

Physiology Team 431
Reproductive Block

Lecture 7

physiology of labor

Done by : Sara Alhaddab & Alwaleed Bakrman

Revised by : Nour Al-Khawajah & Mohammed Asiri

Onset and physiology of labor

□ Parturition :

□ Definition:

- Uterine contractions that lead to expulsion of the fetus to extrauterine environment
- Towards the end of pregnancy the uterus become progressively more excitable and develops strong rhythmic contractions that lead to expulsion of the fetus.
- Uterus is spontaneously active, it contracts continuously, and sometimes women can feel it.
- Spontaneous depolarization of pacemaker cells (found in the fundus), these cells send impulses through gap junctions. (just like the heart).
- Gap junctions spread depolarization.
- Exact trigger is unknown: there are hormonal and mechanical changes at the end of pregnancy, these changes lead to delivery.

□ Hormonal changes:

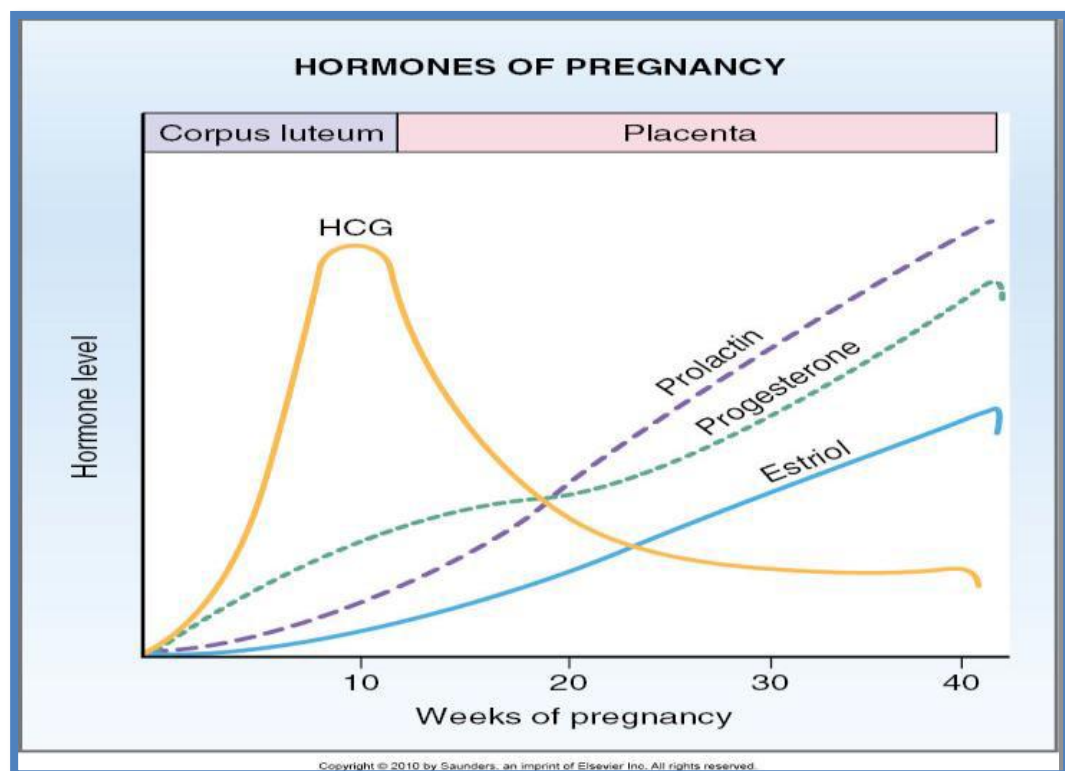
□ Estrogen/Progesterone ratio:

- **Estrogen stimulates uterine contractility** by ↑ GAP junctions with onset of labour , ↑ Oxytocin receptors and local oxytocin production , ↑ Prostaglandins synthesis (prostaglandin is released locally from the fetus membranes).
- **Progesterone inhibits uterine contractility** and promotes uterine inactivity during pregnancy. (opposing the estrogen)

□ From 7th month till term:

- Progesterone secretion remain constant
- Estrogen secretion continuously increases
- Increase estrogen/progesterone ratio, as a preparation for labor

