NUTRITION DURING LACTATION

CHAPTER 6

NUTD 238

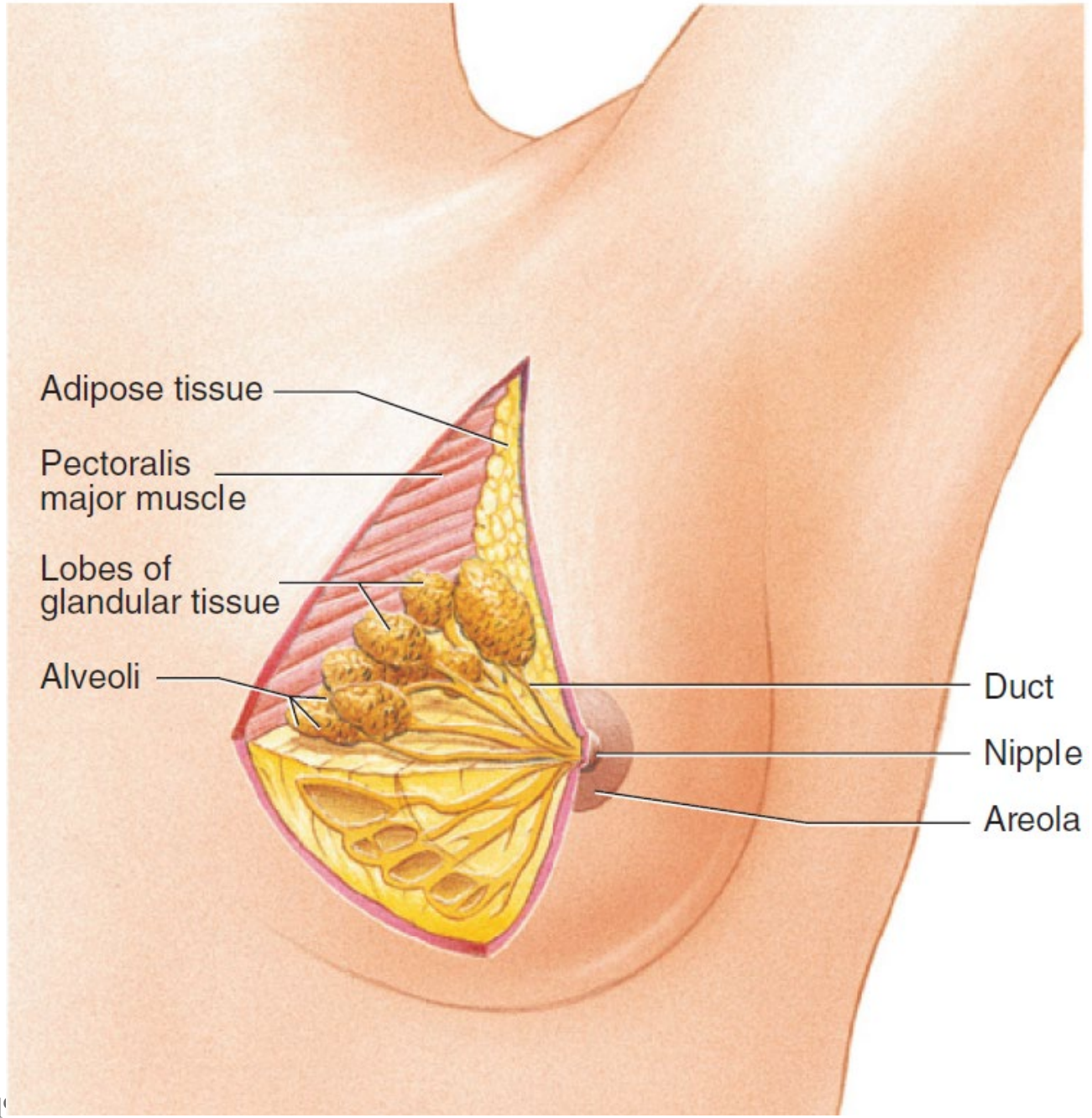
M Aqeel & S Muhanna

Lactation Physiology

M Aqeel & S Muhanna

Functional units of the mammary gland

Structure	Function/ Definition
Mammary Gland	Source of milk for offspring
Alveoli	Round-shaped cavity present in the breast
Secretory Cells	Responsible for secreting milk components into the ducts
Myoepithelial Cells	Specialized cells that line the alveoli and that can contract to cause milk to be secreted into the duct
Oxytocin	A hormone produced during letdown that causes milk to be ejected into the ducts


Adipose tissue
Pectoralis major muscle
Lobes of glandular tissue
Alveoli
Duct
Nipple
Areola

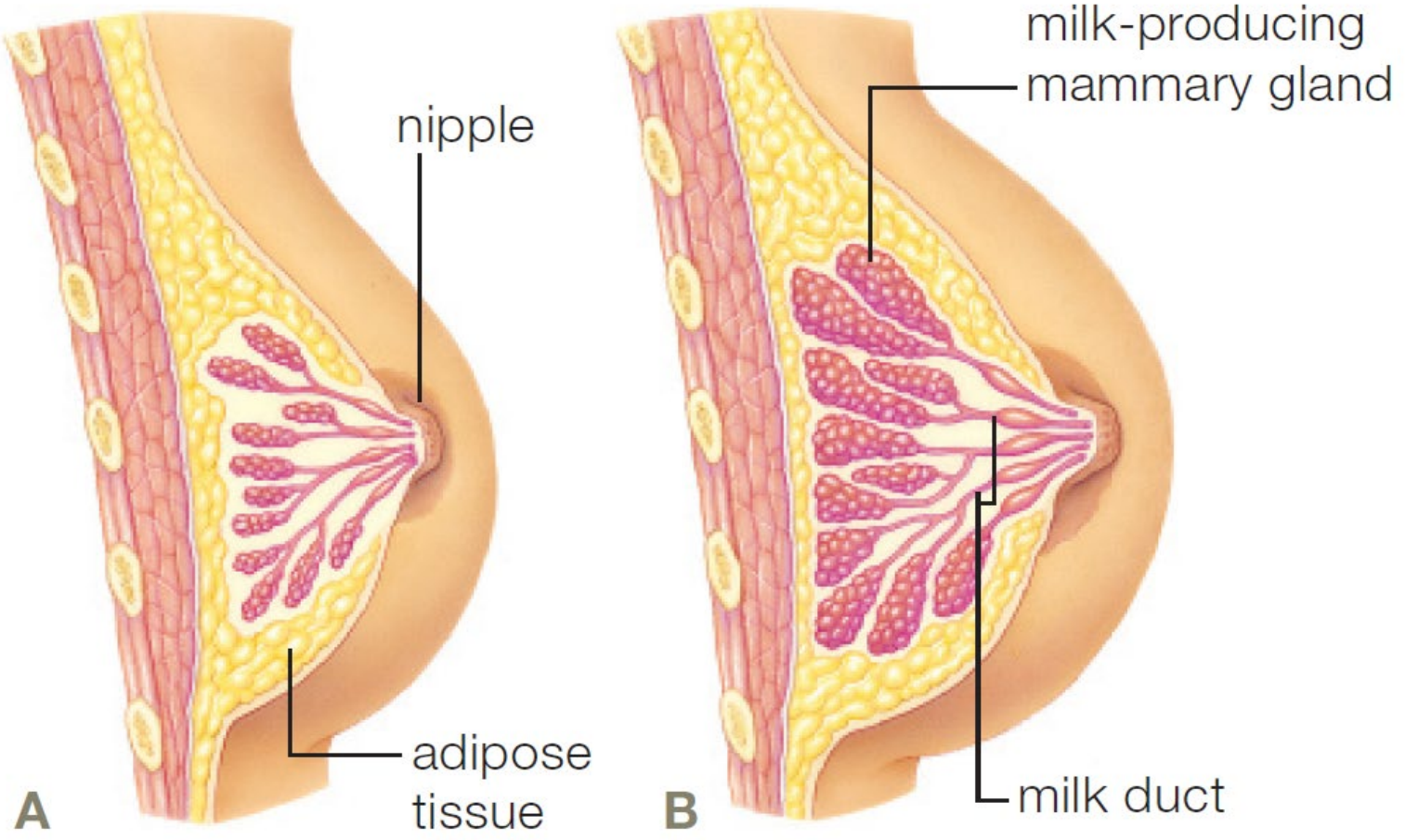


ILLUSTRATION 6.2 ◗ Breast of a mature woman, before pregnancy and during lactation.

Mammary gland development

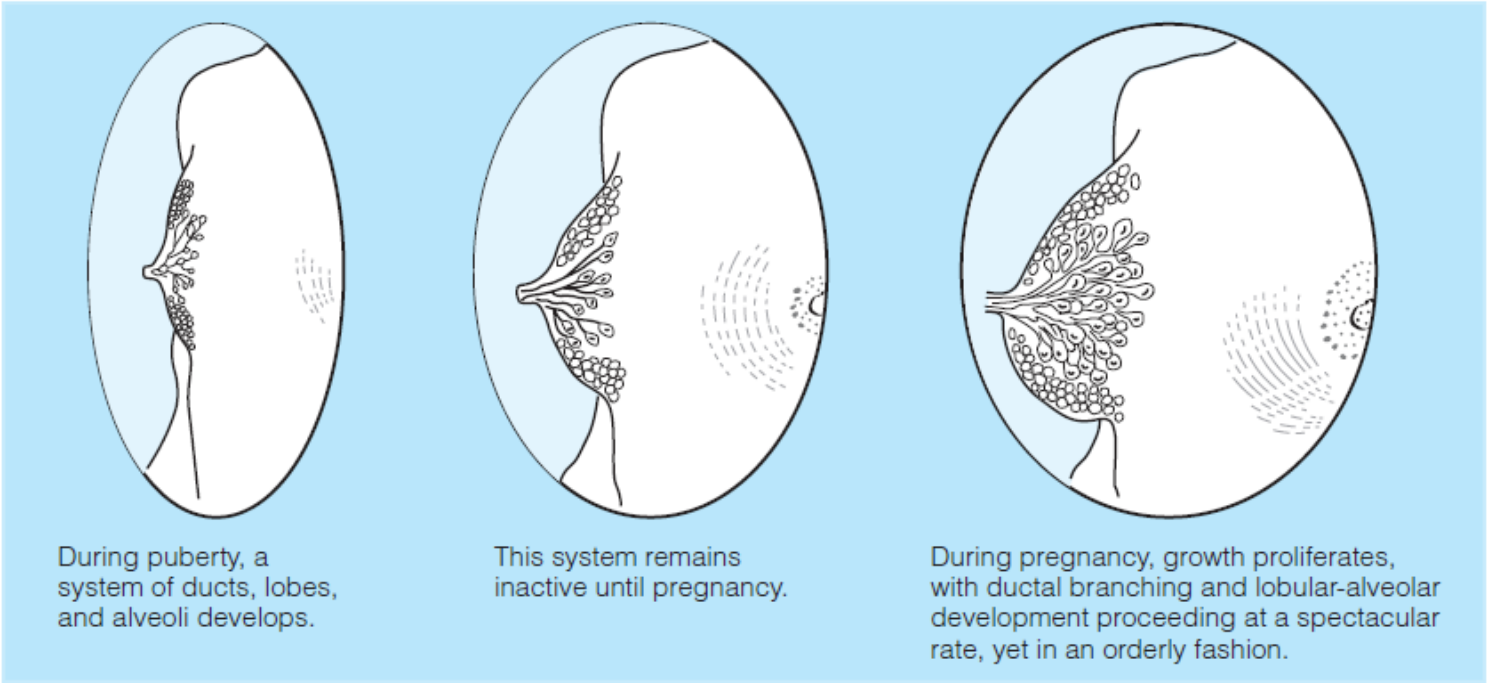
- Puberty- maturation of the ovaries- release of estrogen and progesterone- stimulate breast development

