

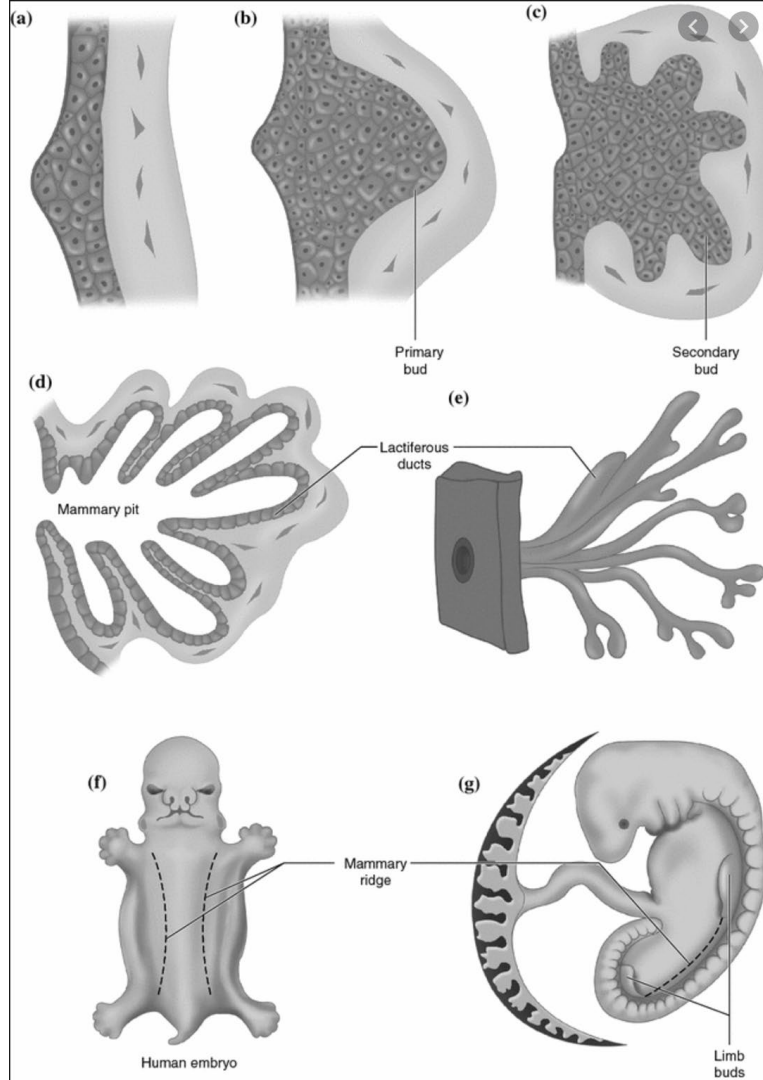
Anatomy & Physiology of Lactation



Karen Martinot, DNP, WHNP-BC, IBCLC

Breast Anatomy & Development

Embryogenesis



(Weatherley-White, 1980)

Pubertal Breast Changes Thelarche

Estrogen influences duct growth

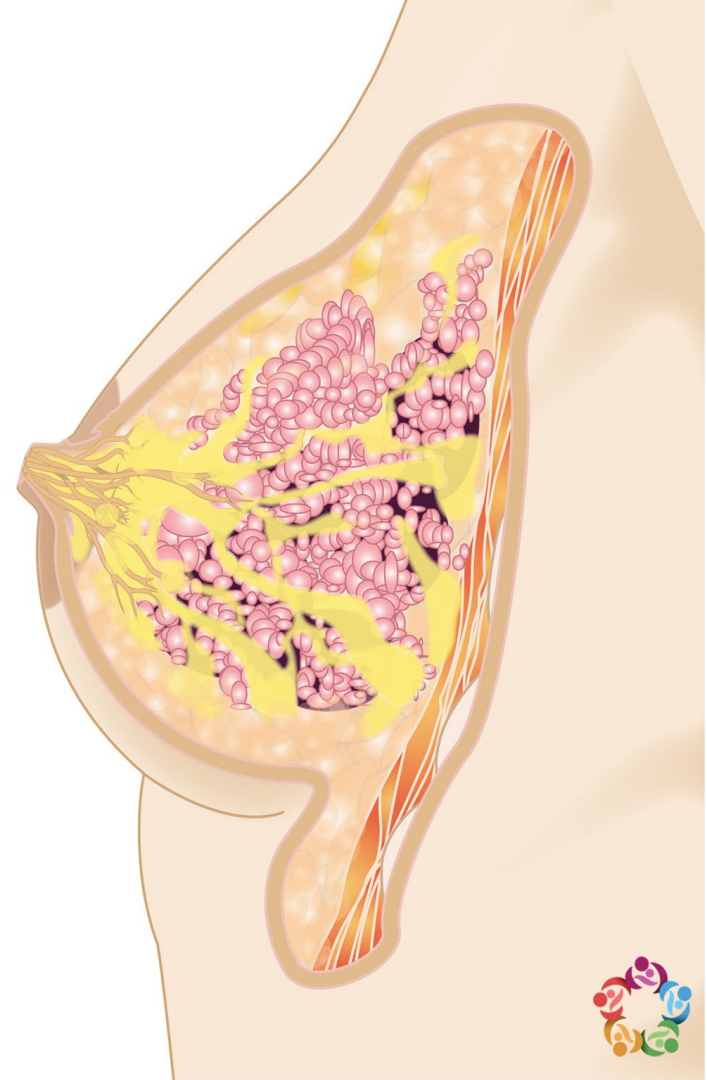
Progesterone influences secretory tissue development

Terminal ends of ducts develop into alveoli

(Marshall & Tanner, 1969)



The Mature Mammary Gland



(Lactation Education Resources, 2018)

