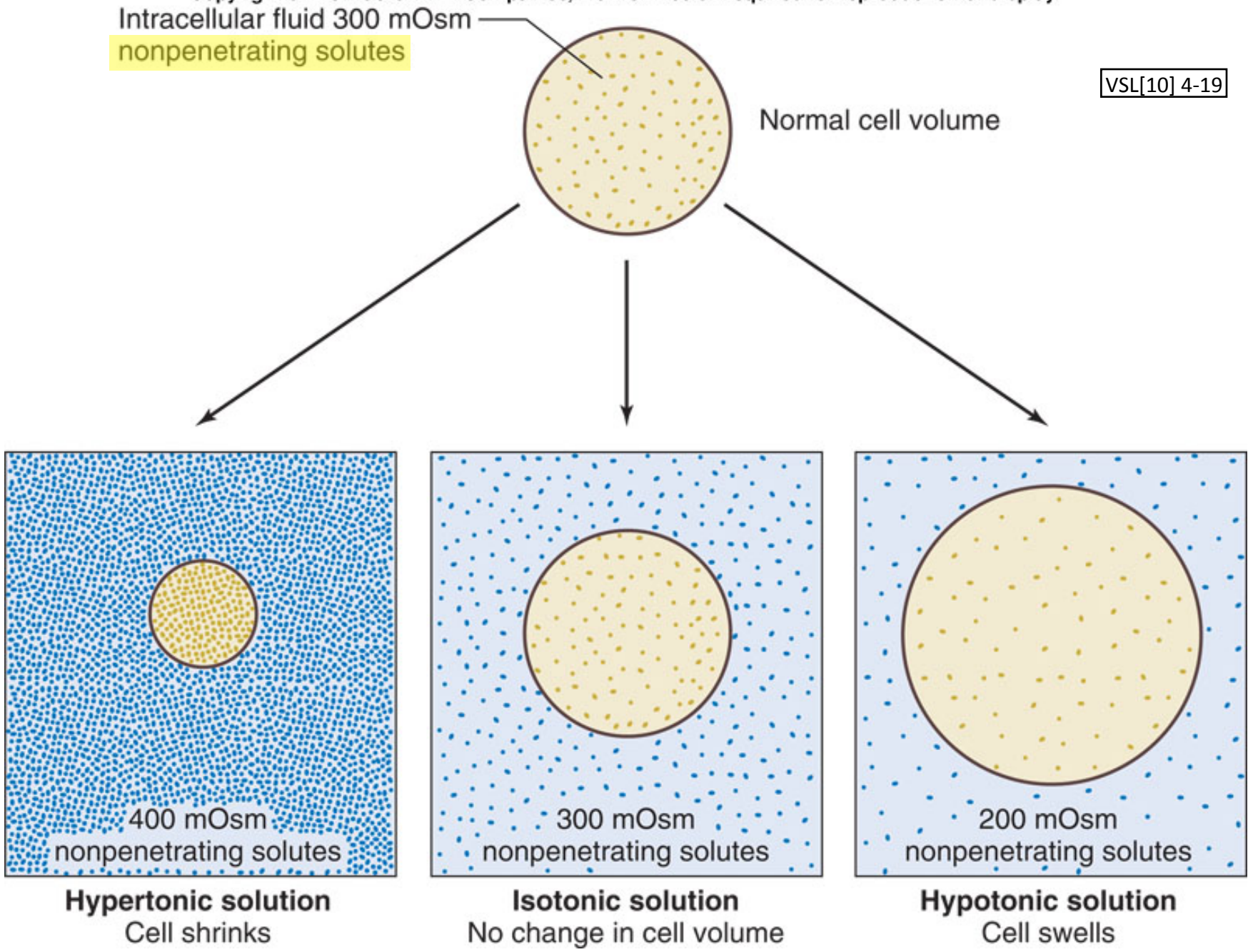


VSL[10] 4-19

B&L[5]