Table 6.3 Hormones contributing to breast development and lactation

Hormone	Role in Lactation	Stage of Lactation
Estrogen	Ductal growth	Mammary gland differentiation with menstruation
Progesterone	Alveolar development	After onset of menses and during pregnancy
Human growth hormone	Development of terminal end buds	Mammary gland development
Human placental lactogen	Alveolar development	Pregnancy
Prolactin	Alveolar development and milk secretion	Pregnancy and breastfeeding (from the third trimester of pregnancy to weaning)
Oxytocin	Letdown: ejection of milk from myopithelial cells	From the onset of milk secretion to weaning

- Estrogen stimulates development of the glands that make milk
- Progesterone allows the tubules to elongate and the cells that line the tubules (epithelial cells) to duplicate

Illustration 6.2 Breast development from puberty to lactation.



Lactogenesis (milk production)

- **Three stages:**

1. *Lactogenesis I:* begins during the last trimester of pregnancy. Milk begins to form- lactose and protein increase; extend to first few days postpartum
2. *Lactogenesis II:* begins **2-5 days postpartum**; increased blood flow to the mammary gland; significant changes in milk composition and amount
3. *Lactogenesis III:* begins after 10 days; milk composition is stable

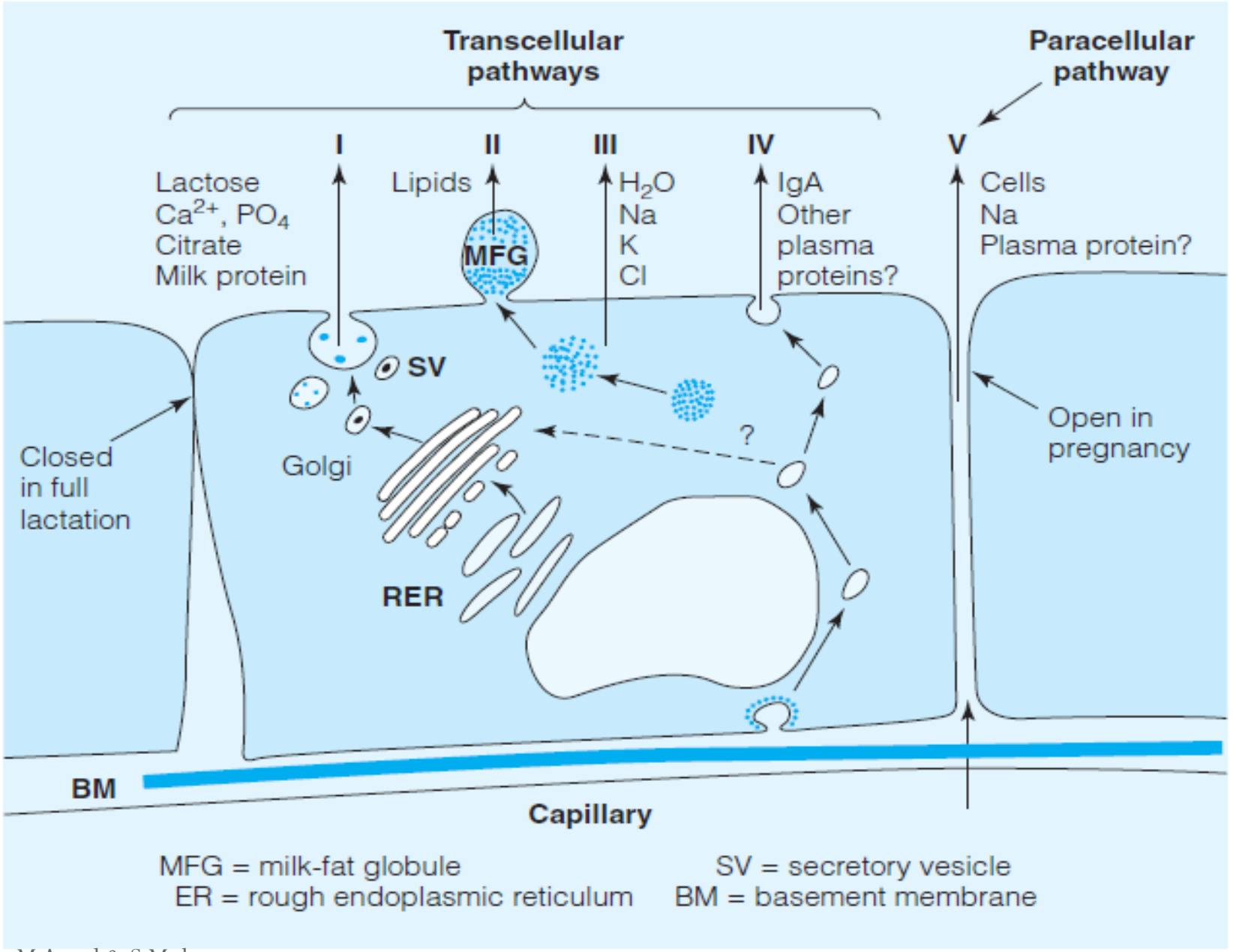
Hormonal control of lactation

- **Prolactin**: stimulates **milk production**; suckling stimulates its release; stimulated by stress, sleep, and sexual intercourse
  - This hormone is suppressed last 3mos of pregnancy ***by prolactin- inhibiting factor*** released by the hypothalamus

- **Oxytocin**: stimulation by suckling or nipple stimulation; leads to **milk letdown**
  - Also leads to shrinking of uterus

Milk secretion

- The secretory cell in the breast uses five pathways for milk secretion
- ***Lactose*** is made in the secretory cells and secreted into ducts
- Water, Na, K, and Cl are able to pass through alveolar cell membranes by diffusion
- Milk fat (TG)- from the mother's blood and from new fatty acids produced in the breast
  - Fats are made soluble in milk by addition of a protein carrier to form milk-fat globules which are then secreted into the ducts
- Immunoglobulin A is captured from the mother's blood and taken into the alveolar cells- secreted into the milk ducts



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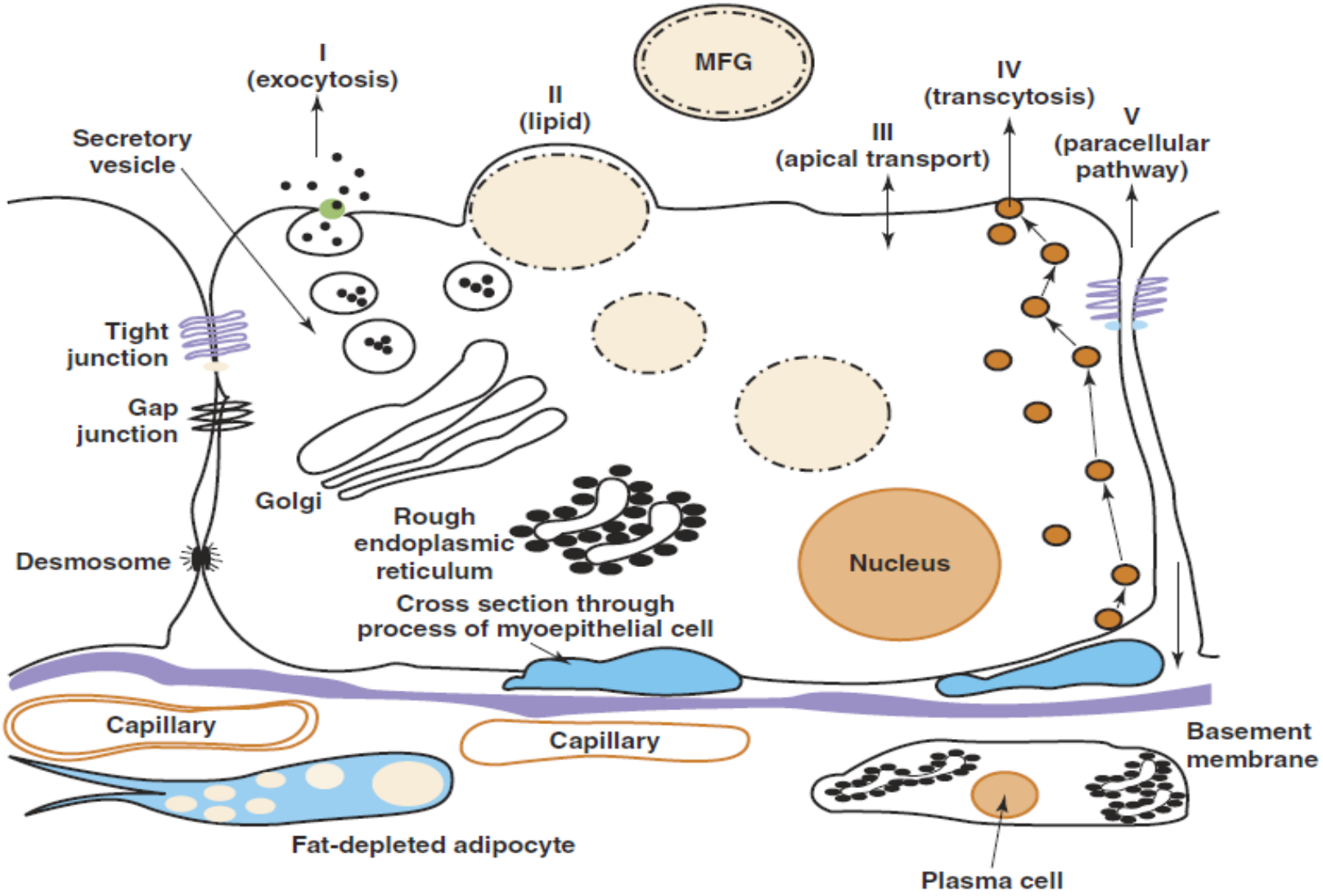


ILLUSTRATION 6.3 ◗ Cellular mechanisms for milk synthesis and secretion.

