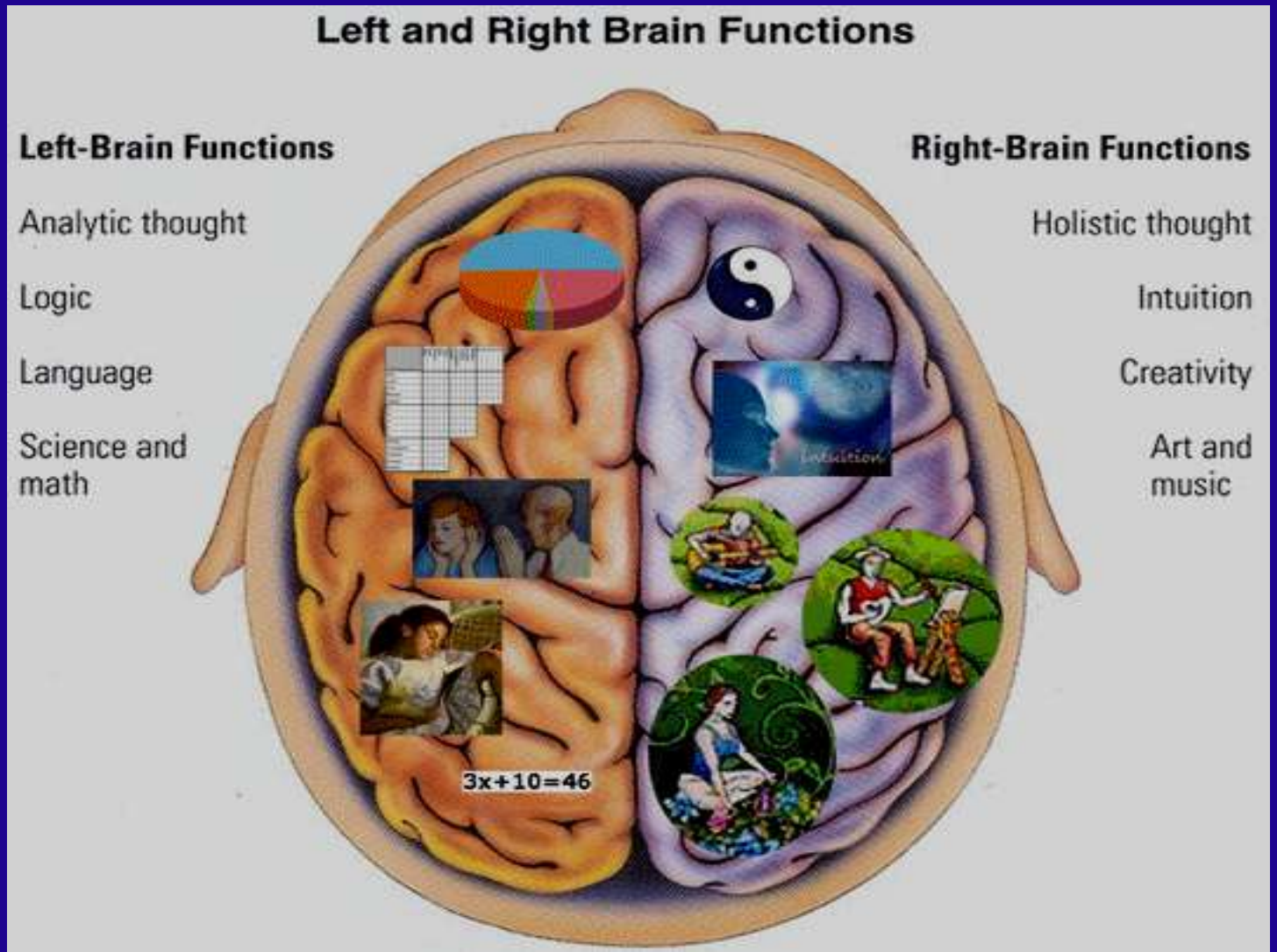
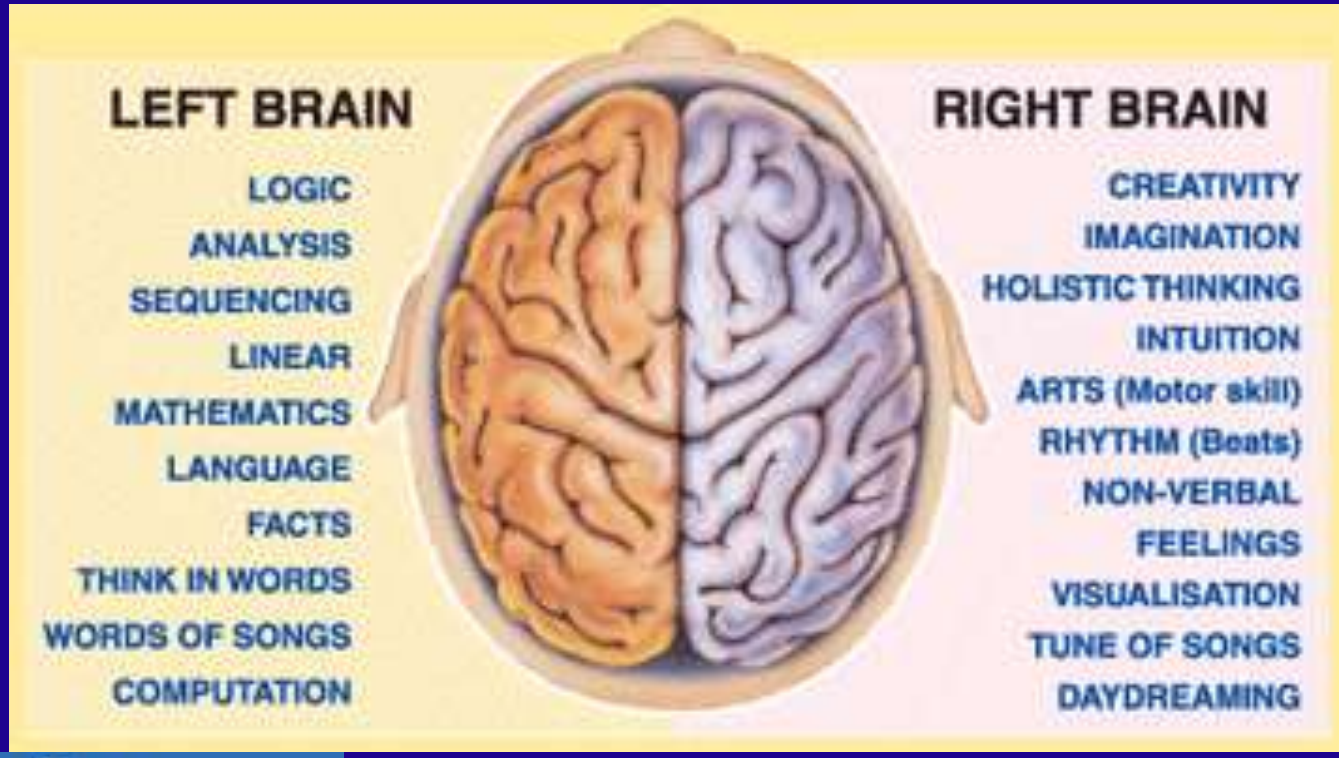
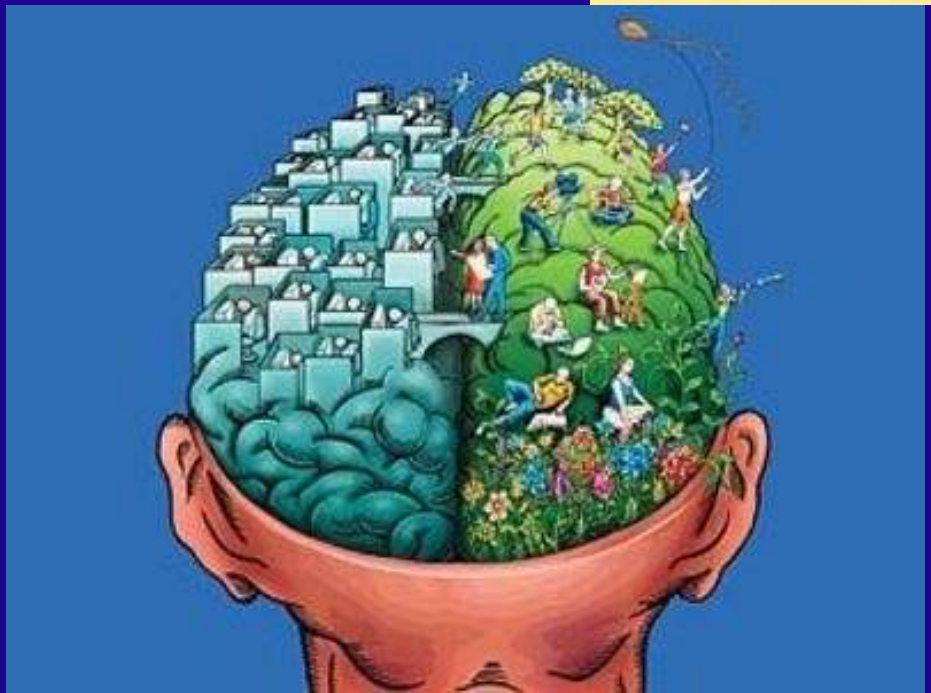
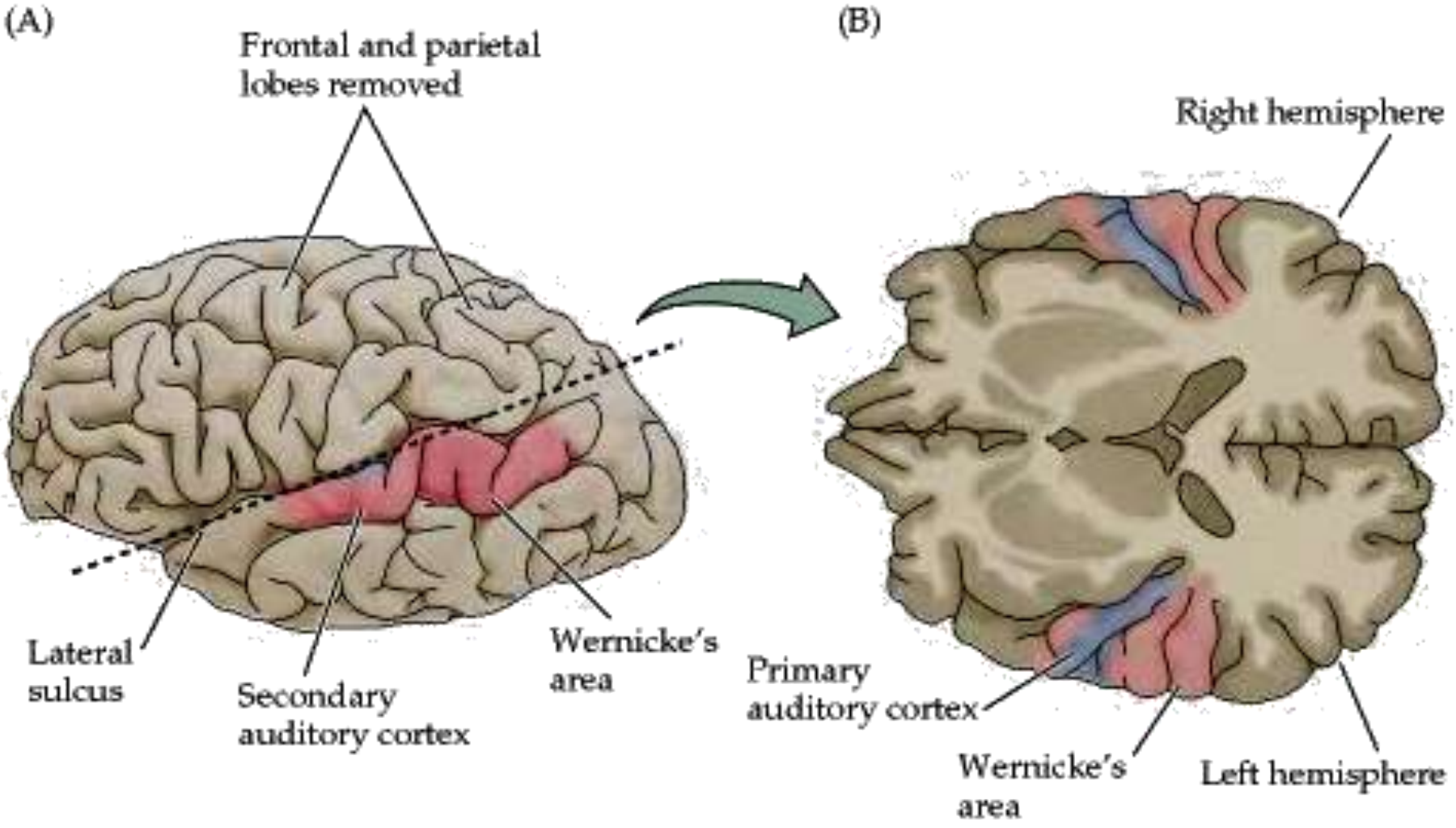
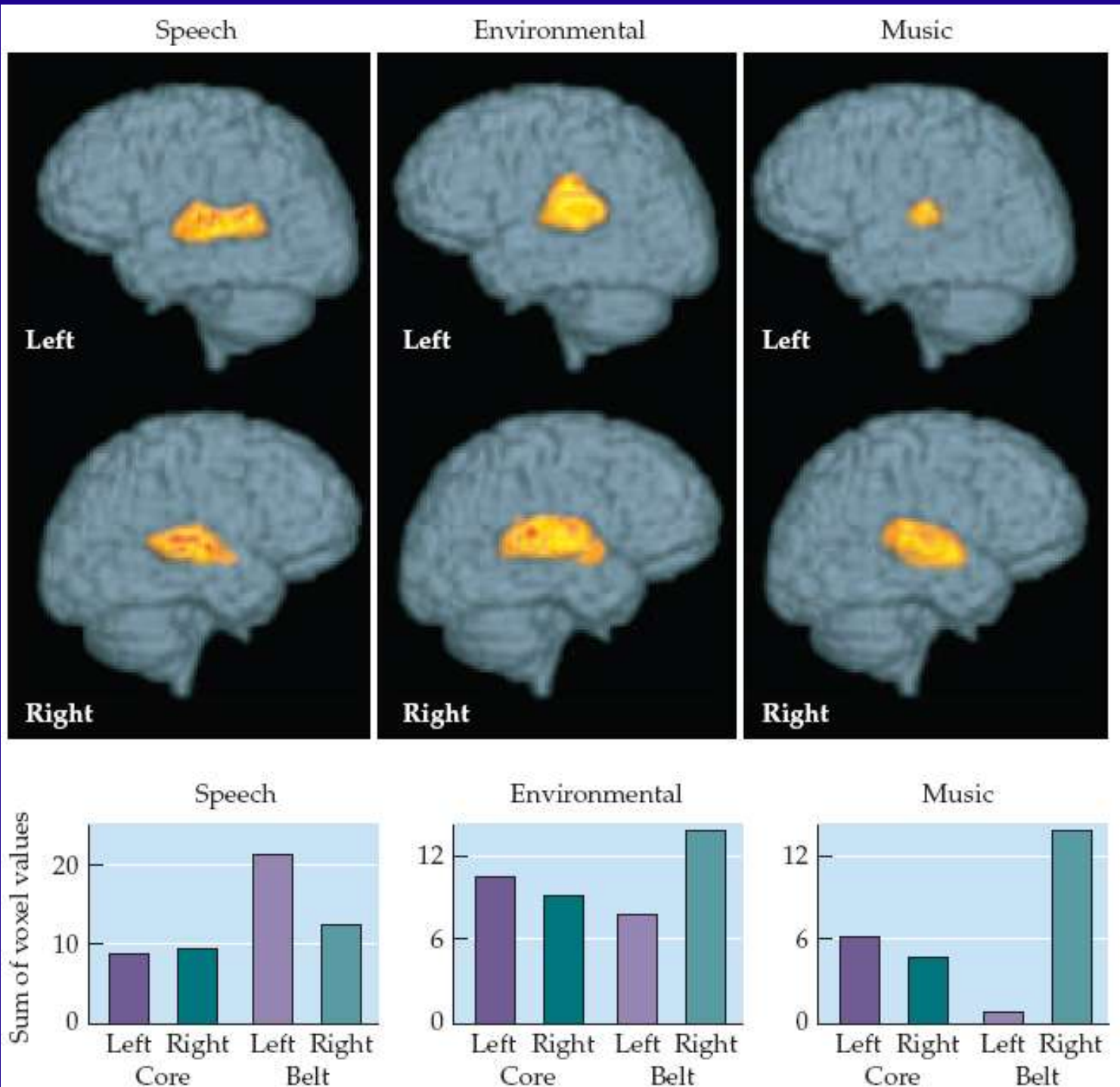
Brain and higher cortical functions




