Kognitív idegtudomány

Introduction to neurosciences for MAs.

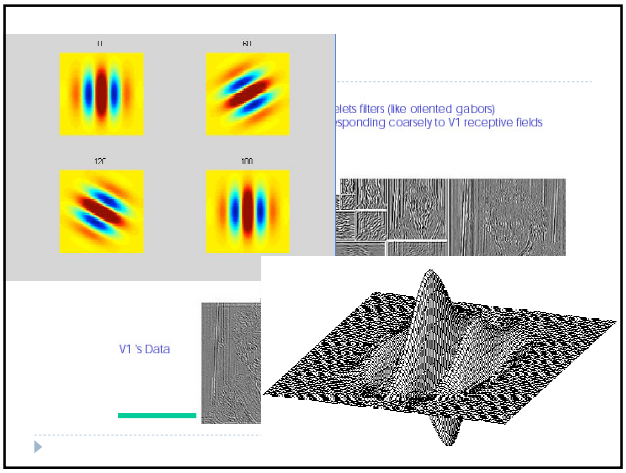
Látás 4.

Cortex after V1

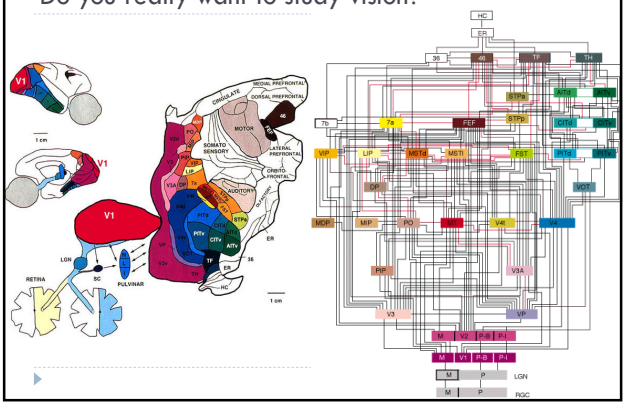
Striate Cortex: Summary

Type	Layer	Input		Output
	I			
Pyramidal	II } III	Koniocellular, IVCα, IVCβ	Orientation (simple) Color (blobs) Binocular (III)	V2, V3, V4,
	IVA			
Pyramidal	IVB	IVCα	Motion (complex)	V2, V5(MT)
Spiney	IVCα	Magnocellular		IVB, II, III
Spiney	IVCβ	Parvocellular		II, III
Pyramidal	V			Colliculus
Pyramidal	VI			LGN

3

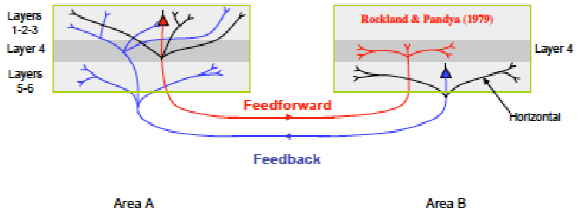


Do you really want to study vision?



6. Reciprocal extrinsic connections

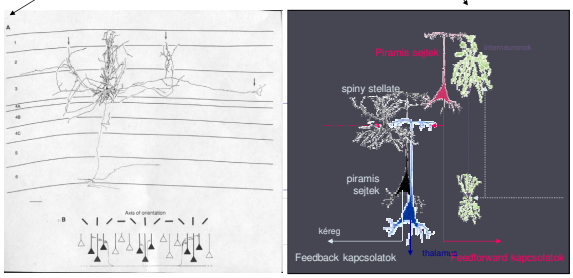
Distinct areas are linked by reciprocal connections. Source and target layers differ systematically between feed-forward and feed-back connections. This microanatomical detail allows us to construct a hierarchy of visual cortical areas.



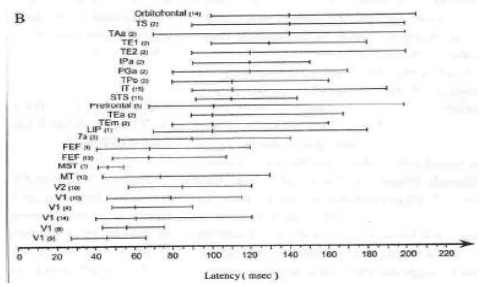
2 types of connections : feedforward or feedback

Belső és külső kapcsolatok(az idegszövet 95%-a)