	Progesteron	Estrogen
GAP junctions	↓	↑
Oxytocin receptor	↓	↑
prostaglandins	↓	↑
Others	↑ resting membrane Potential	-



❑ **Oxytocin:**

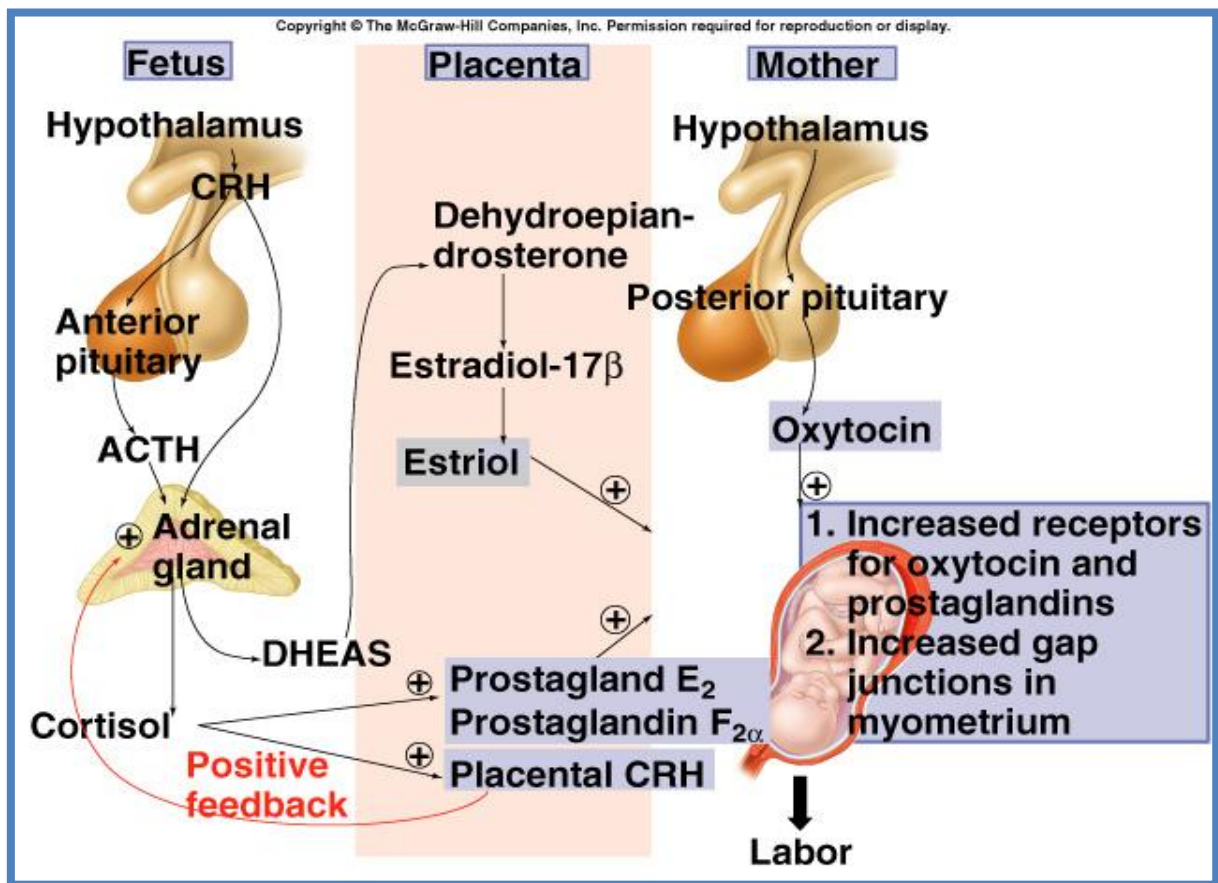
- Dramatic Increase of oxytocin receptors (200 folds) during **late** pregnancy **by the action of estrogen**.
- Has a role in the separation of the placenta.
- **Gradual** transition from passive relaxed to active excitatory muscle (↑responsiveness).
- Increase in oxytocin secretion at labor due to cervical stimulation by the head of the fetus
- Oxytocin increases uterine contractions by:
 - ✓ **Directly:** by stimulating its receptors
 - ✓ **Indirectly:** by stimulating prostaglandin production.