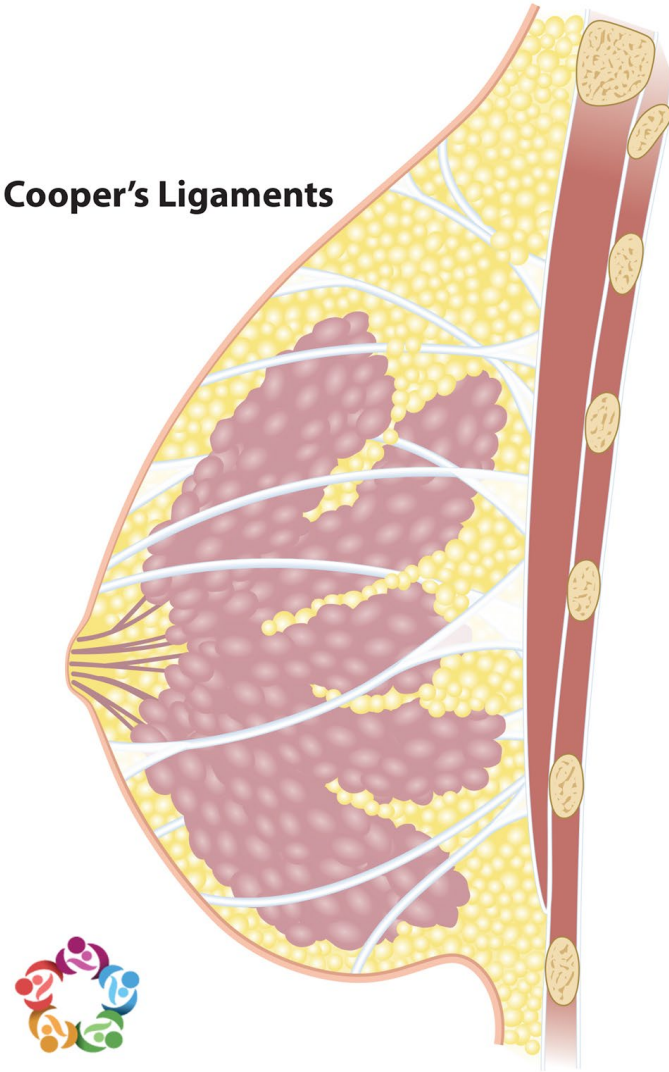


Cooper's Ligaments

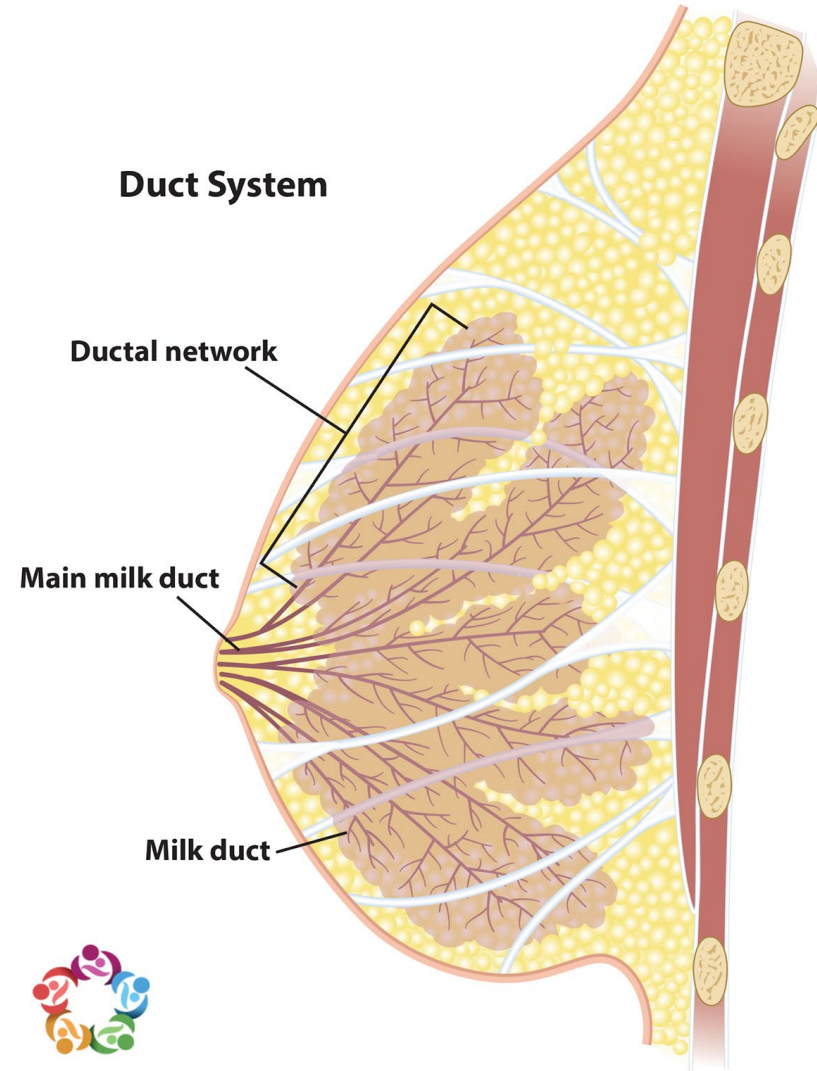
Suspensory ligaments of Cooper

(Lactation Education Resources, 2018)

Cooper's Ligaments



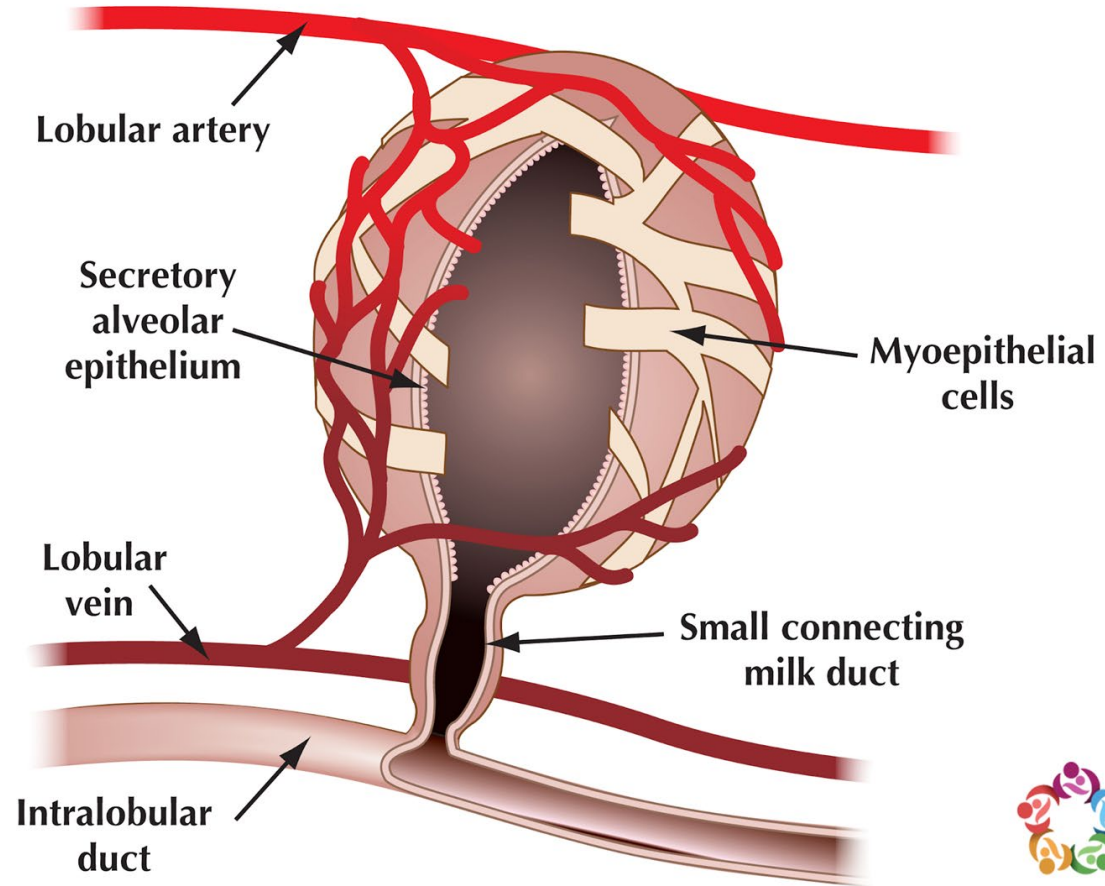
Duct System



(Lactation Education Resources, 2018)

