PATHWAYS OF LIGHT RECEPTION

The Sun

Eye

Retinol Ganglion Cells

● = M-Cells
M-Cells are sensitive to coarse visual form that is moving fast (a quick glimpse of the world - what and where the stimulus is). This provides a figure ground framework and guides the P-Cell pathway in the process of foviation.

○ = P-Cells
P-Cells are sensitive to special detail that is stationary or moving slow. They comprise 80% of the retinal ganglion cells in primates.

8th Nerve

This pathway directly affects balance and coordination

SUPERIOR COLLICULUS
(MID-BRAIN)
This area subserves peripheral retinal detection and foveation eye movements (sets up conditions for fixation and foveation). Receiving input from auditory, vestibular, and visual areas, it integrates the information we use to orient ourselves in a moving world. This area also tells your eyes which way to move when you hear something. It represents everything other than the fovea. thus acting as the brain's gyroscope.

3rd Nerve

4th Nerve

6th Nerve

Medial Longitudinal Fasciculus
This pathway directs eye movement control

This pathway tells the visual cortex what the Superior Colliculus is going to tell the eyes to do.

This pathway gives Superior Colliculus feedback about visual information that has already been cortically processed.

Retino-Tectal Pathway
Approximately 20% of the primary axons from the optic nerve thought to represent rod-rich receptive fields send secondary axon collaterals down this pathway.

M-Cells project to magnocellular layers in the dorsal LGN (color blind, fast , high contrast sensitivity, low resolution)

Optic Nerve (Primary Axons)

P-Cells project to parvocellular layers in the dorsal LGN (color selective, slow, low contrast, high resolution)

LATERAL GENICULATE NUCLEUS
(Thalamus)
100% of optic nerve fibers synapse here. This is a decision-making area specialized in processing and relaying visual information. It determines what gets to the visual cortex possibly based on what the cortex needs.

POSTERIOR PARIETAL CORTEX (Top of Brain) Brodman's Areas 5 & 7. Tells us where things are (analyzes motion).

ANGULAR GYRUS
Werneke's area for receptive language. Integrates all sensory inputs relating to language (Cortex sends visual component of language to this area).

M-Cells in the dLGN project to the visual cortex, then several areas including Post. Parietal Cortex

Optic Radiations

P-Cells in the dLGN project to the visual cortex, then several areas including Inf. Temporal Cortex

Feedback pathway from visual cortex to LGN and possibly to Hypothalamus

Magnacellular pathway projects into this area

VISUAL (Striate) CORTEX
Largest sensory area in the brain. Information received by this area goes to three major integration centers and is then relayed to the frontal cortex where we determine what to do with this information.

Parvocellular pathway projects into this area.

INFERIOR TEMPORAL CORTEX (Bottom of Brain)
Brodman's Area 22. Tells us what things are.
Analyzes form and color (different frequencies of light).

ACCESSORY OPTIC TRACT
Approximately 10% of the primary axons from the optic nerve send secondary axon collaterals down this pathway. Less than the full 10% actually reach the accessory Optic System

Less than 20% of the info received by the dLGN of the retina. The majority is extra retinal, thereby providing a means whereby retinal input can be integrated with other inputs, thus providing the brain a wholistic view of the world.

Site of the body's biological clock.

Geniculo-hypothalamic Tract (?%)

Retinohypothalamic Tract (10%)

Supra-Chiasmatic Nuclei

Para-ventricular Nuclei

Medial Forebrain Bundle

Inter-mediolateral cell column

Preganglionic Sympathetic Neuron

Superior Cervical Ganglia

Nervi Conari

PINEAL GLAND
(Body's "Light Meter")
Affects:
1. Reproductive functions
2. Growth
3. Body temperature
4. Blood pressure
5. Motor activity and sleep
6. Tumor growth
7. Brain Neurotransmitter metabolism
8. Immune system
9. Modifies functions of:
   Adrenals
   Pancreas
   Pituitary
   Thyroid
   Thymus
10. Possibly affects longevity and aging and development of chronic degenerative diseases

The pineal gland secretes the hormone melatonin, which influences the functioning of every cell in the body, thus orchestrating the internal physiology of the entire organism in order to synchronize it with the external environment.

ACCESSORY OPTIC SYSTEM
(Brain Stem)
Deals with general arousal and activation of the CNS and also affects emotions. Light information received here affects the Locus Coeruleus which is involved in Catecholamine release and thought to effect the lack of plasticity seen following the brain's critical period for vision development.

HYPOTHALAMUS
Integrates nervous system, endocrine system, immune system, moods (this information also goes to Limbic System).
Controls:
ANS, energy balance, fluid balance, heat regulation, circulation and breathing, activity and sleep, growth and maturation, reproduction, and emotions.

Controls Sympathetic

Posterior Lateral Hypothala-mus

Anterior Medial Hypothala-mus

Controls Parasympathetic

Neural Connection

Releasing Factors

Post. | Ant.
Pituitary

Sympathetic

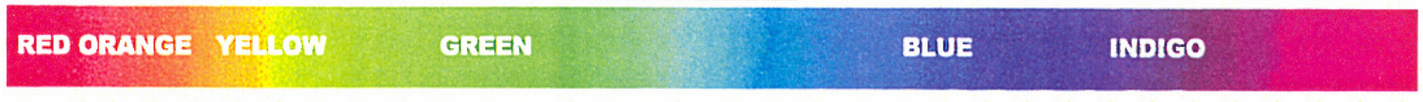
Parasympathetic

Mam. gland ← Oxytocin
Kidneys ← Anti. Diu. Hor. (Vasopressin)

Prolactin → Breasts
Growth Hor. → Musc/Bones
Thy. Stim. Hor. → Thyroid
Melan. Stim. Hor. → Skin Pig.
Follicle Stim. Hor. → Testes
Luteinizing Hor. → Ovaries
ACTH → Adrenal Cortex

OCULAR EFFECTS
1. Dialtes pupil
2. Protrudes eyeball
3. Lessens lacrymation
4. Upper lid retracted, lagging
5. Ocular hypotension
6. Lessens accommodation
7. Causes exophoria-reflex
8. Low adduction tendency
9. Inhibits ocular activity

OCULAR EFFECTS
1. Contracts pupil
2. Widens eye slit
3. Increases lacrymation
4. Upper lid-ptosed, puffy
5. Ocular hypotension
6. Increases accommodation
7. Causes esphoria-reflex
8. Low abduction tendency
9. Activates ocular activity



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