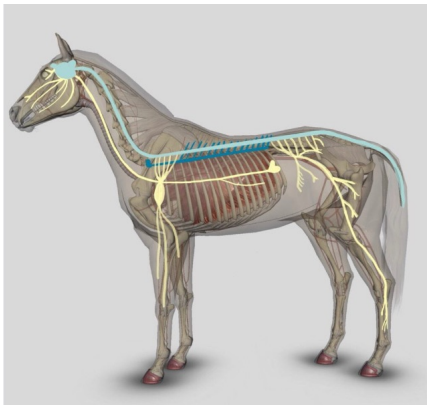
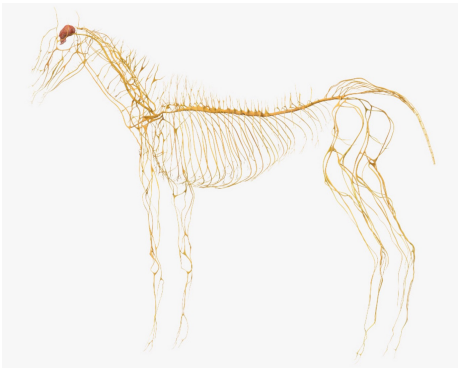
UNIVERSITÀ DEGLI STUDI DI TERAMO



Le cellule nervose



Prof.ssa Pia Lucidi

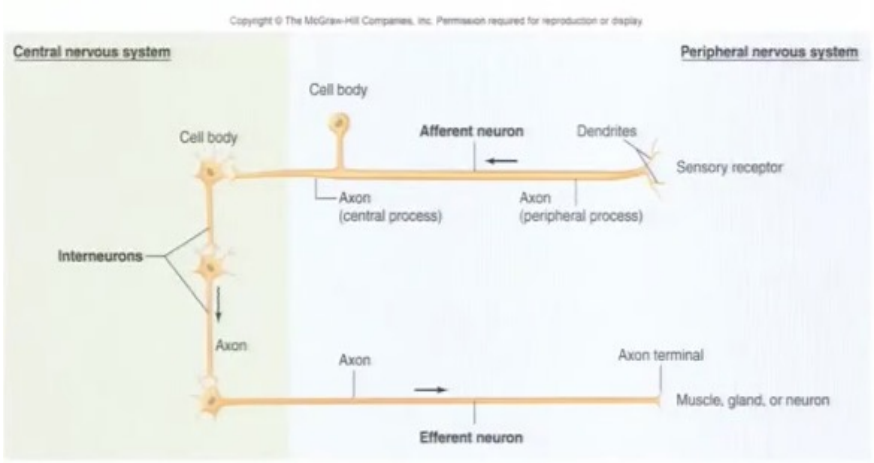
Laboratorio di Cognizione e Benessere Animale
RICEVIMENTO
Fine lezione o per appuntamento: plucidi@unite.it

1

CONCETTI SOGLIA

- Divisioni del Sistema Nervoso
- Classificazione funzionale dei neuroni
- Potenziali di membrana:
  - riposo
  - graduato
  - azione

2

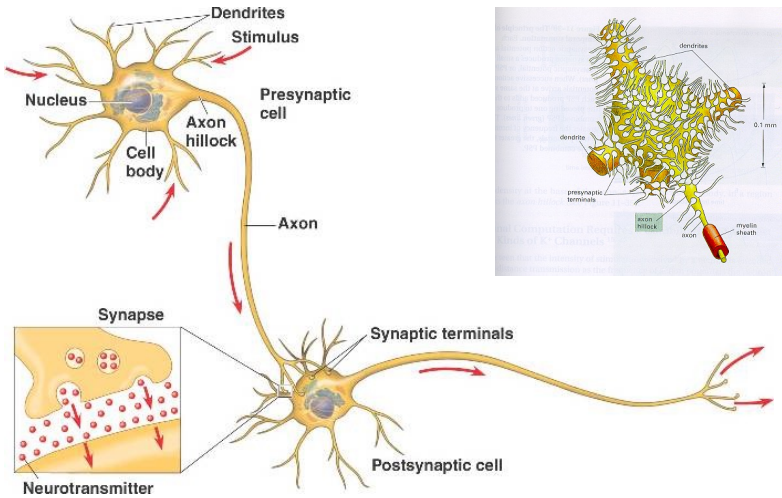


SNC: cervello, midollo

SNP: nervi cranici, nervi spinali
neuroni afferenti sono sensoriali (informazioni **verso** il SNC)
neuroni efferenti inducono cambiamenti (informazioni **dal** SNC alla periferia)

