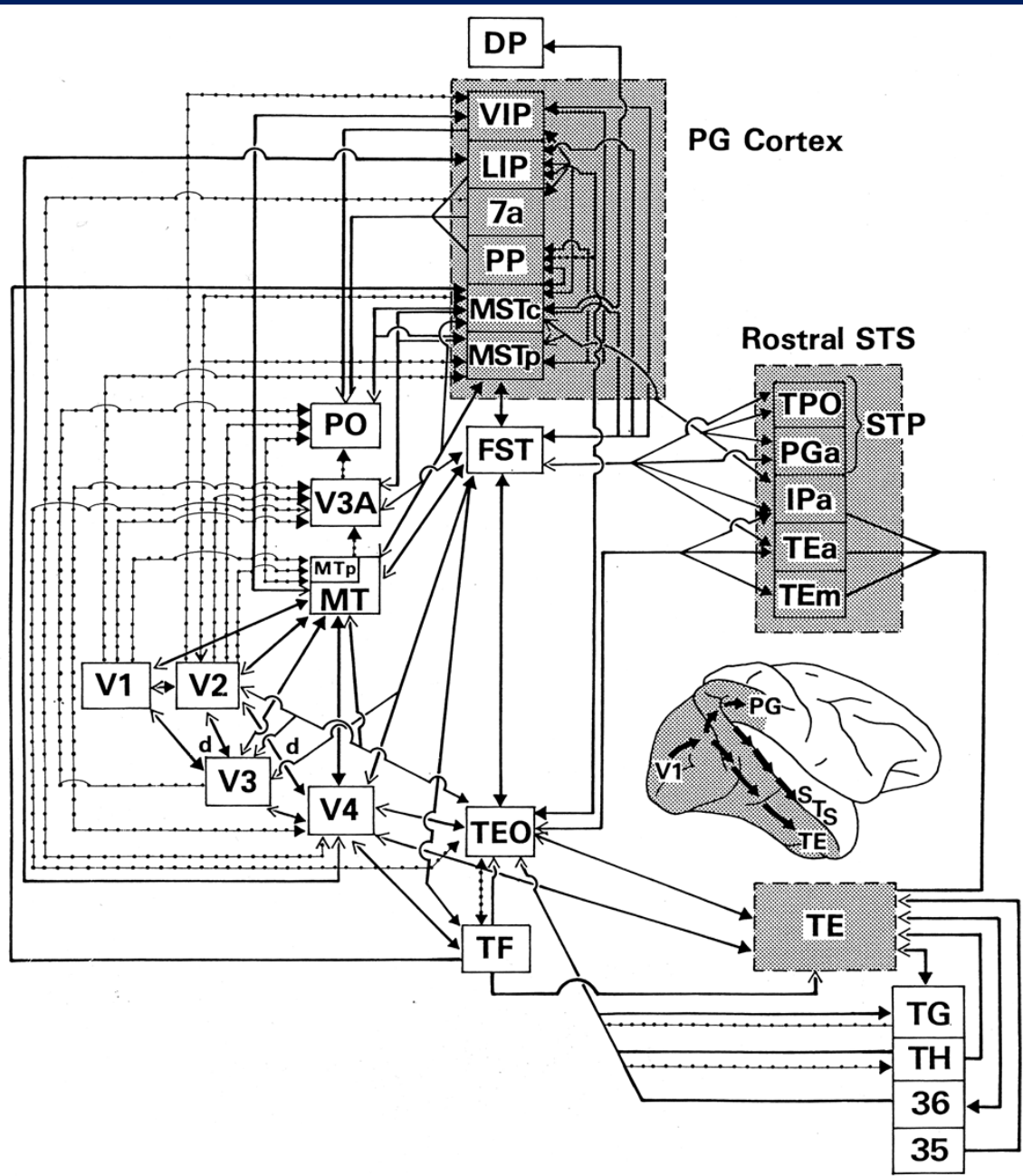


Long-distance Cortical Connections, at the Single Axon Level

AREA **A**  AREA **B**

AREA **A**  AREA **B**

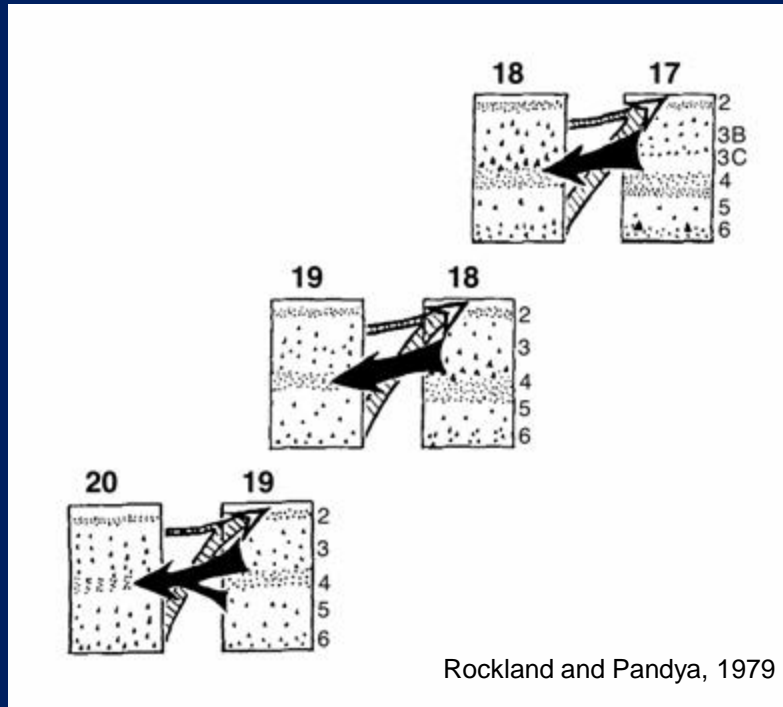


Distler et al., 1993

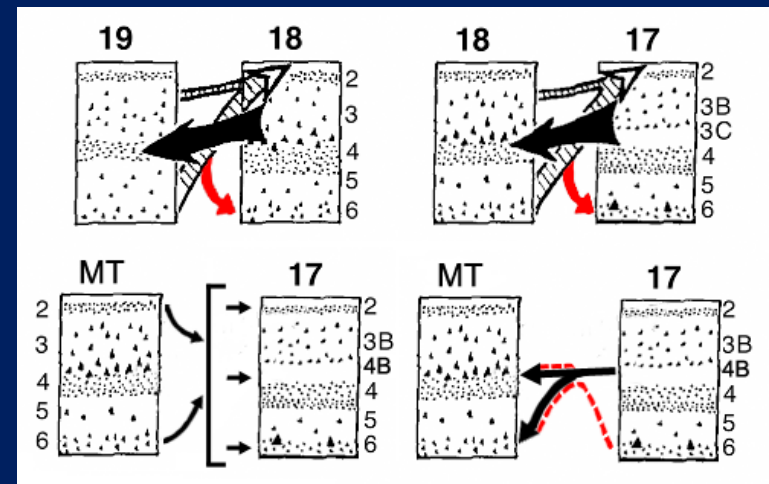
FEEDFORWARD and FEEDBACK CONNECTIONS

BUT What about:

- Topography (central vs. peripheral fields) ?
- Neuronal subtypes?
- Target identity?
- Synaptic efficacy and interactions?



** Divergence ??
 ** Convergence ??



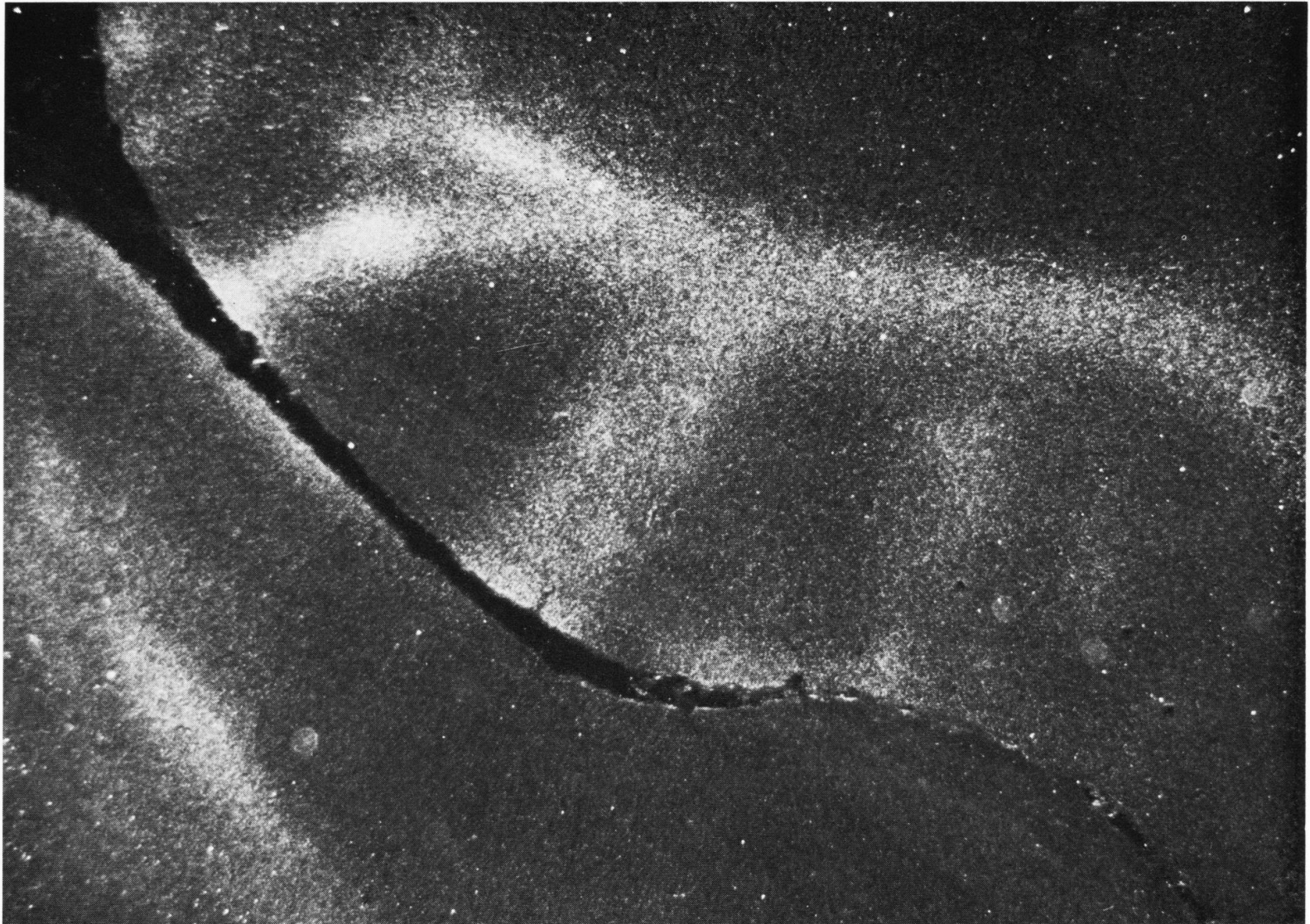
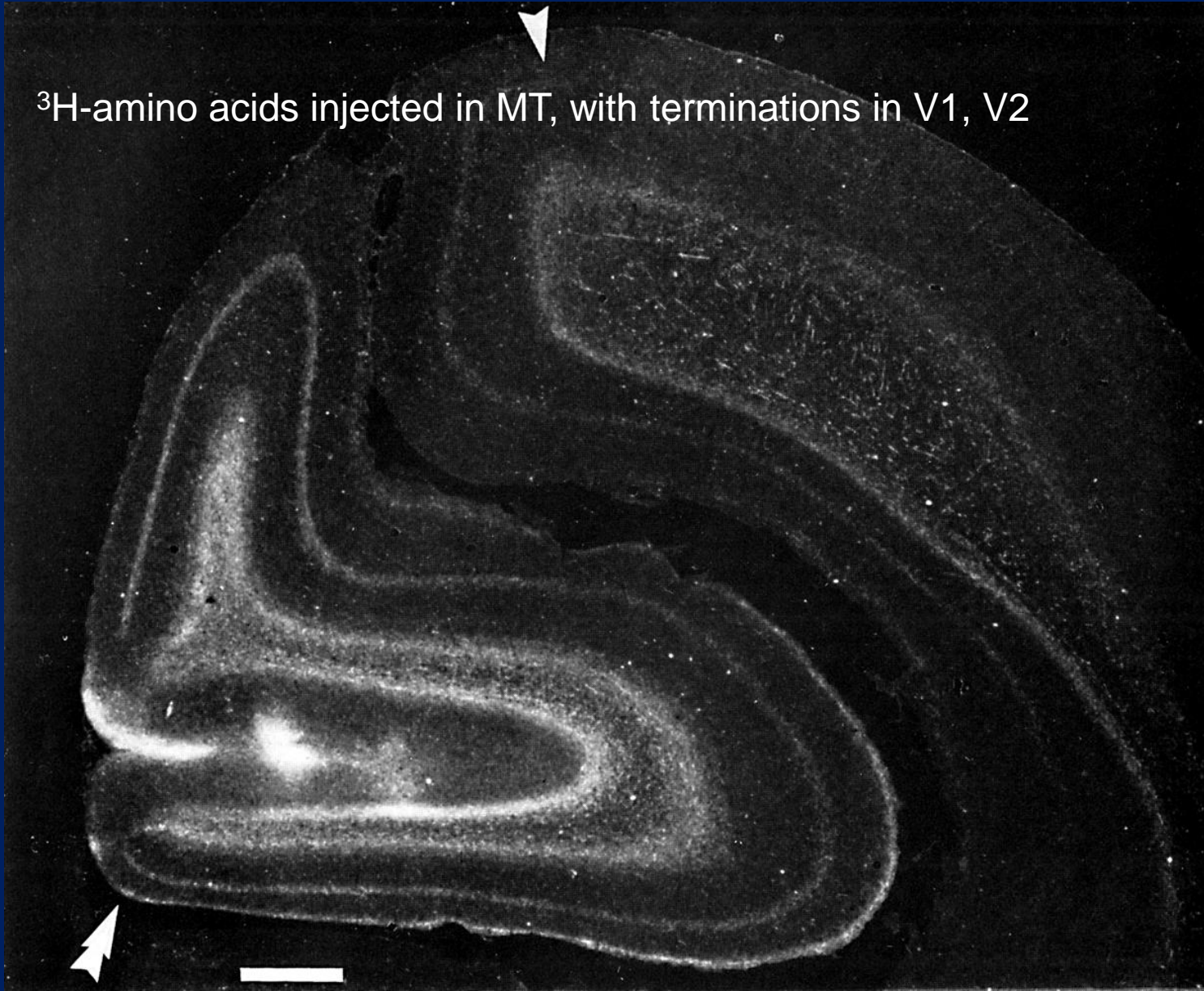
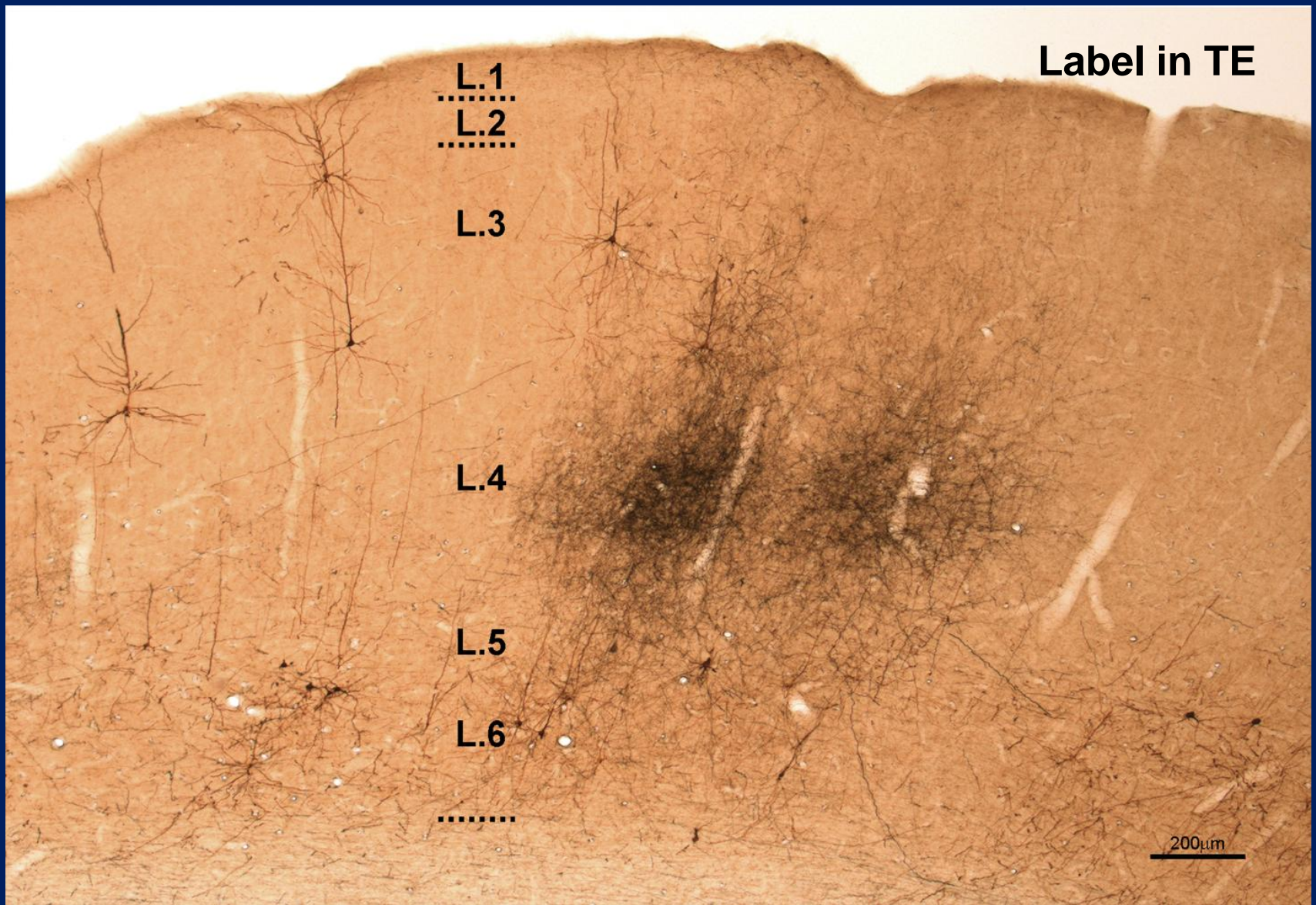


Fig. 4. Dark-field autoradiogram of columns in the homotopical region of the principal sulcus in the contralateral hemisphere of the 4-day-old monkey (P 9) given a single injection in the dorsal bank of the principal sulcus of the opposite hemisphere. $\times 25$.

^3H -amino acids injected in MT, with terminations in V1, V2



Shipp and Zeki, 1989

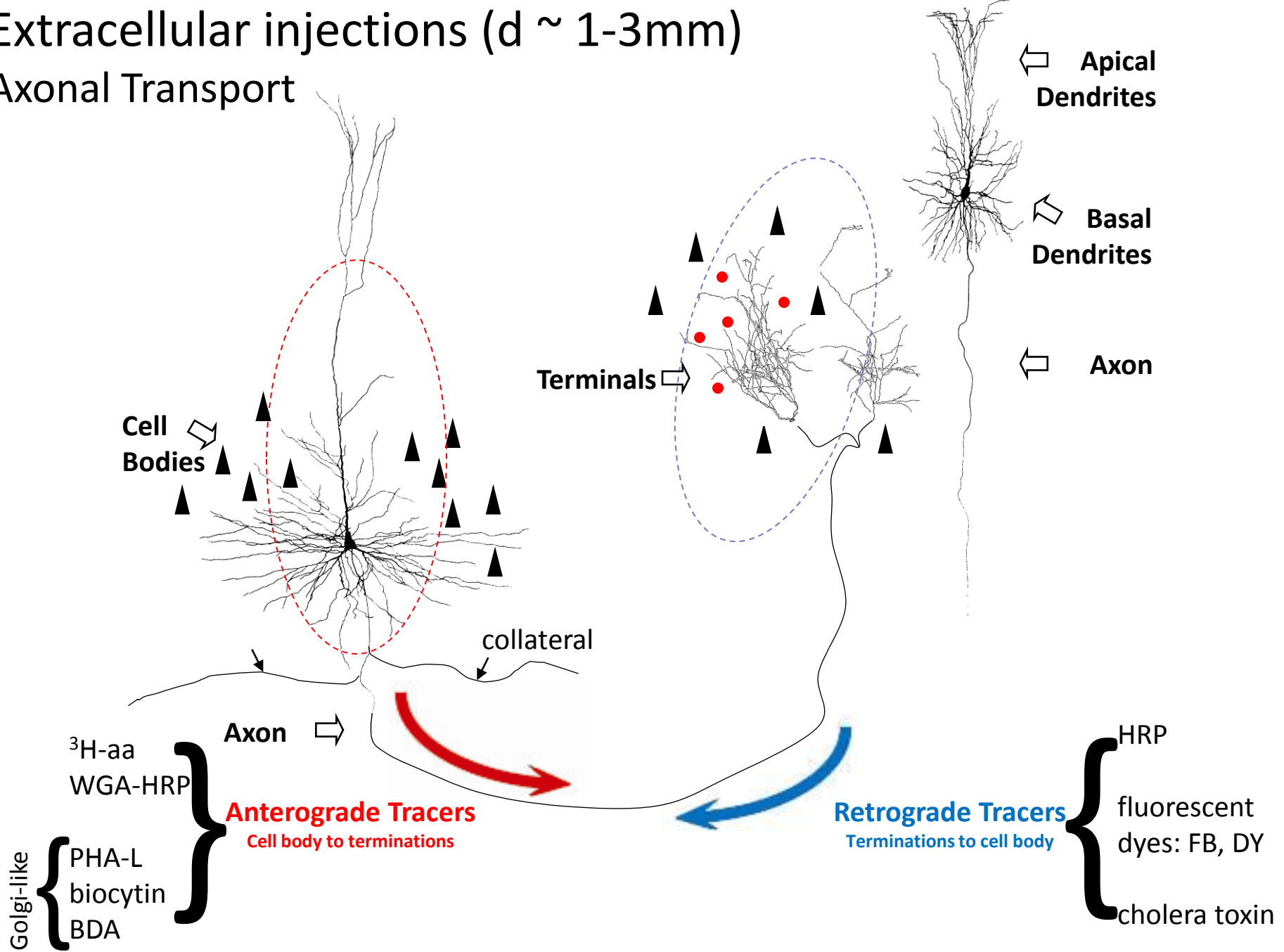


BDA and AdSynEGFP in V4

IMURA AND ROCKLAND, 2005

Extracellular injections (d ~ 1-3mm)

Axonal Transport



METHODS

Extracellular tracer
injection ($\sim 1.0 \mu\text{l}$);
anterograde or retrograde



