جامعة المستقبل

كلية التقنيات الصحية والطبية

قسم تقنيات البصريات

First Stage 2023-2024

Anatomy of The Eye

Practical Lecture Title

Lens - Transparent Media

Lecture Number: 6 / course 2

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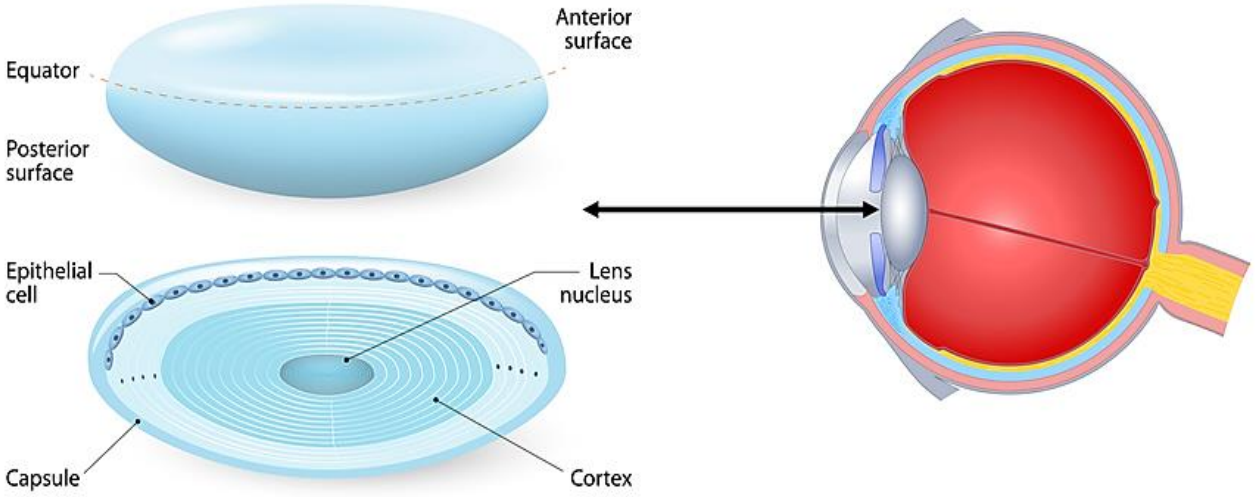
OPTOMETRIST

عدسة العين LENS

The lens of the eye is a transparent, biconvex structure located behind the iris and pupil. It plays a crucial role in focusing light onto the retina for clear vision.



1. Structure

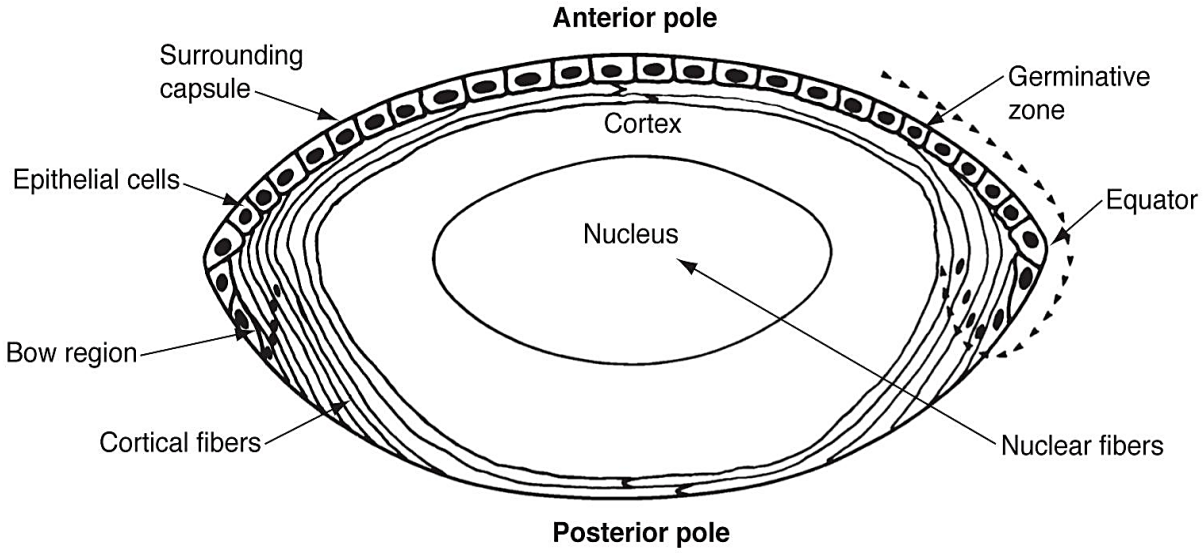
A. **Lens capsule**: This is the outermost layer of the lens, made up of a thin, transparent basement membrane that completely surrounds the lens fibers.

