**B7 COORDINATION AND RESPONSE**

**7.1 - NERVOUS CONTROL IN HUMANS**

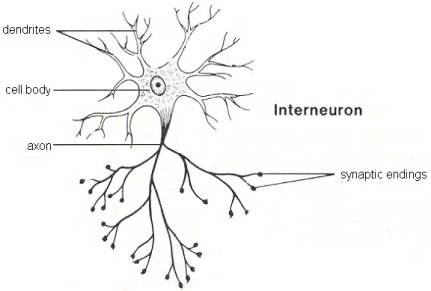
**1. Describe the human nervous system in terms of the central nervous system (brain & spinal cord as areas of coordination) & the peripheral nervous system, which together serve to coordinate & regulate body functions.**

* The human nervous system is made of two parts-central nervous system (CNS) and peripheral nervous system(PNS);
* CNS - brain and spinal cord, which have the role of coordination;
* PNS - nerves, which connect all parts of the body to the CNS;
* Sense organs are linked to the PNS; they contain groups of receptor cells;
* When exposed to a stimulus they generate an electrical impulse, which passes along peripheral nerves to the CNS, triggering a response.
* Peripheral nerves contain sensory and motor neurons;
* Sensory neurons transmit nerve impulses from sense organs to the central nervous system;
* Motor neurons transmit nerve impulses from the CNS to effectors (muscles or glands)
* Neurons are covered with a myelin sheath, which insulates them to make transmission of the impulse more efficient;
* Relay neurons pick up messages from other neurons and pass them on to other neurons.
* The cytoplasm (mainly axon and dendron) is elongated to transmit the impulse for long distances.

