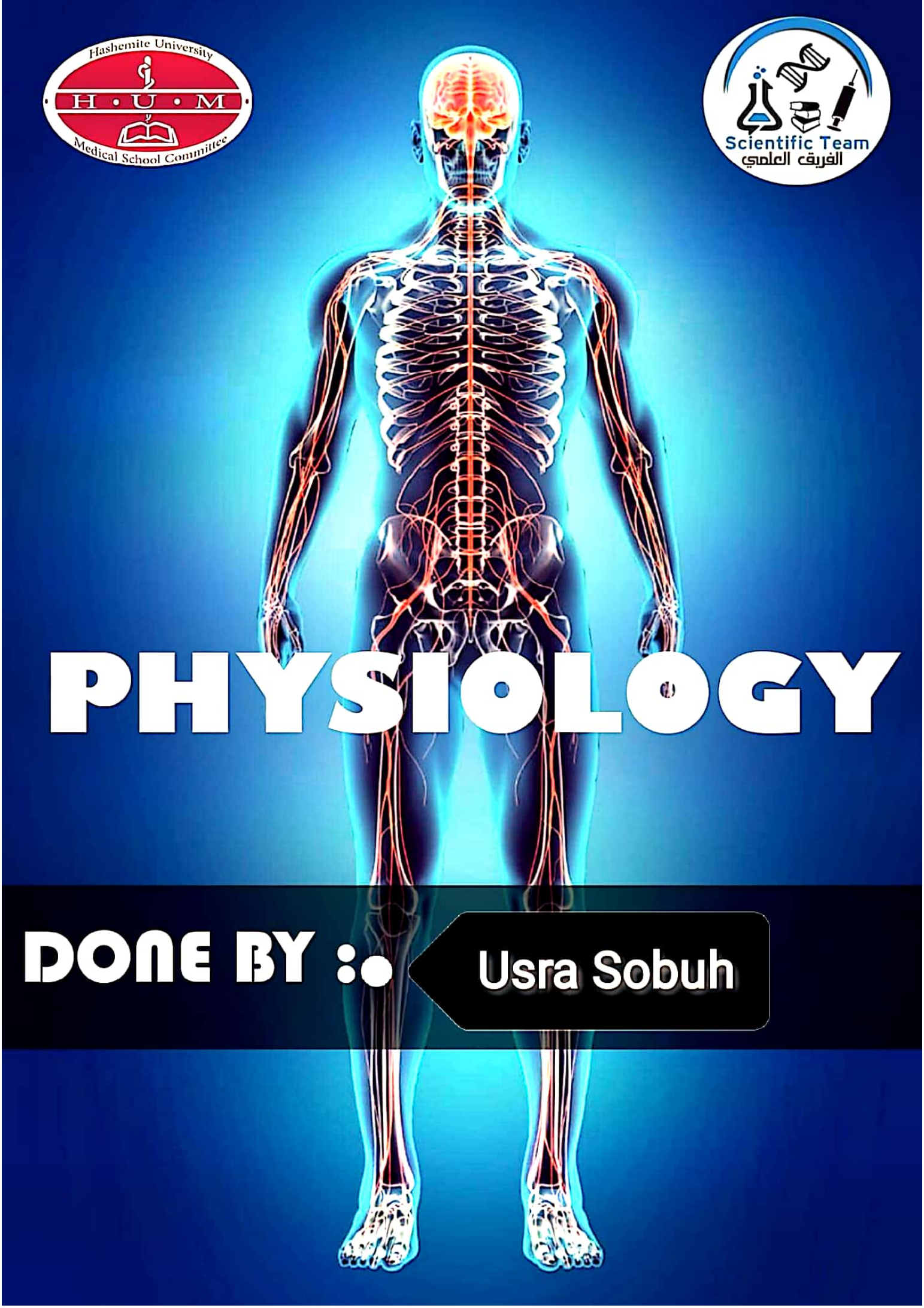


Pregnancy and Lactation-II

Chapter 83
Unit X1V

Dr Iman Aolymat

Response of the mother's body to pregnancy (maternal changes during pregnancy)

