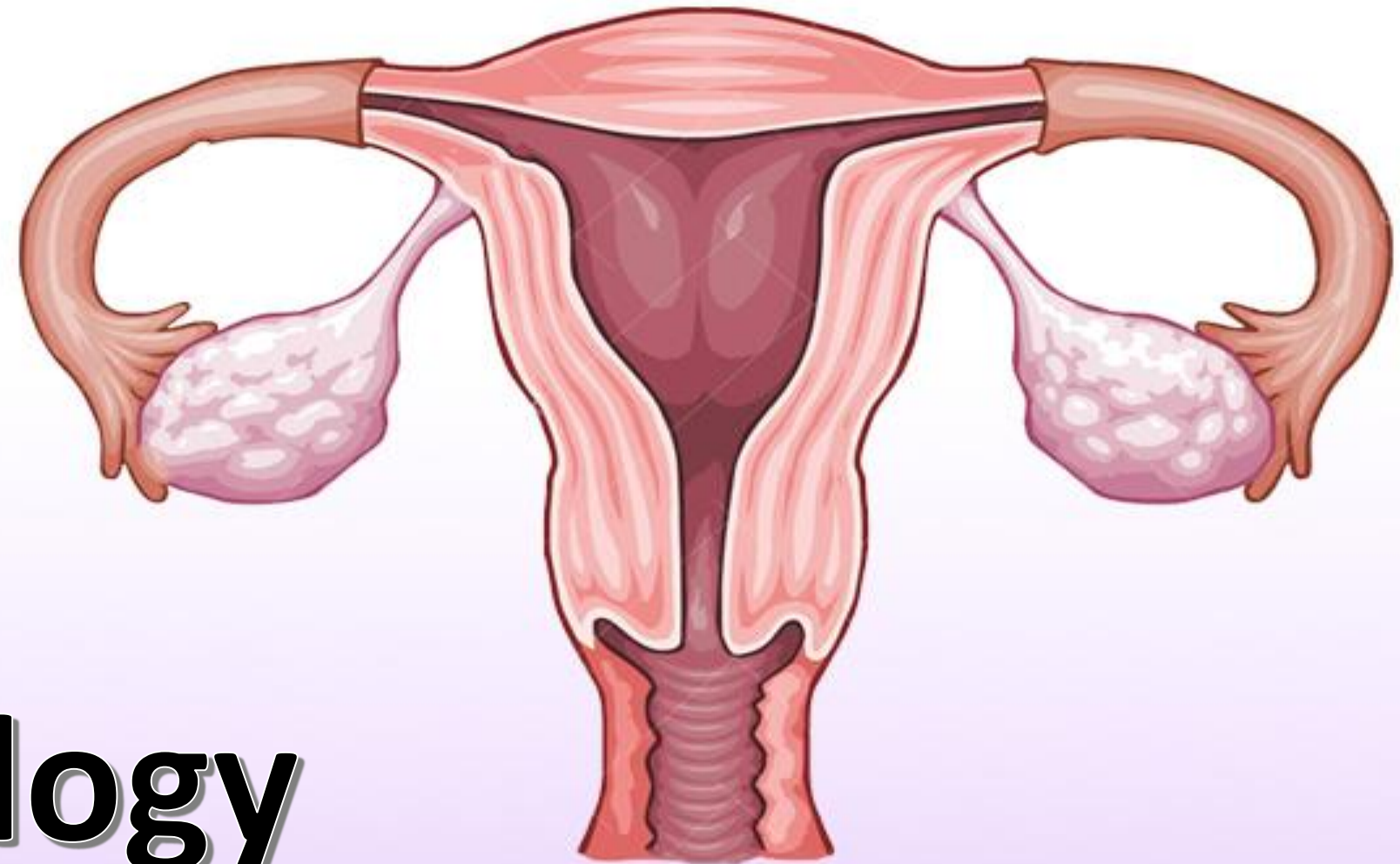




Physiology team



# L7-Physiology of Labor



## Sources:

- ✓ Male slides
- ✓ Guyton 1011-1014

# Objectives

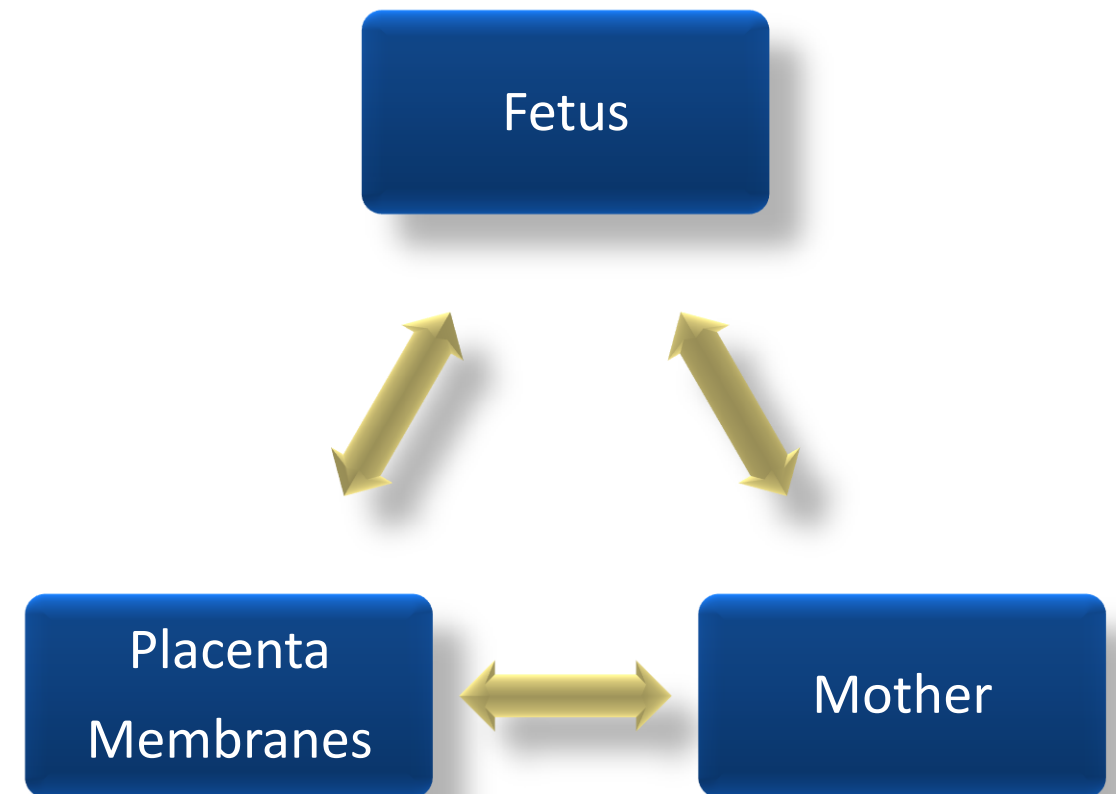
**By the end of this lecture, you should be able to:**

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

# Parturition

Normal Pregnancy	Parturition
Uterine quiescence	Coordinated uterine activity
Immature fetus	Maturation of the fetus
Closed cervix	Progressive cervical dilation

