

Jaw Protrusability and Feeding

- Suction feeding
- Ram feeding
- Suction feeding and Jaw Protrusion



Feeding Habits and Gut Morphology

- Feeding Guilds
 - Detritivores
 - Herbivores
 - Carnivores
 - Omnivores
- Most fish euryphagous carnivores, ontogenetic shifts common
- Digestive tract anatomy
 - Low quality prey –
 - High quality prey –

Digestive Tract

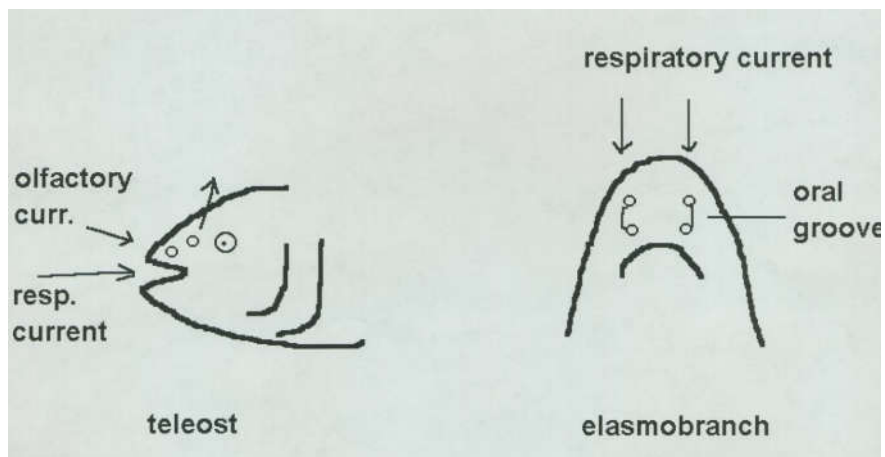
- Esophagus
- Stomach
- Small intestines
 - Pyloric caeca



Chemoreception

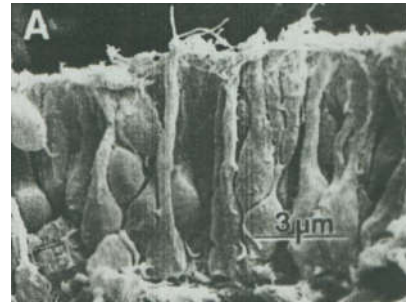
- Olfactory reception

- Taste



Sensory Epithelium

- Composed of:
 - receptor neurons: high densities
 - 25,000/mm² in salmonids
 - 500,000/mm² in cyprinodontids
 - supporting cells
 - basal cells
- Receptor neurons:
 - ciliated – 8 cilia
 - microvillous – 80 microvilli



Taste

- Taste buds
 - Detection limits:
 - *Pimephales* - p-chlorophenol <0.0005 ppm
 - *Oncorhynchus* - morpholine 1x10⁻⁶ ppm
 - Catfish - amino acids 10⁻⁷ – 10⁻⁹ ppm
- Palatal organ:
- Elasmobranchs:
- Examples:

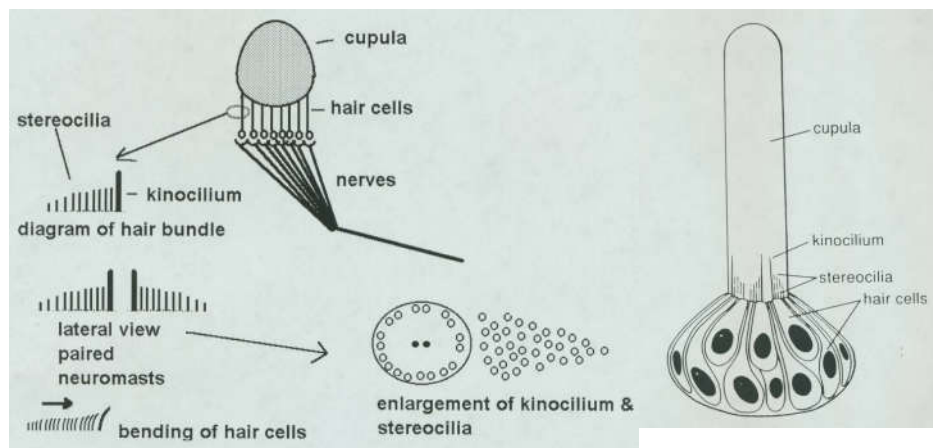


Chemoreception Examples

- Salmon imprinting of natal stream, return migration
- Recognize smell of juveniles (Pheromone hypothesis) for parental care
- Kin recognition, mitigates aggressive interactions
- Schooling aggregation
- Schreckstoff
- Food location
 - Ion concentrations detected by gill parasite catfish
 - sharks