Survival period ($\sim 14\text{-}18$ days)



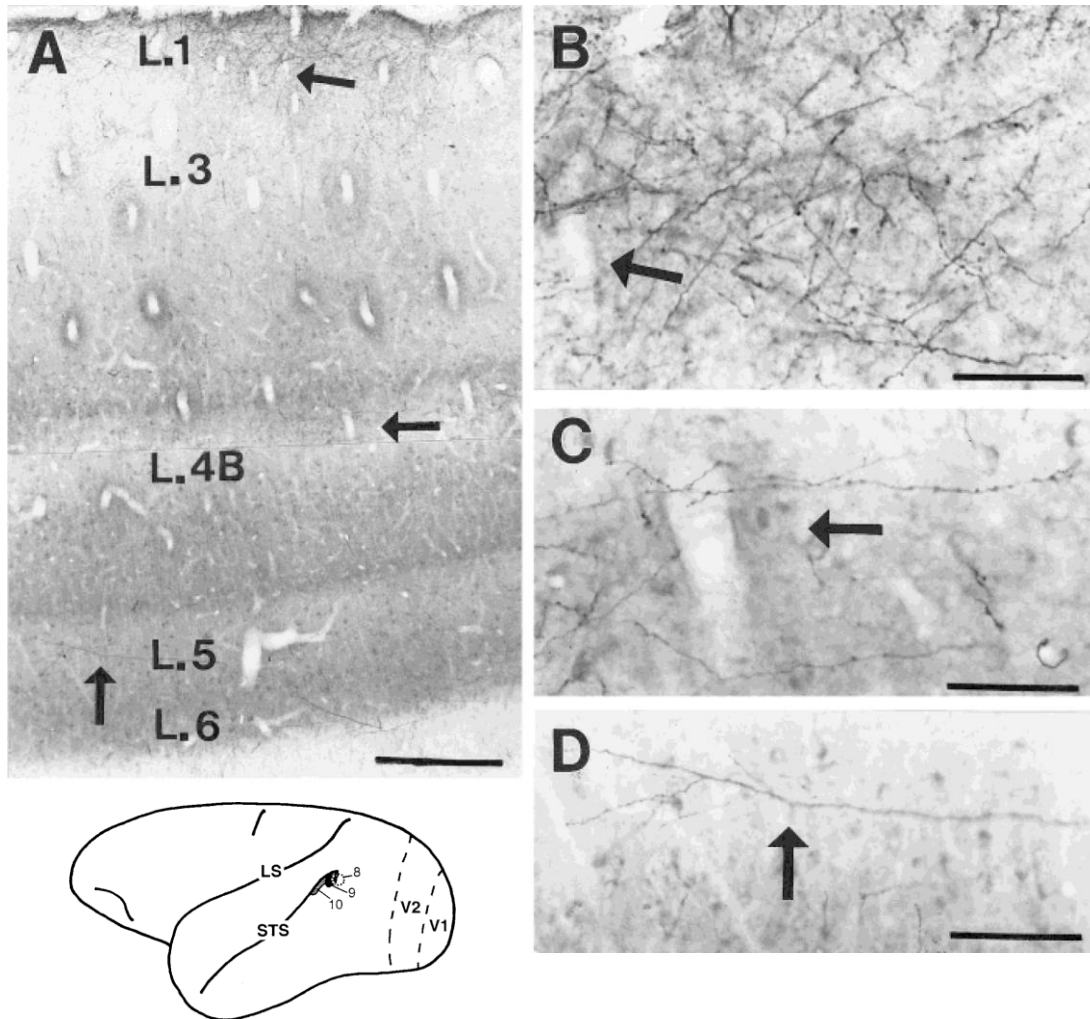
Perfusion



Histology (BDA: $50 \mu\text{m}$
serial sections)

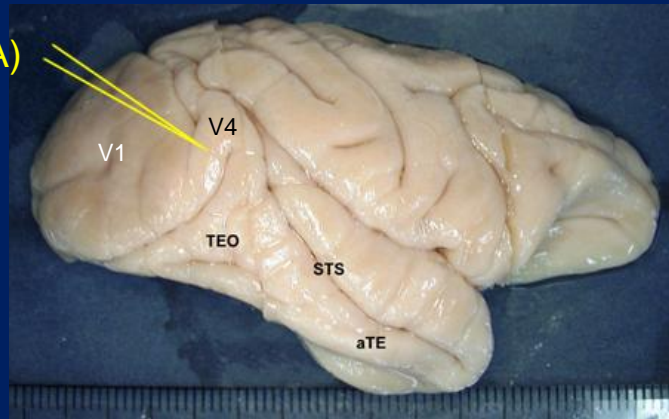


LM analysis

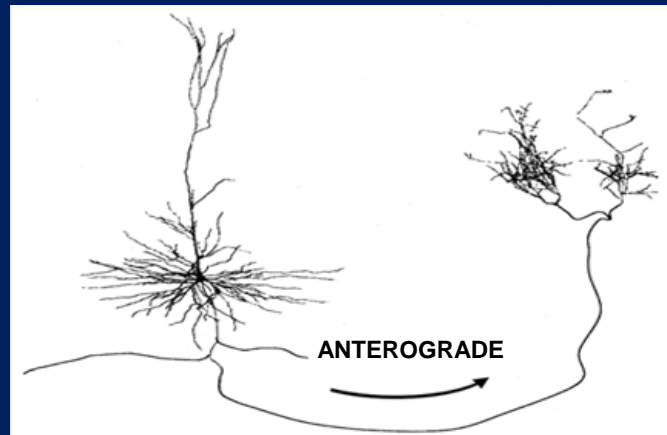


Rockland and Knutson, 2000

Tracer (BDA)



- surgery and craniotomy
- extracellular tracer injection (1.0-2.0 μ l) biotinylated dextran amine (BDA)

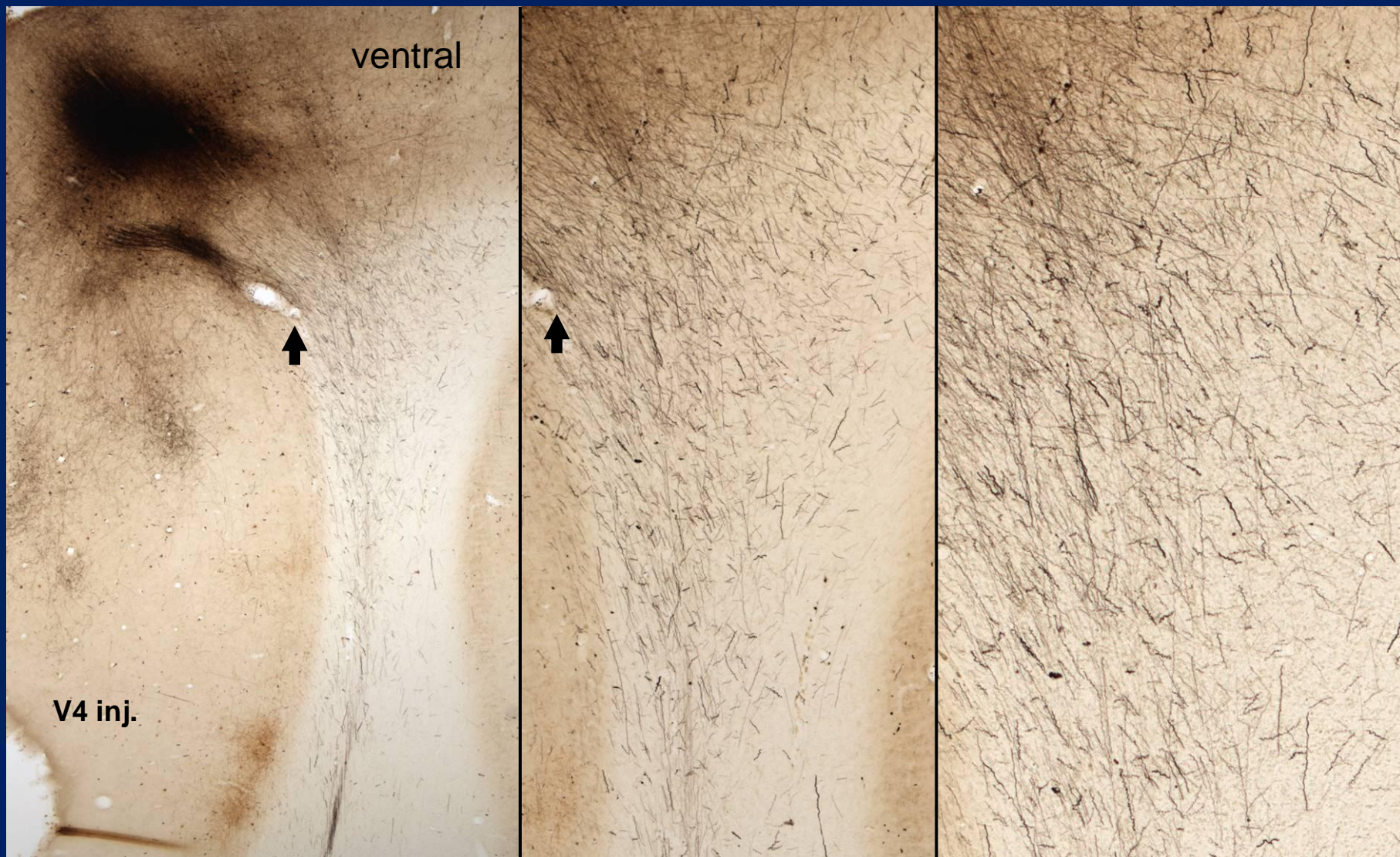


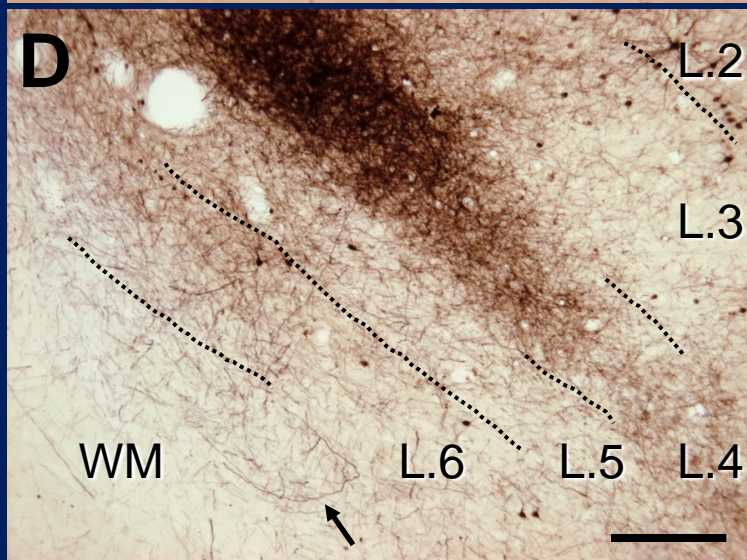
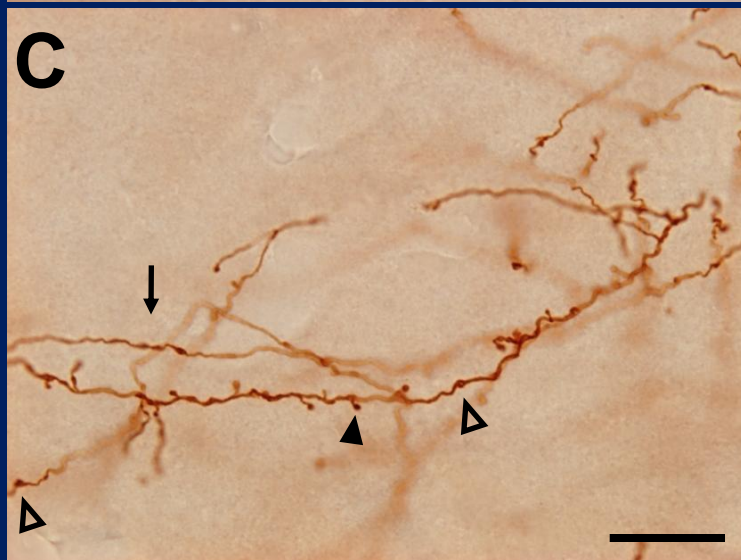
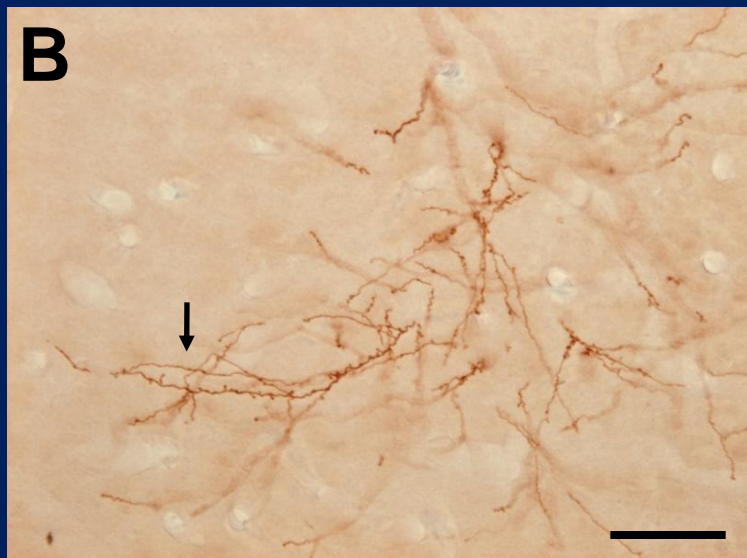
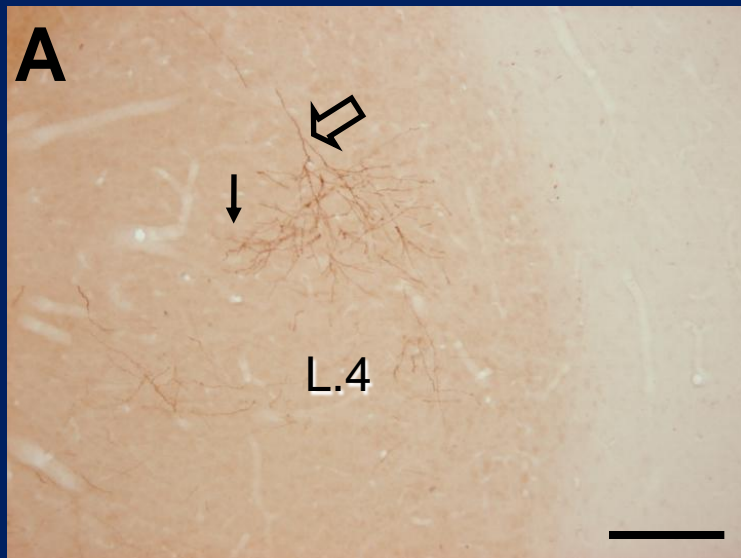
- post injection survival (18-21 days), for transport
- perfusion; histology
- analysis (single section or serial section analysis)

ventral



V4 inj.





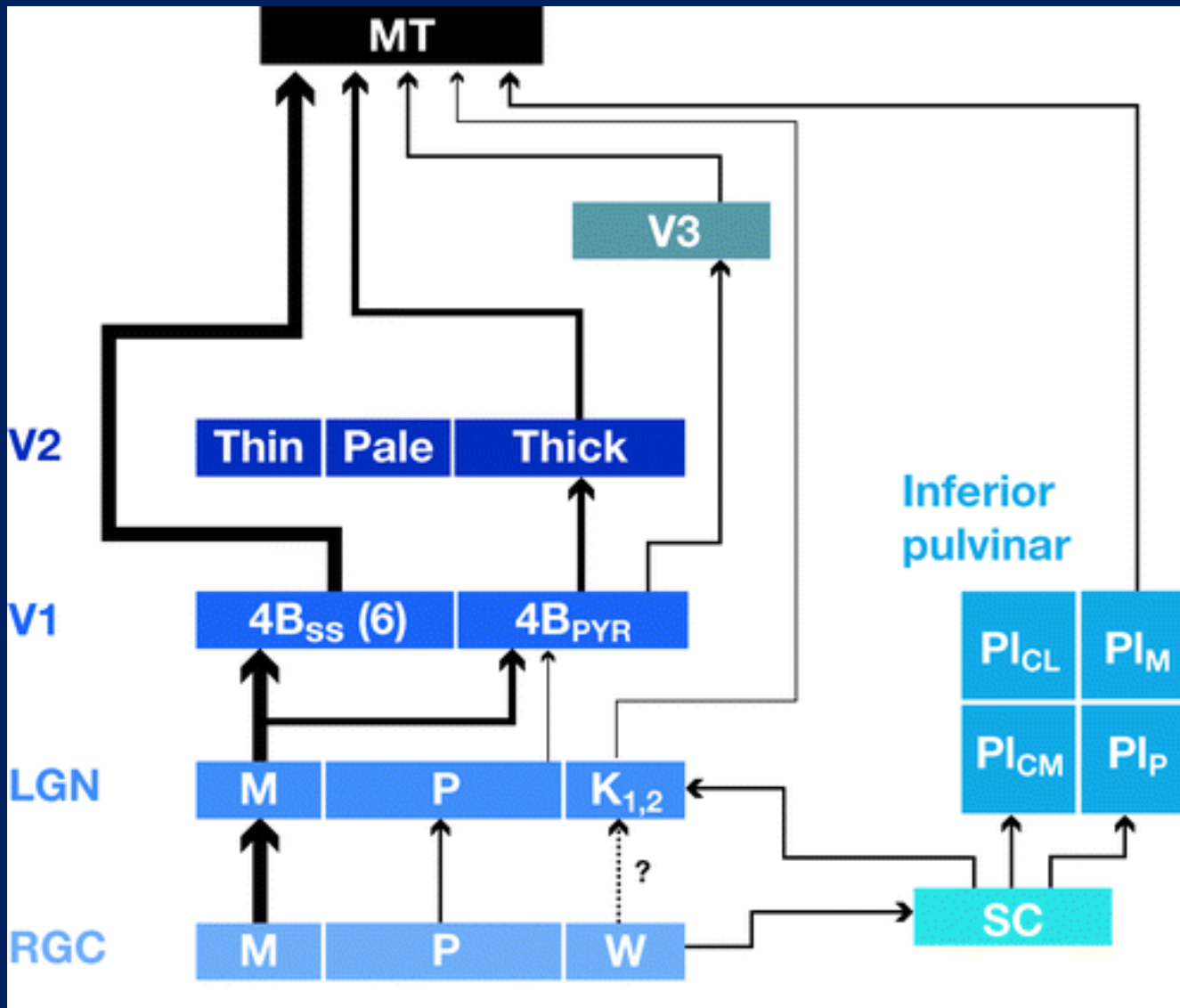
Area MT



Pulvinar
(LGN)

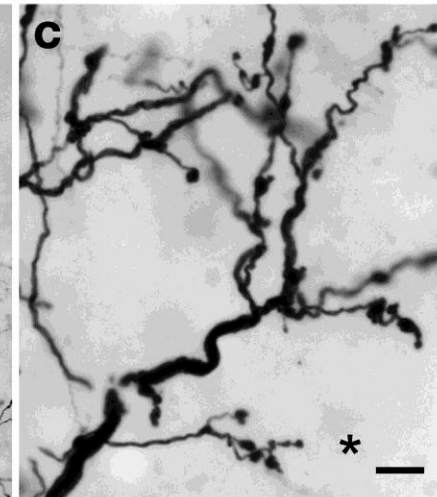
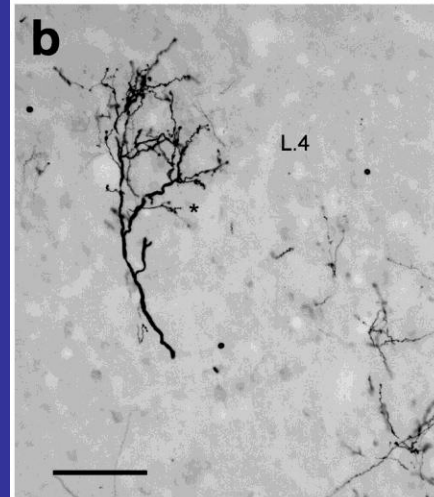
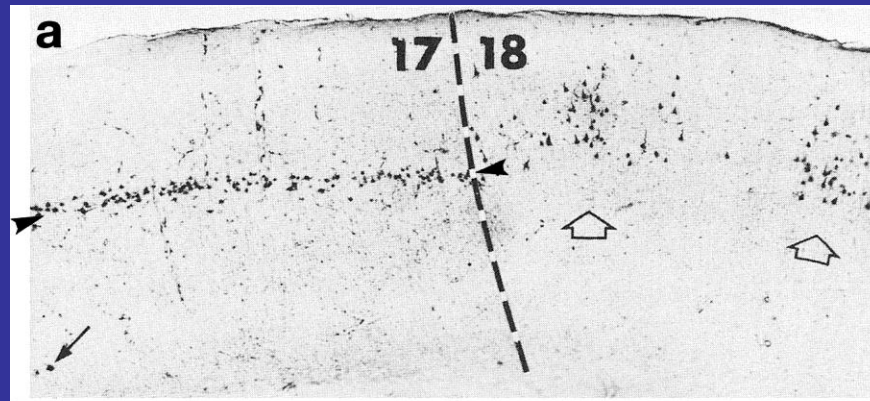


V1 \rightleftharpoons V2



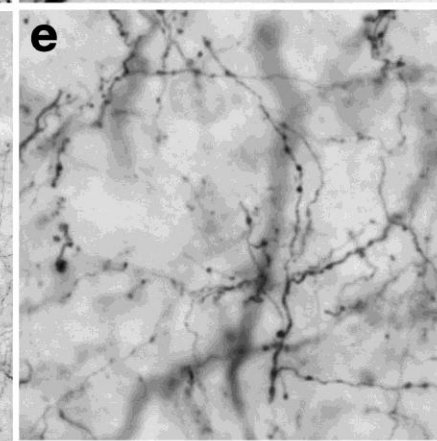
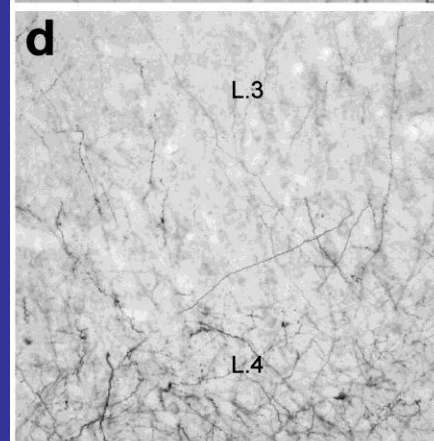
L. 4B
L. 5/6

