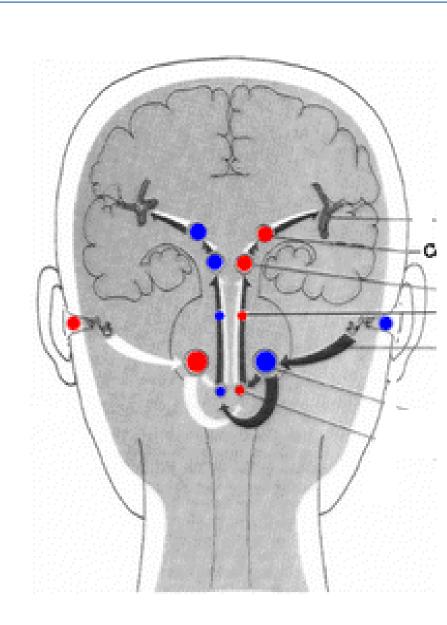




Die Hörbahn

- Übersicht
- Hirnstamm
- Mittelhirn
- Zwischenhirn
- Kortex

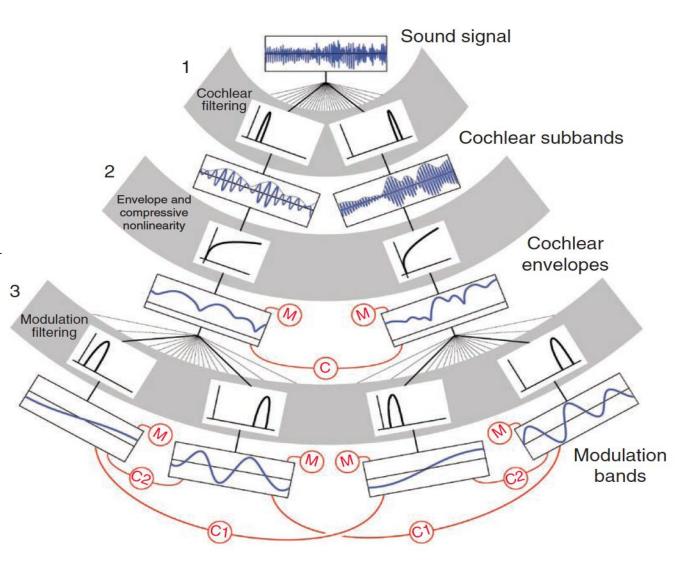


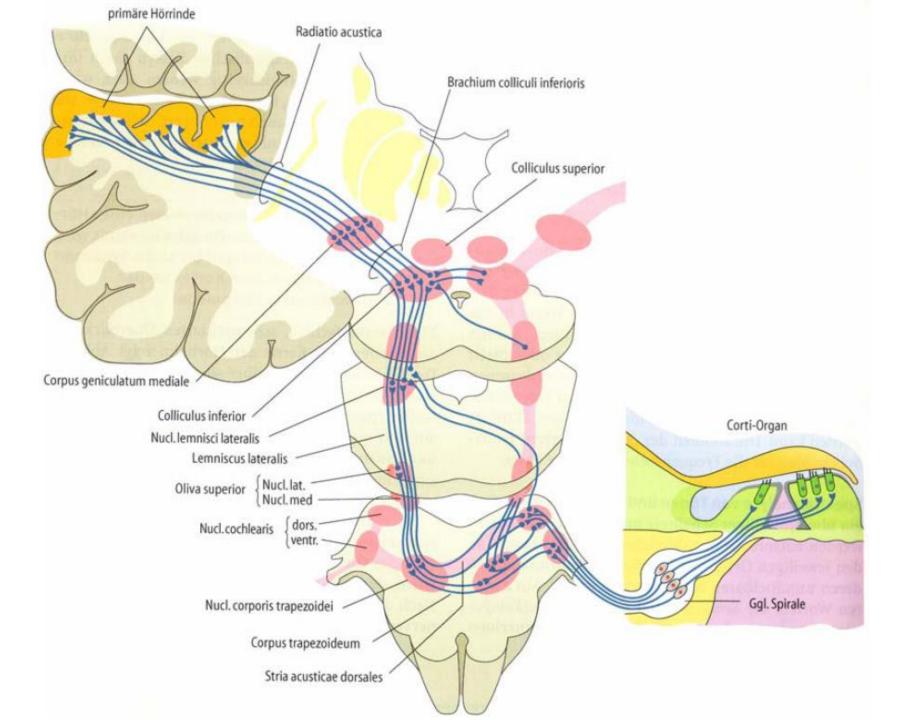
Texture extraction by time-averaged statistics

Josh H McDermott, Michael Schemitsch & Eero P Simoncelli, 2013

Filter banks:

- -Frequency
- -Spectral Modulation
- -Temporal Modulation



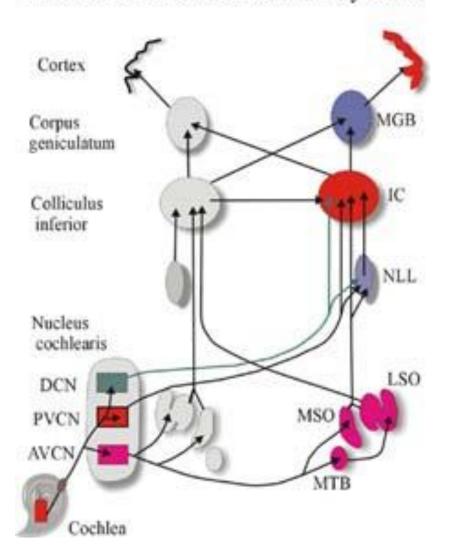


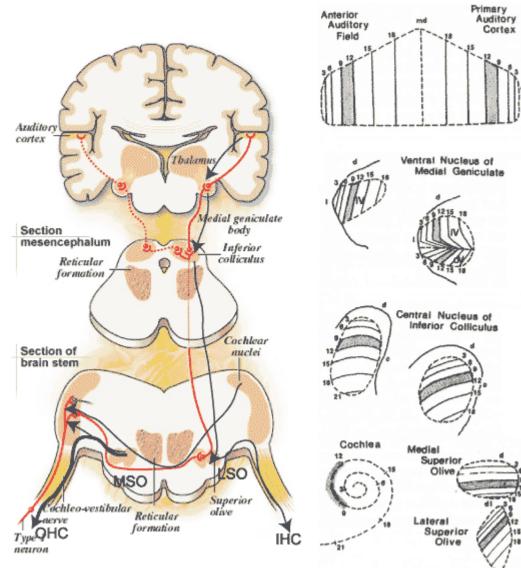


Hörbahn



Afferenzen des auditorischen Systems



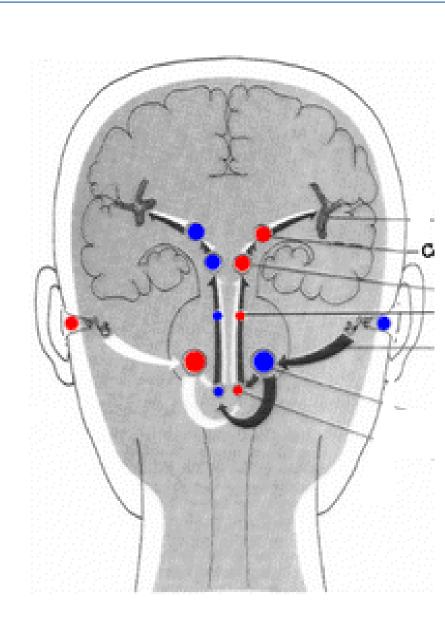






Die Hörbahn

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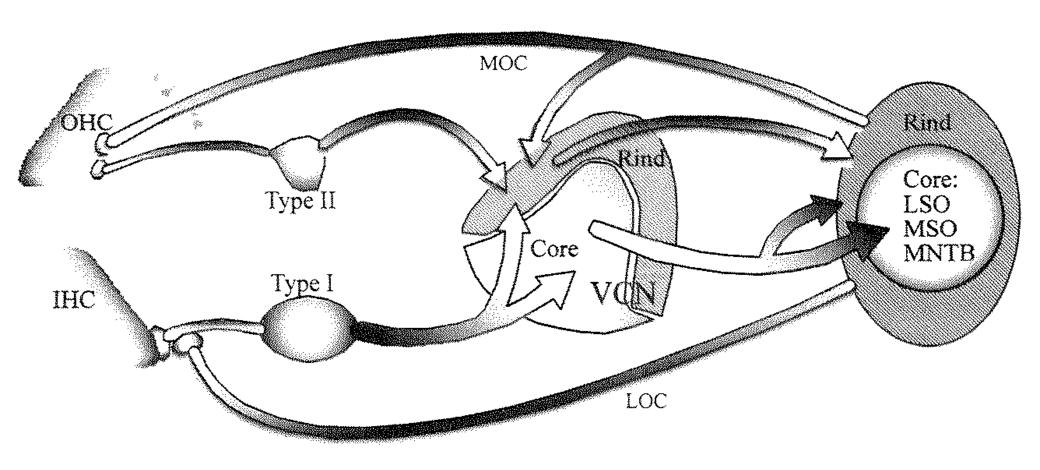


Cochlea

Verarbeitung im Hirnstamm



Superior Olive



Integrative Functions in the Mammalian Auditory Pathway (Eds.: Oertel, Fay, Popper, Springer)

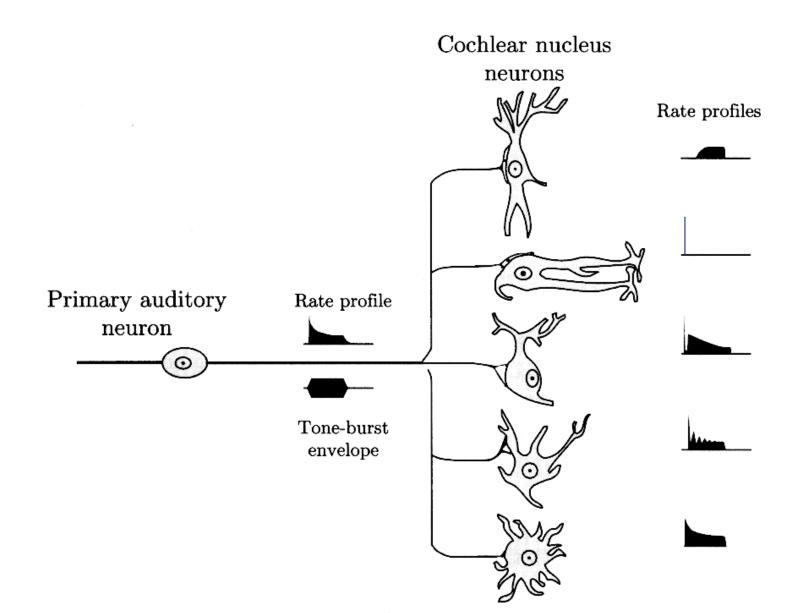
Spiral Ganglion

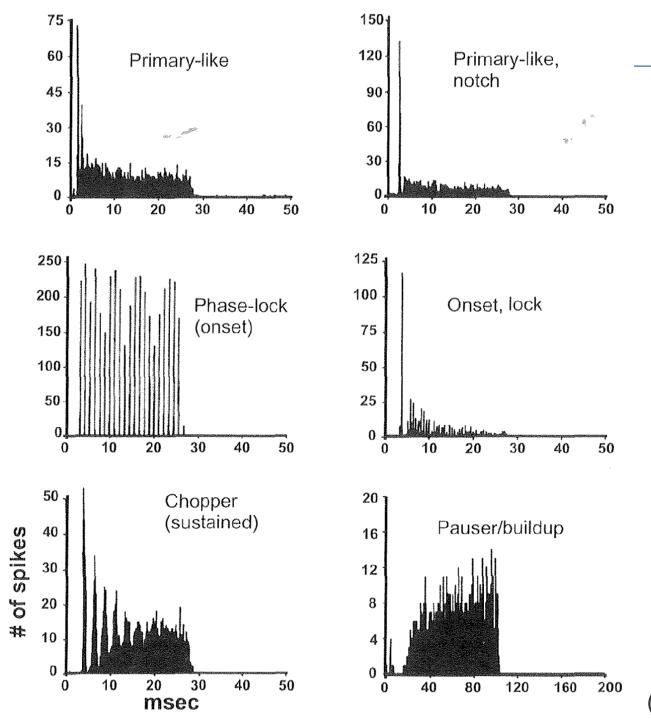
Cochlear Nuclei



Neurone im Hirnstamm









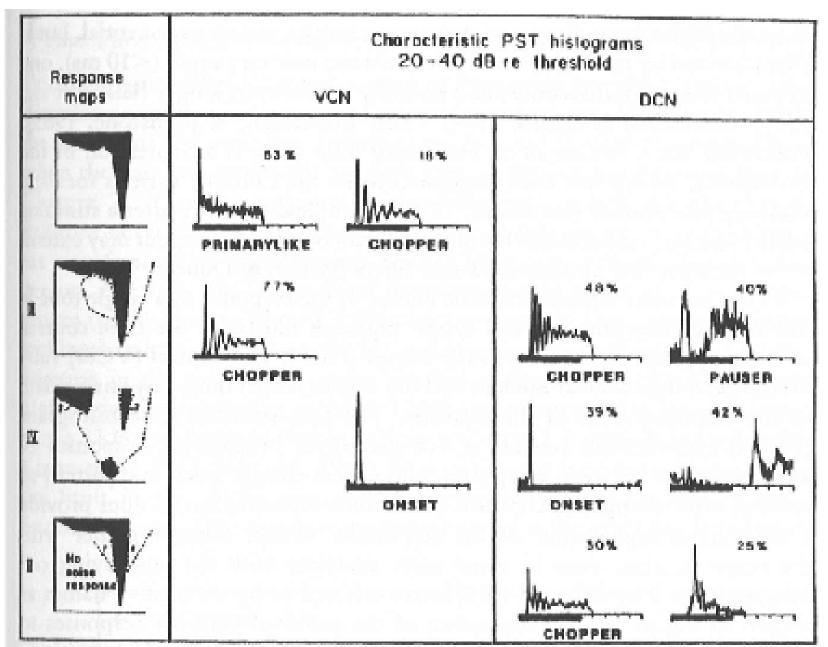
Neurone im auditorischen Hirnstamm

Integrative Functions in the Mammalian Auditory Pathway (Eds.: Oertel, Fay, Popper, Springer)

