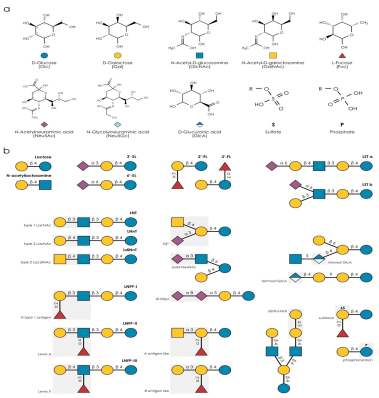
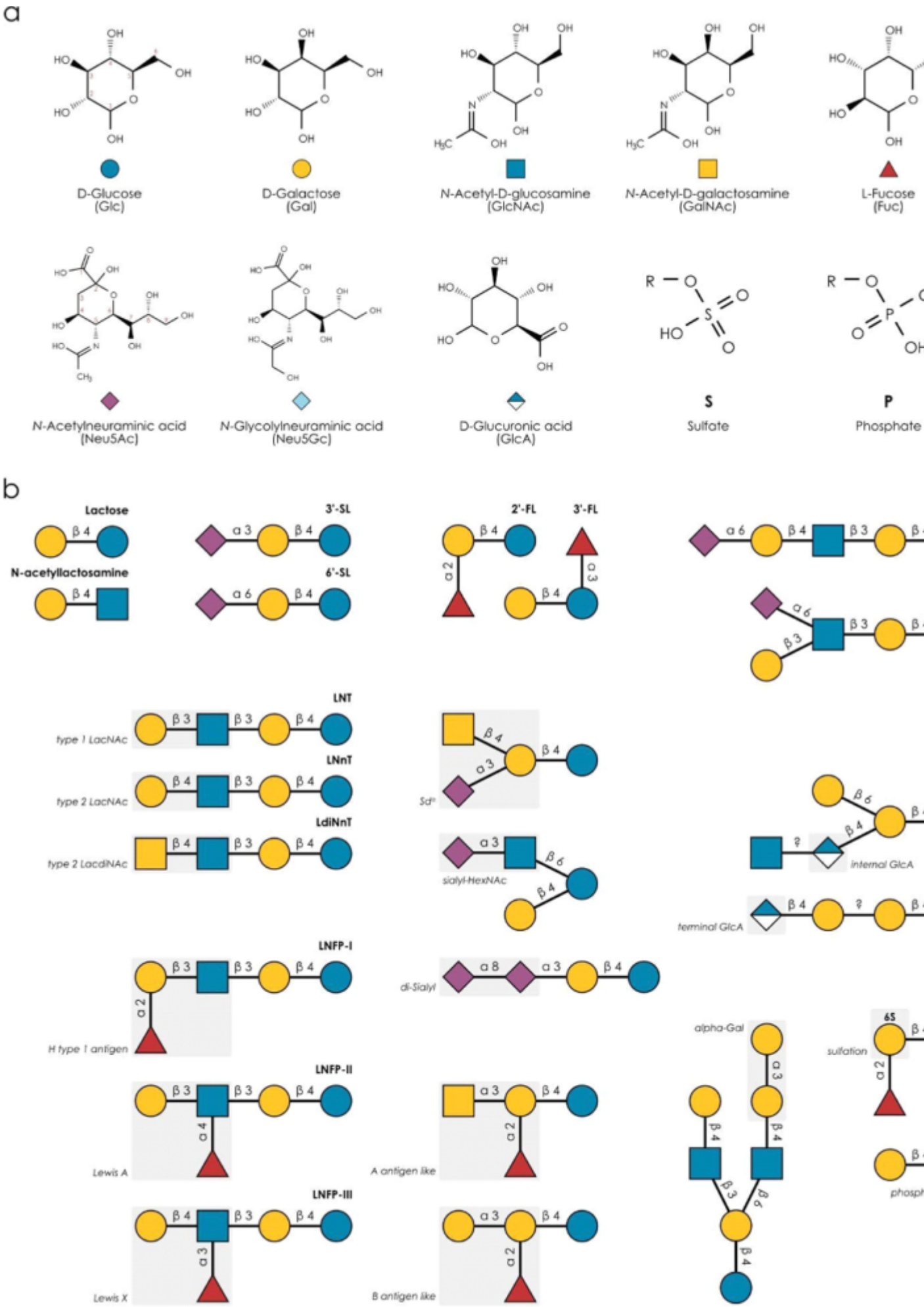


The evolving world of milk oligosaccharides: Biochemical diversity understood by computational advances

Description

Milk oligosaccharides, complex carbohydrates unique to mammalian milk, play a crucial role in infant nutrition and immune development. This review explores their biochemical diversity, tracing the evolutionary pathways that have led to their variation across species. The authors highlight the intersection of nutrition, biology and chemistry in understanding these compounds.


a
D-Glucose (Glc)
D-Galactose (Gal)
N-Acetyl-D-glucosamine (GlcNAc)
N-Acetyl-D-galactosamine (GalNAc)
L-Fucose (Fuc)
N-Acetylneuraminic acid (Neu5Ac)
N-Glycolylneuraminic acid (Neu5Gc)
D-Glucuronic acid (GlcA)
S
Sulfate
P
Phosphate
b
Lactose
N-acetyllactosamine
3'-SL
6'-SL
2'-FL
3'-FL
LNT
type 1 LacNAc
LNnT
type 2 LacNAc
LdiNnT
type 2 LacdiNAc
Sd^a
sialyl-HexNAc
internal GlcA
terminal GlcA
LNFP-I
H type 1 antigen
di-Sialyl
LNFP-II
Lewis A
A antigen like
alpha-Gal
sulfation
LNFP-III
Lewis X
B antigen like

An overview of our current understanding of the diversity in milk oligosaccharide biochemistry**.** (**a**) Chemical structures of monosaccharides and modifications found in milk oligosaccharides. Representative carbon atom numbering is shown with Glc (for hexoses) and Neu5Ac (for sialic acids). (**b**) Common and well-investigated structures, such as 2â??-fucosyllactose (2â??-FL) or 3â??-sialyllactose (3â??-SL), are shown together with some recently discovered structures [9], such as the LacdiNAc-containing lacto-*N*,*N*-neotetraose (LdiNnT), as a representative subset of the ~700 known MO structures. Relevant motifs are highlighted in grey.

In addition, they discuss the latest computational and analytical techniques that have revolutionised the study of lacto-oligosaccharides and provide insights into their structural complexity and functional roles. This brief but essential review aims not only to provide a deeper understanding of milk oligosaccharides but also to discuss the way towards their potential applications.

Category

1. News