Pathological physiology of special senses

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Talks on NS

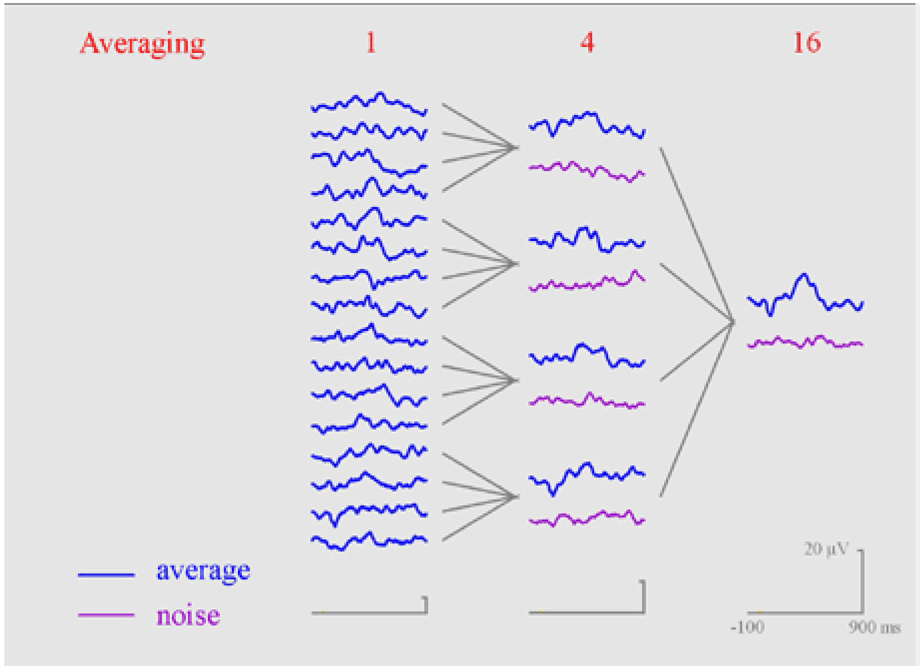
Talk 1 - Pain and Motor disorders

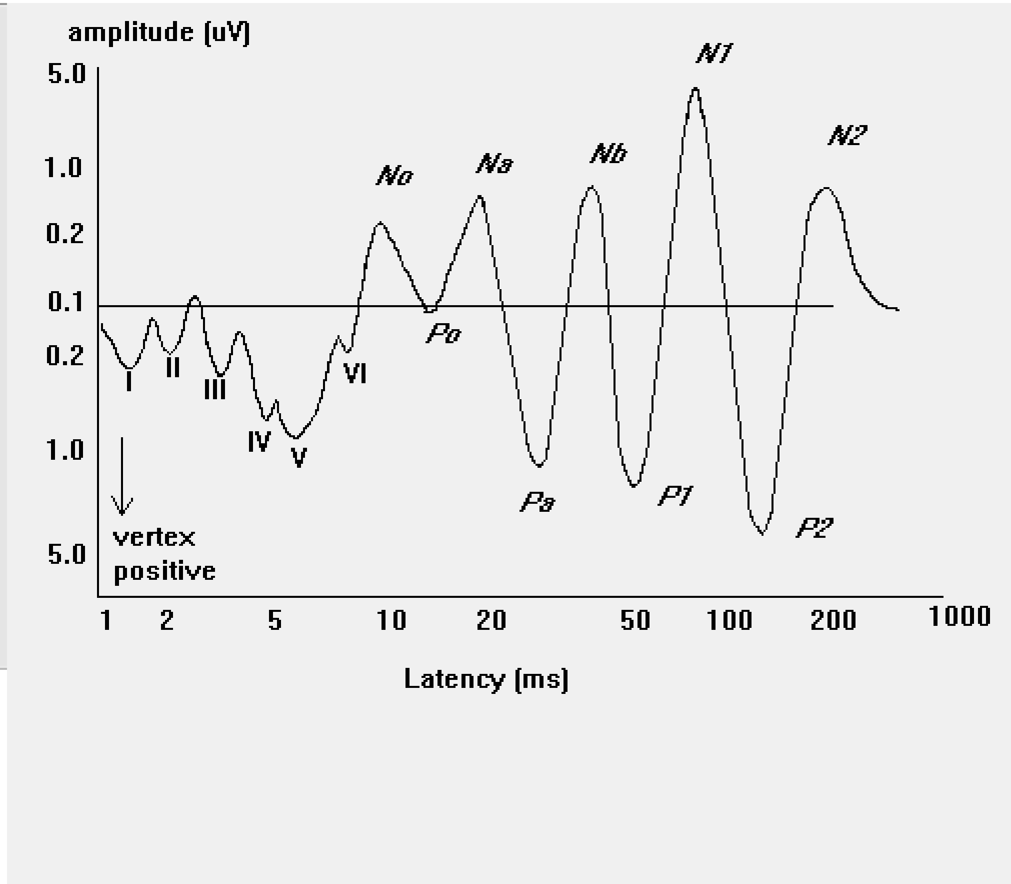
Talk 2 - Syndromes in neurosciences

Talk 3 - Disorders of special senses

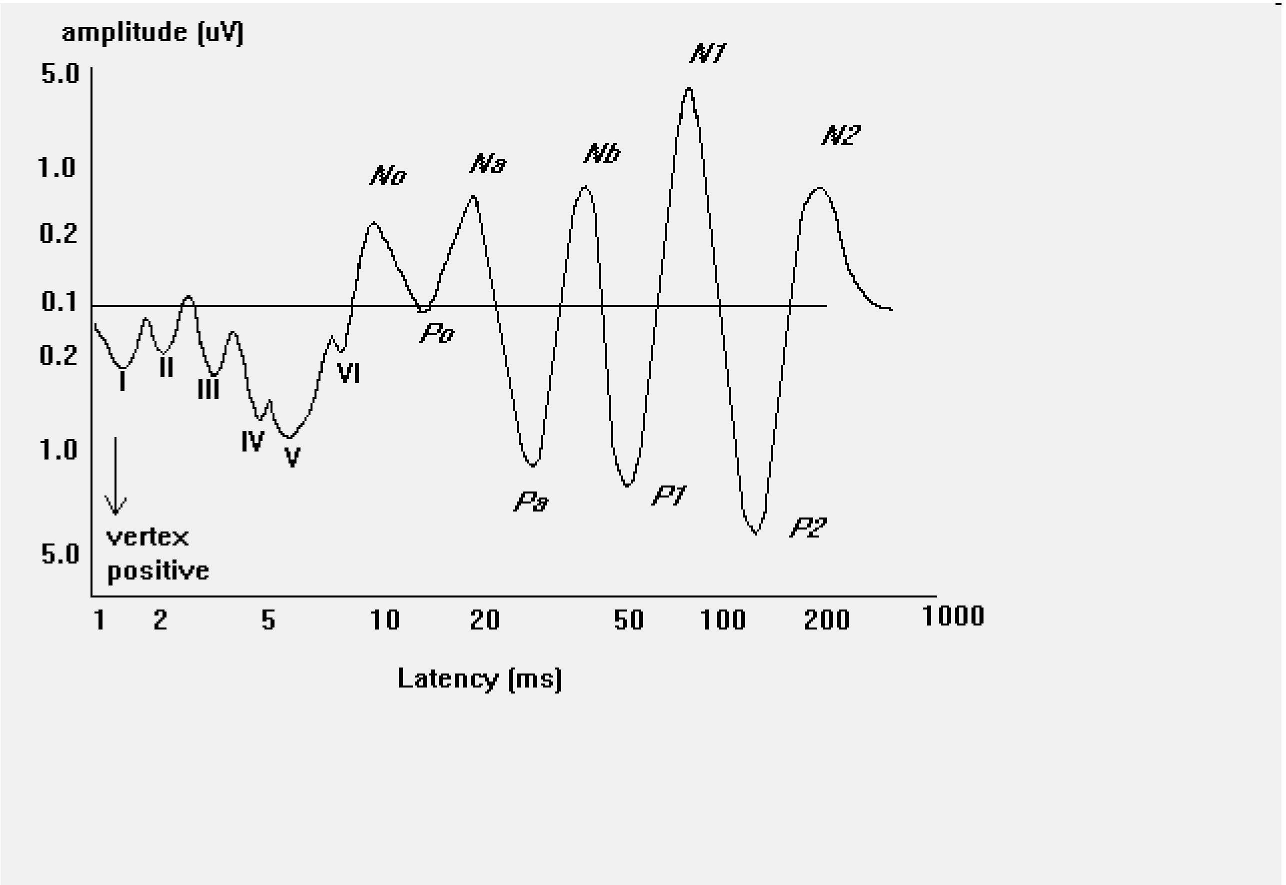
Talk 4 - Cognitive functions, dementias, etc.

Evoked potentials



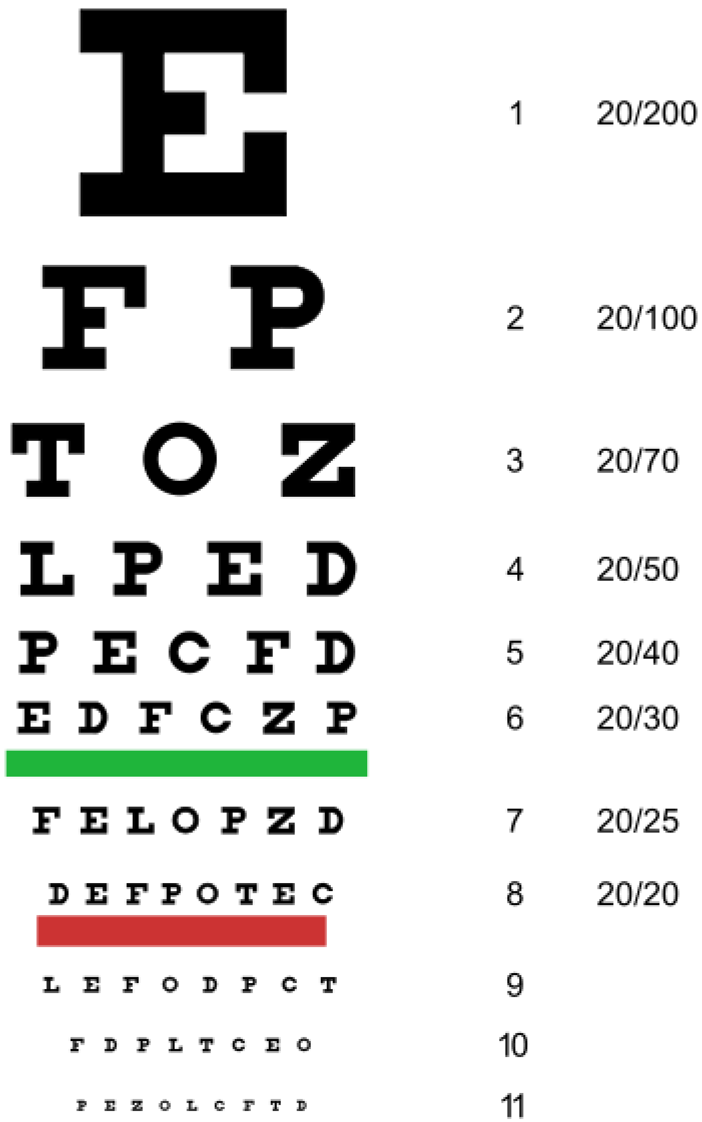


Evoked potentials – auditory as example



Objective Audiometry:
Brainstem or cortical evoked response audiometry BERA (CERA)

Vision



Snellen (N/36)

optotypes have (N/32)

letters with defined (N/28)

letter size, or number of points(N/26)

seen from a calibrated distance. (N/24)

This is written as fraction. (N/22)

The best vision is: 6/6 (N/20)

From distance six meters/ (N/18)

we see six points (B/16)

(one arch minute each). (B/14)

Functional classification of vision impairment

1 normal vision 6/6

2 low vision worse than (<) 6/18

(on the best eye with corrective lenses)

