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PHS 204

Question: Discuss lactation and gestation period in a normal female

**Lactation** describes the secretion of [milk](https://en.wikipedia.org/wiki/Milk) from the [mammary glands](https://en.wikipedia.org/wiki/Mammary_gland) and the period of time that a [mother](https://en.wikipedia.org/wiki/Mother) lactates to feed her young. In humans the process of feeding milk is also called [breastfeeding](https://en.wikipedia.org/wiki/Breastfeeding) or nursing. Newborn infants often produce some milk from their own breast tissue, known colloquially as [witch's milk](https://en.wikipedia.org/wiki/Witch%27s_milk). Galactopoiesis is the maintenance of milk production. This stage requires [prolactin](https://en.wikipedia.org/wiki/Prolactin). [Oxytocin](https://en.wikipedia.org/wiki/Oxytocin) is critical for the *milk let-down reflex* in response to [suckling](https://en.wikipedia.org/wiki/Suckling).

In most species, milk comes out of the mother’s nipples; however, the platypus (a non-placental mammal) releases milk through ducts in its abdomen. In only one species of mammal, the dayak fruit bat, is milk production a normal male function.

In some other mammals, the male may produce milk as the result of a hormone imbalance. This phenomenon may also be observed in newborn infants as well (for instance, witch’s milk).

**Purpose**

The chief function of a lactation is to provide [nutrition](https://en.wikipedia.org/wiki/Nutrition) and immune protection to the young after birth. Due to lactation, the mother-young pair can survive even if food is scarce or too hard for the young to attain, expanding the environmental conditions the species can withstand

***Hormonal Influences***

From the eighteenth week of [pregnancy](https://en.wikipedia.org/wiki/Pregnancy) (the second and third [trimesters](https://en.wikipedia.org/wiki/Physiology_of_pregnancy)), a woman's body produces [hormones](https://en.wikipedia.org/wiki/Hormone) that stimulate the growth of the [milk duct](https://en.wikipedia.org/wiki/Milk_duct) system in the [breasts](https://en.wikipedia.org/wiki/Breast):

[Progesterone](https://en.wikipedia.org/wiki/Progesterone) influences the growth in size of [alveoli](https://en.wikipedia.org/wiki/Alveolar_gland) and lobes; high levels of progesterone inhibit lactation before birth. Progesterone levels drop after birth; this triggers the onset of copious milk production.

[Estrogen](https://en.wikipedia.org/wiki/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. Breastfeeding mothers should avoid estrogen-based birth control methods, as a spike in estrogen levels may reduce a mother's milk supply.

[Prolactin](https://en.wikipedia.org/wiki/Prolactin) contributes to the increased growth and differentiation of the alveoli, and also influences differentiation of ductal structures. High levels of prolactin during pregnancy and breastfeeding also increase insulin resistance, increase growth factor levels (IGF-1) and modify lipid metabolism in preparation for breastfeeding. During lactation, prolactin is the main factor maintaining [tight junctions](https://en.wikipedia.org/wiki/Tight_junction) of the ductal epithelium and regulating milk production through osmotic balance.

[Human placental lactogen](https://en.wikipedia.org/wiki/Human_placental_lactogen) (HPL) – from the second month of pregnancy, the [placenta](https://en.wikipedia.org/wiki/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](https://en.wikipedia.org/wiki/Follicle_stimulating_hormone) (FSH), [luteinizing hormone](https://en.wikipedia.org/wiki/Luteinizing_hormone) (LH), and [human chorionic gonadotropin](https://en.wikipedia.org/wiki/Human_chorionic_gonadotropin) (hCG), through control of estrogen and progesterone production, and also, by extension, prolactin and growth hormone production, are essential.

[Growth hormone](https://en.wikipedia.org/wiki/Growth_hormone) (GH) is structurally very similar to prolactin and independently contributes to its galactopoiesis.

