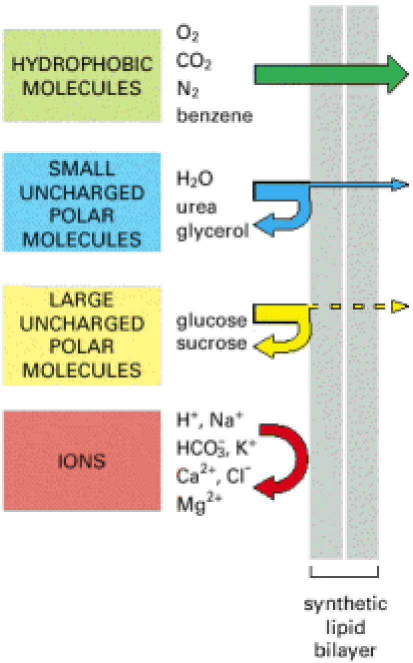
Μεμβρανική Μεταφορά

- Αρχές της μεμβρανικής μεταφοράς
- Οι πρωτεΐνες-φορείς και οι λειτουργίες τους
- Ιοντικοί δίαυλοι και το δυναμικό της μεμβράνης

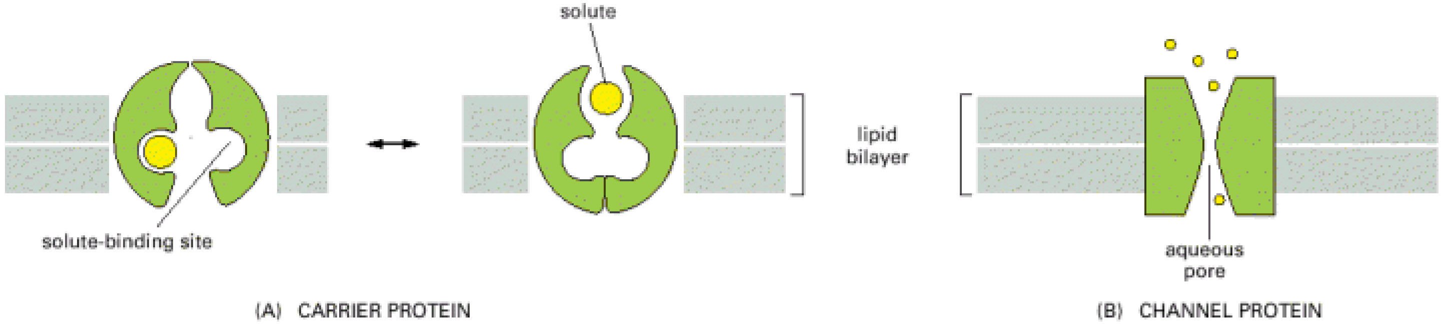
Οι συγκεντρώσεις των ιόντων στο εσωτερικό του κυττάρου διαφέρουν πολύ από τις συγκεντρώσεις στον εξωκυττάριο χώρο

Συστατικό	**Ενδοκυττάρια συγκέντρωση (mM)**	**Εξωκυττάρια συγκέντρωση (mM)**
Cations		
Na^+	5-15	145
K^+	140	5
Mg^{2+}	0.5	1-2
Ca^{2+}	10^{-4}	1-2
H^+	7×10^{-5} ($10^{-7.2}$ M or pH 7.2)	4×10^{-5} ($10^{-7.4}$ M or pH 7.4)
Anions*		
Cl^-	5-15	110

