



# REBRODUCTIVE BLOCK



## LECTURE 8

---

### HORMONES AFFECTING FEMALE BREAST

**DONE BY:**

Leena Alyahya

Noor alzahrani

**REVISED BY:**

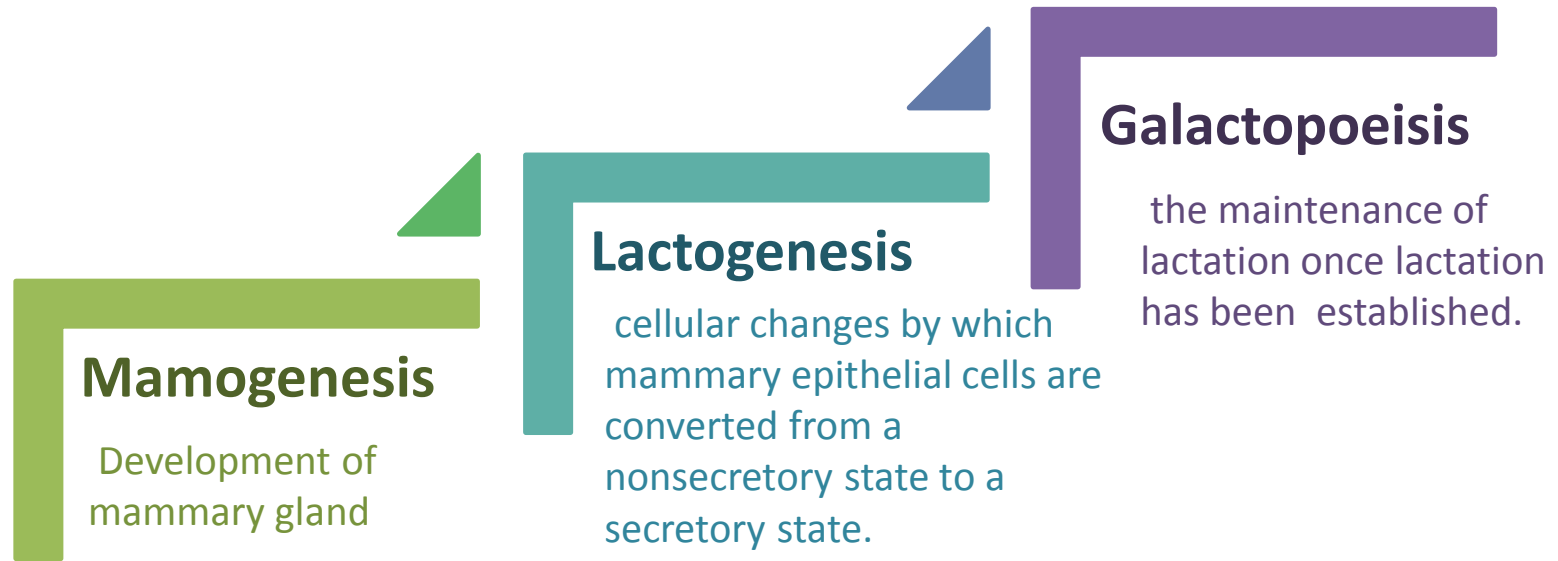
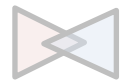
Fahad Al-Rashed

BELIEVE YOU CAN & YOU'RE  
HALFWAY THERE!  
THEODORE ROOSEVELT

- Hormonal requirement for **breast development** (**Mamogenesis**)
- Hormones involved in the **process of lactation** (**Lactogenesis**) and their physiological action
- Physiological basis of **suckling reflex** and its role in lactation
- **Galactopoeisis**
- **involution** (the termination of milk production).



- [Lactation and suckling reflex](#)
- [Hormones of the Placenta: Estrogen, Progesterone & hCG](#)



## Overview of the Anatomy

Male's Slide

### Structures of the Mammary Gland

Each breast consists of ~ 23 lobes of secretory tissue:

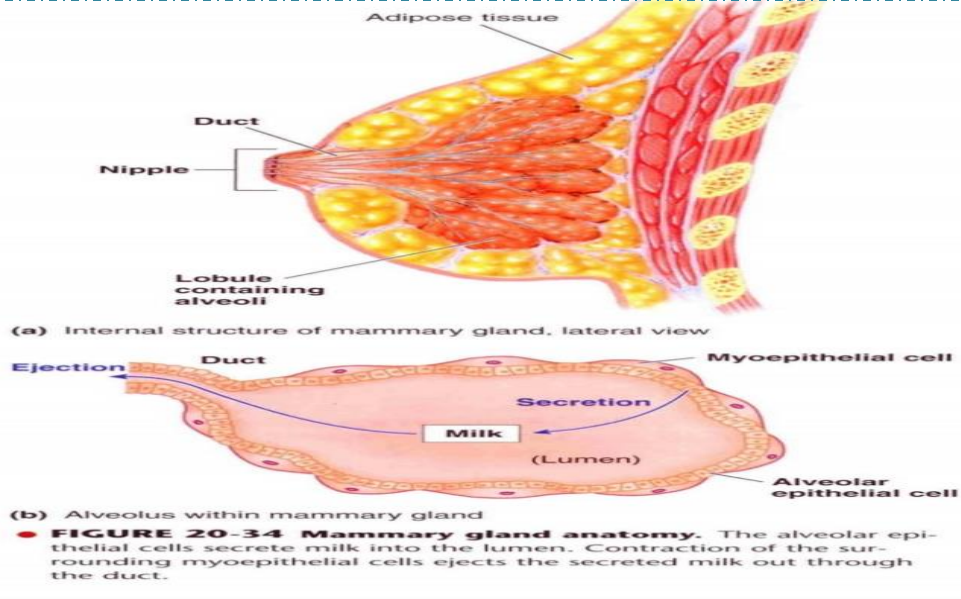
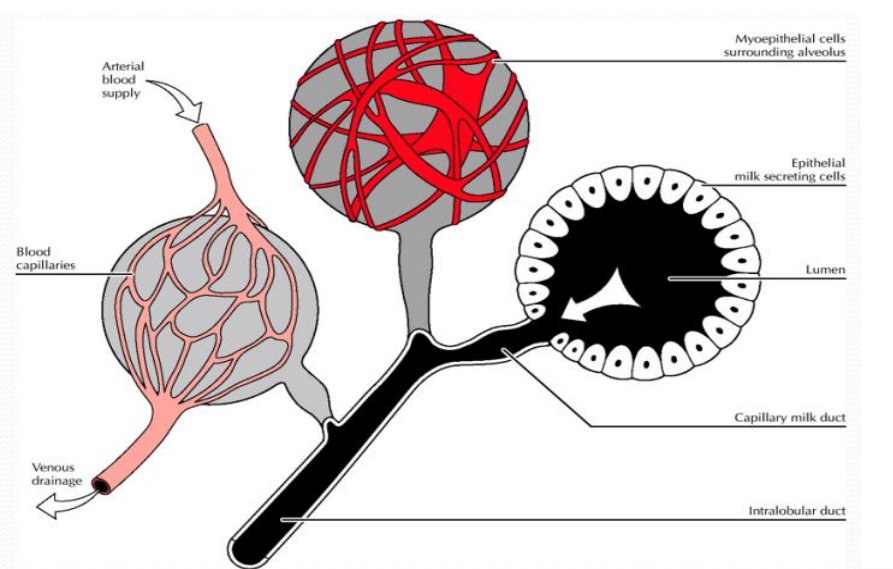
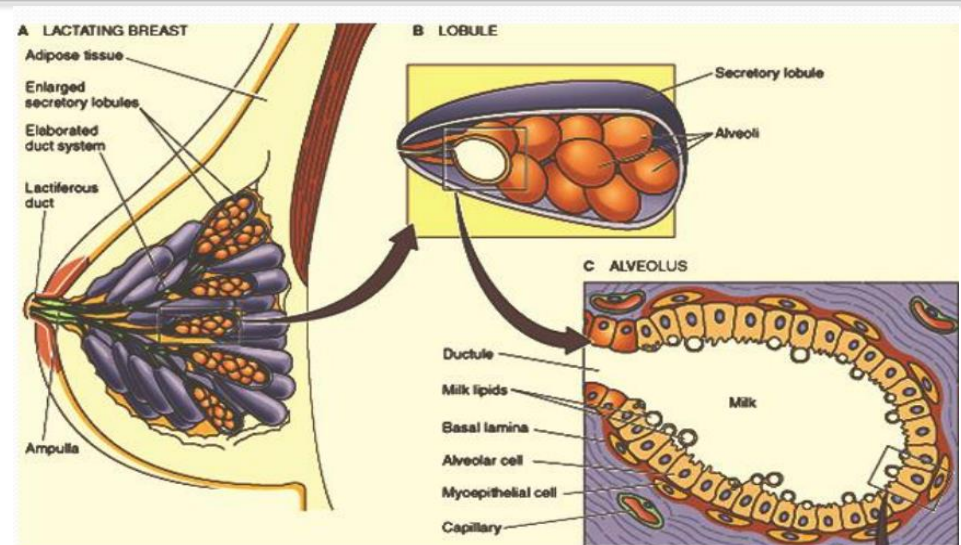
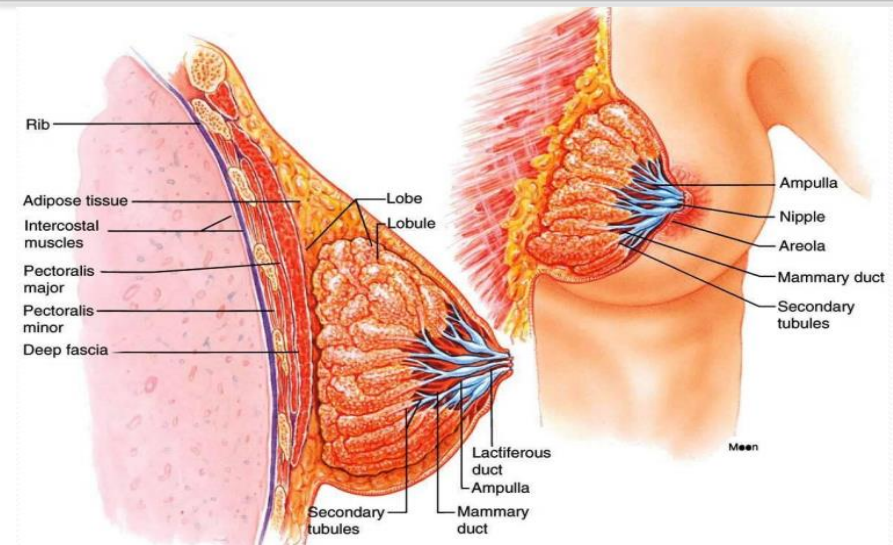
- 1) Each lobe has one lactiferous duct
- 2) Lobes (and ducts) are arranged radially c. Lobes are composed of lobules
- 3) Lobules are composed of alveoli (functional unit of breast)

### Ductal System

- Alveolar tubule
- Secondary tubule
- Mammary duct
- Ampulla (lactiferous sinus)
- Lactiferous duct