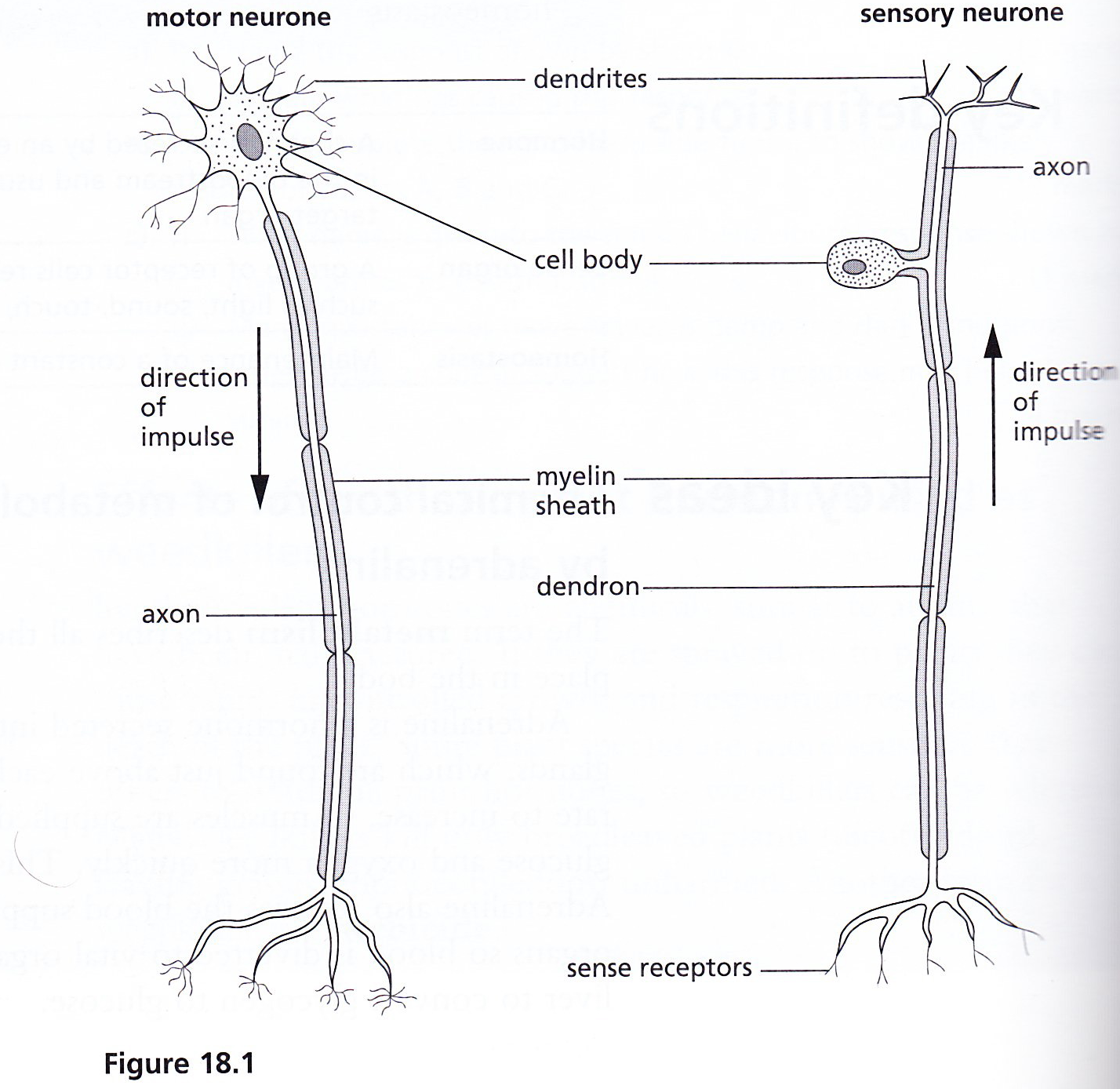
COMPARISON OF MOTOR AND SENSORY NEURON

|  |  |  |
| --- | --- | --- |
| *Structure* | *Sensory neuron* | *Motor neuron* |
| 1.Cell body | Near end of the neuron, just outside the spinal cord | At start of neuron, inside the spinal cord |
| 2.Dendrites | Present at the end of neuron | Attached to cell body and inside the spinal cord |
| 3. Axon (takes impulses away from cell body) | Very short stretch into spinal cord | Very long, stretches from spinal cord into a muscle |
| 4. Dendron | Very long stretches to a receptor | None |

