

# غدد صم

## المحاضرة الخامسة

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## Hormonal influences [\[ edit \]](#)

From the twenty-fourth week of [pregnancy](#) (the second and third [trimesters](#)), a woman's body produces [hormones](#) that stimulate the growth of the [milk duct](#) system in the [breasts](#):

- [Progesterone](#) influences the growth in size of [alveoli](#) and lobes; high levels of progesterone inhibit lactation before birth. Progesterone levels drop after birth; this triggers the onset of copious milk production.<sup>[3]</sup>
- [Estrogen](#) stimulates the milk duct system to grow and differentiate. Like progesterone, high levels of estrogen also inhibit lactation. Estrogen levels also drop at delivery and remain low for the first several months of breastfeeding.<sup>[3]</sup> Breastfeeding mothers should avoid estrogen-based birth control methods, as a spike in estrogen levels may reduce a mother's milk supply.
- [Prolactin](#) contributes to the increased growth and differentiation of the alveoli, and also influences differentiation of ductal structure. High levels of prolactin during pregnancy and breastfeeding also increase insulin resistance, increase growth factor levels (IGF) and modify lipid metabolism in preparation for breastfeeding. During lactation, prolactin is the main factor maintaining [tight junctions](#) of the ductal epithelium and regulating milk production through osmotic balance.
- [Human placental lactogen](#) (HPL) – from the second month of pregnancy, the [placenta](#) releases large amounts of HPL. This hormone is closely associated with prolactin and appears to be instrumental in breast, nipple, and areola growth before birth.
- [Follicle stimulating hormone](#) (FSH), [luteinizing hormone](#) (LH), and [human chorionic gonadotropin](#) (hCG), through control of estrogen and progesterone production, and also, by extension, prolactin and growth hormone production, are essential.
- [Growth hormone](#) (GH) is structurally very similar to prolactin and independently contributes to its galactopoiesis.
- [Adrenocorticotropic hormone](#) (ACTH) and [glucocorticoids](#) such as [cortisol](#) have an important lactation inducing function in several animal species, including humans. Glucocorticoids play a complex regulating role in the maintenance of tight junctions.
- [Thyroid-stimulating hormone](#) (TSH) and [thyrotropin-releasing hormone](#) (TRH) are very important galactopoietic hormones whose levels are naturally increased during pregnancy.
- [Oxytocin](#) contracts the [smooth muscle](#) of the [uterus](#) during and after birth, and during orgasm(s). After birth, oxytocin contracts the smooth muscle layer of band-like cells surrounding the alveoli to squeeze the newly produced milk into the duct system. Oxytocin is necessary for the *milk ejection reflex*, or *let-down*, in response to suckling, to occur.

From the twenty-fourth week of pregnancy (the second and third trimesters), a woman's body produces hormones that stimulate the growth of the milk duct system in the breasts:

من بداية الاسبوع الرابع والعشرين (المرحلة الثانية والثالثة) من الحمل، يبدأ جسم  
الام الحامل في انتاج الهرمونات التي تحفز نمو جهاز الغدد اللبنية في الثدي.

- Progesterone influences the growth in size of alveoli and lobes; high levels of progesterone inhibit lactation before birth. Progesterone levels drop after birth; this triggers the onset of copious milk production.<sup>[3]</sup>

**البروجسترون** يؤثر على نمو حجم الحويصلات والفصوص – المستويات العالية من البروجسترون تمنع ادرار الحليب قبل الولادة.  
ينخفض معدل البروجسترون بعد الولادة بشكل ملحوظ مما يساعد على بداية ادارا الحليب.

**من اين يفرز؟**

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**من اين يفرز؟**  
**من الجسم الاصفر خلال النصف الثاني من الدورة**

Non-lactating

Engorged



Milk glands

 ADAM.

