FIGURE 39 (Continued)
Occasionally, clusters of undifferentiated germinal cells that have failed to migrate can be found adjacent to the ependyma and ventricles (Figure 40). These cell “rests” (neural tube remnants) can sometimes be found in the fourth or lateral ventricles. The cells appear small, round, and dark with minimal cytoplasm. They are sometimes mistaken as a lesion. Another common example of this phenomenon in mice is small clusters of retained external granule cells on the surface of the cerebellum.

**Cell Rests**

Occasionally, clusters of undifferentiated germinal cells that have failed to migrate can be found adjacent to the ependyma and ventricles (Figure 40). These cell “rests” (neural tube remnants) can sometimes be found in the fourth or lateral ventricles. The cells appear small, round, and dark with minimal cytoplasm. They are sometimes mistaken as a lesion. Another common example of this phenomenon in mice is small clusters of retained external granule cells on the surface of the cerebellum.

**SUMMARY**

The general similarity of the anatomy, biochemistry, and physiology of the nervous system among mammals permits rodents to be employed as models of human neurological function and disease. However, the extreme complexity and relatively large size of the human brain and spinal cord relative to the simple form and more primitive function of the mouse counterparts may thwart translational medicine efforts. The best means of ensuring that data extrapolation from mouse to human is performed in a rational manner is for the neuroscientists engaged in mouse studies to understand the equivalent and divergent features of the brain and spinal cord for these two species. This chapter and the references in the Further Reading and Relevant Websites list provide a thorough introduction of the major points needed for such a nervous system comparison.

**ACKNOWLEDGMENTS**

We thank the following individuals for providing illustrations: Sara Samuelson, S. S. Illustrations (sarasamuelson.com); Dr. Robert Garman, University of Pittsburgh; Dr. Noor Kabani, McGill University; and Dr. Robert Switzer of Neuroscience Associates. We also thank Kerrie Allen, Brian Johnson, Meilany Wijaya, Mike Hobbs, Randy Small, Christiane Ullness, Susan Rozelle, Kim Howard, and Chiyen Miller for expert technical assistance. Finally, we thank Dr. Denny Liggitt, Dr. Piper Treuting, and Dr. Thomas Montine for encouragement.
FURTHER READING AND RELEVANT WEBSITES


Toronto Centre for Phenogenomics, Mouse Imaging Centre: http://www.mouseimaging.ca/technologies/C57Bl6j_mouse_atlas.html.


Introduction

The mammalian eye is similar between mice and humans, with most gross and histologic differences due to relative sizing (Table 1). Fixation of the eye and the retina in particular can be challenging due to poor penetration of fixatives through the sclera. In addition, routine formalin fixation can impart numerous artifacts, including separation of the retinal pigment epithelium from the outer segment of the retina. Davidson’s fixative [ethyl alcohol (33%), 37–39% formalin (22%), glacial acetic acid (11.5%), and water (33%)] provides excellent preservation of the retina but is not commonly used by most investigators. Therefore, except where noted, the mouse tissues in this chapter were fixed with 10% neutral buffered formalin. Refer to the Further Reading section for additional methods regarding eye dissection and histologic techniques.