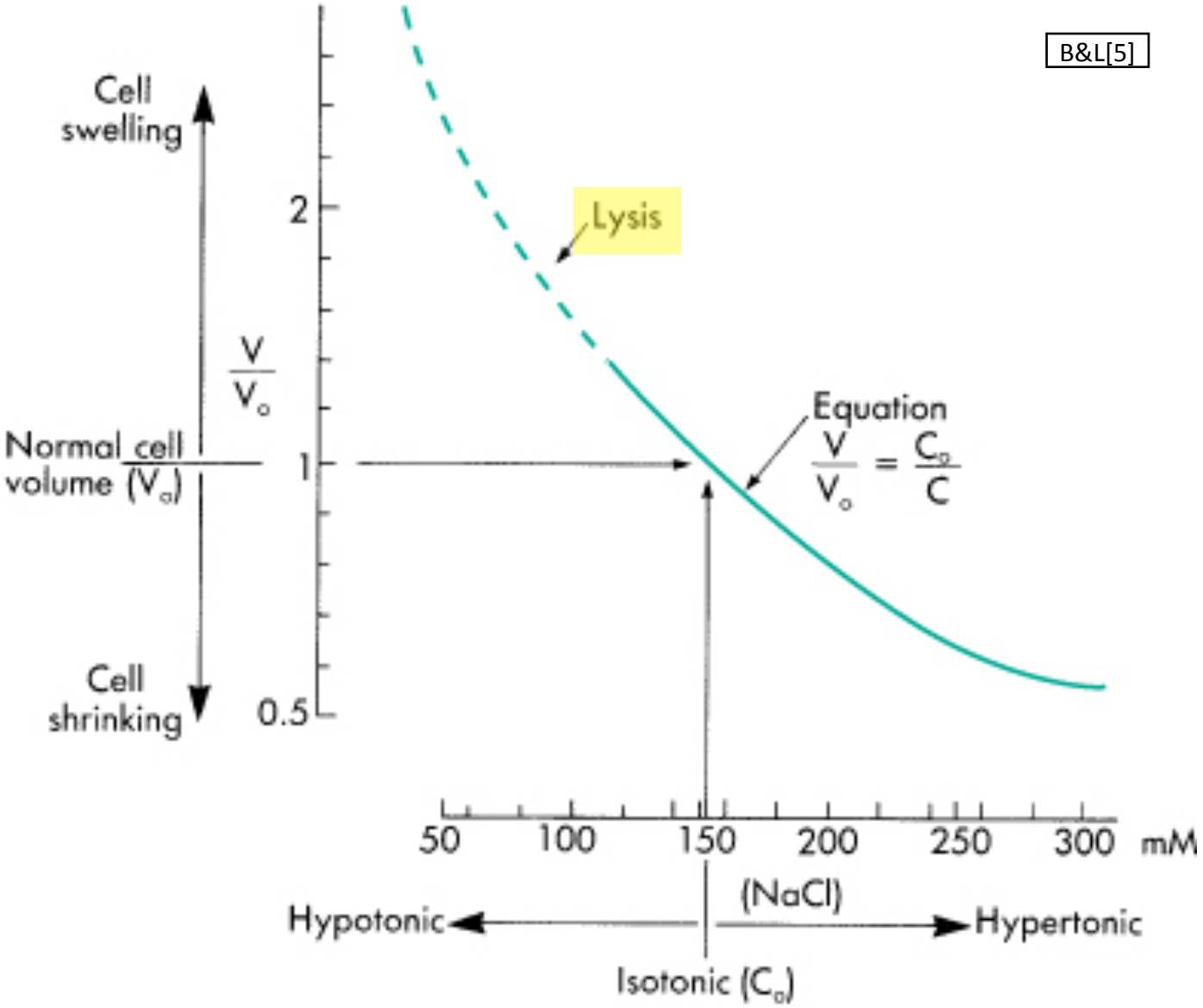
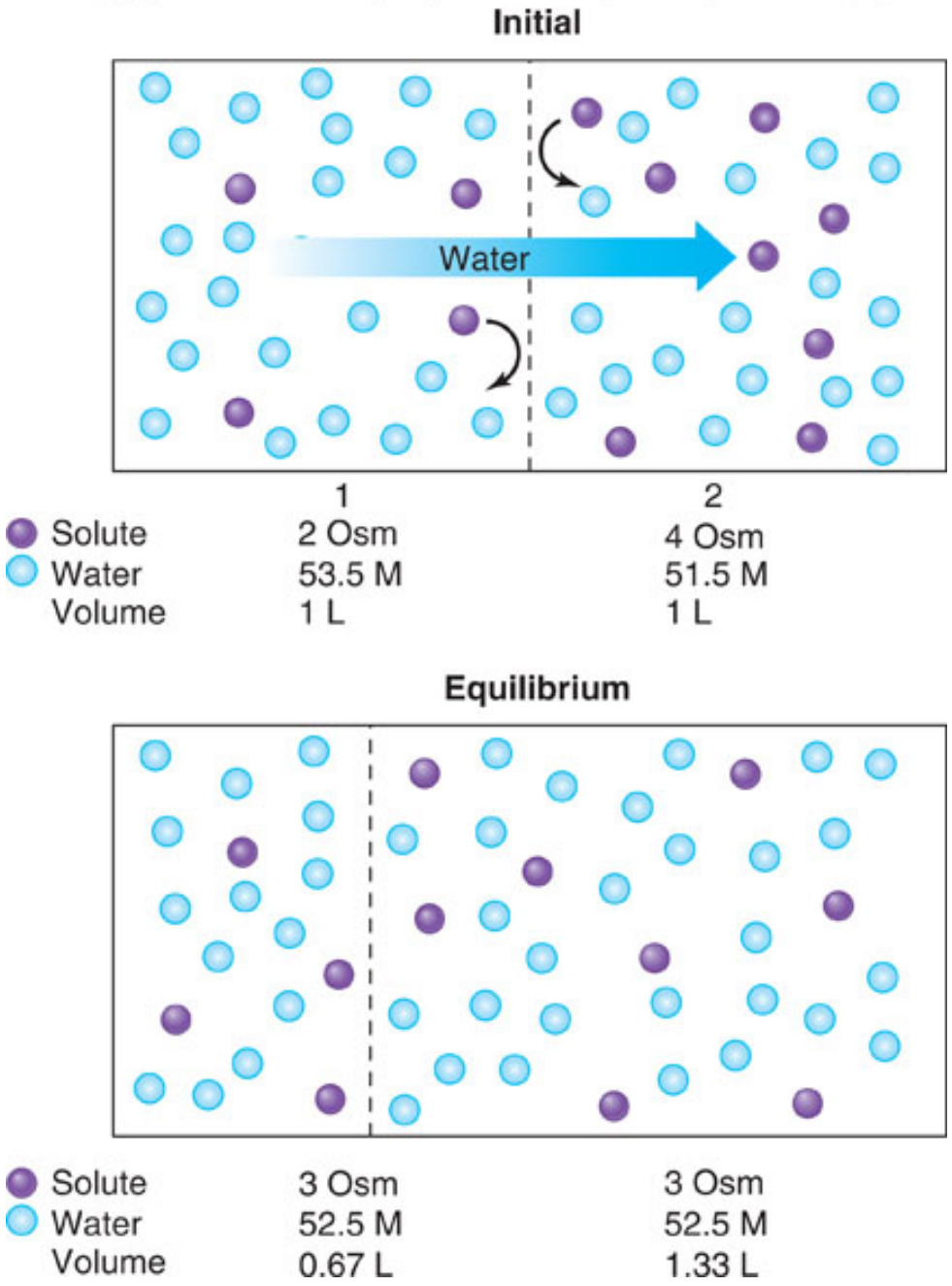