[Adrenocorticotropic hormone](https://en.wikipedia.org/wiki/Adrenocorticotropic_hormone) (ACTH) and [glucocorticoids](https://en.wikipedia.org/wiki/Glucocorticoid) such as [cortisol](https://en.wikipedia.org/wiki/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](https://en.wikipedia.org/wiki/Thyroid-stimulating_hormone) (TSH) and [thyrotropin-releasing hormone](https://en.wikipedia.org/wiki/Thyrotropin-releasing_hormone) (TRH) are very important galactopoietic hormones whose levels are naturally increased during pregnancy.

[Oxytocin](https://en.wikipedia.org/wiki/Oxytocin) contracts the [smooth muscle](https://en.wikipedia.org/wiki/Smooth_muscle) of the [uterus](https://en.wikipedia.org/wiki/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.

**Colostrum**

Colostrum is the first milk a breastfed baby receives. It contains higher amounts of white blood cells and antibodies than mature milk, and is especially high in immunoglobulin A (IgA), which coats the lining of the baby’s immature intestines, and helps to prevent pathogens from invading the baby’s system. Secretory IgA also helps prevent food allergies. Over the first two weeks after the birth, colostrum production slowly gives way to mature breast milk.

**Secretory differentiation**

During the latter part of pregnancy, the woman's breasts enter into the secretory differentiation stage. This is when the breasts make [colostrum](https://en.wikipedia.org/wiki/Colostrum), a thick, sometimes yellowish fluid. At this stage, high levels of progesterone inhibit most milk production. It is not a medical concern if a pregnant woman leaks any colostrum before her baby's birth, nor is it an indication of future milk production.

**Secretory activation**

At [birth](https://en.wikipedia.org/wiki/Childbirth), prolactin levels remain high, while the delivery of the placenta results in a sudden drop in progesterone, estrogen, and HPL levels. This abrupt withdrawal of progesterone in the presence of high prolactin levels stimulates the copious milk production of *Secretory Activation*.

When the breast is stimulated, prolactin levels in the blood rise, peak in about 45 minutes, and return to the pre-breastfeeding state about three hours later. The release of prolactin triggers the cells in the alveoli to make milk. Prolactin also transfers to the breast milk. Some research indicates that prolactin in milk is greater at times of higher milk production, and lower when breasts are fuller, and that the highest levels tend to occur between 2 a.m. and 6 a.m

**Autocrine control - Galactapoiesis**

The hormonal [endocrine](https://en.wikipedia.org/wiki/Endocrine) control system drives milk production during pregnancy and the first few days [after the birth](https://en.wikipedia.org/wiki/Postpartum). When the milk supply is more firmly established, [autocrine](https://en.wikipedia.org/wiki/Autocrine) (or local) control system begins.

During this stage, the more that milk is removed from the breasts, the more the breast will produce milk. Research also suggests that draining the breasts more fully also increases the rate of milk production. Thus the milk supply is strongly influenced by how often the baby feeds and how well it is able to transfer milk from the breast. Low supply can often be traced to:

* not feeding or [pumping](https://en.wikipedia.org/wiki/Breast_pump) often enough
* inability of the infant to transfer milk effectively caused by, among other things:
  + jaw or mouth structure deficits
  + poor latching technique
* rare maternal endocrine disorders
* hypoplastic breast tissue
* inadequate calorie intake or malnutrition of the mother