Eye

Gross Anatomy

The average adult mouse eye is approximately 4 mm in diameter. The human eye measures 23.5–25 mm in diameter. In both species, the outer layer of the eye provides structural integrity and consists anteriorly of the optically clear cornea and posteriorly of the opaque sclera. The transition zone between the cornea and sclera is termed the limbus. Posterior to the limbus, the eye consists of three main layers (from external to internal): sclera, uvea, and retina. The space within the eye can be subdivided into three compartments: the anterior chamber, the posterior chamber, and the vitreous cavity (Figure 1–3). The anterior chamber is the space between the iris and cornea. The posterior chamber is the space bound anteriorly by the iris and posteriorly by the lens and anterior vitreous.
face. This space is also filled with aqueous fluid. The vitreous cavity occupies the space between the posterior chamber and the retina. It is filled with vitreous gel. The mouse orbit is composed of eight bones: maxilla, lacrimal, zygomatic, frontal, temporal, sphenoid, ethmoid, and palatine. This differs from humans: the temporal bone serves as the caudal wall in mice, whereas in humans the sphenoid is the principal bone of the caudal wall. The external bony orbit is oval, with the space projecting in a roughly pyramidal manner to a depth of approximately 5 mm. The orbital cavity contains the globe, extraocular muscles, optic nerve, intraorbital lacrimal gland, Harderian gland, blood, lymphatics, and nerves, all within loose fibroadipose connective tissue. The Harderian gland is not present in humans. It is located behind the eye deep within the orbit and is variably colored due to melanocytes and porphyrin pigment (Figures 2, 4, and 5). The

### TABLE 1  Eye

<table>
<thead>
<tr>
<th>Feature</th>
<th>Mouse</th>
<th>Human</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Gross</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Orbital bones</td>
<td>8 bones</td>
<td>7 bones</td>
</tr>
<tr>
<td>Extraocular muscles</td>
<td>7 (4 recti, 2 oblique, 1 retractor bulbi)</td>
<td>6 (4 recti, 2 oblique)</td>
</tr>
<tr>
<td>Harderian gland</td>
<td>Large retrobulbar gland, variably pigmented</td>
<td>Not present</td>
</tr>
<tr>
<td>Lacrimal glands</td>
<td>2 glands (intra- and extraorbital); no accessory glands</td>
<td>2 lobes (palpebral and orbital); accessory glands—Krause and Wolfing</td>
</tr>
<tr>
<td>Nictitating membrane</td>
<td>Present</td>
<td>Plica semilunaris, a fold of conjunctiva at the medial canthus, thought to be a vestige of nictitating membrane</td>
</tr>
<tr>
<td>Conjunctiva</td>
<td>Tarsal, forniceal, bulbar; no caruncle present at medial canthus</td>
<td>Tarsal, forniceal, bulbar; caruncle present at medial canthus</td>
</tr>
<tr>
<td>Cornea</td>
<td>Transparent anterior portion of the globe</td>
<td>Same; 10.5 × 11.5 mm</td>
</tr>
<tr>
<td>Sclera</td>
<td>Tough outer sheath of globe; thickest posteriorly</td>
<td>Same</td>
</tr>
<tr>
<td>Lens</td>
<td>Huge volume (proportion) compared with human</td>
<td>9–10 × 3–6 mm (35 mm³ vs. 5 mm³ vitreous volume)</td>
</tr>
<tr>
<td>Pupil</td>
<td>Round</td>
<td>Same</td>
</tr>
<tr>
<td>Retina</td>
<td>Vascularity radial</td>
<td>Vascularity with arcades</td>
</tr>
<tr>
<td>Optic nerve</td>
<td>Centrally located on globe; leaves orbit inferocaudal position</td>
<td>Nasally located on globe</td>
</tr>
<tr>
<td><strong>Histology</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cornea</td>
<td>5 layers; Bowman’s layer indistinct; thinner stroma (proportionately); stroma is bulk of mass</td>
<td>5 layers; Bowman’s layer prominent</td>
</tr>
<tr>
<td>Sclera</td>
<td>Relatively thin; choroid often seen through sclera anteriorly</td>
<td>Thinnest behind rectus insertions</td>
</tr>
<tr>
<td>Lens</td>
<td>Avascular; posterior capsule is thinnest; epithelium originates at equator</td>
<td>Same</td>
</tr>
<tr>
<td>Iris</td>
<td>Pupillary border of the iris often in contact with anterior lens capsule; iridal layers same as humans but indistinct</td>
<td>Iridial layers: anterior border layer, stroma, muscular layer, posterior pigmented epithelium</td>
</tr>
<tr>
<td>Ciliary body</td>
<td>Posterior ciliary processes attach directly to the sclera; anterior ciliary processes blend with iris</td>
<td>Directly attached to the sclera; distinct separation of iris</td>
</tr>
<tr>
<td>Iridocorneal angle</td>
<td>Iris processes often present</td>
<td>Iris processes infrequently present</td>
</tr>
<tr>
<td>Retina</td>
<td>Lack fovea; dichromatic vision</td>
<td>Fovea; trichromatic vision</td>
</tr>
<tr>
<td>Retinal pigmented epithelium</td>
<td>Yes</td>
<td>Same</td>
</tr>
<tr>
<td>Choroid</td>
<td>Thin pigmented vascular network consisting of 3 layers (from inner to outer): choriocapillaris, stroma, lamina fusca</td>
<td>Proportionately thicker than in mice</td>
</tr>
<tr>
<td><strong>Cells</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Iris clump cells</td>
<td>Contain phagocytized melanosomes that are round and located at root and pupillary margin; numbers vary by strain</td>
<td>Not present</td>
</tr>
<tr>
<td>Dendritic melanocytes</td>
<td>Contain numerous melanosomes; determine iris color; in albino mice, melanosomes lack melanin</td>
<td>Albino humans have variable pigmentation depending on type and subtype of albinism</td>
</tr>
<tr>
<td>Iridial fibrocytes</td>
<td>Not identified</td>
<td>Present</td>
</tr>
<tr>
<td>Rods</td>
<td>95% of photoreceptors</td>
<td>95% of photoreceptors</td>
</tr>
<tr>
<td>Cones</td>
<td>Two types</td>
<td>Three types; highest density at the macula</td>
</tr>
<tr>
<td>Orbital muscles</td>
<td>Skeletal</td>
<td>Same</td>
</tr>
</tbody>
</table>
FIGURE 1  **Horizontal section of human eyeball.** The basic structure of the eye is similar between the two species. The outer layer of the eye provides structural integrity and consists of the cornea anteriorly and the sclera posteriorly. The transition zone between cornea and sclera is termed the limbus. The eye consists of three main layers (from external to internal): sclera, uvea, and retina. The interior space within the eye is subdivided into three compartments: the anterior chamber, the posterior chamber, and the vitreous cavity. The anterior and posterior chambers are filled with aqueous fluid. The vitreous cavity is filled with vitreous gel. Source: © Elsevier, Inc., www.netterimages.com.