B. **Lens epithelium**: This is a single layer of cuboidal cells that cover the anterior surface of the lens capsule.

C. **Lens cortex**: This is the outer region of the lens, composed of concentric layers of relatively young and newly formed lens fibers.

D. **Lens nucleus**: This is the central region of the lens, composed of the oldest and most compacted lens fibers. These fibers have a higher refractive index than the cortex, contributing to the overall refractive power of the lens.

E. Zonular fibers: These are thin, fibrous strands that attach the lens capsule to the ciliary body of the eye. They play a crucial role in changing the shape of the lens during accommodation, which is the process of focusing on objects at different distances.



2. Shape: The lens has a biconvex shape, meaning it is curved on both sides. This curvature allows for the refraction and focusing of light rays onto the retina.

3. Accommodation: The ability of the lens to change its shape is called accommodation. This process is facilitated by the ciliary muscles, which are connected to the lens by suspensory ligaments (zonules). When these muscles contract, the tension on the lens is reduced, allowing it to become more rounded and increase its refractive power for near vision.

4. **Refractive power**: The lens accounts for approximately one-third of the eye's total refractive power (i.e., 18-22 D), which is the ability to bend light rays and focus them onto the retina. The cornea contributes to the remaining two-thirds of the refractive power.

5. **Refractive index**: The refractive index of the lens in the human eye varies across its different regions:

   - ✓ Lens cortex: The refractive index of the lens cortex (the outer layers) about 1.386
   - ✓ Lens nucleus: The refractive index of the lens nucleus (the central region) is higher than the cortex, about 1.406

6. **Transparency**: The lens is transparent, allowing light to pass through unobstructed. This transparency is maintained by the precise arrangement of lens fibers and the absence of blood vessels or pigmentation within the lens.

7. **Aging and cataracts**: As people age, the lens can gradually become less flexible and lose its transparency, leading to conditions like presbyopia (age-related farsightedness) and cataracts (clouding of the lens).

