Reproductive Physiology

Lecture 7

Physiology of Labor

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Objectives

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

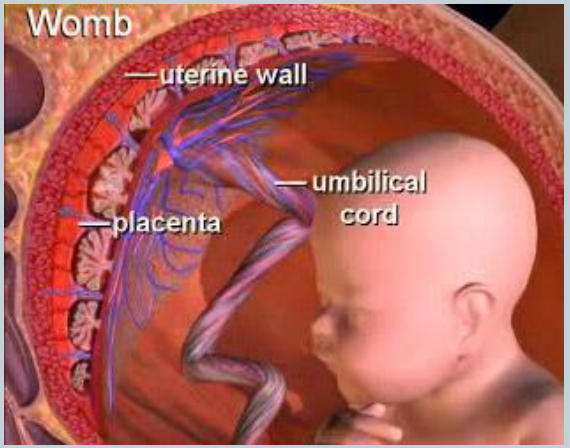
- Define parturition (labour, labor)
- Recognize the factors triggering parturition
- Describe the hormonal changes that occur before and during parturition
- Understand the phases of parturition
- Understand the clinical stages of labour

Parturition

- Definition
  - Uterine contractions that lead to expulsion of the fetus to 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.

Parturition

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

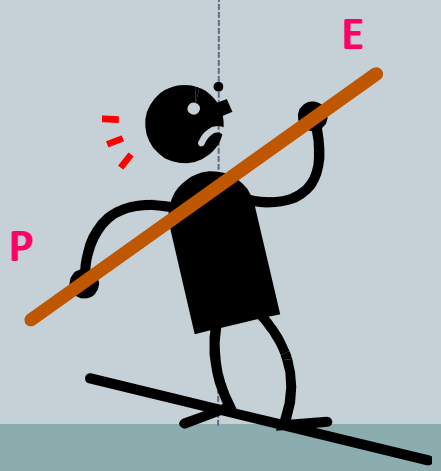


Hormonal changes

- 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
  - Increase estrogen/progesterone ratio

Hormonal changes

- **Progesterone**
  - ▼ GAP junctions
  - ▼ Oxytocin receptors
  - ▼prostaglandins
  - ▲ resting mem. Potential
- **Estrogen**
  - ▲ GAP junctions with onset of labour.
  - ▲ Oxytocin receptors.
  - ▲ Prostaglandins



