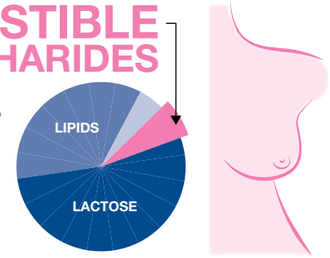
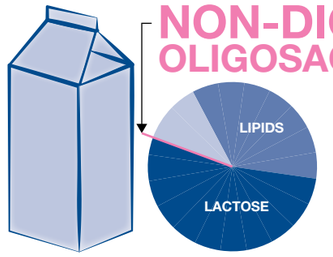
Early infant nutrition the role of prebiotics

Medicine

HUMAN MILK is regarded as the **OPTIMAL DIET FOR INFANTS**[1]

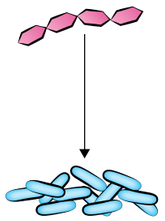
NON-DIGESTIBLE OLIGOSACCHARIDES ARE THE THIRD MOST ABUNDANT COMPONENT OF HUMAN MILK after lactose and lipids[2]





NON-DIGESTIBLE OLIGOSACCHARIDES ARE ALMOST ABSENT IN COW MILK which is generally the basis for infant formulas[2,3]

HUMAN MILK OLIGOSACCHARIDES were originally discovered as a **PREBIOTIC "BIFIDUS FACTOR"**[3]



MILK VS FORMULA[2-5]

Human milk feeding is widely regarded as first choice for infant nutrition. It is a complex substance, and its components fulfil many nutritive, developmental and immunoprotective functions in infant nutrition and within the infant GI tract.

However, breastfeeding may not always be possible, and so infant formulas have been developed to provide nutritional and functional properties as close as possible to human milk.

As key bioactive components of human milk oligosaccharides (HMOs) structurally diverse and highly variable. They have been found to:

- resist digestion by enzymes and reach the colon intact
- promote the intestinal colonisation of beneficial microbes
- stimulate the maturation of the infant gut for extrauterine life
- compensate for developmental immaturity of the gut
- protect against intestinal colonisation by pathogenic bacteria.

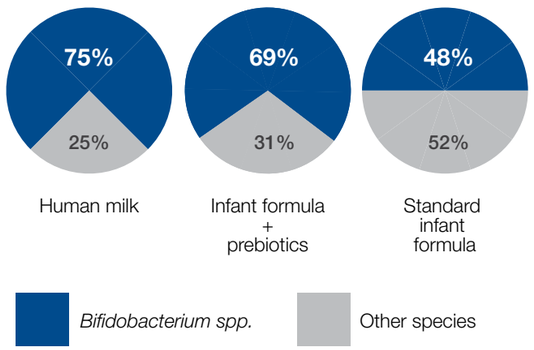
Much of these benefits stem from the ability of HMOs to stimulate the growth of beneficial bacteria, in particular *Bifidobacterium spp.*, and the subsequent production of SCFAs by these bacteria.

The gut ecophysiology in early life may have consequences for the metabolic, immunologic and neurologic development of infants which can carry on into later life.

