Unconsciousness

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Unconsciousness

Outline & Learning Objectives

- Definitions of key terms
- Physiology of consciousness
- Assessment & Differential Diagnosis
- Management
- Medically Induced Coma

Definitions

Definitions

- Consciousness
- Sleep
- Delerium
- Dementia
- Coma

Consciousness

- Self-awareness
- Access to memories
- Ability to manipulate abstract ideas
- Focus of attention

Sleep

- A state of reduced interaction with the environment
- Reversible
- Different from anaesthesia/coma.

Delirium

- Acute condition with altered mental state
- Organic basis
- Syndrome (not a diagnosis)
  - Multiple causes.
    - inability to focus attention & mental confusion
    - impairments in awareness & temporal and spatial orientation
  - Many similarities to coma.

Coma

- Unrousable unresponsivenss.
  - No response to pain.
  - Reflects a lack of CNS function
- Usually has preserved brainstem function
  - Brain mediated reflexes are preserved.

Brain Death

- Irreversible state
- Loss of all brain function
  - No response to pain
  - No brainstem reflexes
- Exclusions
  - Temperature, drugs

Pathology with normal conscious states

Dementia

- Not the same as alteration of consciousness
- Alert mental state
  - Anosognosia (unawareness of illness)

Ischaemic Stroke

- Ischaemic stroke will only affect consciousness if brainstem affected
  - Hemorrhagic stroke is different.
- Usually has focal neurology.

Locked in syndrome

- Awareness, sleep-wake cycles
- May have some meaningful behaviour

- Due to
  - High level spinal injury
  - Guillain-Barré syndrome
  - Parkinson’s disease (severe) or similar

Pathology with altered conscious states

Epilepsy

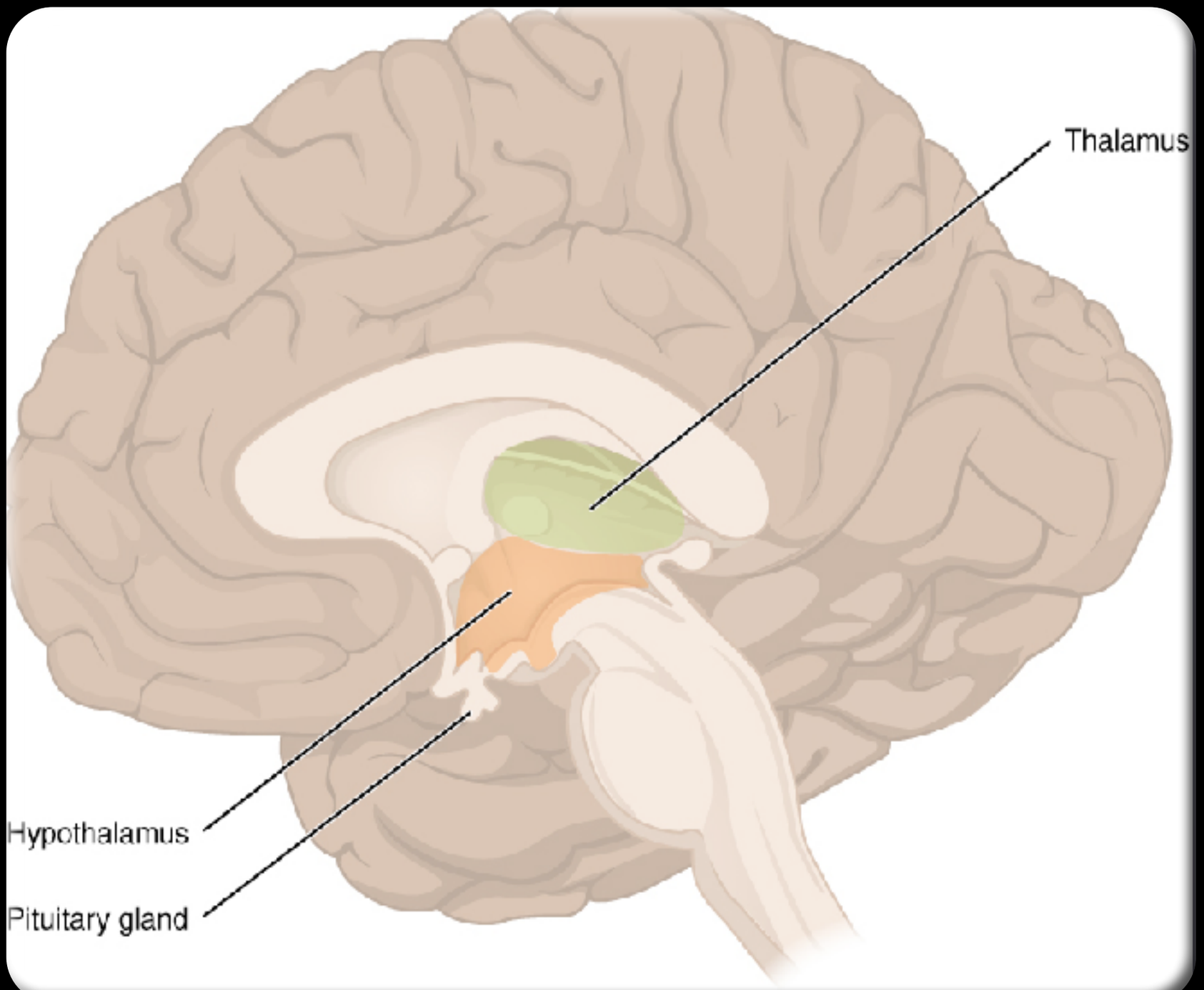
- Epilepsy is a condition of uncontrolled discharge of neurones
  - Generalised seizures are associated with a loss of consciousness
  - Partial seizures are associated with an altered conscious state

