# Lecture 1

## Case Study

- Jane experienced a deep pain in her left eye, which she noticed while watching a movie in a cinema
- She reported seeing haloes around all lights
- Her vision was 6/6 (20/20) in the left eye and 6/15 (not good enough for driving)
- Examination revealed a narrow anterior chamber angle
- Her intraocular pressure was 60 mmHg in the affected eye, compared to 15 mmHg in the other
- The primary symptoms Jane exhibited were deep-seated pain, reduced vision, and significantly raised IOP
- The high pressure was caused by fluid being unable to drain out of the ACA

## Structure and Coats of the Eye

- The eyeball is comprised of three distinct coats
    - **Outer Coat:** Consists of the Cornea and the Sclera
        - The **Cornea** is responsible for transparency
            - Its collagen is extremely ordered, laid down parallel to one another in sheets of uniform diameter
        - The **Sclera** provides strength and protection to the eyeball
            - It appears pink and its collagen whirls around the eyeball
        - Injury to the cornea's collagen pattern disrupts the fibrils, causing the cornea to whiten (a scar)
    - **Middle Coat:** Consists of the Ciliary body, Iris, and Choroid
    - **Inner Coat:** Is the Retina, which covers 5/6 of the eyeball
- The Anterior Chamber Angle is the location where the Iris and Cornea meet

## Aqueous Humour

- The Ciliary Body, part of the middle coat, has two primary functions
    - **Aqueous Humour Production**
        - Aqueous humour is formed by the ciliary epithelial cells
        - The fluid is important for maintaining the health of the lens and cornea
        - It is the fluid that creates intraocular pressure
        - The fluid is produced in the region of the finger-like ciliary processes

        - The fluid is pushed forward to the pupil and drains out between the cornea and iris at the ACA
    - **Accommodation (Focusing)**
        - Accommodation involves the contraction of the ciliary muscles
        - A chunk of muscle goes in a circle, forming the ciliary muscle
        - Ligaments attach to the ciliary processes and stick between the processes and the lens
        - Pressure is placed on these ligaments to alter the shape of the lens
        - When looking far away, the lens remains thin
        - When reading up-close, the sphincter muscle contracts, and the lens becomes thicker

# Optical Factors and Refractive Errors

- Variable focus is provided by the crystalline lens
    - The lens is comparable to a balloon suspended within the donut-shaped ciliary muscle
    - The lens thickens with age and becomes less plastic
    - **Presbyopia** is the loss of near focusing ability that typically occurs around 40–45 years of age, requiring reading glasses
- Refractive Errors are size or shape errors of the eye, such as long or short-sightedness, and they cause blur
    - The length of the eye determines its focusing power (Axial)
    - Eye growth determines the refractive state
    - A short eye results in hyperopia (farsightedness), while a long eye results in myopia (nearsightedness)
- The Cornea/tears have a fixed radius, and 85% of refraction occurs at the tear surface
- Clarity of the optical media affects visual acuity (VA)
    - **Cataracts** involve an opaque lens, blocking the light path
    - **Corneal opacities** occur when the cornea is scratched, likened to trying to see through a dirty window
- Pupil size also affects VA, which is the ability to see finer details

# Structure of the Neural Retina

- The Neural Retina contains six types of neurons: rods, cones, Horizontal Cells (HCs), Bipolar Cells (BCs), Amacrine Cells (ACs), and Ganglion Cells (GCs)
- Light must pass through all the retinal layers before reaching the photoreceptors
    - Photoreceptors are located on the outside of the retina
    - Ganglion cells are located on the inside