## Interactions



# Parturition

40 weeks

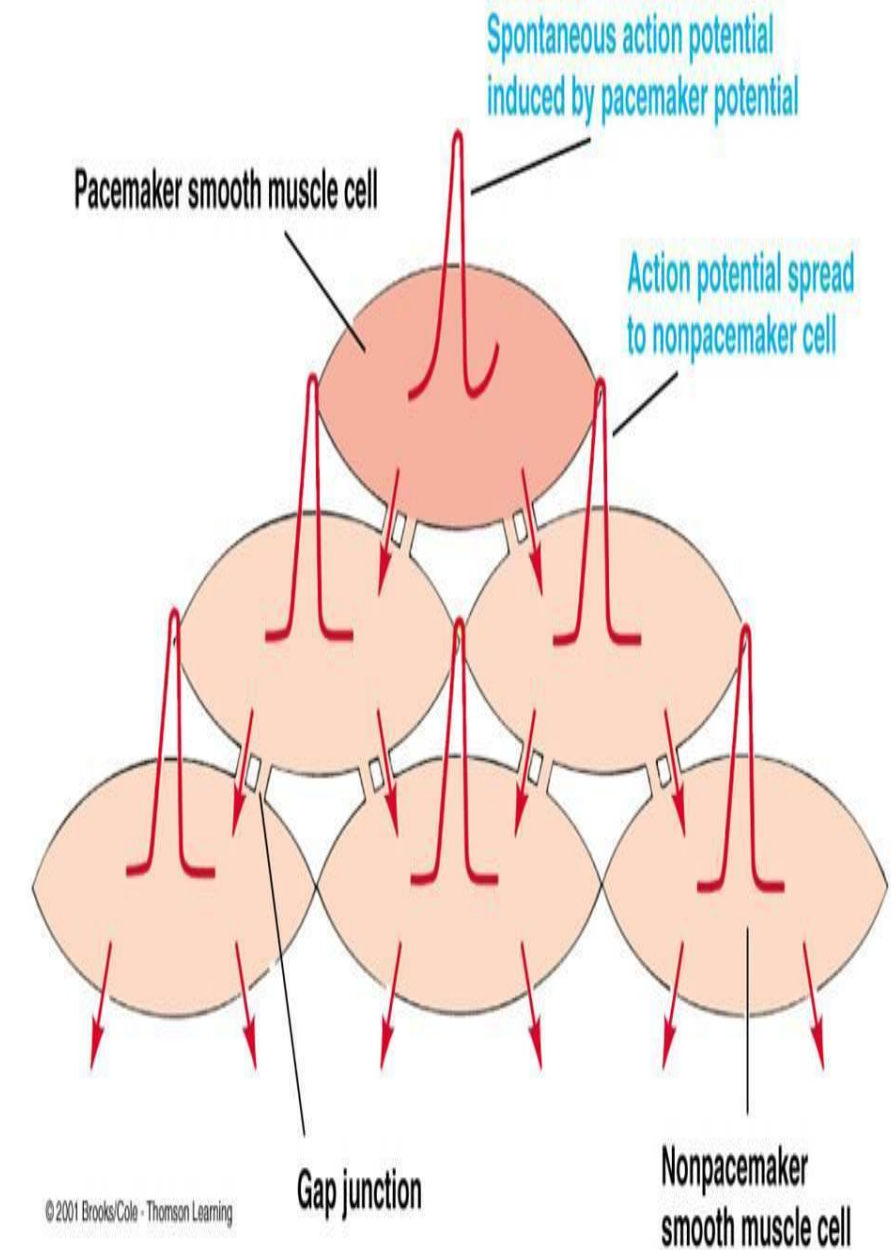
- **Definition**

- 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. (the exact cause of the increased activity of of the uterus is not known). But at least two categories of effects lead to that :
  - 1- hormonal changes .
  - 2- Mechanical changes

# Parturition

- Uterus is spontaneously active.\*
- Spontaneous depolarization of pacemaker cells.
- Gap junctions spread depolarization

\*during pregnancy and before parturition start to occur , uterus is relaxed due to mainly the effect of progesterone.



# 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 increases uterine contractions by :
  - Directly on its receptors
  - Indirectly by stimulating prostaglandin production

## 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 and Upregulation of myometrial gap junctions
  - Indirect effect:** Upregulation of oxytocin receptors

# Hormonal changes

	Progesterone	Estrogen
Uterine contractility	inhibits uterine contractility	stimulates uterine contractility
From 7 <sup>th</sup> month till term	Progesterone secretion remains constant or decreases slightly*	Estrogen secretion increases continuously*
	▼ GAP junctions	▲ GAP junctions with onset of labour.
	▼ Oxytocin receptors	▲ Oxytocin receptors.
	▼ prostaglandins	▲ Prostaglandins
	▲ resting membrane Potential (-45 _ -30) the more it decrease the more excitable it become	