- Oxytocin receptors increase during late pregnancy
 - Oxytocin secretion increases at labour.

❑ **Prostaglandins:**

- Central role in **initiation & progression** of human labor
- Locally produced (intrauterine)
- Oxytocin and cytokines stimulate its production.
- Prostaglandins $F_{2\alpha}$ Rs are the most important ones for labor.
- Prostaglandin stimulates uterine contractions by:
 - ✓ **Direct effect:**
 - Through their own receptors
 - Upregulation of myometrial gap junctions
 - ✓ **Indirect effect:**
 - Upregulation of oxytocin receptors

Prostaglandin E2 has 4 types of receptors, two receptors have contraction effect on the fetus and the other two have relaxing effect on the lower part of the uterus. So prostaglandin E2 has both contraction and relaxation effects.



□ **Mechanical changes:**

□ **Stretching the muscle of the uterus**, same as in stretch reflex, Increases contractility by:

- ✓ Fetal movements stimulate contraction.
- ✓ Multiple pregnancy; more than one fetus as in twins, triplets,, more stretch of the uterus leading to preterm delivery.

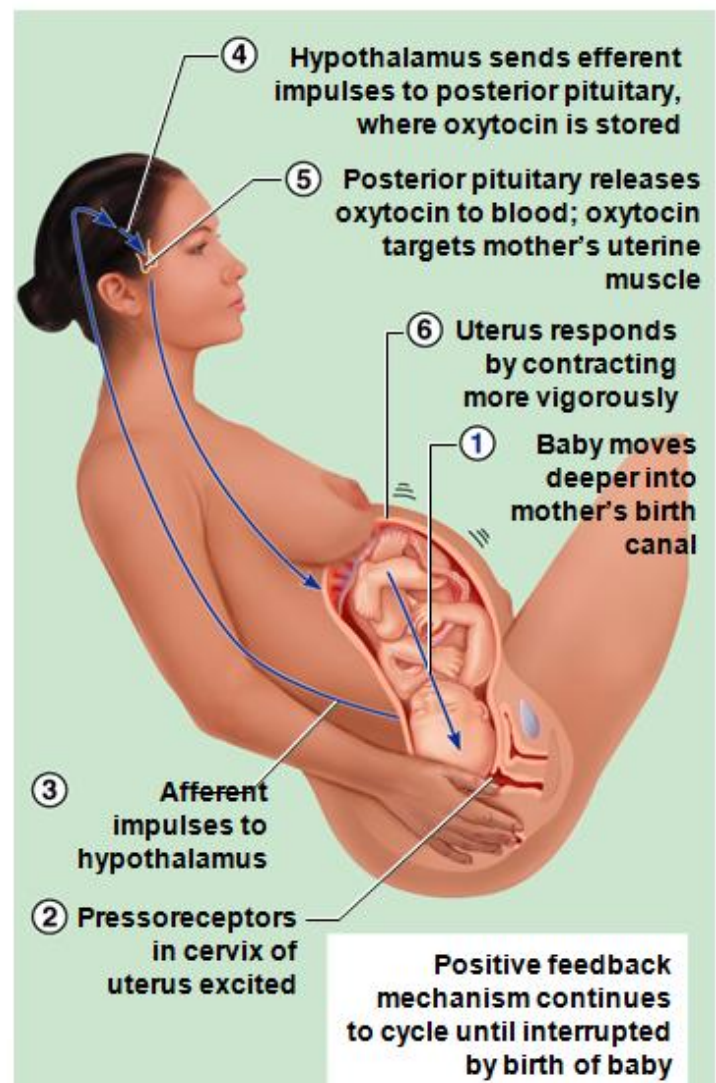
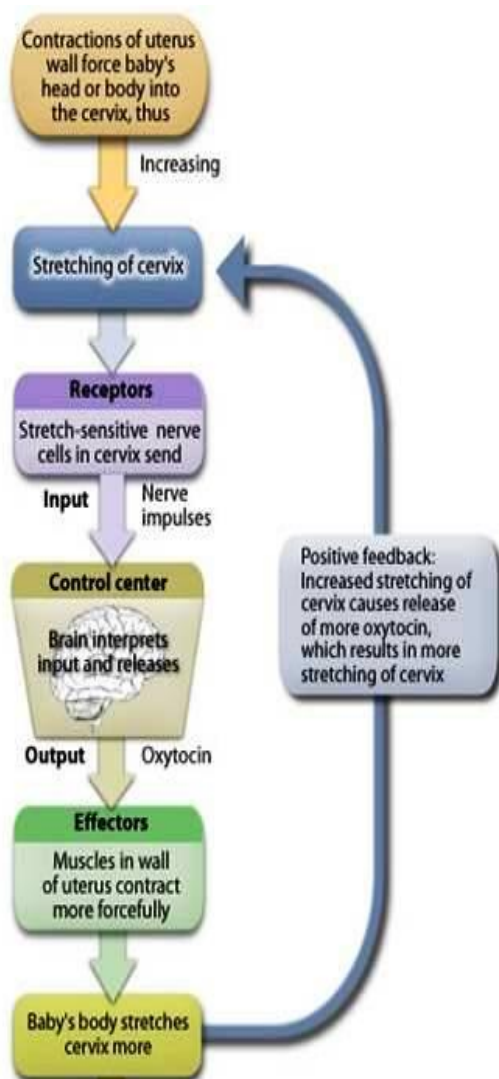
□ **Stretching of the cervix (causes oxytocin release)** Increases contractility (reflex):

