

SEMINARIO DI MEDICINA SPERIMENTALE E NEUROSCIENZE

Guido Rodriguez

Paolo Vitali



Neurofisiologia Clinica (DIMI)

Universita' di Genova

I ciclo: il cervello, le sue funzioni, i segnali elettrofisiologici, la loro elaborazione e l'uso clinico

II ciclo: l'esplorazione funzionale cerebrale in fisiologia ed in patologia

III ciclo: la coregistrazione spaziale e temporale di differenti segnali cerebrali.

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I ciclo: il cervello, le sue funzioni,
come guardiamo il cervello: dal macroscopico al microscopico,
le funzioni cerebrali e le modalità di studio

I segnali elettrofisiologici: elettroencefalogramma e sua genesi;
altri segnali elettrofisiologici, la loro elaborazione e l'uso clinico

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Neurofisiologia Clinica (DIMI)

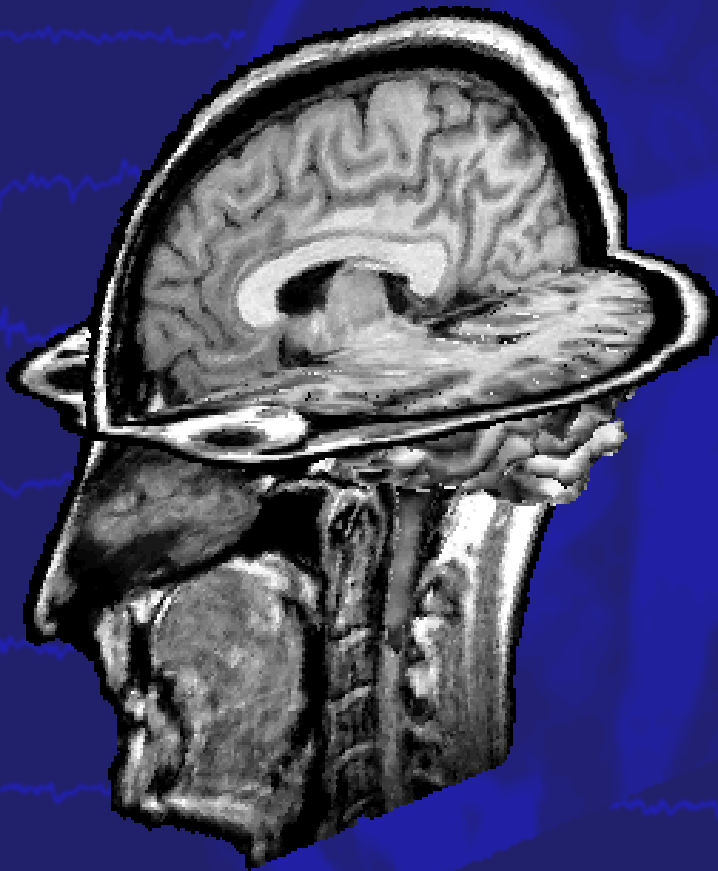
Universita' di Genova

Metodi

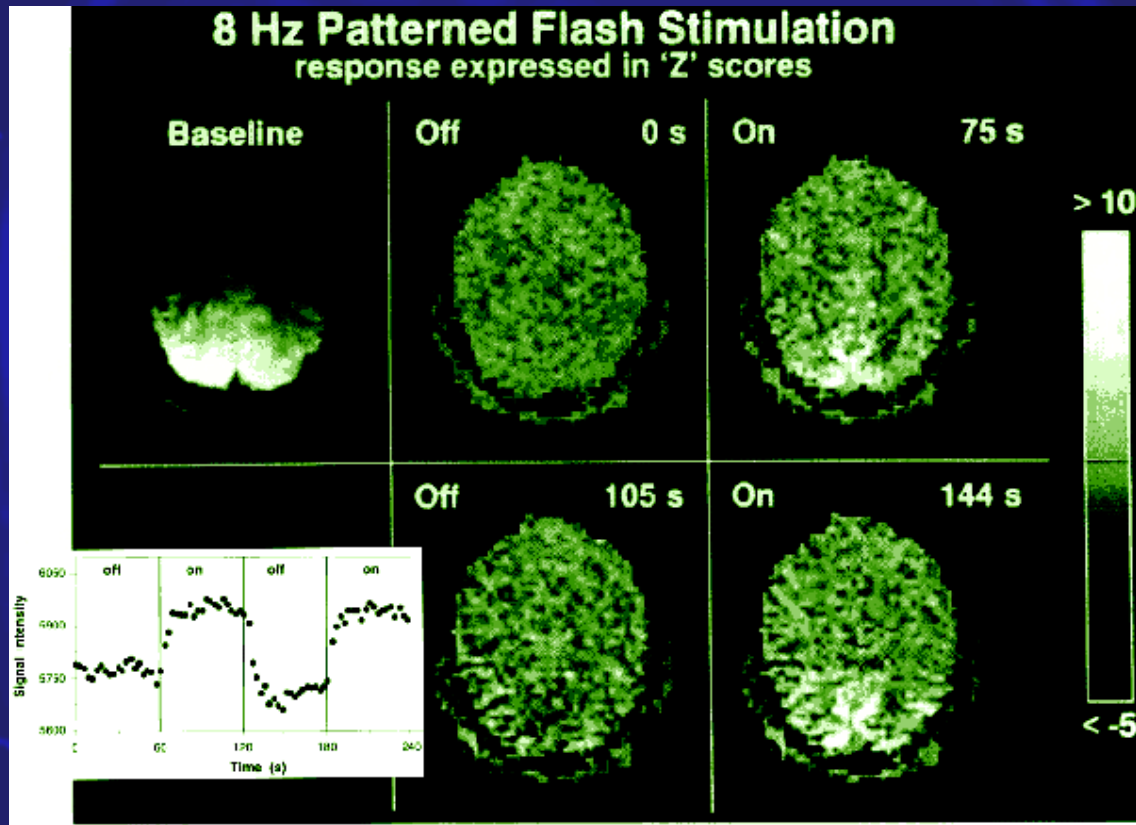
Useremo nel discorso delle immagini che derivano essenzialmente da tre sistemi:

- la Risonanza Magnetica (strutturale e funzionale)
- la PET (Positron Emission Tomography)
- la SPECT (Single Photon Emission Tomography)

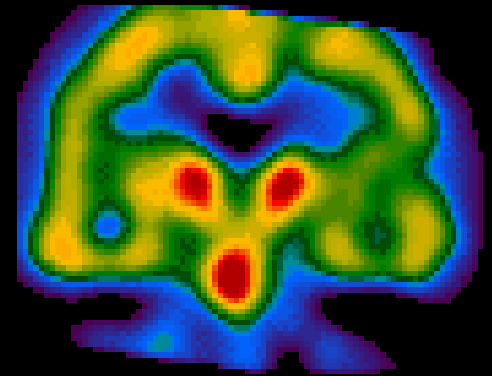
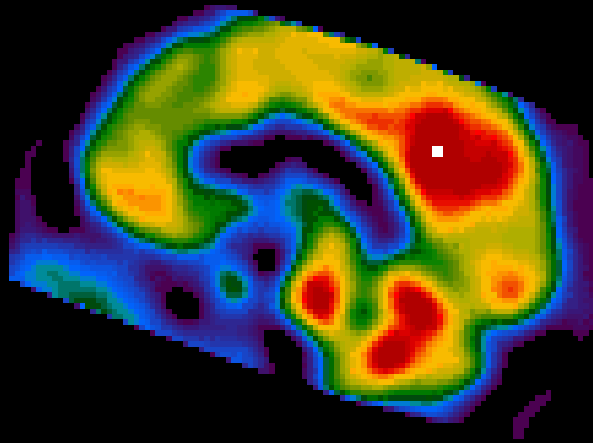
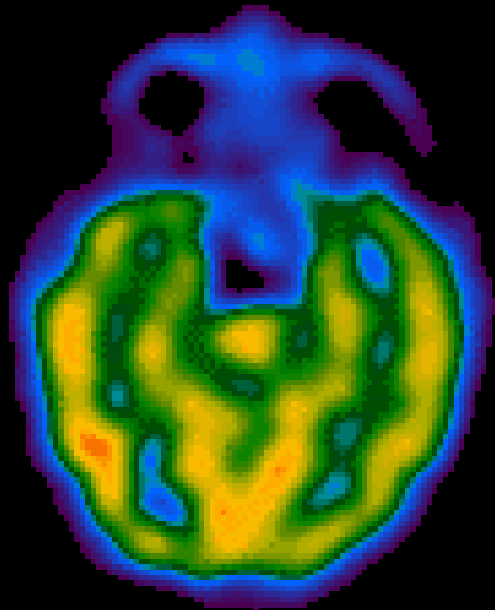
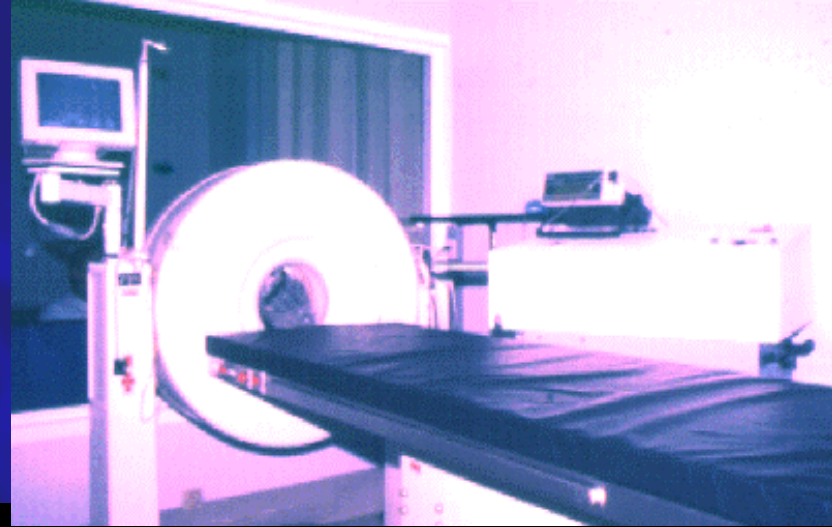
MRI (Magnetic Resonance Imaging)



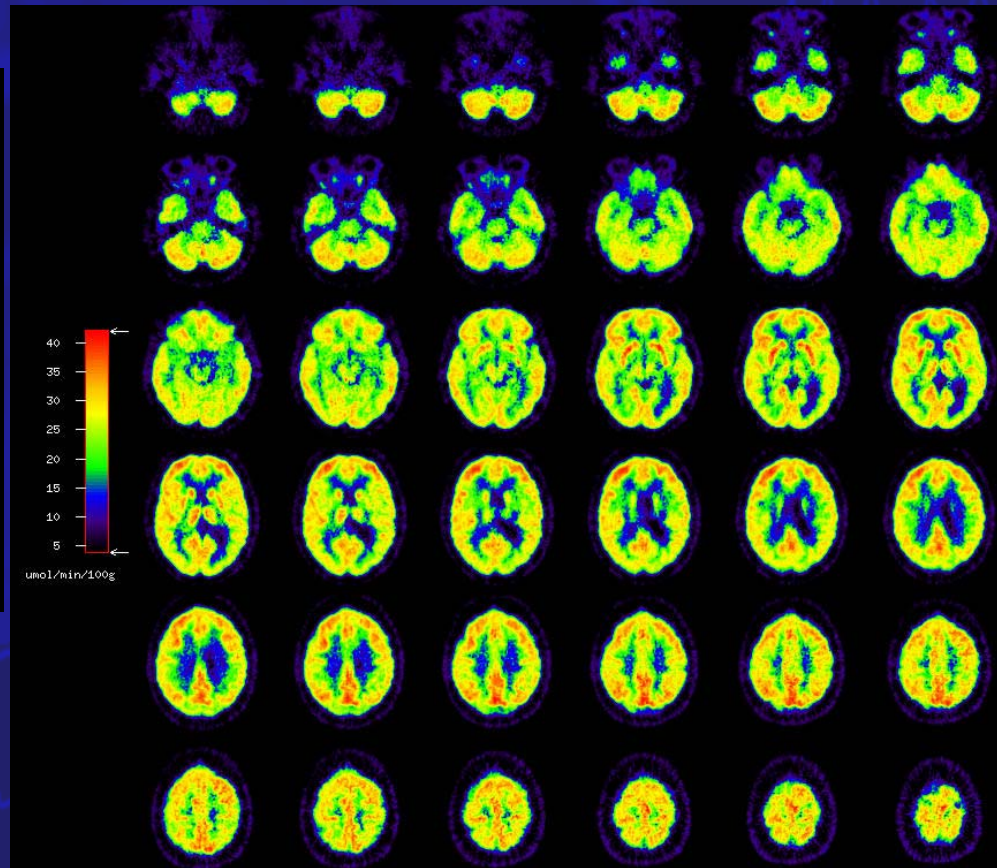
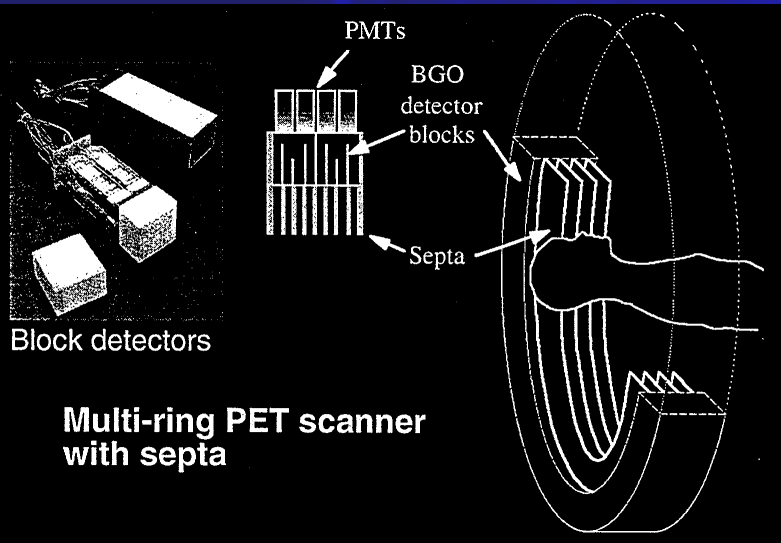
La functional MRI (fMRI)



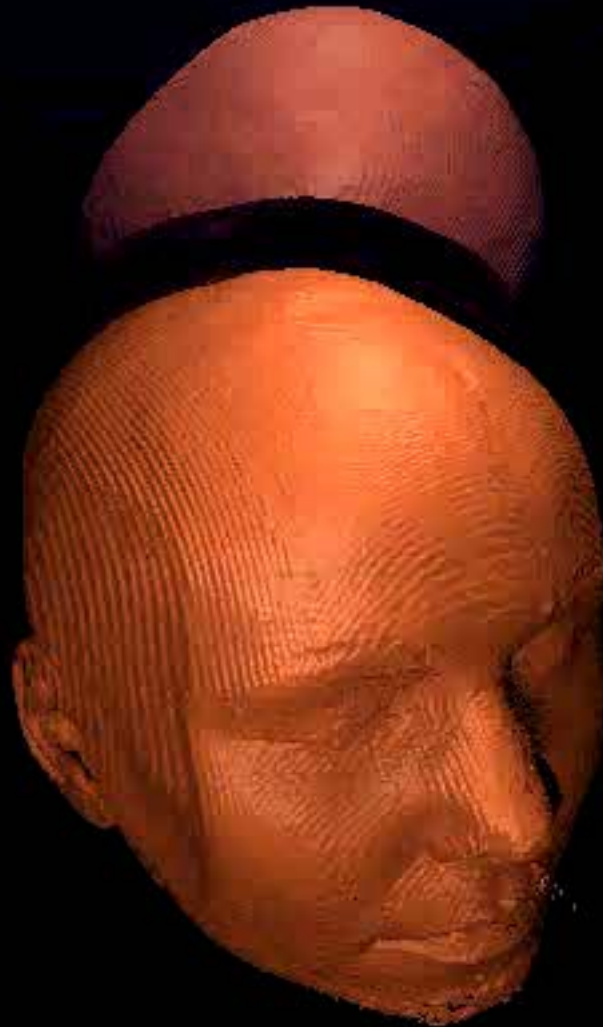
La SPECT (Single Photon Emission Computed Tomography)



