

## Breast development and anatomical variations

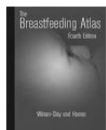
Evelyne Ruf, MD, IBCLC (since 1993)  
Lactation Clinic  
Family Health Promotion Center, Sharjah

### Objectives

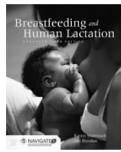
- Summarize the embryology of the human breast (fetal development)
- Summarize further mammatogenesis (from birth to puberty)
- Enumerate anatomical variations of the breast

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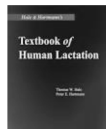
### Sources (books)



'The BF Atlas'  
Wilson-Clay & Hoover,  
4<sup>th</sup> Edition (2008)  
and CD from 2<sup>nd</sup> edition



'BF and Human  
Lactation'  
J. Riordan & K.  
Wambach  
5<sup>th</sup> Edition (2016)



'Textbook of Human  
Lactation'  
Thomas Hale & Peter  
Hartmann  
1<sup>st</sup> Edition (2007)



'Core  
Curriculum'  
ILCA  
3<sup>rd</sup> Edition  
(2013)



Breastfeeding – A Guide for the Medical Profession  
By Ruth Lawrence and Robert Lawrence (2011, 7th Ed.)

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### PLAN

#### Introduction

##### A. Breast development

- Embryonic and fetal development
- Further mammatogenesis

##### B. Anatomical variations

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### Introduction

The mammary gland begins development early in embryologic life and only culminates in the postpartum lactation of the adult female.



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### Introduction (cont.)

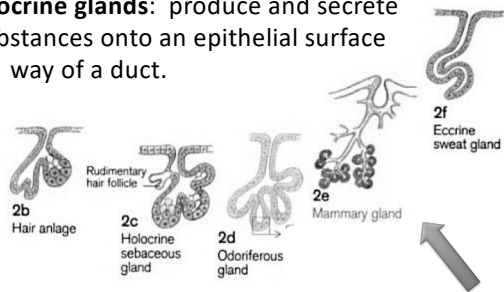
- During **4<sup>th</sup> week** of embryologic development, formation of **multi-layered skin** present at birth.
- Specialized structures formed by the epidermis outgrowing into the dermis, i.e. 'epidermal glands' (hair, teeth, fingernails, eccrine glands, **apocrine glands...**) begin to appear.



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## Introduction (cont.)

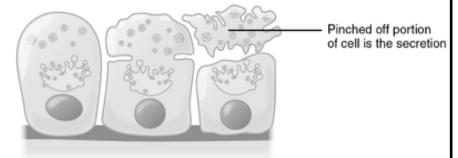
**Exocrine glands:** produce and secrete substances onto an epithelial surface by way of a duct.



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## Introduction (cont.)

**Apocrine secretion:** the release of secretory materials is accompanied with loss of part of cytoplasm.



The mammary gland is considered to be a **modified and highly specialized type of apocrine gland**.

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<https://en.wikipedia.org/wiki/Apocrine>

## Introduction (end)

- **Embryologic development** of the mammary gland:
  - series of **highly ordered events**
  - involving **interactions among a number of distinct cell types**
  - regulated by an array of systemic and local factors such as **growth factors and hormones**.
- Development is initially identical among males and females of the same species.

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## Fetal development: an overview

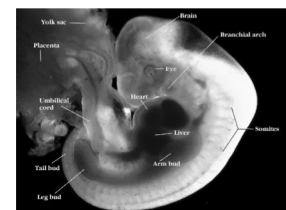
Gestational Age	Stage of Development of the Breast
4 weeks	Appearance of mammary streak [Lawrence]
5-6 weeks	Appearance of ectodermal ridge (milk line)
7-8 weeks	Mammary disc appears Primitive blood vessels are formed
10-12 weeks	Formation of epithelial buds
16 weeks	Mammary vascular system completely formed
13-20 weeks	Parenchymal branching of the buds
20 weeks	15-20 solid cords (ductal structures) formed
32 weeks	Canalization of the solid cords completed to form primary milk ducts
32 weeks-term	Some lobulo-alveolar development Increased periductal stroma Lobules have a single layer of epithelium

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Hale & Hartmann 2-1 & Lawrence Table 2-1

## From 4th week: Mammary streak/ridges

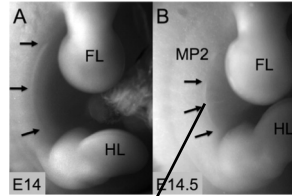
- Paired ectodermal thickenings termed **mammary ridges** or **milk lines** develop on the ventral surface of the embryo and extend in a curvilinear fashion convex towards the midline from the axilla to the medial thigh.