LEFT BRAIN
LOGIC
ANALYSIS
SEQUENCING
LINEAR
MATHEMATICS
LANGUAGE
FACTS
THINK IN WORDS
WORDS OF SONGS
COMPUTATION
RIGHT BRAIN
CREATIVITY
IMAGINATION
HOLISTIC THINKING
INTUITION
ARTS (Motor skill)
RHYTHM (Beats)
NON-VERBAL
FEELINGS
VISUALISATION
TUNE OF SONGS
DAYDREAMING

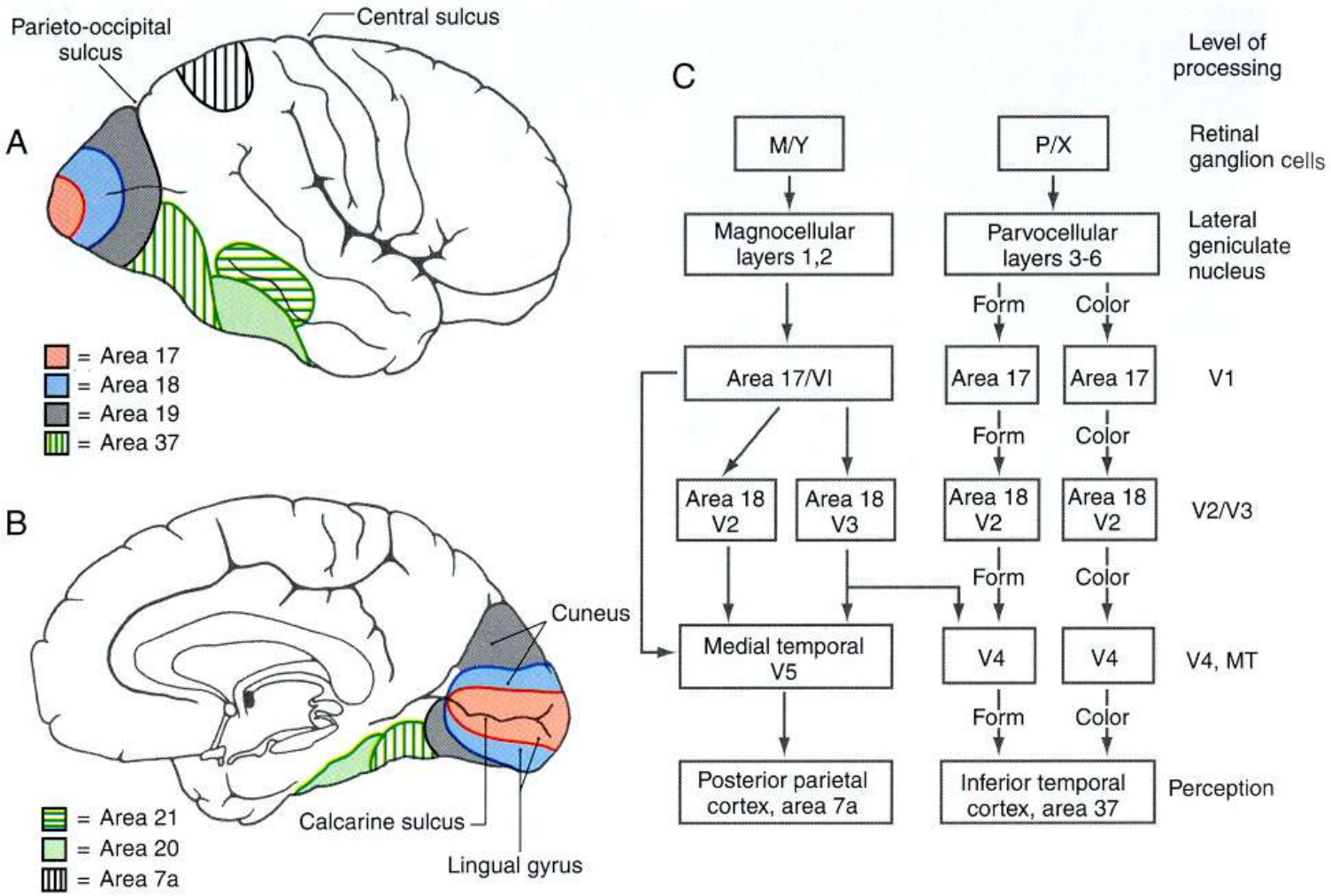



(A)
Frontal and parietal lobes removed
Lateral sulcus
Secondary auditory cortex
Wernicke's area
(B)
Right hemisphere
Primary auditory cortex
Wernicke's area
Left hemisphere

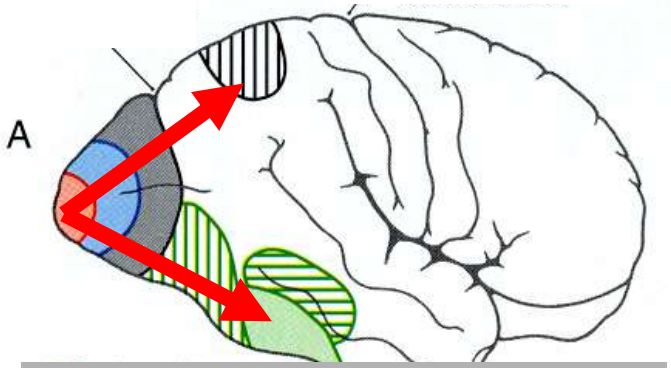

Speech
Environmental
Music
Left
Right
Left
Right
Left
Right
Speech
Environmental
Music
Sum of voxel values
20
10
0
12
6
0
12
6
0
Left Right Left Right
Core Belt
Left Right Left Right
Core Belt
Left Right Left Right
Core Belt

Cortical processing

- Parallel
- Continues

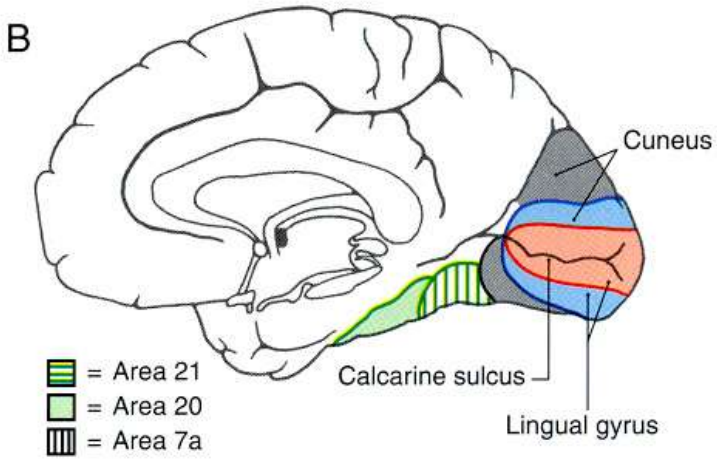

A
Parieto-occipital sulcus
Central sulcus
= Area 17
= Area 18
= Area 19
= Area 37
B
Cuneus
= Area 21
= Area 20
= Area 7a
Calcarine sulcus
Lingual gyrus
C
Level of processing
M/Y
P/X
Retinal ganglion cells
Magnocellular layers 1,2
Parvocellular layers 3-6
Lateral geniculate nucleus
Form
Color
Area 17/VI
Area 17
Area 17
V1
Area 18 V2
Area 18 V3
Area 18 V2
Area 18 V2
V2/V3
Medial temporal V5
V4
V4
V4, MT
Posterior parietal cortex, area 7a
Inferior temporal cortex, area 37
Perception