## INACTIVE BREAST

Adipose tissue

Lactiferous  
duct system

Lactiferous  
sinus

Opening  
of sinus

## LACTATING BREAST

Adipose tissue

Enlarged  
secretory lobules

Elaborate  
duct system

Myoepithelial cell

Basal lamina

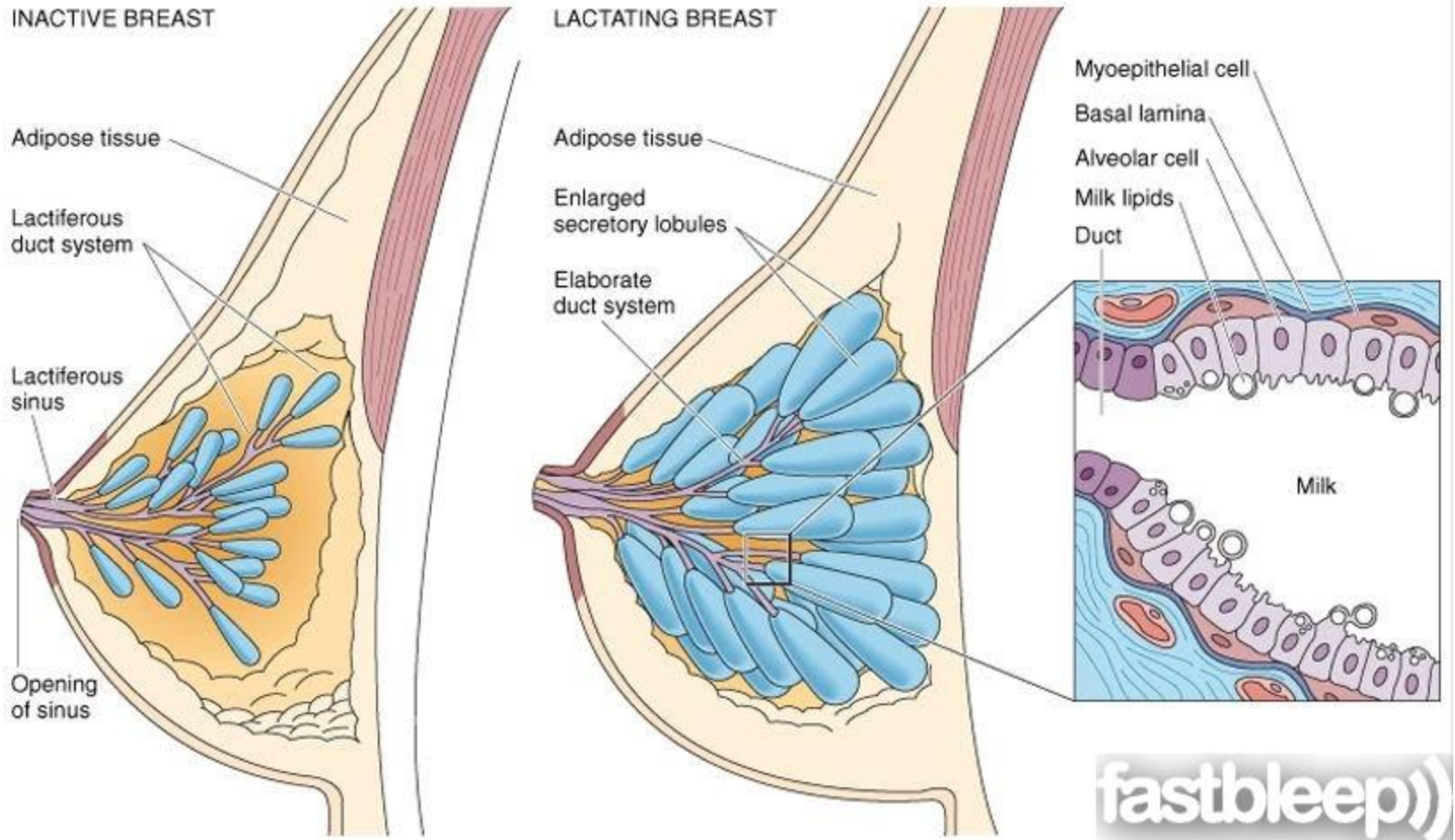
Alveolar cell

Milk lipids

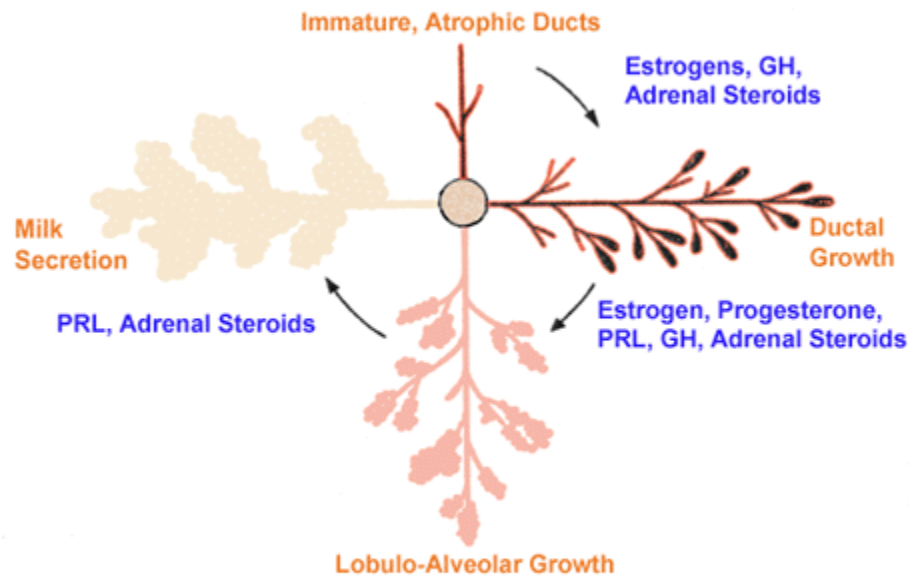
Duct

Milk

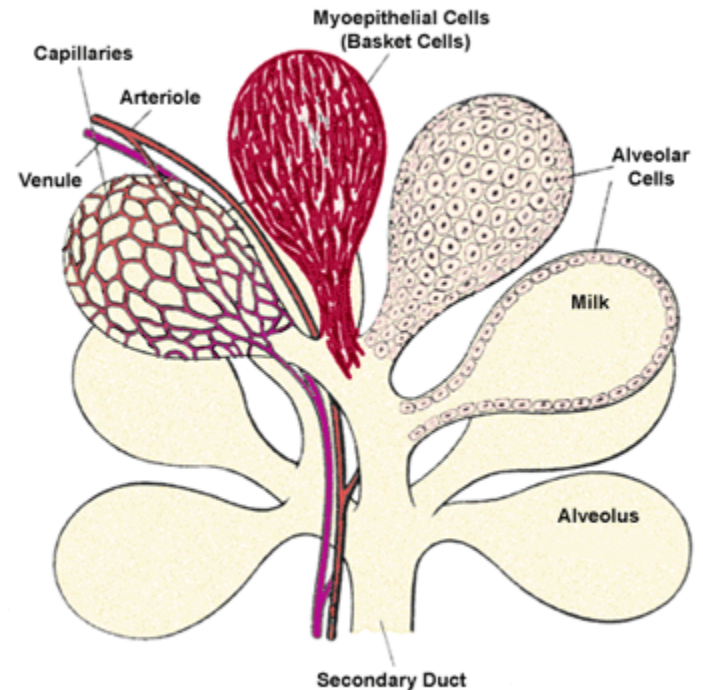
fastbleep))



## Hormonal Control of Breast Development



## Microanatomy of the Breast Alveolus



(Modified from Austin & Short (ed) *Reproduction in Mammals, Book III: Hormonal Control of Reproduction*, Cambridge University Press: Cambridge, UK, 1984.)



***Table 16. Mammogenic, lactogenic and galactopoietic (lactopoietic) hormones***

<b>Mammogenic</b>	<b>Lactogenic</b>	<b>Lactopoietic</b>
Estrogens Progesterone Prolactin Growth hormone	Prolactin Insulin Glucocorticoids	Growth hormone Glucocorticoids Thyroid hormones Insulin Parathyroid hormone Prolactin (in goat and ewe)

