Chapter 9-7: The Ear

The ear is the organ of hearing and balance in the body. The structures of the ear translate vibrations in the air into vibrations in fluid, and then sensory impulses. The sensory impulses are interpreted at the cerebral cortex of the brain. The ear also contains receptors that act to maintain equilibrium; these are located at a different site than are the receptors for hearing.

This plate describes the general structure of the ear. Both internal and external structures are discussed, and we provide some insights into the hearing process.

Notice that this plate shows a cross section of the ear. The ear and its structures make up a complex organ system. As you read about the structures below, locate and color them in the diagram. We use subscript numbers to indicate relationships between various main structures.

The ear is generally discussed according to its three main regions: the **external ear (A)**, the **middle ear (B)**, and the **internal ear (C)**. The brackets that encompass these regions should be colored in bold colors.

The outer ear consists of the visible portion known as the **pinna (D)**, which you should color with a single, light color. Both the pinna and the **external auditory canal (D_1)** collect sound waves and channel them toward the middle ear. A light color is recommended for the canal. At the lowermost portion of the pinna is the familiar **earlobe (D_2)** known as the lobule. Its fatty tissue may be seen within.

We now move to the middle ear and see which structures are responsible for moving air vibrations along to the inner ear. Continue your coloring below as you read.

The partition between the external ear and the inner ear is the **tympanic membrane (E)**, which is also known as the eardrum. Sound vibrations cause the membrane to vibrate, and this membrane also marks the opening to an air-filled space within the **temporal bone (F)**, called the **tympanic cavity (F_1)**. This is the site of the **Eustachian (auditory) tube (G)**. The Eustachian tube leads to the nasopharynx and ensures that equal air pressures exist on both sides of the tympanic membrane (in the ear and atmosphere).

Three important landmarks of the middle ear are the **auditory ossicles (H)**. They include the **malleus (H_1)**, the **incus (H_2)**, and the **stapes (H_3)**. They vibrate in unison with the tympanic membrane and transmit vibrations to the membrane at the opening of the inner ear.