# Overview of the Anatomy



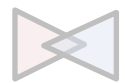
**SLIDES**

**IMPORTANT**

**FEMALES' NOTES**

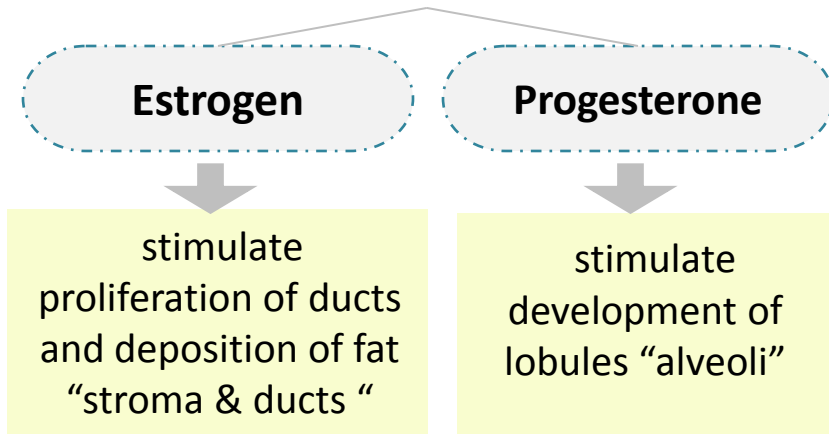
**EXPLANATION**

**MALES' NOTES**



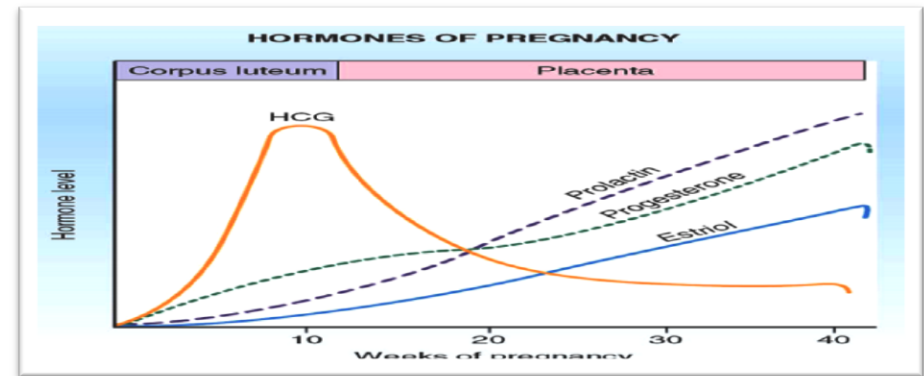
# Breast development (**mamogenesis**)

## During puberty:



## During pregnancy:

- Complete development of glandular tissue



- Endocrine system plays a major role in synchronizing "at the same time" development (**mamogenesis**) and function (**lactogenesis**) of mammary gland with reproduction.

## Three categories of hormones "which are responsible of mamogenesis and lactogenesis":

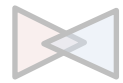
Reproductive hormones (Endocrine)	Metabolic hormones (Endocrine)	Mammary hormones (Autocrine)
Estrogen, progesterone, prolactin, oxytocin and hPL "Humen Placental Lactogen"	GH, corticosteroids, thyroxin, PTH "Parathyroid hormone" and insulin	GH, prolactin, parathyroid hormone-related protein (PTHrP) and leptin "secreted by mammary gland it self"

# Breast development (mamogenesis)

1

Important

Reproductive hormones	Function	Notes
<b>Estrogen</b> (placenta)	<ul style="list-style-type: none"> <li>❖ Growth &amp; branching of ductal system (with GH)</li> <li>❖ Fat deposition in the stroma</li> </ul>	<p>Although estrogen and progesterone are essential for physical development of the breasts, they <b>inhibit actual production and secretion of milk in pregnancy</b></p>
<b>Progesterone</b> (placenta)	<ul style="list-style-type: none"> <li>❖ Growth of lobule-alveolar system (budding of alveoli and secretory changes in epithelial cells)</li> </ul>	<p>“there is no milk secretion during pregnancy . Prolactin is inhibited by Estrogen and Progesterone , so ones their levels fall down (delivery or intrauterine fetal death) prolactin can produce milk”</p>
<b>Prolactin</b> (anterior pituitary)	<ul style="list-style-type: none"> <li>❖ Its level increases during pregnancy (10-20 times)</li> <li>❖ Its main function is <b>milk production also stimulating mammary gland ductal growth and proliferation of alveolar epithelial cells.</b></li> </ul>	<p>Sudden drop in Estrogen &amp; Progesterone after delivery <b>allows milk production</b></p> <p>Prolactin is controlled mainly by <b>hypothalamic hormone PIH (Dopamine)</b></p> <p>“Prolactin inhibitory hormone”</p> <p>“ normally it’s under inhibitory effect , there is no stimulator for Prolactin “</p>
<b>Human placental lactogen</b> (placenta)	<ul style="list-style-type: none"> <li>❖ Facilitate <b>mammogenesis</b></li> <li>❖ Delay milk production</li> </ul>	<p>It also called “ <b>Somatomammotropin</b> ”</p> <p>“ Has no related to milk secretion”</p>



# Stages of Lactogenesis

- Lactogenesis** : cellular changes by which **mammary epithelial cells are converted from a non-secretory state to a secretory state.**



