



DEVELOPMENT OF THE MUCOSAL IMMUNE SYSTEM OF THE NEWBORN INFANT*

Proper development in the first 3 years of an infant's life is crucial to promote the **maturation of the immune system** and support protection against infections or allergy



HUMAN MILK

Human milk is considered the optimal nutrition for all infants and provides the best level of protection

The WHO recommends exclusive breastfeeding for at least 6 months of life however, according to recent European studies, only 25% of the newborns are exclusively breastfed for the first 6 months of life.

Reduced allergy development¹

Reduced diabetes²

Reduced obesity³

Reduced GIT disorders⁴

Reduced infections⁵



Human milk contains many (bioactive) components such as Human Milk Oligosaccharides (HMOs), which are highly abundant in human milk



The HMO structures present in human milk are diverse with multiple functions



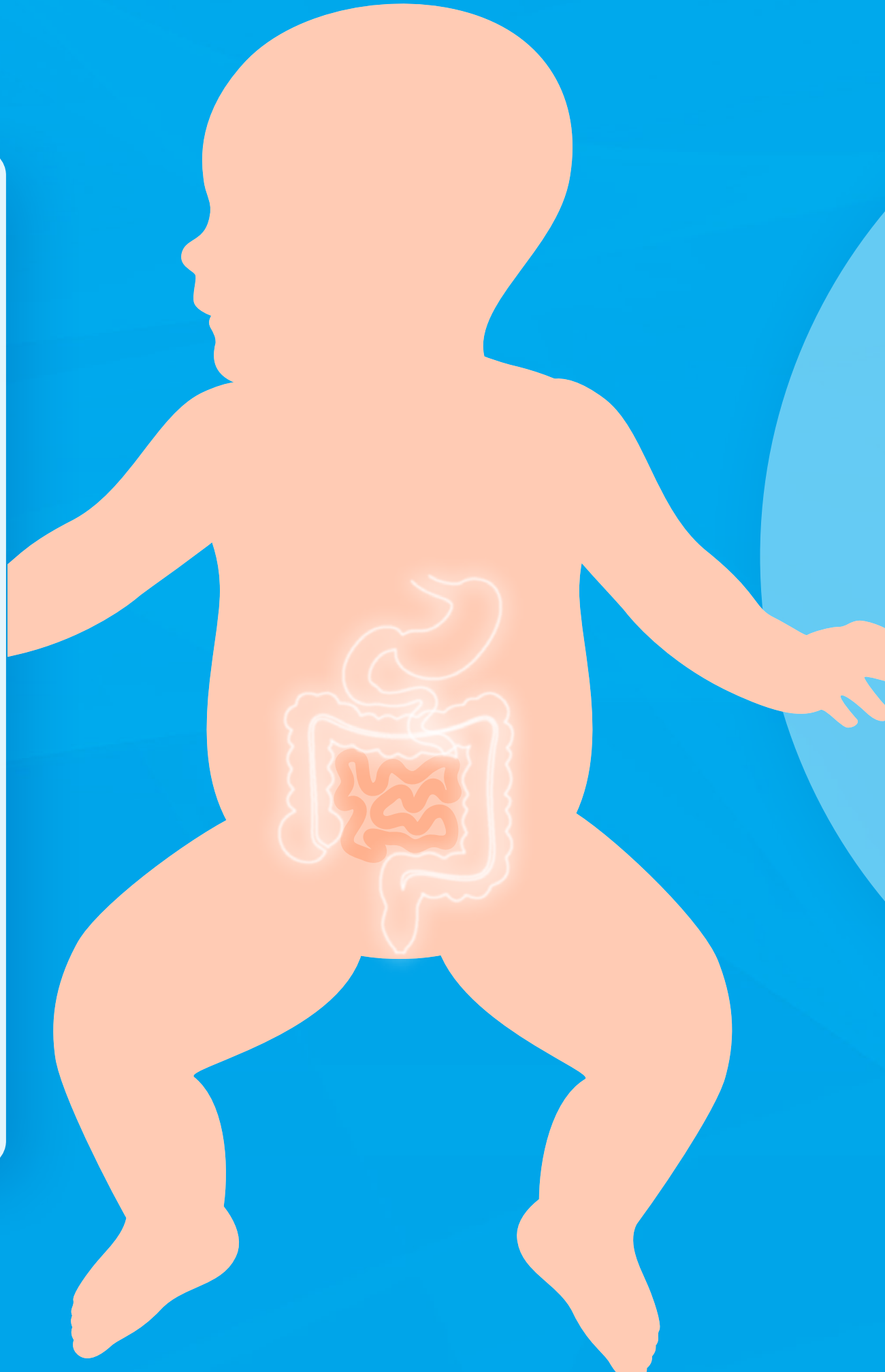
Specific HMO structures can interact with Intestinal epithelial cells and immune cells modulating mucosal immune development early in life