**3. Identify motor (effector), relay (connector) and sensory neurons from diagrams.**



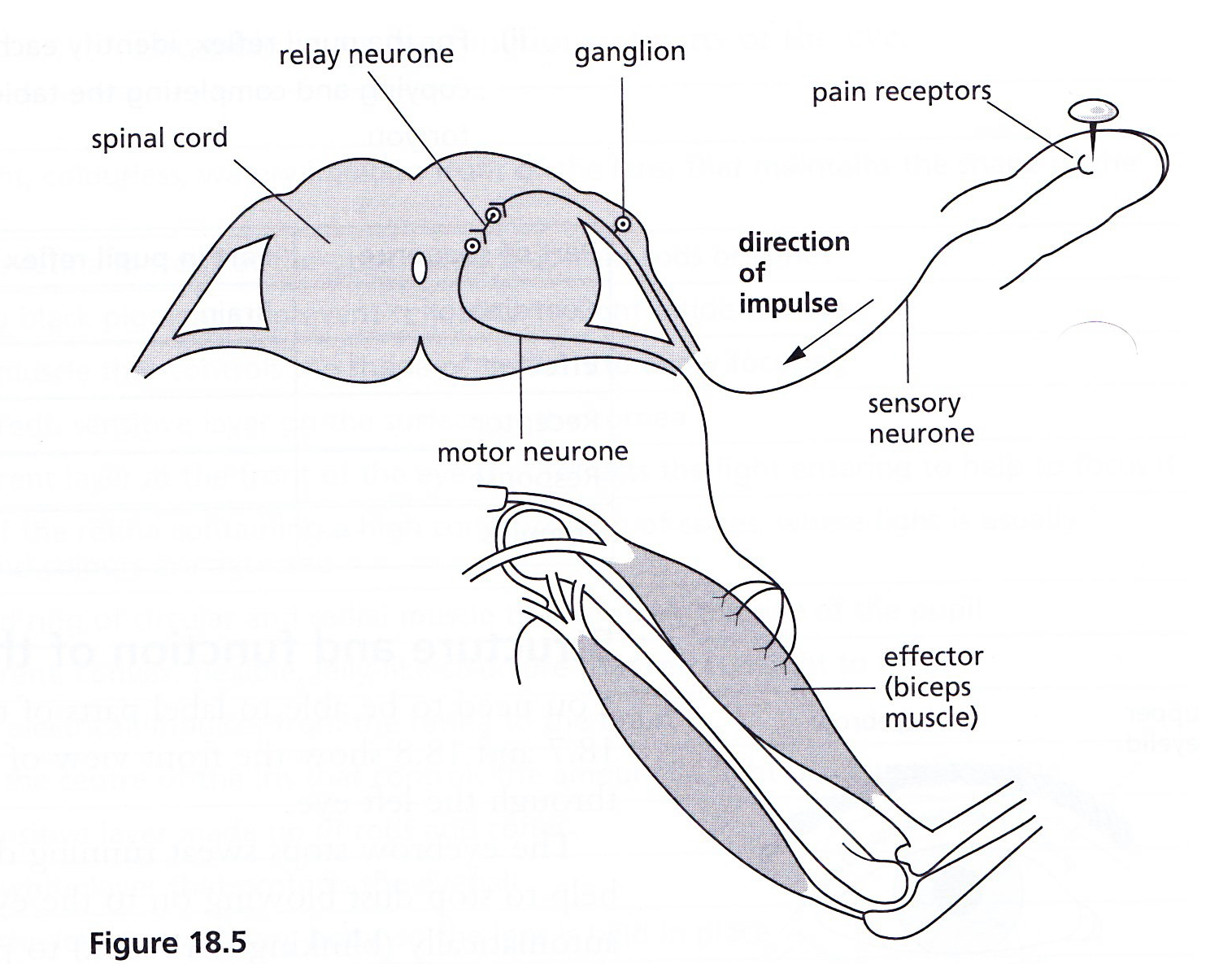
Relay neuron

****

**4. Describe a simple reflex arc in terms of sensory, relay and motor neurons and a reflex action as a means of automatically and rapidly integrating and coordinating stimuli with responses.**

* A reflex action is a fast, automatic response to a stimulus;

*REFLEX ARC*

****

* A reflex arc describes the pathway of an electrical impulse in response to a stimulus;
* In diagram above, the stimulus is a pin sticking in the finger;
* The response is the withdrawal of the arm due to contraction of the biceps;
* Relay neurons are found in the spinal cord, connecting sensory neurons to motor neurons;
* Neurons do not connect directly with each other: there is a gap called a synapse.
* The sequence of events is

Stimulus (sharp pin in finger)

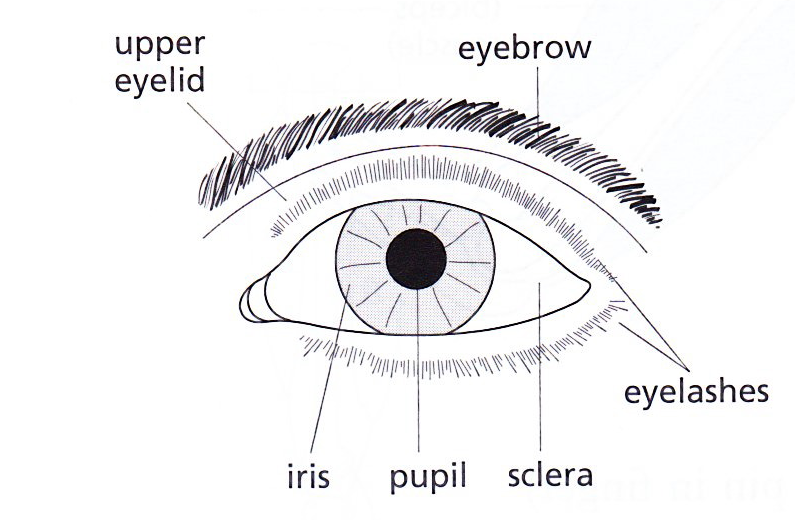
Receptor (pain receptors in skin)

