Hypothalamus
An Extremely Important Structure

Psychology 372
Physiological Psychology
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Overview
- Is very small
- Weighs only about 4 grams
  Brain = 1400 grams
- Contains a variety of specialized structures.

Regulates
- Control of blood pressure and electrolyte composition.
- Body temperature
- Energy metabolism
- Reproduction
- Emergency responses to stress

Regulates Mechanisms by
- Receiving sensory information from all areas of the body.
- Comparing sensory information with biological set points.
- Adjusting the system to restore the body balance when deviations from biological set points occur.

Some Set Points
- Blood sugar
- Hormone levels
- Temperature
- Sodium

Hypothalamic Regions and Related Structures
- Can be divided into three regions
  - Anterior
  - Middle
  - Posterior
Anterior

- Contains the Preoptic Nucleus
  - Is concerned with the integration of sensory stimuli that is related to set points.

Preoptic Nuclei Control

- BP
- Blood composition
- Temperature
- Hormones
- Reproductive activity
- Others

Middle Third

- Overlays the pituitary stalk
- Contains
  - Dorsomedial Nuclei
  - Ventromedial Nuclei
  - Paraventricular Nuclei
  - Supraoptic Nuclei
  - Arcuate Nuclei

Paraventricular Nuclei

- Includes magnocellular and parvocellular components
- Controls the Pituitary Gland
- Contains neurons that innervate sympathetic and parasympathetic neurons in the Medulla and Spinal Cord.
- Regulates autonomic responses

Ventromedial and Dorsomedial Nuclei

- Regulates
- Growth
- Feeding
- Maturation
- Reproduction

Is Between the Medial Forebrain Bundle

- MFB are long pathways
- Runs through the lateral hypothalamus
- Connects the hypothalamus with the
  - Brain Stem
  - Basal Forebrain
  - Amygdala
  - Cortex
Function

- Help organize behaviors
- Autonomic functioning
- Highly involved with the addiction process
- Heavily loaded with Dopamine Neurons

Posterior Third

- Mammillary Body
  - Function unknown
- Posterior hypothalamic Nuclei
  - Contains Tuberoamammillary Nucleus
    - Regulates wakefulness and arousal

Endocrine System

- Regulated by the Hypothalamus
- Direct Connection
  - Sends neuroendocrine materials from the posterior pituitary
- Indirect
  - Sends hormones into the anterior pituitary
  - Regulates the production and release of pituitary hormones into circulatory system

Some Hypothalamic Hormones

- TRH (Thyrotropin-Releasing Hormone)
  - Pit. Thyrotropin and Prolactin
- GRH (Growth Releasing Hormone)
  - Pit. Growth Hormone
- PRF (Prolactin-Releasing Factor)
  - Pit. Prolactin
- PIH (Prolactin Release-Inhibiting Hormone)
  - Pit. Prolactin
- Others

Thirst

- Drinking is controlled by two mechanisms
  - Osmolarity (Determined by Sodium)
  - Vascular volume (Fluid)
- Act on Osmoreceptors in Hypothalamus
- Acts on the Kidney

Kidney

- Secretes Renin
- Renin cleaves Angiotensinogen into Angiotensin I (A1)
- A1 is hydrolyzed into A2
Angiotensin II

- Causes
  - Vasoconstriction
  - Release of aldosterone
  - Release of Vasopressin by paraventricular nucleus
    - Regulates water retention
- Subfornical Organ is very sensitive to A-II
- Preoptic area also receives information from baroreceptors
- Both regulate drinking.

Hunger

- Past
- Regulated by
  - Lateral Hypothalamus
    - Stimulate, animal starts eating
    - Destroy, animal stops eating
  - Ventromedial Hypothalamus
    - Stimulate, animal stops eating
    - Destroy, animal becomes obese

Today

- Not as clear cut
- Usually damage nearby structures
- Example
  - Damage Lateral, damage trigeminal system and dopamine fibers in MFB
  - Results in decreased stimuli activating visual, olfactory, and somatosensory stimuli.
    - Result, don’t start eating.
  - May also alter set points.
  - LH and VMH are still important, but probably work with other systems.

Pleasure

- Past. When stimulated animal would not do anything else.
- Today, Not as clear cut.
- Involved with MFB which is more important.

Conclusion

- Is an extremely important structure
- Is involved with many other things
  - Sexual behavior
  - Temperature
  - Etc.
- Damage causes lots of problems.