Course: Animal Form and Function

COMMUNICATION II: Senses

iii) TASTE

- ✓ The receptors for taste, or gustation are chemoreceptors.
- ✓ They may be on the body surface of an animal or in the mouth and throat.
- ✓ For example, the surface of the mammalian tongue is covered with many small protuberances called **papillae.**
- ✓ In the crevices between the papillae are thousands of specialized receptors called taste buds.
- ✓ Taste buds are barrel-shaped clusters of chemoreceptor cells called gustatory cells and supporting cells.
- ✓ Extending from each receptor cell are gustatory hairs that project through a tiny opening called the taste pore.
- ✓ The four generally recognized taste sensations are **sweet (sugars), sour (acids), bitter (alkaloids), and salty (electrolytes).**

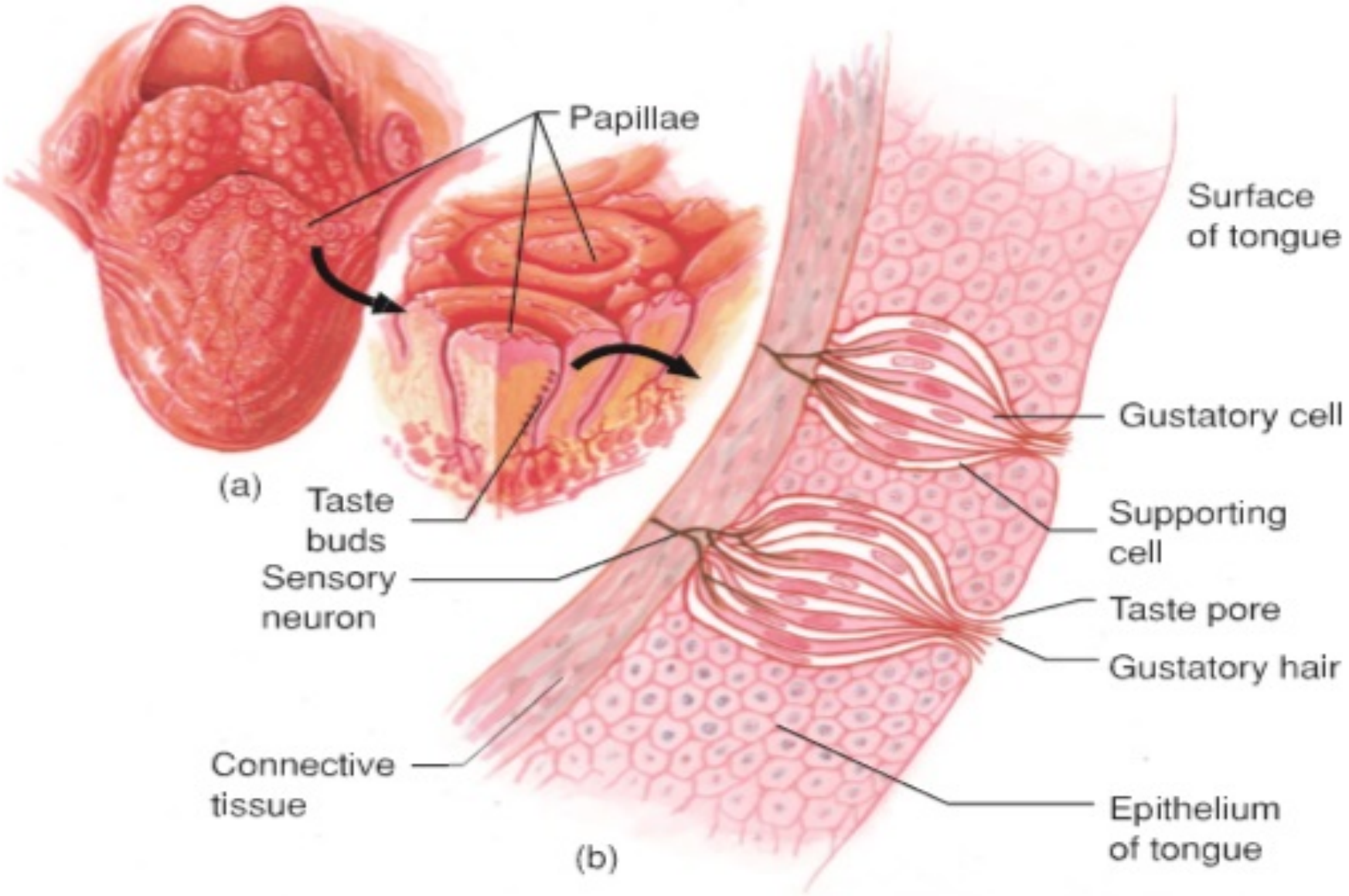

Fig: Taste. (a) Surface view of the human tongue, showing the many papillae and the numerous taste buds between papillae. (b) Supporting cells encapsulate the gustatory cell and its associated gustatory hair.