- mainly due to higher levels of hormones of pregnancy which affect the whole body

ENLARGMENT OF SEXUAL ORGANS

- Uterus
- Ovaries
- Vagina → introitus opens more widely preparing to baby delivery
- Breast

APPEARANCE

- Edema
- Acne
- Pigmentation
- Masculine or acromegalic features

Response of the mother's body to pregnancy

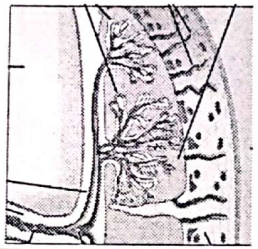
Weight gain

وزن الطفل بالشهر السابع
(1.7 - 1.5) تقريبا

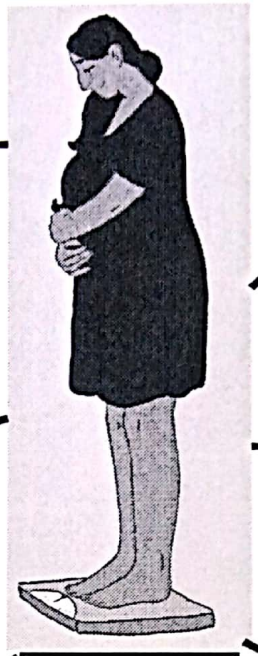
greatest growth during last trimester, weight doubles in the last 2 months

يختلف من طفل لآخر
ومن أم لأخرى

1 3.5 kg fetus



2 2 kg amniotic fluid, placenta & Fetal membranes



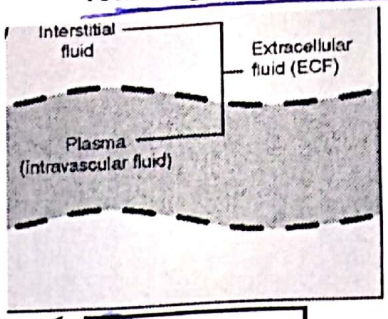
11- 25 kg

mostly during the **last two trimesters**

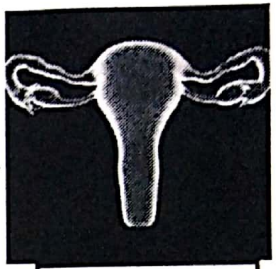
3 1.3-6 kg fat accumulation

in multiple regions
breast, SC, thigh...

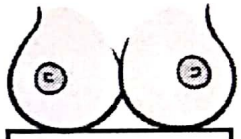
extra fluid → excreted in the urine during few days after birth → due to loss of fluid-retaining hormone from the placenta



6 2.5 kg blood & ECF



5 1.3 kg uterus



4 1 kg Breasts

approximately duplicated

Response of the mother's body to pregnancy

Nutrition during pregnancy

especially in the early period → fetal organogenesis.

- Increased desire for food caused by ① hormones ② ↑ food consumption.
- mother → less absorption of protein, calcium, phosphate, and iron → supply to the fetus
-
- Nutritional and dietary needs change (need more iron, calcium, phosphates, vit D, vit K
- vitamin K → prothrombin → to prevent hemorrhage (brain hemorrhage)
- Iron deficiency → hypochromic anaemia

↓ normal physiologic state that compensated by iron uptake.

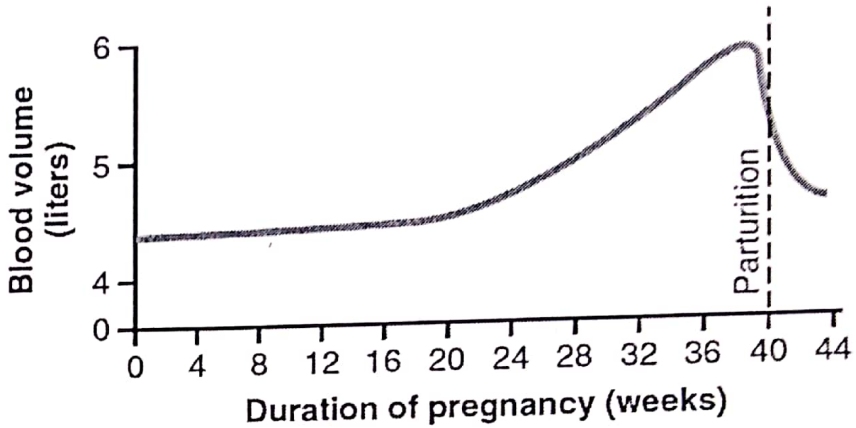
↓ cerebral hemorrhage may be caused by overstretching of the fetal head in the birth canal during delivery * maximal dilation of the cervix is 10 cm, while fetal head diameter is larger than 10 cm.

