

Physiology of Labor



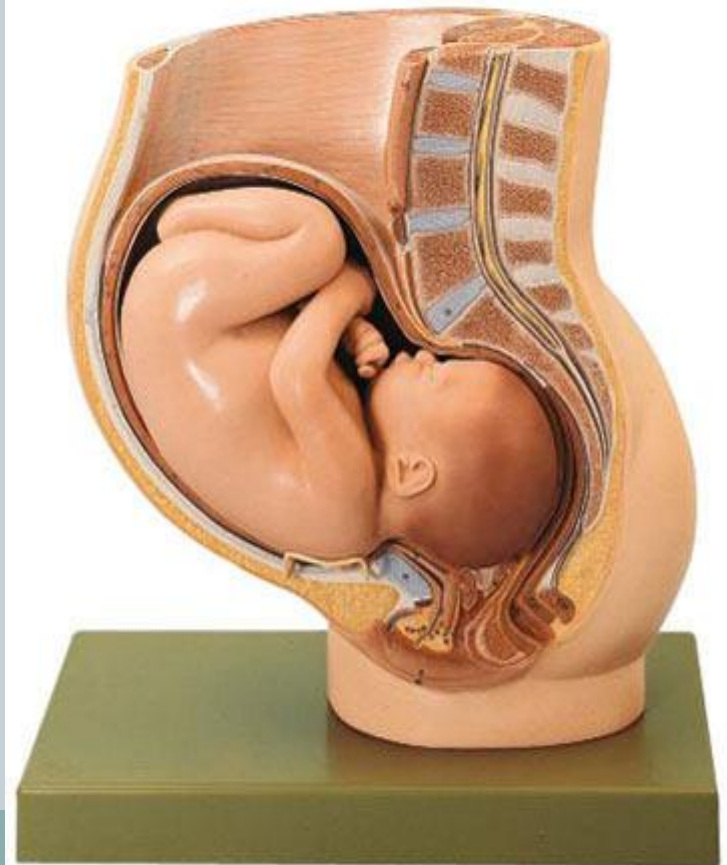
GUYTON & HALL, Chapter 82

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Objectives



By the end of this lecture, you should be able to:

- Define labor/labour (parturition)
- Recognize the factors triggering the onset of labor
- Describe the hormonal changes that occur before and during labor
- Describe the phases of uterine activity during pregnancy and labor
- Know the clinical stages of labor

Labor



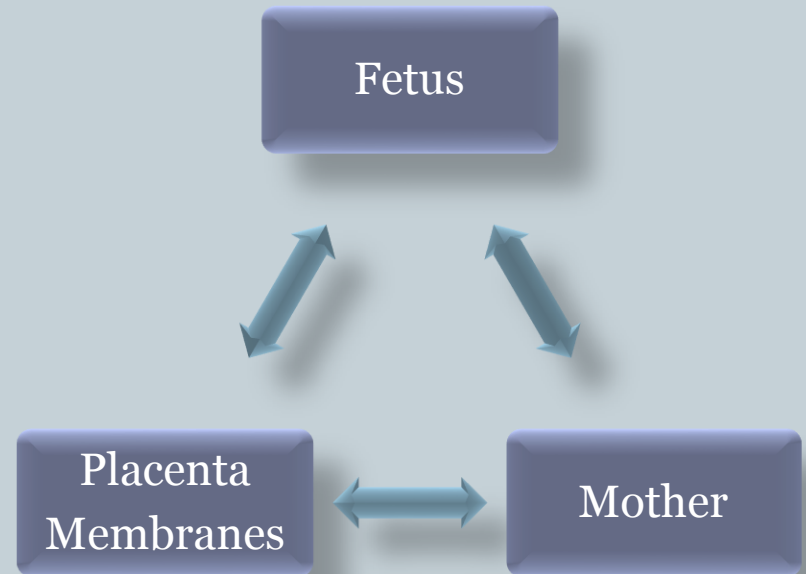
- **Normal Pregnancy**

- Uterine quiescence
- Immature fetus
- Closed cervix

- **Labor**

- Coordinated uterine activity
- Maturation of the fetus
- Progressive cervical dilation

Interactions



Labor

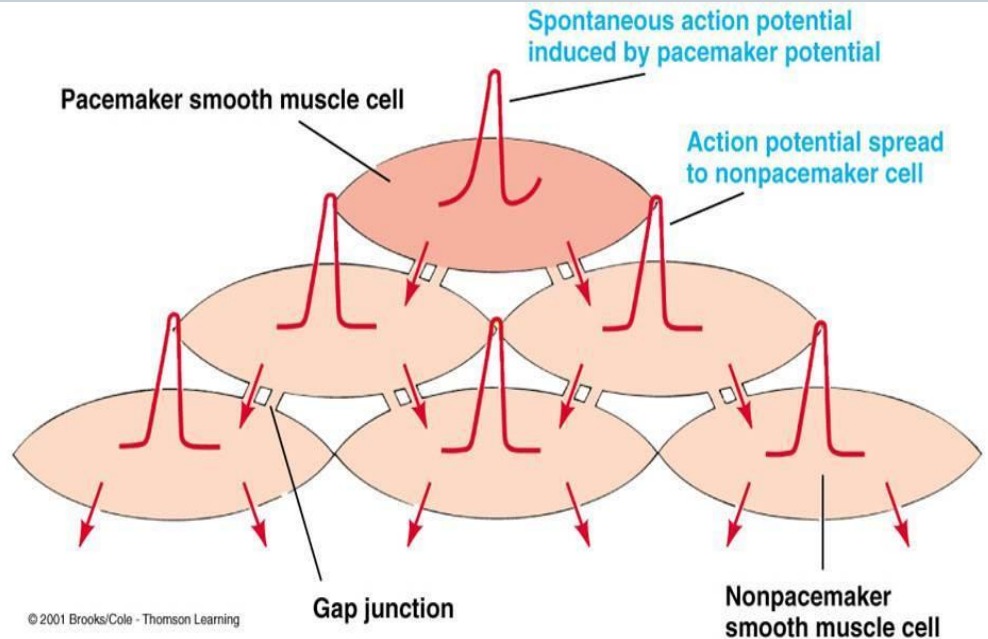


- **Definition**
 - Uterine contractions that lead to expulsion of the fetus to the extrauterine environment
 - Towards the end of pregnancy the uterus becomes progressively more excitable and develops strong rhythmic contractions that lead to expulsion of the fetus.