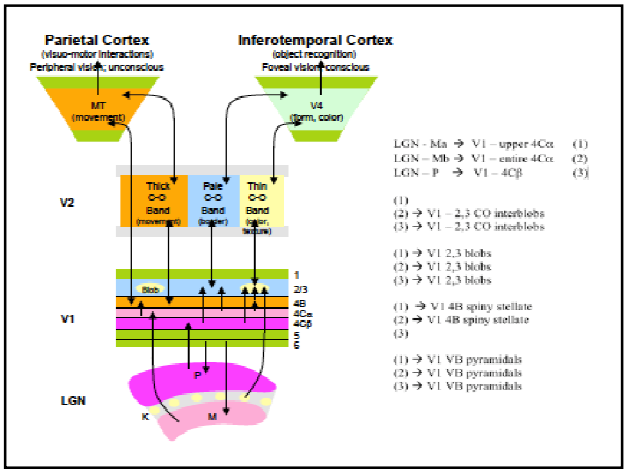
Belső: Intralaminaris (horizontális) kapcsolatok
Inter-lamináris (vertikális) kapcsolatok



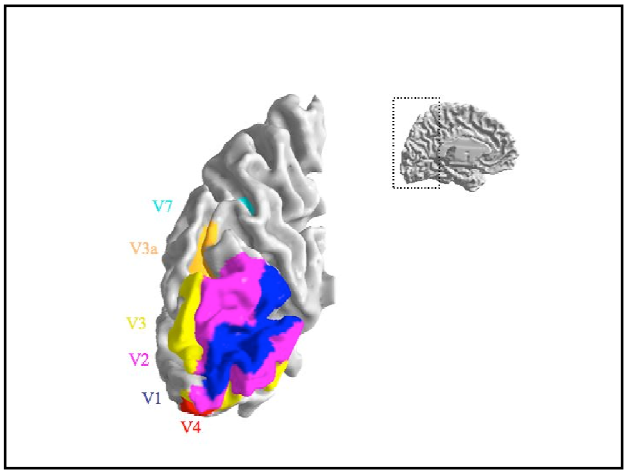
Latencies

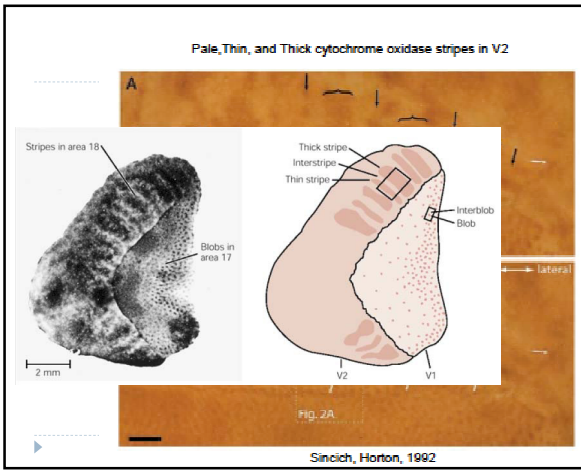


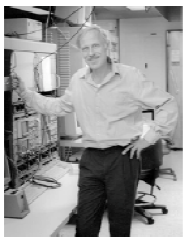
Latencies of neurons to visual stimulations in different Cortical areas.