3

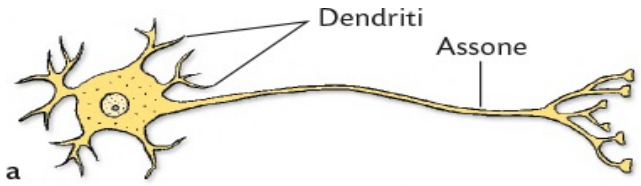
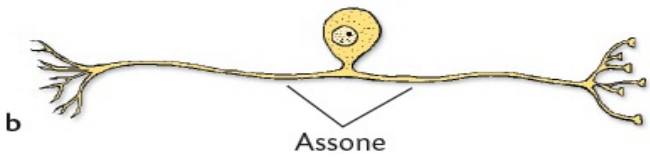
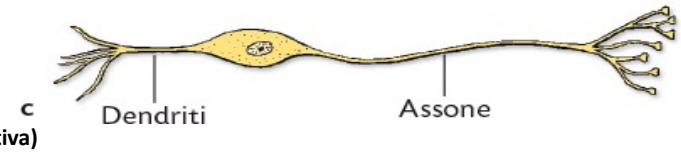
Il neurone



100 miliardi di neuroni nel cervello umano

100.000 miliardi di sinapsi

4

TIPO DI NEURONE	CONFORMAZIONE
Neurone multipolare (motoneuroni, cell. Purkinje, più del 90%)	
Neurone pseudounipolare (gangli delle radici dorsali spinali)	
Neurone bipolare (retina, mucosa olfattiva)	

O.V. Sjaastad, O. Sand, K. Hove
Ambrosiana
Fisiologia degli animali domestici
Copyright 2013 C.E.A. Casa Editrice