Labor



- Uterus is spontaneously active.
- Spontaneous depolarization of pacemaker cells.
- Gap junctions spread depolarization
- Exact trigger is unknown
 - Hormonal changes
 - Mechanical changes



Hormonal changes

Increased ratio of estrogens to progesterone

- Progesterone & Estrogen
 - Progesterone inhibits uterine contractility
 - Estrogen stimulates uterine contractility
- From 7th month till term
 - Progesterone secretion remains constant or decreases slightly
 - Estrogen secretion increases continuously
 - The estrogen/progesterone ratio increases sufficiently toward the end of pregnancy to be at least partly responsible for the increased contractility of the uterus

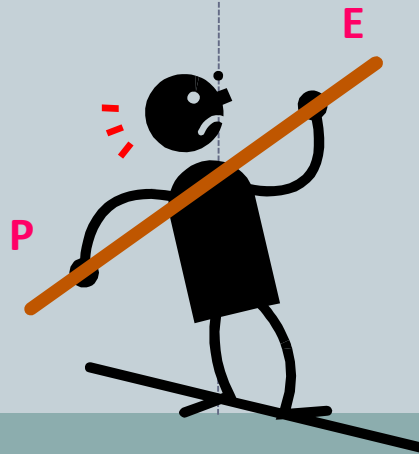
Hormonal changes

- **Progesterone**

- ▼ GAP junctions
- ▼ Oxytocin receptors
- ▼ prostaglandins
- ▲ resting mem. Potential

- **Estrogen**

- ▲ GAP junctions with onset of labour.
- ▲ Oxytocin receptors.
- ▲ Prostaglandins



Hormonal changes



- **Oxytocin**

- Dramatic ▲ of oxytocin receptors at the last few months of pregnancy
 - ✦ gradual transition from passive relaxed to active excitatory muscle (↑ responsiveness).
- Increase in oxytocin secretion at labor by posterior pituitary gland.
- Oxytocin increases uterine contractions by
 - ✦ Directly on its receptors
 - ✦ Indirectly by stimulating prostaglandin production

Hormonal changes



- **Prostaglandins**

- Central role in initiation & progression of human labour
- Locally produced (intrauterine)
- Oxytocin and cytokines stimulate its production
- Prostaglandin stimulates uterine contractions by:
 - ✦ Direct effect:
 - Through their own receptors
 - Upregulation of myometrial gap junctions
 - ✦ Indirect effect:
 - Upregulation of oxytocin receptors

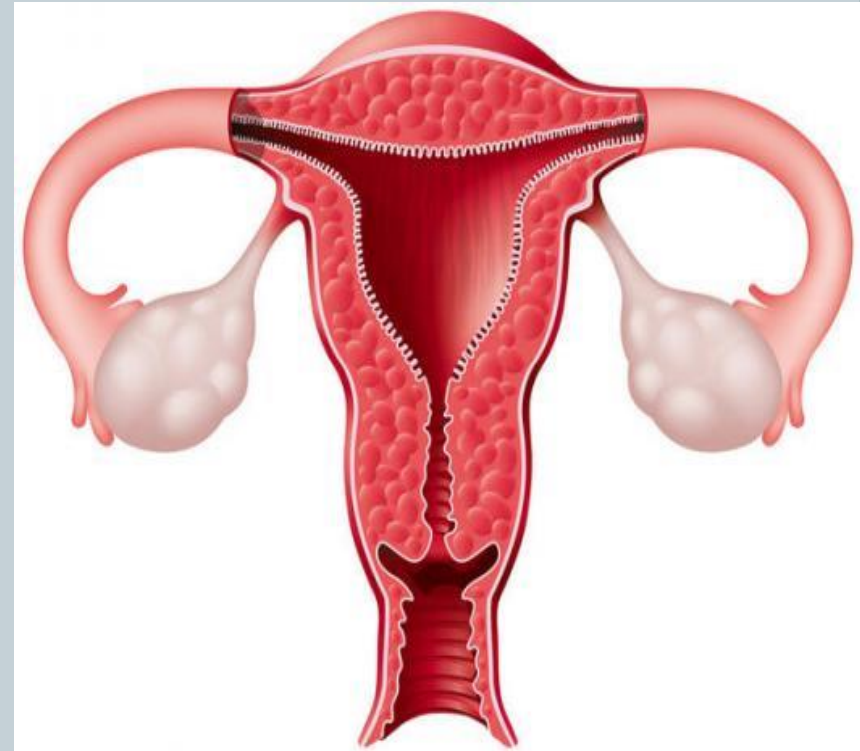
Mechanical changes

- **Stretch of the uterine muscle**

- Increases contractility
 - ✦ Fetal movements
 - ✦ Multiple pregnancy

- **Stretch of the cervix**

- Increases contractility (reflex)
(Positive feedback mechanism)
- Membrane sweeping & rupture
- Fetal head



Onset of labor



- During pregnancy
 - Periodic episodes of weak and slow rhythmical uterine contractions (Braxton Hicks) 2nd trimester
- Towards the end of pregnancy
 - Uterine contractions become progressively stronger.
 - Uterine contractions change suddenly, within hours, to become strong contractions leading cervical stretching and force the baby through the birth canal.