Harderian duct opens at the base of the nictitating membrane (sometimes referred to as the “third eyelid”). This membrane, composed of a thin core of cartilage covered by loose connective tissue and conjunctiva, is located between the upper lid and the globe at the medial canthus of the eye. It is very small and only occasionally seen in histologic sections (Figures 6 and 7). Humans lack a nictitating membrane, but they do possess a fold of conjunctiva at the medial canthus.

- **Need-to-know**
  - The mouse eye lacks a fovea centralis.
  - The human eye has a relatively small lens.
Conjunctiva

Gross Anatomy

The conjunctiva is a ring of mucus membrane that lines the posterior lids and anterior eye. The palpebral conjunctiva begins at the lid margin and lines the posterior aspect of the eyelids. It then reflects back on itself to form the dorsal (superior) and ventral (inferior) fornices. The conjunctiva drapes over the anterior surface of the eye as bulbar conjunctiva and inserts at the limbus. In mice, the dorsal fold of conjunctiva is supported by a cartilaginous plate to form the nictitating membrane. In humans, the conjunctiva at the medial canthus forms a small fold termed the plica semilunaris, which is thought to be a vestigial remnant of the nictitating membrane. Just medial to the plica semilunaris is the caruncle, which in humans is a fleshy knob of tissue near conjunctival epithelium that contains adnexal structures including hair follicles, sebaceous glands, and accessory lacrimal glands. Mice lack a caruncle.

Need-to-know

- The mouse lens is relatively larger than that of humans.
- Formalin fixation imparts numerous artifacts to the eye, including retinal separation from the pigmented epithelium and lens fiber shredding.