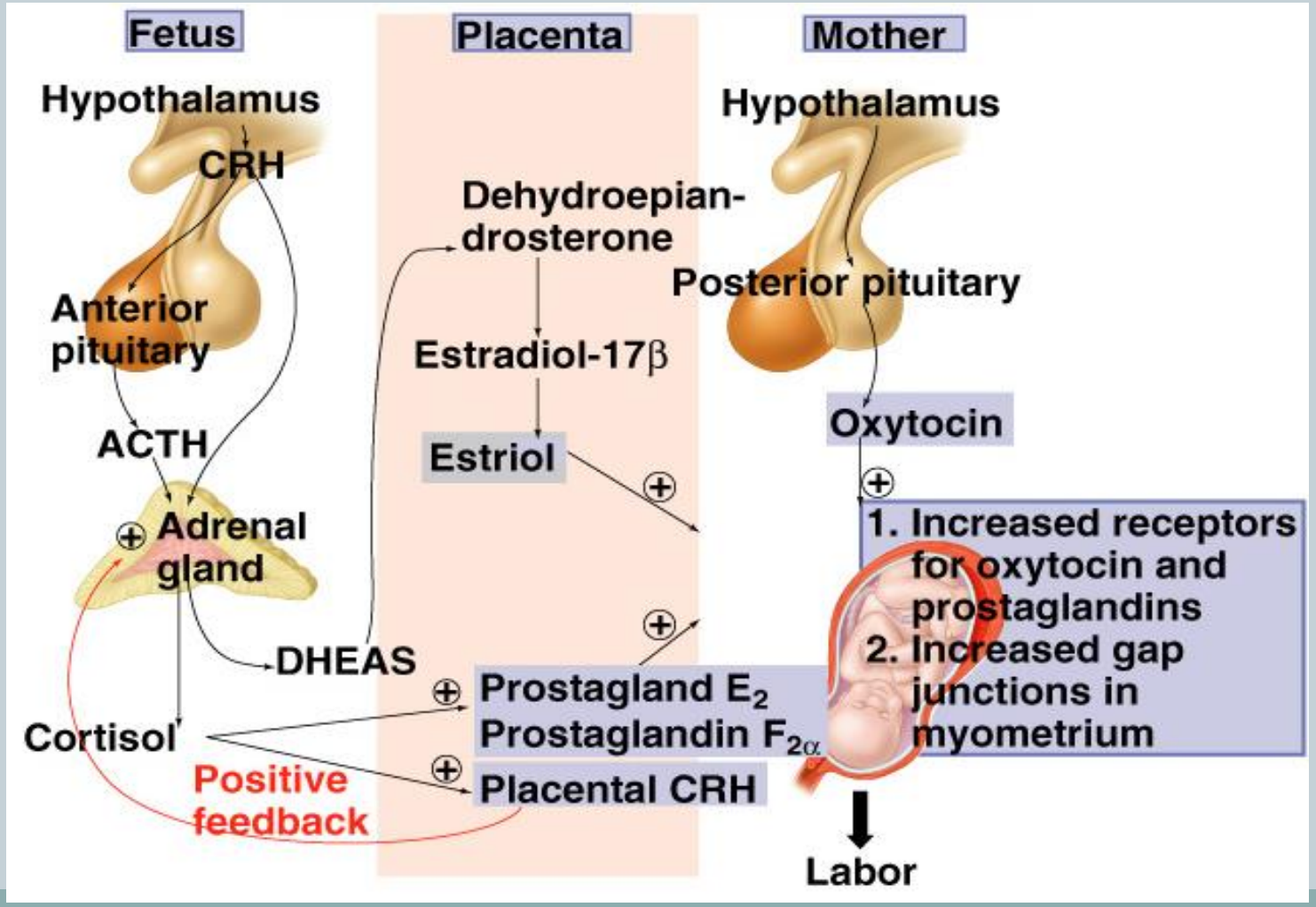
Hormonal changes

- **Oxytocin**
  - Dramatic ▲of oxytocin receptors (200 folds)
    - gradual transition from passive relaxed to active excitatory muscle (↑responsiveness).
  - Increase in Oxytocin secretion at labor
  - Oxytocin increase 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

