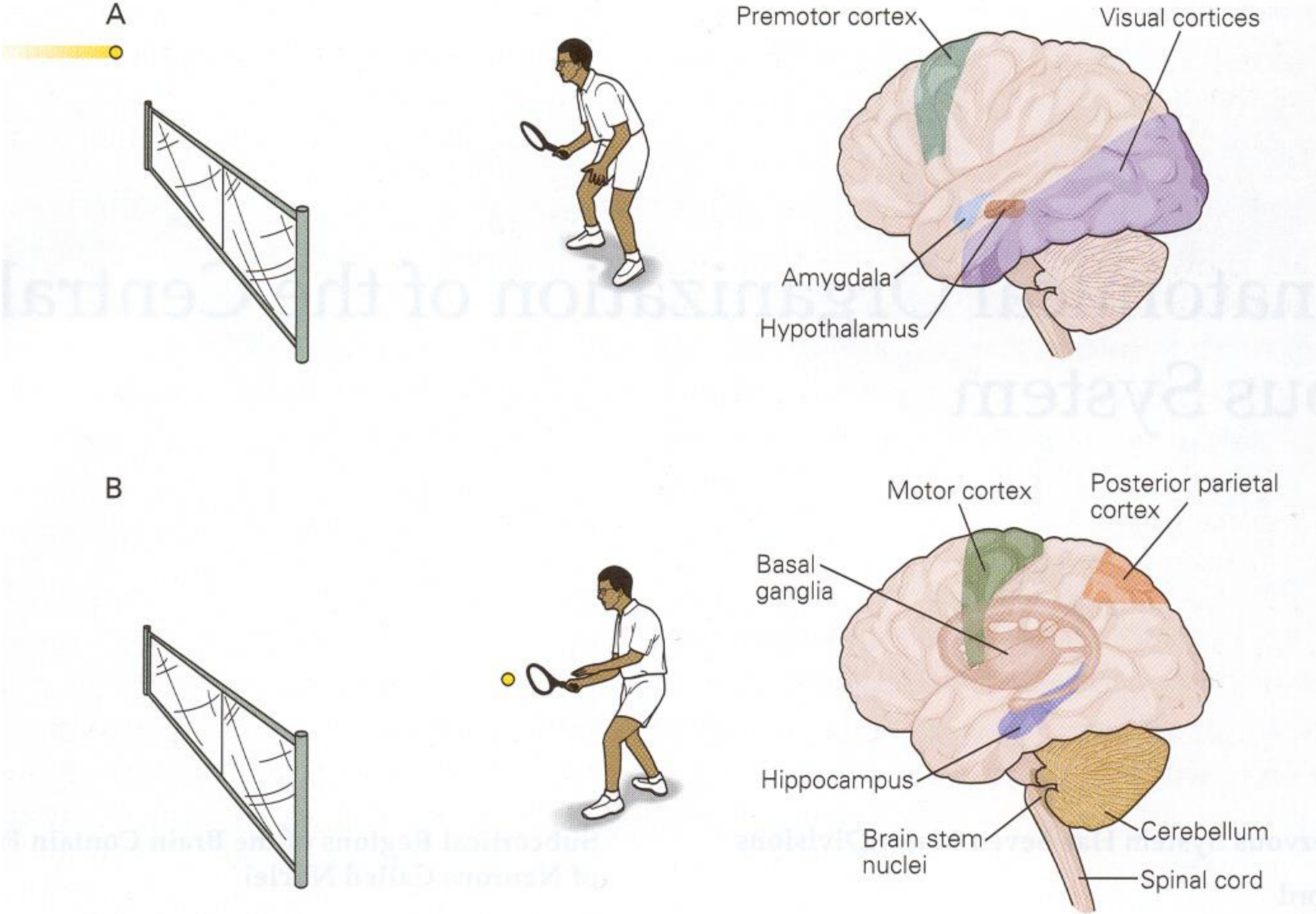
Touch, sensors, input projections at medulla and talamus, receptive fields, cortical areas, basic structure of mapping, using and change continuously sensory information.

11.46


A
Premotor cortex
Visual cortices
Amygdala
Hypothalamus
B
Motor cortex
Posterior parietal cortex
Basal ganglia
Hippocampus
Brain stem nuclei
Cerebellum
Spinal cord

The most important functional principles:

1) Each functional system links various brain regions: each characterized by different modes of analysis of the information, i.e. depending on the *features* that optimally define the best classification of the sensory input data;

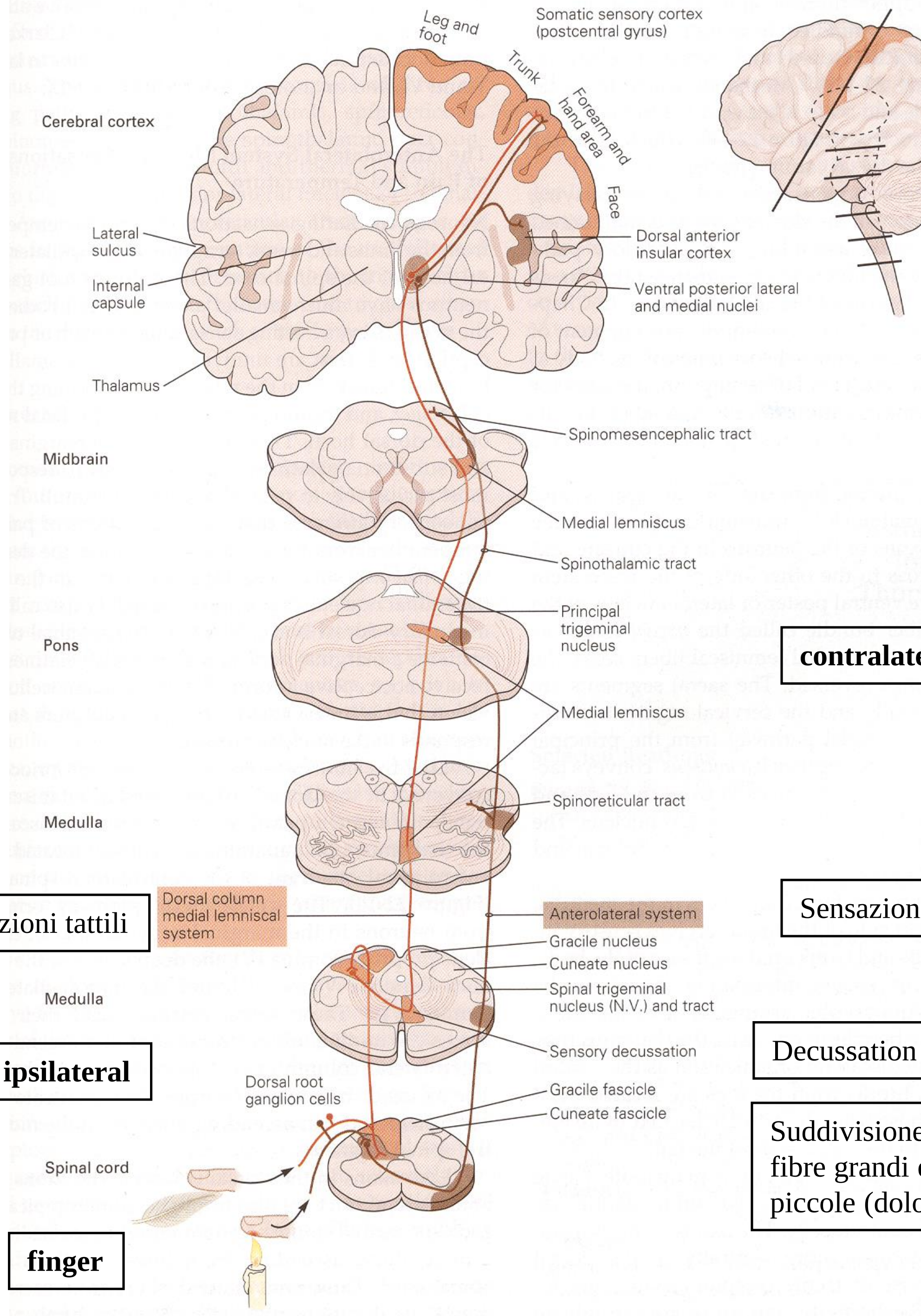
2) axons (nerve fibers) connect different brian areas via definite ways common to all human beings;

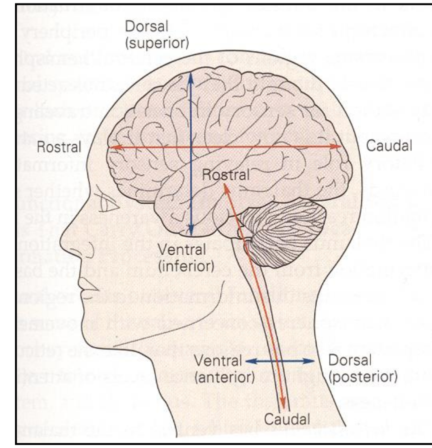
3) the relative magnitude of the cortical maps (sensorial and Motor, *see later*) is a high fidelity topographic representation of the sensitive and motor tissues;

4) the information processing is organized in a hierarchical mode, but under various precise serial and parallel stages;

5) since we are creatures with a bilateral symmetry the evolution favoured a special type of connectivity called "decussation" obtained by crossings of fibers from left and right (or *viceversa*) regions, thus helping and increasing information content.

11.51





contralateral

Sensazioni tattili

Sensazioni dolorose e termiche

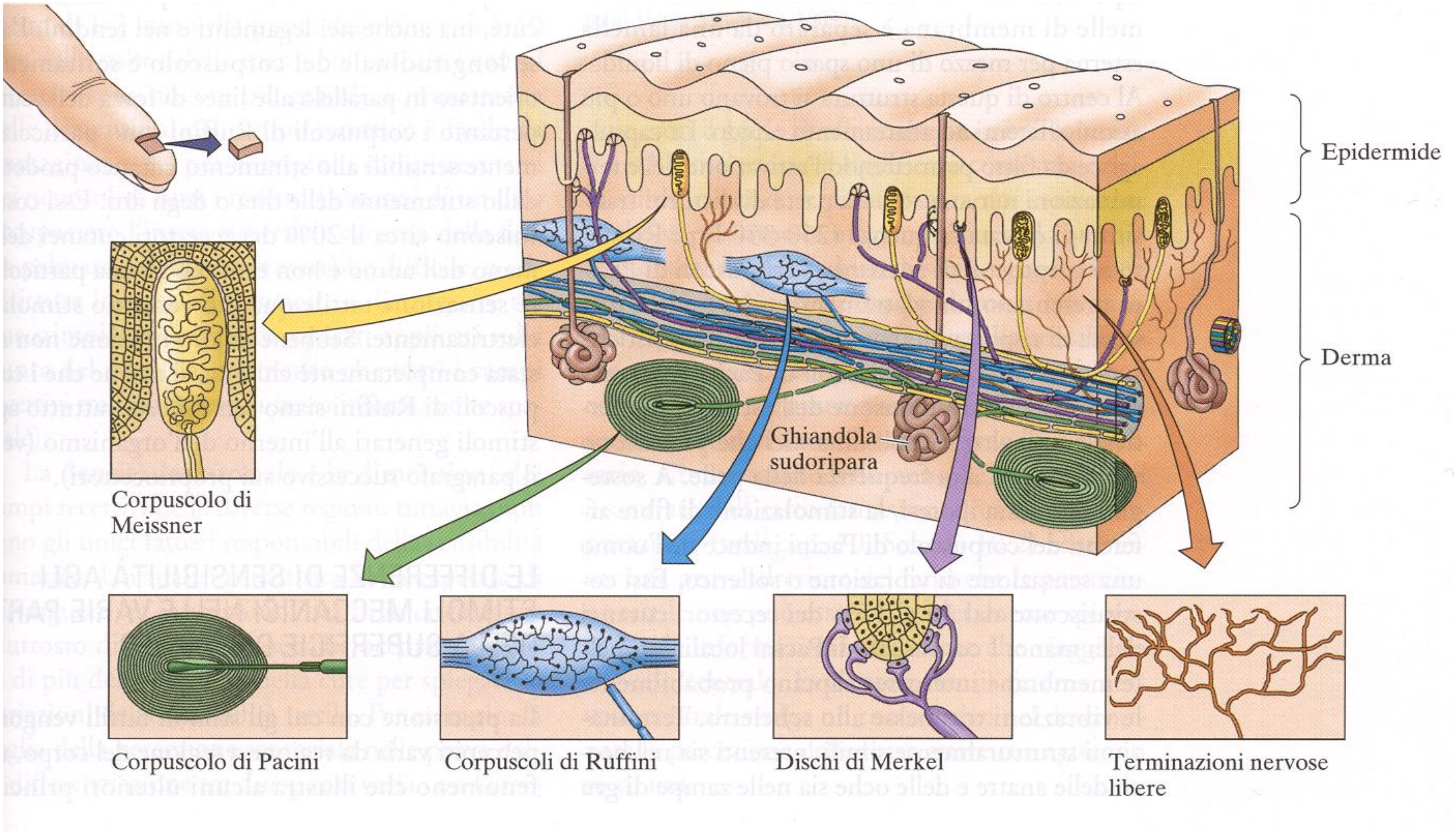
Decussation = crossing from one to the other side

ipsilateral

Suddivisione fibre grandi e piccole (dolore)

finger

11.56


Epidermide
Derma
Ghiandola sudoripara
Corpuscolo di Meissner
Corpuscolo di Pacini
Corpuscoli di Ruffini
Dischi di Merkel
Terminazioni nervose libere

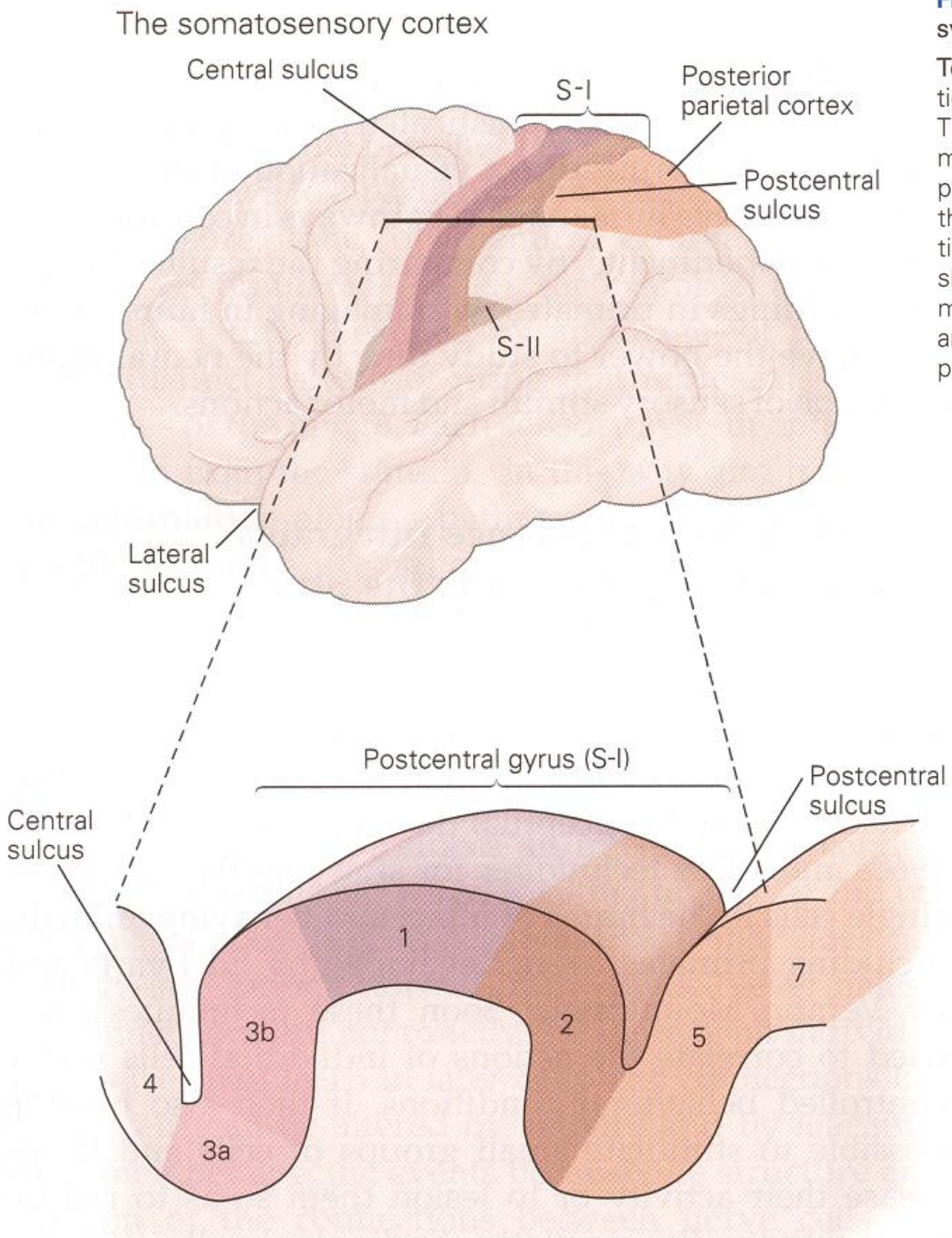


Figure 20-1 The neural architecture of the somatosensory system.