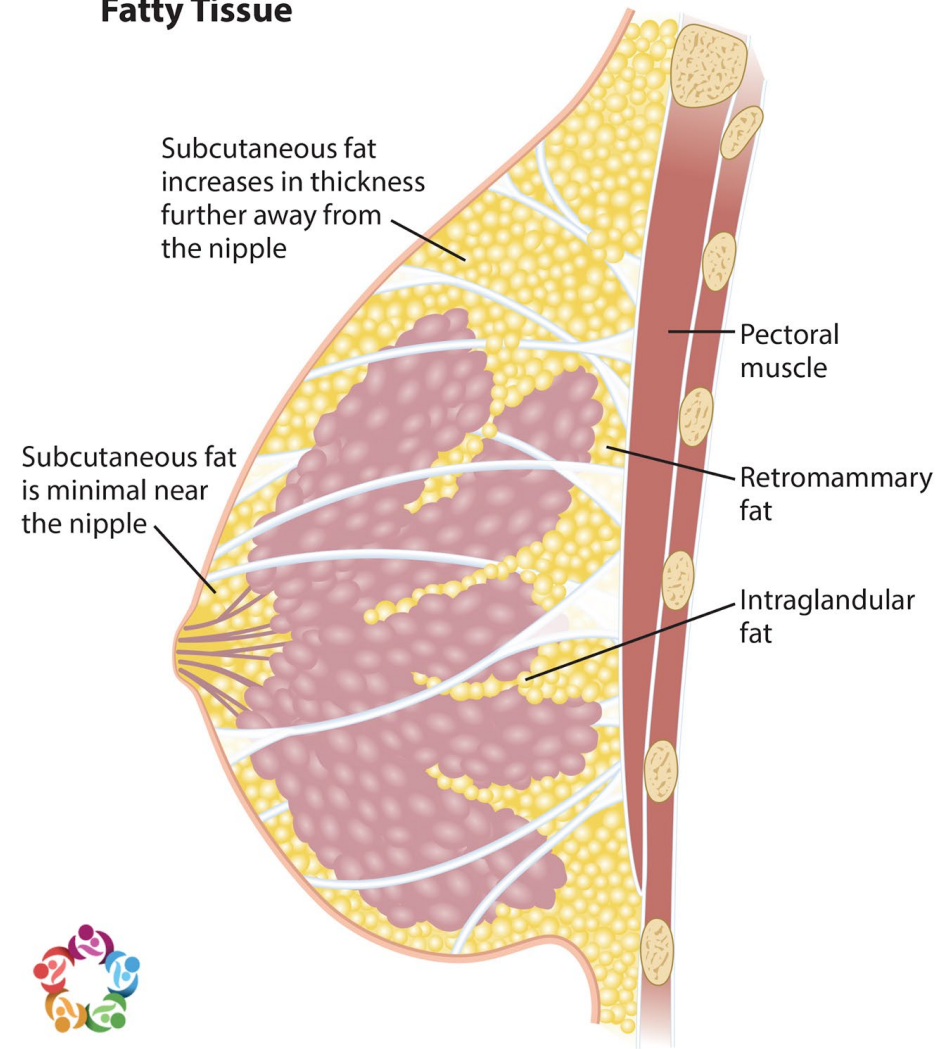


Alveola



Fatty Tissue

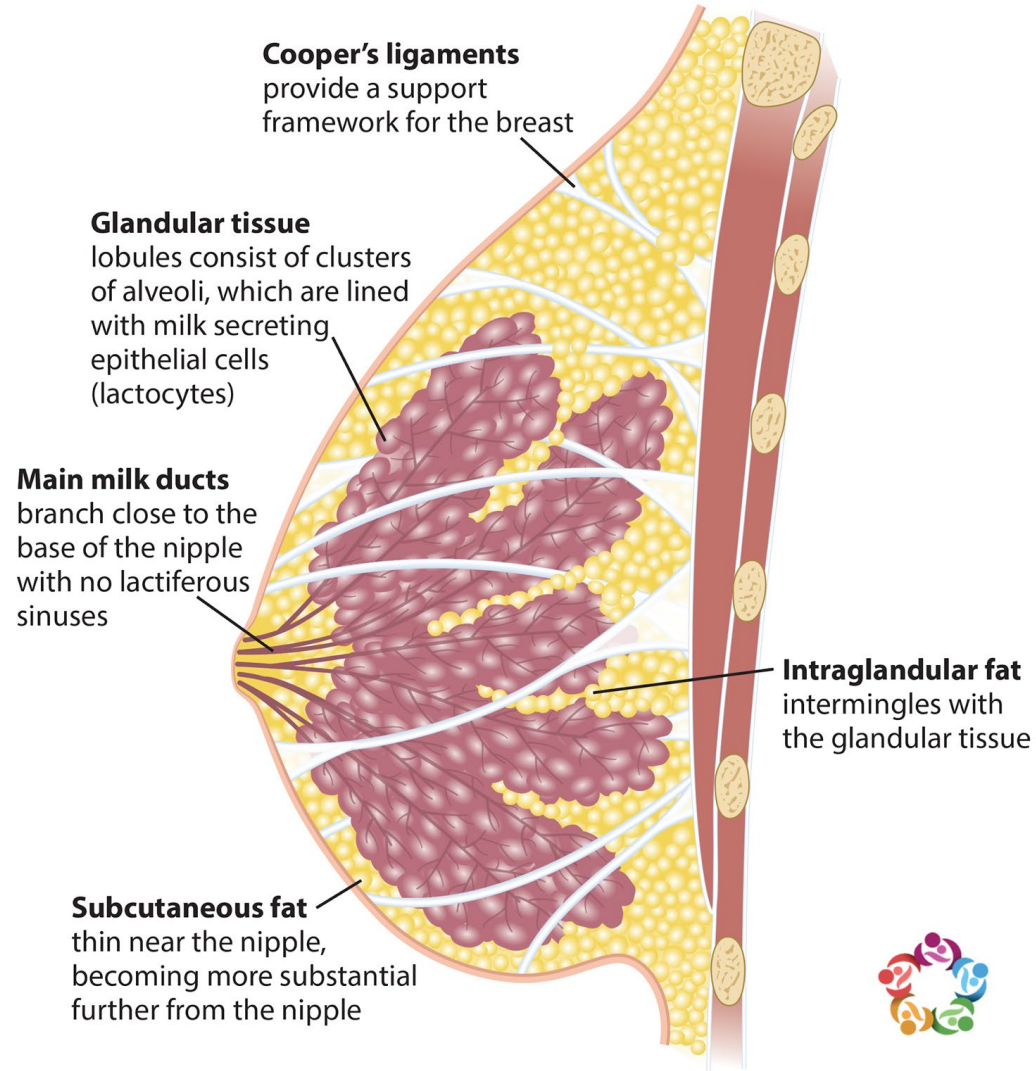
Fatty Tissue



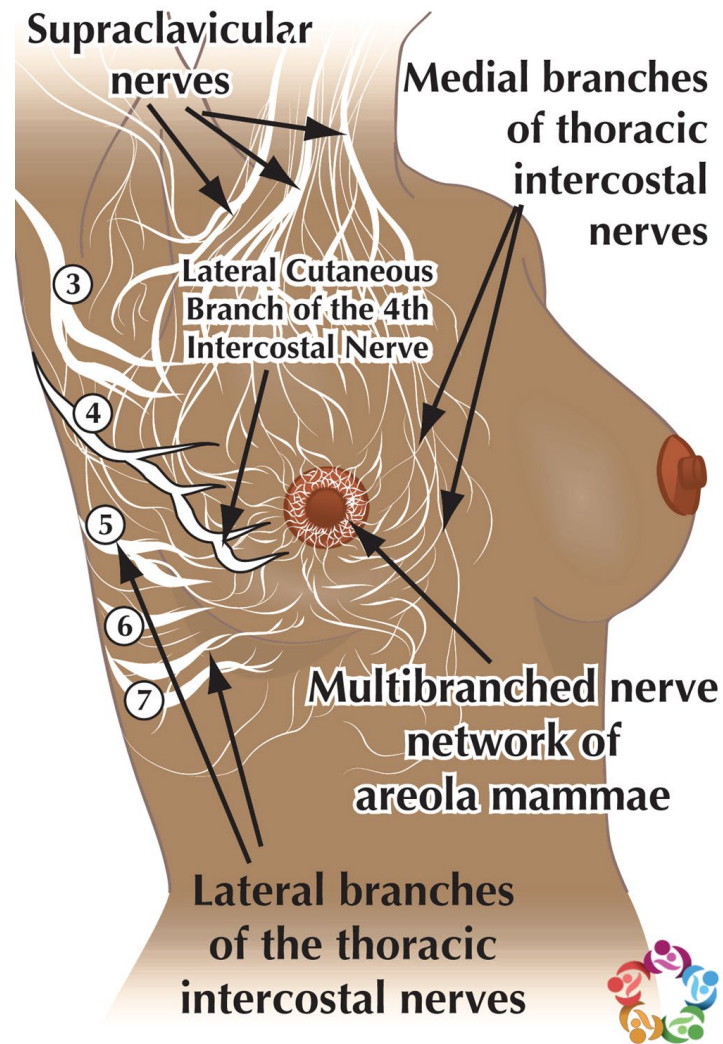
The Mature Mammary Gland

An interior view

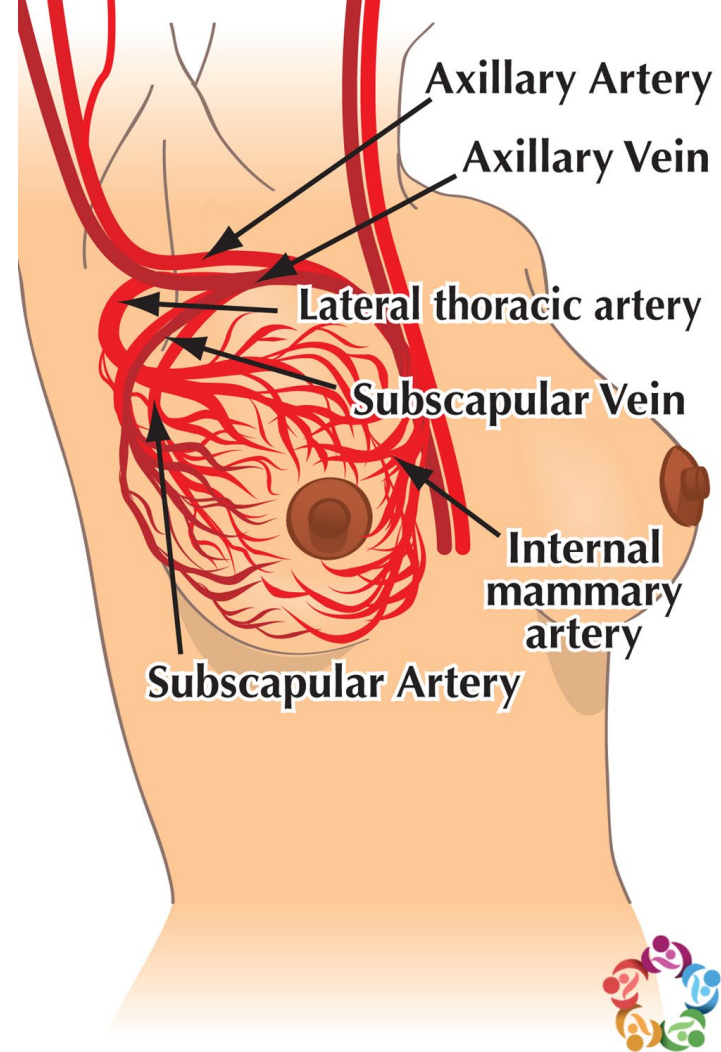
(Lactation Education Resources, 2018)



Nerves



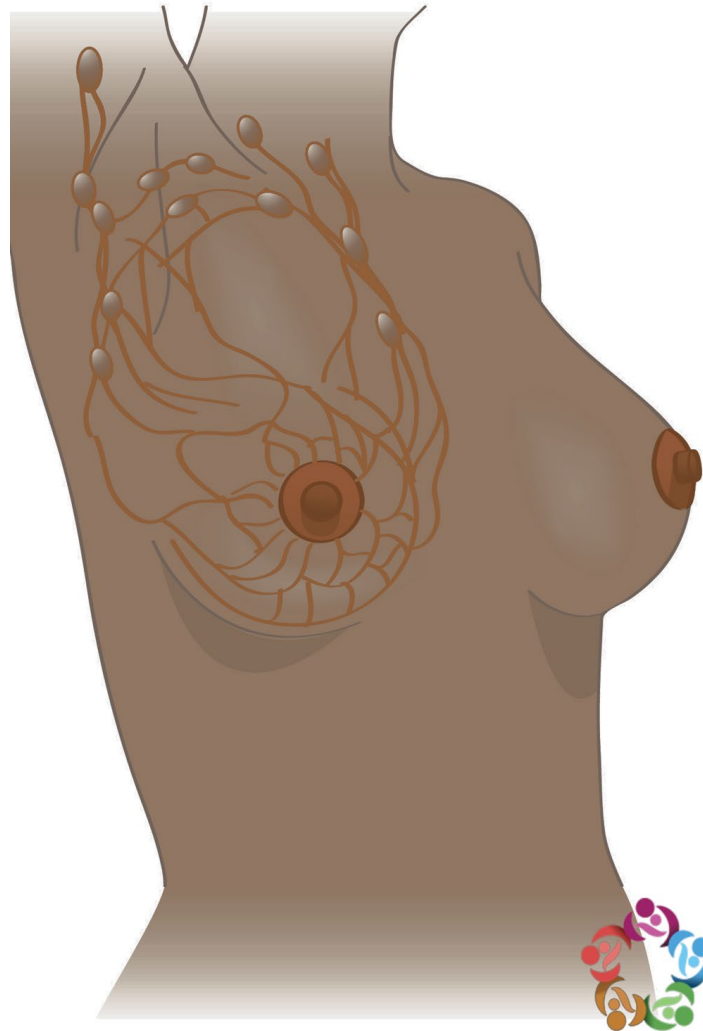
Vascular system



(Lactation Education Resources, 2018)



