



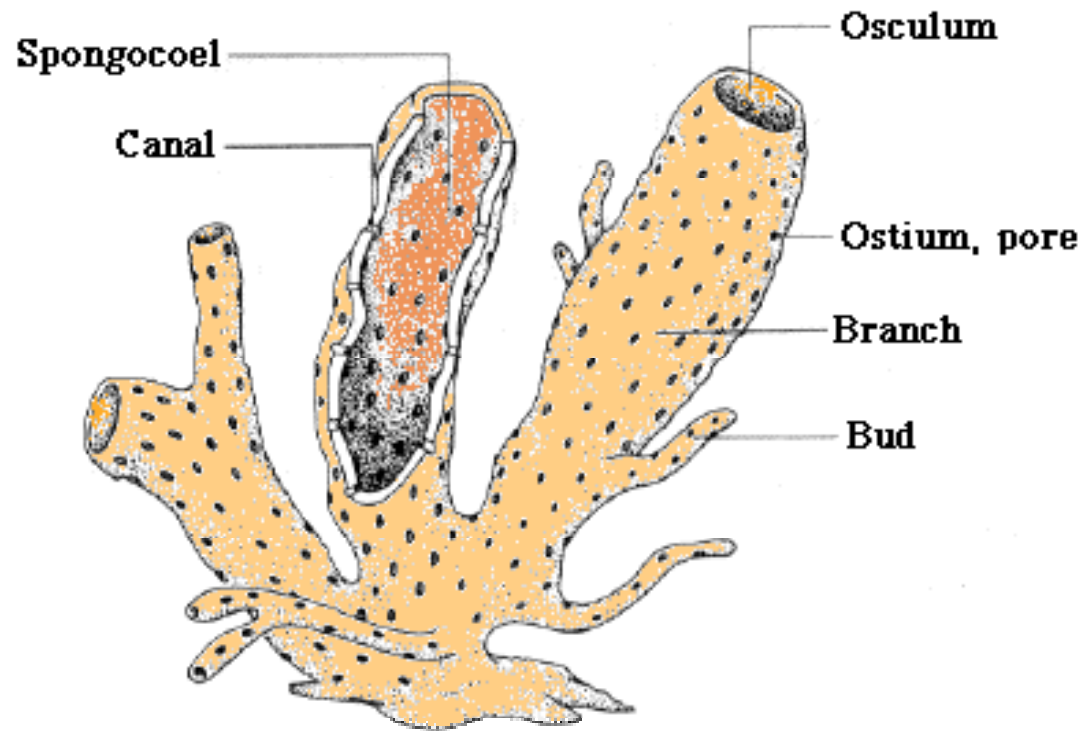
Simmetria centrale



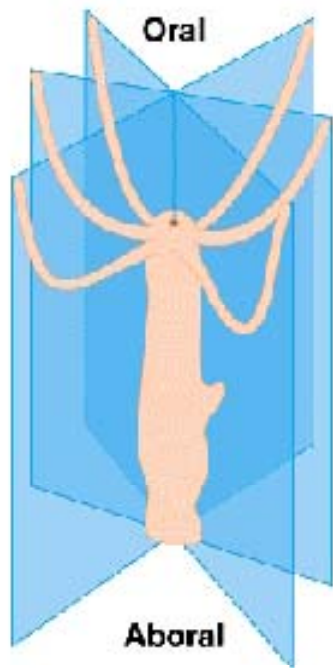
Simmetria radiale



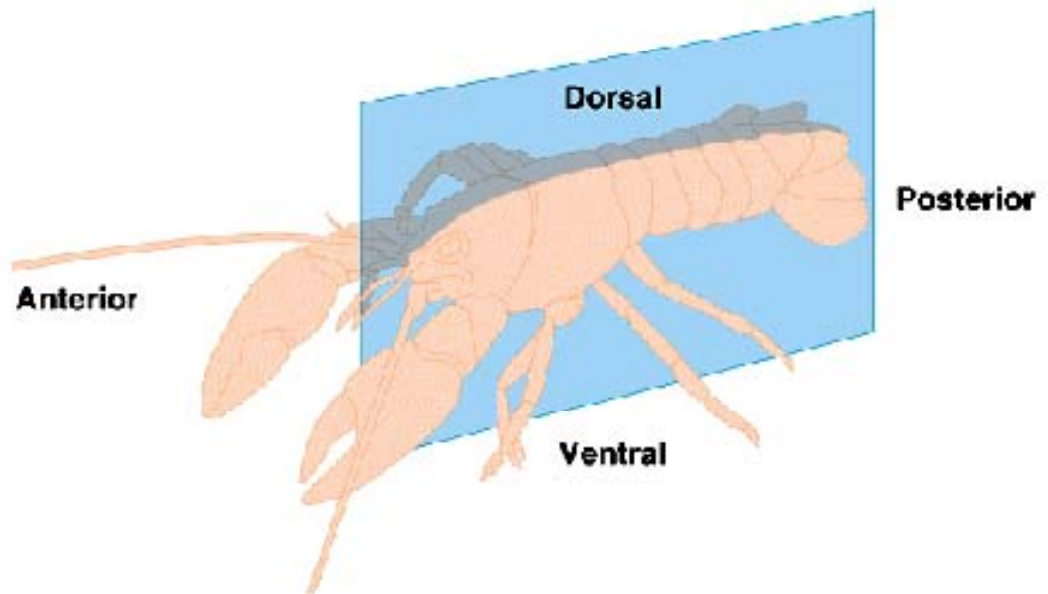
Simmetria bilaterale



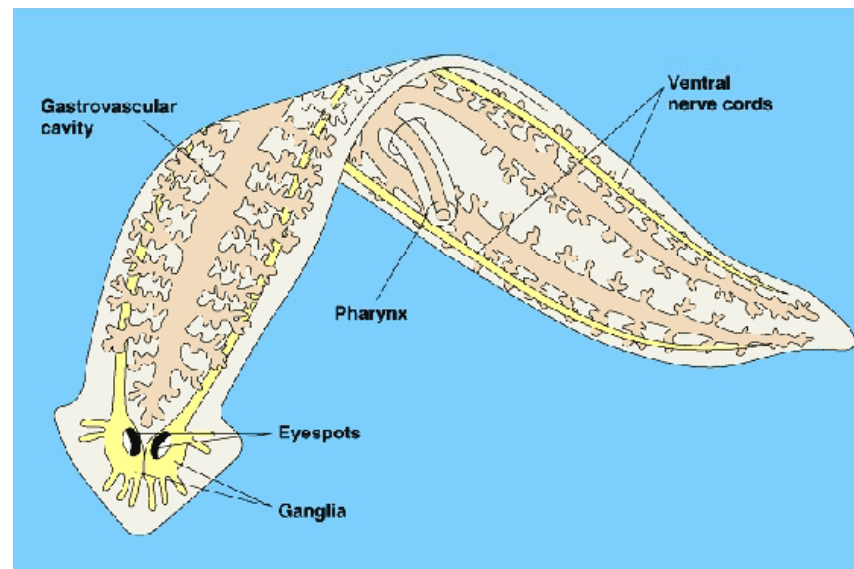
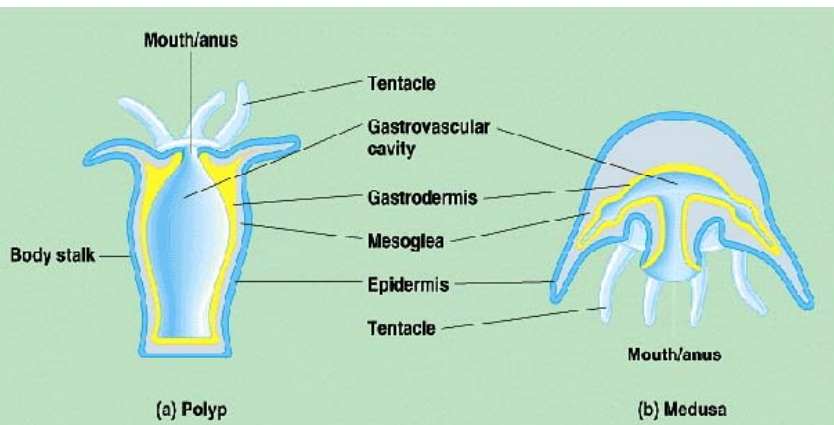
Le spugne sono gli unici membri del regno animale non simmetrici

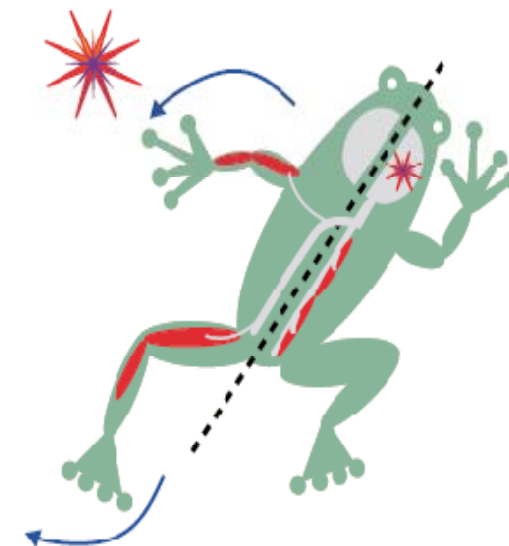
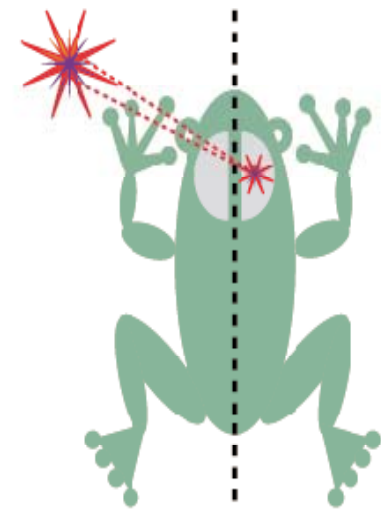
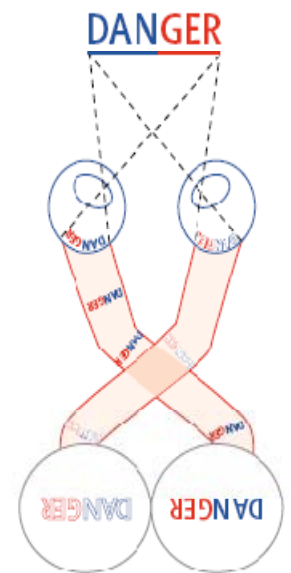
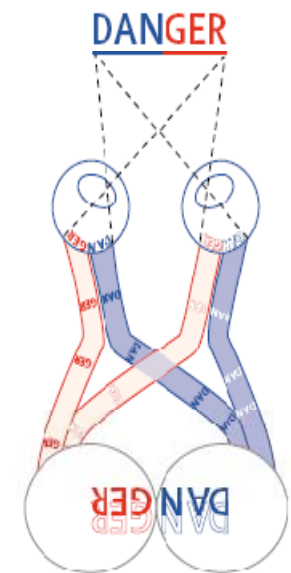
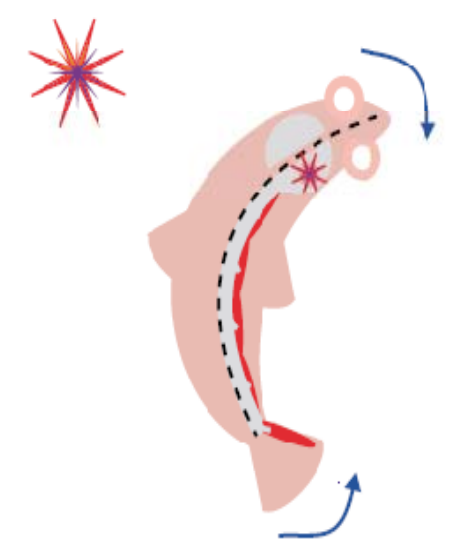
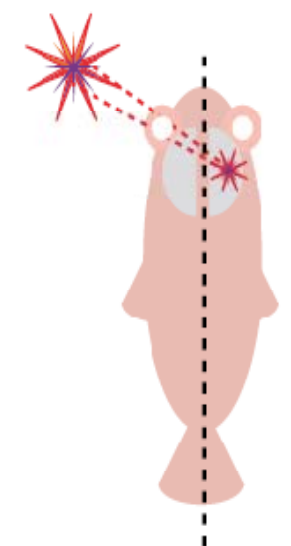
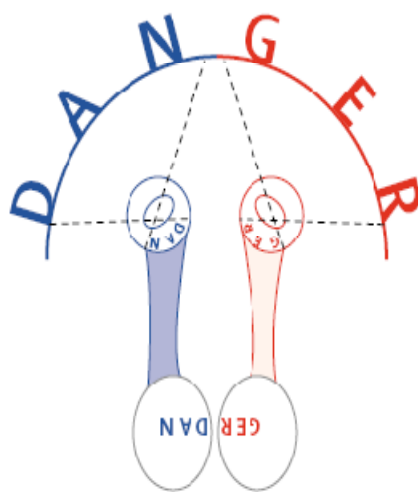
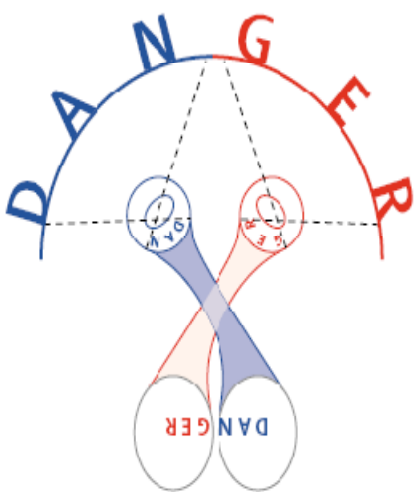