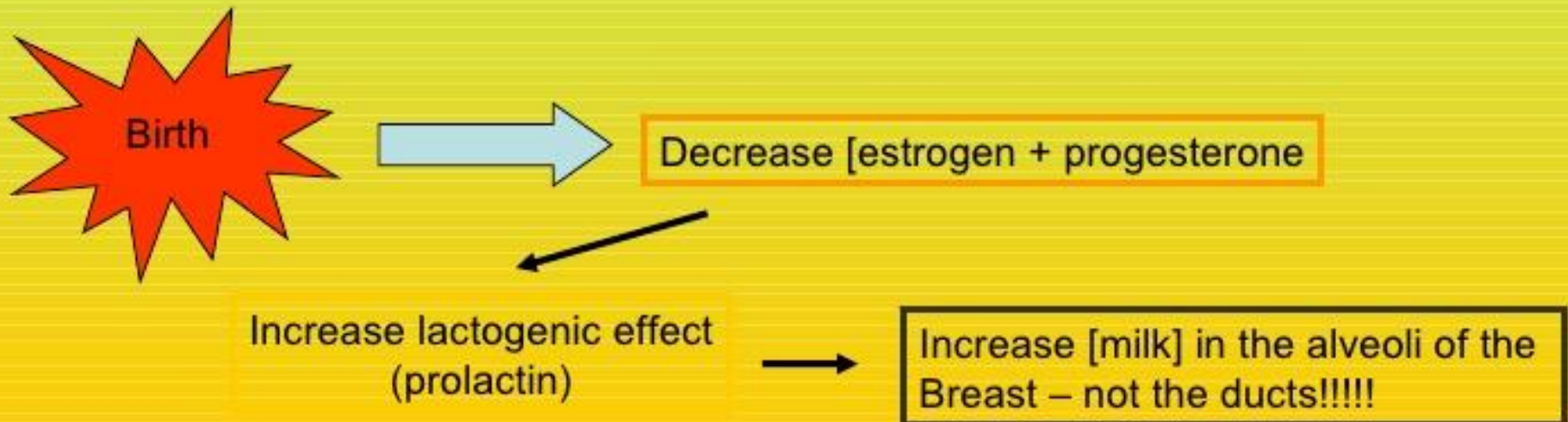
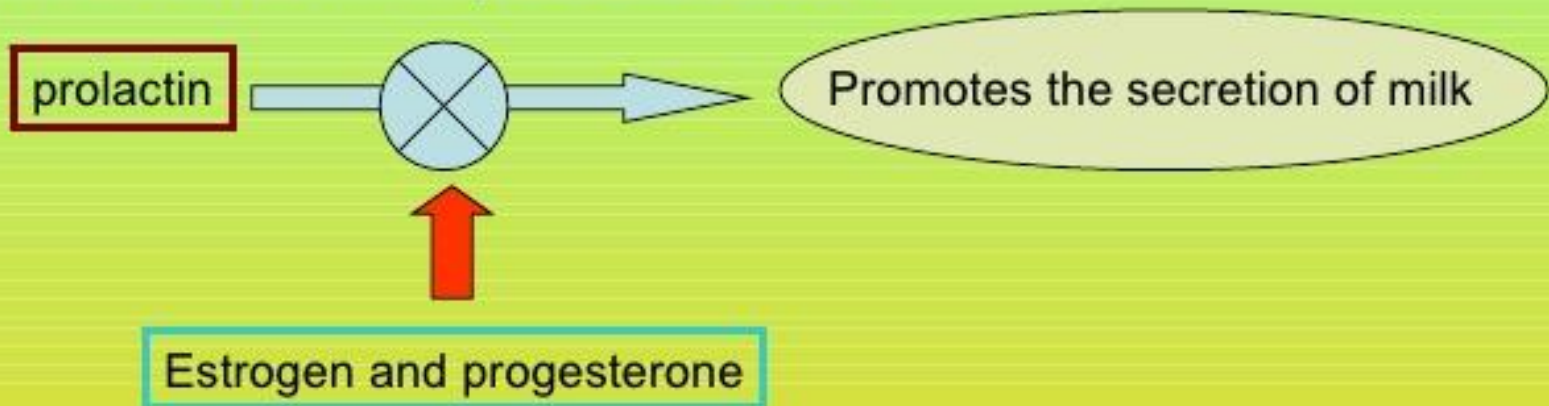
**Mammogenesis = mammary development**

**Lactogenesis = initiation (onset) of lactation**

**Lactopoesis = milk secretion (maintenance of lactation)**

# Lactation:

- Function of **prolactin**:



# *Symptoms of low progesterone*

- A LUTEAL PHASE LESS THAN 12 DAYS
- SUGAR CRAVINGS
- OVARIAN CYSTS
- LOW BASAL BODY TEMPERATURES
- IRREGULAR PERIODS
- ALLERGY SYMPTOMS
- ARTHRITIS
- SPOTTING IN THE DAYS BEFORE YOUR PERIOD BEGINS
- RECURRENT EARLY MISCARRIAGE
- BLOOD CLOTS DURING MENSTRUATION
- COLD HANDS AND FEET

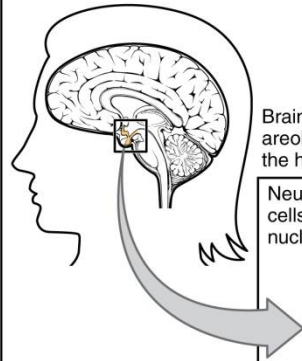
more info at [NaturalFertilityandWellness.com/symptoms-of-low-progesterone/](http://NaturalFertilityandWellness.com/symptoms-of-low-progesterone/)

Increased milk production triggers increased suckling by infant (positive feedback loop).

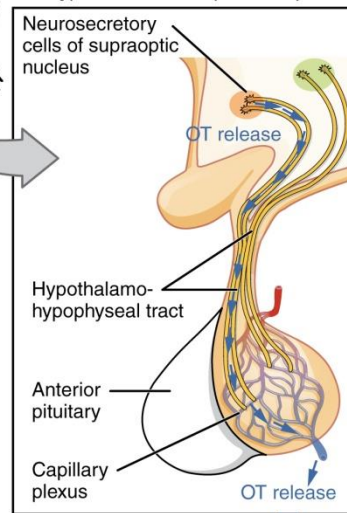
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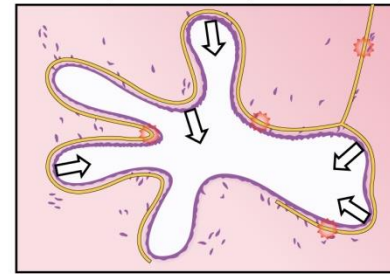
Suckling triggers sensory nerve impulses in the areola.



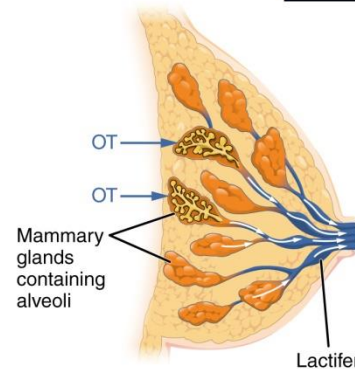
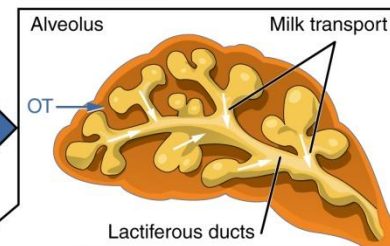
Brain receives sensory impulses from the areola and releases oxytocin (OT) from the hypothalamus and posterior pituitary.