metabolism during pregnancy

- increased thyroxine, adrenocortical hormones, and sex hormones
- increased basal metabolic rate 15% → second half of pregnancy
- extra load → more muscle activity → more energy
- Increased insulin secretion
- Increased insulin resistance → more glucose available for fetal supply

caused by weight gain

Changes in maternal circulation



- Increased **blood flow** through the placenta → 625 ml/min
- Increased maternal **cardiac output** → 30-40% (by 27th wk)
- The last 8 wks→ cardiac output **falls** just above normal level
- Maternal blood volume is increased by 30% → mostly during the second half of pregnancy→ caused by :-

1-↑ aldosterone & E →fluid retention

2-Increased bone marrow activity ↑ blood cells mainly RBCs as a feedback for increased BV.

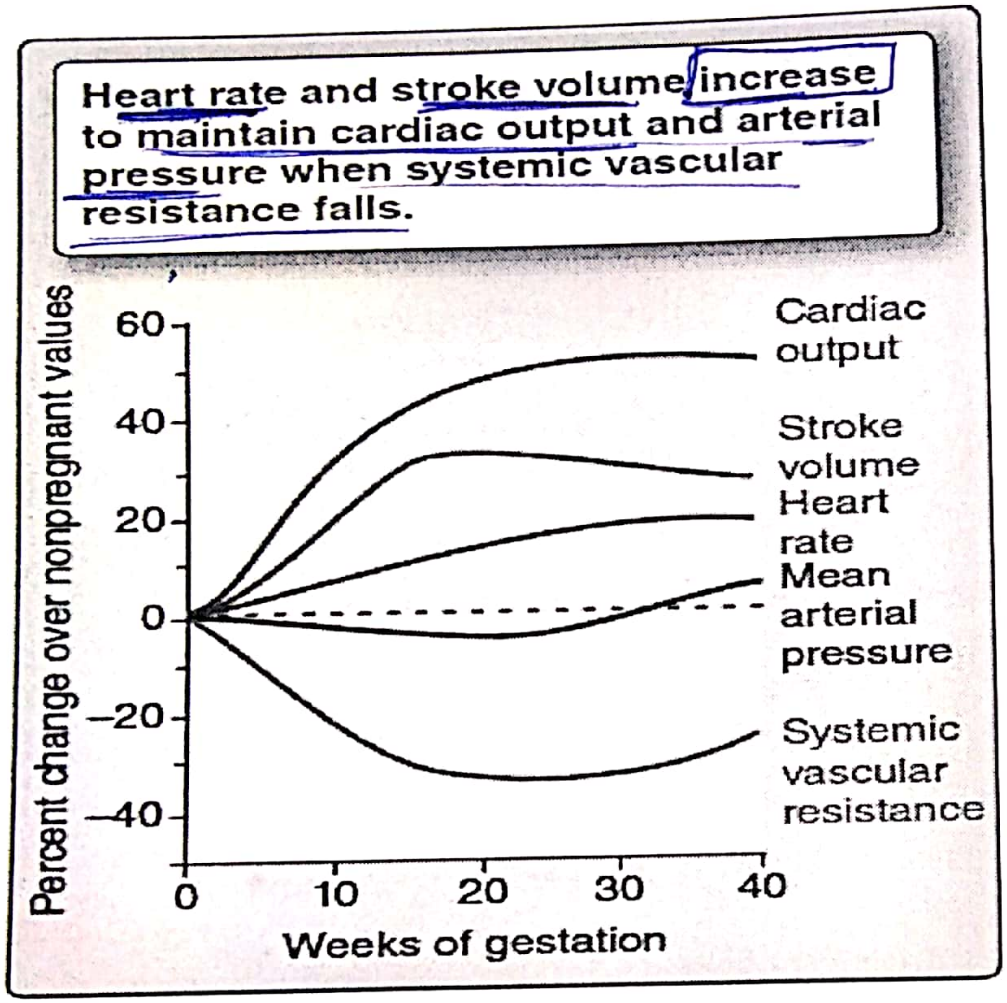
1-2 L extra blood → ¼ lost through bleeding during delivery