\*Increase estrogen/progesterone ratio

# Mechanical changes

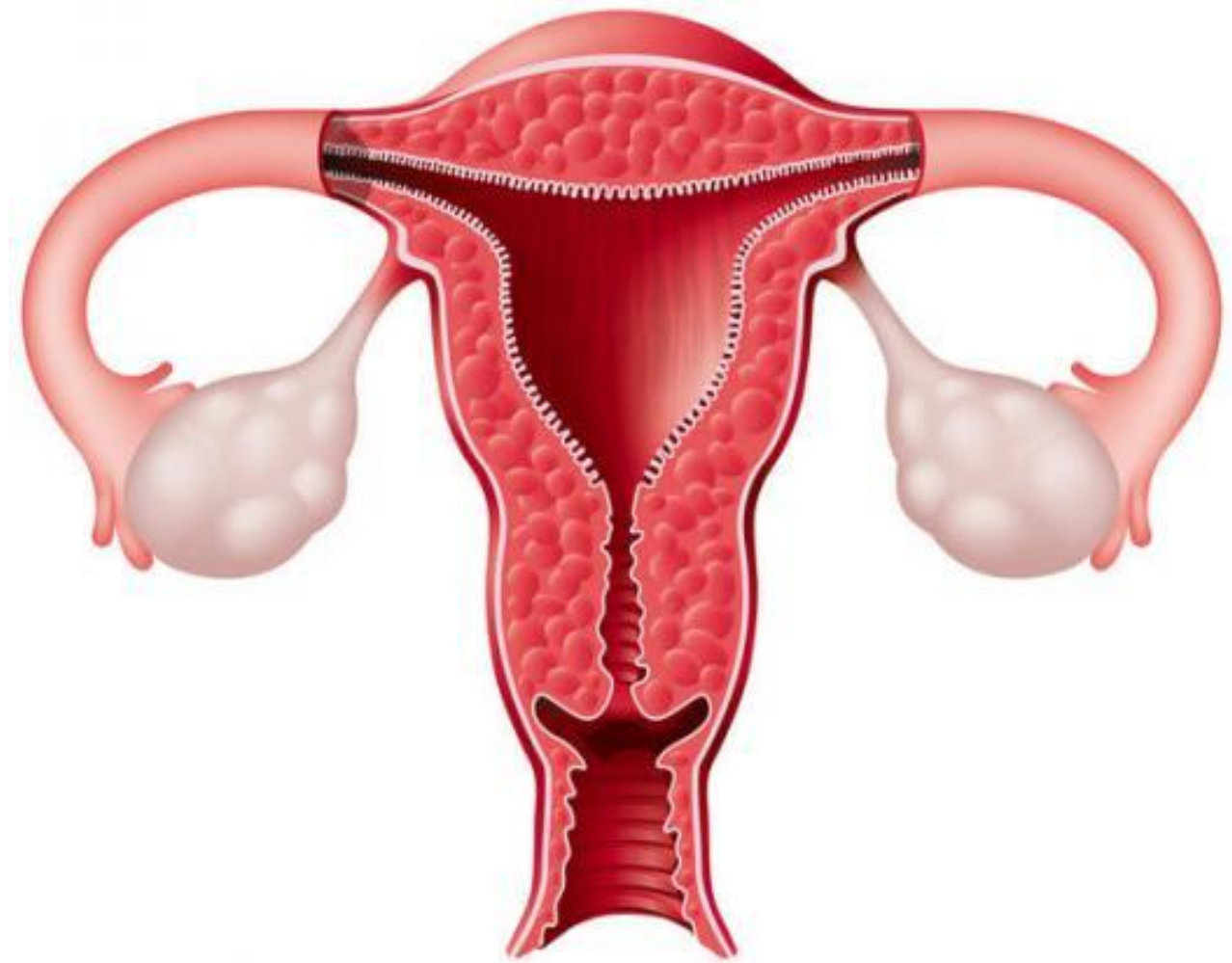
## Stretch of the uterine muscle (stretch sensitive receptors )