3 (practical) blindness < 3/60

or narrowing of visual angle less than $< 10*10^o$

other norm $< 6/60$, $< 20*20^o$

4 *amblyopia*

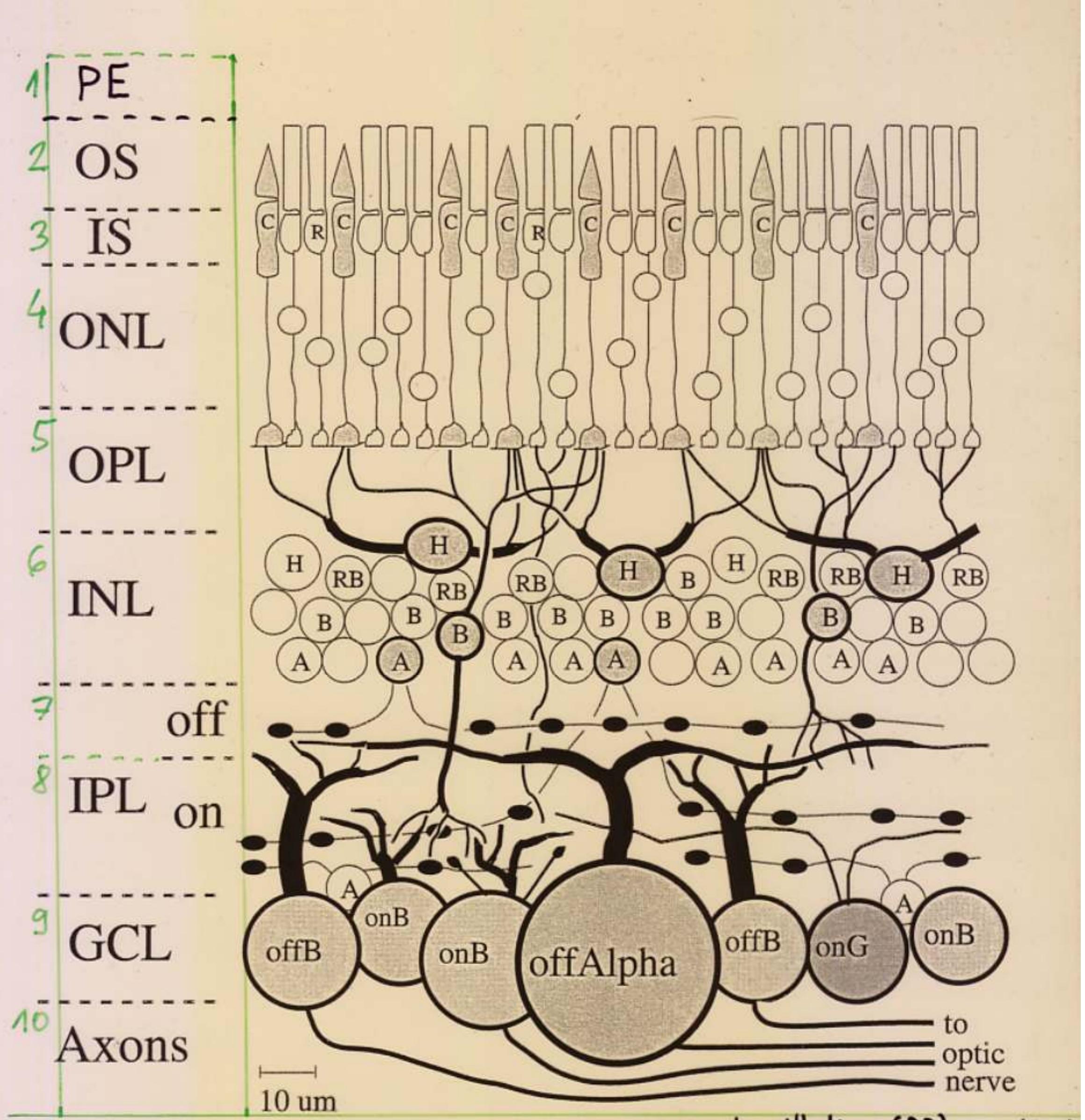
Causes of blindness

A ordered by frequency in the developed countries:
1 diabetes: retinopathy, 2 glaucoma, 3 senilní poruchy,
4 injuries, 5 others

B ordered by frequency in the third world countries:
1 trachoma (chlamydia trachomatis), 2 onchocercosis (onchocerca volvulus),
3 xeroftalmia (vit. A avitaminosis), 4 cataract, 5 glaucoma,
6 injuries, 7 senile macular degeneration, 8 diabetic retinopathy
9 genetic causes, 10 neurologic causes

C overall incidence:
developed countries 0,2 %, worldwide 1 %,
some third world countries several %

Ten layers of retina

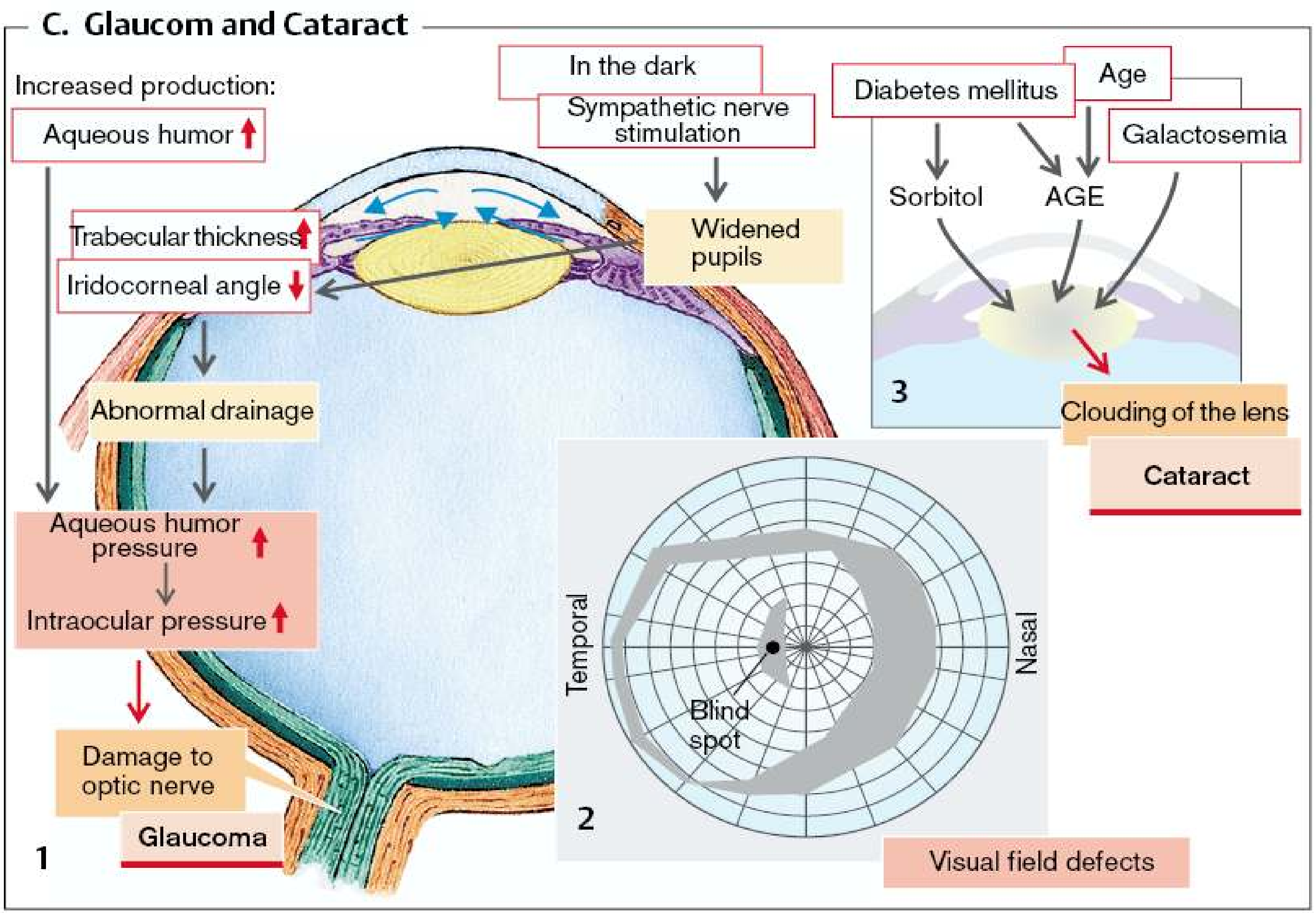


pigment epithelium (PE), cones (c), rods

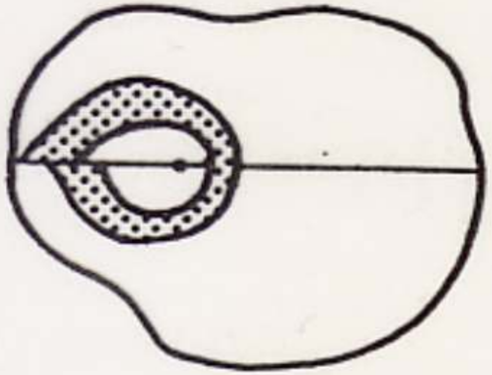
Figure 1. Structure of the retina, showing the outer segments (OS), inner segments (IS), outer nuclear layer (ONL), outer plexiform layer (OPL), inner nuclear layer (INL), inner plexiform layer (IPL), ganglion cell layer (GCL), horizontal cells (H), bipolar cells (B), amacrine (A), and rod bipolar (RB) cells.

Glaucoma and Cataracta

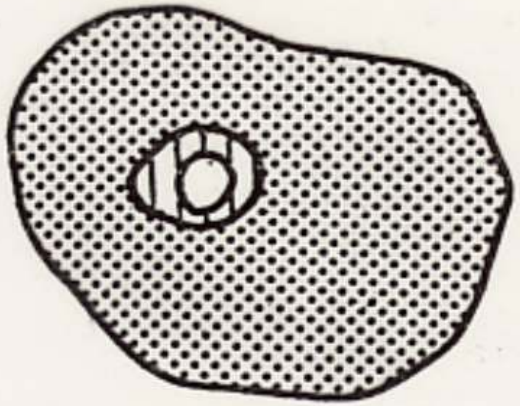
AGE – Advanced Glycation End products,
Age = as ageing



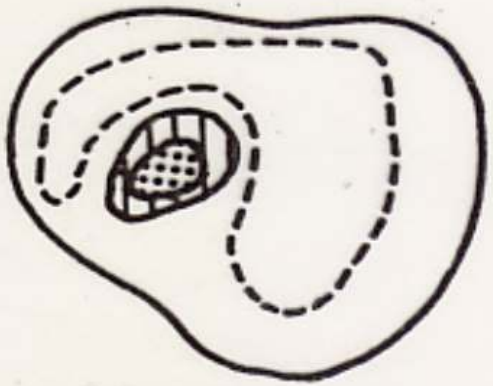
Other defects of perimeter



Obr. 11—1. Zorné pole při pokročilém glaukomu: kolem centrálního bodu probíhají obloukovité skotomy ze slepého bodu do temporální periférie (podle sítnice), nazální podle perimetrie. Končí v horizontále ostrou hranicí.

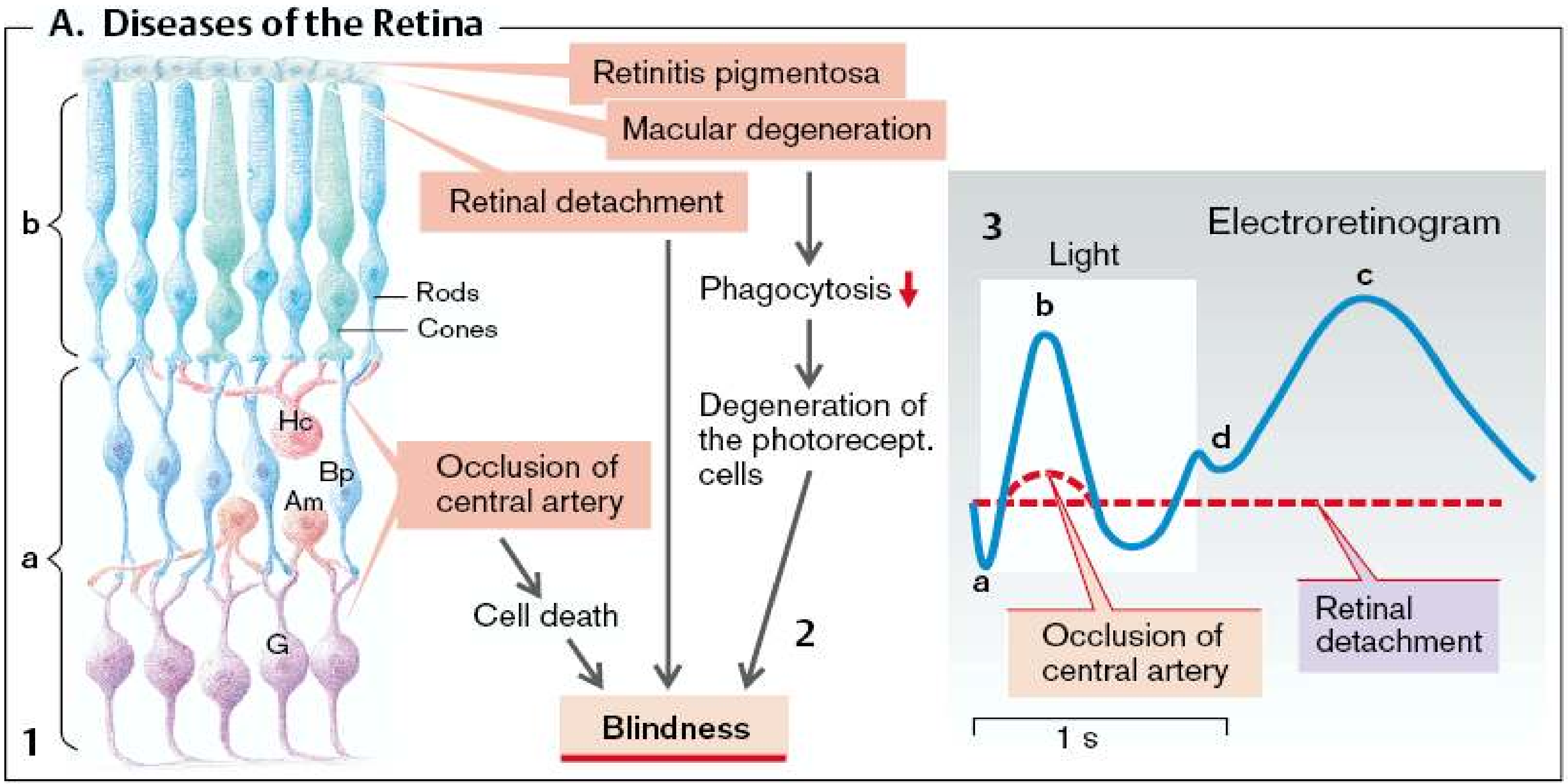


Obr. 11—2. Zorné pole při otravě chininem (podobné vidíme u tabes dorsalis nebo v konečných stadiích tapetoretinálních degenerací sítnice). Koncentrické zúžení zorného pole okolo centrálního bodu: centrální vidění může být dobré po nějakou dobu.