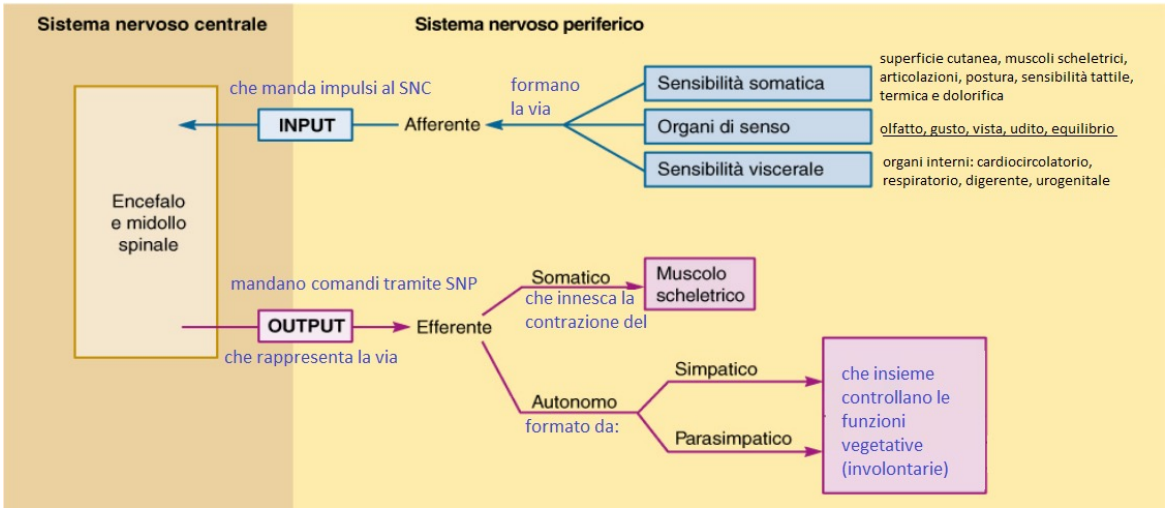
5

Classificazione funzionale

- **Neurone afferente (sensoriale)**
  - Trasporta dalla periferia al SNC le informazioni necessarie x la percezione e la coordinazione motoria
- **Neurone efferente (motore, motoneurone)**
  - Trasporta il segnale dal SNC (cervello o midollo) ai muscoli e all'apparato ghiandolare
- **Interneuroni:** i più numerosi, tutti quelli non specificatamente sensitivi o motori
  - **I. di ritrasmissione o proiezione:** da una regione all'altra del cervello, distanze considerevoli, assoni lunghi.
  - **I. locali**: all'interno di circuiti locali, assoni brevi

