

# Breastfeeding and Breast Milk – from Biochemistry to Impact

A Multidisciplinary Introduction

Published by

Family Larsson-Rosenquist Foundation



Thieme

*Bibliographical data of the German National Library (Deutsche Nationalbibliothek)*

The German National Library (Deutsche Nationalbibliothek) lists this publication in the German National Bibliography; detailed bibliographic information can be found on the internet at <http://dnb.d-nb.de>.

© 2018 Georg Thieme Verlag KG

Rüdigerstr. 14  
70469 Stuttgart  
Deutschland

[www.thieme.de](http://www.thieme.de)

Printed in Germany

Editorial Office: Lingua-World GmbH, Köln  
Drawings: Martina Berge, Stadtbergen; Nadja Stadelmann, Luzern  
Cover design: Thieme Group  
Cover graphic: Nadja Stadelmann, Luzern  
Typesetting by Druckhaus Götz GmbH, Ludwigsburg  
Printed by Westermann Druck Zwickau GmbH, Zwickau

ISBN 978-3-13-220401-0

1 2 3 4 5 6

Also available as an e-book:  
eISBN (PDF) 978-3-13-220411-9  
eISBN (epub) 978-3-13-220421-8



This PDF of "Breastfeeding and Breastmilk – from Biochemistry to Impact" is exclusively published on LactaHub.

It is licensed under the Creative Commons Attribution CC BY-NC-ND 4.0 License, and it may be used under the terms of that license or any later version of the Creative Commons Attribution License.

**Important note:** Medicine is an ever-changing science undergoing continual development. Research and clinical experience are continually expanding our knowledge, in particular our knowledge of proper treatment and drug therapy. Insofar as this book mentions any dosage or application, readers may rest assured that the authors, editors, and publishers have made every effort to ensure that such references are in accordance with **the state of knowledge at the time of production of the book**.

Nevertheless, this does not involve, imply, or express any guarantee or responsibility on the part of the publishers in respect to any dosage instructions and forms of applications stated in the book. **Every user is requested to examine carefully** the manufacturers' leaflets accompanying each drug and to check, if necessary in consultation with a physician or specialist, whether the dosage schedules mentioned therein or the contraindications stated by the manufacturers differ from the statements made in the present book. Such examination is particularly important with drugs that are either rarely used or have been newly released on the market. Every dosage schedule or every form of application used is entirely at the user's own risk and responsibility. The authors and publishers request every user to report to the publishers any discrepancies or inaccuracies noticed. If errors in this work are found after publication, errata will be posted at [www.thieme.com](http://www.thieme.com) on the product description page.

Some of the product names, patents, and registered designs referred to in this book are in fact registered trademarks or proprietary names even though specific reference to this fact is not always made in the text. Therefore, the appearance of a name without designation as proprietary is not to be construed as a representation by the publisher that it is in the public domain.

This book, including all parts thereof, is legally protected by copyright. Any use, exploitation, or commercialization outside the narrow limits set by copyright legislation without the publisher's consent is illegal and liable to prosecution. This applies in particular to photostat reproduction, copying, mimeographing or duplication of any kind, translating, preparation of microfilms, and electronic data processing and storage.

## 23 Towards a Common Understanding of Human Lactation

**Melinda Boss, MPS, B.Pharm, Senior Research Fellow; Peter E. Hartmann E/Prof, PhD, BRurSc**

Reviewed by

Donna Geddes, PhD, PostGrad Dip (Sci), DMU

Margaret C. Neville, E/Prof, PhD

Bo L. Lönnerdal, Distinguished E/Prof, PhD

Rafael Pérez-Escamilla, Prof, PhD

Valerie Verhasselt, Prof, MD, PhD

### 23.1

### Preface

Throughout this book you may have noticed that different terminologies have been used. Conflicting advice is one of the most common factors that impact on a mother's confidence in her ability to breastfeed and sustain lactation. Consistent terminology is the most basic requirement for the prevention of conflicting advice. Even such basic terms as lactation and breastfeed have either varying or no definition in the scientific literature. For example, does lactation encompass both the mother and the child? Does a breastfeed refer to the infant removing milk from one breast or does it refer to the infant removing milk during a session, which may include more than one breast? These questions can be answered by a glossary that defines a common language. This glossary was developed in parallel with the content of this book and was not available to authors at the time of writing. The use of varying terminologies in preceding chapters serves to further highlight the need for such standardisation. This is an essential starting point towards a common medical and scientific understanding of human lactation.

**Terms are included if they have a clear link to the medical or scientific understanding of human lactation.**

- Preference is given to objective terms that are quantifiable (e.g. "slow weight gain", rather than "failure to thrive").

**Terms that are NOT included:**

- Medical diagnoses that are well defined elsewhere and require no additional modification of definition when occurring concomitantly with human lactation
- Organisations, groups, associations
- Acronyms (e.g. L.A.T.C.H.)
- Medications
- Qualifications, e.g., degrees, credentialing, certifications, etc.
- Layman's terms are avoided where possible.

## 23.2

**Alphabetical List of Terms**

**24-h milk intake** The volume of breastmilk, expressed breastmilk and infant formula consumed by the infant over a period of 24 hours. The volume of breastmilk consumed at the breast is calculated by recording a breastmilk transfer measurement after each feed from each breast for at least 24 hours. The volume of breastmilk consumed by the infant is calculated as the sum of all feeds over a 24-hour period. This ensures that a breastfeeding session (sometimes referred to as a “meal”) is not counted twice in a 24-hour period. For example, if the first feed occurred at 7 am on the first day with the next feed at 9 am, and the first feed on the second day occurred at 6.30 am with the next feed at 8.30 am, the 6.30 am feed would not be included in the 24-hour calculation.

See also 24-h milk production (p. 366), 24-h milk profile (p. 366), Breastmilk transfer measurement (p. 369)

**24-h milk production** The volume of milk produced by the mother over a period of 24 hours. This can be calculated in several ways:

1) A breastmilk transfer measurement is recorded after each feed from each breast for at least 24 hours. The total milk production normalised to 24 hours is calculated using:  $MP = \text{SUM} * (24/\text{TIME}) * [(n-1)/n]$

Where MP is the 24-h milk production, SUM is the total of all breastmilk transfer measurements, TIME is elapsed time from beginning of the first feed to beginning of the last feed and n is the total number of feeds. This ensures that milk produced beyond the 24-hour period is not included, but milk produced by the mother after the last feed before 24 hours, but within the 24-hour period, is included.

Breastmilk expressed over the same 24-hour period is also weighed, summed and added to this total.

2) Maternal milk is expressed from both breasts simultaneously in a relaxed, monitored environment for 10 minutes each hour. This is repeated every hour for 3 consecutive hours. The volume of milk expressed at the fourth expression multiplied by 24 provides an estimate of 24-h milk production.

3) Deuterium oxide-to-the-mother technique measures milk intake over a period of 5–14 days by measuring the changes in deuterium in mother and infant after a maternal dose. Deuterium oxide is uniformly distributed in total body water. Milk intake can be calculated from measuring the decrease in concentration of deuterium in maternal saliva together with the change in deuterium concentration in the infant’s urine over 5–14 days. This method only works when milk production is stable. It cannot be used to study changing production, such as that which occurs during secretory activation.

See also 24-h milk profile (p. 366), 24-h milk intake (p. 366), Breastmilk transfer measurement (p. 369).

**24-h milk profile** A summary of individual infant milk intake (at the breast, expressed breastmilk and/or infant formula) and maternal milk production. A 24-h milk profile is carried out over a continuous 24-hour period and includes

consecutive breastmilk transfer measurements, number of breastfeeds, amount and duration of breastfeeds, breastmilk expressions and infant intake of previously expressed breastmilk and/or infant formula.

See also 24-h milk intake (p. 366), 24-h milk production (p. 366), Breastmilk transfer measurement (p. 369)

**$\alpha$ -lactalbumin** A major nutritional protein present in the whey fraction of human milk. It constitutes about 10–20% of the total protein content of human milk. Metabolically it forms part of the lactose synthase complex.

**Abscess (Breast)** See Breast abscess (p. 368)

**Accessory nipple** See Polythelia (p. 382)

**Accessory breast tissue** See Polymastia (p. 382)

**Acini** See Alveoli (p. 366)

**Acquired immune system (also adaptive immune system)** Refers to cells of the immune system which are characterised by their high antigen specificity and their capacity to differentiate into memory cells upon subsequent encounters with the same antigen. The presence of memory cells allows accelerated and enhanced immune response.

See also Entero-mammary pathway (p. 372)

**Acute weaning** The abrupt termination of breastfeeding. See also Weaning (p. 386)

**Adaptive immune system** See Acquired immune system (p. 368)

**Adenohypophysis pituitary gland (also Anterior pituitary gland)** See Pituitary gland (p. 382)

**Adenoma, lactational or lactating** See Lactating adenoma (p. 375)

**After Pains (also after birth pains)** Breastfeeding in the immediate postpartum period lowers the risk of blood loss by inducing uterine contractions. These contractions can be associated with deep lower back and abdominal cramping pain in some women. The intensity of the pain varies, increases with parity and usually spontaneously resolves within the first two weeks postpartum.

**Allergy** An inappropriate inflammatory response of the immune system towards innocuous molecules present in the air such as pollens, house dust mite or in food such as milk, egg, fish, peanut. Symptoms include red eyes, itchiness, runny nose, eczema, hives or asthma attack. See also Cow’s milk protein allergy (p. 371), Hen’s egg allergy (p. 373), Food allergy (p. 373)

**Alveoli (also acini)** The terminal ends of the milk ducts. Formed by a single spheroid layer of lactocytes arrayed around a central cavity (lumen), surrounded by blood capillaries and a web of stellate myoepithelial cells. Milk is secreted into the lumens of these structures.

**Alveolar development (formerly mammatogenesis)** Proliferative activity in the mammary gland during pregnancy that leads first to stem cell division from the terminal end

buds of the rudimentary ducts and then to active proliferation of the resulting cells to form the alveolar structures responsible for milk production.

**Amastia** Complete absence of breast tissue, nipple and areola.

**Amazia** Absence of breast tissue in the presence of the nipple and areola.

**Amenorrhoea (Lactational)** See Lactational amenorrhoea (p. 376)

**Ankyloglossia (also Tongue-tie)** Classic ankyloglossia is considered to be an obvious short or inelastic lingual frenulum, or one attached close to the tip of the tongue that may or may not cause a change in shape (heart shape). Other classifications include those that are thicker, fibrous and are located further towards the posterior tongue. Both types may limit tongue function, however there is no reliably validated tool available to assess tongue function for tongue-tie. Ankyloglossia may or may not inhibit effective breastfeeding with symptoms ranging from nipple pain, difficulty attaching to the breast and/or poor milk transfer.

**Antenatal** Before birth, during or relating to pregnancy.

**Anterior pituitary gland** See Pituitary gland (p. 382)

**Apoptosis** A form of cell death without inflammation that occurs as a normal and controlled part of an organism's growth or development. Programmed cell death. See also Mammary involution (p. 377)

**Areola** The pigmented area surrounding the nipple. Its surface is dotted with small projections due to the presence of Montgomery's glands.

**Areolar glands** See Montgomery's glands (p. 379)

**Artificial feeding** Infant is fed only on a breastmilk substitute, that is, any food being either marketed or otherwise represented as a partial or total replacement for breastmilk.

**Artificial formula** See Infant formula (p. 374)

**Artificial nipple** See Artificial teat (p. 367)

**Artificial teat (also artificial nipple)** An artificial device that is often shaped to resemble a maternal nipple. This is attached to a bottle and used to provide the infant with expressed breastmilk or infant formula.

**At-breast supplementer (also Supplemental nursing system, Supply line)** A feeding tube device consisting of a fine tube leading from a reservoir of breastmilk and positioned just past the tip of the nipple so that as the infant suckles at the breast, milk can be sucked through the tube to nourish the infant.

**Attachment** See Bonding (p. 368) and Positioning and latch (p. 382)

**Attachment Parenting** A parenting philosophy based on the dynamic interpersonal relationship between parents and their children.

**Aurora kinase A** A cell cycle-regulated kinase that may be involved in microtubule formation and/or stabilisation at the spindle pole during chromosome segregation – thought to have a key role in secretory activation by stimulating the formation of bi-nucleated lactocytes.