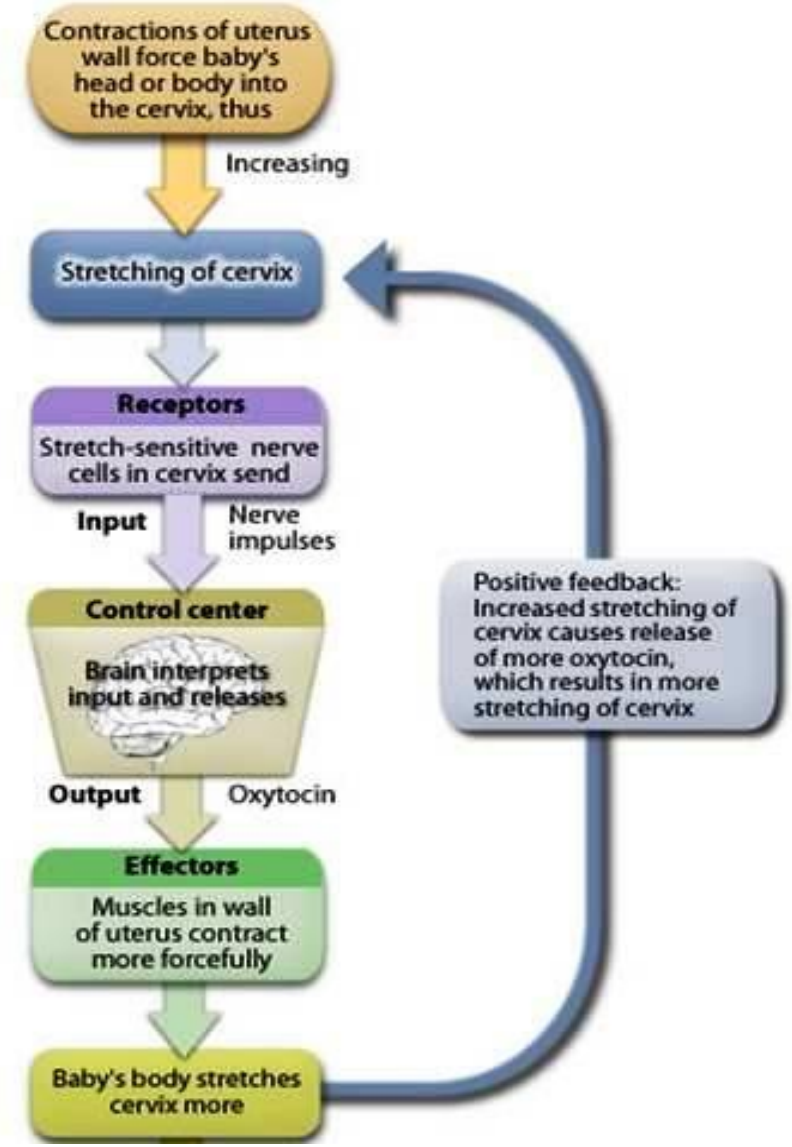
Parturition



Mechanical changes

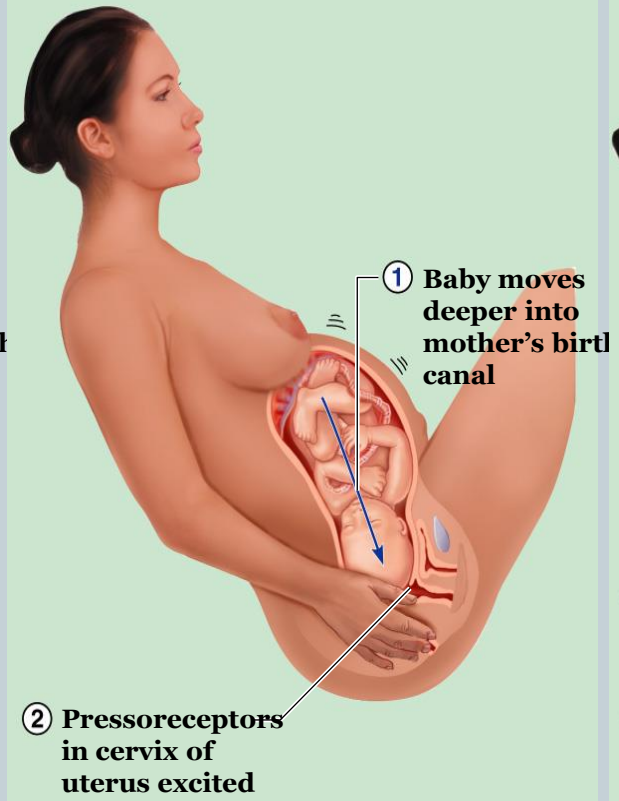
- **Stretch of the uterine muscle**
  - Increases contractility
    - Fetal movements
    - Multiple pregnancy
- **Stretch of the cervix**
  - Increases contractility (reflex)
    - Membrane sweeping & rupture
    - Fetal head
      - Positive feedback mechanism