Obr. 11—3. Zorné pole při retrobulbární neuritidě. Zbývá ještě absolutní centrální skotom, okolo širší relativní skotom, periferní izoptera je vyhnutá.

Other defects of retina



Diabetic retinopathy

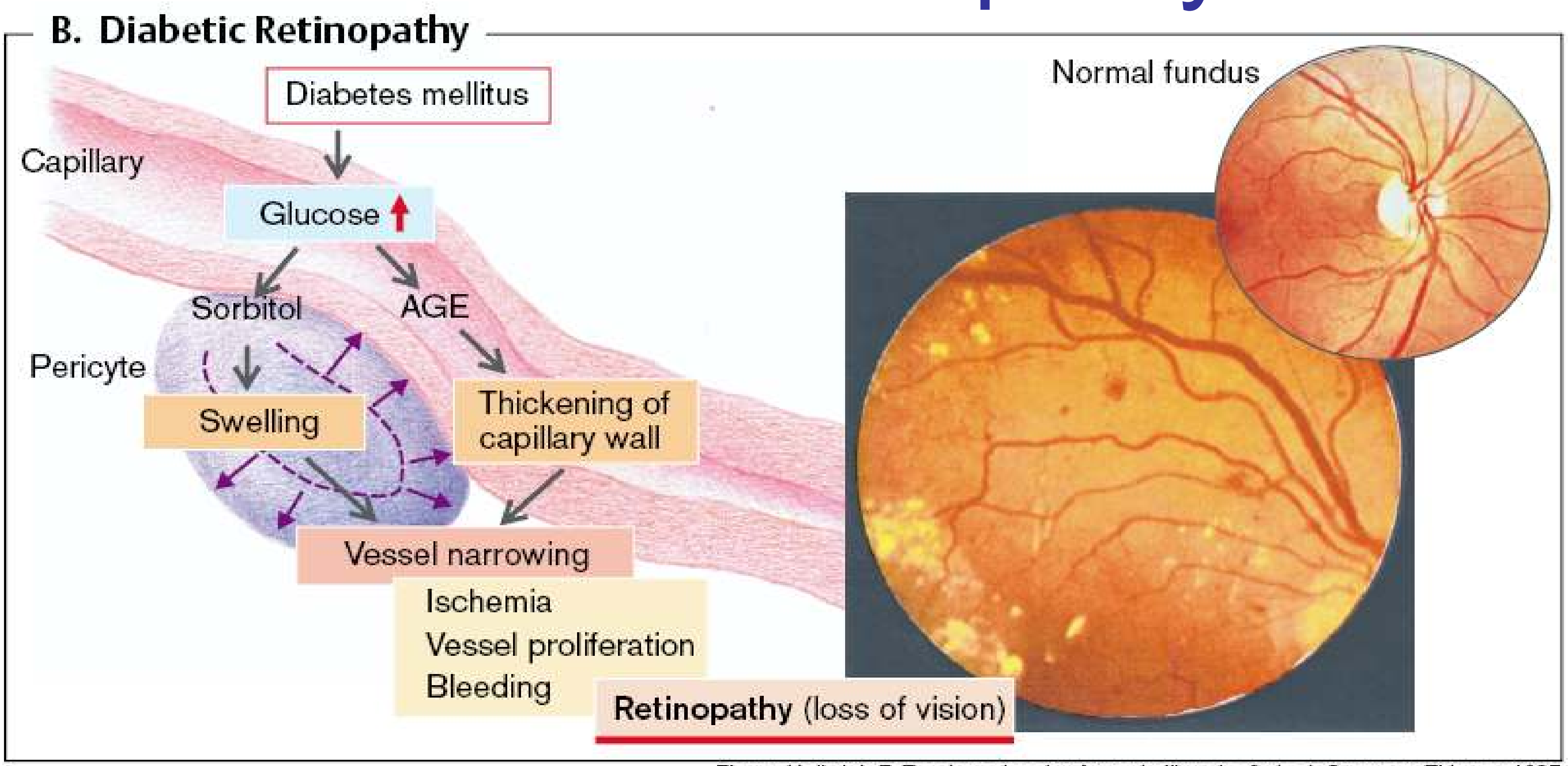
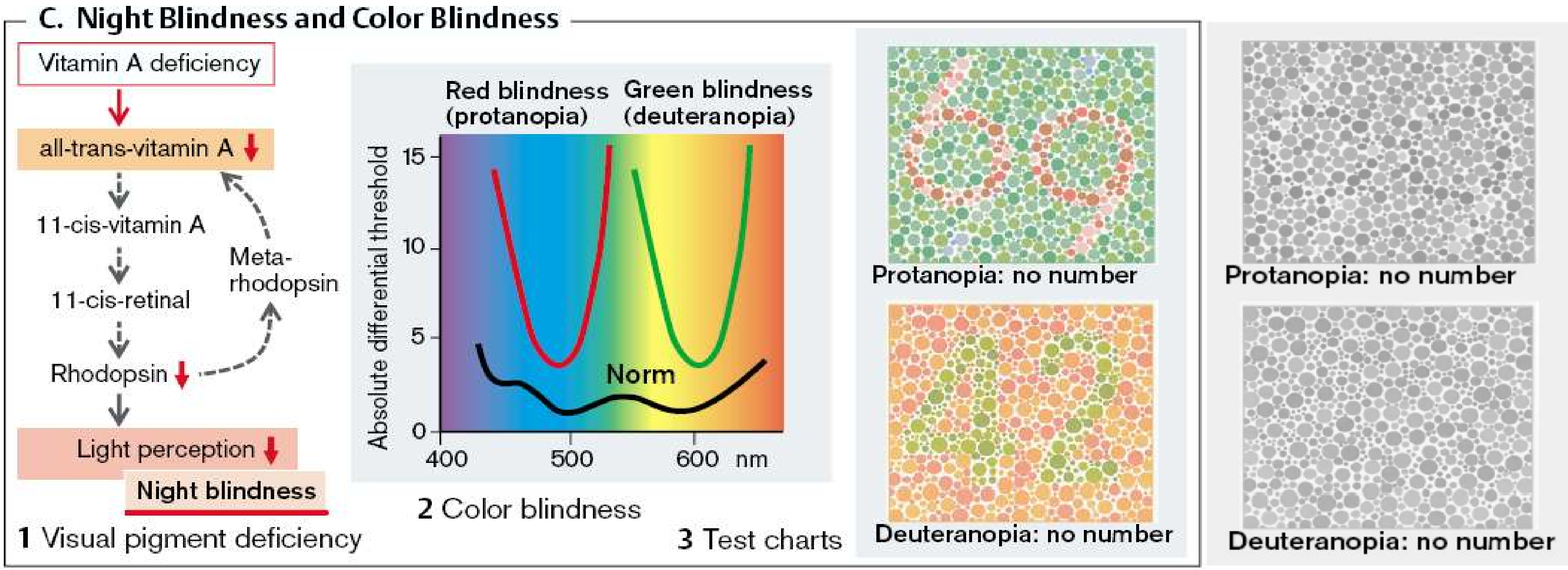


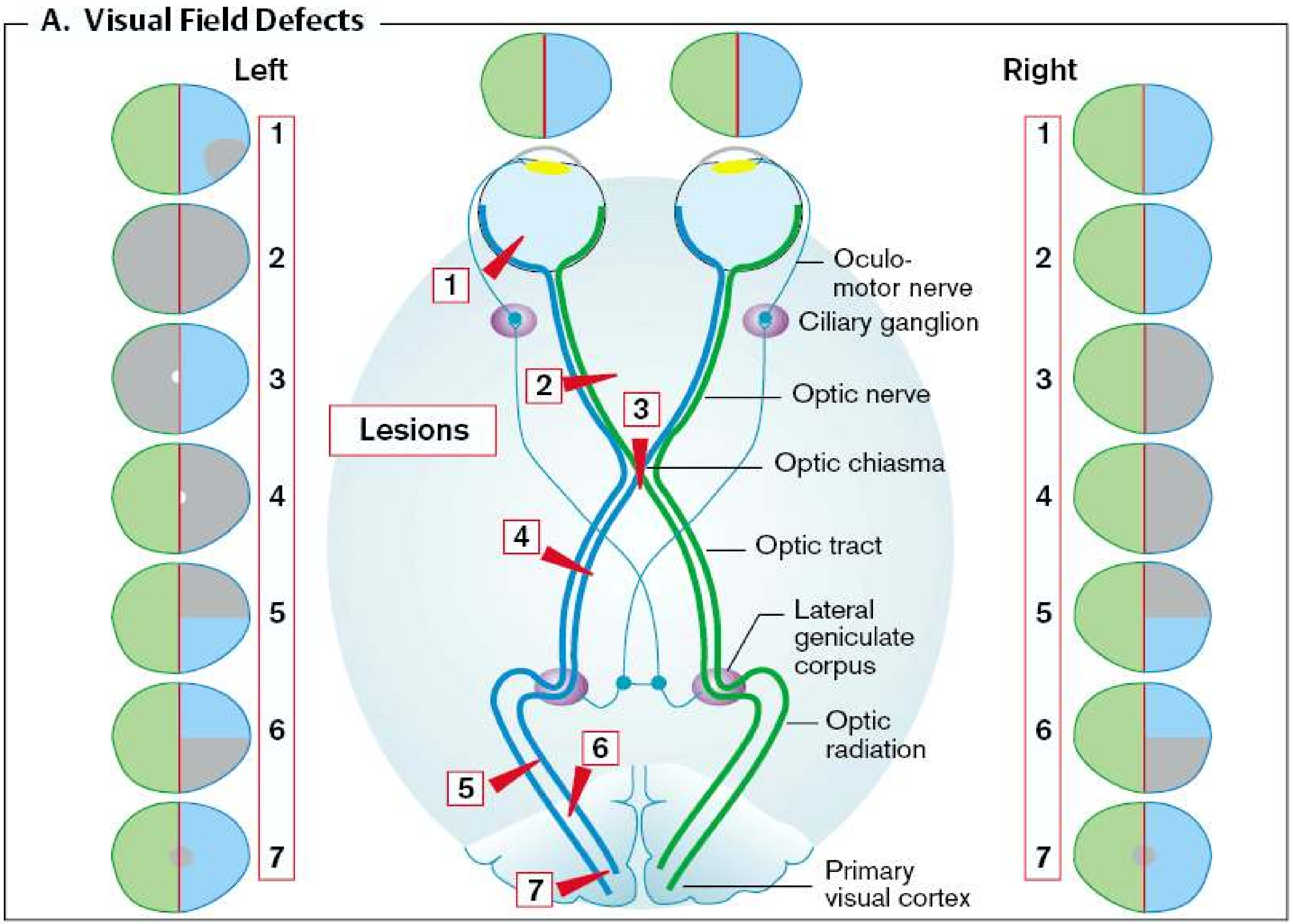
Photo: Hollwich F. Taschenatlas der Augenheilkunde. 3rd ed. Stuttgart: Thieme; 1987

