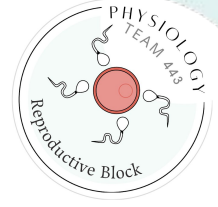


Physiology of Labor

Reproductive physiology



Objectives



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.



[Click here](#) for the team channel!



**This Lecture was presented by:
PROF.MOHAMMED Mansour & Dr.Hana Alzamil.**



[Editing File](#)



-مازاحم القرآن شيئاً إلا باركه-

اضغط هنا لتسمع تلاوة للشيخ بدر التركي -من المسجد الحرام-
خمس دقائق من وقتك فقط!

Parturition / Labor

Definition:

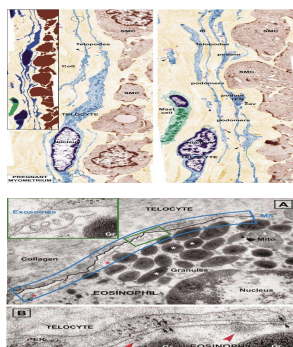
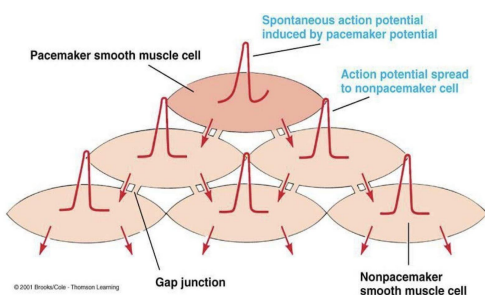
Labor/Parturition: Uterine contractions that lead to expulsion of the **fetoplacental unit/ fetus** to the extrauterine environment.

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

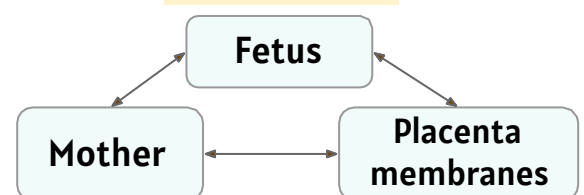
Does the non-pregnant uterus contract??? **Yes, during menstrual cycle (cramps). Also during sexual intercourse helping sperm suction and transport (previous lecture)**

- Uterus is spontaneously active.
- Spontaneous depolarization of pacemaker cells (telocytes⁽¹⁾).
- GAP junctions spread depolarization⁽²⁾.
- Exact trigger of labor is unknown.
- Why pacemaker is a pacemaker? because of spontaneous activation. How? through background current. what stimulates pacemaker? 1-hormonal changes 2-mechanical changes.

Normal Pregnancy:	Male slides	During Labor:
Uterine quiescence		Coordinated uterine activity
Immature fetus		Maturation of the fetus
Closed cervix		Progressive cervical dilation



Telocytes Interactions



Interactions between fetus, mother, and placental membranes will induce labor (437 team)

-ايشن الشيء الي بيبدأ ال labor ؟
 مافيش حاقة كذا!!!

-It's multifactorial including hormonal & mechanical changes.

Parturition / Labor

During labor two types of changes occur:



HORMONAL Changes

Estrogen

Progesterone

Oxytocin

Prostaglandin



MECHANICAL Changes

Stretch of uterine muscle

Stretch of cervix

Generally, estrogen increases contraction & progesterone decreases contraction.

I- Hormonal Changes

SAQ

Progesterone

Inhibit uterine contractility

↓ GAP junctions

↓ Oxytocin receptors

↓ Prostaglandins **F**

↑ Negativity of the resting membrane potential

Estrogen

Stimulate uterine contractility

↑ GAP junctions

↑ Oxytocin receptors

↑ Prostaglandins **F**

-Does estrogen itself contracts the uterus?
 No, it facilitates the contraction, How? Via
 1-increasing oxytocin receptor. 2-increasing prostaglandin.
 - اذا oxytocin & progesterone همارأس حربة هم الي يدخلون الاقوال.

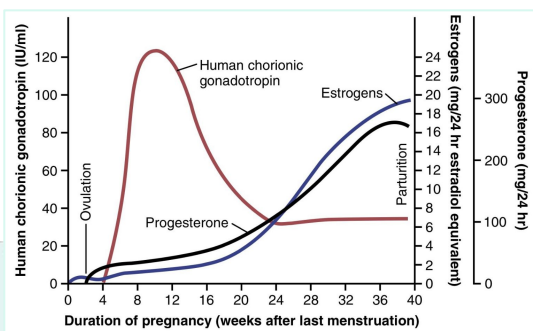
From the 7th month till term

SAQ

Secretion remains constant or decreases slightly

Secretion increases continuously

Estrogen/Progesterone ratio increases sufficiently towards the end of pregnancy to be at least partly responsible for the increased contractility of the uterus