In fishes and Amphibians

- taste buds may also be found in the skin.

For example,

- ✓ a **sturgeon's taste buds** are abundant on its head projection, which is called the rostrum.
- ✓ In other fishes, taste buds are widely distributed in the roof, side walls, and floor of the pharynx, where they monitor the incoming flow of water.
- ✓ In fishes that feed on the bottom (**catfish, carp, suckers**), taste buds are distributed over the entire surface of the head and body to the tip of the tail.

iv) VISION

Vision (photoreception) is the primary sense that vertebrates in a light-filled environment use, and consequently, their photoreceptive structures are well developed

Structure of vertebrate eye:

- the eyeball has a lens, a sclera (the tough outer coat), a choroid layer and an inner retina.
- The transparent cornea is continuous with the sclera.
- Choroid tissue also extends to the front of the eyeball to form the iris, ciliary body, and suspensory ligaments.
- The iris is heavily endowed with light-screening pigments, and it has radial and circular smooth muscles for regulating the amount of light entering the pupil.
- A clear fluid (aqueous humor) fills the anterior and posterior chambers, which lie between the lens and the cornea.
- The lens is behind the iris, and a jellylike vitreous body fills the vitreous chamber behind the lens. The moist mucous membrane that covers the eyeball is the conjunctiva.