Top: A lateral view of a cerebral hemisphere illustrates the location of the primary somatic sensory cortices in the parietal lobe. The somatic sensory cortex has three major divisions: the primary (S-I) and secondary (S-II) somatosensory cortices and the posterior parietal cortex. The relationship of S-I to S-II and to the posterior parietal cortex is seen best from a lateral perspective of the surface of the cerebral cortex. **Bottom:** A section shows the four distinct cytoarchitectonic regions of S-I (Brodmann's areas 3a, 3b, 1, and 2) and their spatial relationship to area 4 of the motor cortex and areas 5 and 7 of the posterior parietal cortex.

Esistono dunque 4 mappe sensoriali che rappresentano differenti tipi di informazioni. Informazioni muscolari, delle giunture sono nella area 3a, quelle relative alla pelle e al tatto sono nella area 3b. Nella area 1 sono processate informazioni della area 3b e poi combinate con quelle presenti nell'area 3a e processate nell'area 2.

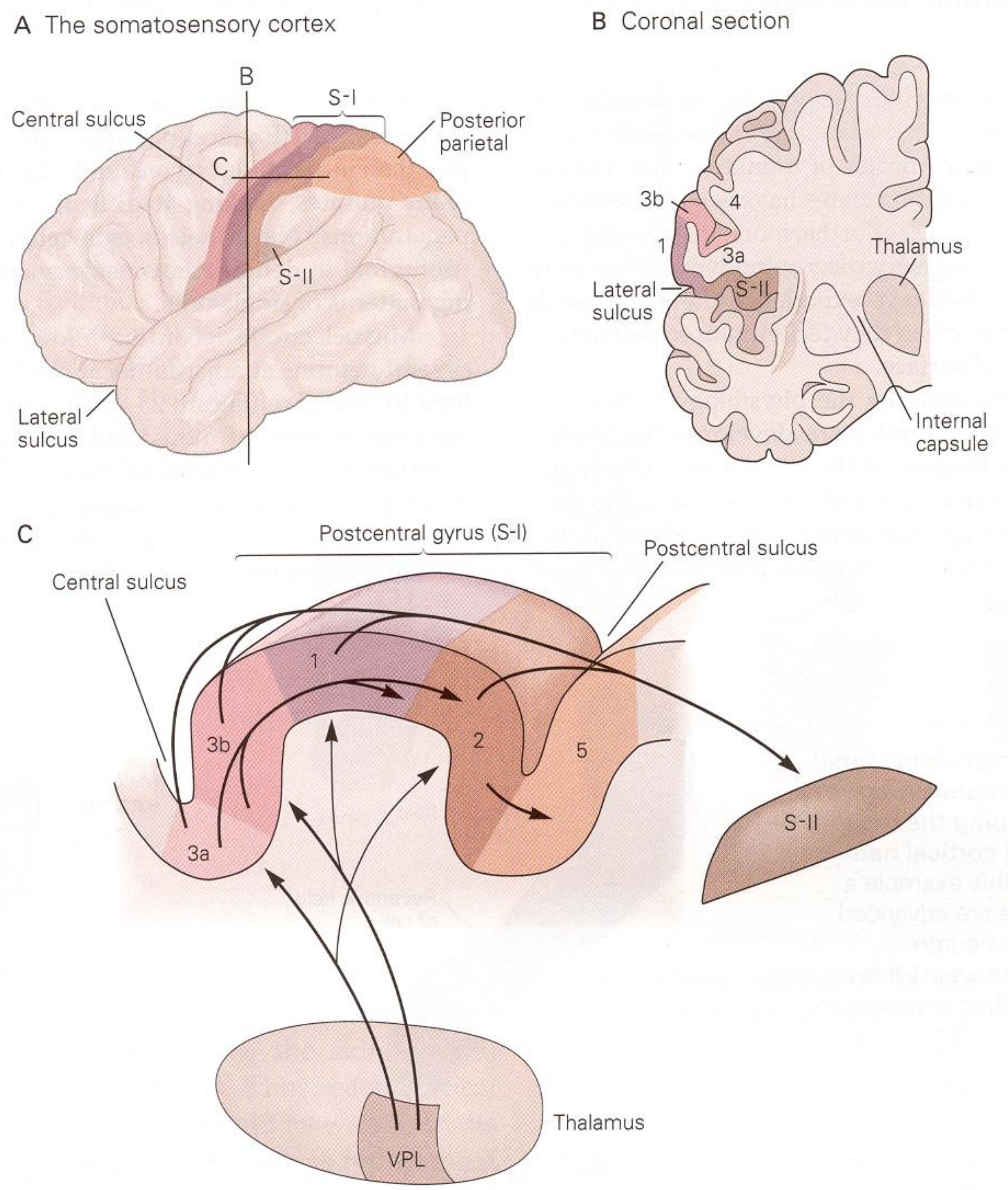


Figure 23-1 The somatic sensory cortex has three major divisions: the primary and secondary somatosensory cortices and the posterior parietal cortex.

A. The anatomical location of the three divisions of the somatic sensory cortex is seen best from a lateral perspective of the surface of the cerebral cortex. The *primary somatic sensory cortex* (S-I) forms the most rostral portion of the parietal lobe. It covers the postcentral gyrus, beginning at the bottom of the central sulcus and extending posteriorly to the postcentral and intraparietal sulci. The postcentral gyrus also extends into the medial wall of the hemisphere to the cingulate gyrus. The *posterior parietal cortex* (Brodmann's areas 5 and 7) lies immediately posterior to S-I. The *secondary somatic sensory cortex* (S-II) is located on the parietal operculum of the lateral sulcus (fissure of Sylvius).

B. The relationship of the S-I to the S-II cortex is illustrated in a coronal section through the cortex. The S-II cortex lies lateral to S-I, and extends laterally to the insular cortex, forming the superior bank of the lateral sulcus. The numbers on the section indicate Brodmann's cytoarchitectural areas.

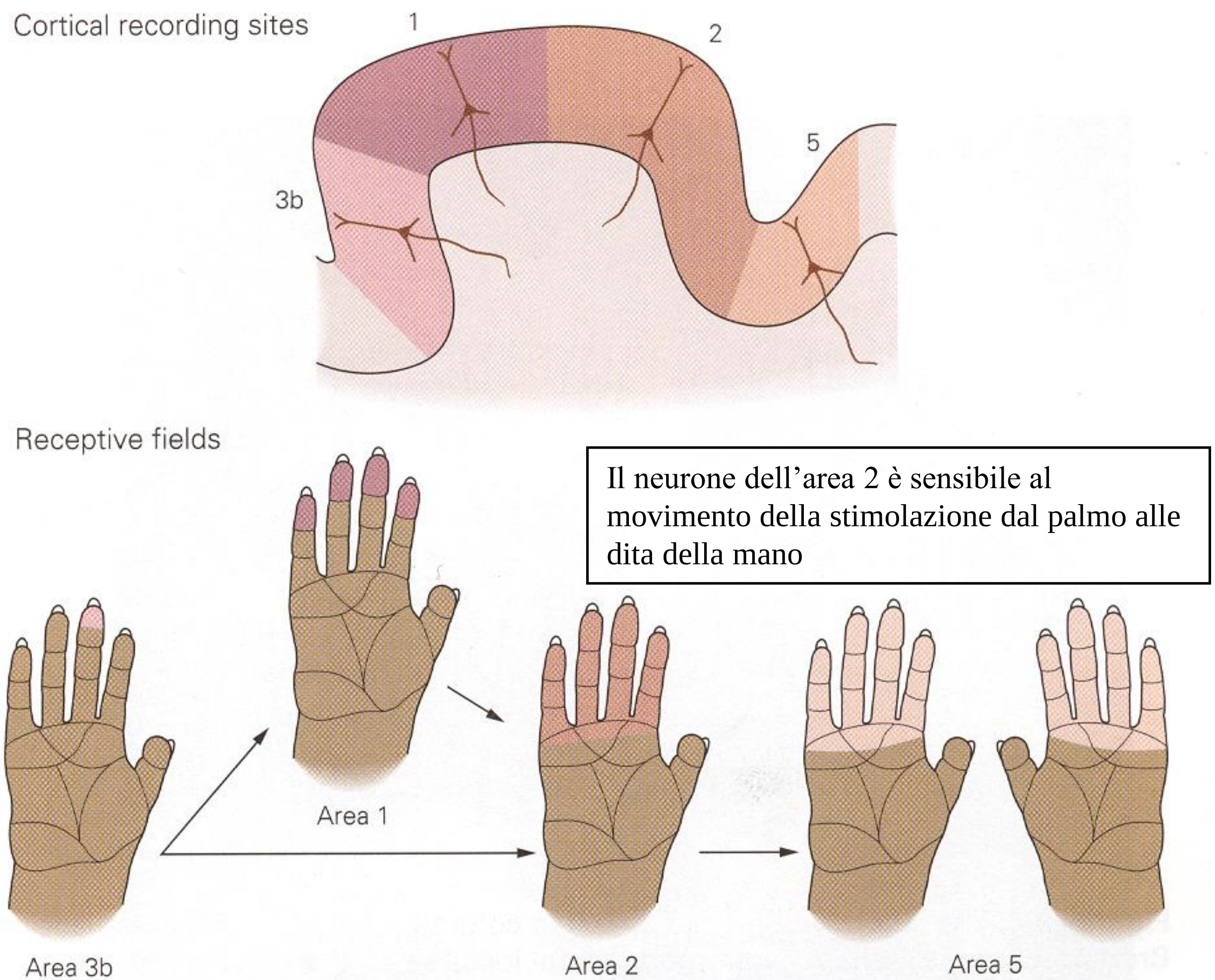
C. S-I is subdivided into four distinct cytoarchitectonic regions (Brodmann's areas). This sagittal section illustrates the spatial relationship of these four regions to area 5 of the posterior parietal cortex. Somatosensory input to the cortex originates from the ventral posterior lateral nucleus of the thalamus. Neurons in this nucleus project to all areas in S-I, mainly to Brodmann's areas 3a and 3b but also to areas 1 and 2. In turn, neurons in areas 3a and 3b project to areas 1 and 2, and all of these project to S-II and to posterior parietal cortex. These higher-order somatosensory areas also contain distinct cytoarchitectonic and functional subregions that are not illustrated here. (Modified from Jones and Friedman 1982.)

Le aree 3b e 1 ricevono dai recettori della pelle e le aree 3a e 2 dai fusi muscolari e dai tendini.

Stimolazioni periferiche attivano i neuroni corticali e viceversa una stimolazione dei neuroni corticali produce la “sensazione” tattile in una parte specifica della pelle.

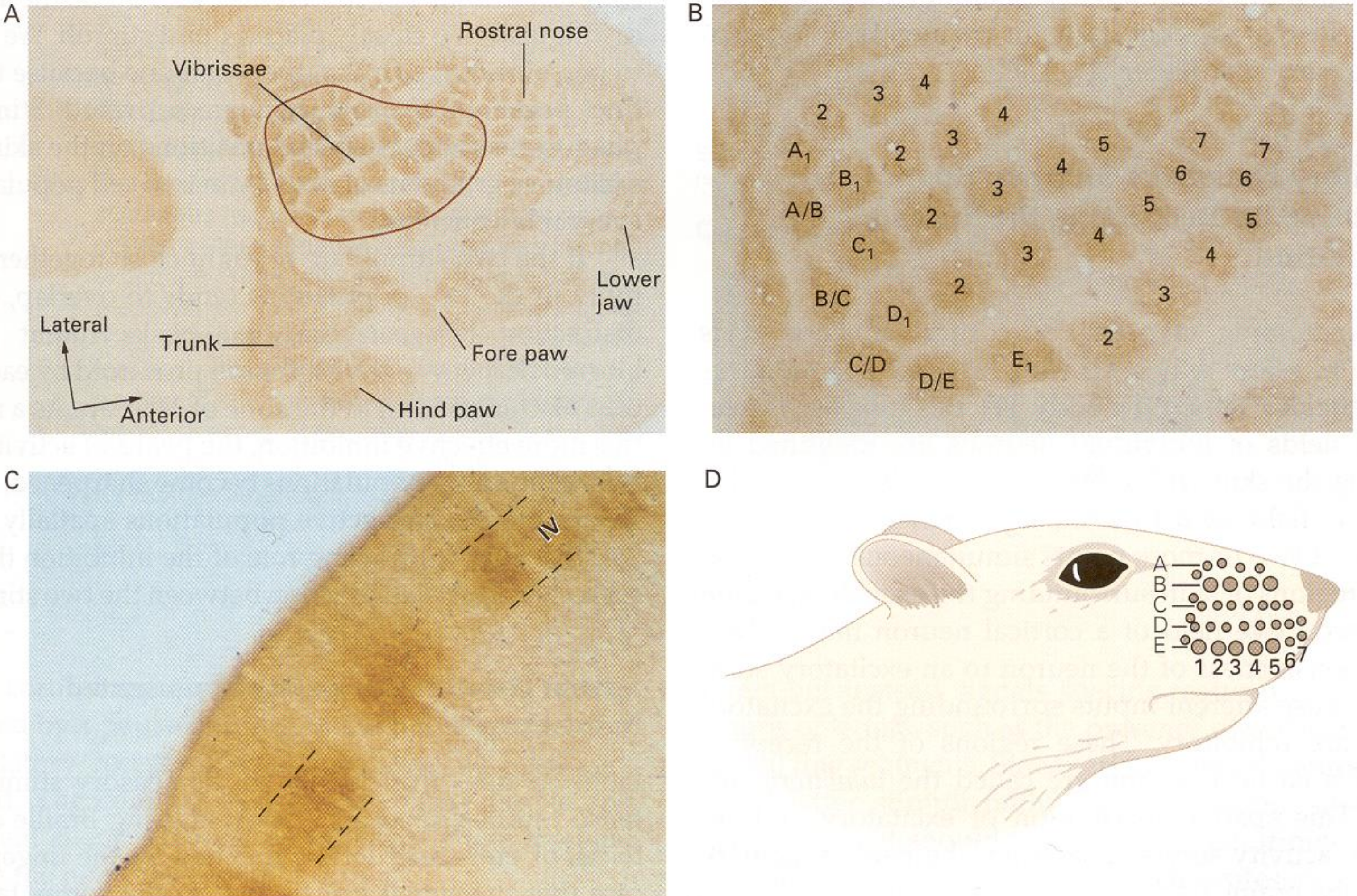
I campi recettivi delle aree 3b, 1, 2 e successive sono sempre più ampi. Il neurone dell’area 2 è sensibile al movimento della stimolazione dal palmo alle dita della mano