	Lactogenesis 1	Lactogenesis 2
Definition - Time	“It is the Cytological and enzymatic differentiation of alveolar epithelial cells” - <u>starts at mid-pregnancy (5<sup>th</sup> month)</u>	“Copious secretion of all milk Components” - <u>Around parturition withdrawal of progesterone + high level of prolactin</u>
Events	<ul style="list-style-type: none"> <li>Expression of many genes involved in <b>synthesis</b> of milk components : (<b>increases</b> in uptake transport systems for amino acids, glucose, and calcium required for milk synthesis)</li> <li>Estrogen &amp; Progesterone are high during pregnancy &gt;&gt; Inhibit the milk secretion action of prolactin “unwanted effect during pregnancy”</li> </ul>	<ul style="list-style-type: none"> <li>Further <b>increase</b> in expression of milk protein genes</li> <li>Glands absorb <b>increased</b> quantities of metabolic substrates from the blood.</li> <li>Movement of cytoplasmic lipid droplets and casein into alveolar lumina</li> <li>Transfer of immunoglobulins</li> <li>Secretion of <b>colostrum</b> followed by milk</li> <li>Suckling stimulates further increase in expression of genes involved in milk secretion with expansion of alveolar epithelium</li> <li><b>Lactation is maintained by removal of milk “suckling”</b></li> </ul>
Hormones involved in the stage	<ul style="list-style-type: none"> <li>Progesterone (suppresses milk secretion)</li> <li><b>Prolactin</b> and placental lactogen</li> <li>Growth hormone</li> <li>Glucocorticoids (Cortisol)</li> </ul>	<ul style="list-style-type: none"> <li>Prolactin (milk production)</li> <li>Oxytocin (milk let-down)</li> </ul> <p><u>colostrum</u> : the milk that secreted from the mother during the first 24 H after delivery until the 4<sup>th</sup> day and contains high amount of immunoglobulin.</p>

■ SLIDES

■ **IMPORTANT**

■ FEMALES' NOTES

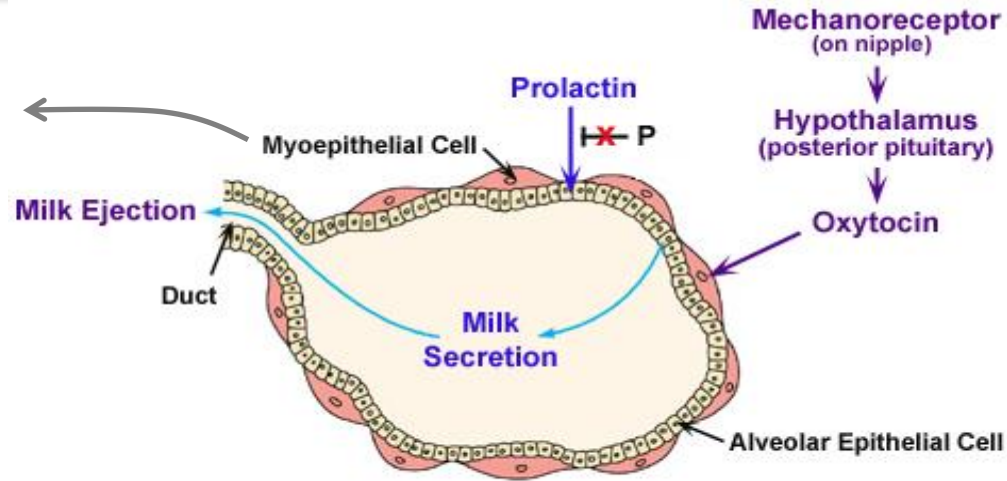
■ EXPLANATION

■ MALES' NOTES

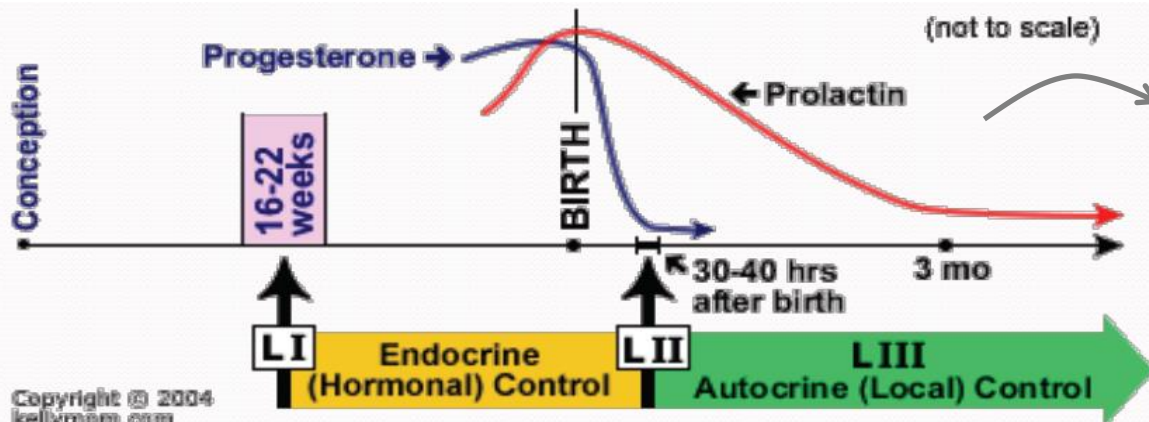


# The Hormonal Regulation of Lactogenesis

- **Oxytocin** → stimulate myoepithelial cells to cause contraction, thus leads to **milk ejection**
- **Prolactin** → **promotes milk synthesis and production**. Secreted by anterior pituitary, starting from 5th week of pregnancy until birth, then cycles.



Alveolus of Mammary Gland

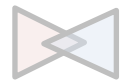


- Galactogenesis 1 starts at 2nd trimester of pregnancy
- Galactogenesis 2 start shortly before the birth