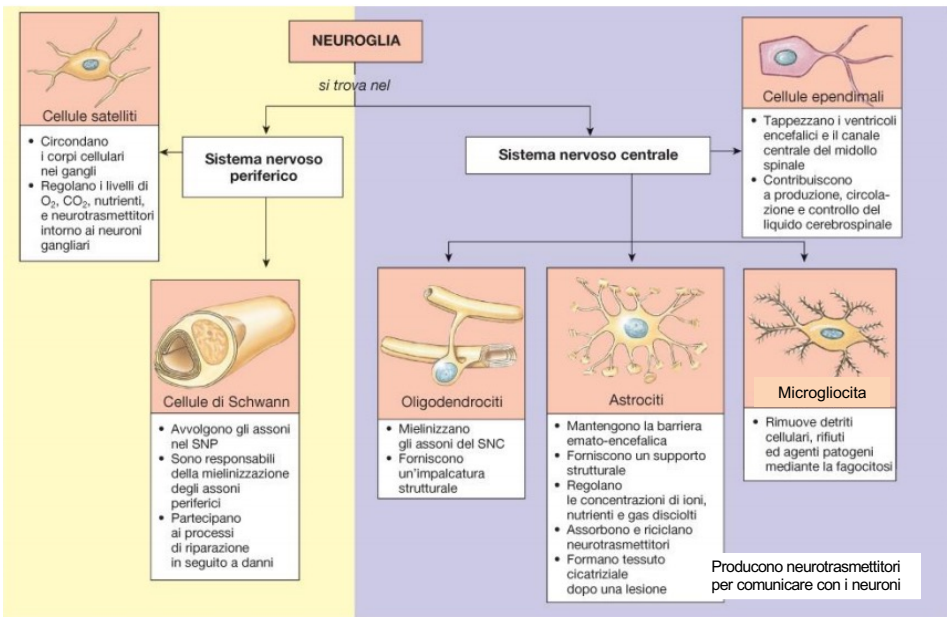
6

Organizzazione del SNC e SNP

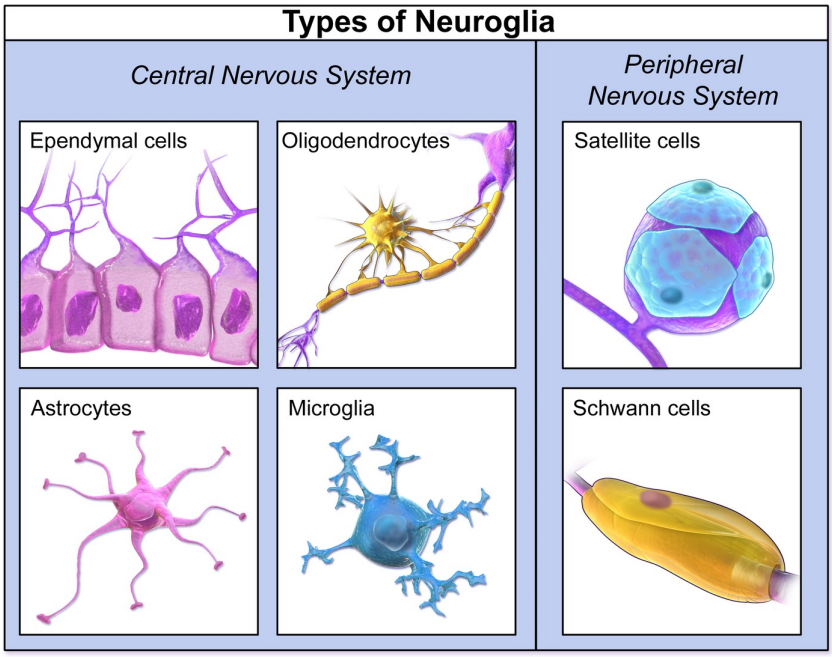


7

Cellule gliali

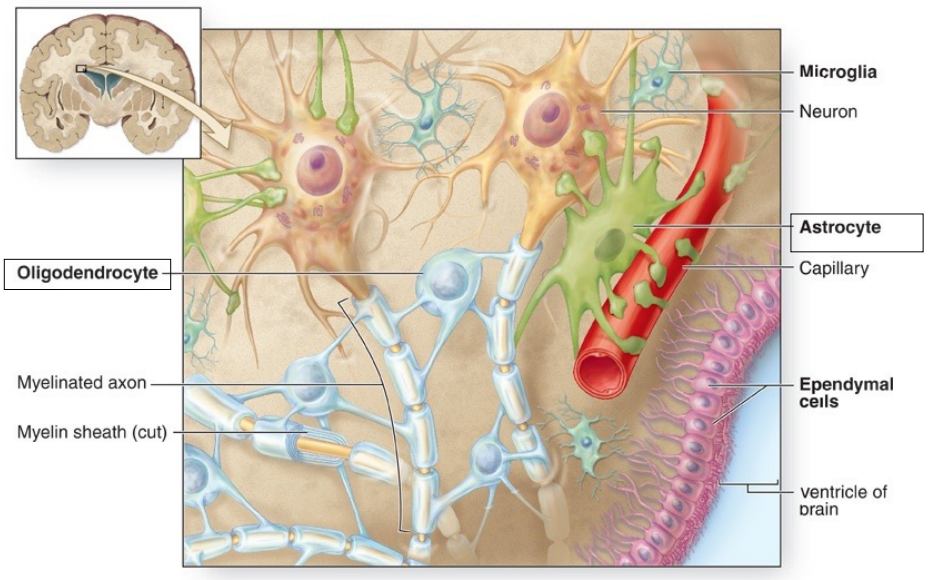


8



9

Copyright © The McGraw-Hill Companies, Inc. Permission required for reproduction or display.

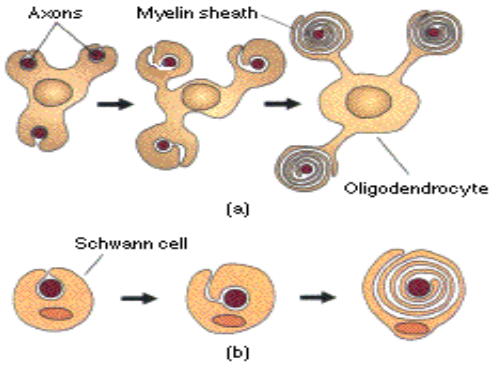


10

Formazione guaina mielinica

SNC

SNP



Mentre gli oligodendrociti nel SNC possono avvolgersi in numerosi tratti internodali (in media 15), le cellule di Schwann nel SNP circondano un unico tratto internodale di un solo assone. Anche la composizione chimica della mielina elaborata dai due tipi cellulari è alquanto diversa.

11

Neuroni e cellule gliali sono all'incirca uguali numericamente

J Comp Neurol. 2009 Apr 10;513(5):532-41. doi: 10.1002/cne.21974.

Equal numbers of neuronal and nonneuronal cells make the human brain an isometrically scaled-up primate brain.

Azevedo FA[1], Carvalho LR, Grinberg LT, Farfel JM, Ferretti RE, Leite RE, Jacob Filho W, Lent R, Herculano-Houzel S.

