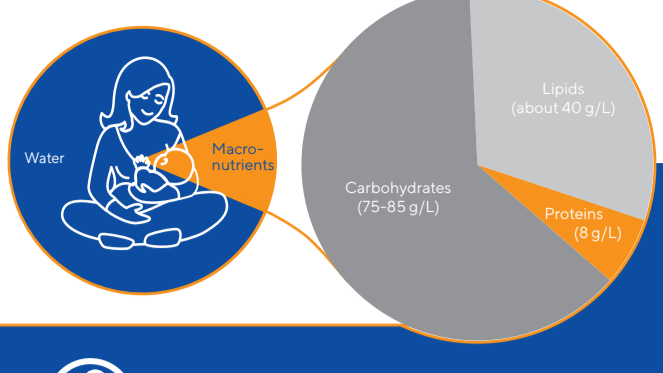


## Proteins

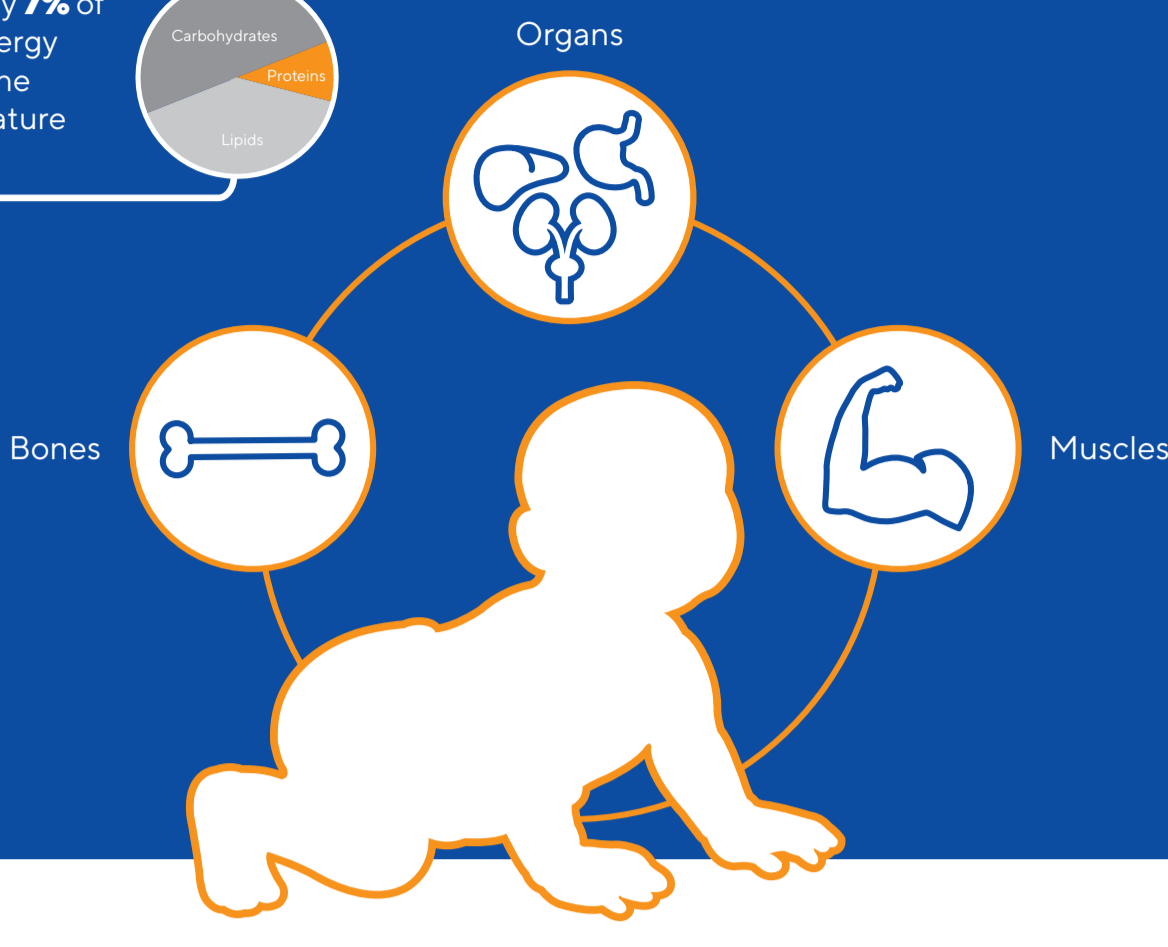
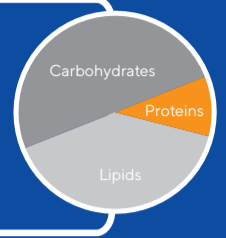
The main function of proteins is to maintain, repair and provide structure for tissues and cells. The whey/casein ratio in human milk is adapted to infants' specific needs and is therefore unique for each stage of lactation.



