Sonno e Sogni

Prof. Marcello Costantini

Psicobiologia II

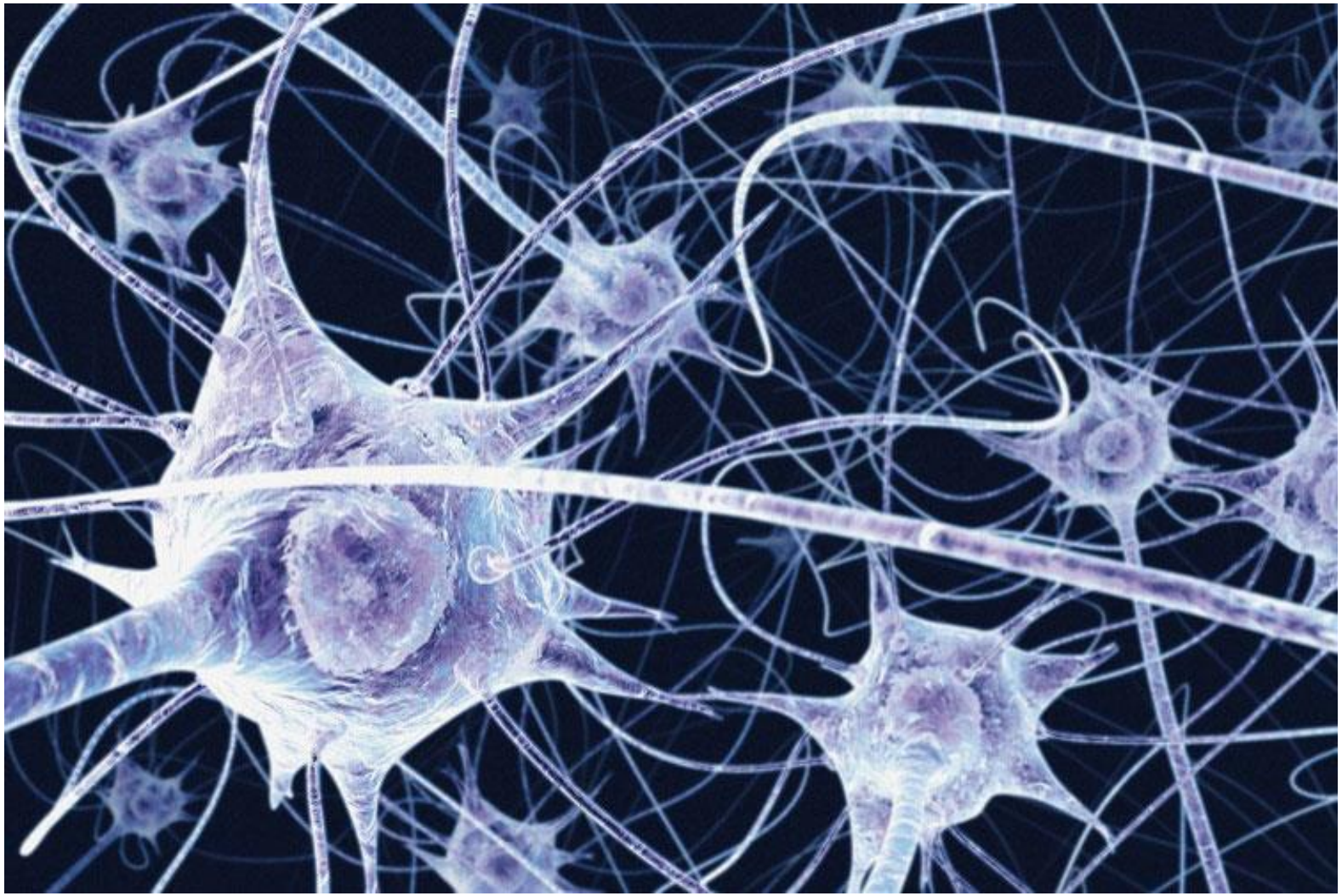
marcello.costantini@unich.it

Stanza 316 - edificio ITAB

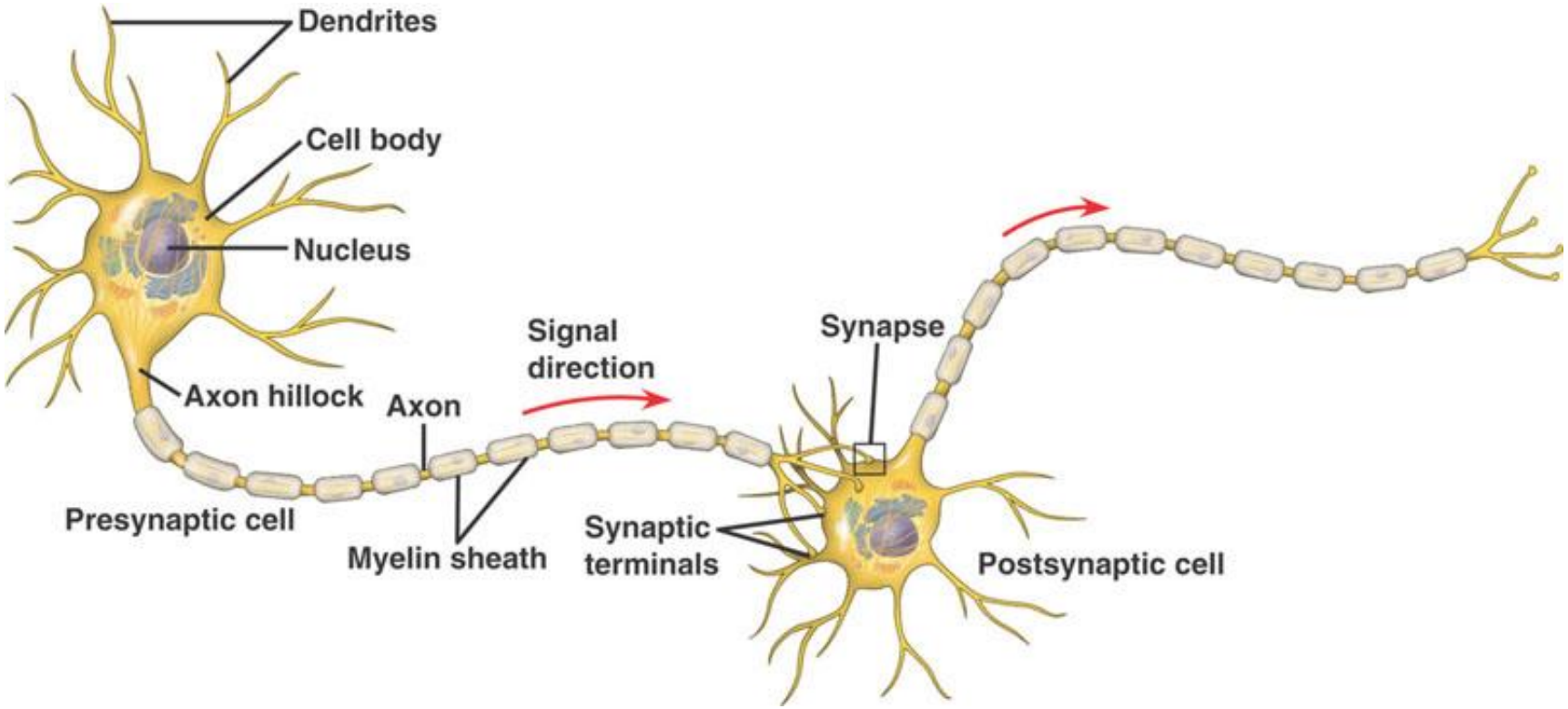
EEG

elettroncefalogramma

Centinaia di bilioni di neuroni



Correnti post-sinaptiche dendridiche



Local Field Potential - LPF

- Spontaneous electrical rhythms of mammalian brain first documented in 1870 by Richard Caton
- Development of human electroencephalography due to Hans Berger (1873-1941)

- Search for 'mind-brain links' (cortical metabolism & mental events)
- First recorded electrical activity of human brain in 1924

HANS BERGER: FROM PSYCHIC ENERGY TO THE EEG

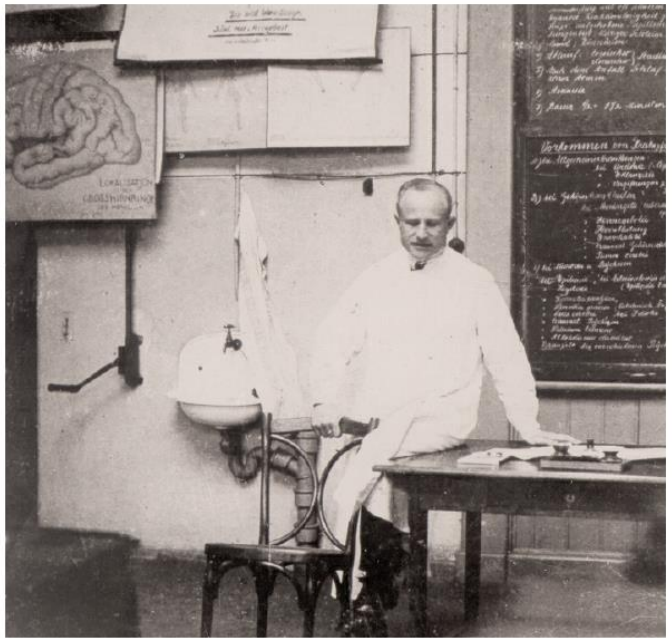


FIGURE 1

Berger lecturing at the University of Jena during the 1920s. It was during this time that he returned to the study of electrophysiology and successfully recorded the human EEG from the intact skull for the first time.

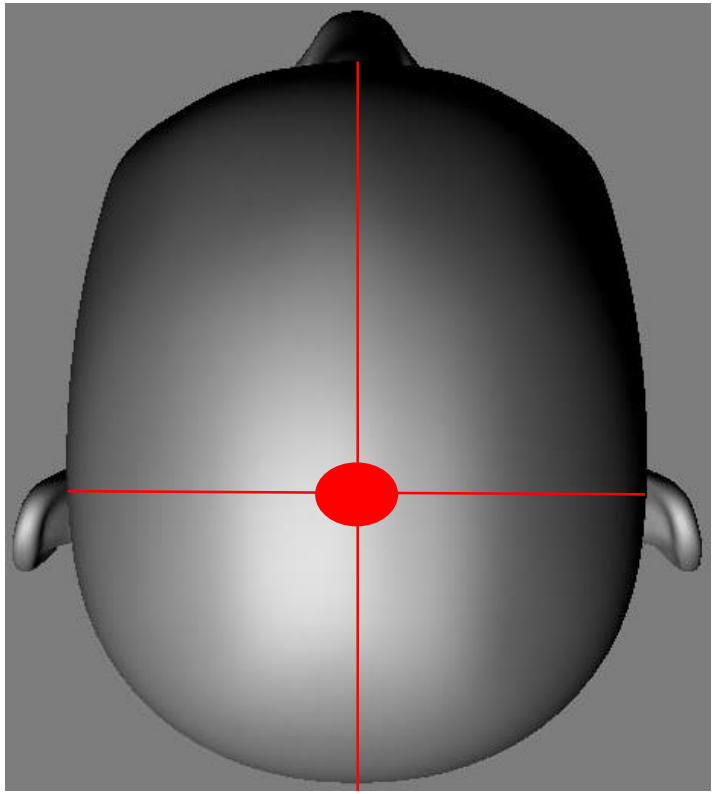
From Millett, 2001, Perspectives in Biology and Medicine