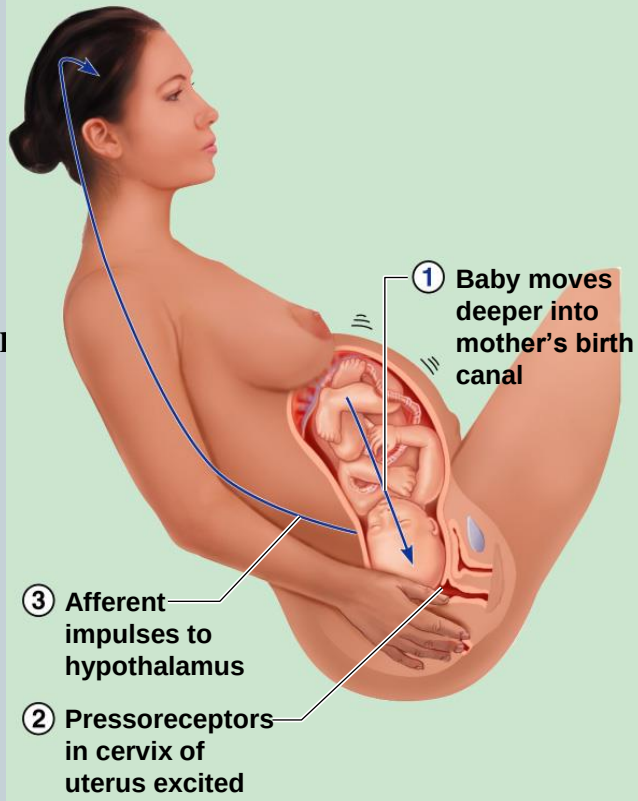
Positive feedback mechanism



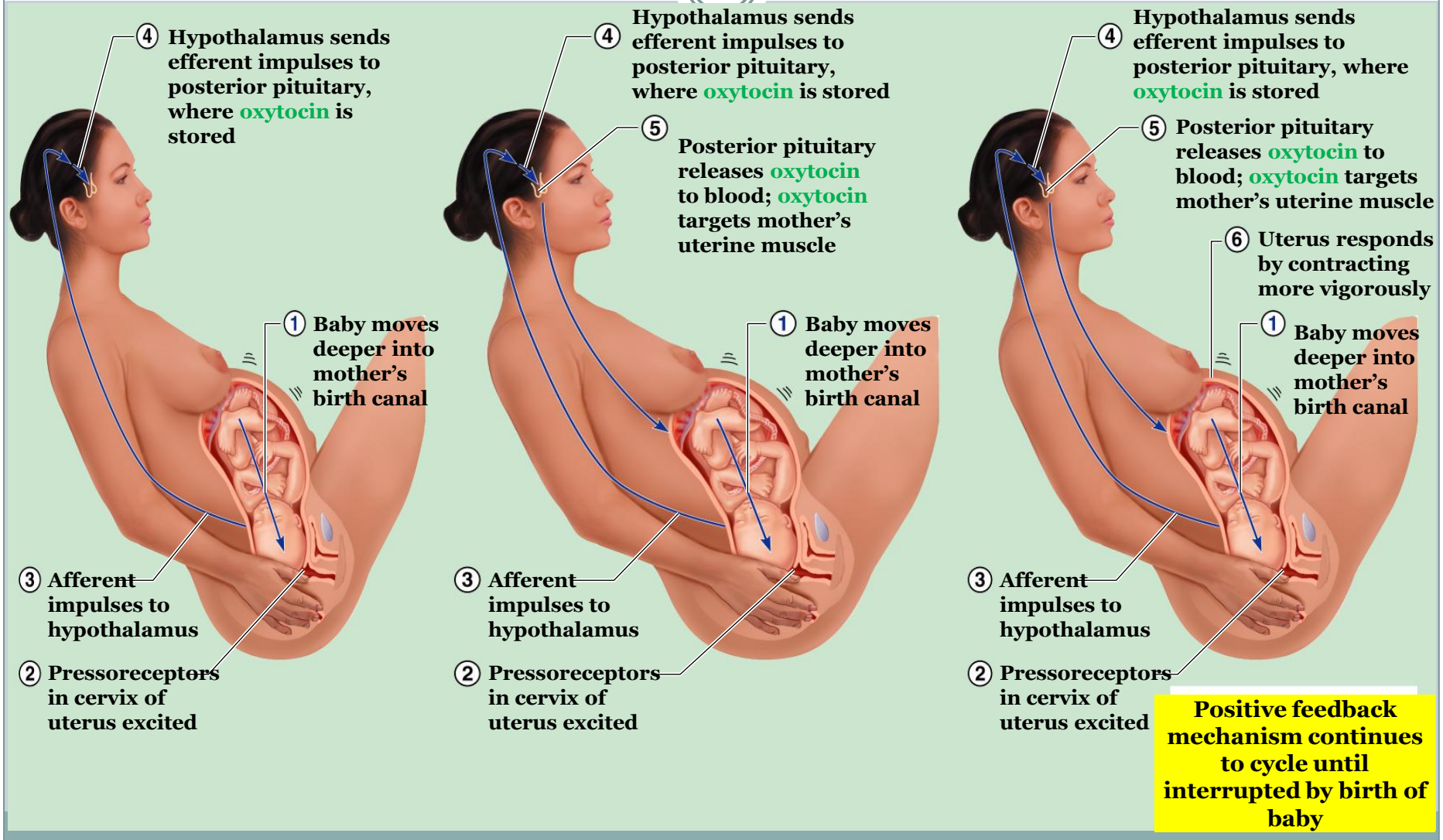
Ferguson reflex

Initiation of Labor





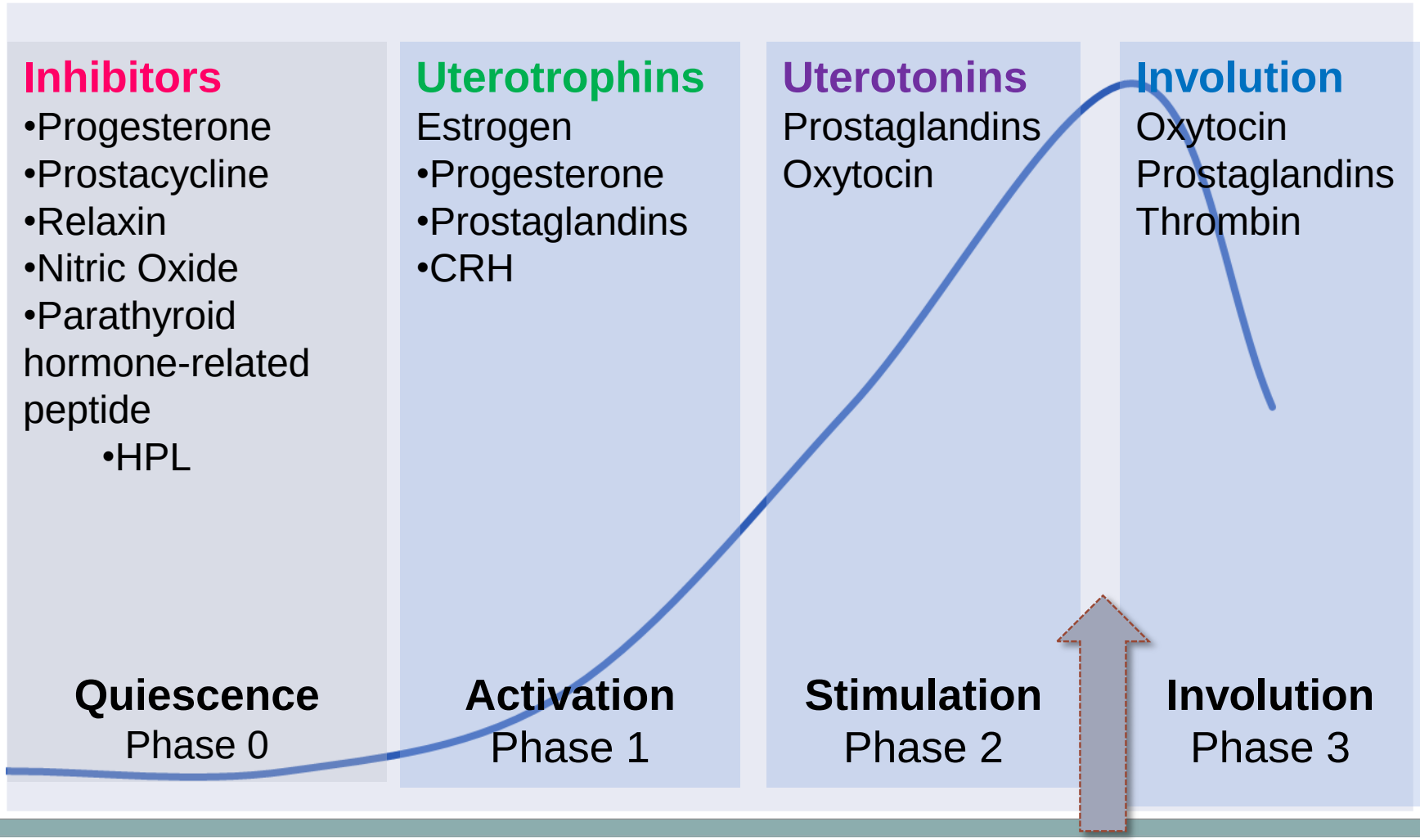
Initiation of Labor



Phases of uterine activity

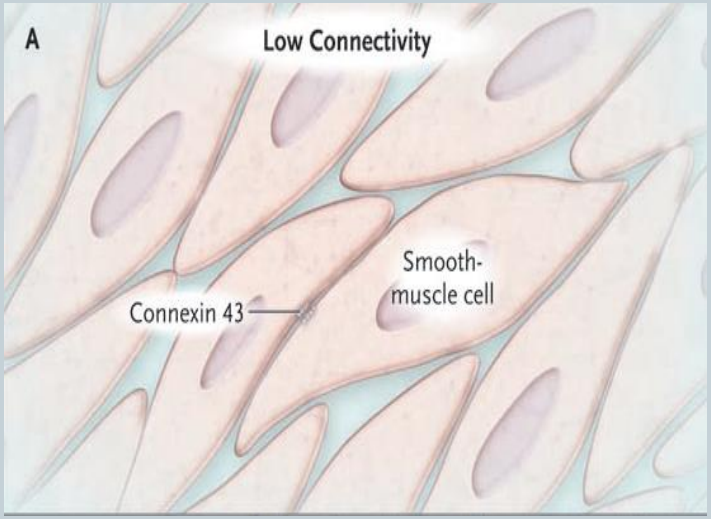
- **Phase 0**
  - Pregnancy: uterus is relaxed (quiescent)
- **Phase 1**
  - Activation
- **Phase 2**
  - Stimulation: stage 1 & stage 2
- **Phase 3 =** stage 3
  - Delivery of the placenta and uterine involution

Phases of uterine activity



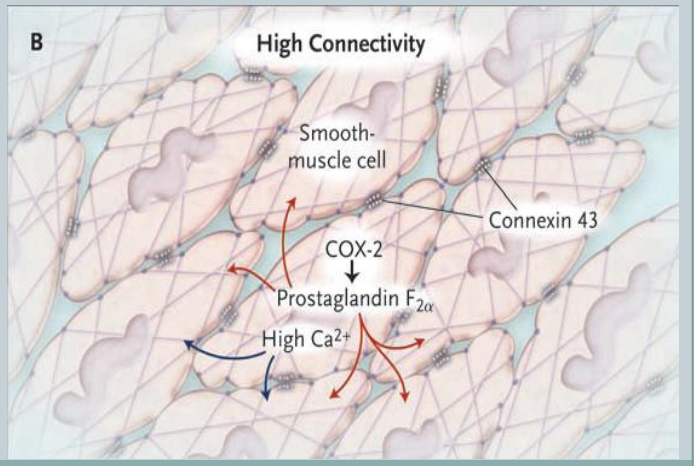
Phases of uterine activity

- **Phase 0 (pregnancy)**
  - Increase in cAMP level
  - Increase in production of
    - Prostacyclin (PGI_2) causes uterine relaxation
    - Nitric oxide (NO) causes uterine relaxation



Phases of uterine activity

- **Phase 1 (activation)**
  - Occurs in third trimester
  - Promote a switch from quiescent to active uterus
  - Increase excitability & responsiveness to stimulators by
    - Increase expression of gap junctions
    - Increase G protein-coupled receptors
      - Oxytocin receptors
      - Increase PGF receptors



Phases of uterine activity

- **Phase 2 (stimulation)**
  - Occurs in last 2-3 gestational weeks
  - Increase in synthesis of uterotonins
    - Cytokines
    - Prostaglandins
    - Oxytocin
  - Includs 2 stages:
    - Stage 1
    - Stage 2

Phases of uterine activity

- **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

Mechanism of parturition

- 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 minuets
- As labour progress: 1 contraction/ 1-3 minutes
- Abdominal wall muscles contract
- Rhythmical contractions allow blood flow