⊕ **Author information**

Abstract

The human brain is often considered to be the most cognitively capable among mammalian brains and to be much larger than expected for a mammal of our body size. Although the number of neurons is generally assumed to be a determinant of computational power, and despite the widespread quotes that the human brain contains 100 billion neurons and ten times more glial cells, the absolute number of neurons and glial cells in the human brain remains unknown. Here we determine these numbers by using the isotropic fractionator and compare them with the expected values for a human-sized primate. We find that the adult male human brain contains on average 86.1 +/- 8.1 billion NeuN-positive cells ("neurons") and 84.6 +/- 9.8 billion NeuN-negative ("nonneuronal") cells. With only 19% of all neurons located in the cerebral cortex, greater cortical size (representing 82% of total brain mass) in humans compared with other primates does not reflect an increased relative number of cortical neurons. The ratios between glial cells and neurons in the human brain structures are similar to those found in other primates, and their numbers of cells match those expected for a primate of human proportions. These findings challenge the common view that humans stand out from other primates in their brain composition and indicate that, with regard to numbers of neuronal and nonneuronal cells, the human brain is an isometrically scaled-up primate brain.

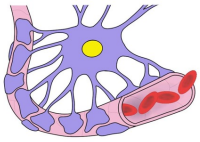
12

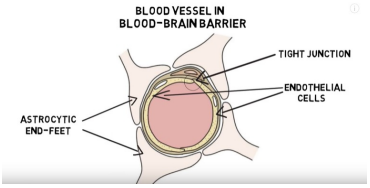
ALTRE CELLULE NERVOSE

- **POLIDENDROCITI**: sono chiamate anche cellule progenitrici degli oligodendrociti (OPC)
  - sono capaci di differenziarsi in oligodendrociti, neuroni*, astrociti*
  - rappresentano circa il 10-12% delle cellule
  - sono distribuite prevalentemente nell'ippocampo e nella corteccia
  - funzione non completamente definita

13

Barriera ematoencefalica





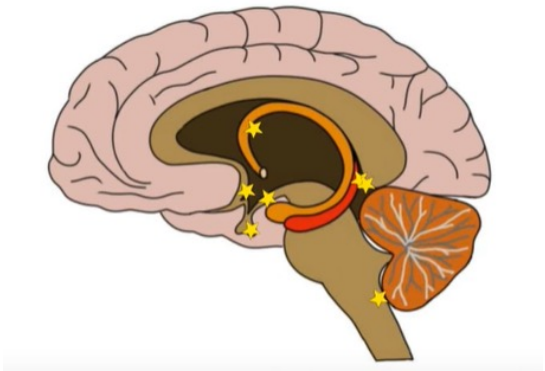
Come è stata scoperta: osservando che alcuni coloranti vitali non erano in grado di penetrare nel tessuto cerebrale se iniettati nel sistema circolatorio

La BEE (in inglese BBB) è formata principalmente dalle cellule endoteliali dei vasi – unite da tight junction – e dagli astrociti

Mantiene stabile l'ambiente intorno ai neuroni e impedisce il passaggio di sostanze tossiche (es. norepinefrina e glutammato circolanti le cui concentrazioni ematiche possono aumentare notevolmente per stress e persino dopo i pasti)

14

Dove la barriera emato-encefalica non serve



In alcune regioni del cervello la barriera ematoencefalica non è presente, cioè laddove c'è bisogno che le cellule nervose entrino in diretto contatto con il flusso sanguigno, per es. nelle cellule ipotalamiche neurosecernenti in generale ma forse anche in altre regioni cerebrali

