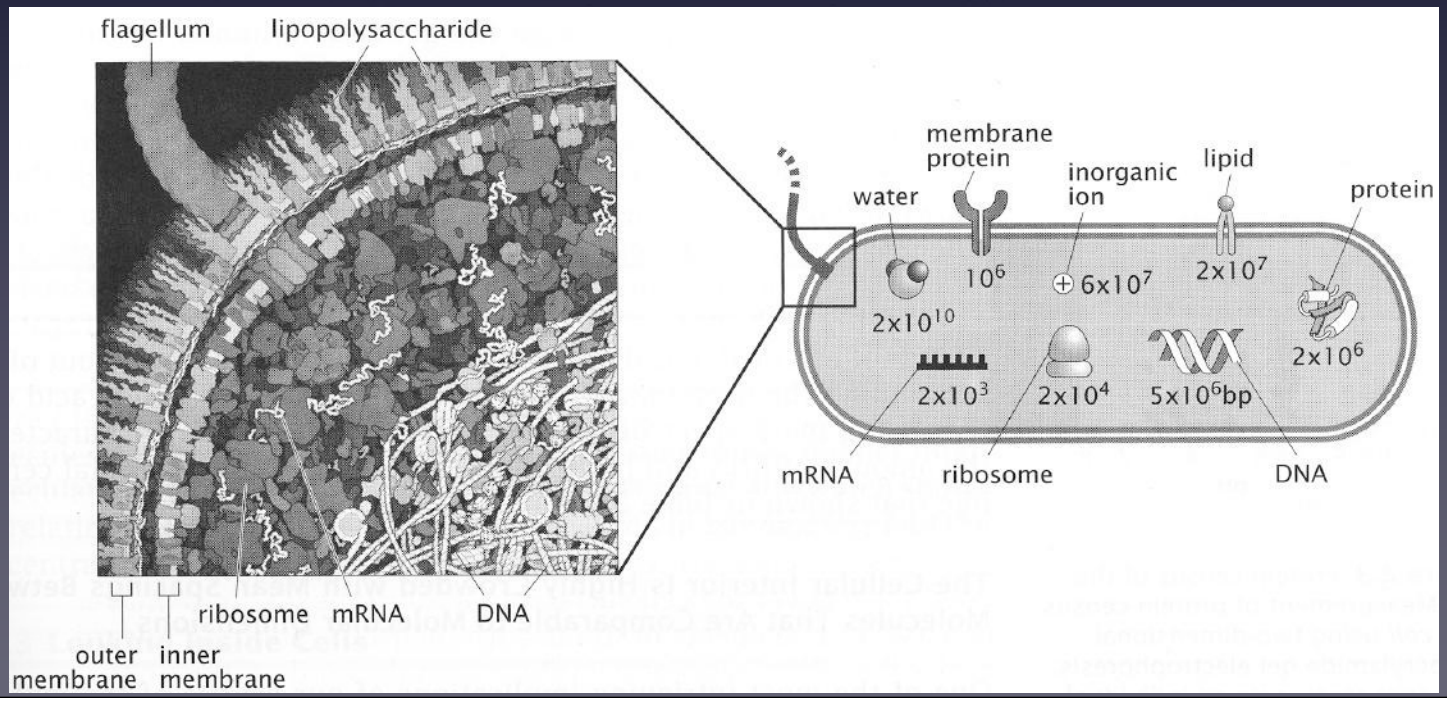
E. coli

adapted from *Phillips et al. – Physical Biology of the Cell*

cell volume	$V_{E\ coli}$	1 μm^3
cell mass	$m_{E\ coli}$	1 pg
repl cycle time	$t_{E\ coli}$	3,000 s
surface area	$A_{E\ coli}$	6 μm^2
genome length	$N_{E\ coli}$	5×10^6 bp
swimming speed	$v_{E\ coli}$	20 μm/s

biology by numbers:

order-of-magnitude estimates are *essential* for model building!



double-stranded DNA

length per bp	l_{bp}	0.34 nm
volume per bp	V_{bp}	1 nm^3
charge density per unit length	λ_{DNA}	2 e/0.34 nm
persistence length	ξ_{DNA}	50 nm

amino acids and proteins

typical diameter	$d_{protein}$	4–5 nm
typical volume	$V_{protein}$	25 nm^3
avrg. mass of AA	M_{AA}	100 Da
typ. protein mass	$M_{protein}$	30 kDa
protein conc in cell	$c_{protein}$	300 mg/mL
diffusion const in water	$D_{protein}$	100 $\mu m^2/s$

lipid bilayers

thickness	d_{bl}	5 nm
area per lipid	A_{lipid}	0.5 nm^2
lipid mass	m_{lipid}	800 Da
self-diffusion const	D_{lipid}	5 $\mu m^2/s$