Narcolepsy

- Due to the lack of orexin in the hypothalamus
- Loss of stabilising switch
- Sudden onset of sleep

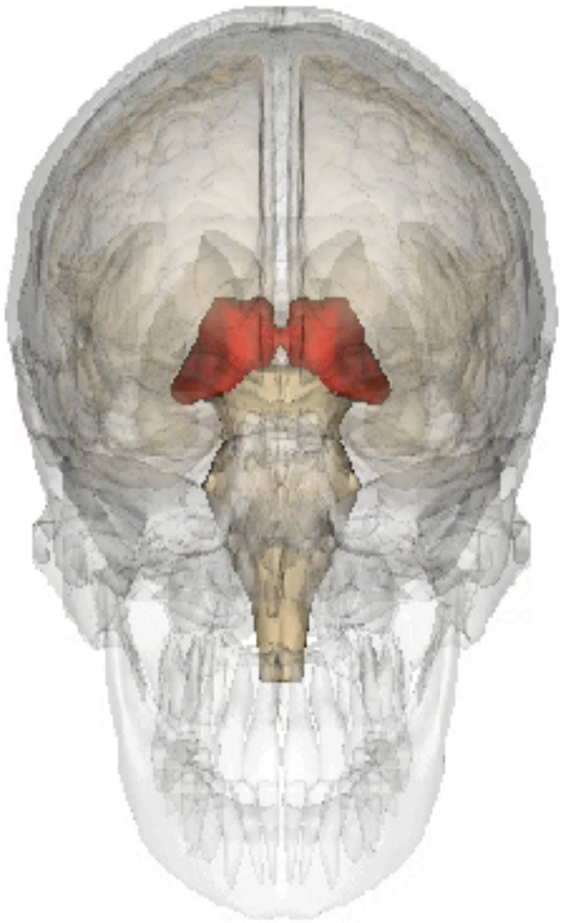
Physiology of Consciousness

The Diencephalon



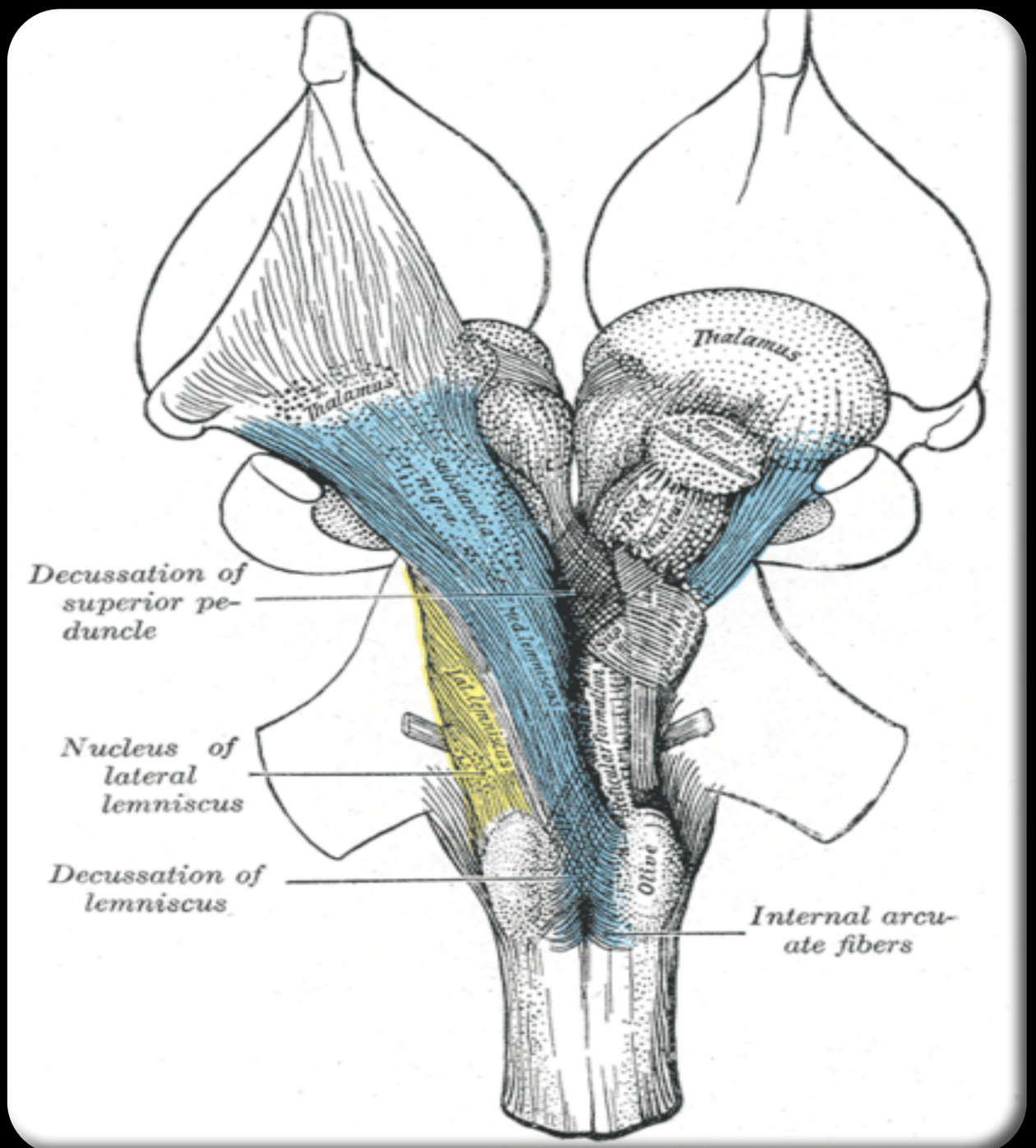
- “Interbrain"
- Region of the embryonic vertebrate neural tube
- Gives rise to posterior forebrain structures