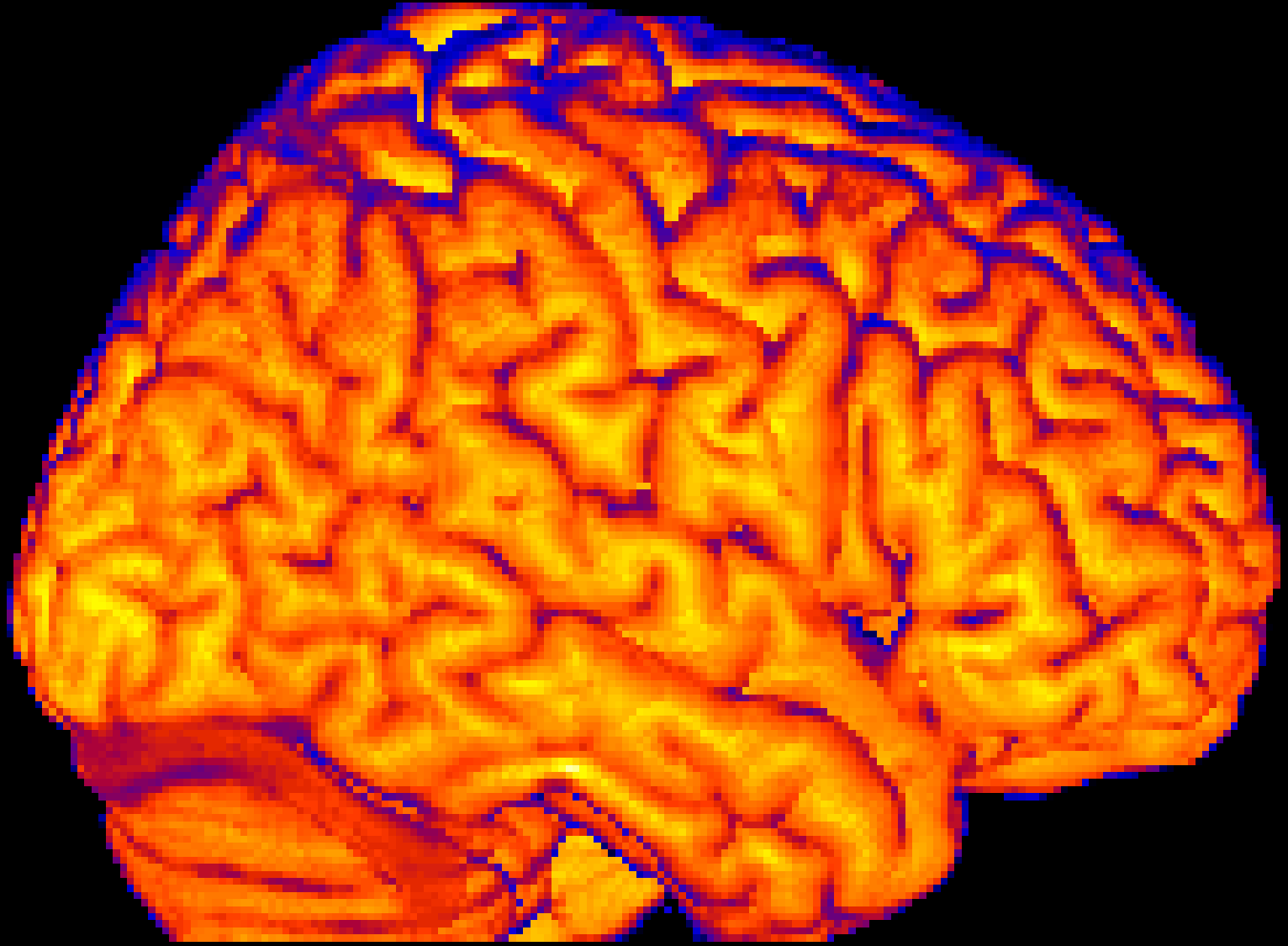
La PET (Positron Emission Tomography)



Il cervello

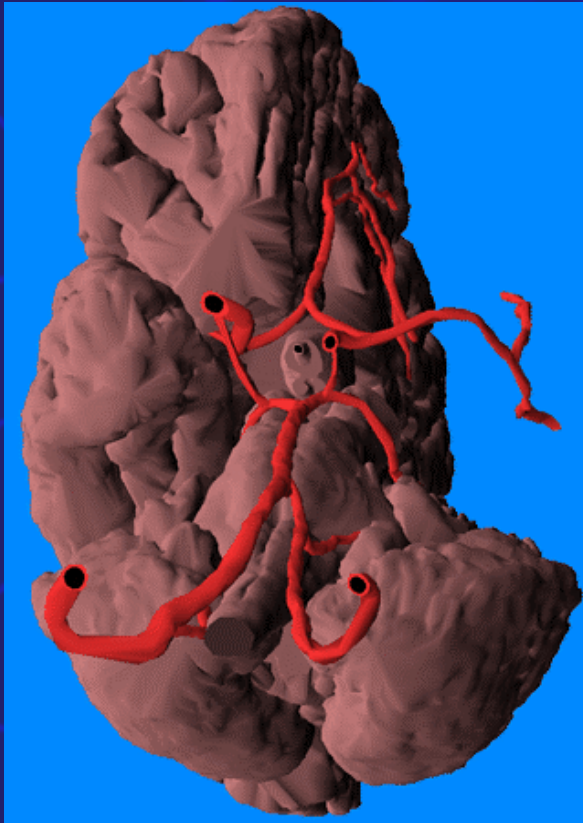


Il cervello

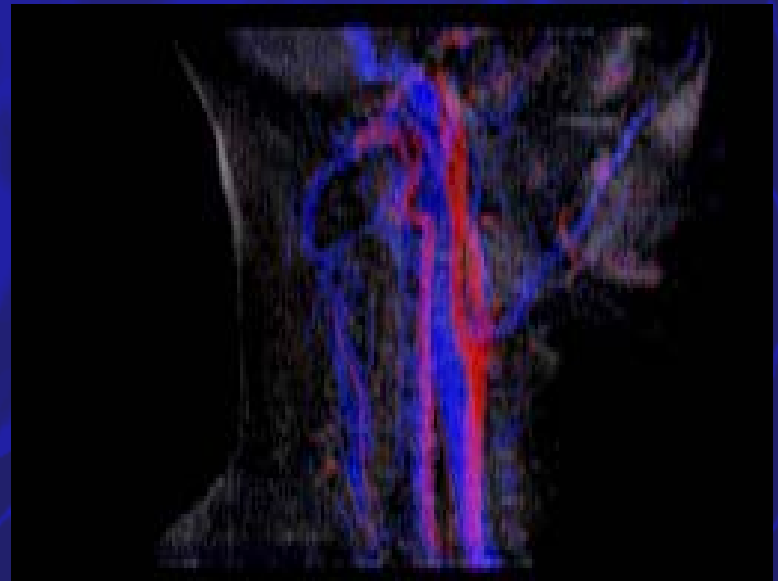


La vascolarizzazione cerebrale

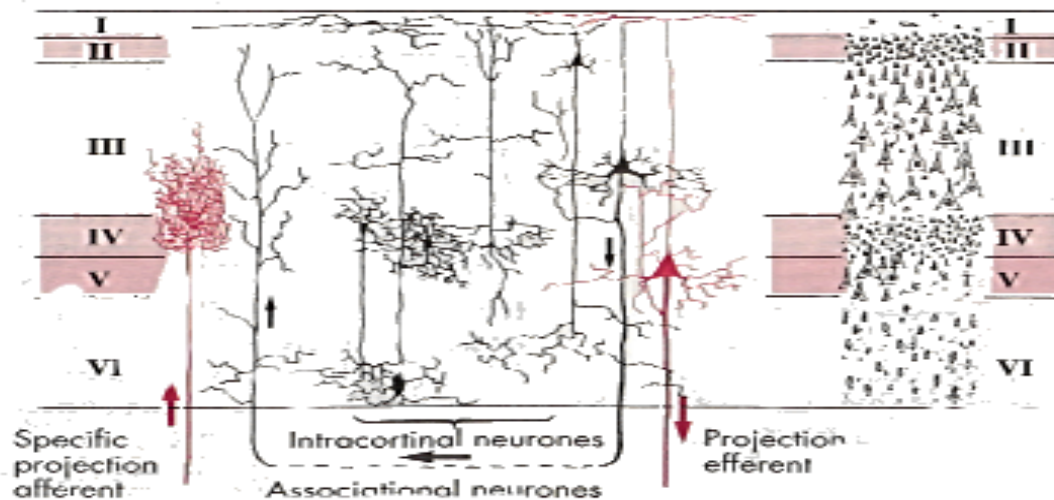
Poligono di Willis



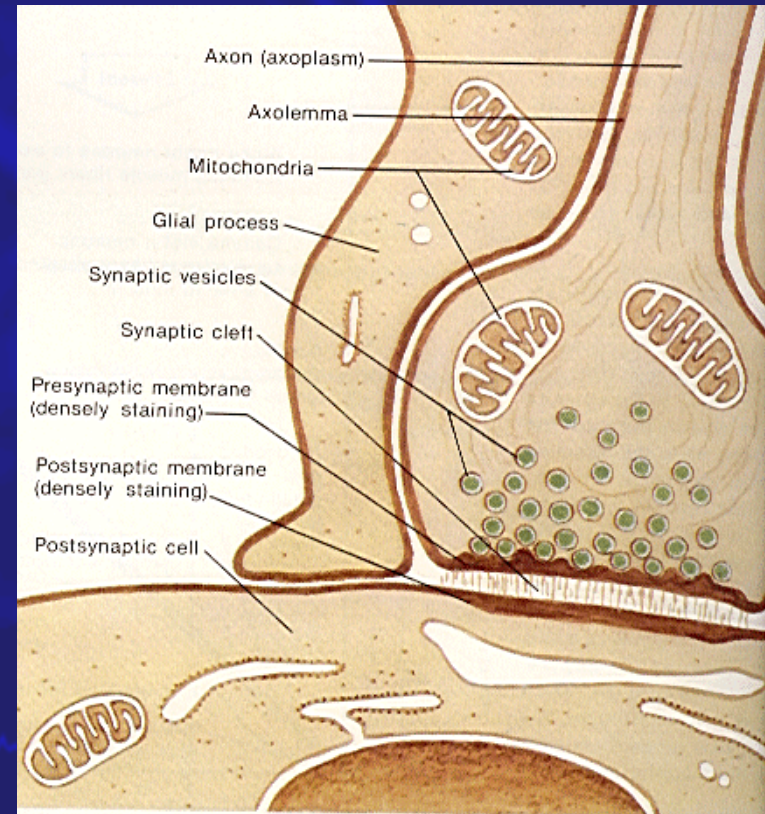
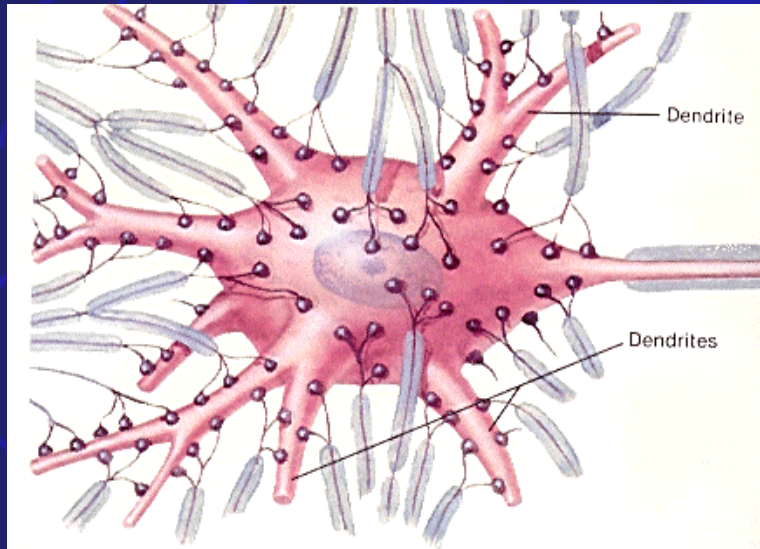
Tronchi SovraAortici



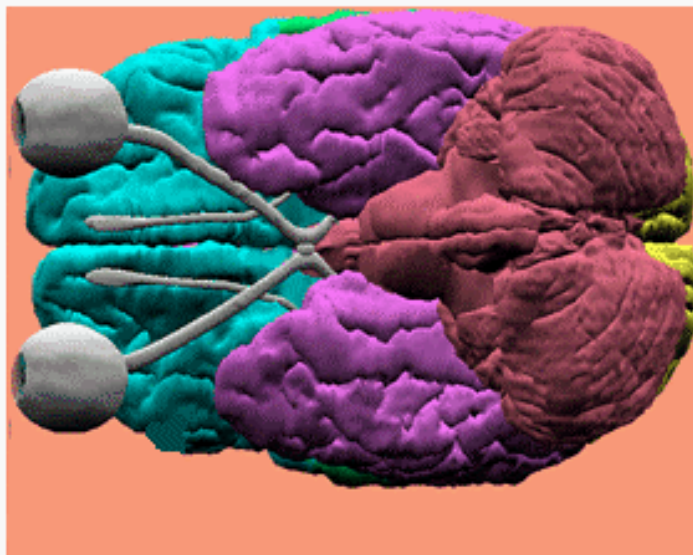
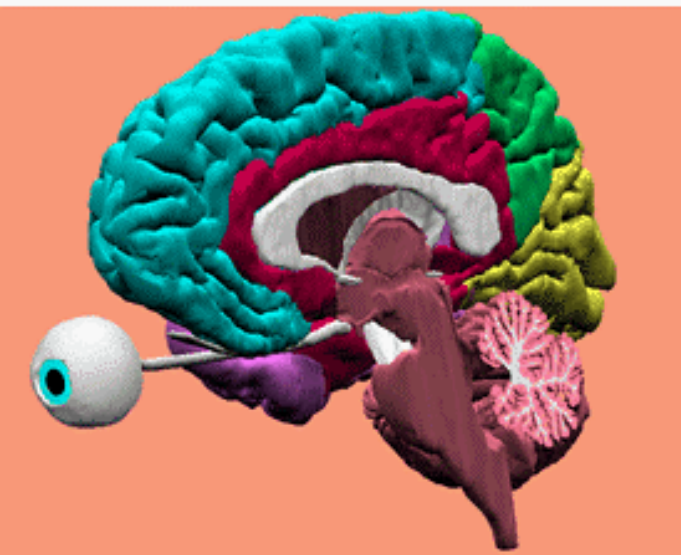
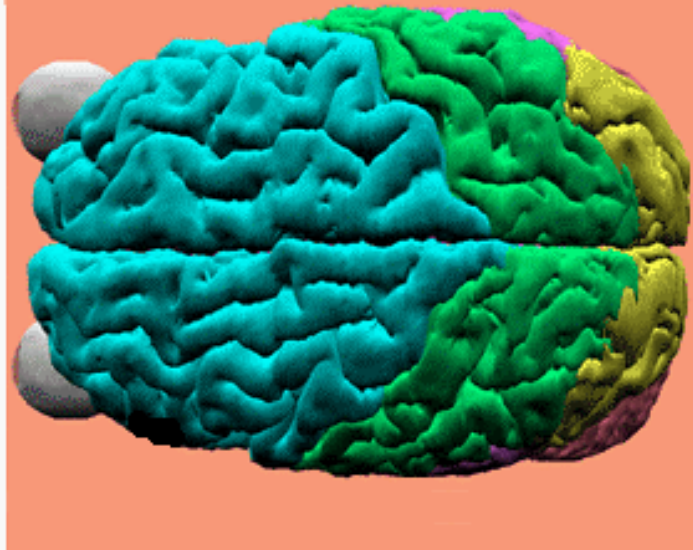
La citoarchitettura nell'area 4 ha mostrato nello strato V le cellule piramidali giganti di Betz – con lunghi assoni verso il midollo spinale e dendriti che si orientano verso la superficie della corteccia prendendo contatto con tutti i vari campi per un'area di circa $\frac{1}{2}$ mm di raggio. Inoltre l'area 4 si caratterizza per una relativa mancanza di cellule dei granuli nello strato IV. Lo strato III e IV sono quelli ove alla corteccia arrivano le afferenze dai diversi siti sottocorticali. L'area 6 si caratterizza per cellule piramidali più piccole e cellule dei granuli in maggior numero. Lo strato III e IV sono quelli ove alla corteccia arrivano le afferenze dai diversi siti sottocorticali



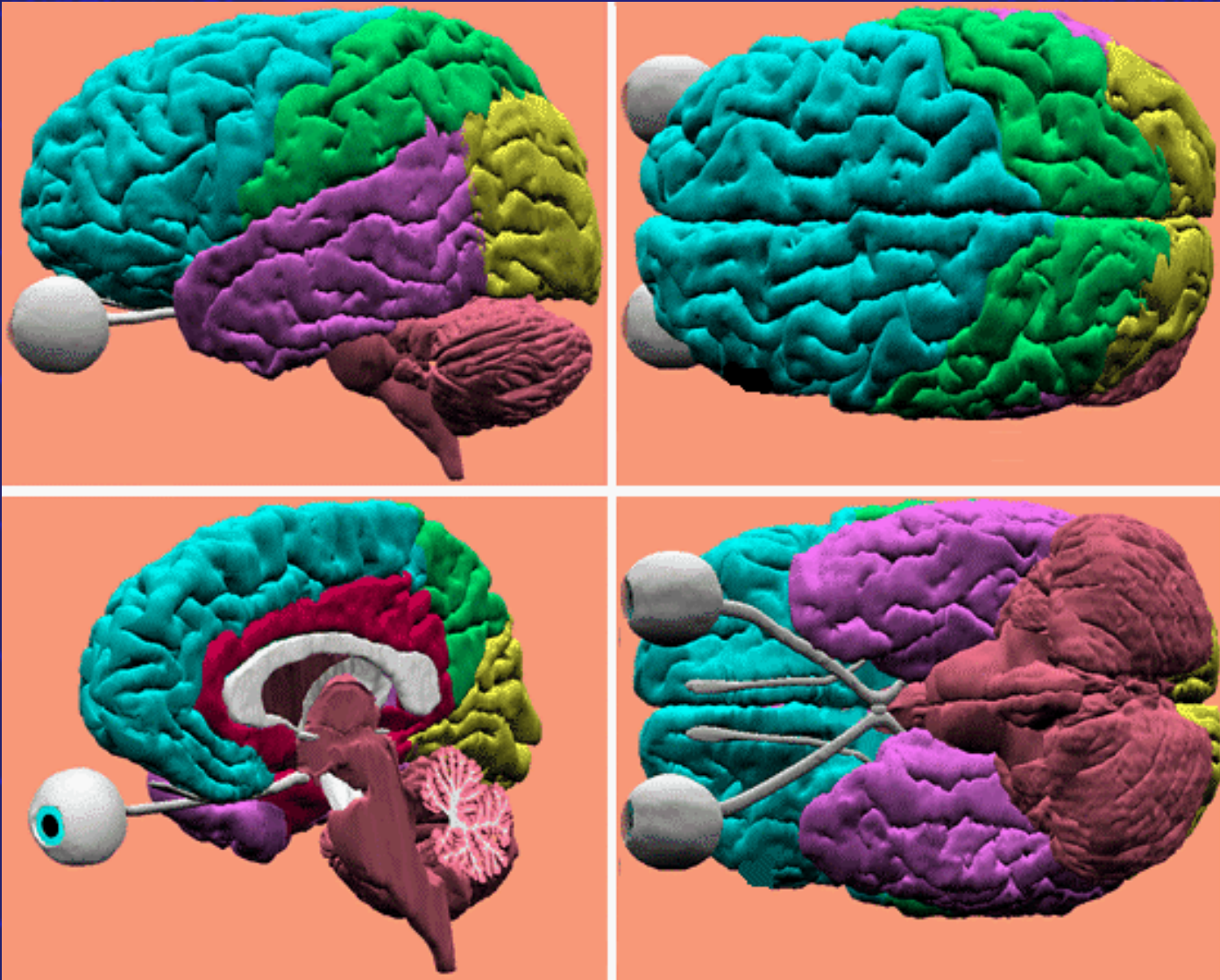
Il neurone, la sinapsi, la trasmissione dell'informazione