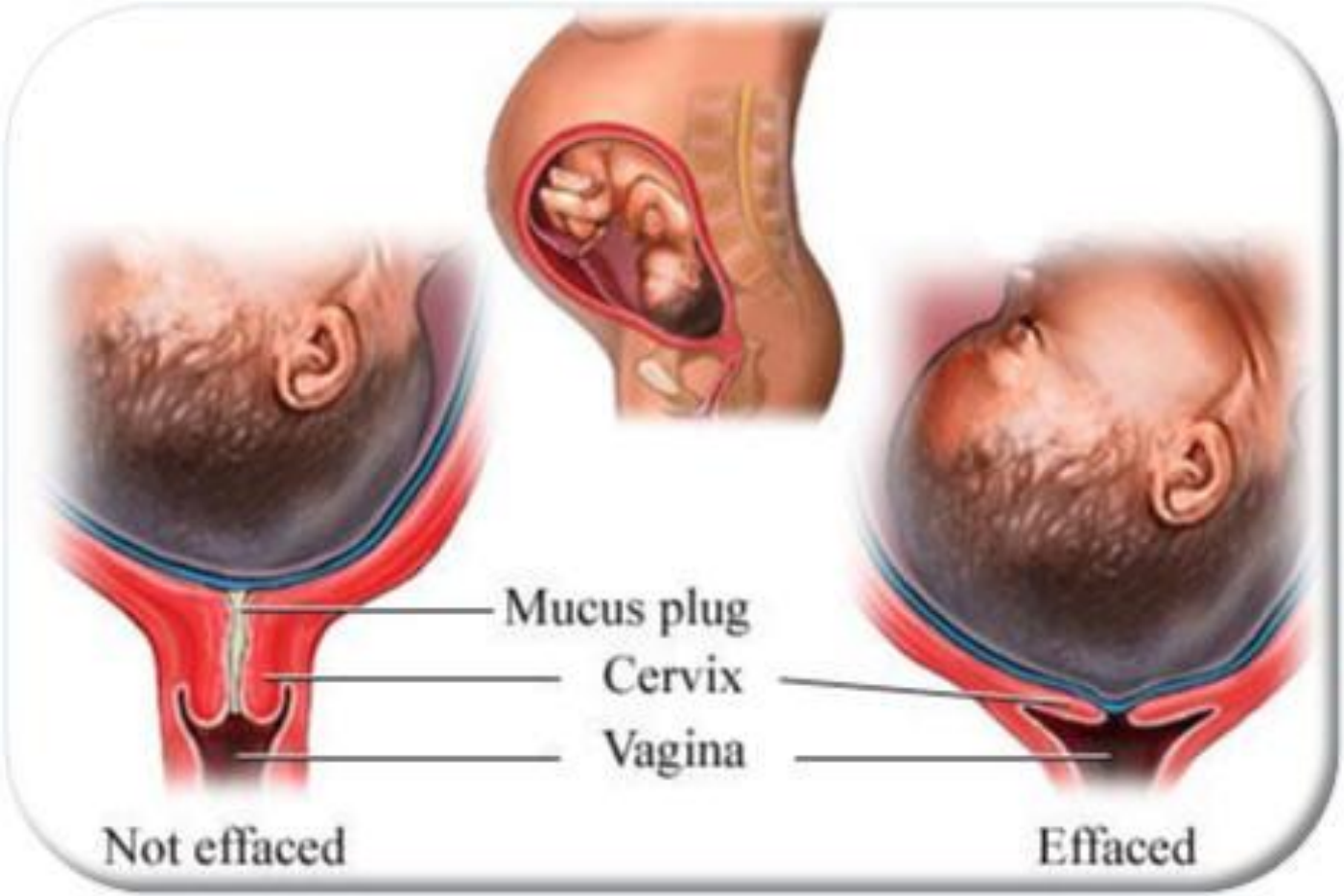
Onset of labor

- 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
  - Suddenly uterine contractions become very strong leading to:
    - Cervical effacement and dilatation