Role of Thalamus



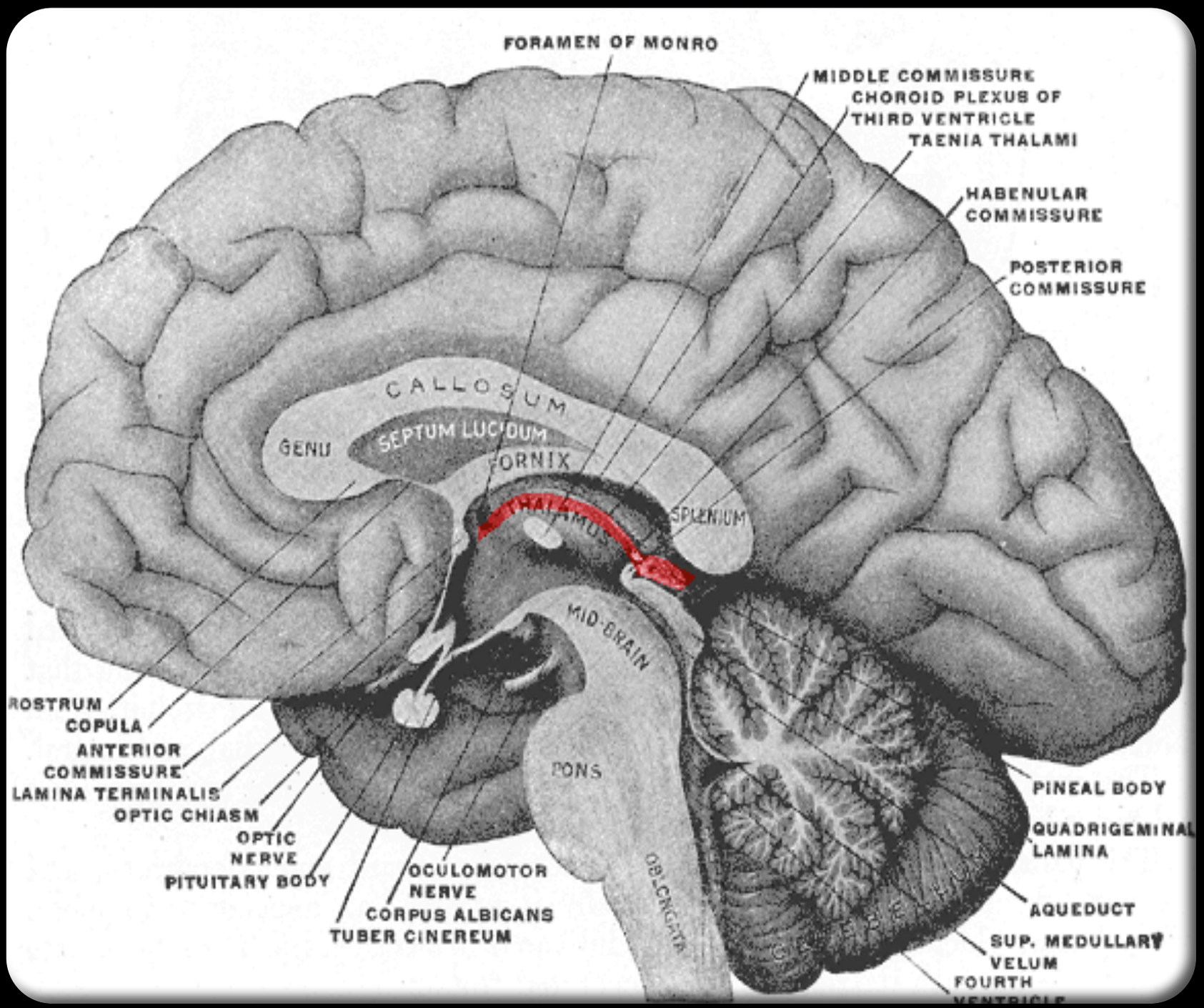
- Directing sensory input (except olfaction)
- Motor function control
- Autonomic and endocrine function control
- Homeostasis

Reticular Activating System



- Very Broad term
- Several nuclei:
  - Midbrain Reticular Formation
  - Mesencephalic nuclei
  - Pontine Tegmentum
  - Thalamic intralaminar nucleus
  - Hypothalamus
- Is not the sole component of alertness