Figure 23-3 The receptive fields of neurons in the primary somatic sensory cortex are larger than those of the sensory afferents. Each of the hand figurines shows the receptive field of an individual neuron in areas 3b, 1, 2, and 5 of the primary somatic sensory cortex, based on recordings made in alert monkeys. The colored regions indicate the region of the hand where light touch elicits action potentials from the neuron. Neurons that participate in later stages of cortical processing (Brodmann’s areas 1 and 2) have larger receptive fields and more specialized inputs than neurons in area 3b. The neuron illustrated from area 2 is directionally sensitive to motion toward the fingertips. Neurons in area 5 often have symmetric bilateral receptive fields at mirror image locations on the contralateral and ipsilateral hand. (Adapted from Gardner 1988, Iwamura et al. 1994.)



Il neurone dell’area 2 è sensibile al movimento della stimolazione dal palmo alle dita della mano

12.05



baffi

Figure 23-9 The representation of whiskers in the somatosensory cortex of the rat. (Adapted from Bennett-Clarke et al. 1997).

A. Photomicrograph of a horizontal section through layer IV of the somatosensory cortex of a juvenile rat that has been stained for serotonin. The dark immunoreactive patches correspond to the cortical representations of specific parts of the body. The largest part of the cortical map is devoted to the face representation (whiskers, nose, and lower jaw). mascella

B. Enlarged view of the whisker representation. Neurons that receive projections from the whisker fields are arranged in discrete circular units called *barrels*. Each barrel is most responsive to a single whisker.

C. Coronal section through the rat somatosensory cortex. The barrels form dense patches localized to layer IV of the cortex.

D. The topographic arrangement of the barrels in the cortex corresponds to the spatial arrangement of the whiskers in discrete rows and columns on the face.

How implement the code to best spatially organize and diffuse sensory data temporally different

Dito, finger

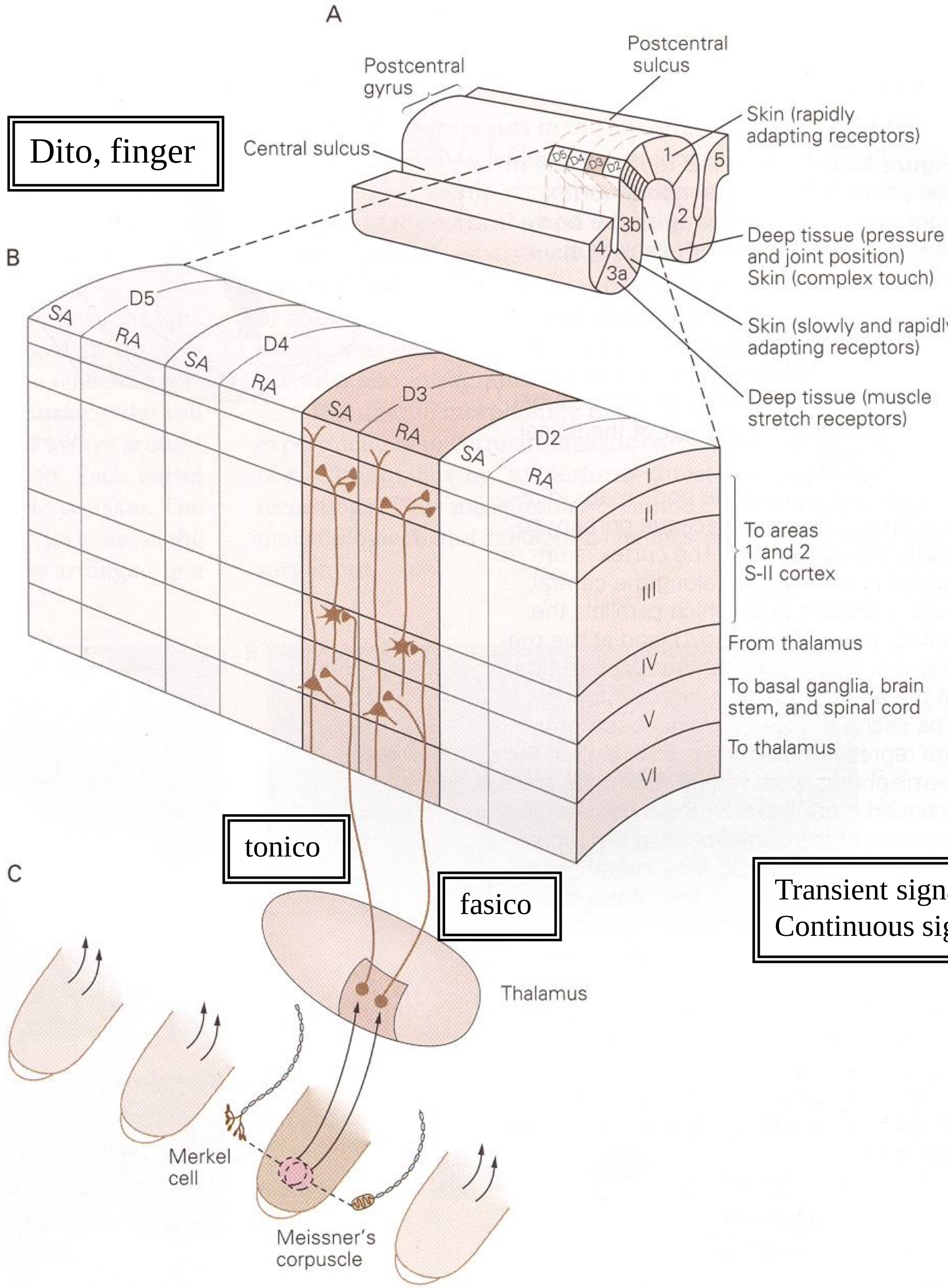


Figure 23-7 Each region of the somatic sensory cortex receives inputs from primarily one type of receptor.

A. In each of the four regions of the somatic sensory cortex—Brodmann's areas 3a, 3b, 1, and 2—inputs from one type of receptor in specific parts of the body are organized in columns of neurons that run from the surface to the white matter. (Adapted from Kaas et al. 1981.)

B. Detail of the columnar organization of inputs from digits 2, 3, 4, and 5 in a portion of Brodmann's area 3b. Alternating columns of neurons receive inputs from rapidly adapting (RA) and slowly adapting (SA) receptors in the superficial layers of skin. (Adapted from Sur et al. 1984.)

C. Overlapping receptive fields from RA and SA receptors project to distinct columns of neurons in area 3b.

tonico

fasico

Transient signal = fasico
Continuous signal = tonico

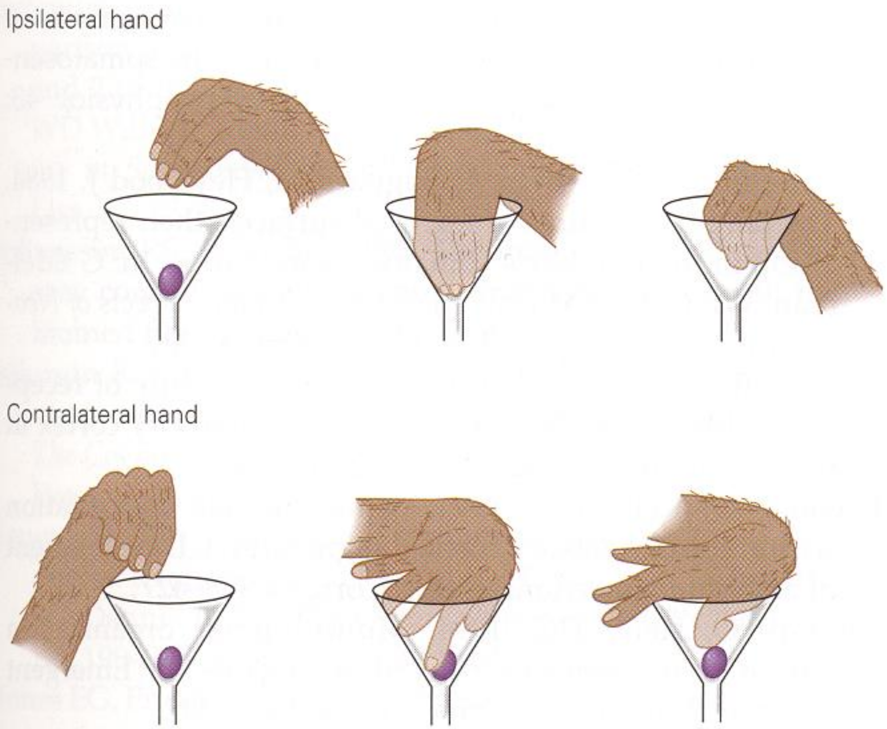
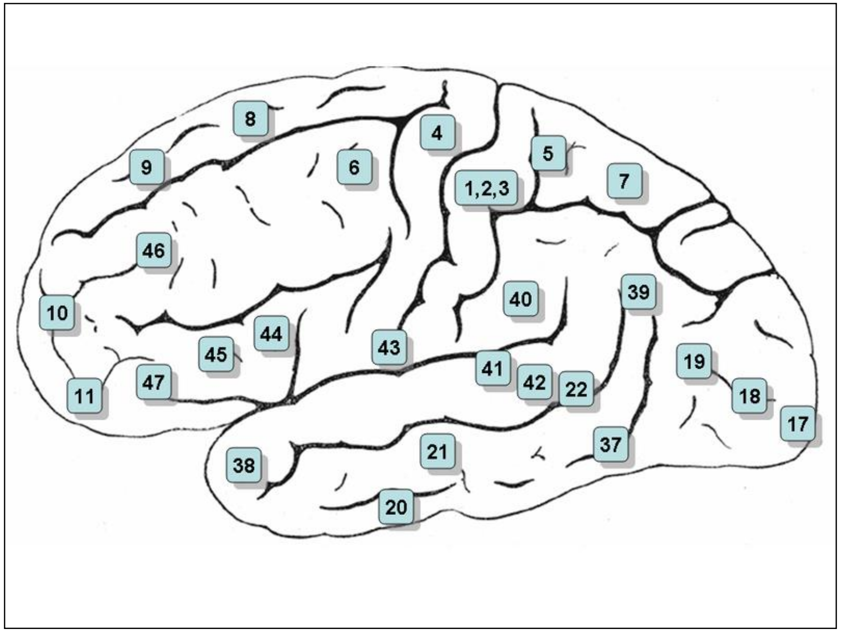
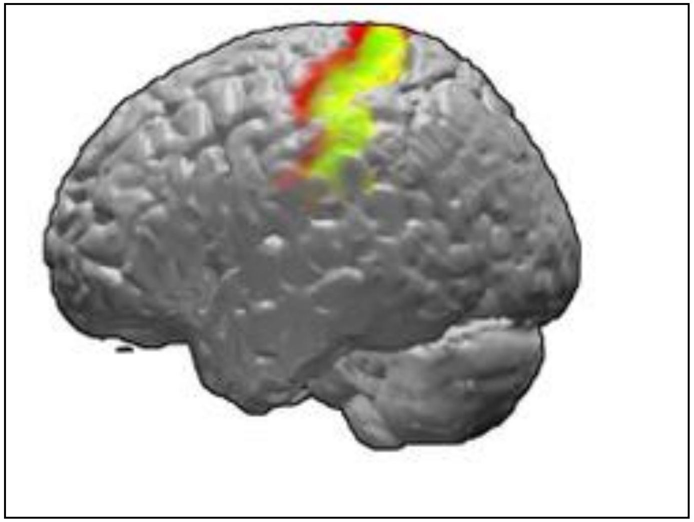


Figure 23-15 A monkey's finger coordination is disrupted when synaptic transmission in the somatic sensory cortex is inhibited. Muscimol, a GABA agonist, was injected into Brodmann's area 2 on the left side of a monkey brain. Within minutes after injection of muscimol, the finger coordination of the right hand (contralateral) is severely disorganized. The monkey is unable to remove a grape piece from a funnel. The injection effects are known to be specific to the injected hemisphere because the left hand (ipsilateral) continues to perform normally. (Adapted from Hikosaka et al. 1985.)

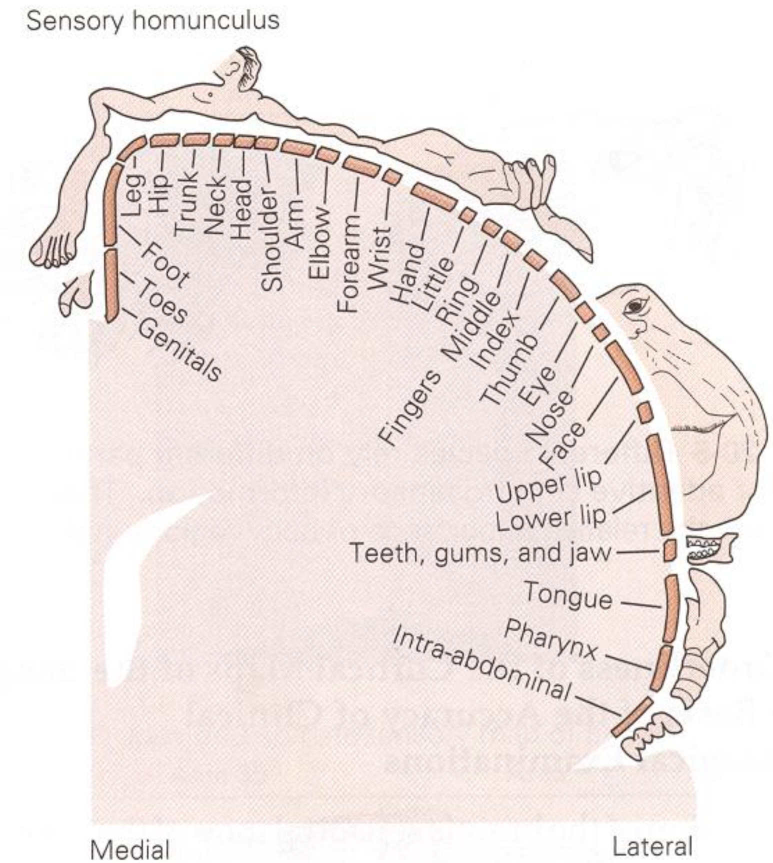




Ricordarsi la decussazione

Brodmann areas 3, 1 and 2 of human brain. Brodmann area 3 is in red, area 1 in green, and area 2 in yellow.