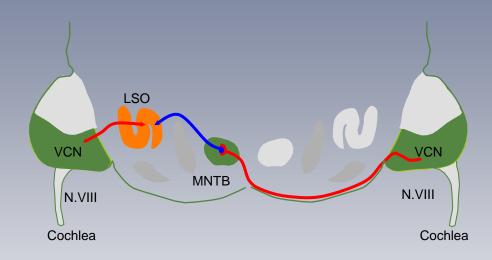


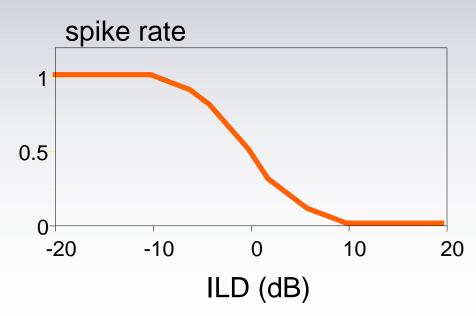
Verarbeitung im Hirnstamm

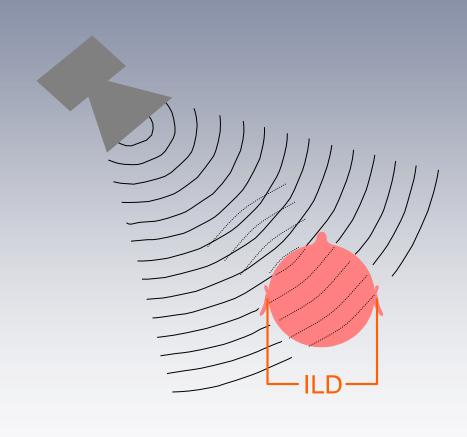




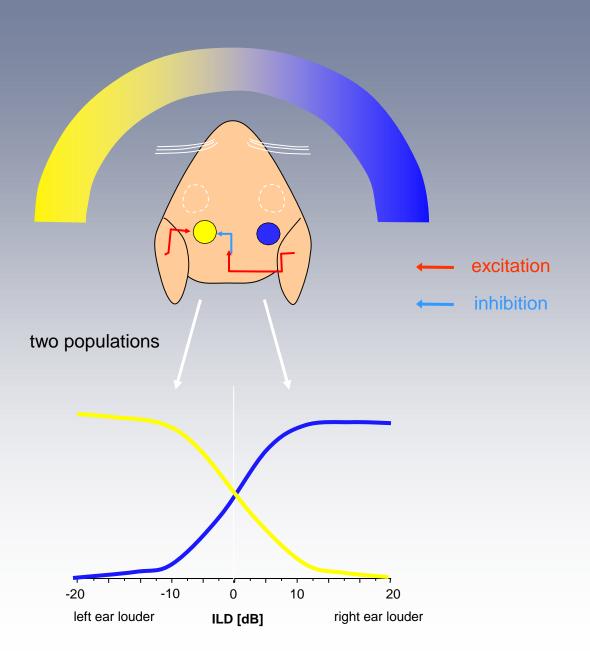
ILD coding in the LSO

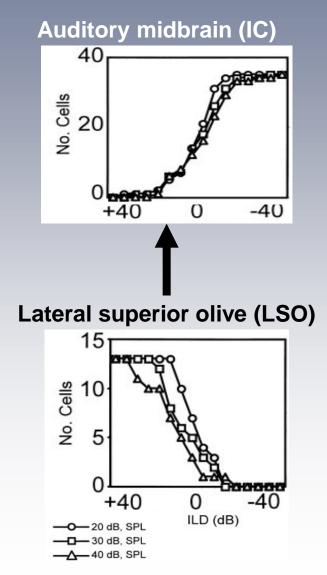




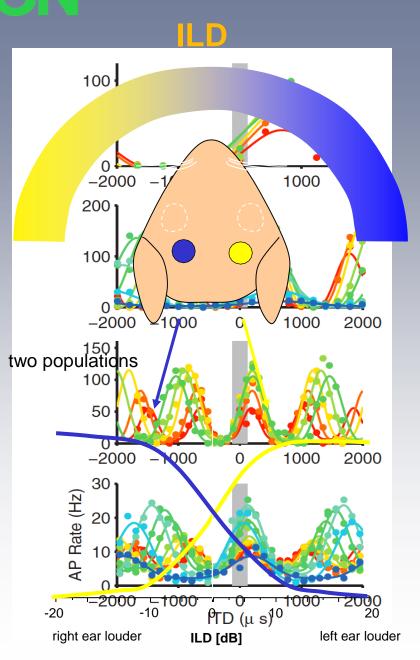


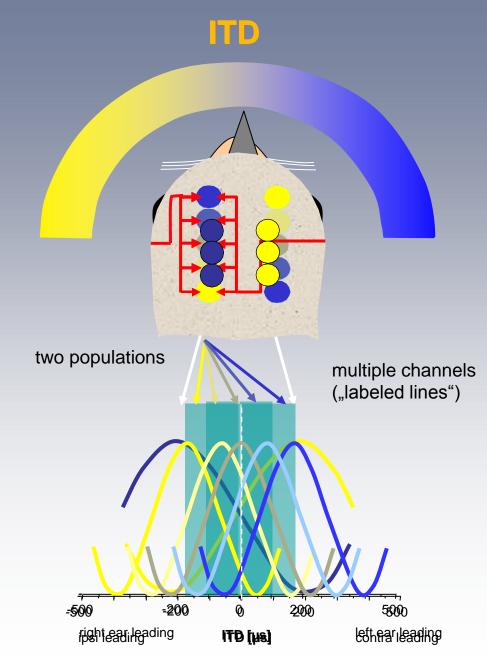
Representation of ILDs





HID armort existings Stragt existegy





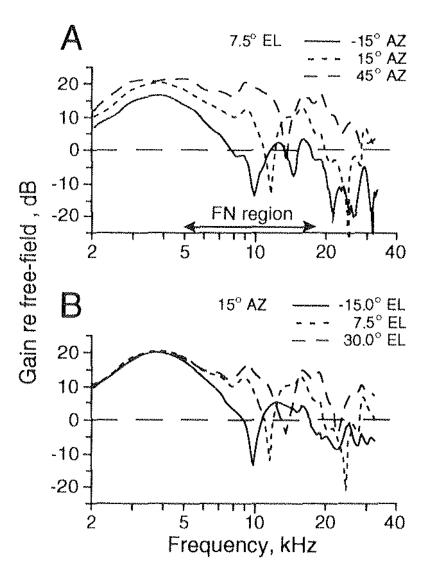
Grothe et al. (2010) Physiol Rev



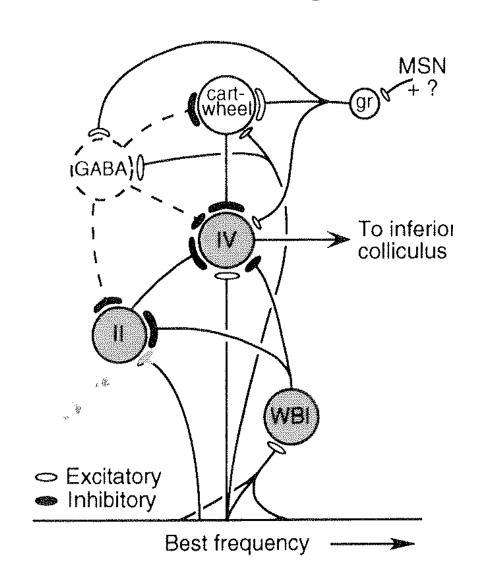
DCN: sensitive to spectral peaks & notches