toward the end of pregnancy, the daily production of placental estrogens increases to about 30 times the mother's normal level of production. However, secretion of estrogens by the placenta is quite different from secretion by the ovaries. Most important, the estrogens secreted by the placenta are not synthesized de novo from basic substrates in the placenta. Instead, they are formed almost entirely from androgenic steroid compounds, dehydroepiandrosterone and 16-hydroxydehydroepiandrosterone, which are formed in the mother's adrenal glands and in the fetus's adrenal glands. these weak androgens are transported by the blood to the placenta and converted by the trophoblast cells into estradiol, estrone, and estriol. the cortices of the fetal adrenal glands are extremely large, and about 80% consists of a so-called fetal zone,

Parturition / Labour

I- Hormonal Changes cont...

Oxytocin
(increases uterine contractions
most important one)

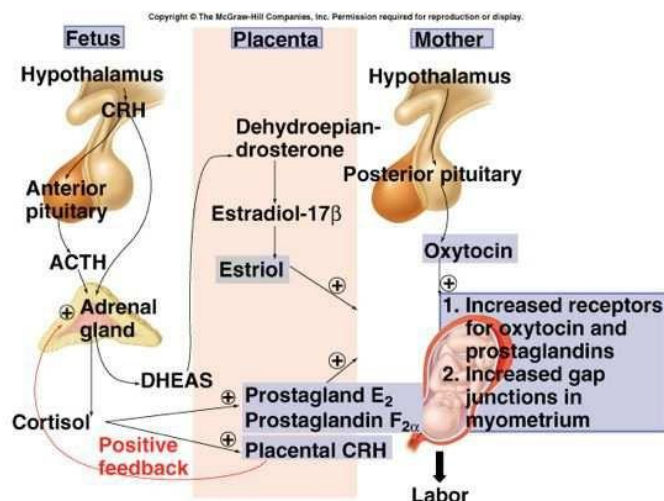
Prostaglandins
(increases cervical dilation and
effacement)

Dramatic ↑ of oxytocin receptors
(200) folds

- Gradual transition from passive released to active excitatory muscle (↑ responsiveness).
- Increase in oxytocin secretion at labor by **posterior pituitary gland**.
- Oxytocin increases uterine contraction by:
 1. **Directly** on its receptors.
 2. **Indirectly** by stimulating prostaglandin (**PGF_{2α}**) production.

-The highest amount immediately before labor.
-if you want to give it as a drug you need to check if the cervix is dilated enough or not ,unless it can cause rupture and eventually both fetus and mother die.

- Central role in initiation and progression of human labor (**Not only initiation**).
- Locally produced (intrauterine), **paracrine**.
- Oxytocin and cytokines stimulate its production.
- Prostaglandin stimulate uterine contractions by:
 1. **Direct effect:**
 - 1 Through their own receptors.
 - 2 Upregulation of myometrial GAP junctions (**Similar to estrogen**).
 2. **Indirect effect:**
 - Upregulation of oxytocin receptors.



***In 7th month :**
1) fetal adrenal (hormonal)
2) Size & stretch (mechanical)
-facilitate the labor process.

2- Mechanical Changes

Stretch of the uterine muscle	Stretch of the cervix
<ul style="list-style-type: none"> ● Increase in contractility <p>Examples of mechanical stretch eliciting uterine contractions:</p> <ul style="list-style-type: none"> - Fetal movements. Because it will stretch the uterus and lead to contractions. So, if a woman is pregnant with twins or more we give her progesterone to stably her pregnancy and prevent early contractions. - Multiple pregnancy/size of uterus (Twins, triplets) 	<ul style="list-style-type: none"> ● Stretch of the cervix → Increase contractility (reflex) (Positive feedback mechanism) <p>Examples of mechanical changes stretching or irritating the uterine cervix:</p> <ul style="list-style-type: none"> - Membrane sweeping and rupture - Fetal head. (the head of the baby stretches the cervix more forcefully than usual or irritates it in other ways).