Figure 20-4 Somatic sensory and motor projections from and to the body surface and muscle are arranged in an orderly way in the cortex. The sensory map illustrated here is for Brodmann's area 1 in the postcentral gyrus of the parietal cortex. Each area within the somatosensory cortex (areas 3a, 3b, 1, and 2) contains a full representation of the body (see Figure 20-5). Parts of the body that are important for tactile discrimination, such as the tip of the tongue, the fingers, and the hand, have disproportionately large representations reflecting greater degrees of innervation. (Adapted from Penfield and Rasmussen 1950.)



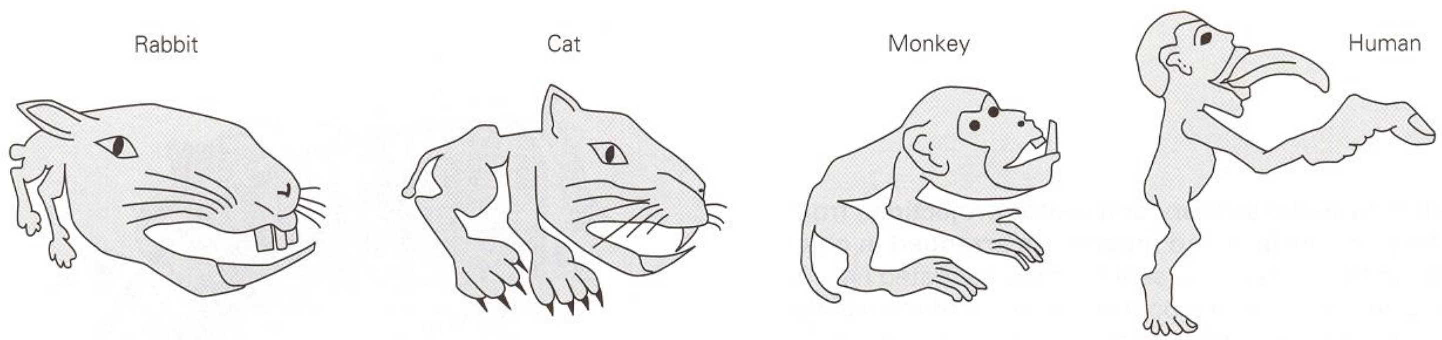


Figure 20-5 Different species rely on different parts of the body for adaptive somatosensory information. These drawings show the relative importance of body regions in the somatic sensibilities of four species, based on studies of evoked potentials in the thalamus and cortex.

Plasticità per esperienza sensoriale (dopo 4-5 mesi di insegnamento)

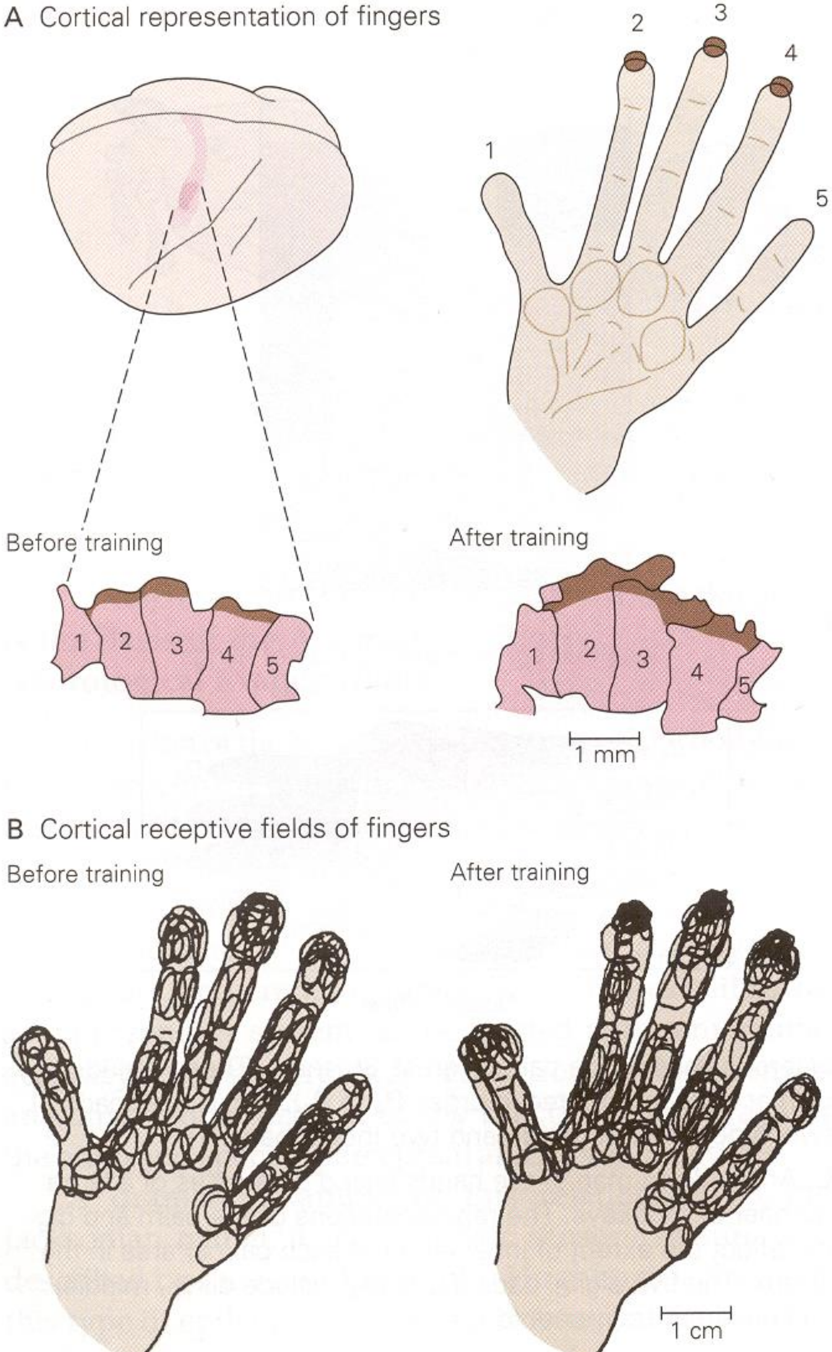
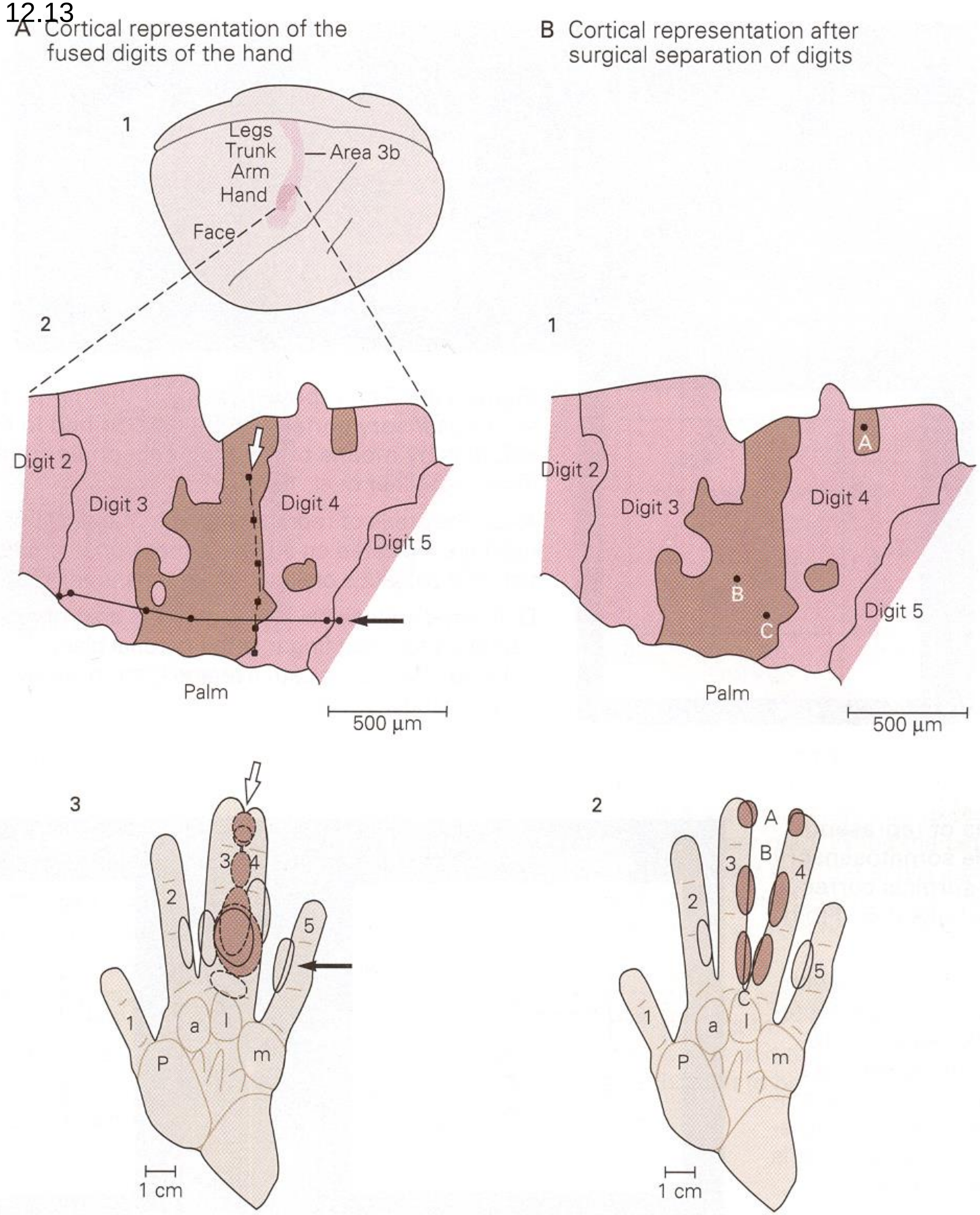


Figure 20-7 Increased use of selected fingers enlarges the cortical representation of those fingers. (Adapted from Jenkins et al. 1990).

A. The regions in cortical area 3b representing the surfaces of the digits of an adult monkey are shown before training and after training. During the period of training the monkey performed a task that required repeated use, for one hour per day, of the tips of the distal phalanges of digits 2, 3, and occasionally 4. There is a substantial enlargement of the cortical representation of the stimulated fingers after training (**brown**).

B. Cells with receptive fields on the surfaces of the digits were identified before and after training. The receptive field for a cortical neuron is the area on the skin where a tactile stimulation either excites or inhibits a cell. After training, the number of receptive fields in the distal phalanges of digits 2, 3, and 4 is larger than before learning (as indicated by the denser outlines).



Plasticità per alterazione sensoriale indotta:
Conclusione: la demarcazione delle aree corticali è geneticamente determinata dalla presenza corretta delle afferenze sensoriali, ma è modificabile con l'apprendimento e con la correlazione temporale dell'informazione in arrivo.

Figure 20-8 **The normal discontinuities in the cortical representation of the digits of an adult owl monkey become blurred after surgical fusion of the digits.** (Adapted from Clark et al. 1988.)

A. 1. A dorsolateral view of the cortex of an owl monkey shows the representation of the animal's body in area 3b of the primary somatosensory cortex. **2.** This detailed drawing of portions of the representation of the hand shows the areas for digits 3 and 4 and surrounding skin surfaces 5.5 months after surgical fusion of these digits. The areas of representation that changed after digit fusion are indicated in **brown.** Instead of the normal discontinuity between the two digits, 3 and 4, a large common area (340–1000 µm in width) now represents the parts of the digits that are fused. Stimulation of the surface of either one of the two fused digits evokes responses in cortical cells within this zone. In contrast, the discontinuity in the areas representing the fused digits and the two adjacent free digits (2 and 5) remains sharp. Evoked potentials were obtained in two series of sites corresponding to sequential stimulation of the digits in two axes: a rostral-to-caudal axis (**dashed line**) and medial-to-lateral (**solid line**). **3.** The receptive fields for the neurons at the recording sites shown in part 2. The **solid** and **white arrows** indicate sequences of stimulation corresponding to the sequences of recording sites shown in part 2.

B. Even after the fused digits are separated, the common area of representation remains. Thus, the intermingling of the representation of digits 3 and 4 is achieved centrally and does not result from peripheral regeneration that spares the site of contact. Evoked potentials were obtained at points A, B, and C in area 3b of the cortex **(1)** by stimulation of digits 3 and 4 at discrete sites **(2).**

12.19

Paziente normale. Rappresentazioni ottenute con la magneto-encefalografia (MEG).

