Introducción a la Fisiología de Sistemas
Neurona sensorial

A Potencial receptor o sináptico

B Acción integradora

C Potencial de acción

D Señal de salida (liberación de neurotransmisor)
(a)

Temperature

Open window

Feedback

Heater ON

OFF

Cooler ON

Actual

Desired

Time
Lungs are invaginated into the body and contain the environmental medium.

External gills are evaginated from the body and project directly into the environmental medium.

Internal gills are evaginated from the body, and project into the environmental medium where it is pumped through a superficial body cavity.

(a) Polychaete annelid with gill tufts
(b) Polychaete annelid with tentacular fan
(c) Sea star with branchial papulae and tube feet used as gills

Key:
- Convection
- Diffusion

The branchial papulae are gills...

...and the tube feet function partly as gills.
Aquatic snail
- Gill leaflets hanging in the mantle cavity are ventilated by ciliary currents.

Clam (a lamellibranch mollusc)
- Visceral mass
- Gill lamella
- Water for gill ventilation is drawn into and expelled from the mantle cavity through openings called siphons.
- Cilia on the sheetlike gills of a clam drive water into and through the gills.

Squid (a cephalopod)
- Mantle cavity
- Gills
- Funnel (formed from mantle)
- The gills of a squid are ventilated by the musclegenerated flow of water the animal uses to move about by jet propulsion.

Pulmonate land snail
- Lung (mantle cavity)
- A land snail lacks gills, but has a lung derived from the mantle cavity.
- Lateral carapace wall
- Branchial chamber
- Body wall
- Sternum
- Coxa
- Basischium
Structure

- Ingestion
  - Headgut
  - Foregut
  - Midgut
  - Hindgut

Function

- Receiving
- Conducting
- Storage
- Digestion
  - Digestion (Acidic secretions)
  - Absorption → Assimilation (Basic secretions)
- Storage of waste
- Defecation
(a) Freshwater teleost

- Salt loss by diffusion
- Water uptake by osmosis
- Gills
- Hyperosmotic to ambient water
- Salts and water in food (generally do not drink)
- Active uptake of $\text{Na}^+$ and $\text{Cl}^-$
- Large amounts of urine, very hyposmotic to plasma

(b) Marine teleost

- Salt gain by diffusion
- Water loss by osmosis
- Gills
- Hyposmotic to ambient water
- Salts and water in food
- Salts and water in seawater ingested (source of net water gain)
- Small amounts of urine, nearly isosmotic to plasma, rich in $\text{Mg}^{2+}$ and $\text{SO}_4^{2-}$
- Active extrusion of $\text{Cl}^-$, active or passive outflux of $\text{Na}^-$

<table>
<thead>
<tr>
<th>In</th>
<th>Out</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drinking</td>
<td>69%</td>
</tr>
<tr>
<td>Preformed</td>
<td>4%</td>
</tr>
<tr>
<td>Metabolic</td>
<td>26%</td>
</tr>
<tr>
<td>Evaporation</td>
<td>43%</td>
</tr>
<tr>
<td>Urine</td>
<td>51%</td>
</tr>
<tr>
<td>Feces</td>
<td>7%</td>
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</tbody>
</table>
(b) Clearance of glucose

1. Glucose molecules
2. Filtration (100 mL/min)
3. 100 mL, 100% glucose reabsorbed
4. No glucose excreted
5. Clearance of glucose = 0 mL/min