Hans Berger

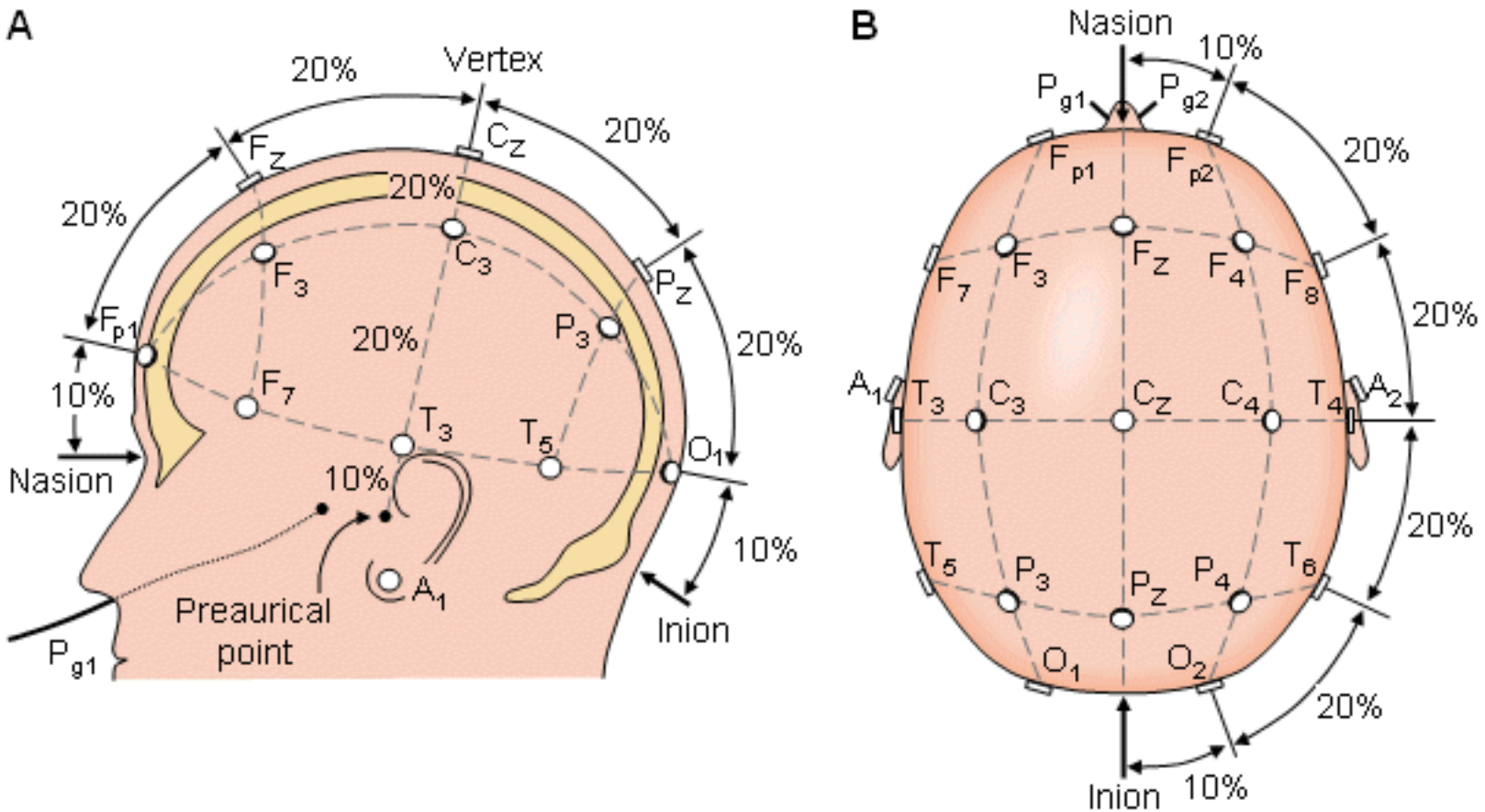
"It was a case of spontaneous telepathy in which at a time of mortal danger, and as I contemplated certain death, I transmitted my thoughts, while my sister, who was particularly close to me, acted as the receiver."