TRANSPARENT MEDIA الأوساط الشفافة

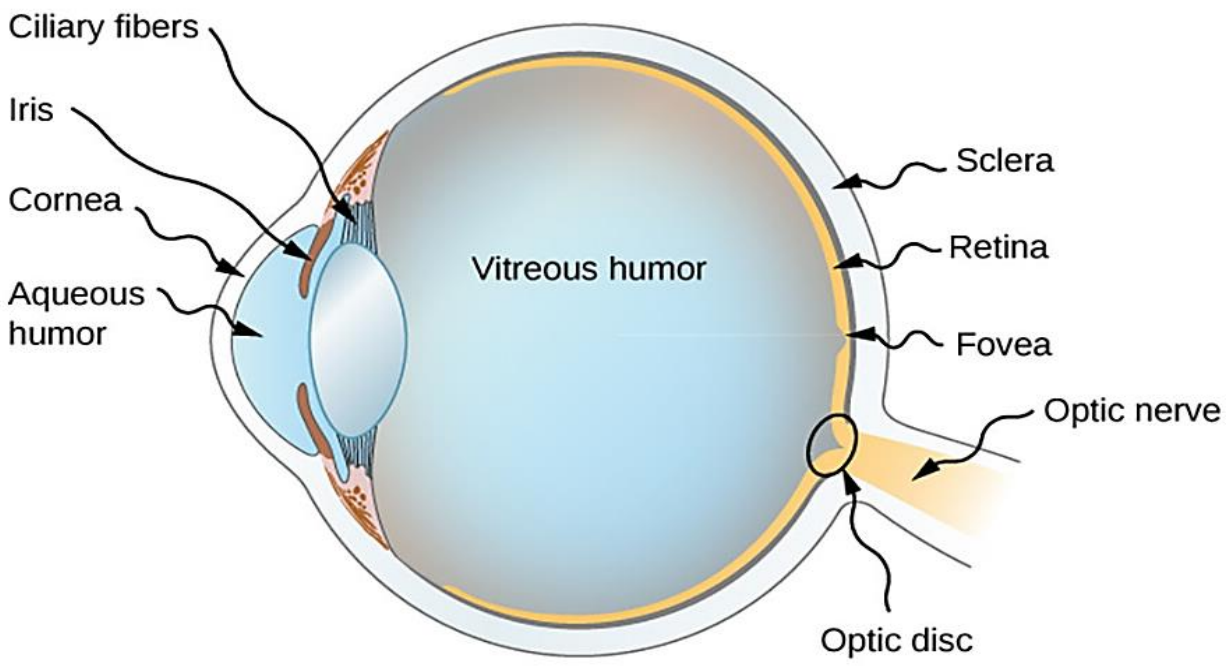
the context of the eye refers to the structures within the eye that allow light to pass through and reach the retina at the back of the eye.

The main transparent media in the eye are:

1. Cornea: It was explained previously
2. Lens: It was explained previously
3. Aqueous humor: It will be explained in the lecture
4. Vitreous humor: It will be explained in the lecture

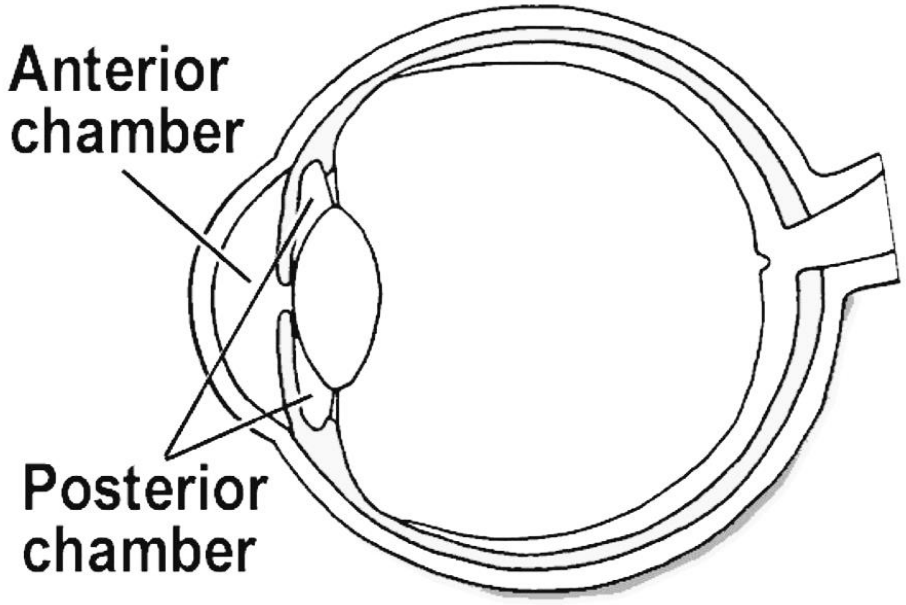
Aqueous Humor السائل المائي

The aqueous humor is the clear fluid that fills the anterior chamber and posterior chamber of the eye, which are the spaces between the cornea and lens.



