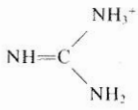
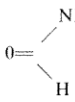
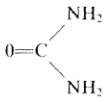
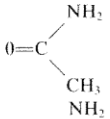
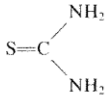
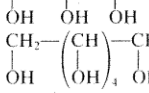
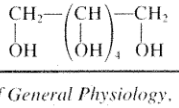
TABLE 3.1

Permeability Ratio of Alkali Ions and Organic Molecules[a]

Transporting molecules	Molecular formula	Molecular dimension[b] (Å)	pK_a	$R = \frac{\text{permeability of test molecules}}{\text{permeability of } Na^+}$ Uncharged form (n)[c]	Charged form (n)[c]
Alkali ion					
Sodium	Na^+	$r = 0.90$	—	—	1.0
Potassium	K^+	$r = 1.33$	—	—	1.47 ± 0.26 (5)
Rubidium	Rb^+	$r = 1.48$	—	—	1.52 ± 0.41 (6)
Cesium	Cs^+	$r = 1.69$	—	—	1.91 ± 0.65 (7)
Calcium	Ca^{2+}	$r = 0.99$	—	—	0.22 ± 0.08 (7)
One- or two-carbon compound					
Ethanolamine	$NH_2—(CH_2)_2—OH$	3.84 × 4.11 × 7.93	9.5	≈0	0.72 ± 0.17 (9)
Ethylenediamine	$NH_2—(CH_2)_2—NH_2$	3.84 × 4.11 × 6.82	9.98, 7.52	≈0	0.63 ± 0.20 (15) 0.57 ± 0.14 (5)[d]
Ethylamine	$NH_2—(CH_2)_2—H$	3.84 × 4.11 × 5.98	10.63	≈0	0.45 ± 0.16 (7)
Methylamine	$NH_2—CH_3$	3.79 × 3.87 × 4.32	10.62	≈0	0.82 ± 0.30 (6)
Ethylene glycol	$OH—CH_2—OH$	3.84 × 4.11 × 6.50	14.77	0.19 ± 0.05 (9)	—
Carbonyl and related compound					
Guanidinium		3.00 × 5.12 × 5.49	—	—	0.92 ± 0.21 (3)
Formamide		3.00 × 4.38 × 5.35	—	0.17 ± 0.05 (4)	—
Urea		3.00 × 4.97 × 5.34	—	0.12 ± 0.05 (4)	—
Acetamide		3.76 × 5.12 × 5.30	—	≈0	—
Thiourea		3.77 × 5.77 × 5.90	—	0.04 ± 0.016 (3)	—
Other compounds					
Tris(hydroxymethyl) aminomethane	$(CH_2—OH)_3—C—NH_3^+$	6.03 × 6.89 × 7.71	8.1	≈0	0.11 ± 0.04 (4)
Glycerol		4.69 × 5.99 × 6.90	—	0.05 ± 0.02 (3)	—
Mannitol		7.38 × 8.11 × 11.92	—	≈0	—

[a] Reproduced from the *Journal of General Physiology*, 1978, Volume 71, p. 402, by permission of the Rockefeller University Press (Huang *et al.*, 1978). Measurements were by tracer uptake into muscle cells in tissue culture at 37°C and are reported as the difference in uptake between cells exposed to acetylcholine and control cells (not exposed).

[b] r, Radius of the crystal size of alkali ion. Molecular dimensions of organic molecules were estimated from CPK model.

[c] Number in parentheses represents the number of experiments done for the specific molecules.

[d] Doubly-charged form.