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## Mammary streak/ ridges (cont.)

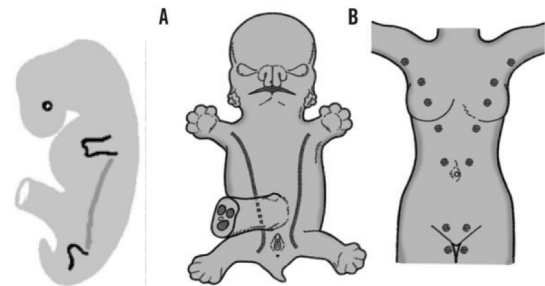
- This is the first morphologic evidence of mammary gland development.
- In normal human development, these ridges disappear **except at the level of the fourth intercostal space** on the anterior thorax, where the mammary gland subsequently develops.



MP: mammary primordia

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## Milk lines

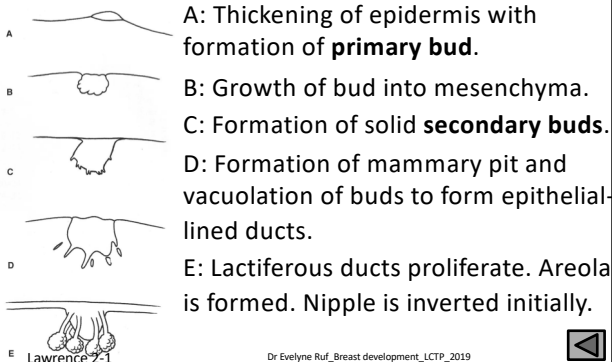


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<http://ueu.co/wp-content/uploads/2014/09/loadBinaryCA1LDGWU.jpg>

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## Early development



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## 20 weeks gestation: ducts appear



- Small lumina develop within the buds (through apoptosis of the central epithelial cells)
- Coalesce and elongate to form the lactiferous ducts.

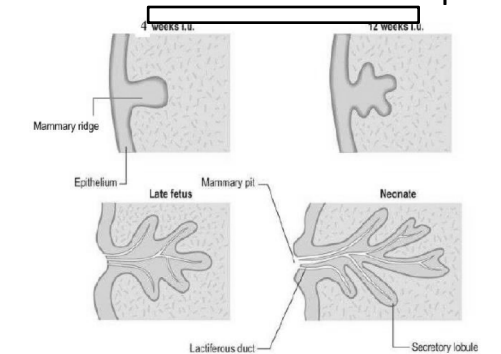
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## 20 weeks : ducts appear (cont.)

- The canalization of the mammary buds with formation of the lactiferous ducts is induced by placental **hormones** entering the fetal circulation.
- These hormones include progesterone, growth hormone, insulin-like growth factor, estrogen, prolactin, adrenal corticoids, and triiodothyronine.

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## Overview of fetal breast development



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Image from  
image.slidesharecdn.com/breastanatomy

## PLAN

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## Mammogenesis

- Is defined as growth and differentiation/development of the mammary gland to the stage prior to active secretion. [BF & HL]
- The mammary system is unlike other organ systems: from birth through puberty, pregnancy and lactation, no other human organ\* displays such dramatic changes in size, shape, and function as does the breast.

\* Except perhaps the uterus

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## At birth

- Approximately **15-20 lobes (4 – 18)** of glandular tissue have formed, each containing a lactiferous duct.
- Support for the breast:
  - skin envelope
  - and the fibrous suspensory ligaments of Cooper

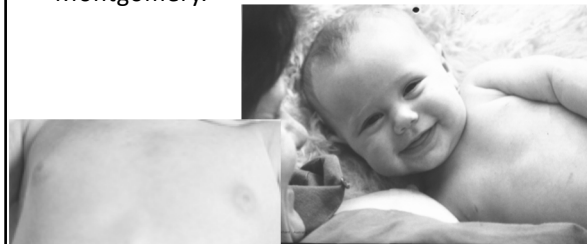


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<http://www.breastfeeding-problems.com/cluster-feeding.html>

## At birth (cont.)

- The nipple appears as a **small pit** in the center of a thickened areola containing a few glands of Montgomery.