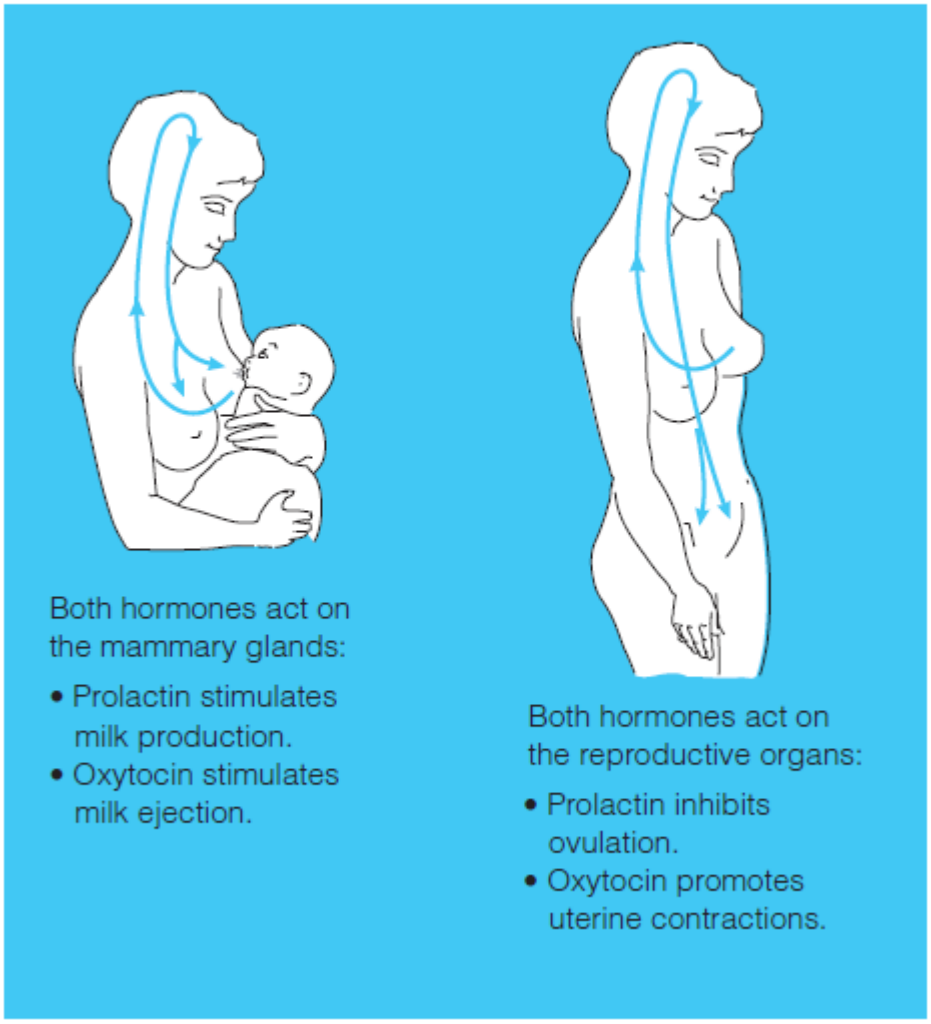
Letdown reflex

Suckling- stimulate nerves- reach hypothalamus- release oxytocin from posterior pituitary gland- contraction of myoepithelial cells surrounding secretory cells- milk released into ducts

- Milk letdown can happen by hearing a baby cry, sexual arousal, and thinking about nursing

Illustration 6.4 The letdown reflex.

An infant suckling at the breast stimulates the pituitary to release the hormones prolactin and oxytocin.



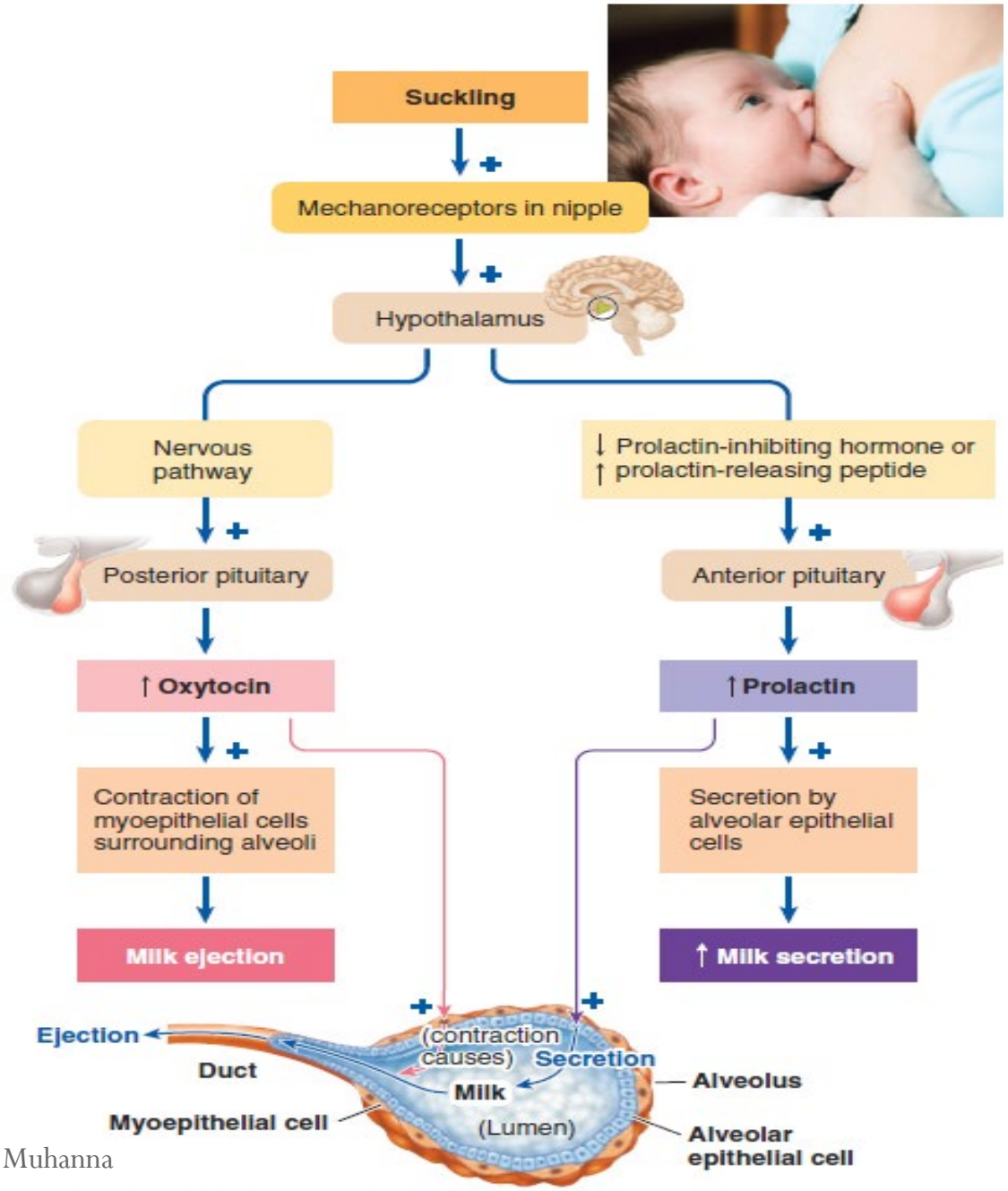


ILLUSTRATION 6.4 ▸ The letdown reflex.

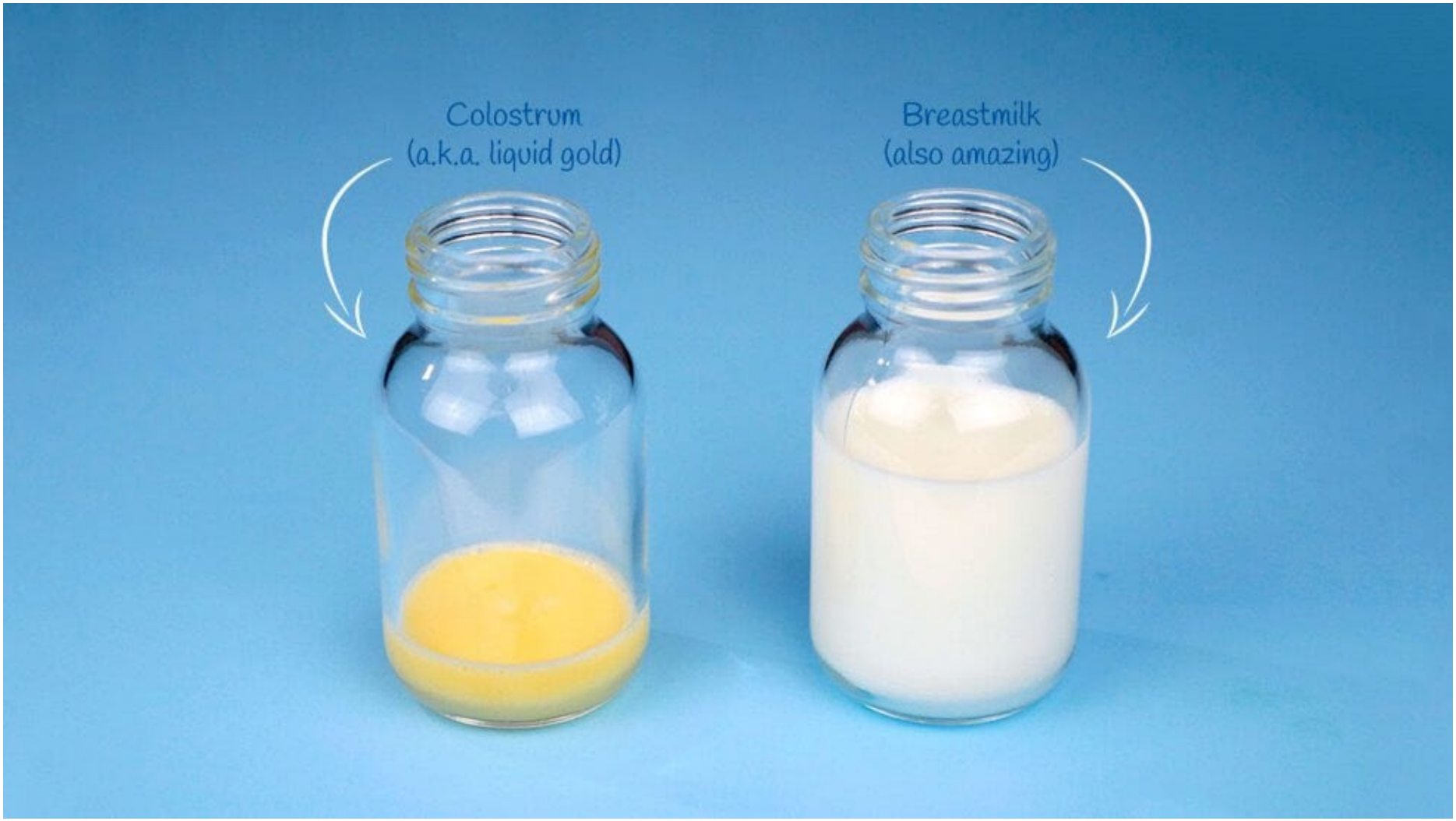
Human milk composition

- **<u>Exclusive BF for 6months after birth</u>**

- *Human milk composition is changeable:*
  - Over a single feeding
  - Over a day
  - According to the age of the infant or gestation at delivery
  - Presence of infection in the breast
  - With menses
  - Maternal nutritional status