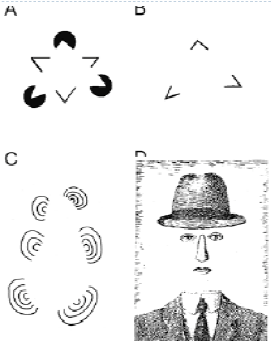
V2



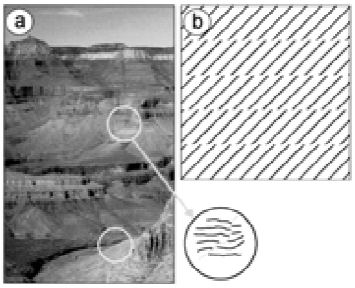


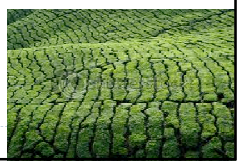


Ruediger von der Heydt

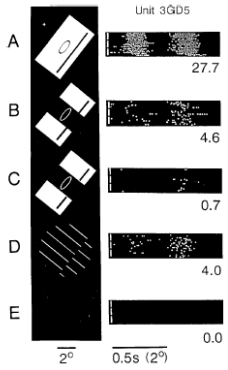


Grouping and illusory contours





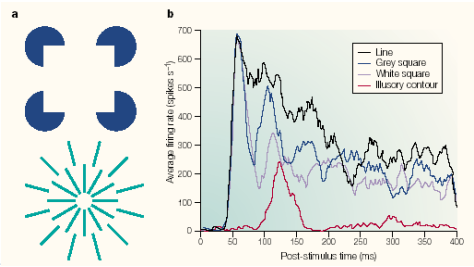
V2



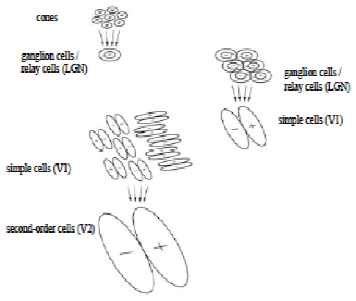
Peterhans and Von der Heydt

V1

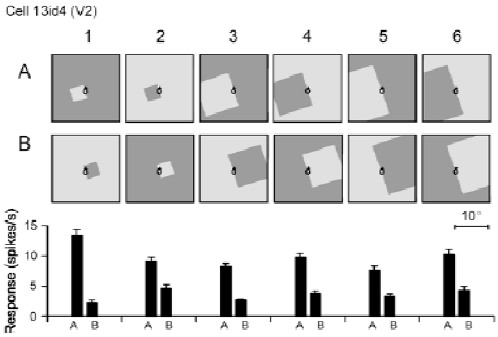
- feed-back... (Lee and Nguyen)

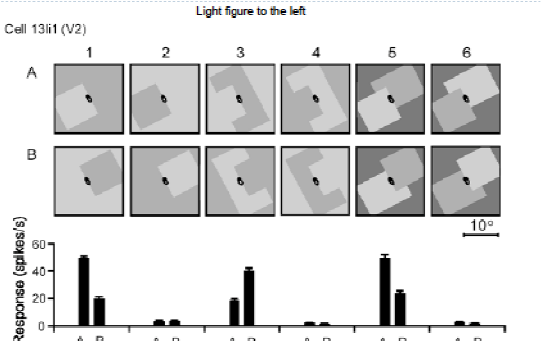


A hierarchy of receptive fields: increasing size and complexity

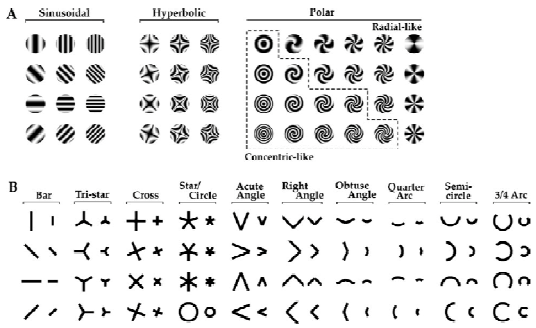


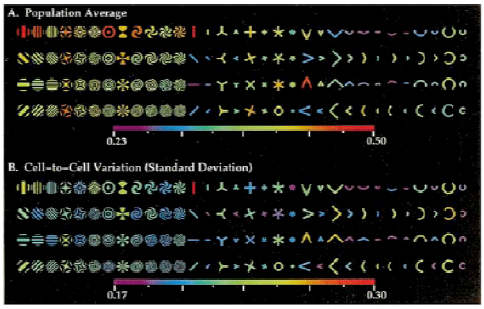
Border ownership





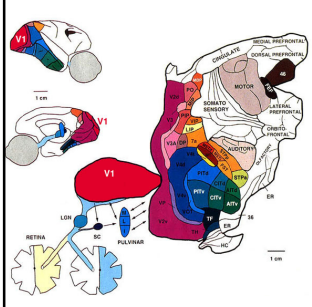
Complex shapes

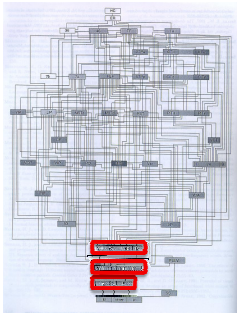




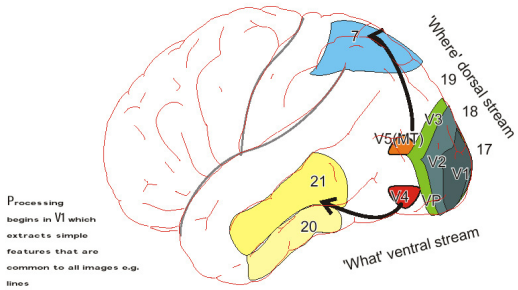
Parallel pathways

Do you really want to study vision?