Mamogenesis and Lactogenesis Galtopoesis

■ SLIDES ■ IMPORTANT ■ FEMALES' NOTES ■ EXPLANATION ■ MALES' NOTES



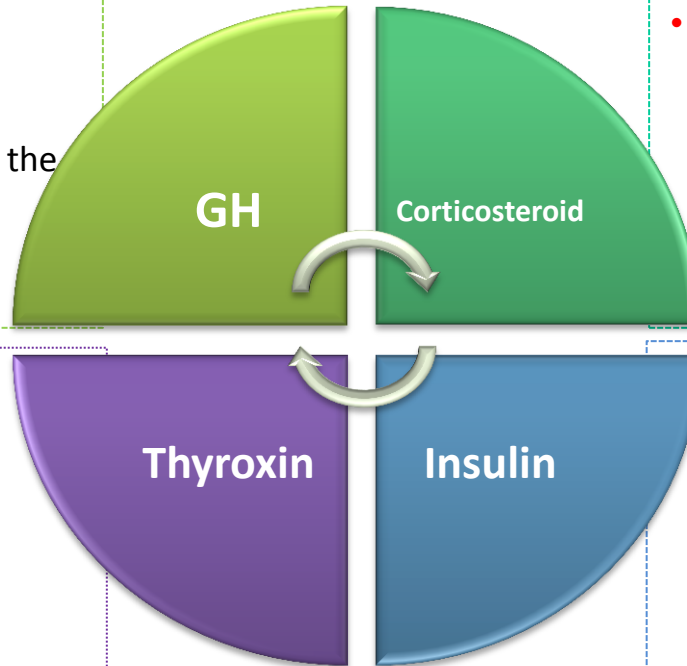


# The Hormonal Regulation of Lactogenesis

## 2 Metabolic Hormones "Direct Effect"

- Can be produced **locally**
- Its secretion is stimulated by **progesterone**
- **Increases** production of **IGF-1** by the liver
- Mediate **cell survival** and **ductal growth**

- Essential for **milk production**
- **Thyroxin & TSH** level **decreases** during **lactation**
- **TRH increases** leading to **stimulation of PRL** (nasal administration to treat inadequate lactation) \*



- **Increases** during **pregnancy** (fivefold)
  - Involved in **breast development**
- (permissive action on milk protein synthesis)

- **Low** during **lactation**
- **Shunt of nutrients** from storage depots to milk synthesis
- Involved in glucose uptake which is critical for lactose biosynthesis
- Involved in expression of milk protein genes

\* As we know TRH secreted from the hypothalamus stimulate the secretion of TSH from AP and prolactin so women with inadequate lactation can be treated with TRH

# The Hormonal Regulation of Lactogenesis

## 3 Mammary Hormones “From the Breasts”

GH

- Progesterone stimulates its secretion

Leptin

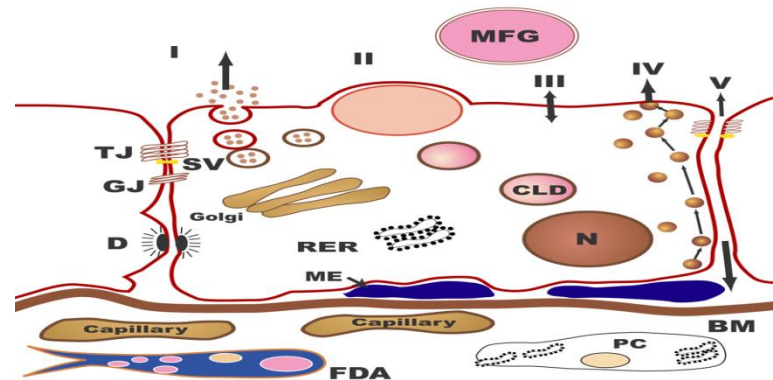
- Increases during pregnancy (increase adipose tissue)
- Decreases with lactation

PTHrP

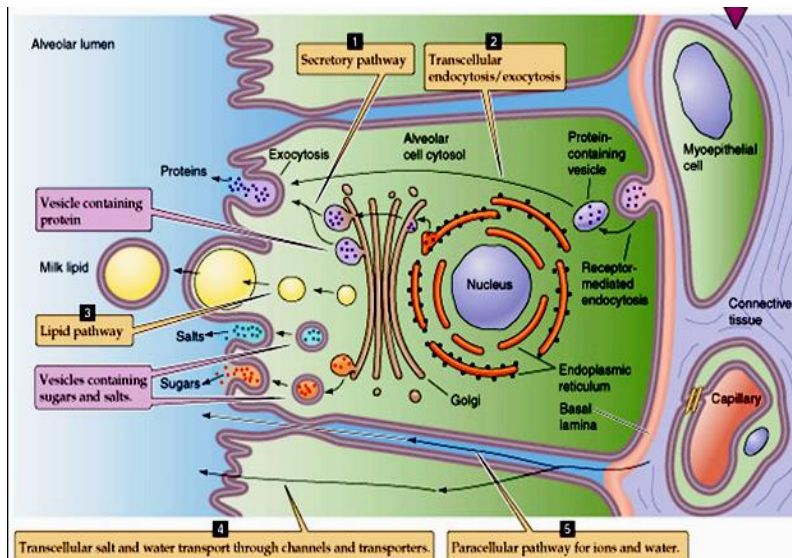
- Increases during lactation
- Mobilizes bone calcium
- Increase in alkaline phosphatase

### The Secretory epithelial cell :

- Exocytosis of Milk protein, lactose, and other components of the aqueous phase in Golgi-derived secretory vesicles.
- Milk fat secretion via the milk fat globule.
- Direct movement of mono valent ions, water, and glucose across the apical membrane of the cell.
- Transcytosis of components of the interstitial space.
- The paracellular pathway for plasma components and leukocytes. **Pathway V is open only during pregnancy, involution, and in inflammatory states such as mastitis.**



SV = Secretory vesicle. MFG = Milk fat globule  
 FDA = Fat-depleted adipocyte TJ = Tight junction  
 CLD = Cytoplasmic lipid droplet. GJ = Gap junction.  
 D = Desmosome. ME = Myoepithelial cell.