Continued research into the (bioactive) components in human milk is important to better understand the underlying mechanisms in the maturation of the immune system and development of an infant.

STUDY AIMS

Within the PhD Thesis of Veronica Ayechu-Muruzabal⁶ specific effects of human milk oligosaccharides (HMOs), non-digestible oligosaccharides (NDOs) and postbiotics in the intestinal epithelial cells (IEC) and innate and adaptive immune cells were studied, in order to understand how **bioactive components can promote the maturation and development of the mucosal immune system.**



STUDY FINDINGS

Non-digestible oligosaccharides (incl 2'FL) are important for shaping mucosal and systemic immunity

IMMUNE ASPECTS STUDIED:

- Intestinal epithelial cells
- Innate and adaptive immune cells
- Extracellular vesicles
- Galectins
- Dendritic cells
- Non digestible oligosaccharides, postbiotics, Gos/Fos, 2'FL, 3'GL

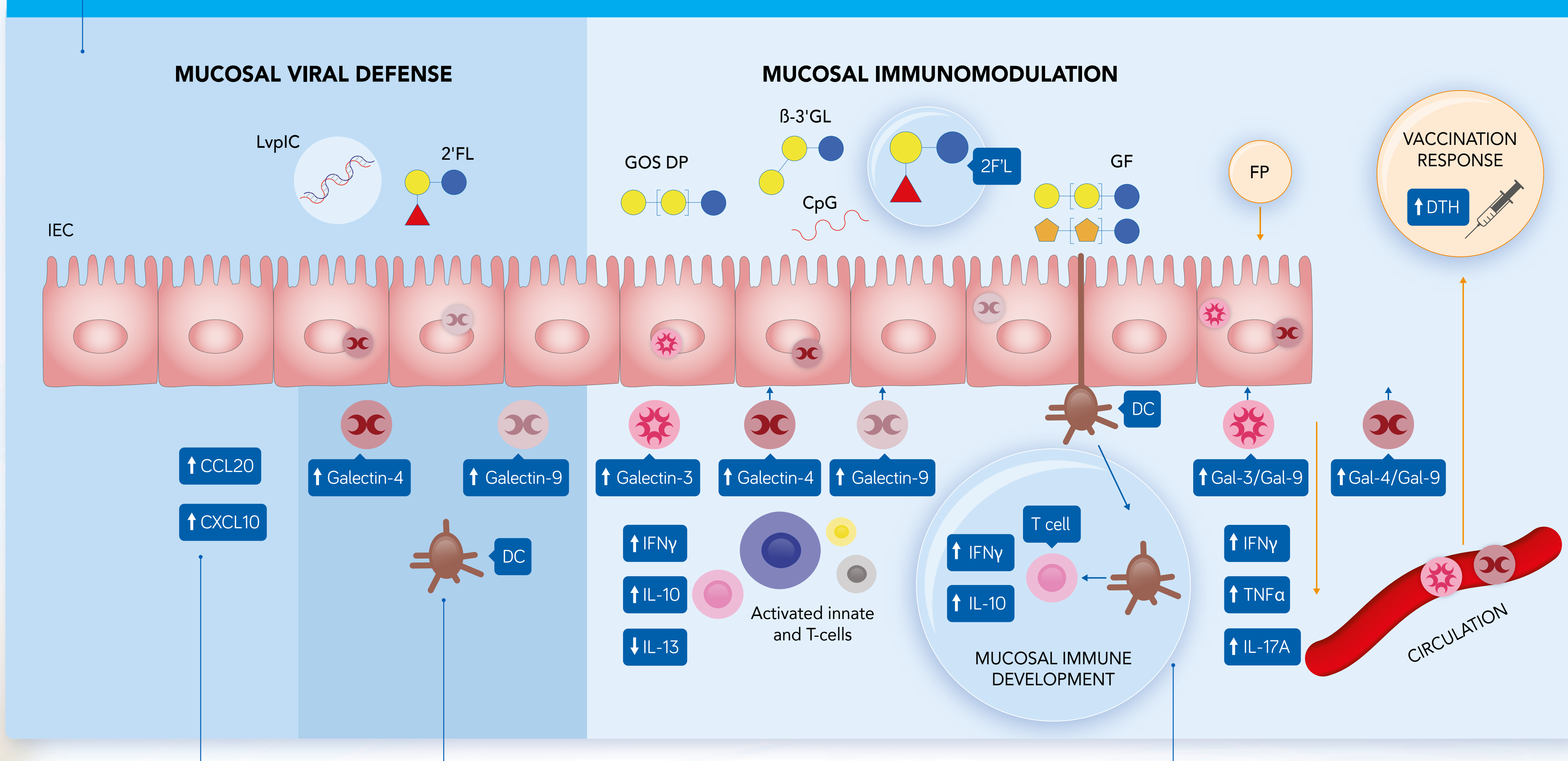


Intestinal Epithelial cells (IECs) are important cells involved in the regulation of immune responses upon a viral trigger and during inflammation



Exposure of IECs to 2'FL enhances galectin release within an inflammatory condition and instruct dendritic cells to drive Th1 and regulatory-type immune development⁷

AN OVERVIEW OF THE EFFECTS PROMOTED BY NDOs AND POSTBIOTICS



Exposure of IECs to a viral trigger and 2'FL promote the secretion of chemokines (CCL20 and CXCL10) capable of attracting important immune cells⁵

In addition, 2'FL was shown to condition Dendritic Cells to instruct Th1 and regulatory-type immune responses indicating the ability of 2'FL to support mucosal immune development