- Edema due to increase in **venous pressure** in lower limbs→ compression of the inferior vena cava by the uterus and the pressure of the fetal on the common iliac veins & Decrease plasma protein concentration → caused by increased BV.

→ the increase in RBCs production less than the increase in blood volume

so, hematocrit less than normal → iron deficiency anemia

Changes in maternal circulation

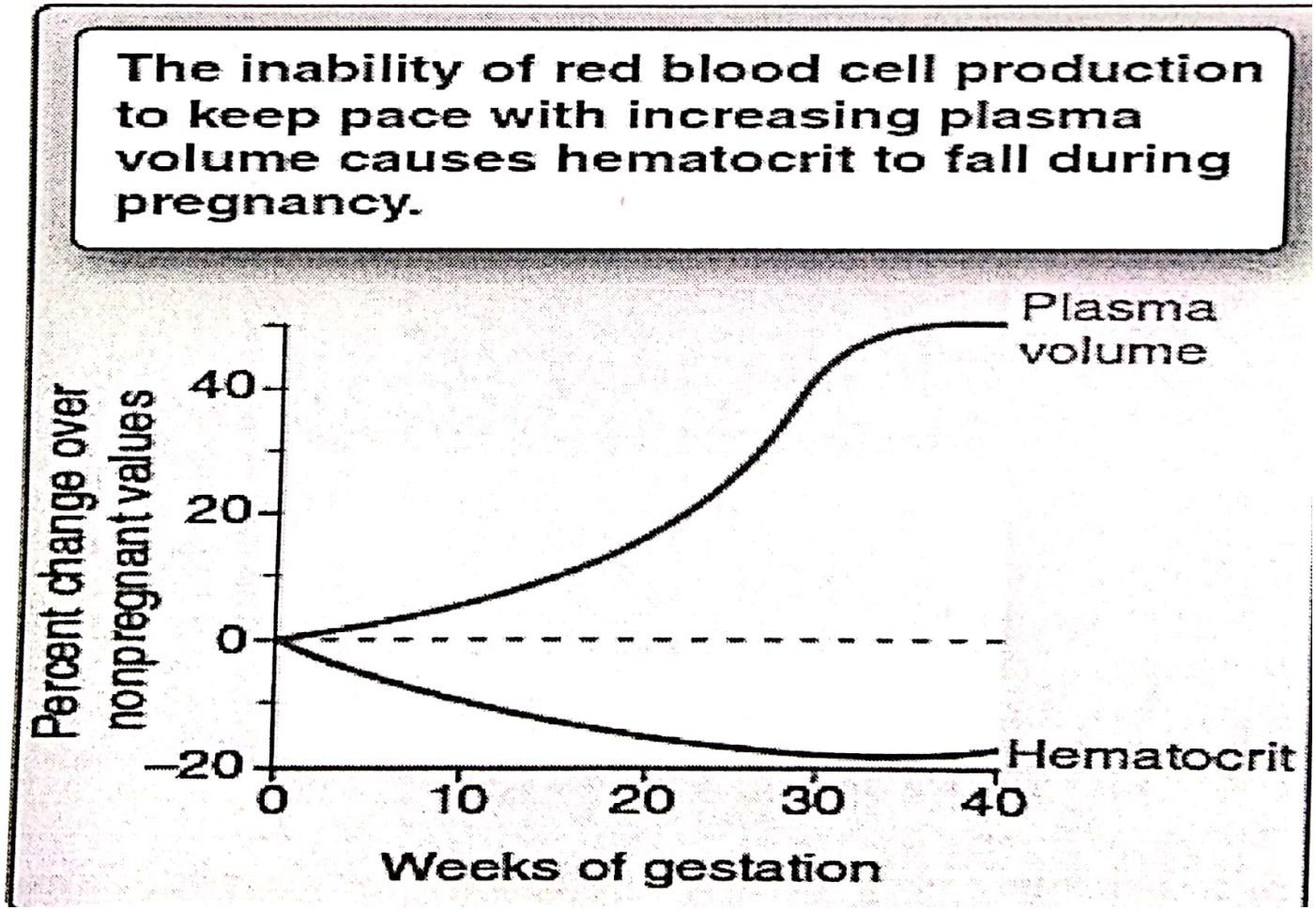


- Systemic arterial pressure declines slightly during pregnancy
- fall is greater for diastolic than for systolic pressures
- mean arterial pressure increase to pre-pregnancy levels by about 36 weeks.

- Systemic vascular resistance decreases due to release of NO and ednotheline

* in the first antenatal care visit we must measure the blood pressure and record it.

Changes in maternal plasm volume and Hematocrit pregnancy



Respiration

hyperventilation

- Increased alveolar ventilation → due to progesterone
- Increased tidal volume (40%) → causes dec in maternal plasma CO2 -- slight alkalosis

so, the affinity of maternal blood to the oxygen is decreased while the affinity of fetal blood is increased

Maternal kidney function

caused by → ① fluid retention and edema
② enlarged uterus compress the urinary bladder.

- Increased urine formation especially in the last trimester
- Increased tubular reabsorption → sodium, chloride and water by 50% ↓ caused by estrogen and aldosterone