#### Milk ejection reflex mechanism

This is the mechanism by which milk is transported from the breast alveoli to the nipple. Suckling by the baby innervates slowly-adapting[[10]](https://en.wikipedia.org/wiki/Lactation" \l "cite_note-Grachev_1977-10) and rapidly-adapting [mechanoreceptors](https://en.wikipedia.org/wiki/Mechanoreceptor) that are densely packed around the [areolar](https://en.wikipedia.org/wiki/Areola) region. The electrical impulse follows the [spinothalamic tract](https://en.wikipedia.org/wiki/Spinothalamic_tract), which begins by innervation of fourth [intercostal nerves](https://en.wikipedia.org/wiki/Intercostal_nerve). The electrical impulse then ascends the [posterolateral tract](https://en.wikipedia.org/wiki/Posterolateral_tract) for one or two vertebral levels and synapses with second-order neurons, called tract cells, in the posterior dorsal horn. The tract cells then decussate via the [anterior white commissure](https://en.wikipedia.org/wiki/Anterior_white_commissure) to the anterolateral corner and ascend to the [supraoptic nucleus](https://en.wikipedia.org/wiki/Supraoptic_nucleus) and [paraventricular nucleus](https://en.wikipedia.org/wiki/Paraventricular_nucleus) in the [hypothalamus](https://en.wikipedia.org/wiki/Hypothalamus), where they synapse with oxytocinergic third-order neurons. The somas of these neurons are located in the hypothalamus, but their axon and axon terminals are located in the [infundibulum](https://en.wikipedia.org/wiki/Pituitary_stalk) and [pars nervosa](https://en.wikipedia.org/wiki/Pars_nervosa) of the [posterior pituitary](https://en.wikipedia.org/wiki/Posterior_pituitary), respectively. The oxytocin is produced in the neuron's soma in the supraoptic and paraventricular nuclei, and is then transported down the infundibulum via the [hypothalamo-neurohypophyseal tract](https://en.wikipedia.org/wiki/Hypothalamo-neurohypophyseal_tract) with the help of the carrier protein, [neurophysin I](https://en.wikipedia.org/wiki/Neurophysin_I), to the pars nervosa of the posterior pituitary, and then stored in [Herring bodies](https://en.wikipedia.org/wiki/Herring_bodies), where they are stored until the synapse between second- and third-order neurons.

Following the electrical impulse, oxytocin is released into the bloodstream. Through the bloodstream, oxytocin makes its way to [myoepithelial cells](https://en.wikipedia.org/wiki/Myoepithelial_cells), which lie between the extracellular matrix and luminal epithelial cells that also make up the alveoli in breast tissue. When oxytocin binds to the myoepithelial cells, the cells contract. The increased intra-aveolar pressure forces milk into the lactiferous sinuses, into the lactiferous ducts (a study found that lactiferous sinuses may not exist. If this is true then milk simply enters the lactiferous ducts), and then out the nipple

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**2. GESTATION**

**Gestation** is the period of [development](https://en.wikipedia.org/wiki/Prenatal_development) during the carrying of an [embryo](https://en.wikipedia.org/wiki/Embryo) or [fetus](https://en.wikipedia.org/wiki/Fetus) inside [viviparous](https://en.wikipedia.org/wiki/Viviparity) [animals](https://en.wikipedia.org/wiki/Animals). It is typical for [mammals](https://en.wikipedia.org/wiki/Mammal), but also occurs for some non-mammals. [Mammals during pregnancy](https://en.wikipedia.org/wiki/Pregnancy_(mammals)) can have one or more gestations at the same time, for example in a [multiple birth](https://en.wikipedia.org/wiki/Multiple_birth).

The time interval of a gestation is called the [gestation period](https://en.wikipedia.org/wiki/Gestation_period). In [human obstetrics](https://en.wikipedia.org/wiki/Obstetrics_and_gynecology), [gestational age](https://en.wikipedia.org/wiki/Gestational_age) refers to the [fertilization age](https://en.wikipedia.org/wiki/Human_fertilization#Fertilization_age) plus two weeks. This is approximately the duration since the woman's [last menstrual period (LMP)](https://en.wikipedia.org/wiki/Menstruation#Onset_and_frequency)) began.

In mammals, pregnancy begins when a [zygote](https://en.wikipedia.org/wiki/Zygote) (fertilized ovum) implants in the female's [uterus](https://en.wikipedia.org/wiki/Uterus) and ends once the fetus leaves the uterus. On the main article link above, are average and approximate gestation values ordered by number of days (note: human gestational age is counted from the last menstrual period; for other animals the counting method varies, so these figures could be 14 days off)

Human pregnancy can be divided roughly into three trimesters, each approximately three months long. The first trimester is from the last period through the 13th week, the second trimester is 14th–27th week, and the third trimester is 28th–42nd week.Birth normally occurs at a [gestational age](https://en.wikipedia.org/wiki/Gestational_age) of about 40 weeks, though it is common for births to occur from 37 to 42 weeks. From the 9th week of pregnancy (11th week of [gestational age](https://en.wikipedia.org/wiki/Gestational_age)), the embryo is called a fetus.