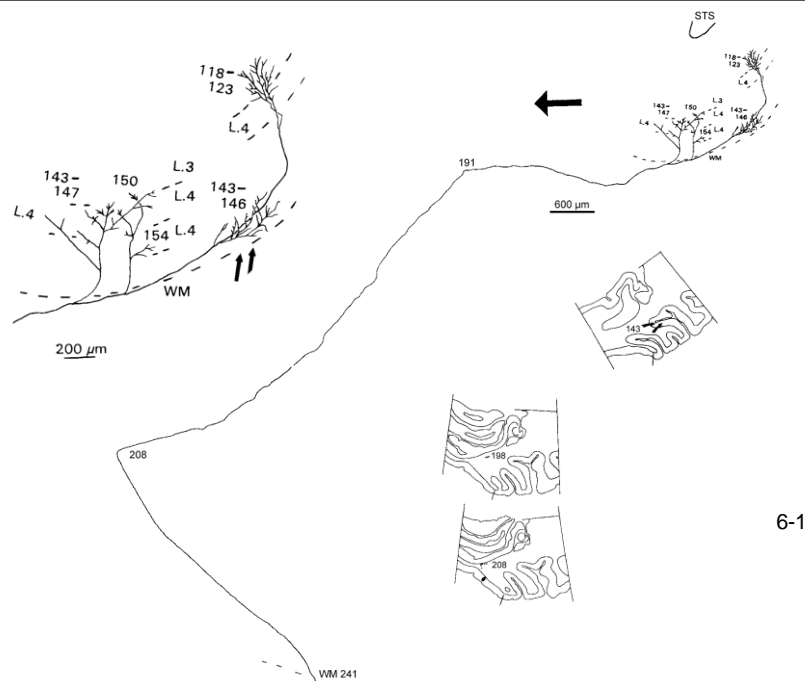
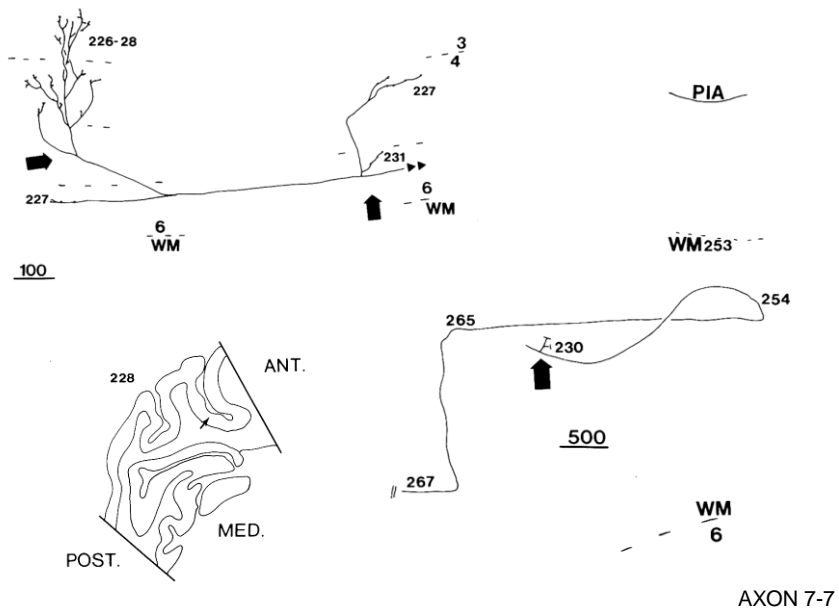
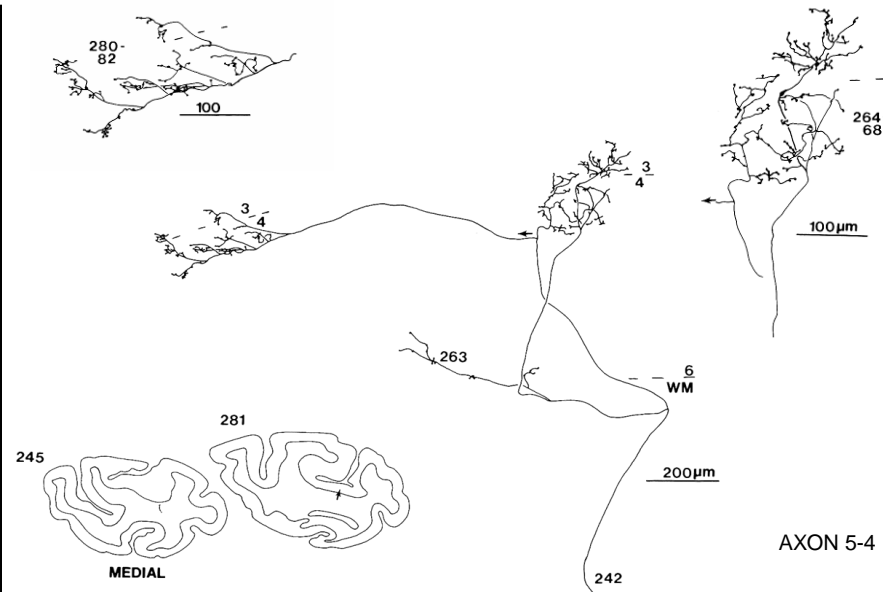
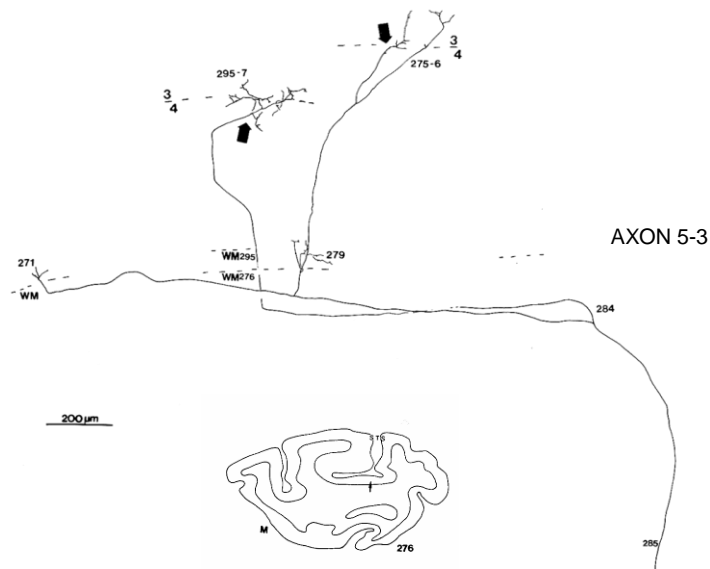
MT,
V1 → L. 4
L. 6

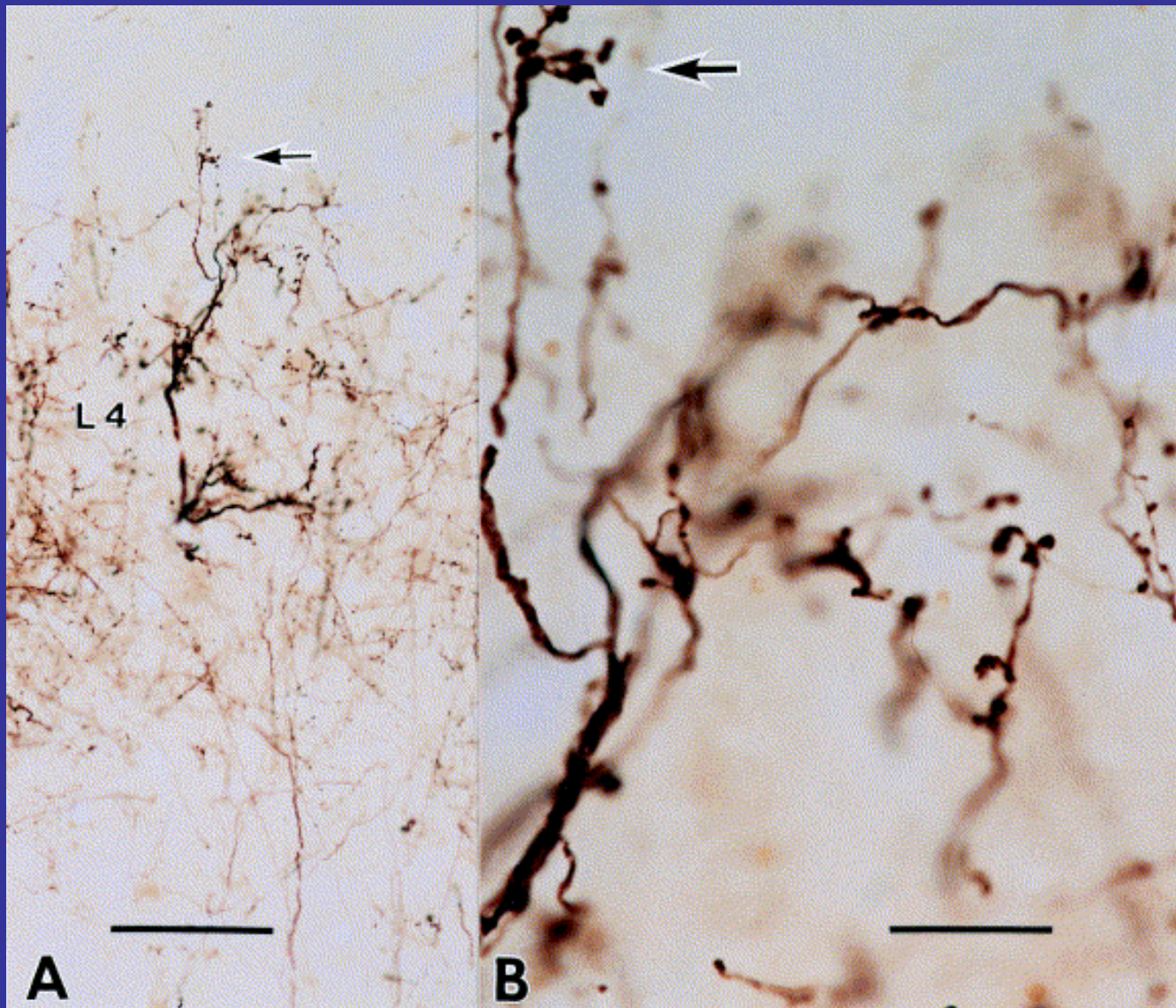


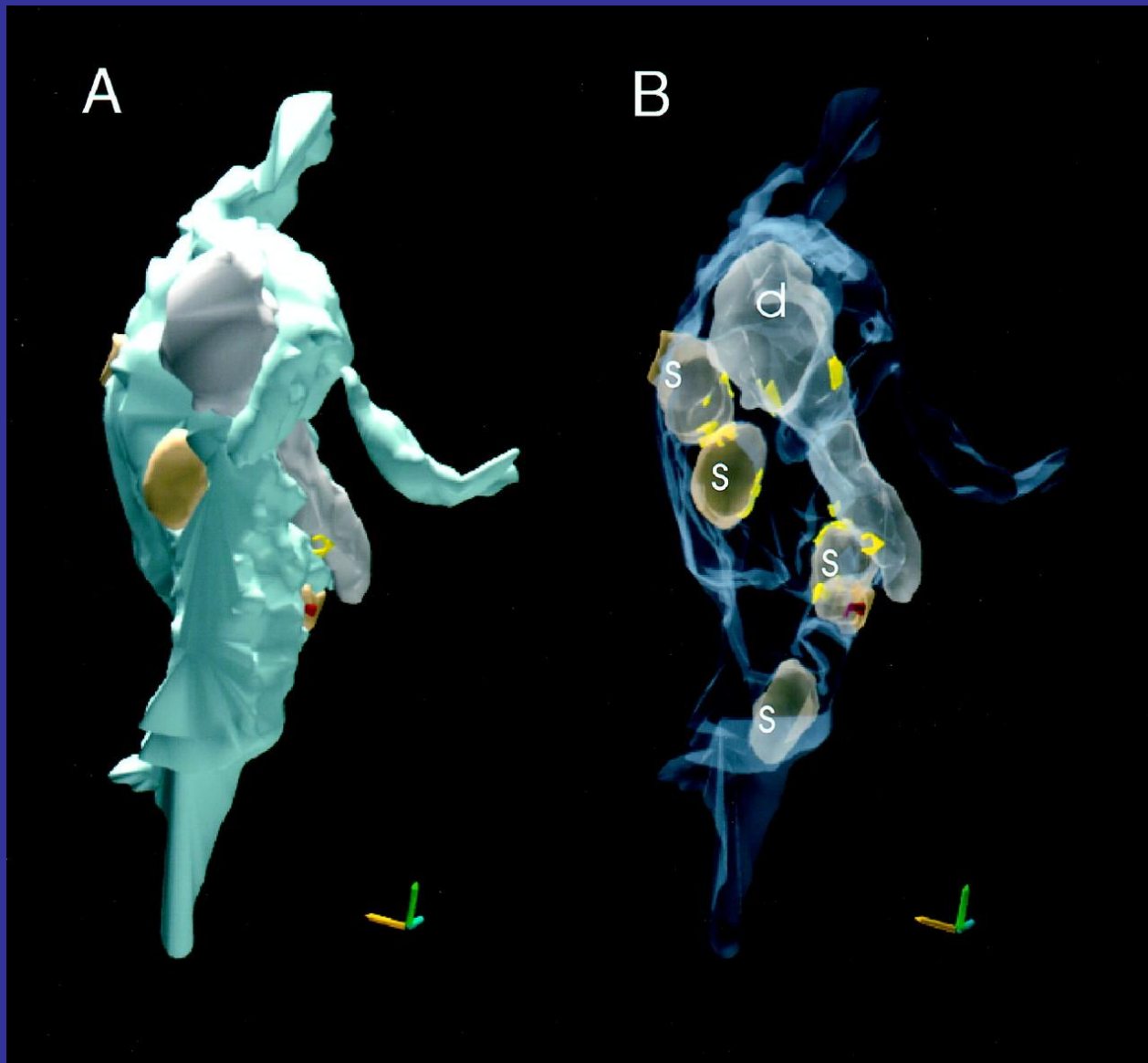
L. 3

V2 → L. 4 (1-4)

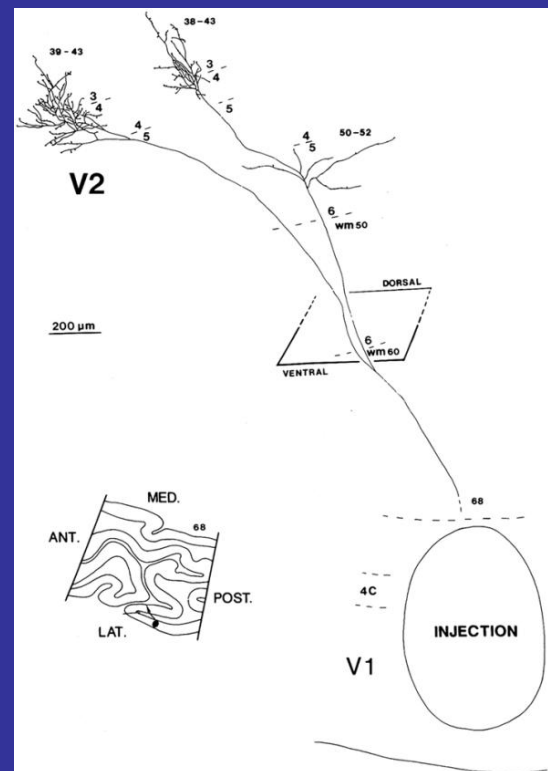
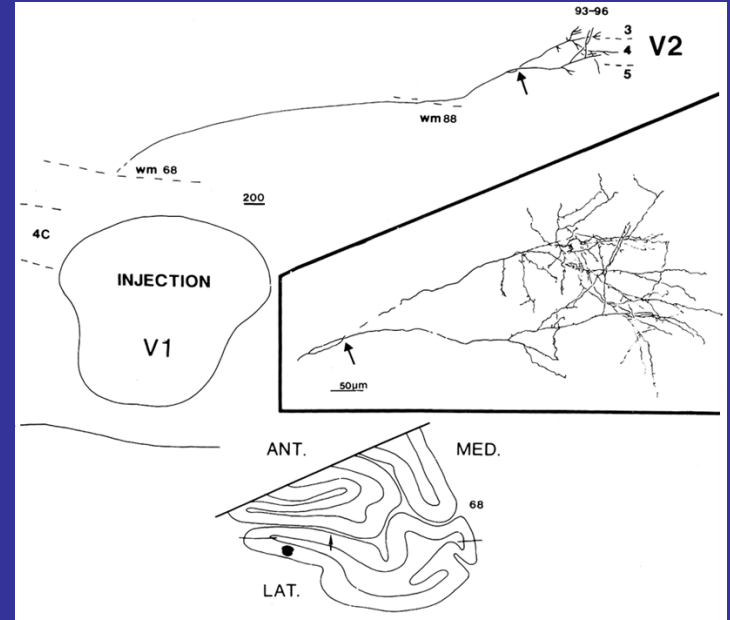
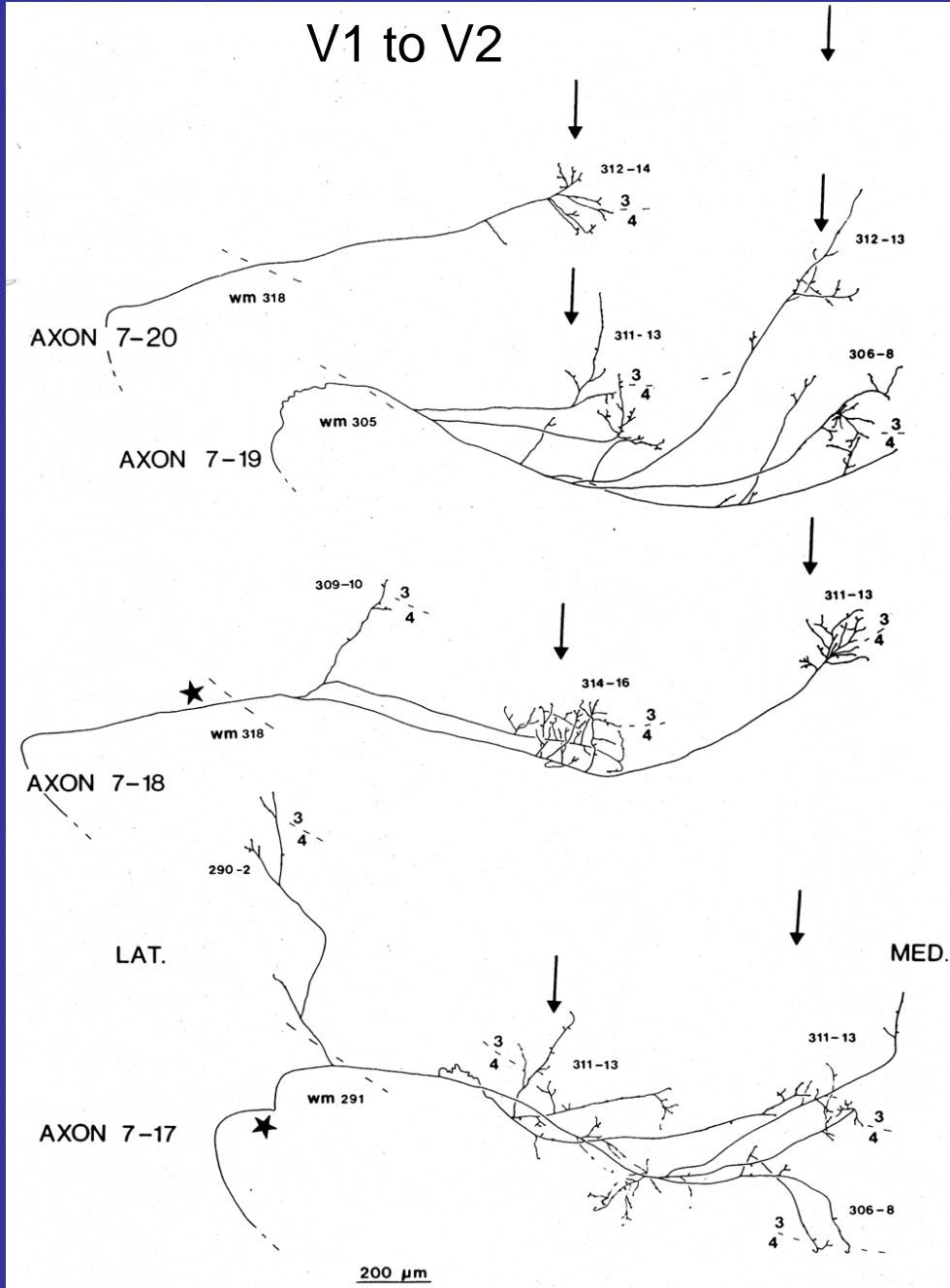




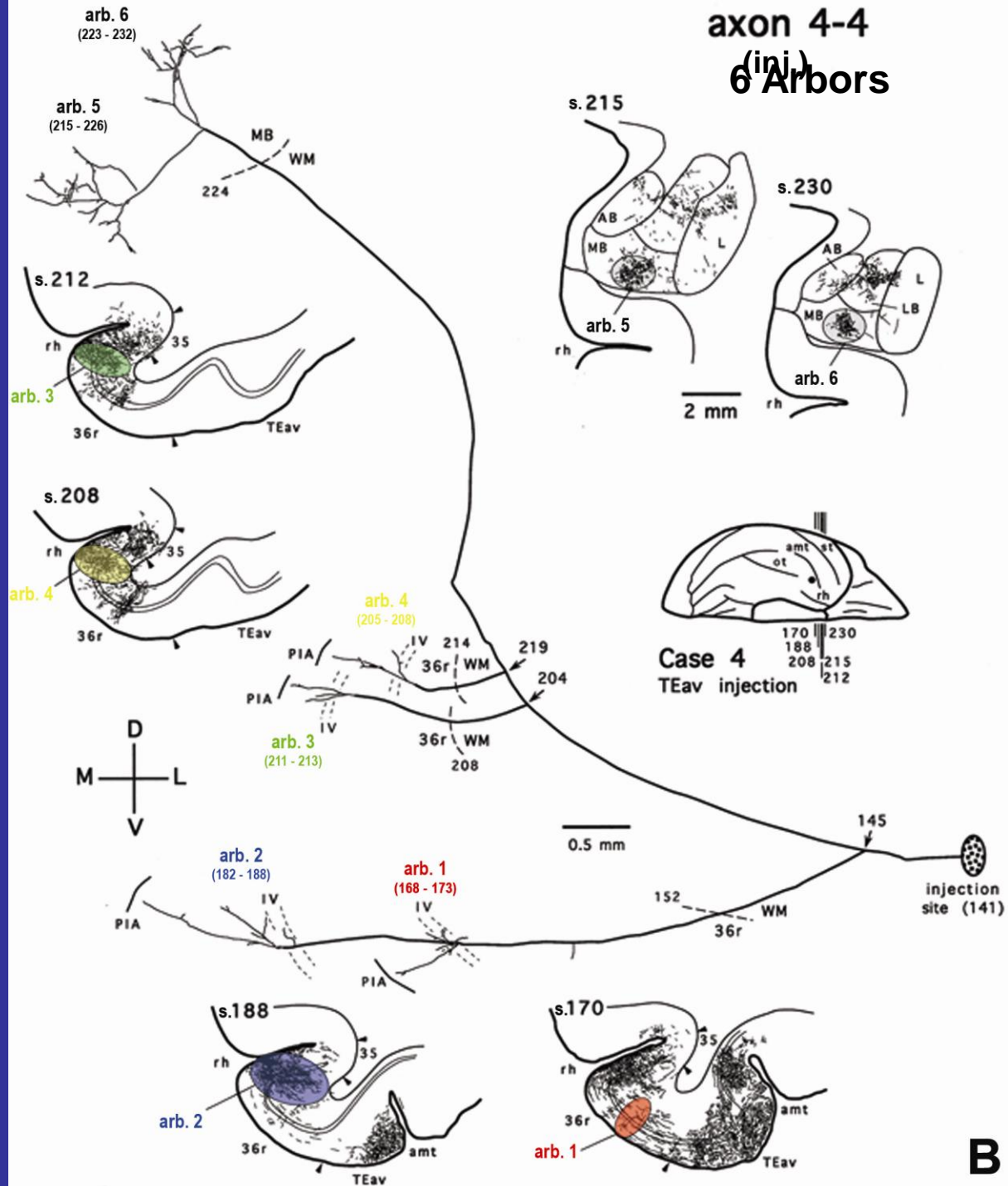




A large bouton in L. 4, and 5 postsynaptic targets (4 spines, 1 dendrite)