Coordinator (spinal cord)

Effector (biceps muscle)

Response (biceps muscle contracts, hand is withdrawn from pin

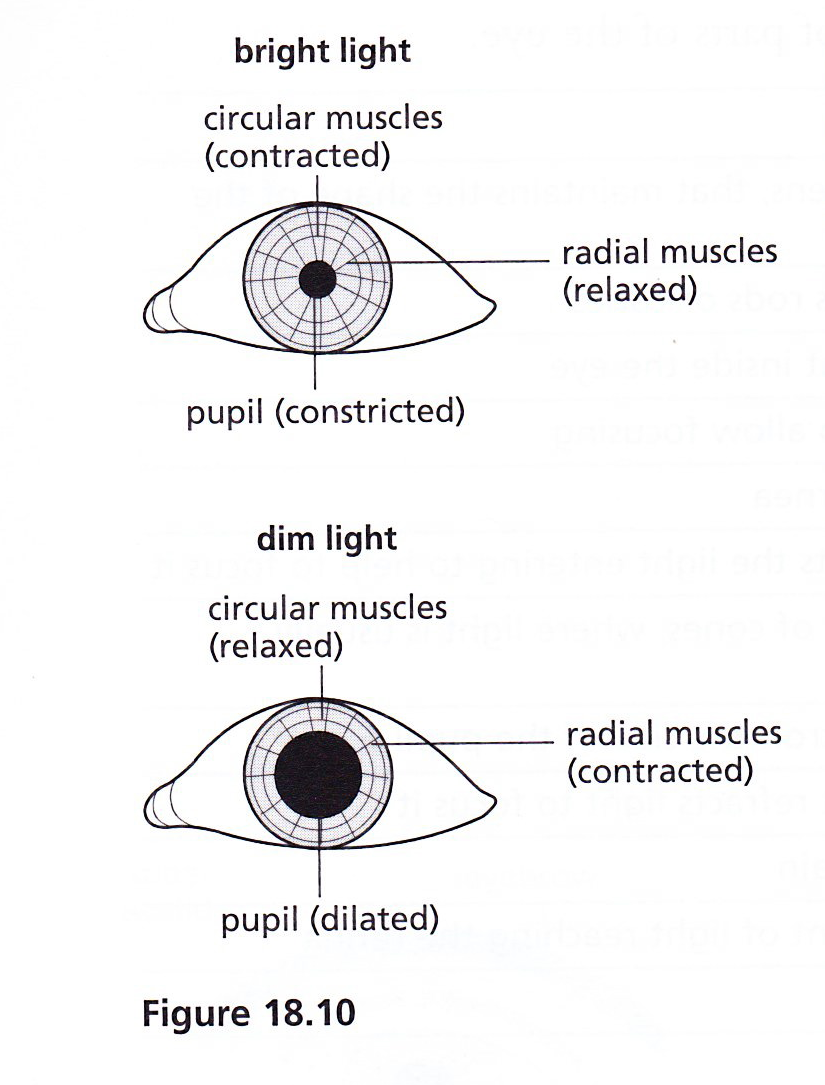