**Available milk** The volume of milk available to either the sucking infant or for expression by either hand or a breast pump. It is calculated as the storage capacity of the breast multiplied by the degree of fullness.

**Axillary mammary tissue (also axillary mammary tail)** Glandular tissue that extends from the breast towards the axilla partly under the lateral border of the pectoralis major muscle.

**$\beta$ -lactoglobulin** A whey protein present in cow's milk but not found in human milk.

**Baby blues** See Postnatal blues (p. 382)

**Baby-led attachment** A pattern of instinctive movements of the infant occurring when placed on the maternal chest in a prone position. These movements enable the infant to locate the areolar area of the breast and latch on to the nipple largely unassisted.

**Bifidobacteria** Gram-positive anaerobic bacteria in breastmilk and common in the gut of breastfed infants that ferment sugars (particularly human milk oligosaccharides) and produce short chain fatty acids such as acetate, propionate and butyrate which play an important role in immune homeostasis.

**Bile salt-stimulated lipase (BSSL)** Present in low concentrations in the whey fraction. Upon activation by bile salts in the duodenum it hydrolyses a range of lipid substrates (short and long chain mono-, di- and triacylglycerides, cholesterol esters, retinol esters and p-nitrophenyl esters).

**Bilirubin** A yellow compound that occurs in the normal catabolic pathway that breaks down haeme.

**Bioactive component** Non-nutritive components of food (e.g., human milk) that have an impact on health via a regulatory effect on biological processes.

**Birth weight** The body weight of an infant at its birth.

**Bleb** See Blocked nipple pore (p. 368)

**Blocked milk duct (also plugged duct, clogged duct, caked breast, caked duct, focal engorgement)** A tender lump in the breast ranging from the size of a pea to a large wedge-shaped area. Not associated with either systemic illness or inflammation.

Note: It can be difficult to differentiate between engorgement, blocked milk duct, mastitis and breast abscess because they are a continuum without distinct boundaries. Each includes some element of milk stasis or impaired drainage.

See also Breast abscess (p. 368), Pathological engorgement (p. 381), Mastitis (p. 377)



**Blocked nipple pore (also bleb, nipple white spot)** A milk-filled blister on the nipple, thought to be caused by either the closure of a fine layer of skin growing over a duct opening or by thickened milk. Presents on the nipple and/or areola as a white, clear or yellow dot. May sometimes stand out as a large blister.

**Blood-milk barrier** The barriers to the passage of blood constituents into milk directly from the extracellular space as well as direct passage of milk constituents from the alveolar lumen to the interstitium. In full lactation this passage is closed by tight junctions. This barrier is open in pregnancy, possibly in mastitis and during late involution.

**Bonding (also attachment)** A strong and affectionate connection between mother and infant, influenced positively by the hormone oxytocin.

**Bottle-fed** See Bottle-feeding (p. 368)

**Bottle-feeding** The act of feeding an infant from a bottle.

**Bovine serum albumin** A species-specific protein that is present in cow's milk, but only in low concentrations in the milk of women who consume cow's milk.

**Breast (this term is interchangeable with Mammary gland)** A female secretory and secondary sex organ. The breast remains in a quiescent state until conception triggers a process of complete remodelling that results in the synthesis and secretion of breastmilk. Functional maturity is only reached during lactation. The breast then returns to a quiescent state after involution, caused by gradual weaning of the infant. See also Mammary gland (p. 377)

**Breast abscess** Characterised by a fluctuant, palpable mass that is usually tender and often associated with a localised, painful inflammation of the breast. Fever and malaise are often, but not always present.

It can be difficult to differentiate between engorgement, blocked milk duct, mastitis and breast abscess because they are a continuum without distinct boundaries. Each includes some element of milk stasis or impaired drainage. See also Pathological engorgement (p. 381), Blocked milk duct (p. 367) and Mastitis (p. 377)

**Breast and nipple herpes** See Herpes of the nipple and breast (p. 373)

**Breast and nipple thrush** See Candidiasis of the nipple and breast (p. 370)

**Breast augmentation** See Mammary augmentation (p. 377)

**Breast cancer (also mammary carcinoma)** Malignant neoplasm in the parenchyma of the breast.

**Breast compression** See Breast massage (p. 368)

**Breast cup** See Breast shell (p. 368)

**Breast cyst** A benign fluid-filled lump. The mass is characteristically firm, smooth, lobulated and freely moveable. Differs from a galactocoele in that it is not filled with milk. See Galactocoele (p. 373) and Breast lumps in lactation (p. 368)

**Breast expression** See Breastmilk expression (p. 369)

**Breast feed** See Breastfeed (p. 369)

**Breast lumps in lactation** A palpable mass detected in the breast during lactation. Most lumps detected during lactation are related to the breastfeeding process, such as blocked milk ducts, mastitis and galactocoeles. Some may result from causes other than pregnancy and lactation, such as prior surgery, breast cysts, benign tumours and breast cancer. See Blocked milk duct (p. 367), Mastitis (p. 377), Galactocoele (p. 373), Breast cyst (p. 368), Lactating adenoma (p. 375), Fibroadenoma of the mammary gland (p. 372) and Breast cancer (p. 368)

**Breast massage** Gentle manipulation of the mammary gland by rubbing or kneading. Methods used show inter-cultural variations. There are also substantial differences in the intricacy and duration of the massage techniques. Uses vary from relieving blocked ducts, assistance with secretory activation, to comfort.

**Breast milk** See Breastmilk (p. 369)

**Breast pad (also nursing pads)** A single use or washable absorbent pad worn against the breast to prevent breastmilk leakage onto clothing between breastfeeds.

**Breast pump** A manual or electric device for withdrawing milk from a woman's breast(s) by suction. See also Manual breast pump (p. 377), Electric breast pump (p. 372) and Hospital-grade breast pump (p. 374)

**Breast pumping** See Breastmilk expression (p. 369)

**Breast reduction** See Mammary reduction (p. 377)

**Breast refusal (also breast aversion, breast rejection)** Feeding behaviour where an infant is reluctant to attach after having previously breastfed well. When brought to the breast to feed the infant typically turns its head slowly from side to side, crying desperately, arching its back, pushing its head away from the breast and punching with its fists. This action is extremely distressing to the mother. See also Neonatal breast refusal (p. 379)

**Breast shell (also milk cup, breast cup, Meredith shield)** A hard plastic dome worn inside the bra. Consists of an inner and outer section that snap together. The inner section surrounds the nipple and the outer section separates the nipple from the bra and clothing. Marketed as an aid in the management of inverted and/or damaged nipples. See also Nipple shield (p. 380)

**Breast shield** The part of a breast pump that consists of a plastic conical device designed to cover the areolar area and then forms a tunnel that encompasses the nipple and allows the milk to flow into a collection bottle.

**Breast storage capacity (also storage capacity)** The amount of milk available to the infant when the breast is full. It is calculated from the cream content of milk samples collected before and after each feed from each breast, and the volume of milk consumed during each feed from each breast for a 24-hour period of breastfeeding. See also Potential storage capacity (p. 382), Degree of fullness of the mammary gland (p. 371)

**Breastfed** Past tense of breastfeed.  
See also Ever breastfed (p. 372)

**Breastfeed (also breast feed, breast-feed)** Removal of milk from one breast by the infant, usually of 8–15 minutes duration.  
See also Paired breastfeed (p. 381), Cluster breastfeed (p. 370) and Breastfeeding session (p. 369)

**Breastfeeding (also nursing)** The act of the infant removing milk from the mammary gland.  
See also Breastfeeding session (p. 369), Nutritive sucking (p. 380) and Non-nutritive sucking (p. 380)

**Breastfeeding cues (also feeding cues, hunger cues)** Infant behaviours that indicate a readiness to breastfeed. The infant is awake in the quiet, alert stage and may also suckle its hands. These behaviours occur prior to infant crying, which is considered to be a late cue. Usually more pronounced in the early postnatal period.

**Breastfeeding indicator** A measurable variable used to assess breastfeeding practices and defined by the World Health Organization. Key breastfeeding indicators include exclusive breastfeeding rate, predominant breastfeeding prevalence, timely complementary breastfeeding prevalence, continued breastfeeding prevalence and bottle-feeding prevalence.

**Breastfeeding patterns** Summary of population data for healthy, term, exclusively breastfeeding dyads between 1 and 6 months of age. Includes breastfeeding frequency, breastfeed duration, average quantity of breastmilk ingested, percentage of available milk removed, 24-hour milk production etc.

**Breastfeeding positions (also feeding positions)** The positions in which the mother holds her infant while breastfeeding, e.g., cradle, transition, straddle, football hold. See also Positioning and latch (p. 382)

**Breastfeeding session** Breastfeeding session can comprise of a breastfeed, a paired breastfeed or a cluster breastfeed. To be included in a breastfeeding session, the beginning of each breastfeed must occur within 30 minutes of cessation of feeding from the previous breast.

**Breastfeeding to need (also feeding to need, demand breastfeeding, demand feeding)** Maternal response to the infant's hunger cues and breastfeeding accordingly. The frequency and milk intake can vary considerably from feed to feed but 24-h intakes remain relatively stable as the infant's appetite regulates milk intake according to need.

**Breastmilk (also human milk)** The secretion produced by the lactocytes of the human maternal mammary gland from approximately 5 days after birth. Breastmilk contains a complex array of proteins, carbohydrates, lipids, micronutrients, vitamins and biologically active compounds involved in the growth, development and immune protection of the infant. Includes both transitional and mature breastmilk.

See also Colostrum (p. 370), Transitional breastmilk (p. 386), Mature breastmilk (p. 378)

**Breastmilk appearance** See Breastmilk colour (p. 369)

**Breastmilk colour (also breastmilk appearance)** Human milk is low in casein, therefore the colour is determined by the fat content, which varies depending upon the fullness of the maternal breast. If the breast is full of milk, the first milk expressed is usually pale blue in colour because of the low-fat content. If the breast is drained of milk the expressed milk is dense white in colour due to the high fat content of the residual milk. In contrast, cow's milk is white in colour due in large part to the high content of casein, which remains relatively constant as the gland is emptied. See also Milk fat (p. 378)

**Breastmilk expression (also breast pumping, milk expression)** Removal of breastmilk by either hand, manual breast pump or electric breast pump.

**Breastmilk feeding** When the infant is fed with expressed human milk.

**Breastmilk jaundice** A prolongation of physiological jaundice. Breastmilk jaundice occurs more than 24 hours after birth. It is a long-term jaundice in an otherwise healthy, breastfed infant and extends up to 8–12 weeks of life. Breastmilk jaundice tends to run in families, occurs equally often in males and females and affects 0.5% to 2.4% of all newborns.  
See also Jaundice (p. 375), Pathological jaundice (p. 381) and Physiological jaundice (p. 381)

**Breastmilk substitute** Any food being marketed or otherwise presented as a partial or total replacement for breastmilk, whether or not it is suitable for that purpose (as defined by the World Health Organisation).  
See also Infant formula (p. 374)

**Breastmilk transfer** The amount of breastmilk transferred to an infant over the course of a breastfeed.  
See also Breastmilk transfer measurement

**Breastmilk transfer measurement (also test-weigh)** A measurement to determine the amount of milk transferred to the infant during a breastfeed. The fully clothed infant is weighed immediately pre and postbreastfeeding using digital scales (accurate to <2.0g). The difference in the weights is equivalent to the amount of milk transferred to the infant. For improved accuracy, a correction should be made for insensible water loss from the infant during the feed.

**Caesarean Section** The use of surgery to deliver one or more infants.

**Caked breast** See Blocked milk duct (p. 367)

**Caked duct** See Blocked milk duct (p. 367)

**Candida** A genus of yeasts that is a common cause of fungal infections.

See also Candidiasis of the nipple and breast (p. 370)

**Candidiasis of the nipple and breast (also thrush in lactation, candida mastitis)** A condition characterised by nipple pain +/– breast pain throughout and after breastfeeds together with extreme nipple sensitivity. The syndrome is usually diagnosed clinically and whether *Candida* (usually *Candida albicans*) is the causative organism is yet to be conclusively supported by laboratory tests. Usually secondary to factors reducing natural immunity and/or skin trauma.