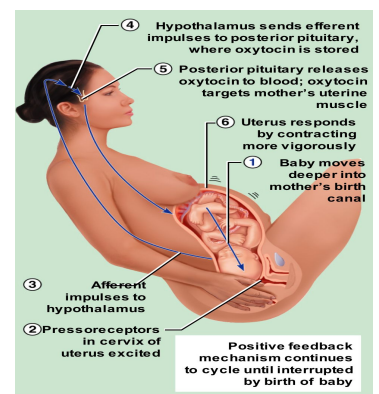
The onset of labor

During Pregnancy:

periodic episodes of weak and slow rhythmic 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 to cervical stretching and force the baby through the birth canal.
- **Cervical effacement and dilatation.**



Labor contractions obey all the principles of Positive Feedback:

1. **Stretching of the cervix causes the entire body of the uterus to contract.**
(Nervous feedback)
2. **Stretching of the cervix also causes pituitary gland to secrete oxytocin.**
(Hormonal feedback)

When the fetus reaches maturity, its hypothalamus will start releasing CRH in high level which will stimulate the anterior pituitary to release ACTH that acts on the cortex of the adrenal gland which will release DHEAS and cortisol. DHEAS will be taken up by the placenta and converted to estriol (estrogen). Cortisol will also be taken up by the placenta and it will stimulate PGs production and placental CRH production, CRH will go back to the fetal blood to stimulate release cortisol (positive feedback). The mother's hypothalamus will release oxytocin from the posterior pituitary (the posterior pituitary becomes bigger and steals the supply from anterior pituitary, if a pregnant women loses blood during childbirth she is at a risk of ischemia to AP "Sheehan syndrome") . The end result: Increased oxytocin and PGs receptors. Increased gap junctions. When the duration of pregnancy exceeds 40 weeks, membrane sweeping is done. Membrane sweeping is a procedure in which the membrane is separated from the uterine wall to induce PGs release and contraction of the uterus, MED442

Mechanism of Labor/ Parturition

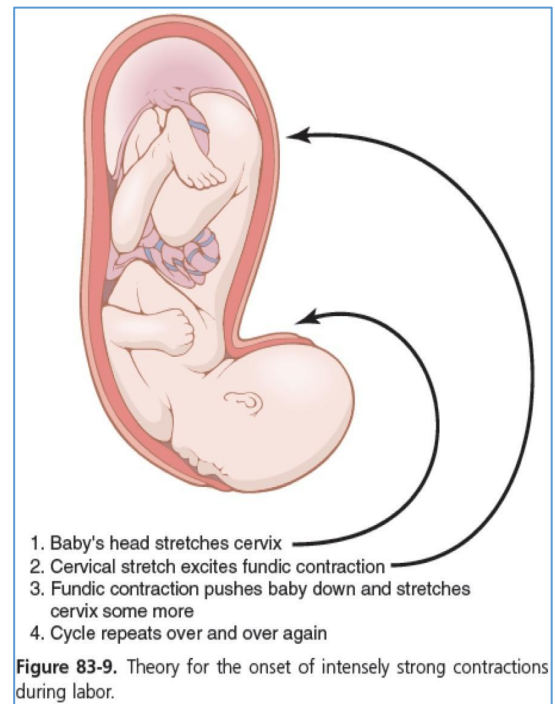
Contractions start at the fundus and spread to the lower segment

The intensity of contractions is strong at the fundus but weak at the lower segment

In early stages:
1 contraction/ 30 minutes.
As labor progresses:
1 contraction/ 1-3 minutes.

Abdominal wall muscles contract

Rhythmical contractions allow blood flow



Phases of parturition

Phase zero (Pregnancy) / (quiescence)

Occurs during **early pregnancy**. The uterus is relaxed (quiescent).

Increase in cAMP level.

It has been hypothesized that the higher progesterone levels increase in production of:- Prostacyclin (PGI₂), Nitric oxide (NO), and Parathyroid hormone-related protein (PTHrP) which can all cause uterine relaxation.

Phase one (Activation)

Occurs in **third trimester**.

Promote a switch from quiescent to active uterus.

Increase excitability & responsiveness to stimulation by:-

Increasing expression of gap junctions.

Increasing G protein-coupled receptors & ion channels (Oxytocin receptors & PGF2 alpha receptors).

Phase two (Stimulation)

Occurs in the **last 2-3 gestational weeks**.

Increase in synthesis of uterotonins (cytokines, prostaglandins and oxytocin).

Includes 2 stages:-

Stage one.

Stage two.

Phase three (Uterine involution)

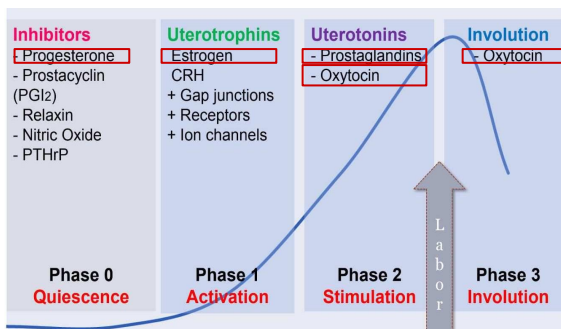
Occurs **4-5 weeks after delivery**.

Pulsatile release of oxytocin.