FIGURE 2  Mouse globe in situ. In this coronal section of decalcified mouse head, the eye is maintained in situ. Note the large and round lens (L) that fills the majority of the vitreous chamber. The Harderian gland (H) is located deep in the posterior orbit. Artifactual shredding of the lens (arrowhead) and separation of the retina (thin arrow) are common in this type of preparation. The nictitating membrane (arrow) is located on the dorsal aspect of the globe. The eyelids and optic nerve are not present in this section. Cornea (C) is indicated.

FIGURE 3  Juvenile human globe with retinoblastoma. Note the flattened and relatively smaller lens (L) of the human. Cornea (C) is indicated.
Normal human and mouse conjunctiva has a stratified nonkeratinizing squamous epithelium that is most notable for goblet cells (Figures 8 and 9). Goblet cells are filled with mucus that contributes to the tear film and that stains with periodic acid–Schiff (PAS), mucicarmine, and alcian blue. Goblet cells are most abundant in the fornices and overlying the plica semilunaris; they are sparse or absent at the limbus. Beneath the conjunctival epithelium lies the substantia propria, which contains vasculature, nerves, mast cells, lymphocytes, and plasma cells. The substantia propria

- **Need-to-know**
  - Humans do not have a Harderian gland.
  - Trauma to the gland from retro-orbital sinus phlebotomy can occur.

**FIGURE 4**  **Harderian gland.** Gross dissection of the orbit with the eye and extraocular muscles removed to expose the retrobulbar Harderian gland (arrow). This structure is unique to mice, located behind the eye deep within the orbit with the ductal opening at the base of the nictitating membrane. This large lobular gland has variable brown coloration due to melanocytes and porphyrin pigment.

**FIGURE 5**  **Harderian gland.** Histologically, the Harderian gland is a branched tubuloalveolar gland lacking distinct ducts. Acini are lined by a single layer of columnar epithelium. The cytoplasm has numerous droplets containing the secretory products, which are lipids and porphyrin. Porphyrin can accumulate within the acinar lumens as a dark-staining laminated material (inset). Note the mild melanosis (arrow).

- **Need-to-know**
  - Female mice in certain strains have increased porphyrin production.
Comparative Anatomy and Histology

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Propria of the conjunctiva also contains lymphoid tissue and lymphatic vessels; this is notable given that the eyeball is not known to possess lymphatic drainage. Dark-skinned humans and pigmented rinse strains may have collections on conjunctival pigment. In humans, the pigment lie in the basal epithelium while mice may have pigment-laden macrophages in the conjunctiva, particularly in the conjunctiva overlying the nictitating membrane.

Gross Anatomy

The cornea is a transparent tissue that, along with the sclera, contributes to the structural integrity and optical properties of the eye.

Histology

The human and mouse cornea are made up of five layers (from anterior to posterior): epithelium, Bowman’s layer, stroma, Descemet’s membrane, and endothelium (Figures 10 and 11). The epithelium is composed of four to seven layers of nonkeratinizing stratified squamous cells. The corneal stem cells that repopulate the epithelial layer are found at the limbus, the transition zone between the cornea and sclera. The epithelium rests on a basement membrane. Posterior to the epithelial basement membrane is Bowman’s layer. Bowman’s layer is not a true basement membrane but is a condensation of stroma made up of acellular type I collagen. If Bowman’s layer has been violated, it will not regenerate. In humans, Bowman’s layer is easily visualized and is 8–14 µm thick; in mice, Bowman’s layer is difficult to see by light microscopy but is readily seen by electron microscopy. Posterior to Bowman’s layer is the corneal stroma, which makes up the bulk of the cornea. Stroma contains collagen fibrils, collagen-producing keratocytes,
and glycosaminoglycans, predominantly keratan sulfate. The collagen fibers are arranged in a regular orientation and spacing that confers optical clarity.