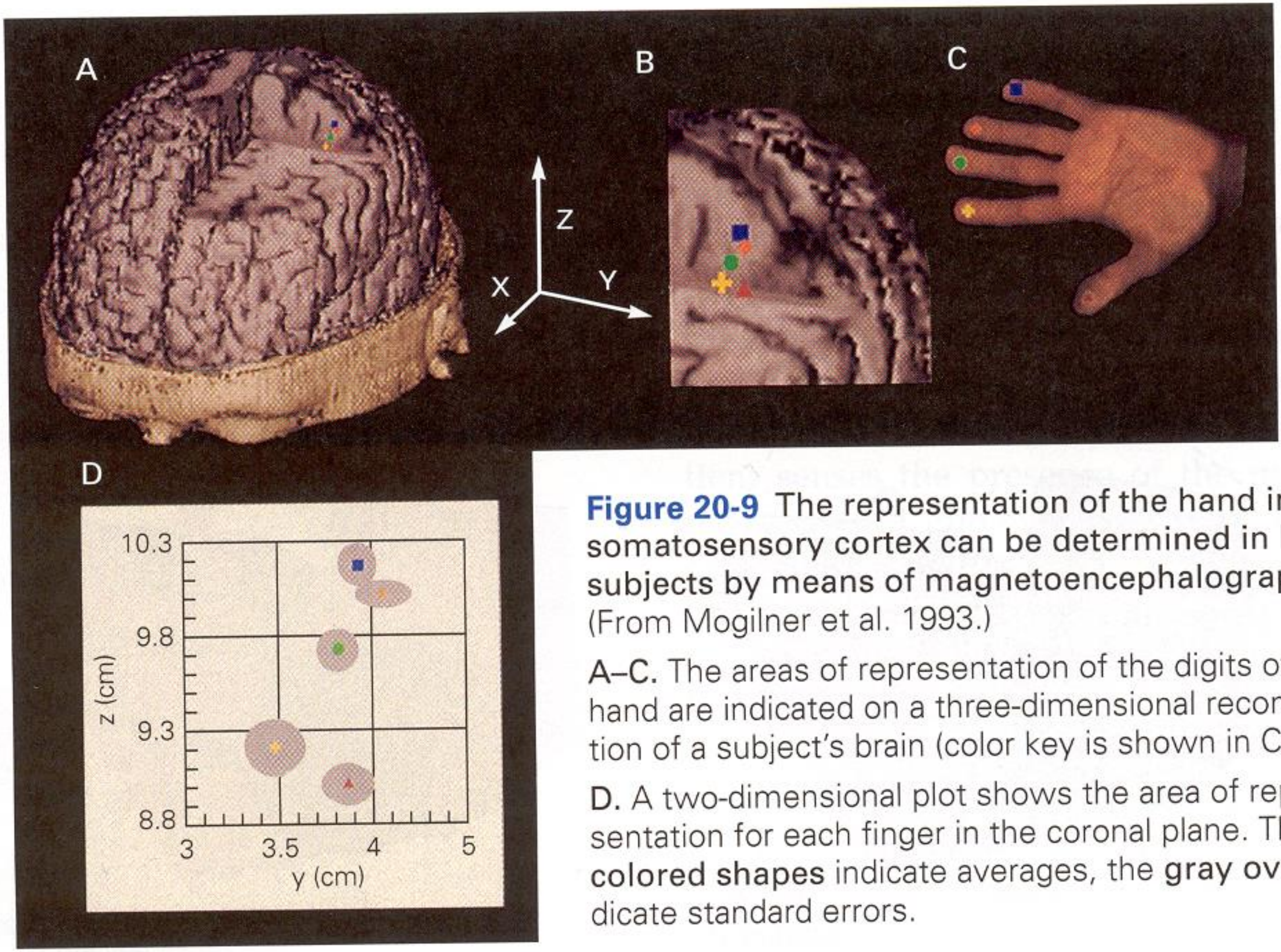


Figure 20-9 The representation of the hand in the somatosensory cortex can be determined in living subjects by means of magnetoencephalography. (From Mogilner et al. 1993.)

A–C. The areas of representation of the digits of the hand are indicated on a three-dimensional reconstruction of a subject's brain (color key is shown in C).

D. A two-dimensional plot shows the area of representation for each finger in the coronal plane. The **colored shapes** indicate averages, the **gray ovals** indicate standard errors.

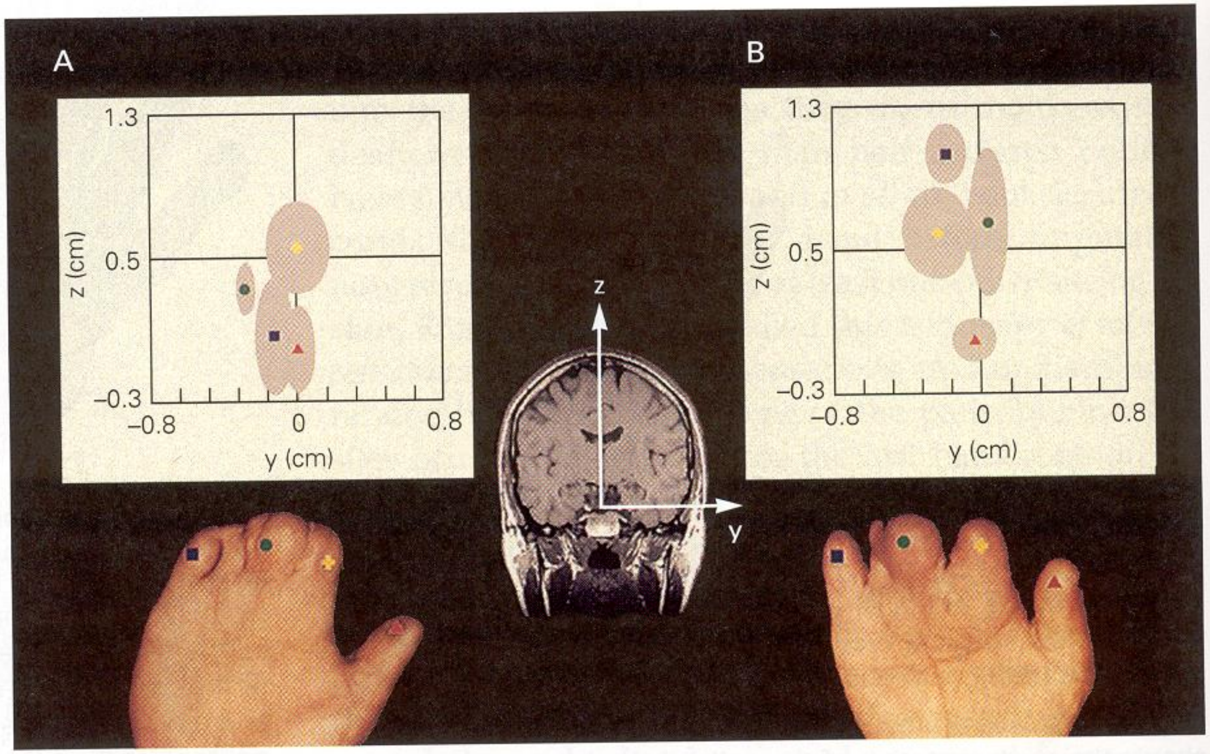
12.22

Paziente con sindactilia (fusione congenita delle dita) prima e dopo (26 giorni) l'operazione.

Figure 20-10 **The area of representation of the hand in the somatosensory cortex changes after surgical correction of syndactyly of digits 2–5.** (From Mogilner et al. 1993.)

A. A preoperative map of a patient with syndactyly shows that the cortical representation of the thumb, index, middle, and little fingers is abnormal and lacks any somatotopic organization. For example, the distance between sites of representation of the thumb and little finger is significantly smaller than normal.

B. Twenty-six days after surgical separation of the digits 2–5 the organization of the inputs from the digits is somatotopic. The distance between the sites of representation of the thumb and little finger has increased to 1.06 cm.



La sindrome dell'arto fantasma. I pazienti hanno la sensazione della presenza dell'arto amputato. **Ipotesi**: 1) possibile attività delle afferenze sensoriali amputate; 2) re-arrangiamneto delle mappe corticali, le aree dell'arto amputato ricevono afferenze da altre parti del corpo secondo lo schema noto. Perciò stimolazioni in aree sensoriali (che sono contigue in corteccia) producono sensazioni che si riferiscono all'arto mancante.

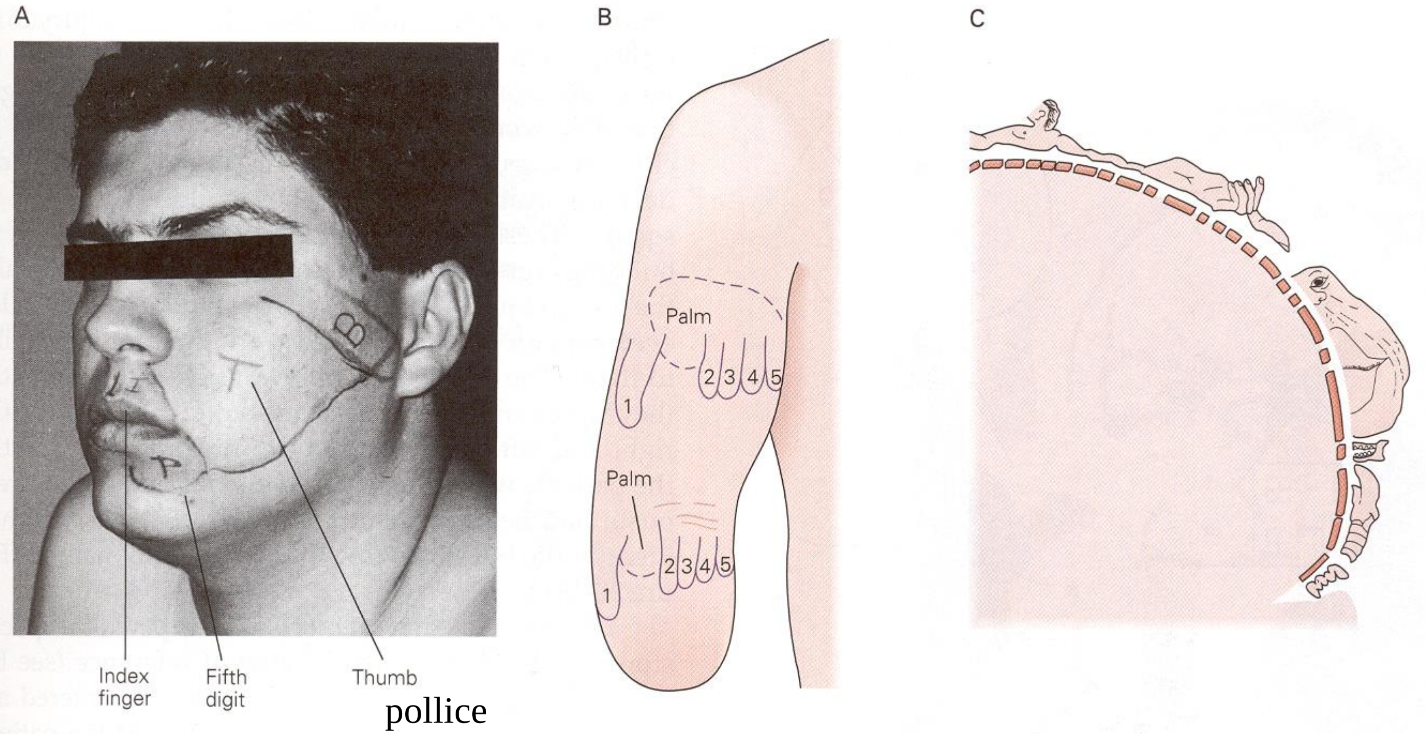


Figure 20-11 Phantom limb sensations can be evoked by stimulating body surfaces. (From Ramachandran 1993.)

A. A subject whose arm was amputated above the left elbow shows sites on his face where stimulation (brushing the face with a cotton swab) elicits sensation referred to the phantom digits. Regions of the body that evoke referred sensations are called *reference fields*. Stimulation of the region labeled T always evoked sensations in the phantom thumb. Stimulation of facial areas marked I, P, and B evoked sensation in the phantom index finger, pinkie, and ball of the thumb, respectively. This patient was tested four weeks after amputation.

B. The upper arm of a subject who experienced referred sensation in the face and in two distinct areas on the arm—one area close to the line of amputation and a second area 6 cm above the elbow crease. Each area is a precise spatial map of the lost digits; the maps are almost identical except for the absence of fingertips in the upper map. When the patient imagined pronating his phantom lower arm, the entire upper map shifted in the same direction by about 1.5 cm. Stimulating the skin region between these two maps did not elicit sensations in the phantom limb.

C. Portion of sensory homunculus showing how the cortical area receiving inputs from the hand is flanked by the regions devoted to the face and the arm. Rearrangement of these cortical inputs is thought to be responsible for some types of phantom limb sensation.

La visione

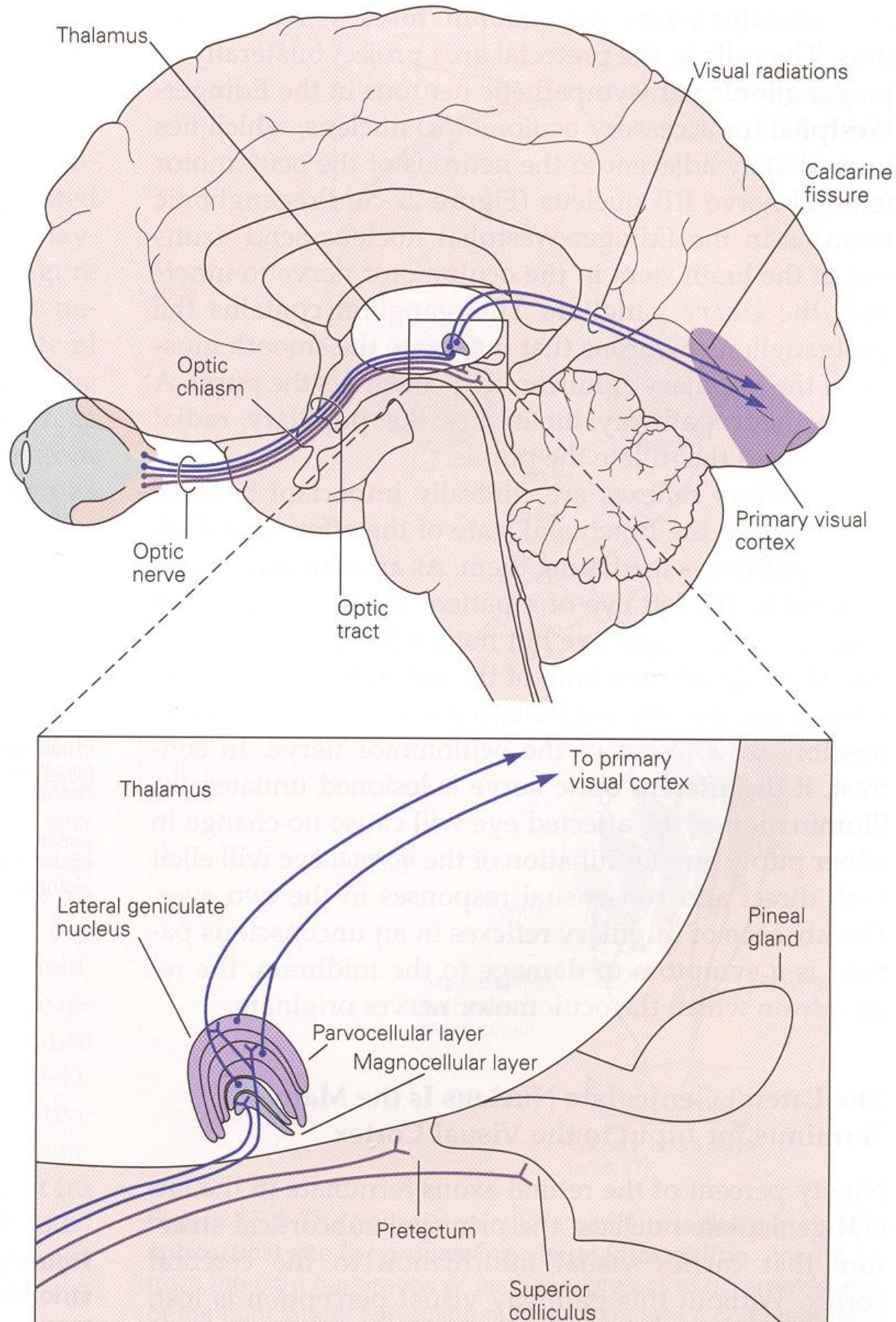


Figure 27-4 **A simplified diagram of the projections from the retina to the visual areas of the thalamus (lateral geniculate nucleus) and midbrain (pretectum and superior colliculus).** The retinal projection to the pretectal area is important for pupillary reflexes, and the projection to the superior colliculus contributes to visually guided eye movements. The projection to the lateral geniculate nucleus, and from there to the visual cortex, processes visual information for perception.