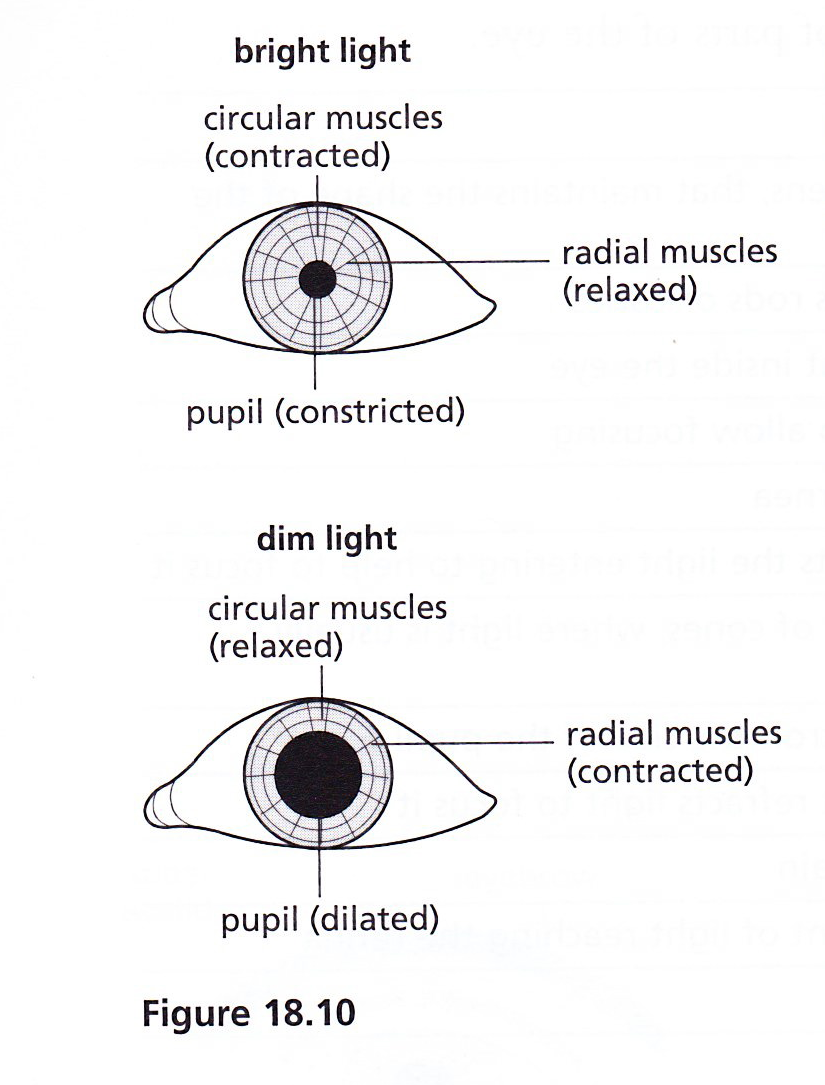
**2. Describe the structure and function of the eye, including accommodation and pupil reflex.**