Strumentazione

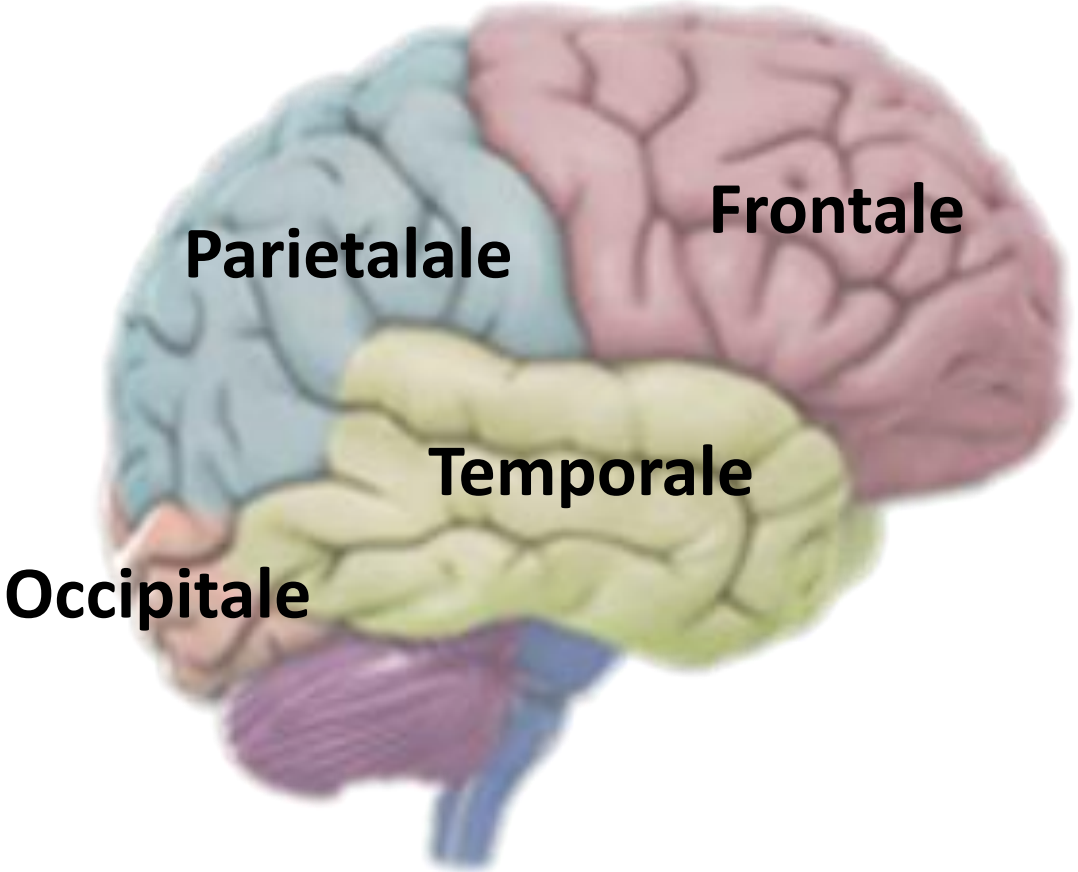
10/20 sitema internazionale



10/20 sitema internazionale

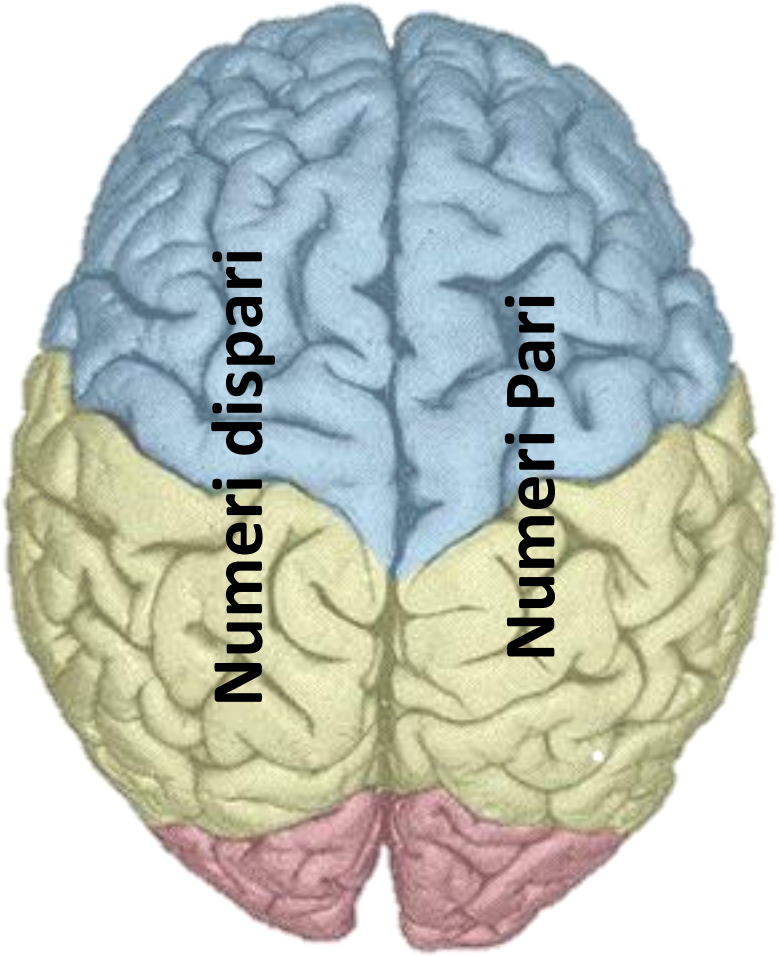


10/20 sitema internazionale

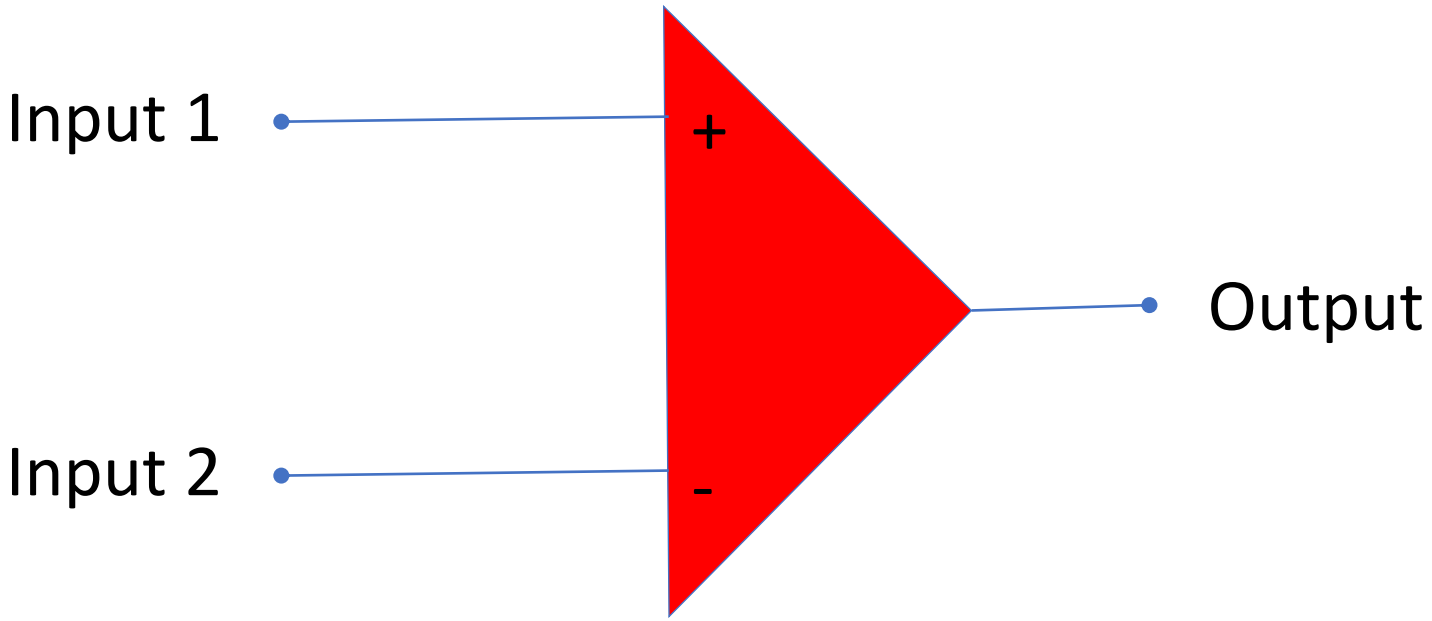


F = Frontale
P = Parietale
T = Temporale
O = Occipitale

10/20 sitema internazionale



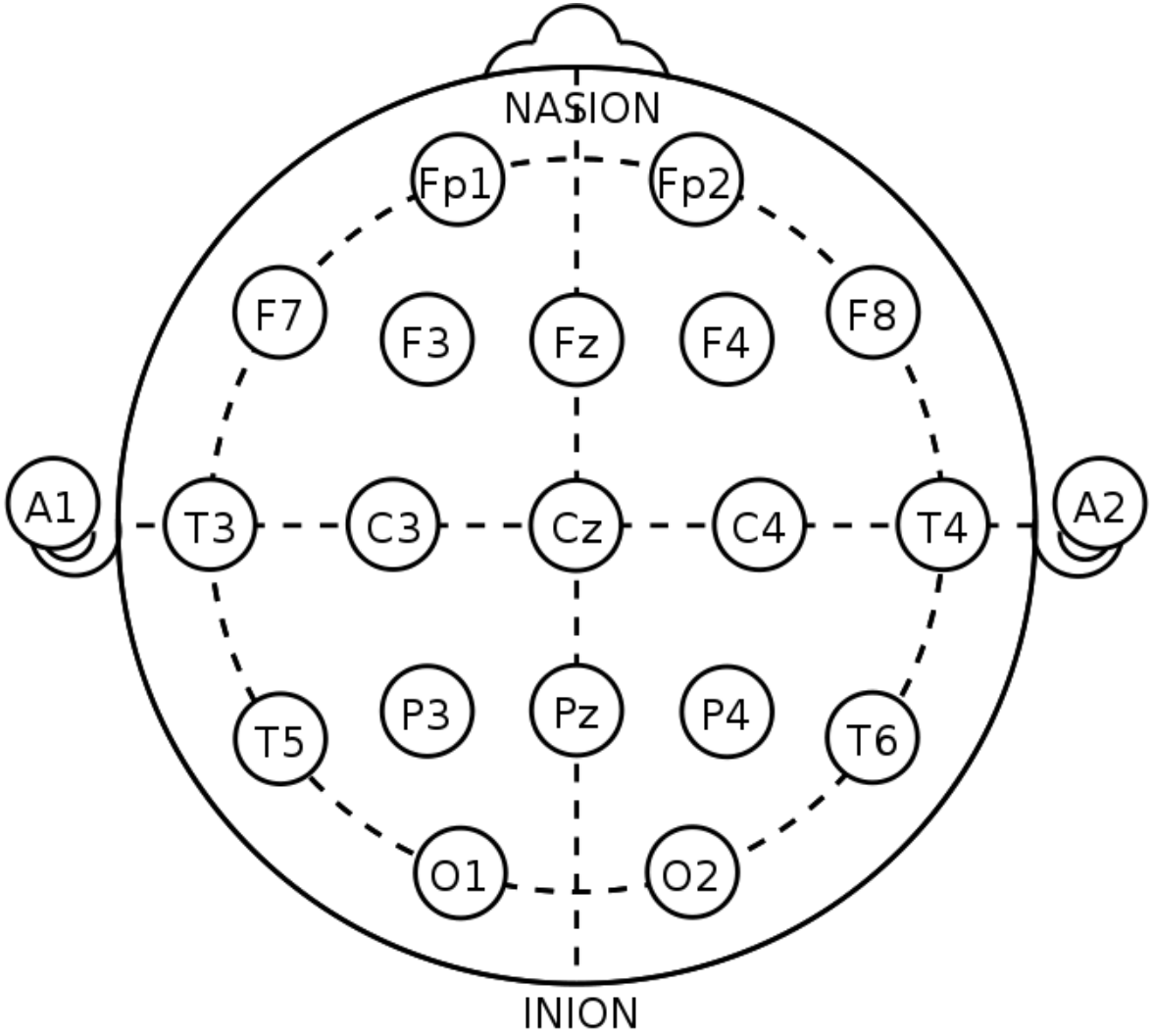
Montaggi EEG



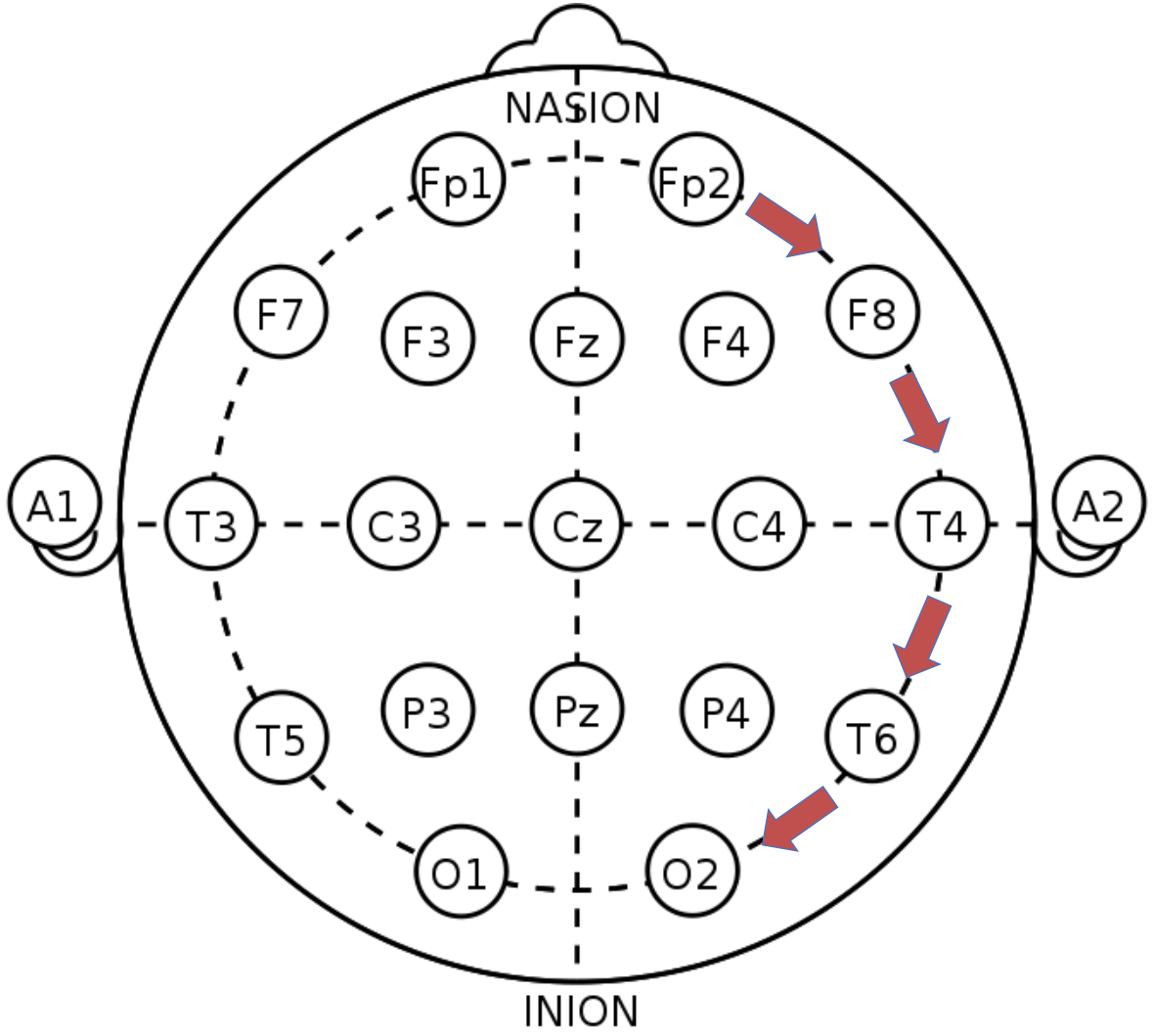
Montaggi EEG

- Bipolare
- Riferimento comune
- Riferimento medio

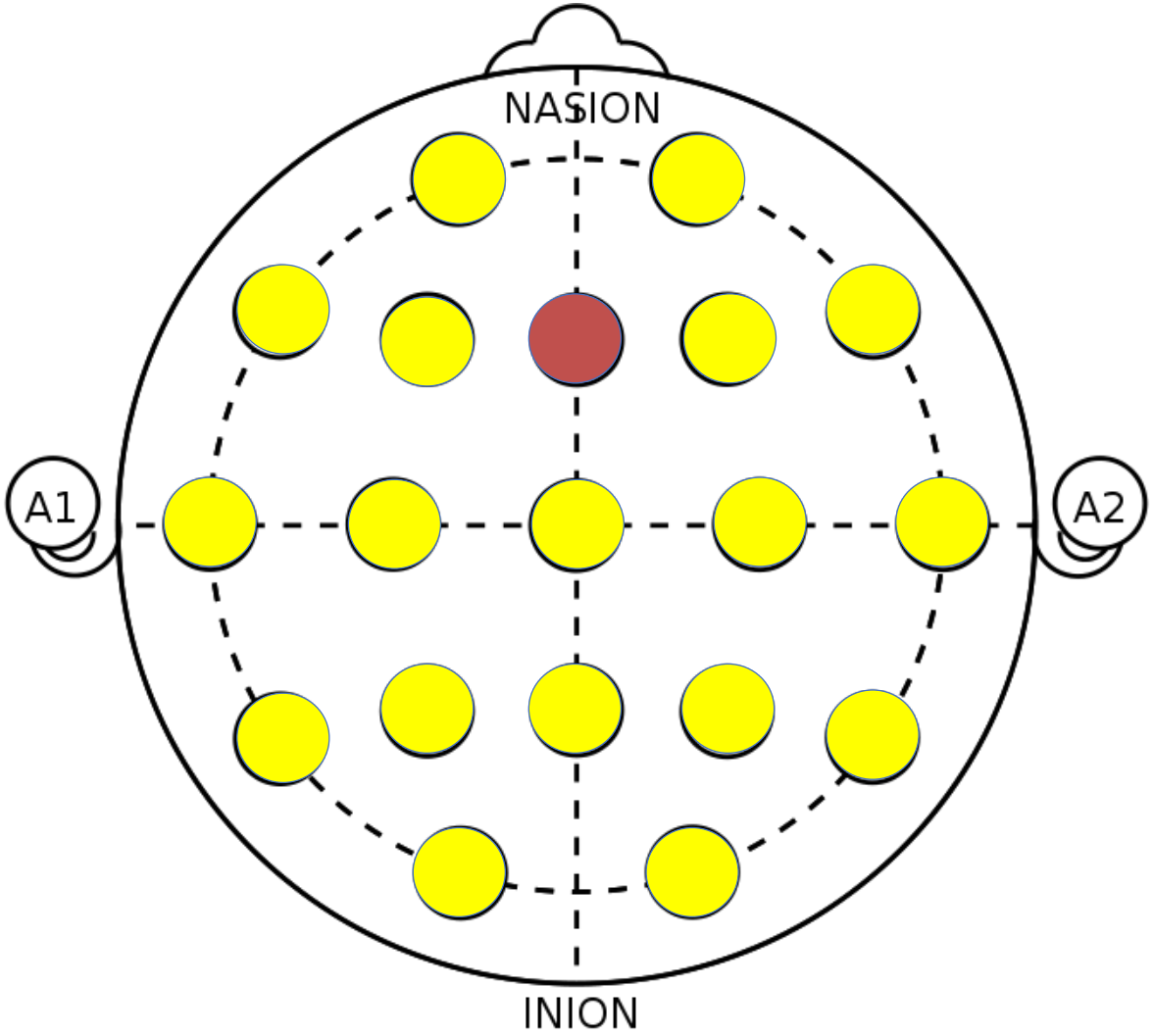