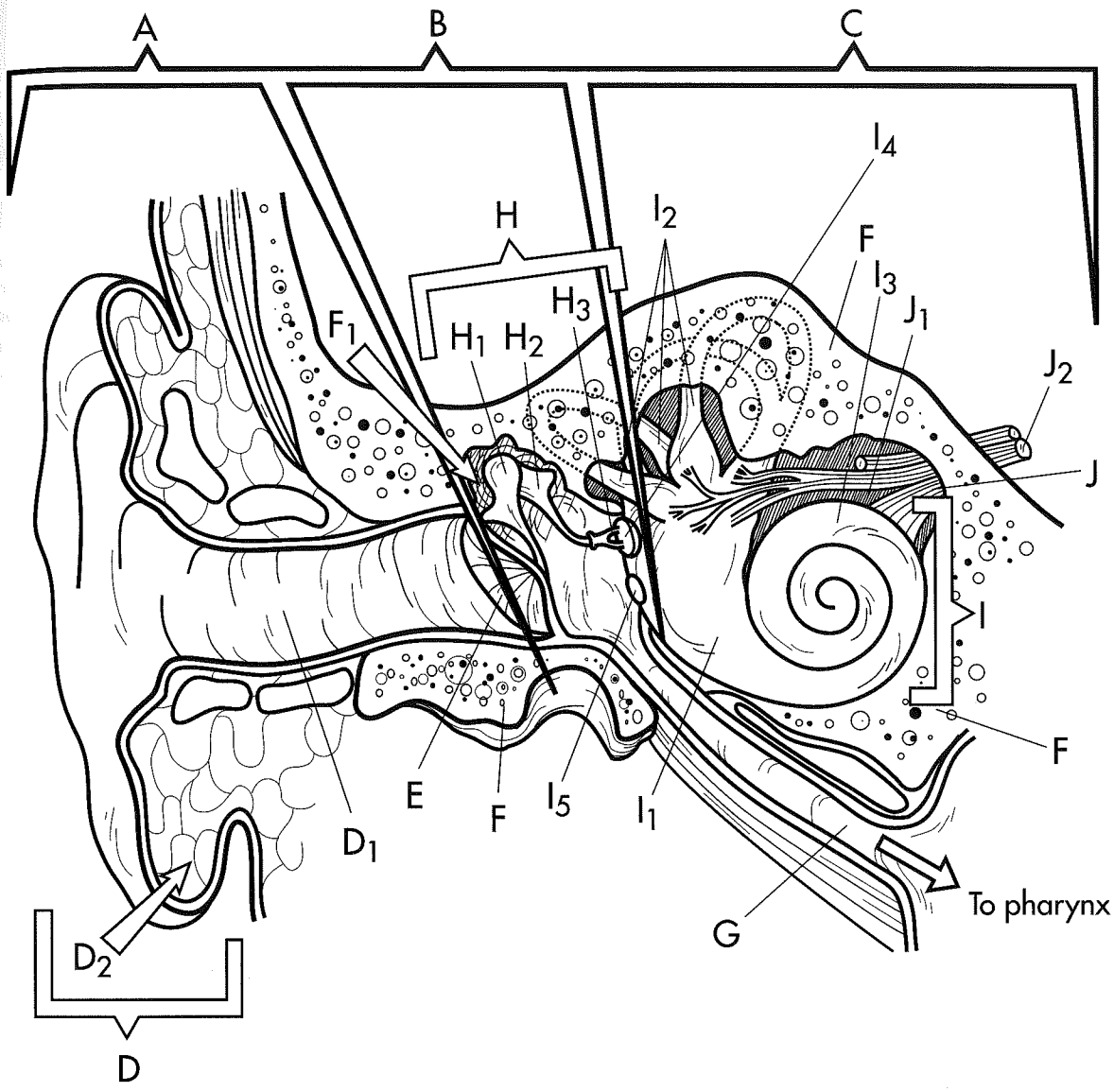
We will now discuss the inner ear. In the inner ear, vibrations are converted into sensory impulses, and equilibrium is maintained as well.

The inner ear contains an intricate network of interconnecting chambers and passages. Its two main parts are the **bony labyrinth (I)**, which is outlined by a bracket, and the membranous labyrinth inside it. Between the bony and membranous labyrinths, there is a vibration-conducting fluid called perilymph.

The bony labyrinth consists of three main parts: the first is the **vestibule (I_1)**, the central chamber that contains fluid-filled sacs that are associated with the sense of equilibrium. As the fluid moves, equilibrium is established. The second part is made up of the three **semicircular canals (I_2)**, which are also filled. The semicircular canals contain tiny hairs that are stimulated by the movement of the head. The brain interprets the information it receives from these canals to determine the rate and direction of movement.

The third structure is the spiral, **coiled cochlea (I_3)**. The cochlea is firmly connected to the stapes (H_3) by a membranous partition called the **oval window (I_4)**. When the auditory ossicles (H) vibrate, the vibrations are transferred to perilymph within the cochlea and as this fluid moves about, the local nerve fibers are stimulated. Sensory impulses arise from this stimulation, and these are sent to the brain. The **round window (I_5)** relieves the pressure exerted at the oval window.

The sensory impulses are transferred through the **vestibulocochlear nerve (J)** to the brain for interpretation. The nerve thus detects sensations for both equilibrium and hearing.



The Ear

- External Ear .....A
- Middle Ear .....B
- Internal Ear C
- Pinna.....D
- External Auditory Canal .....D_1
- Earlobe (Lobule).....D_2
- Tympanic Membrane.....E
- Temporal Bone.....F
- Tympanic Cavity.....F_1
- Eustachian (auditory) Tube .....G
- Auditory Ossicles ....H
- Malleus .....H_1
- Incus .....H_2
- Stapes .....H_3
- Bony Labyrinth I
- Vestibule .....I_1
- Semicircular Canals ..I_2
- Coiled Cochlea.....I_3
- Oval Window .....I_4
- Round Window.....I_5
- Vestibulocochlear Nerve.....J