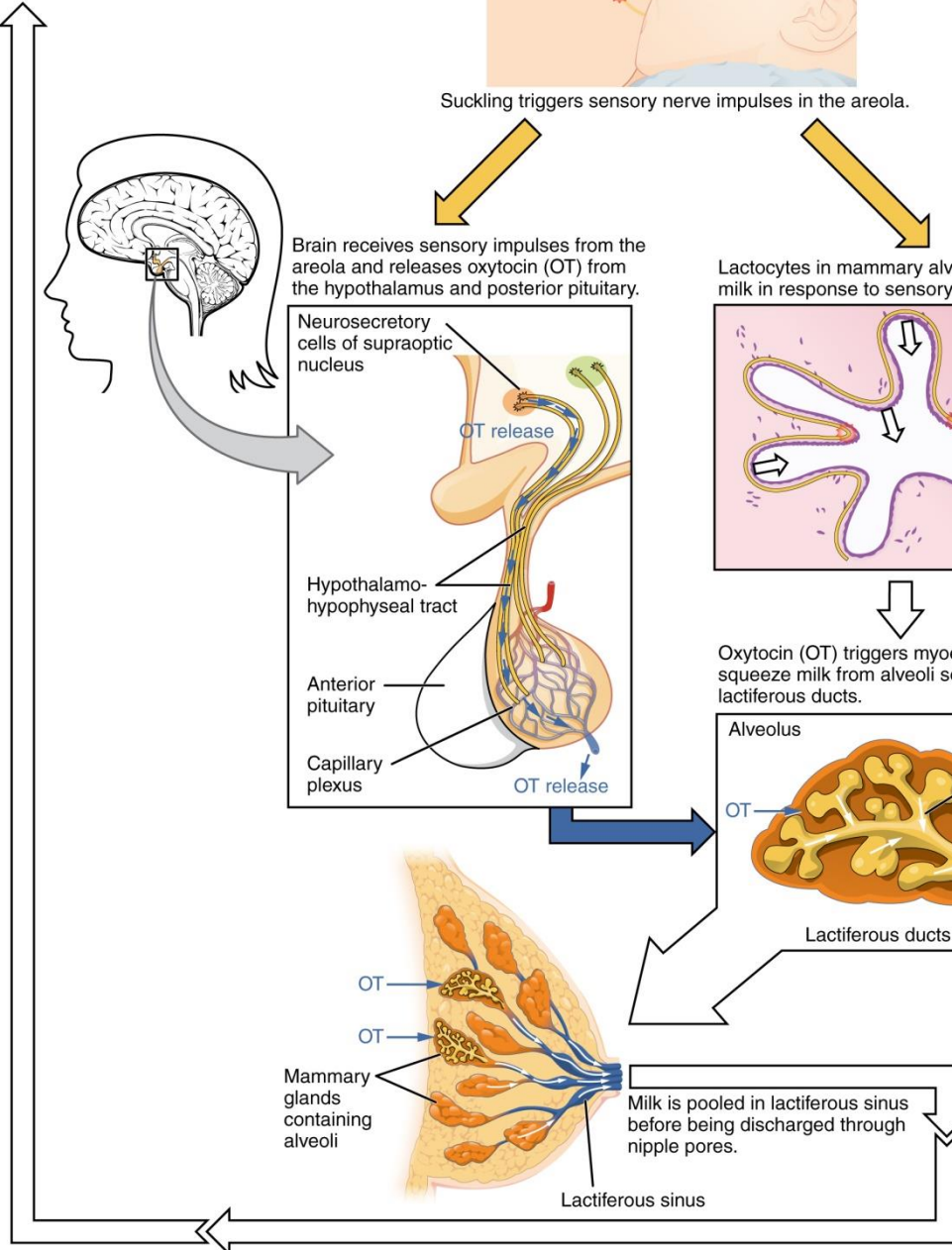
Lactocytes in mammary alveoli produce milk in response to sensory nerve impulses.



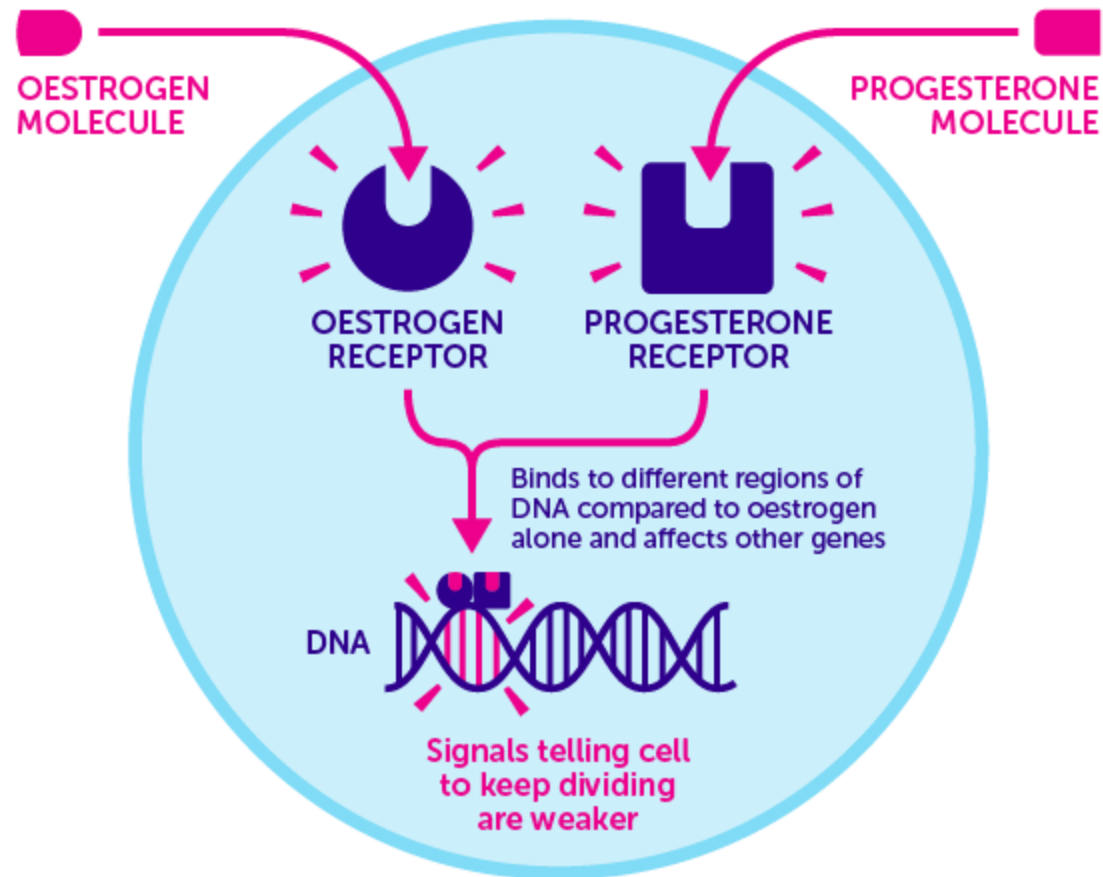
Oxytocin (OT) triggers myoepithelial cells to squeeze milk from alveoli so it drains into lactiferous ducts.



