Hypo-osmotic - Hypo-ionic Regulation

- Medium osmolarity (mOsm)
- ECF osmolarity (mOsm)

E.g. *Uca, Artemia*

Marine teleosts

0 1000

0 1000
Crustacea:

- *Uca* - hemolymph Na = 447 mM in 175% sw (~ 800 mM)

- *Artemia* - hemolymph Na = 300 mM in as much as 4-5 M NaCl !!!

Marine teleosts
Marine Teleost
(image from Tree of Life)

Problems:
• osmotic water loss
• diffusive salt gain
• ion uptake by gut

Solutions:
• drink sea water
• active salt extrusion

[Diagram showing physiological processes involving water and ions in a marine teleost fish]
Fluid absorption across teleost gut: NO ACTIVE TRANSPORT OF H₂O! Must move ions and cause H₂O to move by osmosis.

<table>
<thead>
<tr>
<th></th>
<th>ant.</th>
<th>mM</th>
<th>post.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Na</td>
<td>450</td>
<td>100</td>
<td>20</td>
</tr>
<tr>
<td>K</td>
<td>9</td>
<td>6</td>
<td>0.8</td>
</tr>
<tr>
<td>Cl</td>
<td>520</td>
<td>90</td>
<td>50</td>
</tr>
</tbody>
</table>

>95% of salts absorbed

Blood:
Na = 200
K = 4
Cl = 190

~75% of H₂O absorbed
Apical pit of chloride cell on surface of gill lamella

CC - mitochondria-rich chloride cell
AC - accessory cell, PC - pavement cell
Seawater (or gland lumen)

- $\text{Cl}^-$
- $\text{Na}^+$

Apical membrane

- $\text{K}^+$
- $\text{Na}^+/\text{K}^+$ ATPase

Basolateral membrane

- $\text{Na}^+$
- $2\text{Cl}^-$
- $\text{K}^+$