Diencephalon

- From interventricular foramen to posterior commissure
- Divisible into:
  - Thalamus
  - Hypothalamus
  - Subthalamus
  - Epithalamus
  - Metathalamus
Thalamus

- Large mass of grey matter, lateral to 3\textsuperscript{rd} ventricle.
- Processes the affarent impulses to cerebral cortex.
- Reciprocal connections with cerebral cortex & subcortical grey masses.
- Anterior & posterior ends
- Surfaces: **Medial**- lined by ependyma; forms lateral wall of third ventricle; interthalamic adhesion; hypothalamic sulcus
  
  **Superior**- anterior tubercle; related to fornix, stria terminalis, caudate nucleus.

  **Inferior**- related to hypothalamus anteriorly, to subthalamus posteriorly; post. Surface exhibits two swellings- MGB & LGB.

- **Lateral**- in contact with internal capsule.
Thalamus - internal structure

- Stratum zonale
- External medullary lamina
- Internal medullary lamina -
  - **Anterior** - anteroventral, anterodorsal, anteromedial
  - **Medial** - Dorsomedial
  - **Lateral** - Dorsal - lateral dorsal, lat. Posterior, pulvinar
  - **Ventral** - ventral anterior, ventral lateral, ventral posterior
Thalamic nuclei-contd.

- Midline nuclei - closely associated with interthalamic adhesion; concerned with visceral activity; connected to hypothalamus, dorsomedian & to intralaminar nuclei.

- Intralaminar nuclei - separate medial & lateral nuclei. Main nuclei-centromedian, parafascicular; affarents from reticular formation, fore brain, pallidal; efferent to putamen.
• **Anterior nucleus:**
  Mamillary body → AN → cingulate gyrus
  (mamillothalamic tract)

• **Dorsomedial nucleus:**
  Amygdaloid body → DM → cingulate gyrus, parietal lobe, prefrontal cortex
  Globus pallidus
  } piriform lobe
Ventral group

• **Ventral anterior**: Globus pallidus \(\rightarrow\) VA \(\rightarrow\) Premotor & motor c. cortex

• **Ventral lateral**: sub. nigra, GP, precentral C.C \(\rightarrow\) VM \(\rightarrow\) precentral C. C.

• **Ventral Posterior**: Ventral Posteromedial (VPM) (largest somatic relay) Ventral posterolateral (VPL)
  Medial lemniscus \(\rightarrow\) VPL \(\rightarrow\) Sup. Thalamic radiations \(\rightarrow\) Sensory C. Cortex (3,1,2)
  Spinothalamic tract \(\rightarrow\) VPL (post. Limb of Int. capsule)

Trigemino-thalamic
Solitariothalamic \(\rightarrow\) VPM \(\rightarrow\) Sensory Cerebral Cortex (3,1,2)
Lateral Group

- Lateral dorsal
- Lateral posterior
- Pulvinar

Superior colliculus $\rightarrow$ LD, LP, P $\rightarrow$ sup. Parietal lobule, cingulate gyrus, parahippocampal & hippocampus, Parietal area

Retina $\rightarrow$ P $\rightarrow$ association visual area
Afferent connections

1. Spinothalamic tract
   Medial lemniscus
   Trigemino-thalamic
   Solitariothalamic
2. Optic tract
3. Auditory pathway
4. Mamillothalamic tract
5. Cerebellar fibres
6. Corpus striatum &
   globus pallidus
7. From cerebral cortex
Thalamic radiations (efferent)