**Casein/casein micelle** A family of related phosphoproteins that form a micellar structure (casein micelles with  $\alpha$ s1,  $\beta$  and  $\lambda$  caseins subunits). It is a major protein in most mammals but only constitutes 10% of the total protein in human colostrum and 40% in mature human milk. The casein micelles and the phosphorylation of the casein molecules contribute to the high availability of calcium in human milk by enabling calcium to remain soluble at high concentrations.  $\lambda$  Casein is hydrolysed in the infant's stomach and the remaining proteins coagulate to form a soft casein curd.

In contrast, the high concentration of casein in cow's milk forms a very firm curd when ingested.

**Cells in human milk** See Human milk cells (p. 374)

**Cellulitis** Inflammation of subcutaneous connective tissue caused by a bacterial infection of the skin and its underlying dermis and subcutaneous fat. Symptoms include a painful area of redness that increases in size over several days. Must be differentiated from mastitis if it occurs on the breast during lactation.

**Cephalohaematoma** A collection of blood under the scalp of a newborn infant. The blood is located between the bones of the skull and the lining over the bones and is usually due to injury during the birthing process.

**Choanal atresia** Congenital obstruction of the nasal passage, usually by membranous or bony tissue.

**Cleft lip and palate** Relatively common birth defect resulting from incomplete merging or fusion of embryonic processes normally uniting in the formation of the face. Clefts range from a slight notch in the upper lip to a full opening of the lip into the floor of the nasal cavity (hard palate and soft palate). May be unilateral or bilateral.

**Clogged milk duct** See Blocked milk duct (p. 367)

**Cluster breastfeed** A series of breastfeeds occurring within a period of 30 minutes or less

**Colic** See Infantile colic (p. 375)

**Colostrum** The usually yellowish viscous secretion of the breast produced during the first two to four days postpartum. It is synthesised by the lactocytes of the maternal mammary gland in small volumes (about 30 mL in the first 24 h after birth). Compared to mature milk, colostrum has high concentrations of sodium, chloride, protein (particularly IgA), and low concentrations of lactose and citrate. See also Pre-colostrum (p. 383)

**Coloured breastmilk** Breastmilk that varies in appearance from the common breastmilk colour. May be pink, red, pink-orange, green or brown. Known causes include drugs, diet, bacterial infection and haemorrhage. Often benign.

See also Breastmilk colour (p. 369)

**Complementary feeding** Nutrient-containing first foods given during the transition from exclusive breastfeeding to family foods while breastfeeding is maintained.

Complementary breastfeeding commences during weaning, that is from around six months postpartum.

See also Exclusive breastfeeding (p. 372), Non-exclusive breastfeeding (p. 380), Predominant breastfeeding (p. 383), Supplementary feeding (p. 385), Substitute feeding (p. 385) and Weaning (p. 386)

**Conditioned milk ejection reflex** The ejection of milk in the absence of stimulation of the nipple to activate the neuro-hormonal reflex, i.e. in response to thinking about the infant, hearing an infant's cry.

See also Milk ejection reflex (p. 378)

**Congenital** A condition existing at birth which may be either hereditary or due to an influence on gene expression occurring up to the moment of birth.

**Congenital lactose intolerance** A very rare autosomal recessive disorder that is characterised by the complete absence of the enzyme lactase.

See also Lactose intolerance (p. 376), Developmental lactose intolerance (p. 371), Primary lactose intolerance (p. 383), Secondary lactose intolerance (p. 384)

**Constipation** A delay or difficulty in passing bowel motions. Rarely occurs in exclusively breastfed infants. Sometimes a breastfed infant may not pass a stool for 7 to 10 days and in the absence of symptoms this is not regarded as problematic.

See also Infant dyschezia (p. 374)

**Contralateral** Pertaining to the opposite side of the body.

**Cooper's ligaments (also ligamenta suspensoria)** Fibrous ligaments that provide a framework for breast tissue to maintain its structural integrity. They travel from the underlying pectoral fascia terminating at the skin.

**Core biopsy (breast)** A procedure involving insertion of a hollow needle into the breast to remove a small sample of tissue from an area of concern for laboratory testing.



**Corpus luteum** A hormone-secreting structure that develops in an ovary after ovulation. It degenerates after a few days unless conception has occurred.

**Costal** Relating to the ribs (for example costal cartilage).

**Costochondritis** Inflammation of the cartilage that connects a rib to the sternum. May be an extra-mammary musculoskeletal cause of breast pain.

**Co-sleeping (also rooming in)** Mother and infant sleeping in proximity (within arm's reach) of one another. This permits the mutual monitoring and exchange of caregiver–infant sensory signals and cues.

**Cow's milk protein allergy (CMPA)** A food allergy caused by cow's milk proteins. Intact cow's milk proteins have been identified in human milk. Rarely, cow's milk protein allergy can occur during exclusive breastfeeding. See also Allergy (p. 366), Hen's egg allergy (p. 373), Food allergy (p. 373)

**Cream** The milk fat fraction that rises to the top of the container when milk either stands for a time or is centrifuged.  
See also Milk fat (p. 378)

**Crematocrit** A measure of the proportion of cream in a milk sample, determined by centrifuging the sample and measuring the depth of the cream layer as a proportion of the depth of the milk sample.

**Crying** See Normal infant crying (p. 380)

**Cup feeding** Placing breastmilk in a small cup and holding it to the infant's lips so that a small amount of milk can flow into the infant's mouth.  
See also Paladai (p. 381)

**Daily breastmilk intake** The sum of breastmilk consumed by an infant over a 24-hour period.  
See also 24h milk production (p. 366)

**Dancer hand position** A breastfeeding position whereby the mother uses her hand to stabilise her infant's jaw and facilitate breastfeeding when muscular weakness is present.

**Degree of fullness of the mammary gland** Measured using the computerised breast measurement system, the degree of fullness of the mammary gland is a proportion of the amount of milk present in the mammary gland compared to the breast storage capacity at any particular time during the day. The degree of fullness ranges from 1.0 for a full breast to 0.0 for a drained breast.  
See also Breast storage capacity (p. 369), Potential storage capacity (p. 382)

**Delayed secretory activation** Secretory activation that occurs more than 72hr after birth. The mother still has the ability to achieve full milk synthesis unless primary lactation failure is present.  
Also see Primary lactation failure (p. 383), Secretory activation (p. 384)

**Demand breastfeeding** See Breastfeeding to need (p. 369)

**Dermatitis** See Nipple and areolar dermatitis (p. 379)

**Developmental lactose intolerance** Occurs in preterm babies of less than 34 weeks gestation and is a consequence of prematurity. Preterm infants should continue to receive breastmilk in all cases if available.  
See also Congenital lactose intolerance (p. 370), Lactose intolerance (p. 376), Primary lactose intolerance (p. 383), Secondary lactose intolerance (p. 384)

**Deviated nasal septum** Deformity of the nasal septum often caused by pressure on the foetus during pregnancy or parturition.

**Diabetes** Impaired ability to produce or respond to insulin.  
See also Gestational diabetes mellitus (p. 373), Type 1 diabetes mellitus (p. 386), Type 2 diabetes mellitus (p. 386)

**Diabetes insipidus** Caused by a low or absent secretion of the water-balance hormone vasopressin from the pituitary gland or poor renal response to vasopressin.

**Diagnostic ultrasound** An ultrasound-based imaging technique used for visualising internal body structures for possible anomalies or pathology.  
See also Therapeutic ultrasound (p. 385)

**Donor human milk** Excess human milk voluntarily contributed to a milk bank by lactating women. Usually the donor mothers are screened (similar to blood donor screening) and the milk is pasteurised before being given to the recipient infant.

**Donor human milk bank** An organisation that may recruit and screen breastmilk donors, then collects, processes, stores and dispenses the donated milk. There is no payment to the donor or cost to the recipient.  
See also Human milk bank (p. 374), Milk sharing (p. 379)

**Double pumping** See Simultaneous pumping (p. 384)

**Doula** A companion who provides non-medical support and assistance to the new mother throughout the perinatal period.

**Draught** See Milk ejection (p. 378)

**Duct** See Milk duct (p. 378)

**Ductal papilloma** See Intraductal papilloma (p. 375)

**Ductal obstruction** Scarring or other trauma that results in complete or partial blockage of milk ducts.

**Dummy (also pacifier)** A rubber, plastic or silicon nipple designed to be given to an infant to suckle. In its standard appearance it has a teat, mouth shield and handle. The mouth shield and the handle are large enough to avoid the danger of the child either choking or swallowing it.

**Duration of lactation** See Lactation duration (p. 375)

**Dyad (breastfeeding)** The interactional relationship between a breastfeeding mother and her infant.

**Dysphagia** Difficulty swallowing

**Dysphoric milk ejection reflex (D-MER)** A sudden onset of negative emotions, which occur just prior to stimulation of the milk ejection reflex. Symptoms may continue for up to several minutes. Mothers describe themselves as happy between milk ejection reflex episodes.  
See also Milk ejection (p.378)

**Echogenicity** The ability to bounce an echo, for example, to return the signal in ultrasound examinations. Echogenicity is higher when the surface bouncing the sound echo reflects increased sound waves.

**Eczema (Atopic dermatitis)** See Nipple and areolar dermatitis (p.379)

**Egg Allergy** See Hen's egg allergy (p.373)

**Electric breast pump** A breast pump for personal use that requires a power source, either a power outlet or battery. May be either single or double (able to express milk from both breasts simultaneously).  
See also Hospital-grade breast pump (p.374)

**Endocrine** Glands that secrete hormones directly into the circulatory system to be carried towards distant target organs

**Engorgement** See Physiological engorgement (p.381), Pathological engorgement (p.381)

**Entero-broncho-mammary pathway** See Entero-mammary pathway (p.372)

**Entero-mammary link** See Entero-mammary pathway (p.372)

**Entero-mammary pathway (also entero-mammary link, entero-broncho-mammary pathway)** The pathway towards the end of pregnancy whereby lactogenic hormones influence the migration of lymphocytes from aggregates in the gut to the mammary glands. This results in secretory IgA antibodies in breastmilk that are protective against microbes from the mother's gut and her upper respiratory tract secretions. It follows that breastfeeding should be initiated directly after birth to provide protection from exposure to microbes from birth onwards.

**Established lactation** Lactation from the time that breastmilk becomes mature until weaning commences. Breastmilk is currently considered to be mature after about 2–3 weeks postpartum, however more research is needed to accurately determine the markers of established lactation.

See also Mature breastmilk (p.378), Transitional breastmilk (p.386), Weaning (p.386)

**Estrogen** See Oestrogen (p.380)

**Ever breastfed** Infants who have been put to the breast, even if only once.

**Eutherian** A subclass of mammals having a placenta through which the foetus is nourished

**Exclusive breastfeeding** The infant receives only breastmilk (includes milk received via breastfeeding, expressed mothers own milk, milk from a donor and milk from a wet nurse). Allows the infant to receive drops, syrups (vitamins, minerals, medicine). Does not allow the infant to receive anything else including water (defined by the World Health Organization).

See also Predominant breastfeeding (p.383), Complementary feeding (p.370), Supplementary feeding (p.385), Non-exclusive breastfeeding (p.380) and Substitute feeding (p.385)

**Expressed breastmilk (EBM)** Breastmilk that has been removed by expression.

**Expression of breastmilk** See Breastmilk expression (p.369)

**Failure to thrive** See Slow weight gain (p.384)

**Familial puerperal alactogenesis** An isolated prolactin deficiency, which causes primary lactation failure (p.383)

**Feedback inhibitor of lactation (FIL)** A local mechanism that down-regulates milk synthesis as milk accumulates in the alveoli. Although there is considerable experimental support for such a mechanism, the exact mechanistic pathway remains elusive.

**Feeding cues** See Breastfeeding cues (p.369)

**Feeding positions** See Breastfeeding positions (p.369)

**Feeding to need** See Breastfeeding to need (p.369)

**Fertility and breastfeeding** See Lactational amenorrhoea (p.376)

**Fibroadenoma of the mammary gland** A benign, solid, mobile tumour of epithelial tissue with a conspicuous proliferation of fibroblasts. Often palpable. Tumour cells can form gland-like structures in the stroma. Most common in women aged 15–35 years.

