

Group #1: Animals and Electromagnetism

1. There are dozens of examples in nature, it is everywhere
 - a. Focus on **electroreception** and **magnetoreception**
 - i. Electroreception – The ability to detect external electric fields
 - ii. Magnetoreception – The ability to sense changes in a magnetic field to perceive direction/position (i.e. to navigate)
2. History
 - a. Human recognition of electric animals dates back to Egyptian times
 - b. Understanding of electromagnetism in animals has only come about during the last several decades (magnetoreception less understood than electroreception)

Electroreception in Animals

1. All senses rely on variations in voltage in response to chemical and environmental stimuli
2. Most animals have sight, smell, taste, touch and hearing. A select few have the electric sense
3. Typical in aquatic animals due to high conductivity of water compared to air
4. Electric organ is found in all fish which generate electric discharges
 - a. This organ works like a large capacitor
5. Strongly electric fish generate electricity for hunting/defense (electric eel, catfish, rays...)
 - a. Some strongly electric fish also use electricity for active electrolocation
6. Weakly electric fish generate electric fields to detect objects, prey, communicate etc.
 - a. Mormyrids are best example: use mormyromast for active electrolocation and can determine object position, distance, size, shape, composition and organic nature
7. Passive electroreception is used by sharks, monotremes and other animals to detect prey
 - a. Relies on varying charges between prey and environment which creates E-fields

Magnetoreception in Animals

1. The earth's magnetic field and its protective magnetosphere make life on earth possible
2. The ability to detect the earth's magnetic field is surprisingly common in the animal world
 - a. All 5 classes of vertebrate and many classes of invertebrate have species capable of magnetoreception
3. The magnetic sense
 - a. Used as a cue for guiding movements over both long and short distances
 - b. Different animals have different levels of magnetic competence (e.g. magnetic compass, magnetic map)
 - c. Magnetoreceptor: "A biological structure that can transduce the strength and/or orientation of the local magnetic field to an animal's nervous system"
4. How do animals detect the magnetic field?
 - a. This question is currently stumping scientists and has resulted in numerous studies in the past decade
 - b. The weakness of the magnetic field helps to limit the types of possible detection mechanisms
 - c. There are currently 3 proposed mechanisms for how animals detect the B-field:
 - i. Biogenic magnetite
 - ii. Electromagnetic Induction
 - iii. Chemical magnetoreception