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IBFAN Calendar

## At birth (cont.)

- Immediately after birth, the newborn's breast may be swollen and secreting small amount of milk (*witch's milk*).
- About 5% of neonates (male and female)
- Infants with galactorrhea have larger breast nodules.



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<http://www.pediatricconsultative.com/photoclinic/galactorrhea-newborn-witch%E2%80%9Smilk>

## At birth (end)

- Caused by the stimulation of the infant's mammary glands by the same hormones produced by the placenta to prepare the mother's breast for lactation.
- This secretory activity subsides within 3 to 4 weeks (sometimes 2 months), then the mammary glands are inactive until shortly before the onset of puberty.

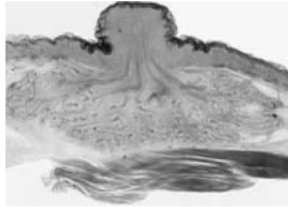
Do not press on the gland...

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## Infancy

- Progressively, the **nipples become everted** (proliferation of the surrounding mesoderm),
- Areolae develops a slight **increase in pigmentation**.
- Development of **erectile tissue** in the nipple areolar complex → further protrusion upon stimulation.



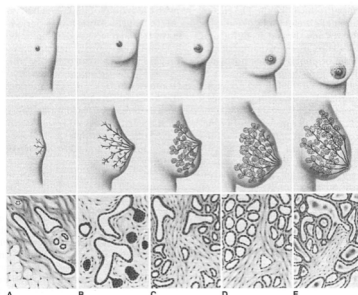
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## Infancy (end)

- Failure of the nipples to evert → **inverted nipples**
  - tethered by fibrous bands and a hypoplastic ductal system
  - can occur in males and females, but clinically significant for breastfeeding (latch problems).
- Any trauma, incision, radiotherapy to breast bud can trigger maldevelopment with **hypoplasia** (→ later affects milk supply).

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## Mammogenesis after birth



Lawrence Fig. 2-3

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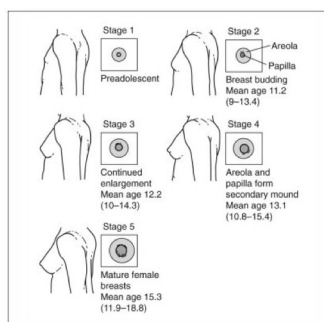
- A: infancy
- B: puberty
- C: adult breast
- D: pregnancy
- E: lactation

## Phases of pubertal breast development (Tanner)

Phase	Age (yr)	Developmental Characteristics
I	Puberty	Preadolescent <b>elevation of nipple</b> with no palpable glandular tissue or areolar pigmentation.
II	11.1 ± 1.1	<b>Breast bud</b> : presence of glandular tissue in subareolar region; nipple and areola project as single mound from chest wall.
III	12.2 ± 1.09	Increase of amount of readily palpable glandular tissue, with <b>enlargement of breast</b> and increased diameter and pigmentation of areola; contour of breast and nipple remains in single plane.
IV	13.1 ± 1.15	Enlargement of areola and increased areola pigmentation: nipple and areola <b>form secondary mound above breast level</b> .
V	15.4 ± 1.7	Final adolescent development of <b>smooth contour with no projection of areola and nipple</b> .

Lawrence Table 2-3  
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## Phases of pubertal breast development (Tanner)



Lawrence Table 2-3

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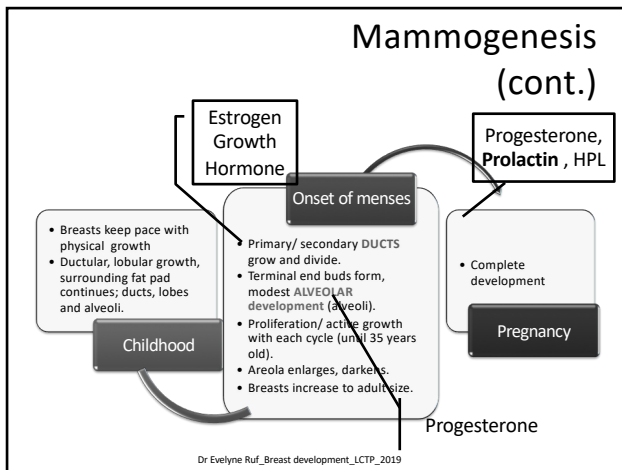
## Mammogenesis (cont.)