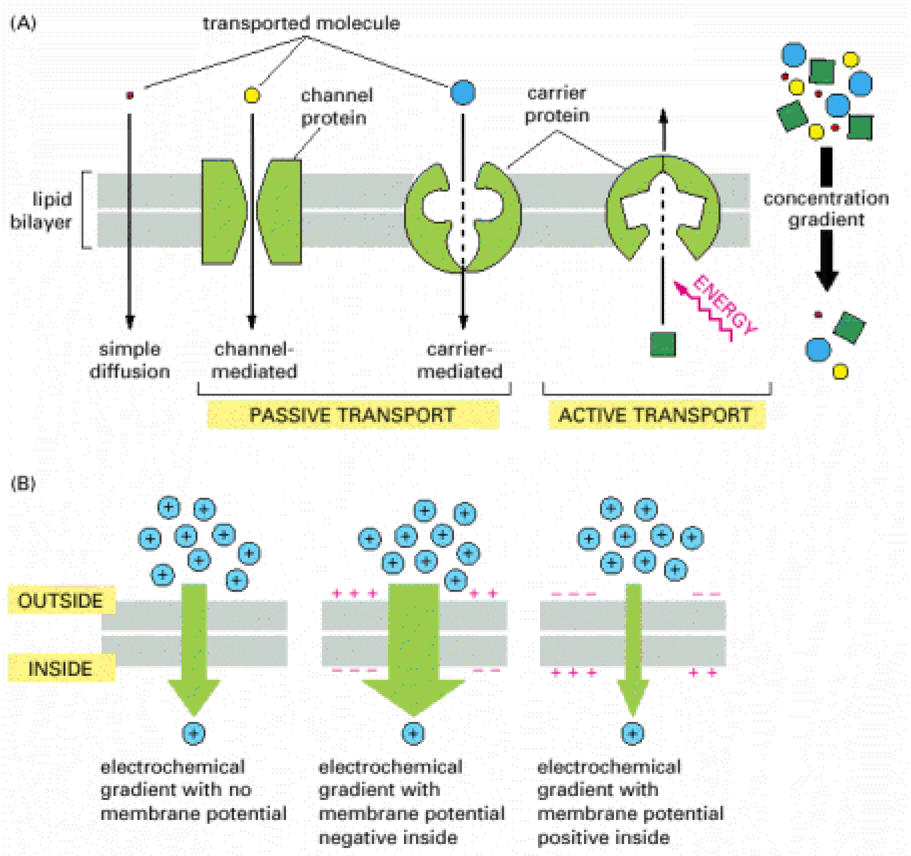
Οι λιπιδικές διπλοστιβάδες είναι αδιαπέραστες από διαλυτές ουσίες και ιόντα



Οι πρωτείνες μεμβρανικής μεταφοράς διακρίνονται σε δύο κύριες κατηγορίες: φορείς και δίαυλοι