I lobi cerebrali

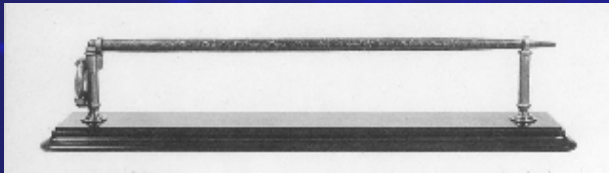


Lobo frontale

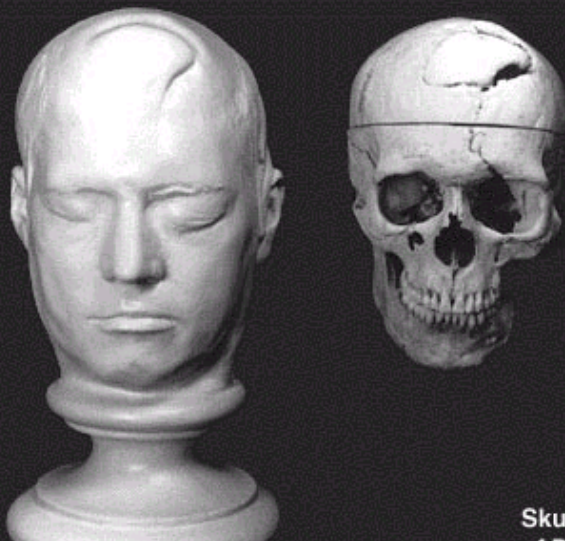


Lobo frontale

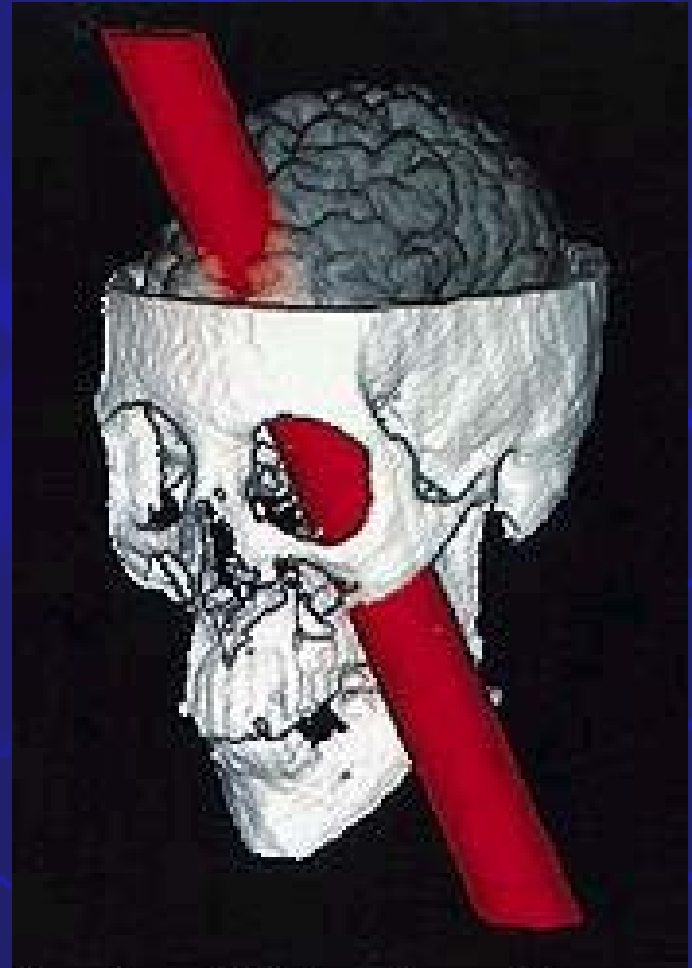
- Il caso di Phineas Gage (1848)



- This is the bar that was shot through the head of Mr. Phineas P. Gage at Cavendish, Vermont, Sept. 14, 1848. He fully recovered from the injury & deposited this bar in the Museum of the Medical College, Harvard University. Phineas P. Gage Jan 6 1850



Skull and death mask



Department of Neurology and Image
Analysis Facility, University

Le torri di Hanoi

Numero Livello: 4

Numero Mosse: 000

0 Ore 0 Minuti e 0 secondi

Stop Riprendi

Mosse Previste: 15

Mosse in Eccesso: 00

A **B** **C**

Comandi Gioco

Sposta da **A** **B** **C** Ritorna a Sposta

Menù Comandi Livelli

3° Livello 4° Livello 5° Livello 6° Livello 7° Livello

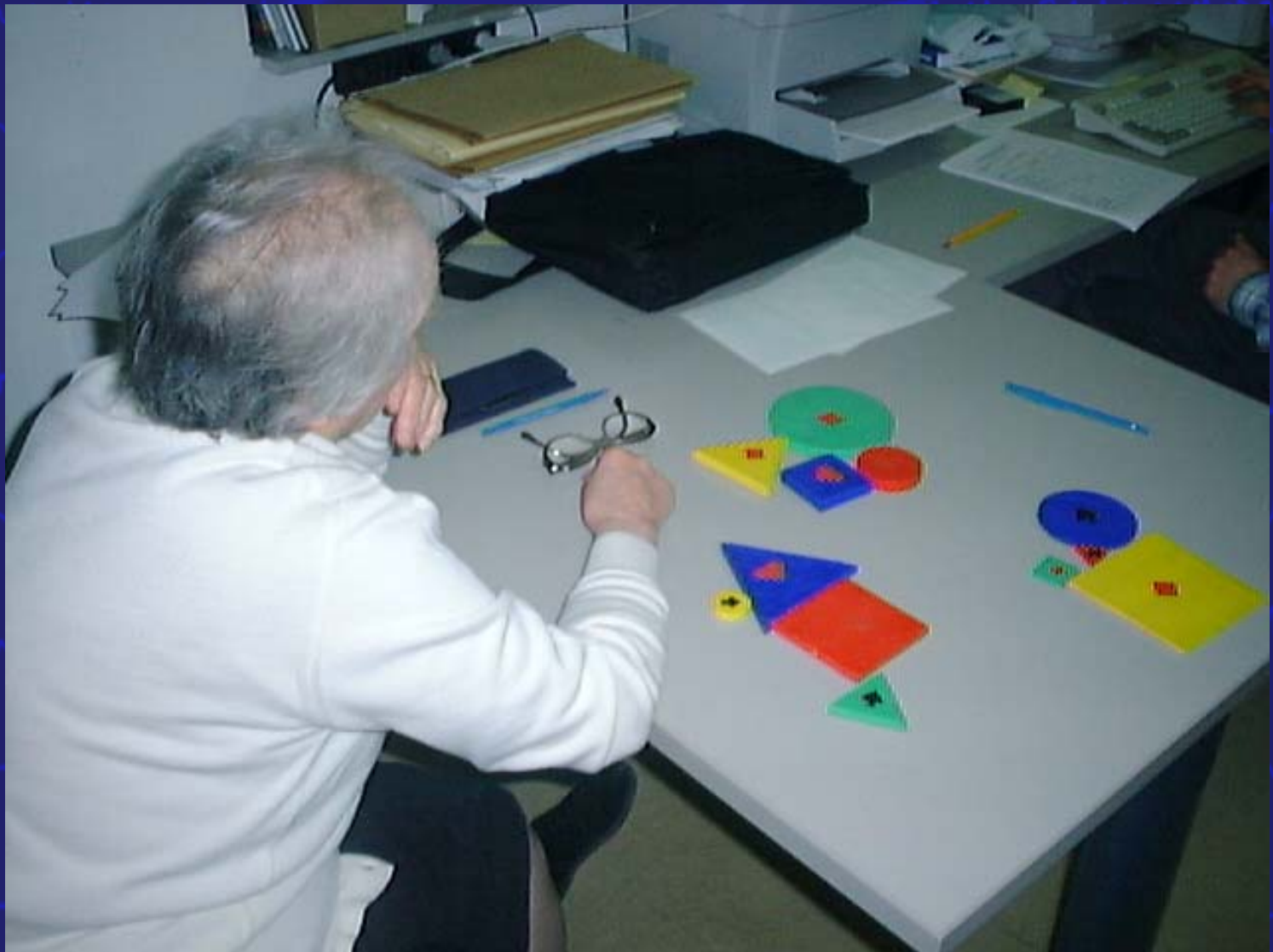
Menù Comandi programma

Salvataggio USCITA

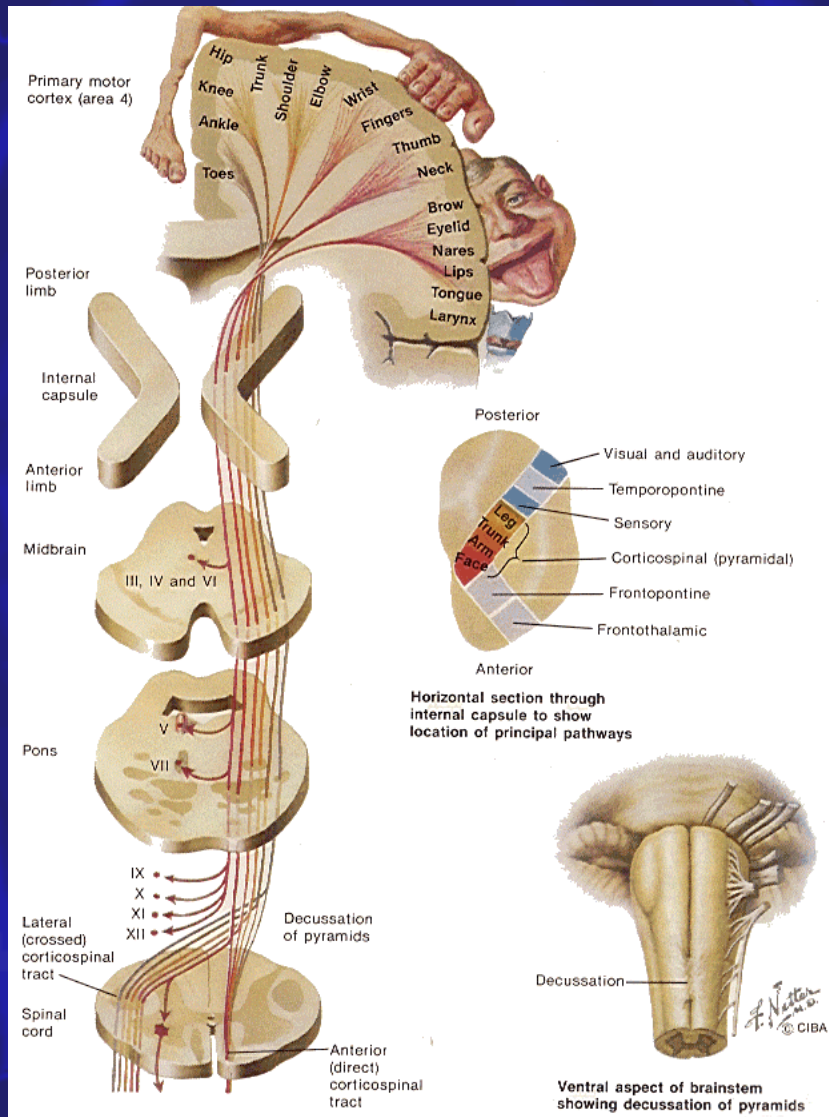
Stroop test

Rosso	Verde	Marrone	Viola
Blu	Viola	Verde	Blu
Marrone	Marrone	Rosso	Verde
Verde	Rosso	Viola	Marrone
Viola	Marrone	Blu	Viola
Blu	Verde	Rosso	Blu
Rosso	Blu	Verde	Viola

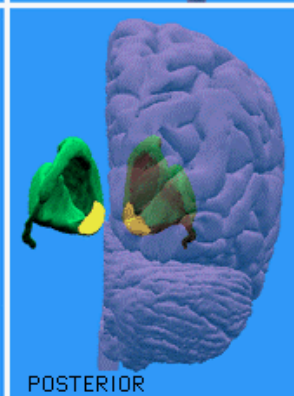
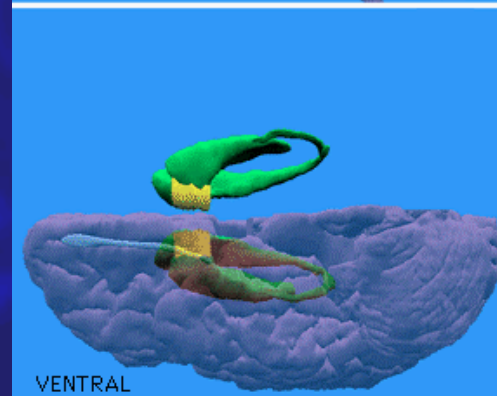
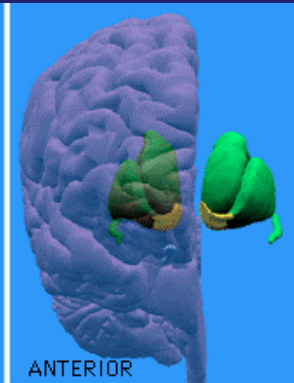
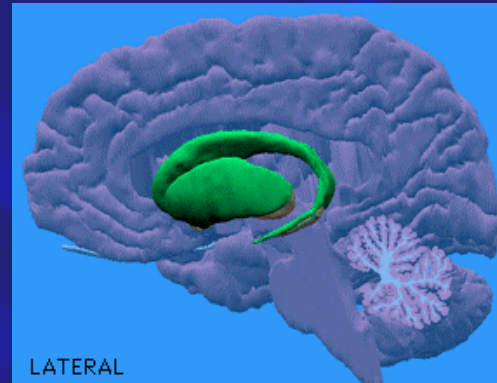
Il test di Weigl



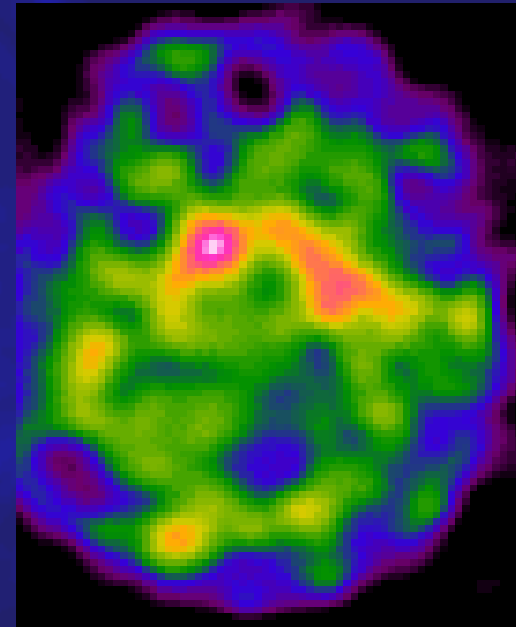
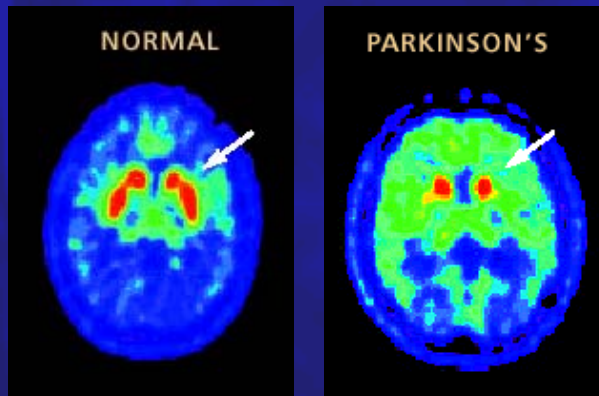
Il controllo motorio



Il talamo e i nuclei della base



Le strutture centrali



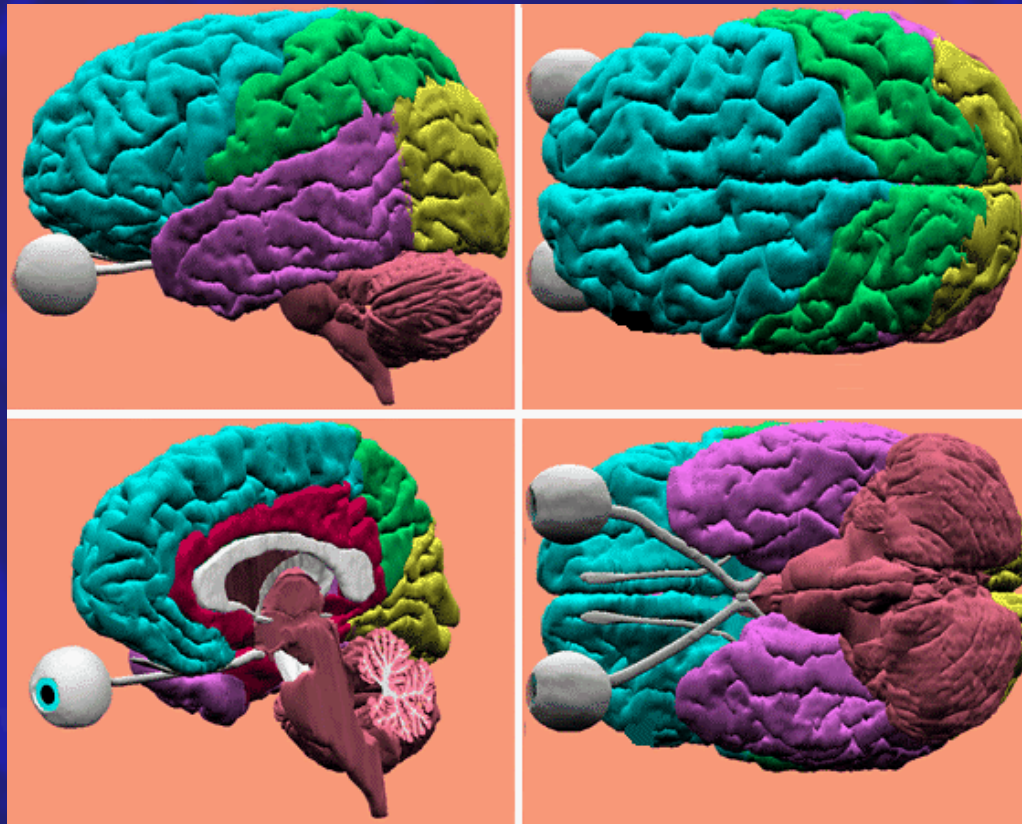
Alterazioni del controllo motorio: morbo di Parkinson