1. Anterior (frontal)
2. Superior (centroparietal)
3. Posterior (occipital)
4. Inferior (temporal)
Hypothalamus

- Below the thalamus, forms lower lateral wall of 3rd ventricle.
- Laterally in contact with internal capsule & subthalamus.
- Posteriorly merges with subthalamus.
- Anteriorly extends up to lamina terminalis.
- Inferiorly related to structures in floor of 3rd ventricle.
- Medial and lateral zones
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<thead>
<tr>
<th></th>
<th>Medial zone (Periventricular and intermediate)</th>
<th>Lateral zone</th>
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<tbody>
<tr>
<td>Preoptic nucleus</td>
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<tr>
<td>Supraoptic region</td>
<td>Paraventricular nu.</td>
<td>Supraoptic nucleus*</td>
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<td>Periventricular cell groups</td>
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<td></td>
<td>Suprachiasmatic nu.</td>
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<td>Intermediate cell groups (= anterior nucleus ?)</td>
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<tr>
<td>Tuberal region</td>
<td>Dorsomedial nucleus</td>
<td>Lateral tuberal nucleus</td>
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<td>Ventromedial nucleus</td>
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<td></td>
<td>Arcuate (infundibular) nucleus</td>
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<td>Premamillary nucleus</td>
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<tr>
<td>Mamillary or posterior region</td>
<td>Posterior nucleus (lies partly in tuberal region)</td>
<td>Tuberomamillary nucleus*</td>
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<td>Mamillary nuclei</td>
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</tbody>
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*From a functional point of view the supraoptic and tuberomamillary nuclei are grouped with the nuclei of the intermediate zone.*
Afferent connections

1. From spinal cord & brainstem (via reticular formation)
2. Nucleus of tractus solitarius
3. Olfactory pathways
4. Limbic system
5. Locus coeruleus
6. From piriform cortex, orbital cortex
7. From subthalamus & zona incerta
Efferent connections

1. To autonomic centres in brain stem and spinal cord e.g. tractus solitarius, dorsal nucleus of vagus, nucleus ambiguus, intermedio-lateral grey column.
2. To hippocampal formation, septal nuclei, amygdaloid complex, tegmentum.
3. To anterior nucleus of thalamus (mamillothalamic tract)
4. To subthalamus & tegmentum (mamillo-tegmental tract)
5. To neocortex
6. Control of pituitary gland
   - neurosecretion
   - release of vasopressin (ADH); oxytocin
   - control of post. Neurohypophysis
   - production of releasing factors (tubero-hypophyseal)
   - hypothalamo-hypophysial portal system
Functions

1. Regulation of eating & drinking behaviour
2. Regulation of sexual activity & reproduction
3. Control of autonomic activity
4. Control of endocrine system
5. Emotional behaviour
6. Response to stress
7. Temperature regulation
8. Biological clock
Epithalamus

- Visceral efferent pathway to convey impulses to brain stem.
- Pineal body
- Habenular trigone
- Stria medullares
Pineal body

- Cone shaped body attached to roof of 3\textsuperscript{rd} ventricle
- Rudimentary gland
- Richly vascular connective tissue along with glia cells and pineal cells.
- Receives fibres from stria medullares, habenular nuclei & post. Com.
- Inhibits gonadal function.
- After 16 yrs., calcerous bodies present which are visible in skull x-rays.
- Identification & position of pineal gland in skull films.
Metathalamus

- Medial geniculate body
- Lateral geniculate body
Lateral geniculate body
Subthalamus

- Lies below post. part of thalamus
- Inferiorly continuous with tegmentum
- Laterally related to internal capsule
- Reticular nucleus: separated from thalamus. Somatic, visceral, auditory, reticular formation send afferents to reticular nucleus which connects to dorsal part of thalamus.
- Zona incerta: connected to reticular nucleus; function not known.
- Subthalamic nucleus: closely related to zona incerta on one side and red nucleus on the other side. Subthalamic fasciculus pass to globus pallidus.
Applied anatomy

- **Lesions of thalamus**: sensory loss
  - thalamic pain
  - thalamic hand
  - abnormal involuntary movements

- **Subthalamic lesions**: sudden, forceful, jerky/violent involuntary movements in a contralateral extremity.

- **Pineal body**: pineal tumors result in alteration of reproductive function.

- **Hypothalamus**: Obesity/wasting
  - Sexual disorders
  - Hypo/hyperthermia
  - Diabetes insipidus
  - Disturbance in sleep
  - Emotional disorders