The mucosal immune modulation seen by specific oligosaccharides was associated with increased secretion of specific galectins

Within inflammatory conditions, the epithelial cells secrete specific vesicles containing Galectin 4 and 9 upon exposure to NDOs, which can signal to distant organs⁸

Within the unique diversity of human milk oligosaccharides, specific structures show immune modulatory capacity. Small structures (incl 2'FL) support Th1 and regulatory-type immune modulation by increasing IFN-gamma and IL-10 while reducing Th2-type IL-13^{6,7}

CONCLUSIONS

Based on the PhD Thesis entitled: **Shaping mucosal and systemic immunity by non-digestible oligosaccharides and postbiotics: GROWING ROOTS WITH FOOD**. New insights are generated regarding the development of mucosal immunity early in life

- ✓ IECs provide not only a physical barrier, but also support the mucosal immune system, regulating innate and adaptive immune responses.
- ✓ Small oligosaccharides including 2'FL support Th1 and regulatory-type immune modulation.
- ✓ Within inflammatory conditions, the epithelial cells secrete specific vesicles containing Galectin 4 and 9 upon exposure to NDOs, known to be able to signal to distant organs/cells.
- ✓ Non-digestible oligosaccharides (incl 2'FL) are important for shaping mucosal and systemic immunity.
- ✓ In addition, human milk components such as non digestible oligosaccharides, postbiotics, GOS/FOS and 3'GL also have an important role to play in shaping the mucosal and systemic immunity.



References

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