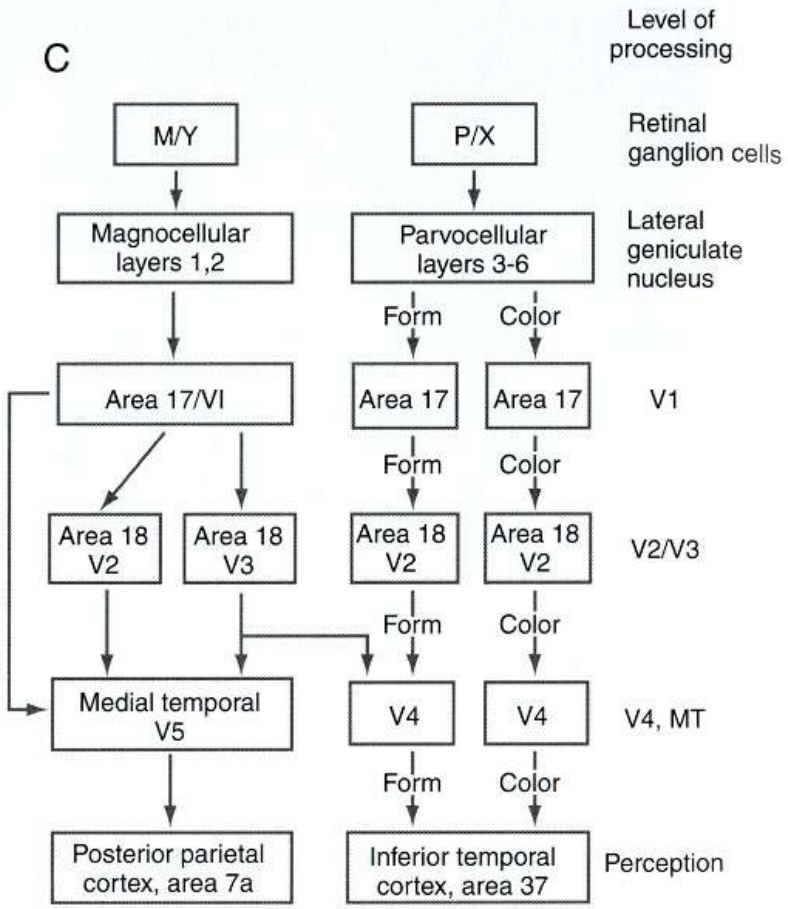
Dorsal "Where" pathway



Ventral "What" pathway

= Area 37

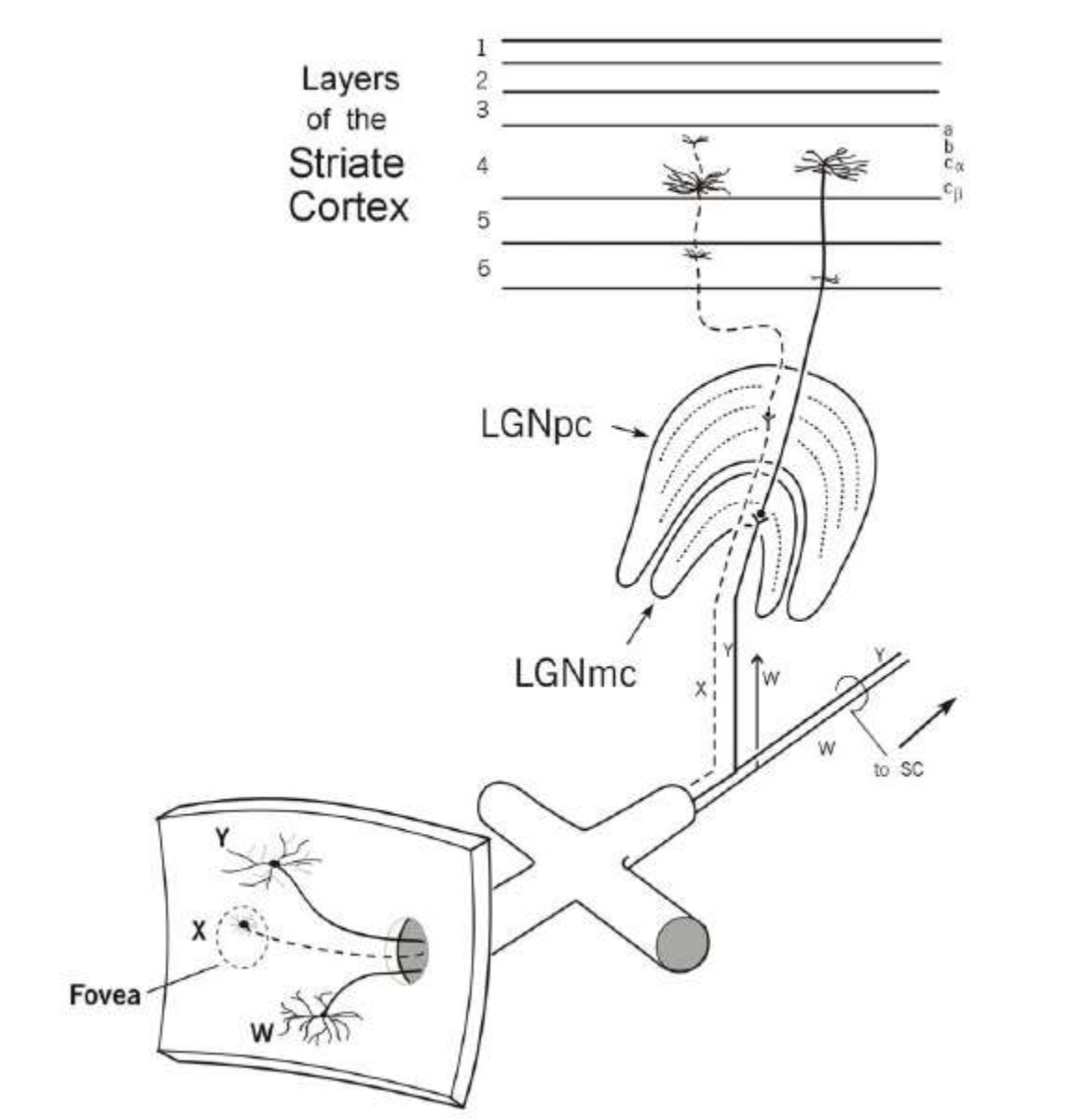


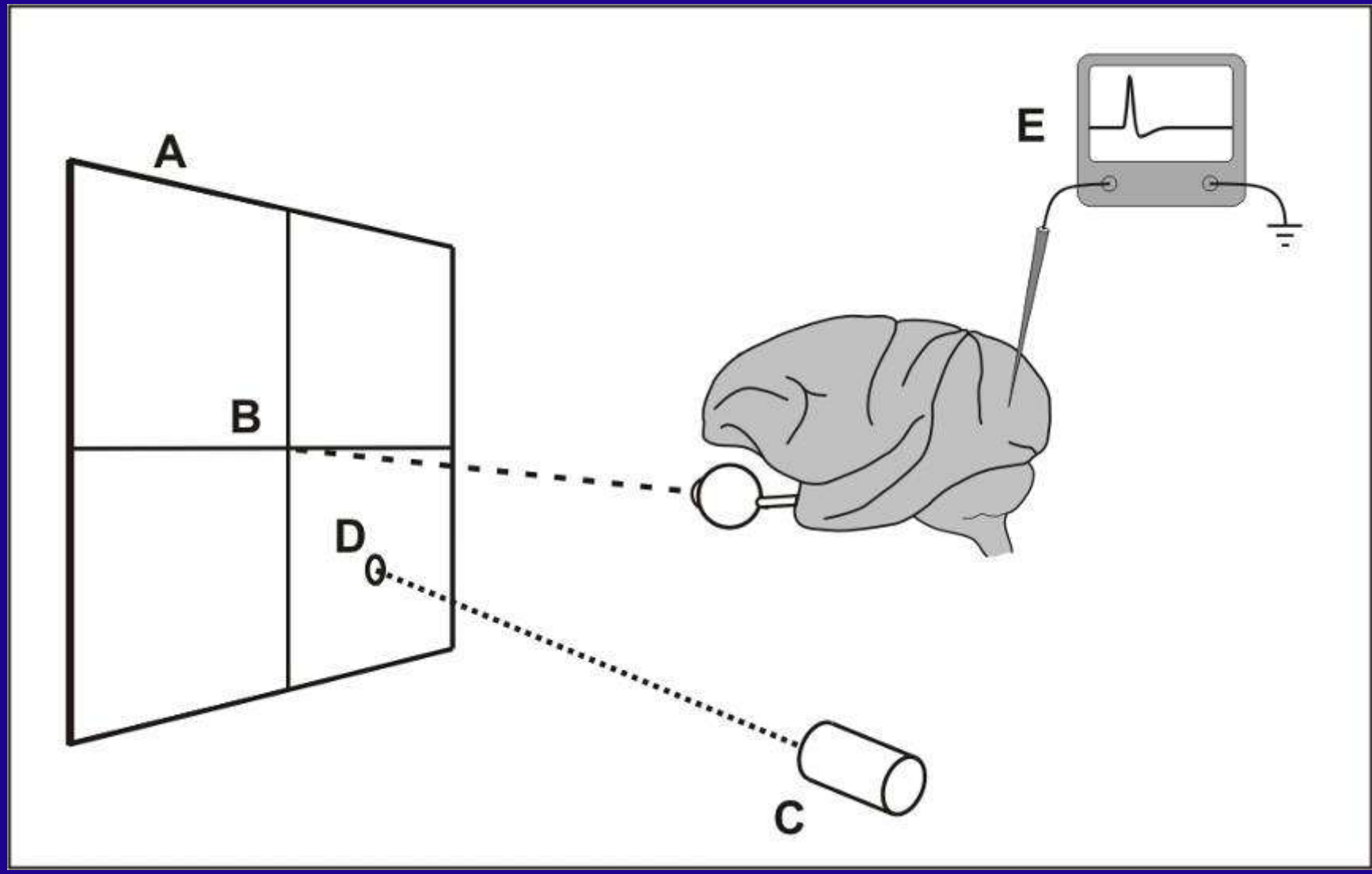


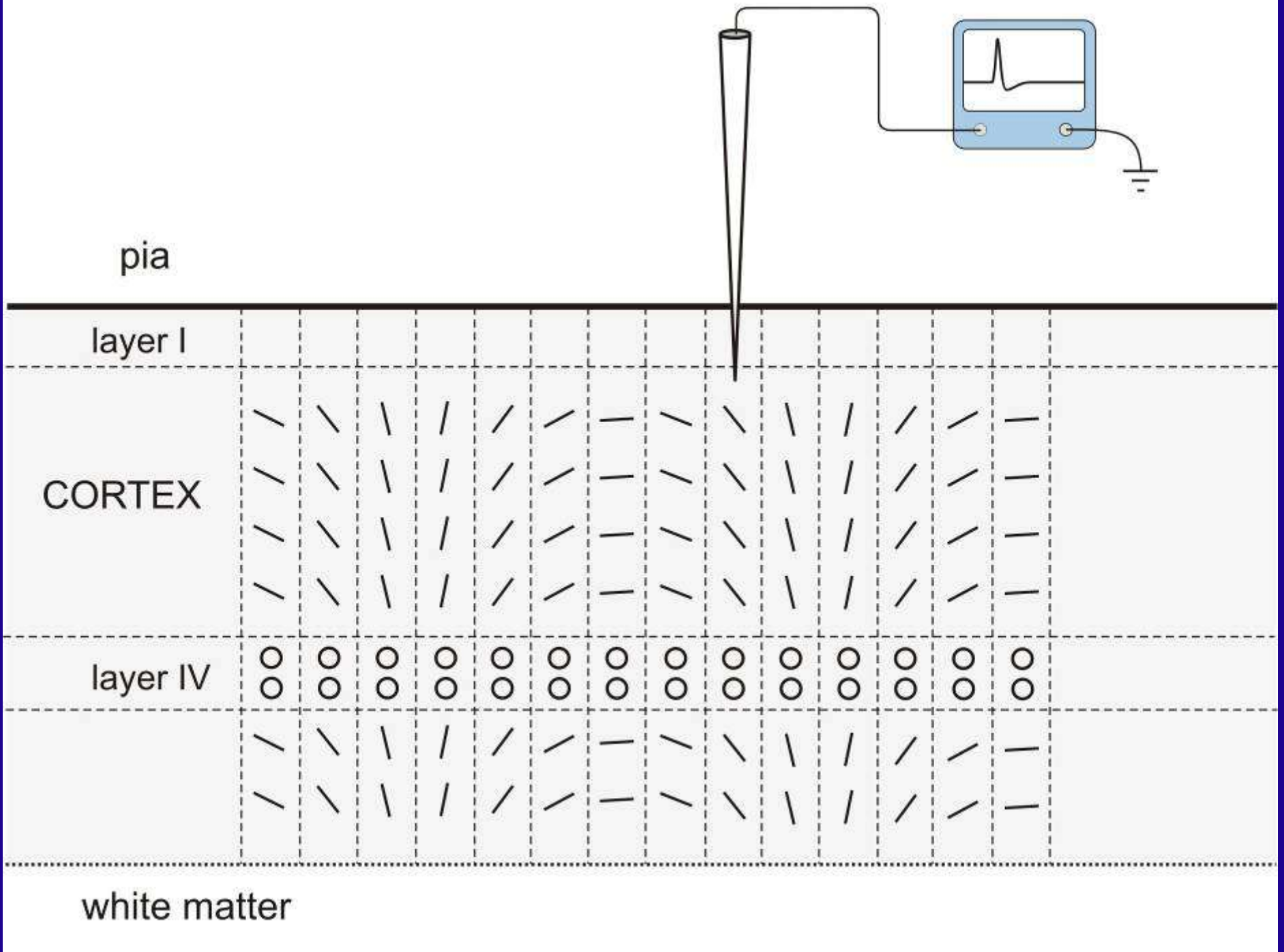
Cortical processing

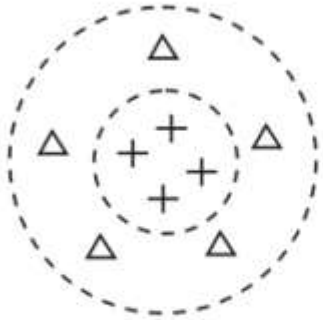
Visual processing as example

Primary visual cortex

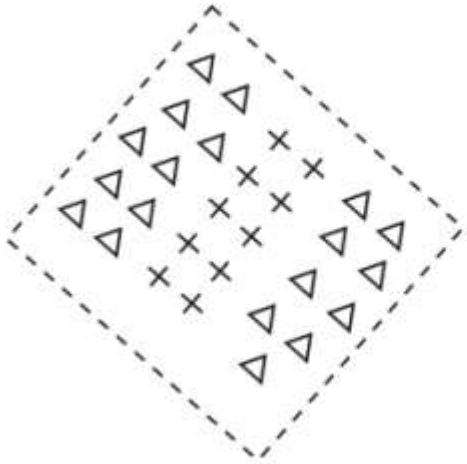


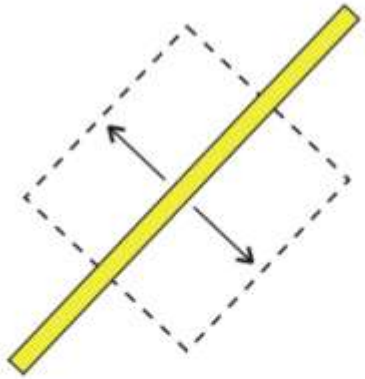

A
B
D
E
C

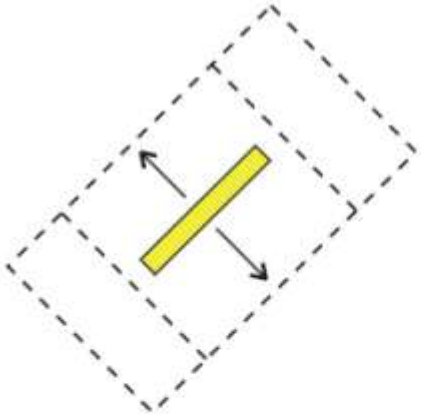