Rockland and Virga, 1990

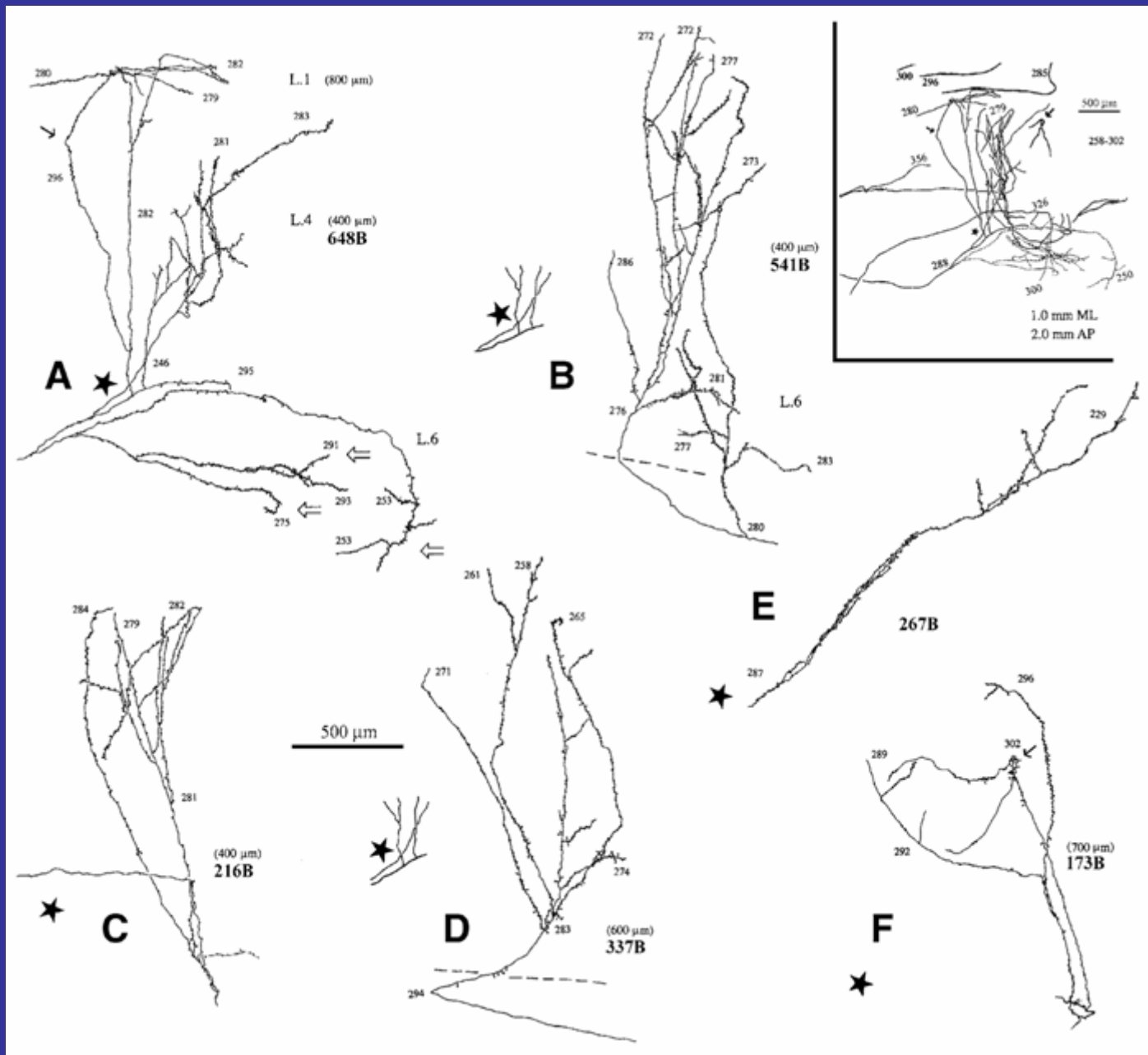


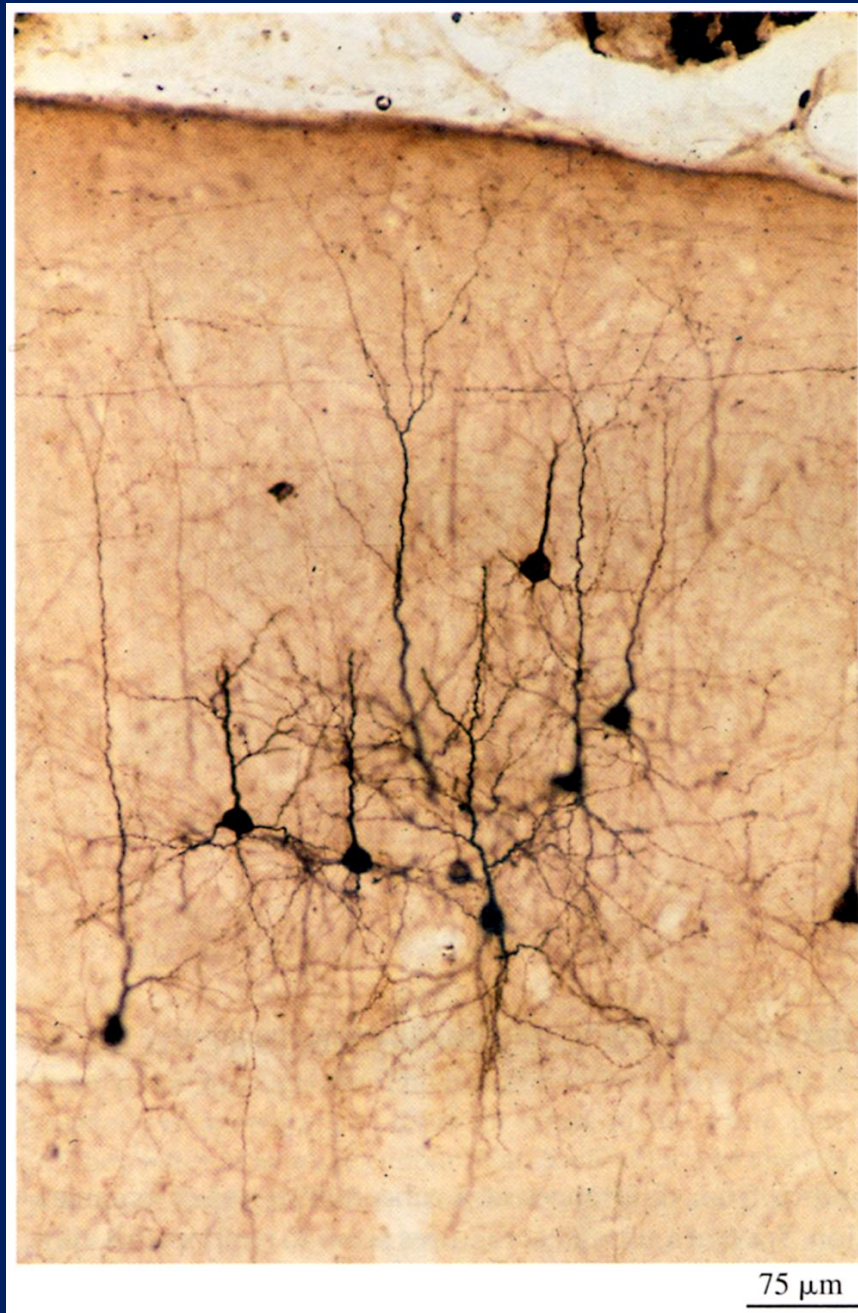
TEav to

-- perirhinal

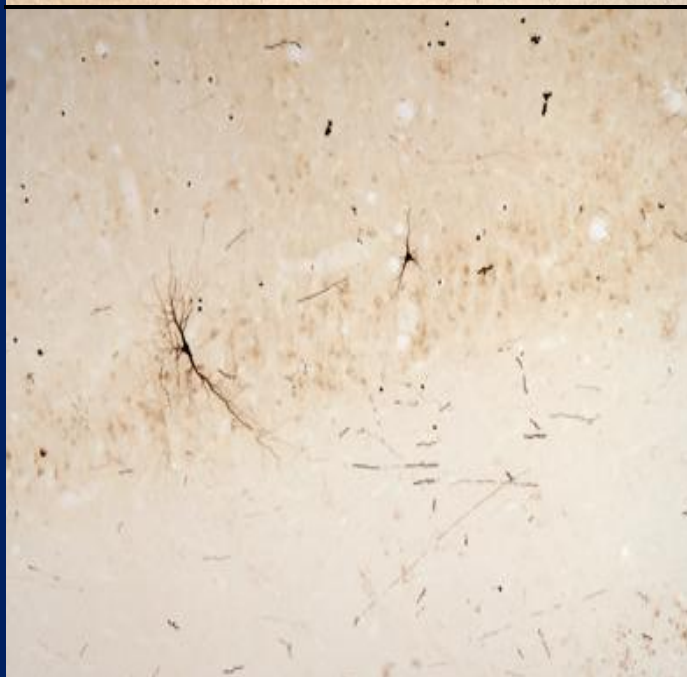
-- amygdala

B

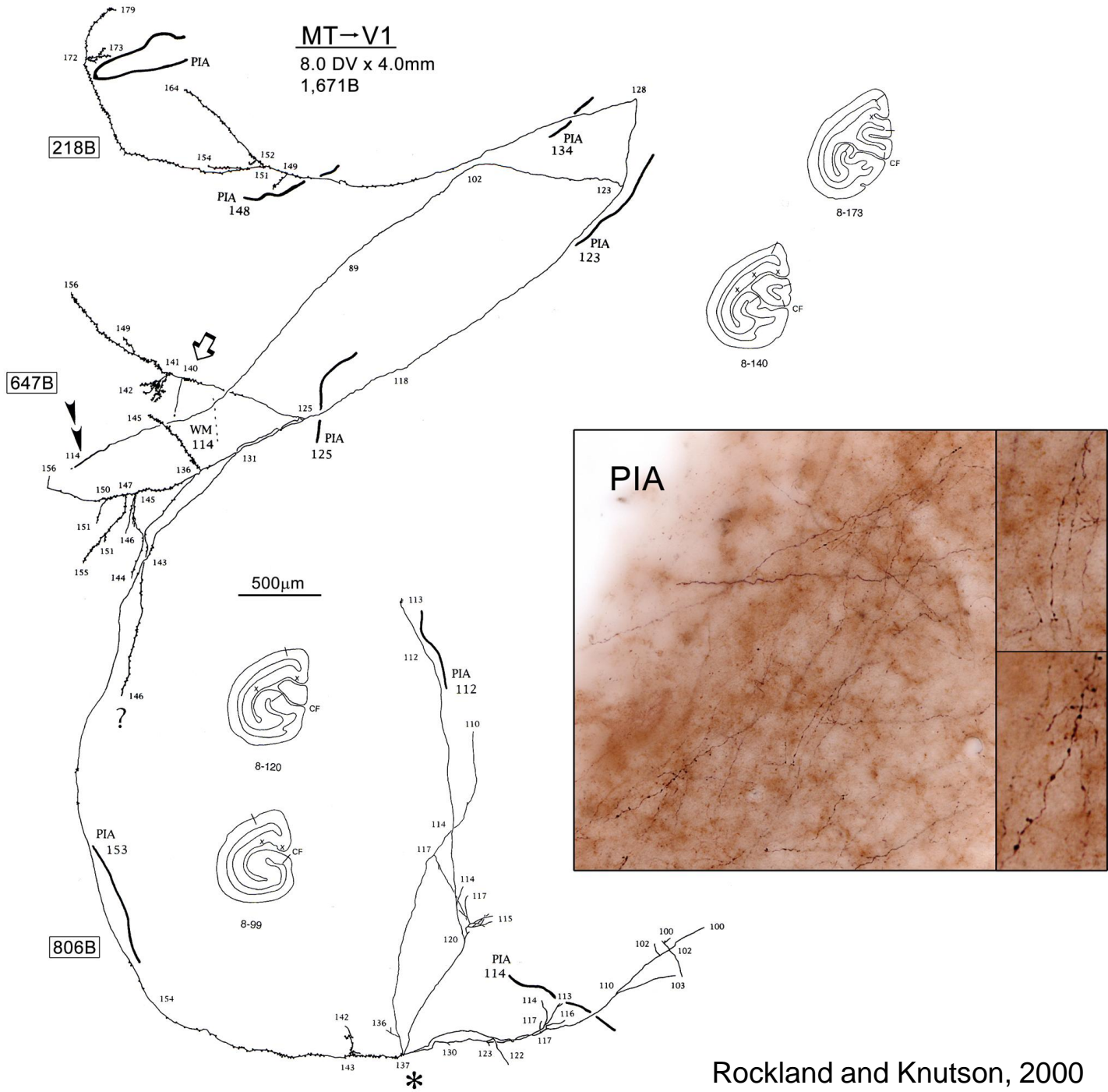


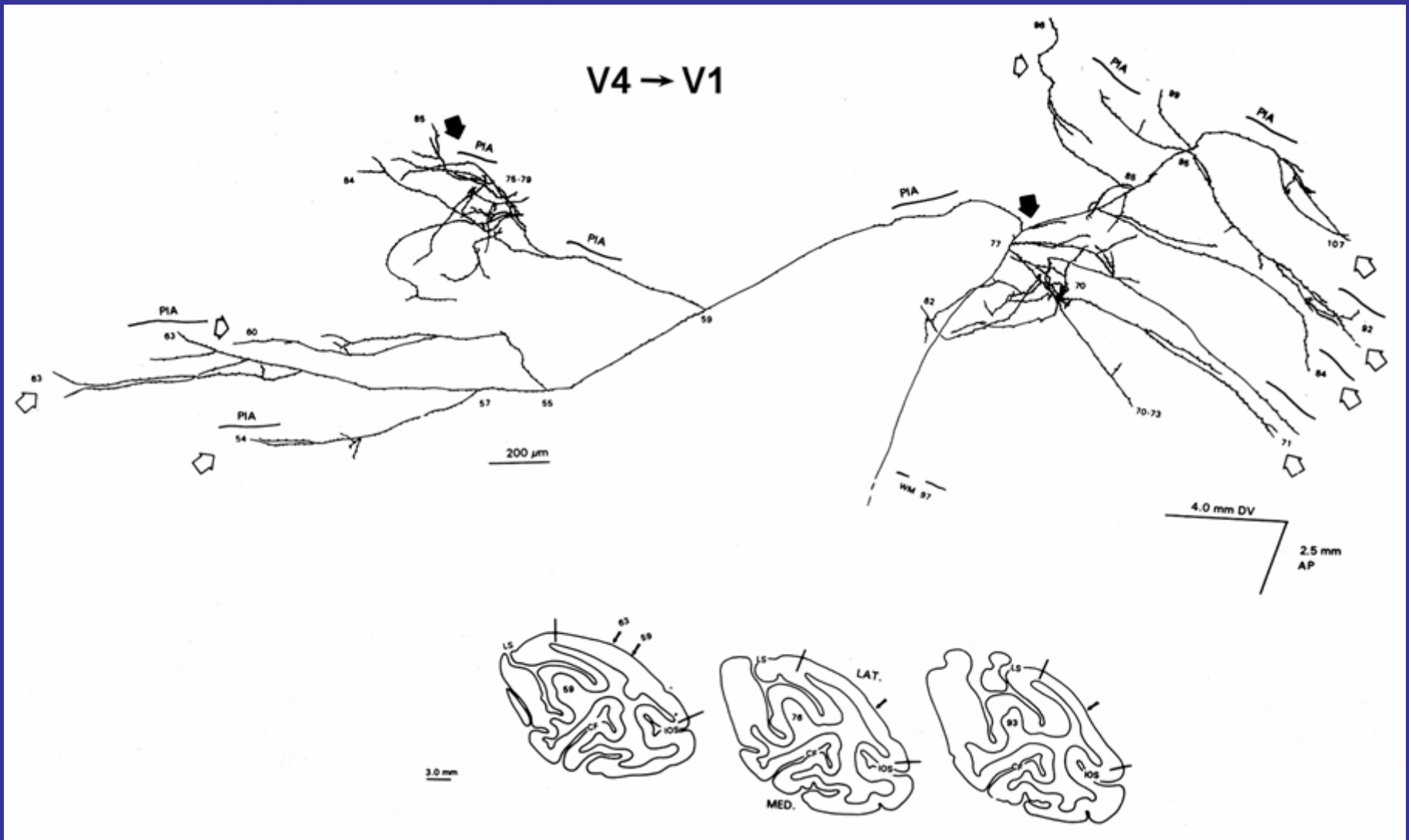


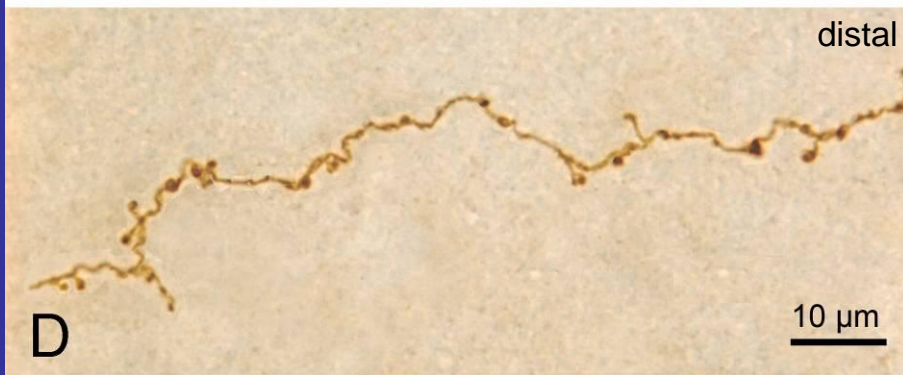
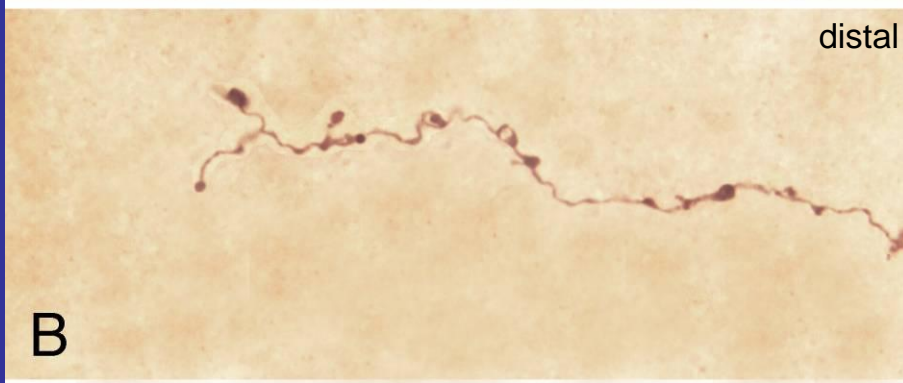
V1 to V2 (BDA retrogradely filled neurons)



MT→V1
8.0 DV x 4.0mm
1,671B

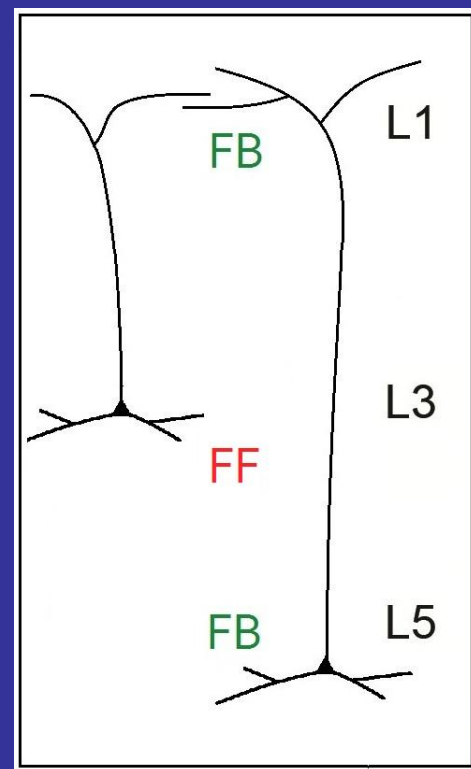
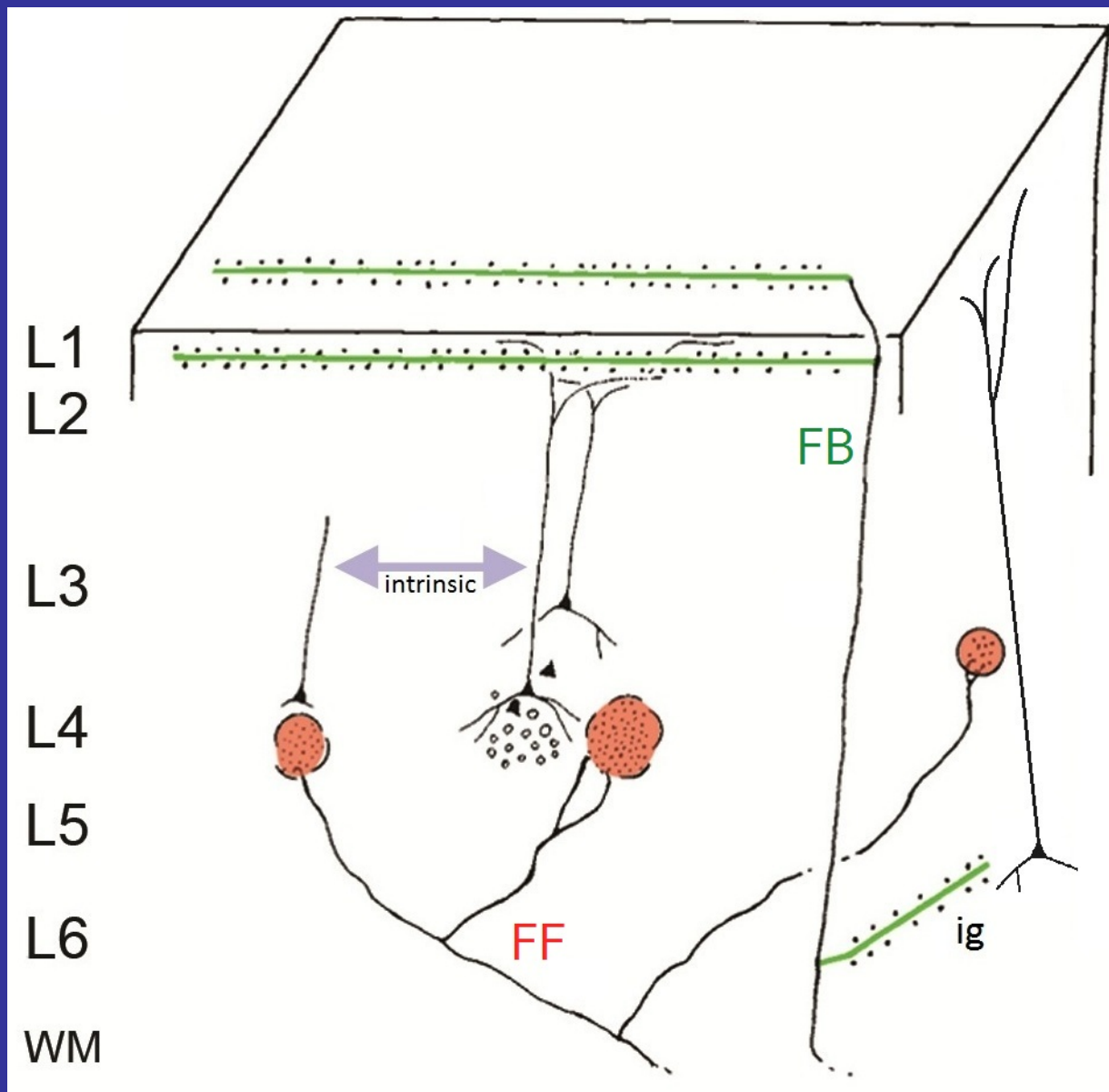