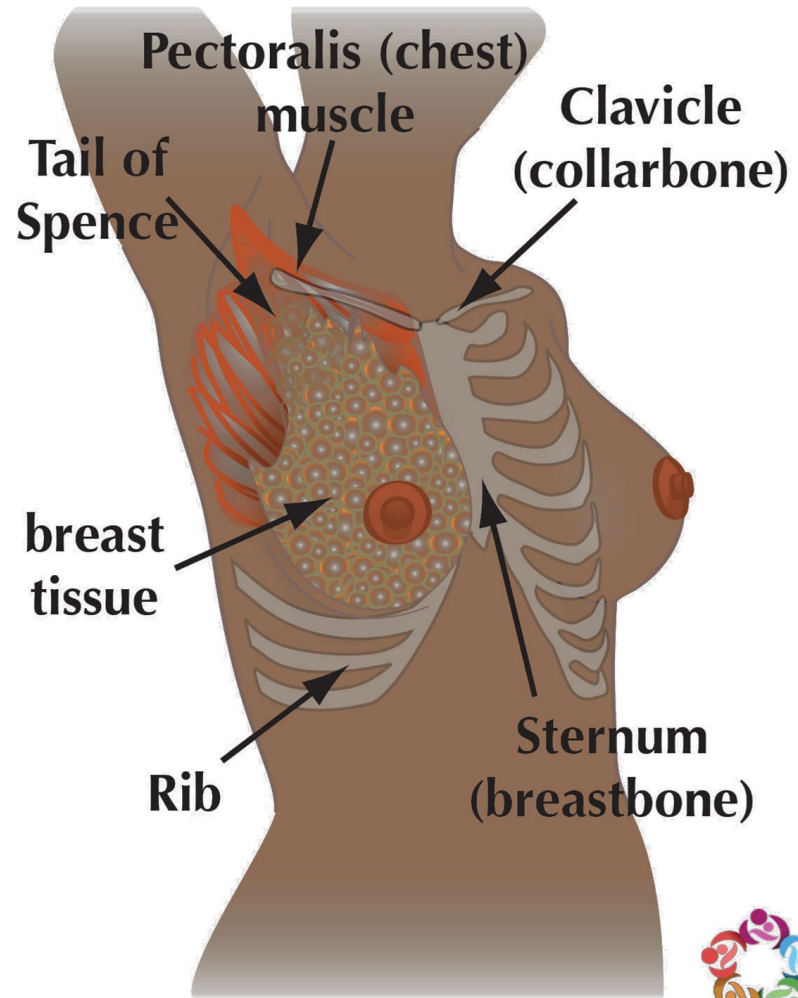
Lymphatics



(Lactation Education Resources, 2018)



Location

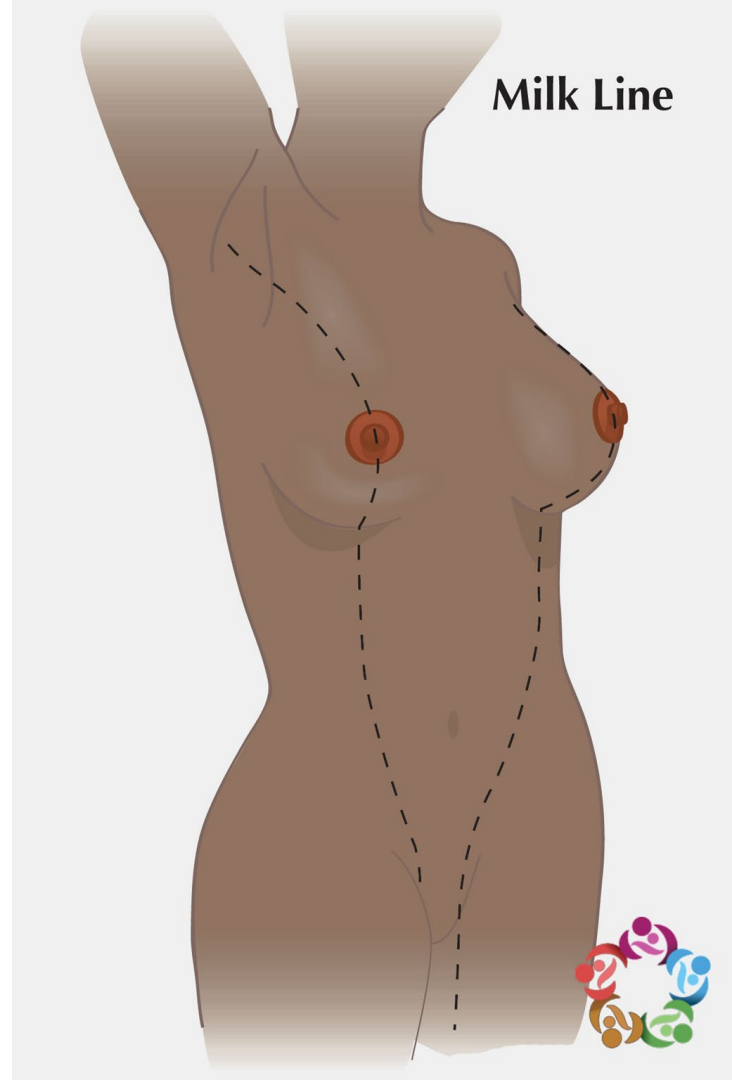


(Lactation Education Resources, 2018)



Milk Line

(Lactation Education Resources, 2018)



Mammogenesis in Pregnancy

Proliferation: Duct growth during 1st half of pregnancy; milk making cells multiply

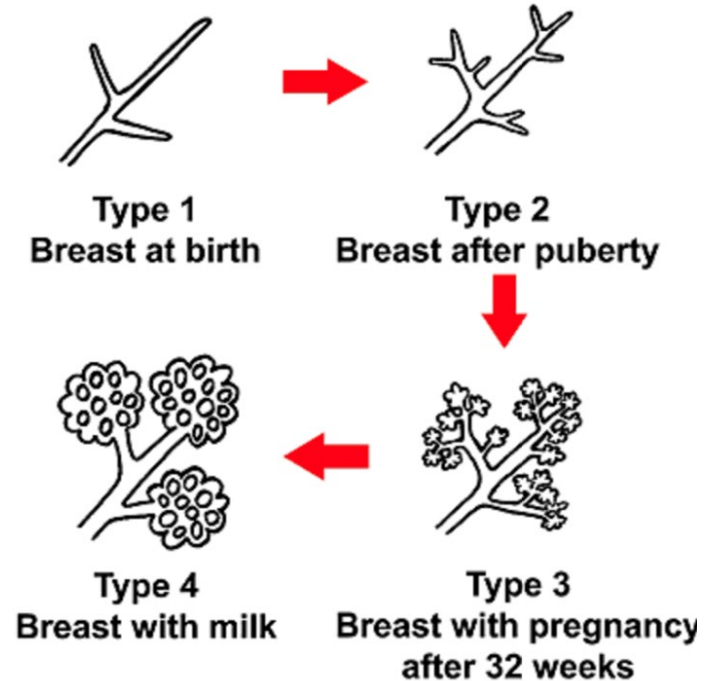
Differentiation: Lobuloalveolar system forms during mid to late pregnancy

Further branching of small ducts

Formation of end buds

Milk-making cells enlarge and differentiate: Alveoli differentiate at the end of the terminal (smallest) ducts

Secretory tissue replaces/displaces adipose tissue



(Mitchell, n.d.; Schanler, R. J., 2022)

Development in Pregnancy/Lactation

Montgomery Glands



- ☐ Increased vascularity
- ☐ Breast size increases
- ☐ Areola darkens
- ☐ Areola becomes enlarged
- ☐ Montgomery Glands often become visible

(Lawrence & Lawrence, 2022; Mitchell, n.d.; Schanler, 2022)



Hormones of Pregnancy Mammogenesis

Placental:

Human Placental Lactogen (HPL)
Human Chorionic Gonadotropin (HCG)
Estrogen
Progesterone

Thyroid:

Thyroxine

Pituitary:

Prolactin

Locally synthesized in the breast: (Mammatropic hormones)

Prolactin
Progesterone
Estrogen
Relaxin
Epidermal growth factor
Parathyroid Hormone related Protein (PTHrP)

Ovaries:

Estrogen & Progesterone

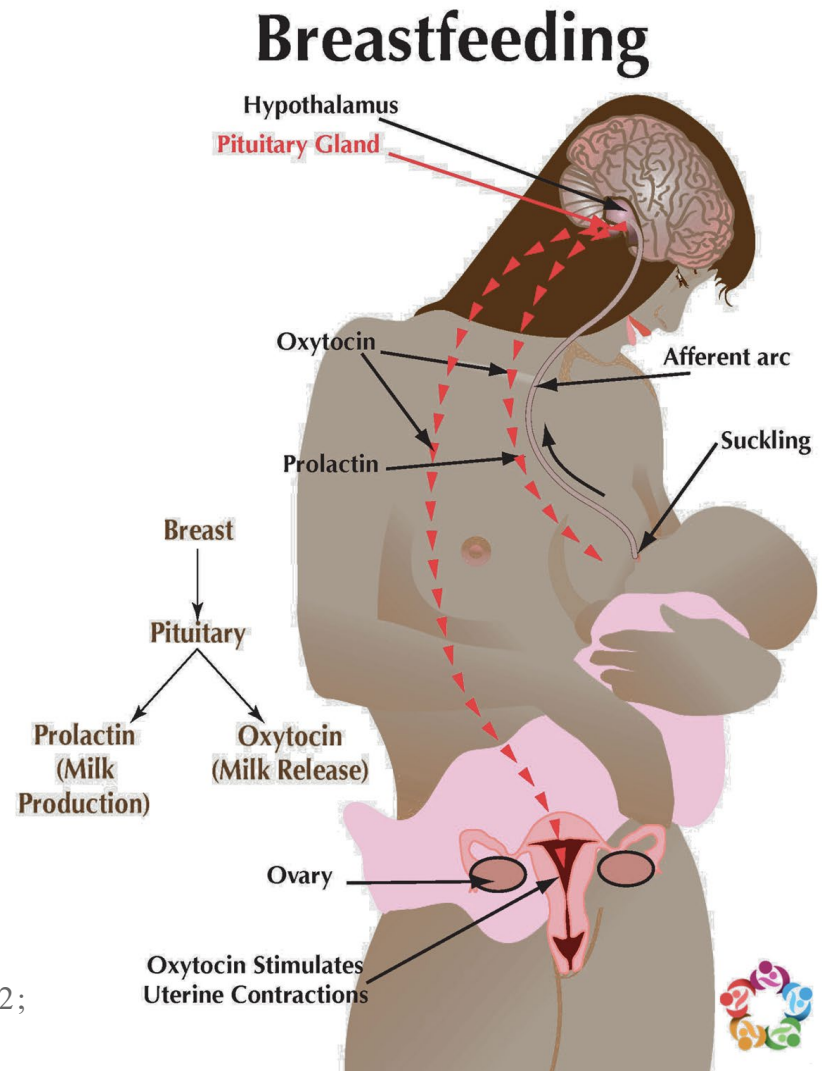
Physiology

Endocrine & Autocrine

Milk Synthesis Endocrine Control

Hypothalamus-Pituitary-Ovarian Complex

(Lactation Education Resources, 2018; Lawrence & Lawrence, 2022;
Schanler, 2022)

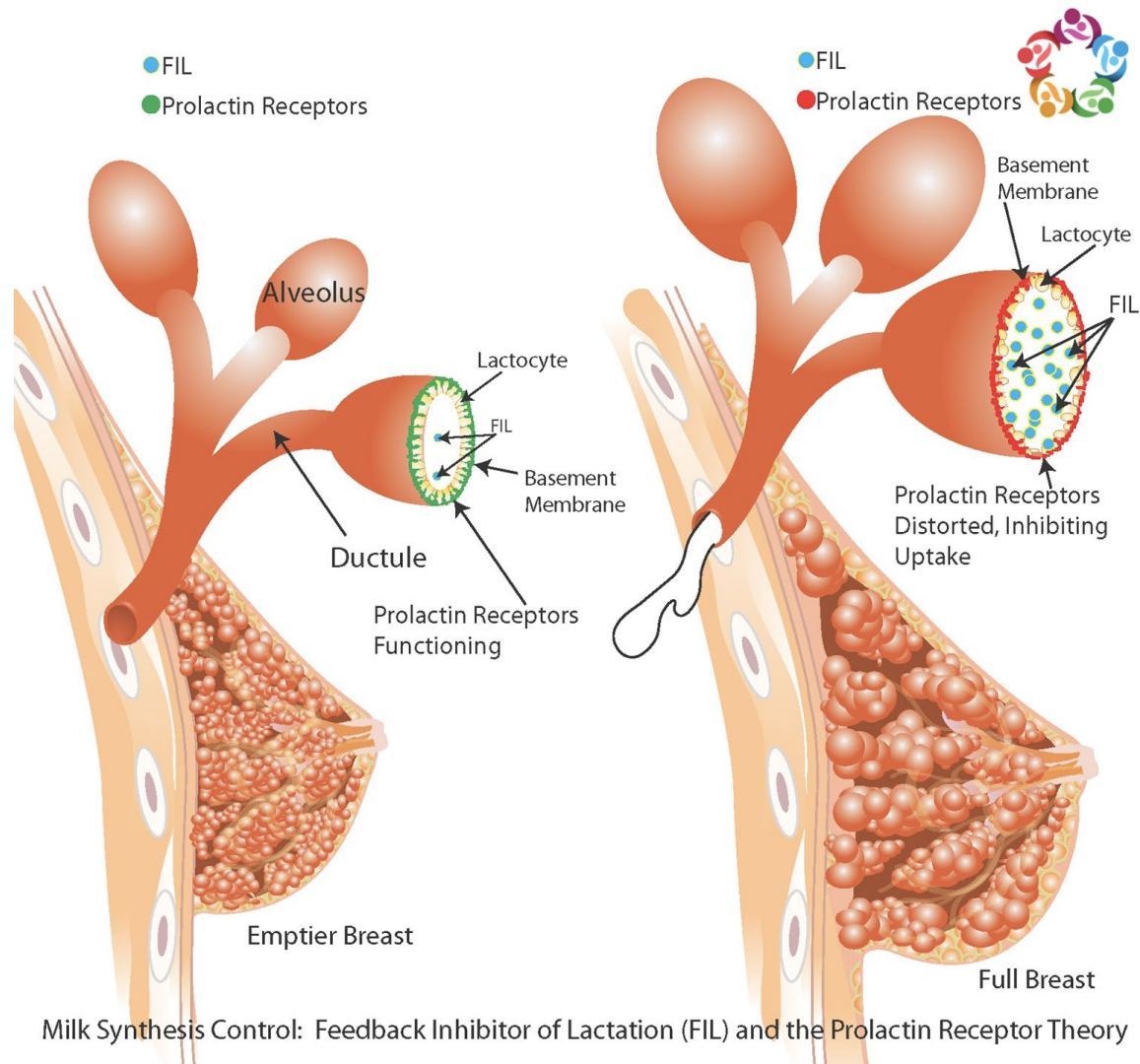


Milk Synthesis Autocrine Regulation

Synonyms for this stage

- Lactation Maintenance Stage
- Lactogenesis 3
- Galactopoiesis

(Lactation Education Resources, 2018;
Lawrence & Lawrence, 2022; Schanler, 2022)



Milk Synthesis Control: Feedback Inhibitor of Lactation (FIL) and the Prolactin Receptor Theory

Involution

Begins at weaning of baby

Gradual, sequenced return to prepregnant state

A reverse in development - a process of efficiency

Remodeling: redistribution of displaced fat

(Lawrence & Lawrence, 2022; Schanler, 2022)