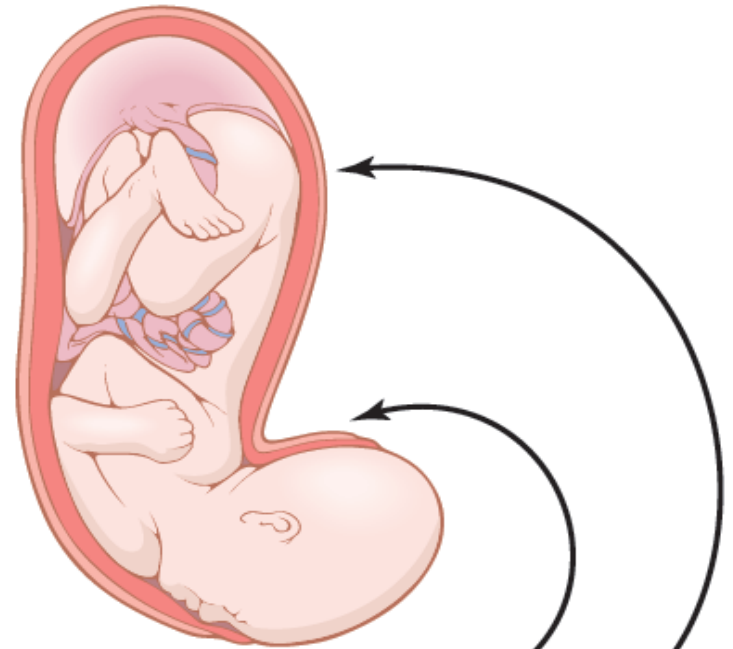
Onset of Labor



Positive feedback mechanisms

Labor contractions obey all the principles of **positive feedback**:

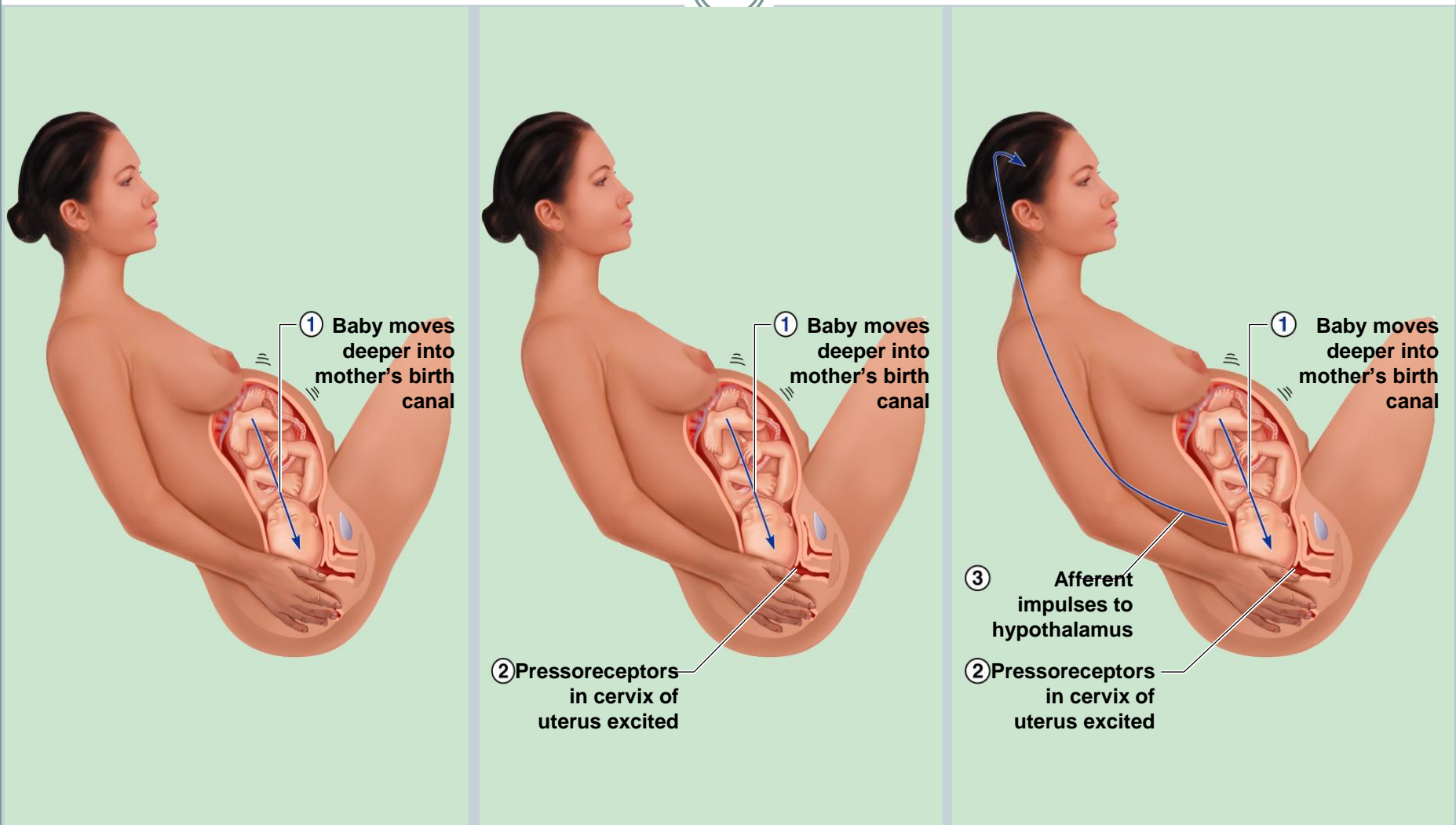
1. Stretching of the cervix causes the entire body of the uterus to contract.
2. Stretching of the cervix also causes the pituitary gland to secrete oxytocin