Montaggio bipolare



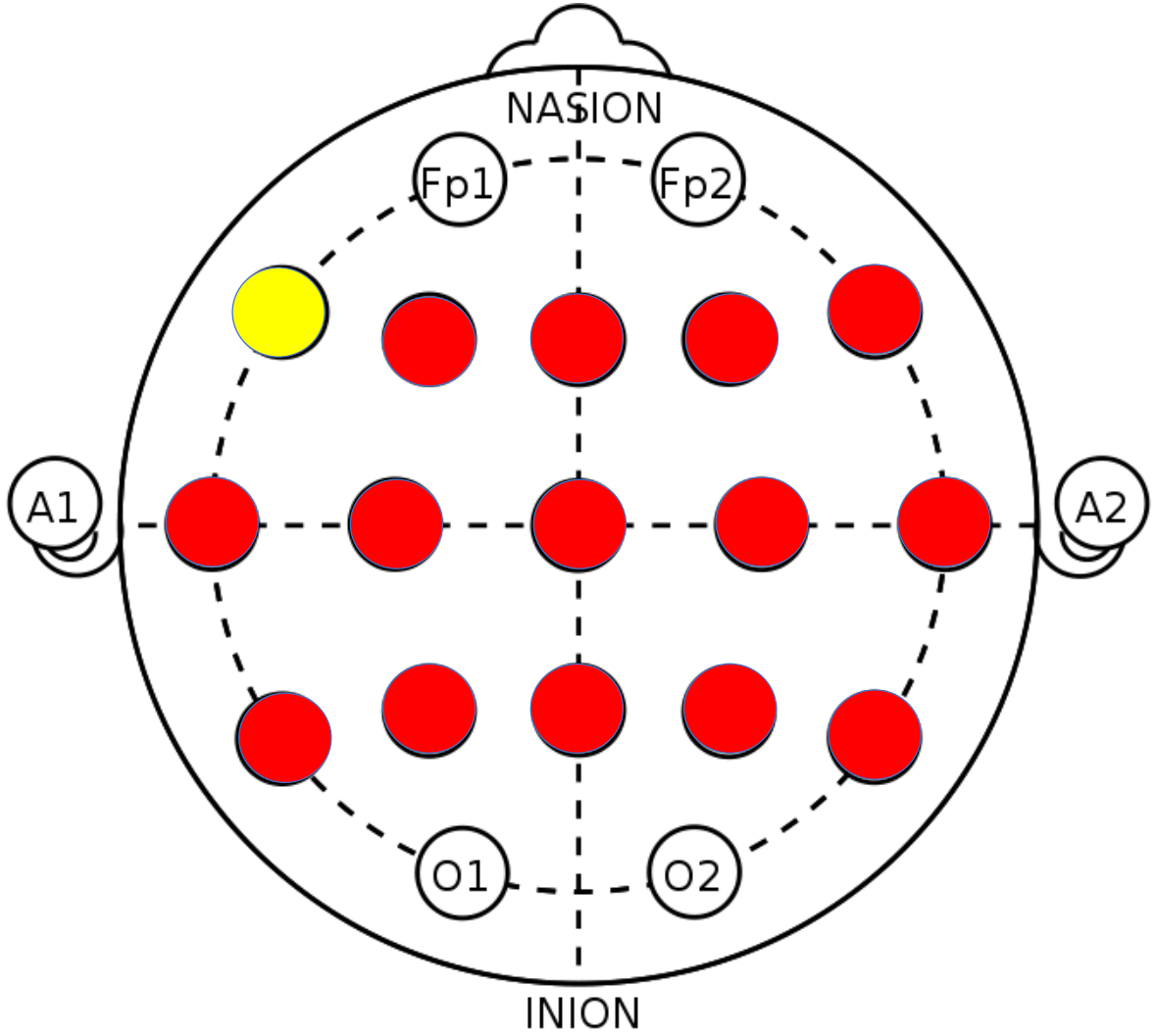
Montaggio bipolare



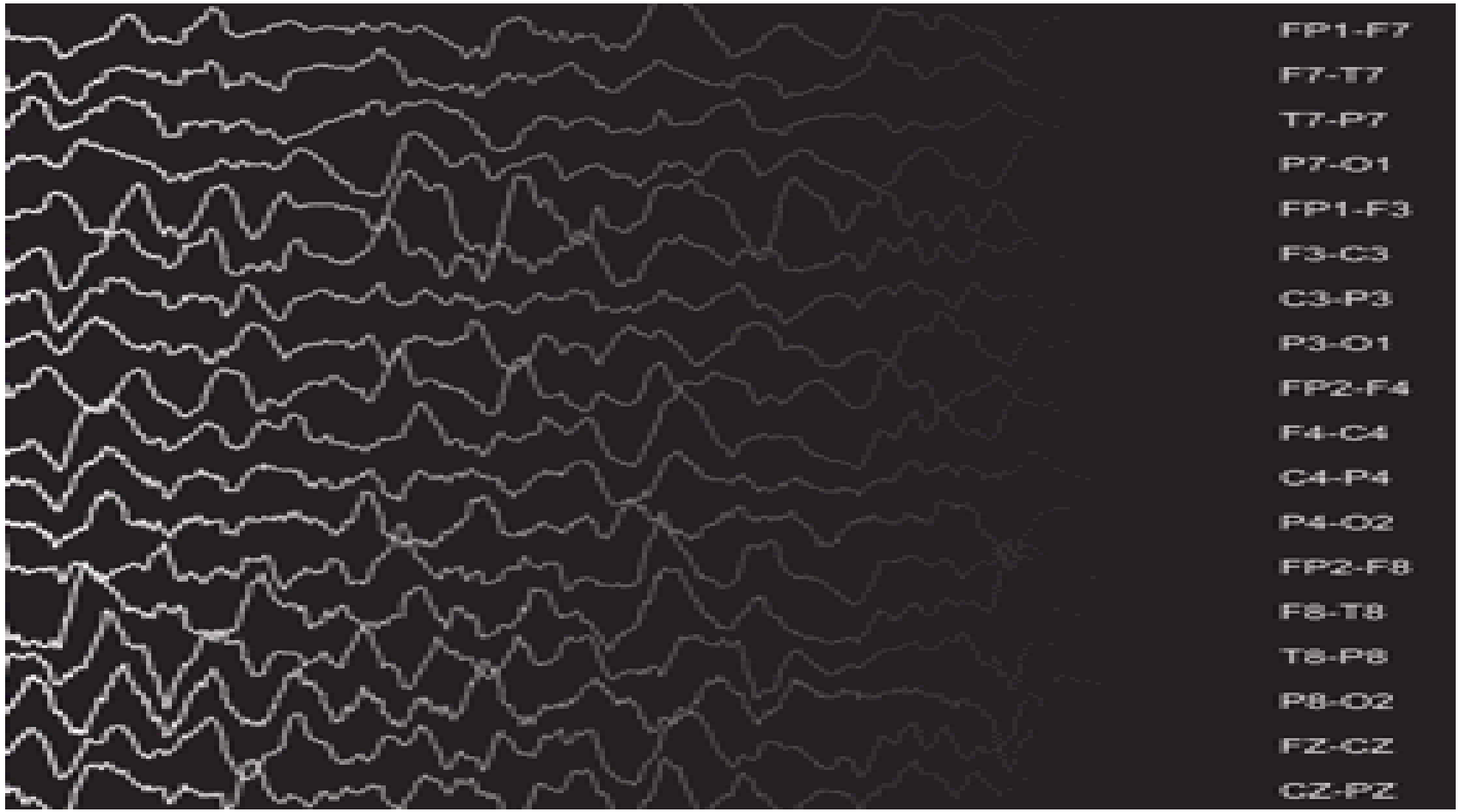
Riferimento comune



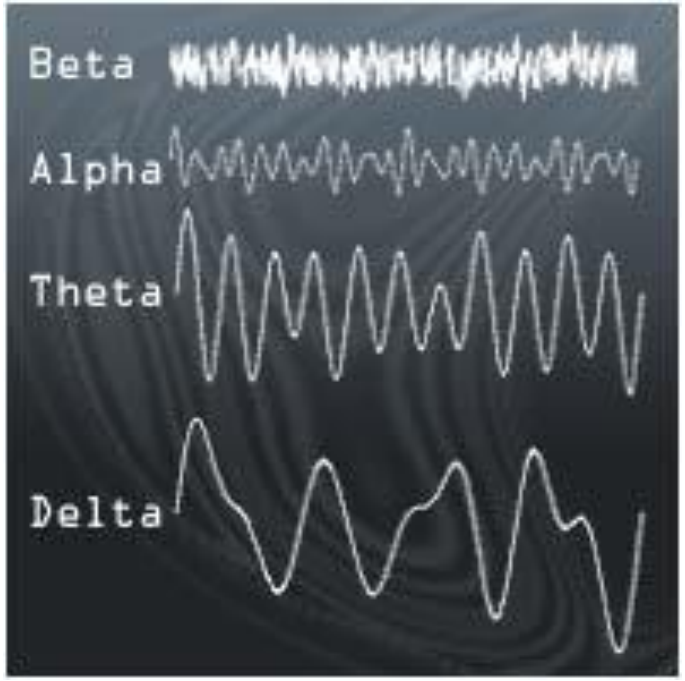
Riferimento medio

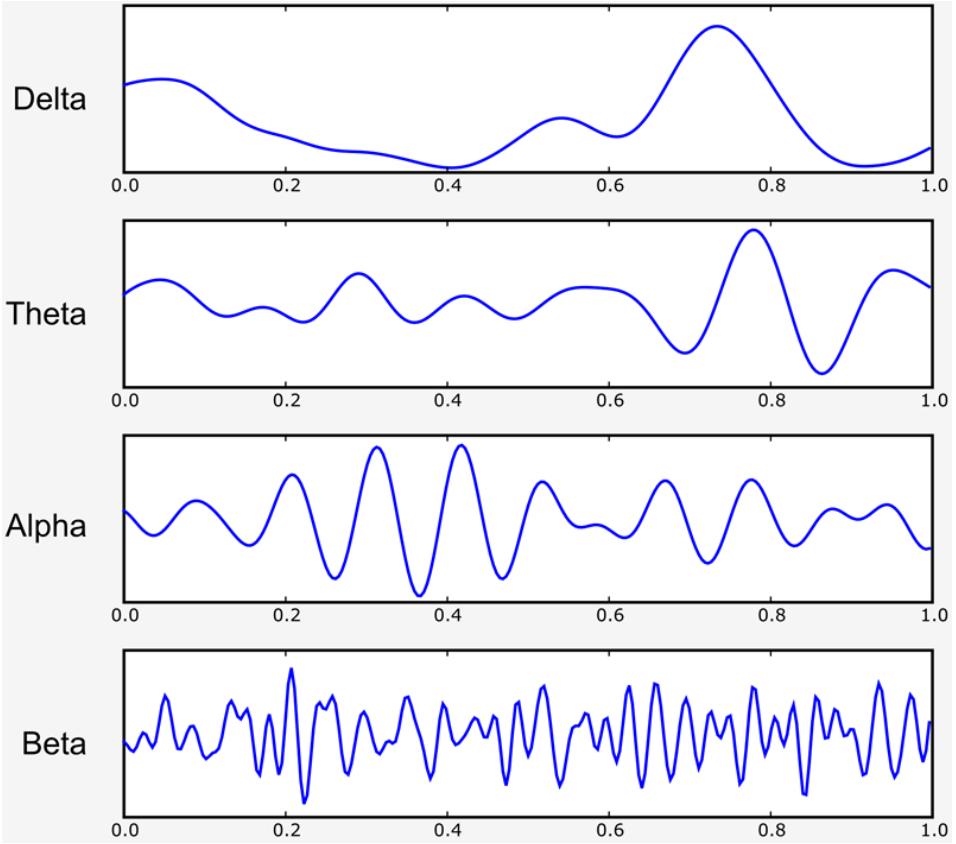


EEG


FP1-F7
F7-T7
T7-P7
P7-O1
FP1-F3
F3-C3
C3-P3
P3-O1
FP2-F4
F4-C4
C4-P4
P4-O2
FP2-F8
F8-T8
T8-P8
P8-O2
FZ-CZ
CZ-PZ

Investigating the EEG





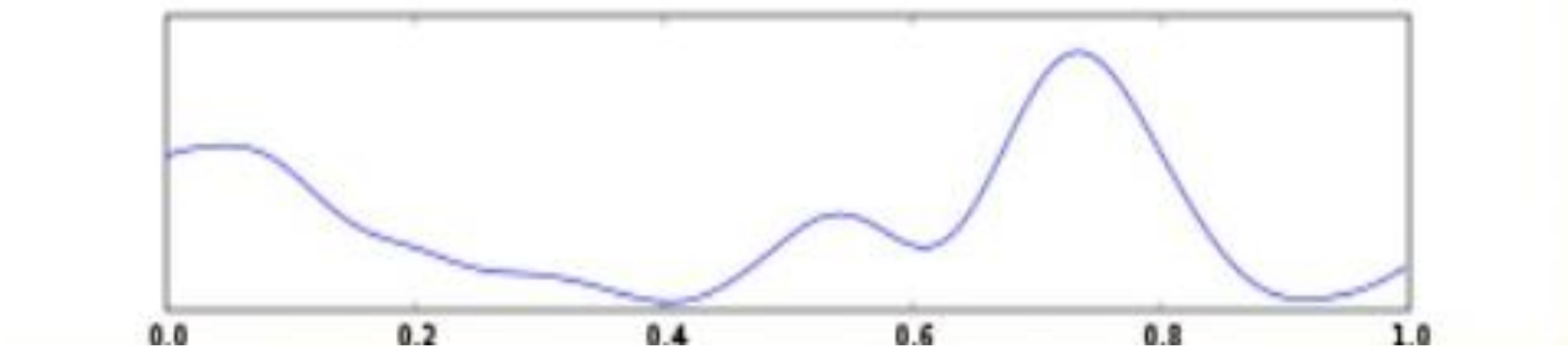
Bande di Frequenza

- Bande di frequenza EEG (1-100Hz) e loro ampiezza (5-100μV):