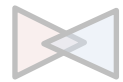
SLIDES

IMPORTANT

FEMALES' NOTES

EXPLANATION

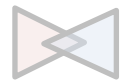
MALES' NOTES



## Definition:

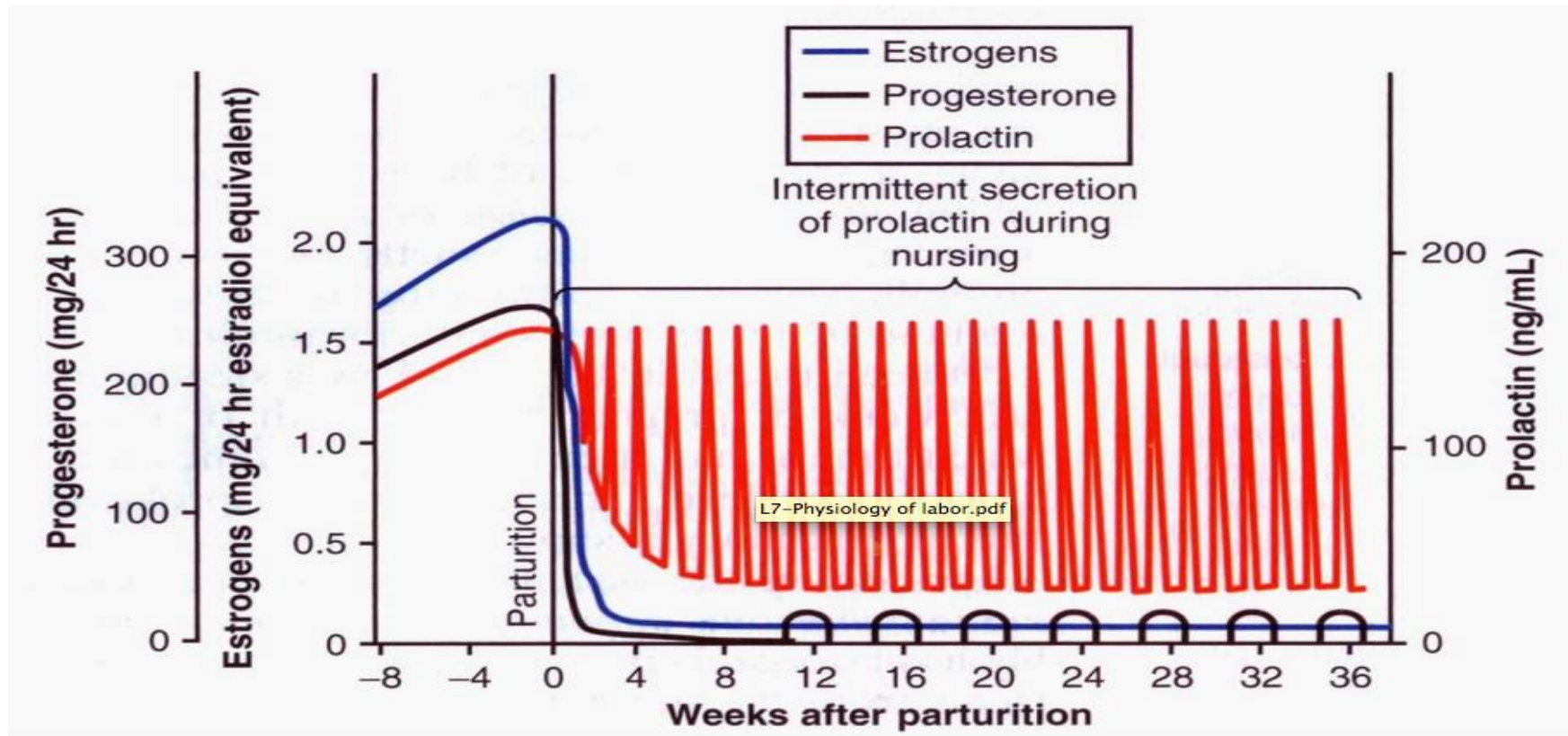
Galactopoeisis is defined as the maintenance of lactation once lactation has been established.

Role of Hormones		
<b>Prolactin</b>	milking-induced surge is a direct link between the act of nursing (or milk removal) and the galactopoeitic hormones involved in maintaining lactation. <b>Prolactin is the most important hormone in maintenance of lactation</b>	
<b>Growth Hormone</b>	support increase in <u>synthesis of lactose, protein, and fat in the mammary gland</u>	
<b>Glucocorticoids</b>	galactopoeitic in physiological doses	
<b>Thyroid Hormones</b>	galactopoeitic	
<b>Role of Ovarian Hormones</b>	<b>Estrogen</b>	<u>very low doses is galactopoeitic</u>
	<b>Progesterone</b>	<u>has no effect on galactopoeisis</u> because there are no progesterone receptors in the mammary gland during lactation