✓ **Anterior Chamber: is the space between the cornea (front) and the iris (colored part).**

✓ **Posterior Chamber: is the small space between the iris (front) and the anterior surface of the lens (back).**



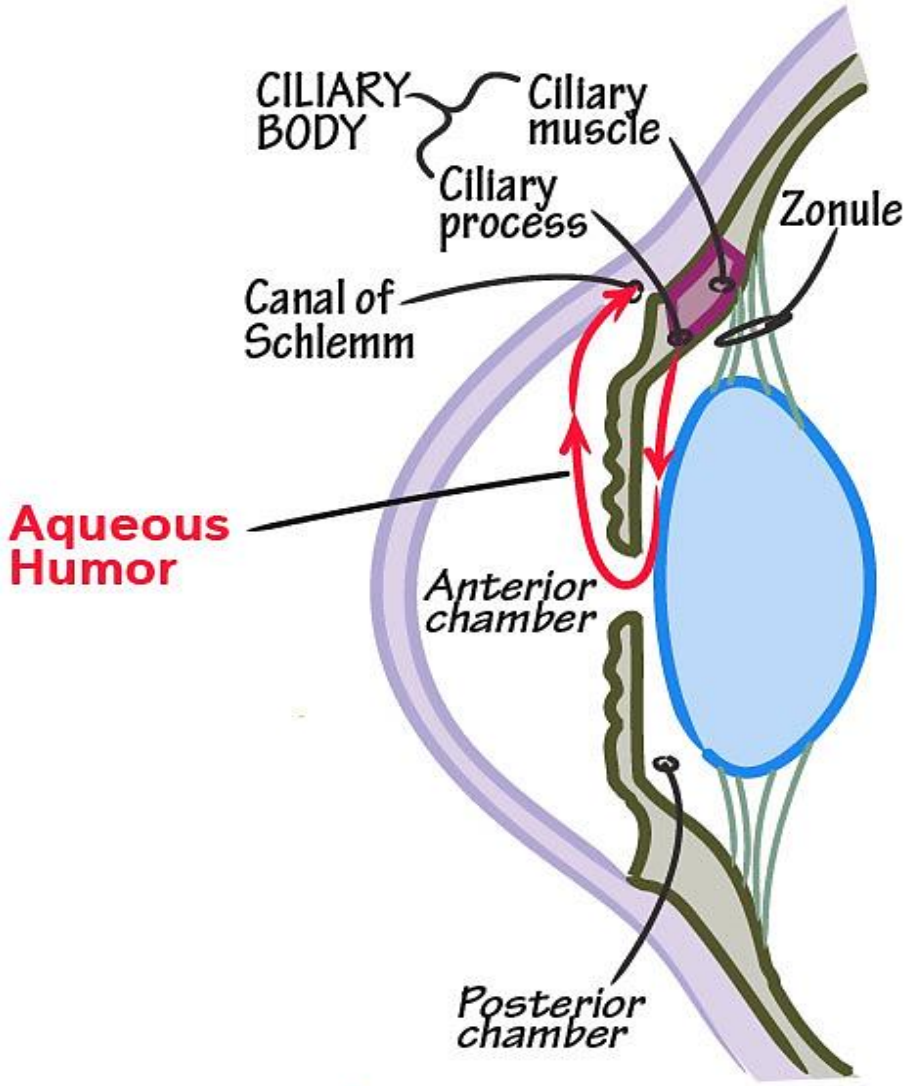
Production of Aqueous Humor

- **It is constantly produced by the ciliary epithelium (part of the ciliary body) at a rate of around 2-3 µl/min**
- **The aqueous humor flows from the posterior chamber, through the pupil into the anterior chamber.**

Circulation of Aqueous Humor

- **It flows from the posterior chamber into the anterior chamber through the pupil.**
- **It is drained out through the trabecular meshwork and Schlemm's canal into the venous system.**

- Problems with drainage can lead to increased intraocular pressure (IOP) and glaucoma.