**Fine needle aspiration (FNA)** A diagnostic procedure using a fine needle to obtain fluid or cells from breast lesions or cysts.

**Flat nipple** A nipple that is level with the areola, or only protrudes slightly from the breast.  
See also Inverted nipple (p.375)

**Focal engorgement** See Blocked milk duct (p.367)

**Follicle stimulating hormone (FSH)** A hormone secreted by the anterior pituitary gland that promotes the formation of ova or sperm.

**Food allergy** An inflammatory immune response to dietary proteins. Can occur during exclusive breastfeeding but usually occurs after the introduction of solids to the infant's diet, e.g., hen's egg allergy.

See also Allergy (p. 366), Cow's milk protein allergy (p. 371), Hen's egg allergy (p. 373)

**Forceful milk ejection** See Strong milk ejection (p. 385)

**Fore milk** See Pre-feed breastmilk (p. 383)

**Frenulum** A fold of mucous membrane, midline on the underside of the tongue that helps to anchor the tongue to the floor of the mouth.

**Frenulotomy (also frenectomy, frenotomy, frenulectomy)** A surgical procedure for excising a frenulum.

**Fresh milk** Milk that has been expressed from the breast and not exposed to any processes such as pasteurisation, freezing or thawing.

See also Raw milk (p. 383)

**Gagging** Involuntary gastric and oesophageal movements of vomiting without expulsion of vomitus.

**Galactocoele** A benign breast lesion characterised by a milk filled cyst thought to develop from an unrelieved blocked duct or defect in the duct wall during pregnancy, lactation or weaning.

See also Breast cyst (p. 368)

**Galactagogue (also lactagogue)** Any food or medication that is shown to improve milk synthesis.

**Galactopoiesis** Maintenance of established milk synthesis by the autocrine system balancing supply to demand.

**Galactorrhoea** See Neonatal galactorrhoea (p. 379)  
N.B. maternal galactorrhoea is outside the scope of this glossary.

**Galactosaemia** A rare condition resulting in the inability to metabolise galactose due to deficiency of either galactose-1-phosphate uridyl-transferase (most common and most severe form), galactokinase or galactose-6-phosphate epimerase. Breastfeeding is contraindicated for infants with this disorder.

**Gastro-oesophageal reflux (GOR)** See Infant regurgitation (p. 375)

**Gastro-oesophageal reflux disease (GORD) (also gastro-oesophageal reflux disease (GERD))** A condition associated with complications of infant regurgitation.  
See also Infant regurgitation (p. 375)

**Gestational age** Age of the foetus measured from the first day of a mother's last menstrual cycle to the current date. A normal pregnancy can range from 38 to 42 weeks.

**Gestational diabetes mellitus (also gestational diabetes) (GDM)** A condition in which a woman without previously diagnosed diabetes exhibits high blood glucose (blood sugar) levels during pregnancy (especially during the third trimester). The cause is usually an improper response to insulin.

See Diabetes (p. 371), Type 1 diabetes mellitus (p. 386), Type 2 diabetes mellitus (p. 386)

**Ghrelin** A peptide produced by ghrelinergic cells in the gastrointestinal tract, which functions as a neuropeptide in the central nervous system and is involved in the regulation of appetite.

**Gigantomastia (also pregnancy related gigantomastia, gravid or gestational gigantomastia)** Rapid and massive hypertrophy of the breast during pregnancy with grossly dilated nipples and areola and prominent dilated superficial veins.

**Glands of Montgomery** See Montgomery's glands (p. 379)

**Glandular parenchyma (also glandular tissue)** Secretory tissue in the mammary gland that secretes milk.

**Gonadotrophin** Any of a group of hormones secreted by the pituitary gland that stimulate the activity of the gonads.

**Gonadotrophin releasing hormone (GnRH)** A hormone produced in the hypothalamus and transported to the pituitary gland through the blood stream. It controls the secretion of follicle stimulating hormone (FSH) and luteinising hormone (LH).

**Graves disease** See Hyperthyroidism

**Haemorrhage** Copious discharge of blood from vessels.  
See also Postpartum haemorrhage (p. 382)

**Hard palate** The anterior bony subsection of the palate (roof of the mouth).  
See also Palate (p. 381), Soft palate (p. 384)

**Hen's egg allergy** An exaggerated immune response that may be related to dietary exposure to eggs. May also occur after weaning.  
See also Allergy (p. 366), Cow's milk protein allergy (p. 371), Food allergy (p. 373)

**Herpes** See Herpes of the nipple and breast (p. 373)

**Herpes of the nipple and breast (also herpes simplex mastitis)** Associated with severe pain combined with a unilateral or bilateral acute erosive dermatosis caused by Herpes simplex virus (HSV) infection. Presents similarly to HSV infections elsewhere on the body.

**Herpes simplex mastitis** See Herpes of the nipple and breast (p. 373)

**Hind milk** See Post-feed breastmilk (p. 382)

**Hirschsprung's disease** Congenital disorder of the colon caused by the failure of ganglion cells to migrate cephalocaudally through the neural crest during the early gestational period. Missing nerve cells in the lower portion of the colon prevent contractions of the affected portion of the intestine. Lack of contractions result in a reduction of the passage of contents, which may result in a blockage of the colon.

**Hospital-grade breast pump** A robust electric breast pump recommended for prolonged, frequent and regular use. May be used by multiple users.  
See also Manual breast pump (p. 377), Electric breast pump (p. 372)

**Human chorionic gonadotropin (hCG)** A hormone produced by the placenta after implantation. The presence of hCG is used in some tests to detect pregnancy.

**Human lactology** The study of, or specialty in, the scientific or medical field of human lactation.

**Human microbiome** The catalogue of symbiotic microbes and their genes that are harboured by a human, primarily in the gut. The human milk microbiome and its effects on the infant microbiome are yet to be fully understood.

**Human milk** See Breastmilk (p. 369)

**Human milk bank** A store of human milk for later use when required.  
See also Milk sharing (p. 379), Donor human milk bank (p. 371)

**Human milk cells** May be breast-derived or blood-derived. Breast-derived human milk cells include lactocytes, myoepithelial cells, progenitor cells and stem cells. Blood derived cells include immune cells, haematopoietic stem cells, haematopoietic progenitors and possibly other blood-derived cells.

**Human milk fortifier** Predominantly protein and mineral supplementation added to human milk so that it meets the nutrients required for the rapid growth rate and bone mineralisation of the preterm infant. May be derived from human breastmilk or bovine milk.

**Human milk metabolomics** The scientific study of the metabolites involved in the metabolic pathways associated with the synthesis of human milk.

**Human milk microbiome** See Human microbiome (p. 374)

**Hydatiform mole** A rare mass that forms from the placenta at the beginning of pregnancy

**Hyperbilirubinaemia** An abnormally large amount of bilirubin in the circulating blood

**Hyperreactio luteinalis** See Theca lutein cyst (p. 385)

**Hypoplastic breasts (also breast hypoplasia, mammary hypoplasia, insufficient glandular tissue)** Underdevelopment of the mammary glands. Clinically this may result in insufficient milk synthesis to exclusively breastfeed the infant. It is difficult to predict the effect of hypoplasia on milk synthesis.

**Hypothalamus** A portion of the brain that has a wide variety of functions – importantly it links the nervous system to the endocrine system via the pituitary gland.

**IgE (Immunoglobulin E)** A class of antibody that has been found only in mammals. It has an essential role in type-1 (acute onset) hypersensitivity reactions that manifest in various allergic diseases.

**Induced lactation** The establishment of lactation for an infant by a non-biological mother.  
See also Relactation (p. 383)

**Infant** A child from birth to 12 months of age.

**Infant dyschezia** A benign, transient condition that causes constipation-like symptoms. It results from a developmental lack of coordination of the relaxation of the pelvic floor and the intra-abdominal pressure increase preceding defaecation.  
See also Constipation (p. 370)

**Infant formula (also artificial formula, artificial milk)** A food manufactured according to compositional standards prescribed in the European Directive or Codex Alimentarius that is suitable as a complete or partial substitute for breastmilk. It is designed to meet the nutritional needs of an infant under one year of age and is usually derived from modified cow's milk but can also be manufactured from either goat's milk or plant sources such as soy.  
See also Breastmilk substitute (p. 369)

**Infant growth after 14 days of age** World Health Organization growth curves are a normative model for breastfed infants and are used to monitor height and weight for age. Growth is expected to follow a trend, tracking a curve roughly parallel to the median. Growth curves for breastfed babies are different from those that are formula-fed.

**Infant-led weaning** A method of introducing complementary foods whereby the infant controls their intake. Foods of a suitable texture are presented in their whole form and the infant is allowed to self-feed by selecting and grasping items. This encourages self-regulation with little parental control over intake. Small, hard foods should be avoided due to increased choking risk.  
See also Mother-led weaning (p. 379)

**Infant output** Number of wet and soiled nappies (diapers) per 24 hours

**Infant regurgitation (also reflux, posset, gastro-oesophageal reflux (GOR), gastroesophageal reflux (GER))** A normal physiologic process defined as the involuntary passage of gastric contents into the oesophagus. Episodes usually last < 3 minutes and occur after meals. The condition is self limiting and benign.

See also Gastro-oesophageal reflux disease (p. 373)

**Infantile colic** A benign and self-resolving behavioural syndrome characterised by recurrent or prolonged periods of crying, fussing or irritability that start and stop without obvious cause and cannot be prevented or resolved by caregivers, in an otherwise healthy infant under 5 months of age. Exact aetiology is unknown.

**Infective mastitis** See Mastitis (p. 377)

**Initiation (of lactation)** See Lactation initiation (p. 375)

**Innate immune system** Cells of the immune system that are activated by molecules found in pathogens (pathogen associated molecular pattern, PAMP) or liberated upon tissue lesion (danger associated molecular pattern, DAMP). The innate immune system provides an immediate, non-antigen specific immune response.

See also Acquired immune system (p. 368)

**International code of marketing of breastmilk substitutes (also WHO code)** A set of resolutions that regulate the marketing and distribution of any fluid intended to replace breastmilk, certain devices used to feed these fluids, and the role of health-care workers who advise on infant feeding. It is intended as a voluntary model that could be incorporated into the legal code of individual nations in order to enhance national efforts to promote breastfeeding and to regulate the composition of foods that can replace breastmilk, when it is not available.

**Intraductal papilloma** A benign breast tumour that can grow to 1 to 2 cm in size inside the milk ducts of the breast, often near the nipple. Sometimes these bodies can bleed or seep fluid, causing a serous or bloody discharge from the nipple.

**Intraglandular fat** Fat dispersed within the mammary parenchymal tissue.

**Intramammary distance** The minimum distance between the right and left sternal lines.

**Intraoral vacuum** Vacuum generated during a breast-feed when the infant's mouth is attached to the maternal breast. Intraoral vacuum peaks at  $-145 \pm 58$  mmHg and coincides with milk flow into the infant's oral cavity.

See also Strong sucking vacuum (infant) (p. 385)

**Intrapartum** Occurring during labour and delivery or childbirth.

**Inverted nipple** Failure of the nipple to evert caused by poor proliferation of the mesenchyme underlying the mammary primordium. Can present either bilaterally or unilaterally and may pose mechanical problems with breastfeeding.

**Involution** See Mammary involution (p. 377)

**Jaundice** A yellowish pigmentation of the skin, the conjunctival membranes over the sclera (whites of the eyes) and other mucous membranes caused by hyper-bilirubinaemia (too much bilirubin in the blood).

See also Pathological jaundice (p. 381), Physiological jaundice (p. 381) and Breastmilk jaundice (p. 369)

**Kangaroo mother care (also Kangaroo care)** A method of preterm and low birth weight infant care defined by the World Health Organisation. It involves carrying the infant chest to chest, usually by the mother, with skin-to-skin contact and breastfeeding. Kangaroo mother care has been associated with early discharge.

See also Skin-to-skin care (p. 384)

**Lactase** The enzyme lactase (EC 3.2.1.108) is a  $\beta$ -galactosidase produced in the small intestine that is essential for the hydrolysis of milk lactose to glucose and galactose. It is present in all normal infants and some adult ethnic groups that depend on cow's milk for nutrition as adults.