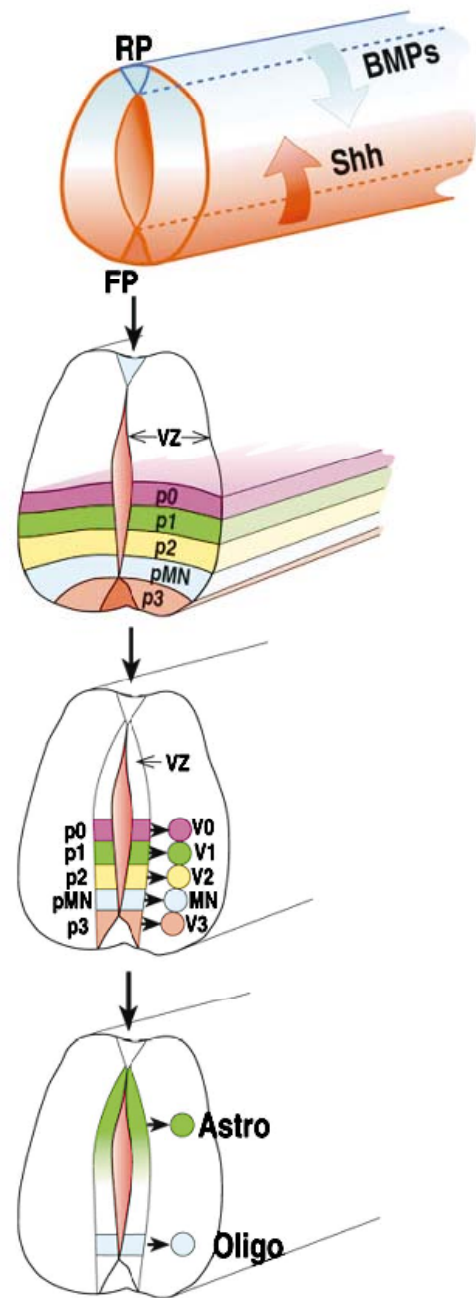
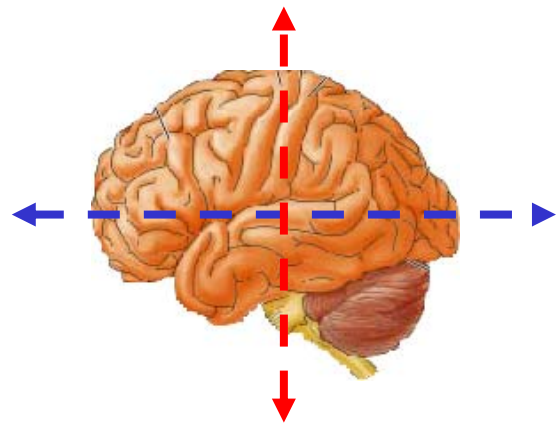
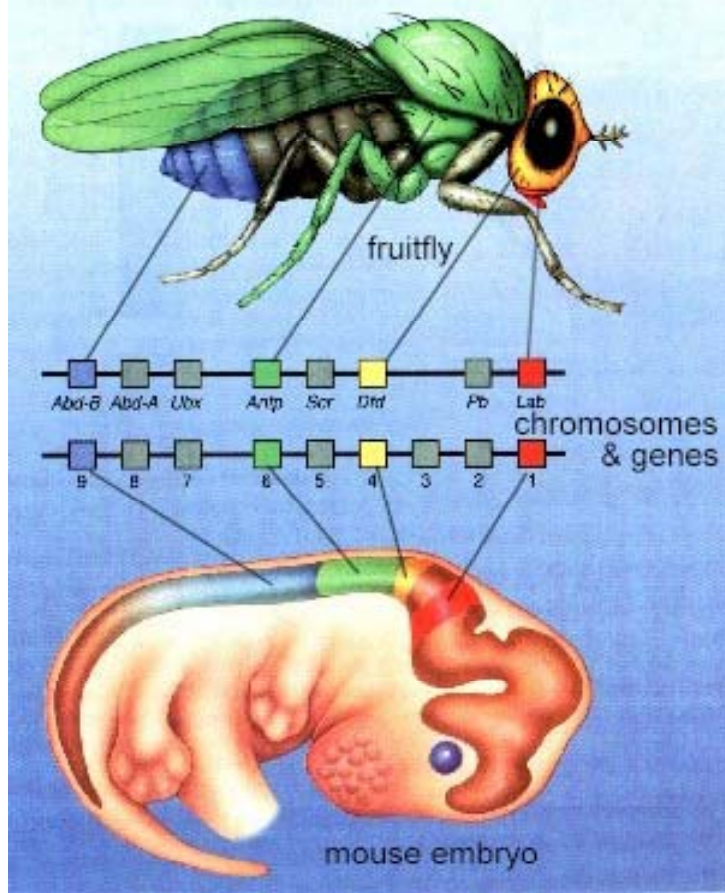
(a) Radial symmetry

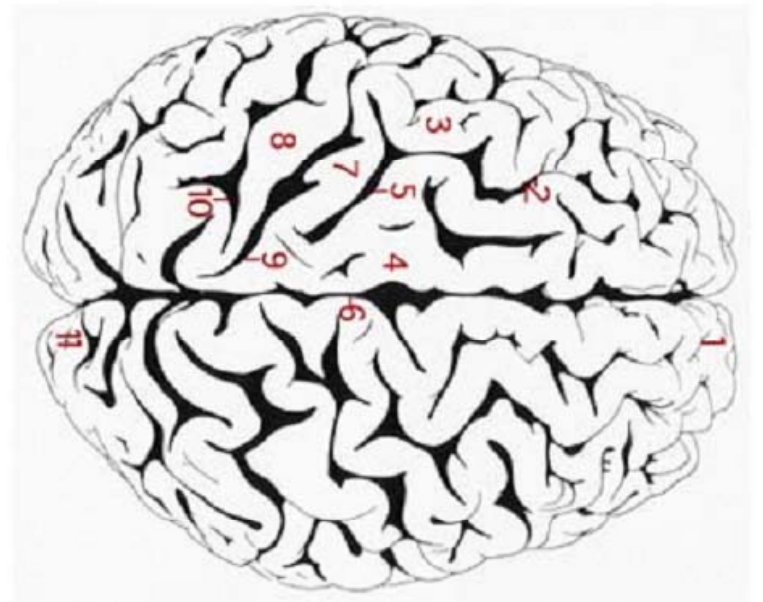
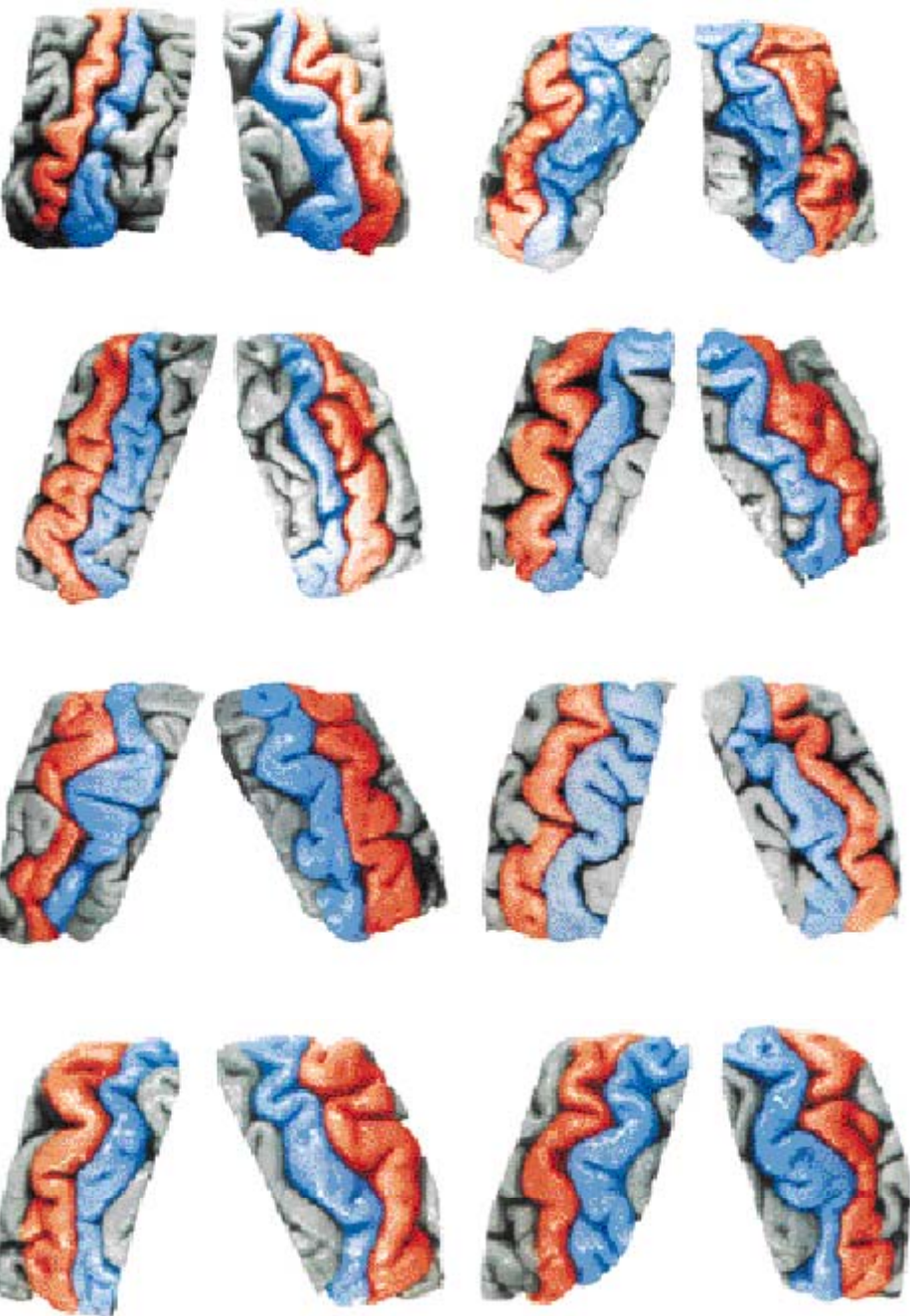


(b) Bilateral symmetry







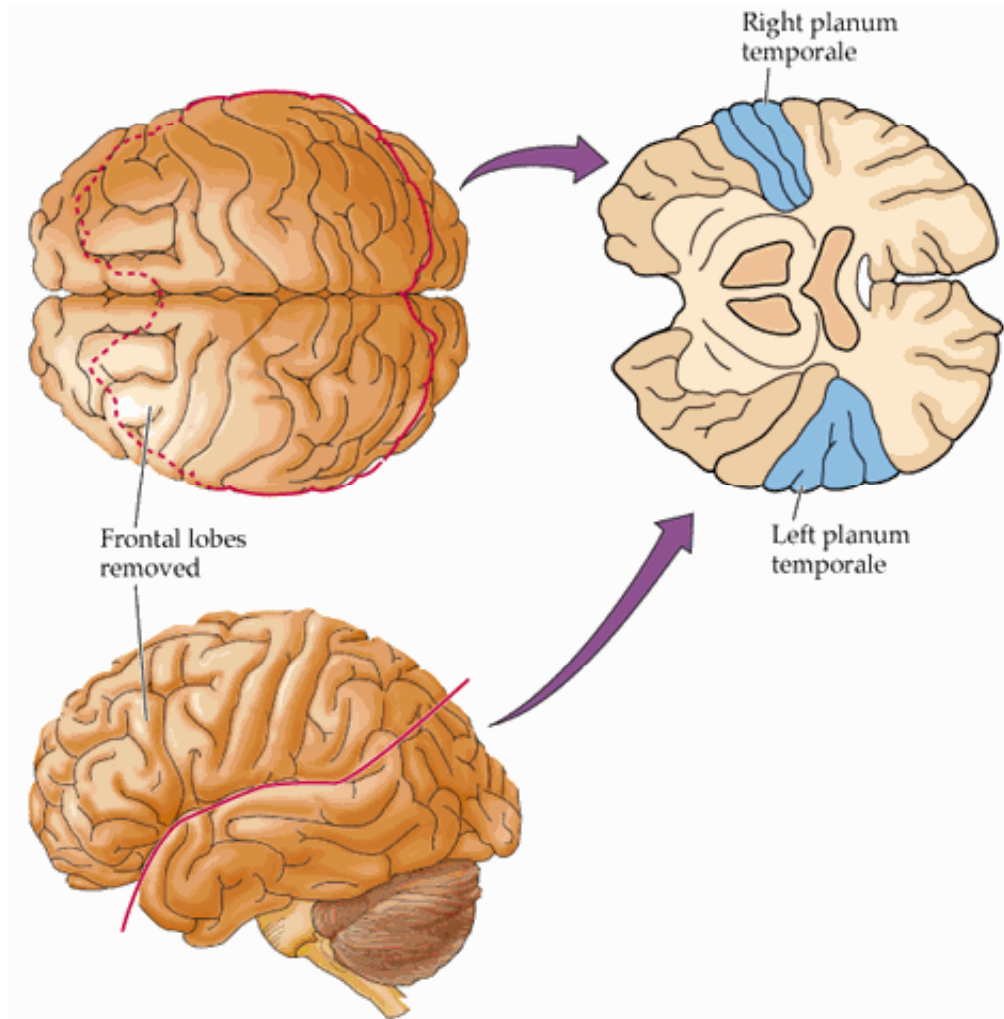
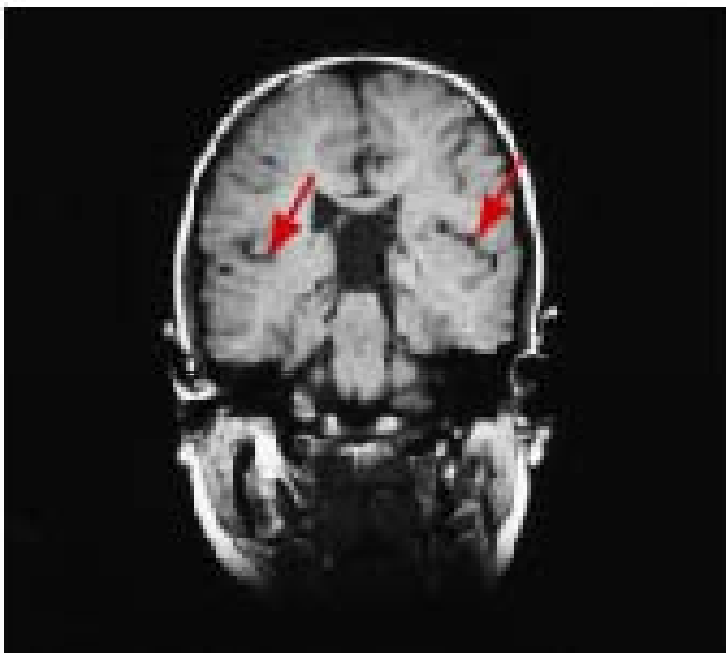


