Retina

Basic Knowledge

The retina is the *innermost* of three successive layers of the globe. It comprises two parts:

- A **photoreceptive part (pars optica retinae)**, comprising the first nine of the 10 layers listed below.
- A **nonreceptive part (pars caeca retinae)** forming the epithelium of the ciliary body and iris.

The pars optica retinae merges with the pars ceca retinae at the *ora serrata*.

Thickness of the retina (Fig. 12.1)

Layers of the retina: Moving inward along the path of incident light, the individual layers of the retina are as follows (Fig. 12.**2**):

1. Inner limiting membrane (glial cell fibers separating the retina from the vitreous body).
2. Layer of optic nerve fibers (axons of the third neuron).
3. Layer of ganglion cells (cell nuclei of the multipolar ganglion cells of the third neuron; “data acquisition system”).
4. Inner plexiform layer (synapses between the axons of the second neuron and dendrites of the third neuron).
5. Inner nuclear layer (cell nuclei of the bipolar nerve cells of the second neuron, horizontal cells, and amacrine cells).
6. Outer plexiform layer (synapses between the axons of the first neuron and dendrites of the second neuron).
7. Outer nuclear layer (cell nuclei of the rods and cones = first neuron).
8. Outer limiting membrane (sieve-like plate of processes of glial cells through which rods and cones project).
9. Layer of rods and cones (the actual photoreceptors).
10. Retinal pigment epithelium (a single cubic layer of heavily pigmented epithelial cells).

11. Bruch's membrane (basal membrane of the choroid separating the retina from the choroid).

Thickness of the retina.

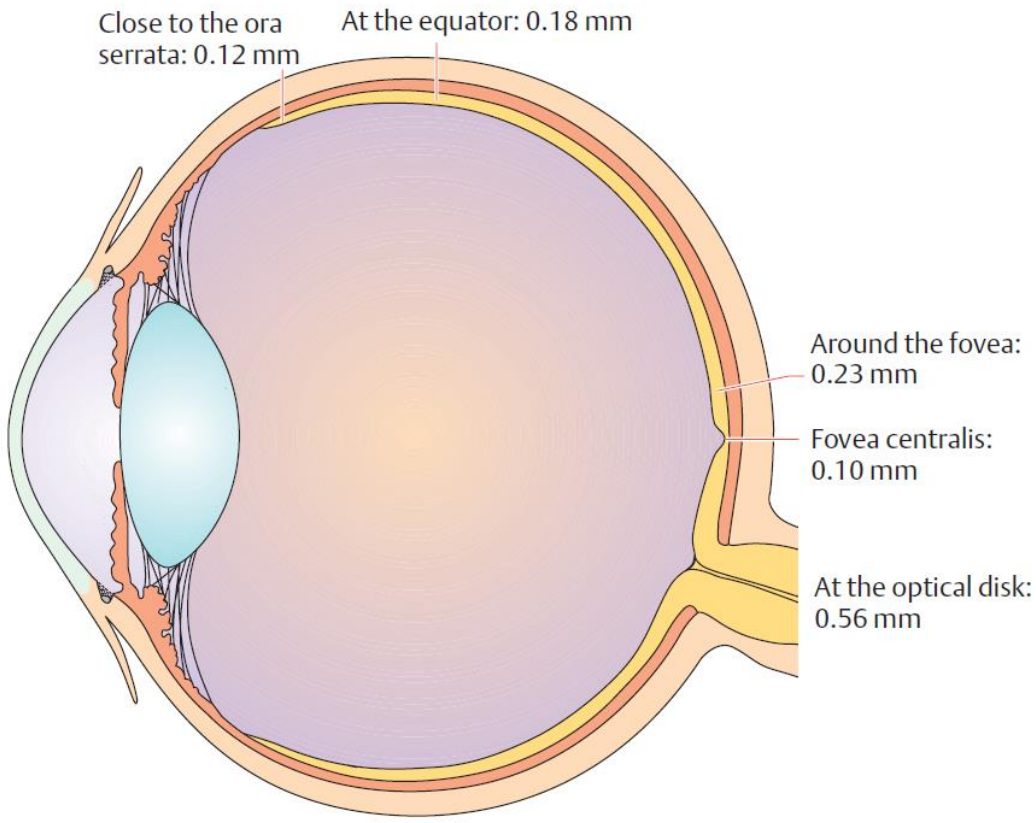


Fig. 12.1 Retinal tears most often occur close to the ora serrata.