** **

**Front view Section through the eye**

|  |  |
| --- | --- |
| *Part of the eye* | *Function* |
| Fovea | An area of the retina containing a high concentration of cones, where light is usually focused and colours are detected |
| Blind spot | Part of the retina in front of the optic nerve that lacks rods or cones |
| Optic nerve | Transmits electrical impulses from the retina to the brain |
| Conjunctiva | A transparent, sensitive layer on the surface of the cornea |
| Sclera | A tough, white layer that protects the eyeball |
| Choroid | Produces a black pigment to prevent reflection of light inside the eye |
| Retina | A light sensitive layer made of rods and cones |
| Ciliary body | A ring of muscle that controls the shape of the lens to allow focusing |
| Suspensory ligament | Attaches the lens to the ciliary body, so the lens is held in place |
| Cornea | A transparent layer at the front of the eye that refracts the light entering to help to focus it |
| Iris | A coloured ring of circular and radial muscle that controls the size of the pupil |
| Lens | A transparent, convex, flexible, jelly-like structure that refracts light to focus it |
| Pupil | A hole in the centre of the iris that controls the amount of light reaching the retina |
| Rods | Sensitive to dim light, do not respond to colour |
| Cones | Function when the light is bright, able to distinguish between different colours of light |

*PUPIL (or iris) REFLEX* *(an e.g. of reflex action)*



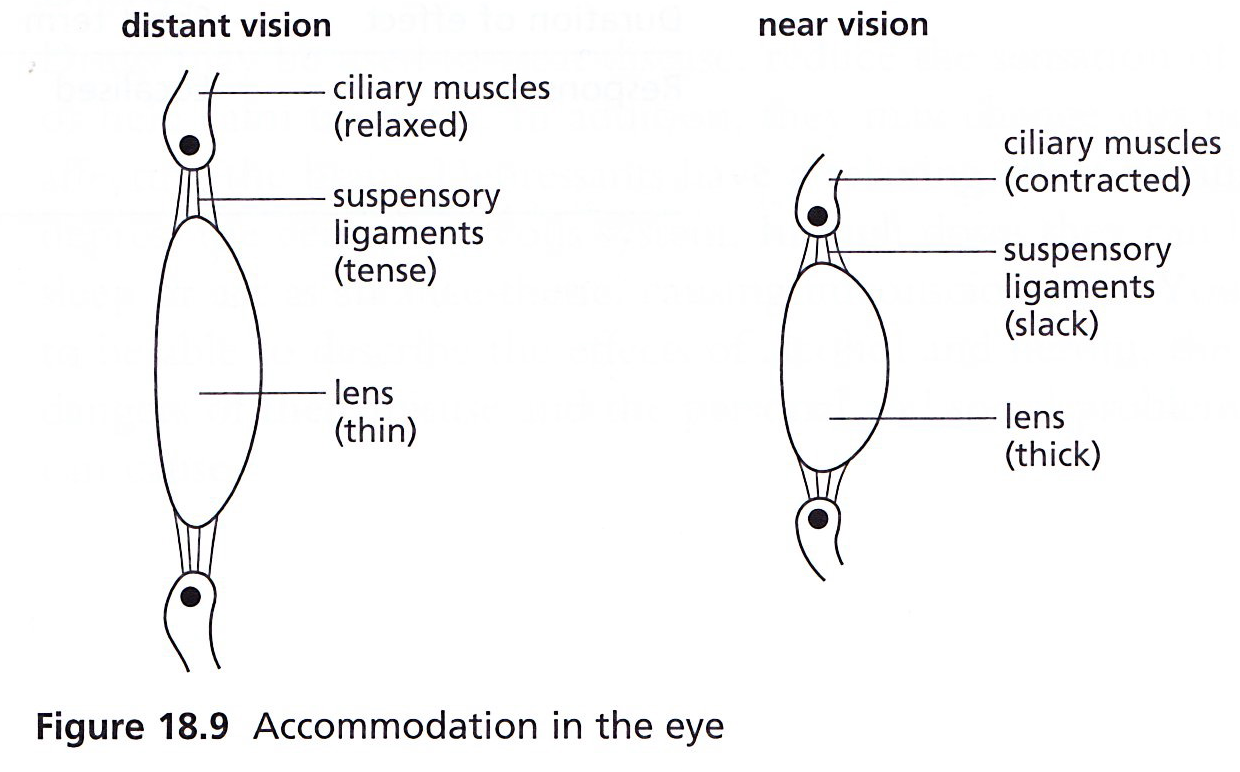
* This reflex action changes the size of the pupil to control the amount of light entering the eye
* *In* *bright light:*

1. Retina detects the brightness of light entering the eye;
2. An impulse passes to the brain along sensory neurons and travels back to the muscles of the iris along motor neurons, triggering a response:
3. Circular muscles contract; radial muscles relax; so iris gets bigger
4. Pupil constricts (gets smaller) so less light falls on the retina (to prevent damage).

* *In dim light:*

1. Retina detects the brightness of light entering the eye;
2. An impulse passes to the brain along sensory neurons and travels back to the muscles of the iris along motor neurons, triggering a response:
3. Radial muscles contract; circular muscles relax; so iris gets smaller
4. Pupil size is increased (dilated) to allow as much light as possible to enter the eye;

*ACCOMMODATION*

****

|  |  |
| --- | --- |
| *To focus on a distant object* | *To focus on a nearby object* |
| Slightly diverging rays of light enter the eye | Greatly diverging rays enter the eye |
| Ciliary muscles relax | Ciliary muscles contract |
| Suspensory ligaments are pulled tight | Suspensory ligaments slacken (loosen) |
| Lens becomes thin | Lens get fatter |
| The thin lens bends the light rays slightly | The thick lens bends the light rays greatly |