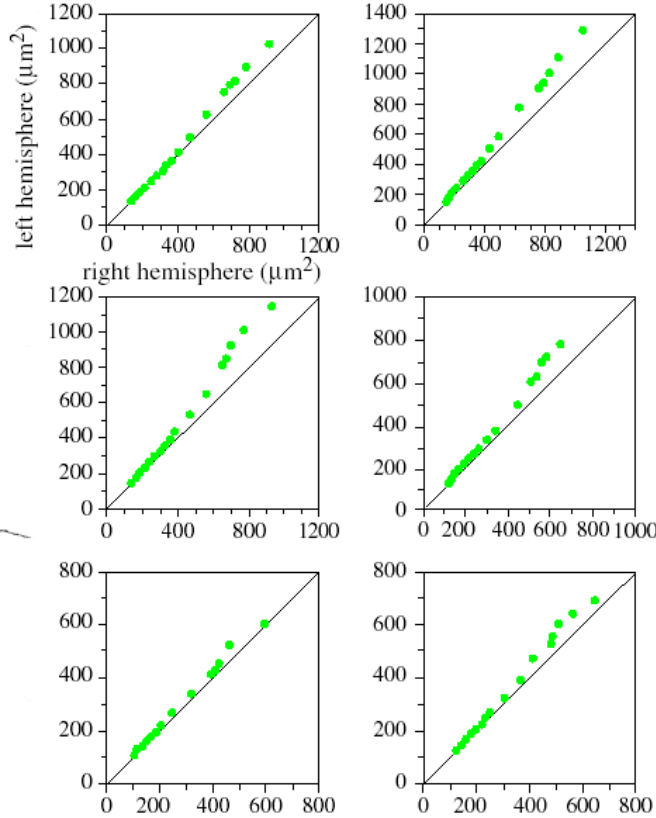
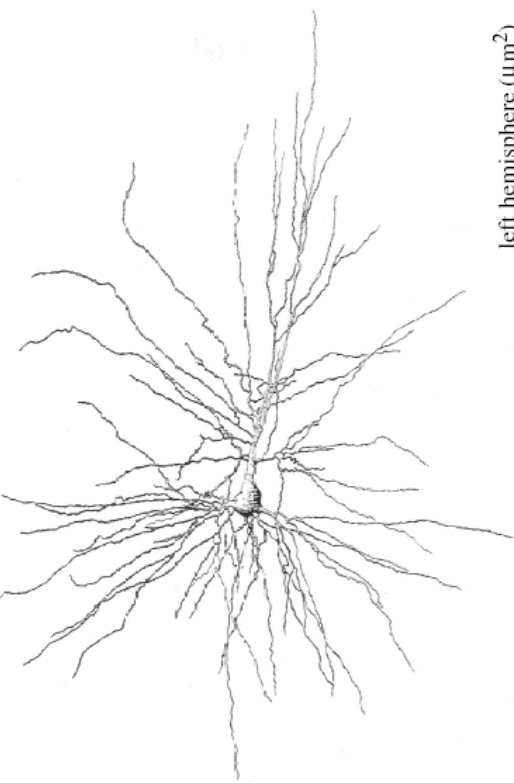
Planum temporale measurements of 100 adult and 100 infant brains

	Side	
	Left hemisphere	Right hemisphere
	Mean	Mean
Infant	20.7	11.7
Adult	37.0	18.4

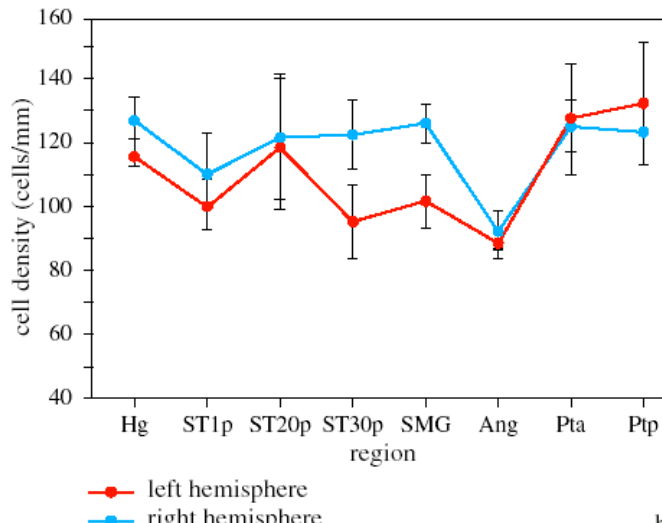
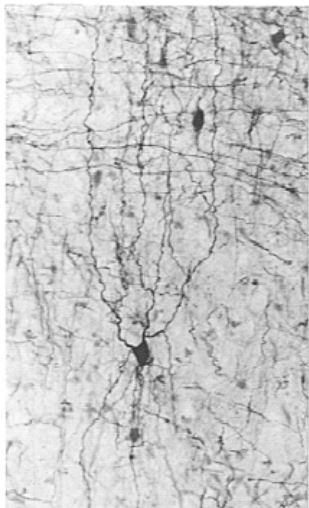
(C) Lato destro

Lato sinistro

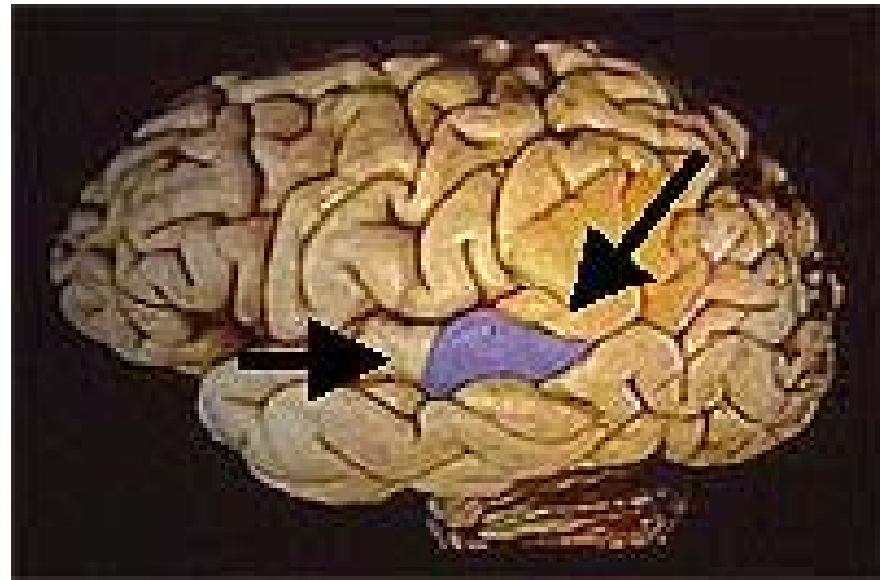
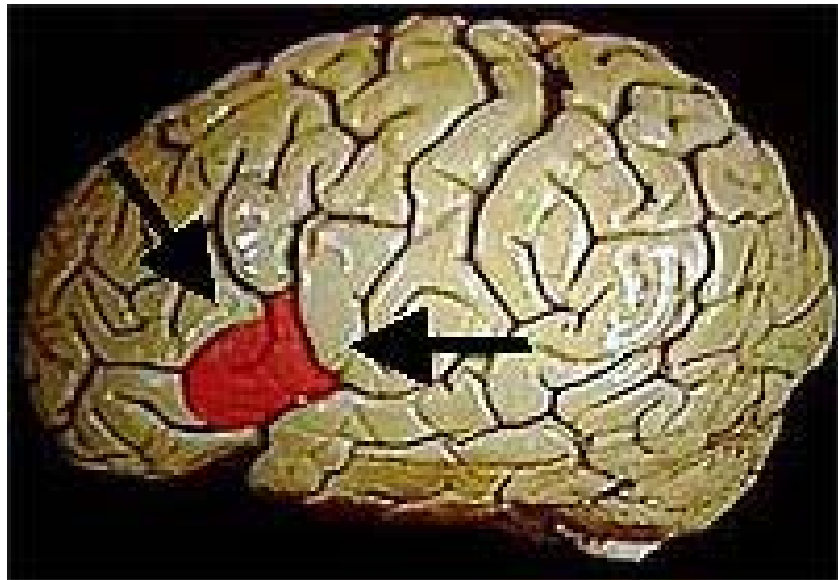
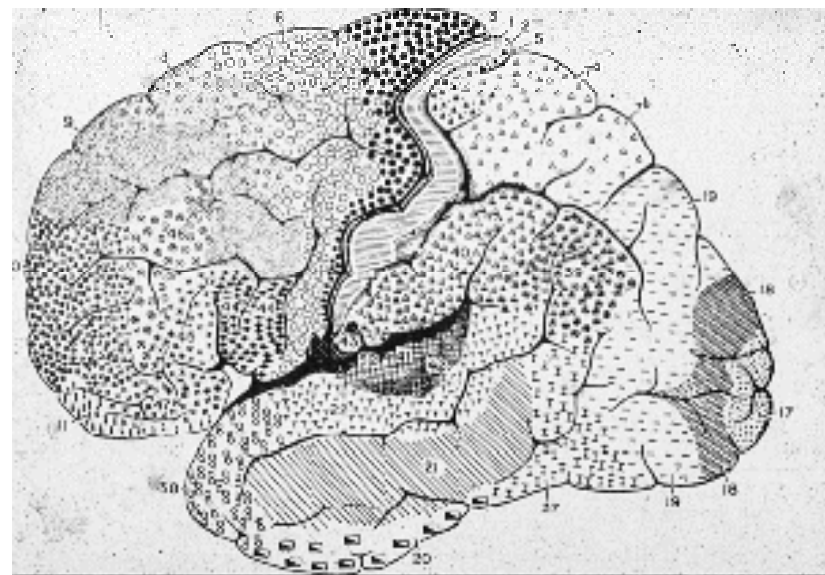
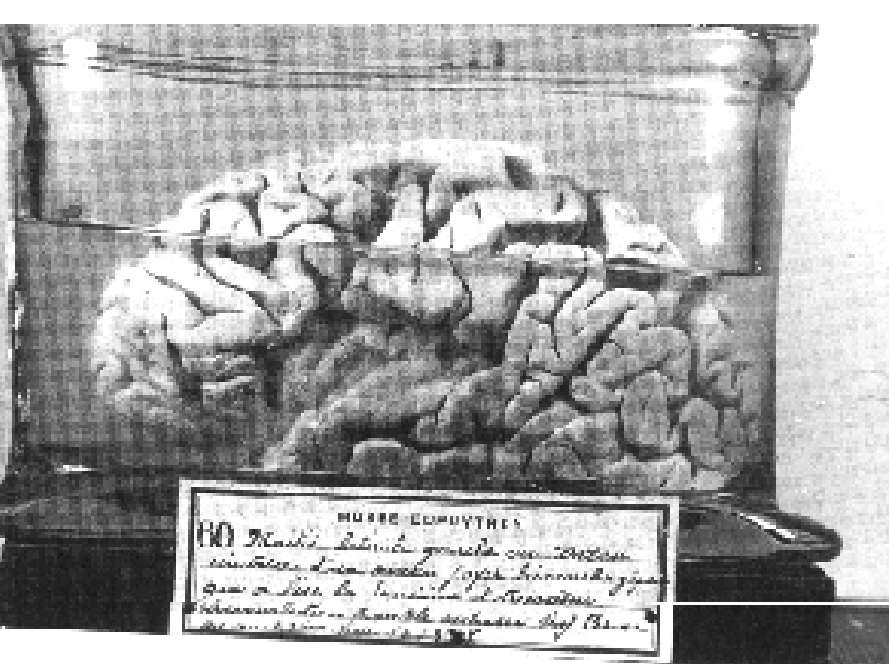




Differenze di dimensione delle cellule piramidali del lobo temporale destro o sinistro



Differenze di densità degli interneuroni del lobo temporale destro o sinistro



LH

**preferenza
mano
(casuale)**



gestualità



linguaggio

RH

**altre funzioni
lateralizzate
(default)**

**Broca: lateralizzazione =
effetto dell'acquisizione di
funzioni complesse legate alla
vita nella società evoluta**

**Il cervello è simmetrico alla
nascita e diviene tanto più
asimmetrico quanto più sono
s sofisticate le funzioni acquisite
dall'individuo**

Asimmetrie anatomiche e funzionali in diverse specie



In molti uccelli canori il controllo del canto è esercitato dall'emisfero sinistro

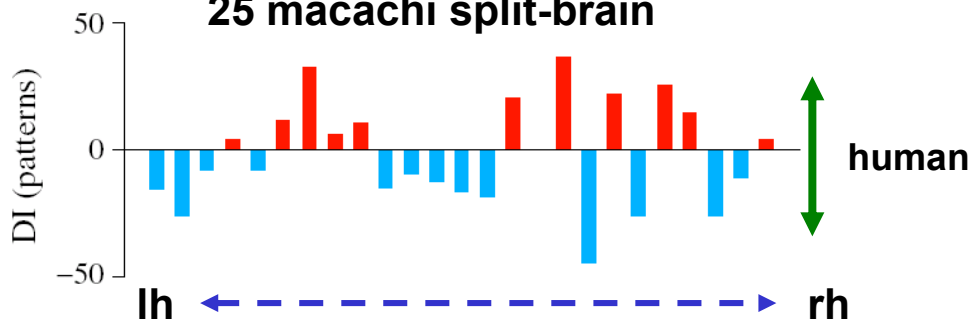


I topi mostrano una notevole preferenza per una zampa, anche se a livello di popolazione la preferenza è 50-50 destra-sinistra

I delfini hanno l'emisfero dx più grande del sx e mostrano una tendenza a nuotare preferenzialmente in senso antiorario