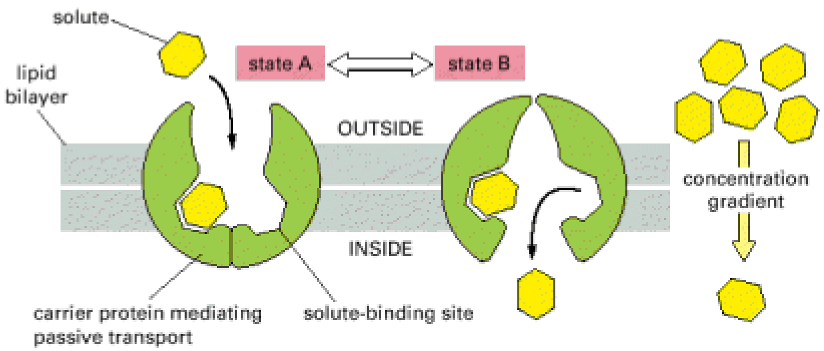


Τα διαλυτά μόρια διαπερνούν τις μεμβράνες με παθητική ή ενεργό μεταφορά

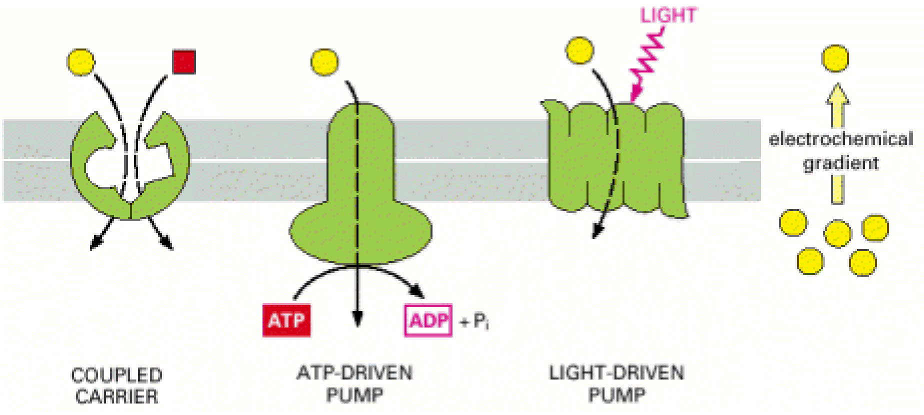


Οι πρωτεΐνες-φορείς και οι λειτουργίες τους

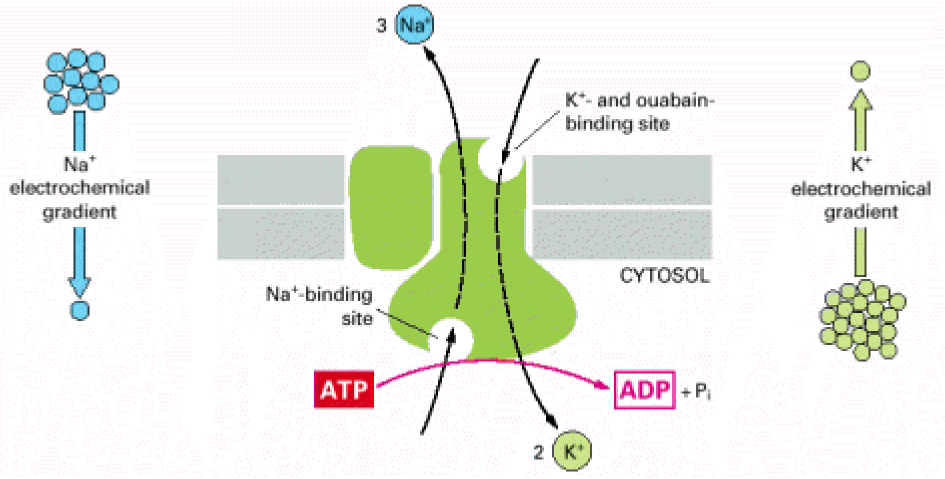
Παράδειγμα πρωτείνης-φορέα που εκτελεί παθητική μεταφορά μιας διαλυτής ουσίας