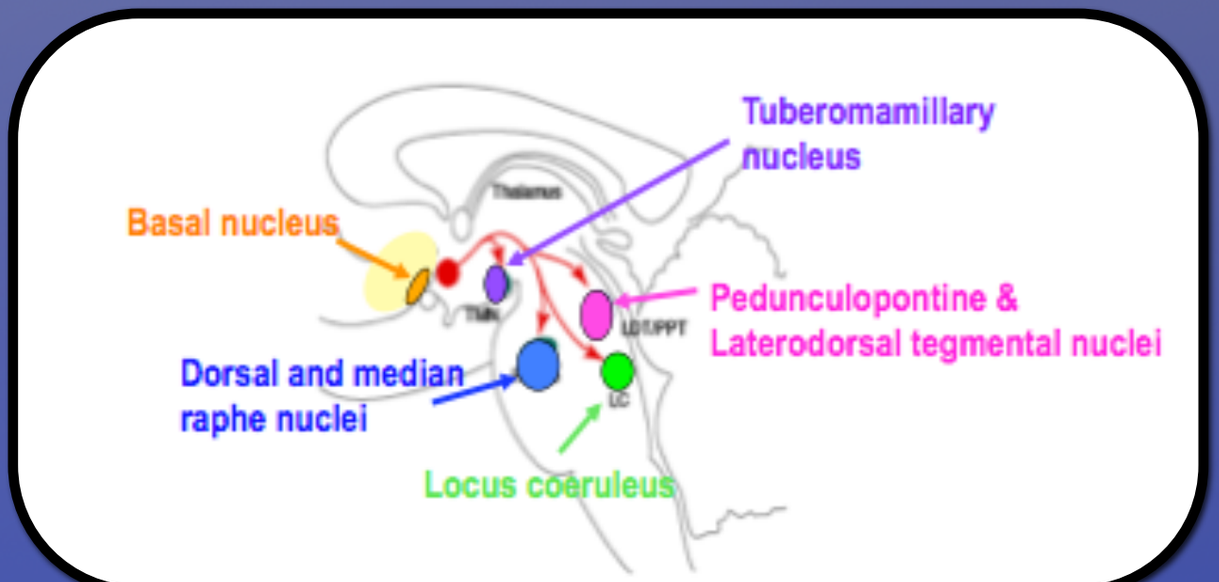
Physiology of consciousness



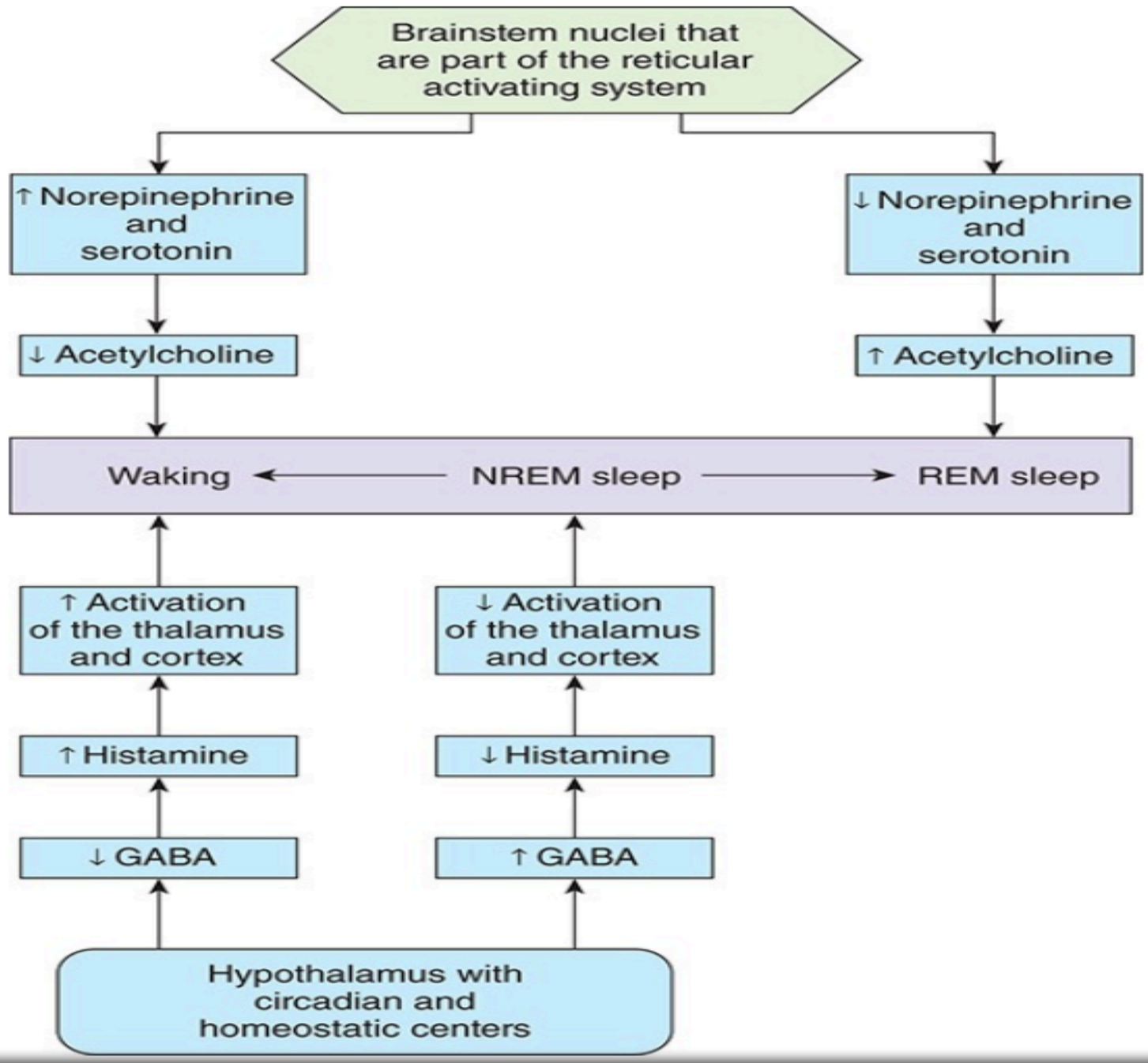
- Within the diencephalon
  - Thalamus
  - Hypothalamus
  - Epithalamus
  - Ventral/Pre-Thalamus
  - Third Ventricle