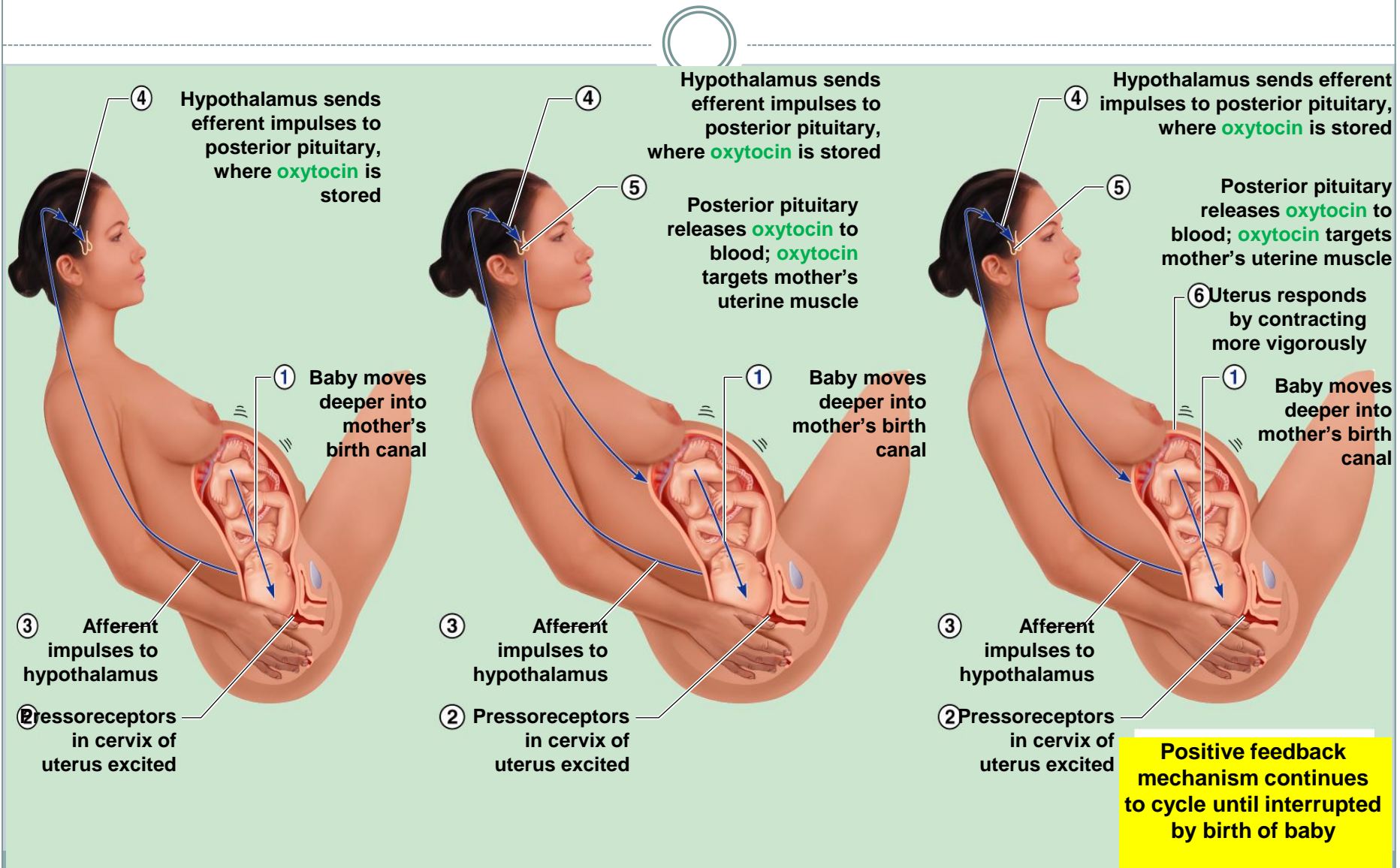
1. Baby's head stretches cervix
2. Cervical stretch excites fundic contraction
3. Fundic contraction pushes baby down and stretches cervix some more
4. Cycle repeats over and over again

Figure 83-9. Theory for the onset of intensely strong contractions during labor.