- Increased renal blood flow and GFR by 50% → renal vasodilation
- Causes of renal vasodilation

  1-NO

  2- Relaxin

Morning sickness

- 70% of pregnancies
- Onset 4-8 wks gestation
- improvement before 14-16 wks

- Mechanisms:
- Relaxation of smooth muscle of stomach
- ? Inc hCG

- Higher frequency of female fetus -- 56%

Pre-eclampsia → تسمم الحمل

- Idiopathic **multisystem** disorder specific to human pregnancy
- **Characterized by:**

1- maternal hypertension

2- proteinuria

3-generalized edema must be distinguished from physiologic edema

- Disease of the placenta
  - Failure of trophoblast invasion of spiral arteries→ Supply of both nutrients and oxygen to the placenta is disturbed
- Decreased RBF & GFR
- Leading cause of maternal and perinatal mortality

Pre-eclampsia

D/C : dilation and curettage :-
dilation of the cervix and surgical removal of part of the lining of uterus or contents of the uterus.

BP normalizes following delivery → faster with Caesarean section and D/C

cause: unknown, thought to be:
limited blood supply to uterine arteries → causing ischemia and endothelial damage with release of:

1- cytokine

A-tumor necrosis factor-α

B- interleukin-6

2-Placental factors that impede angiogenesis causes ischemia

A-soluble fms-related tyrosine kinase1(s-Flt1)

B- soluble endoglin

Eclampsia

fatal severe preeclampsia with :

- Seizure
- Coma
- Decreased kidney output
- Liver malfunction
- Extreme hypertension