pia
layer I
CORTEX
layer IV
white matter



+ = "on" response
△ = "off" response

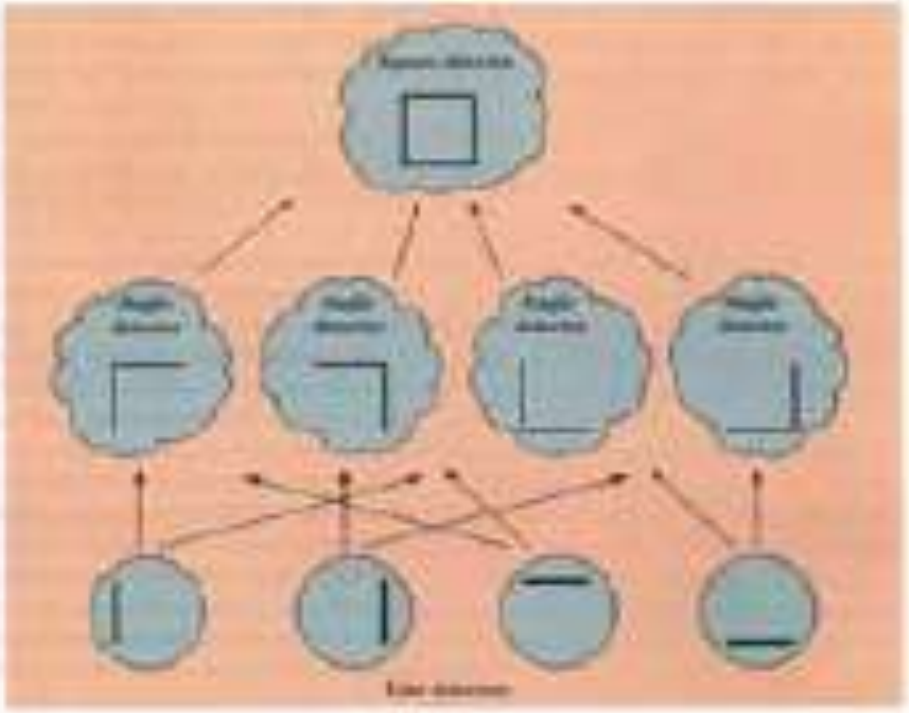


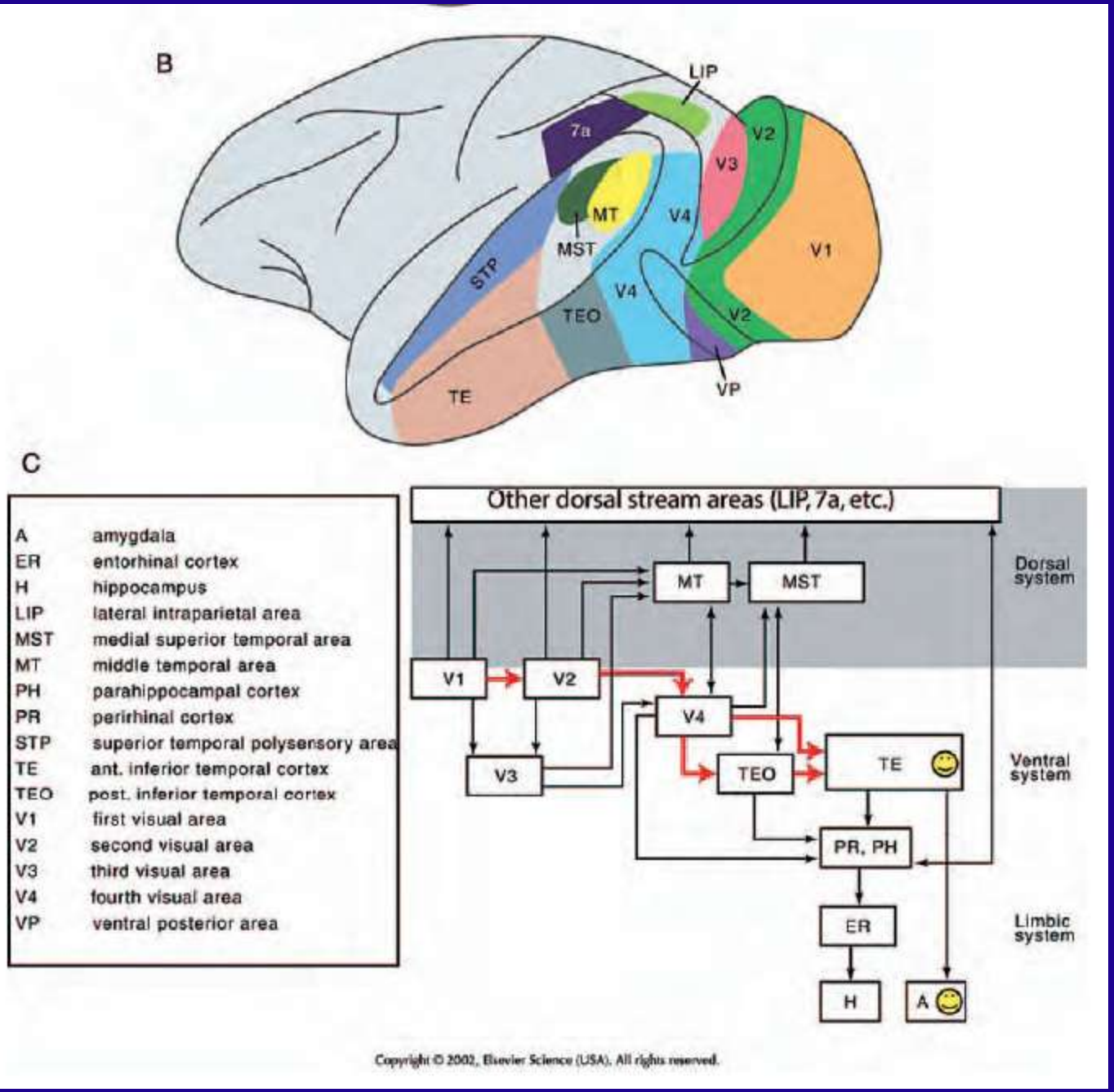


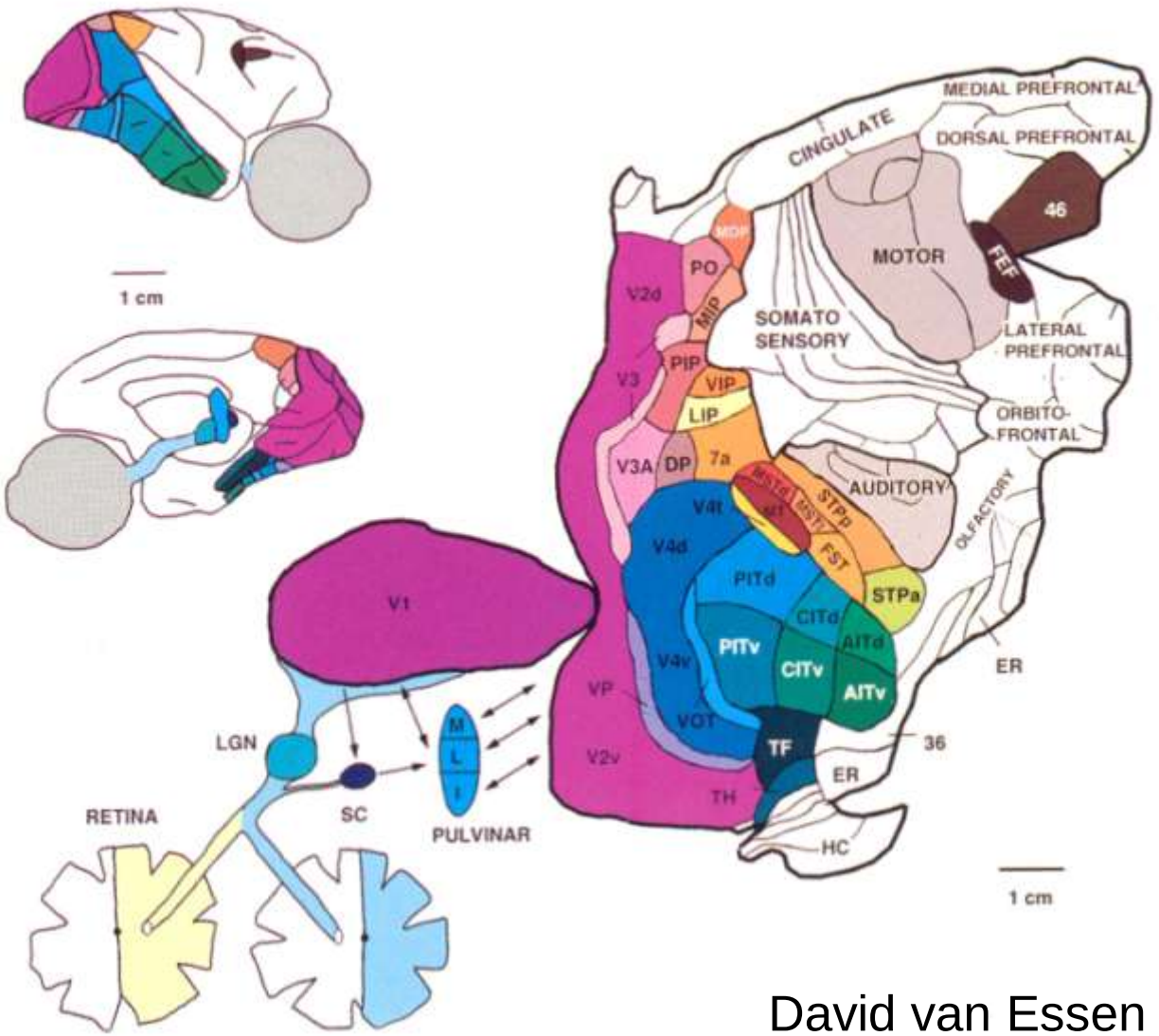


Visual Image Decomposition

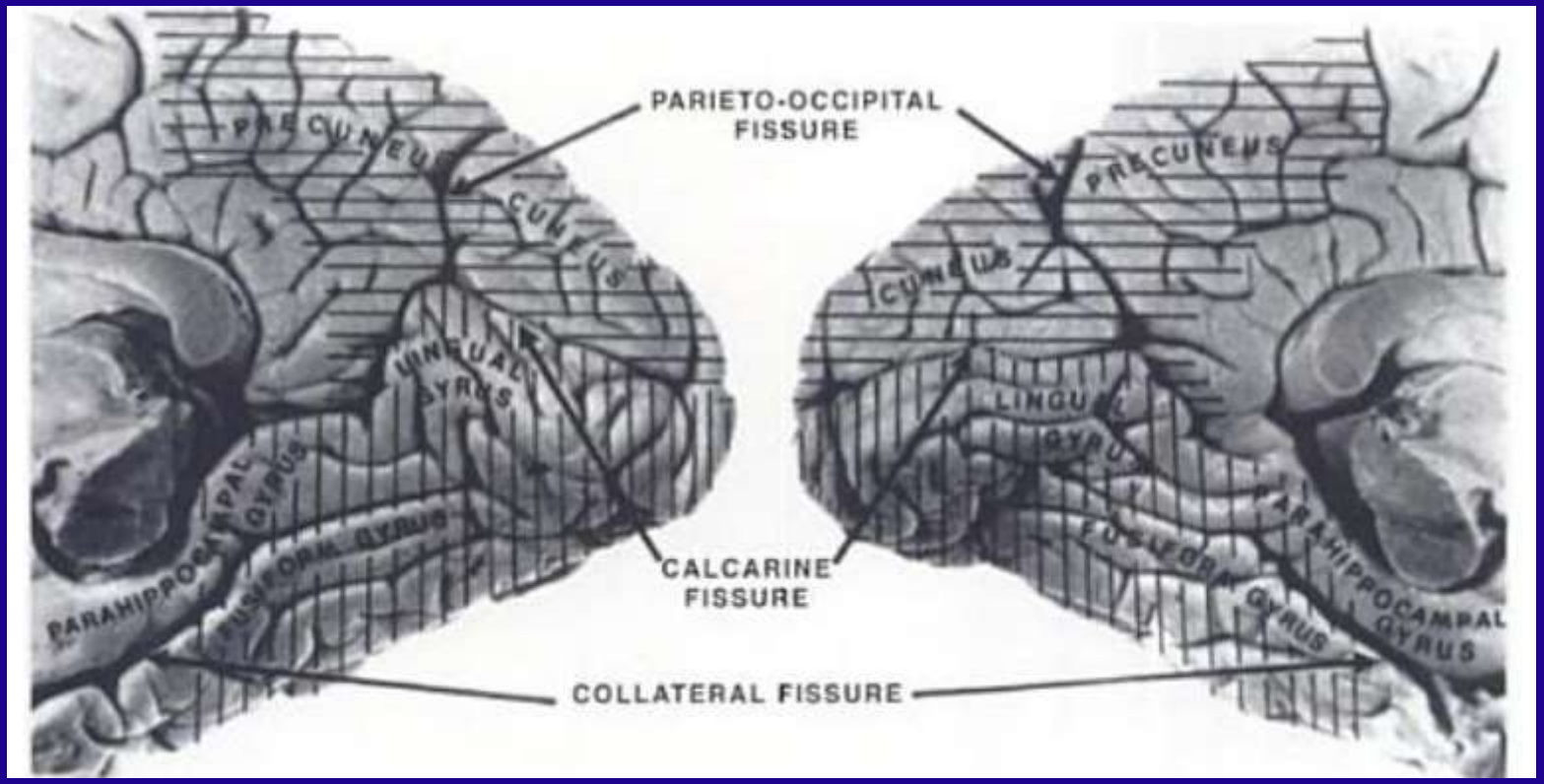
Simple, complex and hypercomplex cells can work together to decompose the outlines of a visual image into short segments, the basis of simple and complex object recognition.