Colostrum

- *First milk*- produced during Lactogenesis II
- Thick, yellow
- Infants may drink only 2-3 tsp of colostrum/ feeding in the first 2-3 days
- Colostrum provides about 580-700 kcal/L and is **higher in protein** and **lower in carbohydrates and fat** than mature milk
- *Secretory immunoglobulin A and lactoferrin (antimicrobial activity)* are the primary proteins present in colostrum
- The [ ] of mononuclear cells, *a specific type of WBC from the mother that provides immune protection*, is highest in colostrum


Colostrum
(a.k.a. liquid gold)
Breastmilk
(also amazing)

BABY STOMACH SIZE

Aya Alfar
HEALTH CLINIC

0593080818 Ayaalfar.official

Table 6.4 Compositions of 100 mL colostrum (days 1–5 postpartum) and mature milk (day 15 postpartum)

Contents	Colostrum	Mature Milk
Calories (kcal)	55	67
Fat (g)	2.9	4.2
Lactose (g)	5.3	7.0
Total protein (g)	2.0	1.1
Secretory IgA	0.5[a]	0.1
Lactoferrin	0.5	0.2
Casein	0.5	0.4
Calcium (mg)	28	30
Sodium (mg)	48	15
Vitamin A (μg retinol equivalents)	151	75
Vitamin B_1 (μg)	2	14
Vitamin B_2 (μg)	30	40
Vitamin C (μg)	6	5

[a]Concentration is considerably higher at 1–3 days postpartum than at days 4 and 5.

Water content

- BM is **isotonic** with plasma
- Water content is enough for infant- do not need to drink water- even in hot weather up until 6 months of age

- Water allows suspension of the milk sugars, proteins, immunoglobulin A, Na, K, citrate, Mg, calcium, Cl, and water-soluble vitamins

Energy

- Human milk provides ~0.65 kcal/mL- ***E content varies with its fat*** *and* *to a lesser degree, protein and carb composition*
- Breastfed infants consume fewer calories than infants fed human milk substitutes (HMS)

- *Reason for difference is unclear- may have to do with:*
  - Composition of BM
  - Inability to see the volume of feedings when providing human milk
  - Differences in the suckling at the breast compared to an artificial nipple

Lipids

- 3-5% in mature milk
- Provide half of the E of human milk

- Foremilk: beginning of feeding; lower in fat
- Hindmilk: end of feeding; higher in fat

Effect of maternal diet on fat composition

- type of fat varies- depend on maternal diet
  - E.g., increased PUFA intake- higher PUFA levels in milk
- Amount of fat in milk can vary during a day, during a feeding, content differs between mothers
- Energy range from ~21- 26 calories/oz

- **DHA:**
  - Amount increases in milk with <u>maternal supplementation</u>
    - Evidence of developmental advantages for infant
    - Increase in levels occurs during last months of pregnancy- **pre-term babies** can benefit from high DHA content in milk

Trans fatty acids and cholesterol

- **Trans FA:**
  - Mother's diet-> milk
- **Cholesterol:**
  - Breastfed infants have higher intakes of cholesterol and higher levels of serum cholesterol than infants fed HMS
  - Cholesterol intake from BM- related to lower cholesterol levels later in life

Protein

- The protein content of mature BM is relatively low (0.8–1.0%) compared to cow's milk
- ***[protein] in milk depends on age of infant rather than on dietary intake or serum levels in mother***
  - More variable content because hormones that guide protein synthesis change with time

- Proteins have a variety of antiviral and antimicrobial effects- *prevent inflammation*

Whey and Casein proteins

- **Whey:**
  - Soluble in water (after precipitation of casein by enzymes, or acid)
  - Include serum proteins, enzymes, immunoglobulins, minerals, hormones, or vitamin-binding proteins e.g., lactoferrin- carries Fe in a form that is easy to absorb

- **Casein:**
  - Major protein in milk
  - Casein, $Ca_3(PO_4)_2$, Mg, and citrate- *white milk*

- *NON PROTEIN NITROGEN*

Milk carbohydrates

- Major carb- lactose: enhances calcium absorption
- Glucose, polysaccharides, oligosaccharides, protein bound carbs

Oligosaccharides

- Second largest carbohydrate component
- Stimulate the **growth of *bifidus* bacteria** in the gut
- Prevent the binding of pathogenic microorganisms to the gut-prevent infection and diarrhea
- Inhibit the growth of *E. coli* and other harmful bacteria

Fat- soluble vitamins

- **Vitamin A:**
  - Colostrum [vit A] higher than mature milk- yellow color of colostrum
  - Some in form of beta carotene

- **Vitamin D:**
  - Most in form 25-OH_2 vitamin D and vitamin D3
  - Vary with amount in maternal diet and exposure to sun

- **Vitamin E:**
  - Alpha tocopherol decreases from colostrum to transitional milk to mature milk
    - Beta and gamma tocopherol levels remain stable
  - Levels in BM are sufficient to meet the needs of a full-term infant/
    - levels in pre-term milk are the same or higher than that in term milk but are still **not enough to meet the needs of a pre-term infant**

- **Vitamin K:**
  - 5% of BF infants are at risk of deficiency/ little vitamin K in BM
  - **does not cross the placenta to the developing baby! And the gut is sterile**
  - Cases of deficiency in exclusively BF infants who did not receive vitamin K at birth

Water soluble vitamins

- Depend on maternal diet/ supplement use

- Except for, Vitamin B12 and folic acid: (less influenced by maternal intake)
  - Bound to whey protein
  - **Hormone levels and age of the infant are more likely to alter BM content of these vitamins than maternal intake**

- B12 deficiency, or low levels of B12 in milk- reported for women:
  - Who have had gastric bypass surgery
  - Consume vegan diets
  - Have latent pernicious anemia
  - Who are malnourished

Minerals

- Highly bioavailable to the infant
- *Mineral content* ***is less than that in cow's milk***
  - The lower [mineral] of BM is easier for the kidneys to handle- major benefit
- Exclusively BF infants are at low risk for anemia, despite the low conc. Of iron in the human milk

Minerals

- **Zinc:**
  - Bound to protein; high bioavailability in comparison to cow's milk and HMS
  - Levels are maintained even in cases of deficiency in maternal intake
  - Intake and requirement of infants decrease after first few months

- **Trace minerals:**
  - Copper, selenium, chromium, manganese, molybdenum, nickel, and fluorine
  - Present in the human body in small [ ]
  - Essential for growth and development
  - Levels in milk are not altered by the mother's diet or supplement use (except fluoride)

Taste of BM

- Slightly sweet and it carries the flavors of compounds ingested, such as mint, garlic, vanilla, and alcohol
  - Transfer of flavor compounds is selective and in relatively low amounts

- Exposing infants to a variety of flavors in milk may contribute to their interest in it and their acceptance of new flavors in solid foods

Benefits of BF to mothers

- Increases levels of oxytocin- stimulates uterine contractions, minimizes maternal postpartum blood loss, and helps the uterus to return to non-pregnant size
- Breastfeeding delays ovulation *(due to release of prolactin)*, longer duration between pregnancies- prevents pregnancy esp if there is exclusive BF; menstrual cycle has not returned
- Increased self confidence and closeness to baby
- Lower risk of breast and ovarian cancer and rheumatoid arthritis

Nutritional benefits of BF **to the infant**

- Composition provides optimal nutrition to the infant/ matches requirements for infant growth and development
- Relatively low protein content meets needs without stressing immature kidneys
- Whey protein- soft, easily digestible
- Good amounts of fat: EFA, SFA, MCTG, cholesterol
- PUFAs-DHA: for optimal development of the CNS: present in some HMS formulas
- Minerals are protein bound and highly bioavailable- meet needs with minimal demand on maternal reserves

Immunological benefits **to the infant**

- Macrophages (WBCs) engulf bacteria and fungi; lactoferrin, and immunoglobulin A and G
- Neutrophils (WBCs): protect against infections
- T, B lymphocytes: protect against organisms in the GIT
- Immunoglobulins: *predominant form- secretory immunoglobulin **A***: protects against viruses
- Bifidus *factor-supports growth of Lactobacillus bifidus*: probiotic bacterium that stimulates antibody production and enhances phagocytosis of antigens

Benefits of BF

Lower infant mortality in developing countries

Fewer acute illnesses

- Lower incidence of diarrhea with exclusive BF
- Lower incidence of GIT infections
- Lower ear infections

Reduction in chronic illness

- Reduce risk of celiac disease, inflammatory bowel disease
- Low asthma
- Less allergies

Benefits of BF

BF and childhood overweight

- BF infants typically leaner than HMS fed infants at 1 year
- Small reduction in risk of OW in children >3yrs who were breastfed

- **Potential mechanisms include:**
  - Metabolic programming, may be related to leptin, ghrelin, and other neuro-metabolic messengers delivered in BM
  - Learned self-regulation of E intake

Benefits of BF

Cognitive benefits:

- Increase in cognitive ability
- Gains increase with duration of BF

Analgesic effects

- May be used to reduce infant discomfort during minor invasive procedures

Socioeconomic benefits

- Decrease in medical costs
- Better work productivity: mothers not missing work due to infant illness

- 101 reasons to breastfeed
  - https://www.sa.sc.edu/healthycarolina/files/2014/04/101-Reasons-to-Breastfeed.pdf

BM supply and demand

- Typical production: 600ml/ day in the month postpartum
- Continues to increase to ~750–800ml/d by 4-5 months postpartum

- **Demand for milk is affected by:**
  - Infant weight and age
  - Caloric density of the milk
  - Increases with twins, triplets
  - Increases by increased frequency of infant suckling
  - Can be increased by pumping milk

- ***Milk synthesis is related to infant demand***
  - The removal of milk from the breast→ signal to make more milk
  - **Most women are able to increase their milk production to meet infant demand**