Cyclical development and dormancy



WINTER

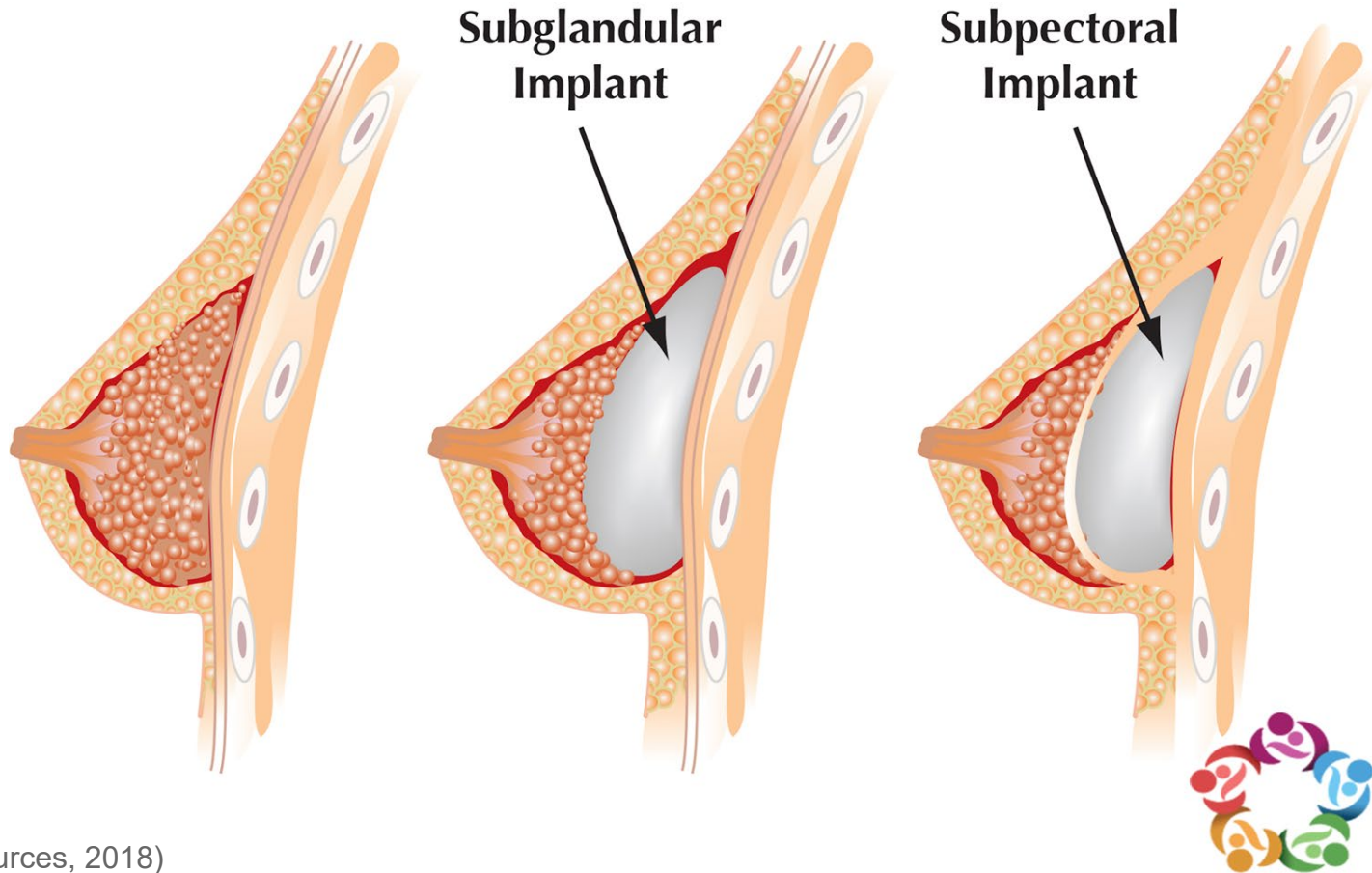
SPRING

SUMMER

FALL

Surgical Alterations

Surgical implants

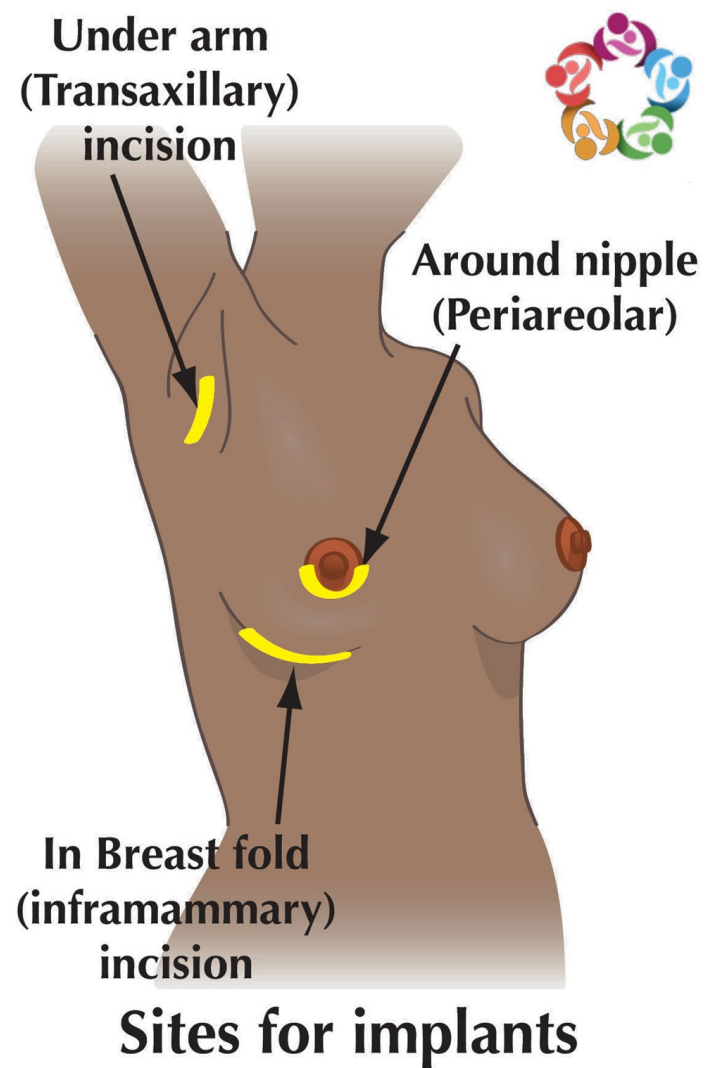


(Lactation Education Resources, 2018)



Augmentation

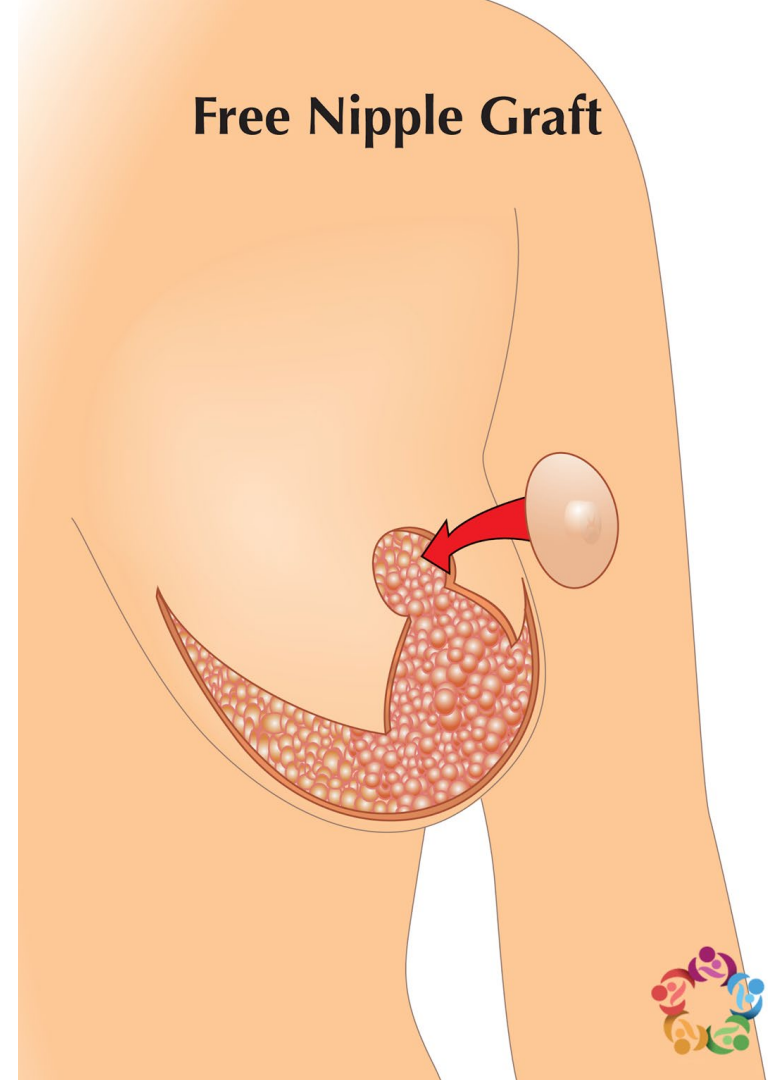
Incision sites



(Lactation Education Resources, 2018)

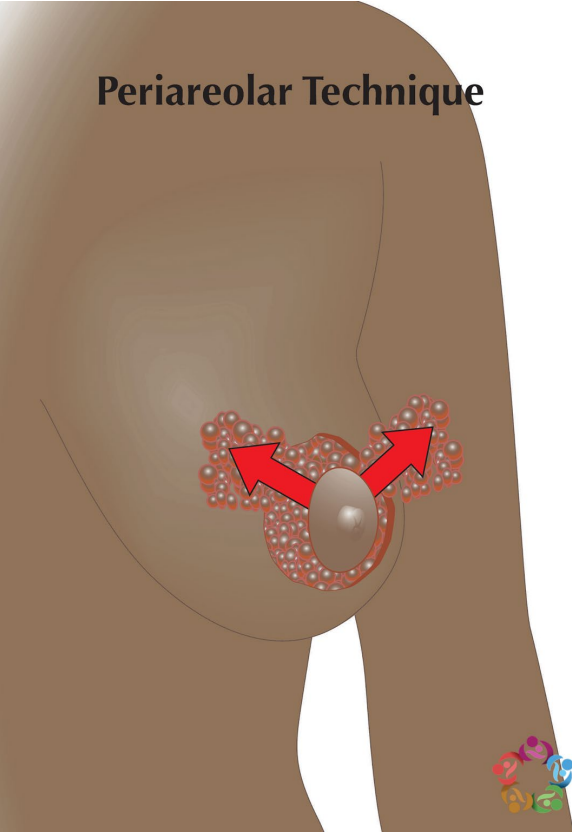
Reduction

(Kraut et al., 2017; Lactation Education Resources, 2018)