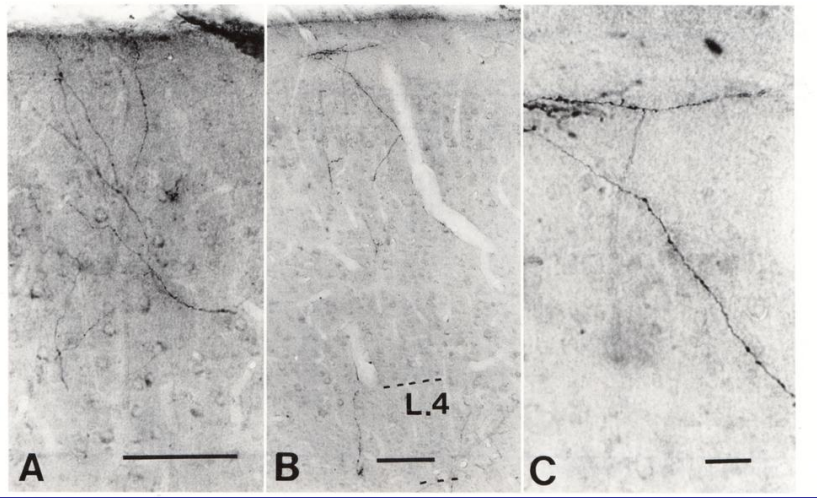




V2 to V1	10.24
V4 to V1	8.50
V4 to V2	6.66

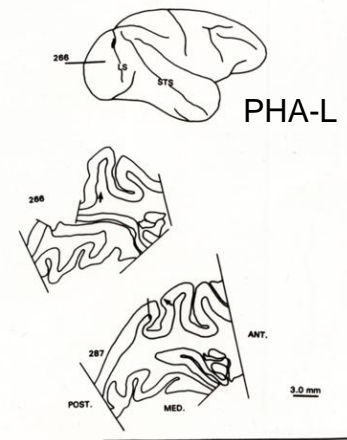
av ibi (n = 10@)



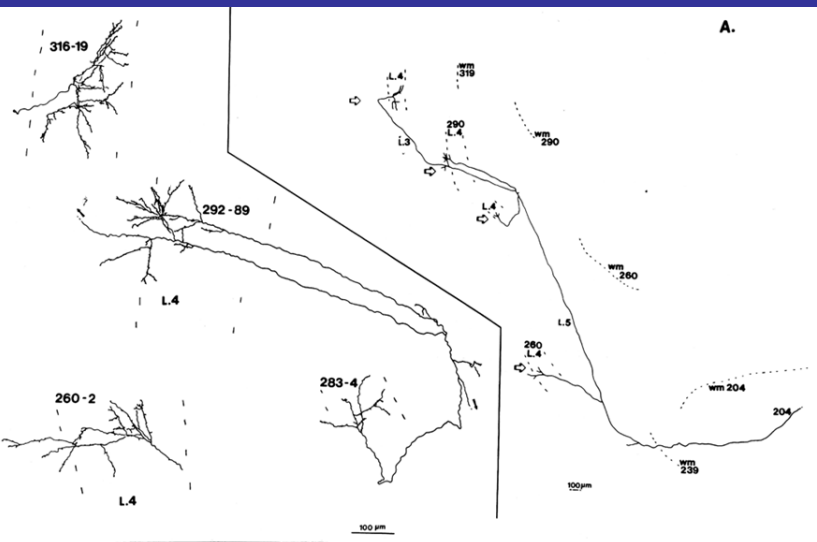
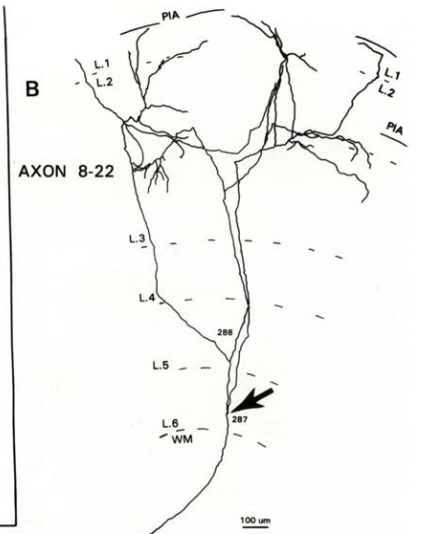


V2 → V4

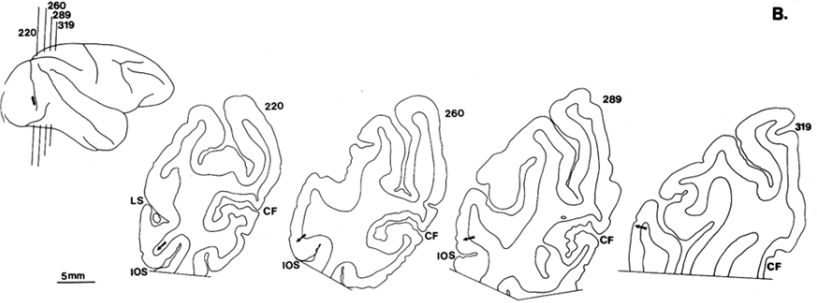
A



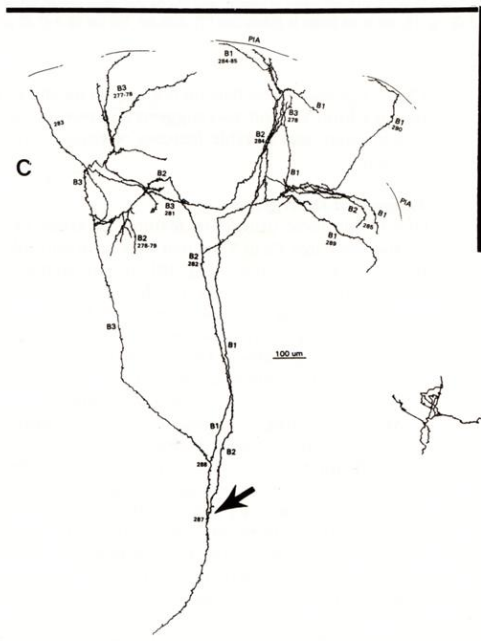
B



A.

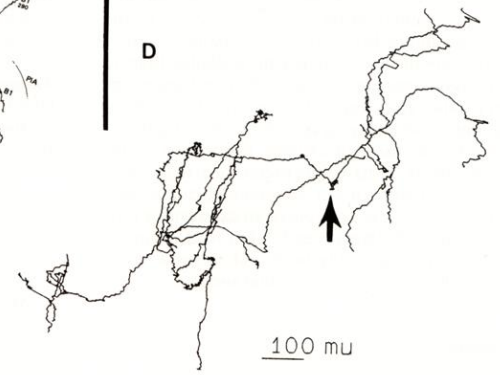


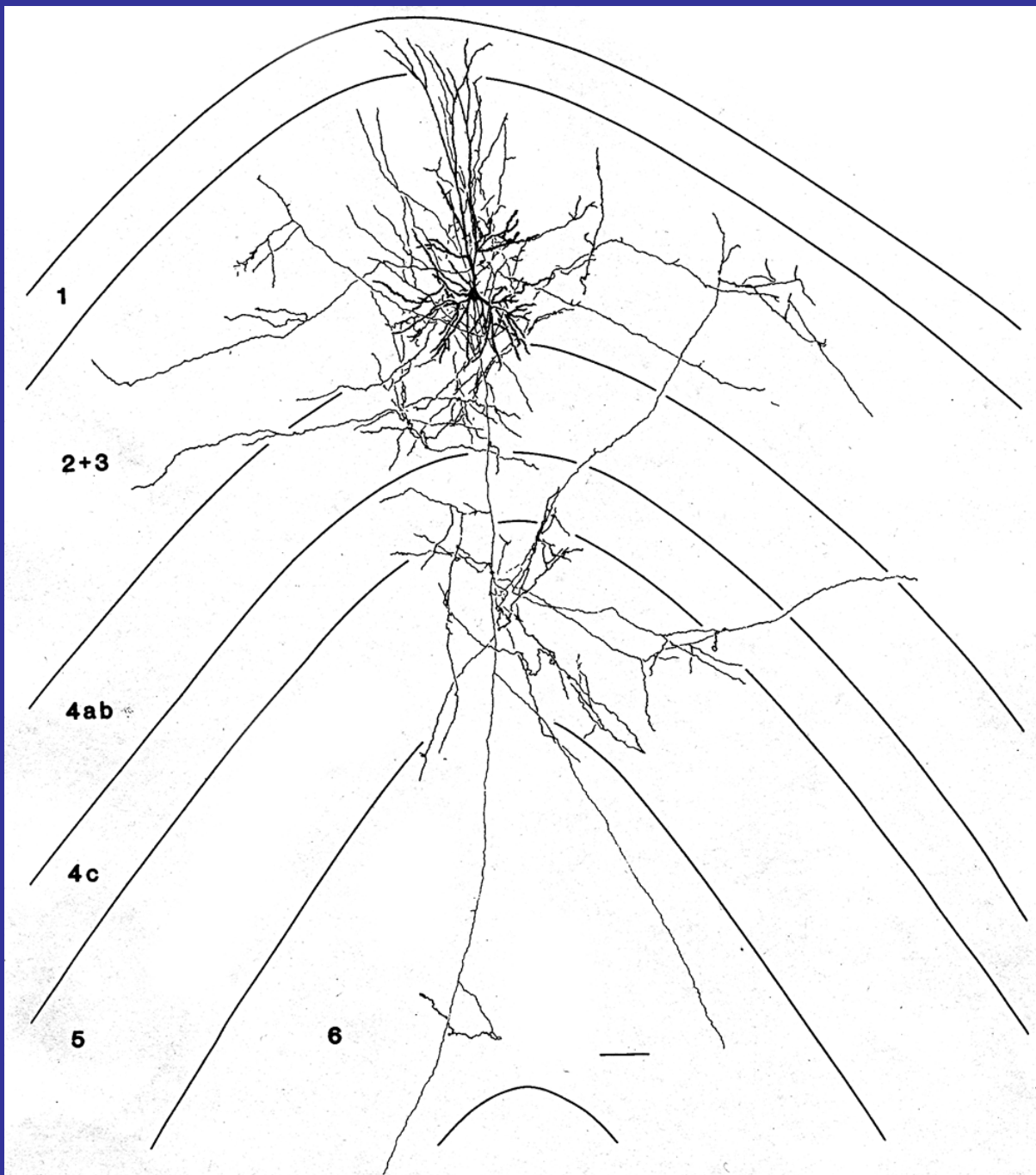
B.



C

D

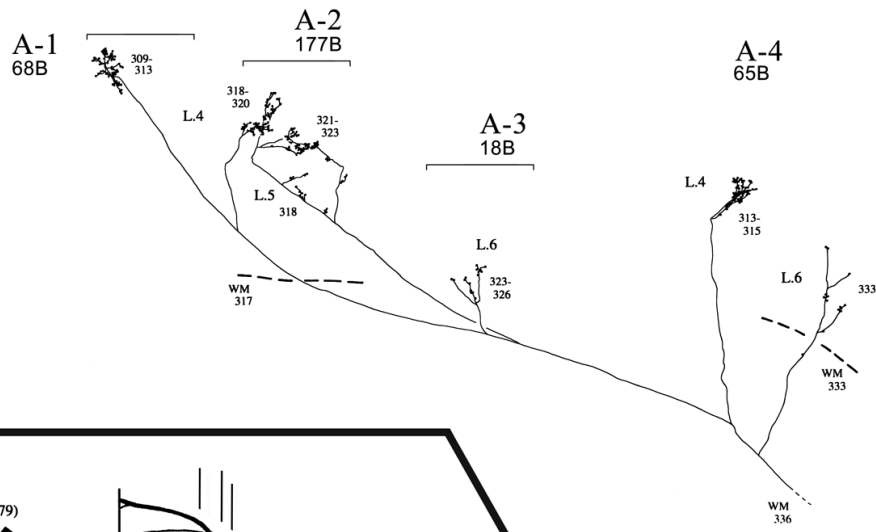




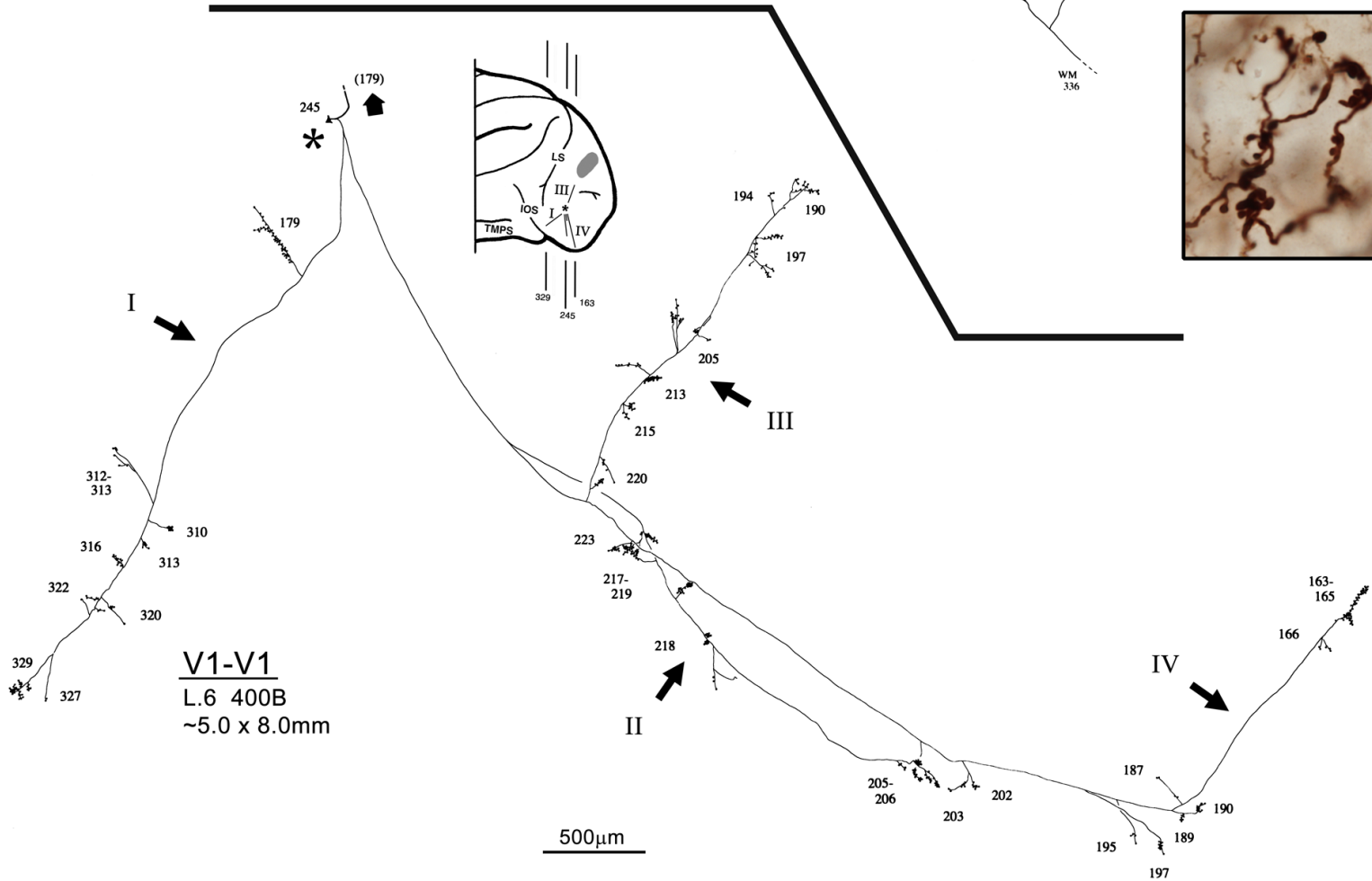
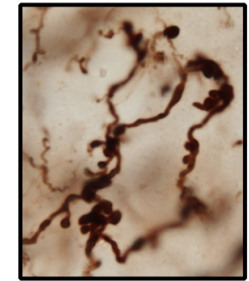
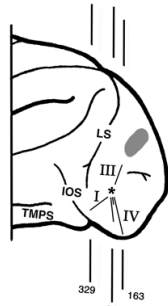
Gilbert and Wiesel,
1983



Binzegger et al., 2004

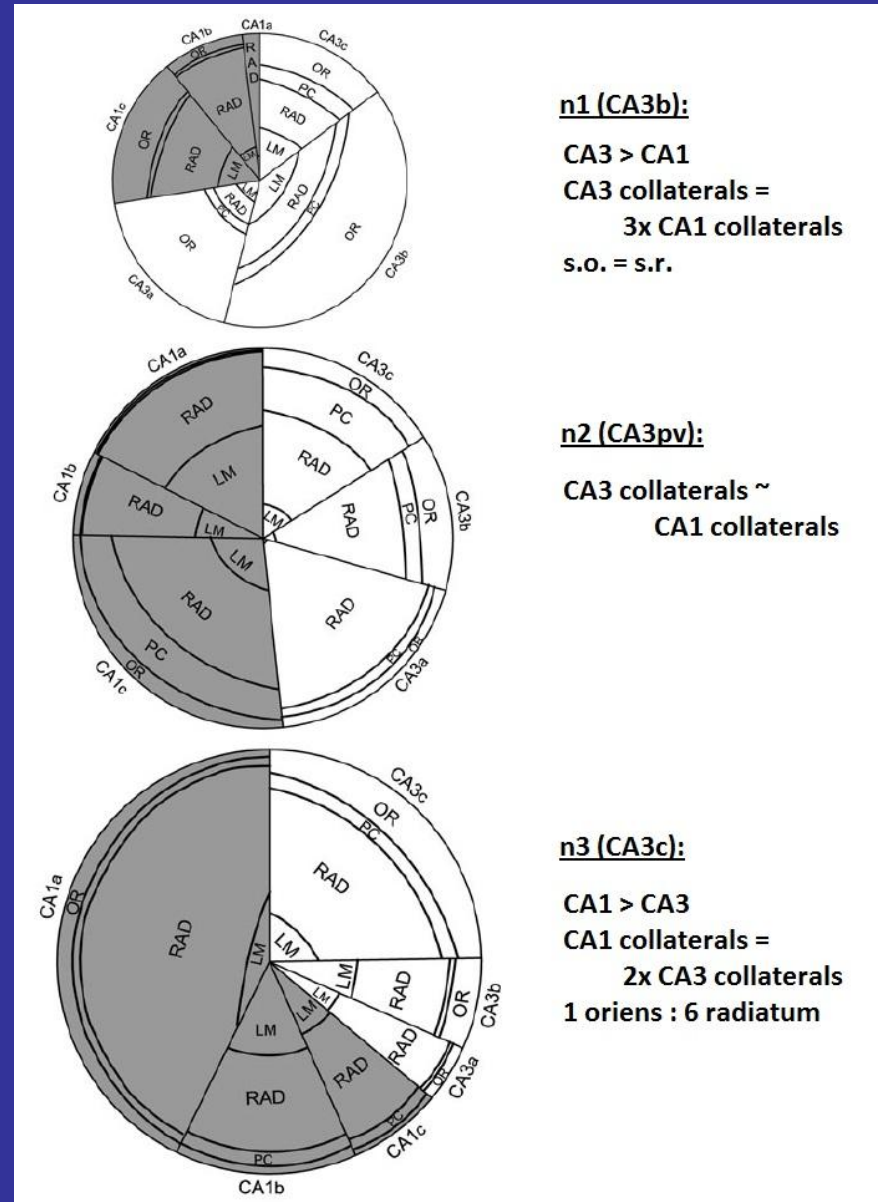
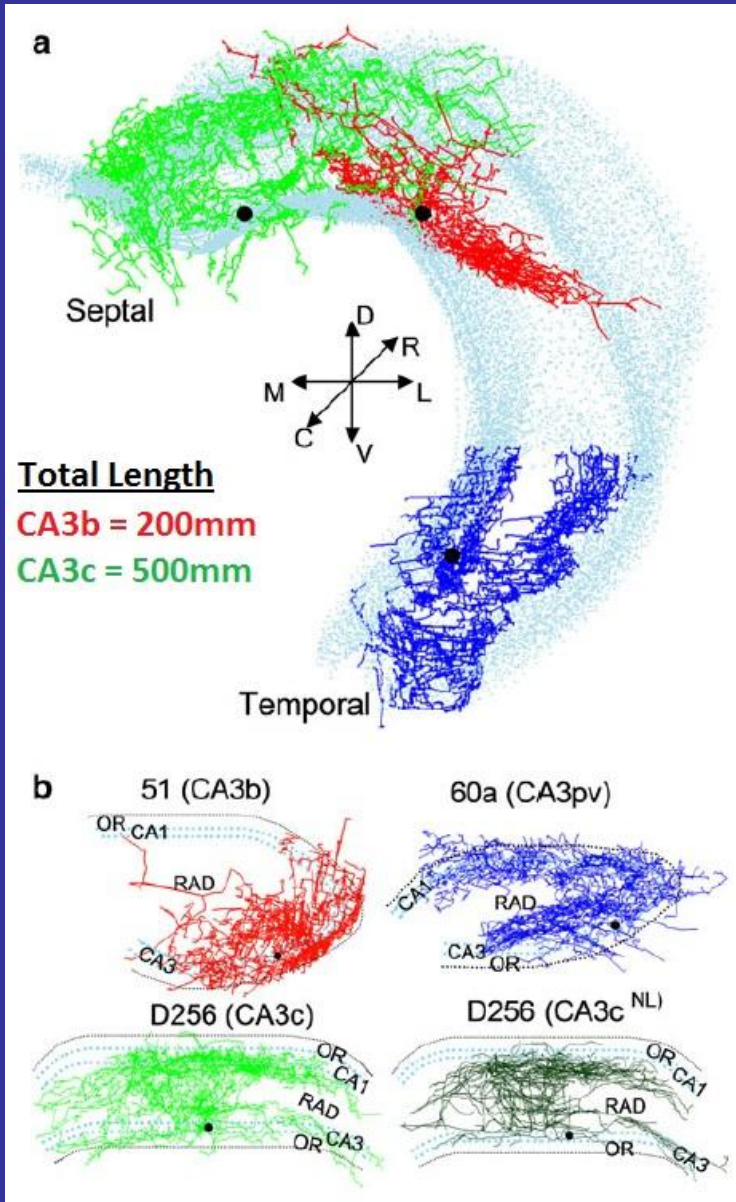