# Galactopoeisis cont. + The Suckling Reflex

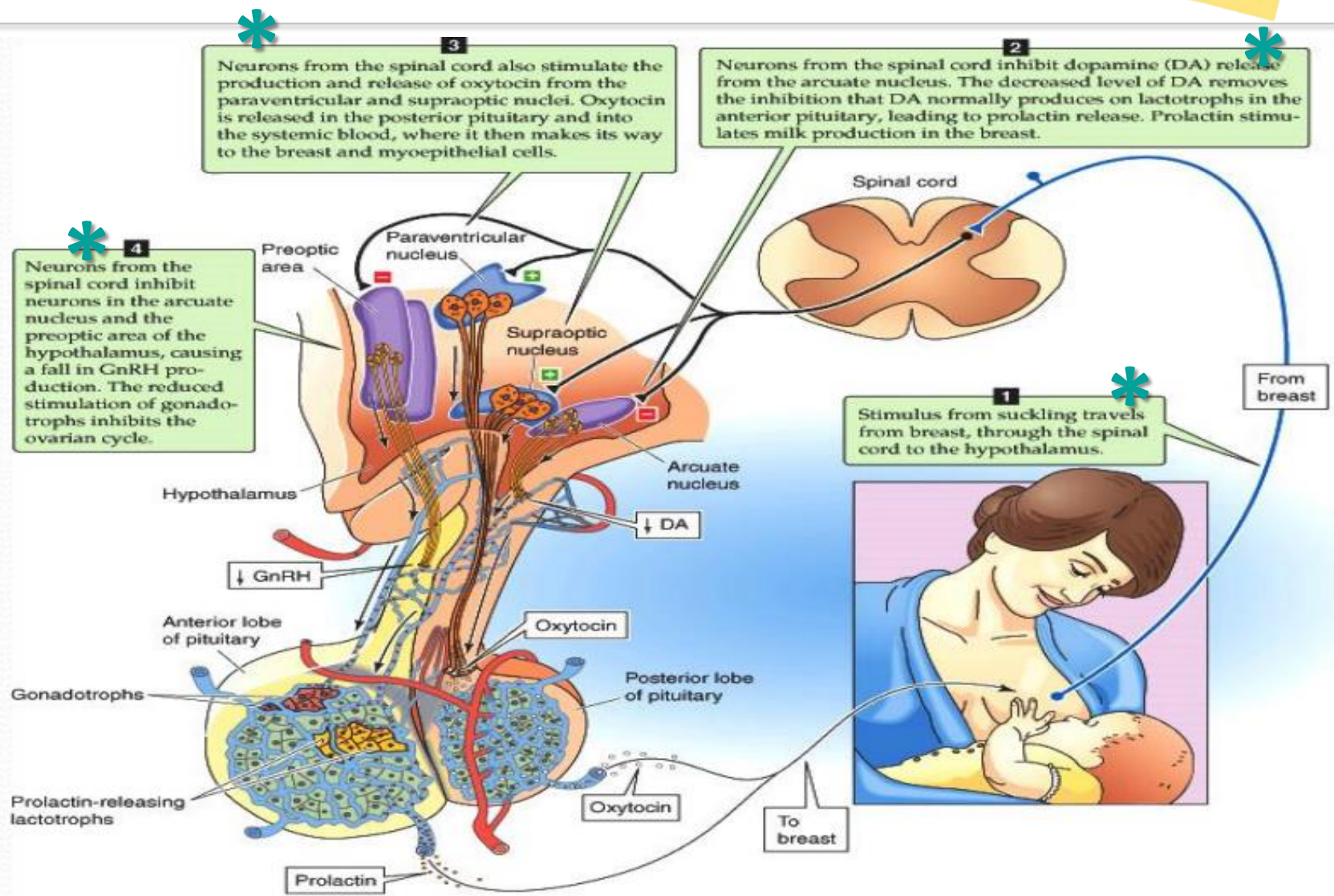
- Normally, All through the lactation, no ovulation occur. But nowadays, this is disturbed because of well-fed mothers and irregular lactation
- Prolactin decrease the GnRH so no ovulation occur > cause of infertility in some woman
- Intermittent secretion of prolactin during nursing



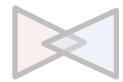


# Galactopoesis cont. + The Suckling Reflex

Important



Copyright © 2009 by Saunders, an imprint of Elsevier Inc. All rights reserved.



- ✓ Milk production is a **use it or lose it process**
- ✓ The more often and effectively the baby nurses, the more milk will be produced
  - Milk production <100 ml/day in day 1 postpartum
  - Milk production by day 3 reaches 500 ml/day
  - Milk composition changes dramatically( low Na & Cl ) due to closure of tight junctions that block paracellular pathway
- ✓ **More fluid intake = More milk production**
- ✓ **Involution:** this is when the breast stop producing milk completely after weaning

## AAP Recommendation « American Academy of Pediatrics :

- ✓ Exclusive breast feeding for the **first six months of life**
- ✓ Continued breast feeding for at least one year, 'As long as is desired by mother and child'
- ✓ Giving the baby some food « honey & yogurt » during the first 2 months is associated with allergy and hypersensitivity reaction due to undeveloped immune system

## The Suckling Reflex

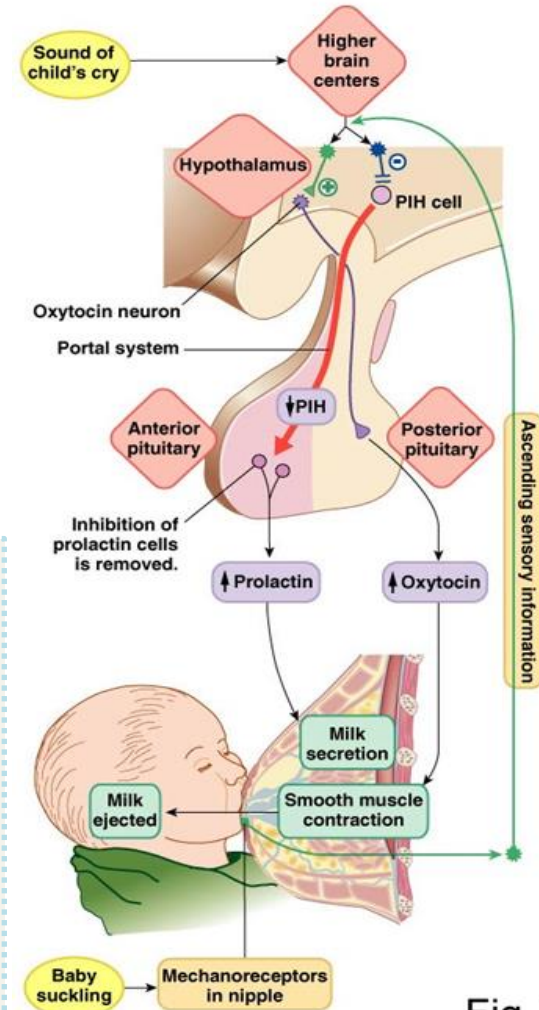
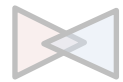
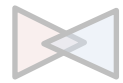