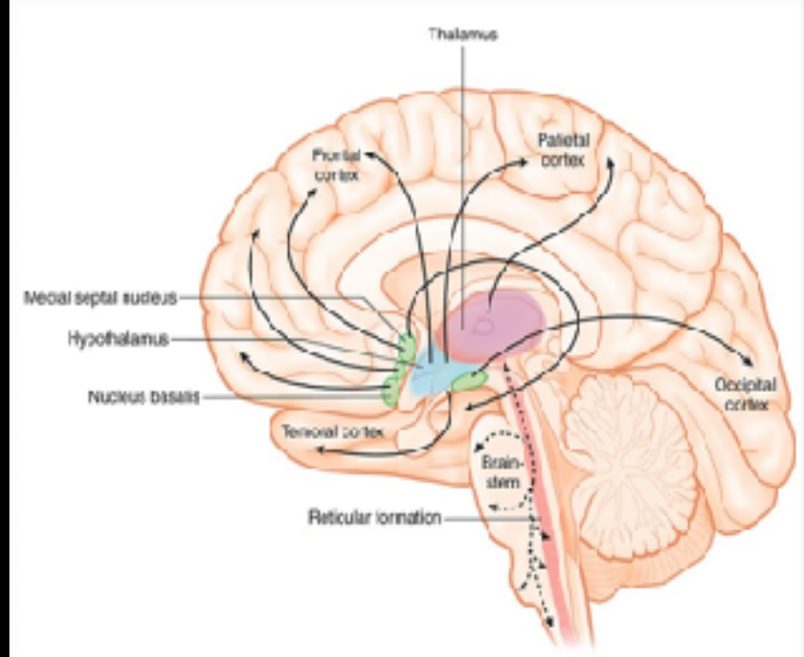
Transmitter systems associated with alertness

- Monoamine systems
  - Serotonin (raphe)
  - Histamine (TMN)
  - Noradrenaline (locus ceruleus)
- Cholinergic systems AcetylCholine
  - Brain stem (LDT and PPT) project to thalamus
  - Forebrain (basal nucleus of Meynert) to cortex