Parallel patways - human



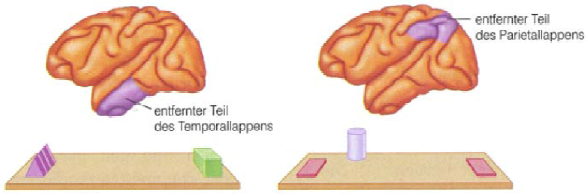
Processing begins in V1 which extracts simple features that are common to all images e.g. lines

It ends in areas that extract very complex features particular to a few related objects e.g. faces.

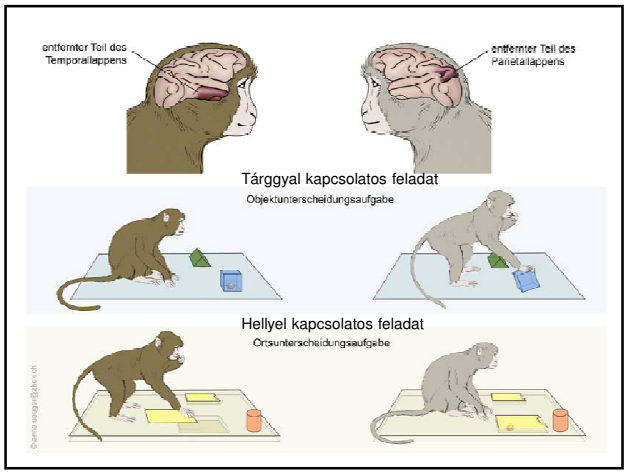
Dual Dissociation

Läsionsexperimente von Pohl (1973) und Ungerleider & Mishkin (1982) mit Menschenaffen zeigten eine Doppelte Dissoziation:

- Entfernung des Temporallappens führt zu Versagen bei einer Objektunterscheidungsaufgabe, wo der dreieckige Klotz ausgewählt werden soll.
- Entfernung des Parietallappens führt zu Versagen bei einer Ortsunterscheidungsaufgabe, wo die näher zu einem Zylinder liegende Verdeckung aufgehoben werden soll.



(Nach Goldstein, 2008)



Dorsal and Ventral Functional Pathways

- Pohl experiments reveal double dissociation
  - Landmark task: monkeys with bilateral parietal lesion have deficit, but monkeys with bilateral temporal lesion can learn task
  - Object discrimination task: monkeys with bilateral temporal lesion have deficit learning task, but monkeys with bilateral parietal lesion do not

Dorsal and Ventral Functional Pathways

- Neuron receptive field differences
  - Parietal lobe neurons
    - Large receptive fields
    - Specific to hemifield
    - More neurons have receptive fields outside the fovea than inside the fovea

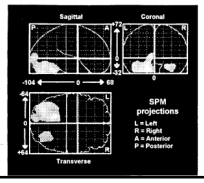
Dorsal and Ventral Functional Pathways

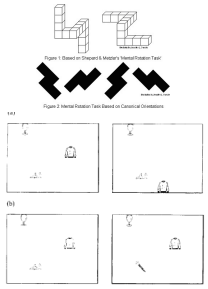
- Neuron receptive field differences
  - **Parietal lobe neurons**
    - Large receptive fields
    - Specific to hemifield
    - More neurons have receptive fields outside the fovea than inside the fovea
  - **Temporal lobe neurons**
    - Large receptive fields
    - Not specific to hemifield
    - More neurons have receptive fields inside the fovea than outside the fovea
    - Majority of neurons respond selectively to complex stimuli

Dorsal and Ventral Functional Pathways

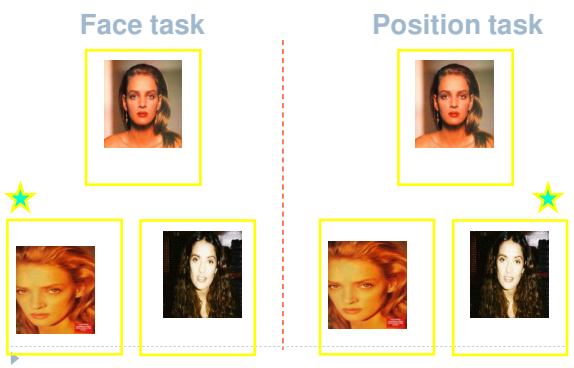
Kohler et al. PET study in humans supports "what/where" distinction

- Position task: greater rCBF in right parietal lobe
- Object task: greater rCBF biaterally at occipito-temporal areas