Fig 2



# SUMMARY

- During **puberty** , **Estrogen** stimulate development of ducts of mammary gland and deposition of fat . While **Progesterone** stimulate development of alveoli .
- Endocrine system has a major role in development “**mamogenesis**” and function “**lactogenesis**” of mammary gland .
- Three categories of hormones which are :
  - 1- **Reproductive** – Endocrine – (Estrogen, progesterone, prolactin, oxytocin and hPL )
  - 2- **Metabolic** – Endocrine – (GH, corticosteroids, thyroxin, PTH and insulin )
  - 3- **Mammary** – **Autocrine** – (GH, prolactin, parathyroid hormone-related protein and leptin)
- **Estrogen and Progesterone** ( from **Placenta** ) **inhibit secretion of milk by inhibiting Prolactin** (Dr. AlOtaibi says that they down regulate prolactin receptors but don't inhibit its secretion)
- **Prolactin (AP)** main function **is milk secretion** and it's controlled by hypothalamic hormone **PIH ( Dopamine)** .
- **Human placental lactogen (Placenta)** “somatomammotropin “ : **facilitate mamogenesis** .



# SUMMARY

## Lactogenesis 1 :

- It is the Cytological and enzymatic differentiation of alveolar epithelial cells
- Hormones (PPGG): **Progesterone – Prolactin – GH - Glucocorticoides**

## Lactogenesis 2 :

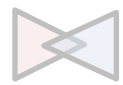
- Copious secretion of all milk Components
- Hormones (PO): **Prolactin** "secretory cells\milk production"  
**Oxytocin** "myoepithelial cells\milk ejection"

## Galactopoeisis

- is the maintenance of lactation once lactation has been established
- Hormones (PPGGET) :-  
**Prolactin – Progesterone - GH – Glucocorticoides -Estrogen – Thyroid**

- **Suckling reflux** :- slide #13 (**very important**)
- The more often and effectively the baby nurses, **the more milk will be produced**
- Milk production <**100 ml/day** in day 1 postpartum
- Milk production by day 3 reaches 500 ml/day
- Exclusive breast feeding for **the first six months of life**





# QUESTIONS

**1. All of the following will Stimulate milk production except :**

- A- Prolactin
- B- Suckling
- C- Oxytocin
- D- Progesterone
- E- Milk let-down reflex

**2. regarding Prolactin hormone choose the incorrect statement :**

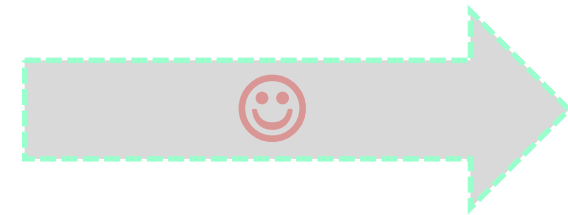
- A- it has action in breast development
- B- it has action in milk production
- C- it has an action in milk ejection
- D- sucking is a factor that can control it
- E- A and B

**3. Regarding lactogenesis , which one is correct :**

- A) Cortisol is involved in the 2<sup>nd</sup> stage .
- B) High level of Prolactin in the 1<sup>st</sup> stage
- C) Progesterone is high during 1<sup>st</sup> stage
- D) Synthesis of milk component during 1<sup>st</sup> stage

**4. Which ONE of the following is released by suckling the nipple?**

- A. Cortisol
- B. Dopamine
- C. Oxytocin
- D. Gonadotropin Releasing Hormone



1	D
2	C
3	D
4	C



# .. Thank You ..



FATIMAH, SARAH, LEENA, NORAH, KHULOOD, MAHA, MAY, NAJLOUD, ROQAIH, TAHANI, EMAN, FAY, HESSAH, MARWAH, NADA, SAMMA, AHLAM, ARWA, ASHWAQ, RAWAN, RAZAN, SHROOG, NOOR, SHADEN, NUHA, ALHANOUF, TUQA, JOHARAH FAHAD.R, NAIF, YAZEED, MOHAMMED.S, HAMAD, OTHMAN, ABDULRAHMAN.AQ, ABDULRAHMAN.R, ABDULLAH.H, ABDULRAHMAN.B, FAHAD.SH, HESHAM, IBRAHEEM.S, MOHAMMED.G

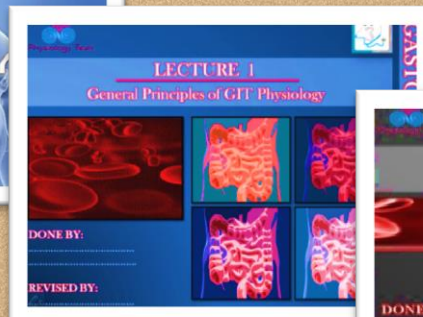
**“the strength of the team is each individual member. The strength of each member is the team.”**

Phil Jackson

32 lectures



11 lectures



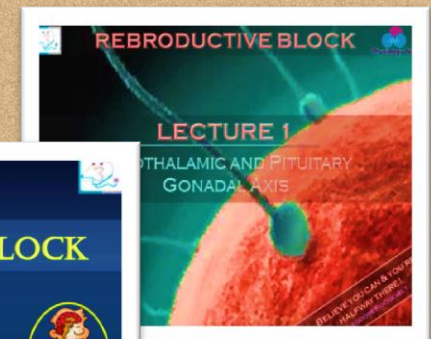
7 lectures



15 lectures



8 lectures





**THE END**

**IF THERE ARE ANY PROBLEMS OR  
SUGGESTIONS,  
FEEL FREE TO CONTACT US:**

**PHYSIOLOGY TEAM LEADERS  
MOHAMMED JAMEEL & SHAIMAA AL-REFAIE**

**432Physiology@gmail.com**

**THANK YOU**



**IF YOU WANT TO SHARE ANY INFORMATION REGARDING PHYSIOLOGY OR  
ANY OTHER SUBJECT .. YOU CAN MENTION THIS ACCOUNT**

**@MED432**

**Actions Speak Louder Than Words**