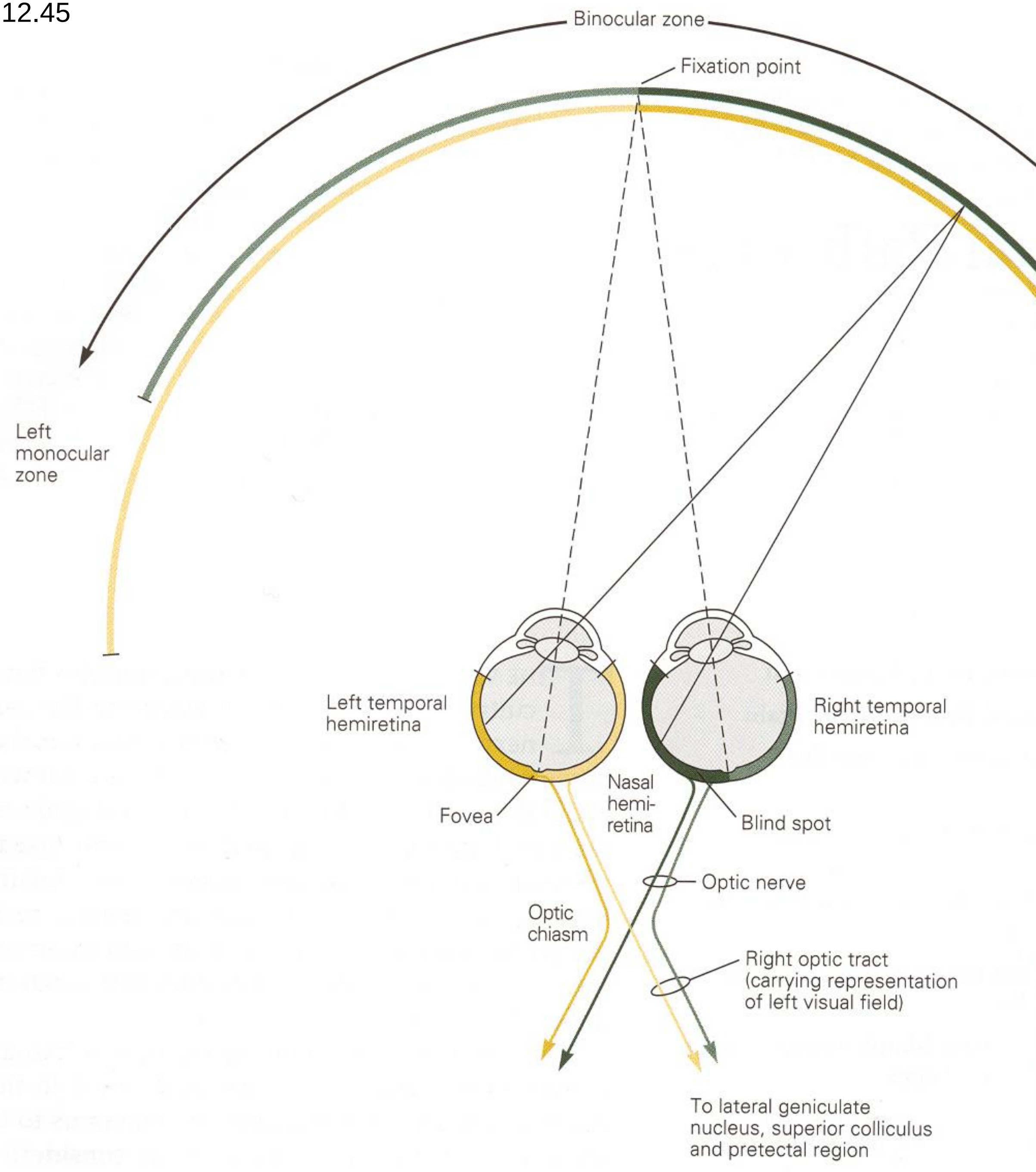


Figure 27-1 The visual field has both binocular and monocular zones. Light from the binocular zone strikes the retina in both eyes, whereas light from the monocular zone strikes the retina only in the eye on the same side. For example, light from a left monocular zone (temporal crescent) falls on only the ipsilateral nasal hemiretina and does not project upon the contralateral retina. The temporal and nasal hemiretinas are defined with respect to the fovea, the region in the center of the retina with highest acuity. The optic disc, the region where the ganglion cell axons leave the retina, is free of photoreceptors and therefore creates a gap, or blind spot, in the visual field for the visual information from one eye, each optic tract carries a complete representation of one half of the binocular zone in the visual field. Fibers from the nasal hemiretina of each eye cross to the opposite side at the optic chiasm, whereas fibers from the temporal hemiretina do not cross. In the illustration, light from the right half of the binocular zone falls on the left temporal hemiretina and right nasal hemiretina. Axons from these hemiretinas thus contain a complete representation of the right hemifield of vision (see Figure 27-6).

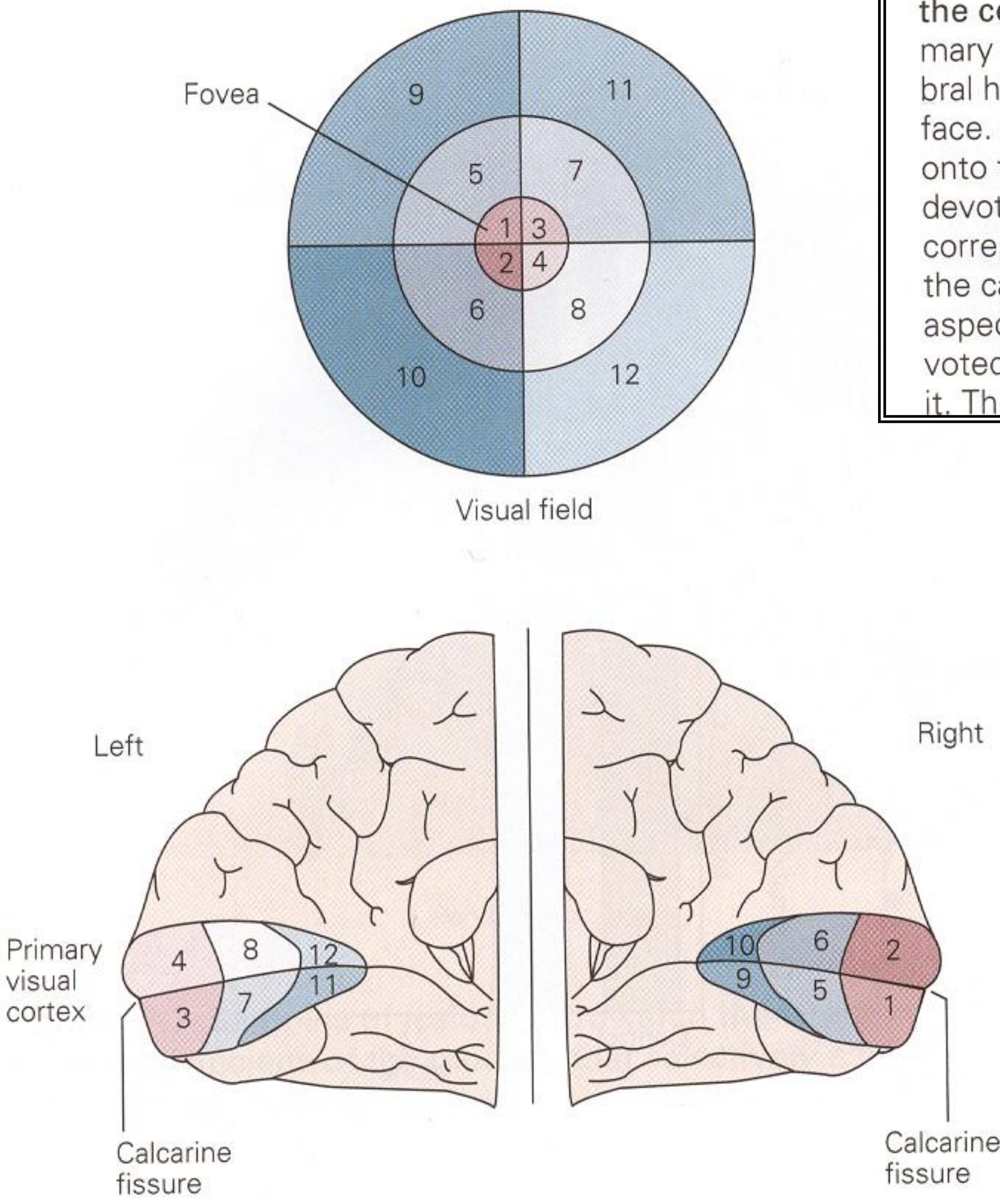


Figure 27-9 Each half of the visual field is represented in the contralateral primary visual cortex. In humans the primary visual cortex is located at the posterior pole of the cerebral hemisphere and lies almost exclusively on the medial surface. (In some individuals it is shifted so that part of it extends onto the lateral surface.) Areas in the primary visual cortex are devoted to specific parts of the visual field, as indicated by the corresponding numbers. The upper fields are mapped below the calcarine fissure, and the lower fields above it. The striking aspect of this map is that about half of the neural mass is devoted to representation of the fovea and the region just around it. This area has the greatest visual acuity.

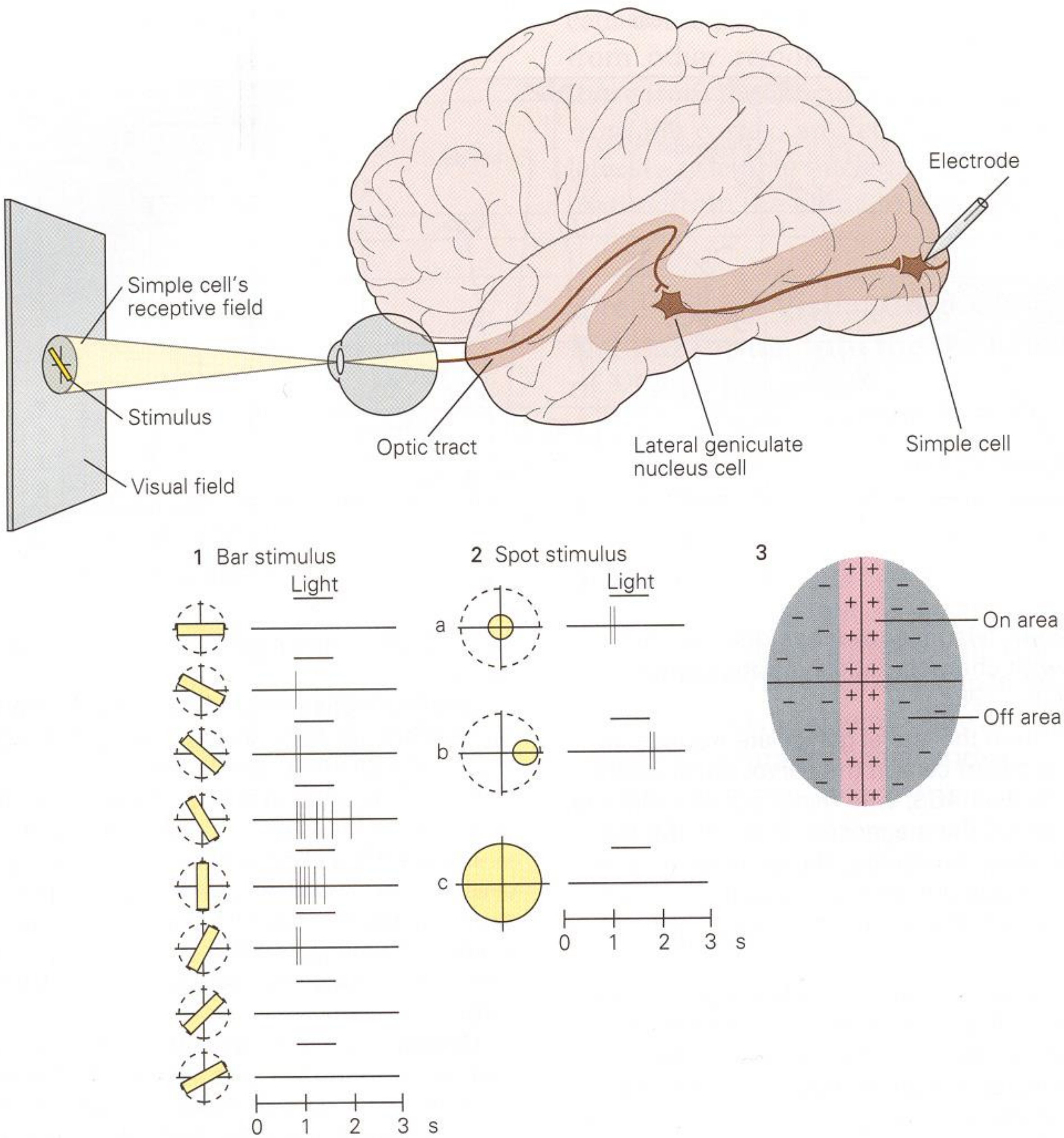


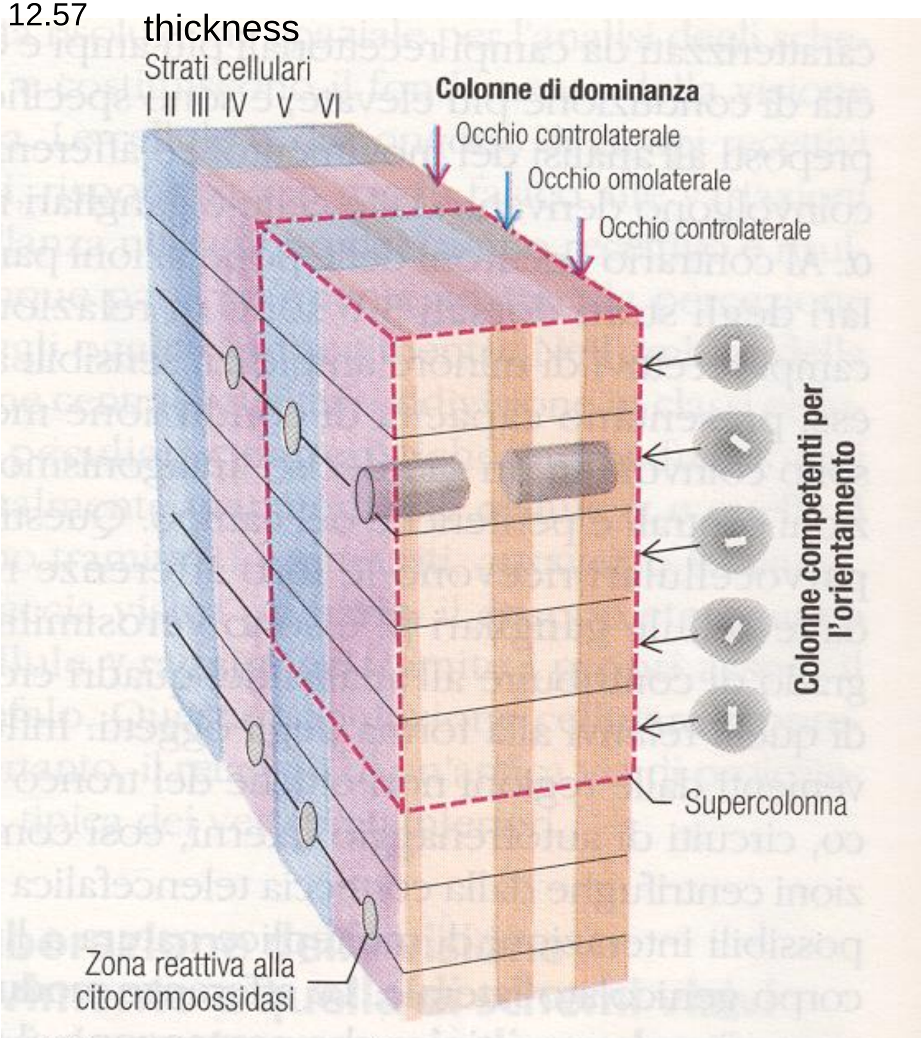
Figure 27-11 Receptive field of a simple cell in the primary visual cortex. The receptive field of a cell in the visual system is determined by recording activity in the cell while spots and bars of light are projected onto the visual field at an appropriate distance from the fovea. The records shown here are for a single cell. Duration of illumination is indicated by a line above each record of action potentials. (Adapted from Hubel and Wiesel 1959 and Zeki 1993.)