Histologically, the stroma often shows regular lamellar clefting, which is an artifact of processing. The posterior-most layers of the cornea are those of Descemet’s membrane, followed by a

Need-to-know
- The conjunctiva is similar between the two species.

Bowman’s layer is indistinct in mice.

FIGURE 9 Higher power view of mouse conjunctiva. Goblet cells are large and pale-staining.

FIGURE 10 Mouse cornea. The mouse epithelium comprises four to seven layers of nonkeratinizing stratified squamous cells. Bowman’s layer is indistinct in contrast to that of humans. The stroma is the thickest layer in both species and is lined by Descemet’s membrane followed by flat endothelium.

FIGURE 11 Human cornea. The epithelium rests on a basement membrane. Posterior to the epithelial basement membrane is Bowman’s layer (arrow), which is 8–14 µm thick in humans but is much less prominent in mice. The bulk of the cornea is the stromal layer. Clefts are artifacts produced during processing. The internal surface is lined by endothelium.
thin flattened layer of corneal endothelium. Descemet’s membrane is the basement membrane of the corneal endothelium. It contains type IV collagen and thereby stains positive with PAS. Descemet’s membrane is arranged in two layers: An anterior banded zone is laid down in utero and a posterior nonbanded zone is added throughout life. The termination of Descemet’s membrane in the peripheral cornea is thickened (termed Schwalbe’s line) in humans and in some mouse strains. The corneal endothelium is a monolayer of cells that actively transport water from the corneal stroma to the anterior chamber, thereby maintaining the cornea’s optical clarity.

SCLERA

Gross Anatomy

The sclera is the tough, opaque outer layer of the eye that provides it with protection and structural integrity. The sclera transitions anteriorly to become cornea at the limbus and posteriorly into the optic nerve dural sheath (Figures 12 and 13). There are a number of emissarial channels that pierce the sclera, serving as conduits for nerves and vasculature. Episceral nerve loops may be visible in both mice and humans as pigmented spots on the anterior sclera. The extraocular muscles insert into the sclera (Figure 13). The sclera ranges from 0.3 to 1.0 mm thick in humans; the posterior pole is the thickest area, and behind the rectus muscle insertions is the thinnest area. In mice, the posterior sclera is thickest and the anterior sclera very thin, such that the underlying uvea may be visible.

Histology

The sclera has three layers. Episclela is the outermost layer of fibrovascular tissue. Scleral stroma is the middle layer, composed primarily of densely packed type I collagen fibers with a random arrangement that accounts for the opaque white color of sclera. The lamina fusca is the thin innermost layer of collagen fibers connecting the scleral stroma to the uvea.

FIGURE 12 Mouse enucleated eyeball. The mouse sclera (S; limbus marked by dashed line) is so thin that the choroid is visible through it, making the globe appear dark in pigmented strains. Cornea (C) and optic nerve (ON) are indicated.

FIGURE 13 Human enucleated eyeball. The sclera (S; limbus marked by dashed line) is thick and white. Note the insertions of ocular muscles (asterisks). Cornea (C) and optic nerve (ON) are indicated.

Need-to-know

- In contrast to all other mouse orbital muscles that insert on the anterior sclera, the inferior oblique muscle inserts on the posterior sclera, lateral to the optic nerve. This insertion can serve as a histologic landmark in enucleated globes.
UVEA

Gross Anatomy

The uvea consists of three components: iris, ciliary body, and choroid. The iris is a ring of tissue with a central opening forming the pupil; it separates the anterior and posterior chambers. The outer edge of the iris, known as the iris root, inserts into the ciliary body. The ciliary body is a band of tissue approximately 6 or 7 mm wide (in adult humans) located between the iris and sclera. It is divided into two parts: a thicker body (pars plicata) anterior to a flatter body (pars plana). The pars plana of the ciliary body is then continuous with the most posterior component of uvea, the choroid. The choroid extends from termination of the pars plana at the ora serrata to the optic nerve.