  - Gamma (>30Hz)<<50μV
  - Beta (12-30Hz) <50μV
  - Alpha (8-12Hz) ~50μV
  - Theta (4-8Hz) >50μV
  - Delta (0.5-4Hz) >>50μV

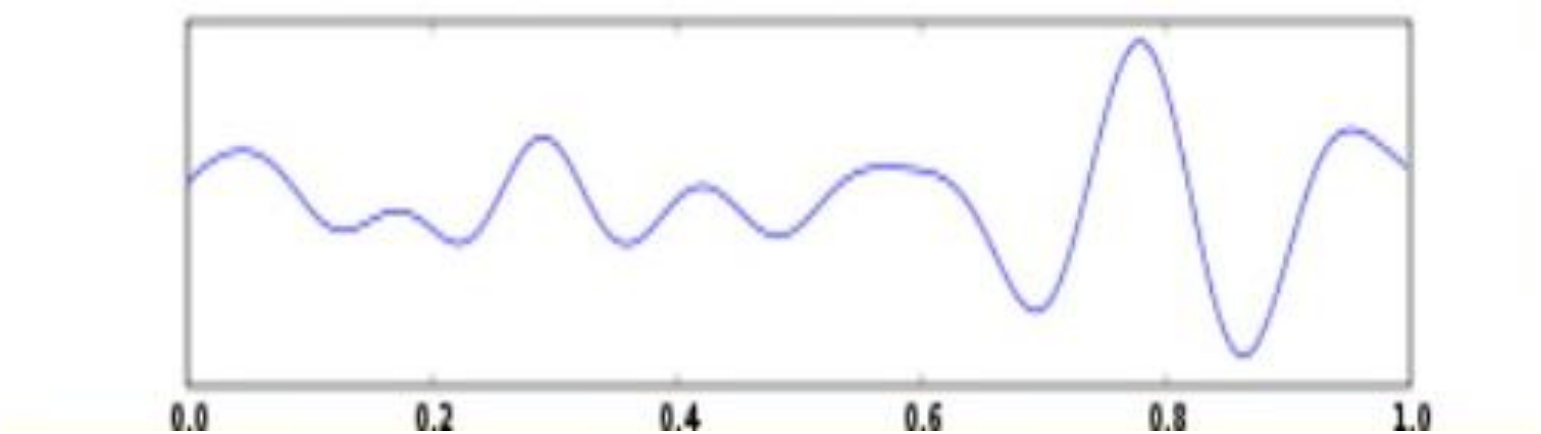
Delta Wave

- Its frequency range is 0.5-4hz. It is usually associated with slow wave sleep.
- Location: frontally in adults, posteriorly in children; High amplitude waves.



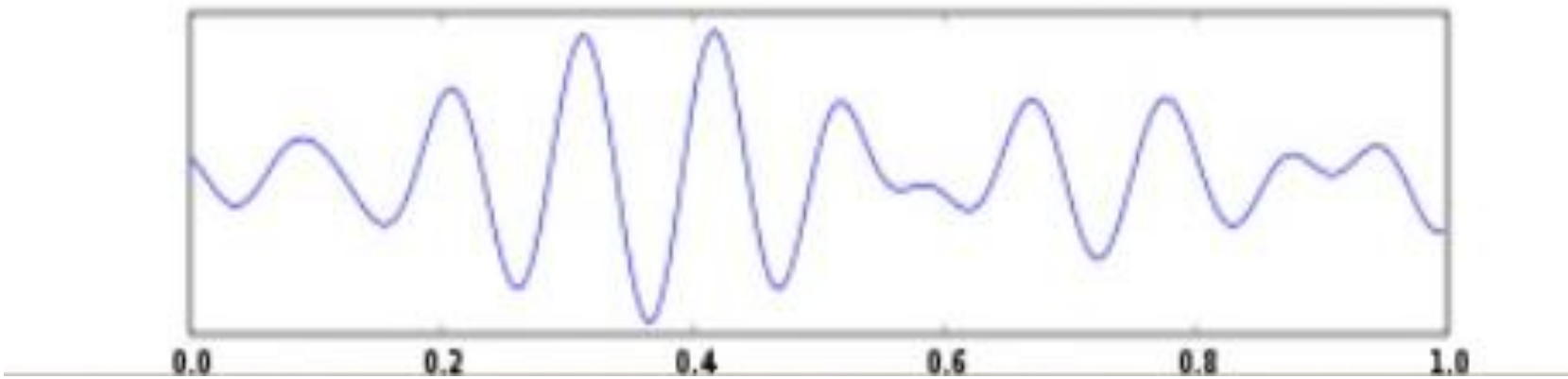
Theta wave

- A specific type of regular oscillation seen in the hippocampus and several other brain regions connected to it.
- EEG oscillations in the 4–8 Hz frequency range, regardless of where in the brain they occur or what their functional significance is



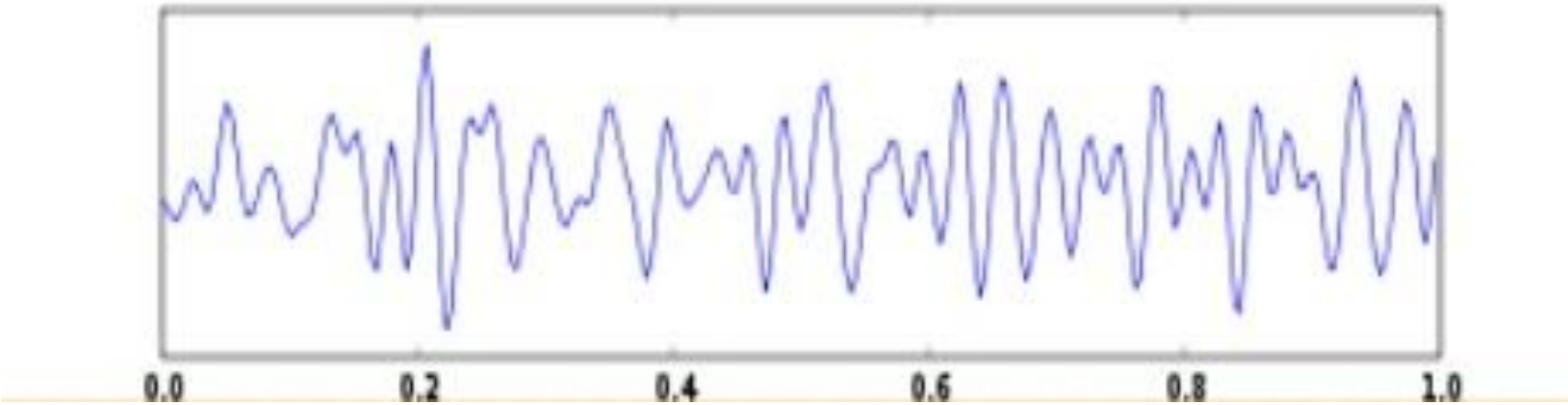
Alpha wave

- Mainly originated from occipital lobe during relaxation with closed eyes. Its frequency range is 8-12hz.
- Location: Posterior regions of the head. c3-c4 at rest



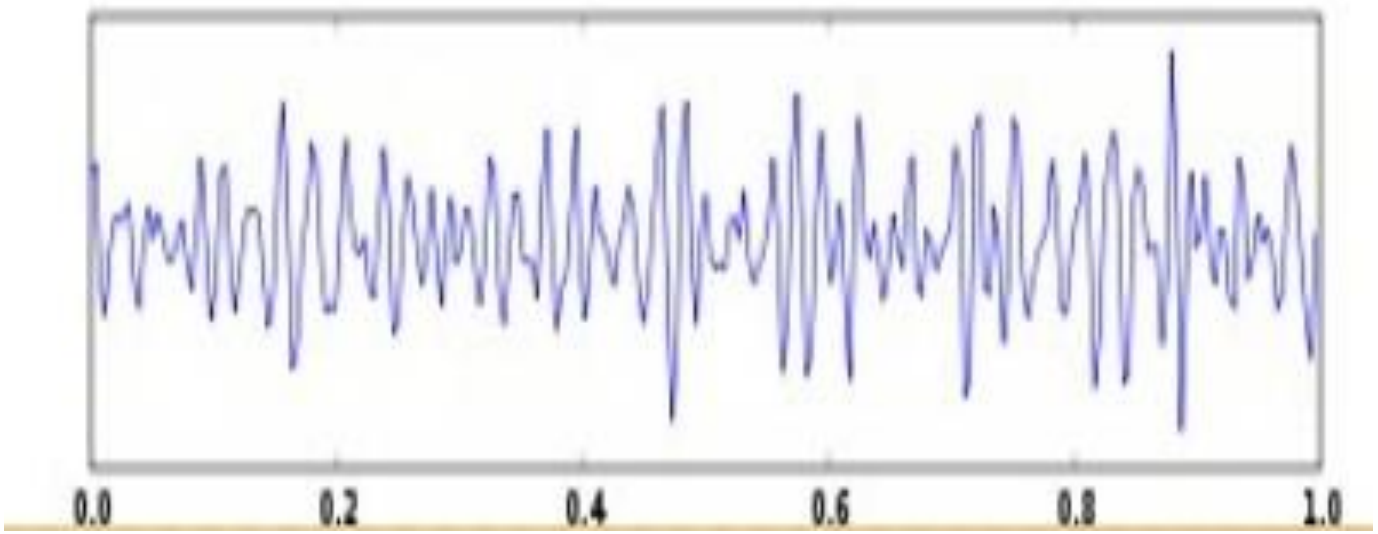
Beta wave

- Low amplitude beta waves with multiple and varying frequencies are often associated with active, busy, or anxious thinking and active concentration.
- Beta waves are split into three sections: Low Beta Waves (12–16 Hz); Beta Waves (16.5–20 Hz); and High Beta Waves (20.5–30 Hz).



Gamma wave

- A gamma wave is a pattern of neural oscillation in humans with a frequency between 30 and 100 Hz, though 40 Hz is typical.
- According to a popular theory, gamma waves may be implicated in creating the consciousness.