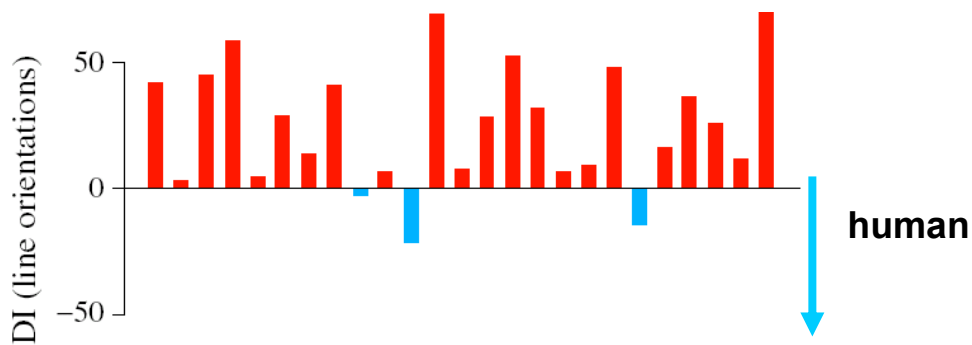


25 macachi split-brain

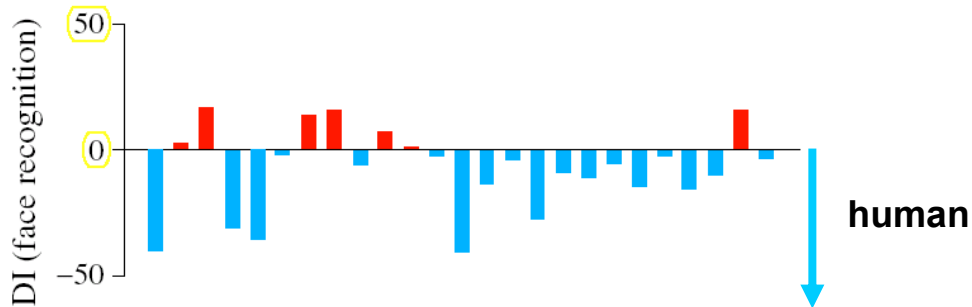


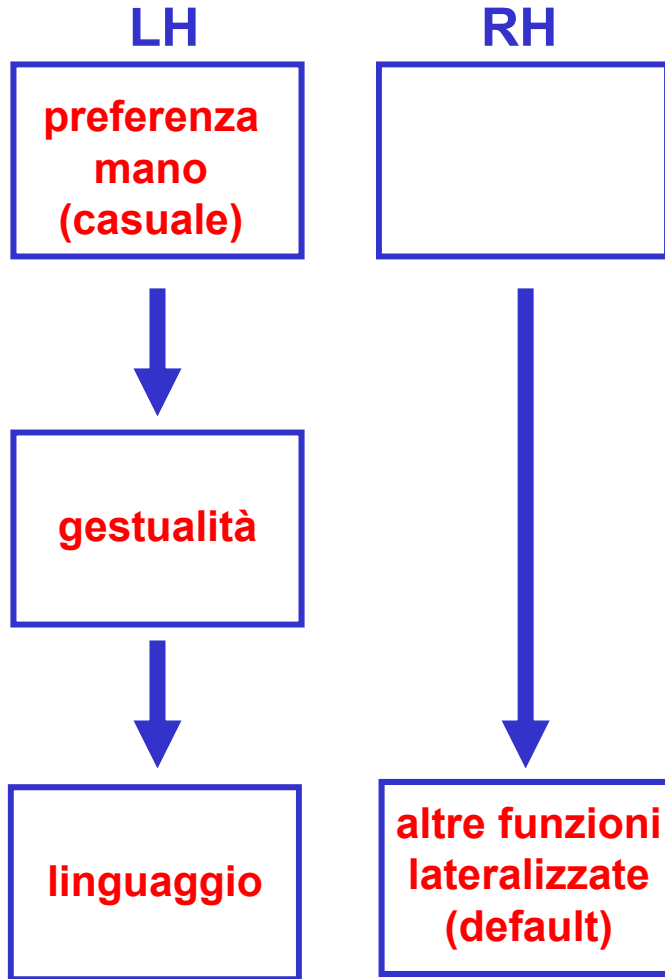
I primati non umani non hanno una mano di preferenza a livello di popolazione.

Tuttavia, ogni individuo tende ad usare preferenzialmente una mano per compiti specifici; ad esempio la sinistra per lanciare o afferrare oggetti, la destra per la manipolazione fine.



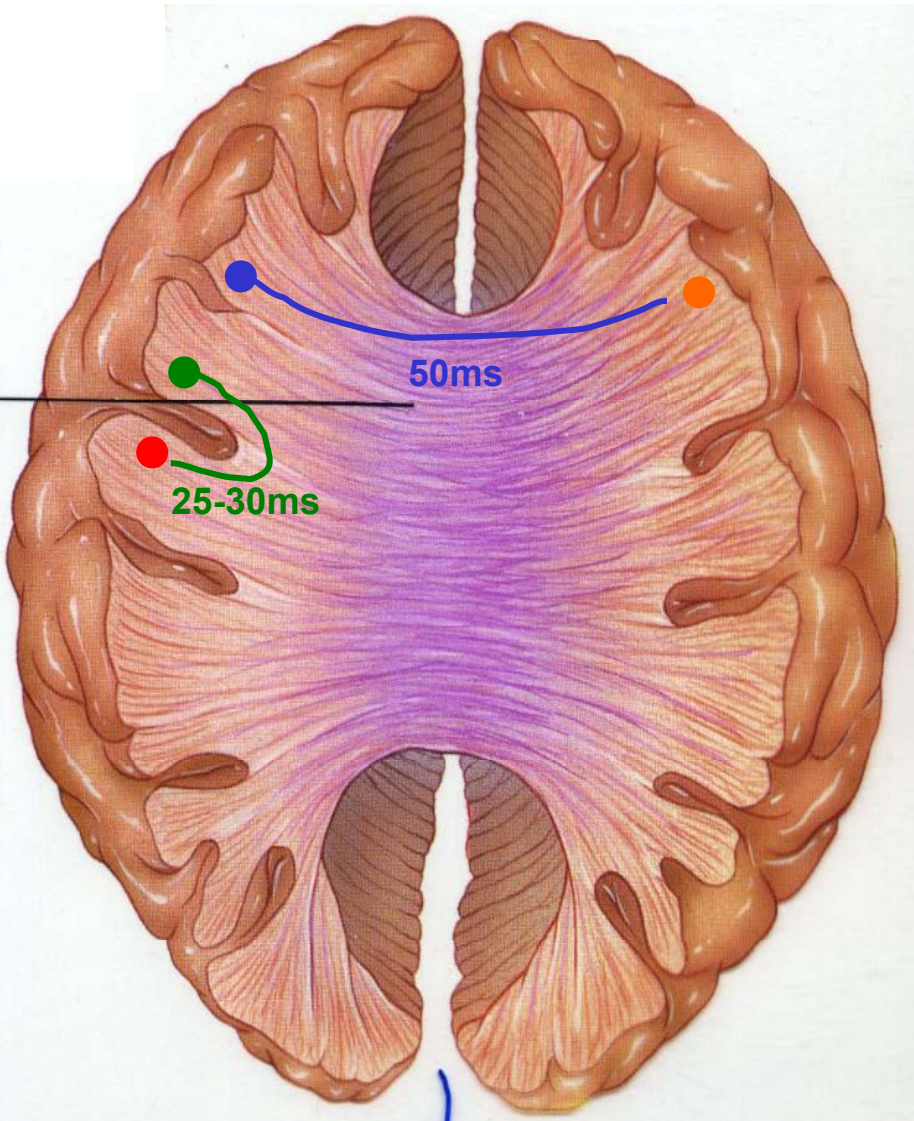
right hemi
left hemi





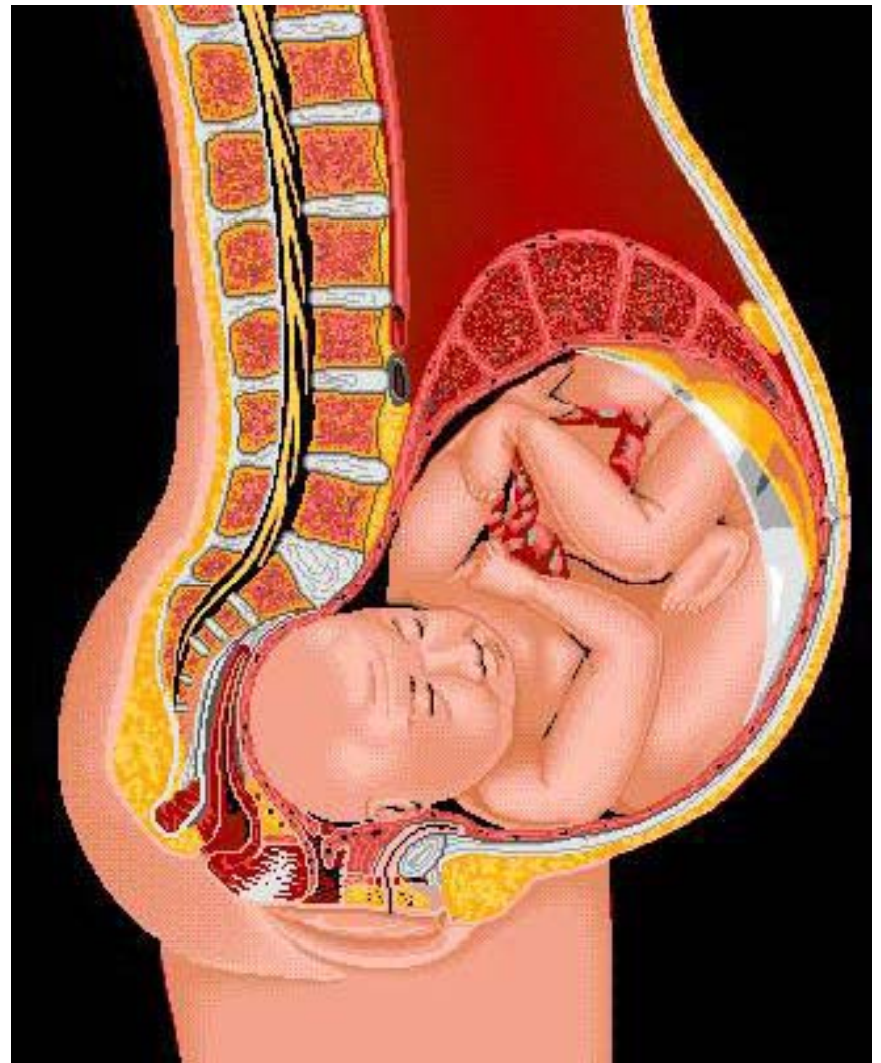
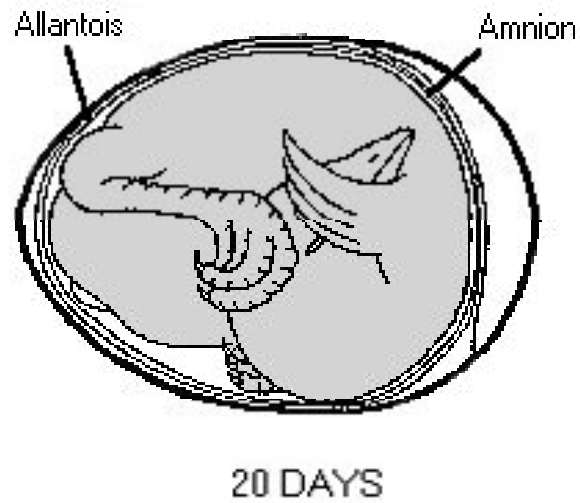
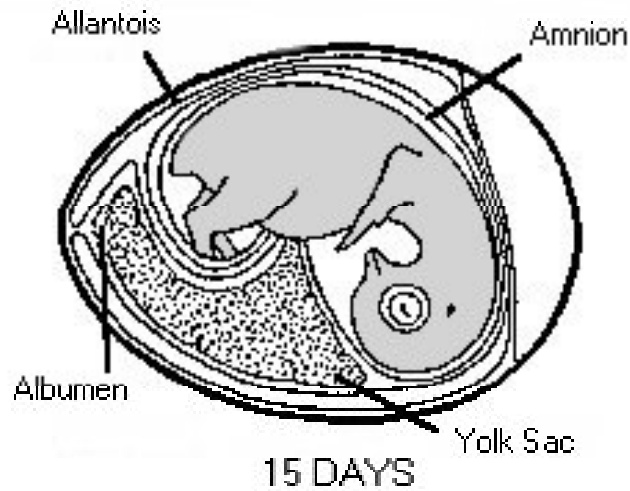
La preferenza per la mano ed il linguaggio non sono presenti nei primati non umani, che tuttavia hanno funzioni lateralizzate

Ne consegue che la lateralizzazione funzionale presente nei predecessori comuni non è direttamente correlata con le funzioni di uso preferenziale di una mano o del linguaggio



Le connessioni intra-emisferiche sono più veloci di quelle transcallosali. C'è quindi un vantaggio evolutivo a lateralizzare le funzioni che richiederebbero numerose connessioni transcallosali.