Onset of Labor



Onset of Labor

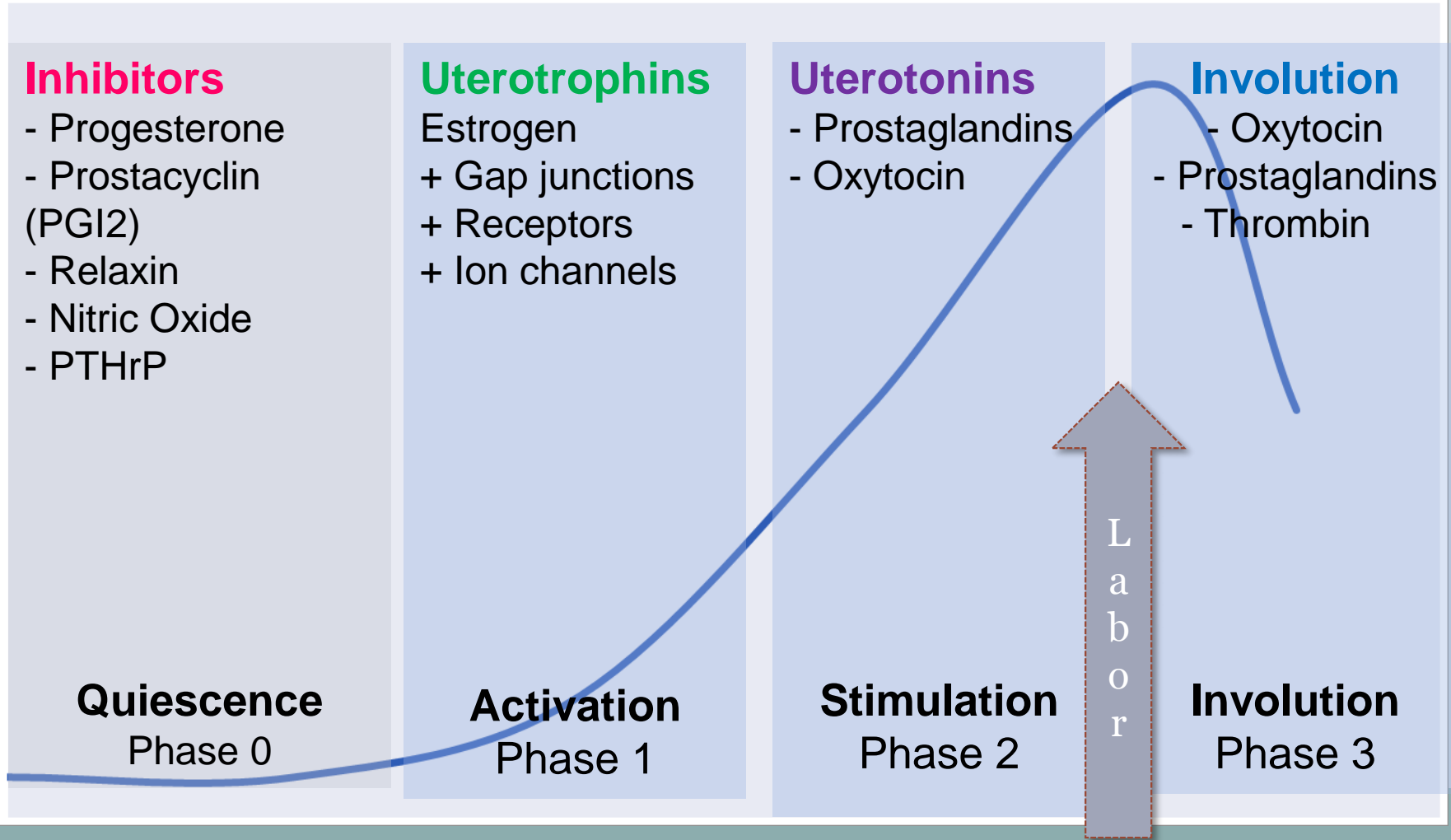


Mechanism of Labor



- Contractions start at the fundus and spread 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 progresses: 1 contraction/ 1-3 minutes
- Abdominal wall muscles contract
- Rhythmical contractions allow blood flow

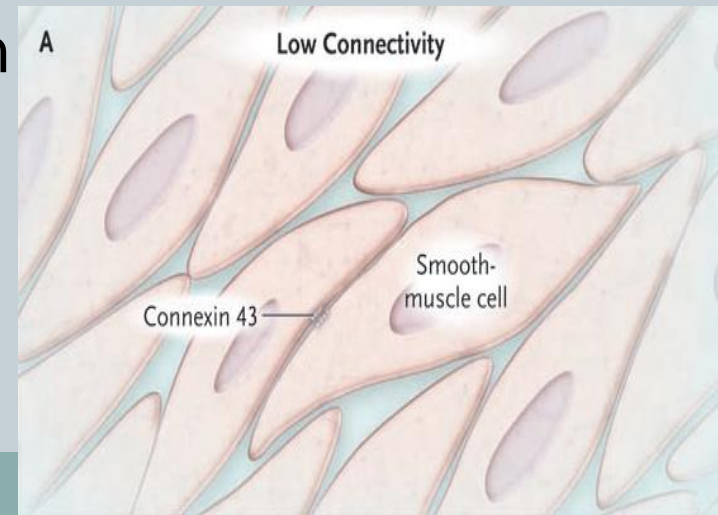
Phases of uterine activity



Phases of uterine activity

- **Phase 0 (quiescence)**

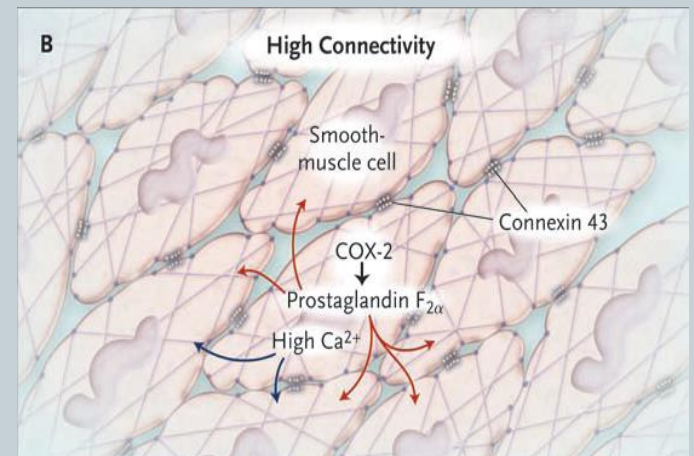
- Occurs during early pregnancy
- Increase in cAMP level
- Increase in production of:
 - ✦ Prostacyclin (PGI_2) causes uterine relaxation
 - ✦ Nitric oxide (NO) causes uterine relaxation
 - ✦ PTHrP inhibits uterine contraction



Phases of uterine activity

- **Phase 1 (activation)**

- Occurs in third trimester
- Promotes a switch from quiescent to active uterus
- Increase excitability & responsiveness to stimulators by
 - ✦ Increasing expression of gap junctions
 - ✦ Increasing receptors and ion channels
 - Oxytocin receptors
 - PG receptors



Phases of uterine activity

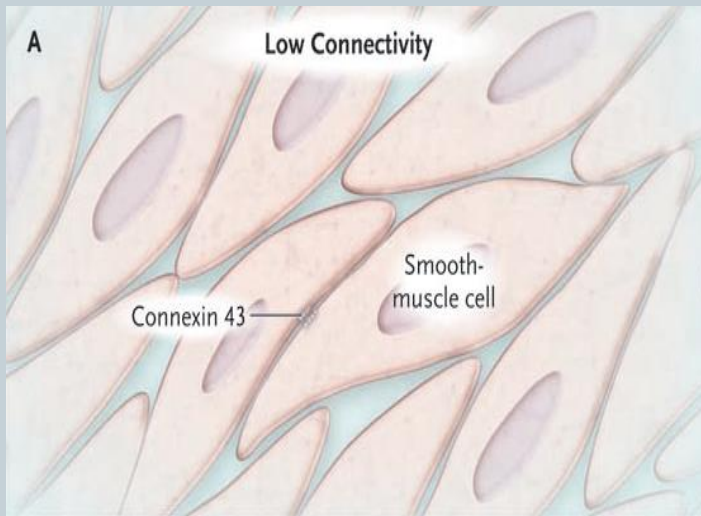


- **Phase 2 (stimulation)**
 - Occurs in the last 2-3 gestational weeks
 - Increase in synthesis of uterotonins
 - ✦ Oxytocin
 - ✦ Prostaglandins
- **Phase 3 (uterine involution)**
 - Pulsatile release of oxytocin
 - Delivery of the placenta
 - Involution of the uterus
 - ✦ Occurs in 4-5 weeks after delivery
 - ✦ Lactation helps in complete involution