AGE – advanced glycation end products

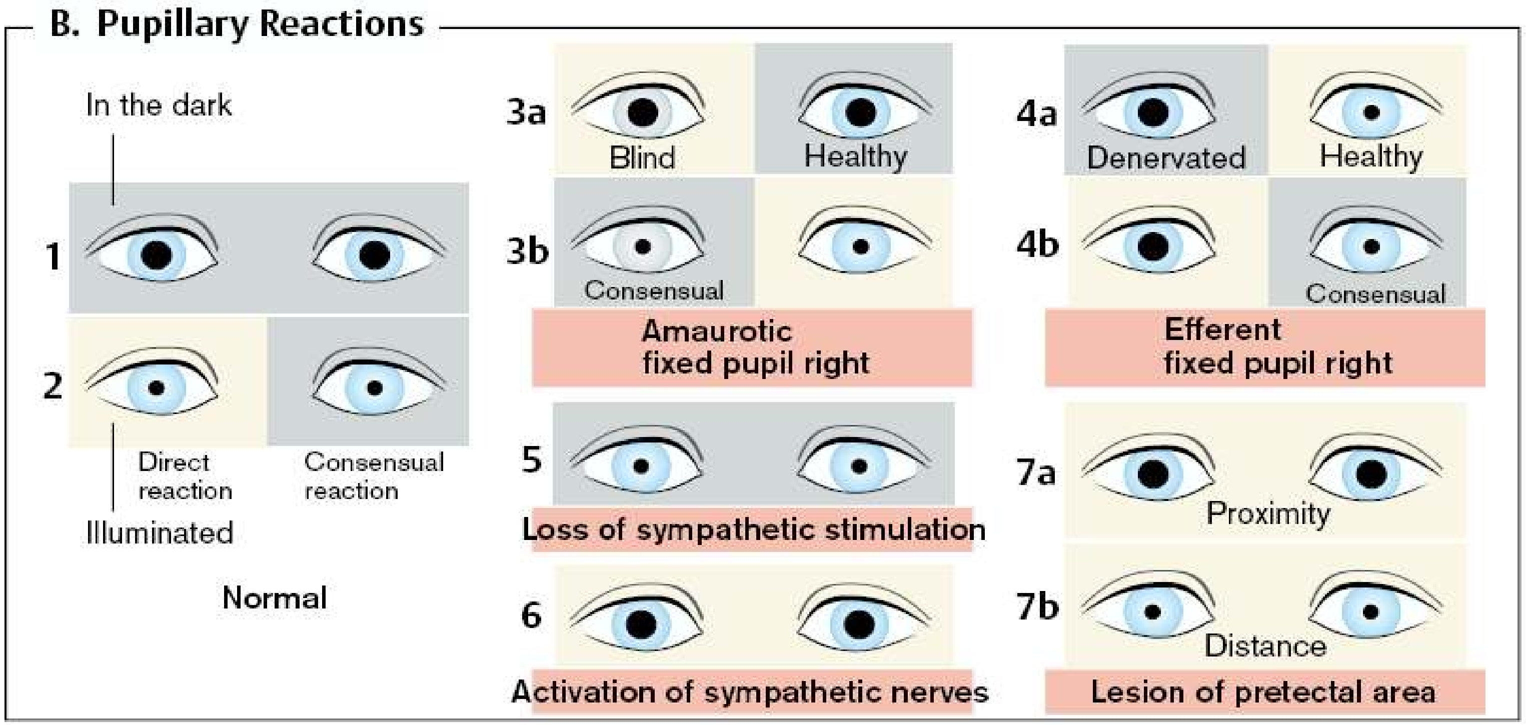
Night blindness and color blindness

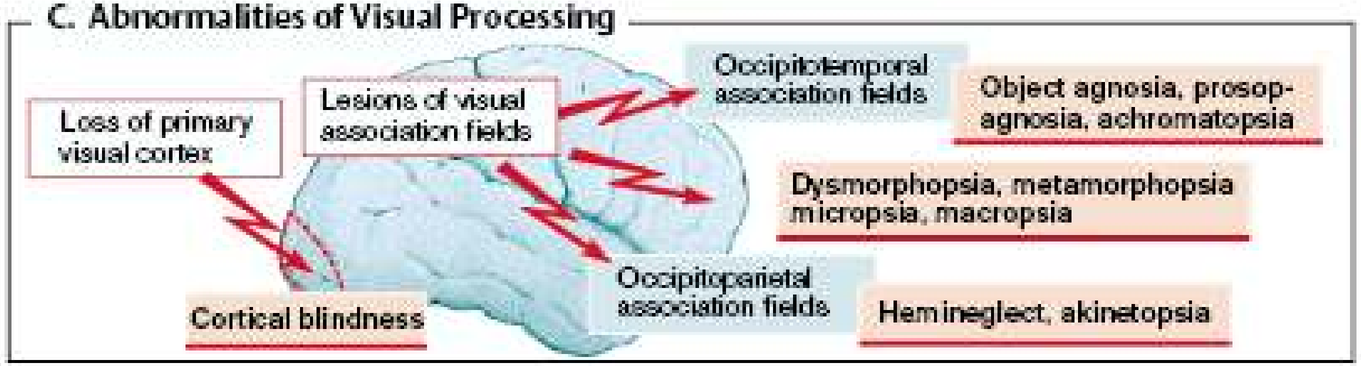


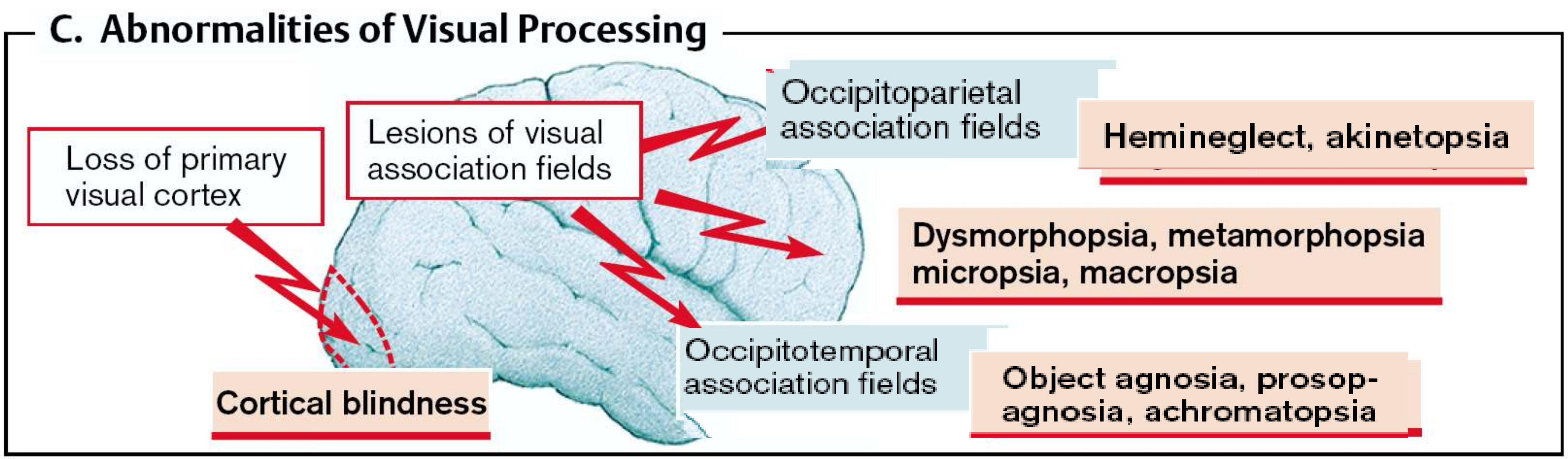
Visual field defects



Pupillary Reactions







Cognitive defects (C) (find differences)

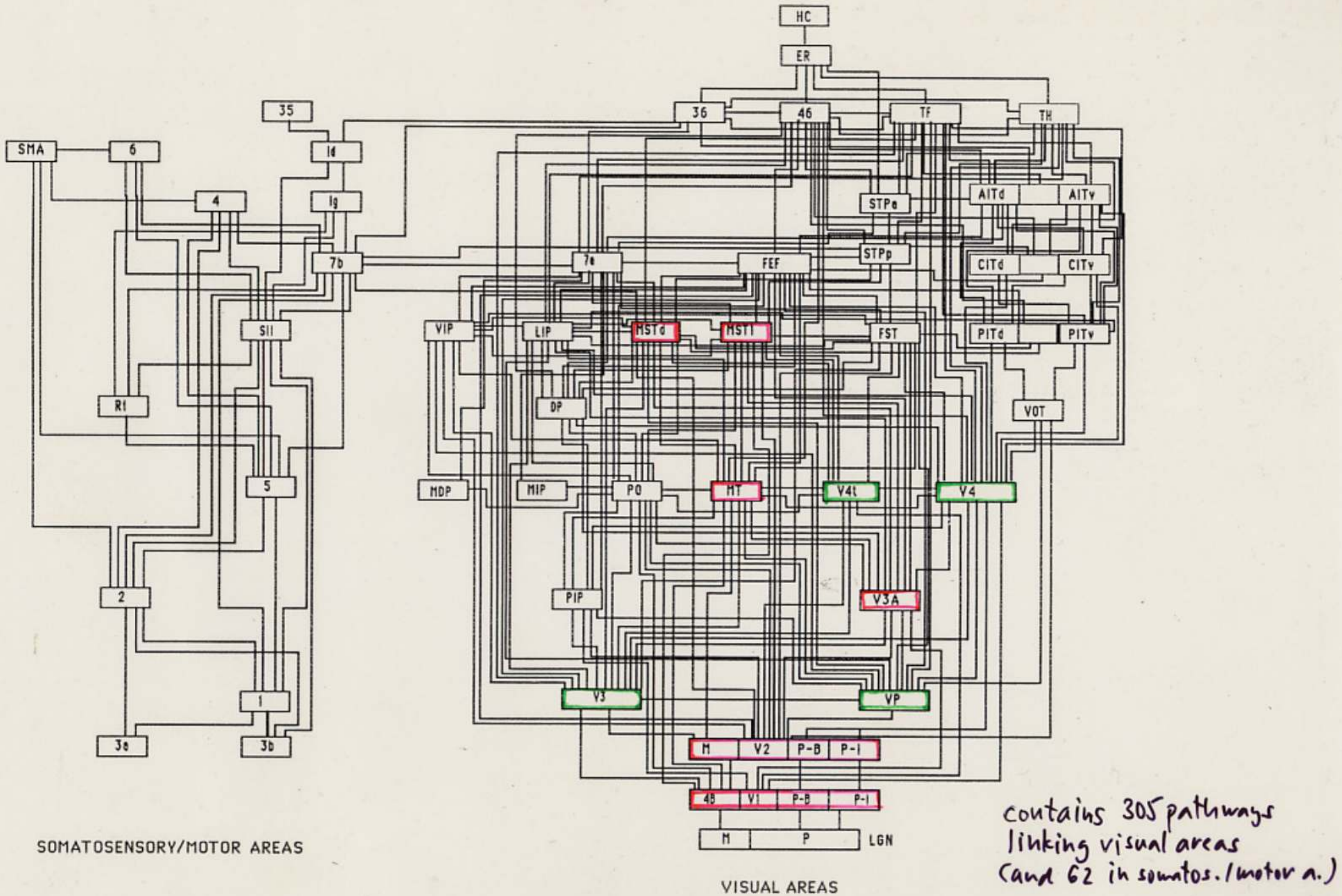
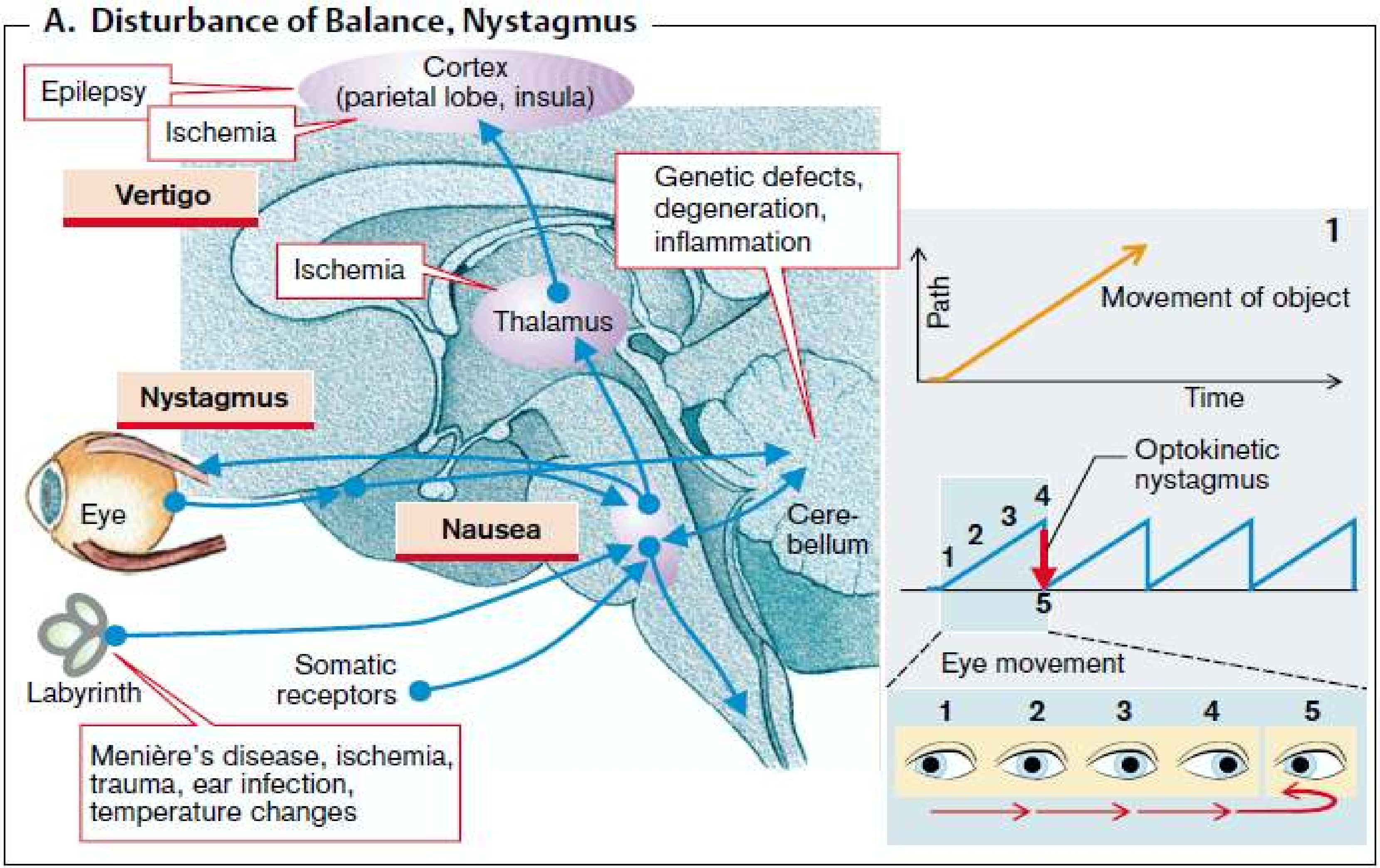