Alterazioni del controllo motorio: morbo di Huntington

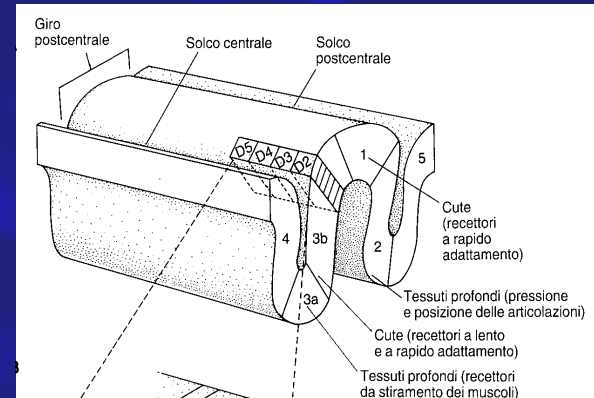
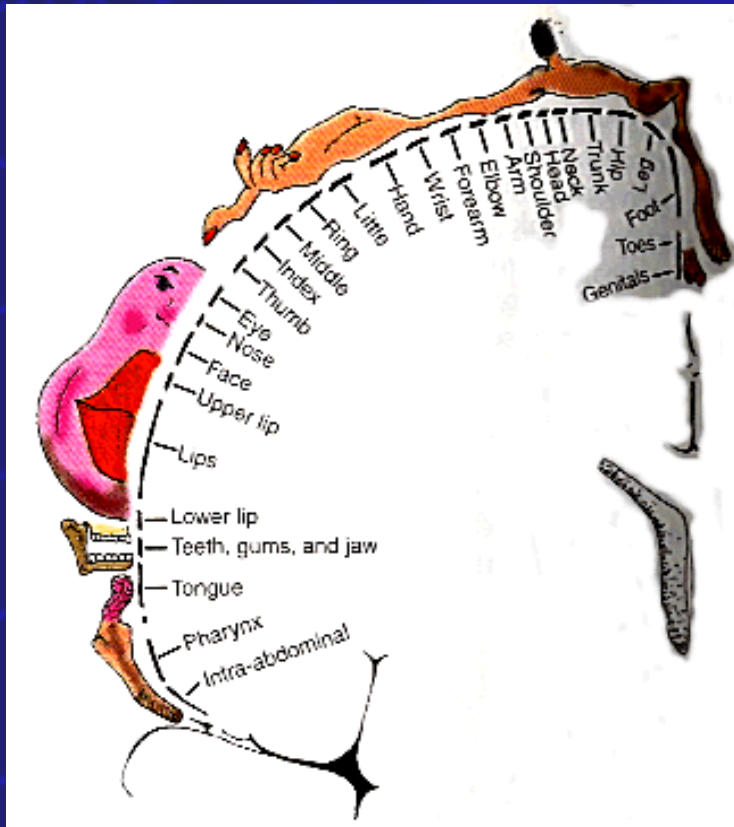


Il lobo parietale



Il lobo parietale

- La corteccia somatosensoriale



Il lobo parietale destro

Aprassia
dell'abbigliamento

Anosognosia

Incapacità
di giudizio
sui rapporti
spaziali

Disturbi
della memoria
topografica

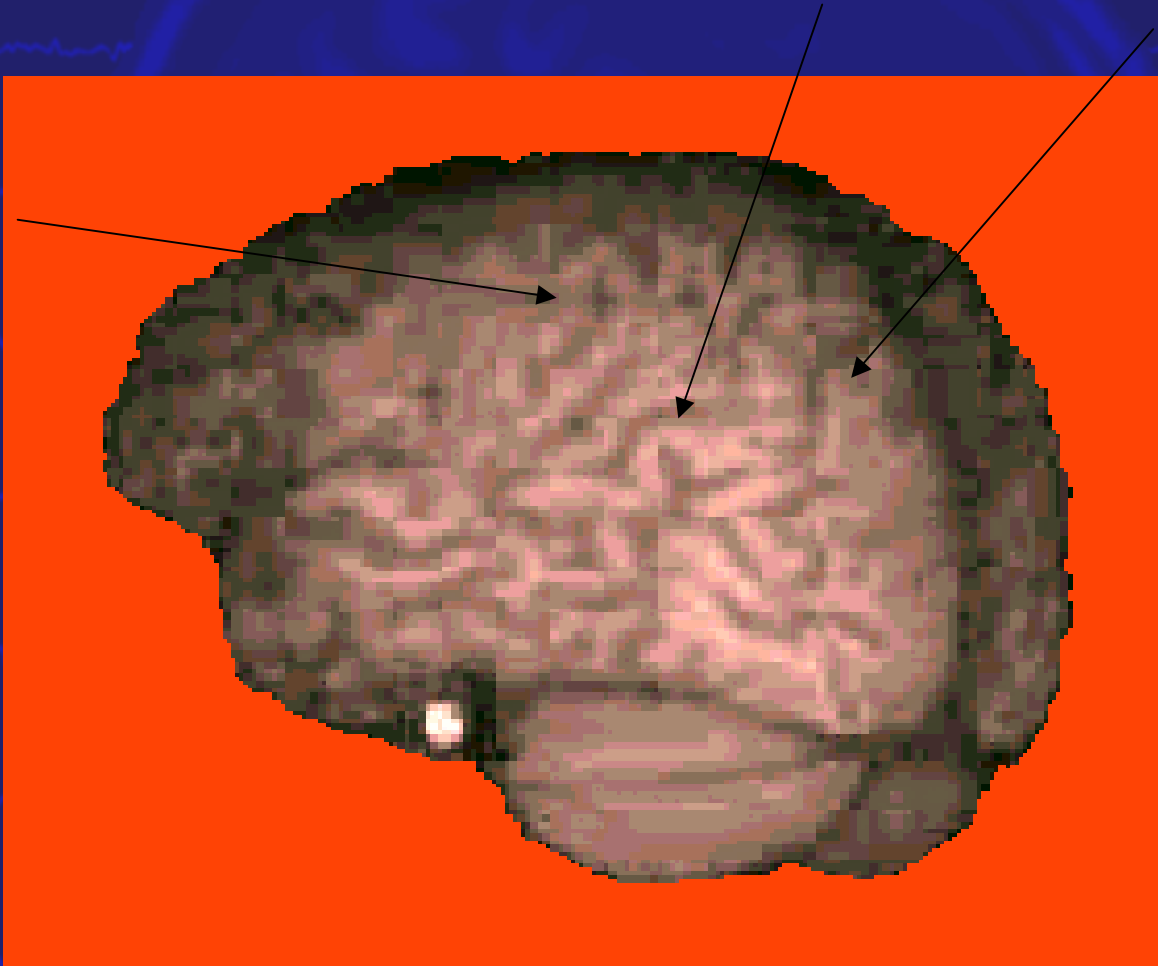


Il lobo parietale sinistro

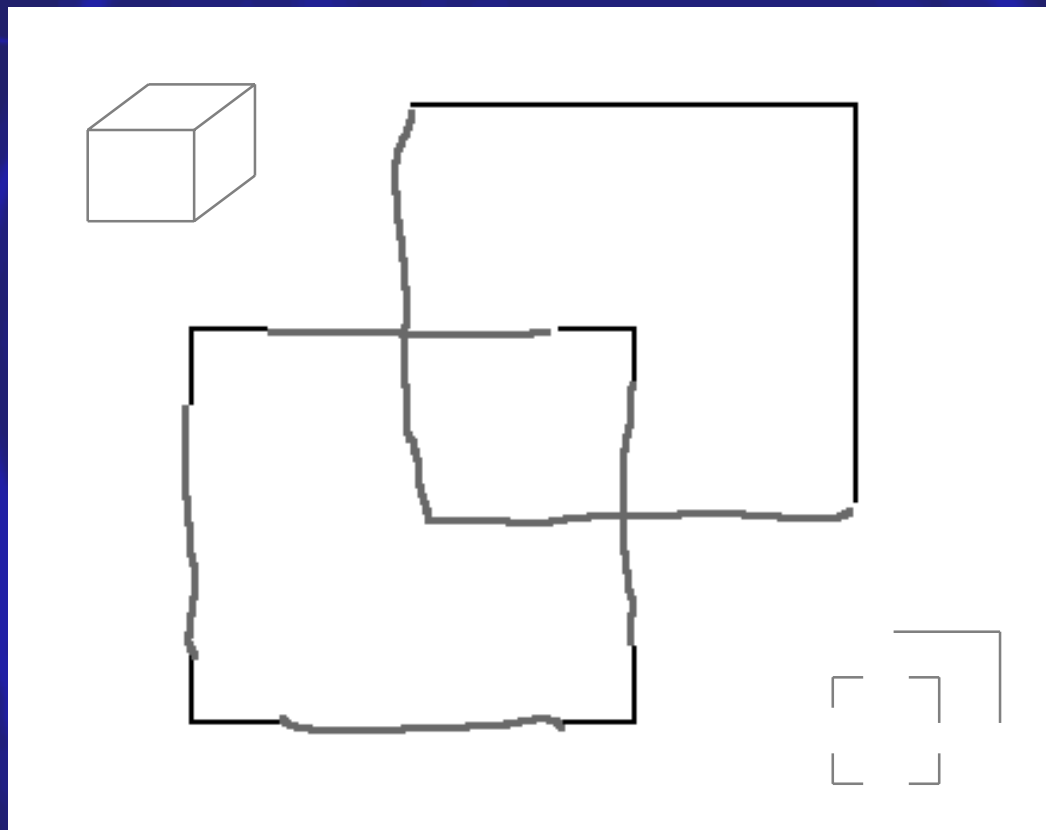
Incomprensione linguaggio parlato

linguaggio scritto

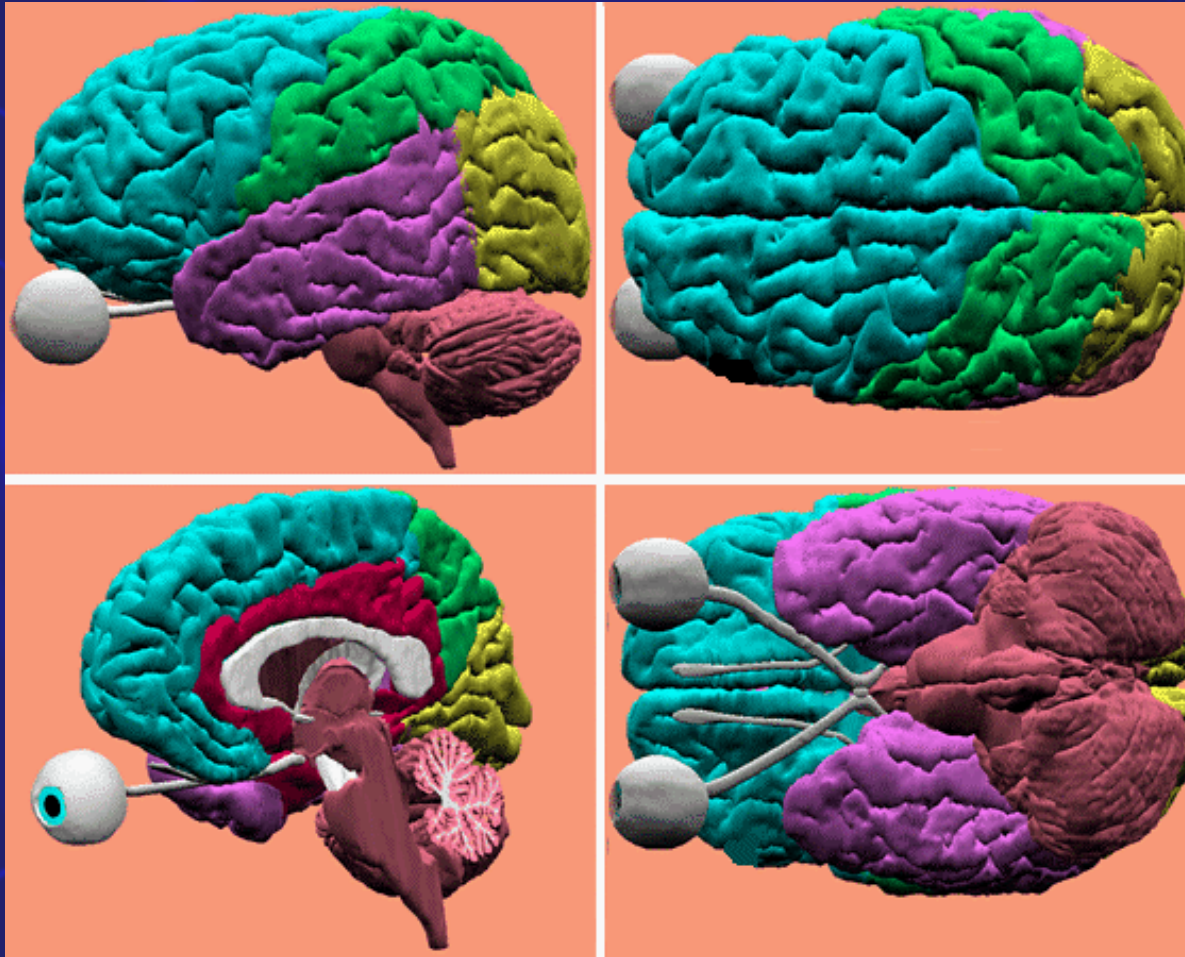
Aprassia
costruttiva



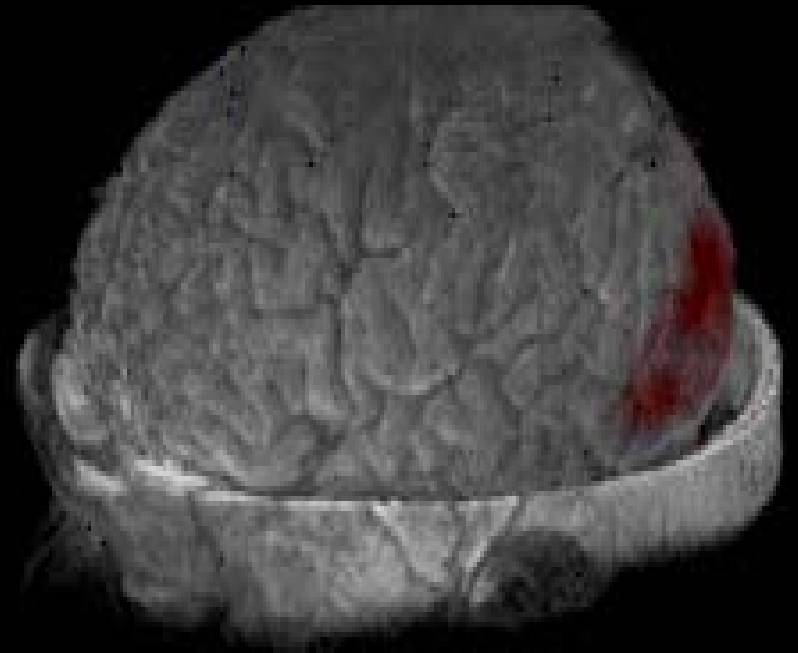
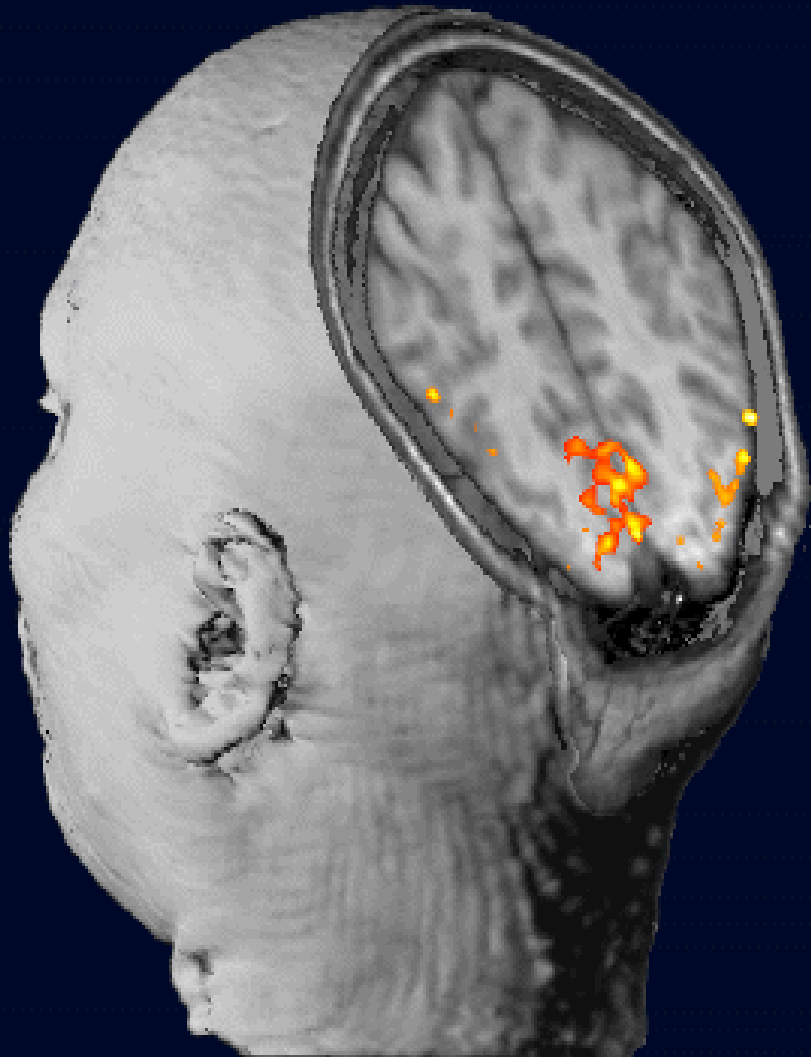
Aprassia costruttiva