- Breasts keep pace with physical growth
- Ductular, lobular growth, surrounding fat pad continues; ducts, lobes and alveoli.

- Primary/ secondary ducts grow and divide.
- Terminal end buds form (alveoli)
- Proliferation/ active growth with each cycle

- Complete development (mainly lactocytes)

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### Also areola changes

- Enlarges, darkens during pregnancy.
- Average diameter in lactation 6.4 cm [BF&HL p. 83]

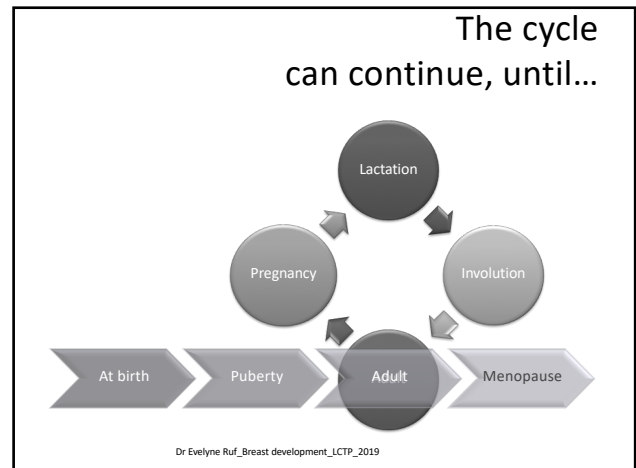
**Non-Pregnant**    **Early Pregnancy**    **Late Pregnancy**

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### After weaning...

- Post-lactational changes present up to 5 years after cessation of lactation:
  - Involution of lobules
  - Infiltration by lymphocytes and plasma cells

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### At menopause

- Menopausal involution:
  - Involution of lobules
  - Remaining mostly ducts, adipose tissue, and fatty tissue

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## So much individual variations...

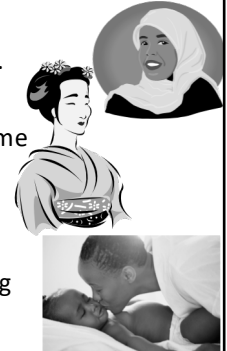


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Breastfeeding Counselling: a training course,  
WHO/CHD/93.4, UNICEF/NUT/93.2

## From Woman to Woman...

- Breasts vary in color, size, shape and placement on the chest wall.
- Genetically influenced
- Lobular size differs within the same breast, from breast to breast.
- Left breast is often larger than right.
- Areola and nipple differ according to race.



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## Large breasts: hyperplasia



BF Atlas 2<sup>nd</sup> ed. 1013 h

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Challenges for the mother (weight, back ache) and for positioning and latching the baby.

## Small breasts

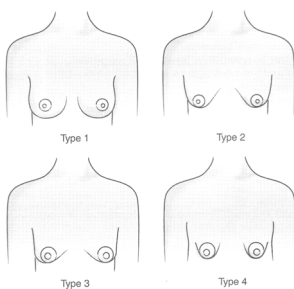
- Hypomastia: abnormal smallness of the mammary gland <http://www.merriam-webster.com/dictionary>
- Breast hypoplasia: underdevelopment of the breast. [Lawrence, p.41]

! Unusual shape: asymmetry, large intermammary space, tubular or conic shape, large areola compared to breast size.