Cat HRTF



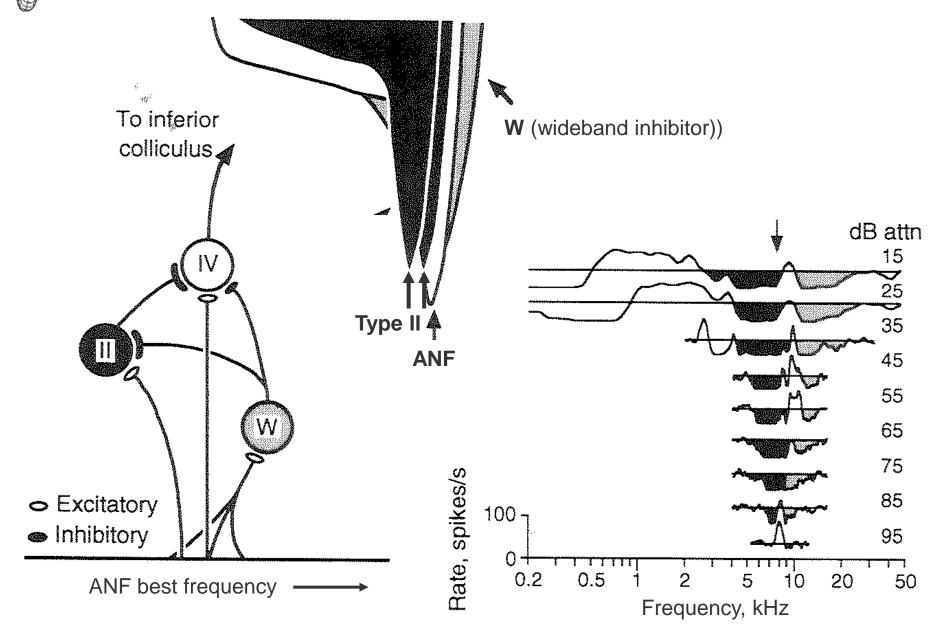
DCN Circuit diagram





DCN: Spectral processing

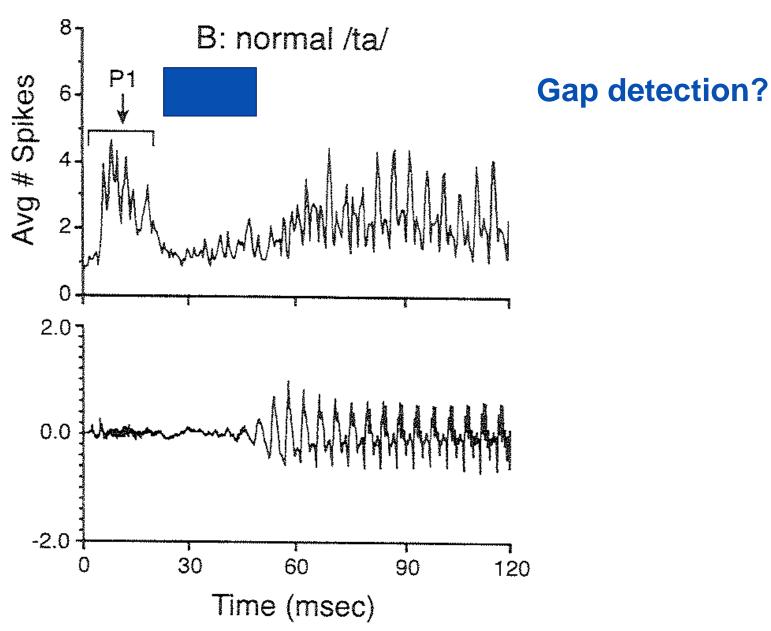






VNLL: Extraction of Temporal Features?



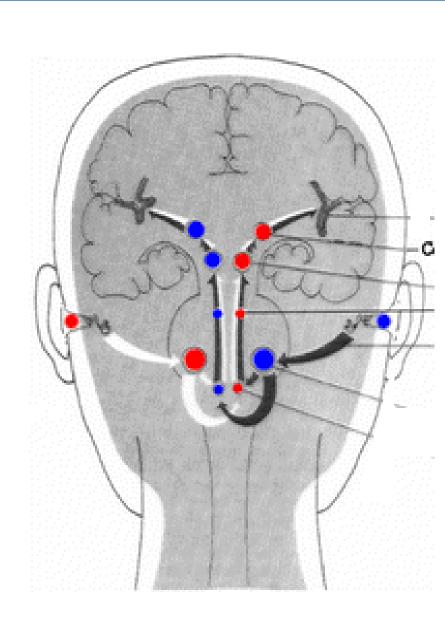






Die Hörbahn

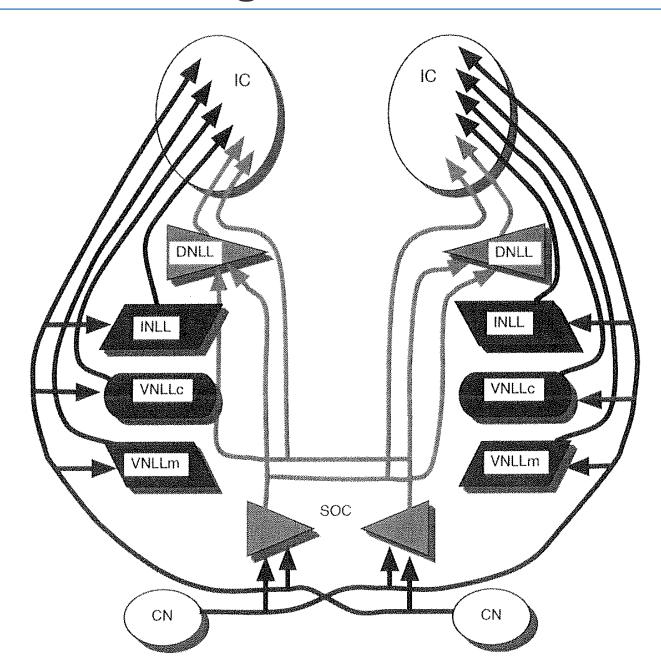
- ✓ Übersicht
- √ Hirnstamm
- Mittelhirn
- Zwischenhirn
- Kortex