### Proteins are important for the development of:<sup>1</sup>



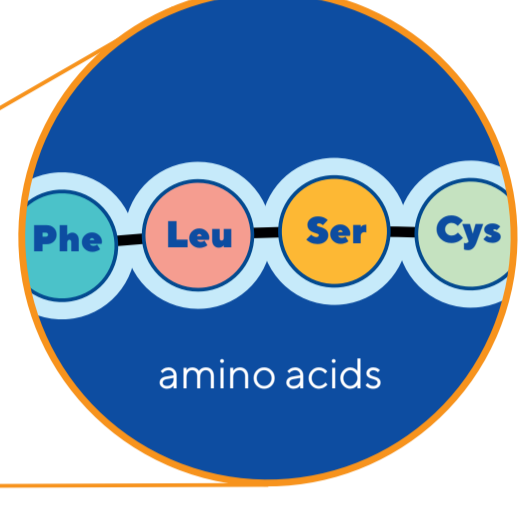
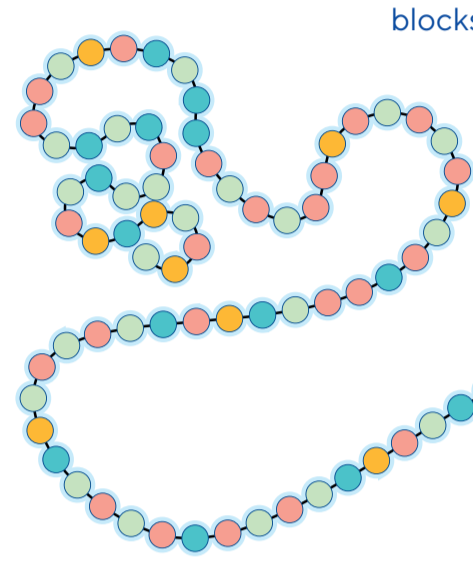
Approximately **7%** of an infant's energy comes from the proteins in mature human milk.<sup>3</sup>



### They also play a role as:

- Enzymes
- Hormones
- Transporters
- Antibodies
- Structural components

Proteins (polypeptides) are biological molecules that are composed of smaller building blocks called amino acids. Amino acids are connected by peptide bonds.<sup>4</sup>



Proteins are made up of 50 or more amino acids. Peptides are composed of 2 to 50 amino acids.



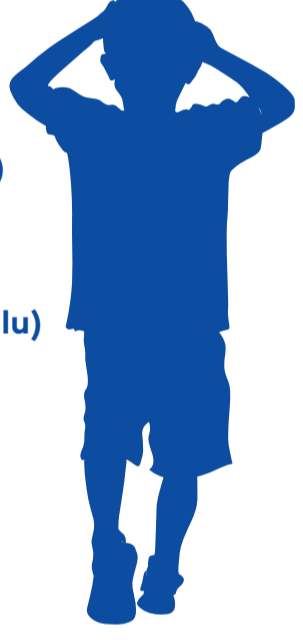
The sequence of the amino acids determines the 3D shape of the protein, which is very important for its specific function.<sup>4</sup>

In total there are **20 amino acids**, divided in **non-essential amino acids** and **essential amino acids**<sup>4,5</sup>

