

Class 35 ADAPTATIONS TO LIFE IN SEAWATER

- Structural support
- Regulating body fluids
- Flotation (buoyancy)
- Success of planktonic "plants"

All organisms (land or sea) must adapt to their environments

Successful competitors must:

- Obtain food (or nutrients to make food)
- AND Minimize food/energy requirements
- Reproduce successfully
- Escape from predators

Life in seawater... Must adapt to:

- Dense and saline fluid
- Sparse food/nutrient resources in many cases

Adaptations (examples):

1. STRUCTURAL SUPPORT
2. REGULATING BODY FLUIDS
3. FLOTATION (BUOYANCY)

1. STRUCTURAL SUPPORT

Density of tissue+skeletons \approx density of seawater- almost weightless

- So...Marine organisms do not require the structural strength of land organisms.
- Marine animals can attain great size

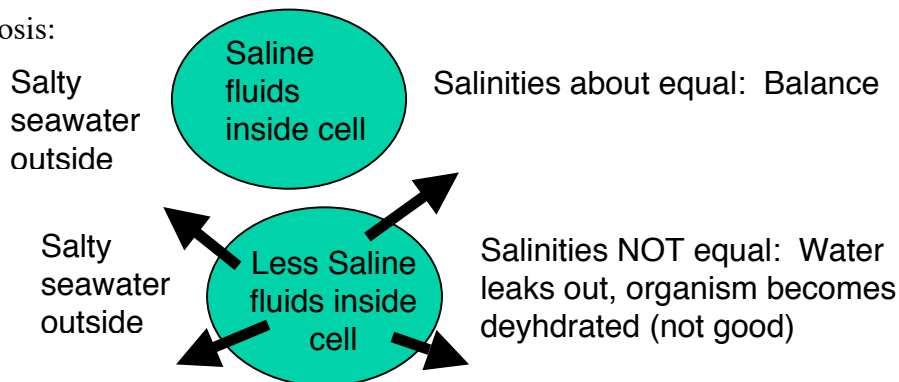
Most marine plants do not need stalks, trunks, etc. Floating is more important.

2. REGULATING BODY FLUID SALINITY

All organisms must maintain roughly constant salinity in internal body fluids ("electrolyte balance"). How does this work in marine animals?

- Invertebrates and sharks -- no problem. Salinity of body fluids (S_{bf}) is similar to sea-water salinity (S_{sw}): $S_{bf} \sim S_{sw}$

Osmosis:



Bony fish -- Body-fluids less saline than seawater (Why? Body-fluid chemistry inherited from ancestors adapted to brackish estuarine environments.)

Water diffuses out of cells --> dehydration would ensue except for...

ADAPTATIONS

They drink a lot of sea water and.....

Excrete salt ions preferentially through ...

... gills

... saline urine

ALSO: Some marine fish can migrate into fresh water

-- opposite process needed for fresh water:

- Absorb salt ions from specialized gills
- Excrete large amounts of dilute urine

3. FLOTATION (BUOYANCY)

Adaptations to stay at the surface or some preferred depth

A. Gas pockets:

Internal gas chambers or "floats" (jellyfish, nautilus, cuttlefish)

Flexible swim bladders (most fish)

Active swimmers (some tuna, sharks) and bottom-dwelling fish have no swim bladders.

B. Storage of low-density oils:

Whales, seals: blubber

Fish and sharks: oil stored in organs, e.g. sharks liver

Plankton: store oils in their cells

C. Appendages . . (especially in plankton)

Spines, ruffles, feathery extensions

Increase frictional resistance to sinking

Adaptations of phytoplankton -- why are they the dominant marine "plants" ?

Requirements ..

Sunlight -- must maintain themselves in the photic zone.

Nutrients (N & P) -- low concentration in surface waters,

Strategies:

a) Maximize sunlight exposure

Stay in photic zone

Buoyancy - (oils)

Small size and spines retard sinking

b) Small, single-celled - better use of light

b) Minimize nutrient needs

Small, simple organisms more efficient

-Nutrients in, wastes out by simple diffusion

These strategies for success are best met by very small and simple plants: phytoplankton!