Tuttavia, questa teoria non spiega perché certe funzioni (es linguaggio) si trovano più spesso da un lato che dall'altro



Una possibile spiegazione sta nell'esposizione asimmetrica agli stimoli sonori durante la vita intrauterina

Ontogenesi della differenziazione emisferica

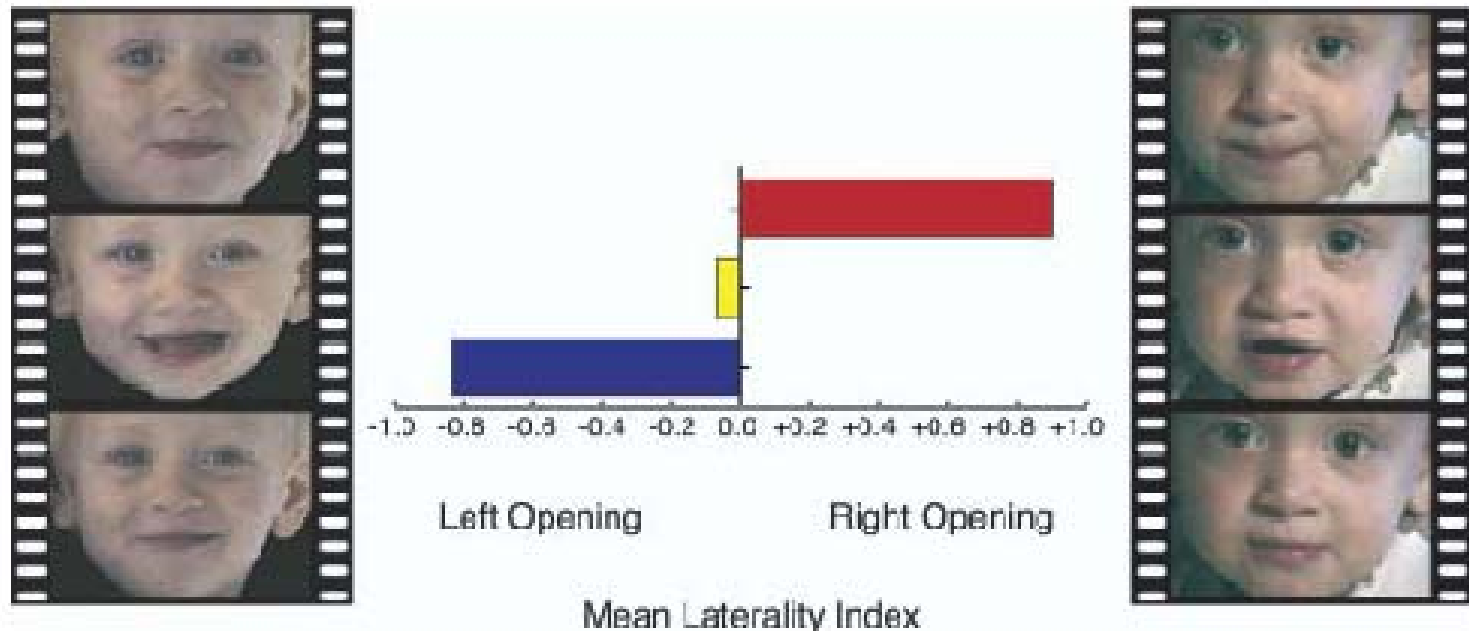
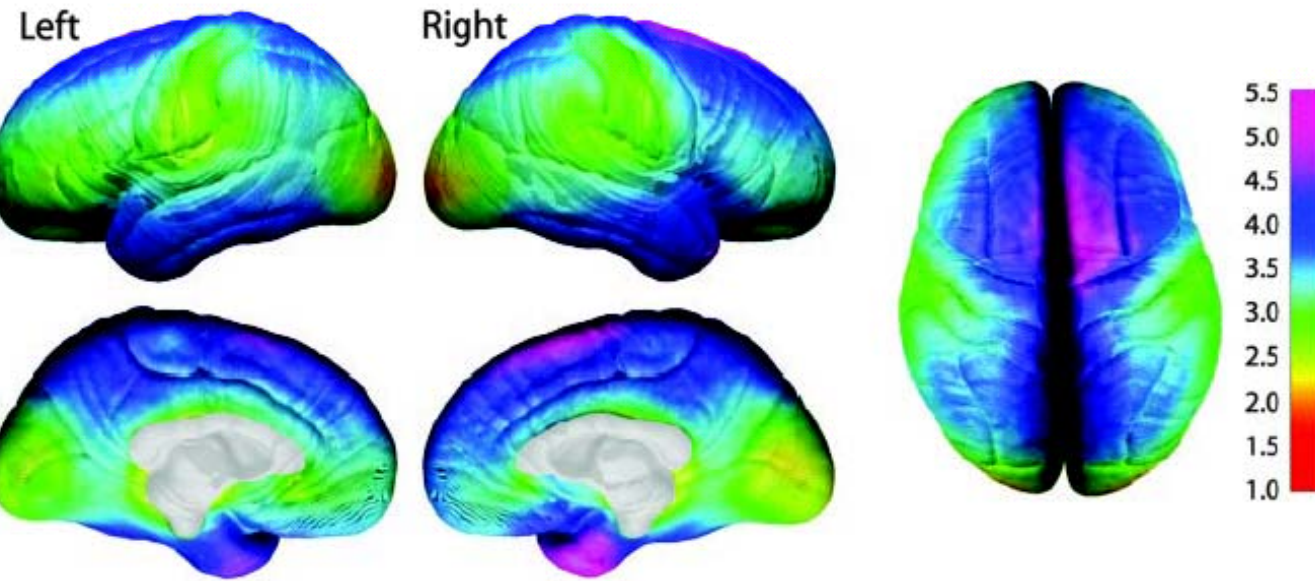
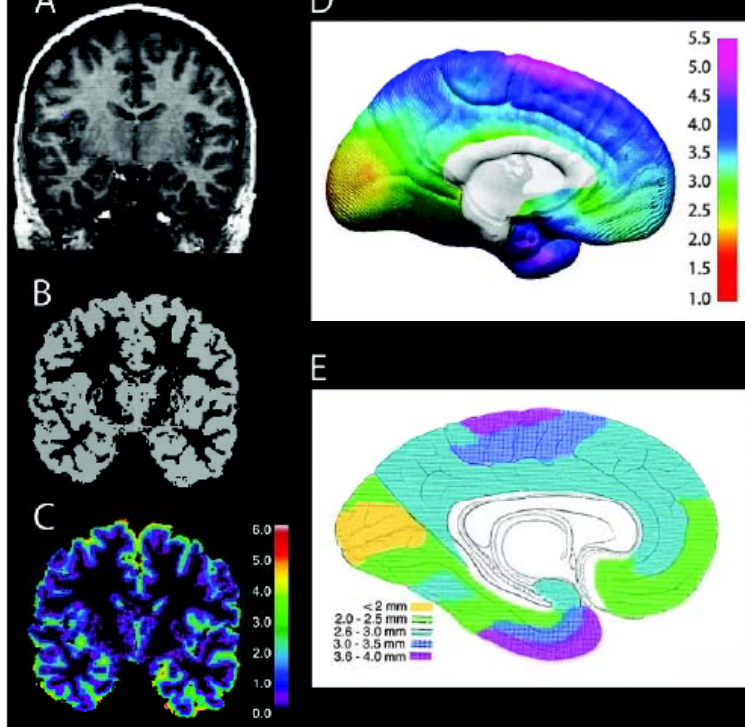
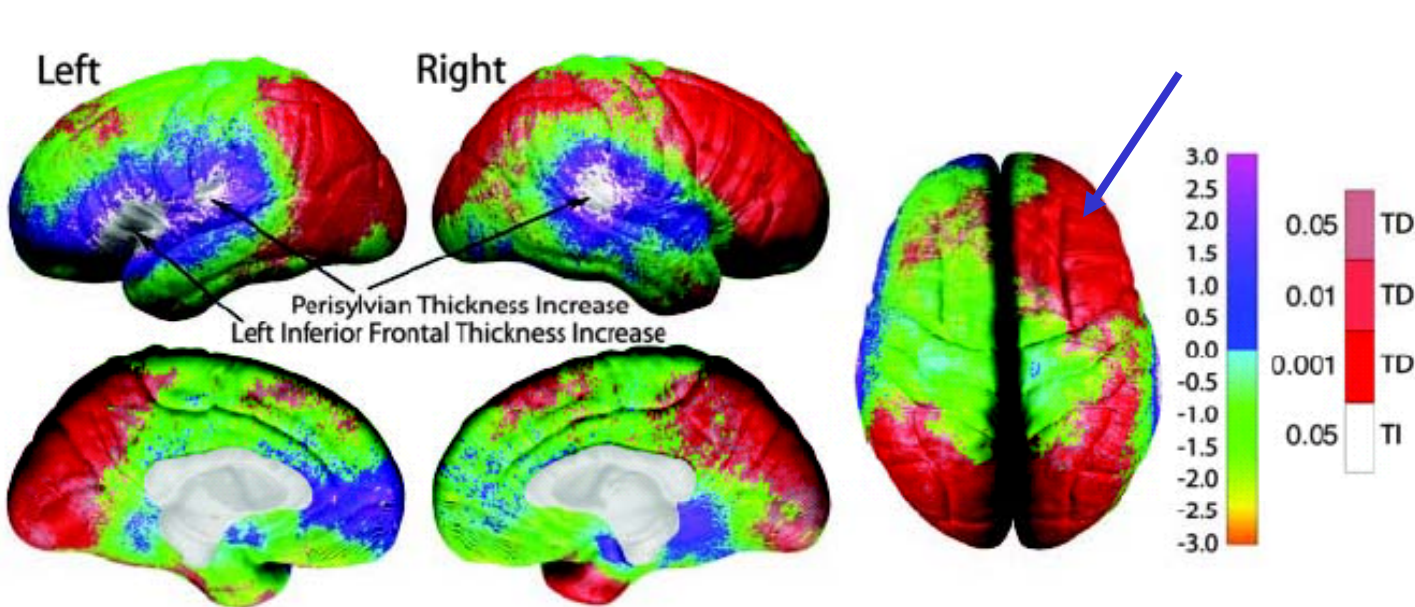


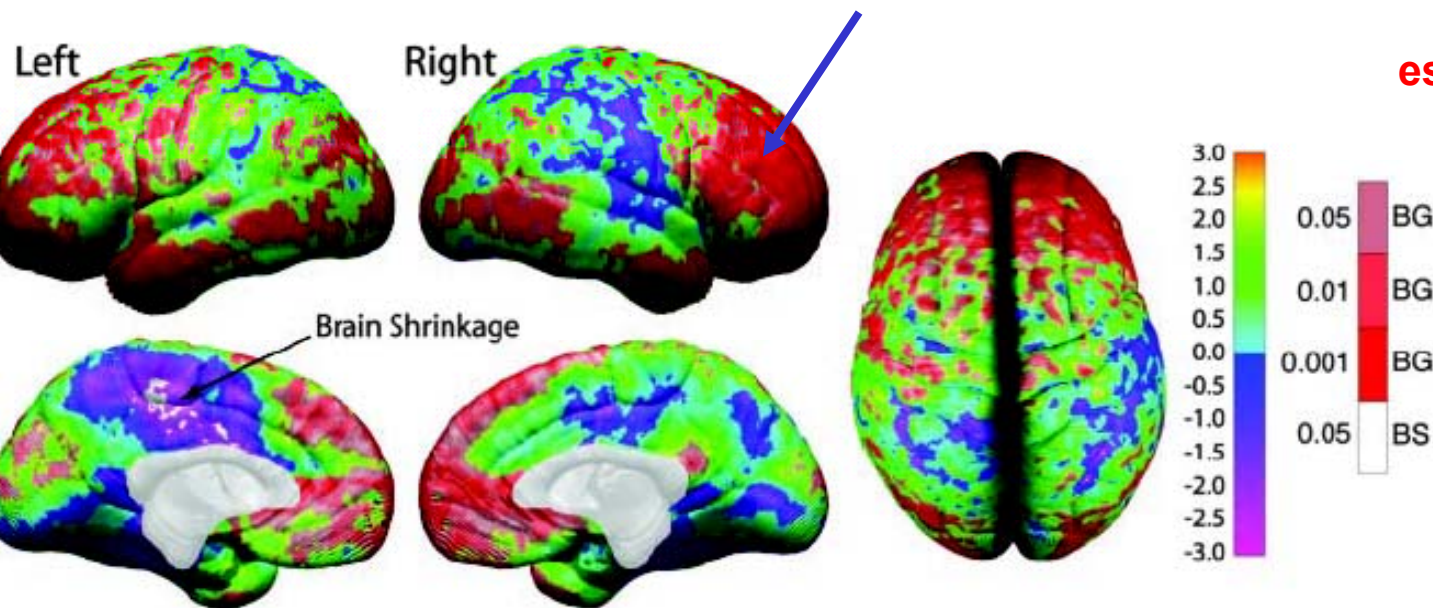
Fig. 1. Consecutive frames from video recordings showing a baby's left mouth opening while smiling (**left**) and right mouth opening while babbling (**right**). Mean LI scores for all of the babies were as follows: babble = +0.88 (red), nonbabble = -0.08 (yellow), and smile = -0.82 (blue).



