ACTIVE TRANSPORT

Requires energy (coupled to energy-yielding reaction, usually ATP hydrolysis)

used for: uptake nutrients
removal of waste, etc. (Na\(^+\))

optimal conc. of inorganic ions

intrinsically directional, though can facilitate reverse diffusion

Charged species transport changes voltage. Rate is affected by both \( V_m \) (memb potential) & conc.

Inside cell is negative, therefore cations move in easily, move out with difficulty.

ACTIVE TRANSPORT MECHANISMS:

Three classes: uniport, antiport, symport, (p 203, fig 8-6)

SIMPLE UNIPORT ACTIVE TRANSPORT:

Ca\(^{++}\) into sarcoplasmic reticulum

(see muscle illustration: p 467)

release triggers contraction, Ca pump, ATP driven recovers

COTRANSPORT: Movement of two solutes is linked

general: http://www.youtube.com/watch?v=NewpaNwevFk

ANTIPORT: solutes transported opposite way: Na/K pump

EXAMPLE: Na/K Pump, six stages: (see page 214)

1) three Na\(^+\) enter permease which is open to the interior of the cell (three small pockets)
2) Na\(^+\) in permease make it subject to PO\(_4\)ylation
3) PO\(_4\)ylated permease alters configuration, opens to outside
4) Na\(^+\) diffuses out
5) two K\(^+\) enter permease
6) dePO\(_4\)ylation occurs, alters configuration, K\(^+\) diffuses into the cell.

(See next page of notes for diagram.)

Na/K pump video:

http://www.youtube.com/watch?v=awz6lIss3hQ

http://www.youtube.com/watch?v=iA-Gdkje6pg

cardiotonic steroids (digitalis and ouabain) inhibit of Na/K pump

SYMPORT: solutes transported same way: Na+ and sugars, amino acids (page 215)

ENERGY SOURCE: Driven by either ATP, PO\(_4\) hydrolysis, or Na\(^-\) or H\(^+\)

EXAMPLE: accumulation of glucose driven by Na+ chemiosmosis.

Also:

Proton pump in bacteriorhodopsin:

1) light causes trans to cis, causing release of H\(^+\) to outside cell causing reversion to trans.
2) Trans form picks up H\(^+\) from inside cell making molecule susceptible to light transformation from trans to cis.

Cis to trans rhodopsin: http://www.youtube.com/watch?v=r6v21W8zRIw