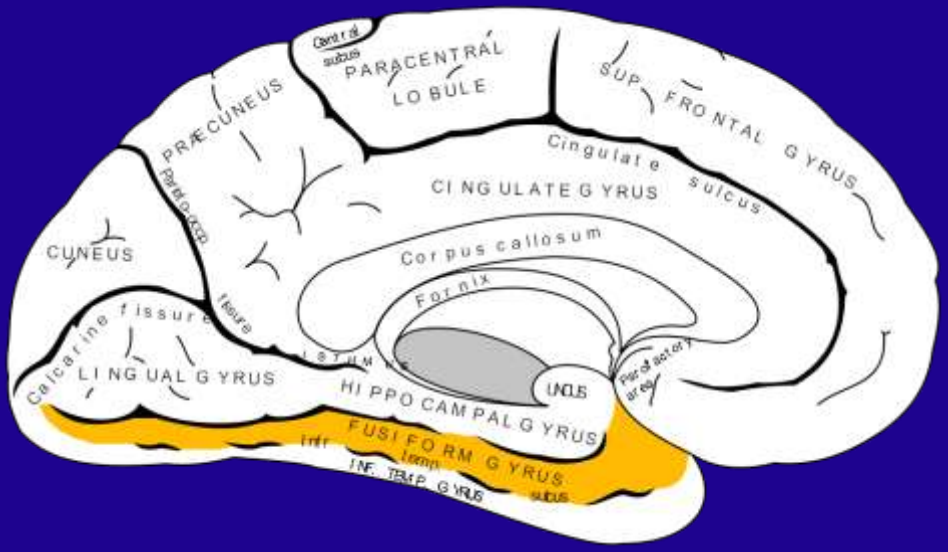


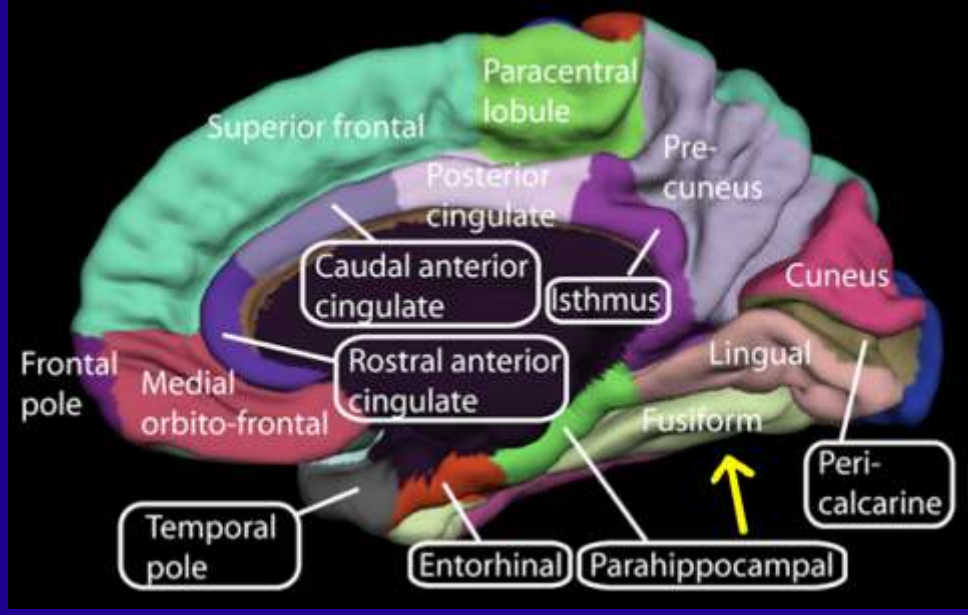


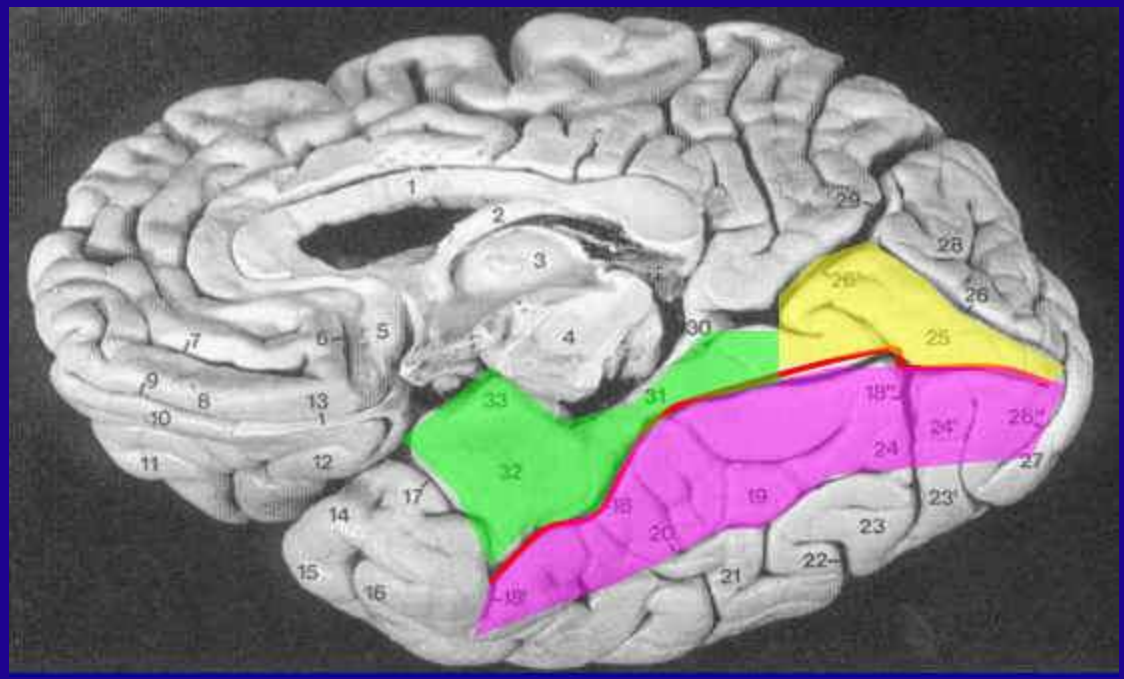


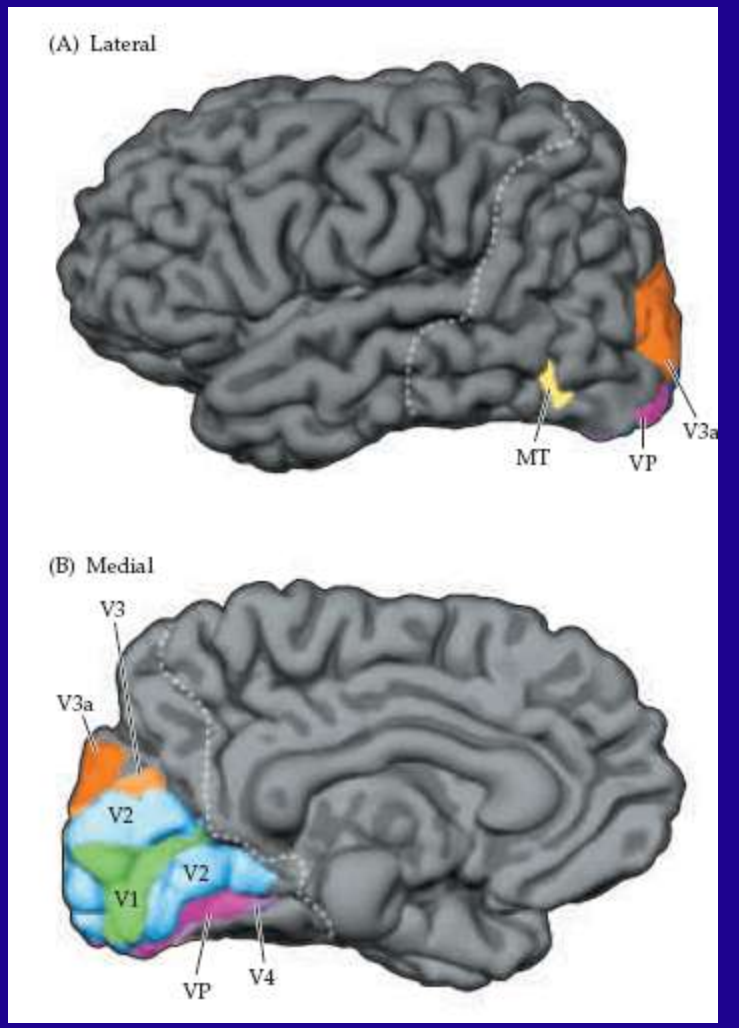
David van Essen

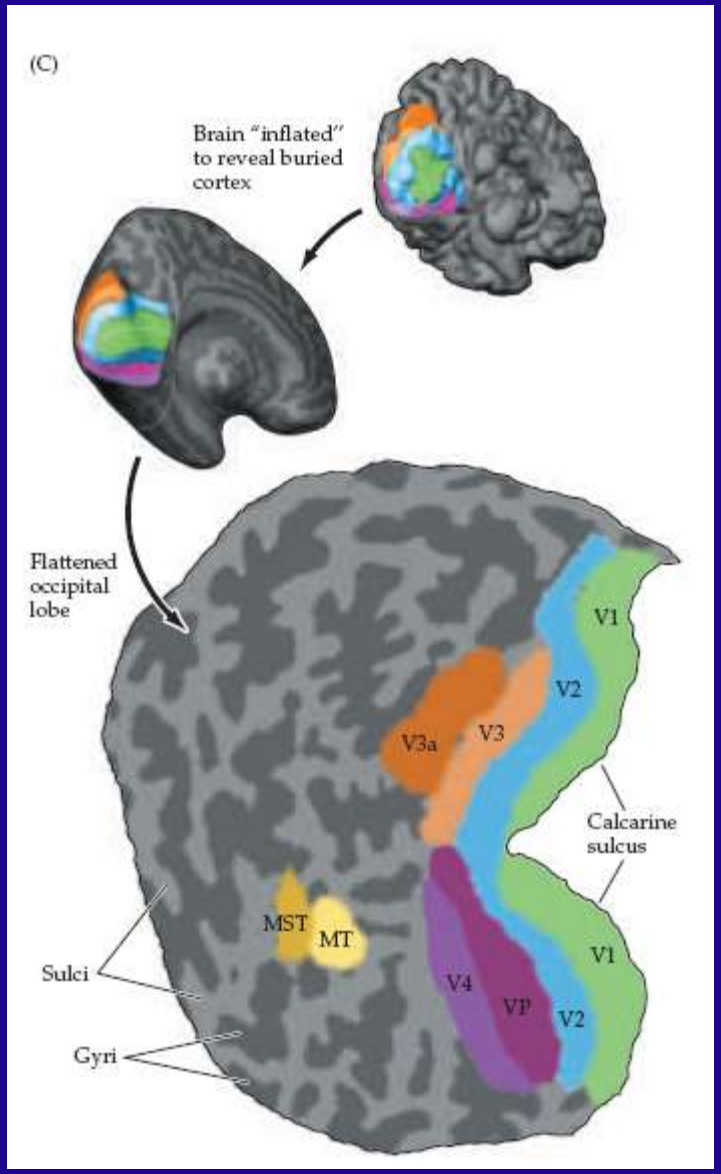

PARIETO-OCCIPITAL FISSURE
PRECUNEUS
CUNEUS
LINGUAL GYRUS
PARAHIPPOCAMPAL GYRUS
FUSIFORM GYRUS
CALCARINE FISSURE
COLLATERAL FISSURE

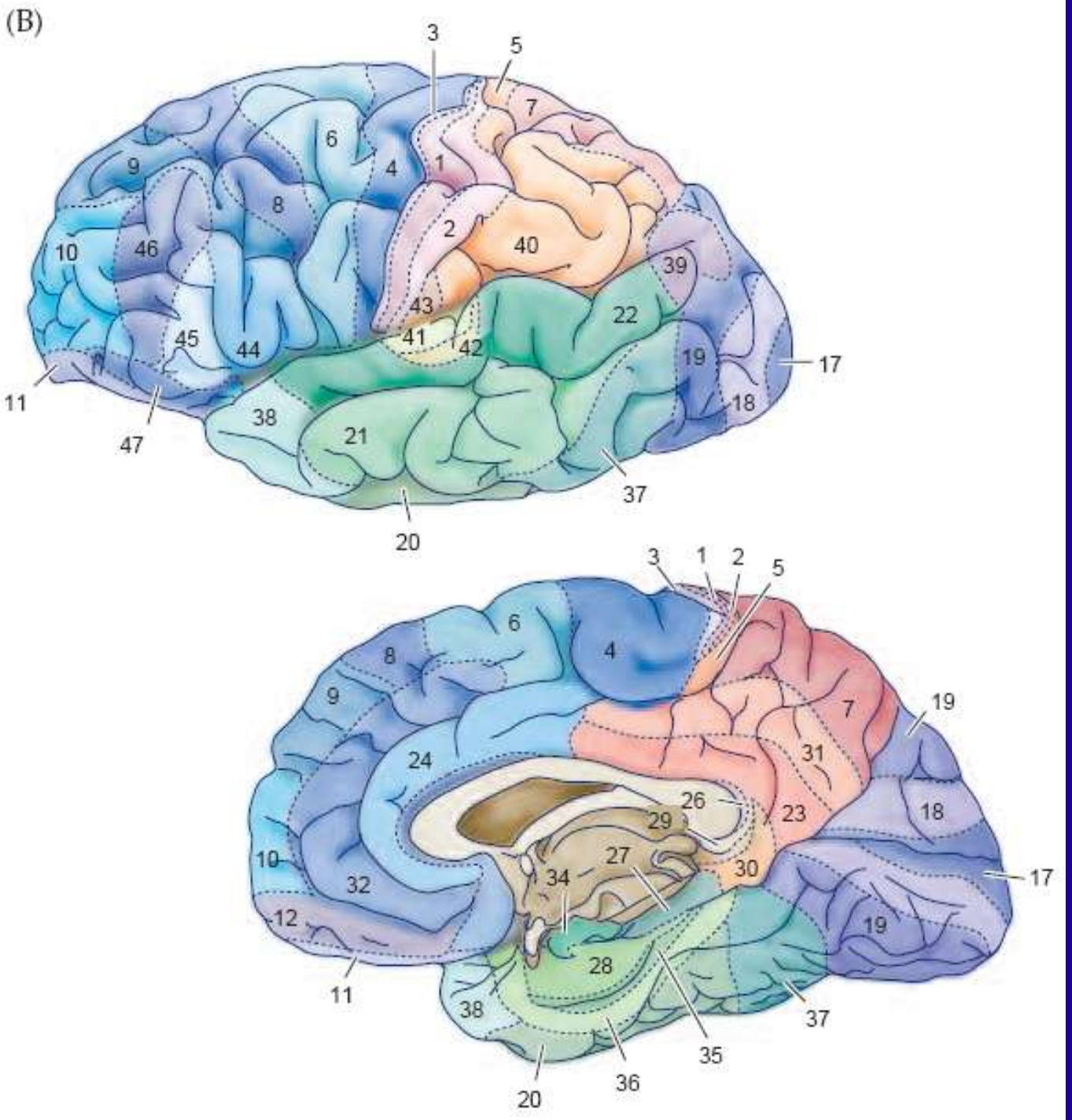

PARACENTRAL LOBULE
SUP. FRONTAL GYRUS
PRÆCUNEUS
Cingulate sulcus
CINGULATE GYRUS
CUNEUS
Corpus callosum
Fornix
LINGUAL GYRUS
HIPPOCAMPAL GYRUS
FUSIFORM GYRUS


Paracentral lobule
Superior frontal
Pre-cuneus
Posterior cingulate
Caudal anterior cingulate
Isthmus
Cuneus
Frontal pole
Medial orbito-frontal
Rostral anterior cingulate
Lingual
Fusiform
Peri-calcarine
Temporal pole
Entorhinal
Parahippocampal




(A) Lateral
MT
VP
V3a
(B) Medial
V3
V3a
V2
V2
V1
VP
V4


(C)
Brain "inflated" to reveal buried cortex
Flattened occipital lobe
V1
V2
V3a
V3
Calcarine sulcus
MST
MT
Sulci
V4
VP
V1
V2
Gyri

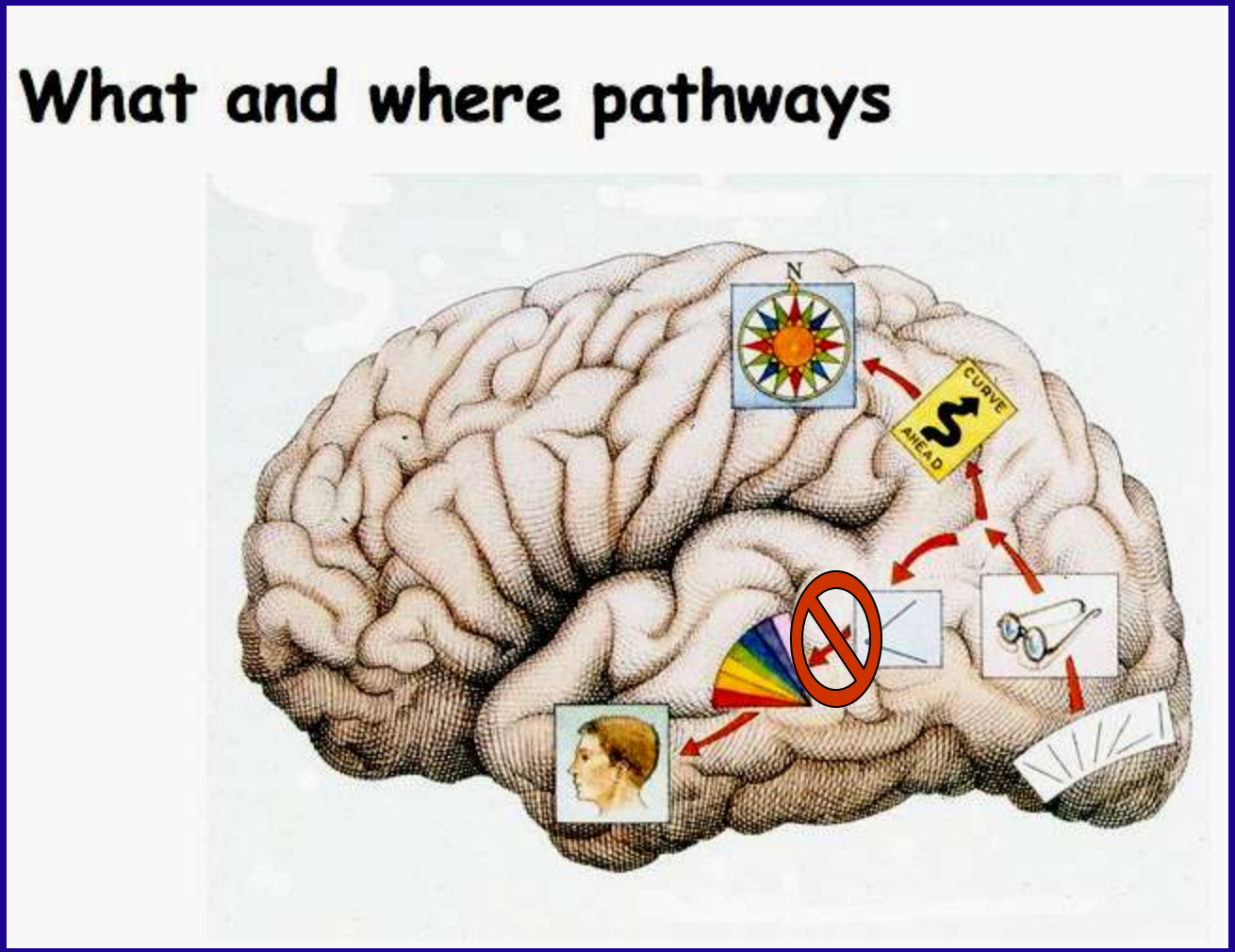

(B)
3
5
7
6
9
4
1
8
2
40
10
46
39
43
22
45
41
42
44
19
17
11
18
38
47
21
37
20
3
1
2
5
6
8
4
9
7
19
24
31
26
23
18
29
10
27
30
34
17
32
12
19
28
11
38
37
35
36
20