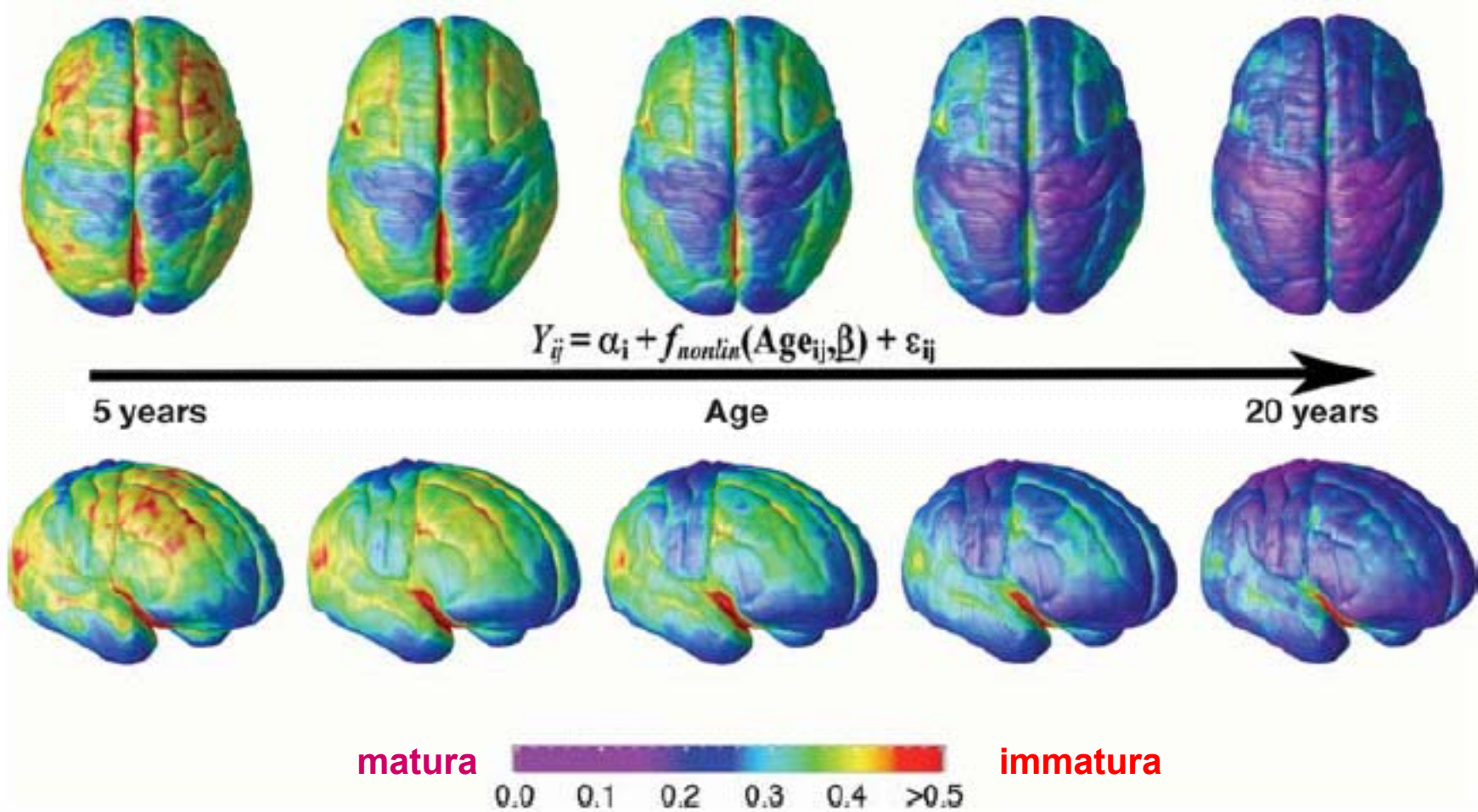
**Spessore corteccia
(5 anni)**



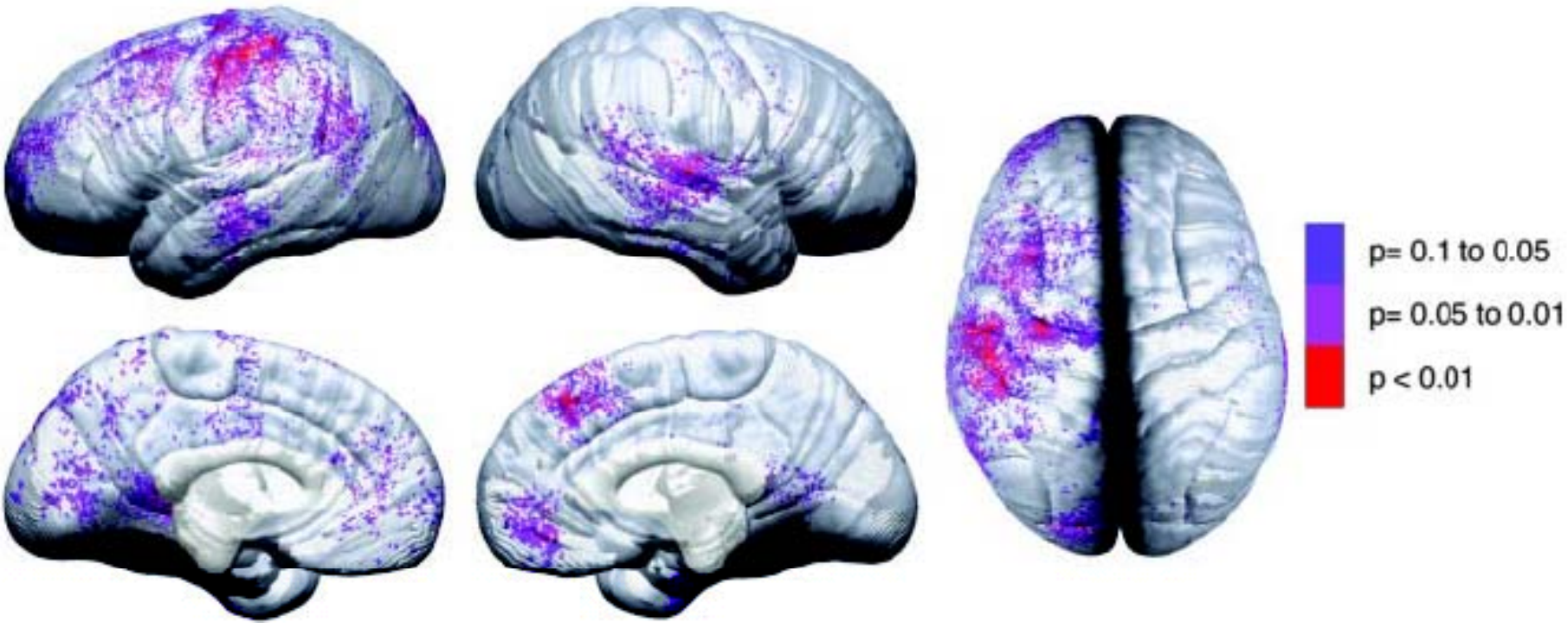
**modificazione
spessore corticale
(5-11 anni)**



**modificazione
estensione corticale
(5-11 anni)**



Correlazione modificazioni di spessore corticale / sviluppo capacità verbali



Hand Write name

Throw ball

Use scissors

Foot

Kick ball

Step on object

Step up stair

Ear

Listen to whisper

Listen to box

Listen through wall

Eye

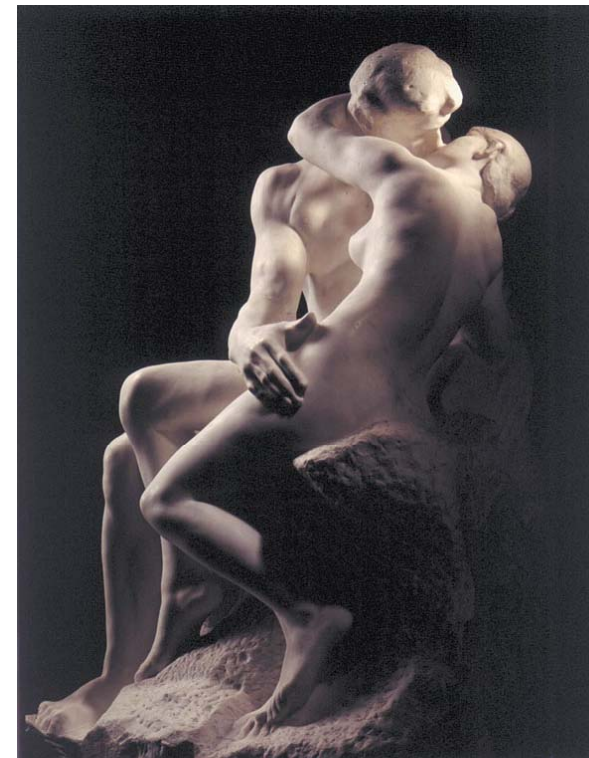
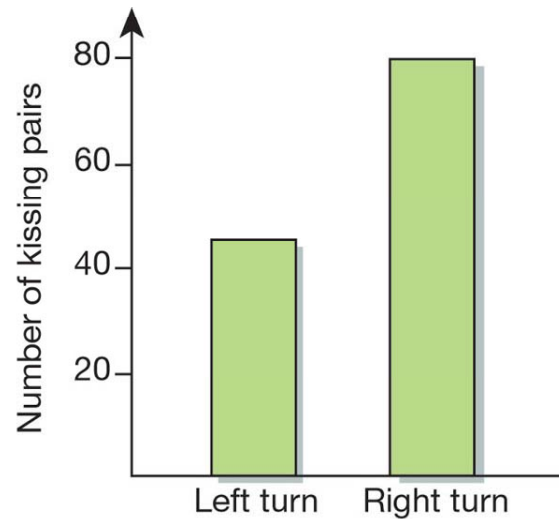
Look in tube

Sight a finger

Look through hole

% of Men and Women who Use the RIGHT SIDE		
	Men	Women
Hand	86	90
Foot	77	86
Ear	55	65
Eye	73	69

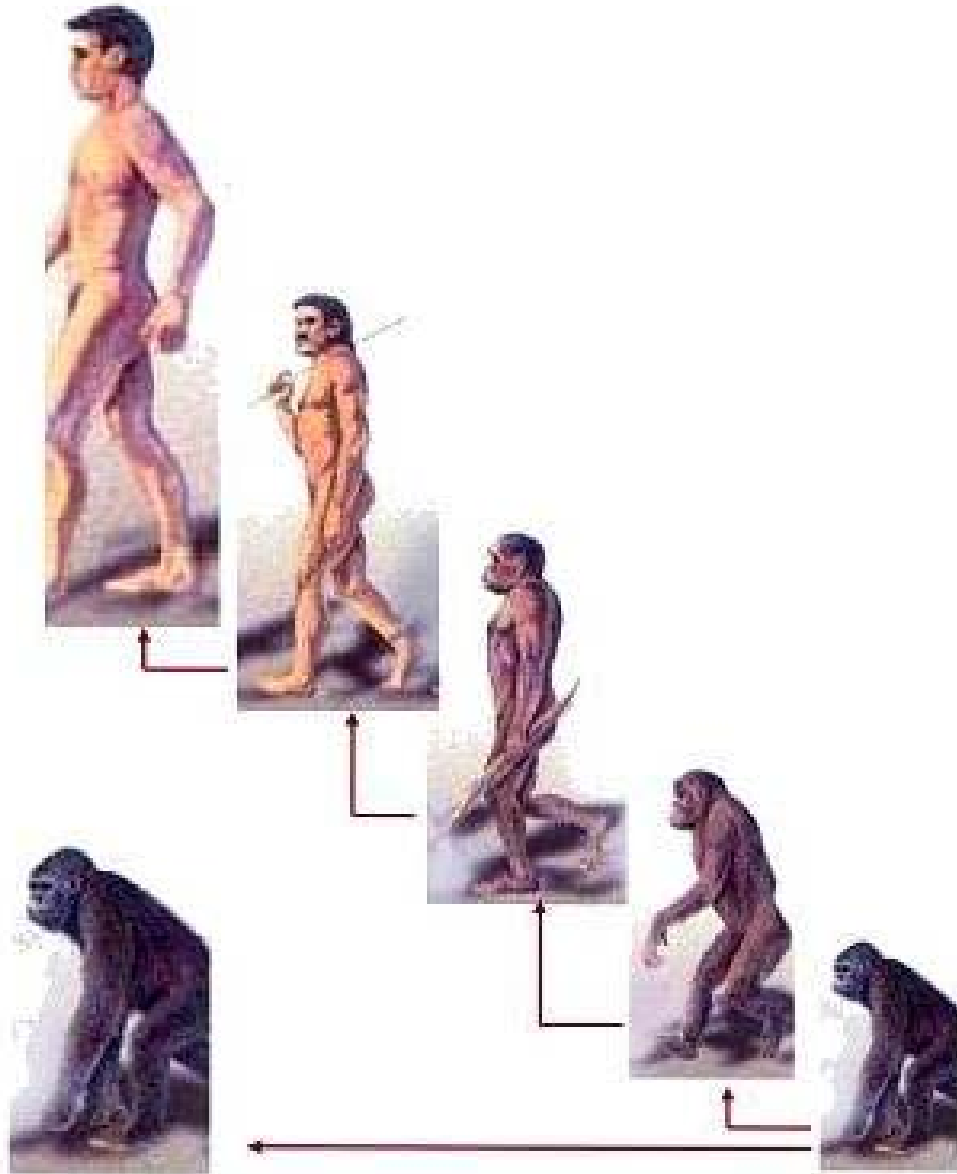
Linguaggio a sx nel
95% destrimani
70% mancini