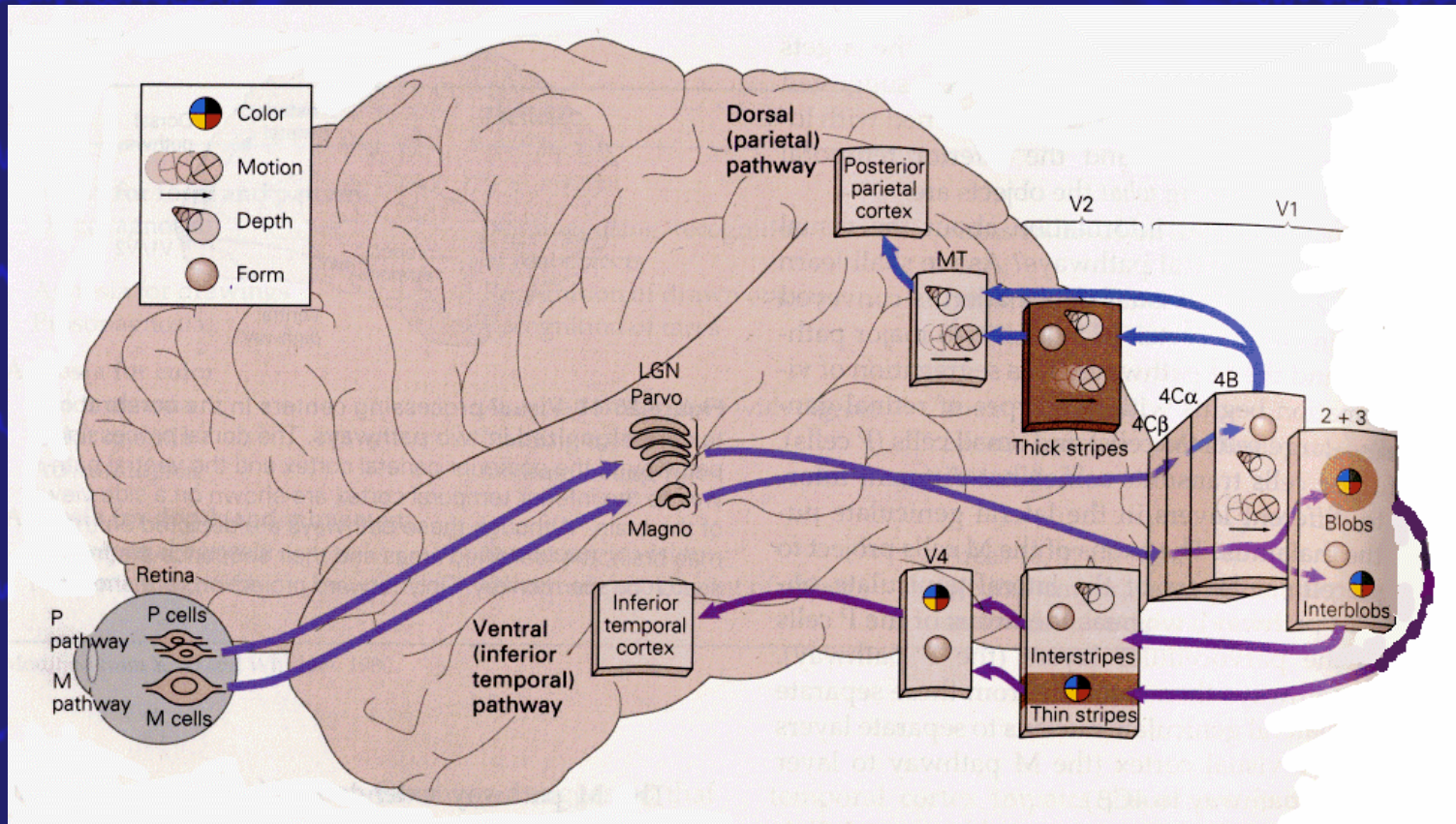
Il lobo occipitale



Lobo occipitale

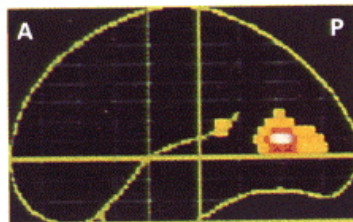


Il lobo occipitale

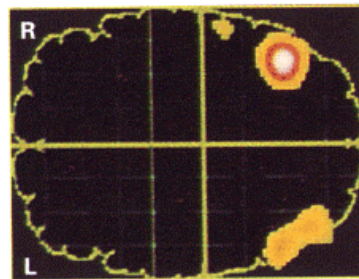


Il lobo occipitale

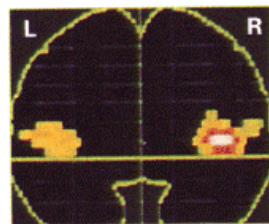
Motion study:
moving vs stationary



Sagittal

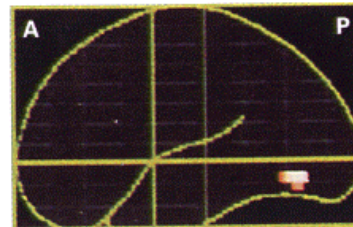


Transverse

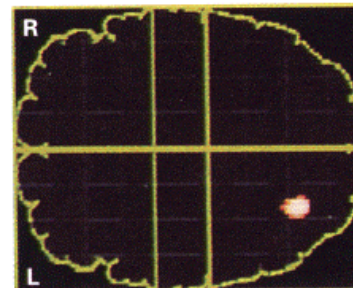


Coronal

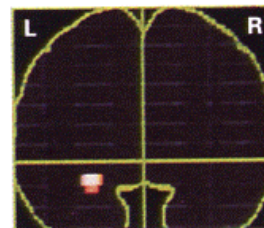
Color study:
color vs gray



Sagittal

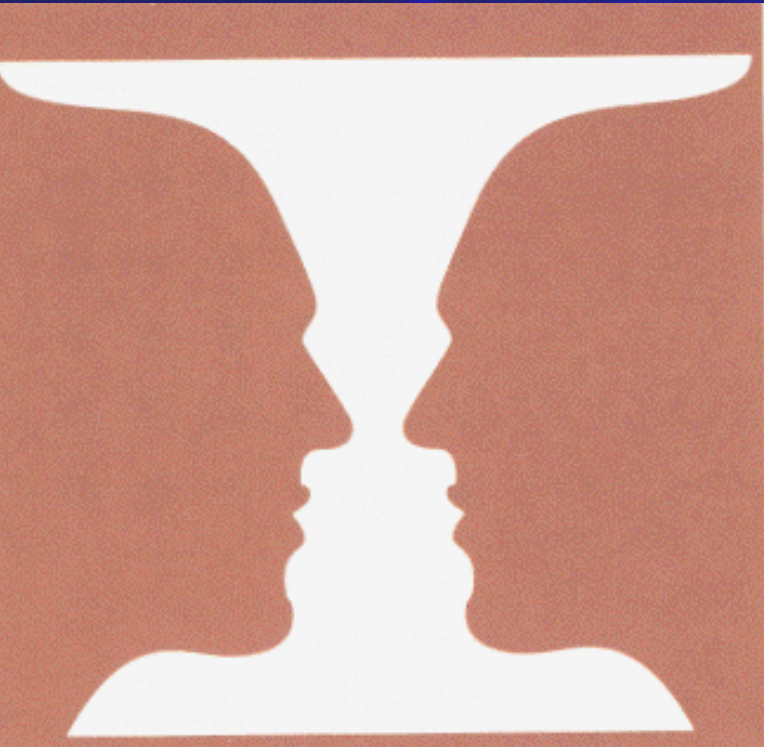


Transverse

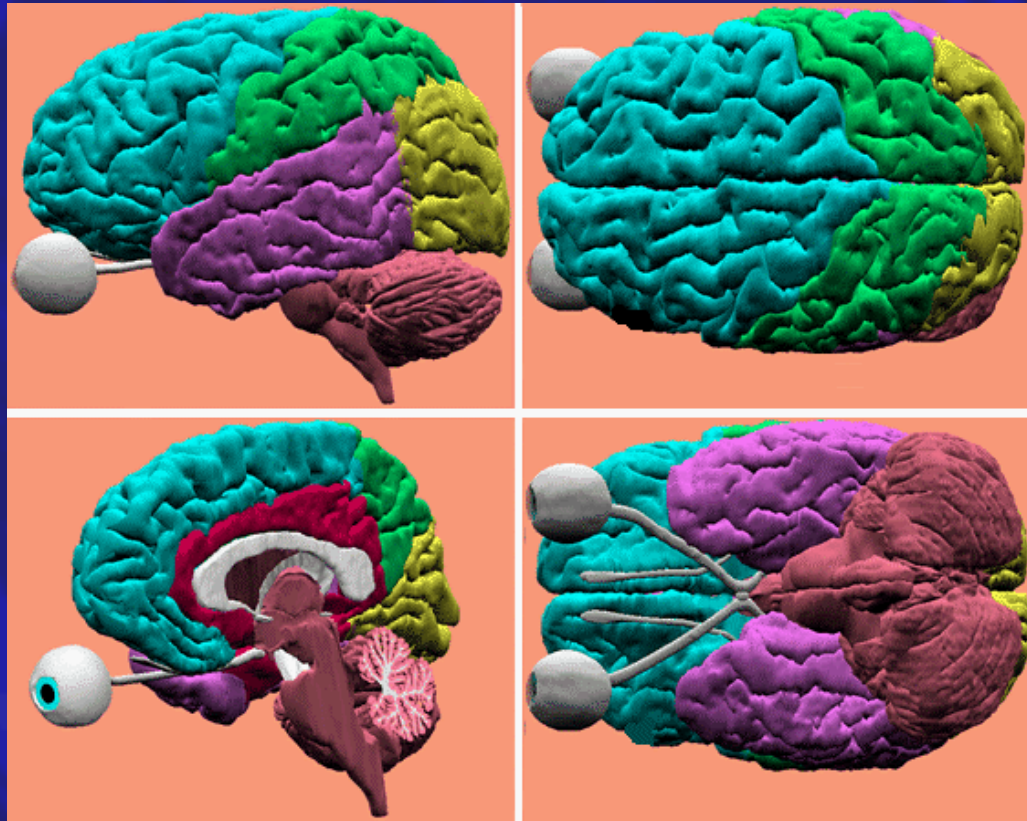


Coronal

Il lobo occipitale

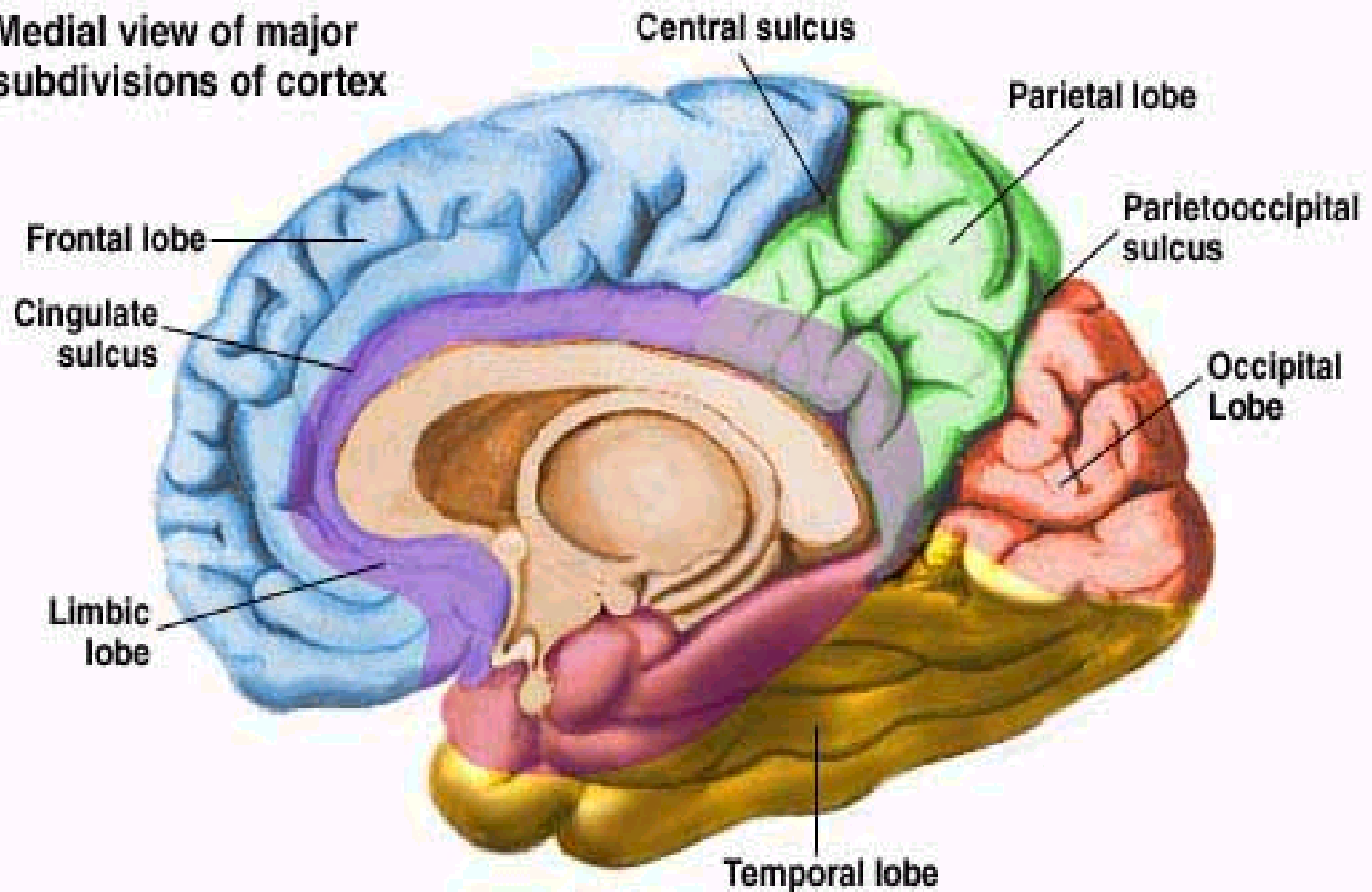