Milk is pooled in lactiferous sinus before being discharged through nipple pores.



## PROGESTERONE PUTS A BRAKE ON OESTROGEN FUELLED GROWTH AND DIVISION OF BREAST CANCER CELLS



# Breast Growth

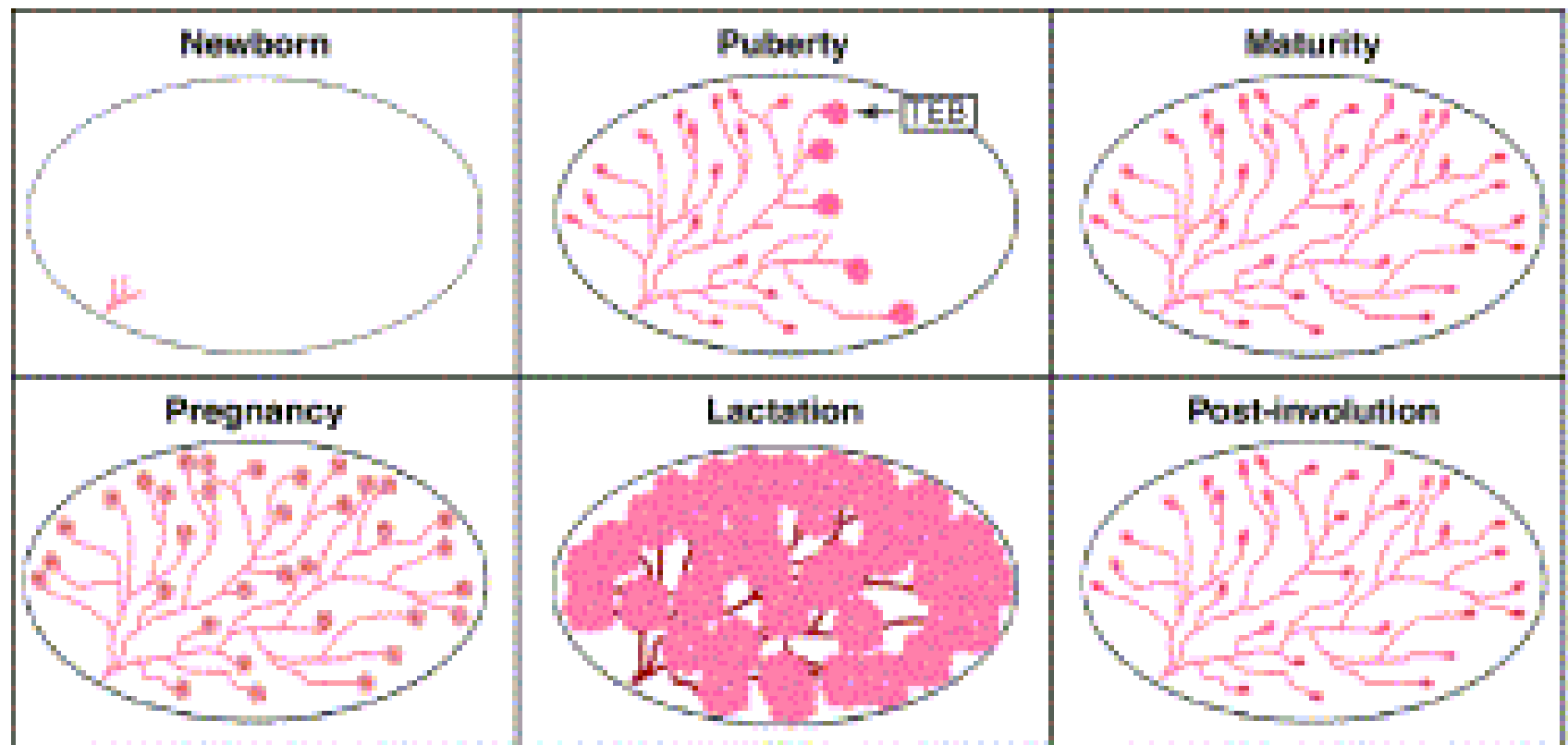
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graph TD; A[Breast Growth] --- B[Estrogen 1]; A --- C[Progesterone 2]; A --- D[Prolactin 3]; A --- E[Human Growth Hormone 4]
```

Estrogen 1

Progesterone 2

Prolactin 3

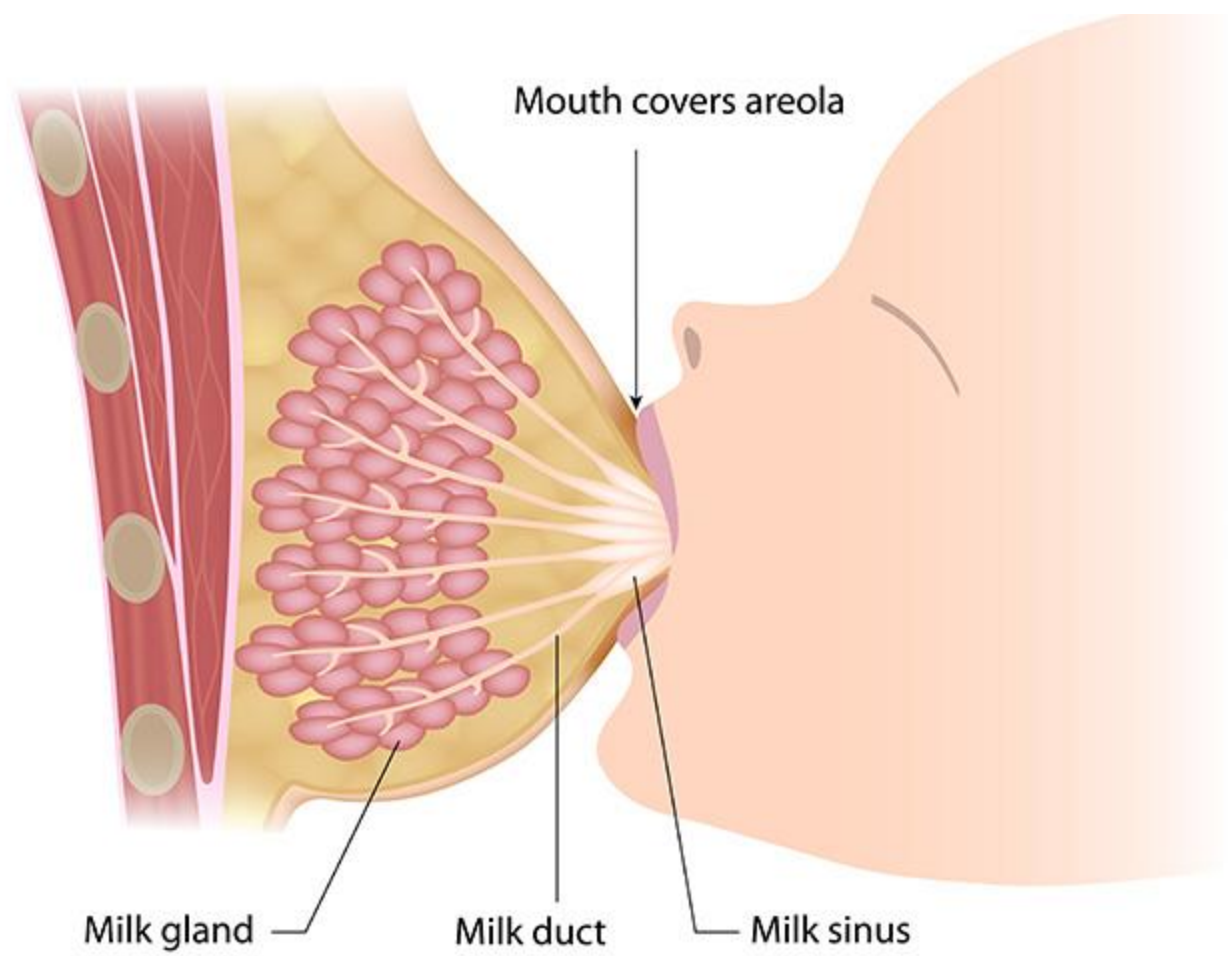
Human Growth Hormone 4



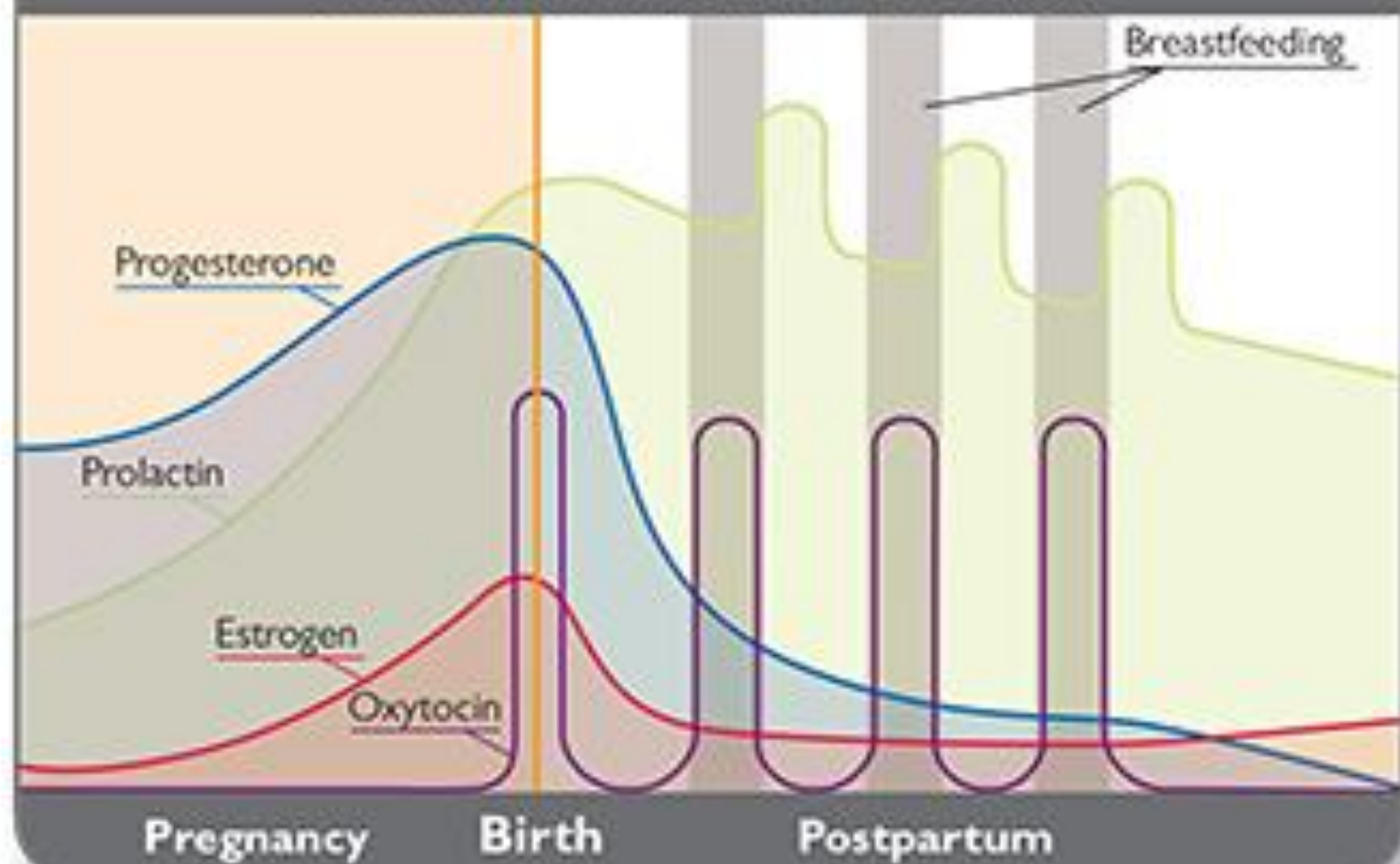








## Hormone Levels of Lactation



*Adapted from Love, 1990*

## Types of Breast Lobules



**Type 1**  
**Breast at birth**



**Type 2**  
**Breast after puberty**

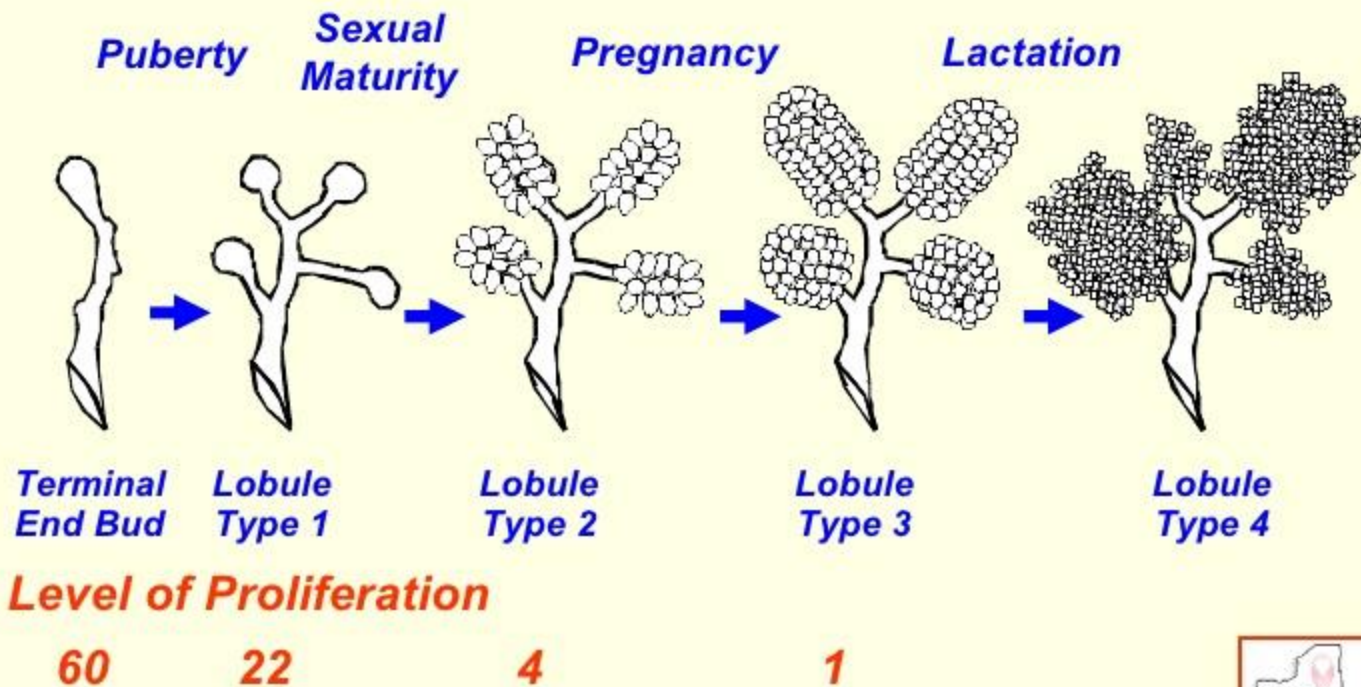


**Type 3**  
**Breast with pregnancy**  
**after 32 weeks**



**Type 4**  
**Breast with milk**

## ***Differentiation of A Breast Lobule Growth to a Functioning Entity***



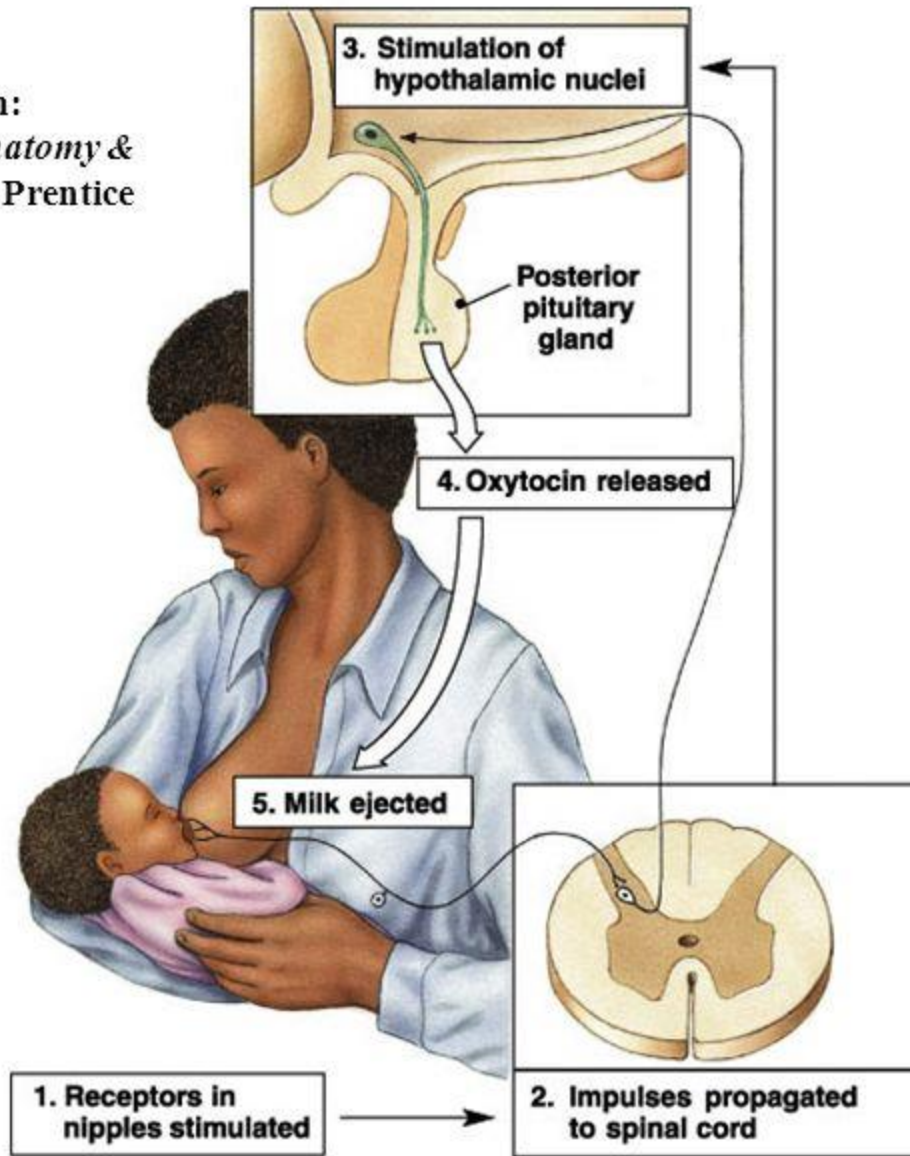


# MILK PRODUCTION

- DURING PREGNANCY
  - ESTROGEN CAUSES DUCTS TO DEVELOP
  - PROGESTERONE DEVELOPS ALVEOLAR GLANDS
  - PROGESTERONE INHIBITS PROLACTIN
- AFTER BIRTH:
  - PROLACTIN NOT INHIBITED
  - MAMMARY GLANDS SECRETE MILK
- SUCKLING: RELEASES OXYTOCIN: ALVEOLAR GLANDS RELEASE MILK
- POSITIVE FEEDBACK
- SLIGHT INHIBITION OF REPRODUCTIVE CYCLE

# Milk-Letdown Reflex

Figure from:  
Martini, *Anatomy & Physiology*, Prentice Hall, 2001