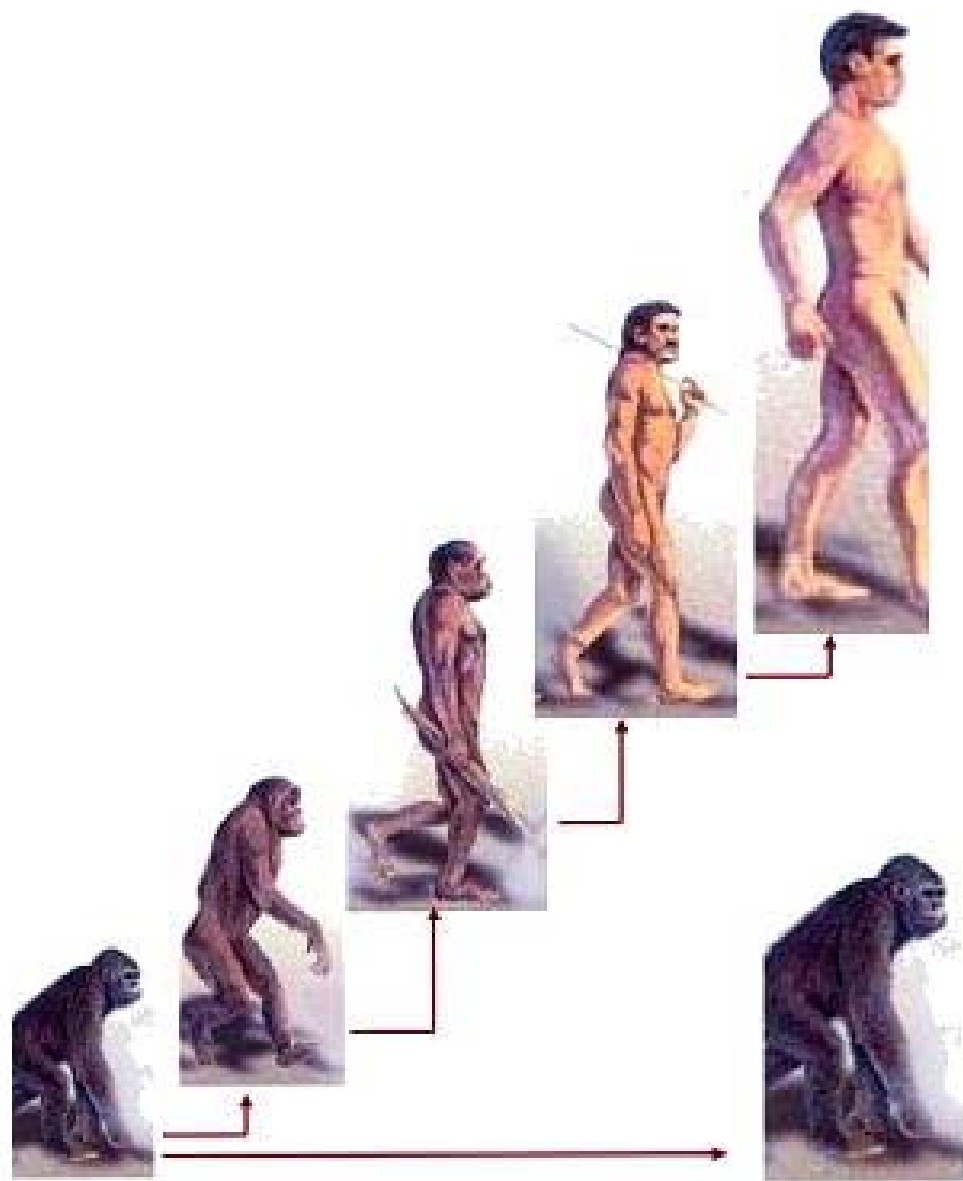


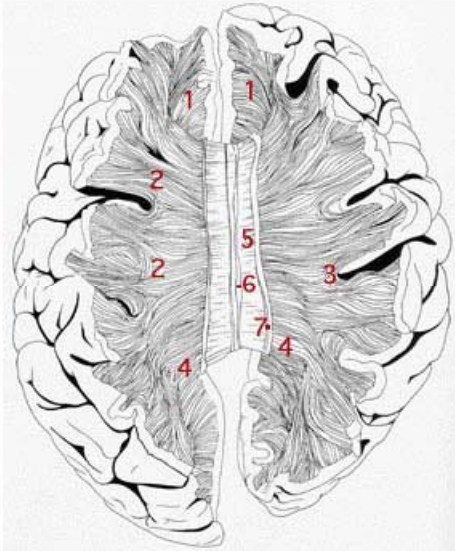
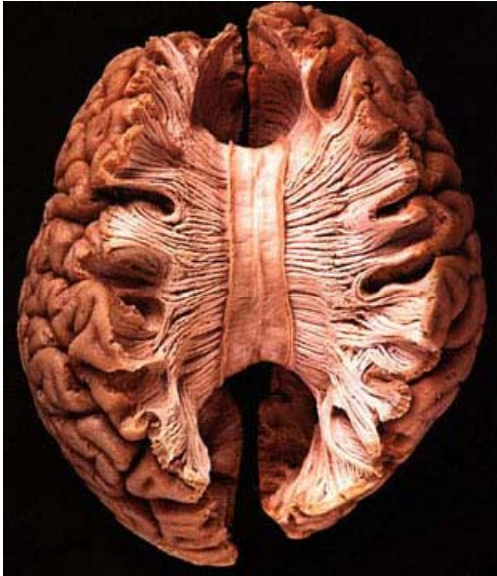
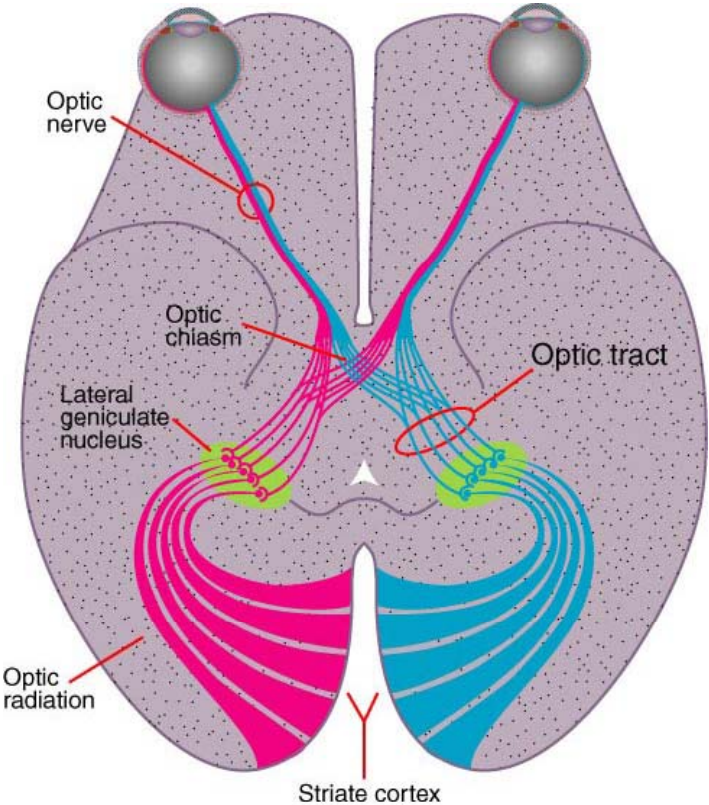
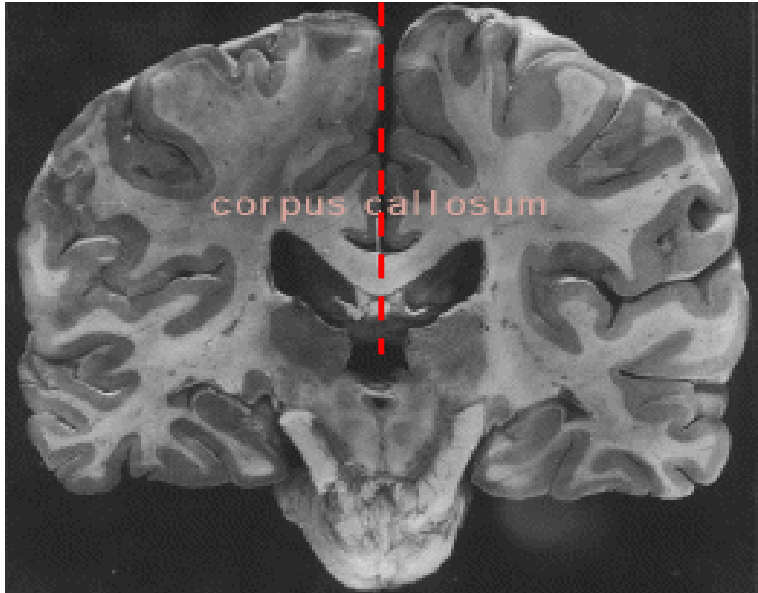
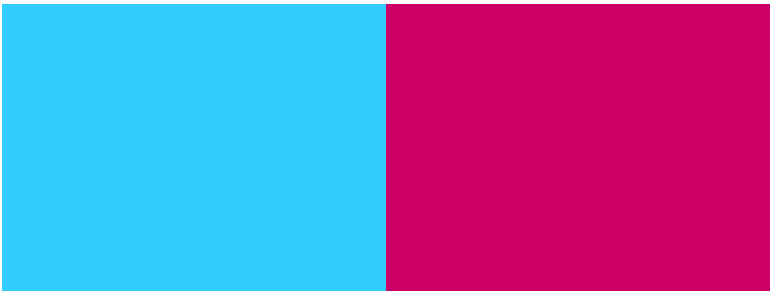
Πλάσι-οκέτιο
πάτα ελ τάσι





הומו-סאפיינס
האדם בן זמננו





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► Identification of an Object in Response to an Olfactory Stimulus by a Person with a Split Brain

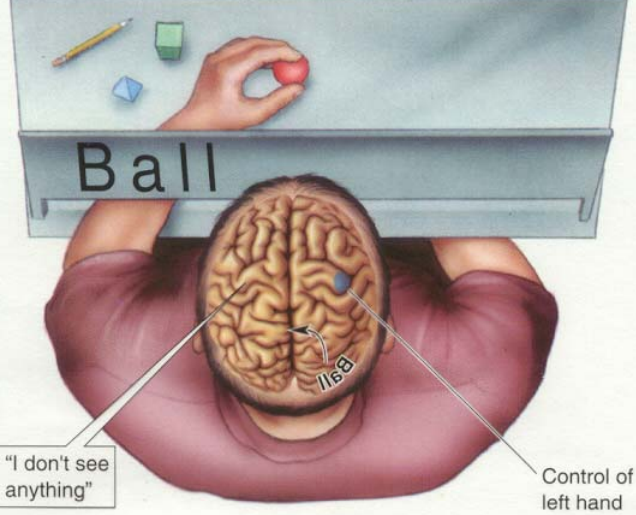
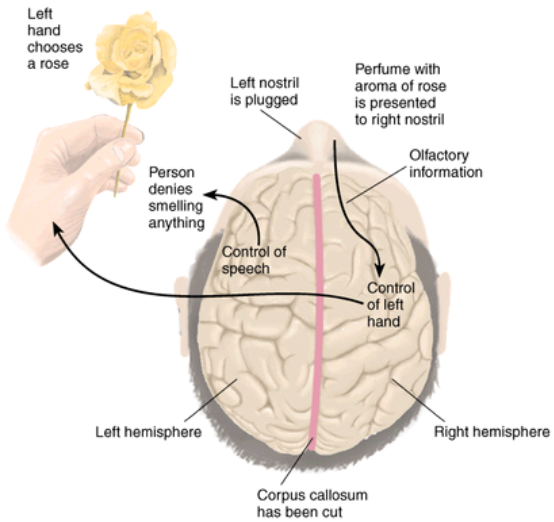
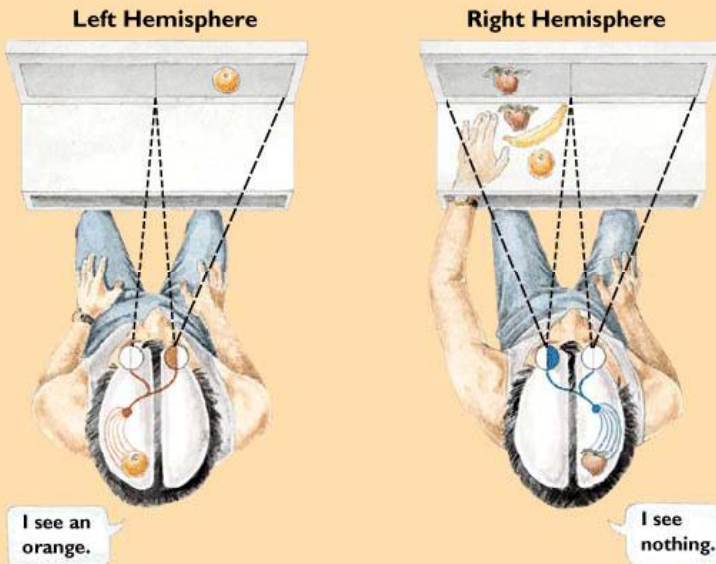
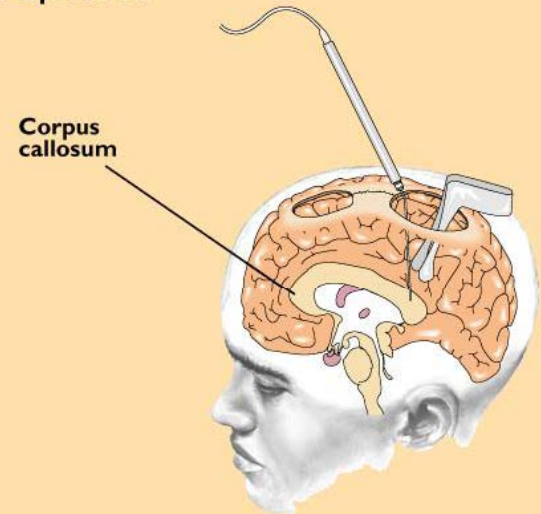


Figure 21.9
Demonstrating language comprehension in the right hemisphere. If a split-brain person sees a word in the left visual field, he will say he sees nothing. This is because the left hemisphere, which usually controls speech, did not see the word, and the right hemisphere, which saw the word, cannot speak. However, the left hand, which is controlled by the right hemisphere, can pick out the object corresponding to the word by touch alone.

Testing a Split-Brain



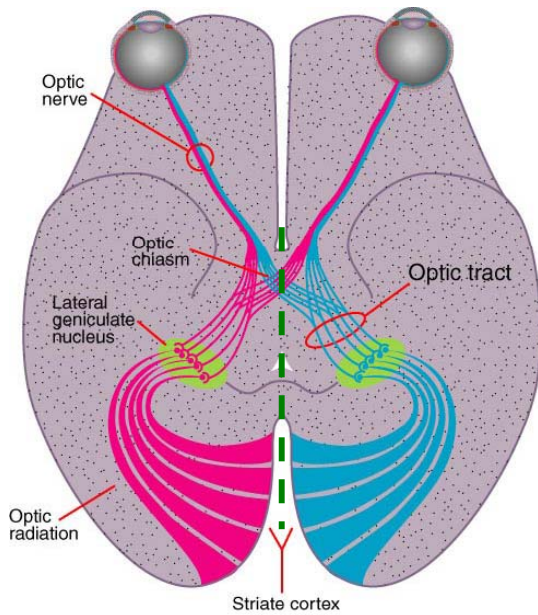
The Split-Brain Operation



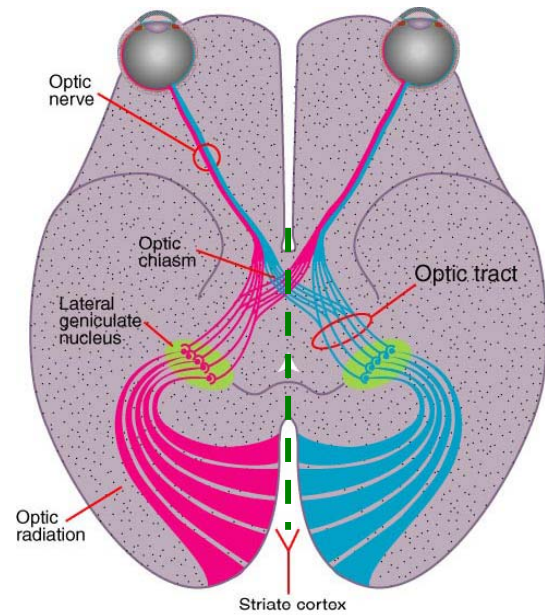
Source: Adapted from Gazzaniga, M. S. *Fundamentals of Psychology*. New York: Academic Press, 1973.