Fasi Del Sonno

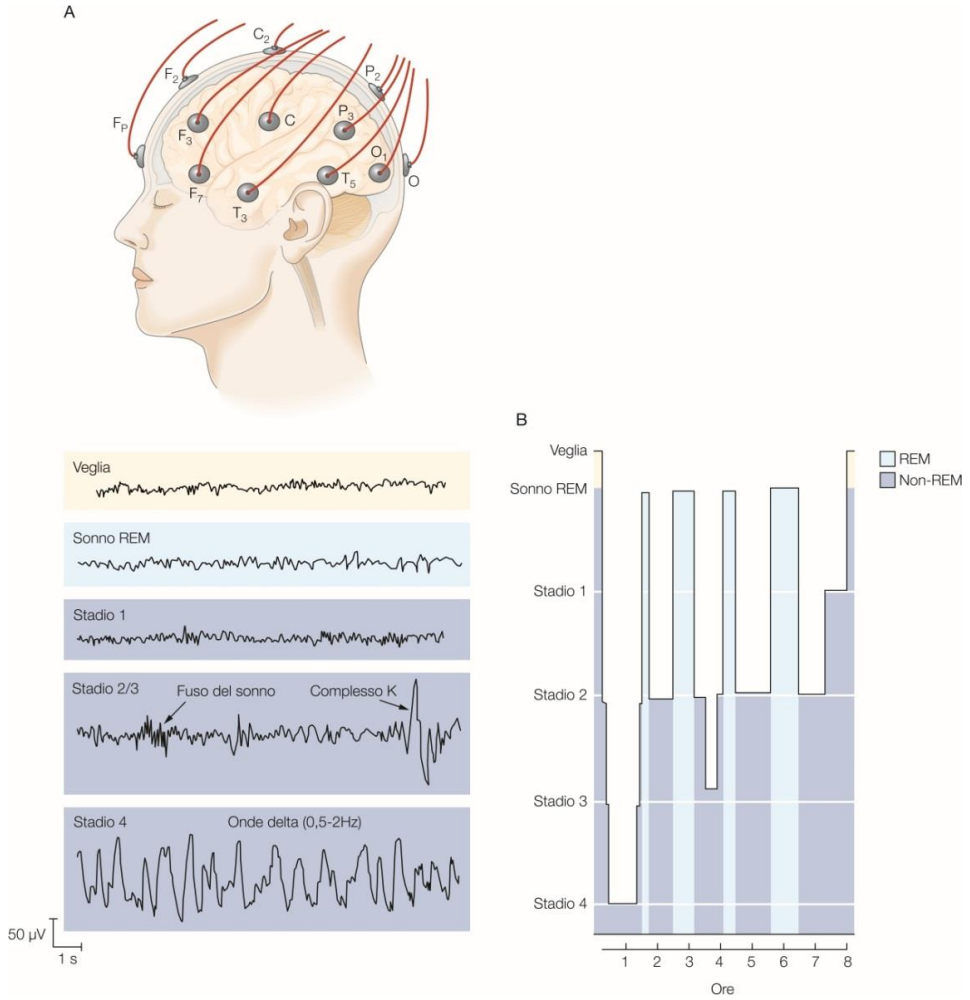


Figura 51-1 **L'attività elettrica cerebrale ha caratteristiche specifiche durante lo stato di veglia e durante ciascuno dei cinque stadi del sonno.**

Fasi Del Sonno

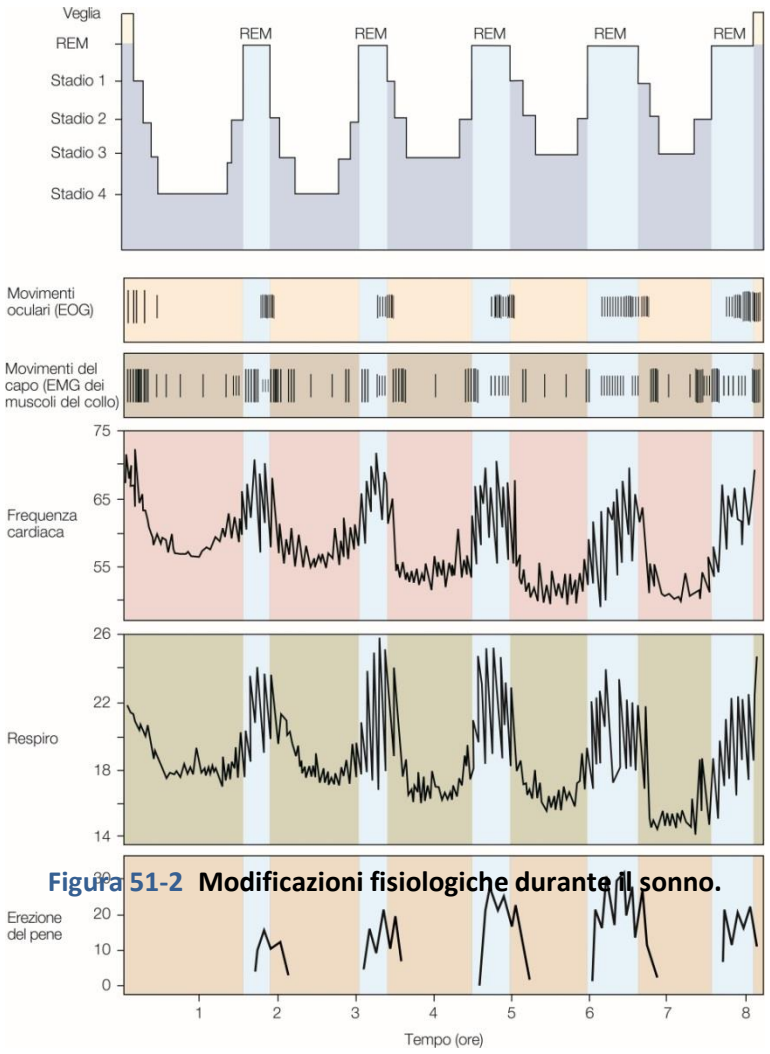
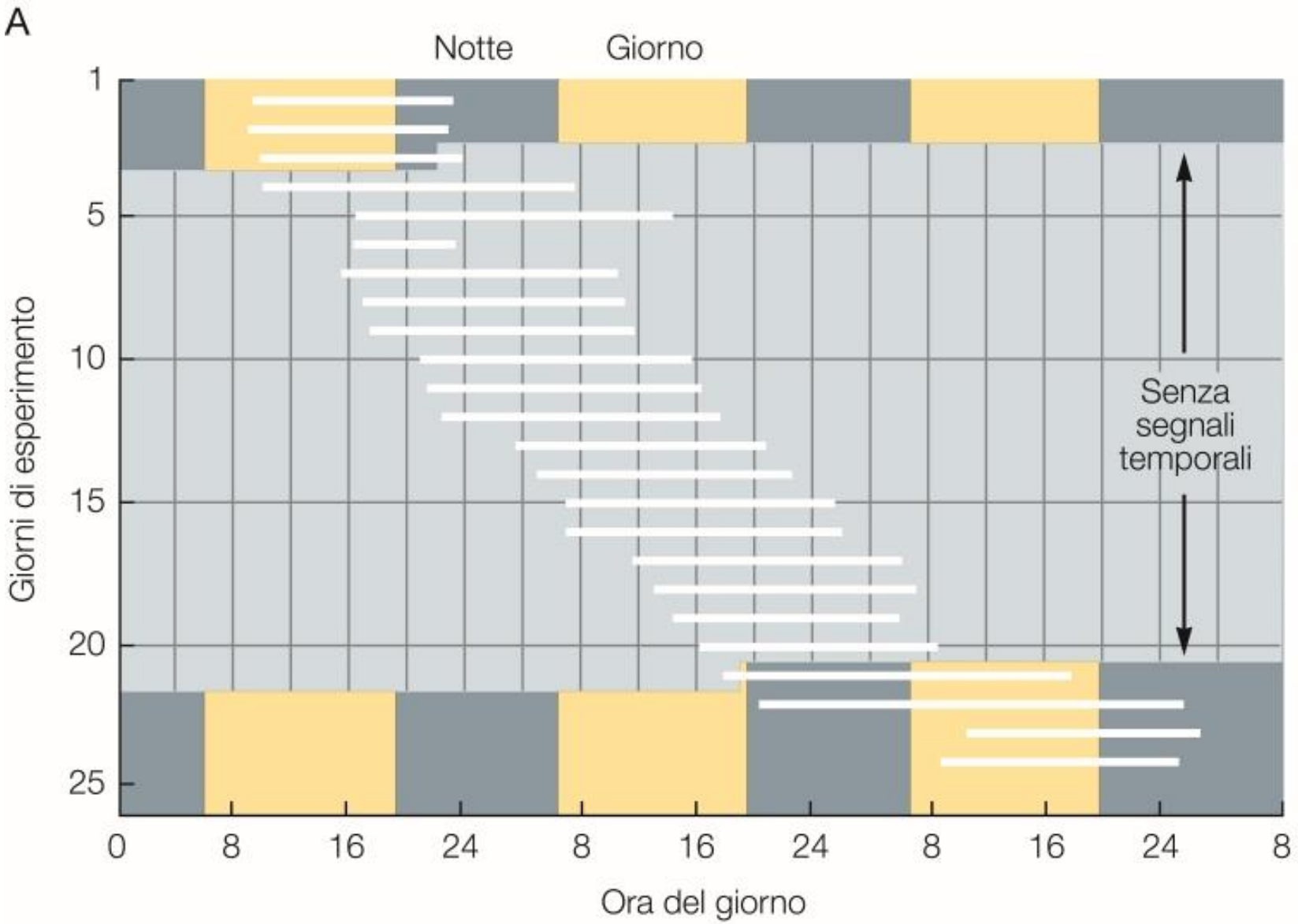


Figura 51-2 **Modificazioni fisiologiche durante il sonno.**

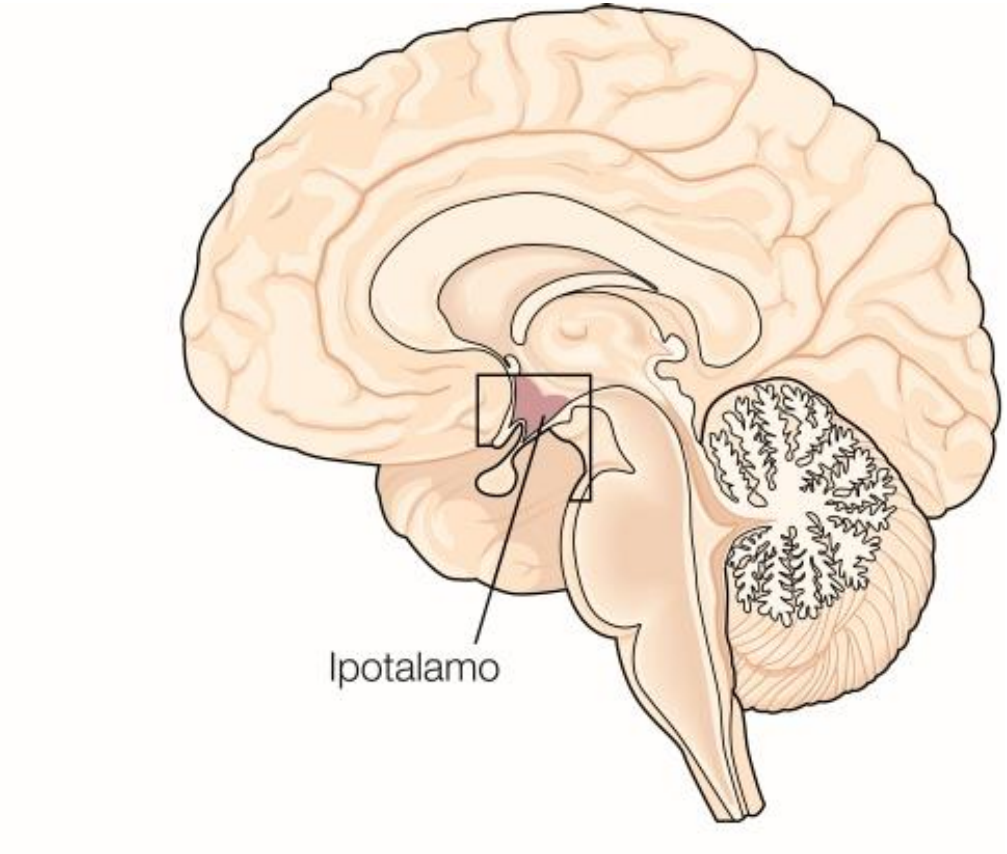
Ritmo Circadiano

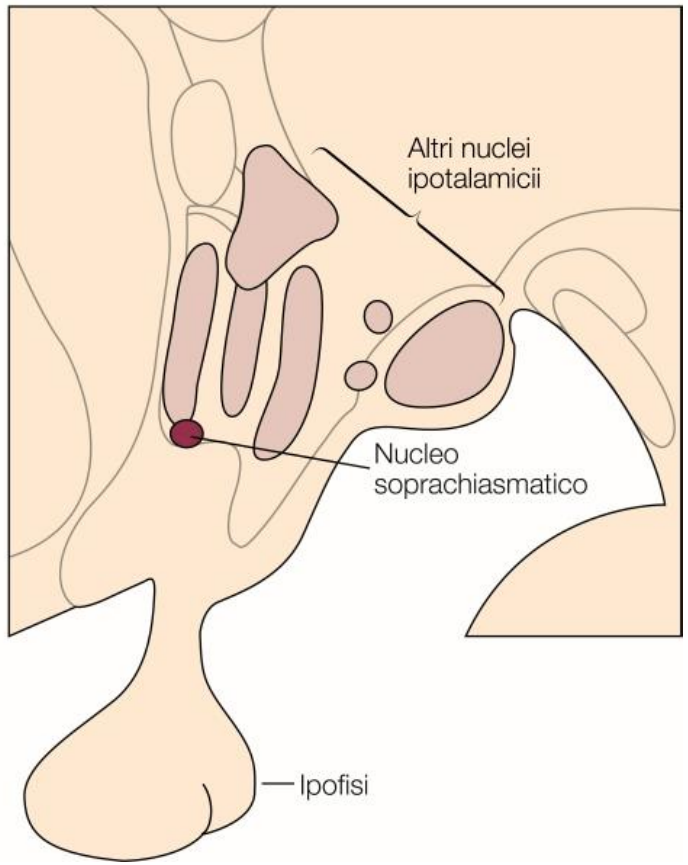
- È dettato dalla rotazione della terra
- È dettato da segnali temporali
- Dura circa 25 se non esposti a segnali temporali
- il ciclo sonno veglia
- Stato di vigilanza
- Capacità di svolgere compiti cognitivi
- Temperatura corporea
- Rilascio di ormoni