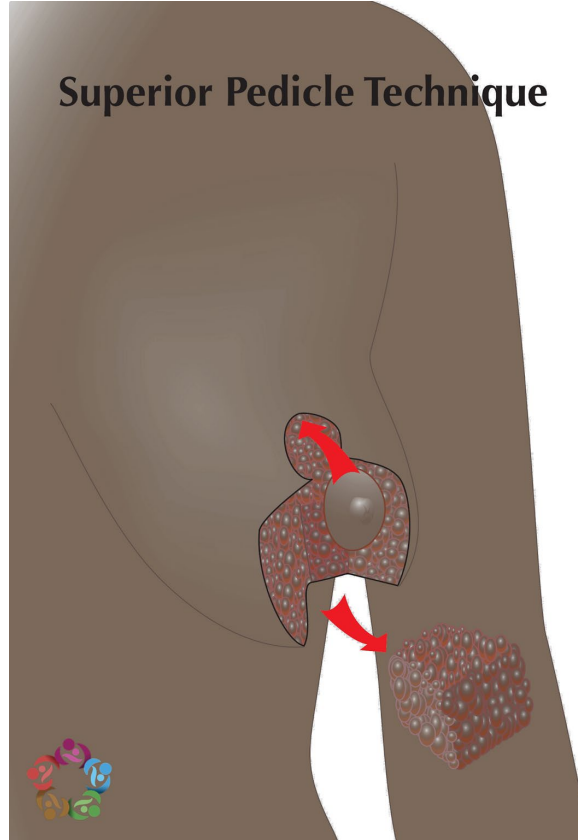


Preserving the subareolar parenchyma

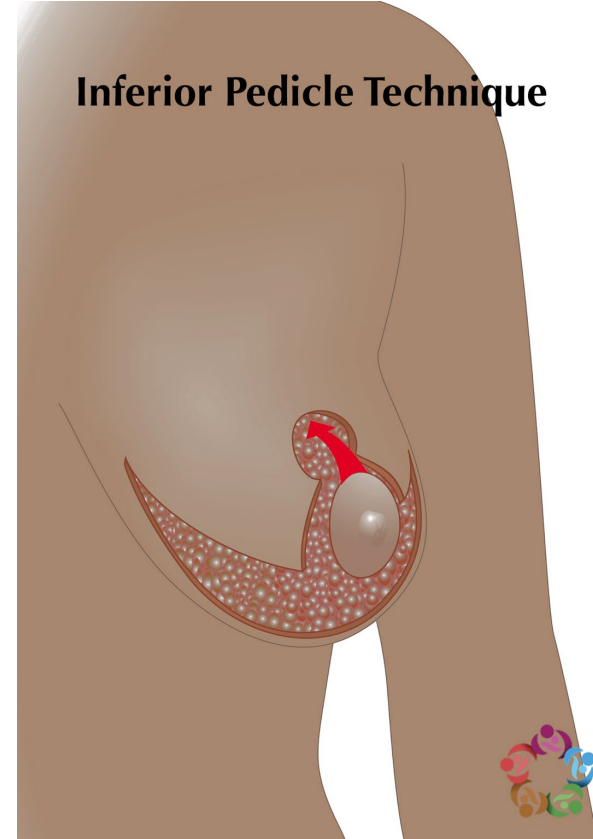
Periareolar Technique



Superior Pedicle Technique

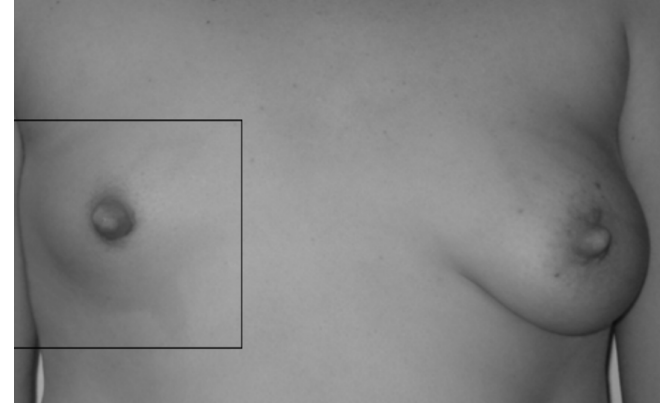


Inferior Pedicle Technique



Developmental Alterations

Hypoglandular/Hypoplastic



(Mitchell, n.d.)

Other Risks to Anatomical Development and Physiology

Risks

Placental Problems:

Small for Gestational age or Intrauterine Growth Restriction (SGA/IUGR)

Chronic Hypertension

Pregnancy Induced Hypertension/Preeclampsia

HELLP syndrome

Low Parathyroid Hormone Related Protein (PTHrP)

Correlates with lower milk supply

(Lawrence & Lawrence, 2022; Schanler, 2022)

Risks

Preterm delivery: possible arrested breast development if severely premature

Endocrine Disorders:

Gestational Diabetes

Type 2 Diabetes

Hypothyroid

Polyendocrine Metabolic Ovarian Syndrome (PMOS)

Obesity/Insulin insensitivity; particularly young onset obesity

Risks

Age:

Very young mother: possibly incomplete pubertal development

Mother age 35 and older: possibly age related endocrine changes

Risks

Exposure to Environmental Contaminants/ Endocrine Disruptors:

Dioxins

Bisphenol A (BPA)

Phthalate esters

Lead

Dichlorodiphenyltrichloroethane (DDT)

Triclosan

Pesticides

Risks

Destruction of normally developed breasts:

Breast Cancer Radiation Therapy

Trauma/Injury

Surgical Alteration

(Kraut et al., 2017; Lawrence & Lawrence, 2022; Schanler, 2022)

Conclusion

Supporting Breastfeeding

Across the 4 Trimesters

Karen Martinot, DNP, WHNP-BC, IBCLC

Recommendations

For breastfeeding
exclusivity and duration

WHO: Exclusively: first 6 months
Duration: **2 years or longer** as
mutually desired by parent and child

AAFP/AAP: Updated in 2022 to
match WHO. Previously one year or
longer as mutually desired parent
and child

ACOG/ACNM/NPWH: Updated in
February 2023 to match WHO/AAP
Previously one year or longer as
mutually desired parent and child

Objective Number	Objective Text	Baseline (2015 births)	2030 Target
MICH-15	Increase the proportion of infants who are breastfed exclusively through age 6 months	35.9%	54.1%
MICH-16	Increase the proportion of infants who are breastfed at 1 year	24.9%	42.4%

Healthy People 2030 includes two vital breastfeeding objectives

—

Ten Steps for Successful Breastfeeding of the Baby Friendly Hospital Initiative

“10 Steps”

1. Have a **written breastfeeding policy** that is routinely communicated to all healthcare staff.
 2. **Train all healthcare staff** in the skills necessary to implement the policy.
 3. **Inform** pregnant women of the **benefits** and **management** of breastfeeding.
 4. Help mothers **initiate** breastfeeding **within one hour of birth**.
 5. **Show mothers how** to breastfeed and how to maintain lactation, even if they are separated from their infants.
 6. Give infants no food or drink other than breastmilk **unless medically indicated**.
 7. Practice **rooming-in**.
 8. Allow mothers and infants to remain **together twenty-four hours a day**.
 9. Encourage **breastfeeding on demand**. Give **no pacifiers or artificial nipples** to breastfeeding infants.
 10. Foster the establishment of **breastfeeding support groups and refer mothers to them on discharge from the hospital**.
-

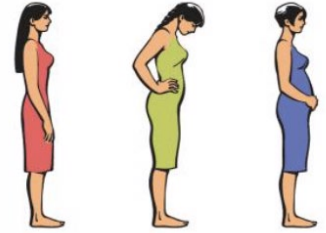
Do your part in the office

But how, exactly?

First Trimester

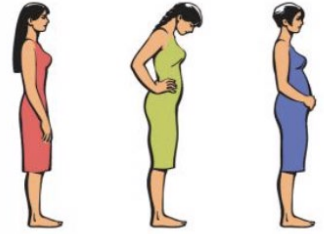
First Trimester

History:



- ☐ What is your experience with breastfeeding?
 - ☐ Prior duration of breastfeeding?
 - ☐ Have you had any surgery or trauma to either breast?
 - ☐ Review medical history for endocrine disorders? PMOS, hypothyroid, diabetes, obesity, trouble getting pregnant, irregular periods
-

First Trimester

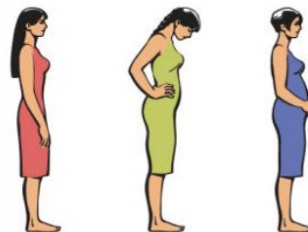


Physical:

Breast exam: Note size, shape, symmetry, nipple shape.