**Lactating adenoma** A solid mass in the breast, which only occurs during pregnancy and lactation, typically arising in the third trimester and involutes after delivery.

**Lactation** A period of sustained milk synthesis, which requires frequent and effective milk removal as well as appropriate hormonal stimulation.

See also Normal human lactation (p. 380)

**Lactation cycle** The progressive changes that occur in the mammary gland from conception, through pregnancy, birth, lactation, weaning and the return to the quiescent state (i.e. non-pregnant non-lactating state).

**Lactation duration** The time of lactation from birth until complete weaning.

See also Lactation duration, recommended (p. 375)

**Lactation duration, recommended** The World Health Organization recommends exclusive breastfeeding for the first 6 months of life then addition of nutritionally adequate and safe complementary foods while breastfeeding continues for up to 2 years of age or beyond.

**Lactation failure** The maternal inability to produce adequate milk for her infant's optimal growth, development and immune protection. Lactation failure may be primary or secondary.

See also Primary lactation failure (p. 383), Secondary lactation failure (p. 384)

**Lactation initiation** A cascade of events resulting in the synthesis and secretion of milk constituents from lactocytes in the mammary gland. Includes alveolar development, secretory differentiation and secretory activation.

See also Alveolar development (p. 366), Secretory differentiation (p. 384), Secretory activation (p. 384)



**Lactation risk categories** Risk categories defined by Dr Thomas Hale to describe the level of risk a medication poses towards the infant or maternal lactation.

**Lactation risk factors** Factors that are known to cause some degree of lactation failure. Includes factors that result in delayed secretory activation, primary lactation failure or secondary lactation failure. See also Delayed secretory activation (p. 371), Lactation failure (p. 378), Primary lactation failure (p. 383) and Secondary lactation failure (p. 384)

**Lactation stages (also stages of lactation)** Include alveolar development, secretory differentiation, secretory activation, established lactation, weaning.

**Lactational amenorrhea** Physiological cessation of menses during lactation. The duration of lactational amenorrhea varies between individuals within societies and also between societies, being as short as 2–3 months in Western societies and as long as 3 years in some Western women and traditional societies.

**Lactational amenorrhoea method (LAM)** Method of contraception for exclusively breastfeeding mothers. No more than four hours between breastfeeds during the day and six hours at night. Supplementary foods should comprise no more than 5–10% of the breastfed infant's energy intake.

**Lactiferous duct** See Milk duct (p. 378)

**Lactiferous sinus** Expanded ductal structures that have failed to be confirmed by recent studies. Previously it was thought that the milk ducts dilated towards the nipple and formed lactiferous sinuses, somewhat analogous to the milk cisterns in ruminants.

**Lactobacilli** Bacteria in the gut of breastfed infants that ferment sugars and produce acetic acid.

**Lactobiome** The collective genomes of the microorganisms found in the mammary secretion at any stage of the lactation cycle. See also Human (p. 376) Microbiome

**Lactocrine** Hormones that influence mammary gland function. See also Lactogenic complex (p. 376)

**Lactocyte** The mammary secretory epithelial cell that is capable of synthesising and secreting milk constituents such as lactose, casein,  $\alpha$ -lactalbumin, lactoferrin etc. See also Human milk cells (p. 374)

**Lactoferrin** An iron-binding whey protein with anti-microbial properties and ATPase activity. It is one of the most abundant proteins in human milk, but occurs in much lower concentrations in cow's milk.

**Lactogenic complex** The reproductive (human placental lactogen, progesterone, oestrogen and prolactin) and metabolic (growth hormone, glucocorticoids, parathyroid hormone related protein and insulin) hormones involved in secretory differentiation, secretory activation and galactopoiesis. See also Lactocrine (p. 376)

**Lactogenesis I** See Secretory differentiation (p. 384)

**Lactogenesis II** See Secretory activation (p. 384)

**Lactology** See Human lactology (p. 374)

**Lactobiome** The collective set of genes that contribute to the production of milk.

**Lactobiome datasets** The genomic data set derived from analysis of multiple inbred mouse strains and many other species. The data includes links to electronic databases that provide detailed annotation for each element. The lactobiomes are available for many other species including cows and goats.

**Lactogenome** The collective set of genes that contribute to the production of milk.

**Lactose** The principal disaccharide in human milk. It is hydrolysed to glucose and galactose in the small intestine and by bacteria in the large intestine.

**Lactose intolerance** A clinical syndrome consisting of one or more of the following: abdominal pain, diarrhoea with bulky, frothy watery stools, nausea, flatulence and bloating after the ingestion of lactose-containing food substances. It is caused by lactase deficiency and can be congenital, developmental, secondary and primary. See also Congenital lactose intolerance (p. 370), Developmental lactose intolerance (p. 371), Primary lactose intolerance (p. 383), Secondary lactose intolerance (p. 384)

**Lactose overload** Lactose overload has been described in theory and is yet to be supported by scientific evidence. It has been proposed that the infant rapidly ingests large volumes of milk, resulting in faster gastric emptying that presents large quantities of lactose to the small intestine for digestion. As a result, the efficiency of lactose hydrolysis in the small intestine is decreased and an excessive amount of lactose is presented to the large intestine. Thus, there is excess lactose fermentation by the bacteria in the large intestine, generating an osmotic load that draws fluid and electrolytes into the intestinal lumen leading to loose stools. This process is proposed to result in symptoms that mimic secondary lactose intolerance.

**Latch** See Positioning and latch (p. 382)

**Leptin** A peptide secreted by adipose tissue that inhibits neuropeptide Y in the brain. It is thought to be an appetite suppressant.

**Let-down (also milk let-down)** See Milk ejection (p. 378)

**Lipase** An enzyme that hydrolyses triacylglycerols, fats and oils.

**Lobe** A collection of lobules that drain into a single milk duct, allowing milk to exit through a nipple pore. Each lobe is separated by connective tissue septa in the human breast.

**Lobule** Lobes divide into lobules that consist of clusters of alveoli lined with lactocytes.

**Lobulo-alveolar system** Secretory elements of the mammary parenchyma (excludes the ductal system).

**Low breastfeeding confidence (also perceived insufficient milk supply (PIM), perception of insufficient milk)** The perception of the mother that her milk supply is not sufficient to meet her infant's requirement, whereas clinical assessment shows that her milk supply is adequate.

**Luteinising hormone (LH)** A hormone produced by gonadotropic cell in the anterior pituitary gland that triggers ovulation and the development of the corpus luteum in women.

**Lumpectomy** A common surgical procedure designed to remove a discrete lump, usually a malignant tumour or breast cancer from an affected woman's breast.

**Lysozyme** A component of the innate immune system with potent bacteriolytic activity.

**Macronutrient** An energy-providing nutrient required to be consumed in large amounts by an organism. In humans, the macronutrients required are carbohydrates, lipids and proteins.

**Mammoplasty** See Mammoplasty (p. 377)

**Mammary augmentation (also breast augmentation)** Plastic surgery terms for breast implants and fat graft mammoplasty approaches used to increase the size, change shape, alter texture of the breasts of a woman. See also Mammoplasty (p. 377), Mammary reduction (p. 377), Mammary reconstruction (p. 377)

**Mammary axillary tail** See Axillary mammary tissue (p. 367)

**Mammary buds** Ectodermal thickenings on the ventrolateral body wall of the foetus that are precursors to the development of mature mammary glands. See also Terminal end buds (p. 385)

**Mammary carcinoma** See Breast cancer (p. 368)

**Mammary gland (this term is interchangeable with Breast)** A female secretory and secondary sex organ. The mammary gland remains in a quiescent state until conception triggers a process of complete remodelling that results in the synthesis and secretion of breastmilk. Functional maturity is only reached during lactation. The mammary gland then returns to a quiescent state after involution, caused by gradual weaning of the infant. See also Breast (p. 368)

**Mammary gland fibroadenoma** See Fibroadenoma of the mammary gland (p. 372)

**Mammary gland stroma** Functionally supportive framework of the mammary gland. Consists of skin, connective tissue and adipose tissue.

**Mammary involution (also regression of the mammary gland)** The return of a lactating mammary gland to a less differentiated state at the cessation of lactation. Mammary involution leads to the quiescent non-lactating state.

**Mammary reconstruction (also breast reconstruction)** Plastic surgery of the mammary gland to recreate the breast with respect to appearance, contour and volume. Often performed after mastectomy. Normal function and sensation are not retained. See also Mammoplasty (p. 377), Mammary reduction (p. 377), Mammary augmentation (p. 377)

**Mammary reduction (also breast reduction)** Plastic surgery of the mammary gland to reduce its size and (frequently) to improve its shape and position. See also Mammoplasty (p. 377), Mammary augmentation (p. 377), Mammary reconstruction (p. 377)

**Mammary ridge** See Milk line (p. 379)

**Mammoplasty (also mammaplasty)** Plastic surgery of the mammary gland to alter its size, shape and/or position. There are three general categories: Mammary augmentation, Mammary reduction and Mammary reconstruction. See also Mammary augmentation (p. 377), Mammary reduction (p. 377), Mammary reconstruction (p. 377)

**Mammogenesis** See Alveolar development (p. 366)

**Mammogram** A record of the breast produced by x-rays, ultrasound, nuclear magnetic resonance etc. and used as a diagnostic or screening tool usually for breast cancer.

**Mammothrophs** Pituitary cells that produce prolactin.

**Manual breast pump** A mechanical breast pump that does not require an electrical power source. See also Breast pump (p. 368), Electric breast pump (p. 372), Hospital-grade breast pump (p. 374)

**Mastectomy** The partial or complete surgical removal of one or both breasts.

**Mastitis (also lactational mastitis, puerperal mastitis)** A clinical and pathological term that describes a wide range of inflammatory disorders of the breast – here refers to mastitis associated with lactation. May be non-infective (featuring pain, swelling, heat and redness at the site) or infective (additionally including fever >38 °C, chills and flu-like body aches). N.B. It can be difficult to differentiate between engorgement, blocked milk duct, mastitis and breast abscess because they are a continuum with indistinct boundaries. Each includes some element of milk stasis or impaired drainage. See also Blocked milk duct (p. 367), Breast abscess (p. 368), Pathological engorgement (p. 381)

**Maternal diet** A prescribed course of eating and drinking for pregnant and/or lactating women. Dietary recommendations for lactating women are the same as for any healthy adult woman. The diet should consist of a variety of foods from each food group and should be balanced.

**Maternity Blues** See Postnatal blues (p.382)

**Maternity Bra (also nursing bra)** A specialised, wire-free brassiere that allows comfortable breastfeeding without the need to remove the bra and provides additional support.

**Mature breastmilk** The secretion produced by the lactocytes of the maternal mammary gland following secretory activation. Breastmilk is currently considered to be mature after about 2–3 weeks postpartum, however more research is needed to accurately determine the true time point and define its chemical composition. See also Colostrum (p. 370), Transitional breastmilk (p. 386), Breastmilk (p. 369)

**Meconium** First stools passed by the infant prior to ingestion of substantial quantities of milk after secretory activation. Appears as a sticky mass of mucous, uniformly bile stained and dark green in colour.

**Meredith shield** See Breast shell (p. 368)

**Metabolomics** See Human milk metabolomics (p. 374)

**Microbiome** See Human microbiome (p. 374)

**Micrognathia** A condition characterised by an undersized jaw. Can cause feeding problems due to airway obstruction, difficulty in coordinating sucking, swallowing and breathing and maternal nipple pain. May correct itself during infant growth. See also Retrognathia (p. 384)

**Micronutrients** A nutrient required in small amounts for the proper functioning of an organism including trace elements such as zinc, copper and iron as well as growth factors, oligosaccharides and other minor milk components, which are presently being carefully evaluated in many laboratories. There are significant knowledge gaps in the micronutrient composition of human milk. Micronutrient studies should measure maternal milk production in addition to milk composition in order to accurately assess the intake of micronutrients by the infant.