Τρεις τρόποι πραγματοποίησης της ενεργού μεταφοράς

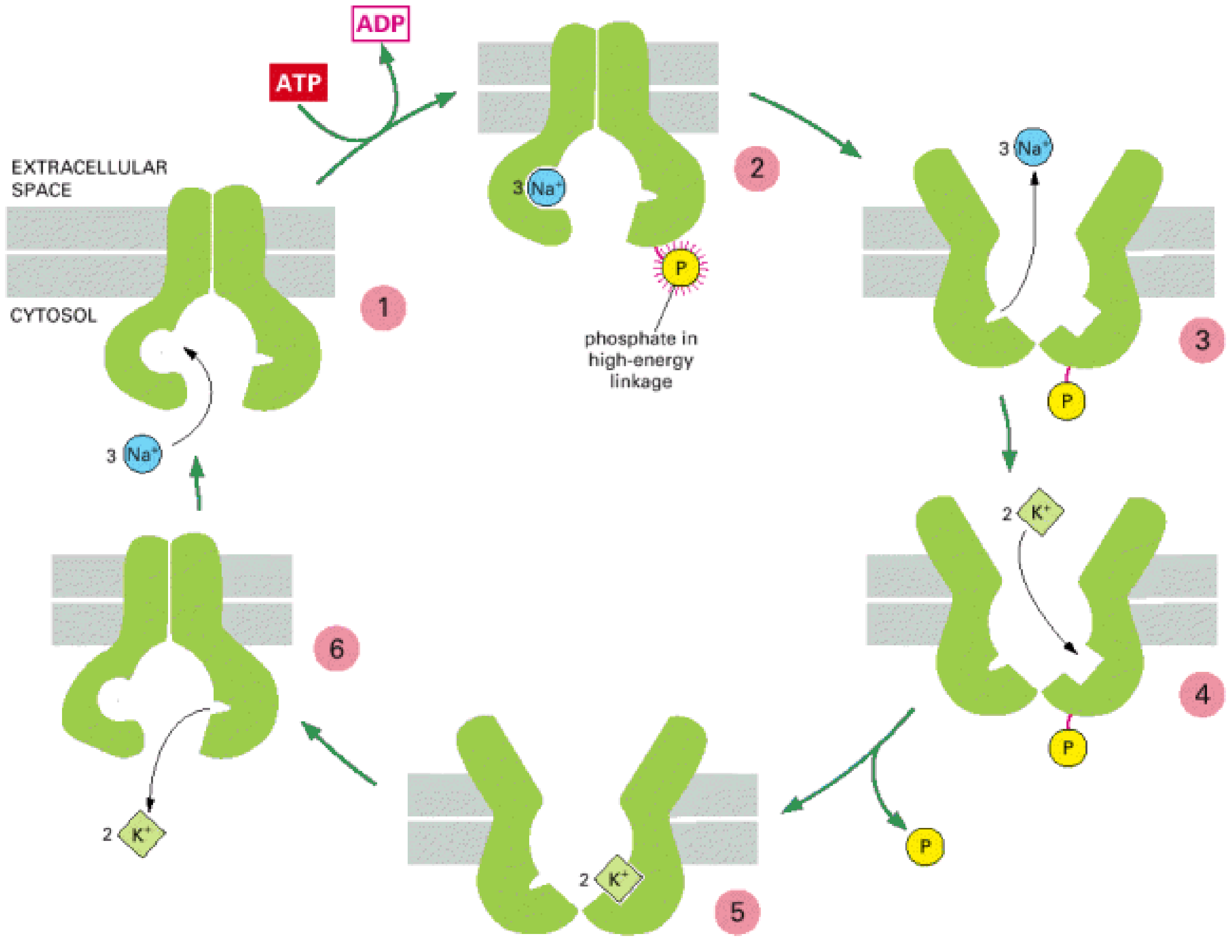


Τα ζωικά κύτταρα χρησιμοποιούν την ενέργεια της υδρόλυσης του ATP για να αποβάλλουν $Να^+$

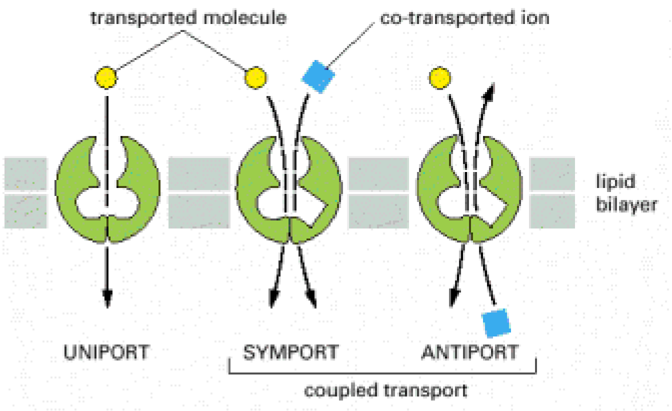


Η αντλία $Να^+$-K^+

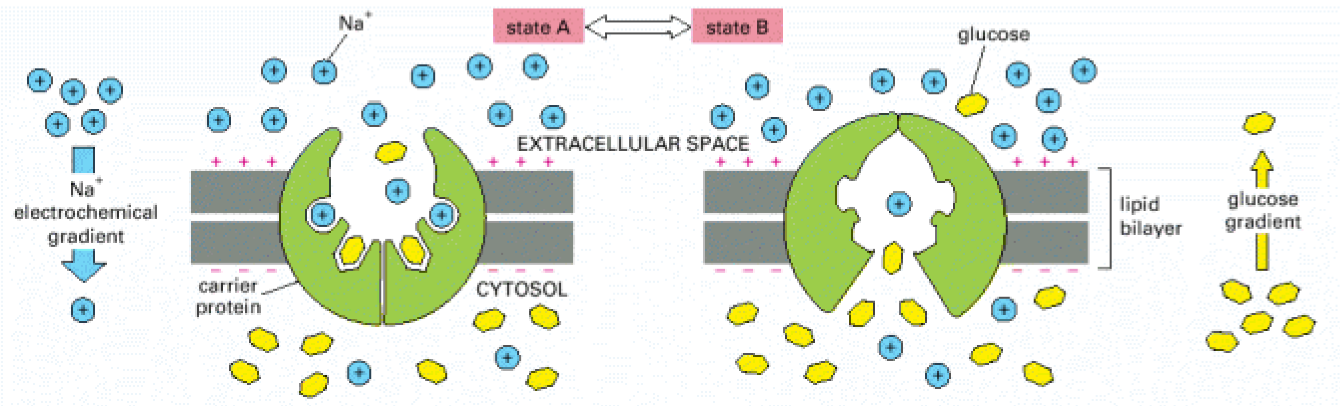
Η αντλία Na^+-K^+ προωθείται από την παροδική προσθήκη μια φωσφορικής ομάδας