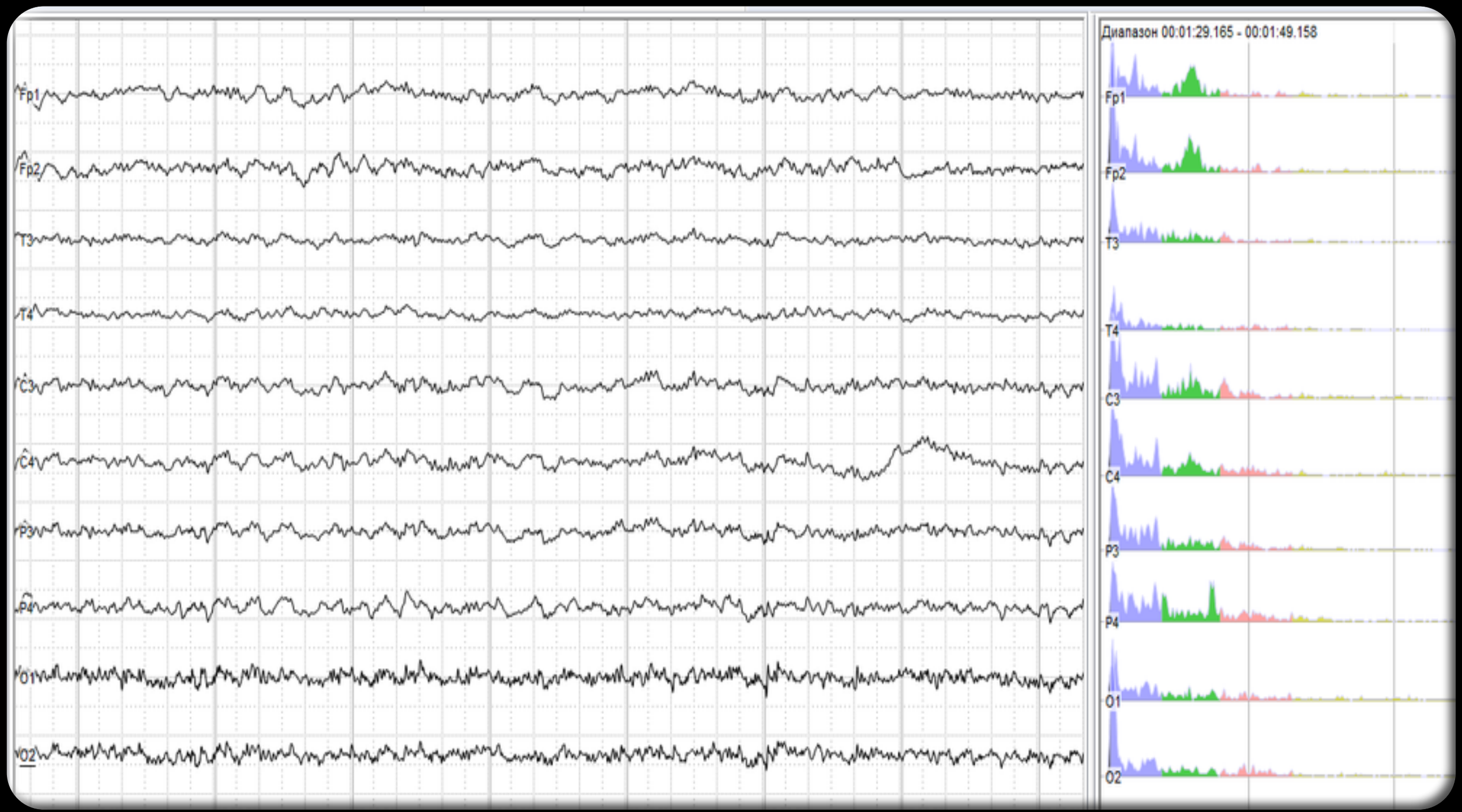
Sleep/Wake Regulation



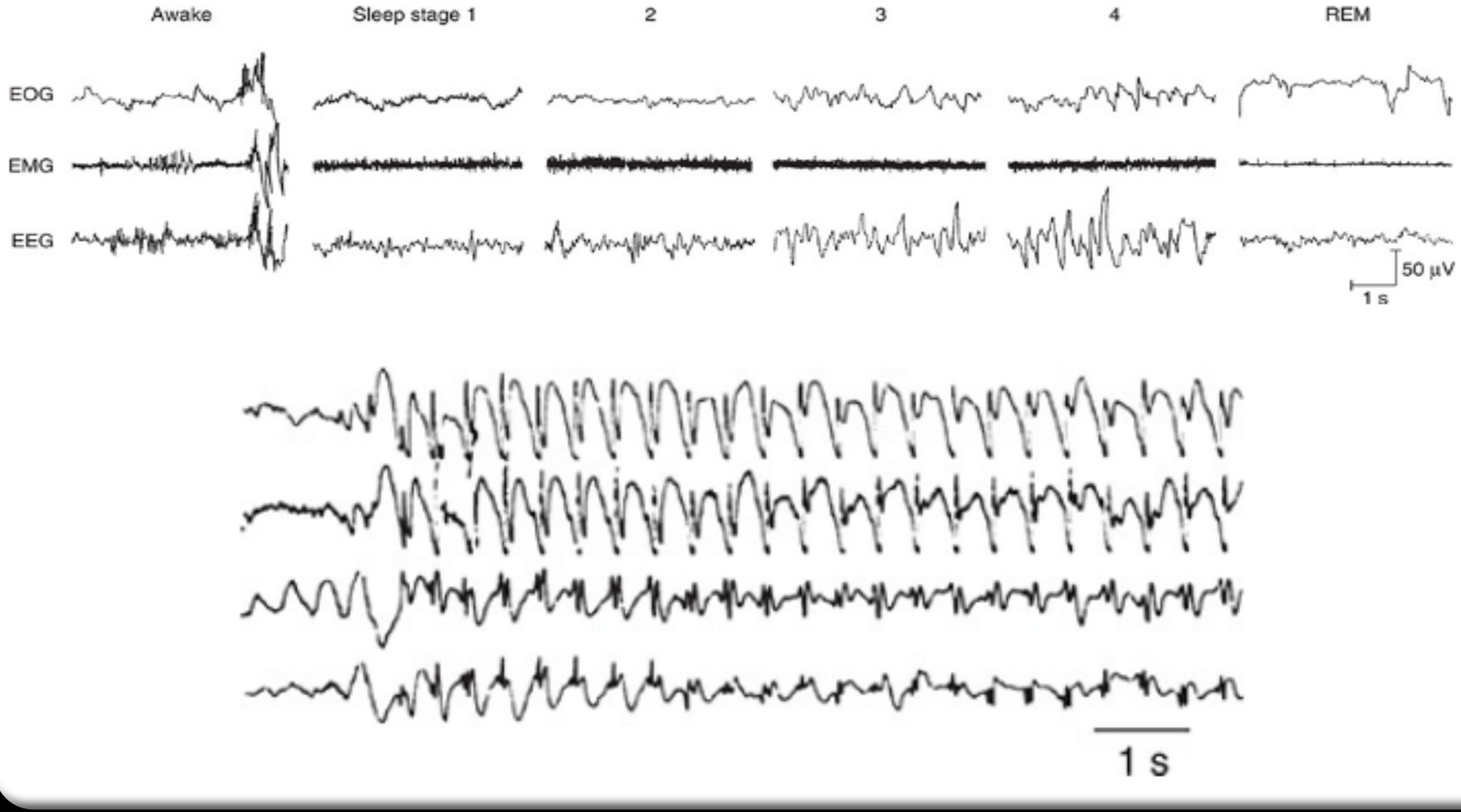


- Regulated via RAS and hypothalamus

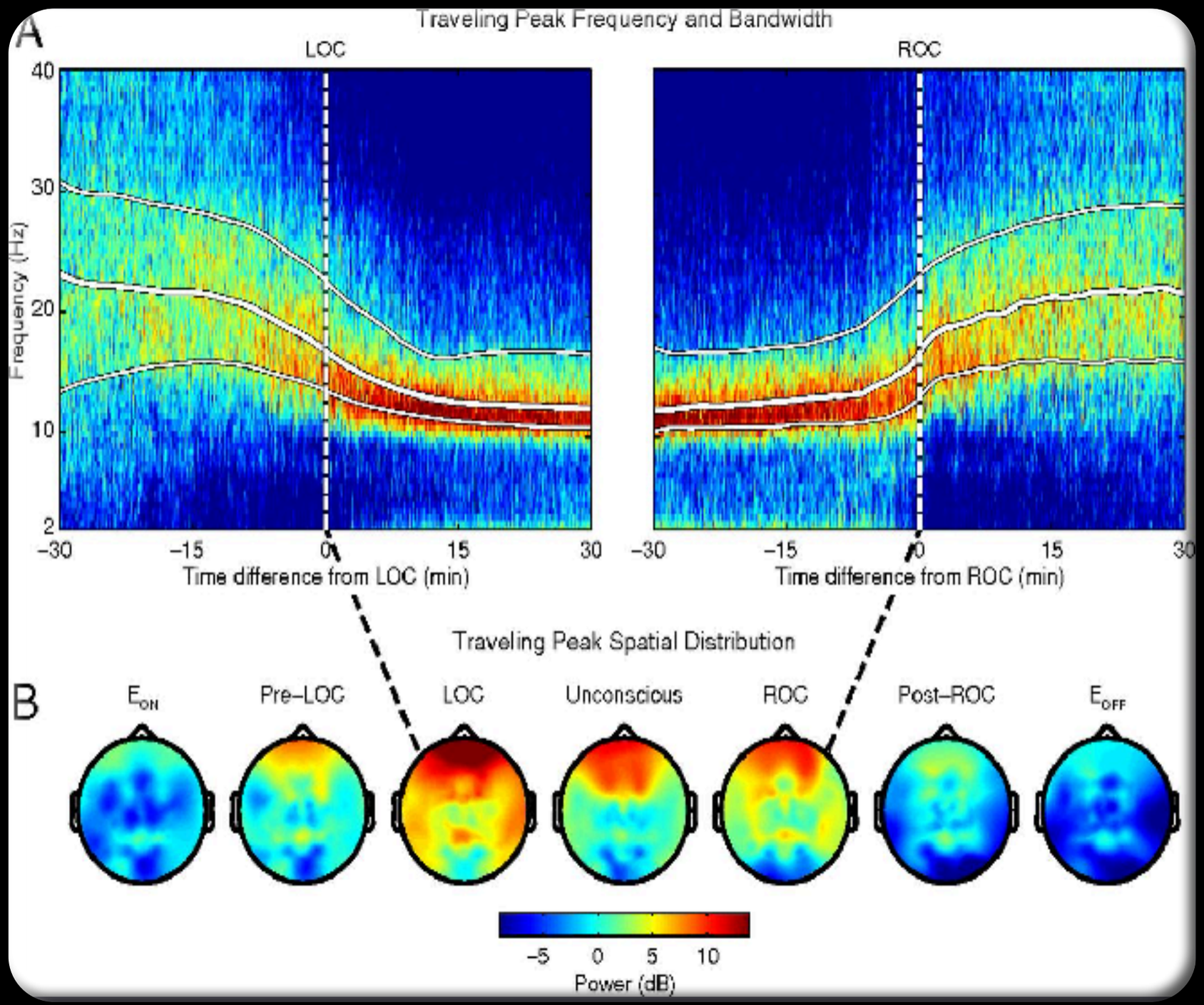
Electroencephalography



EEG patterns



Spectral Frequency



- Consciousness is associated with:
  - Higher frequency firing of neurones
  - Synchronised discharges across larger areas of the brain.

Assessment and Diagnosis

Assessment

- Start from basics.
- Is the person unresponsive
  - Airway
  - Breathing
  - Circulation
- If so
  - ALS or BLS algorithmns apply

ALS causes of unconsciousness

- These are emergencies
- Need to treat quickly
  - Usually within a few minutes

The H's of ALS

Cause	Altered mental state
Hypovolaemia	When MAP < 60mmHg (≈80/50)
Hypoxia	When DO_2 < 400ml/min (SaO_2 < 60%)
H^+ (Acidosis)	With pH < 7.0 or > 7.6
Hyper/hypokalaemia	Only with arrythmias (K+ < 3.0 or > 8.0)
Hypoglycaemia	When BSL < 3.0 or > 30
Hypothermia	When core temp < 28° Celcius

The T's of ALS

Cause	Altered mental state
Toxins	Depends on drug
Tamponade	When MAP < 60mmHg (≈80/50)
Tension Pneumothorax	When MAP < 60mmHg (≈80/50)
Thrombosis (AMI, PE)	When MAP < 60mmHg (≈80/50)
Trauma (Head)	Need raised pressure (CPP > 60 mmHg) *Head injuries may cause hypertension*

Cerebral Perfusion Pressure

- Cerebral Perfusion Pressure
  - Mean Arterial Pressure - Intracranial Pressure
- Needs to be > 60 with acute head injuries
  - Normal ICP 11 mmHg
  - Mild head injury 20 mmHg
  - Severe head injury >40 mmHg