Size of the breast and milk production

- The size of a woman's breast **does not** determine the amount of milk production tissue

- *Size of the breast **does** limit storage because of limitations in the expansion of the ducts*
  - **Daily milk production is not related to the total milk storage capacity within the breast**

- Women with small breasts can produce the same amount of milk as women with large breasts
  - *Larger breasts-may be able to feed infant less frequently to deliver the same volume of milk compared with a woman with smaller breasts*

Frequency of feeding and amount of milk produced

- Feeding **frequency is not consistently related to milk production**
- The rate of milk synthesis is highly variable between breasts and between feedings
- **The breast responds to the *degree* of emptying during a feeding**: *response is a link between maternal milk supply and infant demand*
  - *Amount of milk produced in 24hrs and the total milk withdrawn in that 24hr period are highly related*
  - i.e., breast is fully emptied→ synthesis is high

Mechanism of supply and demand

- Mechanism of supply and demand may be related to protein ***feedback inhibitor of lactation (FIL)***

- FIL is an active whey protein that inhibits milk secretion- ***affects milk quantity not quality*** (inhibits all milk components equally)

MEET FIL

HALF FULL LACTOCYTE

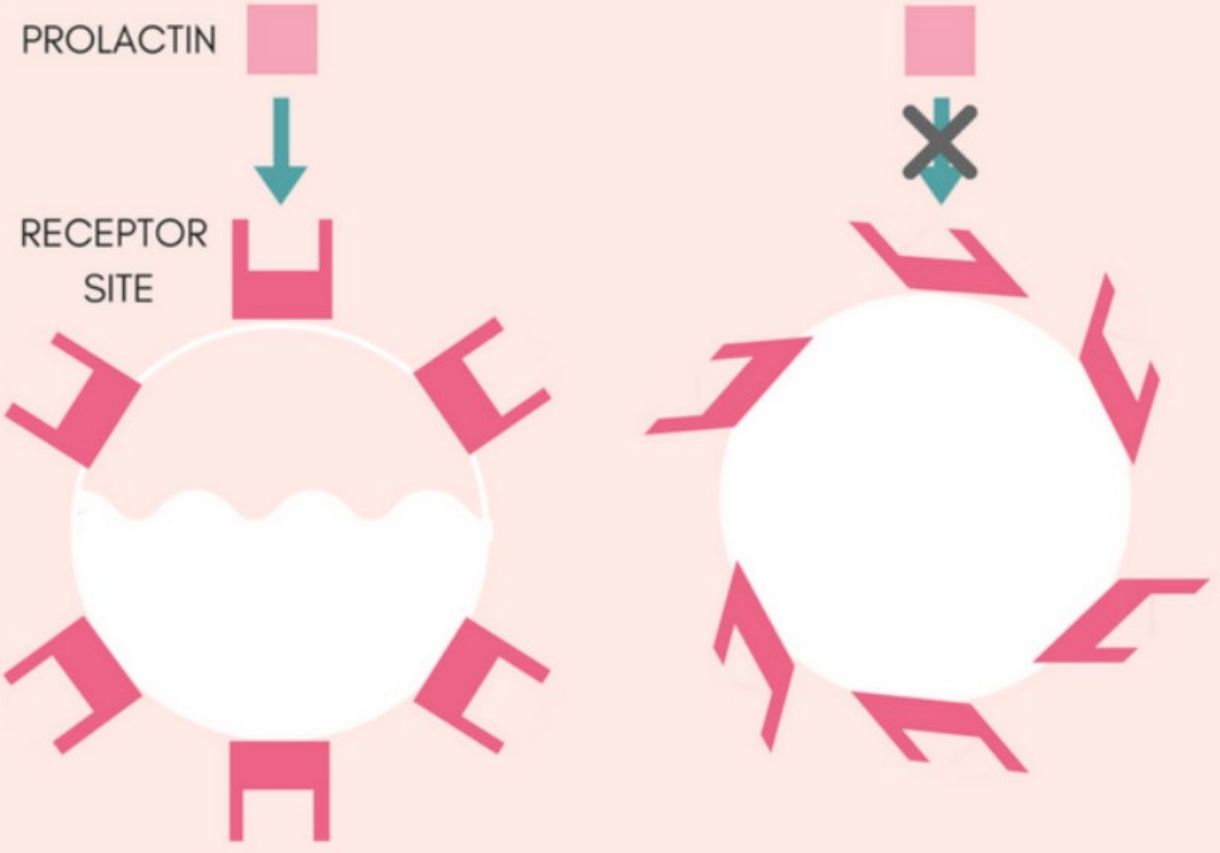
FULL LACTOCYTE

MORE FIL = SIGNAL TO MAKE LESS MILK

More Frequent feeds leads to less FIL accumulation and increased milk production

PROLACTIN

A HORMONE FOR MILK PRODUCTION



WHEN LACTOCYTE IS FULL, IT DISTORTS RECEPTORS SITES

Prolactin cannot bind = Decrease in milk production

BREASTMILK PRODUCTION

How It Works

DEMAND

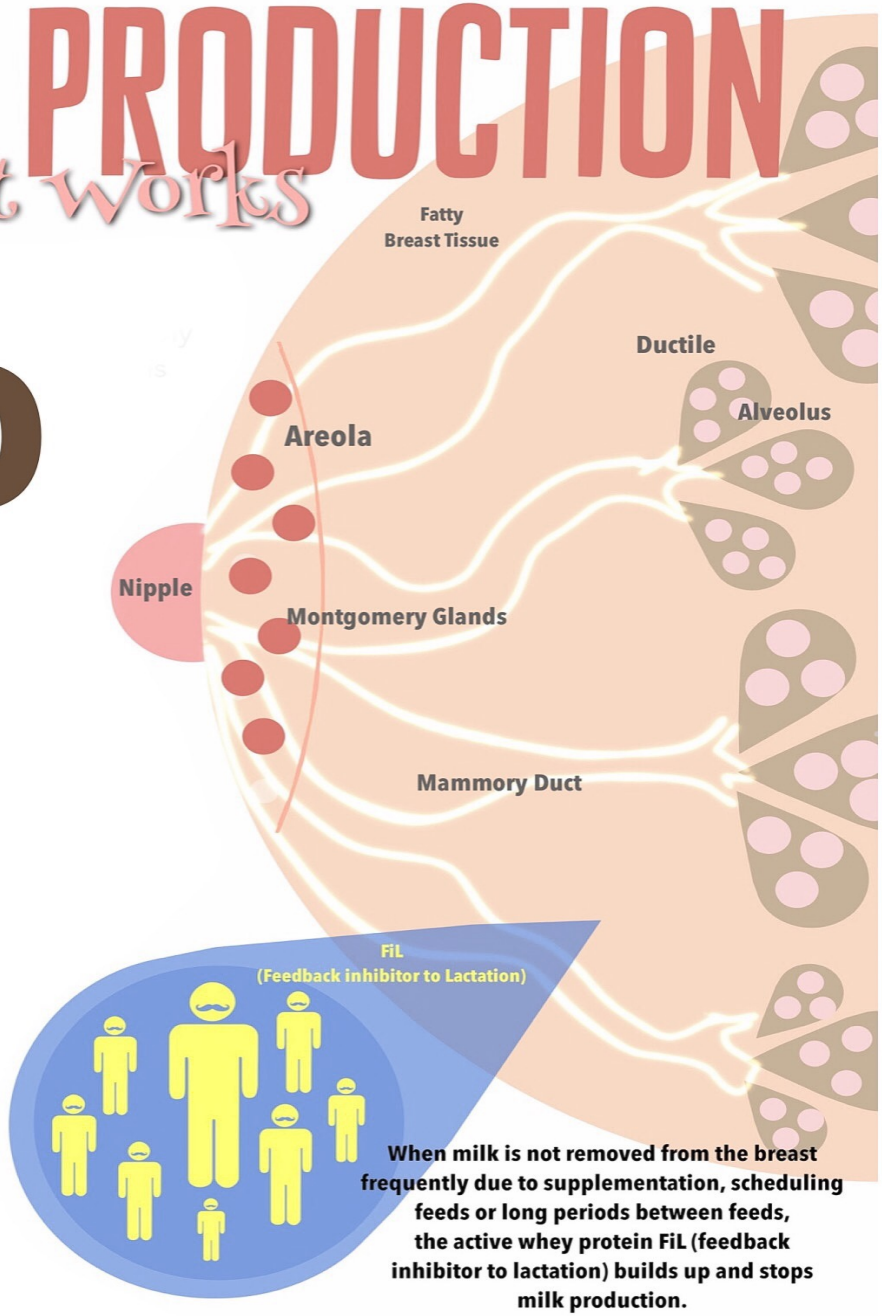
(How often milk is removed from the breast)

=

=

SUPPLY

(Body produces milk to meet the demand)



When milk is not removed from the breast frequently due to supplementation, scheduling feeds or long periods between feeds, the active whey protein FiL (feedback inhibitor to lactation) builds up and stops milk production.

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Pumping/ expressing milk

- Needed for many reasons- maternal or infant illness or separation
- Women can express milk using several different methods:
  - Manually
  - Hand pumps
  - Commercial electric pumps

Electric pumps are efficient: may increase prolactin more than hand expression or hand pumping

- Insufficient milk production is a common problem among women who express milk
- Research: *8-12 or more* milk expressions/day to stimulate an adequate production of milk

- Women who are able to establish an adequate volume of milk (>500 ml/d) in the first 2 wks postpartum are more likely to have enough milk for infant at 4-5 wks postpartum
  - Recommendation to nurse/ pump early and frequently to build a good milk supply

press (back towards your chest)

compress

relax

BF after reduction or augmentation surgery

- **Breast reduction**: may be at risk for unsuccessful lactation
  - Evidence of lower BF rates and duration and greater perception of insufficient milk supply
- Type of surgery- location and amount of breast tissue removed and the damage to remaining tissue-important determinants of ability to breastfeed
  - Incision around areola may damage ducts
- **Breast augmentation**: compression of the ducts in the breast may lead to poor milk production

Effect of silicone breast implants on BF

- The American Academy of Pediatrics does not consider silicone implants a reason not to breastfeed
- Silicone [ ] in milk is not elevated
- Effect is like that of saline implants: compression of ducts leading to poor milk production

The breastfeeding infant

Optimal duration of BF

- Exclusive for 6 months: fewer GI infections than HMS fed infants
- Up to 2 years with complementary food
- Infants fed cow's milk <6months suffer nutritionally significant losses of Fe via intestinal blood loss

Reflexes

- 18 weeks gestation: fetus starts sucking
- 28 weeks gestation: gag reflex is developed
- 34 weeks gestation: the suck has adequate pace and rhythm