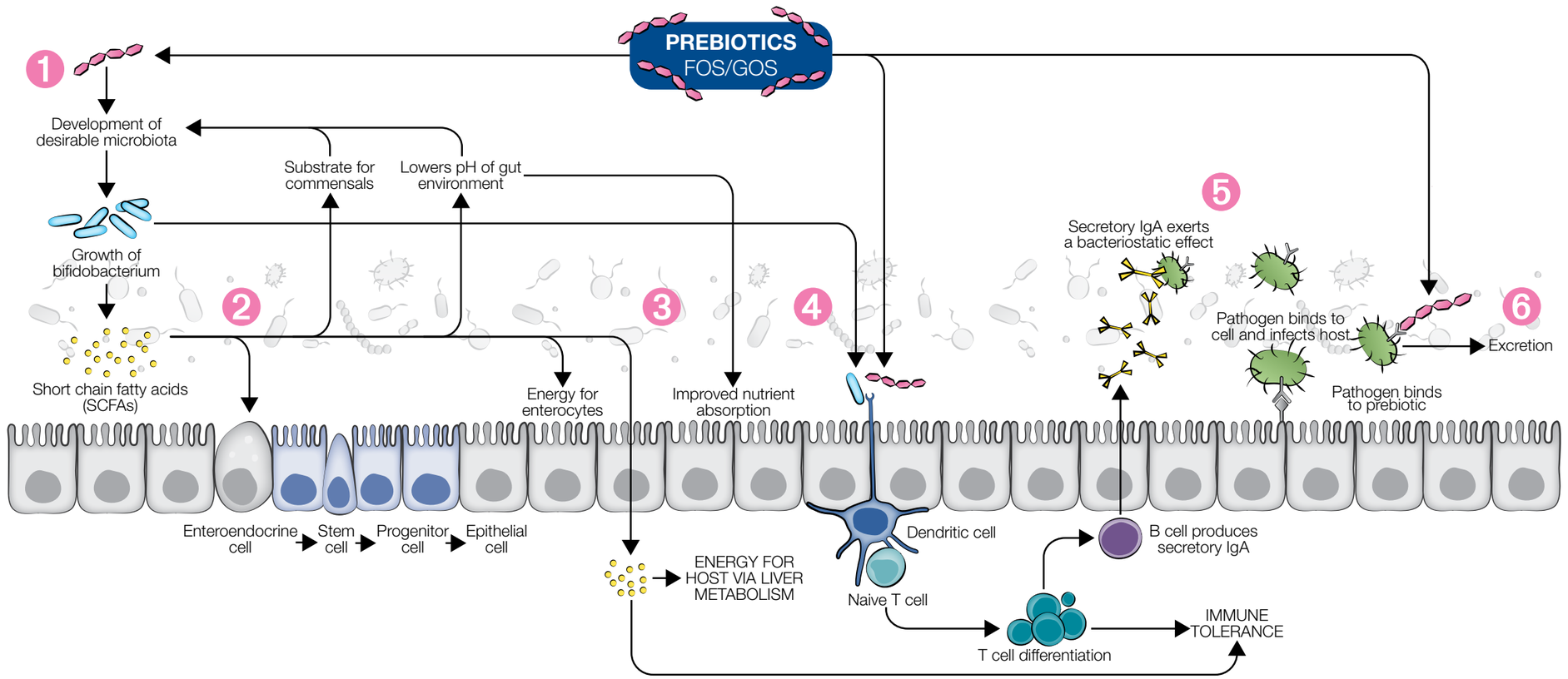
Although it is impossible to replicate the complexities of HMOs, prebiotics such as FOS and GOS have demonstrated capacity to behave in a similar way.

Numerous studies have shown that prebiotic supplementation can be used to alter the gut microbiota of formula-fed infants to more closely resemble that of a breastfed infants and thereby confer similar benefits.

COLONISATION OF BIFIDOBACTERIUM: COMPARISON BY INFANT FEEDING PRACTICE[3]



POTENTIAL EFFECTS OF PREBIOTICS IN INFANTS[1-7]



1 DEVELOPMENT OF GUT MICROBIOTA

Prebiotics promote the growth of *Bifidobacterium spp.* and/or reduce colonisation by potentially harmful bacterial species such as *Escherichia coli* and *Clostridium difficile.*

Bifidobacterium spp. produce SCFAs which:
- act as a substrate for commensal bacteria
- lower the pH of the gut environment, thereby inhibiting the overgrowth of pH-sensitive pathogenic bacteria such as *Enterobacteriaceae spp.* and *Clostridia spp.*

2 MATURATION OF INFANT GUT

SCFAs stimulate enteroendocrine cells to drive intestinal epithelial cell proliferation and differentiation. SCFAs also provide energy for enterocytes thereby improving gut barrier function.

3 METABOLIC EFFECTS

Bacterial fermentation of prebiotics produces SCFAs which can be absorbed and metabolised within the liver to contribute energy to the host.

Lower pH of gut environment increases solubility of some minerals and potentially increases their absorption, e.g. calcium, magnesium, potassium, phosphorus.

4 MATURATION OF THE IMMUNE SYSTEM

Proper immune development and function relies on colonisation of the infant gut with commensal bacteria. Commensal bacteria and prebiotics interact with immune cells and may act as drivers for immune maturation and/or tolerance induction.

SCFAs have been shown to be anti-inflammatory and modulate the immune system.

5 RESISTANCE TO PATHOGENS

Prebiotics encourage the development of a desirable microbiota which can inhibit the growth of pathogenic microrganisms via:
- competitive inhibition
- production of mucins and secretory IgA that can inhibit pathogen adhesion and colonisation
- production of antimicrobial substances, e.g. bacteriocins, catheliciden

Prebiotics also block pathogen binding by acting in a 'decoy' manner. Prebiotics resemble cellular binding sites for pathogens. Pathogens bind irreversibly to prebiotics and are excreted from the body. This effect has been displayed against *E. coli*, *Salmonella* and *Vibrio cholera* toxin, and has been shown to reduce the risk of diarrhoea and the incidence of respiratory diseases.

6 LAXATION

Prebiotics improve stool consistency and frequency.