TABLE 4.22

Turnover Numbers of Some Membrane Transport Systems and Derived Estimates of the Carrier–Substrate Association Rate Constants[a]

System	Temp (°C)	V_{max} (μmol/l cell water sec or as specified in 8, 10)	Number of carrier sites (μmol/l cell water or as specified in 8, 11)	Turnover number (TN) (sec^{-1})	K_m	k_{ass} ($=TN/K_m$) ($M^{-1}sec^{-1}$)
Human red blood cell						
Sugars:						
glucose (1)						
zero trans	20	600	7.9 (2)	76	1.6 mM	4.7×10^4
equilibrium exchange	20	5170	7.9 (2)	654	31 mM	2.1×10^4
galactose (3)						
zero trans	20	653	7.9 (2)	83	13 mM	6.3×10^3
equilibrium exchange	20	7200	7.9 (2)	916	146 mM	6.5×10^3
Anions						
equilibrium exchange, Cl^- (4)	0	6010	32 (4)	189	67 mM	2.8×10^3
equilibrium exchange, HCO_3^- (4)	0	7450	32 (4)	234	20 mM	1.2×10^4
equilibrium exchange, HCO_3^-						
equilibrium exchange, $H_2PO_4^-$ (5)	25	48.6	32 (4)	1.5	60 mM	2.5×10
Uridine						
zero trans (6)	5	0.64	0.22 (7)	2.9	5.4 μM	5.4×10^5
	15	20	0.22 (7)	91	80 μM	1.1×10^6
	25	31	0.22 (7)	141	65 μM	2.2×10^6
	35	175	0.22 (7)	195	141 μM	5.6×10^6
equilibrium exchange (6)	35	510	0.22 (7)	2320	832 μM	2.8×10^6
Sheep red blood cells						
uridine, zero trans (8)	37	2.73×10^{-20}	2.92×10^{-23} (8)	934	470 μM	2.0×10^6
Mitochondria						
ADP/ATP exch (9)					0.8 μM	1×10^7
(K_m for ADP)	18	—	—	8.3	3.5 μM	2.4×10^6
E. coli						
lactose permease						
active transport (10)	25	1.92	0.2 (11)	9.5	170 μM	5.6×10^4
facilitated diffusion (10) (zero trans uptake)	25	.88	0.2 (11)	4.4	18.9 mM	2.3×10^2
Various sources						
Na^+, K^+-ATPase (12)						
Na^+ only						
Na^+ substrate	37	—	—	15	0.6 mM	2.5×10^4
ATP substrate	37	—	—	15	1 μM	1.5×10^7
$Na^+ + K^+$						
Na^+ as substrate	37	—	—	140	15 mM	9.3×10^3
ATP as substrate	37	—	—	140	100 μM	1.4×10^6

[a] Values taken from the following sources, converting from min^{-1} to sec^{-1} where necessary: (1) Lieb (1982), Table IX; (2) Calculated from Lin and Spudich (1974), assuming cell water content of 62 μm^3; (3) Ginsburg (1978); (4) Calculated from Wieth (1979), assuming cell water of 62 μm^3; (5) Calculated from Schnell *et al.* (1981), assuming cell water of 62 μm^3; (6) Plagemann and Wohlhueter (1984a); (7) Calculated from (8), assuming cell water of 62 μm^3; (8) Jarvis and Young (1980), V_{max} in mol/cell sec, number in mol/cell; (9) Klingenberg (1976); (10) Kaczorowski *et al.* (1979), V_{max} in nmol/mg vesicle protein sec; (11) Overath *et al.* (1979), number in nmol/mg vesicle protein; (12) Taken from Tables 6.3 and 6.4, Chapter 6, this volume.