Visual processing of information

Damage to V1

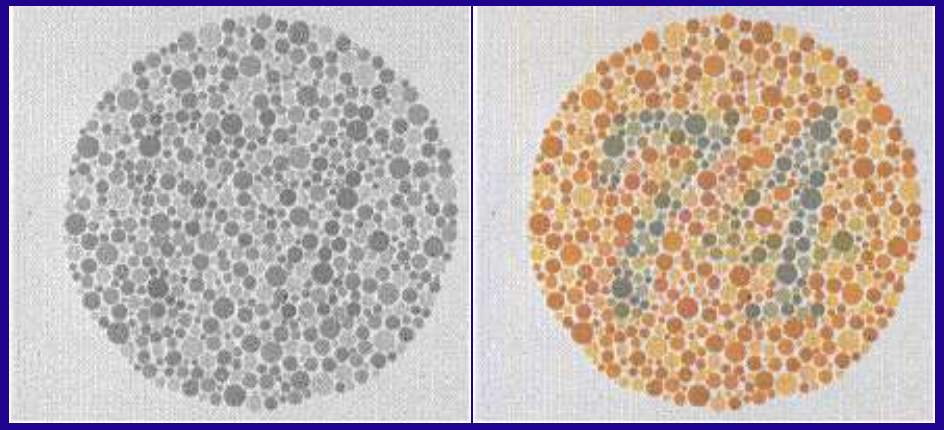
- Blindsight
- Visual hallucination

Damage to “What” pathway



Achromatopsia, agnosia

Achromatopsia



- **Complete achromatopsia-** BL area V4: Lingual/fusiform gyri/occipitotemporal junction

Color agnosia

- **Color agnosia**: loss the ability to retrieve color knowledge
- cannot name colors for objects but can sort
- Cant /Remembering the color of object “even by none verbal way” , like painting pumpkin orange or apple red
- Cant /Color composition

Left or bilateral occipitotemporal region Inferior temporal , fusiform and right lingual

Color anomia

- Inability to name colors or to point to colors given their names, which is not due to aphasia or due to defective color perception

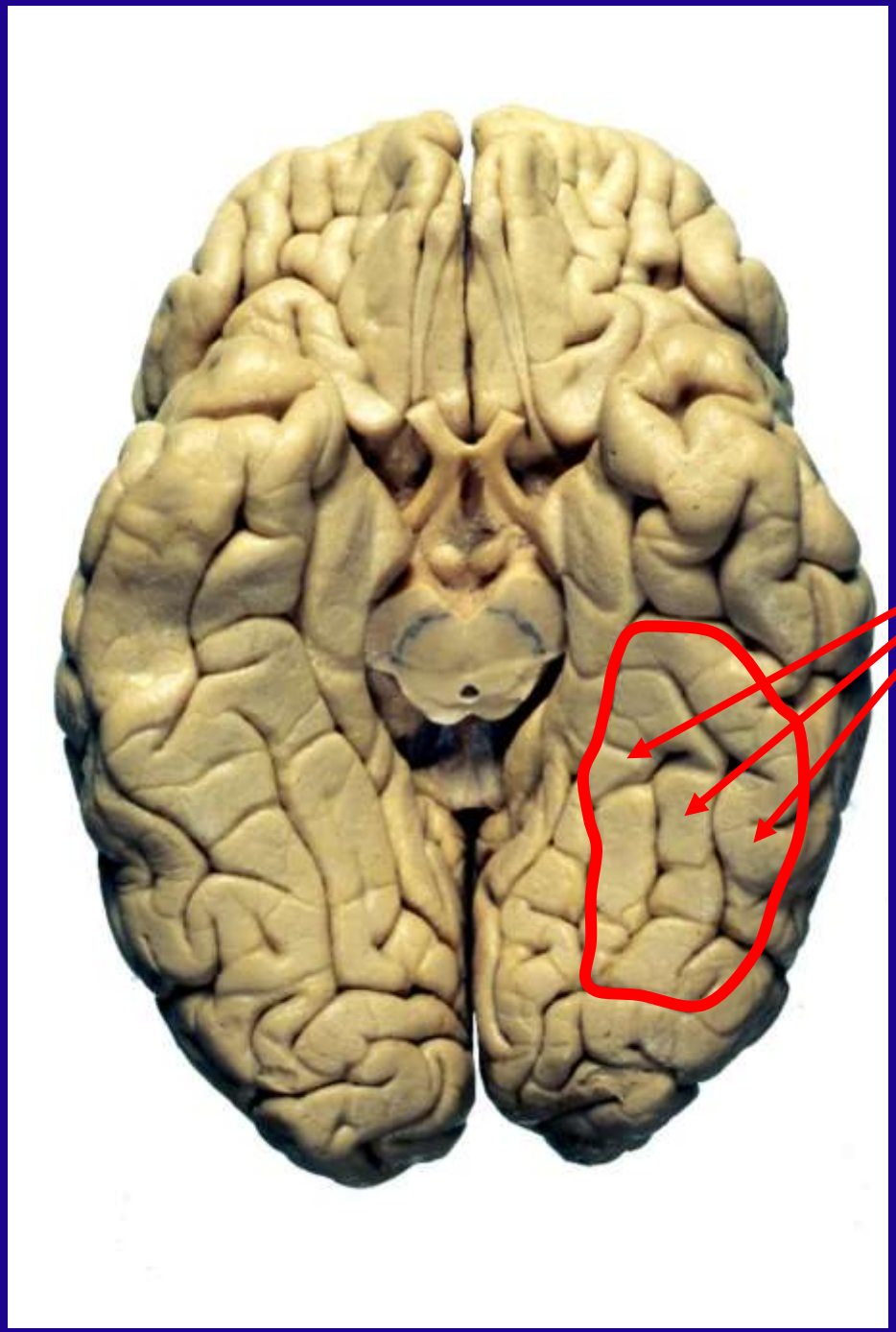
Color anomia

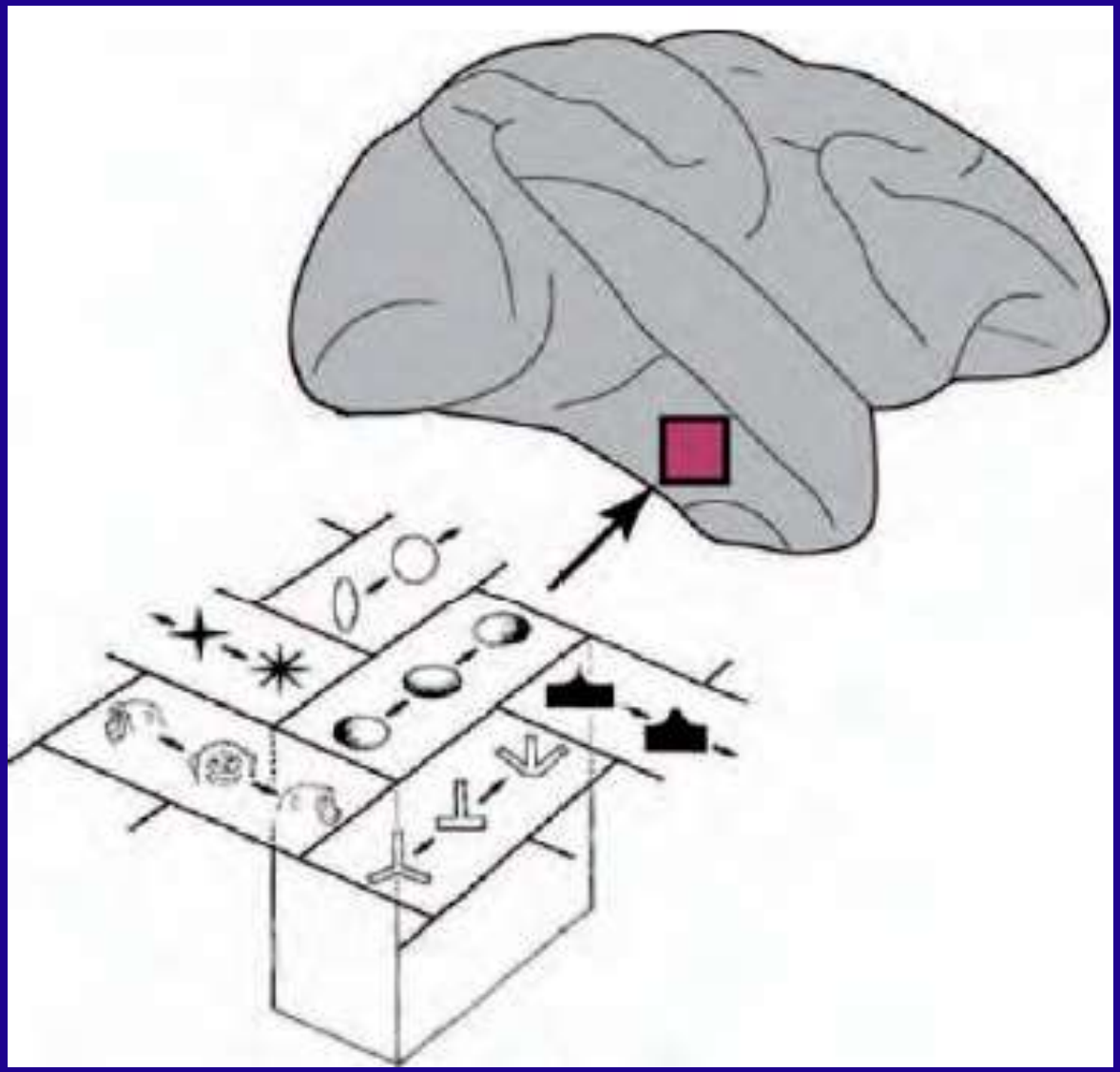
- Inability to name colors or to point to colors given their names, which is not due to aphasia or due to defective color perception

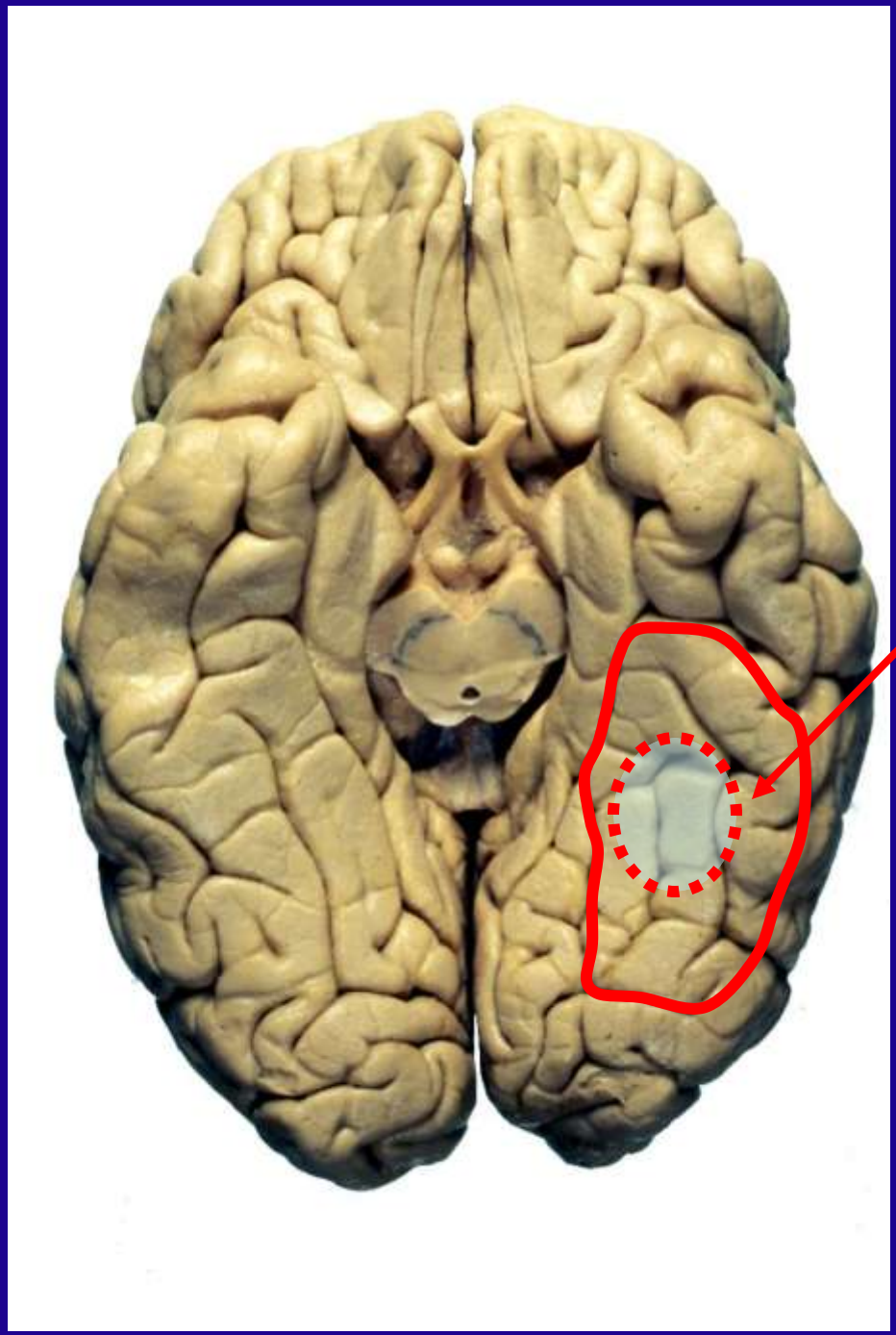
- Usually associated with *left mesial occipitotempora*l region
- hence usually affect the visual cortex or optic rediation leading to right hemianopia , and also associated with alexia