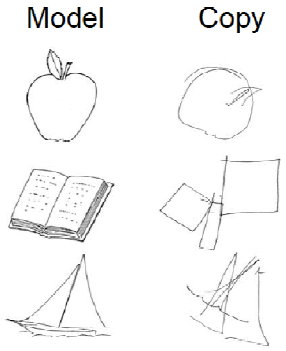




PET/fMRI study in humans supports "what/where" distinction



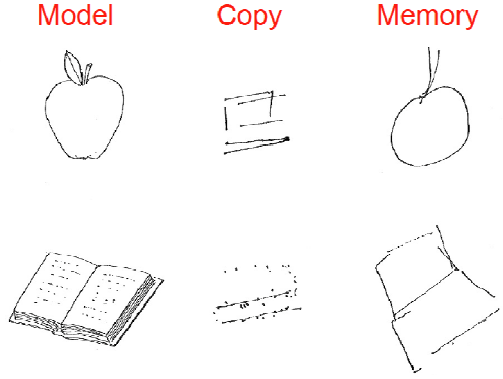
Patient RV: optic ataxia



Goodale & Milner (2004). *Sight Unseen.* Oxford University Press.

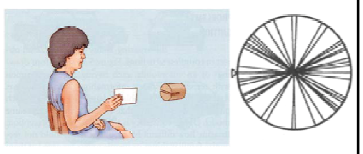
Patient D.F.

- Hypoxia from carbon monoxide poisoning
- •Most salient symptom was visual form agnosia
- •MRI in 1989 showed diffuse cortical damage
- with large lesions in the ventrolateral
- occipital region, sparing V1•
- Clinical and psychophysical testing was largely in the normal range

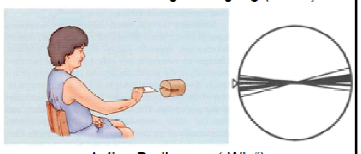


Patientin D.F.: Wahrnehmung vs. Action

- Die Schädigung im ventralen Strom führt dazu, dass eine Karte nicht so ausgerichtet werden kann wie ein Briefschlitz.
- Weil der dorsale Strom aber intakt blieb, kann D.F. einen Brief in einen Briefschlitz einwerfen.



Wahrnehmungsbedingung („Was")

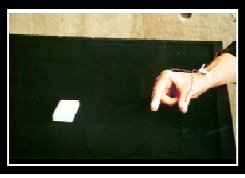


Action Bedingung („Wie")

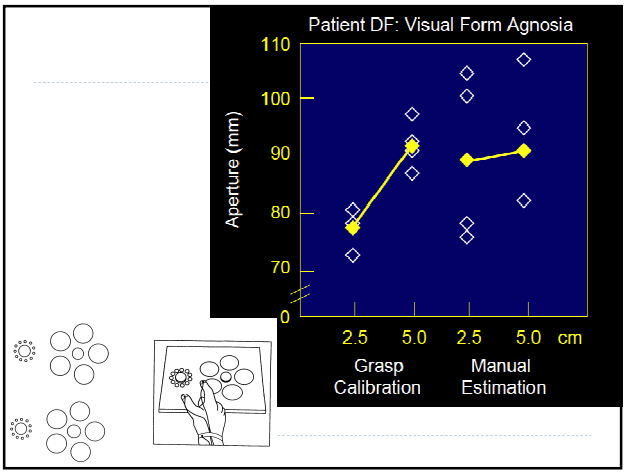
(Modifiziert nach Gazzaniga et al., 1998 und Goodale et al., 1991)

Object size

Grasp



Manual Estimation



'What' pathway impairments

- Impaired recognition of objects (visual agnosia).
- Impaired recognition of faces (prosopagnosia).
- Impaired recognition of words (dyslexia).
- Issue: **Categories of knowledge**?
  - Living versus nonliving things.
  - Sensory versus functional knowledge.
  - Modular account e.g. visual-verbal semantics.