**Recall that oxytocin (OT) is a stimulus for smooth muscle contraction and is secreted by the neurohypophysis**

**OT stimulates myoepithelial cells in the walls of the lactiferous ducts and sinuses**

**Know this pathway**

- **Estrogen** stimulates the milk duct system to grow and differentiate. Like progesterone, high levels of estrogen also inhibit lactation. Estrogen levels also drop at delivery and remain low for the first several months of breastfeeding.<sup>[3]</sup> Breastfeeding mothers should avoid estrogen-based birth control methods, as a spike in estrogen levels may reduce a mother's milk supply.

**الاستروجين** يحفظ جهاز الغدد اللبنية للنمو والتميز. مثل البروجسترون تماما فان المعدلات العالية من الاستروجين تمنع ادرار الحليب. وايضا ينخفض بشكل ملحوظ عند الولادة ويظل منخفضا خلال الشهور العديدة الاولى من الرضاعة. الأم المرضعة عليها ان تتجنب طرق الولادة باستخدام الاستروجين حيث ان الارتفاع في مستوى الاستروجين يمكن ان يقلل ادرار الحليب.

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**من اين يفرز؟**

They are **released** by the follicles on the ovaries and are also **secreted** by the corpus luteum after the egg has been **released** from the follicle and from the placenta. The stimulation for **secretion** of **estrogen** comes from the Luteinizing hormone (LH) from anterior pituitary gland. Oct 8, 2014



- Prolactin contributes to the increased growth and differentiation of the alveoli, and also influences differentiation of ductal structure. High levels of prolactin during pregnancy and breastfeeding also increase insulin resistance, increase growth factor levels (IGF) and modify lipid metabolism in preparation for breastfeeding. During lactation, prolactin is the main factor maintaining tight junctions of the ductal epithelium and regulating milk production through osmotic balance.