Lobo temporale

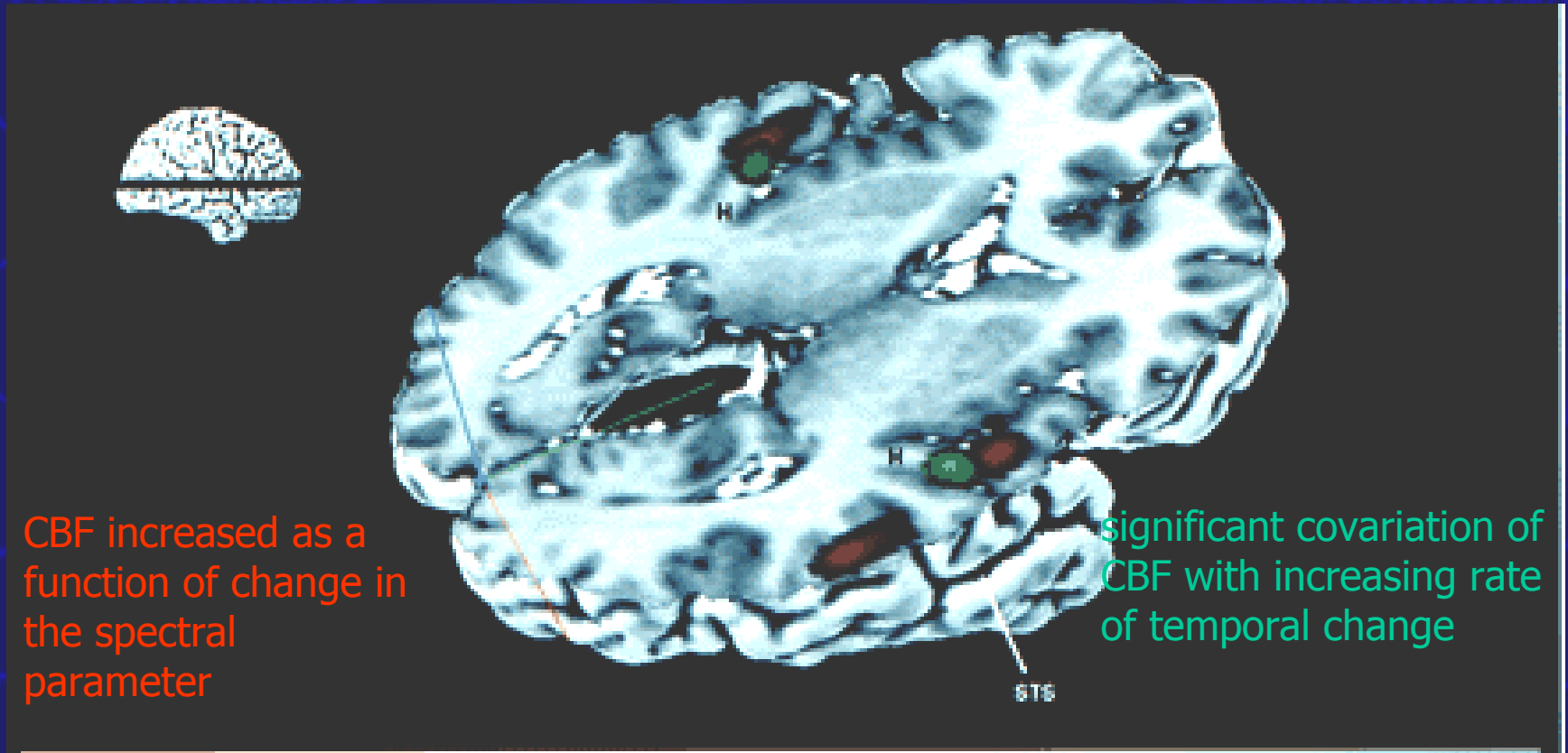


Lobo temporale e limbico

Medial view of major
subdivisions of cortex

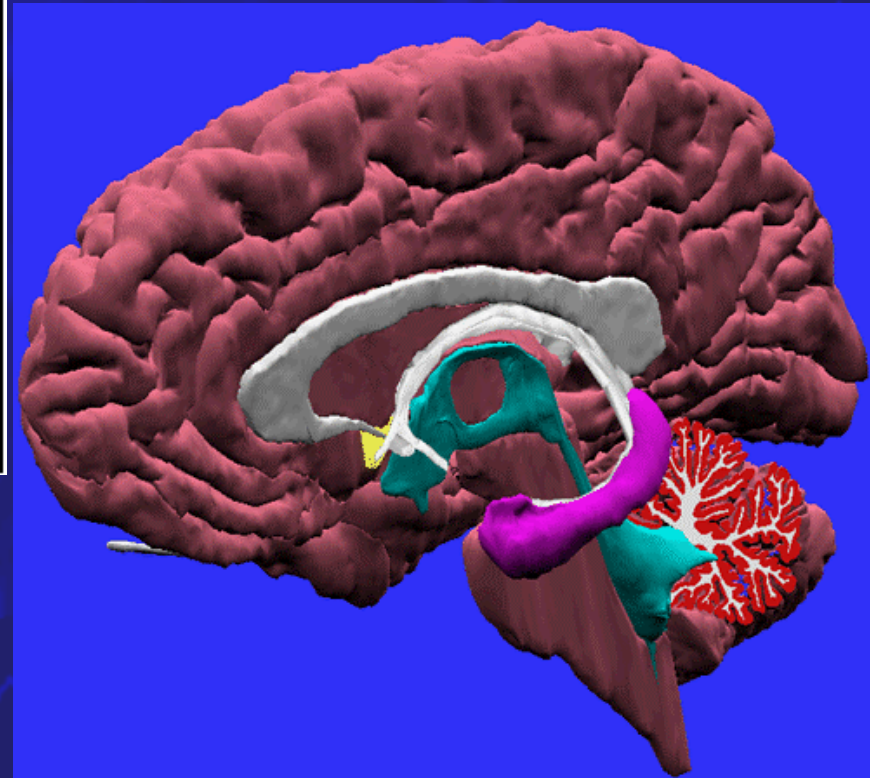
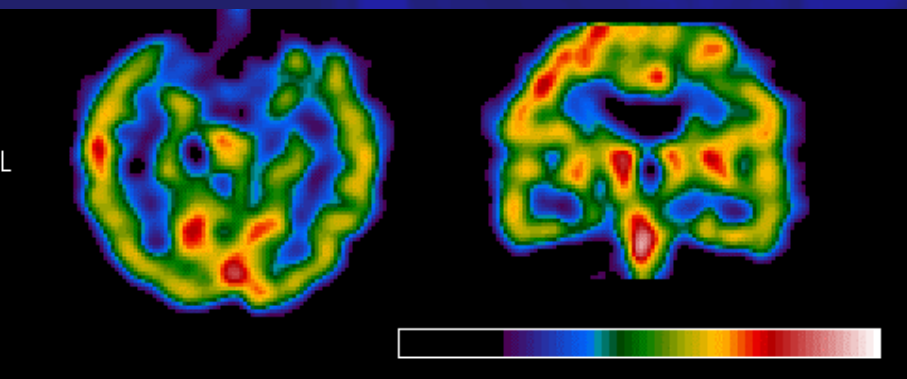
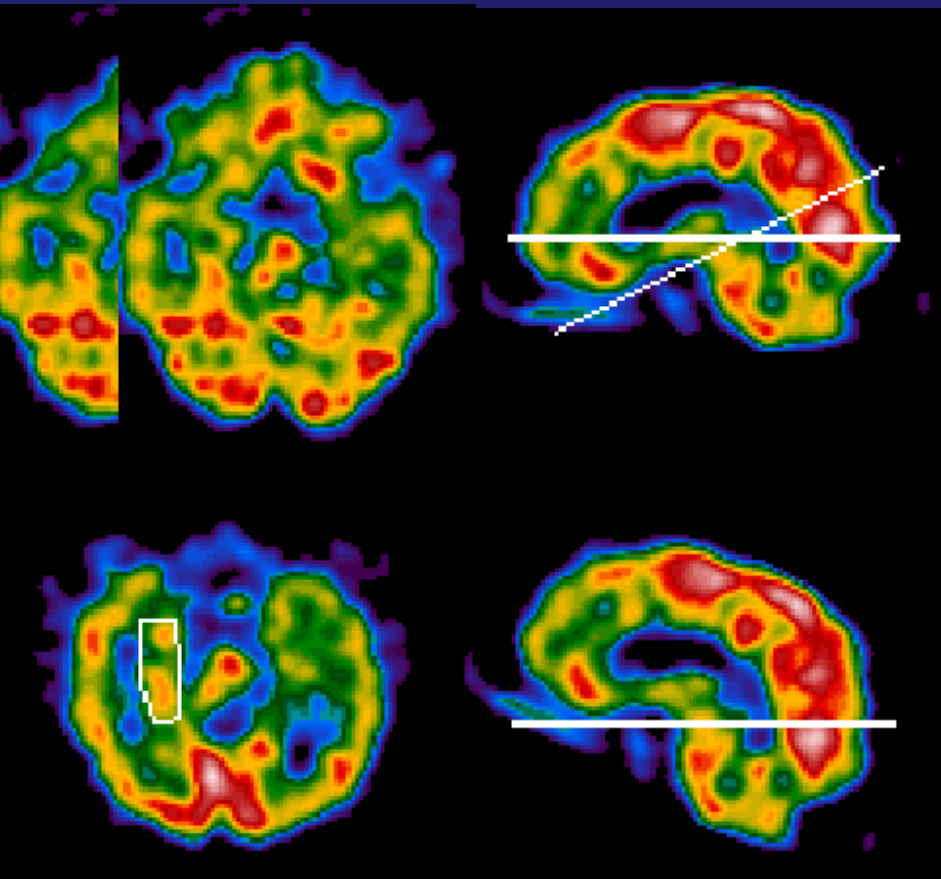


Lobo temporale: la corteccia acustica



Zatorre et al, Cerebral Cortex, Vol. 11, No. 10, 946-953, October 2001

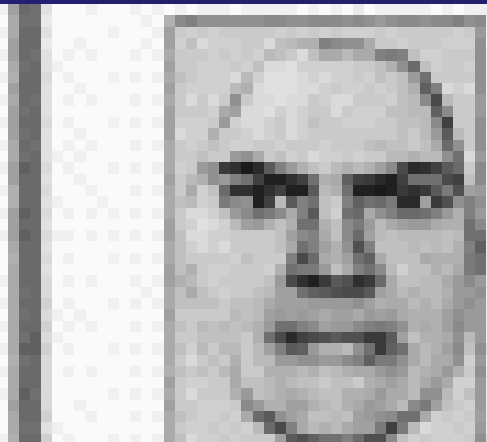
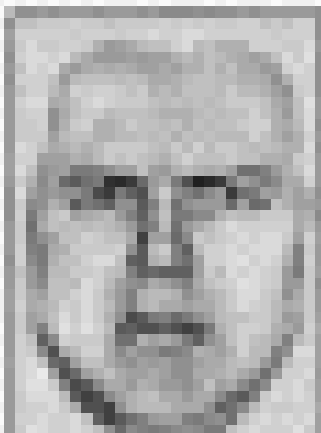
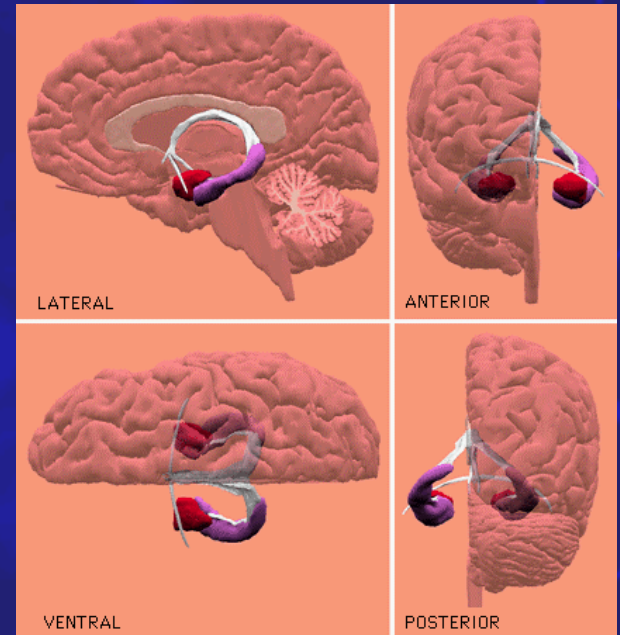
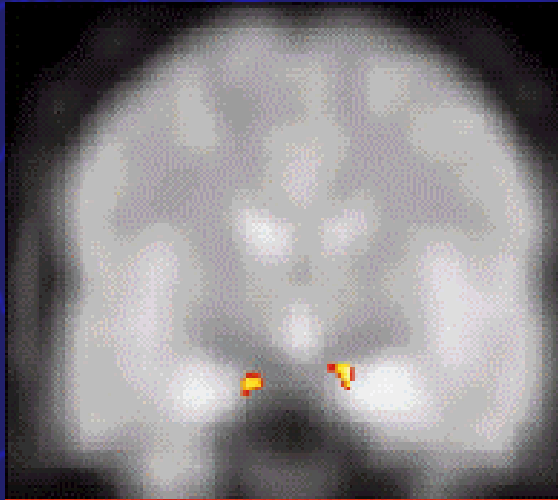
Il lobo temporale mesiale: ippocampo



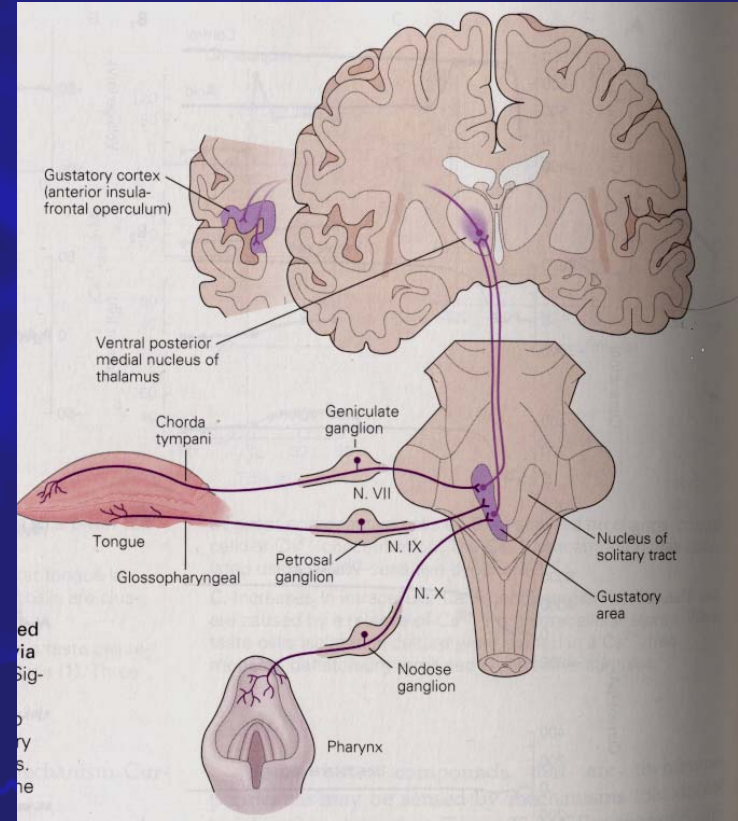
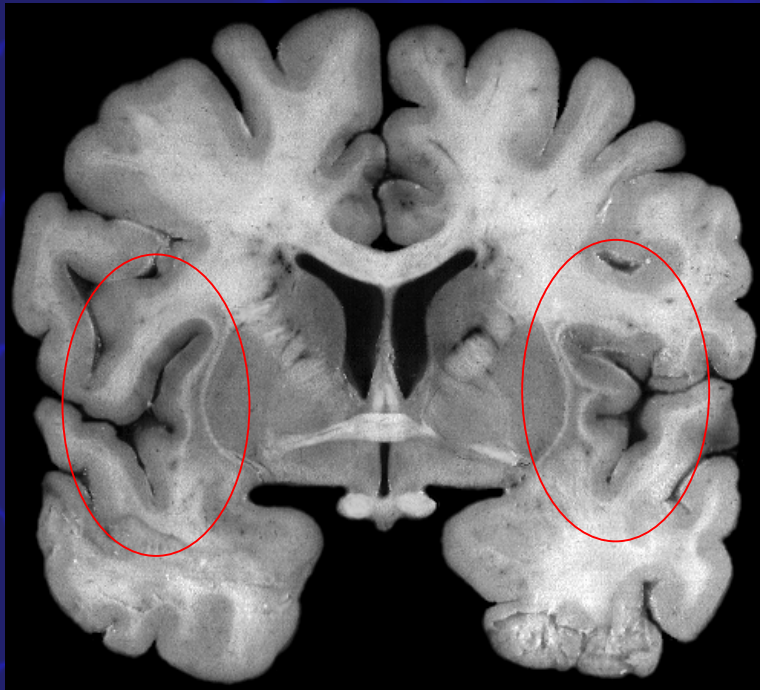
Memoria