Figure 8. *(See facing page for legend.)*

Van Essen D.C. et al., 1990, Cold Spring Harbor Symp. Quant. Biol, 55: 679-696

Nystagmus


A. Disturbance of Balance, Nystagmus
Epilepsy
Ischemia
Cortex (parietal lobe, insula)
Vertigo
Ischemia
Thalamus
Genetic defects, degeneration, inflammation
Nystagmus
Eye
Nausea
Cere-bellum
Labyrinth
Somatic receptors
Menière's disease, ischemia, trauma, ear infection, temperature changes
1
Path
Movement of object
Time
Optokinetic nystagmus
1
2
3
4
5
Eye movement
1
2
3
4
5

Bystrická Pulp Fiction

Slovenský „proces desetiletí“ se stal symbolem boje s mafií

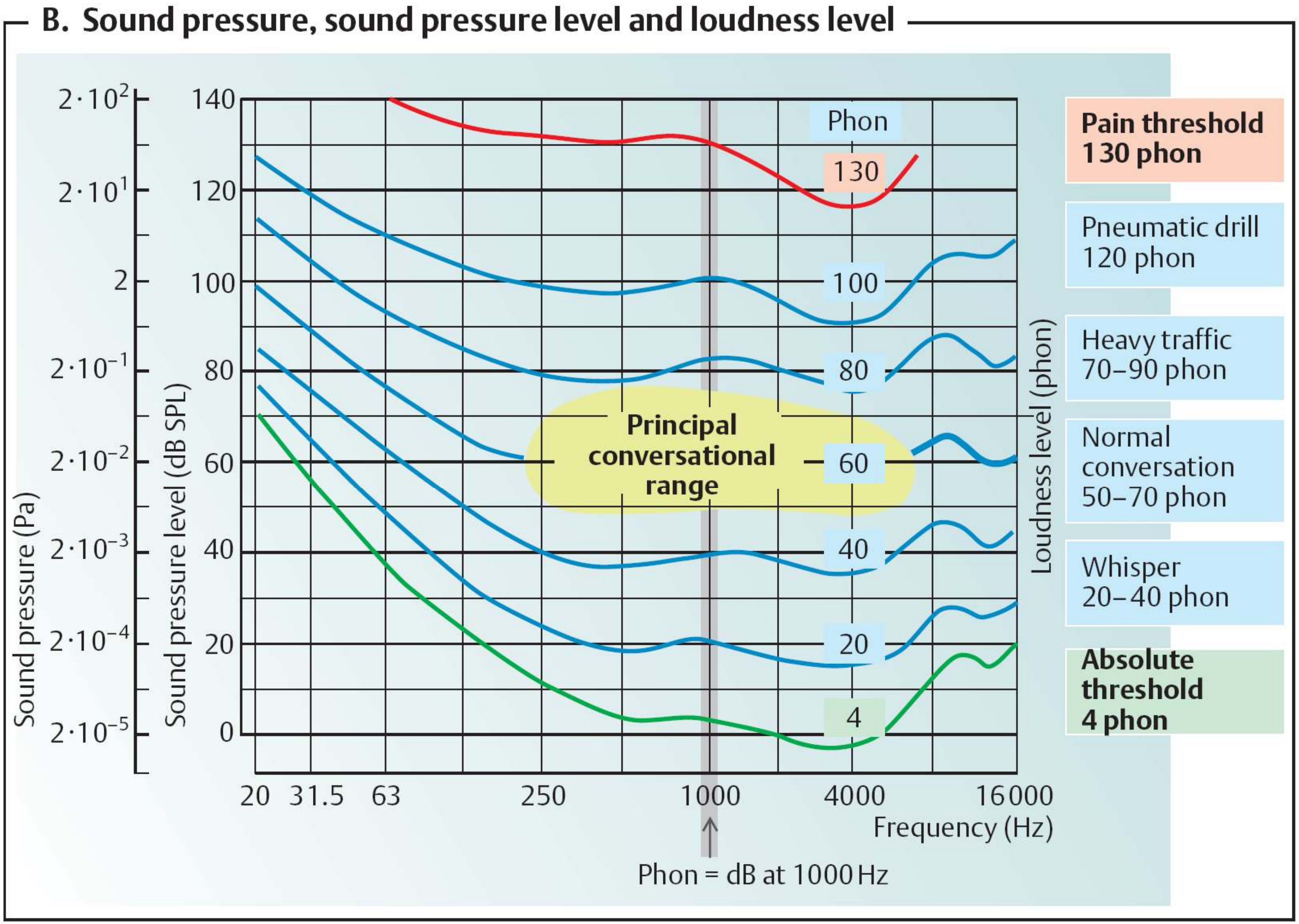
RESPEKT
2005 (

1998
(od 1997 ve slovenském vězení);
4/4/2003
zatčen Mikul
česká

~2007
ve vyšetřovací vazbě na Slovensku

Černákovy kontakty na politickou sféru byly nebezpečnější než lehkost, s jakou se pohyboval v „obyčejném“ životě.

Hearing



Hearing range: x-axis: frequency/ pitch and y-axis: intensity/ volume

Functional classification of hearing loss

(measured without hearing aid)

1 normal hearing (threshold about 4 phon)

2 hardness of hearing

(hearing aid may be indicated:
at the band 500 Hz - 2 kHz bilaterally
threshold rise of 35 - 40 dB,
speech audiometry –threshold rise of more than 35 dB
low comprehension of loud speech at less than 4 m)

3 (practical) deafness

(does not hear loud voice at the ear, own voice,
threshold rise of 75 - 80 dB)

4 *deaf-and-dumbness*

(not rehabilitated deafness from early age)

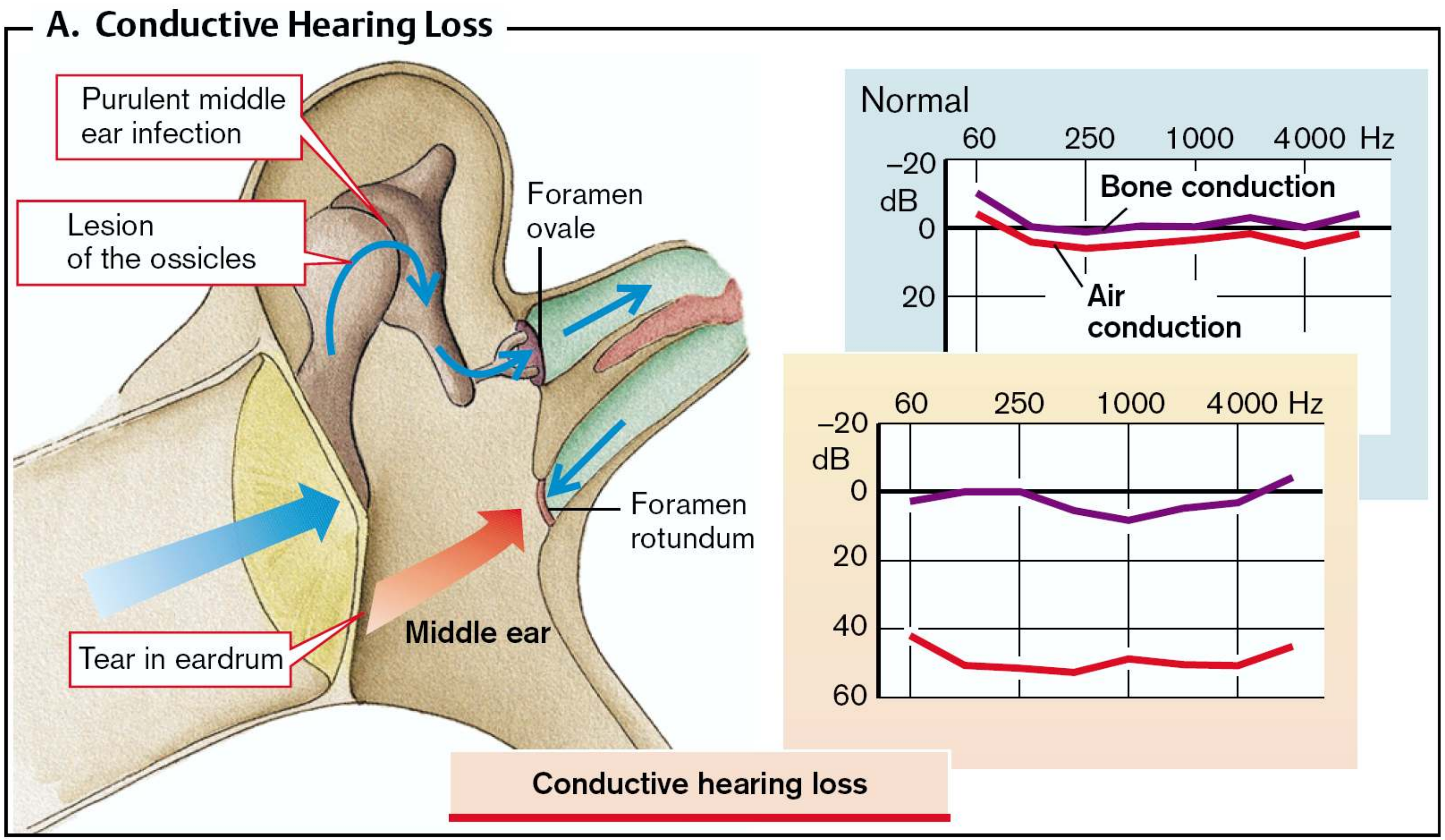
Causes of hearing loss

- otosclerosis (in 0,5 - 1 % of elderly)
- conductive disorders
- sensorineural disorders
- disorders affecting cochlea and leaving intact auditory nerve
- hereditary and inborn disorders
- toxic damage
- meningo-encephalitis
- trauma
- profesional damage
- presbyakusia
- Menier’s disease