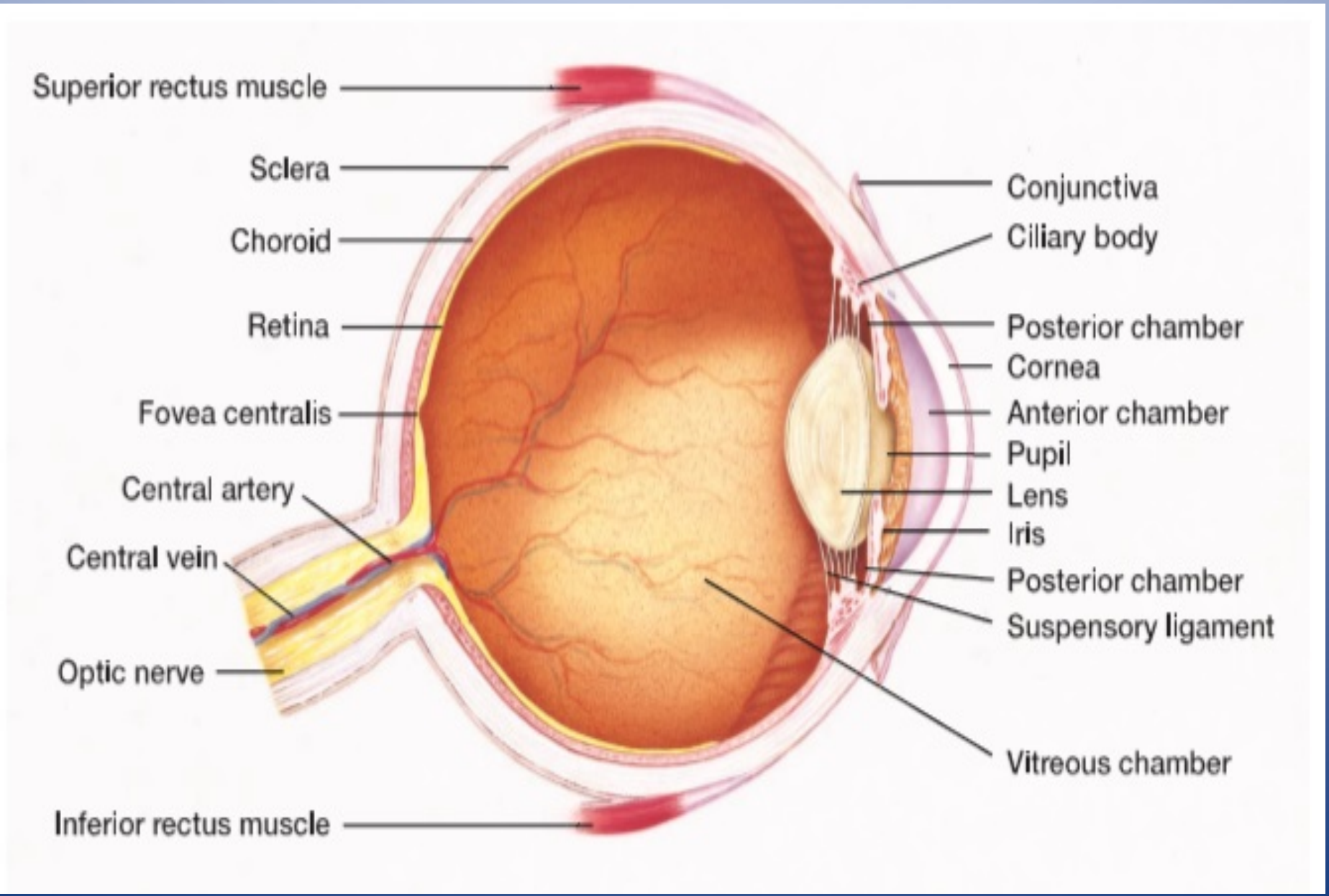

Fig: Internal Anatomy of the Human Eyeball. Light passes through the transparent cornea. The lens focuses the light on the rear surface of the eye, the retina, at the fovea centralis. The retina is rich in rods and cones.

- ✓ Vertebrates can adjust their vision for light coming from either close-up or distant objects. This process of focusing light rays precisely on the retina is called **accommodation**. Vertebrates rely on the coordinated stretching and relaxation of the eye muscles and fibers (the ciliary body and suspensory ligaments) that attach to the lens for accommodation.

In Fishes:

- ✓ The eyes of fishes are similar in most aspects of structure and function to those in other vertebrates.
- ✓ However, fish eyes are lidless,
- ✓ lens is rounded and close to the cornea.
- ✓ Focusing requires moving the lens forward or backward.

In Amphibians

Vision is one of the most important senses in amphibians because they are primarily sight feeders.

For example,

- ✓ the eyes of some amphibians (e.g., anurans, salamanders) are close together on the front of the head and provide the binocular vision and well-developed depth perception necessary for capturing prey.
- ✓ Other amphibians with smaller and more lateral eyes (e.g., some salamanders) lack binocular vision. However, their more laterally placed eyes permit these animals to see well off to their sides.
- ✓ The transparent nictitating membrane (an “inner eyelid”) is movable and cleans and protects the eye

In reptiles

Vision is the dominant sense in most reptiles, and their eyes are similar to those of amphibians.

- ✓ Upper and lower eyelids, a nictitating membrane, and a blood sinus protect and cleanse the surface of the eye.
- ✓ In snakes and some lizards, the upper and lower eyelids fuse in the embryo to form a protective window of clear skin called the **spectacle**.
- ✓ Some reptiles possess a median (parietal) eye that develops from outgrowths of the roof of the optic tectum (midbrain).
- ✓ In the tuatara, the median eye is complete with a lens, nerve, and retina.
- ✓ In other reptiles, the median eye is less developed. Skin covers median eyes, which probably cannot form images.