**Milk** See Breastmilk (p. 369)

**Milk Bank** See Human milk bank (p. 374)

**Milk blister** See Blocked nipple pore (p. 368)

**Milk colour** See Breastmilk colour (p. 369)

**Milk “coming in”** See Secretory activation (p. 384)

**Milk cup** See Breast shell (p. 368)

**Milk duct (also lactiferous duct)** Components of the ductal system that connect the alveoli to the nipple pores

– A milk duct leaving individual alveoli fuses with others to form milk ducts of progressively larger diameter as they progress to the nipple pore. There are no lactiferous storage ducts (lactiferous sinuses) beneath the nipple in women and, in contrast, to farm animals, the larger milk ducts do not empty into milk storage sinuses.

**Milk-blood ratio** Concentration of a given drug or metabolite in human milk in relation to its concentration in maternal plasma or blood.

**Milk ejection (also draught)** The period of time during which milk availability from the nipple is increased as a result of stimulation of the milk ejection reflex. Milk ejection during a breastfeed in women is identified by expansion of the milk ducts, an increase in intra-ductal pressure in the unsuckled mammary gland as well as an acute increase in milk flow during expression of breastmilk. Milk ejection in women lasts for about two minutes. Multiple milk ejections are common during a breastfeed but usually the mother does not sense them. See also Milk ejection reflex (p. 378)

**Milk ejection reflex (also milk let-down)** A neuro-hormonal reflex elicited by infant suckling and the release of oxytocin from the posterior pituitary gland. Oxytocin causes the contraction of the myoepithelial cells surrounding the alveoli in the mammary gland, moving milk into the collecting ducts and expanding these ducts as milk flows towards the nipple. Milk ejection is a reflex that can be conditioned (see conditioned milk ejection reflex). The sensation of milk ejection varies significantly between women, from reports of initial strong pain, to no sensation at all. See also Conditioned milk ejection reflex (p. 370), Strong milk ejection (p. 385), Dysphoric milk ejection reflex (p. 372), Painful milk ejection reflex (p. 381)

**Milk ejection, strong** See Strong milk ejection (p. 385)

**Milk ejection, dysphoric** See Dysphoric milk ejection reflex (p. 372)

**Milk ejection, painful** See Painful milk ejection reflex (p. 381)

**Milk expression** See Breastmilk expression (p. 369)

**Milk fat** The lipid component of the milk of which 98% is triacylglycerol (TAG).

**Milk lipid secretion pathway** A highly conserved pathway in which cytoplasmic lipid droplets are synthesised at the endoplasmic reticulum, pass to the apical membrane, combine into larger droplets and are then secreted into the alveolar lumen as milk fat globules.

**Milk fistula** An abnormal connection that forms between the skin surface and a milk duct in the breast. Usually associated with surgical intervention for either a breast abscess or mass, resulting in milk drainage to the surface of the breast.

**Milk let-down (also let-down)** See Milk ejection reflex (p. 378)

**Milk line (also mammary ridge)** A raised portion of ectoderm on either side of the midline occurring by the time the human embryo has attained a length of 4–6 mm (4<sup>th</sup> week of gestation).

**Milk plasma** See Whey (p. 386)

**Milk production** See 24-h milk production (p. 366)

**Milk profile** See 24-h milk profile (p. 366)

**Milk secretion** The secretory process that results in the synthesis of milk components and their transfer from the lactocyte to the alveolar lumen.

**Milk sharing** The sharing of expressed breastmilk in the community. This is generally a private arrangement between individuals, occurring outside of a clinical setting and supervision.

See also Donor Human Milk Bank (p. 371), Human Milk Bank (p. 374)

**Milk synthesis** Anabolic processes leading to the accumulation of milk components in the lactocyte.

**Mixed breastfeeding** See Partial breastfeeding (p. 381)

**Mondor's disease** A rare condition that involves thrombophlebitis of the superficial veins of the breast and anterior chest wall, often with sudden onset of superficial pain, swelling and redness. Although a lump is usually present the disease is self-limiting and generally benign.

**Montgomery's glands (also glands of Montgomery, areolar glands)** Large sebaceous glands present in the areola surrounding the nipple that produce oily secretions to protect the nipple. Volatile compounds in these secretions may serve as an olfactory stimulus for the newborn.

**Mother-led weaning** Weaning food is offered to the infant on a spoon with a gradual transition from purees to coarser textures, finger foods, and finally family foods. The feeding style has a high level of maternal control. See also Infant-led weaning (p. 374)

**Moro reflex** An infantile reflex normally present in all infants/newborns up to 3 or 4 months of age as a response to a sudden loss of support, when the infant feels as if it is falling. It involves three distinct components: Spreading out the arms (abduction), unspreading of the arms (adduction) and usually crying.

**Motilin** A 22-amino acid peptide hormone occurring in the duodenal mucosa that controls normal gastro-intestinal motor activity by increasing motility and stimulating pepsin secretion.

**Mucosa** The lining between the extracellular and intracellular spaces in internal organs such as the gastrointestinal tract, the bronchial tubes and the breast ducts.

**Multiparous** A woman who has given birth at least twice.

**Multiple breast syndrome** See Polymastia (p. 382)

**Myoepithelial cells** Spindle-shaped contractile cells that surround each alveolus, adjacent to the basal cell membrane of the lactocytes. The myoepithelial cells contract in response to oxytocin, forcing milk into the milk ducts. See also Human milk cells (p. 374)

**Neonatal breast refusal** Feeding behaviour where the infant is unable to attach and breastfeed successfully from birth.

See also Breast refusal (p. 368)

**Neonatal galactorrhoea (also Witch's Milk, neonatal milk)** Colostrum-like secretion formed under the influence of the withdrawal of maternal hormones that can occur in the breasts of both female and male infants.

**Neonatal hypoglycaemia** Low blood glucose during the neonatal period.

**Neonatal intensive care unit (NICU)** An intensive care unit specialising in the care of ill or premature newborn infants

**Neonatal mastitis** Breast inflammation usually associated with neonatal galactorrhoea.

**Neonatal milk** See Neonatal galactorrhoea (p. 379)

**Neuro-hormonal reflex** A reflex that is initiated by stimulation of sensory neurons that cause a release of a neuro-hormone from the neurosecretory cells, e.g., milk ejection reflex.

See Milk ejection reflex (p. 378)

**Nipple** A cylindrical pigmented protuberance on the mammary gland with an average of 9 milk duct openings. The nipple is surrounded by the areola, a circular pigmented area.

**Nipple, artificial** See Artificial teat (p. 367)

**Nipple and areolar eczema** See Nipple and areolar dermatitis (p. 379)

**Nipple and areolar dermatitis** Inflammation of the nipple and/or areola. Presents as an itchy, weeping, burning, painful nipple and/or areola.

**Nipple and breast thrush** See Candidiasis of the nipple and breast (p. 370)

**Nipple erection** Sympathetic mammary stimulation brings about contraction of the smooth muscle of the areola and nipple erection, which causes the nipple to become smaller and firmer.

**Nipple piercing** Cosmetic surgery that has been practiced throughout history and involves perforation of the nipple to enable the application of jewellery. Can result in partial or complete ductal obstruction.

**Nipple pore** A milk duct opening on the nipple that serves as a discrete outlet for breastmilk from a lobe.

**Nipple protector** See Nipple shield (p. 380)

**Nipple psoriasis** A chronic inflammatory skin condition characterised by defined red, scaly plaques on the skin that may itch, burn or bleed.

**Nipple shield (also nipple protector)** A soft silicone device designed to cover the areolar area and the nipple. It has central holes to let the milk pass through. The infant attaches and sucks on the shield and milk flows through the holes.

See also Breast shell (p. 368)

**Nipple tenderness** See Nipple sensitivity (p. 380)

**Nipple sensitivity** Measured by two-point discrimination test. Sensitivity increases markedly at parturition and peaks at day 3.

**Nipple white spot** See Blocked nipple pore (p. 368)

**Nipple vasospasm (also Raynaud's phenomenon of the nipple)** Intermittent ischaemia of the nipple associated with exposure to cold. Features include triphase or biphasic nipple colour change (white, purple, red) and intense nipple + /– breast pain throughout, after and between feeds.

**Non-exclusive breastfeeding** Provision of fluids or foods other than breastmilk (excepting oral rehydration solution and drops or syrups of vitamins, minerals or medicines) to an infant under 6 months of age.

See also Exclusive breastfeeding (p. 372), Partial breastfeeding (p. 381)

**Non-infective mastitis** See Mastitis (p. 377)

**Non-nutritive sucking (NNS)** Infant sucking at the breast without removing any breastmilk. Intermittent swallowing can occur due to the accumulation of saliva.

**Normal bowel output** The range of stool output that might be expected for a healthy, term, exclusively breastfed infant.

Normal bowel output/movement shows wide variation and should not be used as a stand-alone indicator of lactation function.

See also Stools, frequency and appearance (p. 384)

**Normal function** Biological function that does not require medical support or intervention.

**Normal human lactation** A period of sustained milk synthesis that satisfies the following criteria:

Is comfortable for mother and infant; Provides adequate milk for the infant's optimal growth and development; Requires coordinated maternal and infant adaptation that is facilitated by good maternal and infant health.

See also Lactation (p. 375)

**Normal infant crying** Crying is a normal feature of infant development and follows a typical pattern characterised by

an increase in crying until about 6 weeks of age, followed by a gradual decrease until 3–4 months when it remains fairly stable. Crying exhibits a circadian rhythm with episodes clustering in the late afternoon and early evening hours. A normal healthy infant is expected to have some period of contentment.

See also Infantile colic (p. 375)

**Normal urine output (infant)** After secretory activation normal urine output for exclusively breastfed infants is usually expressed as 5 or more heavily wet disposable nappies/diapers (6–8 cloth nappies/diapers) per 24 hours.

**Normal weight loss after birth** Weight loss up to 7% of their birth weight. Birth weight should be regained by 14 days of age.

**Nurse** See Breastfeed (p. 369)

**Nursing bra** See Maternity bra (p. 378)

**Nursing pad** See Breast pad (p. 368)

**Nutritive sucking (NS)** Infant sucking at the breast and removing and swallowing breastmilk.

See also Non-nutritive sucking (p. 380)

**Oestrogen** The primary female sex hormone. It is responsible for the development and regulation of the female reproductive system and secondary sex characteristics.

**Oligosaccharide** Carbohydrate comprised of a small number of monosaccharides. They are the 3<sup>rd</sup> most abundant component in human milk and are comprised of 150–200 different molecules. They support the growth of favourable bacteria (e.g., *Lactobacillus bifidus*) and discourage the growth of intestinal pathogens.

**Oogamous** Reproduction by the union of mobile male (sperm) and immobile female (ova) gametes.

**Osmotic load** Un-absorbable, water-soluble solutes in the large intestine that retain water through osmosis (water movement from low to high concentrations of solute).

**Output – infant** See Infant output (p. 374)

**Oversupply** Maternal failure to down-regulate milk synthesis to match the infant's appetite. Possibly due to ineffective regulation of milk synthesis by autocrine inhibition. It is distinct from engorgement, which occurs in the early postpartum period.

**Ovulation** The development and release of the ovum (egg) from a woman's ovaries.

**Ovum (ova)** The female reproductive cell (gamete) in oogamous organisms.

**Oxytocin** Oxytocin is a peptide containing 9 amino acids, and is a hormone that is produced mainly in the posterior pituitary gland. It is released either by suckling at the nipple, triggering a neuro-hormonal reflex as a result of nipple stimulation or by a conditioned response associated with



the sight, sound or smell of the infant. Oxytocin stimulates milk ejection as well as uterine contractions. Overall, oxytocin is a calming and connecting hormone. It ensures that breastfeeding is a pleasurable experience focusing on the infant.

**Pacifier** See Dummy (p. 371)

**Painful milk ejection reflex** Pain associated with milk ejection. This pain is relieved as soon as milk flow commences.

**Paired breastfeed** Two breastfeeds occurring when the infant removes milk from the second breast within 30 minutes after finishing the first.

See also Breastfeed (p. 369), Cluster breastfeed (p. 370), Breastfeeding session (p. 369)

**Paget's disease of the nipple** A rare type of breast cancer that can manifest as a superficial red scaly lesion on the nipple, resembling dermatitis. More advanced disease may cause tingling, itching, sensitivity and burning pain.

**Paladai** A small, spouted cup used traditionally in India for feeding milk to an infant.  
See also Cup feeding (p. 371)

**Palate** The roof of the mouth separating the oral cavity from the nasal cavity.  
See also Hard palate (p. 373), Soft palate (p. 384)

**Parity** The number of times a female is or has been pregnant and carried the pregnancy to a viable gestational age (including live and stillbirths) a twin pregnancy carried to viable gestational age is counted as 1.