1. The cell's response to a bar of light is strongest if the bar of light is vertically oriented in the center of its receptive field.

2. Spots of light consistently elicit weak responses or no response. A small spot in the excitatory center of the field elicits only a weak excitatory response (**a**). A small spot in the inhibitory area elicits a weak inhibitory response (**b**). Diffuse light produces no response (**c**).

3. By using spots of light, the excitatory or "on" areas (+) and inhibitory or "off" areas (−) can be mapped. The map of the responses reveals an elongated "on" area and a surrounding "off" area, consistent with the optimal response of the cell to a vertical bar of light.

12.57

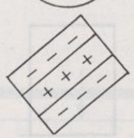
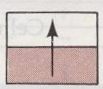
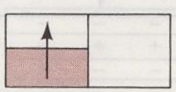


C Supercolonna rappresentata come modulo corticale di analisi

Features of omo-lateral and contra-lateral eyes
Features of vertical and horizontal objects

Why? Because from birth we are accustomed to see the horizon or the trees

Tabella 17.1. Caratteristiche dei campi recettivi a livelli successivi del sistema visivo.

Tipo di cellula	*Forma del campo*	*Qual è lo stimolo più efficace?*	*Quant'è efficace la luce diffusa come stimolo?*	*L'orientamento dello stimolo è importante?*	*Vi sono aree "on" e "off" distinte nei campi recettivi?*	*Le cellule sono attivate da entrambi gli occhi?*	*Le cellule possono rispondere selettivamente al movimento in una direzione?*
Fotocettore		Luce	Molto	No	No	No	No
Gangliare		Puntino o barra stretta sul centro	Moderatamente	No	Sì	No	No
Genicolato		Puntino o barra stretta sul centro	Poco	No	Sì	No	No
Semplice (strati 4 e 6 soltanto)		Barra stretta o bordo (alcune a inibizione terminale	Inefficace	Sì	Sì	Sì (eccetto nello strato 4)	Alcune possono
Complessa (non lo strato 4)		Barra o bordo	Inefficace	Sì	No	Sì	Alcune possono
Complessa a inibizione terminale (non lo strato 4)		Linea o bordo che si arresta; angolo	Inefficace	Sì	No	Sì	Alcune possono

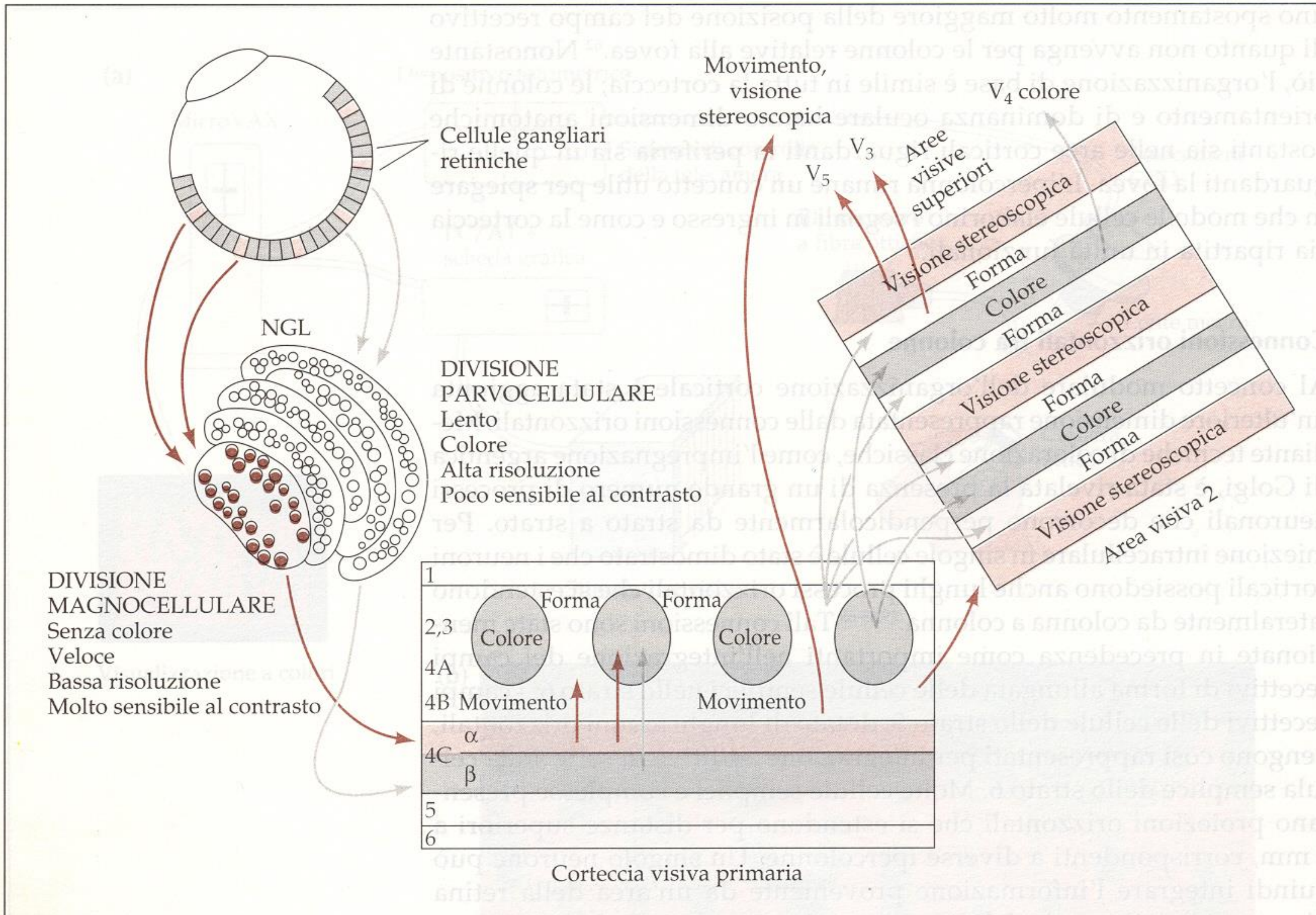
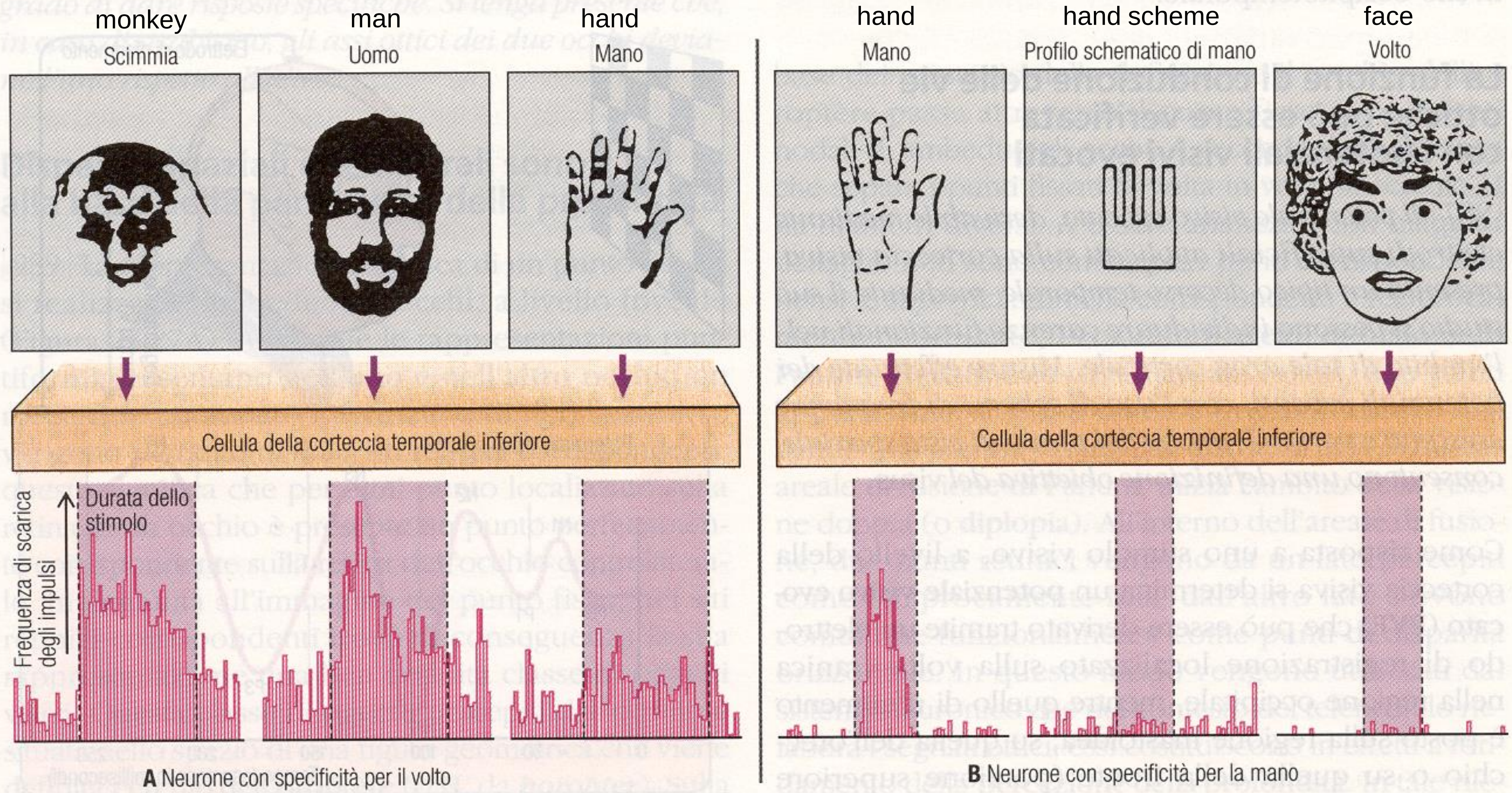


Figura 17.21

Schema delle connessioni delle divisioni magnocellulare e parvocellulare del nucleo genicolato laterale su V_1, V_2, V_3, V_4 e V_5. La via magnocellulare, che è sensibile al contrasto, ha bassa risoluzione, rapide risposte ed è priva di sensibilità cromatica, proietta principalmente sullo strato 4Cα. La divisione parvocellulare, più lenta, sensibile ai colori, con alta risoluzione e bassa sensibilità al contrasto, proietta principalmente sullo strato 4Cβ. Entrambe le divisioni proiettano sui *blob*, che a loro volta proiettano sulle bande sottili in V_2 e da lì su V_4. Le regioni *interblob* proiettano soprattutto verso aree non colorate in V_2 e quindi su V_3. Le vie magnocellulari proiettano primariamente su V_5. Le retroproiezioni su V_1 e le interconnessioni tra le varie aree non sono mostrate. (Vedi anche Tabella 17.2). (Da Livingstone e Hubel, 1987b.)

Figura 23.24 Analisi delle forme complesse per opera del sistema parvocellulare: vengono considerati i neuroni della corteccia sottotemporale di una scimmia. In rapporto alle condizioni di stimolazione di volta in volta attive, le diverse risposte vengono rappresentate come frequenze di impulsi in funzione di una scala temporale. **A** Cellule specializzate per la percezione della forma del volto: si osservi la mancata risposta nel caso in cui venga presentata una mano. **B** Cellule specializzate per la percezione della sagoma della mano: si osservi che queste non solo restano silenti nel caso siano sollecitate dall'immagine di un volto, ma anche da quella di una sagoma che possa ricordare approssimativamente una mano (secondo ➠14).