V1→MT
 L.4 303B
 L.6 38B
 3.5 x 1.2mm

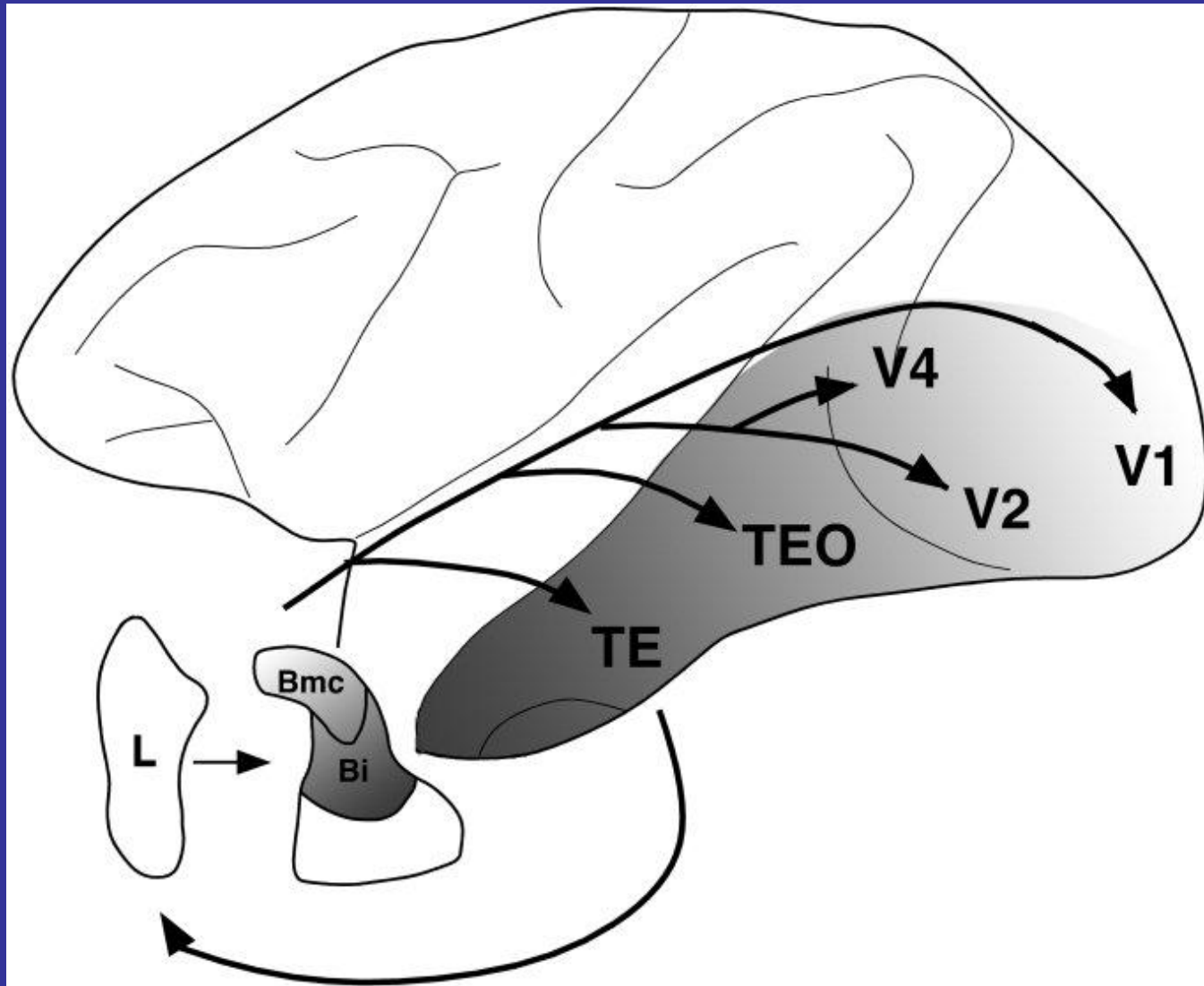


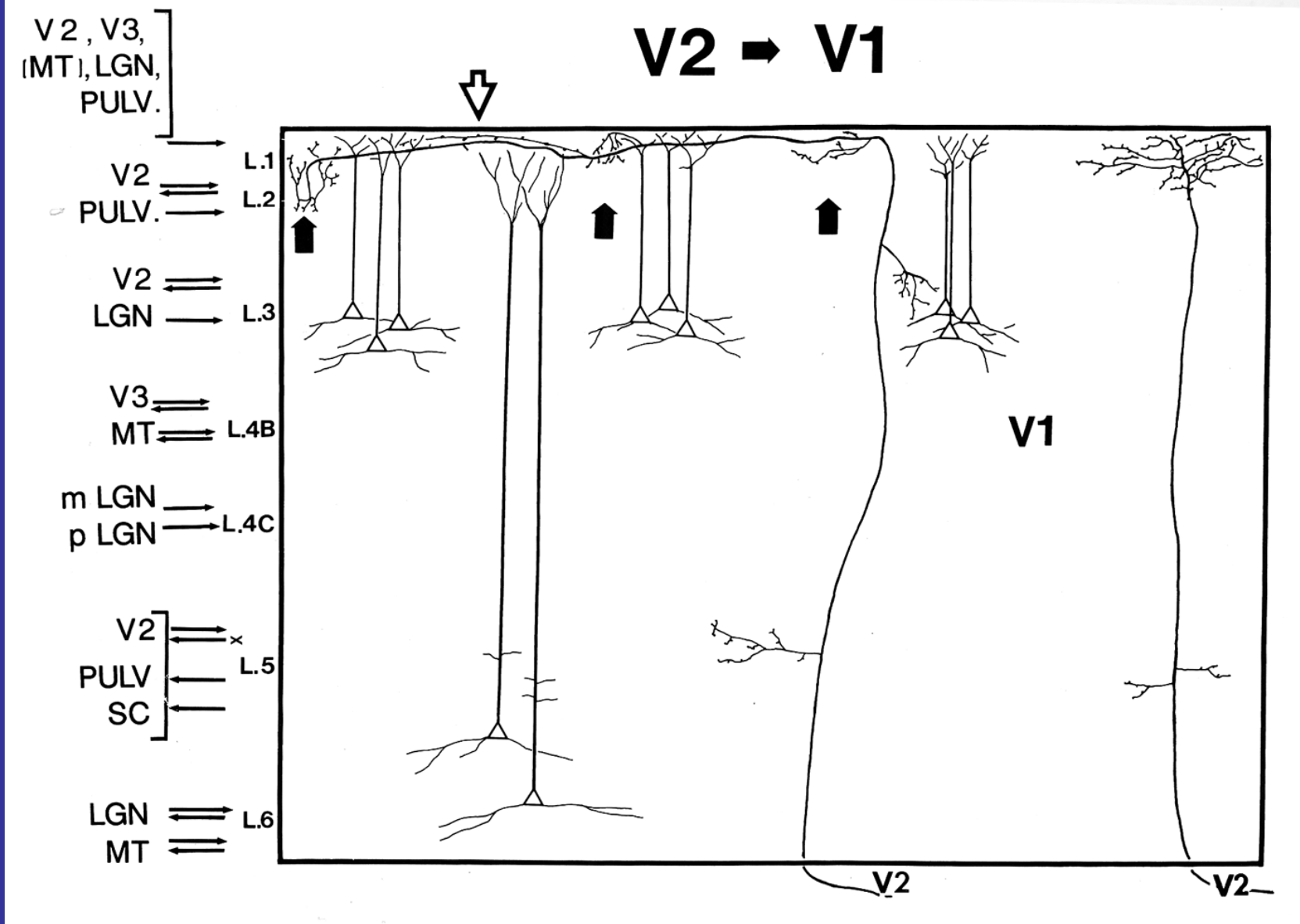
V1-V1
 L.6 400B
 ~5.0 x 8.0mm

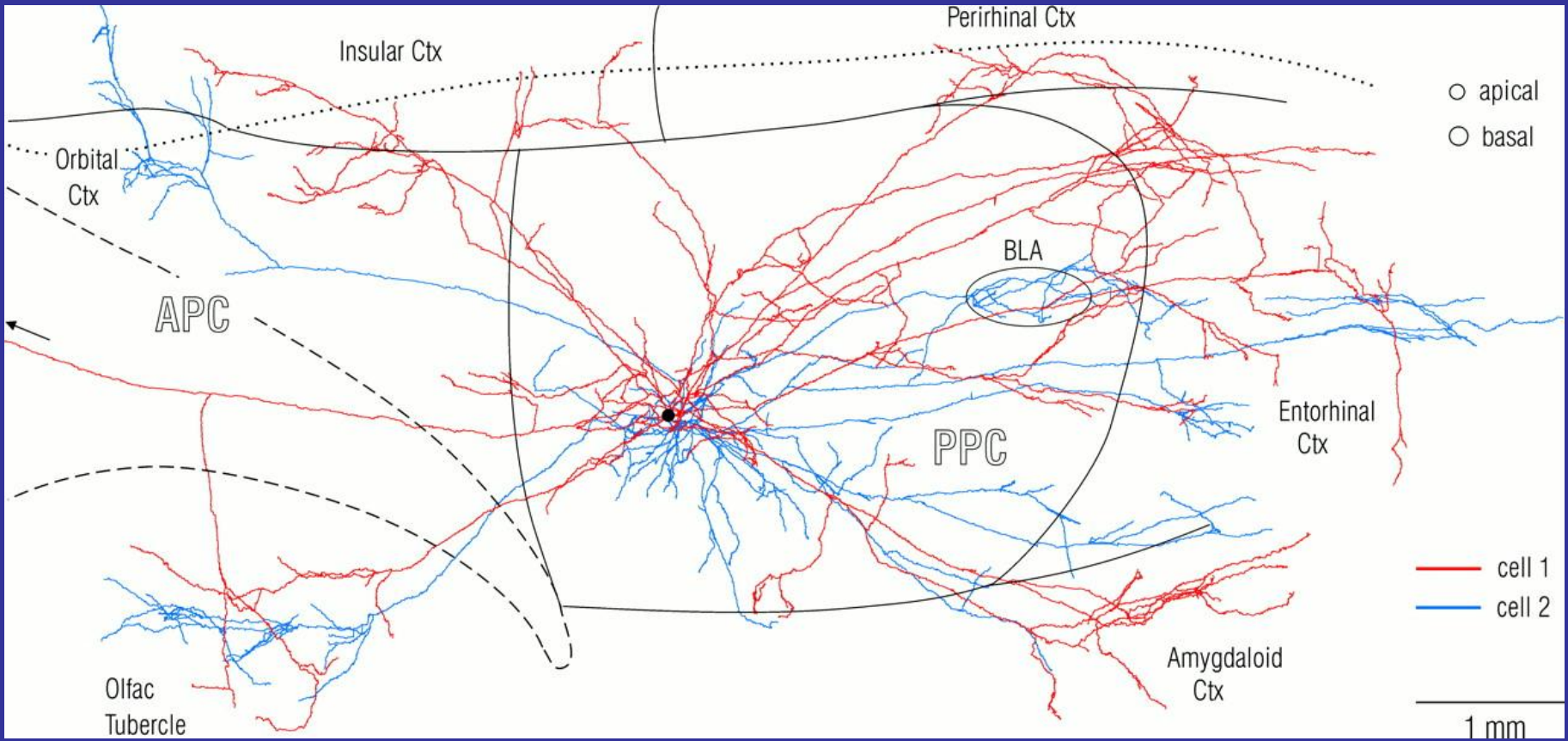
CA3 neurons (n=3) intracellularly filled with with biocytin (rat; *in vivo*; diadem project). Absolute and relative axonal length distributions within individual sub-regional layers for each of the three neurons. (NL: 6 months, vs. 3 weeks + 6 weeks for analysis)

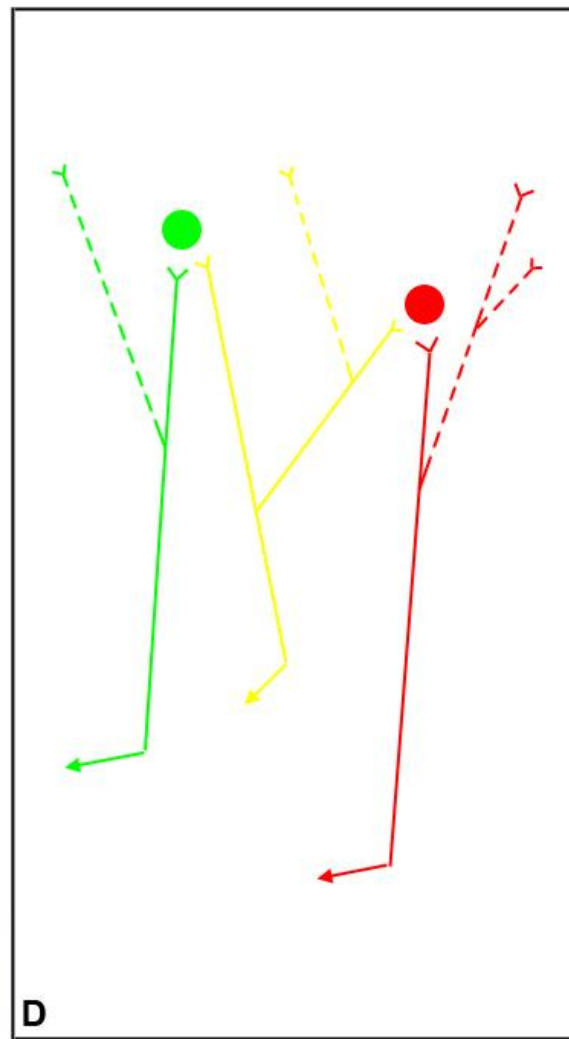
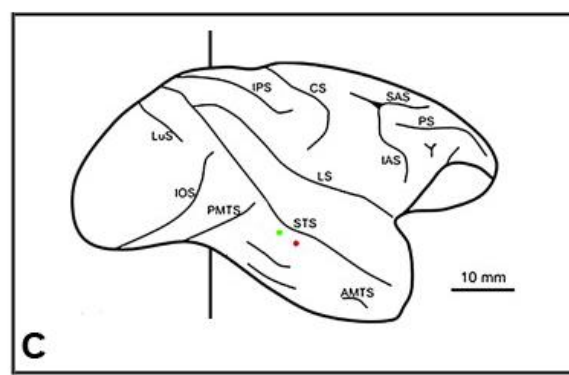
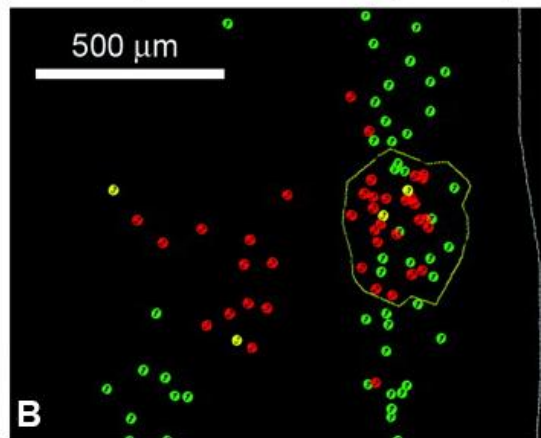
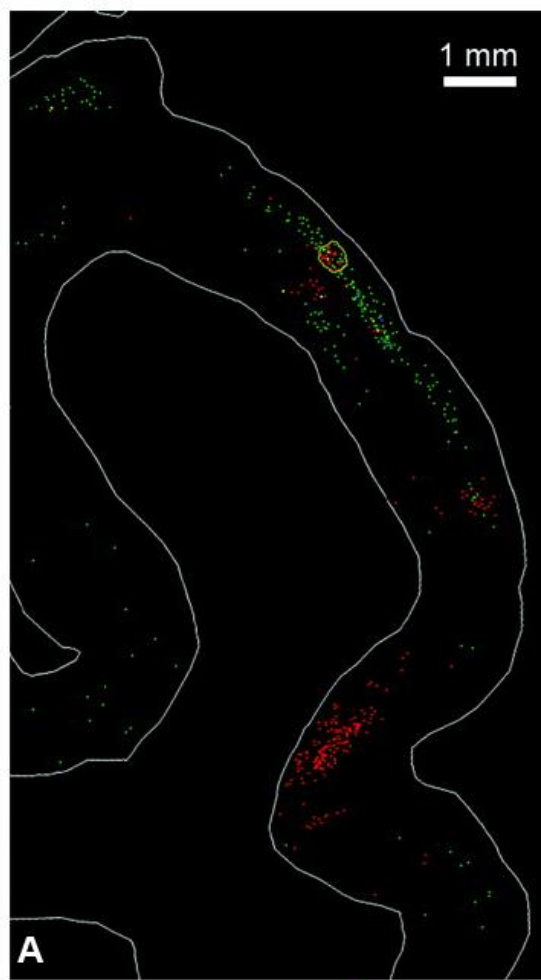


pv = posterior ventral







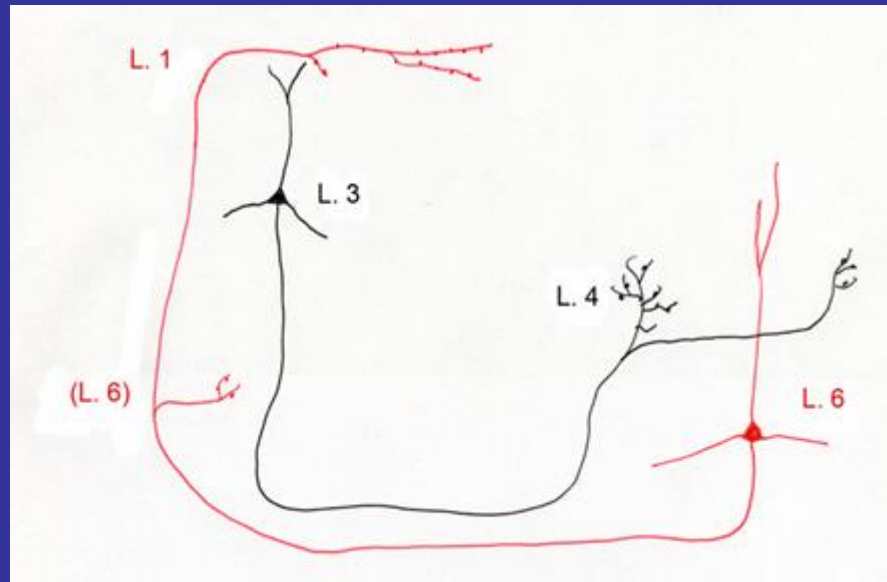


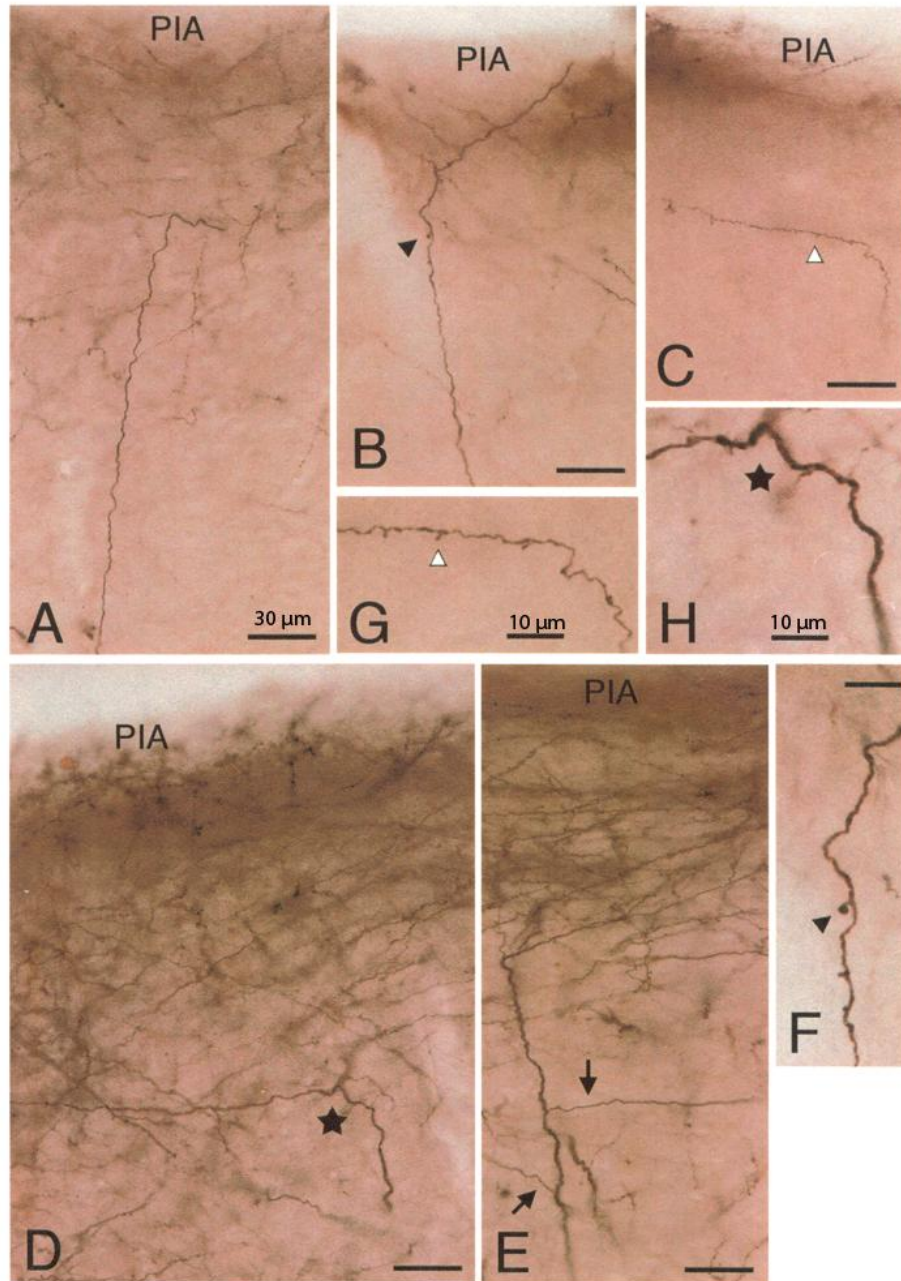
Borra et al., 2010

CTB Injections
in TEp

Corticocortical (Zn+/Zn-)

	<u>"feed forward"</u>	<u>"feed back"</u>	<i>OTHER</i>
- parent cell (pyr.)	L. 3 (5+)	L. 2, 3A, 6	
- postsyn. target	??	Distal (often)	
- layer of termination	L. 4+	L. 1 (6)	
- synapse size (Glu)	small	small	
- arbor	{ small (~250 μ m) multiple	{ divergent >1.0mm	
	zinc+/zinc- ?	zinc+/zinc- ?	