Reflexes

- *Oral search reflex:* infant opening his/ her mouth wide in proximity to the breast while thrusting the tongue forward

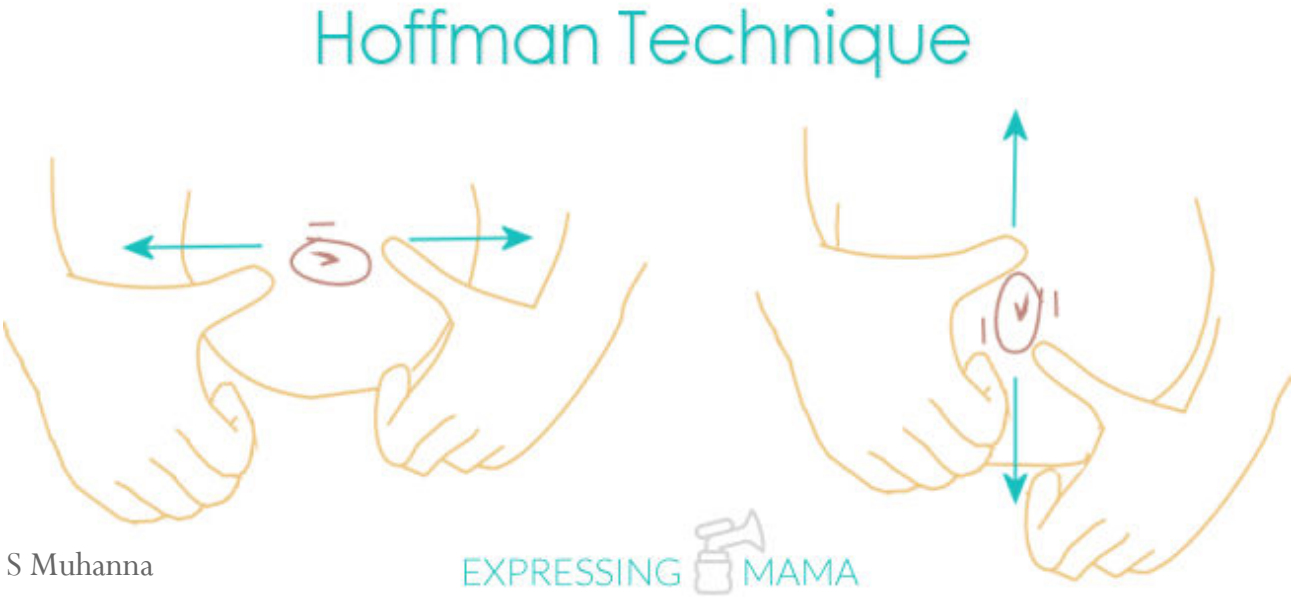
- *Rooting reflex:* results in the infant turning to the side when stimulated on the side of the upper or lower lip

→ *These are important for successful BF in addition to other factors including appropriate positioning and adequate maternal letdown and milk production*

Preparing the breast for BF

- Breasts and nipples begin to be sore in the 1st trimester- tenderness usually decreases by the end of the 1st trimester
- Enlargement of the breast and nipple are evident by the end of the 1st trimester and continue throughout pregnancy
- By the 3rd trimester, Montgomery glands- sebaceous glands that produce oils to lubricate the nipple and areola, become pronounced and the nipples darken
- Gentle massage is recommended to get women accustomed to handling their breasts and prepare them for expressing milk

- Women with flat or inverted nipples may be instructed on the Hoffman technique to break up adhesions



BF positioning

Improper positioning causes pain and possible damage to nipples and breast tissues

ILLUSTRATION 6.5 ▸ Breastfeeding Positioning

Presenting the breast to the suckling infant/ mechanic of BF

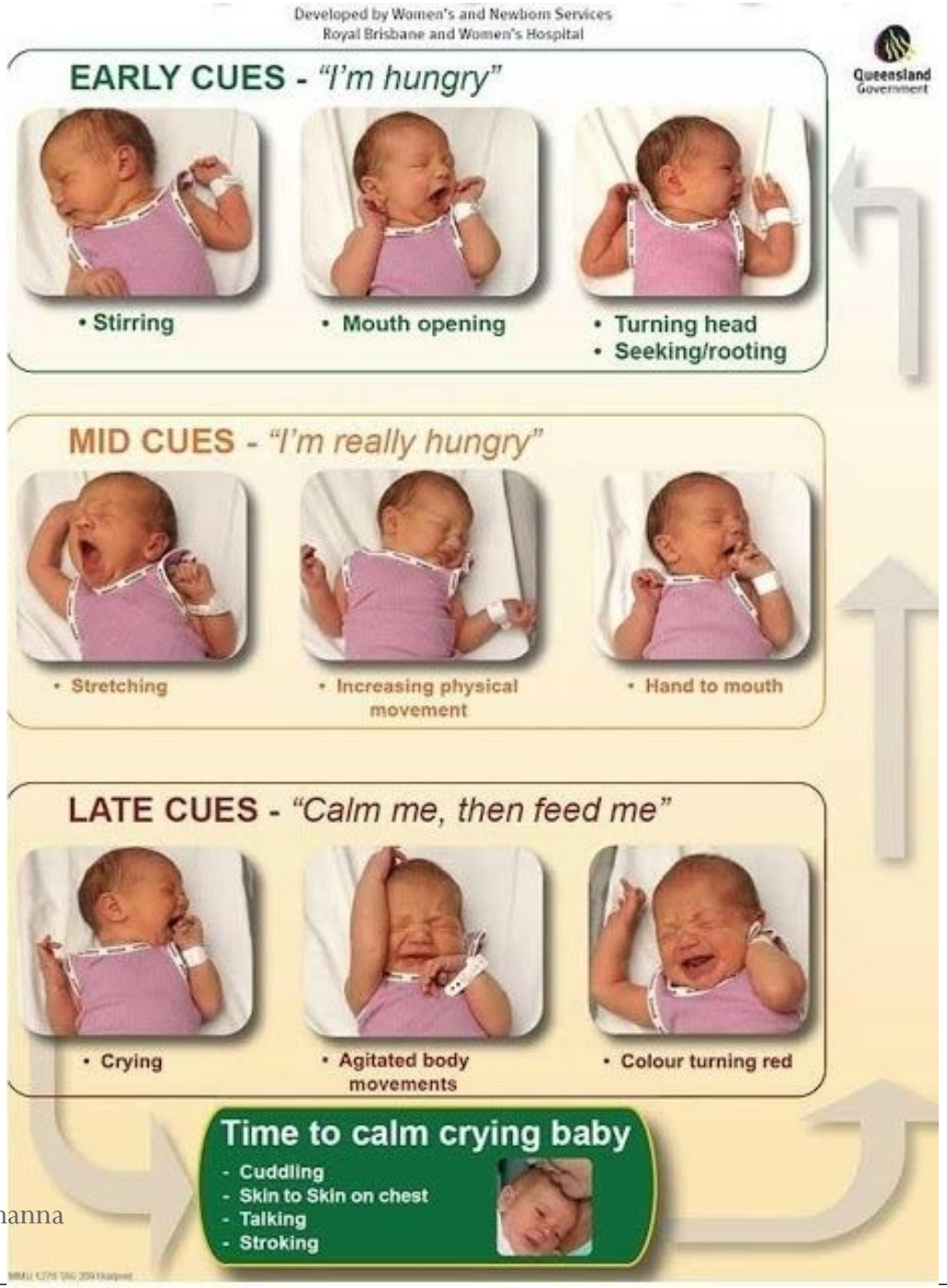
- https://www.youtube.com/watch?v=ybSquGsyTko

Identifying hunger and satiety signals

- **Hungry infants-** bring their hands to their mouth, suck on them, and start moving their head from side to side with their mouth open (rooting reflex)

- Crying is a late sign of hunger

- Feeding begins with non-nutritive sucking .
- **Nutritive** and **non-nutritive** sucks are different:
  - Non-nutritive sucking- quick, shallow suck with no rhythm; amount of milk transfer is usually minimal
  - Nutritive sucking is slower and more rhythmic as the infant begins to suck and swallow


Developed by Women's and Newborn Services
Royal Brisbane and Women's Hospital
Queensland Government
EARLY CUES - "I'm hungry"
• Stirring
• Mouth opening
• Turning head
• Seeking/rooting
MID CUES - "I'm really hungry"
• Stretching
• Increasing physical movement
• Hand to mouth
LATE CUES - "Calm me, then feed me"
• Crying
• Agitated body movements
• Colour turning red
Time to calm crying baby
- Cuddling
- Skin to Skin on chest
- Talking
- Stroking

- Infants should be allowed to nurse as long as they want at one breast (to get both foremilk and hindmilk-satiety)
  - **Feeding for shorter periods from both breasts** can get larger amounts of foremilk- high lactose content can cause diarrhea

- Infants will stop nursing when full

- Infants who fall asleep before they empty the breast can be kept awake by gently tickling the feet, rubbing the head, and talking to the baby

- The higher fat content of hindmilk may help in signaling satiety

If they are still hungry, after burping, they can be offered the other breast.

Feeding frequency

- Stomach emptying occurs in about 1.5 hrs for breastfed infants
- 8 to 12 feedings/day are normal for newborn infants
- Different feeding patterns can meet infant needs
  - Feedings distributed over 24hrs
  - Higher amounts during day…