- Increases contractility :
  - ❖ Fetal movements
  - ❖ Multiple pregnancy

## Stretch of the cervix (collagens & smooth muscles)

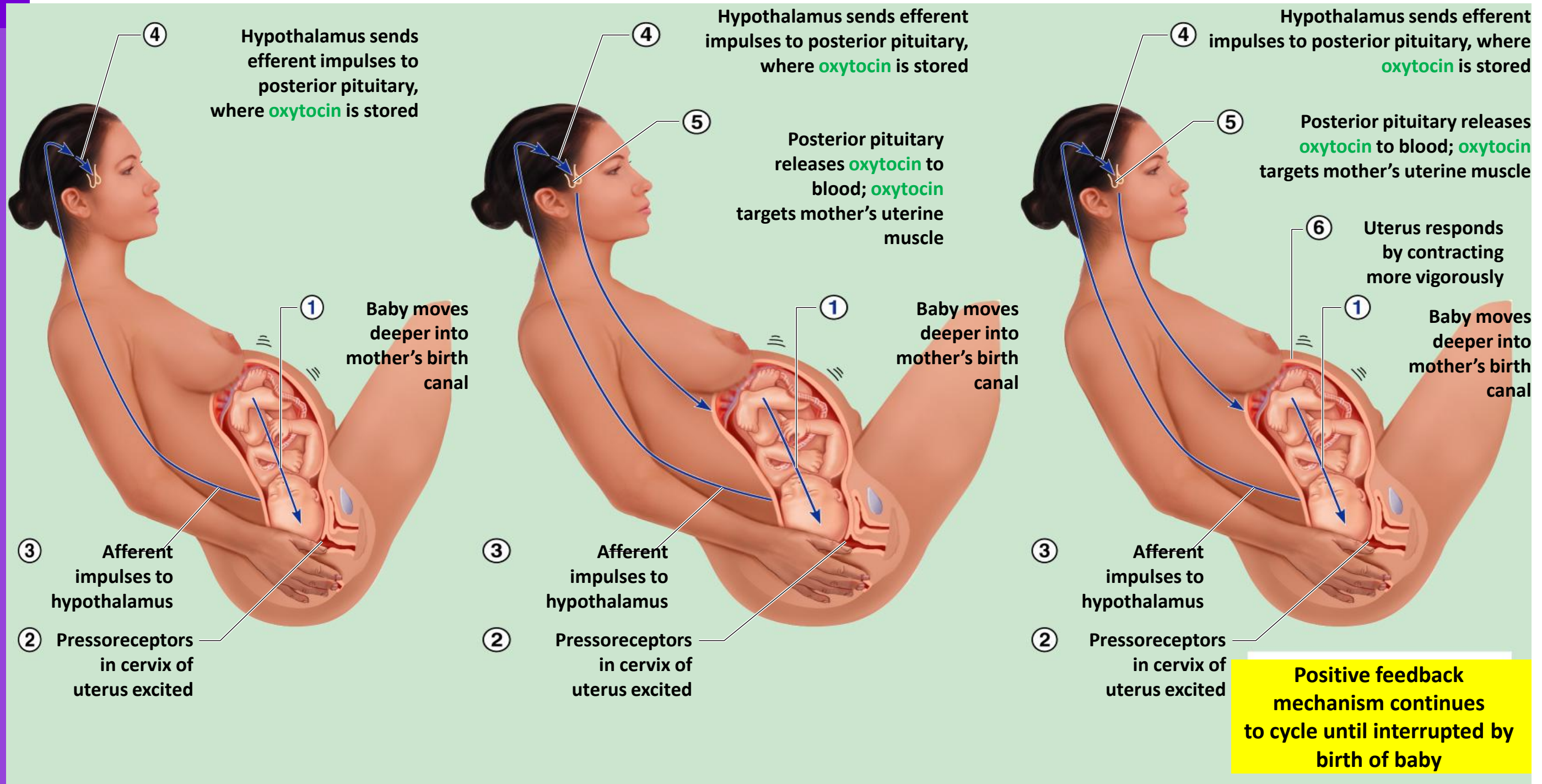
Increases contractility (reflex)  
(Positive feedback mechanism)