Parturition/ labor /delivery

if it was continuous. → cause ischemia and fetal death

- Strong rhythmical uterine contraction

- **Stages of labor**

stage1: labor → the longest one

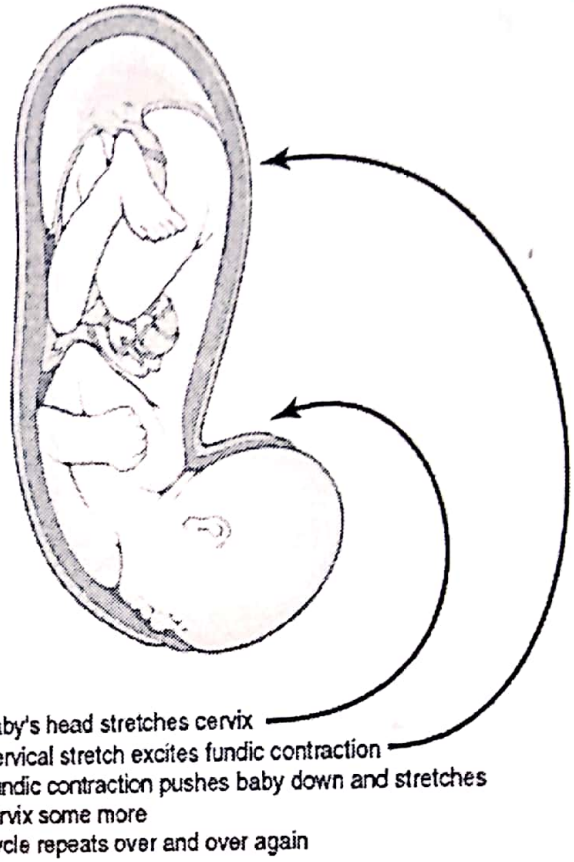
contractions → dilatation of the cervix and opening of vaginal canal

uterine→ (stimulates more contractions positive feedback)

cervical→ head stretching→ more uterine contractions

stage 2: baby delivery

stage 3: placental detachment



1. Baby's head stretches cervix
2. Cervical stretch excites fundic contraction
3. Fundic contraction pushes baby down and stretches cervix some more
4. Cycle repeats over and over again

Parturition/ labor /delivery

each hormone either from mother or baby has the same action.

Hormonal factors

Maternal

1. Oxytocin
2. PG
3. Catecholamines
4. Cortisol
5. Relaxin

Fetal

1. Oxytocin
2. Cortisol
3. PG

Placental

1. Estrogen
2. Progesterone
3. PG

Hormonal factors

1- E & P

↑↑E

Sudden ↓↓ P at end of pregnancy

P inhibits prostaglandin E2 → causes contraction

↑ E/P ratio →

1. + contraction
2. + synthesis and sensitivity of oxytocin receptors
3. + PG

2- Oxytocin

+ uterine contraction

+ PG from decidua

يستخدم في الحث الصناعي

overdosage or inappropriate → continuous contraction → ischemia and fetal death

3- Relaxin

mainly

secreted by placenta & mammary glands

1. Softening cervix
2. Relaxation of symphysis pubis ligaments
3. Dilatation of the cervix
4. + oxytocin receptors
5. - inhibitory action of progesterone

Hormonal factors

4- PGE2
from the decidua → + Calcium concentration → ↑ contraction

5-Catecholamines
adrenaline and noradrenaline
+ uterine contraction

6- cortisol
1. + uterine contraction
2. stress tolerance

Mechanical factors

1. stretch of uterine muscles
2. stretch of the cervix

* during labor the doctor ask the lady to push. (use the abdominal muscles to increase the intraabdominal pressure.)
* without pushing the labor and delivery will continue normally but the pushing make it easier and faster.

Estrogen effect on the breast:

1- growth of ductal system
2- + stroma
3- fat deposition

Progesterone effect on the breast

growth of lobule-alveolar system

E & P → inhibit prolactin

Stages of breast development

1- **puberty** ↑ sex hormones
A-growth of mammary glands
B-fat deposition

2- **during pregnancy**
A-high estrogen
B-complete development of glandular tissue

* full development of the breast occurs after pregnancy

lactation

- **Prolactin**
  - ❖secreted by anterior pituitary gland
  - ❖ + from the 5th week of pregnancy
  - ❖increases 10-20 times by delivery
  - ❖decreases after 7 to 9 months