**Pars anterior pituitary gland (also Anterior pituitary gland)** See Pituitary gland (p. 382)

**Partial breastfeeding (also mixed breastfeeding)** Infant receives both breastmilk and any other food or liquid including water, non-human milk and formula before six months of age

**Parous** A woman that has given birth to one or more children.

**Pasteurisation** A process that is intended to destroy or inactivate microbes in food or drink. This process may be used by donor human milk banks and is known to change the bioactivity of donor human milk.

**Parturition** Childbirth. The process of delivering the baby and placenta from the uterus.

**Pathological engorgement** Characterised by bilateral, uniformly swollen, firm, distended, painful, shiny, warm breasts and may be associated with a low-grade fever. It is caused by vascular dilation associated with secretory activation. Oedema occurs secondary to swelling and obstruction of the lymphatic drainage. Onset is most commonly from day 3–5, but can occur up to 14 days post partum. The condition is mostly preventable by frequent, adequate breast drainage.

N.B. It can be difficult to differentiate between pathological engorgement, blocked milk duct, mastitis and breast abscess because they are a continuum without distinct boundaries. Each includes some element of milk stasis or impaired drainage.

See also Physiological engorgement (p. 381), Blocked milk duct (p. 367), Breast abscess (p. 368), Mastitis (p. 377)

**Pathological jaundice** Pathological jaundice is due to an underlying cause such as haemolysis, hypothyroidism, infection and/or starvation. Jaundice is always pathological if it occurs within the first 24 hours of life.

See also Jaundice (p. 375), Physiological jaundice (p. 381), Breastmilk jaundice (p. 369)

**PCR** See Polymerase chain reaction (p. 382)

**Peer support** Support that is provided by mothers who are currently breastfeeding or who have done so in the past and includes individual counselling and mother-to-mother support groups. Women who provide peer support undergo specific training and may work in an informal group or one-to-one through telephone calls or visits in the home, clinic, or hospital. Peer support includes psycho-emotional support, encouragement, education about breastfeeding, and help with solving problems. Peer support does not include medical advice.

**Perceived insufficient milk supply (PIM)** See Low breastfeeding confidence (p. 377)

**Perception of insufficient milk (PIM)** See Low breastfeeding confidence (p. 377)

**Periareolar surgery** An incision immediately below the lower half of the areola.

**Periareola fat** Fat around the areola area.

**Perinatal** The period immediately before and after birth.

**Perineum** The area between the anus and the vulva.

**Preterm Birth** Birth occurring before 37 weeks of gestational age.

**Pharynx** The membrane-lined cavity behind the nose and mouth, connecting them to the oesophagus.

**Physiological engorgement** A sudden sensation of breast fullness usually associated with secretory activation (milk coming in) 50–60 hours after giving birth. This is considered normal.

See also Pathological engorgement (p. 381)

**Physiological jaundice** The normal pattern of raised serum unconjugated bilirubin in the neonatal period, which gradually decreases to adult levels. Bilirubin levels usually peak by the 3<sup>rd</sup> day of life, and slowly return to normal levels by day 10.

See also Jaundice (p. 375), Pathological jaundice (p. 381), Breastmilk jaundice (p. 369), Bilirubin (p. 367).

**Pituitary gland** This pea-sized gland at the base of the brain is a major endocrine organ. It has an anterior lobe, an intermediate and a posterior lobe. Relevant to lactation prolactin is secreted from the anterior pituitary gland and oxytocin from the posterior pituitary gland.

**Placenta** A flattened circular organ in the uterus of pregnant eutherian mammals, nourishing and maintaining the fetus through the umbilical cord.

**Placental retention** See Retained placenta (p. 383)

**Placental lactogen (hPL)** A polypeptide hormone secreted by the syncytiotrophoblast (the epithelial covering of the highly vascular embryonic placental villi) during pregnancy. Its structure and function are similar to human growth hormone. Placental lactogen can replace prolactin in human in pregnancy.

**Plugged milk duct** See Blocked milk duct (p. 367)

**Poland syndrome** A rare form of severe chest wall and breast hypoplasia. The syndrome includes absence of pectoralis major and minor muscles, breast hypoplasia and syndactyly of the ipsilateral hand.

**Polycystic ovarian syndrome (PCOS)** One of the most common endocrine disorders among women of child-bearing age. Characterised by anovulation, excess androgenic (male) hormones, insulin resistance and ovulation related infertility.

**Polymastia (also accessory breasts, supernumerary breasts, multiple breast syndrome)** Breast tissue found anywhere along the milk line from the base of the axilla (most common) to the vulva region (second most common). The mass of tissue may be with or without an accessory nipple and is separate from the breasts.

**Polymerase chain reaction (PCR)** A biochemical technique used to amplify a single or a few copies of a piece of DNA, generating thousands to millions of copies of a particular DNA sequence. Can be used to analyse extremely small quantities of sample.

**Polythelia (also accessory nipples, supernumerary nipples)** The presence of nipples in addition to those normally existing on the breast. Usually occur along the embryonic milk line.

**Positioning and latch** A subjective assessment of the positioning of the infant at the breast and its attachment to the nipple and areolar area during a breastfeed. Effective positioning and latch to the nipple and areola allows adequate milk transfer during the breastfeeding period, without causing either maternal or infant pain. This requires coordinated maternal and infant adaptation, which is instinctive for the infant and largely learned by the mother. There are few objective assessments for effective and comfortable positioning and latch of the infant to the maternal nipple and areolar area during breastfeeding.

**Positioning** See Positioning and latch (p. 382), Breast-feeding positions (p. 369)

**Posset** See Infant regurgitation (p. 375)

**Posterior pituitary gland** See Pituitary gland (p. 382)

**Post-feed breastmilk (also hind milk)** Milk removed from the mammary gland at the completion of a breast-feed or breast expression.

**Postnatal/Postpartum** Occurring after child birth.

**Postnatal blues (also postpartum blues, maternity blues, baby blues)** Abrupt changes in mood and emotion, which usually peak between days 3 and 6 postpartum. Symptoms are self-resolving.

**Postnatal depression (PND) (also Postpartum depression)** A more severe depression or prolonged symptoms of depression (clinical depression) that lasts more than a week or two and interferes with normal routines including caring for an infant. PND is different from baby blues that are common during the first week after childbirth.

**Postnatal psychosis** A mental disorder that causes gross distortion or disorganisation of a mother's mental capacity in the postnatal period.

**Postpartum/Postnatal** Occurring after child birth.

**Postpartum haemorrhage (PPH)** A condition generally described as blood loss of > 500 mL after delivery (> 1000 mL if severe). It is classified as primary if occurring within 12 hours of delivery or secondary if between 24 hours and 6 weeks postpartum.

**Postpartum thyroiditis (also postpartum thyroid dysfunction (PPTD))** Thyroid dysfunction occurring after pregnancy. May involve hyperthyroidism, hypothyroidism or both sequentially. Hypothyroidism persists in 20% of cases.

**Postpartum thyroid dysfunction (PPTD)** See Postpartum thyroiditis (p. 382)

**Potential storage capacity** The amount of milk available when the breast is full, calculated from the cream content of milk samples collected before and after each feed or expression from each breast, and the volume of milk consumed during each feed, or expressed from each breast for a 24-hour period of breastfeeding and expressing. Includes both milk consumed during breastfeeding and milk expressed.  
See also Degree of fullness of the mammary gland (p. 371), Breast storage capacity (p. 369)

**Prebiotic** Substances that induce the growth or activity of microorganisms and contribute to the well-being of their host.

**Pre-colostrum** A mammary secretion that is produced from as early as 20 weeks gestation in some women and continues up to parturition. It is usually viscous and can range from a light straw to thick yellowish secretion. The composition of pre-colostrum is similar to colostrum. See also Colostrum (p.370)

**Predominant breastfeeding (also full breastfeeding, fully breastfeeding)** Defined by the World Health Organization as the infant receiving breastmilk (including milk expressed by the mother or from a wet nurse) as the predominant source of nourishment.

Allows the infant to receive liquids (water and water-based drinks, fruit juice, oral rehydration solution), ritual fluids and drops or syrups (vitamins, minerals, medicines). Does not allow the infant to receive anything else (in particular non-human milk, food-based fluids). See also Exclusive breastfeeding (p.372), Complementary feeding (p.370), Supplementary feeding (p.385), Substitute feeding (p.385)

**Pre-feed breastmilk (also fore milk)** Milk removed from the mammary gland just before the commencement of a breastfeed or breast expression.

**Primary lactation failure** Occurs rarely and may involve complete absence of secretory activation (e.g., Sheehan's syndrome). Those mothers that experience secretory activation still experience profound low supply. See also Lactation failure (p.378), Secondary lactation failure (p.384)

**Primary lactose intolerance** The normal gradual reduction seen in lactase production during the progression to adulthood for about 70% of the world's population. Its presence depends on ethnicity, and is rare in populations with predominance of dairy foods in the diet (e.g., Northern Europeans). Reduced lactase production usually occurs from 2 years onwards and breastfed children should continue to receive breastmilk in all cases.

See also Congenital lactose intolerance (p.370), Developmental lactose intolerance (p.371), Lactose intolerance (p.376), Secondary lactose intolerance (p.384)

**Primiparous** A woman who has given birth to only one child.

**Primordium** An aggregation of cells in the embryo indicating the first trace of an organ or structure.

**Probiotic** Beneficial bacteria that colonise the human body.

**Progesterone (P4)** A major member of the group of hormones called progestogens, progesterone plays a crucial role in regulating the monthly menstrual cycle, preparing the body for conception, maintaining pregnancy and triggering secretory activation.

**Prolactin (hPRL)** A protein hormone from the anterior pituitary gland that is required for breast growth and the synthesis of milk in women.

**Prone** Lying flat, with the front (ventral) facing surface downward.

See also Supine (p.385)

**Psoriasis of the nipple** See Nipple psoriasis (p.380)

**Puerperium/puerperal** The period between childbirth and the return of the mother's uterus to its normal non-pregnant size (about 6 weeks).

**Pump shield** See Breast shield (p.368)

**Pylorus** The opening from the stomach into the duodenum.

**Raw milk** See Fresh milk (p.373)

**Raynaud's phenomenon of the nipple** See Nipple vasospasm (p.380)

**Recommendation for the duration of lactation** The World Health Organisation recommends exclusive breastfeeding for the first 6 months of life then addition of nutritionally adequate and safe complementary foods while breastfeeding continues for up to 2 years of age or beyond. See also Lactation duration (p.375)

**Reduction mammoplasty** See Mammary reduction (p.377)

**Reflux** See Infant regurgitation (p.375)

**Reference range (reference values)** The prediction interval between which 95% of the values of a reference group fall into, in such a way that 2.5% of the time a sample will be less than the lower limit of this interval, and 2.5% of the time it will be larger than the upper limit of this interval, whatever the distribution of these values. A standard reference range generally denotes the range for healthy individuals.

**Regression of the mammary gland** See Mammary involution (p.377)

**Relactation** Re-establishment of lactation beyond the immediate postpartum period. See also Induced lactation (p.374)

**Relative Infant Dose** A method of estimating the risk to the infant of maternal medication use. Calculated by dividing the infant's dose via breastmilk (mg/kg/day) by the maternal dose (mg/kg/day).

**Resting breast** A non-lactating, non-pregnant breast post lactation. See also Mammary involution (p.378)

**Retained placenta** Placenta not expelled within 30 minutes of the infant's birth. Partial separation of the placenta leads to continued bleeding and either full or partial suppression of secretory activation.

**Retrognathia** A condition where either one or both jaws recede with respect to the frontal plane of the forehead. Refers to position of jaw, rather than size. See also Micrognathia (p. 378)

**Retro-mammary fat pad** The fat pad positioned between the mammary gland and the pectoralis major muscle on the chest.

**Rooming in** A hospital arrangement whereby a newborn infant is kept in the mother's hospital room instead of a nursery.