- Membrane sweeping & rupture
- Fetal head

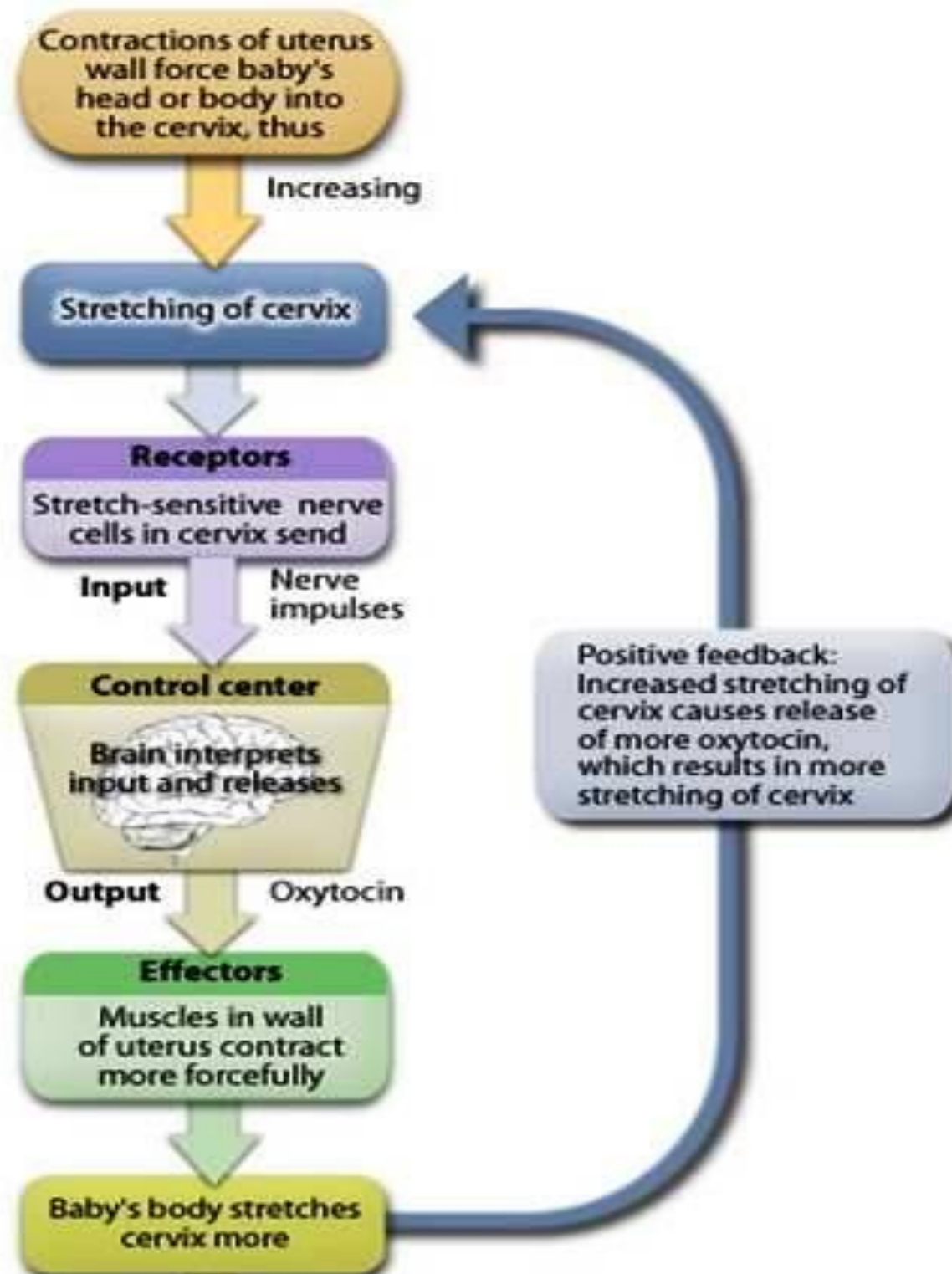




# Initiation of Labor



# Positive feedback mechanism



Ferguson reflex

# Phases of uterine activity

Phase 0 (Quiescence)	Phase 1 (Activation)	Phase 2 (Stimulation) Last 2 weeks of pregnancy	Phase 3 (involution)
<p><b>Inhibitors</b></p> <ul style="list-style-type: none"> <li>- Progesterone</li> <li>- Prostacycline</li> <li>- Relaxin</li> <li>- Nitric Oxide</li> <li>- PHrP</li> <li>- CRH</li> <li>- HPL</li> </ul>	<p><b>Uterotrophins</b></p> <ul style="list-style-type: none"> <li>- Estrogen</li> <li>- Progesterone</li> <li>-Prostaglandins</li> <li>- CRH</li> </ul>	<p><b>Uterotonins</b></p> <p>Prostaglandins</p> <ul style="list-style-type: none"> <li>- Oxytocin</li> </ul>	<p><b>Involution</b></p> <ul style="list-style-type: none"> <li>- Oxytocin</li> <li>Prostaglandins</li> <li>- Thrombin*</li> </ul> <p>( important for blood clotting )</p> <p>* Important there will be question about it</p>

Phase 0 (quiescence)	Phase 1 (activation)	Phase 2 (stimulation)
<ul style="list-style-type: none"> <li>❑ Occurs during early pregnancy</li> <li>❑ Increase in cAMP level</li> <li>❑ Increase in production of: <ul style="list-style-type: none"> <li>Prostacyclin (PGI<sub>2</sub>)</li> <li>Nitric oxide (NO)</li> <li>CRH</li> </ul> </li> </ul> <p style="color: red; text-align: center; font-weight: bold; margin-top: 20px;">All of them cause uterin relaxation .</p>	<ul style="list-style-type: none"> <li>❑ Occurs in third trimester</li> <li>❑ Promotes a switch from quiescent to active uterus</li> <li>❑ Increase excitability &amp; responsiveness to stimulators by : <ul style="list-style-type: none"> <li>➤ Increasing expression of gap junctions . <ul style="list-style-type: none"> <li>➤ Increasing G protein-coupled receptors : <ul style="list-style-type: none"> <li>✓ Oxytocin receptors</li> <li>✓ PG receptors</li> </ul> </li> </ul> </li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>❑ Occurs in the last 2-3 gestational weeks</li> <li>❑ Increase in synthesis of uterotonins : <ul style="list-style-type: none"> <li>Oxytocin</li> <li>Prostaglandins</li> <li>Cytokines</li> </ul> </li> </ul> <p style="color: red; text-align: center; font-weight: bold; margin-top: 20px;">All of them cause uterine contaction</p>
<div style="background-color: #4a7ebb; color: white; padding: 10px; text-align: center; font-weight: bold; font-size: 1.2em;">Phase 3 (involution)</div>	<ul style="list-style-type: none"> <li>❑ Pulsatile release of oxytocin</li> <li>❑ Delivery of the placenta</li> <li>❑ Involution of the uterus:</li> </ul>	<ul style="list-style-type: none"> <li>➤ Occurs in 4-5 weeks after delivery</li> <li>➤ Lactation helps in complete involution</li> </ul>