Use the exam time to educate regarding normal breast changes to expect in pregnancy.

First Trimester



Counseling:

Set the stage that *your organization is committed to supporting* breastfeeding.

“Here at _____ we are **committed** to helping women breastfeed their babies.”

Step 1

Pregnancy is a great time to learn about breastfeeding so we will talk about breastfeeding along the course of your pregnancy. We are all **trained** to help educate you about breastfeeding and I can help you connect with specialists if needed. **Step 2**

Discuss the **benefits of breastfeeding?** **Step 3**

First-Second Trimester

Counseling: Would it be okay if today we discuss the **benefits of breastfeeding?** **Step 3**

Benefits for Mom

Reduces risk of cancer

Reduces risk of Type 2 diabetes

Reduces cardiovascular risks

Supports weight management

Relieves stress - oxytocin

Facilitates bonding

Benefits for Baby

Supports brain development-IQ

Reduces risk of asthma

Reduces risk of obesity

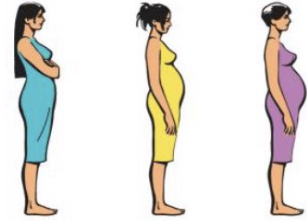
Reduces risk of diabetes

Reduces risk of childhood cancers

Helps calm baby

Second Trimester

Second Trimester

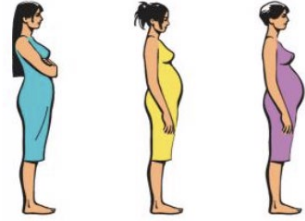


History:

- ☐ Have you noticed any breast changes: prominent veins, darker areola, larger breasts, visible Montgomery glands?
- ☐ What have you been hearing/reading/learning about breastfeeding?
- ☐ Have you signed up for a breastfeeding class?

Physical: as needed to address patient concerns

Second Trimester

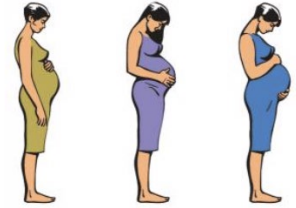


Counseling:

- ☐ Discuss breast changes as good signs that her breasts are preparing to lactate.
 - ☐ Recommend a Breastfeeding Class and discuss available Supports (available remote and in person) [Step 10](#)
 - ☐ “Preparing Breasts” for breastfeeding [Step 5](#)
 - ☐ “Preparing Supplies” for breastfeeding [Step 5](#)
-

Third Trimester

Third Trimester



History: Have you noticed any colostrum? What thoughts and concerns are you having about breastfeeding?

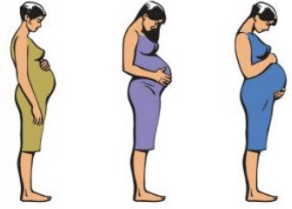
Physical: as needed to address individual concerns

Counseling:

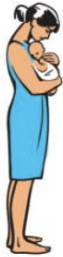
Reassure +/- colostrum at this point is normal.

Provide “Getting off to a good start” anticipatory guidance

Getting off to a good start



- ☐ Breastfeed within the “golden hour” after birth [Step 4](#)
 - ☐ Skin to Skin [Steps 4, 5, 9](#)
 - ☐ Rooming-in [Step 7](#)
 - ☐ Teach mom about feeding cues [Step 9](#)
 - ☐ Avoiding pacifiers [Step 9](#)
 - ☐ Avoid formula unless medically necessary [Step 6](#)
 - ☐ Connect with resources for ongoing support [Step 10](#)
-



COVID-19 positive Mom & Breastfeeding

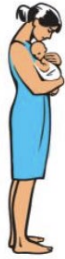
Limit data available suggests that COVID is not spread via breast milk

- Wash hands with soap and water before touching baby
 - Wash hands before breastfeeding
 - Wash hands before pumping or touching pump/bottles
 - Wear a mask while holding baby, breastfeeding, or pumping
 - Follow standard instructions for washing pump after every use
-

“Fourth” Trimester

First 3 months postpartum





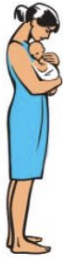
First 3 months Postpartum

History: How is your baby doing? How is breastfeeding going? Are you having any breast or nipple discomfort?

Physical: Note areas of skin breakdown, redness, lumps, tenderness, fullness

Counseling:

- ☐ Discuss family/support with baby care.
 - ☐ Discuss ways to make breastfeeding more comfortable and sustainable.
 - ☐ Refer as indicated to Lactation Consultant and Pediatric Provider.
 - ☐ Discuss returning to work plans.
 - ☐ Education regarding low estrogen state and may need to use lubricant with intercourse
-



Rare Contraindications to Breastfeeding

- Infant is diagnosed with classic **galactosemia**
 - In U.S., mothers infected with the **human immunodeficiency virus (HIV)**₁
(Note: recommendations about breastfeeding and HIV may be different in other countries)
 - Mother is infected with human **T-cell lymphotropic virus type I or type II (HTLV - 1/2)**₁
 - Mother is using an **illicit street drug**
 - Mother has suspected or confirmed **Ebola virus disease**
-

Vaccinations

Contraindicated/Caution in Lactation:

Yellow Fever

Rotavirus



Lactation Resources for Patients

Videos: <https://med.stanford.edu/newborns/professional-education/breastfeeding.html>

Free [Parent Handouts](#) from Lactation Education Resources www.LERon-line.com/

Peer to peer support: <https://www.llli.org> La Leche League

Provider Resources- Books

Egash, A., & Leeper, K. (2023). *The little green book of breastfeeding management for physicians and other healthcare providers* (8th ed.). Institute for the Advancement of Breastfeeding and Lactation Education.

Hale, T. W. (2019). *Medications in mother's milk* (17th ed.). Amarillo, TX: Hale Publishing.

Lawrence, R. A., & Lawrence, R. M. (2011). *Breastfeeding: A guide for the medical profession* (7th ed.). Maryland Heights, MO: Elsevier.

Mohrbacher, N. (2010). *Breastfeeding answers made simple- A guide for helping mothers*. Amarillo, TX: Hale Publishing.

Schanler, R. J. (Ed.). (2022). *Breastfeeding handbook for physicians* (3rd ed.). American Academy of Pediatrics. <https://doi.org/10.1542/9781610024433>

Provider Resources- Websites

U.S. Surgeon General call to action to support breastfeeding.

<http://www.surgeongeneral.gov/library/calls/breastfeeding/index.html>

Human Milk Banking Association of North America: www.hmbana.org

Stanford University Newborn Nursery Website:

<https://med.stanford.edu/newborns/professional-education/breastfeeding.html>

Provider Resources- Continuing Education

Lactation Education Resources: www.LERon-line.com/

Northeastern University: <http://www.northeastern.edu/breastfeedingcme/>

Wellstart: www.wellstart.org/Self-Study-Module.pdf

Jack Newman, MD articles: www.breastfeedingonline.com

National and International Organizations

Baby-Friendly Hospital Initiative, USA: www.babyfriendlyusa.org

Centers for Disease Control and Prevention: www.cdc.gov/breastfeeding

Healthy People 2030: <https://odphp.health.gov/healthypeople>

March of Dimes (preterm baby information): www.marchofdimes.com

United States Breastfeeding Committee: www.usbreastfeeding.org

WIC <http://www.fns.usda.gov/wic/women-infants-and-children-wic>

UNICEF: www.unicef.org

World Health Organization: www.who.int/topics/breastfeeding/en/

Breastfeeding Policy Resources

Business Case for Breastfeeding Tool Kit:

www.ask.hrsa.gov/detail_materials.cfm?ProdID=4135

Patient Protection and Affordable Care Act:

www.doi.gov/whd/regs/compliance/whdfs73.htm

Workplace support in federal law:

<http://www.usbreastfeeding.org/Workplace/WorkplaceSupport/WorkplaceSupportHealthCareReform/tabid/175/Default.aspx>

Break Time for Nursing Mother/ Fair Labor Standards Act:

<http://www.doi.gov/whd/regs/compliance/whdfs73.pdf>

Billing Resources Related to Lactation

American Academy of Pediatrics Lactation Billing Guidance:

<http://www2.aap.org/breastfeeding/files/pdf/coding.pdf>

American College of Obstetrics and Gynecology Billing Guidance:

<https://www.acog.org/programs/breastfeeding/understanding-health-care-coverage-for-breastfeeding>

Websites for Parents

Kelly Mom: <http://kellymom.com>

Breastfeeding Guide (multiple languages):

<http://www.womenshealth.gov/breastfeeding/learning-to-breastfeed>

La Leche League: <https://lalli.org/>

Breast Pump Websites

Medela: www.medela.us

Ameda: www.ameda.com

Hygeia: www.hygeiababy.com

Limerick: www.limerickinc.com

Avent: www.avent.com

Bailey: www.baileymed.com

Conclusion

Outpatient preparation and support of lactation is an important and underutilized opportunity to help women reach their breastfeeding goals and reach the public health goals set by Healthy People 2030.

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