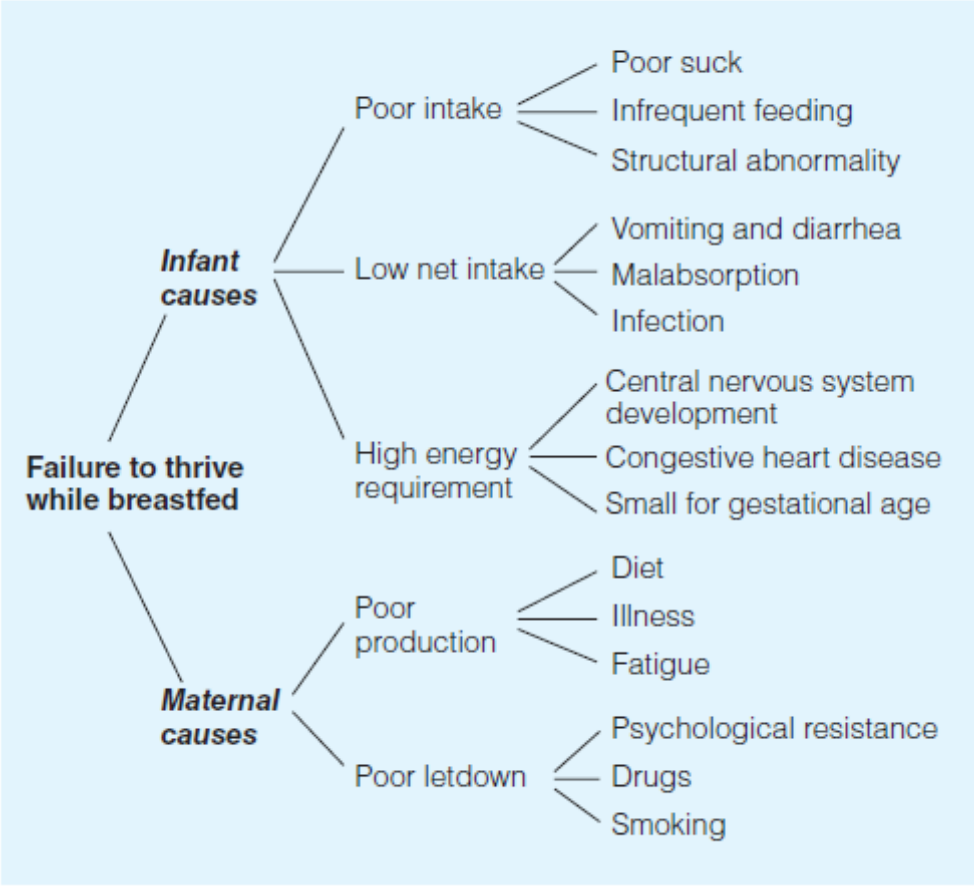
Vitamin supplements for BF infants

- **Vitamin K** supplement at birth: 1.0 mg by injection- known to decrease the risk of VKDB
- Exclusively breastfed infants should be given a supplement of 400 IU of **vitamin D**/ day beginning in the first 2 months of life- risk of rickets
- **Fe** is not needed for BF infants
- **Fluoride** supplements after 6 months based on situation

Identifying breastfeeding malnutrition

- A normal newborn weight loss of up to 7-10-% can occur in the 1st week postpartum- loss of extra fluid;
- wt should be regained within the around 2 weeks after birth
- A loss of >10% should trigger an evaluation of milk transfer to the infant

Illustration 6.7 Diagnostic flowchart for failure to thrive.



- Day 5-7 postpartum, infants who are getting adequate nourishment have wet diapers approximately 6x/d & 3-4 soft, yellowish stools/d
- Urine is pale yellow and dilute
- Stools are loose and seedy
- Infants who are slow gainers and not malnourished are alert, bright, responsive, and develop normally

- **Infant failure to thrive signs:**
  - Apathetic
  - Hard to arouse
  - Weak cry
  - Few wet diapers
  - Urine is concentrated
  - Stools are infrequent

Tooth decay

- Human milk has infection-fighting components that inhibit the formation of dental caries- but they can occur in children who are breastfed

- Frequent nursing at night after 1 year of age is a risk factor for dental caries (does not justify early weaning)

- Dentist visit 6 months after the 1st tooth erupts or by 12 months of age

Maternal diet

	GRAINS Make half your grains whole	VEGETABLES Vary your veggies	FRUITS Focus on fruits	MILK Get your calcium-rich foods	MEAT & BEANS Choose lean with protein
Birth to 6 Months **Mar - Aug** Based on a 2400 calorie pattern*	**8 ounces a day** Aim for at least 4 ounces of whole grains a day	**3 cups a day** Aim for this much weekly: Dark green veggies - 3 cups Orange veggies - 2 cups Dry beans & peas - 3 cups Starchy veggies - 6 cups Other veggies - 7 cups	**2 cups a day** Eat a variety of fruit Go easy on fruit juices	**3 cups a day** Go low-fat or fat-free when you choose milk, yogurt, or cheese	**6½ ounces a day** Choose low-fat or lean meats and poultry. Vary your protein routine—choose more fish, beans, peas, nuts, and seeds.
6 to 12 Months **Sep - Feb** Based on a 2400 calorie pattern*	**8 ounces a day** Aim for at least 4 ounces of whole grains a day	**3 cups a day** Aim for this much weekly: Dark green veggies - 3 cups Orange veggies - 2 cups Dry beans & peas - 3 cups Starchy veggies - 6 cups Other veggies - 7 cups	**2 cups a day** Eat a variety of fruit Go easy on fruit juices	**3 cups a day** Go low-fat or fat-free when you choose milk, yogurt, or cheese	**6½ ounces a day** Choose low-fat or lean meats and poultry. Vary your protein routine—choose more fish, beans, peas, nuts, and seeds.

* These are only estimates of your needs while you breastfeed. Check with your health care provider to make sure you are losing the weight gained during pregnancy.

The calories and amounts of food you need change over time while you are breastfeeding. Your Plan may show different amounts of food for different months, to meet your changing nutritional needs.

Know your limits on fats, sugars, and sodium

	OILS Aim for this much:	EXTRAS Limit extras (solid fats and sugars) to this much:
Birth to 6 Months	7 teaspoons a day	360 calories a day
6 to 12 Months	7 teaspoons a day	360 calories a day

Nutrition assessment of BF women

Table 6.6 Summary of the components of the four steps of the Nutrition Care Process for Breastfeeding Women (ADA)

Step 1. Nutrition Assessment for Breastfeeding Women

- Food and nutrient intake
  - Diet history
- Knowledge/attitudes/beliefs
  - Foods that may increase risk of infant colic
  - Adequate energy intake for return to pre-pregnant weight
- Medications, herbs, and supplements
  - Check for safety and compatibility with breastfeeding (see more on herbs and medications in Chapter 7)
  - Need for supplements based on inadequate intake, missing food groups, or vegan dietary pattern
- Nutrition-related behaviors
  - Excessive dieting or calorie restriction
- Physical activity
  - Return to physical activity after adequate recovery from delivery
- Biochemical data, medical tests, and procedures
  - Gradual return to non-pregnant, non-lactating values
- Anthropometric measures
  - BMI to return to pre-pregnant or ideal levels
- Client history
  - Medical history, treatments (beast surgeries), use of alternative/complementary medicine, social history

Step 2. Common Nutrition Diagnoses for Breastfeeding Women

- Altered maternal BMI
  - Obesity, underweight, or related to rate of weight loss
- Nutrient inadequacy or excess
  - Vegan
  - Lactose intolerance
- Perceived or real inadequate milk production
- Behavioral-environmental
  - Knowledge deficit
  - Need/qualify for WIC services

Step 3. Common Nutrition Interventions for Breastfeeding Women

- Alter energy intake to achieve ideal weight or weight goal
- Reinforce principles of milk production, early signs of infant hunger, and signs of adequate infant milk intake

- Recommend vitamin B_{12} for vegans or other supplements if intake is inadequate

Step 4. Common Nutrition Monitoring and Evaluation Plan Components

- Weight change/BMI
- Infant growth
- B_{12} status

Energy and nutrient needs

- The DRIs for normal-wt lactating women assume that the E spent for milk production is **~500kcal/ day** in the first 6 months and **400kcal afterward** → other research has different findings

- Women use several mechanisms to meet the E needs of lactation
  - Increase food intake
  - Decrease PA

→ *Assessment of adequacy of E intake of BF women should always be made within the context of the mother's overall nutritional status and weight changes and the adequacy of the infant's growth*

Maternal E balance and milk composition

- **Composition of milk** depends on maternal nutrient intake
- Protein–calorie malnutrition results in an E deficit that **reduces the volume** of milk produced but does not usually compromise the composition of the milk

Weight loss during BF

- Current DRIs are written assuming a weight loss of 0.8 kg/month

- *Mechanisms that favor use of maternal fat stores and delivery of nutrients to the breast seem to occur during lactation*
  - Despite of these mechanisms, loss by 12 months postpartum is on avg < the amount needed to return to pre-pregnancy weight

  →**Failure to return to pre-pregnancy wt** may be due to changes in energy intake, EE, and fat mobilization

- Research was done on whether weight loss reduced milk production
- ***Study findings:*** women voluntarily reduced their E intake to 68% of their estimated needs for 7 days→ no differences in infant intake or milk composition were observed
  - Reduce calories< 1500: decrease in milk volume

- Studies of weight loss during lactation suggest that **modest E restriction (500kcal/day)** can be accomplished without large decreases in the quality of the maternal diet

- Continue reading on page 179
  - If lowered the intake of sugary and fatty foods → no change except for calcium & vitamin D

Exercise and BF

- Studies examining the effect of increasing EE on weight and lactation suggest that it is safe
  - *Increase in EE and increase in food intake (to not alter milk composition and volume)*

- Evidence: small energy restriction combined with increase in PA may be effective at helping women to lose weight, while improving their metabolic profile and increasing fat losses

Vitamin and mineral supplements

- Institute of Medicine: well-nourished BFeeding women do not need routine vitamin or mineral supplementation
  - Supplementation should target specific nutritional needs of individual women

- Should take into account how nutrients are secreted into BM and the potential for nutrient-nutrient interactions in mothers and their infants
  - E.g., women who avoid dairy products completely should use Ca (1200 mg) and vitamin D (10µg) supplements

Fluids

- There is no evidence that increasing fluid intake will increase milk production or that a short-term fluid deficit results in a decrease in milk production
- **Fluid demands rise during BF- drink enough fluids to keep urine pale yellow**
- Recommendation: 3.4 L for women 19–30 yrs

Alternative diets

- **Vegans**: dietary plan should include adequate intake of calories, protein, Ca, vit D, B12, Fe, and Zn
- **Vegetarians**: intake of protein are adequate- when E intake is adequate
- Vitamin- mineral supplements should be used when dietary intake is inadequate

Infant colic

- Crying >3hrs a day for more than 3 days a week, for at least one week- in a healthy baby
- It usually shows up when the baby is 2-3wks old
- Colic tends to peak around 6 wks, and then improves significantly between 3- 4 months
- By 4 months of age, 80-90% of infants are over colic- the remaining small % might take another month
- Baby's gender and birth order, whether he/she is breast or bottle fed doesn't affect colic

Causes of colic

- Exact cause is unknown; some possible causes include:
  - A growing digestive system with muscles that often spasm
  - Gas
  - Hormones that cause stomach pain or a fussy mood
  - Oversensitivity or overstimulation by light, noise…
  - A moody baby
  - A still-developing nervous system
  - An infection

- Belief that components of maternal diet are related to infant colic
  - *Observational trial:* mother's consumption of cow's milk, onions, cabbage, broccoli, and chocolate: ↑ likelihood of colic in the infant

- A randomized trial assessing maternal avoidance of cow's milk, eggs, peanuts, tree nuts, wheat, soy, and fish → ↓ in colic symptoms of infants in the first 6 wks of life

→ Exclude only foods that seem to cause problems and replace nutrients that might be lost due to this
  - E.g., excluding dairy foods may limit Ca and vit D intake

Factors influencing BF initiation and duration

- Obesity and BF:
  - Overweight and obesity prior to pregnancy and excess weight gain during pregnancy→ shorter duration of BF: may be related to ↓ prolactin responses early postpartum

- SES:
  - Low-income women often lack the education, support, and confidence to interpret the mixed messages on infant feeding practices

Obstacles to the initiation and continuation of BF

- Insufficient prenatal breastfeeding education
- Lack of support
- Health care provider apathy and misinformation
- Inadequate health care provider lactation management training
- Early hospital discharge
- Lack of routine follow-up care and postpartum home health visits
- Maternal employment, especially in the absence of workplace facilities and support for BF

- Lack of broad societal support
- Media portrayal of bottle-feeding as the norm
- Unfounded concern that BF causes breast sagging
- Commercial promotion of infant formula through distribution of hospital discharge packs, coupons for free or discounted formula, and advertisements

Lack of Knowledge

While breastfeeding is considered a natural skill, some mothers may need education and guidance. Providing accurate information can help prepare mothers for breastfeeding.