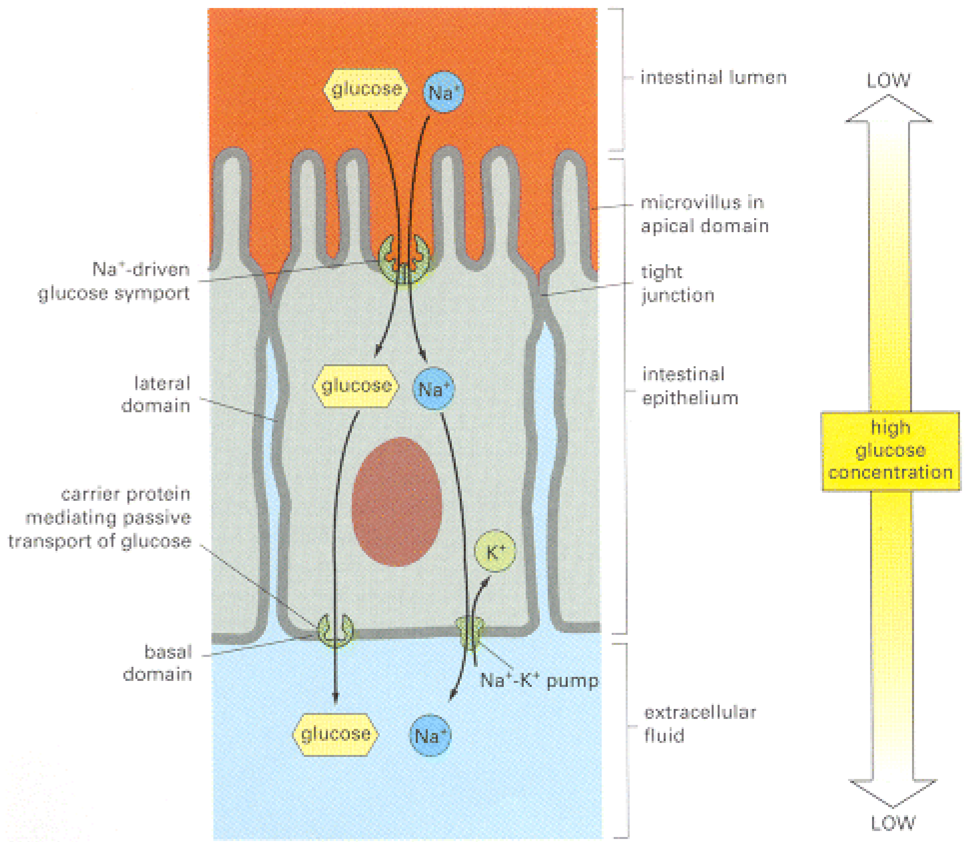
Τρεις τρόποι μεταφοράς μέσω πρωτεϊνών-φορέων



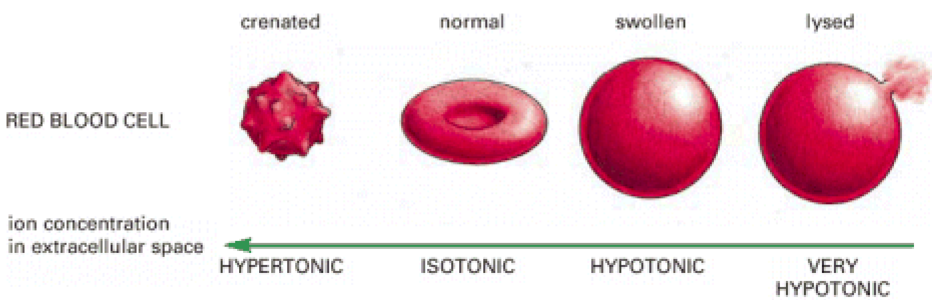
Πώς προωθείται η άντληση της γλυκόζης από τη βαθμίδωση του Na^+