Macula lutea: The macula lutea is a flattened oval area in the center of the retina approximately 3–4mm (15 degrees) temporal to and *slightly below* the optic disk. Its diameter is roughly equal to that of the optic disk (1.7–2 mm).

The macula appears *yellow* when examined under green light, hence the name macula lutea (yellow spot). Located in its center is the avascular fovea centralis, the point at which visual perception is sharpest. The fovea centralis contains only cones (no rods) each with its own neural supply, which explains why this region has such distinct vision. Light stimuli in this region can directly act on the sensory cells (first neuron) because the bipolar cells (second neuron) and ganglion cells (third neuron) are displaced peripherally.

Vascular supply to the retina: The **inner layers** of the retina (the inner limiting membrane through the inner nuclear layer) are supplied by the central artery of the retina. This originates at the ophthalmic artery, enters the eye with the optic nerve, and branches on the inner surface of the retina. The central artery is a genuine artery with a diameter of 0.1mm. It is a terminal artery without anastomoses and divides into four main branches (see Fig. 12.**8**). Because the central artery is a terminal artery, occlusion will lead to retinal infarction.

The **outer layers** (outer plexiform layer through the pigment epithelium) contain no capillaries. They are nourished by diffusion primarily from the richly supplied capillary layer of the choroid. The **retinal arteries** are normally *bright red,* have bright red reflex strips (see Fig. 12.**8**) that become paler with advancing age, and do not show a pulse. The **retinal veins** are *dark red* with a narrow reflex strip, and may show spontaneous pulsation on the optic disk.

Pulsation in the retinal veins is normal; pulsation in the retinal arteries is abnormal.

The walls of the vessels are transparent so that only the blood will be visible on ophthalmoscopy. In terms of their structure and size, the retinal vessels are arterioles and venules, although they are referred to as arteries and veins.

Venous diameter is normally 1.5 times greater than **arterial diameter**. Capillaries are not visible.

Nerve supply to the retina: The neurosensory retina has no sensory supply.