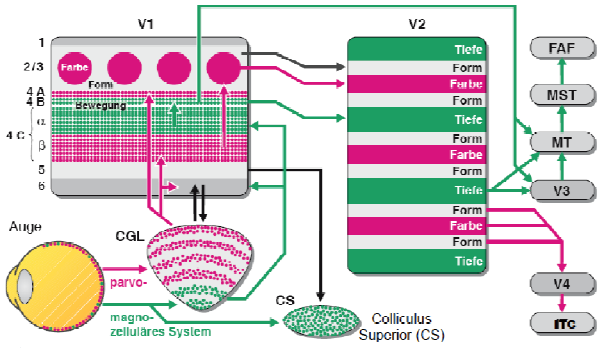
Agnosia

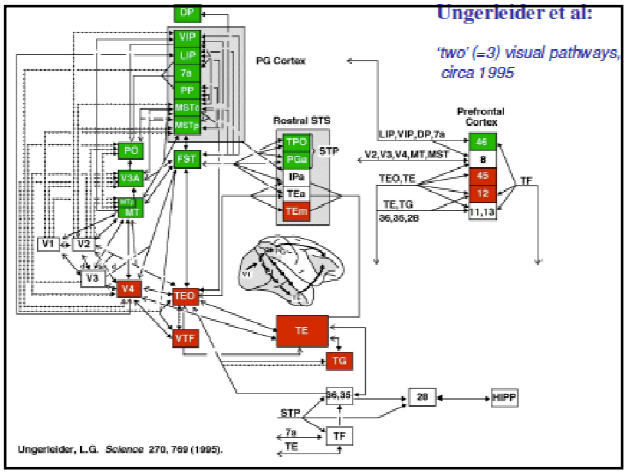
- Agnosia is characterized by an inability to recognize objects despite having intact knowledge of the object's characteristics.
- Agnosics may have difficulty recognizing the geometric features of an object or they may be able to perceive the geometric features but not know what the object is used for.
- Agnosia can be present in other sensory modalities e.g., hearing (auditory agnosia).

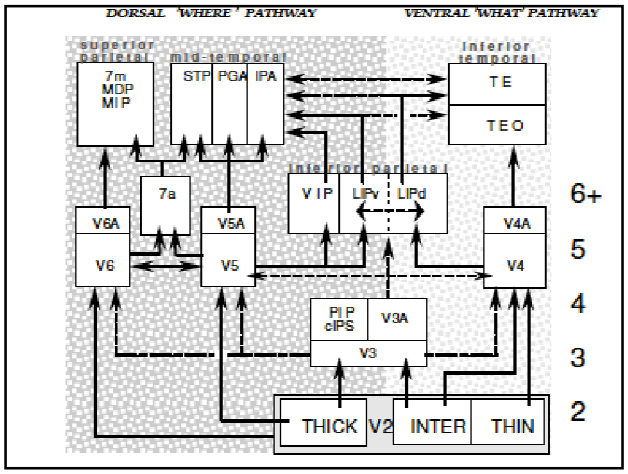
Table 13.1 Summary of visual regions beyond the occipital lobe

	Region	Proposed Function
Ventral Stream Regions		
LO	Lateral occipital	Object analysis
FFA	Fusiform face area	Face analysis
EBA	Extrastriate body area	Body analysis
FBA	Fusiform body area	Body analysis
STS	Superior temporal sulcus	Analysis of biological motion
STSp	Superior temporal sulcus (posterior)	Moving-body analysis
PPA	Parahippocampal place area	Analysis of landmarks
Dorsal Stream Regions		
LIP	Lateral intraparietal sulcus	Voluntary eye movement
AIP	Anterior intraparietal sulcus	Object-directed grasping
VIP	Ventral intraparietal sulcus	Visuomotor guidance
PRR	Parietal reach region	Visually guided reach
cIPS	Intraparietal sulcus	Object-directed action

The development of the two visual parallel pathway idea







Postmortem vizsgálatok

- P.R. Huttenlocher (80-90-es évek)
  - Területspecifikus **szinaptikus-sűrűség** változások
    - V1: 4 hónaposnál maximum, 4 évesnél felnőttszerű
    - Prefrontális kéreg: 3-4 évesnél maximum, késő serdülőkorban csökken

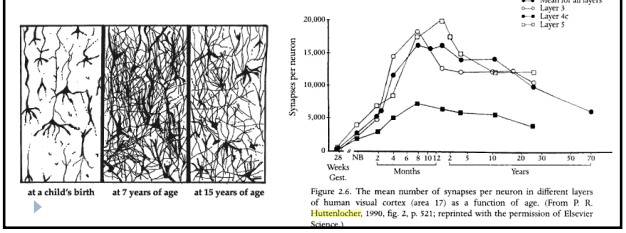


Figure 2.6. The mean number of synapses per neuron in different layers of human visual cortex (area 17) as a function of age. (From P. R. Huttenlocher, 1990, fig. 2, p. 521; reprinted with the permission of Elsevier Science.)

A fejlődő agy növekedési mintázatai