- ✓ Membrane sweeping & rupture (induction contraction).
 - ✓ Fetal head activates oxytocin release by pressing against the cervix.
- Positive feedback mechanism

Positive feedback mechanism: During labour, oxytocin levels rise due to cervical stimulation by the head. It stimulates uterine contractions that push the fetus against the cervix which stimulates more oxytocin release.

□ **Labor and Parturition:**

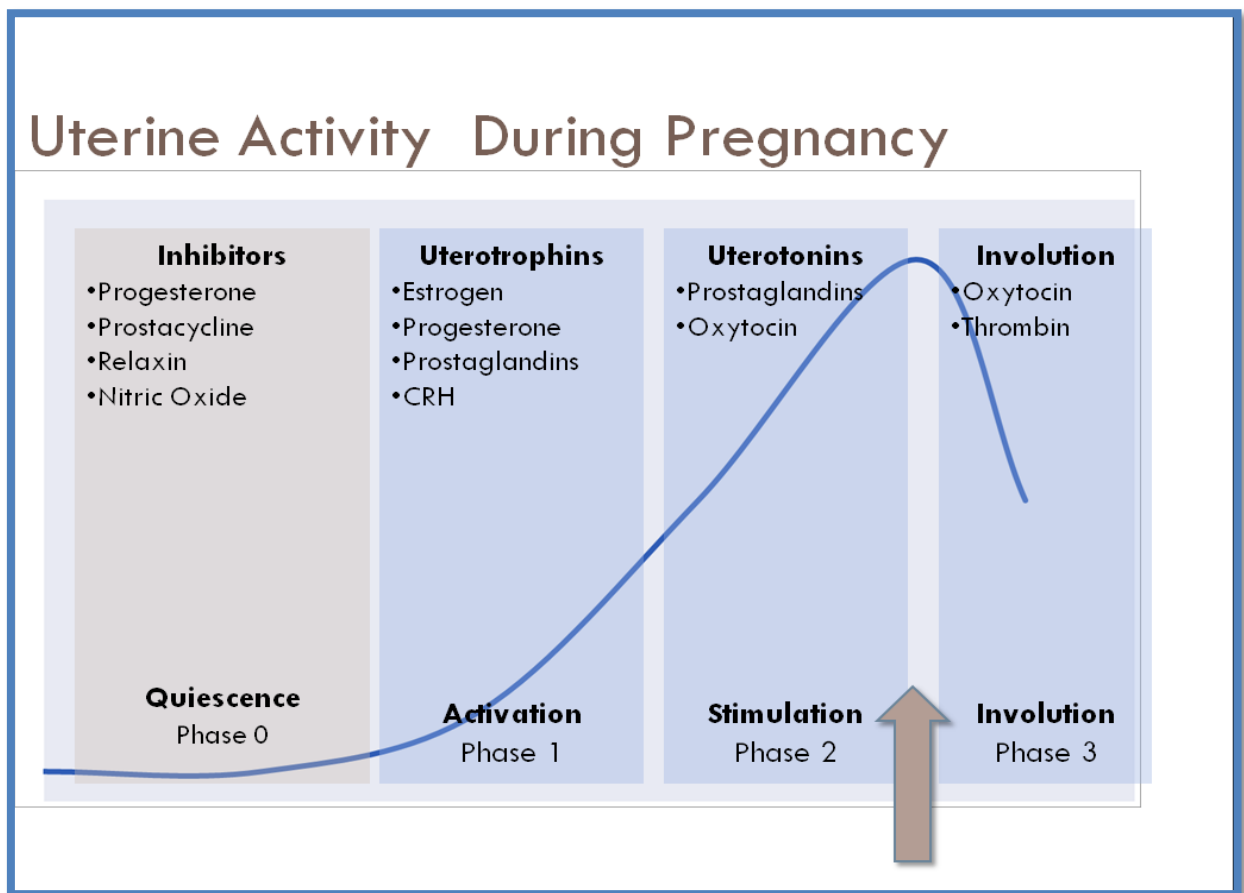
- **Parturition:** Denotes the whole process by which the baby is born, parturition is divided into 4 phases
- **Labor:** Strong uterine contractions, cervical dilatation, forcing the fetus through the birth canal, Labour is divided into 3 stages (discusses later).