Ritmo Circadiano

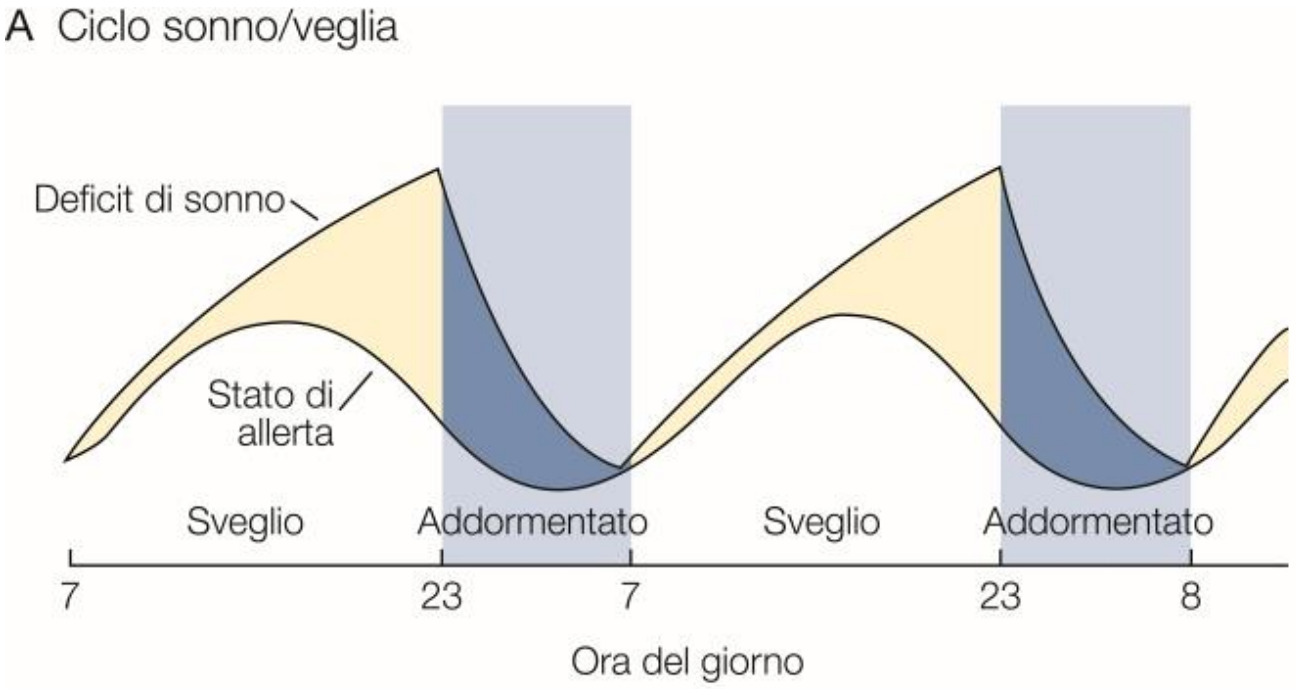


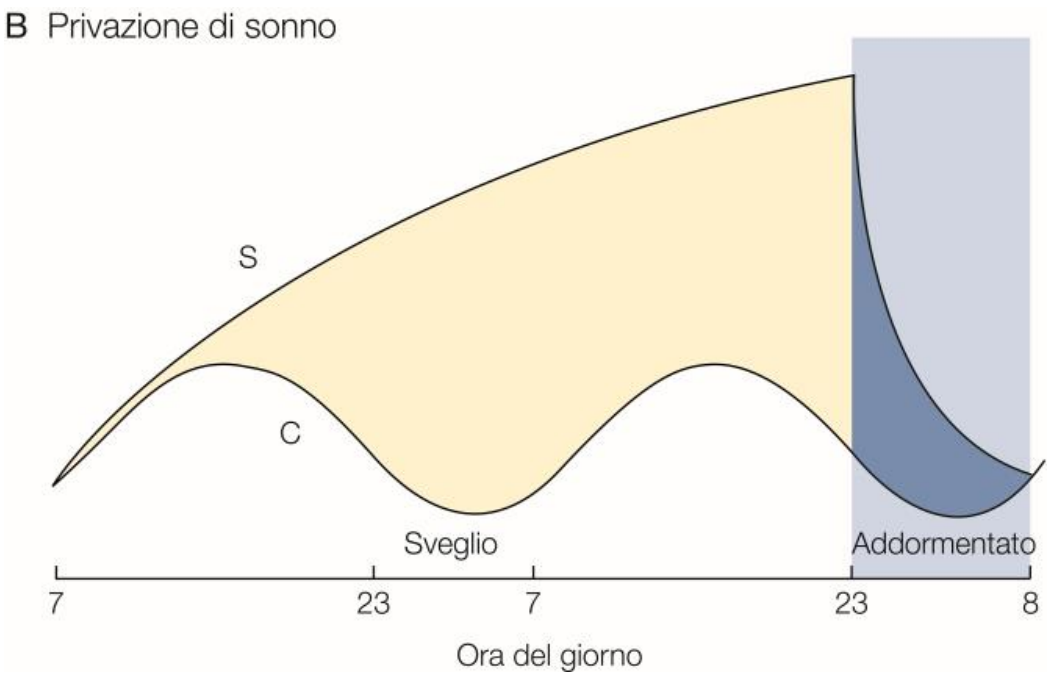
Ciclo sonno-veglia





Ciclo sonno-veglia

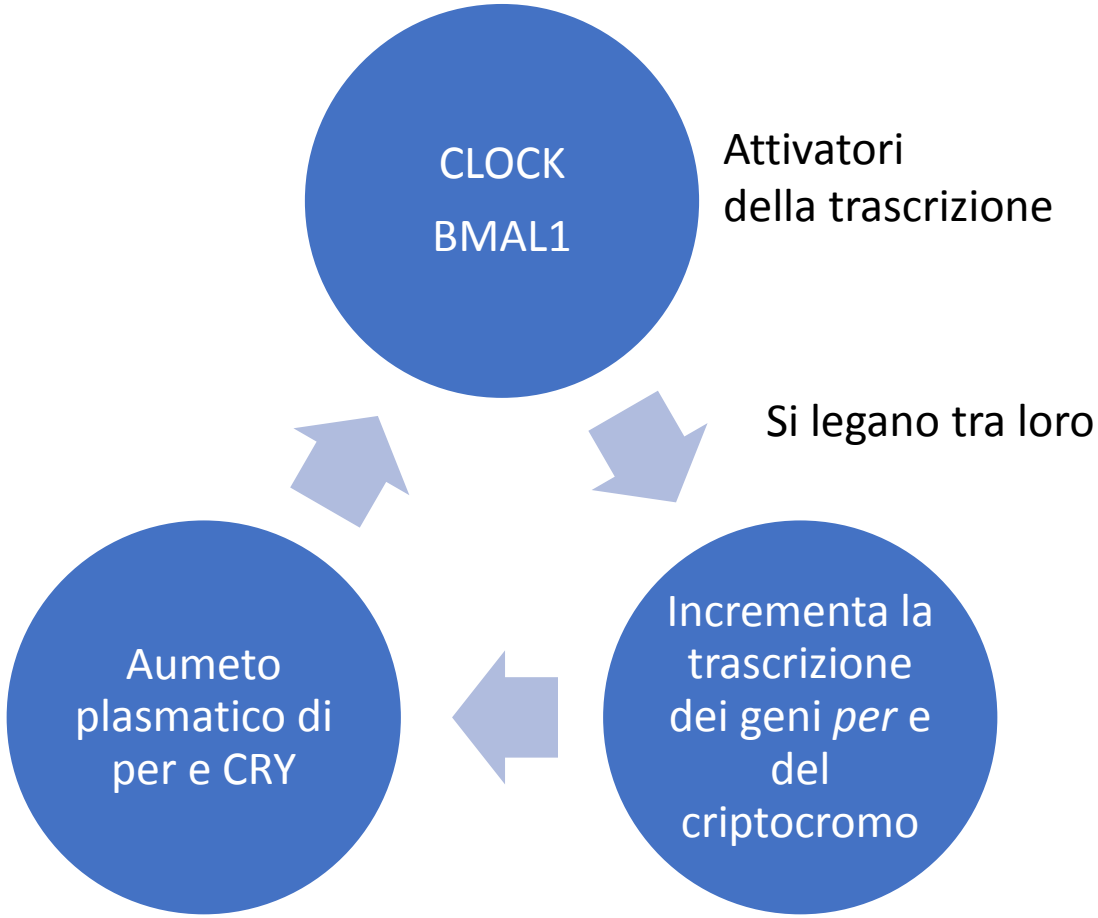




Nucleo soprachiasmatico

- La struttura responsabile della **regolarità** del ciclo sonno-veglia è il nucleo soprachiasmatico
- I 20000 neuroni di questo nucleo sono il nostro orologio biologico
- L'attività dei sui neuroni è sincronizzata con stimoli ambientali come la luce
- La lesione di questo nucleo provoca la perdita del ciclo sonno-veglia
  - Le ore di sonno rimangono costanti, ma distribuite in modo causale
  - Un trapianto ristabilisce il ritmo, come nel donatore
- Il nucleo soprachiasmatico non genera il sonno

Nucleo soprachiasmatico

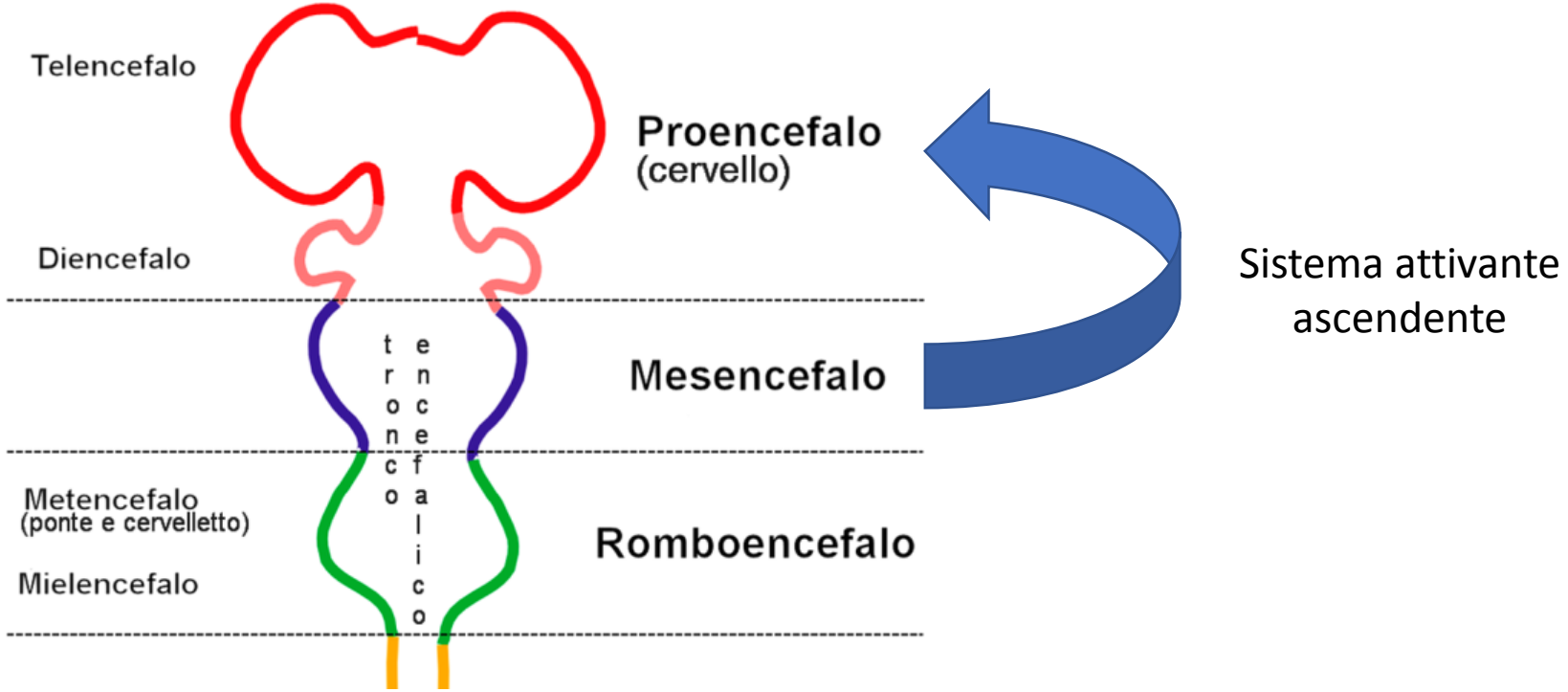


Ritmo ultradiano

- Il ciclo REM non-REM è un ciclo ultradiano
- Il ciclo sonno veglia è un ciclo ultradiano