face-dependent cell Neurons with different specificity **hand-dependent cell**

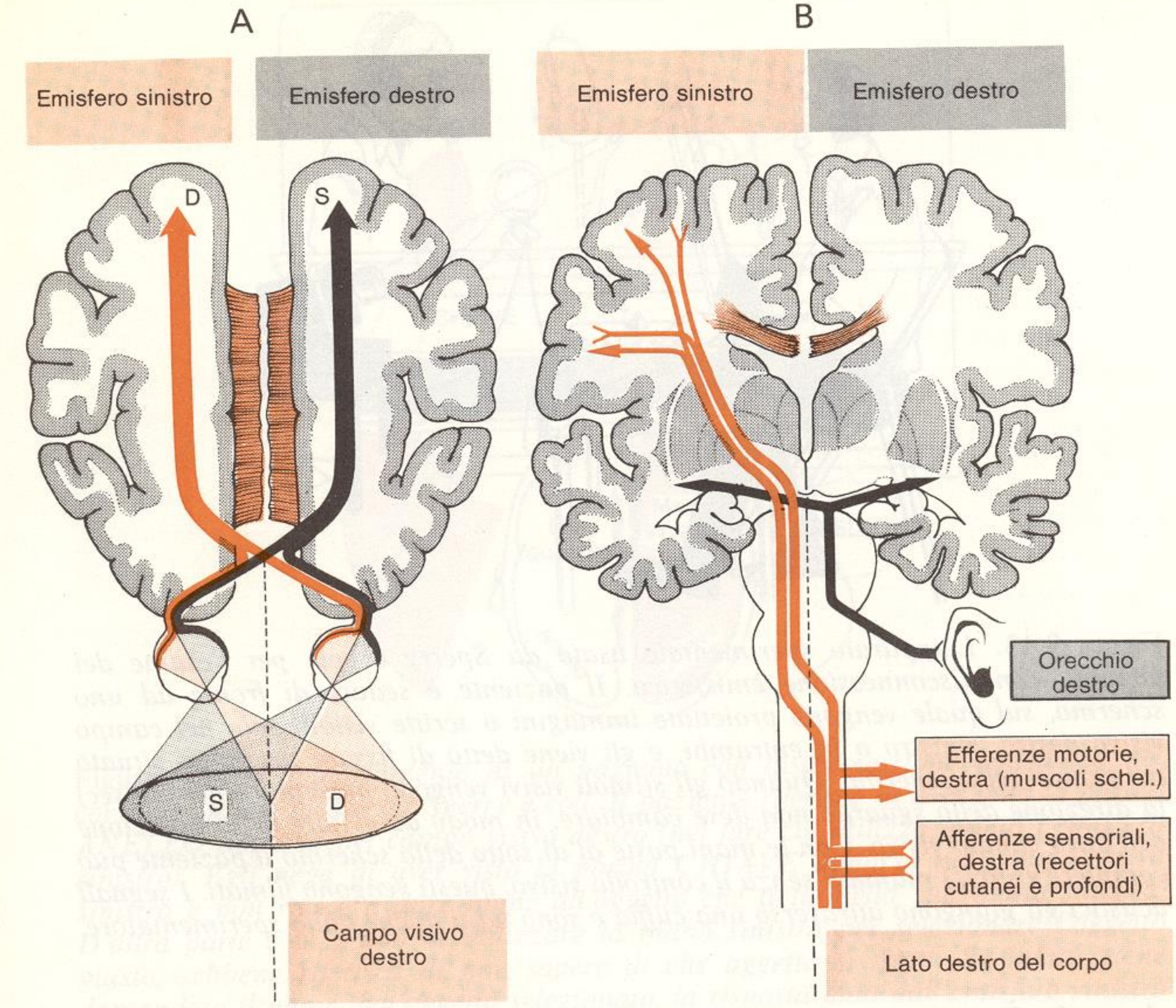
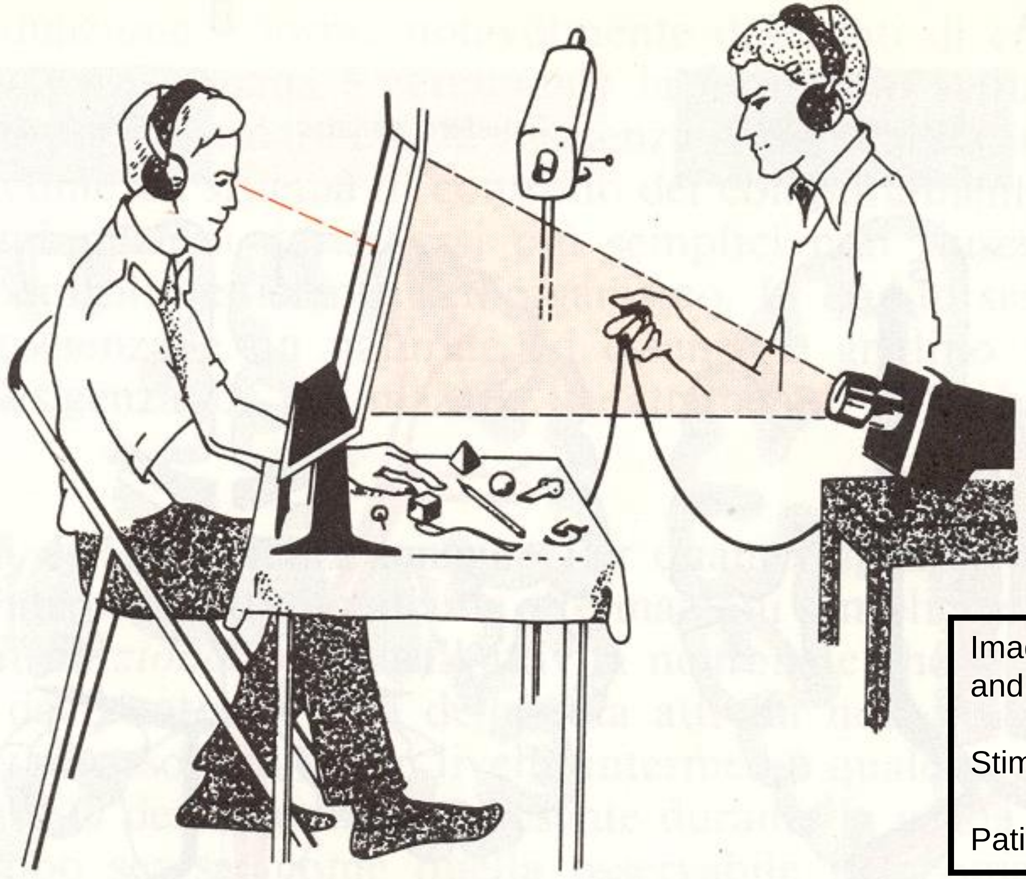


Figura 9.12. *Connessioni somatosensoriali, visive e uditive in pazienti con disconnessione emisferica.* A, *sezione trasversale;* B, *sezione frontale. L'emisfero sinistro invia efferenze motorie e riceve afferenze somatosensoriali dalla parte destra del corpo e viceversa. Il lato destro del campo visivo di ogni occhio proietta alla corteccia visiva dell'emisfero sinistro e il lato sinistro del campo visivo all'emisfero destro. Per contro, anche in questi pazienti, ogni orecchio è connesso con la corteccia uditiva dei due emisferi.*



Images are shown by left or right eyes and patient must fix the center

Stimuli are presented for 0.1 s

Patient cannot see his hands

Figura 9.13. *L'apparato sperimentale usato da Sperry e coll. per l'esame dei pazienti con disconnessione emisferica. Il paziente è seduto di fronte ad uno schermo, sul quale vengono proiettate immagini o scritte visibili solo nel campo visivo destro, sinistro o in entrambi, e gli viene detto di fissare un punto situato nel centro dello schermo. Quando gli stimoli visivi vengono presentati (per 0,1 sec) la direzione dello sguardo non deve cambiare, in modo da evitare la stimolazione dell'altro campo visivo. Con le mani poste al di sotto dello schermo il paziente può compiere esercizi manuali senza il controllo visivo; questi vengono filmati. I segnali acustici gli giungono attraverso una cuffia e sono uditi anche dallo sperimentatore.*

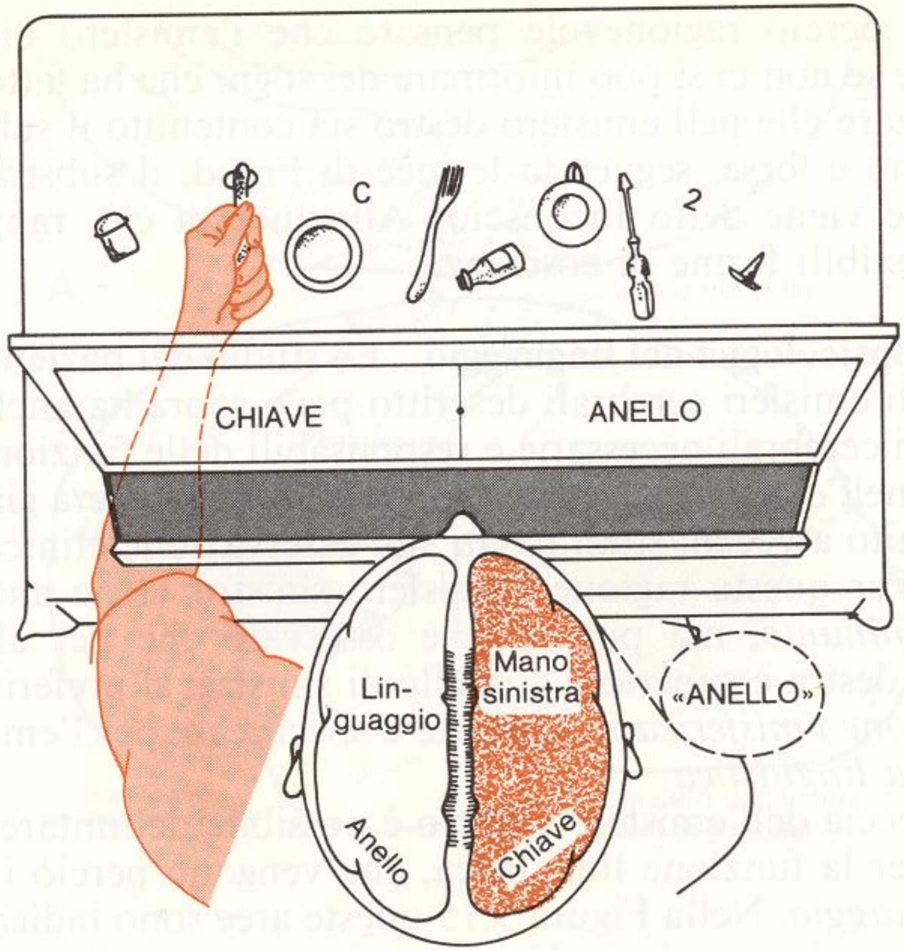


Figura 9.14. *Comportamento di un paziente con disconnessione emisferica nel corso di un test ideato da Sperry e coll. Il paziente riferisce di aver letto la parola ANELLO apparsa nel campo visivo destro (nel fare ciò utilizza quindi l'emisfero sinistro). Egli nega di aver visto la parola CHIAVE apparsa nel campo visivo sinistro e non riesce a dare nome all'oggetto che tiene nella sua mano sinistra. D'altra parte è in grado di utilizzare la mano sinistra per selezionare l'oggetto giusto, sebbene riferisca di non sapere di che oggetto si tratti. Se infatti viene domandato il nome dell'oggetto selezionato, la risposta data dall'emisfero sinistro è ANELLO.*

According to the "chiave" and "anello" names seen in the left-right windows, ***notice*** that the areas of the disconnected-patient brain contain specific informations!

He denys to see "chiave" at left and is unable to name the object in his left hand, but he is able to select the correct object.
On the contrary, his response, from the left hemisfere is "anello"[ring].

Stimuli are presented for 0.1 s
Patient cannot see his hands

Patients with hemispheric disconnection (they are unable to dream)

1) If the object is shown only in the **right** visual hemifield or given in the right hand, he behaves as a normal man (he names and write the object)
2) If the object is shown only in the **left** visual hemifield or given in the left hand, he behaves as if the action was not done or did not exist (he cannot read or give a name)

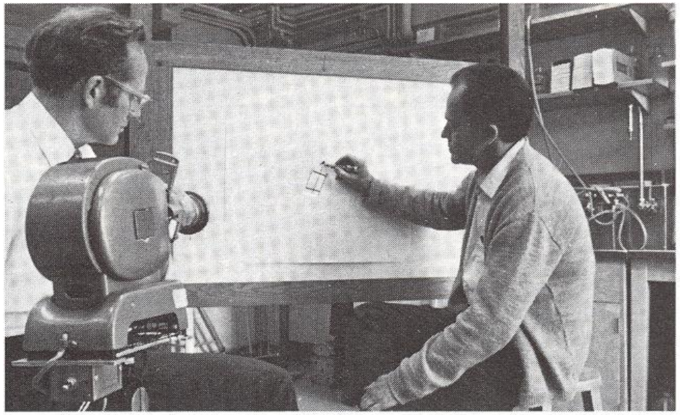
Conclusions: the performance of the **left** hemisphere corresponds to a **normal** brain, indeed this hemisphere with all of the associated areas should be considered as the **neuronal substrate with the specificity of the consciousness (awareness)** and language ability. This hemisphere is analitic and sequential in the information processing.

The isolated right hemisphere is unable to express himself verbally or writing and lives independently. This does not mean that his performances are weak because he is able to recognize musical fragments or conceive or imagine spatial concepts. Patients without disconnections, but with right hemisphere damages, suffer of space “agnosia” (they get lost and are unable to draw three-dimensional objects).

Little boys with fortuitous destruction of the left hemisphere, after about one year, start to speak again and the language dominance is transferred into the right hemisphere. This cannot happen after ten year old boys because the right hemisphere areas are already fixed and unabled to change their use.

«La nostra prima vera scoperta giunse come una sorpresa [...] per tre o quattro ore non avevamo ottenuto assolutamente nulla. Poi, gradualmente cominciammo ad evocare qualche risposta vaga e incoerente stimolando altri punti nell'area medioperiferica della retina. Stavamo inserendo nell'alloggiamento dell'oftalmoscopio un vetrino con un punto nero disegnato, quando improvvisamente la cellula si mise a sparare come una mitragliatrice al monitor audio. Dopo lo smarrimento iniziale e qualche aggiustamento, scoprimmo ciò che stava succedendo. La risposta non aveva nulla a che fare con il punto nero. All'atto dell'inserimento, il bordo del vetrino aveva proiettato sulla retina un'ombra debole ma nitida che formava una linea scura su di uno sfondo illuminato. Questo era ciò che serviva per stimolare la cellula e, per di più, in un ambito ristretto di orientamenti. Una cosa simile non si era mai sentita. Ripensandoci ora è difficile rendersi conto di quanto fossimo lontani da ogni idea circa il ruolo delle cellule corticali nella vita quotidiana di un animale.»

File: 0-4 min LGN ON e OFF
4-7 min area17 simple
7-14 min complex e hypercomplex
14-16 min hyper-profondità



David Hubel & Torsten Wiesel

Nobel 1981

video
Hubel & Wisel cellule
4:20 Semplici linea obliqua,
7:40 complesse
10:13 complessa #2
12:17 end-stop
14:55 vista stereoscopica

Pazienti con disconnessione degli emisferi (non fanno più sogni.)

1) Se l'oggetto è mostrato solo nell' emicampo visivo di **destra** o dato al paziente nella mano destra egli si comporta come un individuo normale (lo nomina e scrive)
2) Se l'oggetto è mostrato solo nell' emicampo visivo di **sinistra** o dato al paziente nella mano sinistra egli si comporta come se l'azione condotta non fosse mai esistita (non riesce a leggere e nominare)

Conclusioni: le prestazioni dell'emisfero di **sinistra** corrispondono ad un cervello **normale** E perciò l'emisfero di **sinistra** con tutte le aree associate sottocorticali deve essere considerato come il **substrato neuronale della specificità della coscienza** e della capacità linguistica. Questo emisfero è analitico e sequenziale nel processamento dell'informazione.

L'emisfero destro isolato non può esprimersi verbalmente o per iscritto e conduce una vita indipendente. Questo non vuol dire che le sue prestazioni non siano notevoli come per esempio nel riconoscere brani musicali e concepire concetti spaziali. L'emisfero destro è capace di analisi spaziale e di sintesi. Pazienti senza disconnessione ma con danni alle aree dell'emisfero destro, che nel sinistro corrispondono al linguaggio, soffrono di agnosia per lo spazio (si perdono e non sanno disegnare oggetti tridimensionali).

Nello sviluppo si rileva che il bambino con distruzione accidentale dell'emisfero sinistro, dopo circa un anno ricomincia a parlare con trasferimento della dominanza nell'emisfero destro. Ciò non può avvenire oltre i dieci anni di età perché le aree dell'emisfero destro sono già forgiate a compiere altre capacità.