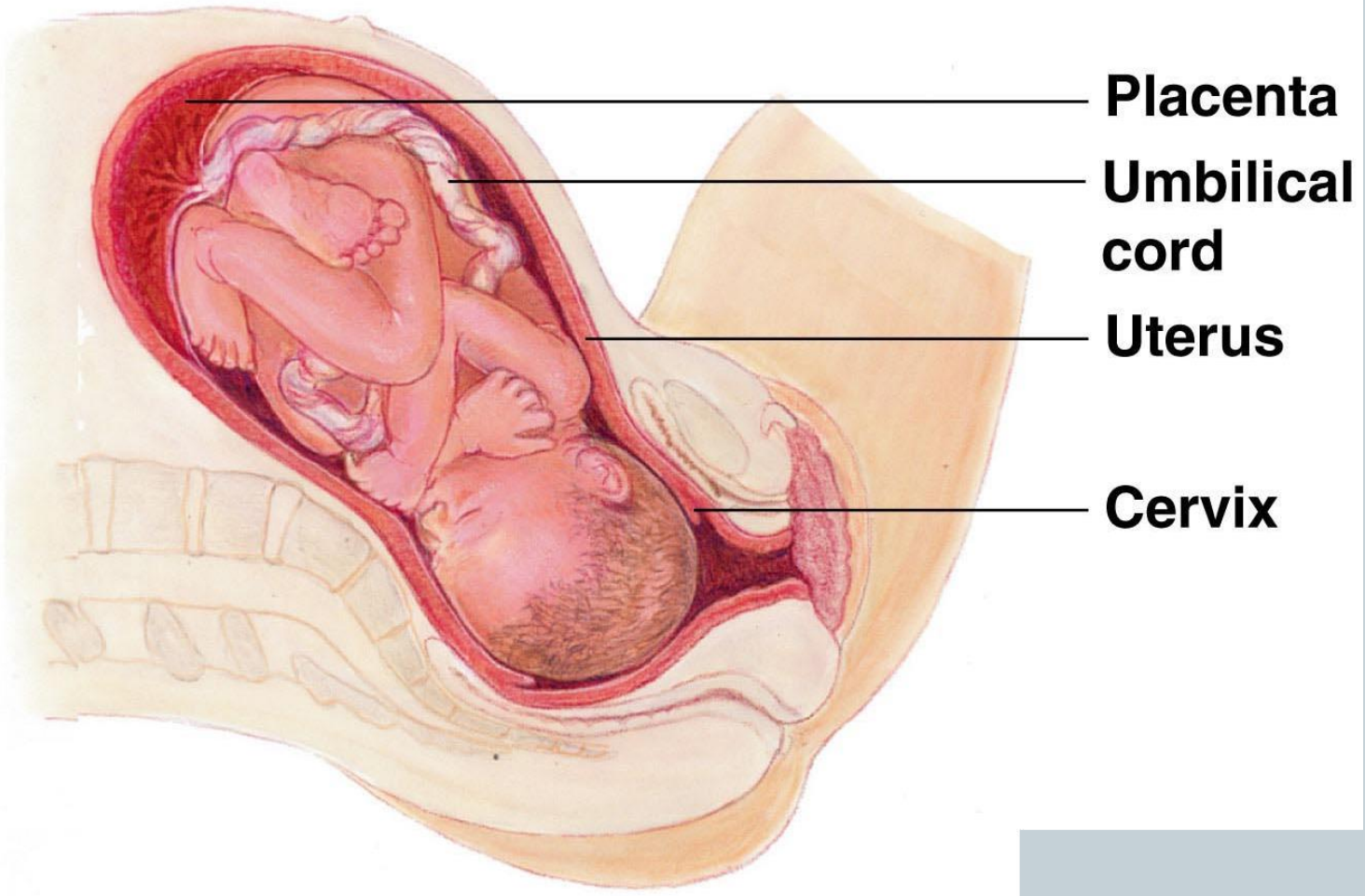
Clinical Stages of Labor

- **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



Clinical Stages of Labor

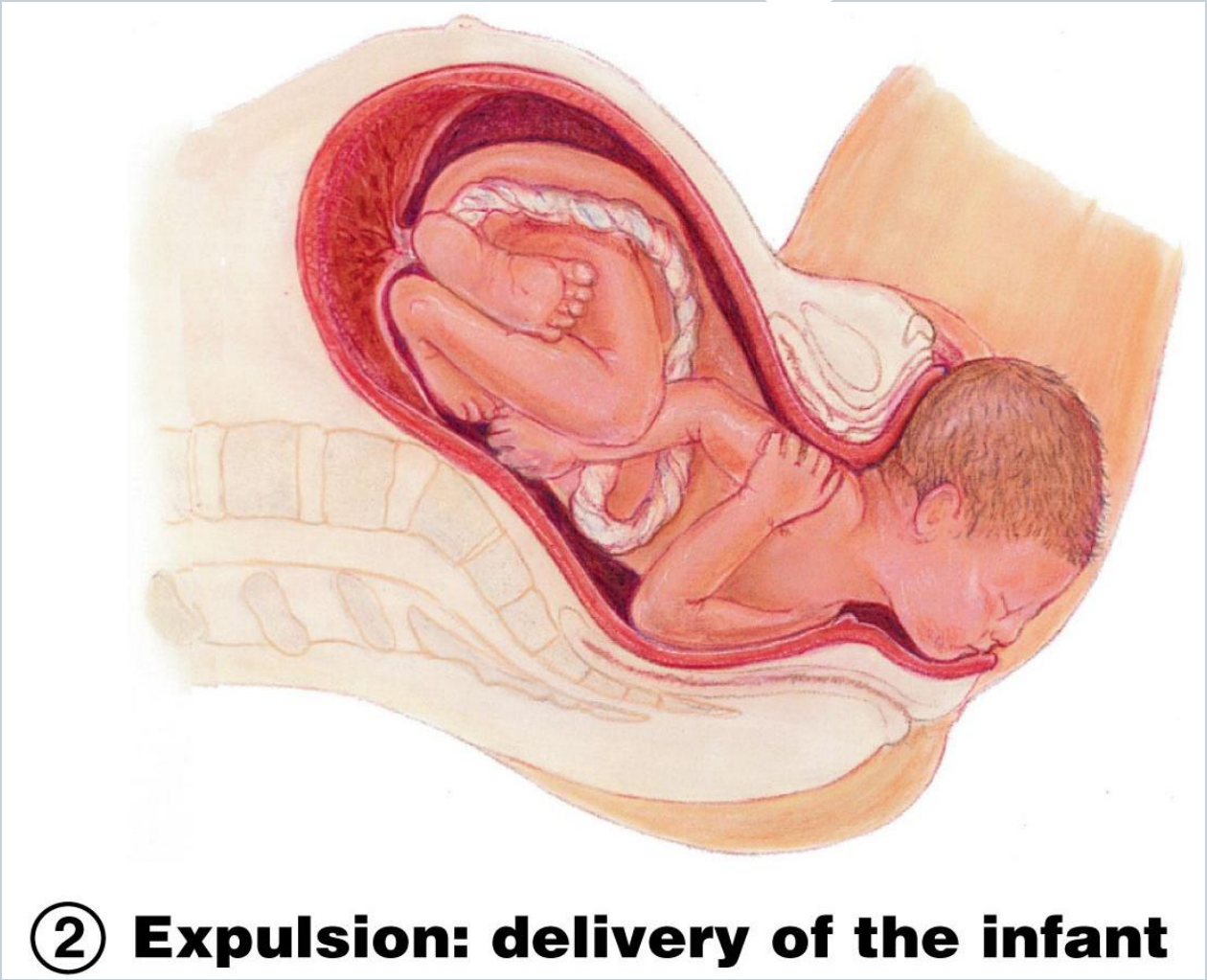


① **Dilation of the cervix**

Stages of Labor

- **Expulsion**
  - Infant passes through the cervix and vagina
