49. Molecular Biology of Vision

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Physiological Background

Photoreceptor Membranes and Visual Pigments

Phototransduction

Color Blindness

Retinitis Pigmentosa

Age-Related Macular Degeneration

References

50. Molecular Biology of Olfaction and Taste

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OLFACTION

The mammalian olfactory system possesses enormous discriminatory power.

The initial events in olfaction occur in a specialized olfactory neurepithelium.

Odor discrimination could involve a very large number of different odorant receptors, each highly specific for one or a small set of odorants.

The information generated by hundreds of different receptor types must be organized to achieve a high level of olfactory discrimination.

The sensitivity of the olfactory system is likely to derive from the capacity of the olfactory transduction apparatus to effectively amplify and rapidly terminate signals.

Odorant recognition initiates a second-messenger system leading to the depolarization of the neuron and the generation of action potentials.

Negative feedback mechanisms mediate adaptation of the olfactory transduction apparatus to prolonged or repetitive stimulation.

Alternative second-messenger pathways may be at work in olfactory transduction.

The vomeronasal organ is an accessory chemosensing system that plays a major role in the detection of conspecific chemical cues, also known as pheromones.

Chemosensory neurons of the vomeronasal system are narrowly tuned to specific chemical cues, and utilize a unique mechanism of sensory transduction.

TASTE

Multiple senses, including taste, contribute to our total perception of food.

Taste receptor cells are organized into taste buds.

Sensory afferents within three cranial nerves innervate the taste buds.

Information coding of taste is not strictly according to a labeled line.

Taste cells have multiple types of ion channels.

Salts and acids are transduced by direct interaction with ion channels.

Taste cells contain receptors, G proteins and second-messenger-effector enzymes.

Sweet, bitter and umami involve receptor-coupled second-messenger pathways that are differentially expressed across the gustatory epithelium.

Gustducin is a taste cell-specific G protein closely related to the transducins.

51. Mechanotransduction

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WHAT IS MECHANOTRANSDUCTION?

Utility of mechanotransduction for organisms

Types of mechanotransduction

Unified model for mechanotransduction

MODEL SYSTEMS

Advantages to use of model systems

C. elegans touch receptors

C. elegans polymodal sensory neurons

Drosophila bristle receptors and chordotonal organs

Evolutionary relationships with vertebrate mechanoreceptors

HAIR CELLS

Auditory and vestibular systems: role of hair cells

Basic hair-cell transduction mechanism

Molecular characterization of hair-cell transduction

DEAFNESS

"Deafness gene" approach

Identified genes (focus on Usher genes)

Relationship to transduction (no transduction genes identified yet?)

OTHER VERTEBRATE MECHANORECEPTORS

Cutaneous mechanoreceptors

Baroreceptors

Others

SUMMARY AND FUTURE DIRECTION