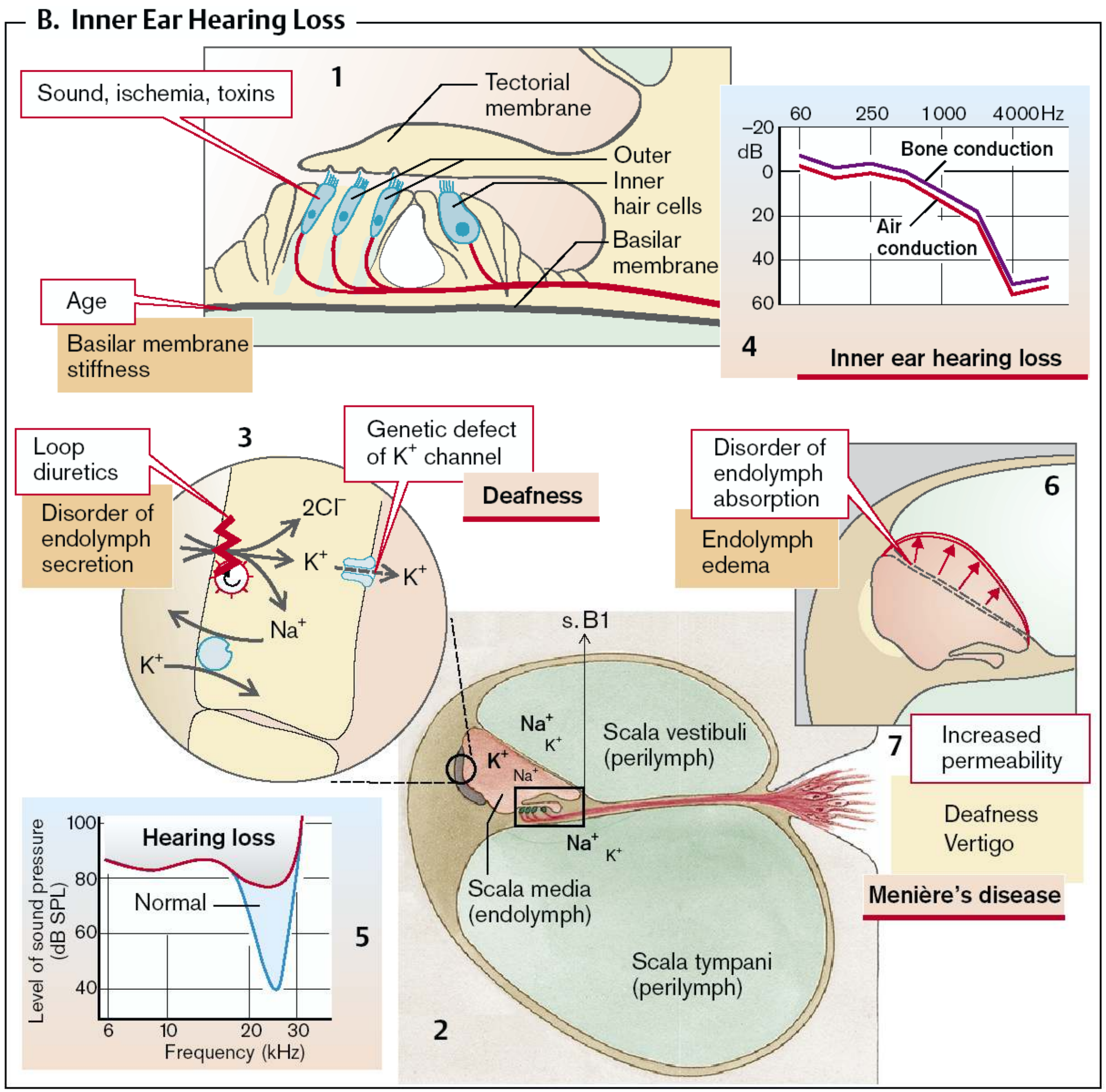
Pitchfork tests

Test	Principle	Norm	Conductive	Sensory-neural
Weber	PF on the vertex of the head	Non-lateral	Lateral to blocked side	Lateral to healthy side
Rinne	First on bone, then in the air	Positive	Indifferent	Positive
Schwabach	(subjective) Patient compared to examiner	Normal	Longer	Shorter

Conduction: through air and bone
Hearing loss: A. conductive, B. sensorineural

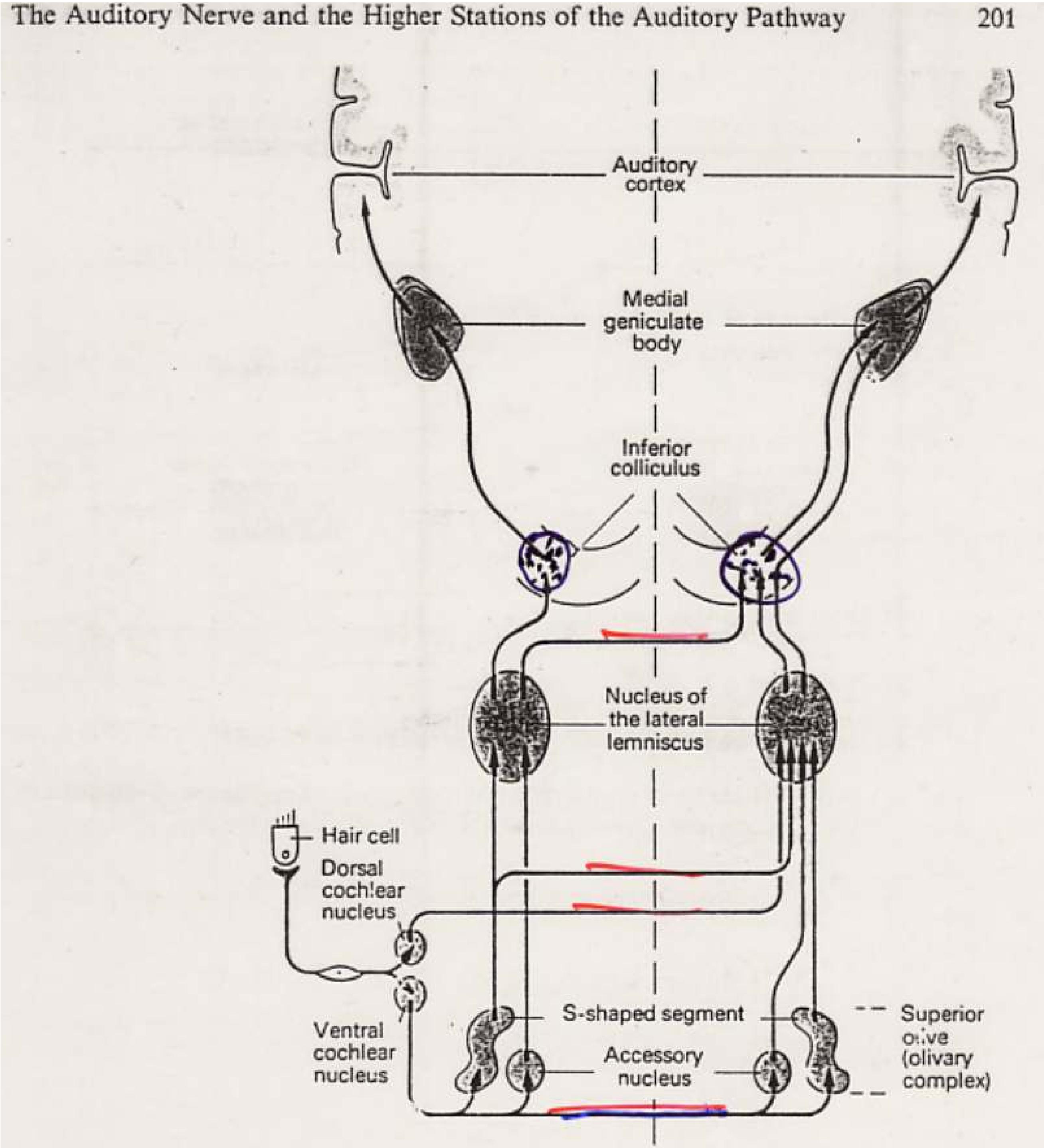


Hearing loss: A. conductive, B. sensorineural



Silbernagl/Lang, Color Atlas of Pathophysiology © 2000 Thieme

Auditory pathway



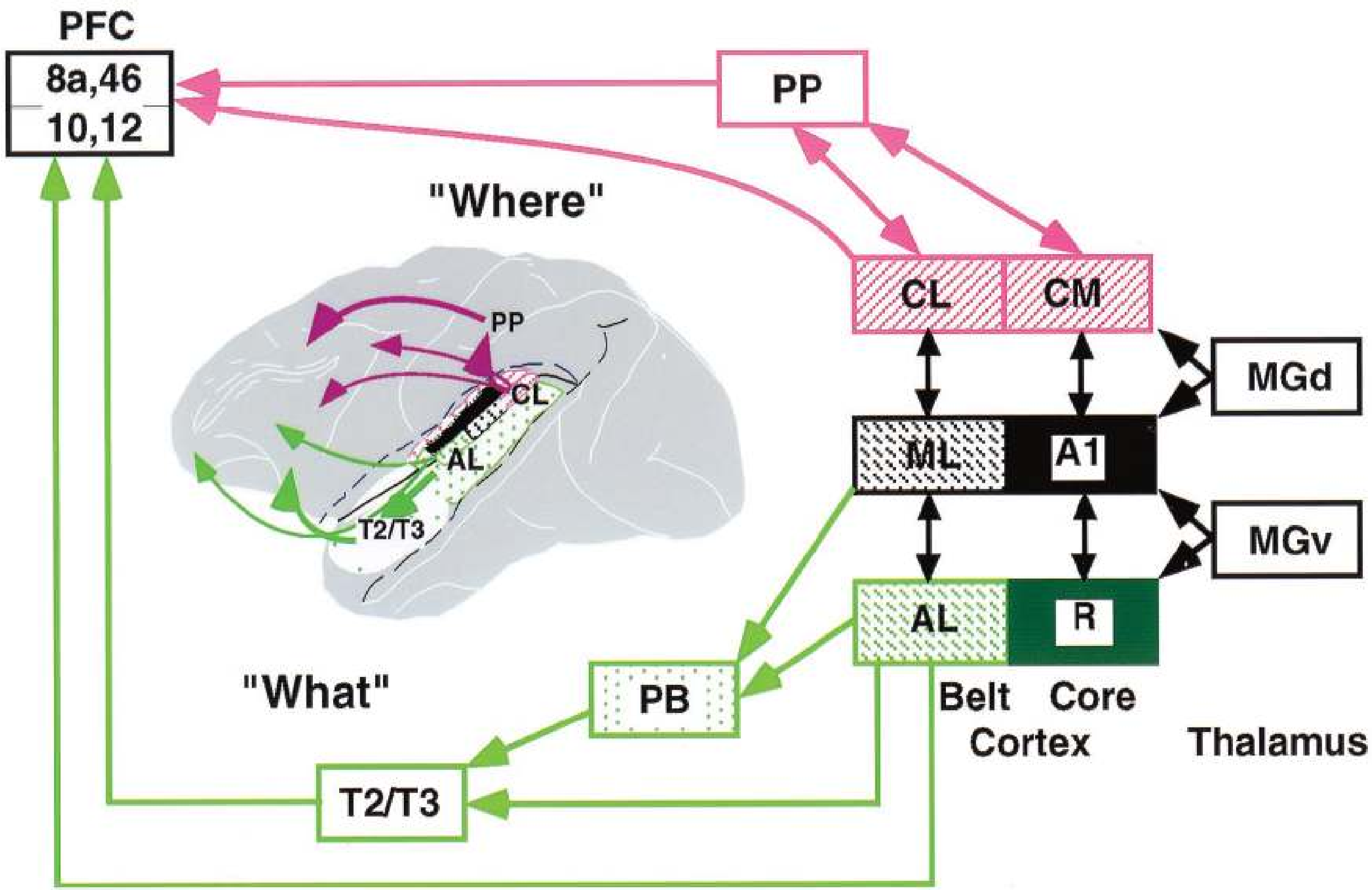


Fig. 6. Schematic flow diagram of "what" and "where" streams in the auditory cortical system of primates. The ventral "what"-stream is shown in green, the dorsal "where"-stream, in red. [Modified and extended from Rauschecker (35); prefrontal connections (PFC) based on Romanski *et al.* (46).] PP, posterior parietal cortex; PB, parabelt cortex; MGd and MGv, dorsal and ventral parts of the MGN.