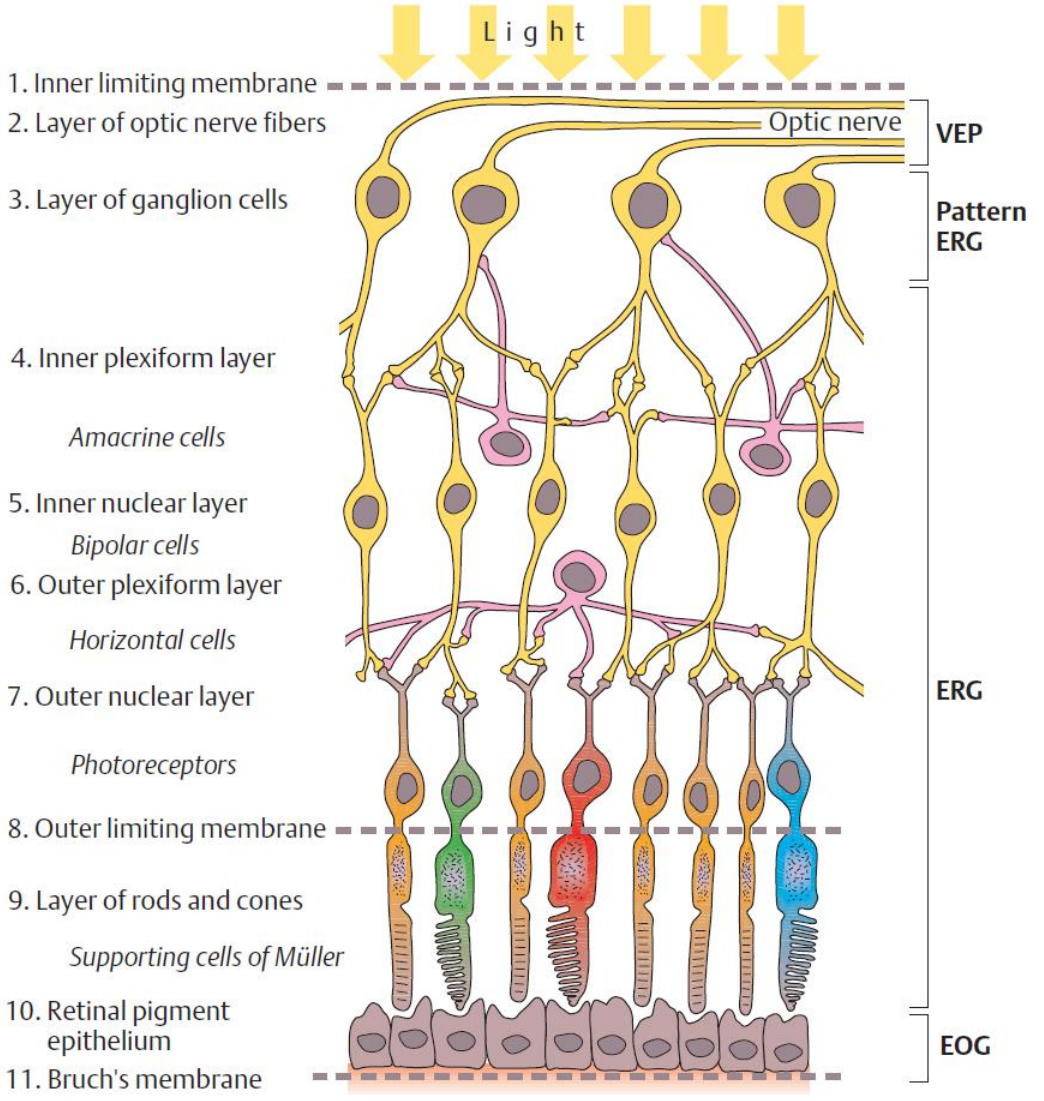
Disorders of the retina are painless because of the absence of sensory supply.

Light path through the retinal layers: When electromagnetic radiation in the visible light spectrum (wavelengths of 380–760 nm) strikes the retina, it is absorbed by the photopigments of the outer layer. Electric signals are created in a multi-step photochemical reaction. They reach the photoreceptor synapses as action potentials where they are relayed to the second neuron.

The signals are relayed to the third and fourth neurons and finally reach the visual cortex.

Light must pass through three layers of cell nuclei before it reaches the photosensitive rods and cones. This inverted position of the photoreceptors is due to the manner in which the retina develops from a diverticulum of the forebrain.

Histology and function of the layers of the retina.



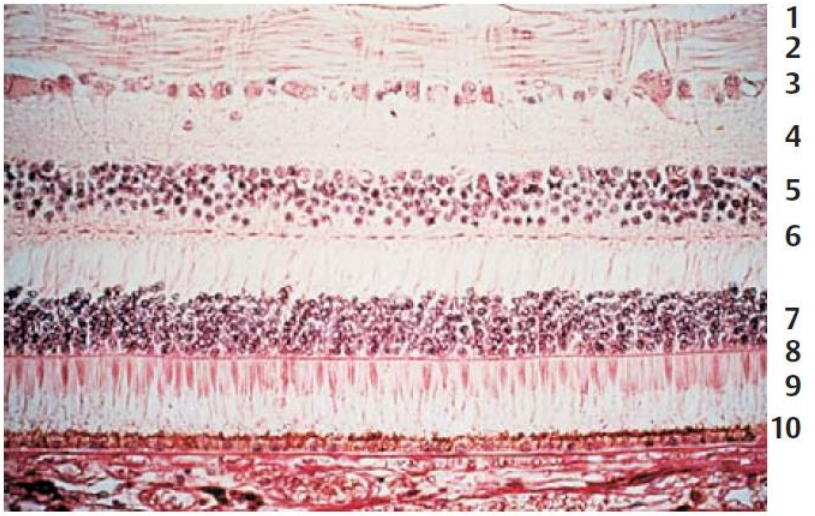


Fig. 12.2