

Physiological Ion Concentrations

Typical extracellular and intracellular ion levels for a mammalian cell, alongside standard DMEM culture medium for comparison.

Ion	Extracellular (plasma)	Intracellular (cytoplasm)	DMEM (culture medium)
Na+	145 mM	5–15 mM	154 mM
K+	5 mM	140 mM	5.4 mM
Ca2+ (free)	1–2 mM	~0.0001 mM (100 nM)	1.80 mM
Mg2+ (free)	1–2 mM	0.5 mM	0.81 mM
Cl-	110 mM	5–15 mM	118 mM
HCO3-	25 mM	8 mM	44 mM
Phosphate (HPO4 2-)	1 mM	70 mM	0.91 mM
Total protein	60–80 g/L	200–300 g/L	0 (serum-free base)

Values are typical for an adult mammalian cell; specific cell types, species, and physiological states vary. Free (ionised) Ca2+ and Mg2+ are shown for the cell rows: most intracellular Ca2+ and Mg2+ is bound or sequestered, not free in the cytosol.

Source: Na+/K+/Ca2+/Mg2+/Cl- from Alberts et al., Molecular Biology of the Cell, 6th edition, Ch 11, Table 11-1. HCO3-/phosphate from standard clinical-physiology ECF/ICF reference ranges (e.g. Guyton & Hall, Textbook of Medical Physiology). DMEM column computed from the Sigma-Aldrich D6046 DMEM formulation sheet (publicly published inorganic-salt composition), converted g/L to mM by molar mass.

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For the theory behind osmolarity and physiological buffers, see the Biotech Techniques Bible series.

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