

# Discovering the Role of Human Milk Oligosaccharides in Neurocognitive Development

Breastmilk provides nutrients and bioactive components that are crucial for early life. Its bioactive components support the immune system, gut health, and brain development<sup>1,2</sup>



Brain development is a rapid and dynamic process in the early years of life, forming the foundation for future cognitive abilities. Breastmilk and its bioactive components, such as human milk oligosaccharides (HMOs), support this critical stage of brain maturation.<sup>3</sup>

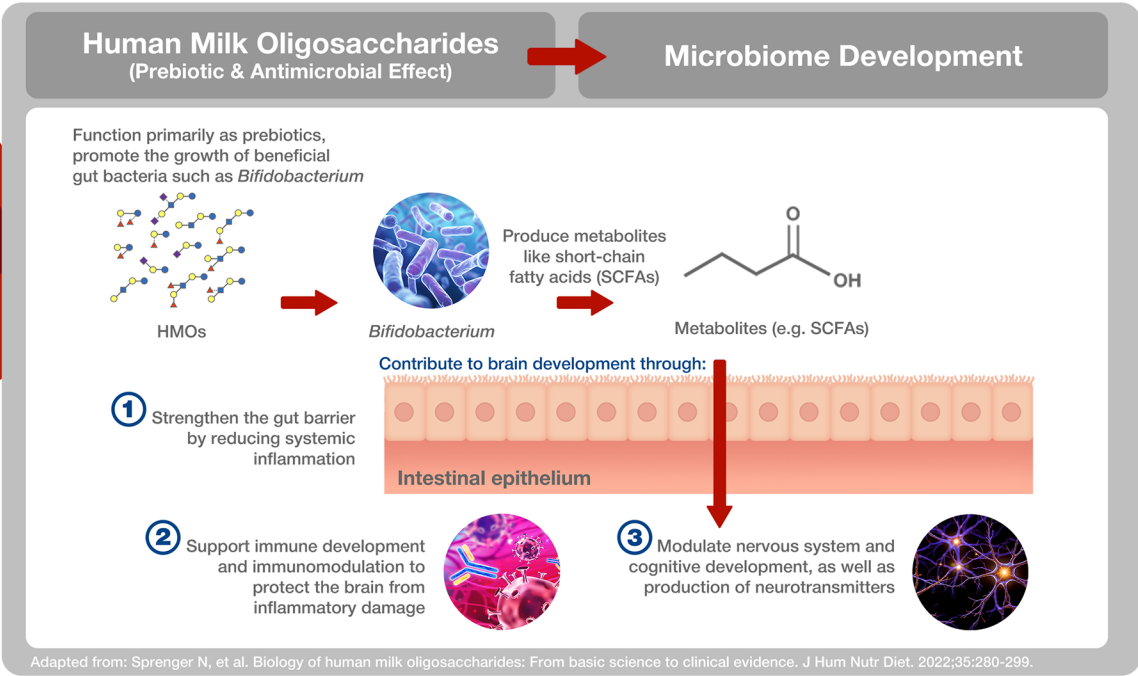
HMOs are the third most abundant solid component in human milk and a major source of sialic acid in the brain. HMOs influence infant cognitive development through the gut\*.<sup>1,2</sup>



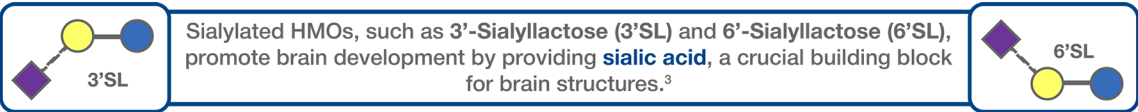
## HMOs Support Neurocognitive Development via Two Modes of Action

Emerging evidence highlights the role of HMOs in supporting neurocognitive development through 1) the interplay between the gut and immune systems and 2) the delivery of sialic acid via sialylated HMOs.

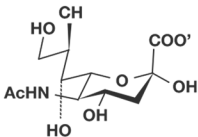
### ① Interactions Between the Gut and Immune Systems



### ② Sialylated HMOs and Brain Development

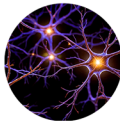
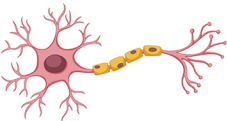


Supports myelin sheath formation for efficient signal transmission for rapid cognitive functions like learning and memory.<sup>3</sup>



Sialic Acid

Contributes to synaptic plasticity by aiding in the formation and remodeling of synapses for cognitive adaptability and problem-solving skills.<sup>3</sup>



## Observational Studies on Human Milk and specific HMOs in Infant Neurocognitive Development<sup>3-7,12</sup>

HMOs	Findings
2'-fucosyllactose (2'FL)	Positively associated with cognitive development at 24 months <sup>3</sup> Higher 2'FL associated with greater head growth and neurodevelopment at 1 month <sup>12</sup>
3'-sialyllactose (3'SL)	Positively associated with receptive and expressive language development between 2-25 months <sup>7</sup> Associated with positive fine motor skills at 12 months <sup>8</sup>
6'-sialyllactose (6'SL)	Significantly correlated with myelination at 3 months, with social skills at 12 months <sup>9</sup> Positively associated with cognitive and motor development at 18 months <sup>10</sup>
2'FL, 3'SL, 3'FL (3'-fucosyllactose)	Promoted cortical gray matter and white matter maturation in infants <sup>9</sup>
Fucosylated HMOs	Associated with reduction in negative emotions at 9 months <sup>8</sup>
Fucosylated and Sialylated HMOs	Positively associated with improved vocabulary at 18 months <sup>11</sup>

### Key Takeaways

- ✓ Breastmilk and its unique components are vital for infant growth, development, and long-term health.
- ✓ HMOs play a crucial role in shaping the infant gut microbiome, supporting the immune system, and promoting brain development.
- ✓ Human milk observational studies highlighted the role of HMOs in infant brain health and its role in the gut-brain connection.
- ✓ Sialylated HMOs provide sialic acid, an important building block for brain development and function.
- ✓ Sialylated and fucosylated HMOs are linked to improved cognitive function and language development among infants, highlighting their potential significance in fostering optimal neurodevelopment.

#### References

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