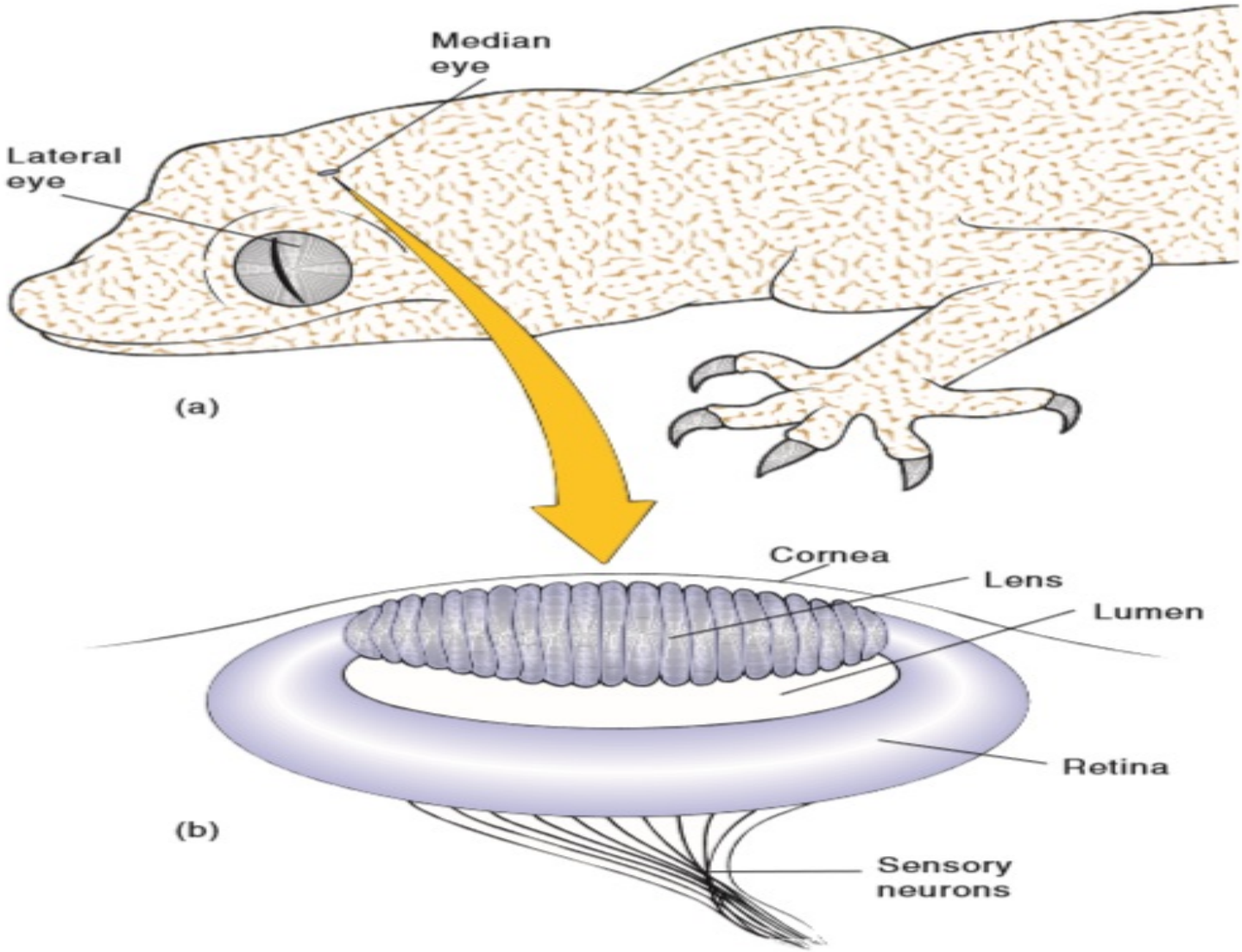

Fig: Median Eye of Reptiles. (a) Median eye in a reptile and its relationship to the lateral eyes (dorsal view). (b) Sagittal section of the median eye.

In birds:

The structure of the bird eye is similar to that of other vertebrates. Birds have a unique, double-focusing mechanism.

- ✓ Padlike structures control the curvature of the lens, and ciliary muscles change the curvature of the cornea.

❑ Structure and function of the retina

- ✓ In all vertebrates, the retina is well developed.
- ✓ Its basement layer is composed of pigmented epithelium that covers the choroid layer.
- ✓ Nervous tissue that contains photoreceptors lies on this basement layer.
- ✓ The photoreceptors are called **rod and cone cells** because of their shape.
- ✓ Rods are sensitive to dim light.
- ✓ cones respond to high-intensity light and are involved in color perception.

❑ Rods:

When a pigment (rhodopsin) in a rod cell absorbs light energy:

- ✓ the energy that this reaction releases triggers the generator potential in an axon and then an action potential that leaves the eyeball via the optic nerve.

When the photoreceptor cells are not being stimulated i.e., in the dark :

- ✓ vitamin A and energy from ATP convert rhodopsin back to its light-sensitive form.

❑ CONES:

- ✓ three types of **cone-shaped, color-sensitive cells** in the retinas of the eyes of primates, birds, reptiles, and fishes.
- ✓ Each type of cone cell responds differently to light reflected from a colored object, depending on whether the cells have **red-, green-, or blue-absorbing pigments.**
- ✓ The pigments are light-absorbing proteins that are particularly sensitive to either the long-wavelength (red), intermediate-wavelength (green), or short-wavelength (blue) region of the visible spectrum.
- ✓ The retinal nerves translate the relative amounts of light that each type of cone absorbs into generator potentials that are then transmitted as a nerve impulse to the brain, where the overall pattern evokes the sensation of a specific hue.