□ Phases of parturition:

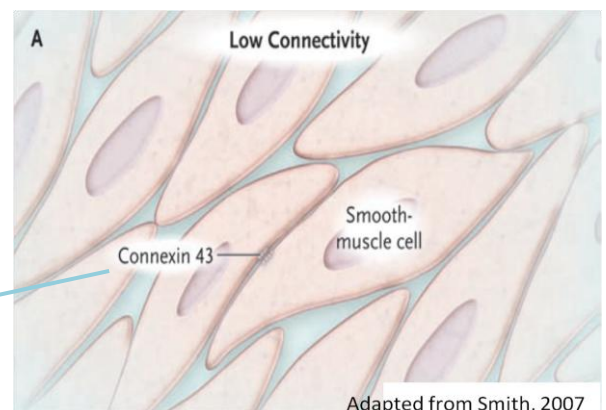
☒ From conception to beginning of labor

- **Phase 0**
 - uterus is relaxed (quiescent)
- **Phase 1**
 - Activation: expression of contraction proteins (more receptors and more gap junctions)
- **Phase 2**
 - Stimulation: stage 1 & stage 2 of labor
 - Cervical dilatation & expulsion of fetus
 - High oxytocin and prostaglandin release.
- **Phase 3**
 - Stage 3 of labor.
 - Delivery of the placenta and uterine involution.



□ Phase 0 : Quiescent uterus (relaxed uterus)

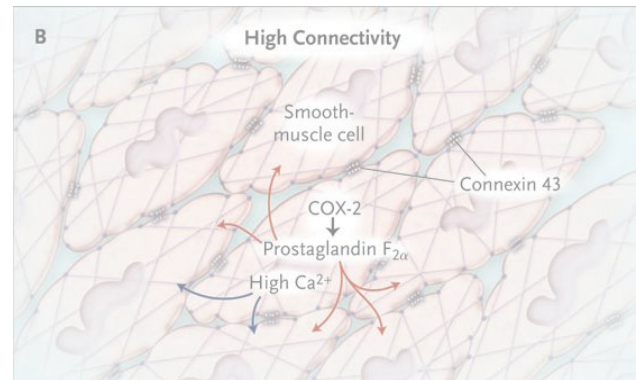
- Increase in cAMP level
- Increase in production of:
 - Prostacyclin (PGI₂) cause uterine relaxation
 - Nitric oxide (NO) cause uterine relaxation



Connexin 43 is a type of gap junction.