PORTACHIAVI



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Dice: mela
Afferra la mela

Dice: non ho
visto niente
Afferra la mela

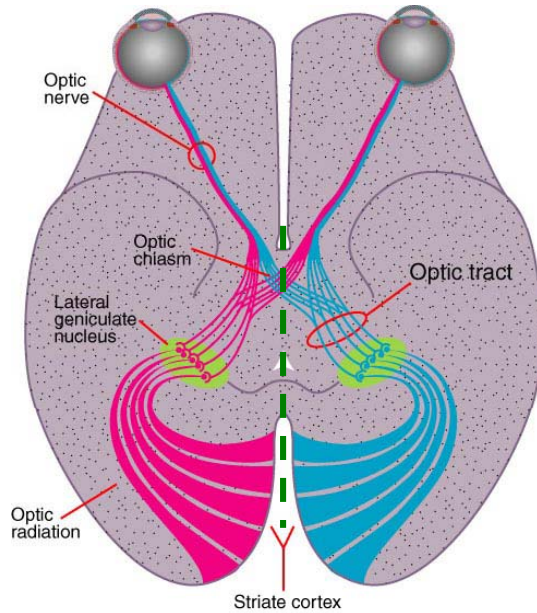
Dice: chiave
Afferra la chiave

Indica la porta

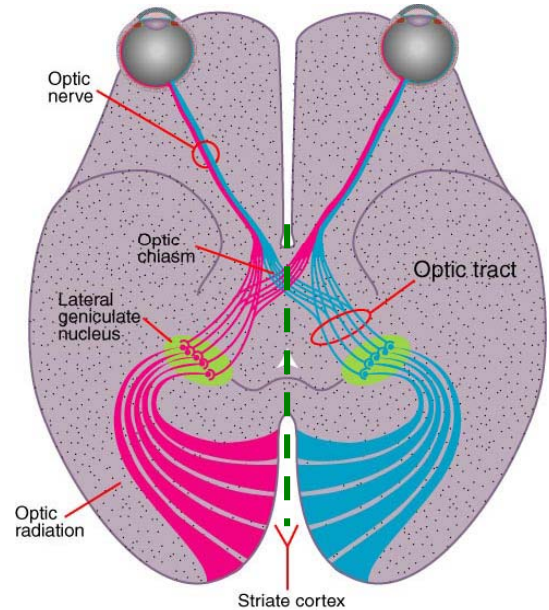
3



martello



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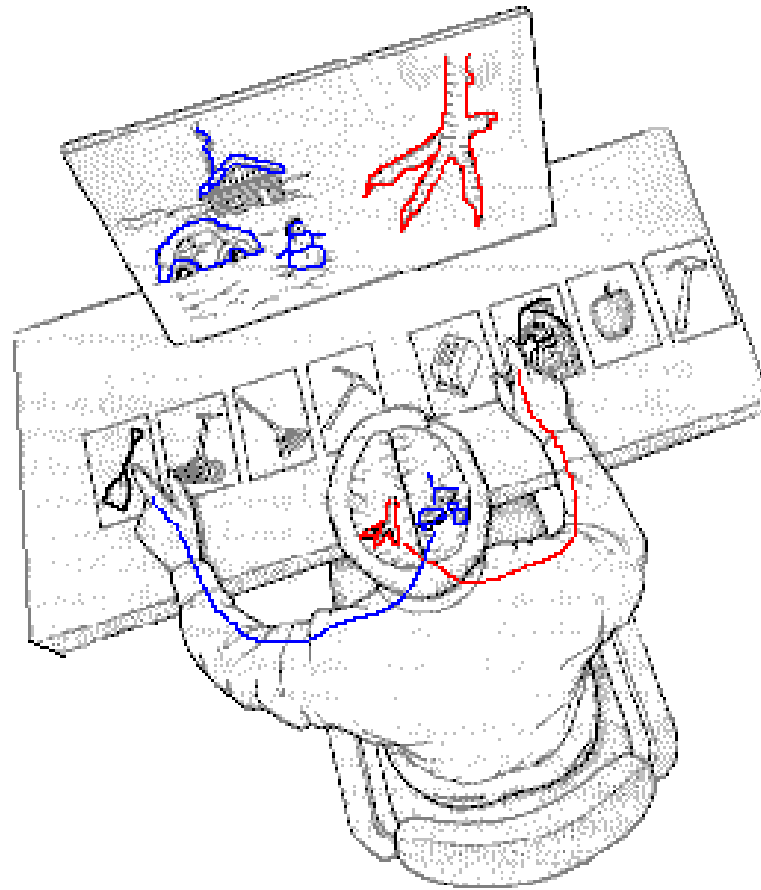


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Dice: pane
Afferra il pane

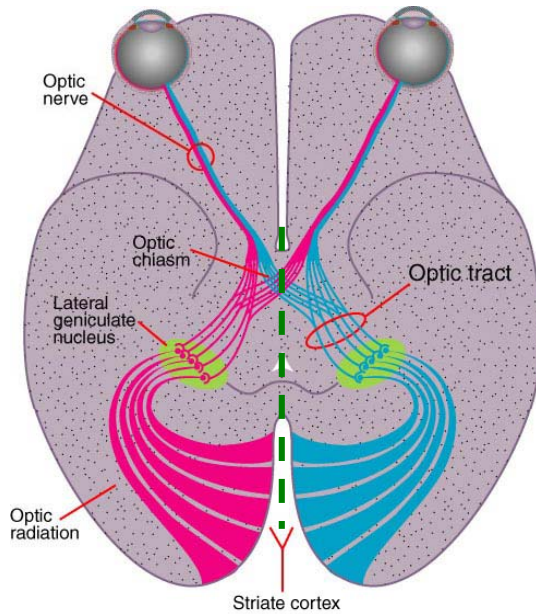
Dice: non ho
visto niente
Afferra 3 salsicce

Dice: non ho visto niente
Afferra il martello
Se gli si chiede “è un martello?”
annuisce con il capo
Se gli si chiede “fa rima con coltello?”
Non sa rispondere



When asked what images he saw on the screen, the patient responded, "I saw a claw and I picked the chicken, and you have to clean out the chicken shed with a shovel."

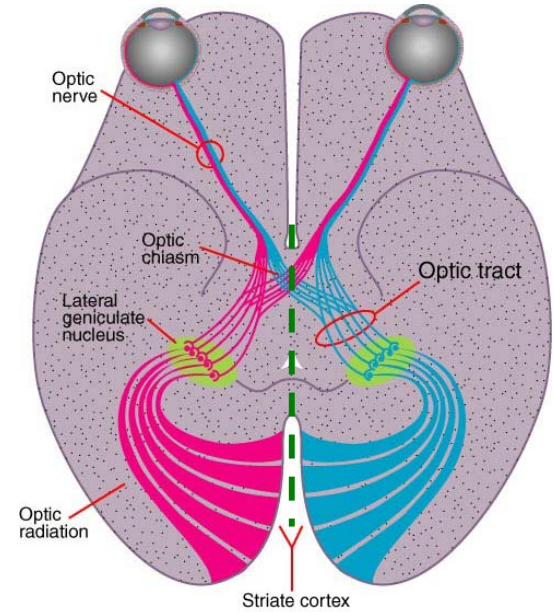
strofina



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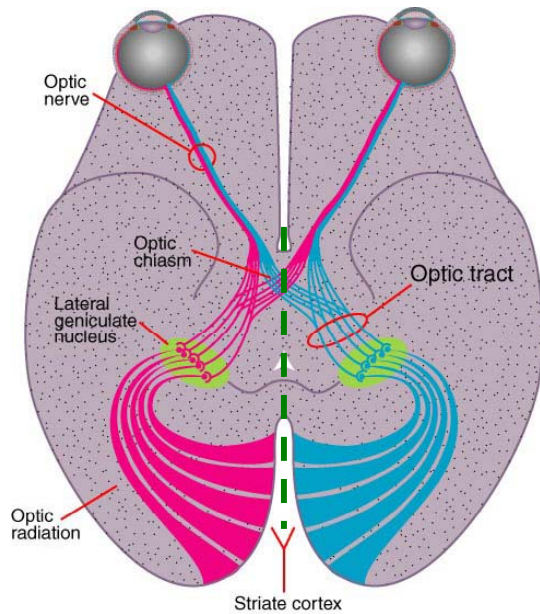
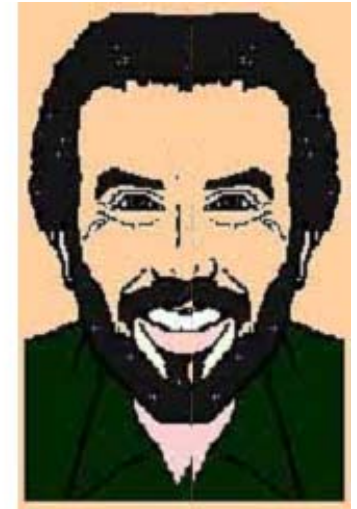
Strofina la mano dx con la sx
Dice: mi prude la mano

ridere



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Ride
Dice: voi siete davvero simpatici



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Riconosce preferenzialmente donna

Dice uomo
Indica uomo

Indica donna

Paul S
Aprassia callosale

LEFT BRAIN

RIGHT BRAIN

Speech: Using words to name, describe, define

Nonverbal imagery; minimal connection with words

Sounds: Interpret language sounds

Interpret non-language sounds, music

Math: Doing arithmetic

Doing geometry

Vision: Translating letters into sounds

Recognizing faces

Tasks: Figuring things out step-by-step; one part at a time

Putting things together to form wholes

Reading & writing

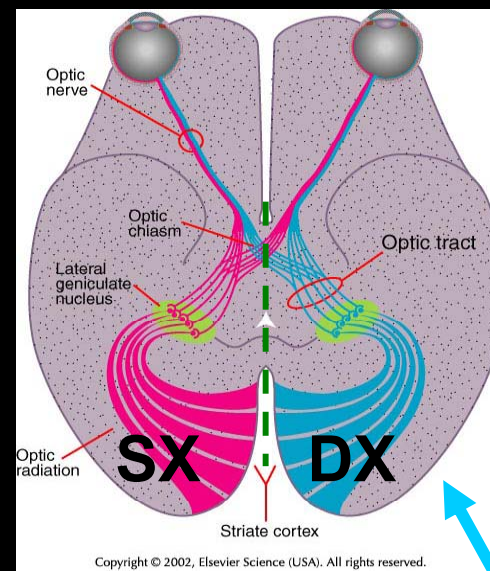
Sensing emotion and humor

Greek alphabet

800–600 Attic (400) Name

Α Α Α	Α	alpha
Β Β Β	Β	bēta
Γ Γ Γ	Γ	gamma
Δ Δ Δ	Δ	delta
Ε Ε Ε	Ε	e psilon
Ϝ ϝ Ϟ		(digamma)
Ζ Ζ Ζ	Ζ	zēta
Η Η Η	Η	ēta
Θ Θ Θ	Θ	thēta
Ι Ι Ι	Ι	iōta
Κ Κ Κ	Κ	kappa
Λ Λ Λ	Λ	lambda
Μ Μ Μ	Μ	mu
Ν Ν Ν	Ν	nu
Ξ Ξ Ξ	Ξ	ksi
Ο Ο Ο	Ο	o mikron
Ϟ ϟ Ϡ	Ϟ	pi
Ϻ		(san)
Ϙ ϙ Ϛ		(qoppa)
Ρ Ρ Ρ	Ρ	rhō
Σ Σ Σ	Σ	sigma
Τ Τ Τ	Τ	tau
Υ Υ Υ	Υ	u psilon
Φ Φ Φ	Φ	phi
Χ Χ Χ	Χ	chi
Ψ Ψ Ψ	Ψ	psi
Ω Ω Ω	Ω	ō mega

segni fonetici



ideogrammi

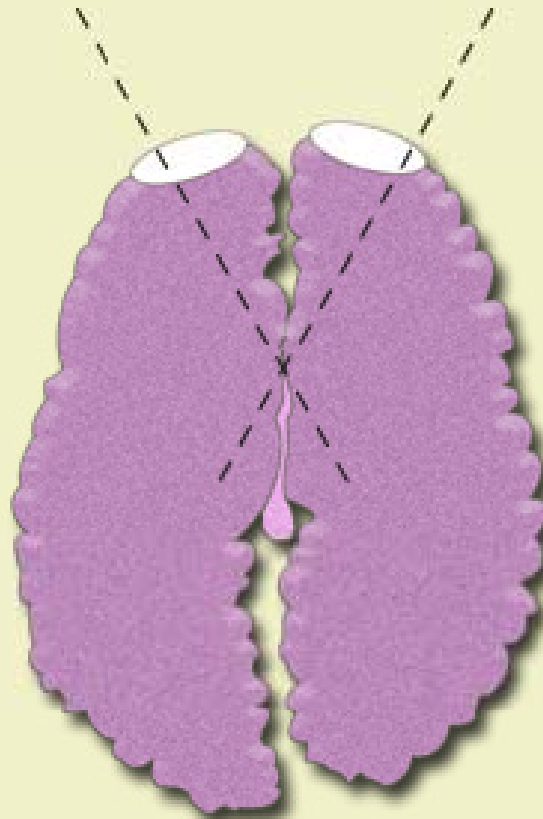




Hemisphere	Left	Right
Thinking	Abstract, linear, analytic	Concrete, holistic
Cognitive style	Rational, logical	Intuitive, artistic
Language	Rich vocabulary, good grammar and syntax; prose	no grammar, syntax; prosody, poor vocabulary metaphoric, verse
Executive capacity	Introspection, will, initiative, sense of self, focus on trees	Low sense of self, low initiative, focus on forest
Specialized functions	Reading, writing, arithmetic, sensory-motor skills; inhibits psi	Three i's, music, rich dream imagery, good face and gestalt recognition, open to psi
Time experience	Sequentially ordered, measured	"Lived" time, primitive time sense
Spatial orientation	Relatively poor	Superior, also for shapes, wire figures
Psychoanalytic aspects	Secondary process, ego functions, consciousness; superego?	Primary process, dream-work, free assoc. hallucinations?
Ideal prototype	Aristotle, Apollonian mode, Marx, Freud, Koestler's Commissar	Plato, Dionysian mode, Nietzsche, Jung Koestler's Yogi

LEFT/RIGHT BRAIN	Males	Females	LEFT/RIGHT BRAIN
Left	Mathematic Ability	Reading Ability	Left
Left	Mechanical Aptitude	Foreign Lang. Mastery	Left
Left	Uses Probing Questions	Verbal Ability	Left
Left	More Analytic	Intuitive Superiority	Right
Left	More Linear Thinker	Uses Evocative Questions	Right
Left	Understanding of Facts	Sees Globally/Holistically	Right
Left	Approach to Creativity likely to be Technical or hardware oriented	Approach to Creativity likely to be intuitive and Relational	Right
Right	Abstract Relations	More Contextual	Right
Right	Better at Problem Solutions	Better at Problem Understanding	Right
Right	Spatial Ability	More understanding of Process	Right
Right	Forming Task Teams	Forming Groups	Right

DOMINANT (*left side*)
verbal
logical
sequential
"computer-like"
analyzes
marks time
plans step-by-step
deals with foreground,
rationale,
"scientific" aspects



NON DOMINANT (*right side*)
non-verbal
images
feels
subjective thinking
symbols
sees patterns
combines ideas
is wholistic
spatial
here-and-now
metaphorical
intuitive
artistic
somatic
more musical
more sexual
responds to the unknown
gestures
makes visual closure
dreams

YOUR BRAIN'S SPLIT PERSONALITY