15

Liquido cefalo-rachidiano

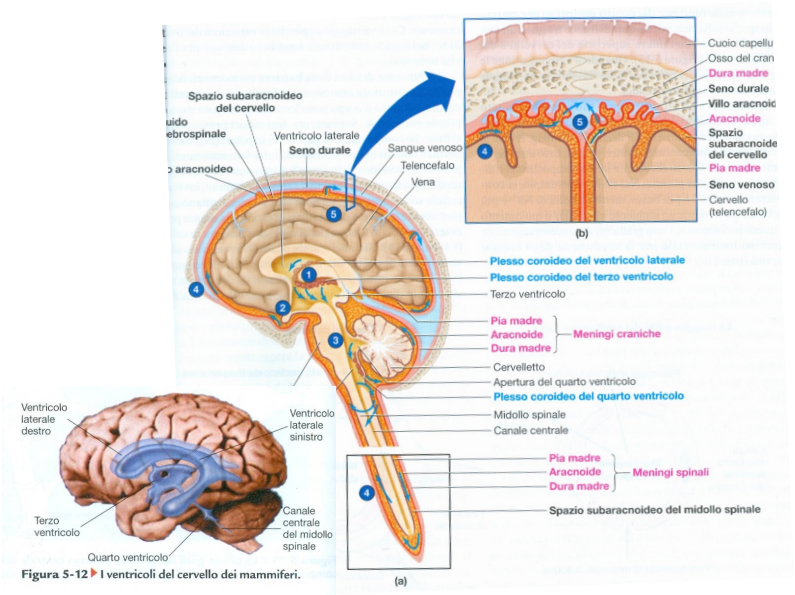
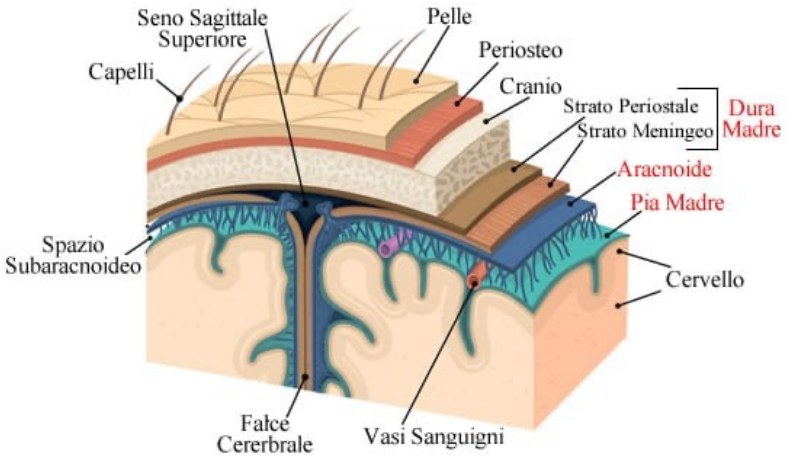


Figura 5-12 I ventricoli del cervello dei mammiferi.