❑ Phase 1 : Activation of uterus (prepares the uterus for delivery)

- Occurs in **third** trimester
- The release of uterotrophins (estrogen, progesterone, Prostaglandins, CRH) increases the size of the uterus and activates the uterus.
- Increase excitability & responsiveness to stimulators by:
 - Increase expression of gap junctions
 - Increase G protein-coupled receptors:
 - Oxytocin receptors
 - Increase PG-F receptors



❑ Phase 2 : Stimulation of uterus (during delivery – baby delivered)

- Occurs in last 2-3 gestational weeks
- Increase in synthesis of uterotonins: Cytokines - Prostaglandins – Oxytocin
- Includes 2 stages of labour : Stage 1 - Stage 2

❑ Phase 3 : Uterine involution (after delivery)

- **Pulsatile** release of oxytocin; to prevent down regulation of the Rs and also to prevent fetal distress.
- Delivery of the placenta
- Involution of the uterus:
 - ✓ Occurs in 4-5 weeks after delivery
 - ✓ Lactation helps in complete involution

The blood vessels become very wide in phase 3, the separation of the fetus from the mother stimulates a very strong contraction that blocks these blood vessels and prevents heavy bleeding from happening.

Involution of the uterus prevents heavy bleeding after delivery.

❑ Mechanism of parturition

- Contractions start at the **fundus** and spreads to the lower segment
- The intensity of contractions is **strong at the fundus but weak at the lower segment**
- In early stages 1 contraction/ 30 minutes
- As labor progress 1 contraction/ 1-3 minutes
- Abdominal wall muscles contract
- Rhythmical contractions allows blood flow

□ Onset of labor:

▣ During pregnancy:

- Periodic episodes of weak and slow rhythmical uterine contractions (Braxton Hicks)
- 2nd trimester

Braxton-Hicks contractions:

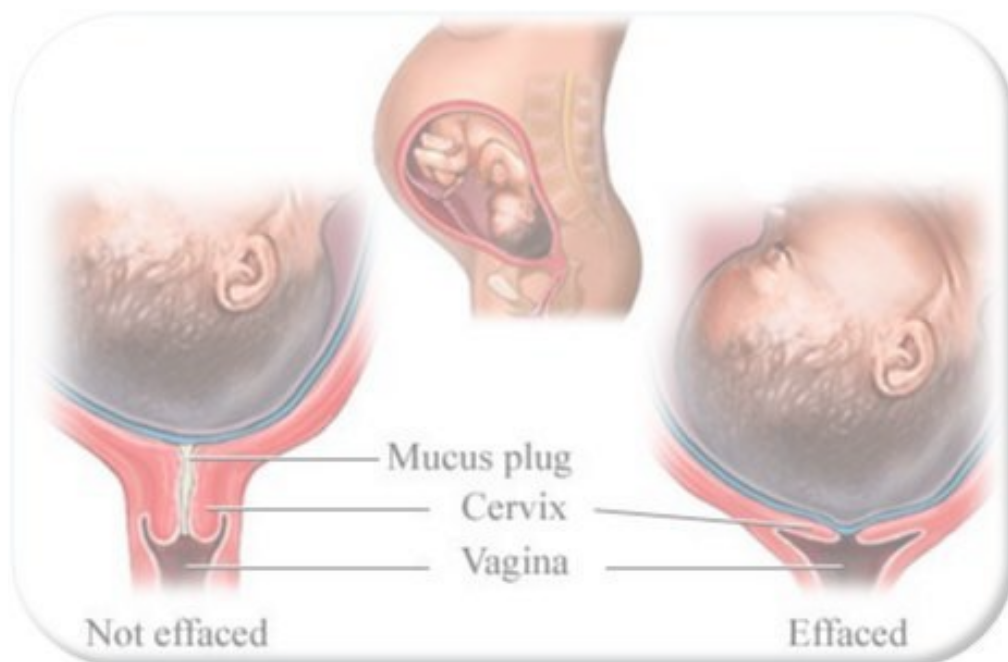
- Labour begins with regular, painful uterine contractions accompanied with cervical dilation.
- True labour is often preceded by several weeks of false labour with irregular painful contractions called Braxton-Hicks contractions with NO cervical dilation.
- Braxton-Hicks contractions are irritability of uterine muscle – weak & slow contractions – begin about 1 month before labor.
- In contrast: stronger contractions stretch cervix and force baby through birth canal
- True labor has circadian rhythm:

▣ Towards end of pregnancy:

- Uterine contractions become progressively stronger & regular suddenly uterine contractions become very strong leading to: Cervical effacement and dilatation

Cervical effacement:

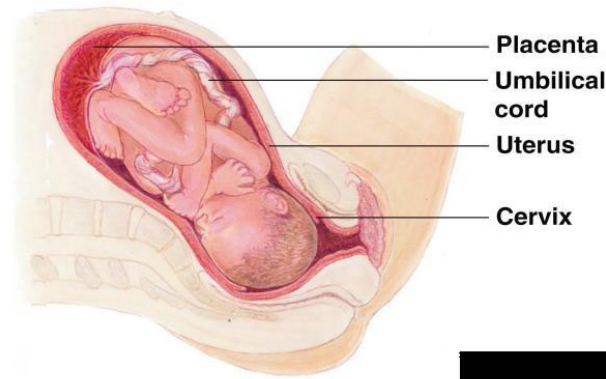
Effacement is the process by which the cervix prepares for delivery. After the baby has engaged in the pelvis, it gradually drops closer to the cervix; the cervix gradually softens, shortens and becomes thinner. You may hear phrases like "ripens," or "cervical thinning" which refers to effacement.



□ Stages of labor:

▣ Stage 1: Dilation:

- Commences with the onset of labour and terminates when the cervix has reached full dilatation (Full dilation is 10 cm) and membranes ruptured (lasts 8-24 hours).
- Uterine contractions begin and increase
- Cervix softens and effaces (thins)
- Cervix becomes dilated
- The amnion ruptures (“breaking the water”)
- Longest stage at 6–12 hours



① **Dilation of the cervix**

▣ Stage 2: Expulsion:

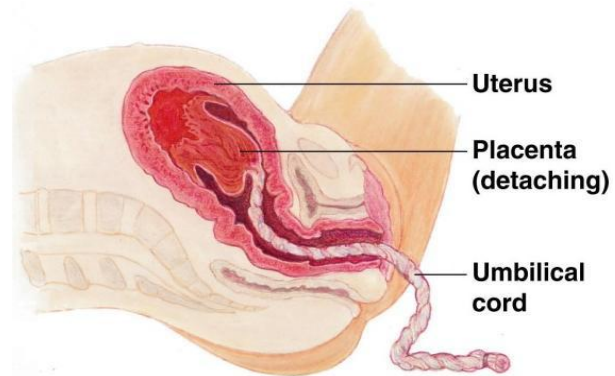
- Stage of expulsion begins at full cervical softening and dilatation and ends with expulsion of the fetus (lasts 1-30 minutes).
- Infant passes through the cervix and vagina
- Can last as long as 2 hours, but typically is 50 minutes in the first birth and 20 minutes in subsequent births
- Normal delivery is head first (vertex position)
- Breech presentation is buttocks-first
- Prolonged second stage might cause mental retardation for the delivered baby.



② **Expulsion: delivery of the infant**

▣ Stage 3: Placental

- Begins with the delivery of the child and ends with the expulsion of the placenta.
- Delivery of the placenta
- Usually accomplished within 15 minutes after birth of infant
- Afterbirth - placenta and attached fetal membranes
- All placental fragments should be removed to avoid postpartum bleeding



③ **Delivery of the placenta**

Questions !

Which one of the following event occur during stage 2 of the labor ?

- a) Dilation of the cervix
- b) Delivery of the fetus
- c) Uterine involution
- d) Expulsion of the placenta

A pregnant lady came to the hospital complaining of regular labor pain for the last 6 hours . vaginal examination revealed that the cervix was 6 cm dilated .

What is your assessment of this labor ?

- a) First stage of labor
- b) False labor
- c) Second stage of labor
- d) Third stage of labor

All of the following increase contraction of the uterus during parturition except :

- a) Estrogens
- b) Progesterone
- c) Stretching of the cervix
- d) Stretching of the uterine muscles

Answers : B – A - B