Histology

The iris consists of five layers (from anterior to posterior): anterior border layer, stroma, muscular layer, and anterior and posterior pigment epithelial layers (Figures 14–17). The anterior border layer is not a separate layer within the stroma but is a condensation of iris stroma. Iris stroma contains vasculature, nerves, melanocytes, macrophages, and fibrocytes (not reported in mice). In mice, the iris stroma appears empty on routine sections or is obscured by heavy pigment (Figure 14) but contains components of the extracellular matrix and collagen. Iris color is derived from the pigmentation and melanin content of melanosomes within stromal melanocytes. Albino mice and humans both have a normal number of melanocytes. Albino mice have a normal number of melanosomes, whereas albino humans may have a normal or decreased number of melanosomes. Albino mice have decreased melanin within their melanosomes, whereas albino humans may have variable pigmentation depending on the type and subtype of albinism (Figure 16). The pupillary border of the iris is often in contact with the anterior lens capsule; however, aqueous humor is still able to flow in the potential space. The muscular layer includes a circular sphincter muscle near the pupil margin that can constrict and thereby limit the amount of light allowed through the pupil. In addition, the muscular layer contains radial dilator muscles that can expand the pupillary aperture. Immediately posterior to the thin layer of dilator muscles are the anterior and posterior pigment epithelial layers arranged in an apex-to-apex configuration. In mouse eyes, the peripheral iris merges seamlessly with the ciliary body such that ciliary processes may be visible on the anterior aspect of the iris (Figures 18 and 19). In humans, the iris and ciliary body are distinct structures; ciliary processes are infrequently seen on the anterior iris.

The ciliary body in cross section is cylindrical in mice and triangular in humans, and it consists of a double-layered epithelium overlying stroma and muscle (Figures 14 and 15). The double layer of epithelial cells includes an outer (facing the ciliary body stroma) pigmented and inner (facing the vitreous) nonpigmented epithelium contiguous with the retinal pigment epithelium (RPE) and retina, respectively. Zonules arise from the nonpigmented epithelium and insert onto the equatorial lens. The nonpigmented epithelium is also the source of aqueous fluid. The stroma of the pars plicata is vascular, whereas the pars plana is relatively avascular. There are three muscle groups within the ciliary body (from inner to outer): circular, radial, and longitudinal muscle fibers. These muscles help to control the tension on zonular fibers extending from the ciliary processes to the crystalline lens, thereby facilitating the focusing of the lens to near objects (accommodation). Mice lack the ability to accommodate; this is visible histologically in their small, cylindrical ciliary bodies that lack circular fibers. The longitudinal muscle fibers connect to the scleral spur (anterior to the ciliary body), providing one of the main attachments of the uvea to the sclera.

The choroid is a thin pigmented vascular network consisting of three layers (from inner to outer): choriocapillaris, stroma, and lamina fusca. The choriocapillaris provides nutrients to the RPE and outer third of the retina. The choroidal stroma is proportionally thinner in mice than in humans, and contains dendritic melanocytes, fibroblasts, and mast cells (Figures 16 and 17). The choroidal
FIGURE 14  **Mouse ciliary body and iris (arrow) from a pigmented strain.** Note the small cylindrical shape and the seamless merging of the peripheral iris with the anterior ciliary body process. Mice lack the ability to accommodate; this is visible histologically in their small, cylindrical ciliary bodies, which lack circular muscle fibers.

FIGURE 15  **Human ciliary body and iris.** The human ciliary body is triangular and consists of a double layer of epithelium overlying stroma and three muscle groups within the ciliary body: circular (innermost), radial, and longitudinal (outermost) muscle fibers. Note the clear separation between the posterior iris and ciliary body (arrow).

**Need-to-know**
- The mouse ciliary body anteriorly merges with the iris.
- Mice cannot accommodate.
- Mice have thin iris stroma that may be obscured in pigmented strains by iris clump cells and dendritic melanocytes.