Integration im IC

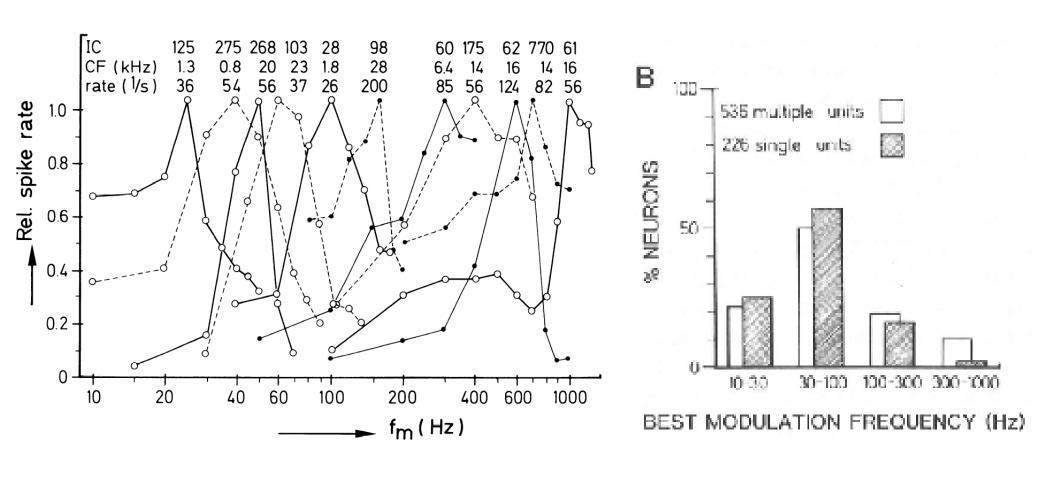






IC: Amplitudenmodulationsfilterbanken (?)