Phases of uterine activity (summary)

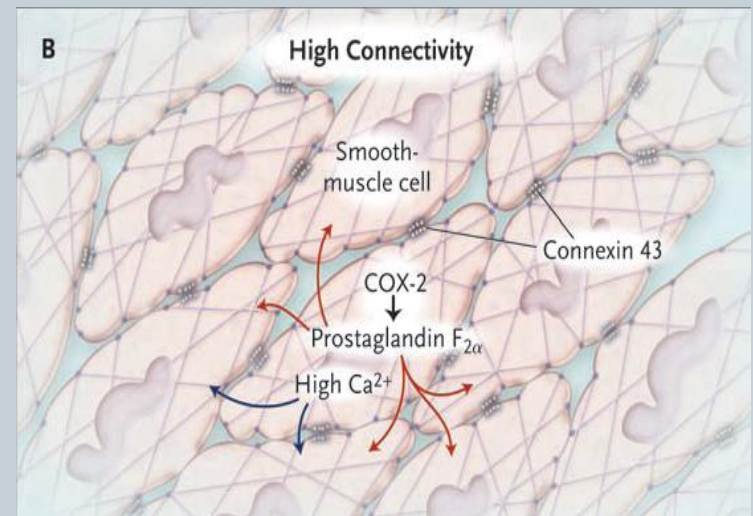


Phase 0 (quiescence)

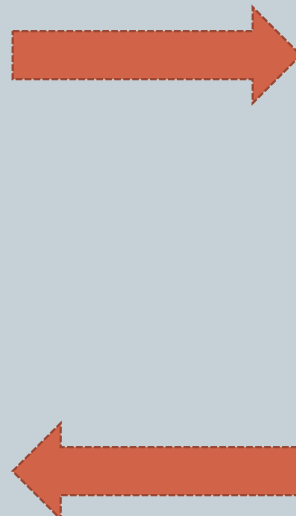


Phase 3 (involution)

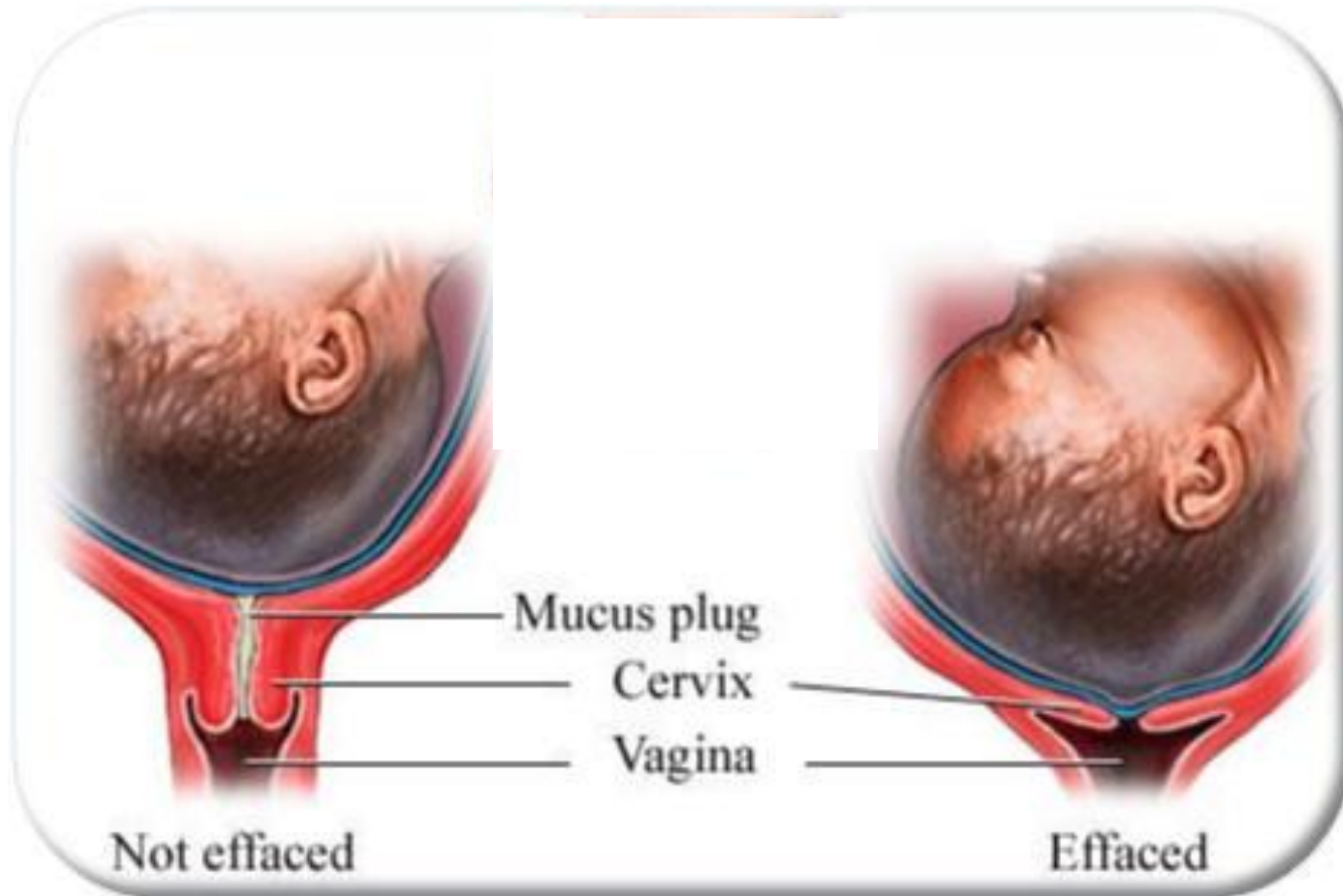
Phase 1 (uterotrophins)