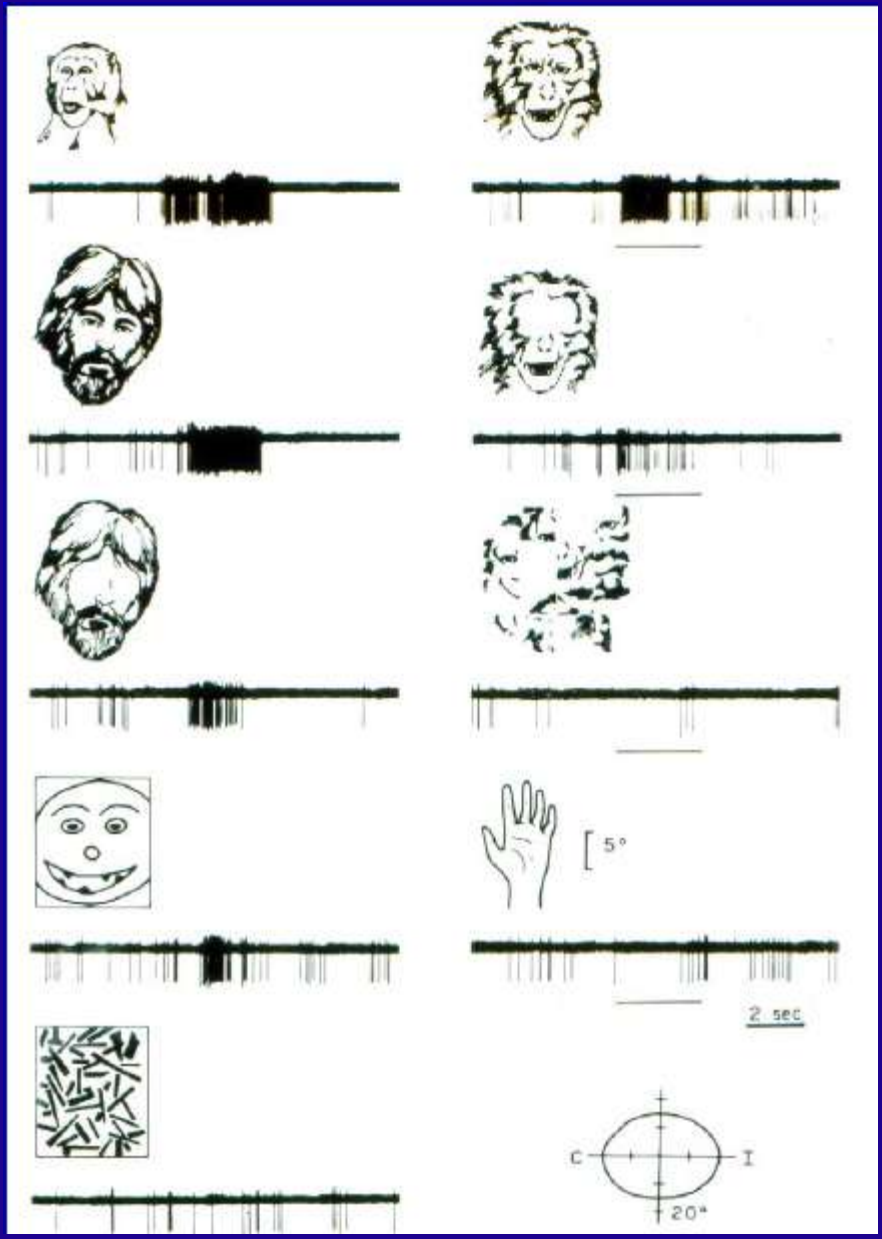
The Neural Basis of Visual Perception

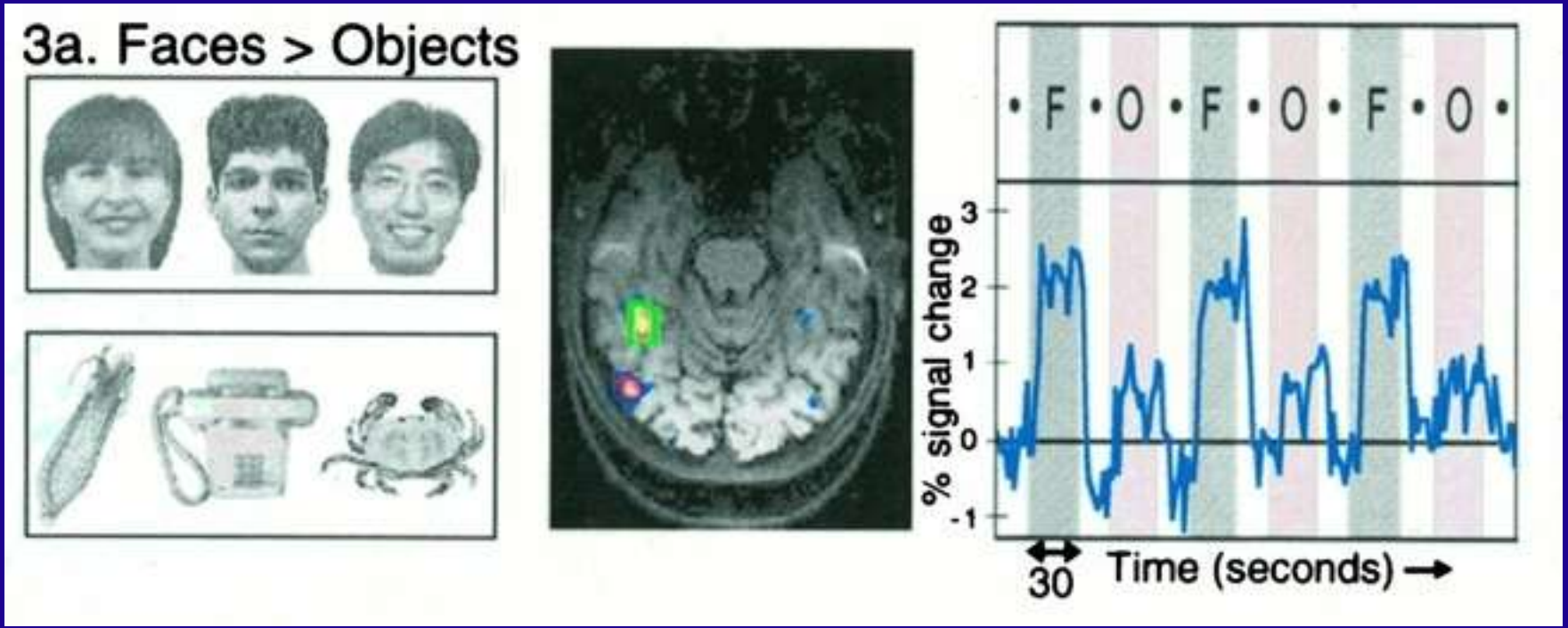
- Visual agnosia is the inability to recognize objects despite satisfactory vision.
  - Caused by damage to the pattern pathway usually in the temporal cortex.
  - For words : Alexia