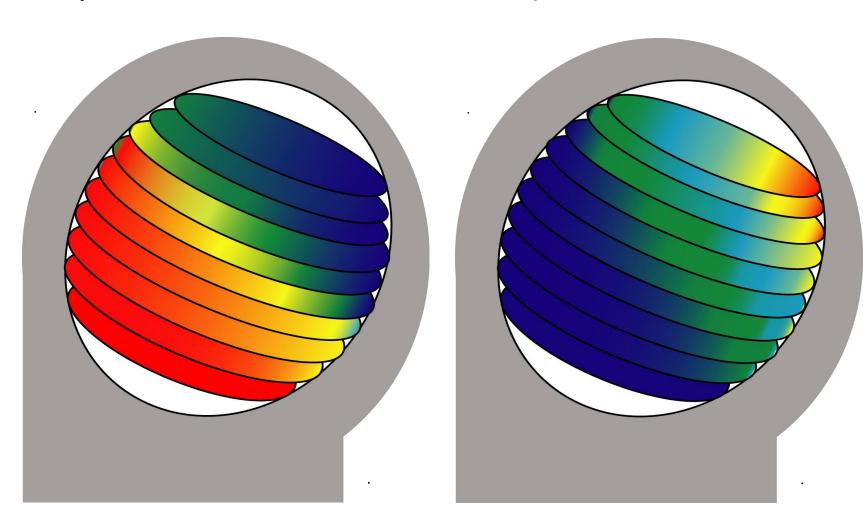




Model organization of the Central Nucleus

Spectral Resolution

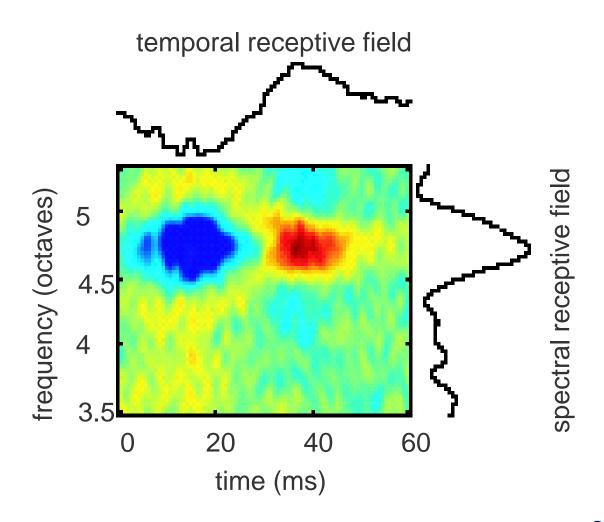
Temporal Resolution





Spectro-Temporal Receptive Fields

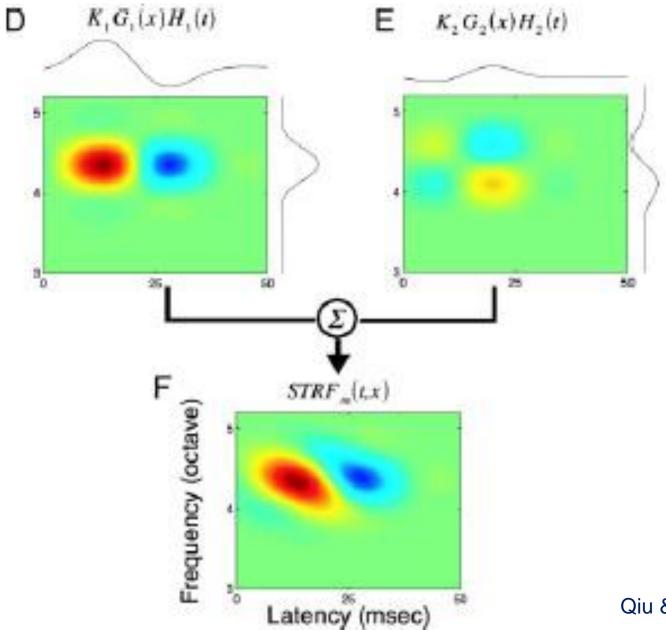






Spectro-Temporal Receptive Fields

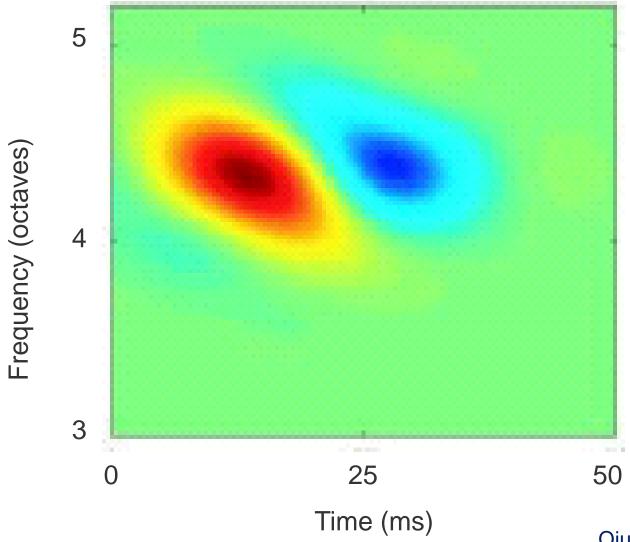






Spectro-Temporal Receptive Fields

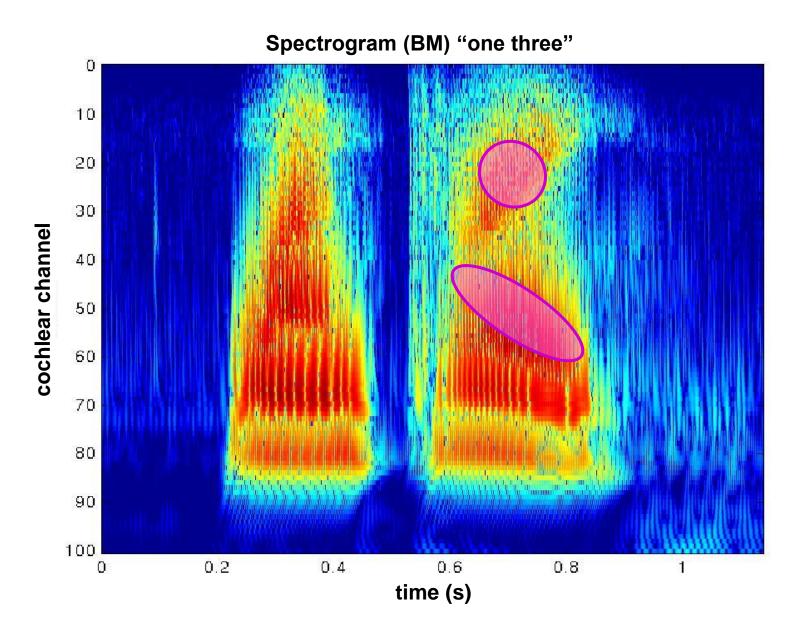






Extraction of formant transitions



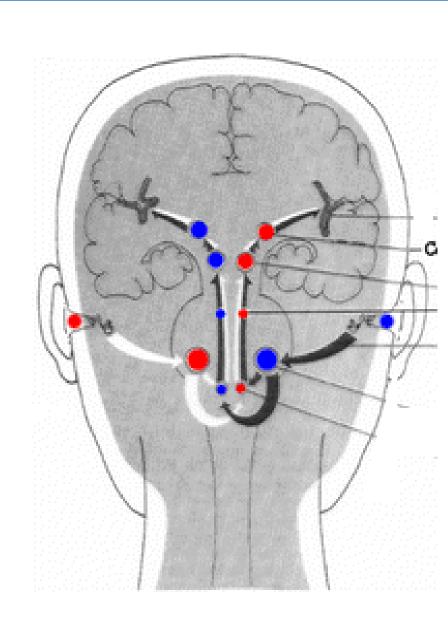






Die Hörbahn

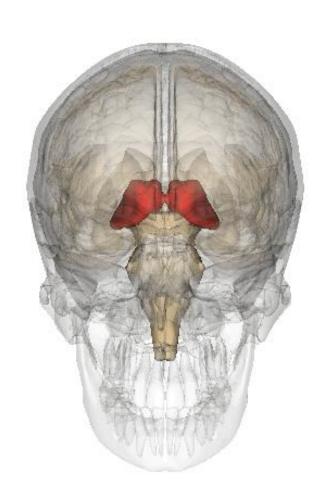
- ✓ Übersicht
- √ Hirnstamm
- ✓ Mittelhirn
- Zwischenhirn
- Kortex