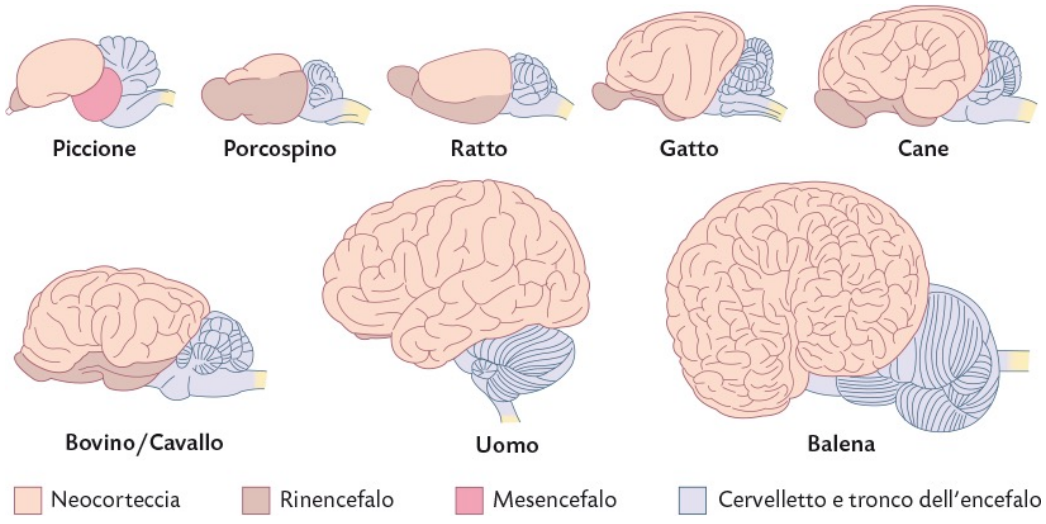
16

Meningi



17

SNC nelle diverse specie



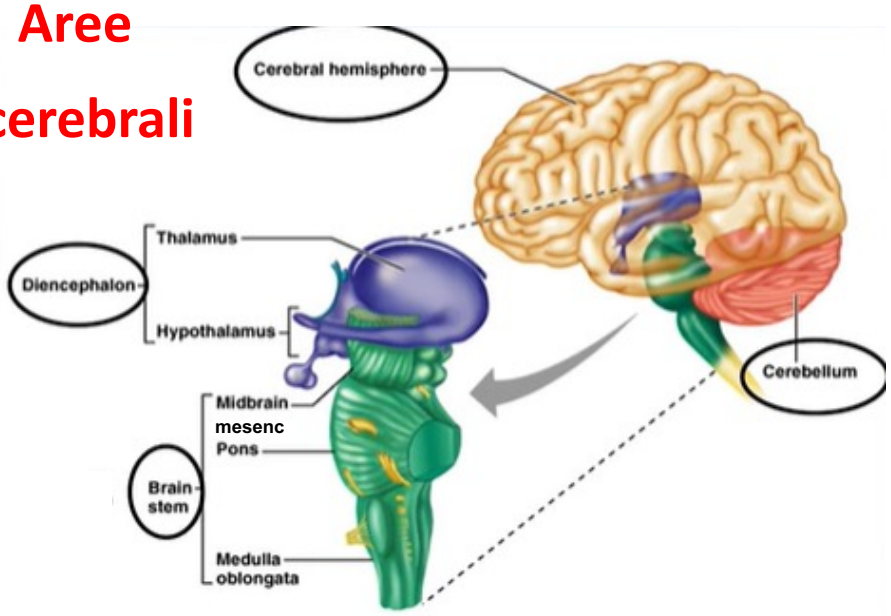
O.V. Sjaastad, O. Sand, K. Hove
Ambrosiana