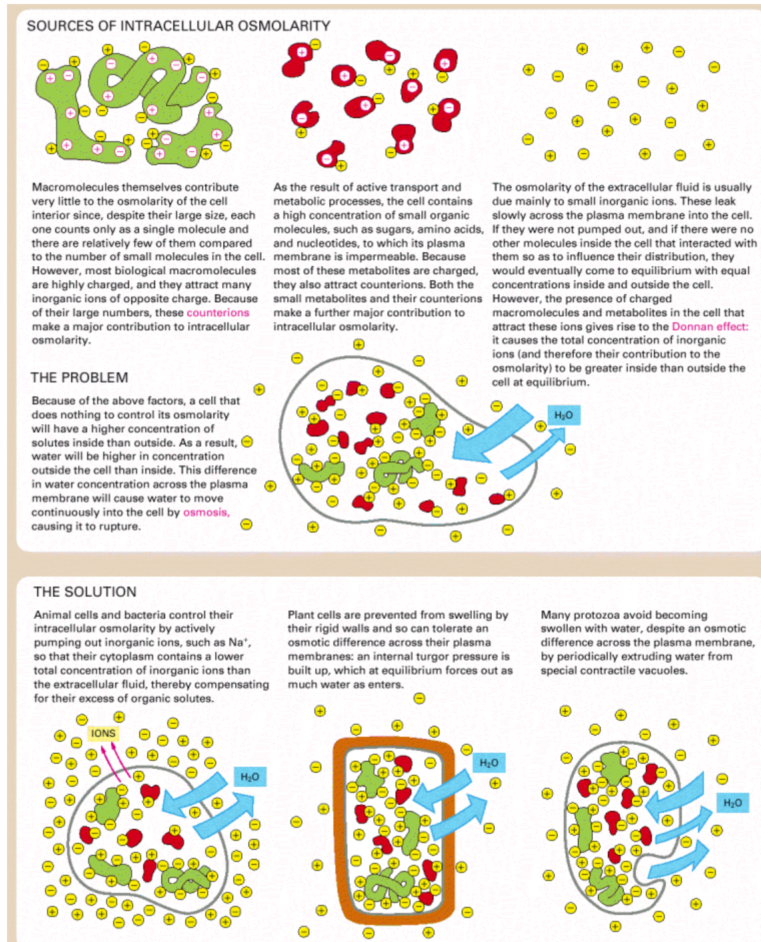
Τα επιθηλιακά κύτταρα του εντέρου διακινούν τη γλυκόζη διαμέσου του εντερικού τοιχώματος, μέσω δύο τύπων μεταφορέων



Η αντλία Na^+-K^+ βοηθά στη διατήρηση της ωσμωτικής ισορροπίας των ζωικών κυττάρων



Ώσμωση



SOURCES OF INTRACELLULAR OSMOLARITY
Macromolecules themselves contribute very little to the osmolarity of the cell interior since, despite their large size, each one counts only as a single molecule and there are relatively few of them compared to the number of small molecules in the cell. However, most biological macromolecules are highly charged, and they attract many inorganic ions of opposite charge. Because of their large numbers, these counterions make a major contribution to intracellular osmolarity.
As the result of active transport and metabolic processes, the cell contains a high concentration of small organic molecules, such as sugars, amino acids, and nucleotides, to which its plasma membrane is impermeable. Because most of these metabolites are charged, they also attract counterions. Both the small metabolites and their counterions make a further major contribution to intracellular osmolarity.
The osmolarity of the extracellular fluid is usually due mainly to small inorganic ions. These leak slowly across the plasma membrane into the cell. If they were not pumped out, and if there were no other molecules inside the cell that interacted with them so as to influence their distribution, they would eventually come to equilibrium with equal concentrations inside and outside the cell. However, the presence of charged macromolecules and metabolites in the cell that attract these ions gives rise to the Donnan effect: it causes the total concentration of inorganic ions (and therefore their contribution to the osmolarity) to be greater inside than outside the cell at equilibrium.
THE PROBLEM
Because of the above factors, a cell that does nothing to control its osmolarity will have a higher concentration of solutes inside than outside. As a result, water will be higher in concentration outside the cell than inside. This difference in water concentration across the plasma membrane will cause water to move continuously into the cell by osmosis, causing it to rupture.
H_2O
THE SOLUTION
Animal cells and bacteria control their intracellular osmolarity by actively pumping out inorganic ions, such as Na^+, so that their cytoplasm contains a lower total concentration of inorganic ions than the extracellular fluid, thereby compensating for their excess of organic solutes.
Plant cells are prevented from swelling by their rigid walls and so can tolerate an osmotic difference across their plasma membranes: an internal turgor pressure is built up, which at equilibrium forces out as much water as enters.
Many protozoa avoid becoming swollen with water, despite an osmotic difference across the plasma membrane, by periodically extruding water from special contractile vacuoles.
IONS
H_2O
H_2O
H_2O

Μία αντλία ασβεστίου επαναφέρει το Ca^{2+} στο σαρκοπλασματικό δίκτυο ενός σκελετικού μυικού κυττάρου