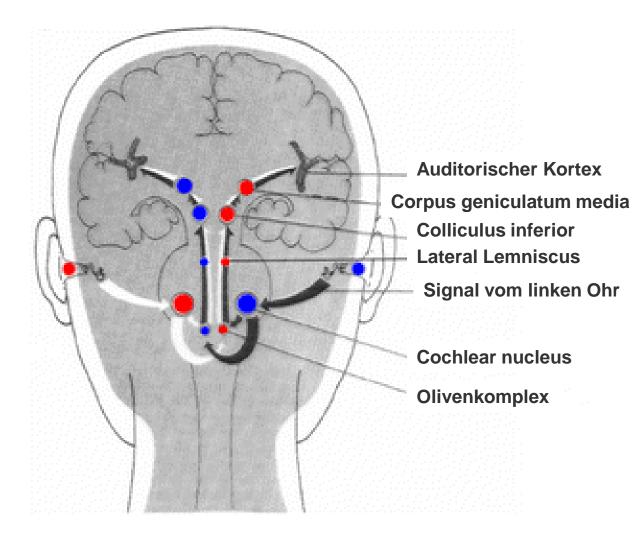




Hörbahn: Thalamus



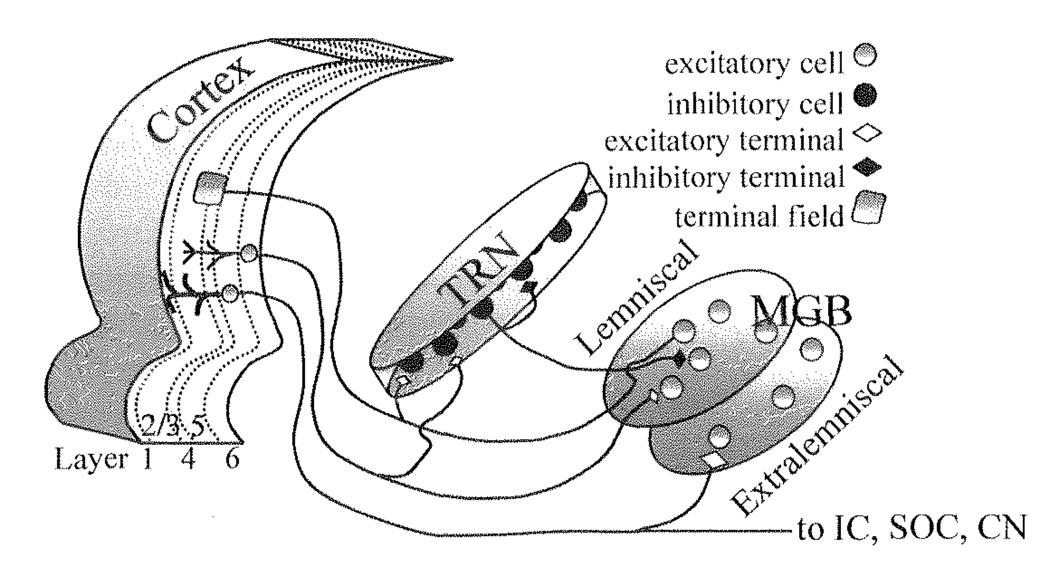




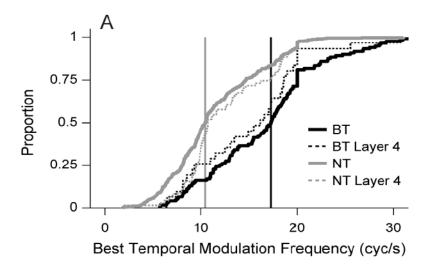


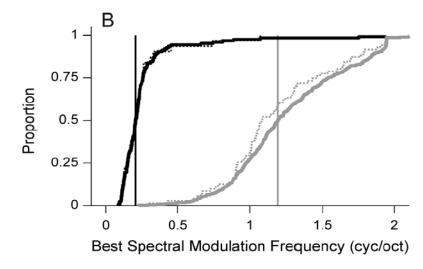
Verarbeitung im Thalamus



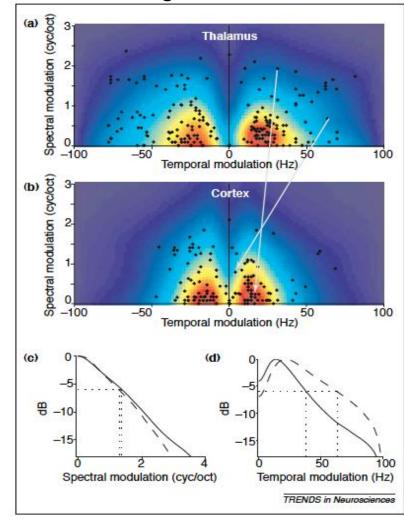


Trade-off in temporal tuning Between broad and narrow A1-regions





Pair-wise recordings of thal&AC neurons



- Reduction of tMTF range between thalamus and AC
- No difference for sMTFs-

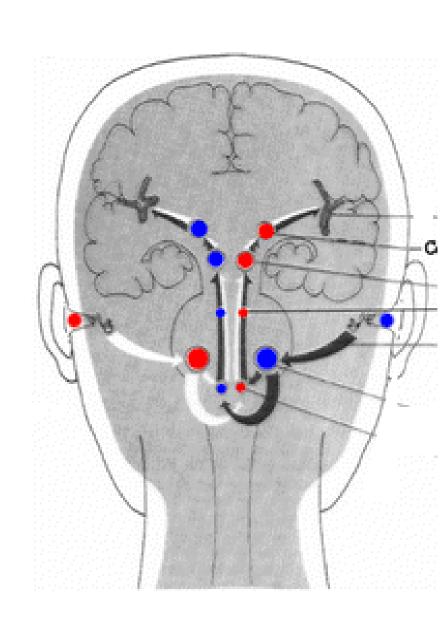
(Miller et al., 2003)





Die Hörbahn

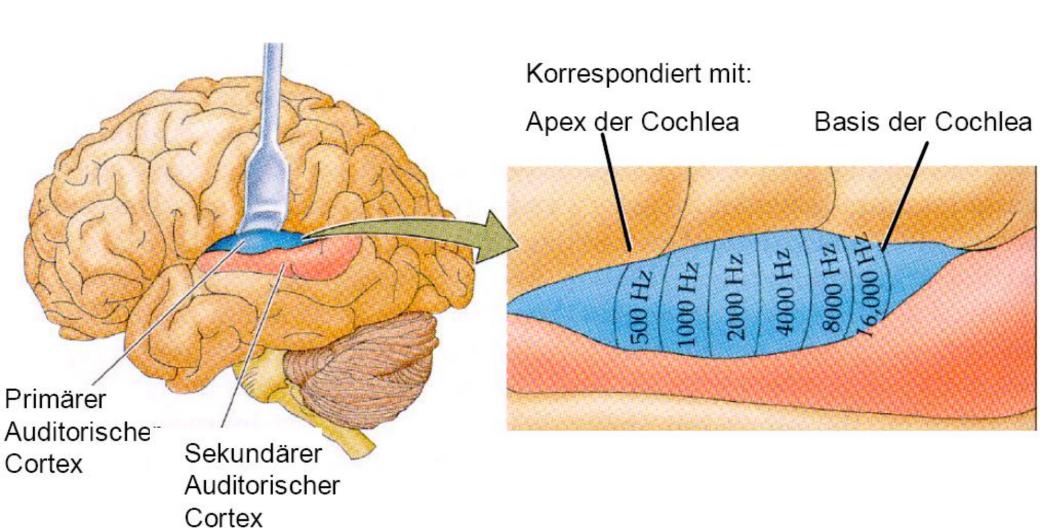
- ✓ Übersicht
- √ Hirnstamm
- ✓ Mittelhirn
- ✓ Zwischenhirn
- Kortex