Various factors can come into play in determining the duration of gestation. For humans, male fetuses normally gestate several days longer than females and [multiple pregnancies](https://en.wikipedia.org/wiki/Multiple_birth) gestate for a shorter period

THE FIRST TRIMESTER

A human being originates when the **sperm** from a man wins the big race and becomes first to burrow itself into a woman's **egg**. This miraculous moment is known as **conception**.

The fertilized egg is now called a **zygote**. The zygote heads for the **uterus** and happily nestles into the uterine wall, where it will reside for the next nine months. Thus begins the most dramatic series of transformations of this tiny speck. It will start undergoing many cell divisions in its initial growth. By week five, **organogenesis** begins. Organogenesis is the development of the **brain**, **heart**, and other vital organs. What was once a zygote is now called an **embryo**.

By week 12, things have progressed at an astonishing rate. The heart is beating, and all organs are formed. There are stubby little arms and legs present, and there are spots for eyes. Although fairly rudimentary and large-headed, this bun-in-the-oven is now called a fetus and resembles a tiny human being. The fetus weighs in at only about half an ounce, making it entirely possible that the mother doesn't even look pregnant yet.

THE SECOND TRIMESTER

The baby’s organs become fully developed during the second trimester. The baby can also start to hear and swallow. Small hairs become noticeable. Later on in the second trimester, the baby will begin to move around. It will develop sleeping and waking cycles that a pregnant woman will begin to notice. During the second trimester, the umbilical cord continues to thicken as it carries nourishment to the fetus

By the end of the second trimester , the fetus’s development will be about 13 to 16 inches long and weighs about 2 to 3 pounds. Fetal development during the second trimester includes the following:

* The fetus kicks, moves, and can turn from side to side.
* The eyes have been gradually moving to the front of the face and the ears have moved from the neck to the sides of the head. The fetus can hear the mother's voice.
* A creamy white substance (called vernix caseosa, or simply vernix) begins to appear on the fetus and helps to protect the thin fetal skin. Vernix is gradually absorbed by the skin, but some may be seen on babies even after birth.
* The fetus is developing reflexes such as swallowing and sucking.
* The fetus can respond to certain stimuli.
* The placenta is fully developed.
* The brain will undergo its most important period of growth from the 5th month on.
* Fingernails have grown on the tips of the fingers and toes, and the fingers and toes are fully separated.
* The fetus goes through cycles of sleep and wakefulness.
* Skin is wrinkly and red, covered with soft, downy hair (called lanugo).
* Hair is growing on the head of the fetus.
* Fat begins to form on the fetus.
* Eyelids are beginning to open and the eyebrows and eyelashes are visible.
* Fingerprints and toe prints have formed.
* Rapid growth is continuing in fetal size and weight.
* The 20th week marks the halfway point of the pregnancy.

**THE THIRD TRIMESTER**

At around [week 32](https://www.healthline.com/health/pregnancy/32-weeks-pregnant), the baby’s bones are fully formed. The baby can now open and close its eyes and sense light. The baby’s body will begin to store minerals like iron and calcium.

By [week 36](https://www.healthline.com/health/pregnancy/36-weeks-pregnant), the baby should be in a head down position. If the baby does not move into this position, the doctor may try to move the baby’s position or recommend that you give birth by a [cesarean section](https://www.healthline.com/health/c-section). This is when the doctor makes a cut in the mother’s belly and uterus in order to deliver the baby.

After [week 37](https://www.healthline.com/health/pregnancy/37-weeks-pregnant), the baby is considered full term and its organs are ready to function on their own.