Figure 1-8 The osmotic behavior of human red blood cells in NaCl solutions. At 154 mM NaCl (isotonic), the red blood cell has its normal volume. It shrinks in more concentrated (hypertonic) solutions and swells in more dilute (hypotonic) solutions. Vo and Co are the red cell volume and intracellular solute concentration, respectively, for the red blood cell in the blood or in an isotonic solution. V and C are, respectively, the cell volume and intracellular solute concentration in a solution that is not isotonic.



VSL[10] 4-18

Van't Hoff equation …

$$\pi = RT\phi ic$$

π = osmotic pressure, mmHg

R = gas constant, ≈62.36 $L \cdot mmHg \cdot °K^{-1} \cdot mol^{-1}$

T = absolute temperature, °K

Φ = osmotic coefficient

i = number of particles

C = molar concentration, $mol \cdot L^{-1}$

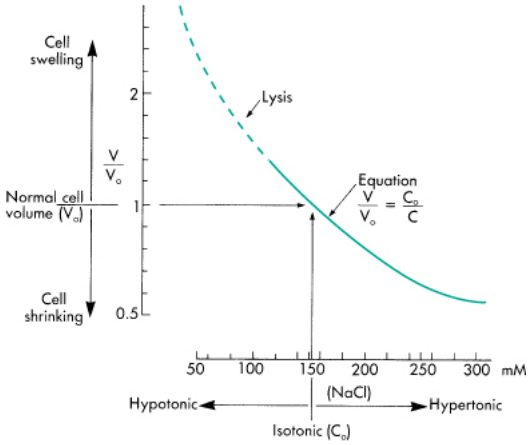
Osmolality = Φ·n·c

where

Φ = osmotic coefficient

n = # of particles (1, 2, 3, …)

C = molal concentration (mol solute/kg solvent)



154 mM NaCl is isotonic to human RBCs

$$Osm_{154\ mM\ NaCl} = 0.93 \times 2 \times 0.154 = 0.286\ Osm = 286\ mOsm$$

Substance	***i***	***Molecular weight***	Φ
NaCl	2	58.5	0.93
KCl	2	74.6	0.92
HCl	2	36.6	0.95
NH_4Cl	2	53.5	0.92
$NaHCO_3$	2	84.0	0.96
$NaNO_3$	2	85.0	0.90
KSCN	2	97.2	0.91
KH_2PO_4	2	136.0	0.87
$CaCl_2$	3	111.0	0.86
$MgCl_2$	3	95.2	0.89
Na_2SO_4	3	142.0	0.74
K_2SO_4	3	174.0	0.74
$MgSO_4$	2	120.0	0.58
Glucose	1	180.0	1.01
Sucrose	1	342.0	1.02
Maltose	1	342.0	1.01
Lactose	1	342.0	1.01

B&L[5], Table 1-2

END

Video 4, Module 1