Auditorischer Kortex

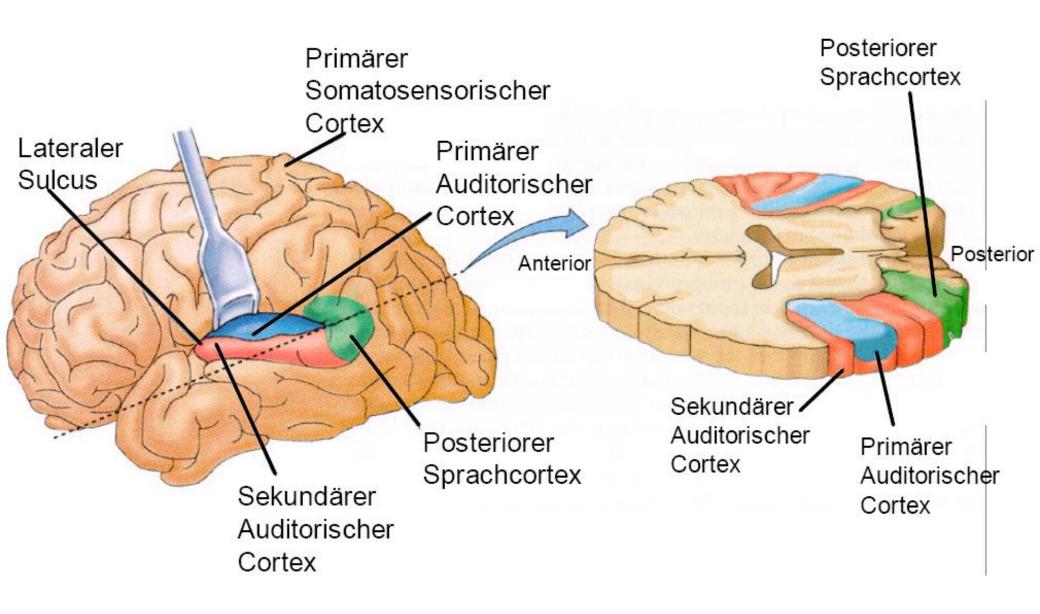


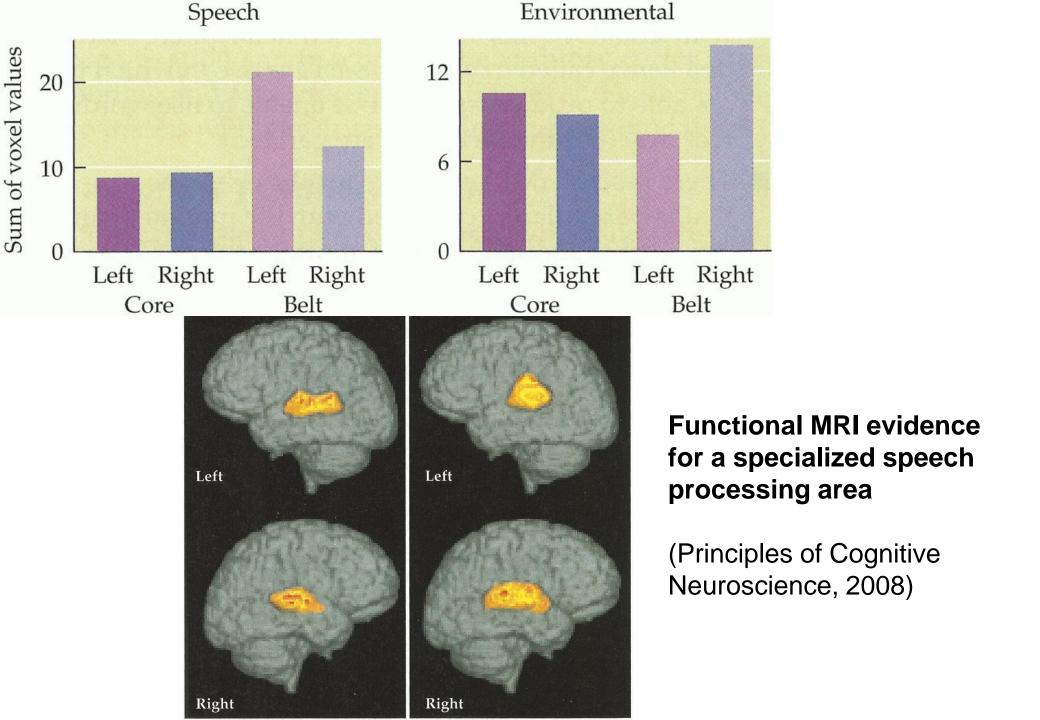




Auditorischer Kortex



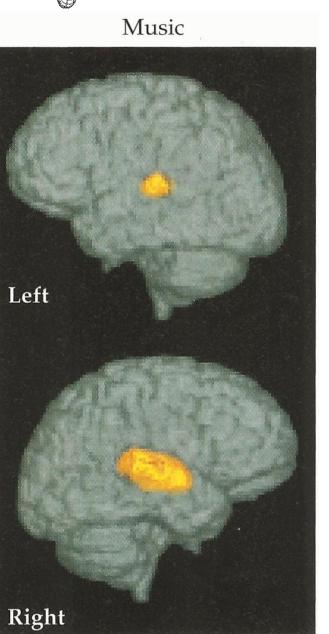


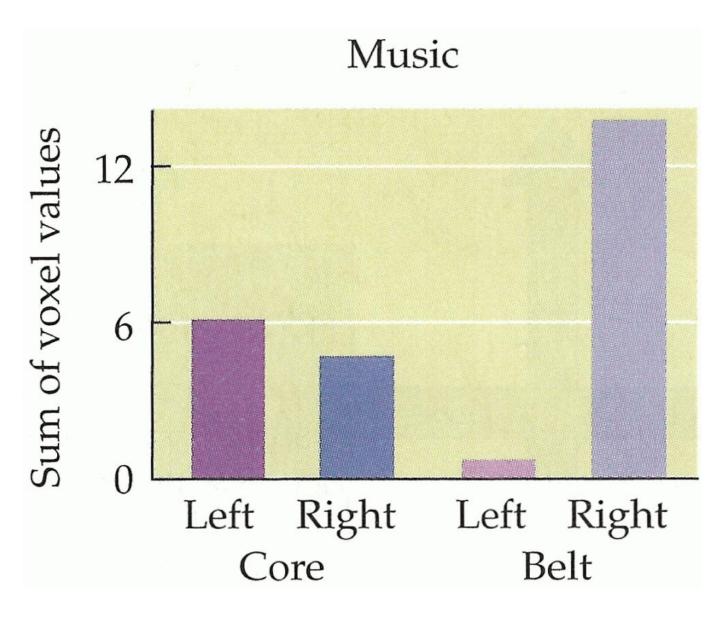




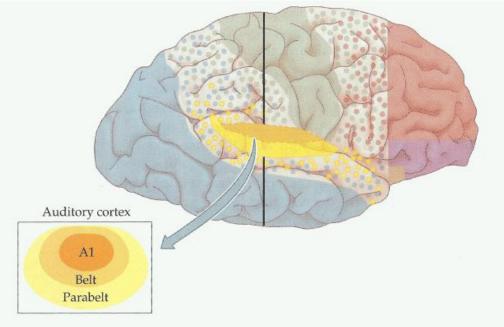
Processing of Music: Evidence of Lateralization







Principles of Cognitive Neuroscience, 2008



Regions of the right hemisphere activated by musical stimuli

(Principles of Cognitive Neuroscience, 2008)

AUDITORY ANALYSIS AND REPRESENTATION

Tuning, melody, harmony, rhythm, dynamics, voice, lyrics, octave equivalence in transposition, scales, keys, modes, chords, meters, arrangement, "mix"

KINETICS AND KINESTHETICS

Foot tapping, dancing, humming, singing, whistling, instrumental and vocal performance, synthesis

VISUAL PERCEPTION

Facial expression, body language, dance expression, music reading, synesthesia

ASSOCIATIONS WITH PEOPLE AND PAST EVENTS

Holidays, funerals, weddings, personal history (Medial temporal lobe not shown)

EXPECTANCY GENERATION, VIOLATION, AND SATISFACTION

Repetition, return, resolution, downbeats and offbeats, key change, appoggiatura, tempo change

PERSONALITY AND PREFERENCE

Genre, style, taste, subculture, generation, collective ego

EMOTIONS AND VISCERAL CONCOMITANTS

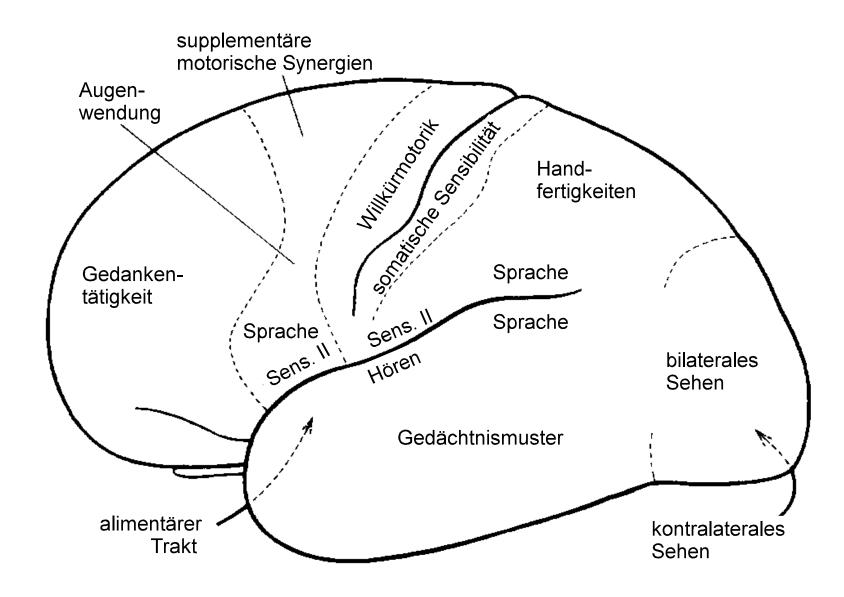
Excitement, heart rate, sex, vascular tone, endorphins, hormones, "goose bumps", chills, shivers, tears

(Medial temporal lobe, basal forebrain, hypothalamus, and midbrain tegmentum not shown)



Verarbeitung von Musik





Klangwelten im Kopf Wege der Musik durch das Gehirn

- 1 Der Hörnerv leitet Klanginformationen an den Hirnstamm weiter.
- Einige Signale erreichen das so genannte limbische System, das eine wichtige Rolle in der Verarbeitung von Gefühlen spielt. Schöne Musik stimuliert jene Bereiche, die auch beim Sex oder beim Schokoladeessen aktiv sind. Auch körperliche Reaktionen auf Musik, wie Weinen oder Gänsehaut, werden hier ausgelöst.
- Die Informationen gelangen in die **primäre Hörrinde** im Großhirn, die Schaltzentrale des Hörens.
- Umliegend finden sich die sekundären Hörareale. In der linken Hirnhälfte werden eher Rhythmen verarbeitet, auf der rechten Seite dagegen Klangfarben und Tonhöhen.
- Die komplizierten Bewegungen, etwa beim Musizieren und Tanzen, werden von motorischen und sensorischen Arealen in der Großhirnrinde gesteuert.