Phase 2 (uterotonins)



Clinical Stages of Labor



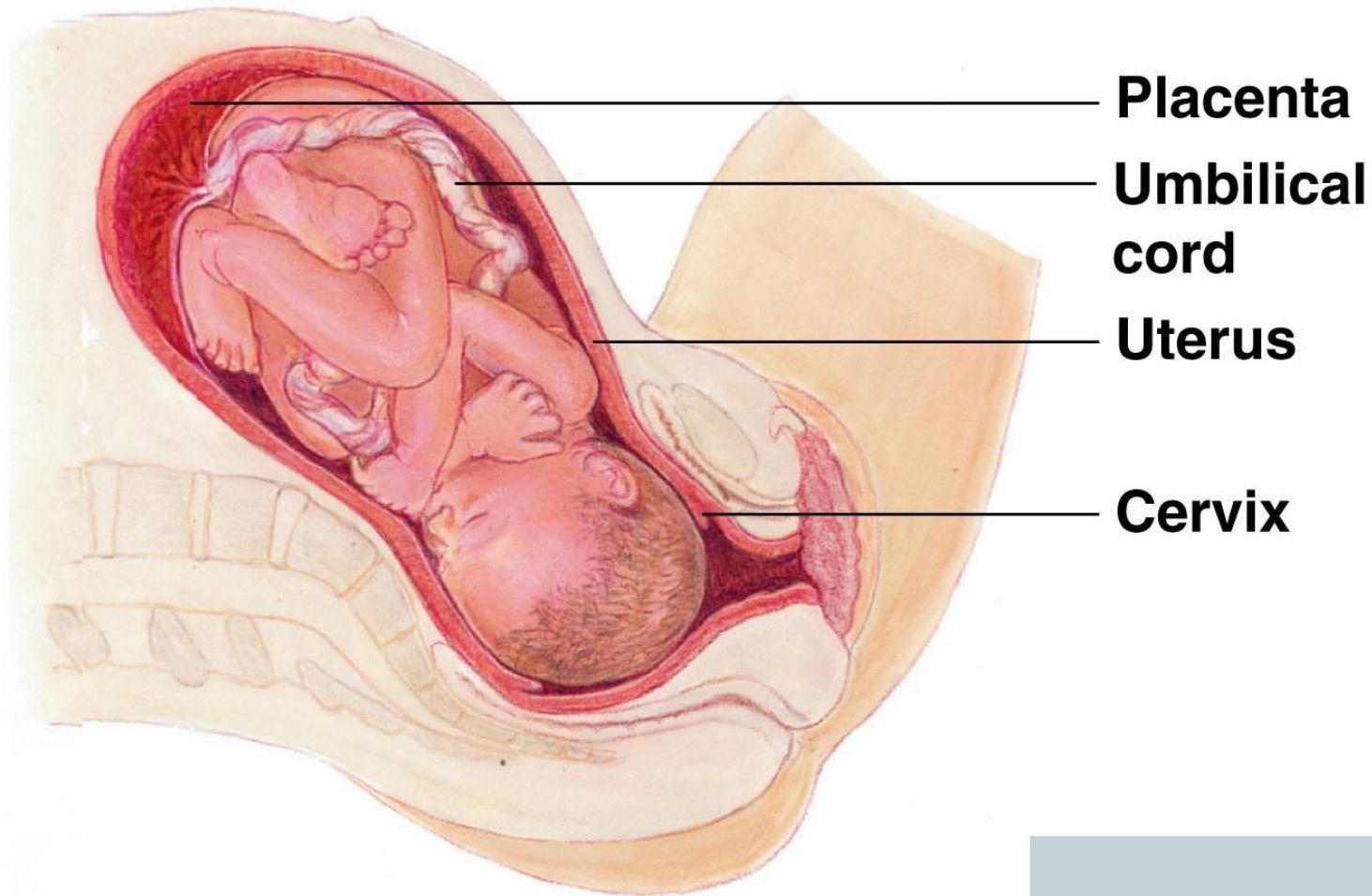
Clinical Stages of Labor



1) Dilation

- Cervix becomes dilated
- Full dilation is 10 cm
- Uterine contractions begin and increase
- Cervix softens and effaces (thins)
- The amnion ruptures (“breaking the water”)
- Longest stage at 6–12 hours