Lactation Problems

Without good support, many women have problems with breastfeeding. Most of these are avoidable if identified and treated early, and need not pose a threat to continued breastfeeding.

Poor Family and Social Support

Fathers, grandmothers, and other family members strongly influence mothers' decisions about starting, continuing, and accommodating breastfeeding.

Social Norms

Many people see breastfeeding as an alternative rather the routine way to feed infants.

Embarrassment

The popular culture's sexualization of breasts compels some women to conceal breastfeeding. Improving support for women to breastfeed can help them better accommodate the demands of everyday life while protecting their infants' health.

Employment and Child Care

Employed mothers typically find that (1) returning to work and (2) lack of maternity leave are significant barriers to breastfeeding.

Health Services

Health care systems and health care providers can improve mothers' breastfeeding experiences by pursuing and obtaining the training and education opportunities they need in order to fully support their patients.

ILLUSTRATION 6.9 ▸ Key barriers to breastfeeding.

BF promotion, facilitation, and support

- Role of the health care system:
  - Power to promote and model optimal BF practices during prenatal care, at delivery, and after discharge

- Prenatal BF education and support:
  - Culturally competent prenatal BF education that is given frequently in person can have a significant positive influence on BF rates

Table 6.7 The Best Start three-step breastfeeding counseling strategy[147]

1. Ask open-ended questions to identify the woman's concerns.
   - Dietitian: "What have you heard about breastfeeding?"
   - Client: "I hear it's best for my baby, but all my friends say it really hurts!"
2. Affirm her feelings by reassuring her that these feelings are normal.
   - Dietitian: "You know, most women worry about whether it will hurt."
3. Educate by clarifying how other women like her have dealt with her concerns. Avoid overeducating or giving the impression that breastfeeding is hard to master.
   - Dietitian: "Did you know that it is not supposed to be painful, and if you are having discomfort, there are people who can help make it better?"

- **Strategy**: peer counselors and peer group discussions with at least one or two women who have successfully breastfed

- Role of surrounding network- spouse, mother, father, grandmothers, friends

- Positive msgs about BF through posters, magazines, and literature in the waiting room…etc
  - **No ads for bottle feeding**

- BF is a learned skill- process associated with success is called "confident commitment"
  1. Confidence in the process of BF
  2. Confidence in the ability to breastfeed
  3. Commitment to making breastfeeding work despite obstacles

TABLE 6.10 World Health Organization's international/ UNICeF code on the marketing of breast milk substitutes

- No advertising of breast milk substitutes
- No free samples or supplies
- No promotion of products through health care facilities
- No company sales representative to advise mothers
- No gifts or personal samples to health workers
- No gifts or pictures idealizing formula feeding, including pictures of infants, on the labels of the infant milk containers
- Information to health workers should be scientific and factual
- All information on artificial feeding, including labels, should explain the benefits of breastfeeding and the costs and hazards associated with formula feeding
- Unsuitable products should not be promoted for babies
- Manufacturers and distributors should comply with the Code's provisions even if countries have not adopted laws or other measures

SOURCE: Adapted from "World Health Organization International Code of Marketing of Breast-milk Substitutes. Geneva, Switzerland: 1981.[155]

Lactation support in hospitals and birthing centers:

Hospital Practices That Influence Breastfeeding Initiation

	← Strongly Encouraging →	← Encouraging →	← Discouraging →	← Strongly Discouraging →
Physical Contact	• Baby put to breast immediately in delivery room • Baby not taken from mother after delivery • Woman helped by staff to suckle baby in recovery room • Rooming-in; staff help with baby care in room, not only in nursery	• Staff sensitivity to cultural norms and expectations of woman	• Scheduled feedings regardless of mother's breastfeeding wishes	• Mother-infant separation at birth • Mother-infant housed on separate floors in postpartum period • Mother separated from baby due to bilirubin problem • No rooming-in policy
Verbal Communication	• Staff initiates discussion re: woman's intention to breastfeed pre- and intrapartum • Staff encourages and reinforces breastfeeding immediately on labor and delivery • Staff discusses use of breast pump and realities of separation from baby, re: breastfeeding	• Appropriate language skills of staff, teaching how to handle breast engorgement and nipple problems • Staff's own skills and comfort re: art of breastfeeding and time to teach woman on one-to-one basis	• Staff instructs woman "to get good night's rest and miss the feed" • Strict times allotted for breastfeeding regardless of mother/baby's feeding "cycle"	• Woman told to "take it easy," "get your rest" . . . impression that breastfeeding is effortful/tiring • Woman told she doesn't "do it right," staff interrupts her efforts, corrects her re: positions, etc.

Hospital Practices That Influence Breastfeeding Initiation

	← Strongly Encouraging →	← Encouraging →	← Discouraging →	← Strongly Discouraging →
Nonverbal Communication	• Pictures of woman breastfeeding • Literature on breastfeeding in understandable terms • Staff (doctors as well as nurses) give reinforcement for breastfeeding (respect, smiles, affirmation) • Nurse (or any attendant) making mother comfortable and helping to arrange baby at breast for nursing • Woman sees others breastfeeding in hospital	• Closed-circuit TV show in hospital on breastfeeding	• Pictures of woman bottle-feeding • Staff interrupts her breastfeeding session for lab tests, etc. • Woman doesn't see others breastfeeding	• Woman given infant formula kit and infant food literature • Woman sees official-looking nurses authoritatively caring for babies by bottle-feeding (leads to woman's insecurities re: own capability of care)
Experiential	• If breastfeeding not immediately successful, staff continues to be supportive • Previous success with breastfeeding experience in hospital			• Previous failure with breastfeeding experience in hospital

In an effort to promote, protect, and support breastfeeding in hospitals and birthing centers worldwide, the World Health Organization (WHO) and UNICEF established the Baby-Friendly Hospital Initiative (BFHI) in 1992 (www.babyfriendlyusa.org).[147] This initiative focuses on 10 evidence-based components of hospital care that impact on breastfeeding success (Table 6.11). The Baby-Friendly

Table 6.10 The Baby-Friendly Hospital Initiative 10 steps to successful breastfeeding

1. Have a written breastfeeding policy that is regularly communicated to all health care staff.
2. Train all staff in skills necessary to implement this policy.
3. Inform all pregnant women about the benefits and management of breastfeeding.
4. Help mothers initiate breastfeeding within half an hour of birth.
5. Show mothers how to breastfeed and how to sustain lactation, even if they should be separated from their infants.
6. Feed newborn infants nothing but breast milk, unless medically indicated, and under no circumstances provide breast milk substitutes, feeding bottles, or pacifiers free of charge or at low cost.
7. Practice rooming-in, which allows mothers and infants to remain together 24 hours a day.
8. Encourage breastfeeding on demand.
9. Give no artificial pacifiers to breastfeeding infants.
10. Help start breastfeeding support groups and refer mothers to them.

SOURCE: World Health Organization, "Protecting, Promoting and Supporting Breast-feeding: The Special Role of Maternity Services," A Joint WHO/UNICIF Statement. Geneva, Switzerland, 1989.[169]

Breastfeeding in Palestine

- only 29% of children aged less than six months are exclusively breastfed, a lower level comparing to the global percentage of 43% and 35% in Middle East and North Africa

- In addition to delay of breastfeeding initiation and inadequate duration of breastfeeding

WHO/UNICEF Baby-Friendly Hospital Initiative (BFHI)

- was adopted in Palestine in 2010
- 26 health facilities are currently implementing this initiative and 6 of them were designated as 'Baby-Friendly' hospitals

TABLE 6.11 ▸ 10 steps to successful breastfeeding

1. Have a written breastfeeding policy that is routinely communicated to all health care staff.
2. Train all health care staff in the skills necessary to implement this policy.
3. Inform all pregnant women about the benefits and management of breastfeeding.
4. Help mothers initiate breastfeeding within half 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 breast milk, unless medically indicated.
7. Practice rooming-in, allow mothers and infants to remain together 24 hours a day.
8. Encourage breastfeeding on demand.
9. Give no artificial 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 or birth center.

Lactation support after discharge

- Breastfeeding support is essential in the 1st few weeks after delivery, as lactation is being established

- Younger women and women with lower SES are more likely to stop BF by 4 wks postpartum and cite:
  - Sore nipples
  - Inadequate milk supply
  - Feeling that the infant is not satisfied

- Lactation consultants: provide education and management to prevent and solve BF problems and to encourage a social environment that effectively supports the BF mother–infant dyad

- A pediatrician, nurse, HC practitioner should see all breastfeeding mothers and their newborns when the newborn is 2-4 days of age
  - Revisit major concerns by mother/ discuss new concerns

The workplace

- **Barriers:**
  - Lack of on-site day care
  - Insufficiently paid maternity leave
  - Rigid work schedules
  - Employers who lack knowledge about BF
- Breastfeeding duration is adversely affected by employment
- The number of hours mothers work/ day is inversely associated with the likelihood that the mother will continue to breastfeed

- Research findings: women who continue to breastfeed once returning to work miss less time from work because of baby-related illnesses, and have shorter absences when they do miss work, compared with women who do not breastfeed

- Choices when returning to work:
  - Express BM during the day into sterile containers, refrigerated or frozen
  - BF during breaks and lunch- time hrs
  - Train the body to produce milk during specific time (at home)

The community

- **Barriers may include:**
  - Lack of access to reliable and culturally appropriate sources of information and social support
  - Cultural perception of bottle feeding as the norm
  - Aggressive marketing of BM substitutes
  - Laws that prohibit breastfeeding in public

- Legislation is used to:
  - Protect a woman's right to breastfeed
  - Regulate breast pumps
  - Provide incentives to employers who provide breastfeeding support

- Legislation addresses issues such as a woman's right to breastfeed in public and express milk at work

Public food and nutrition programs/ model BF promotion programs