Occipitotemporal
gyri

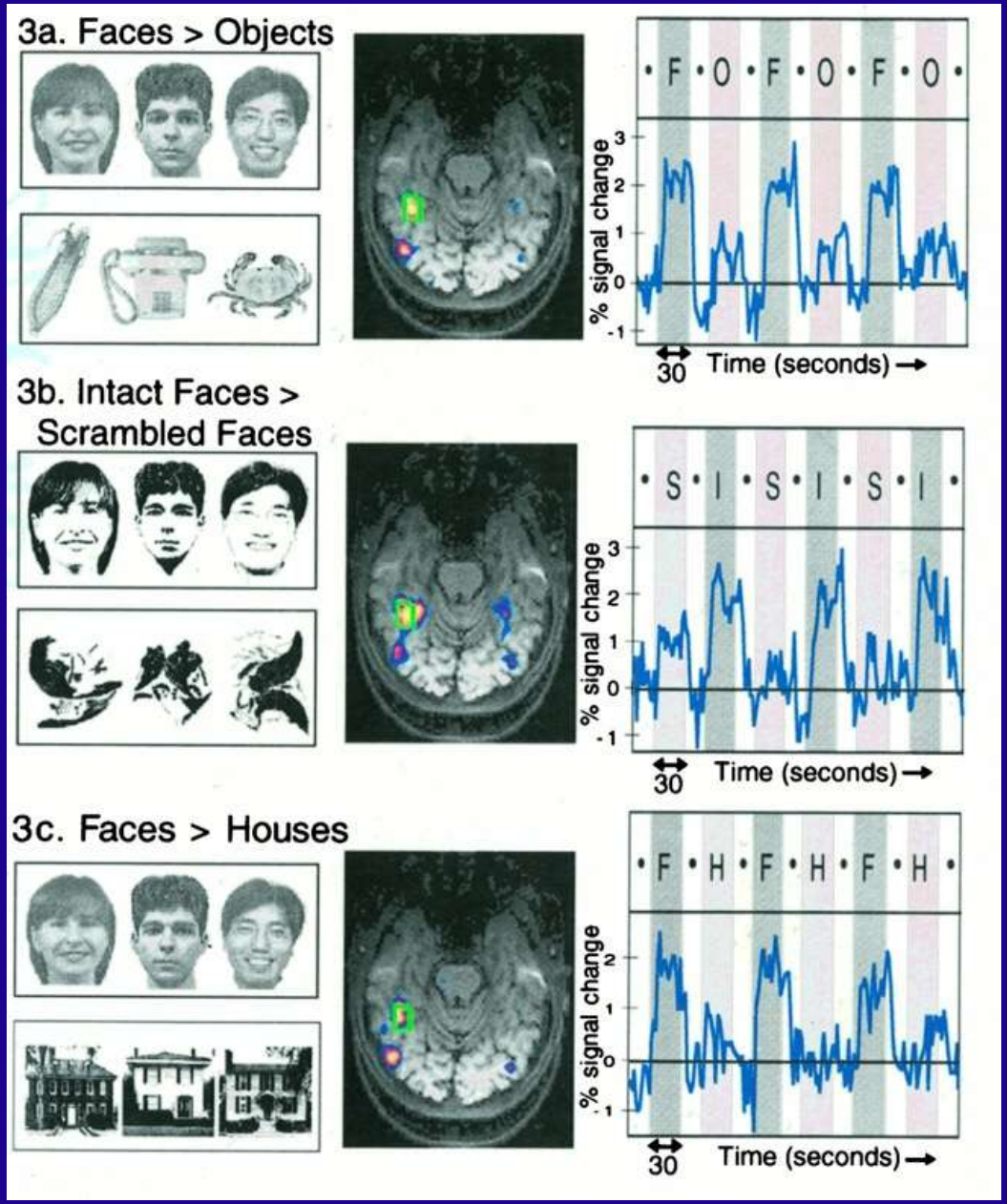



Occipitotemporal
gyri

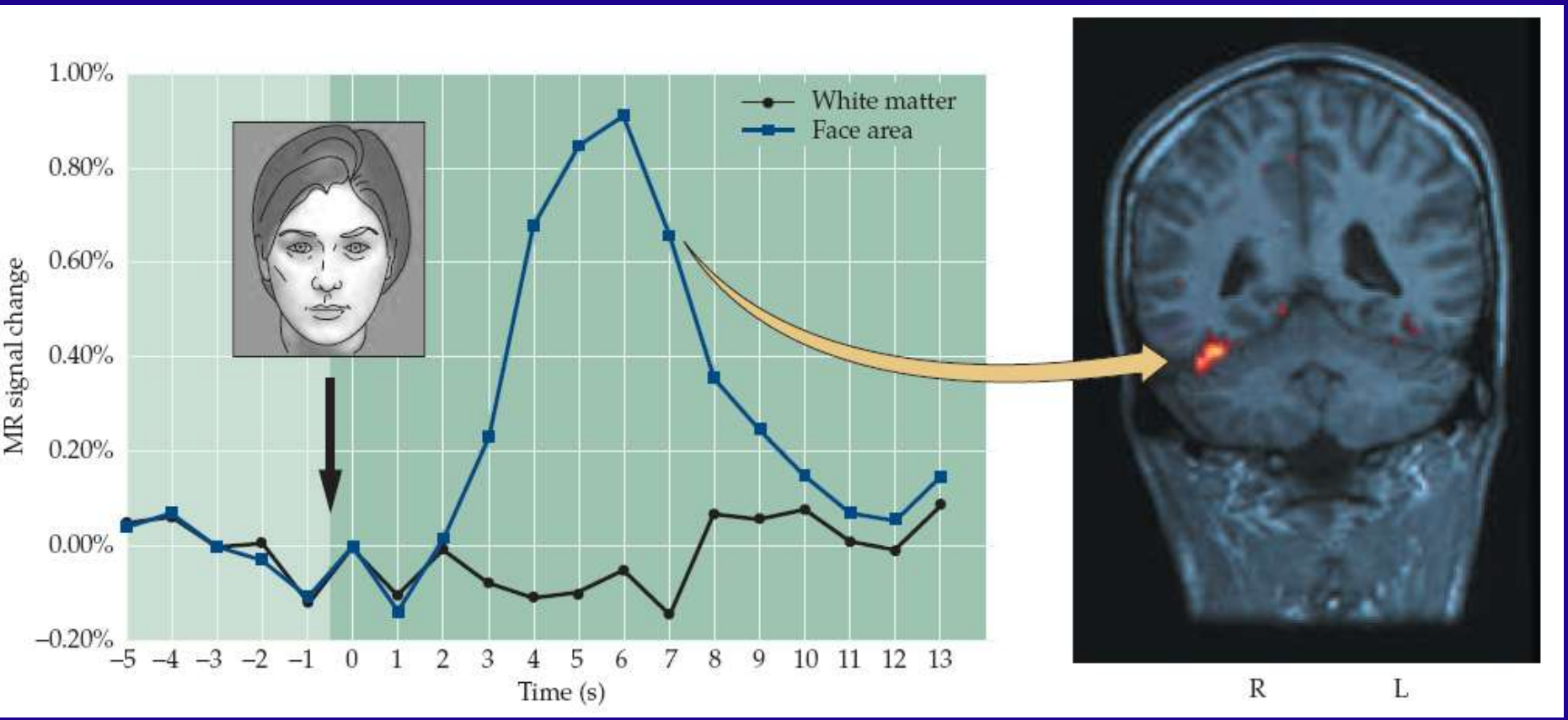

5°
2 sec
C
I
20°



Kanwisher , McDermott, and Chun, 1997

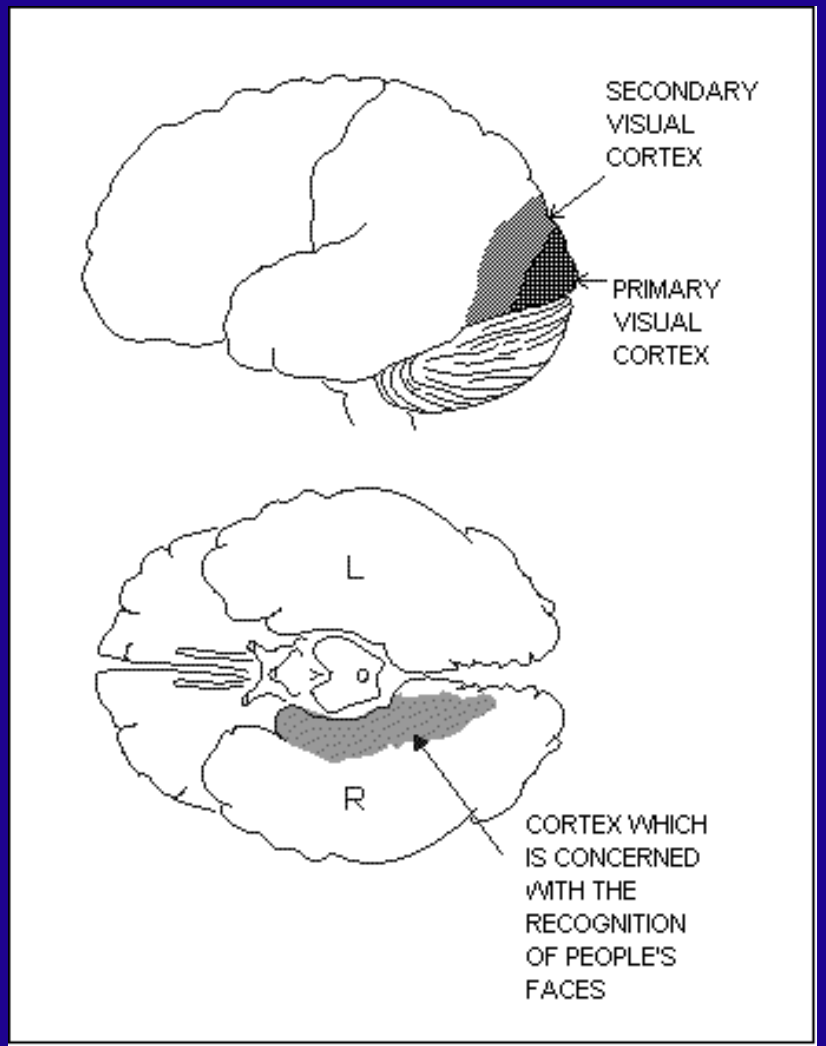


Kanwisher , McDermott, and Chun, 1997

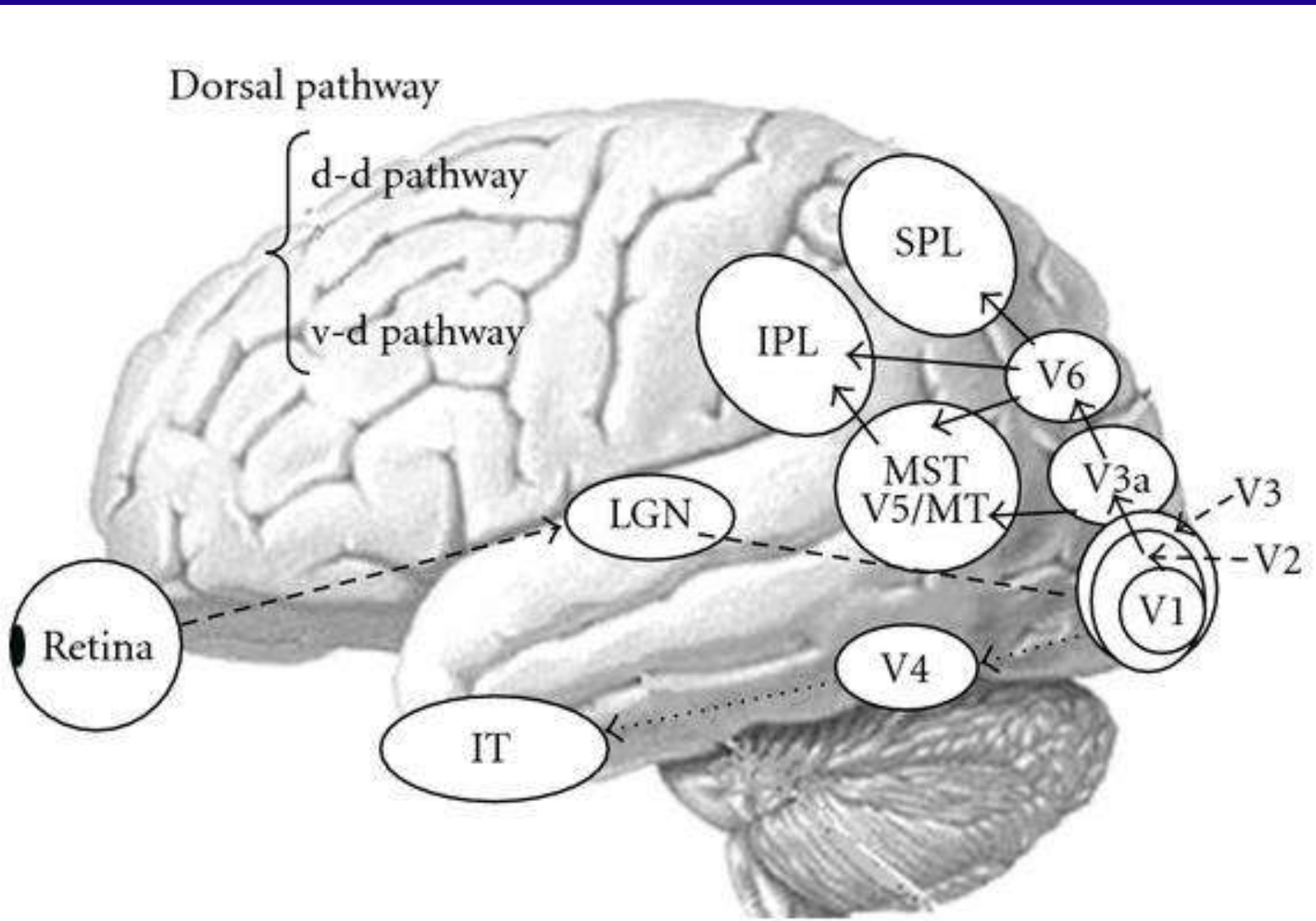

1.00%
0.80%
0.60%
0.40%
0.20%
0.00%
–0.20%
MR signal change
White matter
Face area
–5 –4 –3 –2 –1 0 1 2 3 4 5 6 7 8 9 10 11 12 13
Time (s)
R
L

Agnosia

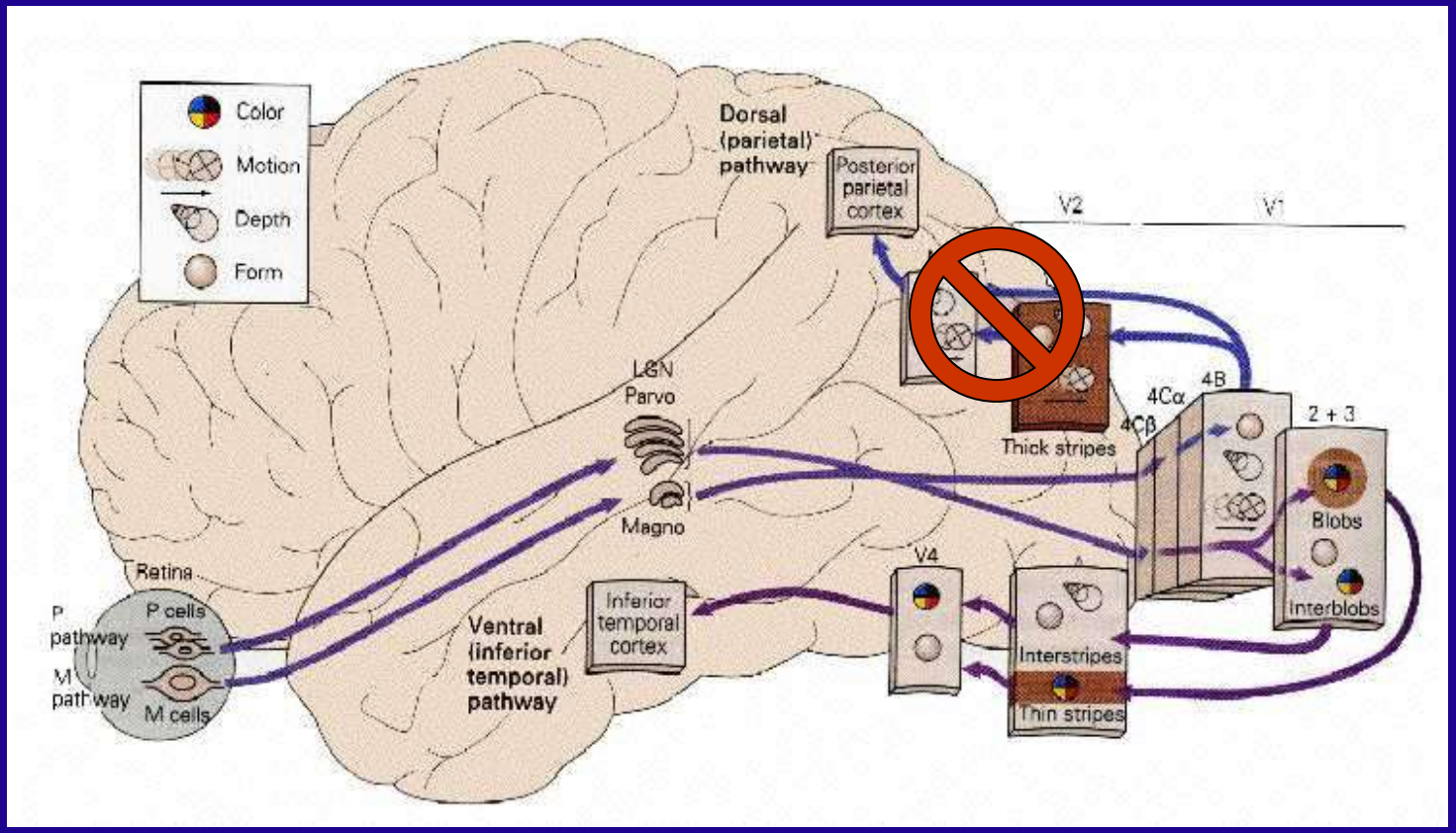
- Prosopagnosia-
  - Inability to recognize or learn faces
  - Identify people by other cues- gait, mannerisms or facial features- spectacles, gait
  - Aware of defect
  - **BL lingual and fusiform gyri of medial occipitotemporal cortex**.



Capgras syndrome


Dorsal pathway
d-d pathway
v-d pathway
SPL
IPL
V6
MST
V5/MT
V3a
V3
V2
V1
LGN
Retina
V4
IT

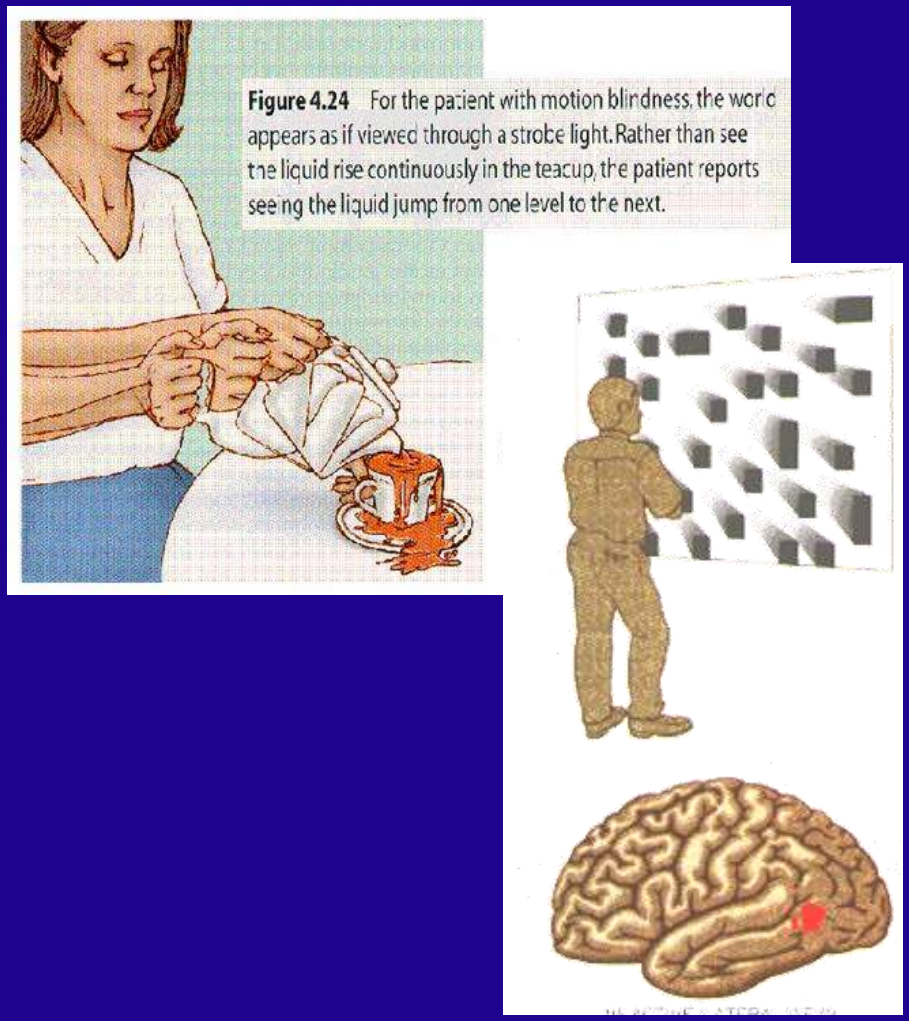
Damage to “where” pathway



Abnormal motion processing & Visuspatial neglect

Akinetopsia

- Clinical features
  - Can't see moving objects (as if under strobe lights); can see still objects
  - People appear suddenly
- Neuropathology
  - **BL lesion** to area MT (V5; T-O-P junction)
  - UL lesions cause subtle defects



Akinetopsia

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