FIGURE 16  **Mouse iris from a nonpigmented strain.** Contrast this with the iris shown in Figure 14. The anterior chamber (AC) and posterior chamber (PC) are indicated.

FIGURE 17  **Human iris with abundant stroma.** The anterior chamber (AC) and posterior chamber (PC) are indicated.
vascularity is supplied by the long and short posterior ciliary arteries and the anterior ciliary arteries; drainage occurs via the vortex vessels. The vortex vessels and optic nerve provide additional points of attachment between uvea and sclera. The lamina fusca serves as a thin weblike attachment between the choroid and sclera.

### Angle

#### Histology

The iridocorneal angle (Figures 18–21) at the base of the iris is attached to the peripheral cornea and sclera, and is the site of aqueous humor drainage. Its anterior border is Schwalbe’s line at the trabecular meshwork (TM). This meshwork contains numerous trabecular beams composed of cores of collagen surrounded by flat endothelium. Mice have fewer beams compared to humans; however, in the posterior meshwork, mouse beams are more tightly packed. In mice, numerous iris processes may be present extending from the iris root to Schwalbe’s line. These iris processes are only infrequently seen in humans. Aqueous fluid filters through the TM into Schlemm’s canal. This circular canal just outside the TM is lined by endothelial cells and in turn empties into external collector channels. These collector channels transmit fluid that ultimately exits via the venous outflow of the eye. In mice, smooth muscle bundles mark the posterior aspect of the canal.

#### Need-to-know

- In mice, the iris may be in contact with the anterior lens capsule.

### Lens

#### Gross Anatomy

The round mouse lens is proportionately larger than the human lens, occupying nearly 75% of the eye (Figures 2 and 22). In adult humans, the biconvex lens is approximately 9 or 10 mm in diameter and approximately 3.5 mm in anterior–posterior depth (Figures 3 and 23). The lens of both species is avascular and aneural, and it is surrounded by a lens capsule that is twice as thick anteriorly as posteriorly. The lens is suspended by zonular fibers extending from the crypts between ciliary processes to the mid-equatorial lens capsule. Because lens fibers are continuously produced, the lens increases in size throughout life. As new lens fibers are laid down on top of old, the central lens (nucleus) contains the oldest fibers produced

in utero, whereas the peripheral lens (cortex) has the newest lens fibers.

The lens structure is similar between the two species. The anterior capsule is thicker than the posterior capsule (Figures 24 and 25). The zonular fibers insert into the mid-equatorial lens capsule as described previously. The lens epithelium is a monolayer of cuboidal cells located just below the anterior and equatorial lens capsule where the cells are columnar. The lens epithelial cells located at the lens equator continue to divide and produce lens fibers throughout life, with mitotic figures sometimes present. Epithelial cells are not present posterior to the lens equator under normal conditions. The central lens fibers, which are the oldest, lack nuclei and have few intracellular organelles.

**Need-to-know**
- The mouse has a large, round lens.

**Histology**

The lens structure is similar between the two species. The anterior capsule is thicker than the posterior capsule (Figures 24 and 25). The zonular fibers insert into the mid-equatorial lens capsule as described previously. The lens epithelium is a monolayer of cuboidal cells located just below the anterior and equatorial lens capsule where the cells are columnar. The lens epithelial cells located at the lens equator continue to divide and produce lens fibers throughout life, with mitotic figures sometimes present. Epithelial cells are not present posterior to the lens equator under normal conditions. The central lens fibers, which are the oldest, lack nuclei and have few intracellular organelles.

**Vitreous**

**Gross Anatomy**

The vitreous is primarily (99%) composed of water; the remainder is collagen (types II and IX), glycosaminoglycans, glycoproteins, and soluble proteins. The vitreous chamber is relatively smaller in mice and mainly occupied by the large lens (Figures 2 and 3).

**Histology**

Due to the high water content, the vitreous chamber appears empty. The volume of vitreous in mice is