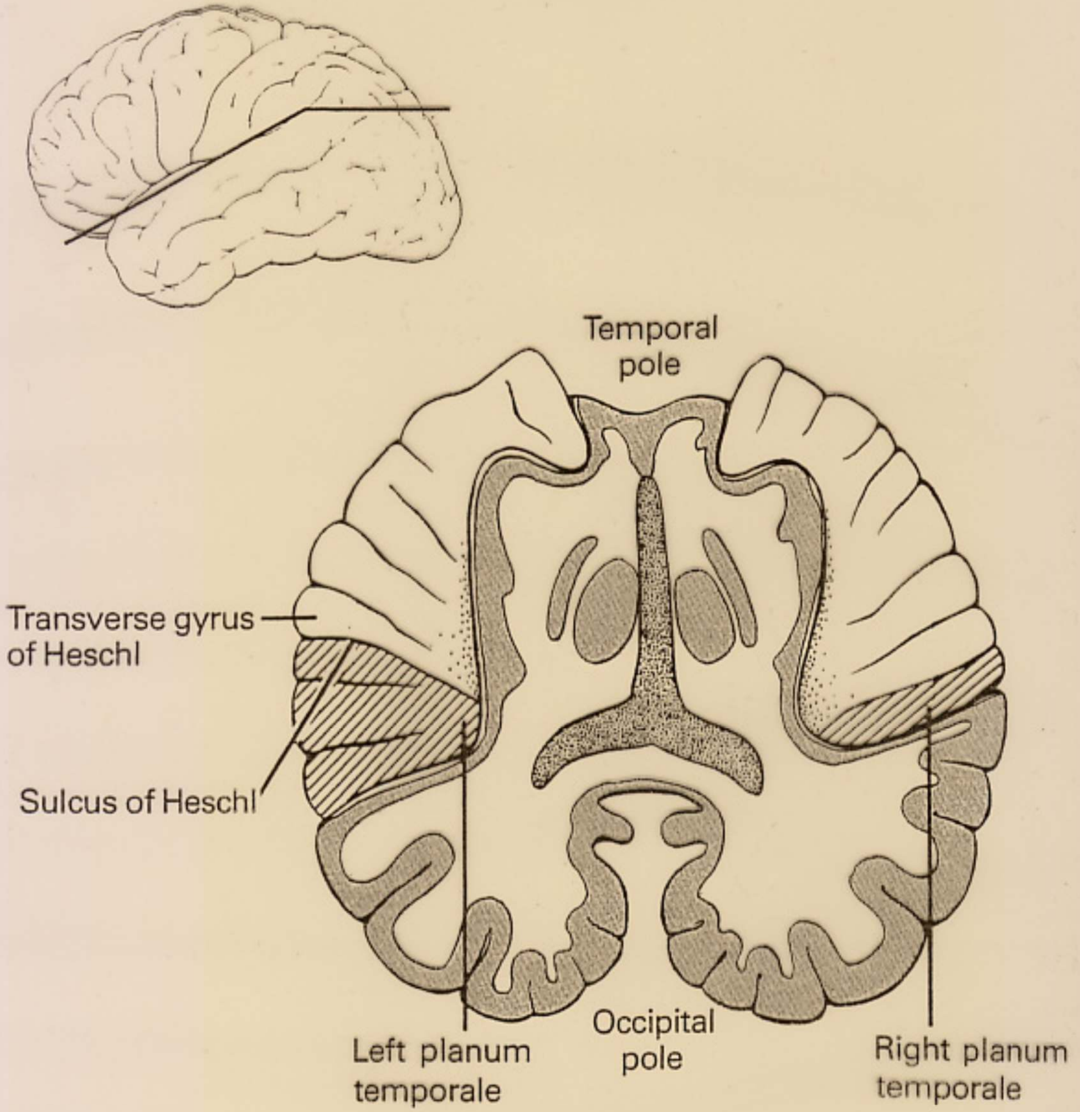


FIGURE 53–8
The planum temporale is larger in the left hemisphere than in the right in the majority of human brains (horizontal section in the plane of the Sylvian fissure). (Adapted from Geschwind and Levitsky, 1968.)

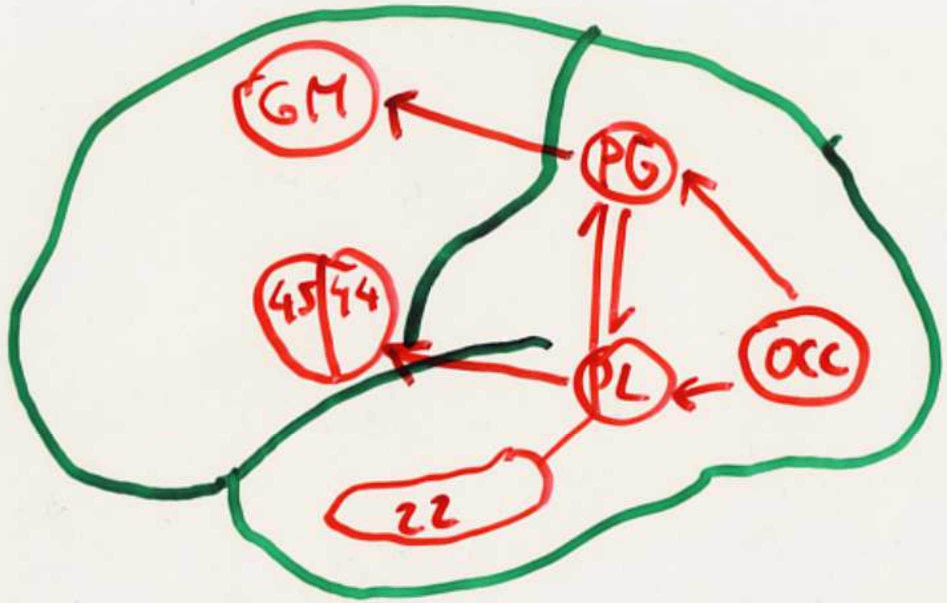
TABLE 53–2. Linguistic Dominance and Handedness

Handedness	Dominant hemisphere (%) Left	Right	Both
Left or mixed handed	70	15	15
Right handed	96	4	0

(Data from Rasmussen and Milner, 1977.)

APHASIAS (acc. Hrbek, Tichý)

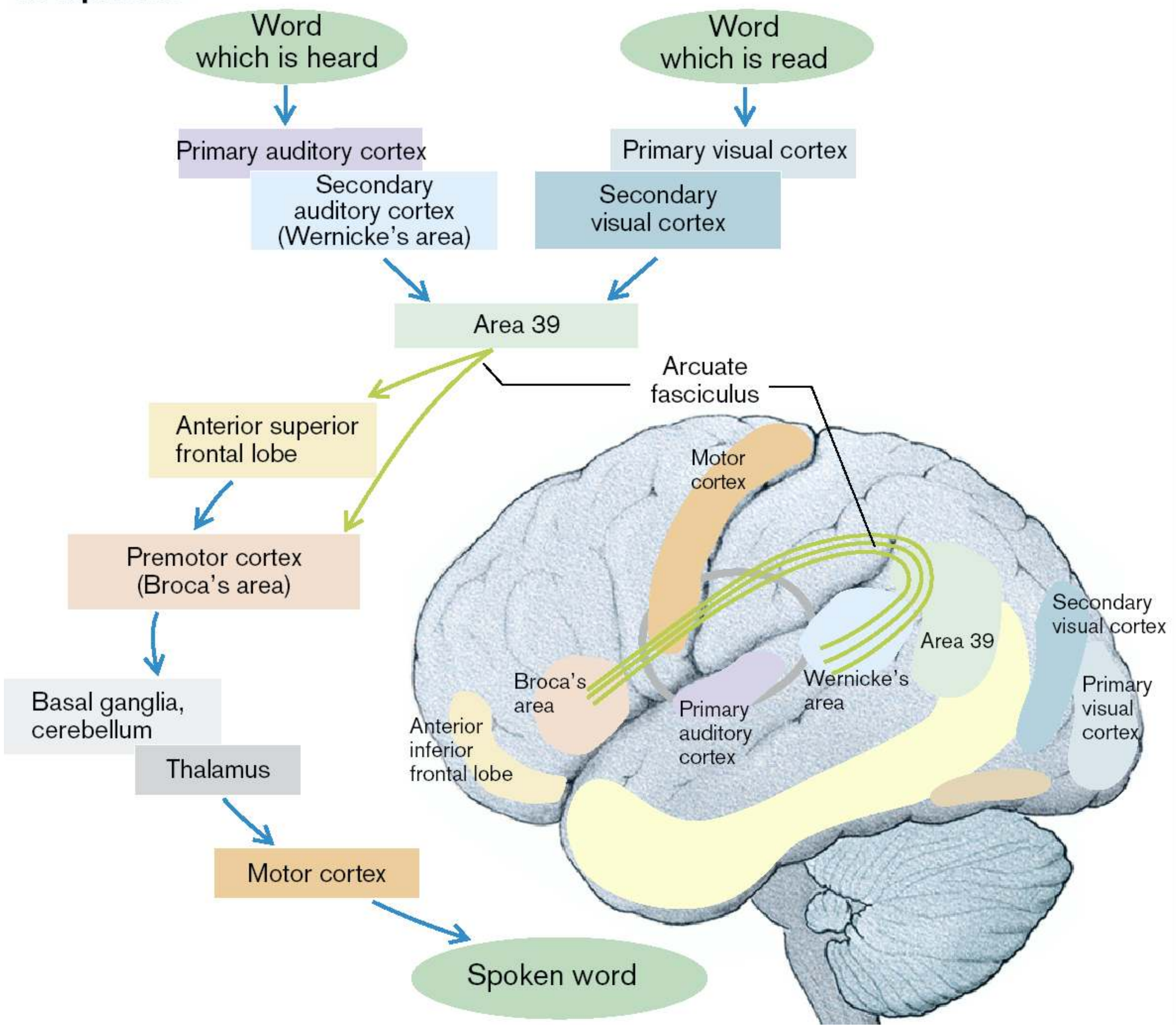
BARTKO, 1985



LEFT OUTER HEMISPHERE

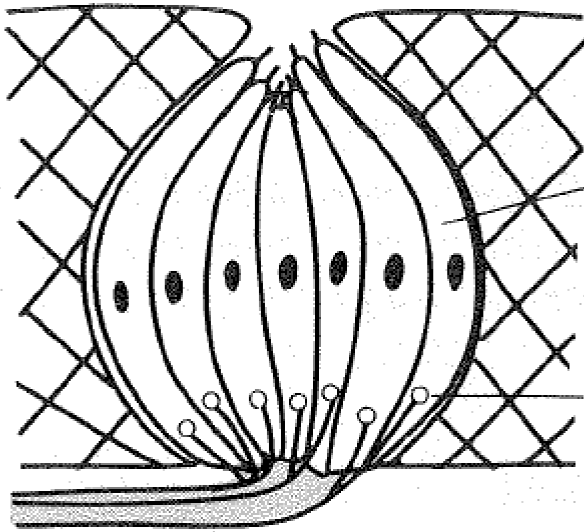
PG - parietal graphesthetic center
PL - parietal logesthetic center
OCC - occipital assoc. center 22 - Wernicke's c. - (logesthetic c.)
GM - graphomotoric center 44, 45 - Broca's c. - (logomotoric c.)

A. Aphasias



Word which is heard
Word which is read
Primary auditory cortex
Primary visual cortex
Secondary auditory cortex (Wernicke's area)
Secondary visual cortex
Area 39
Arcuate fasciculus
Anterior superior frontal lobe
Premotor cortex (Broca's area)
Basal ganglia, cerebellum
Thalamus
Motor cortex
Spoken word
Motor cortex
Broca's area
Anterior inferior frontal lobe
Primary auditory cortex
Wernicke's area
Area 39
Secondary visual cortex
Primary visual cortex

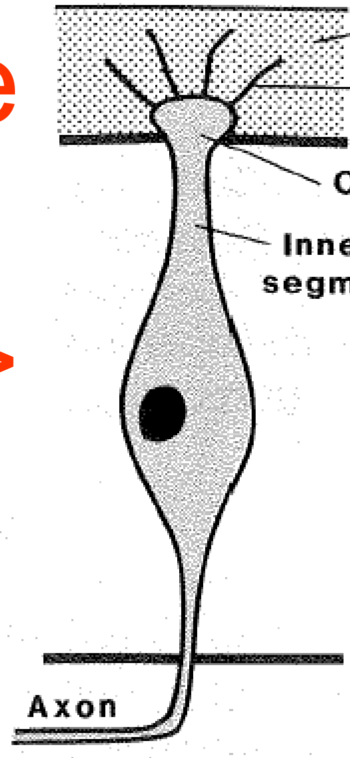
Type	Spontaneous speech	Repetition of words	Language comprehension	Finding words
Broca's aphasia	abnormal	abnormal	normal	impaired
Wernicke's aphasia	fluent (at times logorrhea, paraphasia, neologisms)	abnormal	impaired	impaired
Conduction aphasia	fluent, but paraphasic	markedly impaired	normal	abnormal, paraphasic
Global aphasia	abnormal	abnormal	abnormal	abnormal
Anomic aphasia	fluent	normal, but anomic	normal	impaired
Achromatic aphasia	fluent	normal, but anomic	normal	impaired
Motor transcortical aphasia	abnormal	normal	normal	abnormal
Sensory transcortical aphasia	fluent	fluent	abnormal	abnormal
Subcortical aphasia	fluent	normal	abnormal (transient)	abnormal (transient)



VERTEBRATE TASTE BUD

<-Taste

Smell->



VERTEBRATE OLFACTORY RECEPTOR

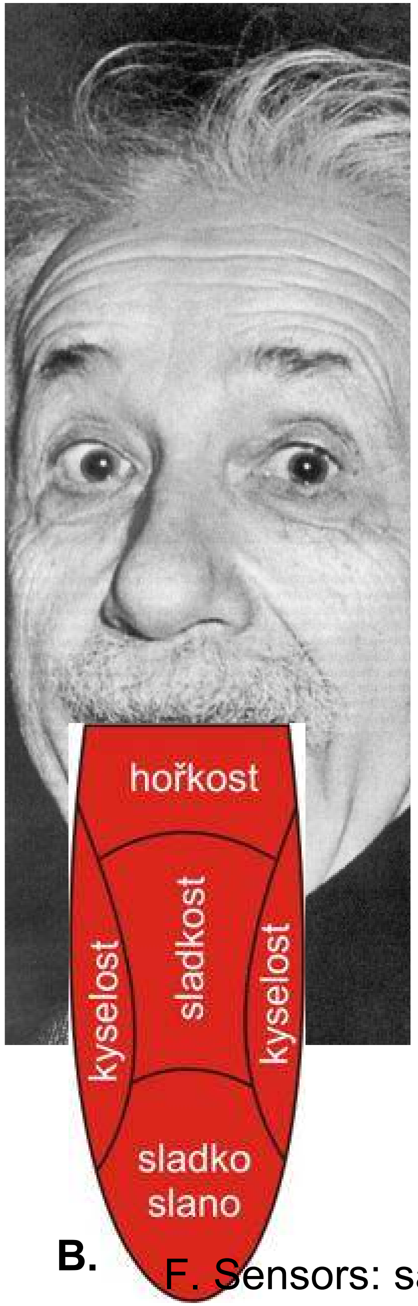
Stereochemical Hypothesis

Size, shape, and charge of the stimulating molecule allow it to combine with one or more of the basic types of receptor molecule to produce a response. Individual sensory receptors may have more than one type of receptor molecule.