  - Can lasts 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

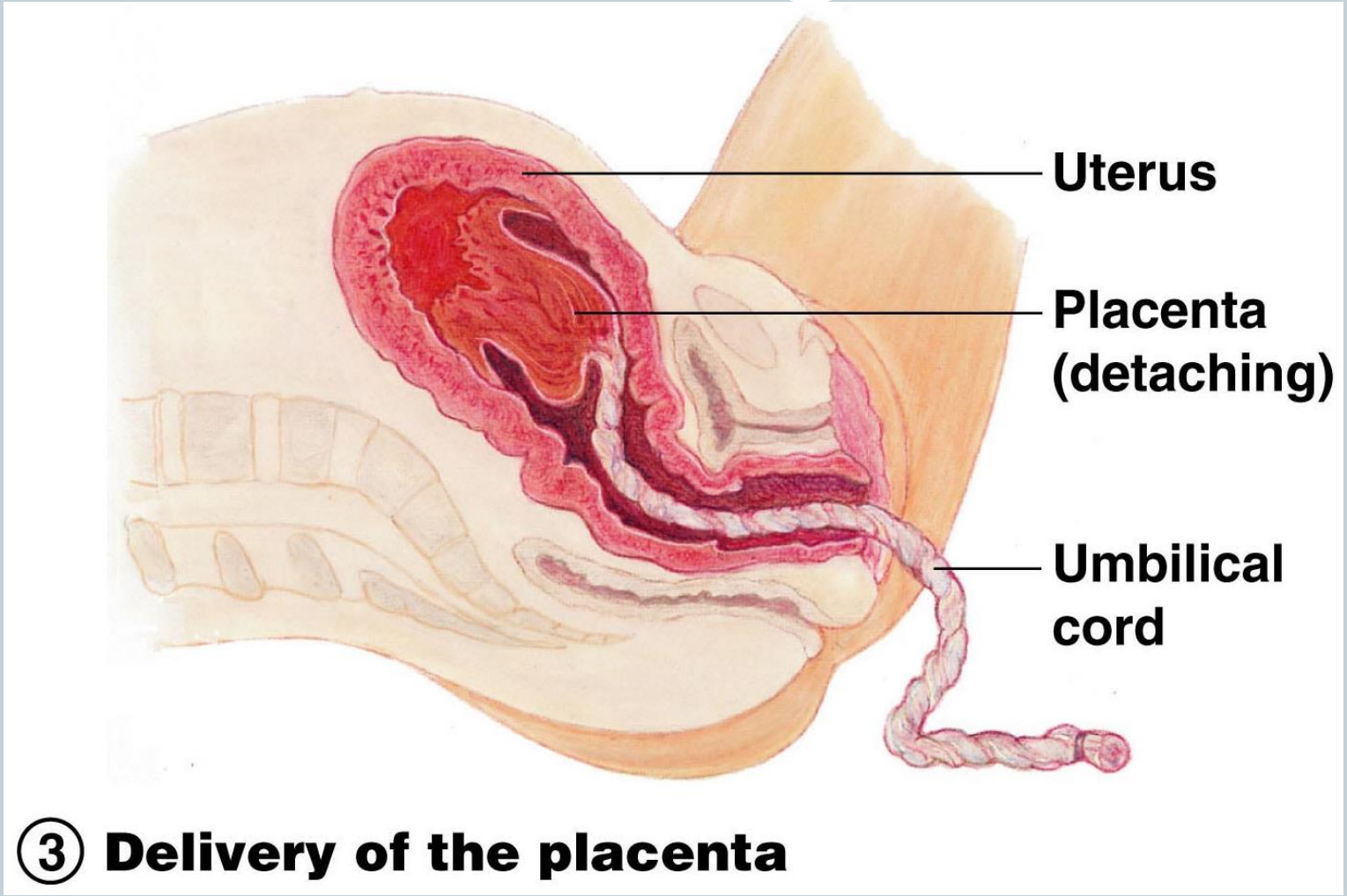


② **Expulsion: delivery of the infant**

Clinical Stages of Labor

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

Clinical Stages of Labor



New arrival

The End

Thank You