Il lobo temporale mesiale: amigdala



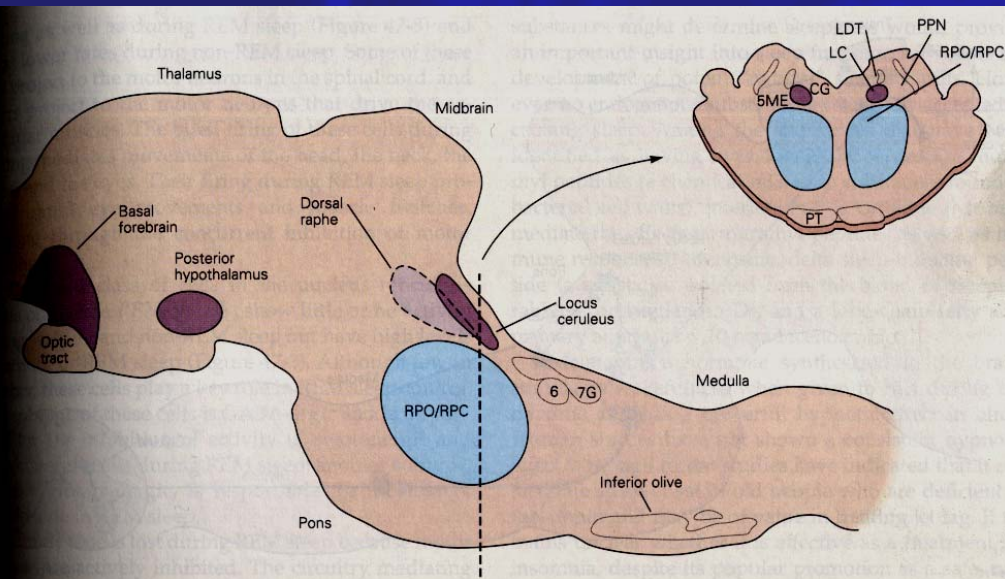
Il lobo dell'insula



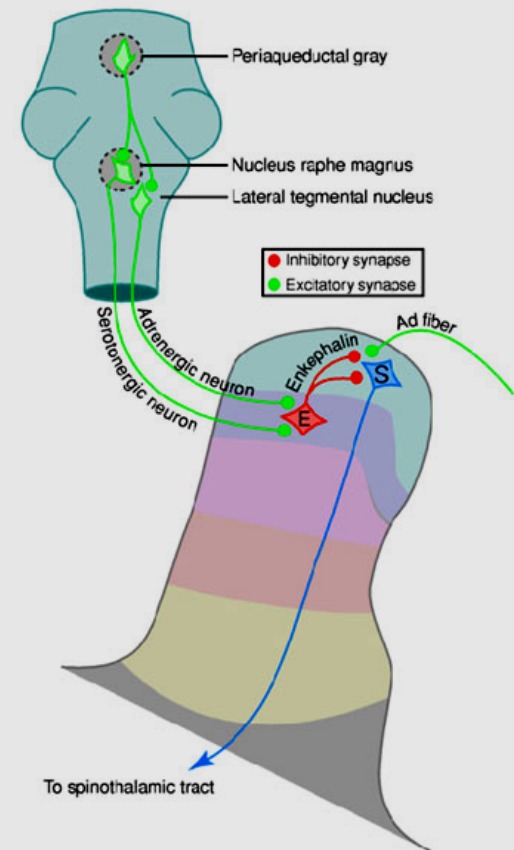
Il tronco encefalico



Il tronco encefalico

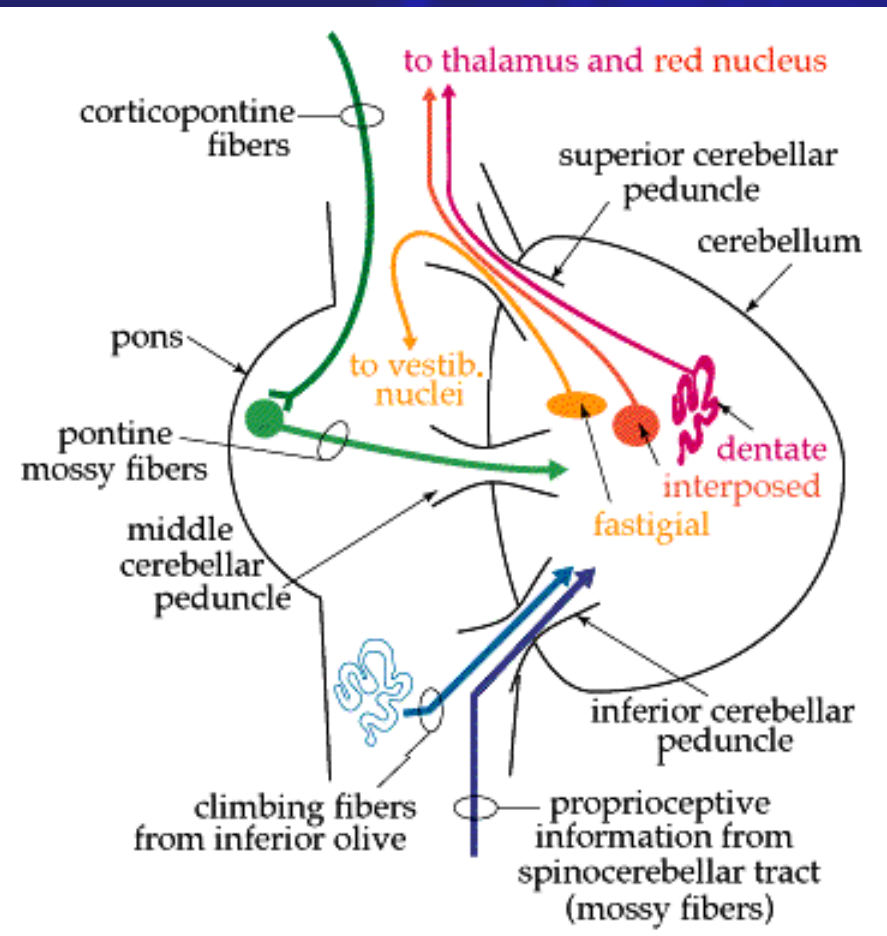


Melzack and Wall's Gate Control theory



Neurons from the PAG innervate neurons in the raphe and lateral tegmental nucleus. These send serotonergic and adrenergic projections, respectively, to spinal interneurons which release enkephalins to inhibit incoming nociceptive inputs.

Il cervelletto



Il cervelletlo

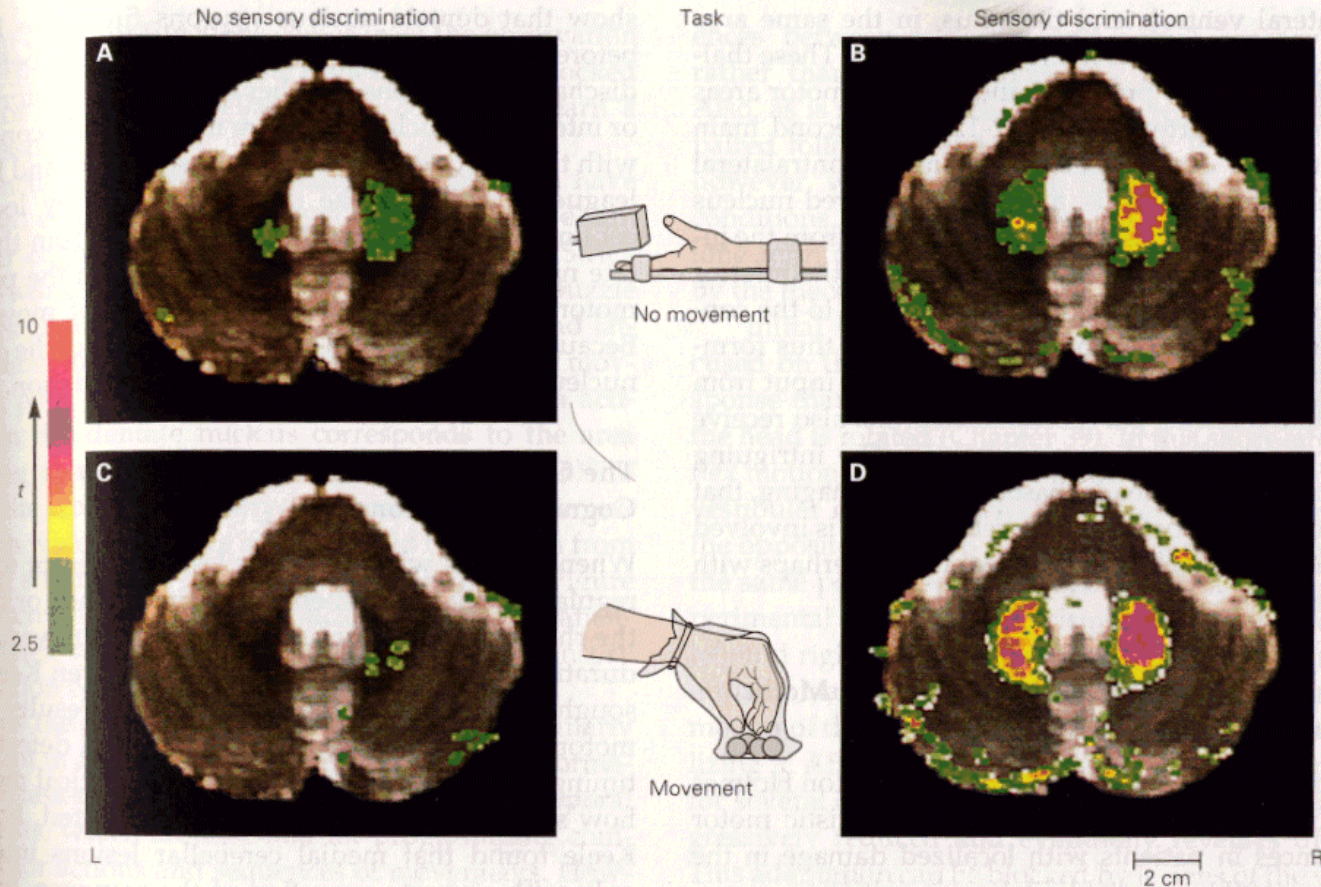
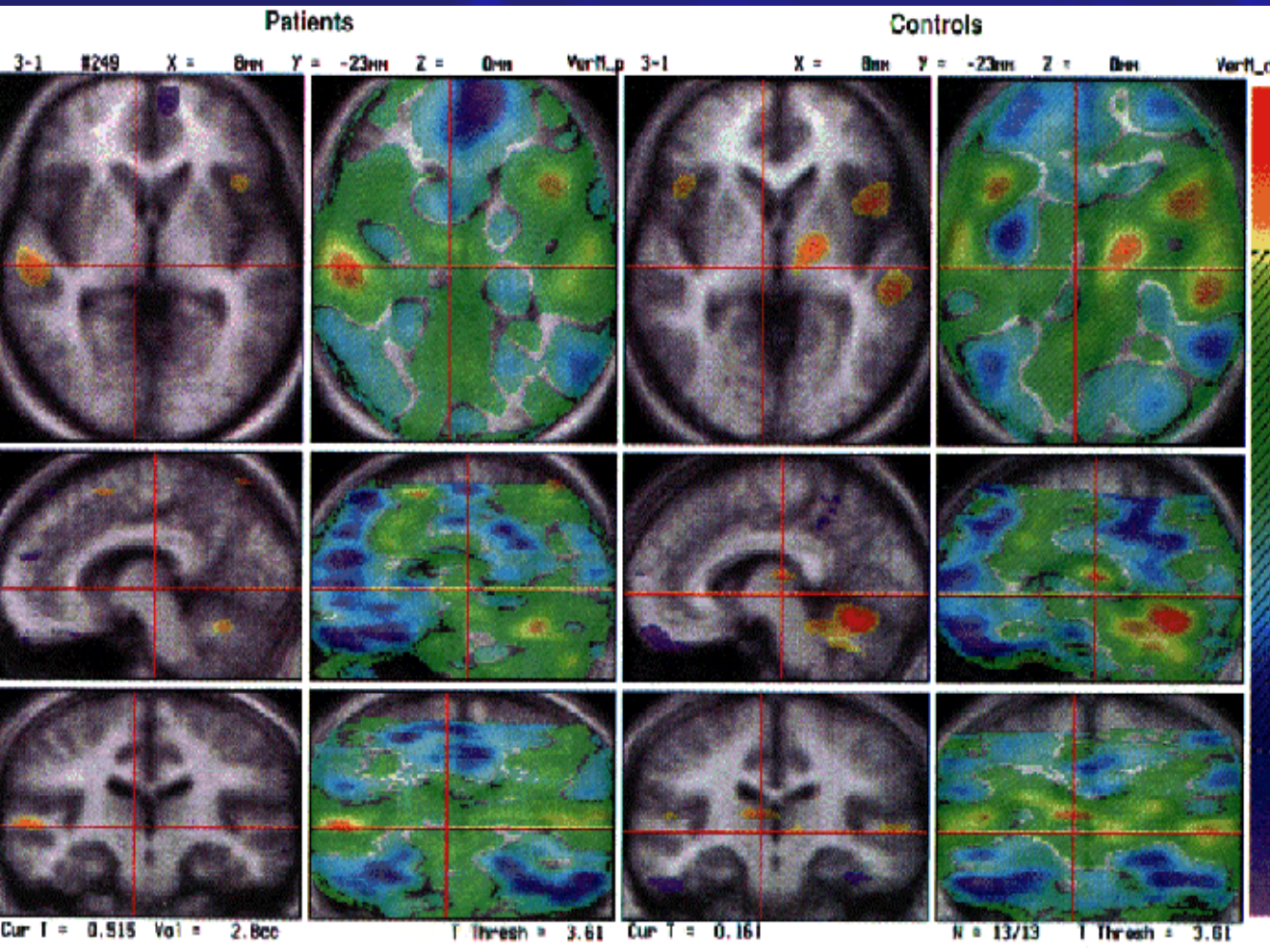


Figure 42-14 Activity in the dentate nucleus is significantly greater when the subject is mentally active during movement. A functional magnetic resonance image (color) overlaid on an anatomical image (gray) shows activation of the dentate nucleus during two pairs of tests. In one pair, subjects first passively experienced sandpaper rubbed across the fingers (A) and

then were asked to discriminate the degree of roughness of the sandpaper (B). In the other pair, subjects were asked to lift and drop a series of objects (C) and then had to identify the felt object from a similar group near the other hand (D). (From Gao JH et al. 1996. *Science* 272:545-547.)

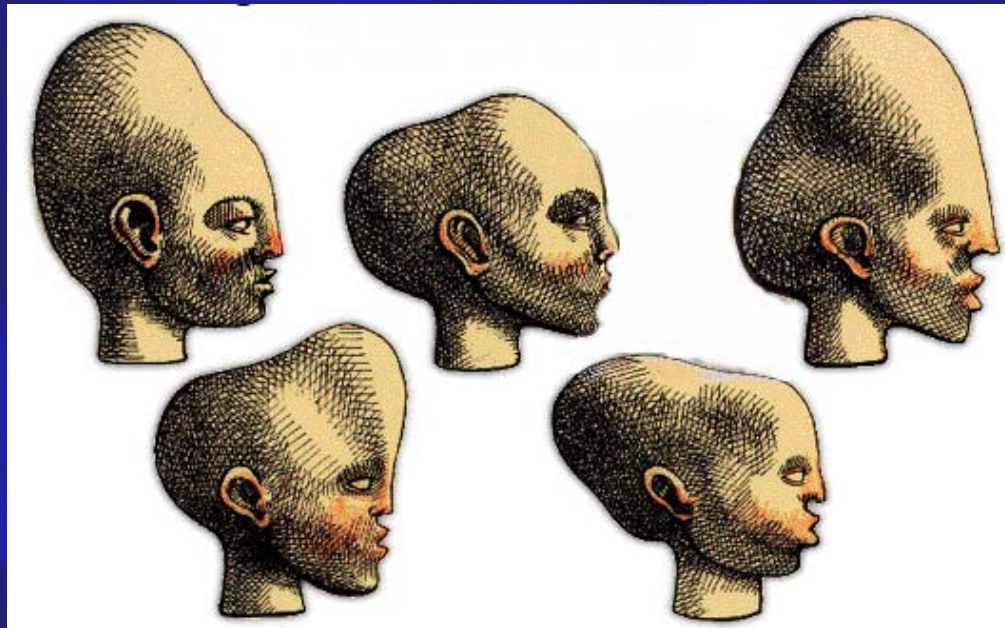
Il cervelletto e le funzioni cognitive



I risultati supportano l'ipotesi di un ruolo del cervelletto nelle funzioni cognitive e suggeriscono che i pazienti con schizofrenia possano soffrire di una “dismetria cognitiva” per un malfunzionamento del circuito cerebello-talamo-prefrontale.

Il modello frenologico

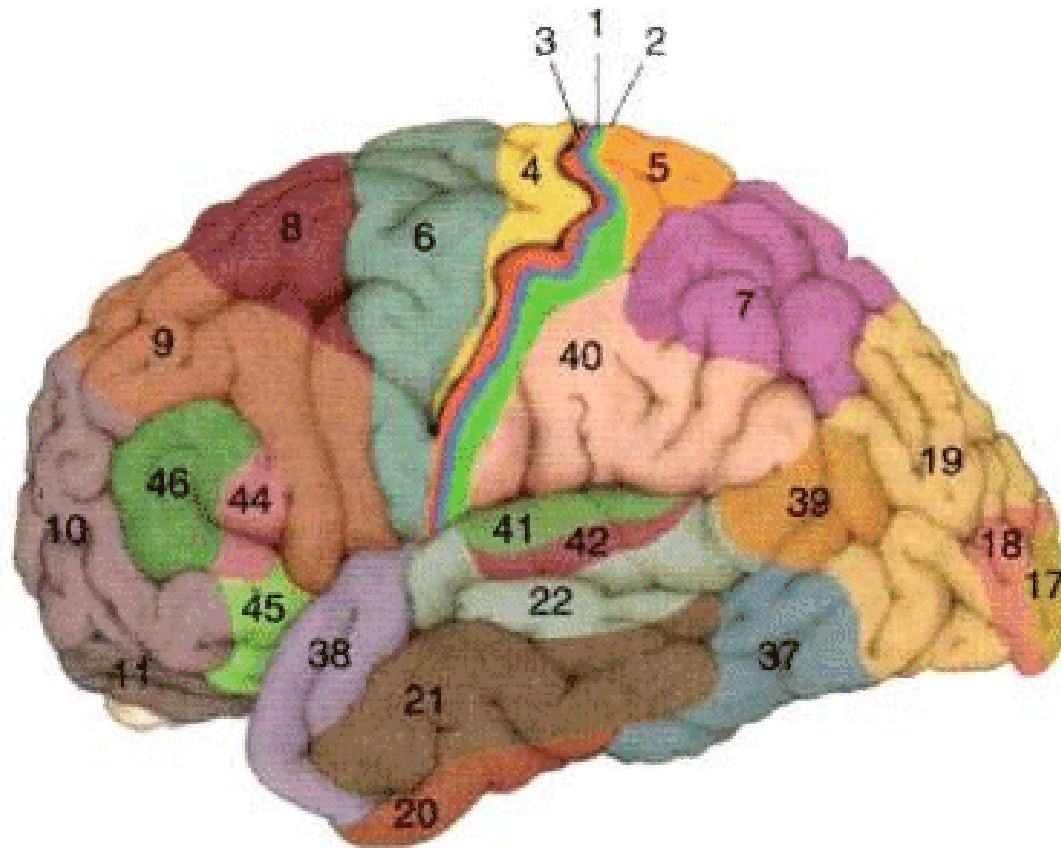
Gall (1810) ipotizza 27 aree cerebrali con 27 funzioni mentali specifiche.



Le immagini funzionali come si collocano?

Una divisione citoarchitettonica della corteccia cerebrale:

le aree di Brodmann (1909)
basate sull'analisi di 1 solo cervello



I modelli lesionali: emisfero sinistro

Broca (1865) Sur la siège de la faculté du langage articulé.

Bull Soc Antropol 6: 377-393

casistica autoptica di afasici espressivi, tutti portatori di lesioni del giro frontale inferiore sinistro

Wernicke (1874) Der aphasische Symptomencomplex.