Delivery of the placenta and involution of the uterus.

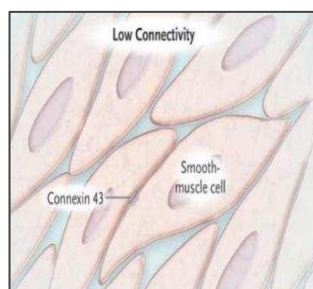
Lactation helps in complete involution.

Includes stage 3.



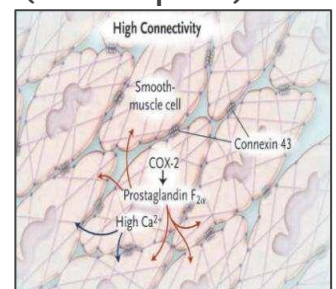
-what highlighted in red (mentioned by doctor).
 -tone = strong (for contraction),
 -trophin= to prepare.

Phase0: Quiescence



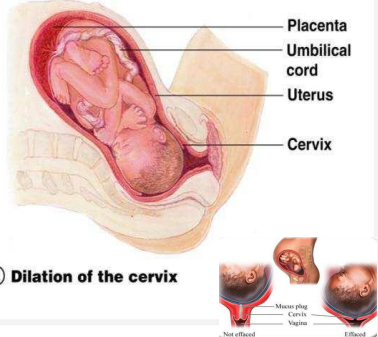
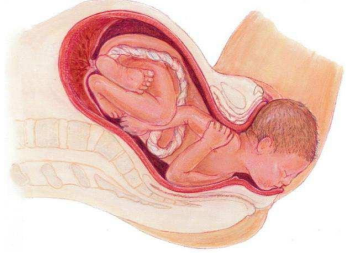
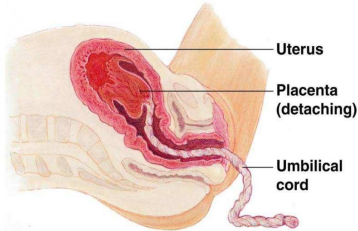
Phase3 (Involution)

Phase1: (Uterotrophins)



Phase2 (Uterotonins)

Stages of Labor SAQ

STAGES	DURATION	NOTES	Picture
<p>Stage 1 (Cervical Dilation)</p>	<p>6-12 hours. 6-20 hours (primipara), 6-14 hours (multipara) It's the longest stage of labor.</p>	<p>Cervix becomes dilated, full dilation is 10 cm. Uterine contractions begin and increase. Cervix softens and effaces (thins) The amnion ruptures "breaking the water".</p>	 <p>① Dilation of the cervix</p>
<p>Stages 2 (Expulsion/ Descent of Fetus)</p>	<p>can last as long as 2 hours in a multipara and 3 hours in a primipara, but typically is 50 minutes in the first birth and 20 minutes in subsequent births.</p>	<p>Begins with complete cervical dilation and ends with delivery of the fetus. It includes: The passive phase (passive descent of the fetal head) The active phase (expulsive phase, bearing down or pushing by the mother) Infant passes through the cervix and vagina. Normal delivery is head first (vertex position). Breech presentation is buttocks-first.</p>	 <p>② Expulsion: delivery of the infant</p>
<p>Stage 3 (Delivery of Placenta stage)</p>	<p>usually accomplished within 15-30 minutes after birth of infant</p>	<p>expulsion of the placenta. Afterbirth—placenta attached to the fetal membranes are delivered. All placental fragments should be removed to avoid postpartum bleeding.</p>	 <p>③ Delivery of the placenta</p>

Giving prostaglandin E2 (PGE2) to a pregnant woman may result in an abortion. What is the best explanation for this finding?

PGE2 strongly stimulates uterine contraction	PGE2 causes constriction of the arteries leading to the placenta	PGE2 stimulates the release of oxytocin from the posterior pituitary	PGE2 increases the secretion of progesterone from the corpus luteum
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During pregnancy, the uterine smooth muscle is quiescent. During the 9th month of gestation the uterine muscle becomes progressively more excitable. What factors contribute to the increase in excitability?

Placental estrogen synthesis rises to high rates	Progesterone synthesis by the placenta decreases	Uterine blood flow reaches its highest rate	Prostaglandin E2 synthesis by the placenta decreases
--	--	---	--

Which one of the following is an action of the estrogen hormone related to labor onset?

Decreases prostaglandins level	Increases the number of oxytocin receptors	Decreases the gap junctions	Increases the negativity of the resting membrane potential
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Answer1: A ,Answer2:B ,Answer3:B

Leaders

Rafan Alhazzani

Fahad Almughaiseeb



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Basic PHYSIOLOGY?