**البرولاكتين** يشترك في عملية نمو وتمييز الحويصلات اللبنية وايضا تؤثر على تمايز وتركيب الاوعية.

النسب العالية من البرولاكتين خلال الحمل والرضاعة يزيد من مقاومة الانسولين وتزيد من نسب عوامل النمو وبالتالي تعدل ايض الدهون للتحضير لعملية الرضاعة. خلال الرضاعة، البرولاكتين يعتبر العامل الرئيسي للمحافظة على ترابط الخلايا الطلائية المبطنة للملاوعية اللبنية ويقوم بانتاج الحليب عبر التوازن الاسموزي.

**من اين يفرز؟**

- Human placental lactogen (HPL) – from the second month of pregnancy, the placenta releases large amounts of HPL. This hormone is closely associated with prolactin and appears to be instrumental in breast, nipple, and areola growth before birth.

**اللاكتوجين المشيمي** بداية من الشهر الثاني للحمل – تفرز المشيمة كميات كبيرة من اللاكتوجين المشيمي – هذا الهرمون يعتبر ذو علاقة وطيدة بالبرولاكتين ويعتبر ذو دور فعال في عملية نمو الثدي والحلمة ,والحلبة الملونة.

**ما هي الهرمونات الاخرى التي تفرز من المشيمة؟**

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**ما هي الهرمونات الاخرى التي تفرز من المشيمة؟**

**human chorionic gonadotropin (hCG),  
progesterone,  
estrogen, and  
human placental lactogen (hPL).**

- Follicle stimulating hormone (FSH), luteinizing hormone (LH), and human chorionic gonadotropin (hCG), through control of estrogen and progesterone production, and also, by extension, prolactin and growth hormone production, are essential.

**الهرمون المحفز للحويصلات و هرمون اللوتنة**, والهرمون المشيمي المحفز للمناسل  
خلال التحكم في انتاج الاستروجين والبروجسترون والبرولاكتين وهرمون النمو.