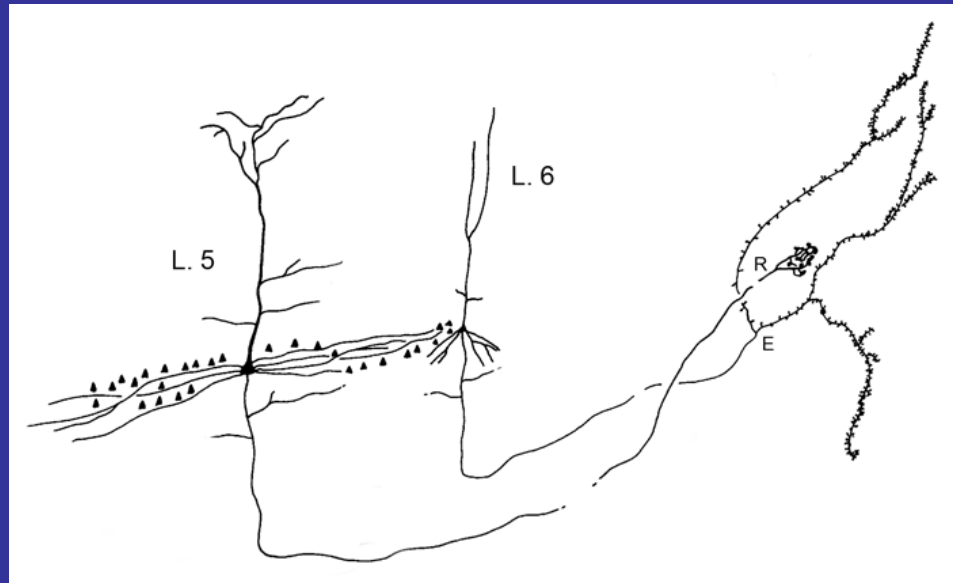


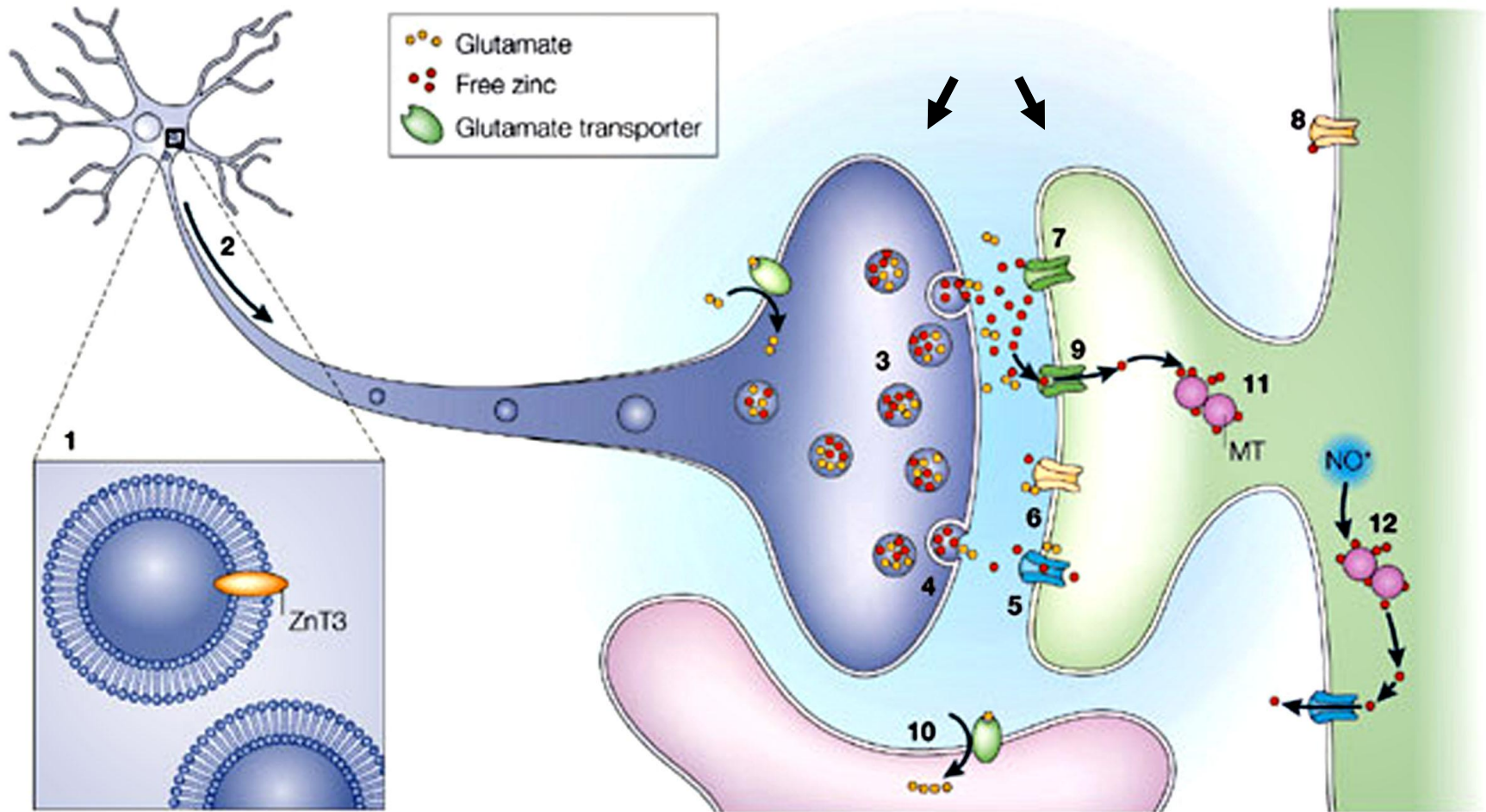


V2 to V1

Corticopulvinar

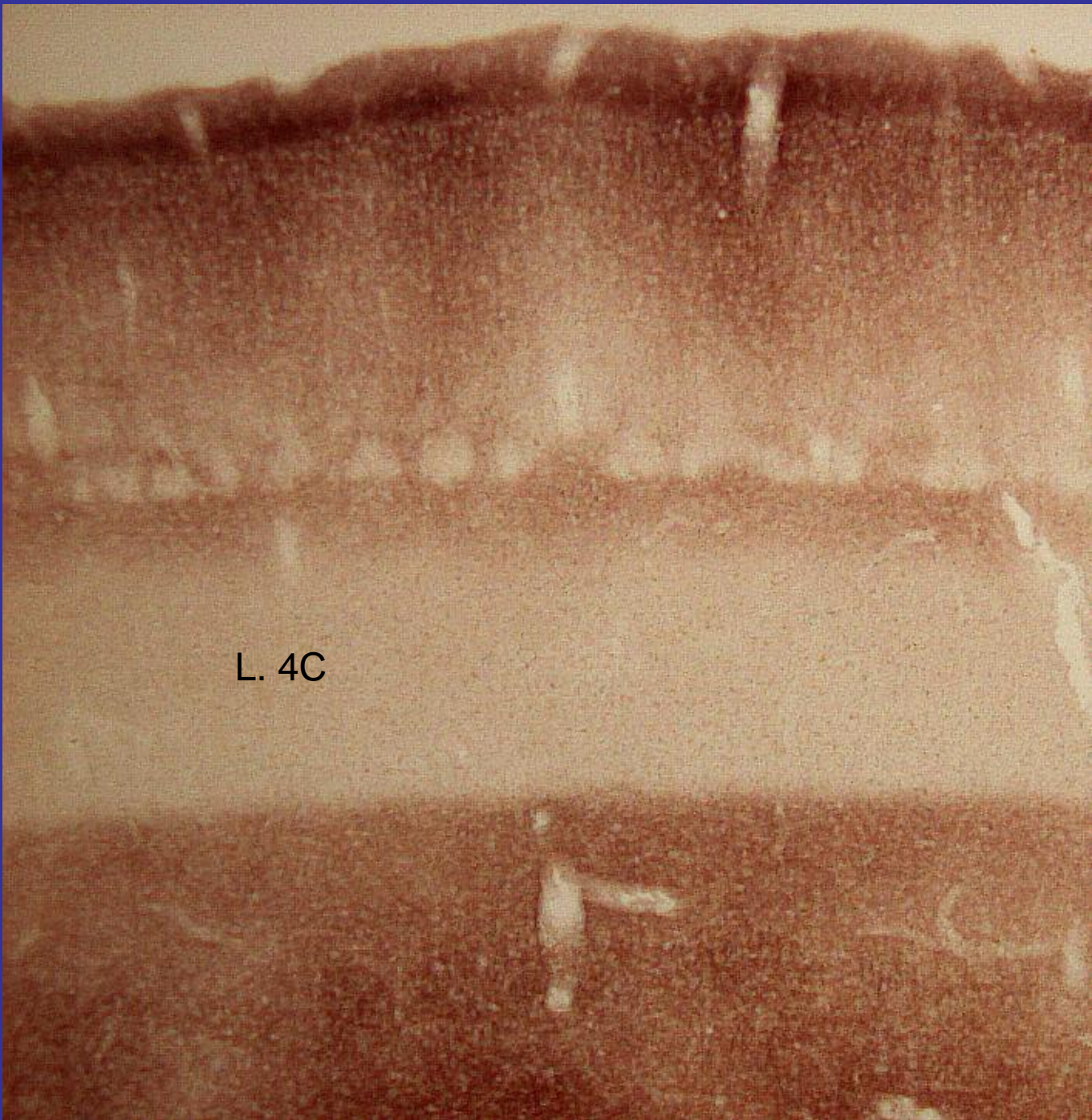
	<u>type 1 (E)</u>	<u>type 2 (R)</u>
- parent cell (pyr.)	L. 6 (many)	L. 5 (few)
- postsyn. target	distal	proximal
- synapse size (Glu)	small	large
- synapse number	{ ~400 – 1,000	{ ~100
- arbor	divergent: >1.0 mm	small: 150um
- efficacy	“modulatory” Zn-	“driving” Zn-





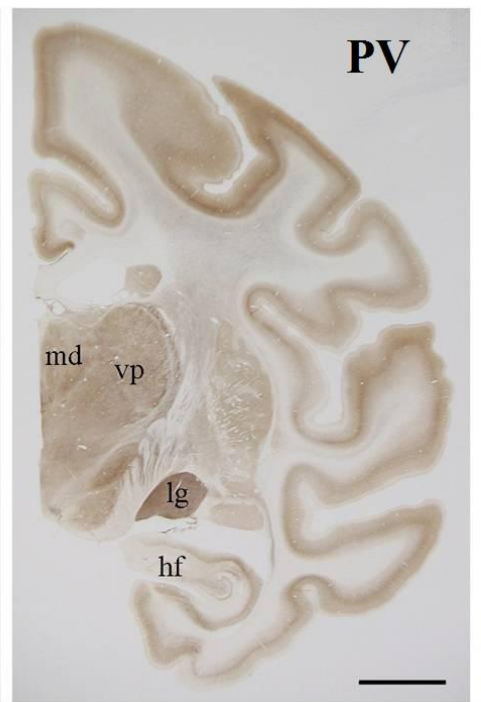
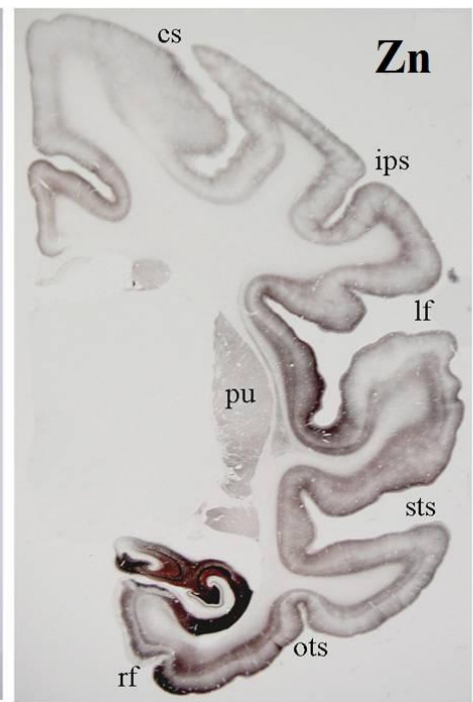
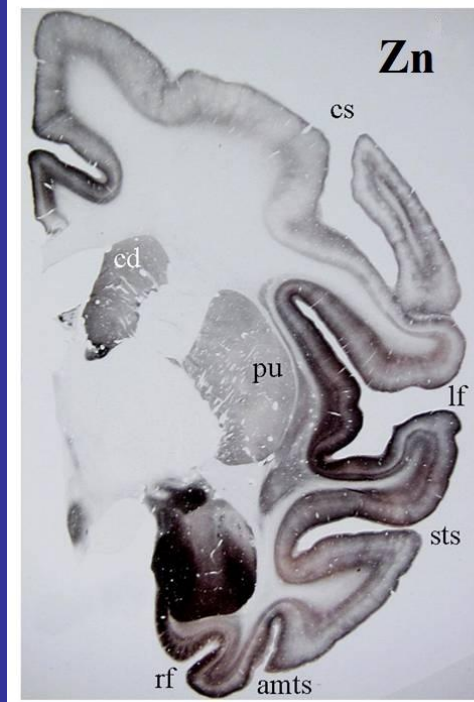
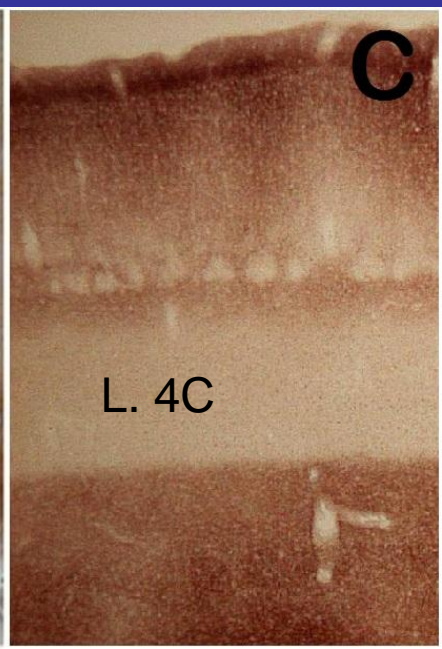
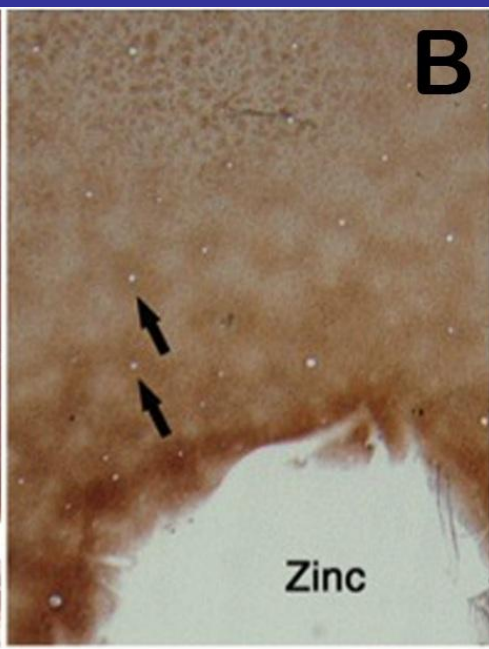
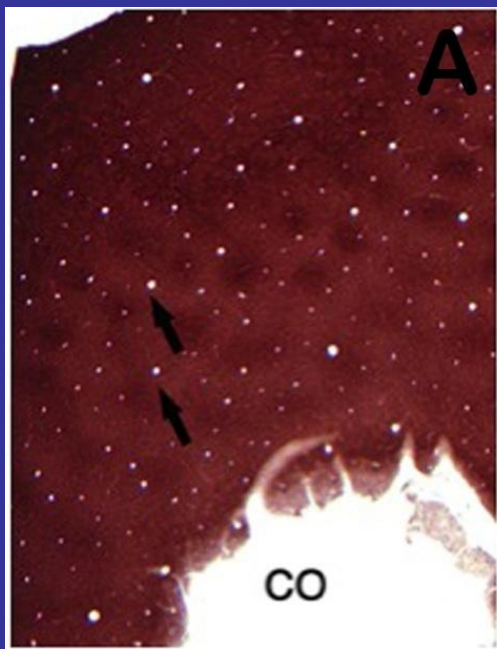
Frederickson et al (2005)