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

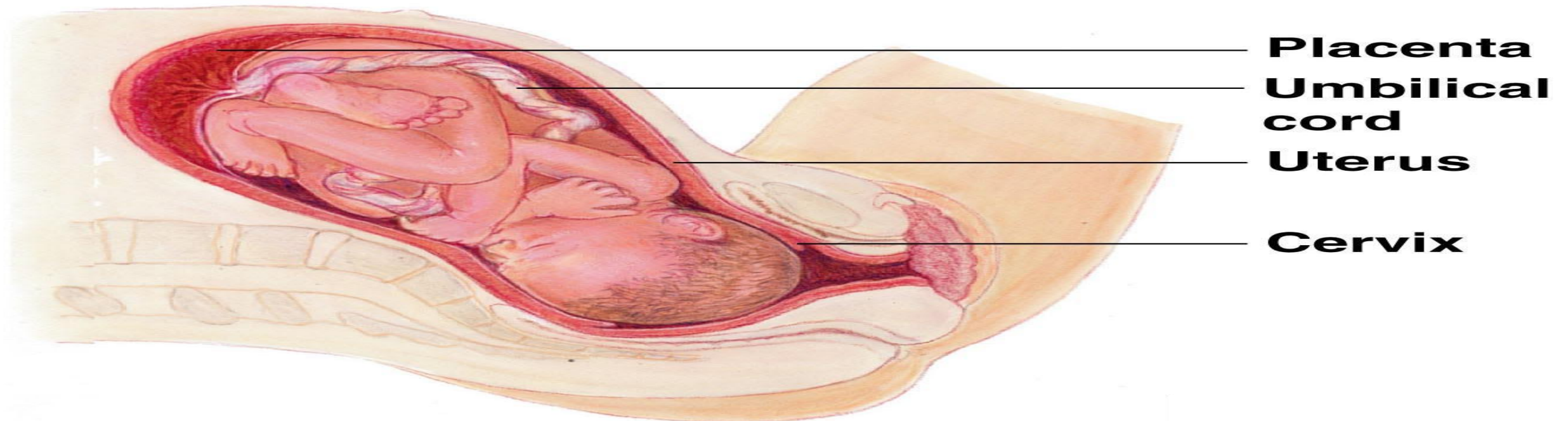
## Onset of labor

- ❑ During pregnancy
  - Periodic episodes of weak and slow rhythmical uterine contractions (Braxton Hicks) 2<sup>nd</sup> 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