**من اين يفرز؟**

- Growth hormone (GH) is structurally very similar to prolactin and independently contributes to its galactopoiesis.

**هرمون النمو** تركيبيا يشبه كثيرا البرولاكتين ويشترك بشكل مستقل في عملية تكوين اللبن.

**من اين يفرز؟**

- Adrenocorticotrophic hormone (ACTH) and glucocorticoids such as cortisol have an important lactation inducing function in several animal species, including humans. Glucocorticoids play a complex regulating role in the maintenance of tight junctions.

**الهرمون المحفز للكظرية والقشريات الجلوكورتيكويدية مثل الكورتيزول** لهما دورا هاما في تحفيز امداد الحليب في العديد من انواع الحيوانات وايضا الانسان. القشريات الجلوكورتيكويدات تلعب دورا معقدا في تنظيم والمحافظة على ترابط الخلايا ببعضها البعض.

**من اين يفرز؟**

- Thyroid-stimulating hormone (TSH) and thyrotropin-releasing hormone (TRH) are very important galactopoietic hormones whose levels are naturally increased during pregnancy.

الهرمون المحفز للدرقية والمطلق للهرمون المحفز للدرقية تعتبر من أهم الهرمونات المنبّهة لتكوين الحليب ويزداد معدله بشكل طبيعي خلال الحمل.

من اين يفرز؟

- Oxytocin contracts the smooth muscle of the uterus during and after birth, and during orgasm(s). After birth, oxytocin contracts the smooth muscle layer of band-like cells surrounding the alveoli to squeeze the newly produced milk into the duct system. Oxytocin is necessary for the milk ejection reflex, or let-down, in response to suckling, to occur.

**اوكسيتوسين** يحفز انقباض العضلات الملساء للرحم خلال وبعد الولادة. بعد الولادة،  
الاوكتوسين يحفز انقباض طبقة العضلات الملساء من الخلايا المحيطة  
بالحوصلات ليتم عصر الحليب داخل الاوعية. الاوكستوسين ضروري لضخ اللبن  
كرد فعل لعملية رضع الطفل للحلمة.