Composition of Aqueous Humor

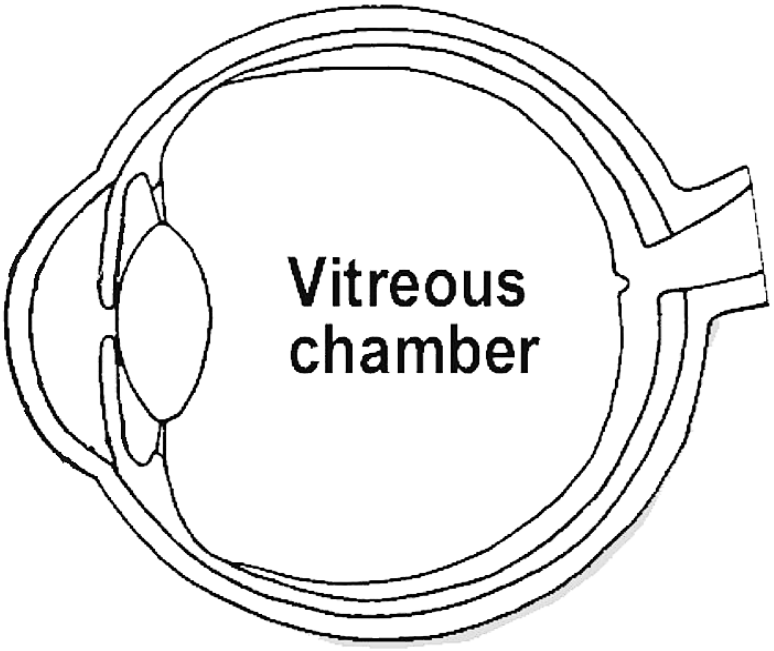
- It is comprised mostly of water (around 99.5%).
- It also contains glucose, amino acids, vitamins, and other substances to nourish the surrounding avascular (no blood vessels) structures like the cornea and lens.
- The refractive index of the aqueous humor is approximately 1.336

Functions of Aqueous Humor

1. **Nourishment** - Provides nutrients and removes waste from the avascular cornea, lens, and trabecular meshwork.
2. **Maintains eye pressure (intraocular pressure or IOP)** - The balance between its production and drainage regulates IOP, which is important for optical and structural integrity.
3. **Transparent medium** - Its clarity allows light to pass through to reach the lens and retina for vision.

Vitreous Humor السائل الزجاجي

- The clear, jelly-like substance that fills the large chamber of the eye between the lens and the retina.
- The refractive index of the vitreous humor is approximately 1.336 - 1.337.
- The vitreous humor takes up about 80% of the eye's volume and helps maintain the globe's spherical shape, which is necessary for proper image focusing on the retina.
- Any cloudiness or opacity in these structures can scatter light and cause vision problems like blurred vision or blindness.



Functions of Vitreous Humor

- **The vitreous acts as a supportive structure that holds the retina in place against the back of the eye.**
- **The viscous nature of the vitreous allows the lens to move freely within the eye for accommodation (focusing) on near and far objects.**
- **Although avascular itself, the vitreous can distribute nutritional factors like glucose, vitamins and proteins to the surrounding structures like the lens and retina.**

Composition of Vitreous Humor

The vitreous humor is composed primarily of water (around 98-99%), with the remaining 1-2% comprising various biochemical components. The main compositions of the vitreous humor are:

1. **Water**
2. **Collagen fibrils**
3. **Hyaluronic acid**
4. **Opticin protein**
5. **Soluble proteins**
6. **Electrolytes: Such as sodium, potassium, chloride, and bicarbonate to maintain a balanced pH.**
7. **Glucose: The main nutrient supplied to the avascular vitreous from surrounding vascularized tissues.**
8. **Ascorbic acid (vitamin C): Acts as an antioxidant.**
9. **Oxygen and carbon dioxide**