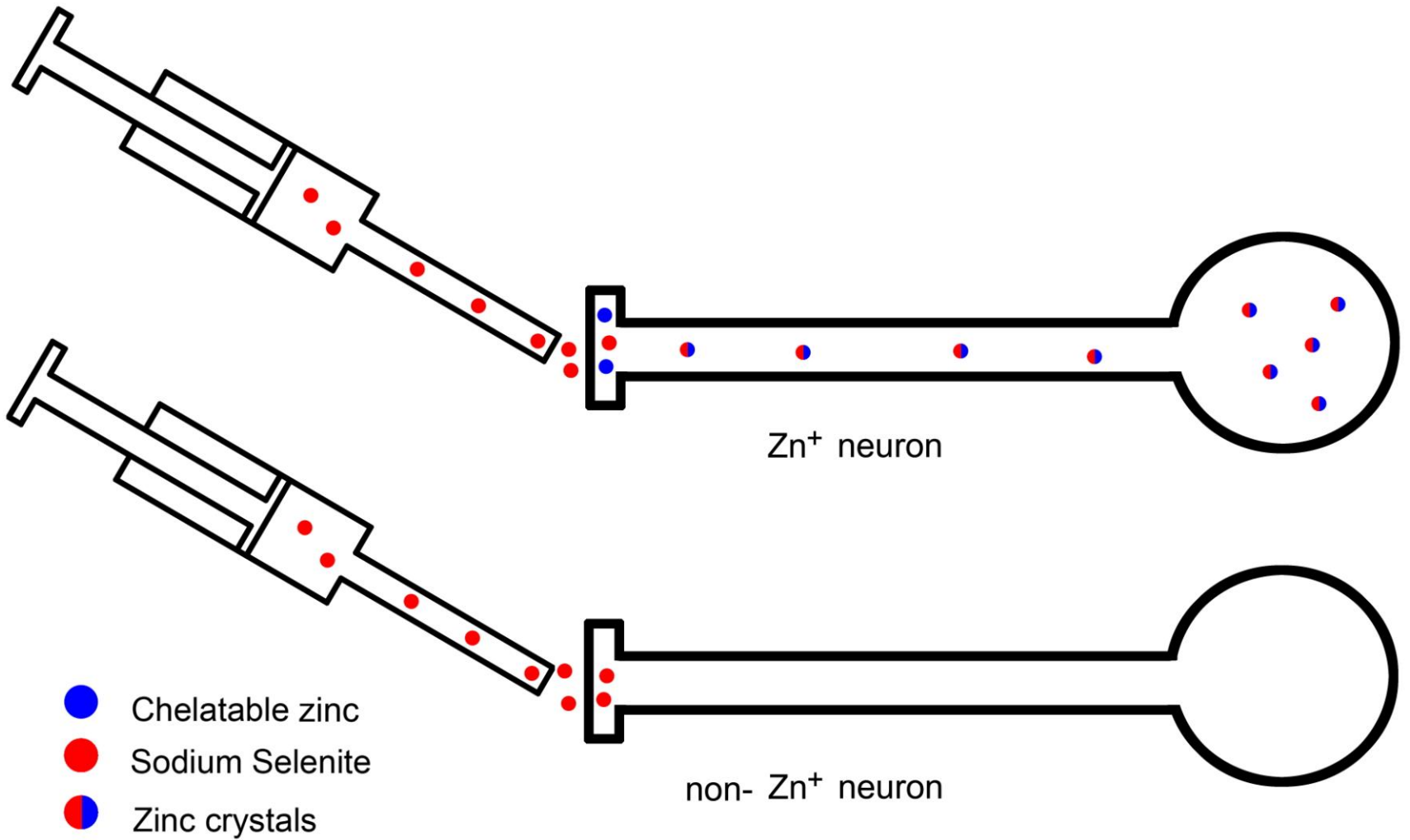
Nature Reviews | Neuroscience

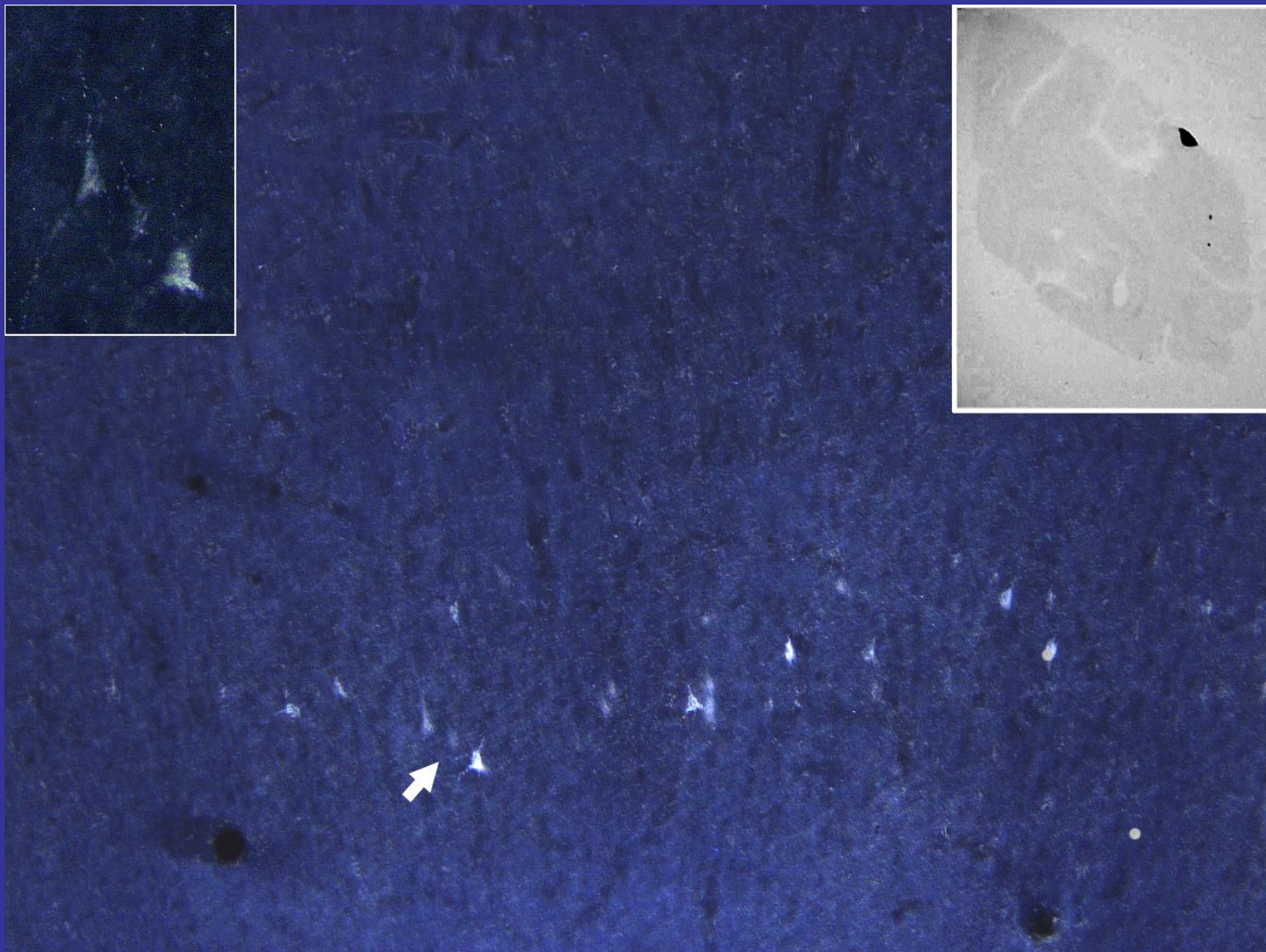
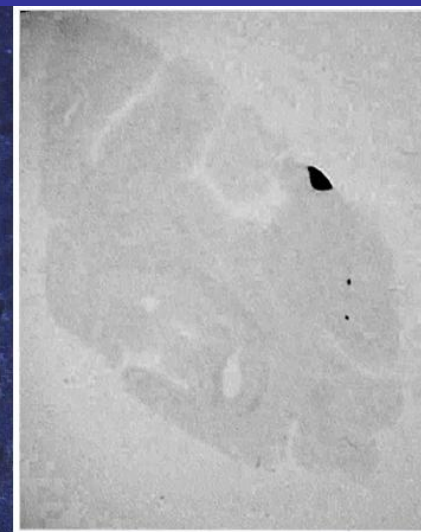
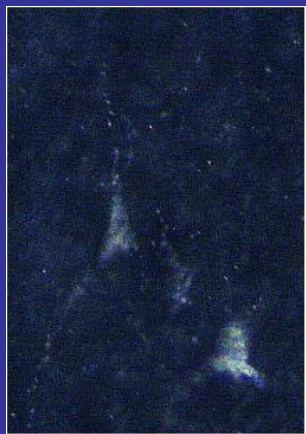


L. 4C

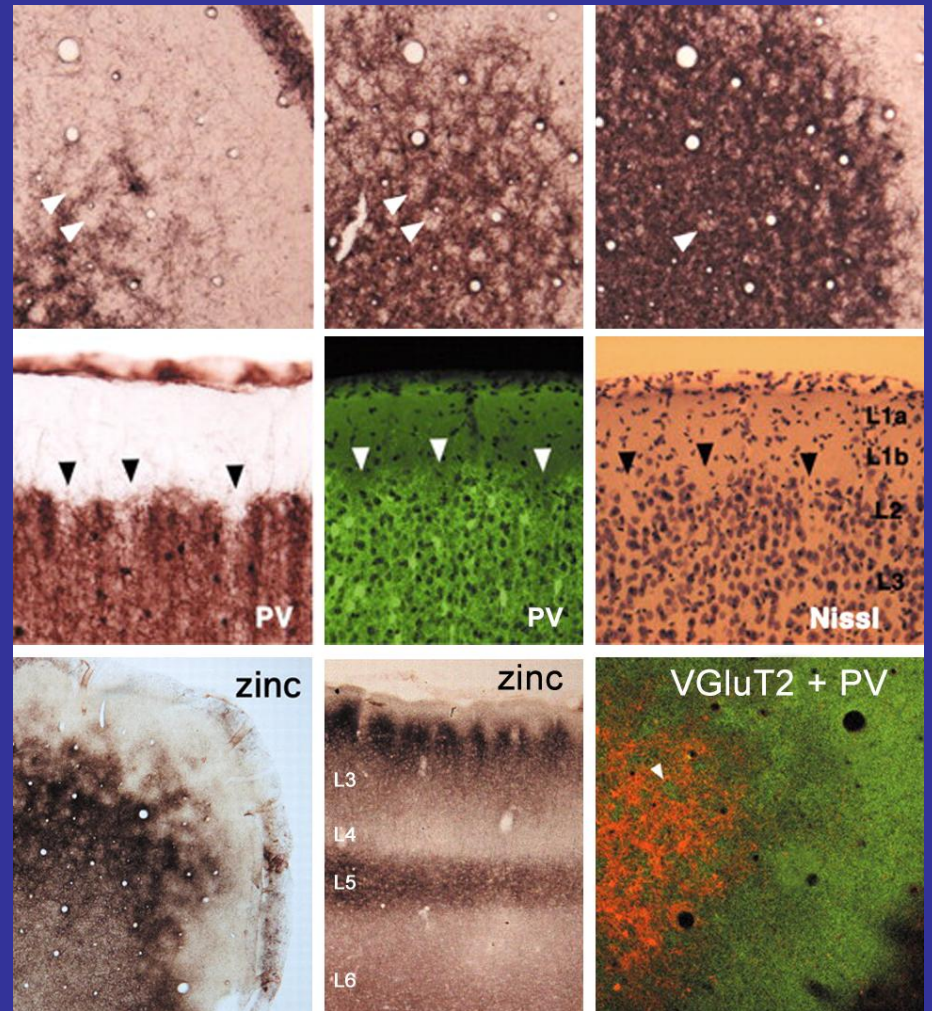
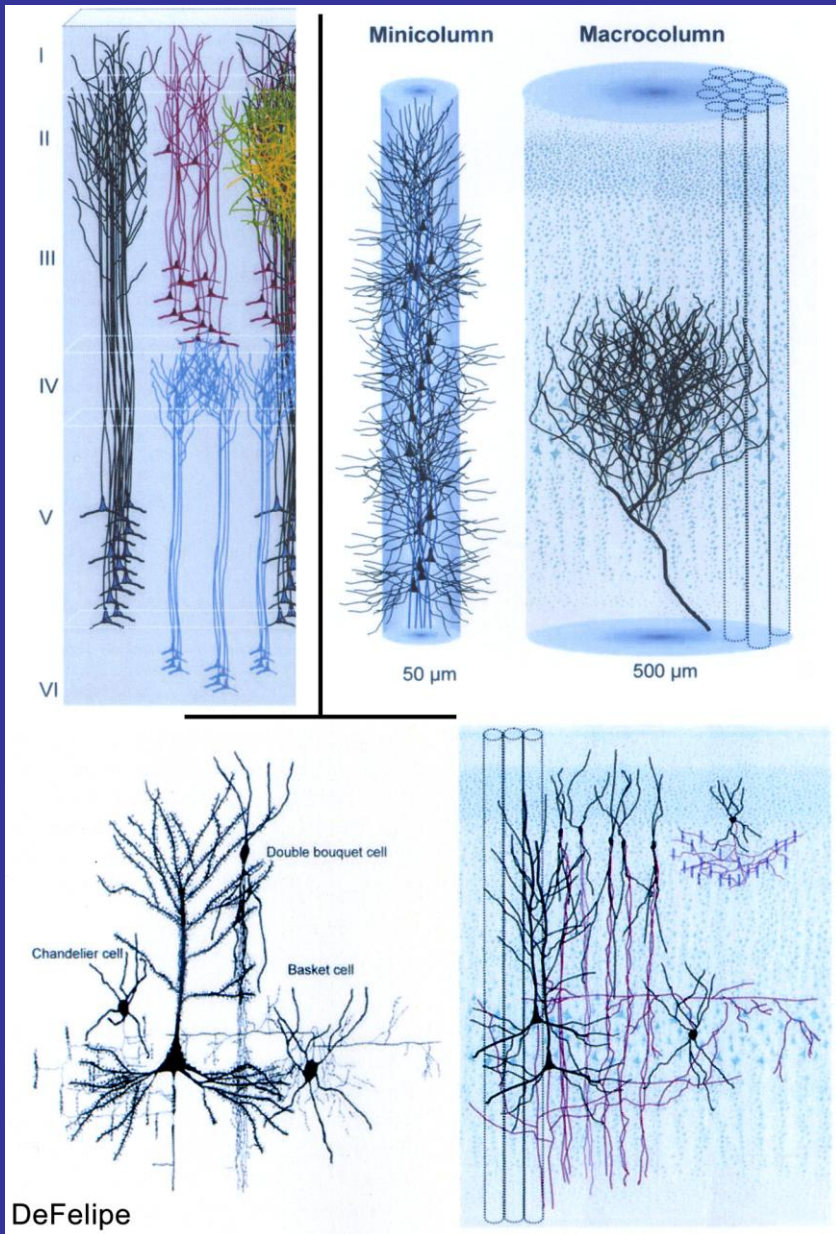
Zn
V1

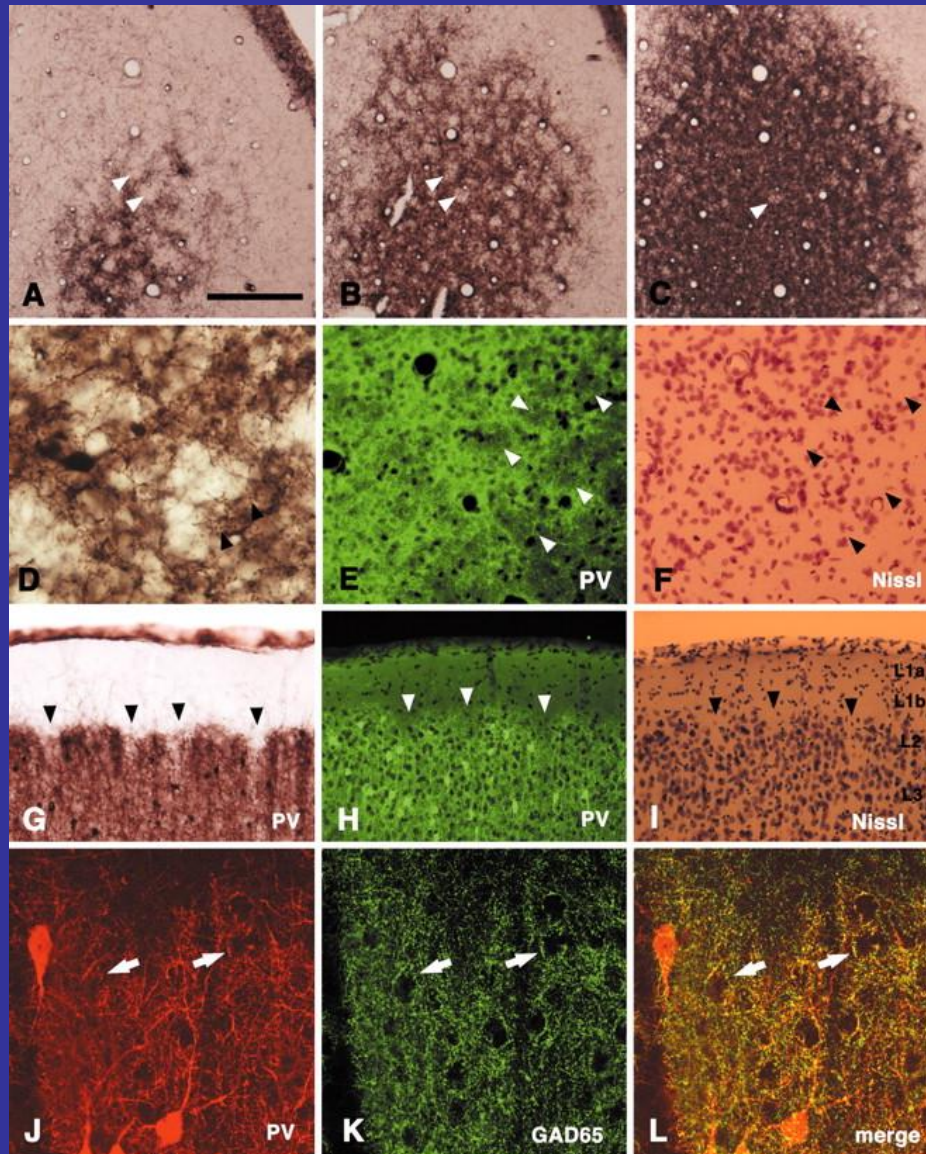


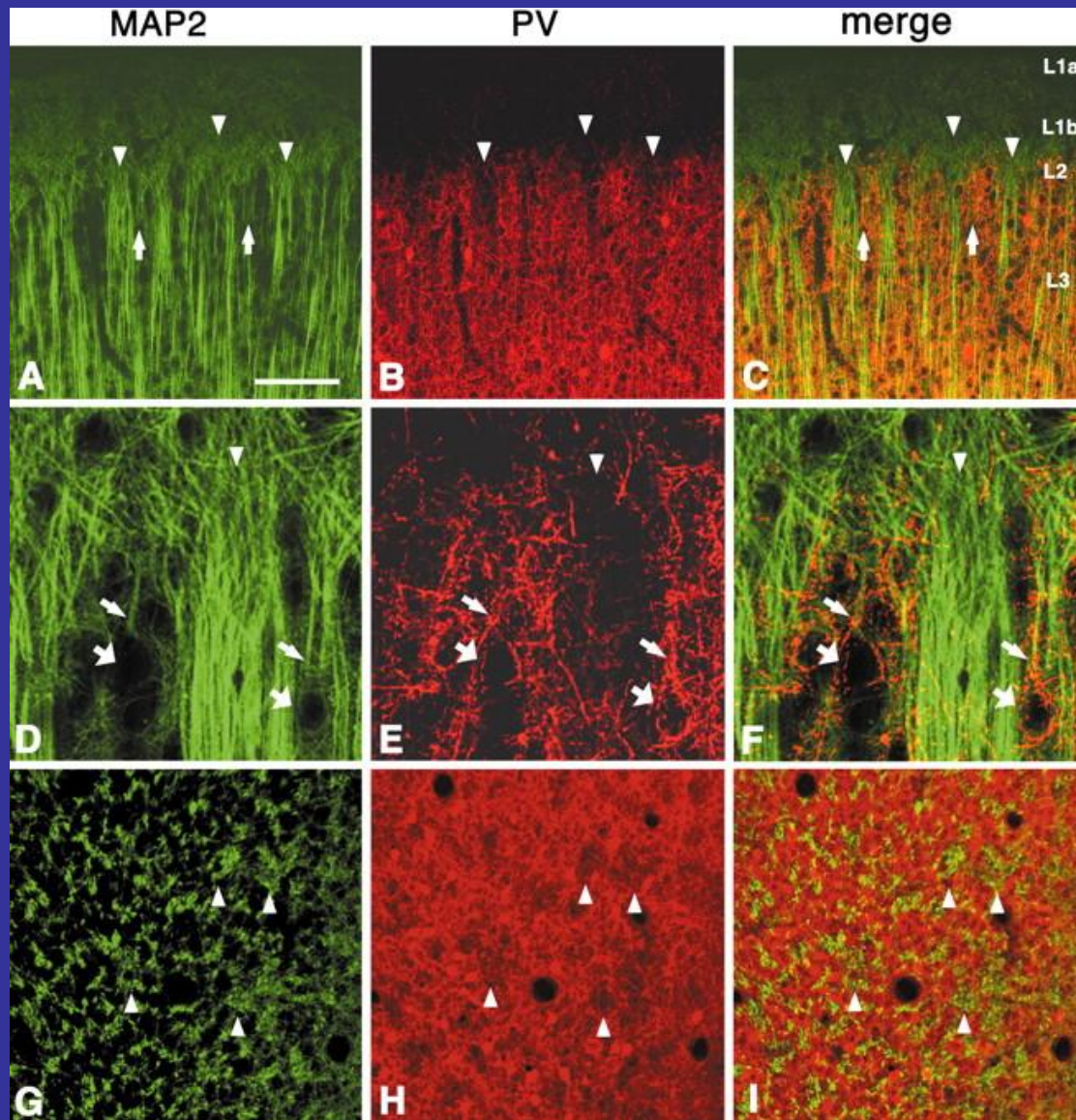


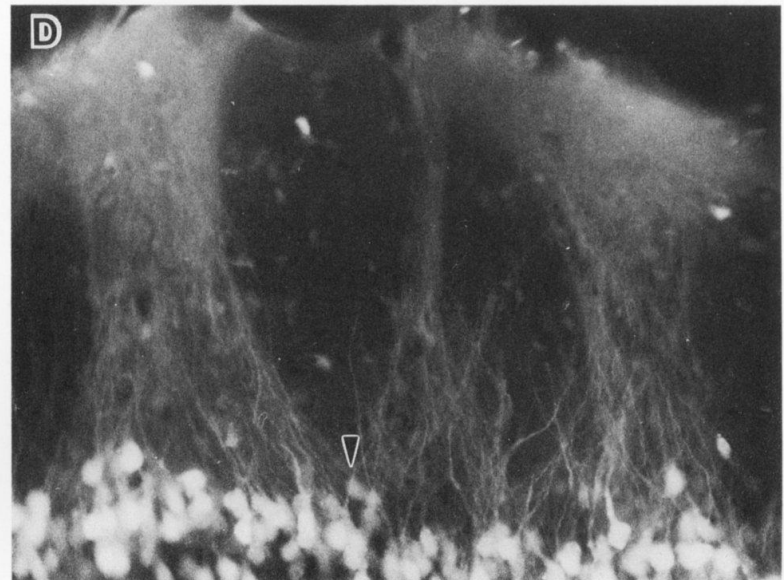
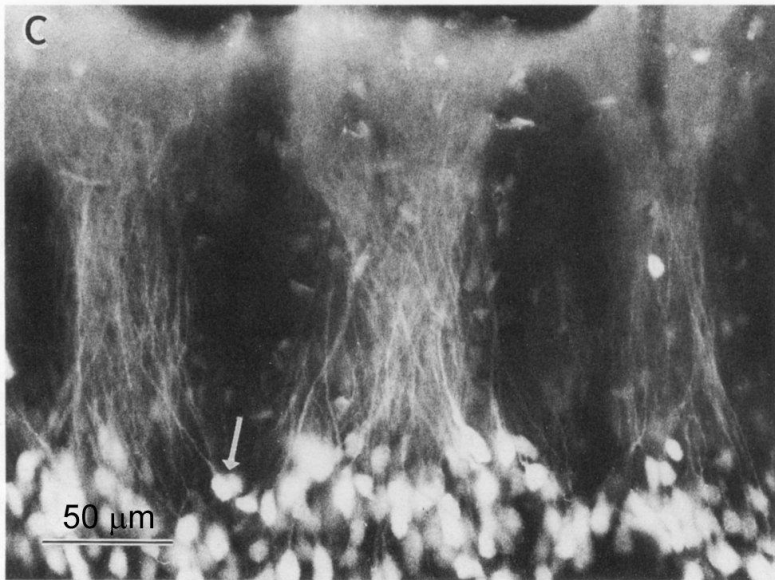
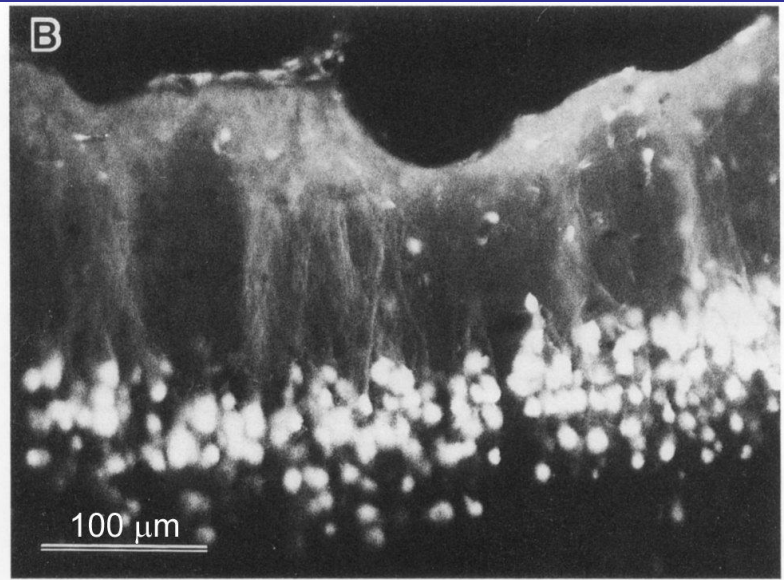
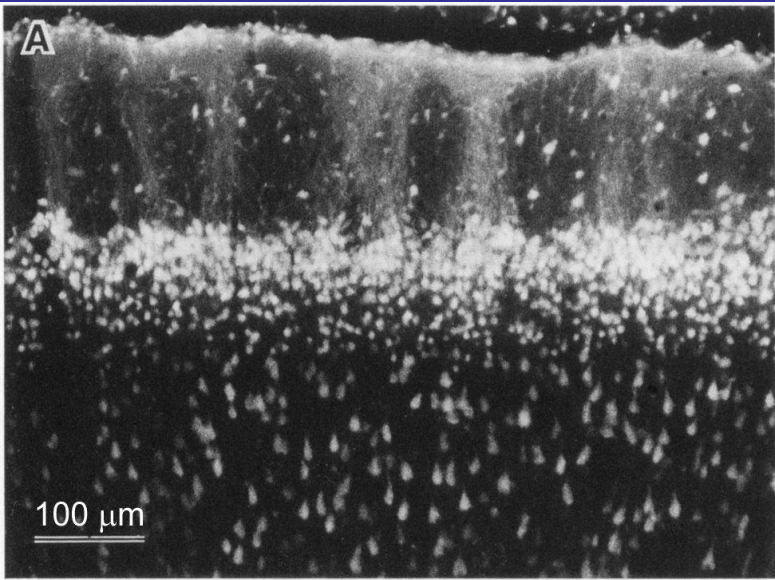


TEO → V4









Wyss et al (1990)

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