## 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

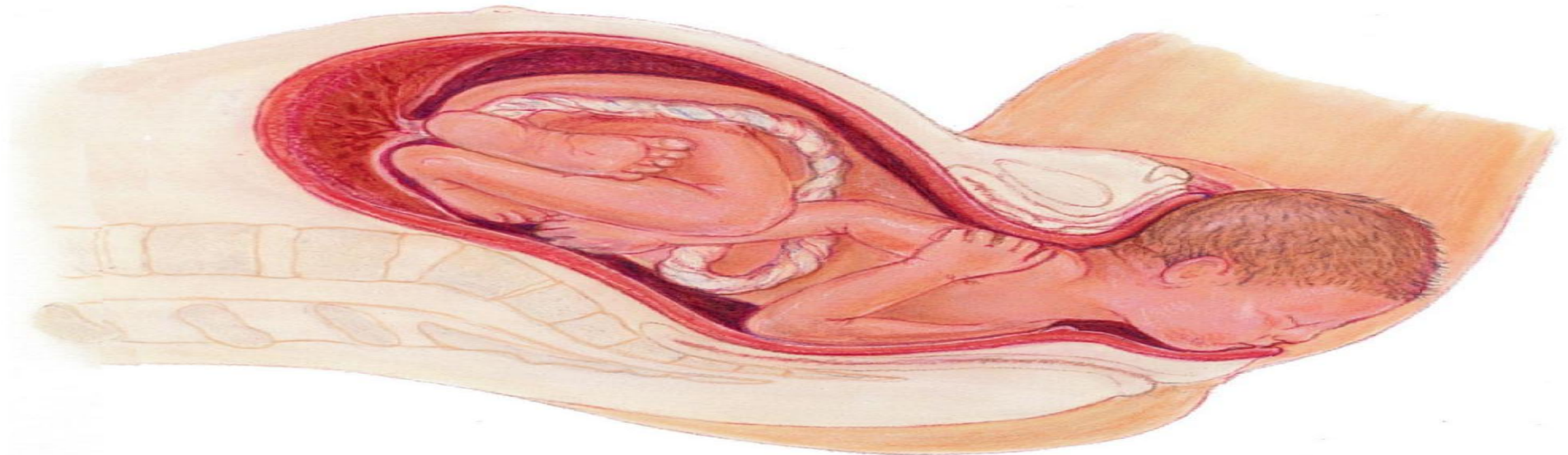


① **Dilation of the cervix**

# 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

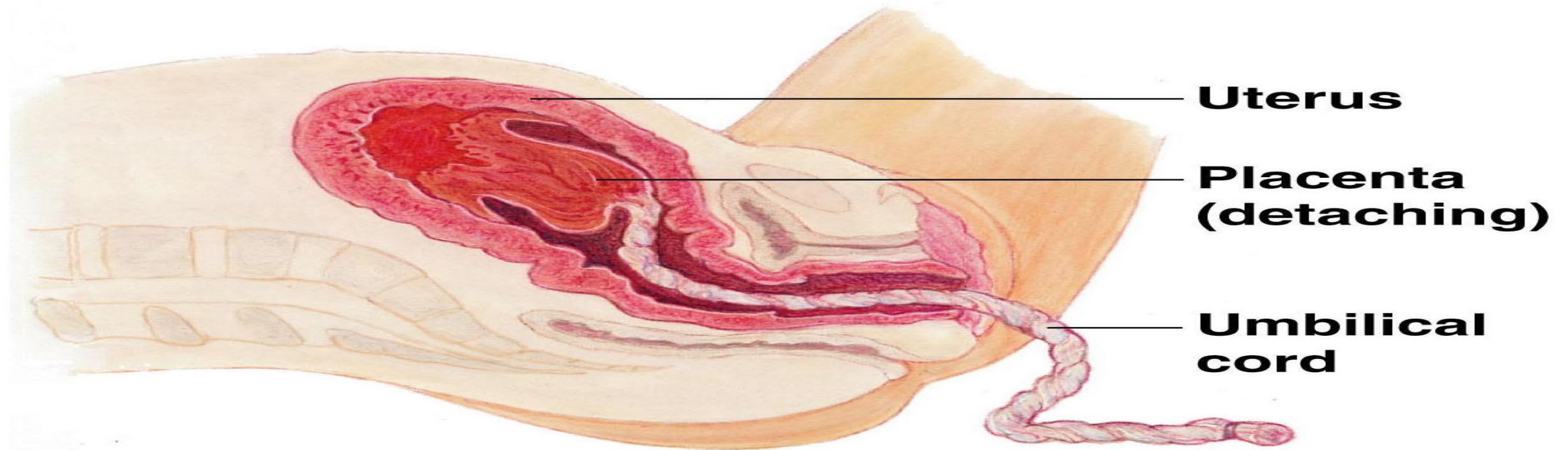


② **Expulsion: delivery of the infant**

# 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 fetal membranes are delivered
- All placental fragments should be removed to avoid postpartum bleeding



### ③ Delivery of the placenta



# summary

## Parturition

- Throughout pregnancy, progesterone increases the threshold for uterine contraction.
- Near term, the estrogen/progesterone ratio increases, which makes the uterus more sensitive to contractile stimuli.
- The **initiating event in parturition is unknown**. (Although oxytocin is a powerful stimulant of uterine contractions, blood levels of oxytocin do not change before labor.)

# MCQs

Q1\ which of the followings is uterine relaxants ?

- A) Prostaglandin
- B) Estrogen
- C) Progesterone
- D) Oxytocin

Q2\which of the followings is wrong about estrogen during labor?

- A) Increase estrogen/progesterone ratio
- B) increase GAP junctions with onset of labour
- C) decrease prostaglandins
- D) increase Oxytocin receptors

Q3\during labor , stretch of the cervix (positive feedback ) will lead to secretion of which of the following hormones ?

- A )oxytocin
- B) GNRH
- C) estrogen.
- D) relaxin.

Q4\which of the followings is an Uterotonins that increase during stimulation phase ?

- A) estrogen
- B) prostaglandins.
- C )progesterone.
- D) CRH

Q5\in which clinical stage of labor , cervix will be dilated?

- A) expulstion stage.
- B) dilation stage .
- C) placental stage.

1- C    2- C    3- A    4- B    5- B



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