**Rooting reflex** Reflex that assists with breastfeeding, whereby the infant turns its head towards anything that strokes its cheek or mouth, searching for the object by moving in a decreasing arc until it is found. Present at birth and generally disappears about four months of age. See also Sucking reflex (p. 385)

**Secondary lactation failure** The most common cause of inadequate milk supply. It is generally due to ineffective or infrequent milk removal resulting in down-regulation of maternal milk synthesis. See also Delayed secretory activation (p. 371), Lactation failure (p. 375), Primary lactation failure (p. 383)

**Secondary lactose intolerance** A condition secondary to any form of gastrointestinal mucosal injury. Breastfed infants should continue to receive breastmilk in all cases. See also Congenital lactose intolerance (p. 370), Developmental lactose intolerance (p. 371), Lactose intolerance (p. 376), Primary lactose intolerance (p. 383)

**Secretory activation (previously lactogenesis II) (also milk coming-in)** The process by which milk synthesis increases after parturition. It is triggered by a fall in serum progesterone during the first two days postpartum. It may be sensed by the mother as an increase in fullness of the breast near the end of the process. Secretory activation is facilitated by breastfeeding as soon as possible after birth.

**Secretory differentiation (previously lactogenesis I)** Secretory differentiation (previously known as lactogenesis I) is the process of differentiation of the mammary epithelial cells to form lactocytes capable of synthesising components unique to breastmilk (lactose, casein,  $\alpha$ -lactalbumin, lactoferrin, etc.). In most mammals it occurs in the second half of gestation.

**Secretory immunoglobulin A (sIgA)** Secretory IgA are found in breastmilk and are specific for microbes present in the environment of the mother. The transfer of sIgA through breastmilk to the upper respiratory and gut mucosa of the infant provides mucosal immunity in the infant period when its own immune system is immature. Trans-placental transfer of IgG covers systemic immunity during this period.

**Sequential pumping (also single pumping)** Mother expresses milk from one breast at a time.

**Sexuality and lactation difficulty** An association of the breast with beauty and sexuality throughout literature and

art cannot be denied and in this sense the aesthetic appreciation of the breast can sometimes negatively influence the mothers desire to breastfeed.

**Sheehan's syndrome** Sheehan's syndrome describes postpartum ischaemia and necrosis of the anterior pituitary gland resulting in a deficiency of prolactin. The effect on lactation is unpredictable, although most women can be expected to have a profoundly low milk supply.

**Shield** See Breast shield (p. 368)

**Short, frequent breastfeeds** Breastfeeds of less than 8 minutes in duration with breastfeeding sessions occurring 11 times or more in 24 hours. N.B. In traditional societies, short frequent feeds are the norm.

**Simultaneous pumping (also double pumping)** Mother expresses milk from both breasts at the same time. Removes both a greater volume of milk and a higher percentage of available milk than sequential pumping.

**Single pumping** See Sequential pumping (p. 384)

**Skim breastmilk** The milk fraction remaining after removal of the fat layer by centrifugation of breastmilk.

**Skin-to-skin care (also STS, SSC)** The practice of holding an infant in contact with an adult caregiver, usually its mother, with the ventral surface of both individuals touching. Typically, the skin is uncovered, allowing direct contact. See also Kangaroo mother care (p. 375)

**Sleep patterns** Normal breastfeeding sleep patterns show that most infants feed between 1 and 3 times at night until 6 months of age and consume 20% of their daily intake during this time. Thus, it is normal for breastfed infants to wake at night under the influence of the 90-minute sleep cycle.

**Slow weight gain (also failure to thrive, weight faltering)** A pattern of weight measurements that descend to cross 2 or more major centiles or that is below the 5<sup>th</sup> percentile on the WHO infant growth charts. Slow weight gain includes infants ranging from those with a normal variant of growth to those with serious problems.

**Soft palate** The posterior soft, flexible subsection of the palate (roof of the mouth). See also Hard palate (p. 373), Palate (p. 381)

**Sonography** See Ultrasonography (p. 386)

**Soother** See Dummy (p. 371)

**Stages of mammary development** Include ductile development at puberty, alveolar development and proliferation in early pregnancy, secretory differentiation after mid pregnancy, secretory activation after parturition, established lactation, weaning.

**Stools, frequency and appearance** Normal bowel output shows wide variation. Prior to secretory activation the infant passes meconium. The stools transition from meco-

nium to loose, yellow curds by day 5 after birth. Only 1.1% of exclusively breastfed infants have discrete, formed stools.

**Stool frequency** The number of stools, greater than 2.5 cm in diameter, passed over a period of 24 hours.

**Storage capacity of the mammary gland** See Breast-feeding storage capacity (p. 369), potential storage capacity (p. 382)

**Strong sucking vacuum** Minimum average peak sucking vacuums of less than –200 mmHg. Can result in maternal nipple pain.

See also Intraoral vacuum (p. 375)

**Strong milk ejection (also forceful milk ejection)**

Forceful milk ejection associated with adverse infant feeding behaviours, e.g., gagging, coughing, clamping down on the nipple, refusing to breastfeed etc.

**Subcutaneous fat** Fat beneath the skin separating the glandular tissue from the dermis.

**Sublingual frenulum** See Frenulum (p. 373)

**Substitute feeding** Where breastfeeding is contraindicated and must be substituted with infant formula.

See also Exclusive breastfeeding (p. 372), Predominant breastfeeding (p. 383), Complementary feeding (p. 370), Supplementary feeding (p. 385), Infant formula (p. 374) and Weaning (p. 386)

**Suck cycle** Describes milk removal from the breast into the infant's oral cavity followed by removal of milk from the oral cavity into the pharynx.

**Suck-swallow-breathe reflex (SSwB)** The reflex that coordinates sucking, swallowing and breathing during breastfeeding. Infants are able to suck and swallow, suck and breathe, but are unable to breathe and swallow simultaneously.

**Sucking, Nutritive** See Nutritive sucking (p. 380)

**Sucking, Non-nutritive** See Non-nutritive sucking (p. 380)

**Sucking reflex** The instinctive sucking on anything that touches the hard palate of the infant. It is linked to the rooting reflex.

**Supernumerary nipple** See Polythelia (p. 382)

**Supernumerary breast** See Polymastia (p. 382)

**Supine** Lying with the back (dorsal) surface downward. See also Prone (p. 383)

**Supplementary feeding** Nutrient-containing fluid feed (including expressed breastmilk, donor human milk or infant formula) given in addition to breastfeeds.

See also Exclusive breastfeeding (p. 372), Predominant breastfeeding (p. 383), Complementary feeding (p. 370), Substitute feeding (p. 385), Weaning (p. 386)

**Supplemental nursing system (SNS)** See At-breast supplementer (p. 367)

**Supply line** See At-breast supplementer (p. 367)

**Swaddling** An age-old practice of wrapping infants in blankets or similar cloth so that movement of the limbs is tightly restricted.

**TAG** See Triacylglycerols (p. 386)

**Tandem breastfeeding** Breastfeeding a child through pregnancy and then, after birth, breastfeeding both the new infant and the older child.

**Tail of Spence** See Axillary mammary tissue (p. 367)

**Teat** See Artificial teat (p. 367)

**Teething ring** A ring for the infant to bite onto.

**Terminal end buds** Sacculations, containing mammary epithelial and stem cells, found at the growing terminus of mammary ducts prior to functional maturation and after involution of the mammary gland.

See also Mammary buds (p. 377)

**Test-weigh** See Breastmilk transfer measurement (p. 369)

**Theca lutein cyst** A rare type of functional ovarian cyst associated with testosterone levels 10–150 times higher than normal. If unresolved at birth, delayed secretory activation occurs until testosterone levels decrease to normal (over 5–31 days). Full milk synthesis is possible if well managed.

**Therapeutic ultrasound** Application of ultrasound to bring heat or agitation into the body. It requires much higher energies and generally a different range of sound wave frequencies than is used for diagnostic ultrasound. See also Diagnostic ultrasound (p. 371)

**Third day blues** See Postnatal blues (p. 382)

**Thrush** See Candidiasis of the nipple and breast (p. 370)

**Thyroid-stimulating hormone (TSH)** A pituitary hormone that stimulates the thyroid gland to produce thyroxine and then triiodothyronine that stimulates the metabolism of almost every tissue in the body. Measurement of serum TSH is the most common method of evaluating thyroid function.

**Tight junctions** The junctions that join the apical borders of adjacent secretory cells in the lactating mammary gland. They are responsible for the lack of exchange of milk and serum components between the interstitial space and the milk space.

**Tongue protrusion reflex (also tongue thrust reflex, tongue extrusion reflex)** A normal response in infants to force the tongue outward when it is touched or depressed. The reflex begins to disappear by about 3–4 months of age.



**Tongue thrust reflex** See Tongue protrusion reflex (p. 385)

**Tongue extrusion reflex** See Tongue protrusion reflex (p. 385)

**Tongue-tie** See Ankyloglossia (p. 367)

**Torticollis (also Wry neck)** Shortening of the sternocleidomastoid muscle, resulting in an ipsilateral head tilt and contralateral rotation of the face and chin.

**Transitional breastmilk** A description of breastmilk as it transitions from colostrum to mature breastmilk after secretory activation. It is yet to be defined objectively, but is generally considered to extend from about 40 hours after birth to 2 to 3 weeks postpartum.  
See also Colostrum (p. 370), Mature breastmilk (p. 378), Breastmilk (p. 369)

**Triacylglycerides** See Triacylglycerols (p. 386)

**Triacylglycerols (TAG) (also triacylglycerides, triglycerides)** Consist of three long chain fatty acids coupled to glycerol by ester linkages.

**Triglycerides** See Triacylglycerols (p. 386)

**Twenty-four-hour milk production** See 24h milk production (p. 366)

**Twenty-four-hour milk profile** See 24h milk profile (p. 366)

**Type 1 diabetes mellitus** A chronic condition in which the pancreas produces little or no insulin (the hormone needed to allow glucose to enter cells to produce energy and synthesise fat and lactose).  
See also Diabetes (p. 371), Gestational diabetes mellitus (p. 373), Type 2 diabetes mellitus (p. 386)

**Type 2 diabetes mellitus** A chronic metabolic disorder that is characterised by high blood glucose, insulin resistance and relative lack of insulin.  
See Diabetes (p. 371), Gestational diabetes mellitus (p. 373), Type 1 diabetes mellitus (p. 386)

**Ultrasonography (sonography)** Ultrasound-based imaging technique, which may be either therapeutic or diagnostic.  
See also Diagnostic ultrasound (p. 371), Therapeutic ultrasound (p. 385)

**Ultrasound, diagnostic** See Diagnostic ultrasound (p. 371)

**Ultrasound, therapeutic** See Therapeutic ultrasound (p. 385)

**Urine output (infant)** See Normal urine output (infant) (p. 380)

**Uterine pains** See After pains (p. 366)

**Vasospasm** See Nipple vasospasm (p. 380)

**Vegan** A diet that does not contain any animal products. Lactating women following a vegan diet should ensure that they have adequate intakes of Vitamin D,  $\omega$ -3 fatty acids, Vitamin B12 and high-quality protein.

**Vegetarianism** Abstaining from the consumption of meat and may include abstention from by-products of animal slaughter. A vegetarian diet that contains some animal-derived food, such as milk, milk derivatives, or eggs, is usually complete for lactating mothers.

**White nipple spot** See Blocked nipple pore (p. 368)

**Weaned** The complete cessation of breastfeeding.

**Weaning** The process of gradually reducing breastfeeding. It begins at the time (about 6 months of age) when foods other than breastmilk are introduced to the infant and ends when breastfeeding has completely ceased.  
See also Infant-led weaning (p. 374), Mother-led weaning (p. 379), Acute weaning (p. 366)

**Weight faltering** See Slow weight gain (p. 384)

**Weight gain, slow** See Slow weight gain (p. 384)

**Weight loss after birth** See Normal weight loss after birth (p. 380)

**Wet nurse** A woman who breastfeeds the infant of another mother, without identifying as that infant's mother.

**Whey (also milk plasma)** Proteins that remain in solution after the precipitation of casein micelles with either chymosin or acid to form a curd. Whey is an extremely complex protein fraction made up of a large number (hundreds in low abundance) of proteins.

**Witch's milk** See Neonatal Galactorrhoea (p. 379)

**Wry neck** See Torticollis (p. 386)