Fisiologia degli animali domestici

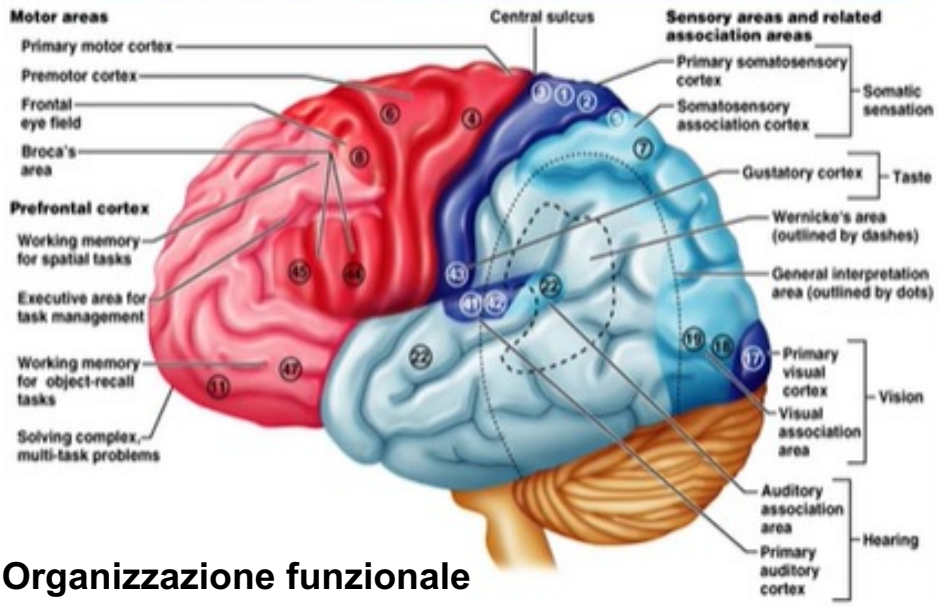
Copyright 2013 C.E.A. Casa Editrice

18

Aree cerebrali



19



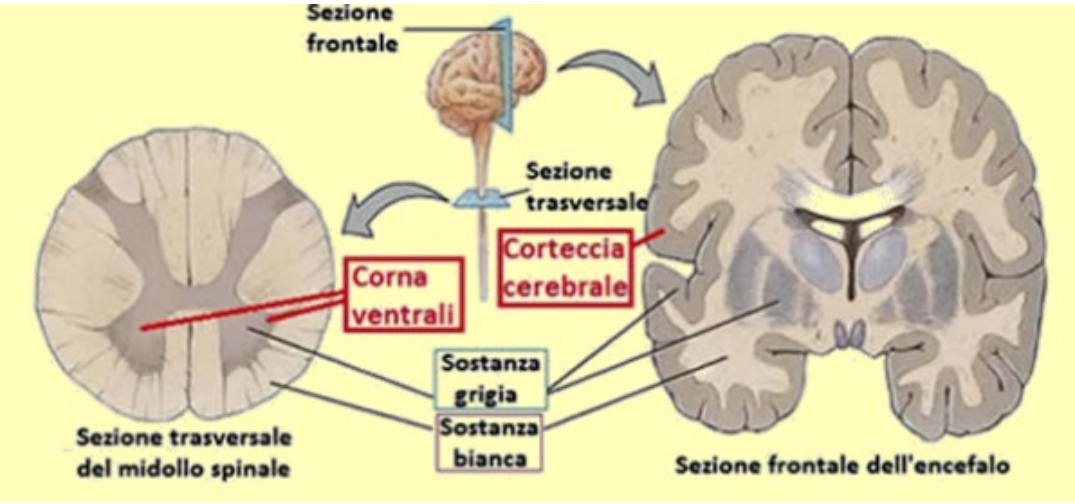
Organizzazione funzionale

Corteccia prefrontale — Aree sensoriali

Area motoria — Aree associative

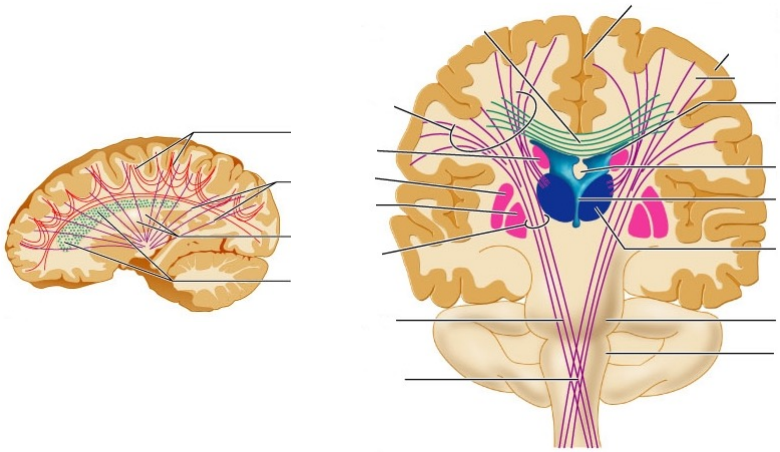
20

Materia grigia e bianca



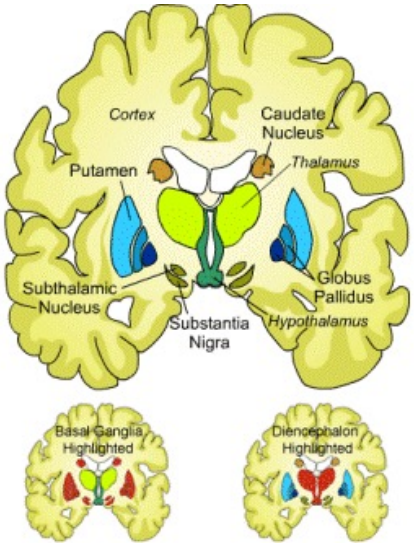
21

Sostanza bianca cerebrale



22

Sostanza grigia profonda



23