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## Breast hypoplasia: different types



Core Curriculum 12-7

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- **Type 1:** round breasts, normal lower, medial, and lateral quadrants
- **Type 2:** Hypoplasia of the lower medial quadrant
- **Type 3:** Hypoplasia of the lower medial and lateral quadrant
- **Type 4:** Severe constriction, minimal breast tissue

## Hypoplastic breasts



Fig. 242 Woman with PCOS

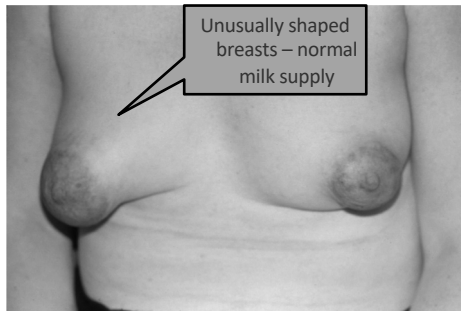


BF Atlas 2<sup>nd</sup> ed. : 1017, 1019, 1020 h



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## Impaired milk supply? Not always

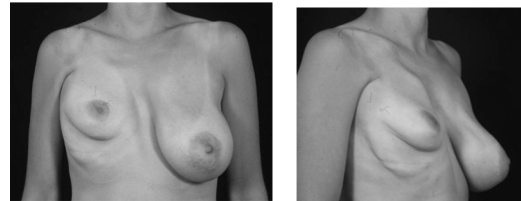


BF Atlas 2<sup>nd</sup> ed. : 1018 h

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## Poland's syndrome

Underdevelopment or absence of the chest muscle (pectoralis) on one side of the body.



[https://en.wikipedia.org/wiki/Poland\\_syndrome](https://en.wikipedia.org/wiki/Poland_syndrome)

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## Areola



Areola size varies from one woman to another.



! If areola size large compared to breast size (not the case on the above picture).

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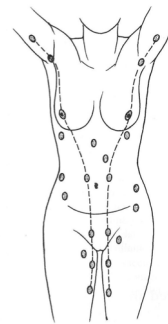
BF Atlas Fig. 219, 221

## Accessory Breast and/or Nipples

Supernumerary nipples, areolae, or breast tissue can develop along the milk line. They can lactate and/or undergo malignant changes.

Lawrence 2-5

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## Ectopic nipples and areolae



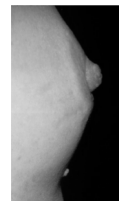
Bilateral accessory areolae/nipples

BF Atlas 1007, 1008h



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## Ectopic nipples

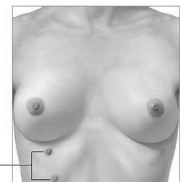


BF Atlas 1006h

Isolated nipples (also in males)



Fig. 188 Accessory nipple



Supernumerary nipples

#ADAM



nairaland.com

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## Ectopic nipples within the main areola



'Double' nipples



BF Atlas 1007, 1008h

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## Ectopic nipples in the axilla



mydermpath.com



SCIENCEPHOTO LIBRARY

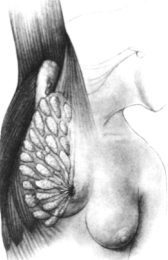
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## Which diagnosis?

Tail of Spence (part of the breast)?



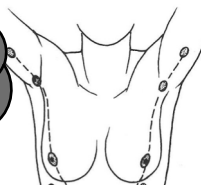
Accessory breast tissue (separate from the breast)?



Lawrence 2-6

In both cases, the size increases with pregnancy and after delivery...

Spence 2-6

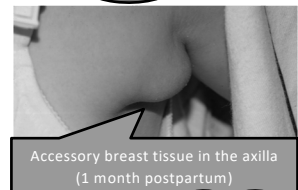


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Similar clinical appearance...



Engorgement of the tail of Spence



Accessory breast tissue in the axilla (1 month postpartum)



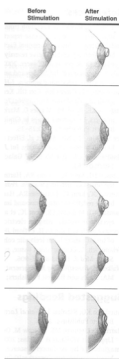
Engorgement of accessory breast tissue

But change of size after a feed occurs only with tail of Spence...

BF Atlas 1002, 1003, 1004h

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## Nipple variations



- **Common nipple**
- **Flat or less: Short shanked nipple**
- **Pseudo-inverted nipple**
- **Retracted nipple:** most common type of inverted nipple. Initially appears graspable, then retracts on stimulation. Responds well to techniques that increase nipple protrusion.
- **Inverted nipple:** retracted both at rest and when stimulated. Very uncommon.

Core Curriculum 15-9

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N-B: More details in session on nipple conditions

# Thank you!

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