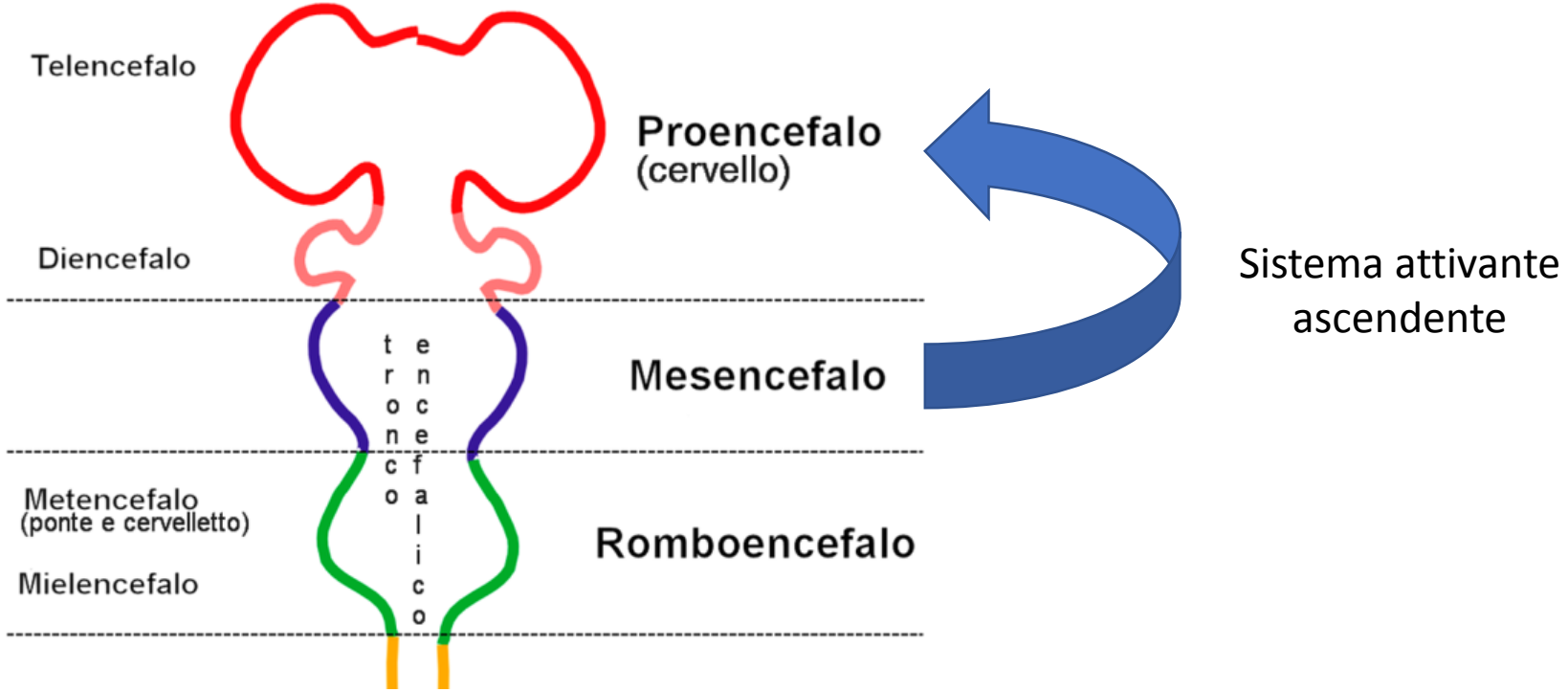
Ciclo sonno-veglia

- 1949 – Magoun e Moruzzi hanno dimostrato che la stimolazione elettrica della regione anteriore del tronco dell'encefalo induce uno stato di vigilanza del proencefalo

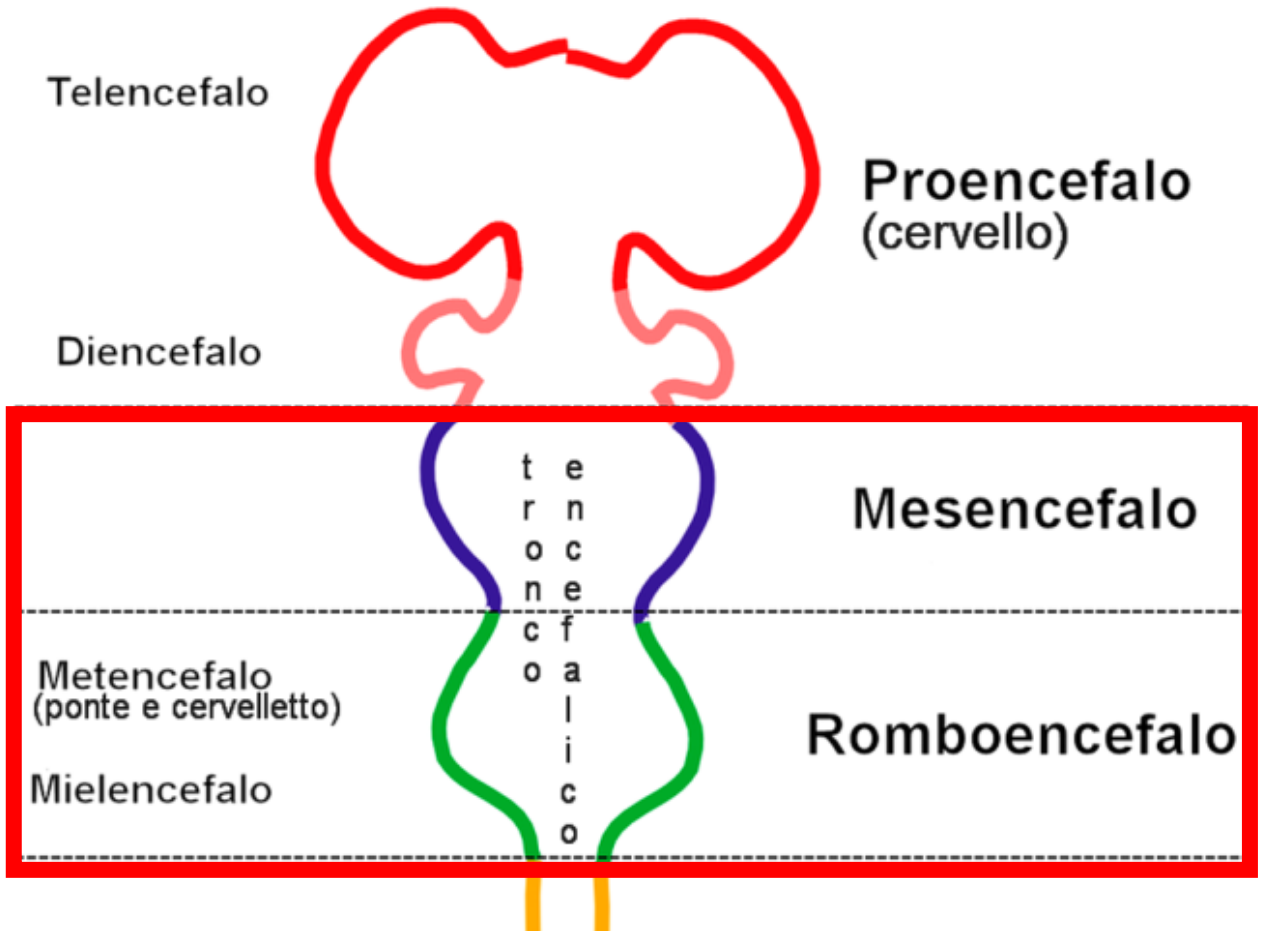


Ciclo sonno-veglia

- Michale Jouvet ha localizzato gruppi di neuroni responsabili della genesi dell'attivazione cerebrale, dell'atonia muscolare e dei movimenti rapidi degli occhi durante il REM a livello del ponte e del bulbo



Ciclo sonno-veglia



La stimolazione chimica del tronco dell'encefalo produce uno stato simile al sonno REM, e atonia muscolare

Una lesione di questa regione previene l'atonia muscolare tipica del sonno REM

Ciclo sonno-veglia

Neuroni colinergici del tronco dell'encefalo e proencefalo basale scaricano prima dell'inizio della veglia o del sonno REM. Questi neuroni proiettano estesamente al proencefalo inclusi il talamo, corteccia e ippocampo.

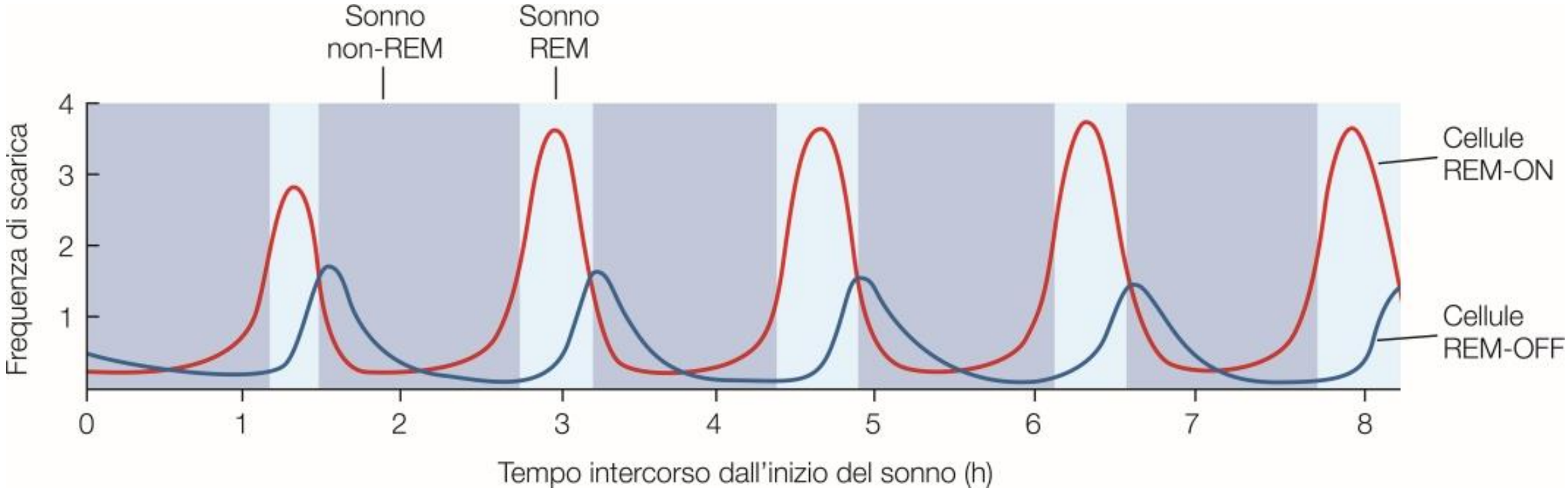
REM-ON

Ciclo sonno-veglia

Neuroni noradrenergici e serotoninergici del tronco dell'encefalo e neuroni istaminergici dell'ipotalamo proiettano estesamente al sistema nervoso e modulano l'eccitabilità durante la veglia

REM-OFF

Ciclo sonno-veglia



PGO

- La scarica fasica durante il sonno REM dei neuroni colinergici provoca, specialmente nei nuclei pontini e genicolati e della corteccia cerebrale delle onde tipiche chiamate onde ponte-genicolo-occipitali (PGO).