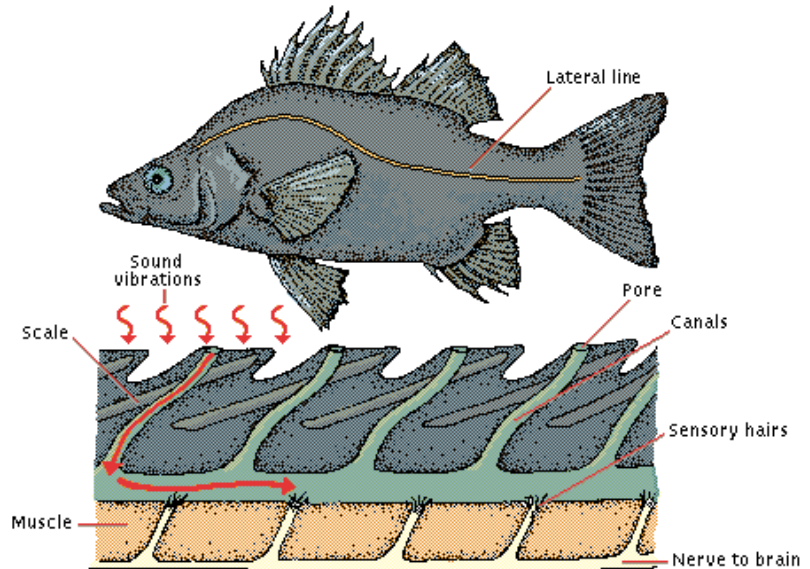
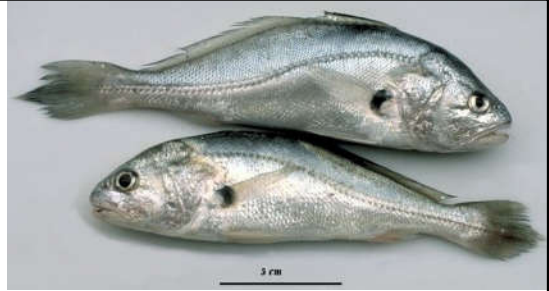
Detecting sound, vibration and water movement

- Lateral line
 - Neuromasts –
 - Cupula –



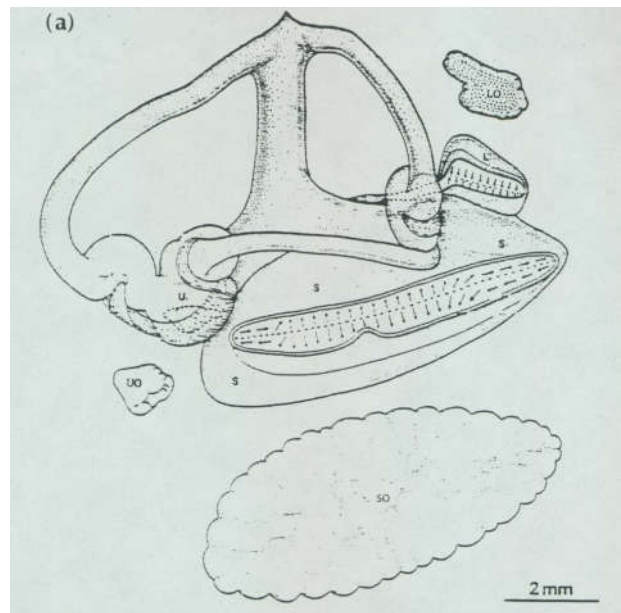
Variability in lateral line

- Jawless fishes:
- Open vs Closed Canals:
- Habitat indicator



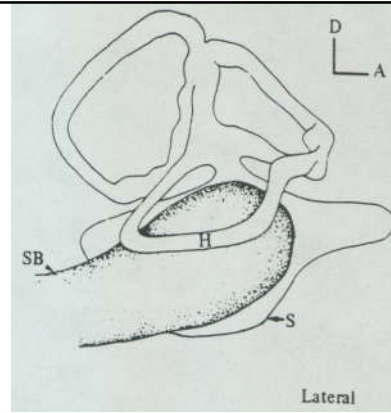
Inner ear

- Embryologically related to the lateral line
- Two parts:
 - semicircular canals
 - otolith organs
- Perception



Swim bladders and hearing

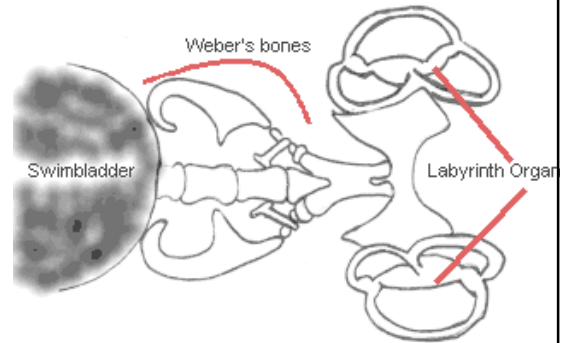
- Swim bladder as hearing receptor
 - Clupeidae - hollow ducts extend from gas bladder to inner ear