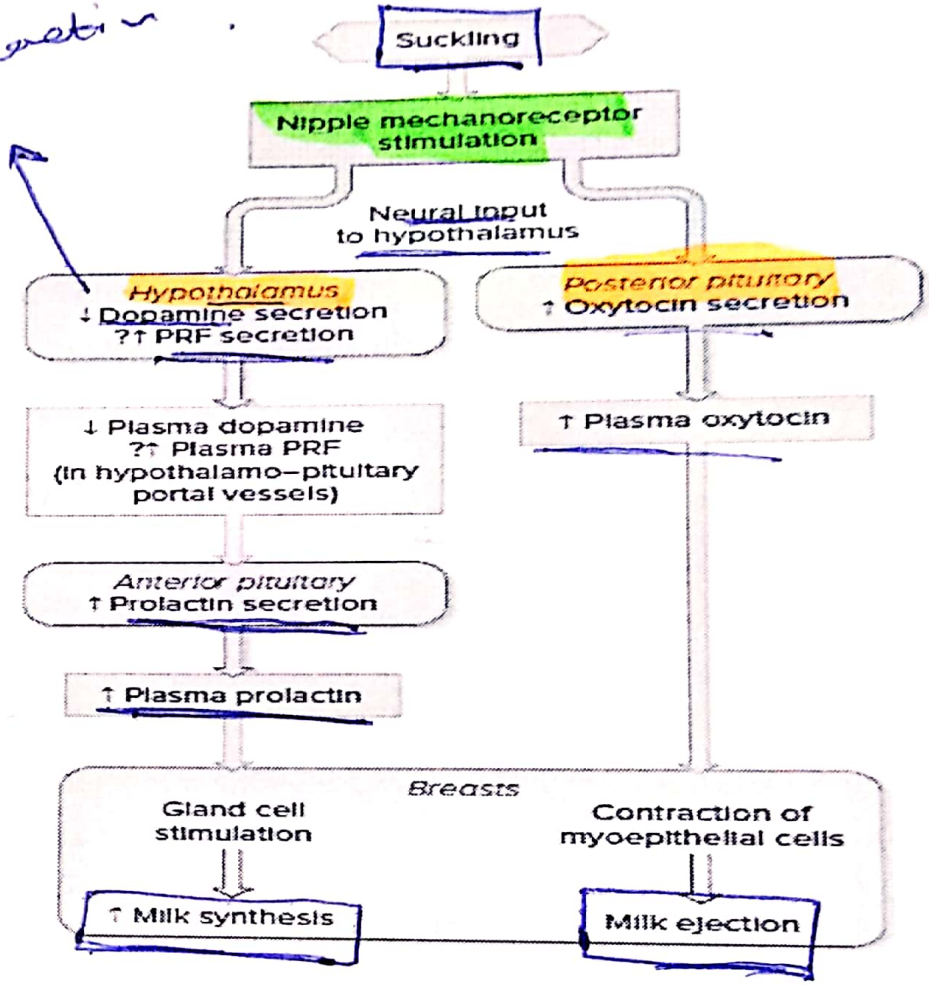
but it's action is inhibited by estrogen and progesterone + prolactin prevents the menstrual cycle or at least make it anovulatory.

- Human chorionic somatomammotropin→ lactogenic effect
- First few days (1-7)→ colostrum (very small amount)→ Protein and lactose almost no fat
- Up to 1.5 L of milk/day- higher in twins- **high energy consumption**
- Milk formation requires increase in growth hormone, cortisol, parathyroid hormone and insulin→ to increase amino acids, fatty acids, glucose and calcium

lactation

- suckling→ hypothalamus→ prolactin surge
- milk ejection from alveoli to ducts is caused by oxytocin
- Prolactin secretion is inhibited by the hypothalamus →prolactin inhibitory Factor
- Dopamine inhibits prolactin secretion
- Prolactin inhibits LH and FSH→ inhibits menstruation for several months

- Enlargement of parathyroid gland to supply needed calcium and phosphate+bone decalcification



lactation

Table 83-1 Composition of Milk

Constituent	Human Milk (%)	Cow's Milk (%)
Water	88.5	87.0
Fat	3.3	3.5
Lactose	6.8	4.8
Casein	0.9	2.7
Lactalbumin and other proteins	0.4	0.7
Ash	0.2	0.7

50% higher

2-3 higher

Calcium & other minerals

milk provides nutrients, antibodies & WBCs

to provide immunity to the fetus