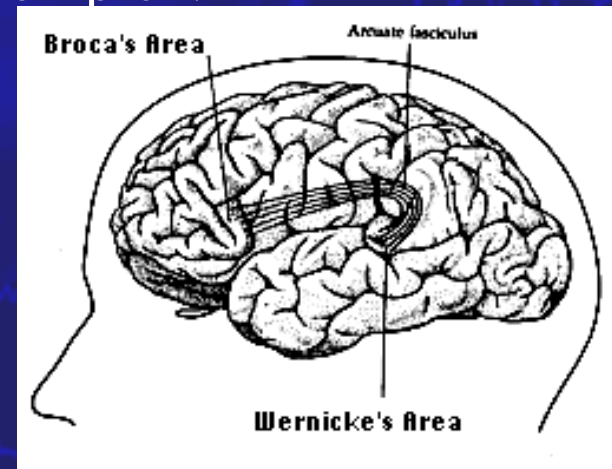
Breslau:Cohn & Weigert

l'afasia di comprensione ha sede nel giro temporale superiore sinistro

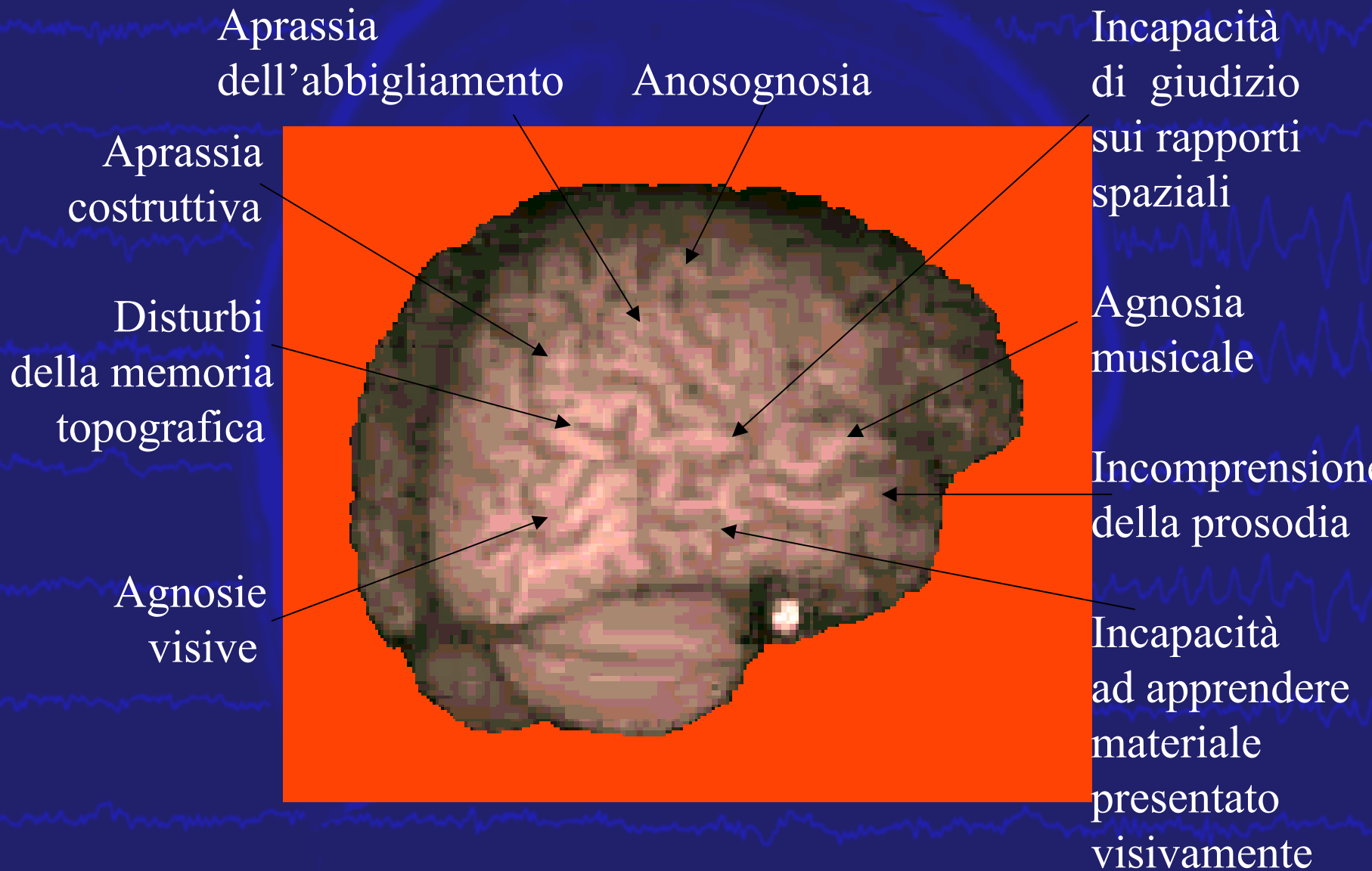
Geswind (1971) Current concepts: aphasia

N Engl J Med 284: 654-656

le aree espressive anteriori (Broca) sono connesse (fascicolo arcuato) a quelle posteriori (Wernicke)



I modelli lesionali: emisfero destro



L'elettrostimolazione delle aree del linguaggio

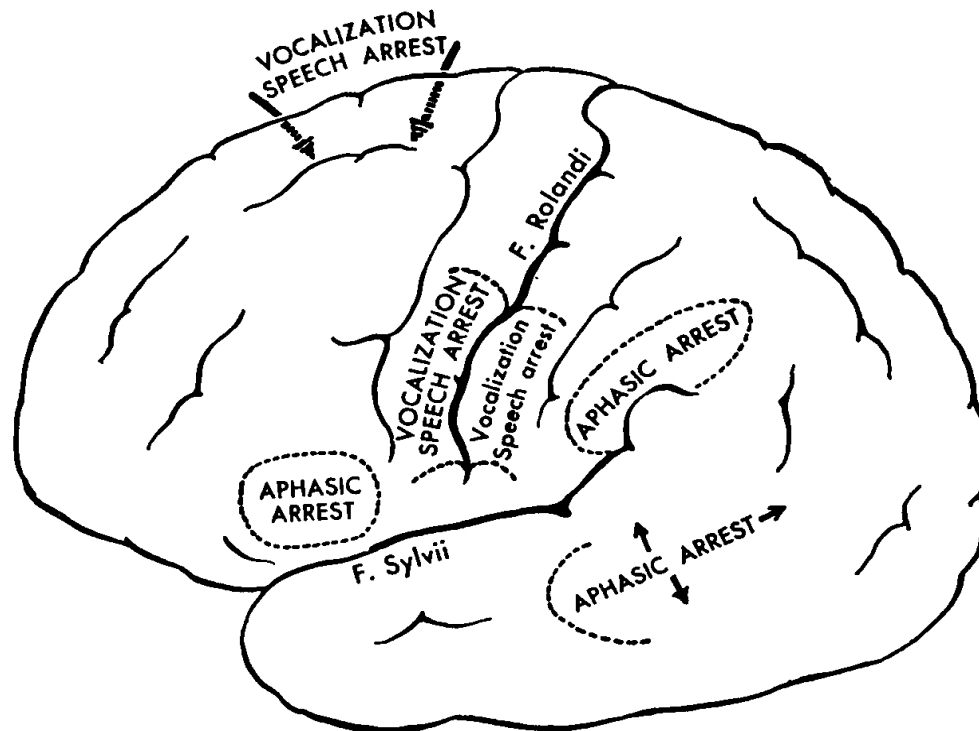


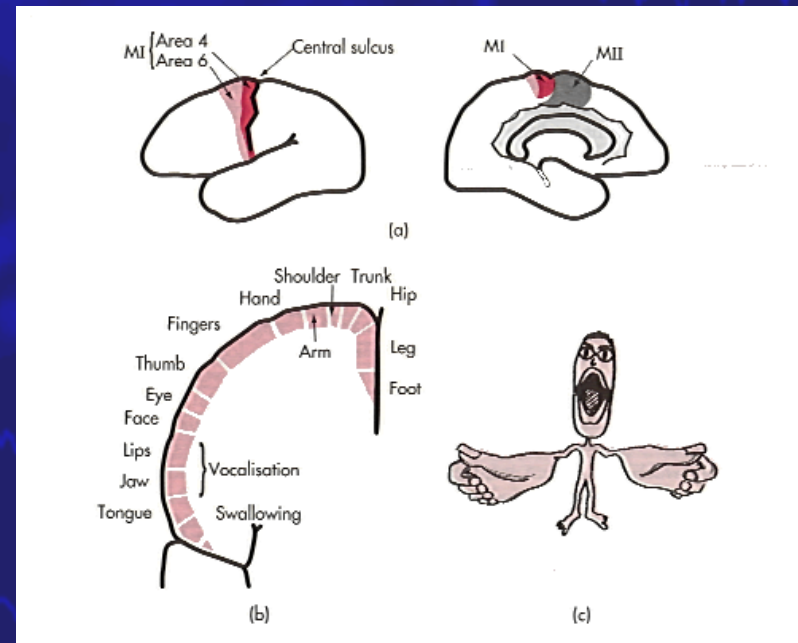
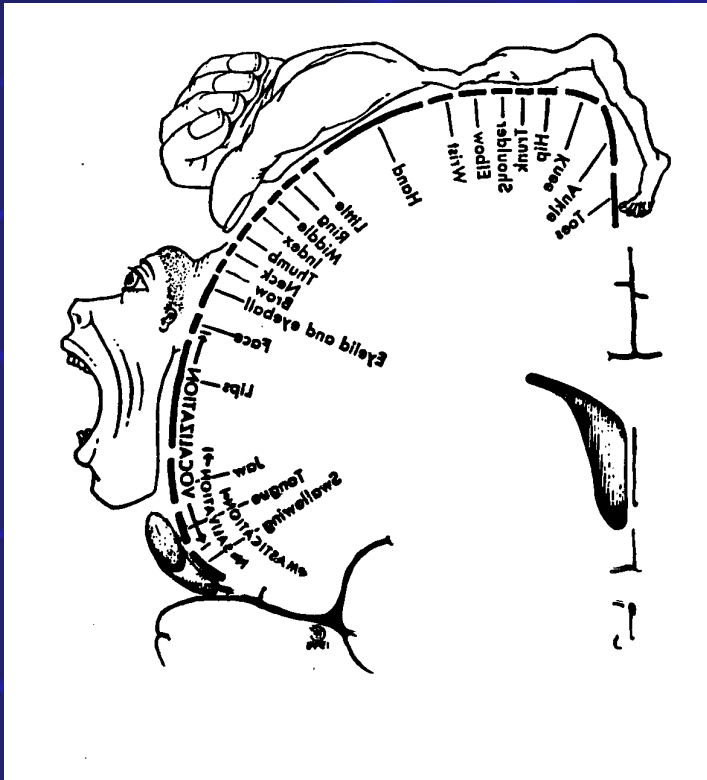
Fig. 56. Summary of areas in which stimulation may interfere with speech or produce vocalization in the dominant hemisphere. Speech interference produced by stimulation of the superior intermediate frontal area within the longitudinal fissure has in certain cases produced evidence of aphasia rather than simple arrest, an observation that calls for further studies

Penfield W. et al. 1950

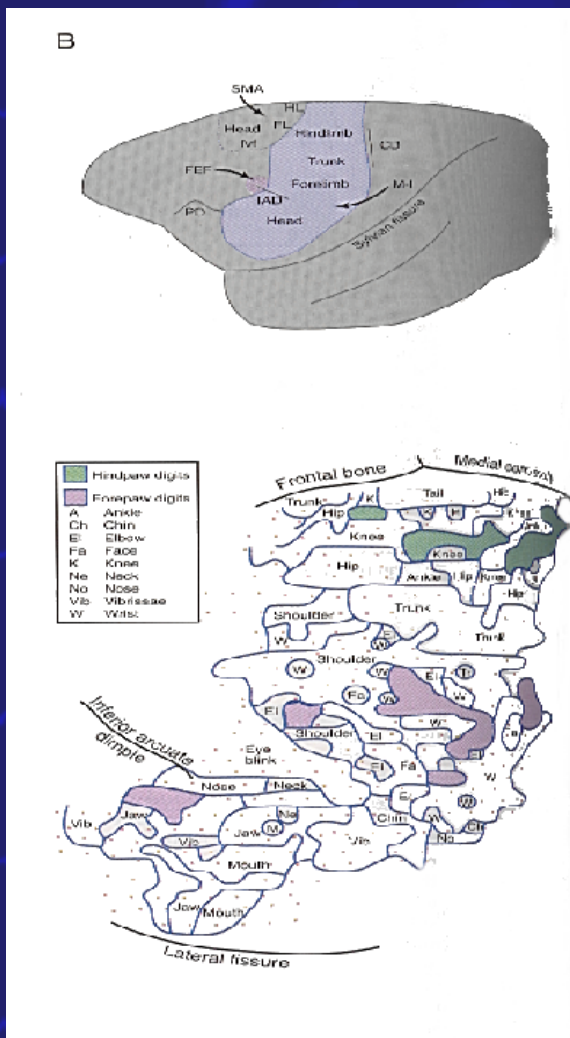
Homunculus di Penfield

Il lavoro di Penfield, effettuato con la stimolazione elettrica della corteccia cerebrale esposta durante interventi chirurgici, diventa un punto di riferimento; le aree motorie così individuate sono al davanti della

scissura del Rolando e corrispondono all'area citoarchitettonica 4 secondo lo schema proposto da Brodmann nel 1907

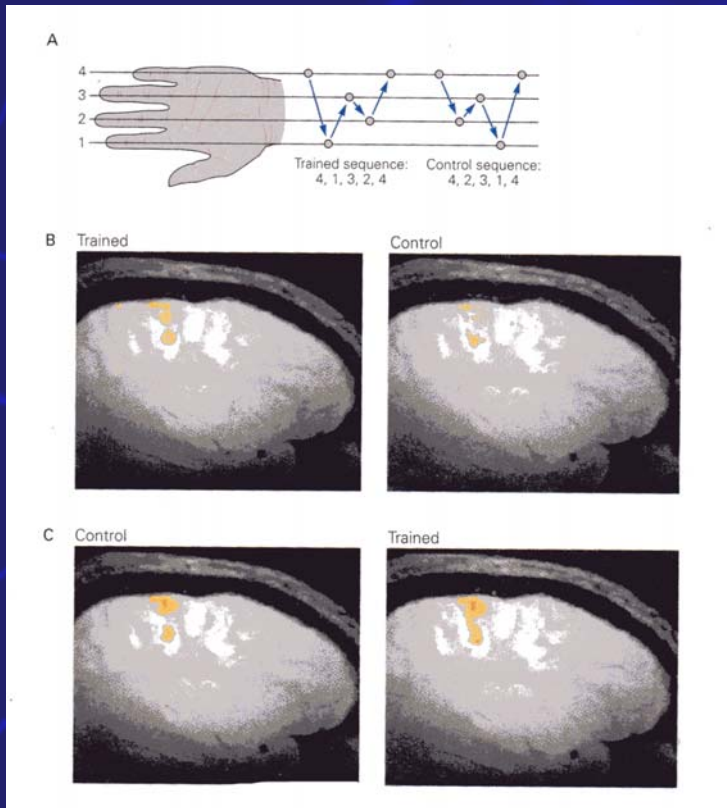


La somatotopia: studio recente

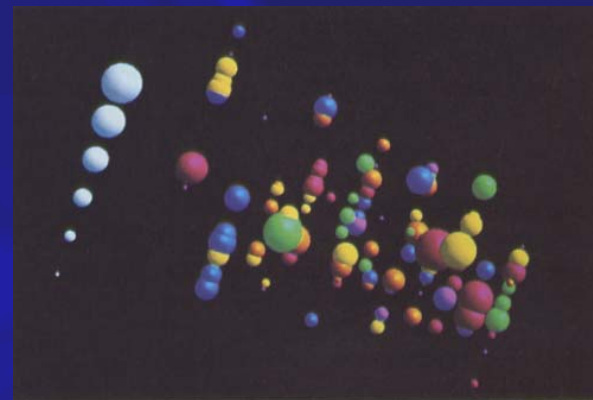


Questa figura è tratta dal lavoro di Gould e coll. 1986. I punti rappresentano le zone di stimolazione ed è evidente il mosaico delle varie parti del corpo che si sovrappongono e le dita della zampa anteriore (viola) e quelle della zampa posteriore (verde) sono in differenti aree e separate da aree di parti del corpo vicine.

La somatotopia e l'appendimento:



Karni 1995

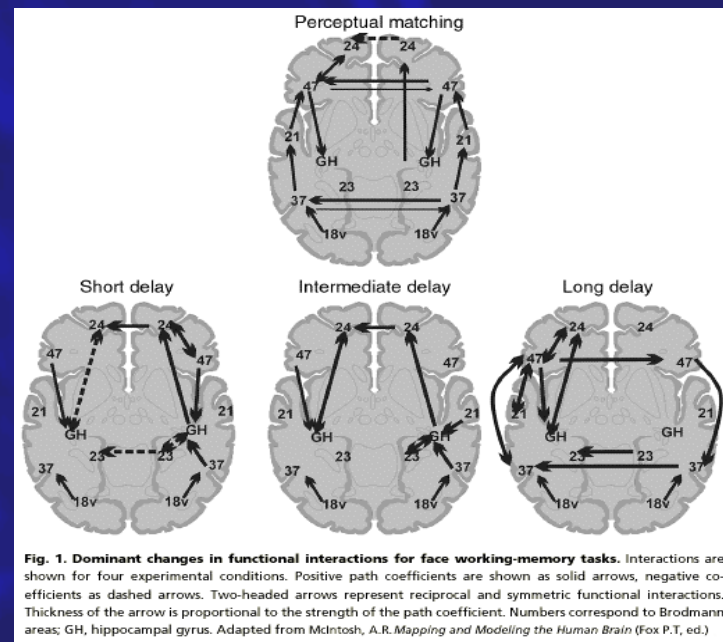


Schieber 1993

La teoria connettivista

Non più un centro per ogni funzione (come pensavano i cognitvisti), ma piuttosto una rete di aree connesse in parallelo, spesso in aree distanziate tra loro. La conoscenza risiede dunque nelle connessioni neuronali, ed il circuito che si viene a creare è dipendente dalla forza di tali connessioni.

In questo studio con neuroimmagini funzionali viene evidenziato, in una prova di working memory visuospatiale, come la connettività funzionale tra le diverse aree cerebrali (dunque la forza delle connessioni) cambia secondo la durata del processo.



fMRI e MEG nel linguaggio



000 msec

La complessità delle azioni