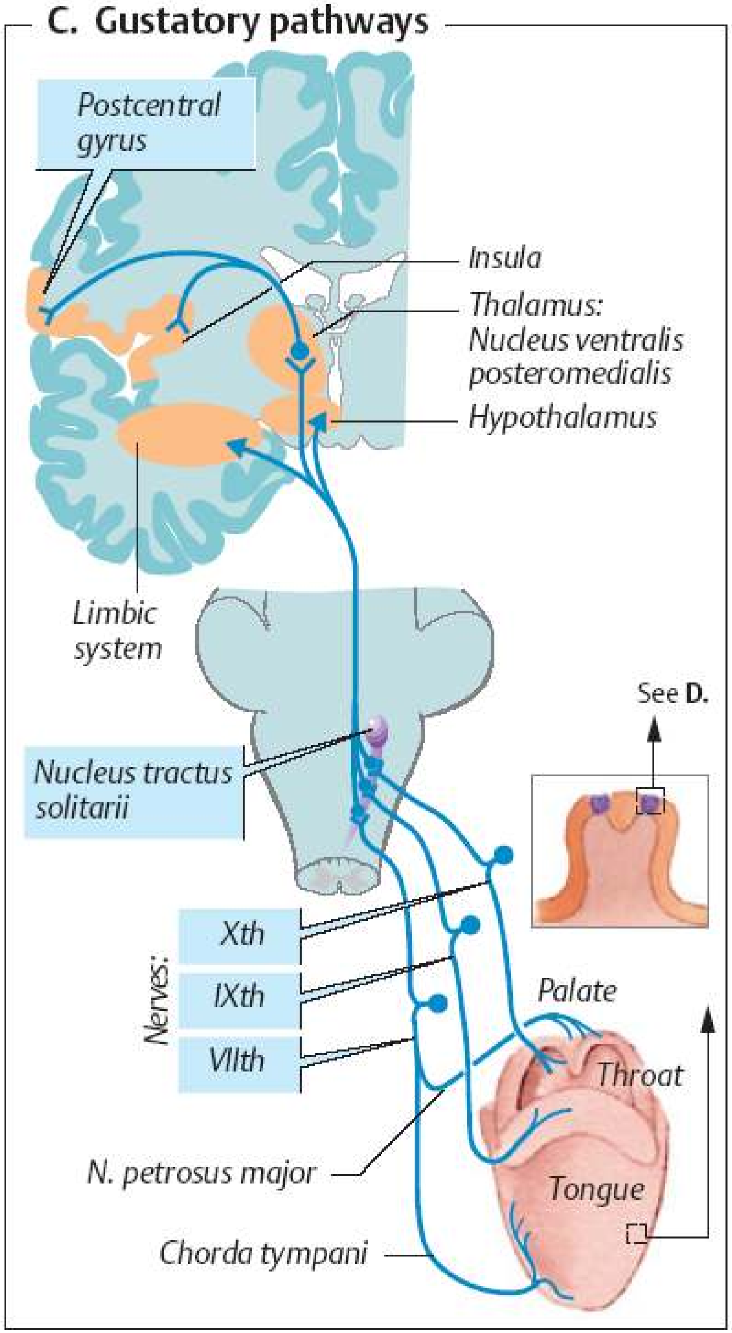
Discrimination of many different odors (several hundred for humans) is possible through (a) excitation or inhibition of impulse production in individual receptors, and (b) *combinations* of receptors recruited (or inhibited) by different odors (Fig. 65B3).

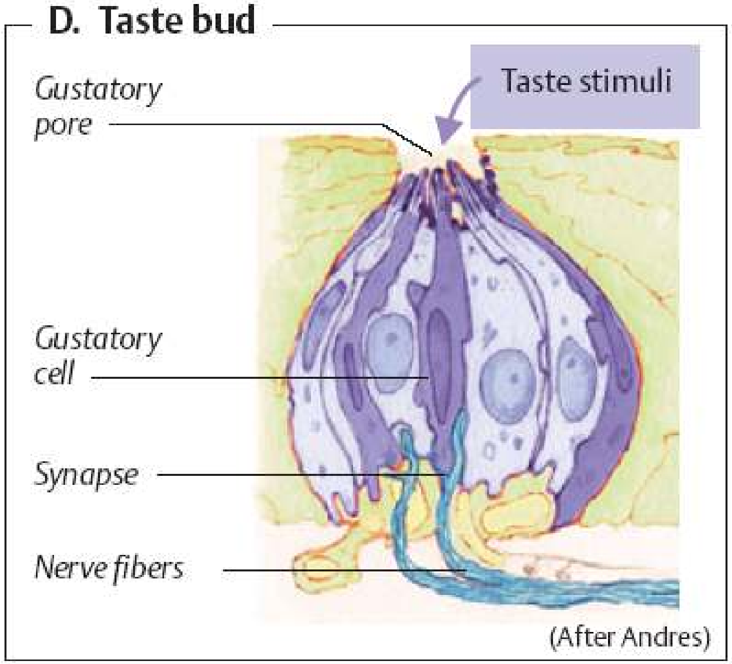
Given the large number of possible combinations of different active receptors, and the variation in impulse production, many different odors can be discriminated with relatively few basic types of receptor molecules.

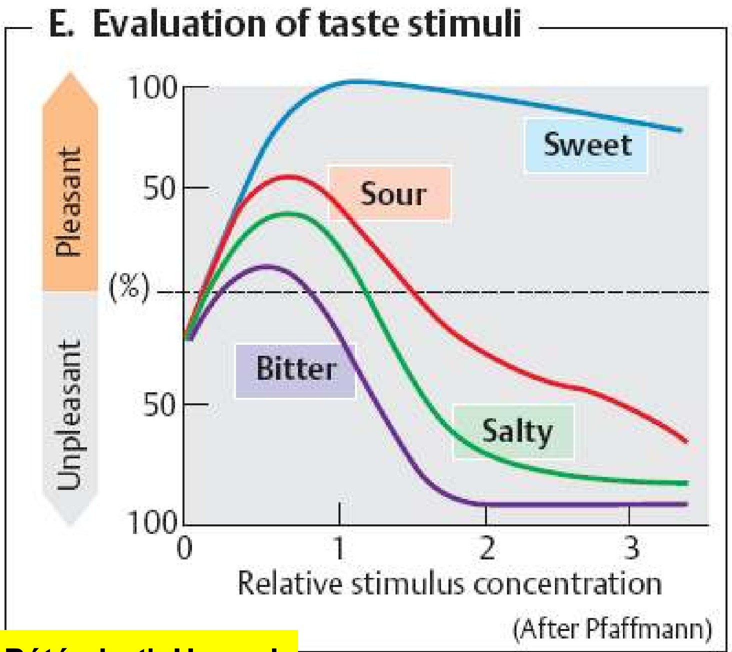
A. **How to stick out the tongue (After Einstein)**



B.



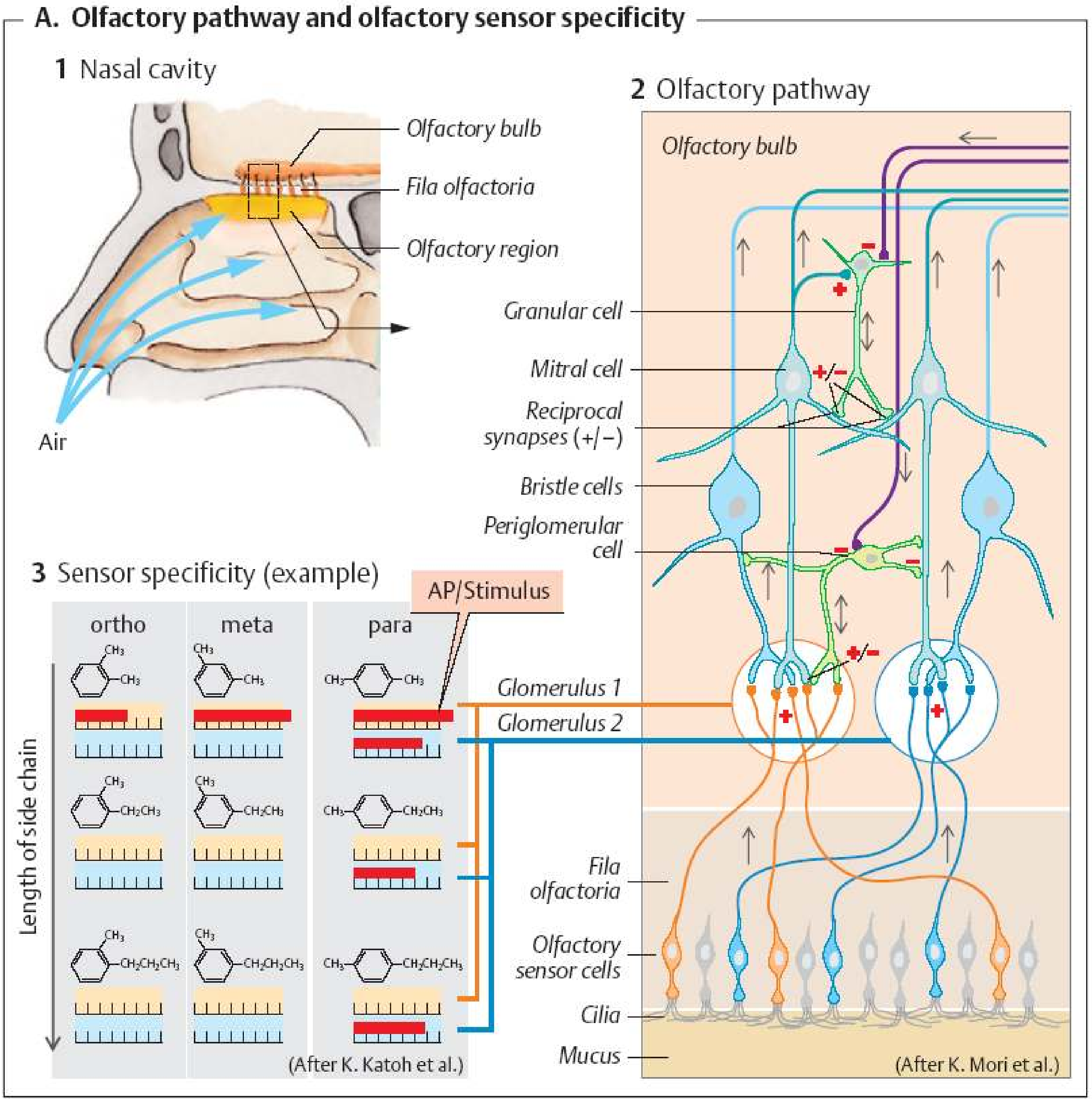




Pátá chuť: Umami

F. Sensors: salty-Na^+ , sour-H^+, sweet-?, bitter>50 protein receptors, umami-mGluR4

Smell



A. Olfactory pathway and olfactory sensor specificity
1 Nasal cavity
Olfactory bulb
Fila olfactoria
Olfactory region
Air
2 Olfactory pathway
Olfactory bulb
Granular cell
Mitral cell
Reciprocal synapses (+/−)
Bristle cells
Periglomerular cell
Glomerulus 1
Glomerulus 2
Fila olfactoria
Olfactory sensor cells
Cilia
Mucus
(After K. Mori et al.)
3 Sensor specificity (example)
AP/Stimulus
ortho
meta
para
Length of side chain
(After K. Katoh et al.)

Adaptation of smell and taste in time