- Elephant fish have gas bubble in head

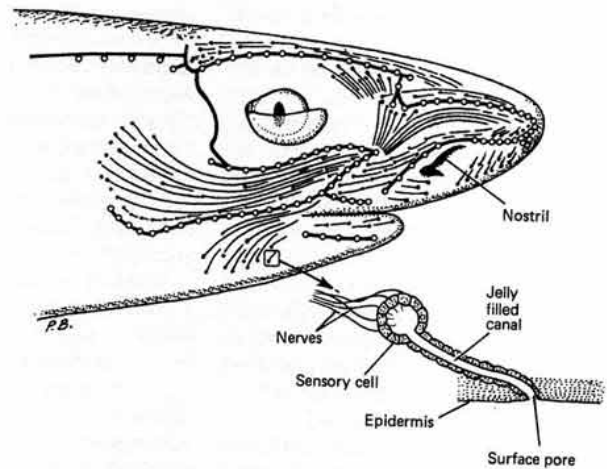


- Weberian apparatus
 - Otophysan fishes (e.g., catfish, minnow)
 - Connected to air bladder



Electroreception

- External pit organs on teleosts
- Ampullae of Lorenzini



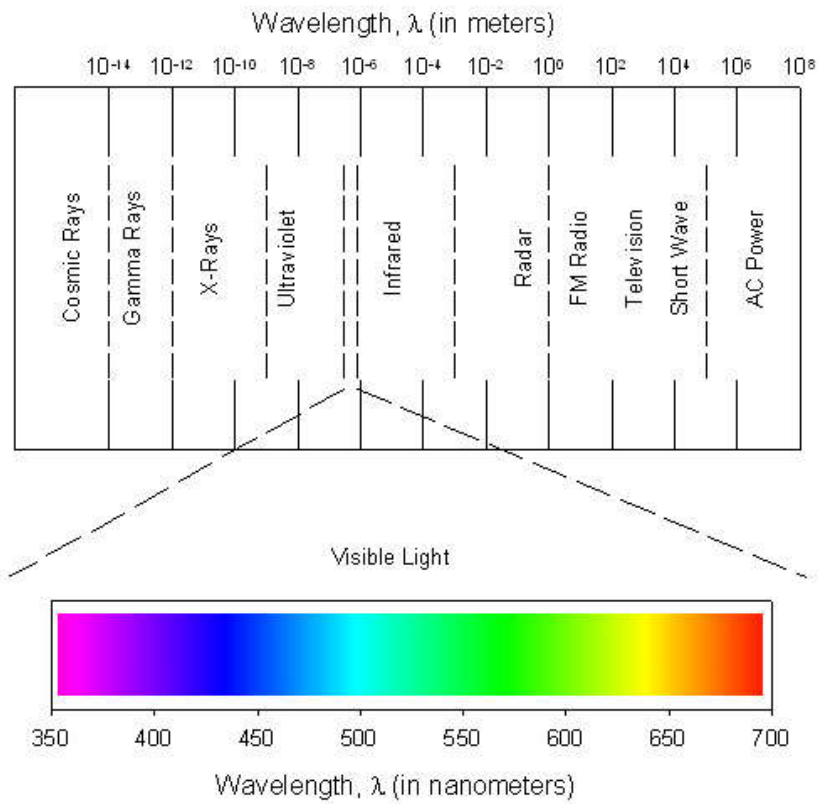
- Weakly electric fishes - gymnotiformes



