SENSORY SYSTEMS (Windows to the World)

MECHANORECEPTORS [tactile (tangoreceptors), vibration (vibroreceptors), currents (rheoreceptors), pressure (baroreceptors), sound (phonoreceptors), gravity (statoreceptors)]

I. Free Nerve Endings

Invertebrates, e.g. in integument

Vertebrates, e.g. dermal "plexus"

II. Neurons with terminal specializations

Invertebrates, e.g. cilia, bristles between epidermal cells, on antennae

III Sensilla

A. Cutaneo-neural (hair organs, setae, corpuscles, hair-follicle organs)

B. Proprioreceptors

C. Statoreceptors (statocysts, air-bubble statoreceptors, semi-circular canals)

D. Phonoreceptors (typanal organs, Johnston's organ, lateral line system, ears)

CHEMORECEPTORS [contact chemoreceptors (gustatory, taste receptors), distance chemoreceptors (olfactory, smell receptors)]

I. Free Nerve Endings (invertebrates)

II. Specialized Neurons, e.g. osphradium, tentacles

III. Sensilla

A. Hair organs

B. Taste-buds

C. Olfactory Epithelium (e.g. Jacobson's organ)

THERMORECEPTORS

I. Free Nerve Endings (?)

II. Sensilla (peg organs, pit organs, corpuscles)

PHOTORECEPTORS

I. On-off fibers

II. Sensilla

A. Directional Indicators (focusing device) e.g., stigma, ocelli

B. Image-forming (cornea, lens, retina)

1. Simple eyes

2. Compound eyes

GALVANORECEPTORS

Classification

1. Passive (e.g. ampullary)

Food location, navigation

2. Active (e.g. Tuberous)

a. Weak

Communication, orientation

b. Strong

As above + predation

Sharks & rays are passive electric fish

Ampullary organ sensitive to low freq. fields (0.1-20 Hz) - 0.005 uV/cm gradient - what a flounders makes at 30 cm. Detect 1.5 V battery across 1500 Km of saltwater.

Gymnotidae & Mormyridae, weakly active electric fish

Tuberous organ sensitive to high freq. fields (50- 5,000 Hz). Self-generated for electro-location & social signals. Can pulse field 300 times/sec.

Electric eels are strongly electric

Current Perspective on Human Olfaction

Two areas of reception

1. Vomeronasal Organ

    a. Associated with pheromone reception

    b. Unique receptors

    c. Axons project to limbic system (innate behavior & emotional responses)

2. Olfactory epithelium patch

    a. 1,000 different receptors (1,000 different genes - human genome only 100,000 genes)

    b. Each olfactory neuron has only one type to receptor

    c. Axons project to cortex (cognitive function)

    d. Perception of 10,000+ odors, thus each odor molecule interacts with several receptor types