### NON-ESSENTIAL

Can be synthesized by the human body

1. Alanine (Ala)
2. Arginine (Arg)
3. Asparagine (Asn)
4. Aspartate (Asp)
5. Cystine (Arg)
6. Glumatic acid (Glu)
7. Glutamine (Gln)
8. Glycine (Gly)
9. Proline (Pro)
10. Serine (Ser)
11. Tyrosine (Tyr)



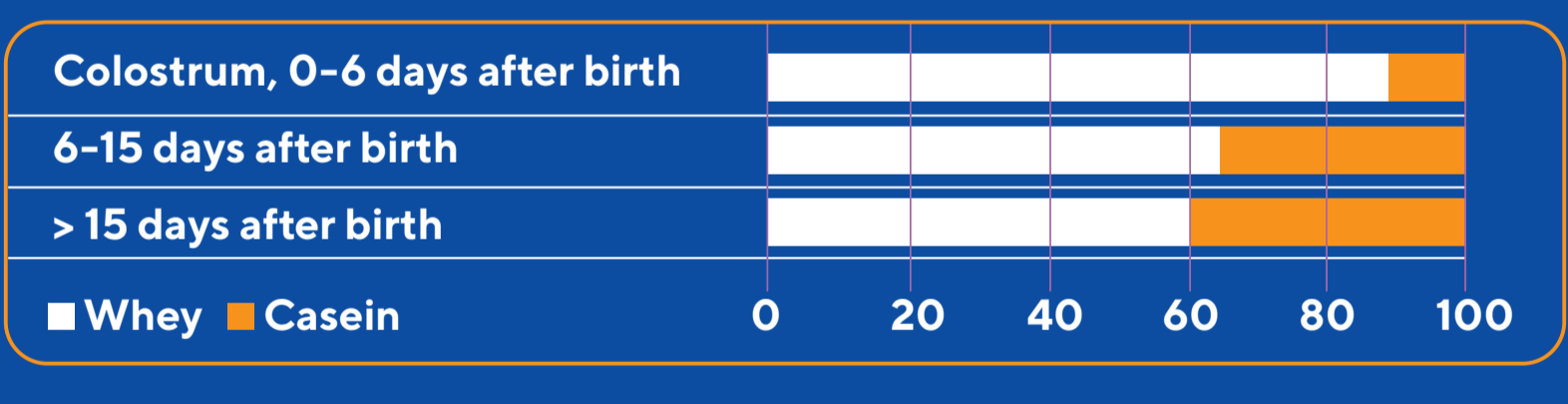
### ESSENTIAL

Cannot be synthesized by the human body and must be ingested via the diet

1. Histidine (His)
2. Isoleucine (Ile)
3. Leucine (Leu)
4. Lysine (Lys)
5. Methionine (Met)
6. Phenylalanine (Phe)
7. Threonine (Thr)
8. Tryptophan (Trp)
9. Valine (Val)



The protein composition of human milk differs depending on the stage of lactation.<sup>3,8</sup>



Proteins from milk deliver all the essential amino acids your body requires<sup>6,7</sup>

There are two major categories of proteins in milk

### Whey

A high proportion of whey proteins may be important for.<sup>9,10</sup>



The promotion of immunomodulation by lactoferrin, α-lactalbumin, and immunoglobulins



Protection against infections in the newborn infant



A gentle digestion

Critical functions in infants with an immature immune and digestive system

### Casein

Casein facts:<sup>8,11</sup>



While whey proteins remain liquid, casein may form a curd in the stomach



Human milk primarily contains κ-casein and β-casein



The casein composition varies between mammals, and also contains αs1-casein and αs2-casein

References: 1: Lawrence & Lawrence 2011. 2: Martinez-Ferez 2006. 3: EFSA 2014;12(7); 4: Whitney et al. 2008. 5: Voedingscentrum Encyclopedie May 2020.; 6: Berrazaga et al. 2019; 7: Rutherford et al. 2015; 8: Lönnerdal et al. 2017; 9: Lönnerdal et al. 2016.; 10: Martin et al. 2016.; 11: Park & Hearlein 2006.

**Disclaimers:**

- Ausnutria acknowledges that breastfeeding is the best food for infants aged 0-6 months and supports prolonging breastfeeding to 24 months (age 2).
- For health care professionals only.