- Communication, prey detection, navigation



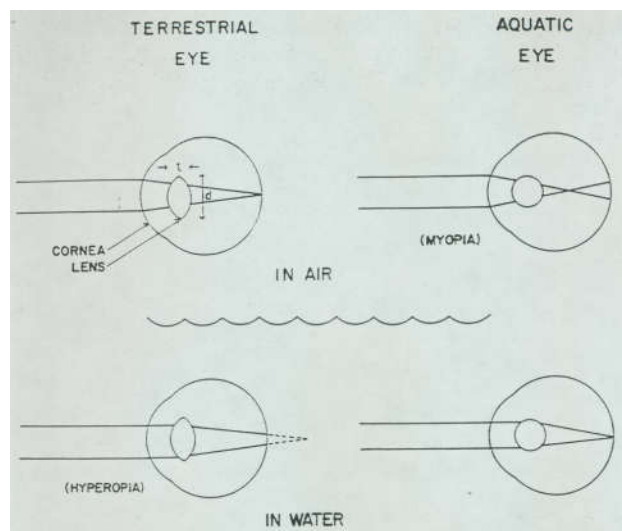
Electromagnetic Spectrum



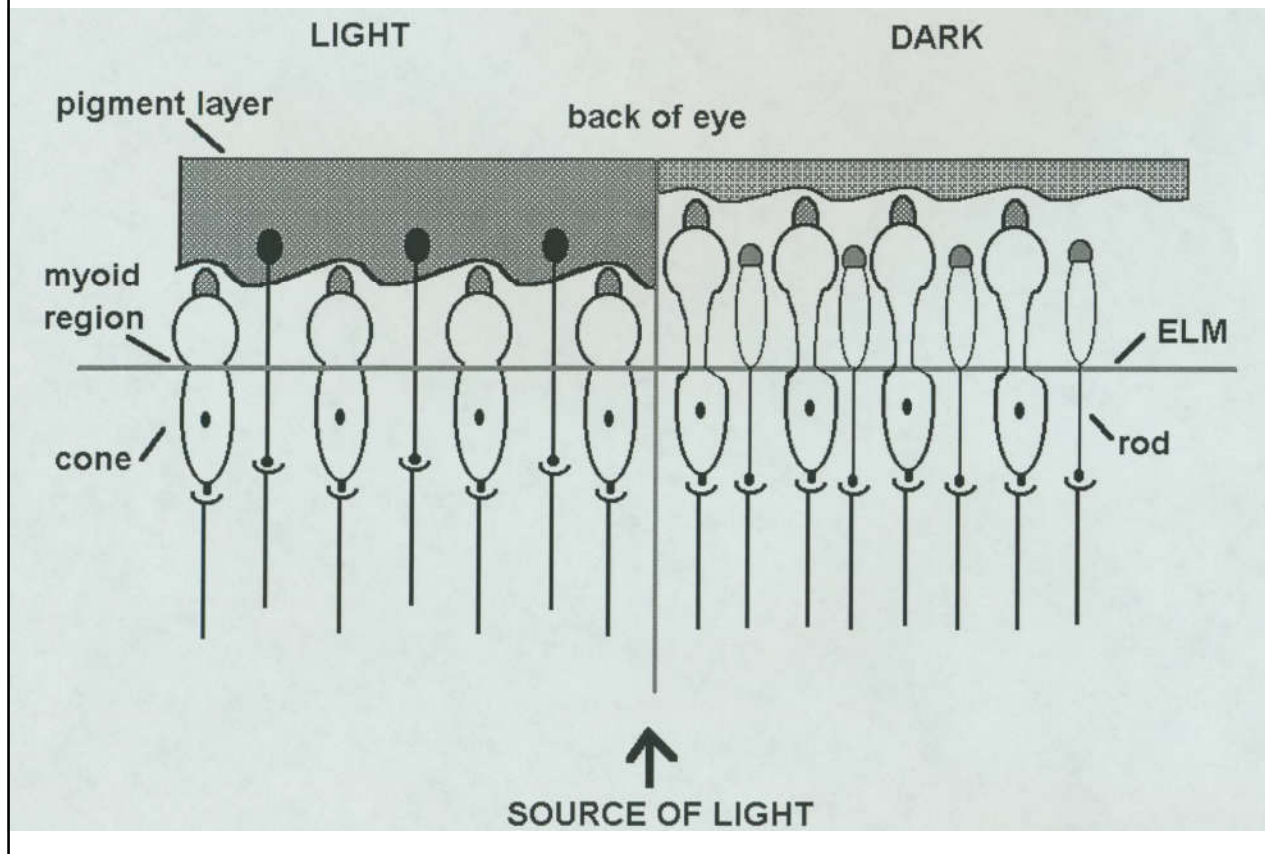
- In some ways, fish vision is better than our own.
- UV, tetrachromic vision in some species

Fish vs Terrestrial Eyes

- Focusing
- Pupils
- Other structures



Rods, cones, photomechanical movement and light accommodation



Reproduction

- Gender System
 - Gonochoristic
 - Gynogenic
 - Hermaphroditic
 - Simultaneous
 - Sequential
 - Protandrous
 - Protogynous
- Sex determination
 - Genetic
 - Environmental
- Mating System
 - Promiscuous
 - Monogamy
 - Polyandry
 - Polygyny
- Secondary traits
 - Monomorphic
 - Dimorphic
 - Seasonally dimorphic
 - Permanently dimorphic
- Number of reproductive acts
 - Semelparous
 - Iteroparous

Reproduction continued

- Site of fertilization
 - Internal
 - External
- Fate of Eggs
 - No parental care
 - Broadcast spawners
 - Pelagic
 - Benthic
 - Brood hiders
 - Eggs guarded
 - Substrate spawners
 - Nest builders
 - Bearers
 - Internal bearers
 - Ovovivipary
 - Vivipary
 - External bearers