Clinical Stages of Labor



① **Dilation of the cervix**

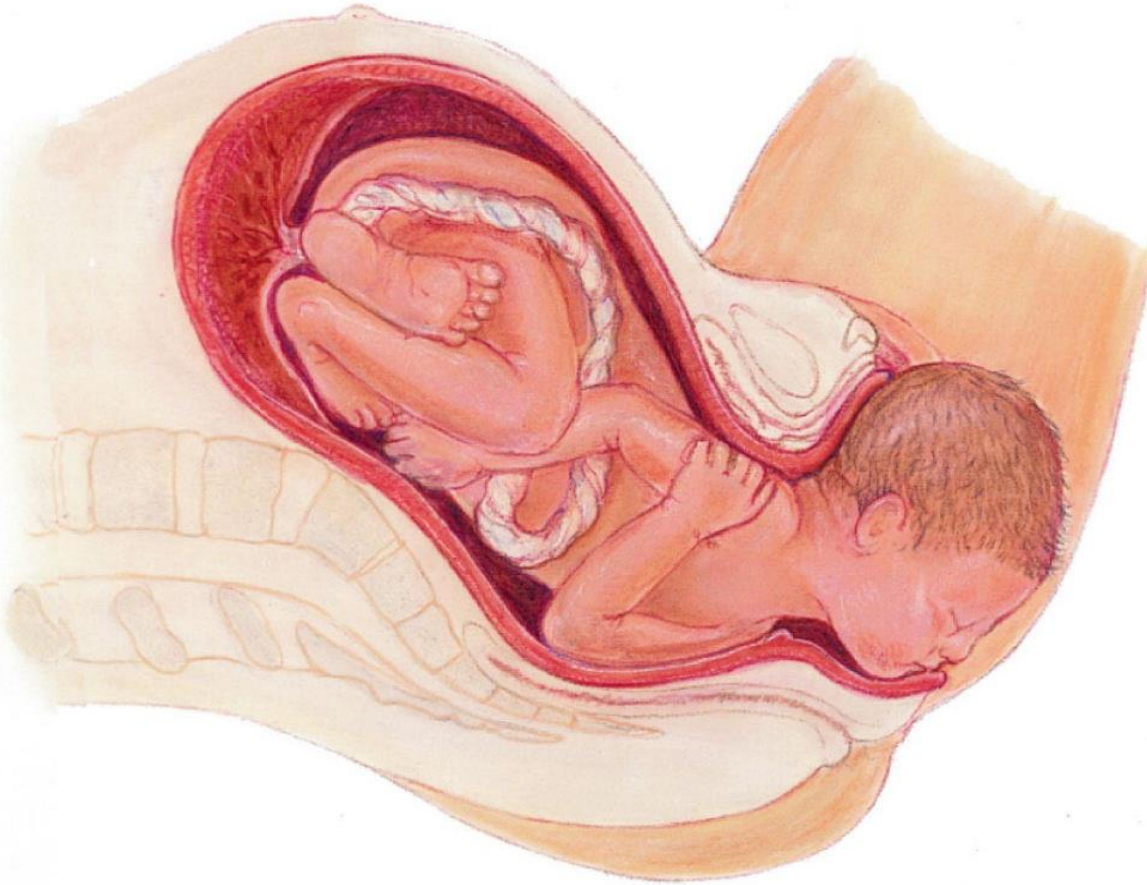
Stages of Labor



2) Expulsion

- 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

Clinical Stages of Labor



② **Expulsion: delivery of the infant**

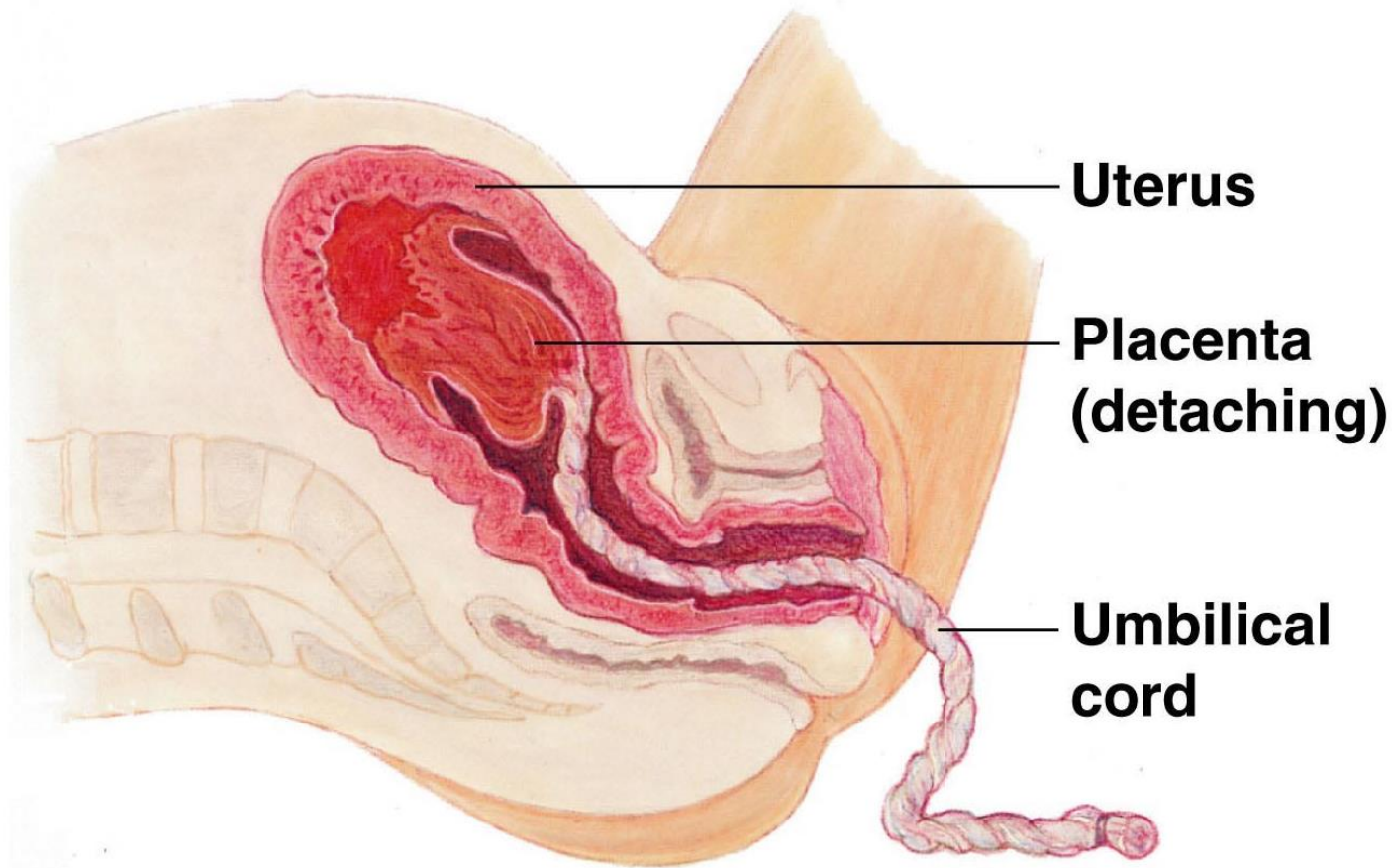
Clinical Stages of Labor



3) Placental stage

- Delivery of the placenta
- Usually accomplished within 15 minutes after birth of infant
- After birth—placenta and attached to the fetal membranes are delivered
- All placental fragments should be removed to avoid postpartum bleeding

Clinical Stages of Labor



③ Delivery of the placenta

New arrival



The End

Thank You