Assess Conscious State

- Glascow coma scale probably the best
- Three areas of assessment
  - Eye movement (Scale of 1-4)
  - Verbal responses (Scale of 1-5)
  - Motor responses (Scale of 1-6)

Assess Conscious State

	Eye	Verbal	Motor
1	Closed	Silent	Immobile
2	Opens to pain	Incomprehensible sounds	Extension to pain Decerebrate
3	Opens to voice	Inappropriate words	Flexion to pain Decorticate
4	Opens spontaneously	Confused or disoriented	Flex/Withdraw to pain
5		Oriented, conversations normal	Localises pain
6			Obeys command

Interpreting the GCS

- Assessing head injury
  - Severe, with GCS < 8 (coma)
  - Moderate, GCS 8 –12
  - Minor, GCS ≥ 13.
- Any reduction in GCS from 15 is abnormal
- GCS falling over time is an emergency.

Differential Diagnosis

- Very long list of causes
  - All disease states end in coma and death
- Focus on ones where there is no obvious other cause

“AEIOU TIPPSSS”

- Alcohol
- Epilepsy
- Insulin & glycaemic changes
- Overdosage of drugs
- Uraemia & metabolic causes

TIPPSSS

- Trauma to head
- Infection (esp in elderly or if intracranial)
- Raised intracranial pressure
- Psychiatric disorder
- Stroke
- Simple Feint
- Stokes-Adams (cardiac arrythmia)

Predisposing Causes

- Cognitive impairment / dementia
- Comorbidity
  - Older Age
  - Dehydration / Malnutrition
  - Drug and alcohol use
  - Psychiatric e.g. depression
- Sensory impairment (vision, hearing)
- Functional dependence

How to assess

- History and examination, basic observations
- Basic chemistry
  - EUC, BSL, FBP, Ca++, ABG's
  - Toxicology
  - TFT's, LFT's
- Imaging - CT Head (vs MRI)

Management

Basics

- Remember ABC's - fix these first
- Assess Glasgow Coma Scale
- If rapidly falling GCS, or if GCS < 12
  - Medical Emergency - minutes count
- If stable (over hours)
  - Requires urgent investigation.

Coma

- General management
  - Support basic organ systems
  - Obtain a diagnosis
  - Manage specific problems and complications

Rapidly Falling GCS

- ALS algorithmn
- IV access (+ take bloods)
- Intubate & mildly hyperventilate
  - Aim for $PaCO_2$ = 30mmHg
- Investigation (including brain imaging)
  - Only do lumbar puncture after imaging

Emergency Management

- Conditions you need to have a plan for
  - Seizures
  - Altered plasma glucose
  - Raised intracranial pressure
  - Head trauma
  - Sepsis

Seizures

- Management (after ABC's)
  - Midazolam 0.1 mg /kg or Diazepam 0.15mg/kg
  - Phenytoin 15mg/kg over 30 minutes
  - Can consider Thiopentone/Propofol

Hypoglycaemia

- Glucose 50%
  - 25-50 mL
  - Need larger bore needles and cannula

Raised ICP

- Imaging essential to exclude masses
- Medical management
  - Mannitol (0.25-0.5 g/kg) ≈ 150ml 20% mannitol
  - Hypertonic saline
  - Prevent hypercapnia
- Surgical management

Trauma

- Primary & Secondary injury
  - Aim to minimise secondary injury
- Aim to normalise
  - CO2, BSL, ICP, CPP
- Aim to prevent
  - Seizures, Hyponatraemia.

Sepsis

- Time to intervention is important:
  - Get samples (blood/urine/sputum/etc)
  - Antibiotics
  - Supportive management (eg for BP)

Induced Coma

Rationale for Benefit

- Anaesthesia (surgery and procedures)
  - Mostly for amnesia - different from coma
- Induced coma in ICU
  - To allow hypothermia
- Trauma
  - Management of head injuries

Induced coma

- Benefit in non traumatic head injuries
  - Reduce core temperature to < 35°
  - Must be done shortly after brain injury
  - No benefit with trauma
- Need to stop normal thermoregulation

Trauma

- Mostly to control airway and $PaCO_2$
  - Usually requires paralysis
    - Thiopentone/Propofol + suxamethonium
    - Midazolam + rocuronium
- Occasionally for oxygenation.

Drugs

- Inhalational anaesthetics
- Intravenous anaesthetics
- Benzodiazepines
- Other sedatives

Inhalational Agents

- Nitrous Oxide, Methoxyflurane
- Desflurane, Sevoflurane, Isoflurane
- Advantages
  - Easy to administer
  - Measure depth of anaesthesia
  - Minimal tolerance
  - Analgesia with N_2O and Methoxyflurane

Intravenous agents

- Proprofol
  - 2 mg/kg induction, 30-50 mg/kg/hr (maintence)
  - Fast onset and offset
- Thiopentone
  - 3-5 mg/kg induction, maintence more complex
  - Reduces ICP and Cerebral O_2 requirements
- IV agents match O_2 with blood flow.

Benzodiazepines

- Midazolam
- Diazepam
- Note differential effects on amnesia versus coma.

Other Agents

- Analgesics: Opiates
  - μ receptor agonists
- Sedatives: Clonidine, Dexmetomidine
  - α2 receptor agonists
- Ketamine
  - NMDA receptor antagonists

Summary

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- Management
- Medically Induced Coma