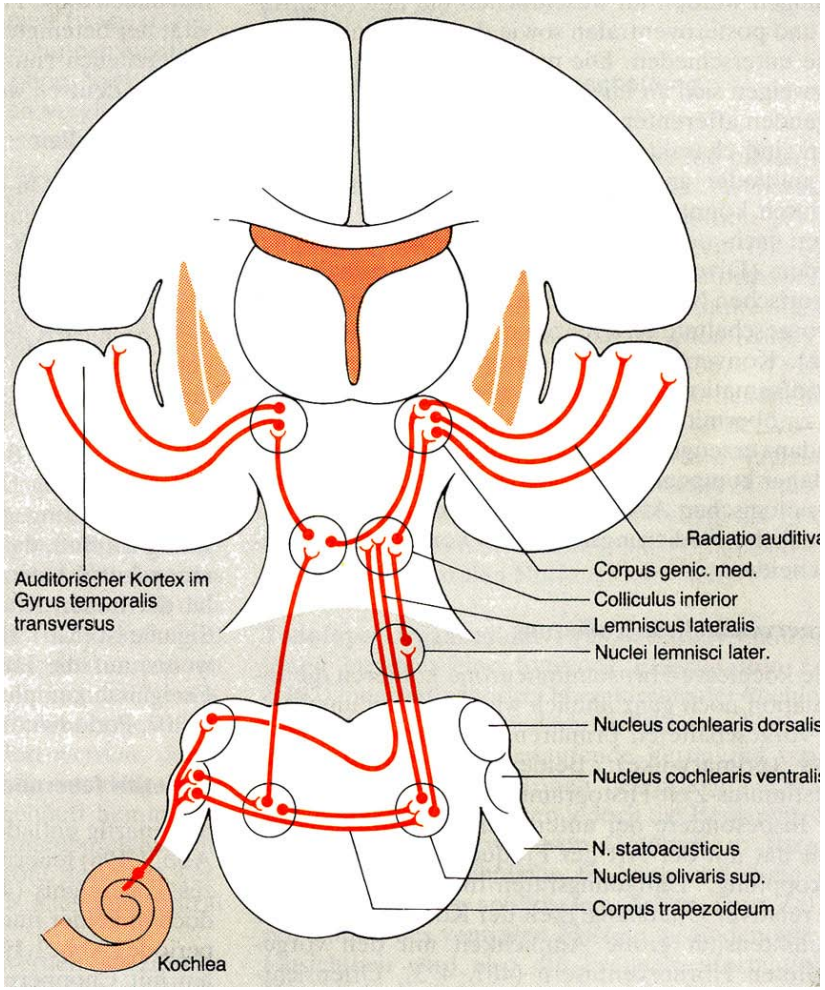
Efferent Feedback in the Cochlea

- **Anatomy**

auditory pathways

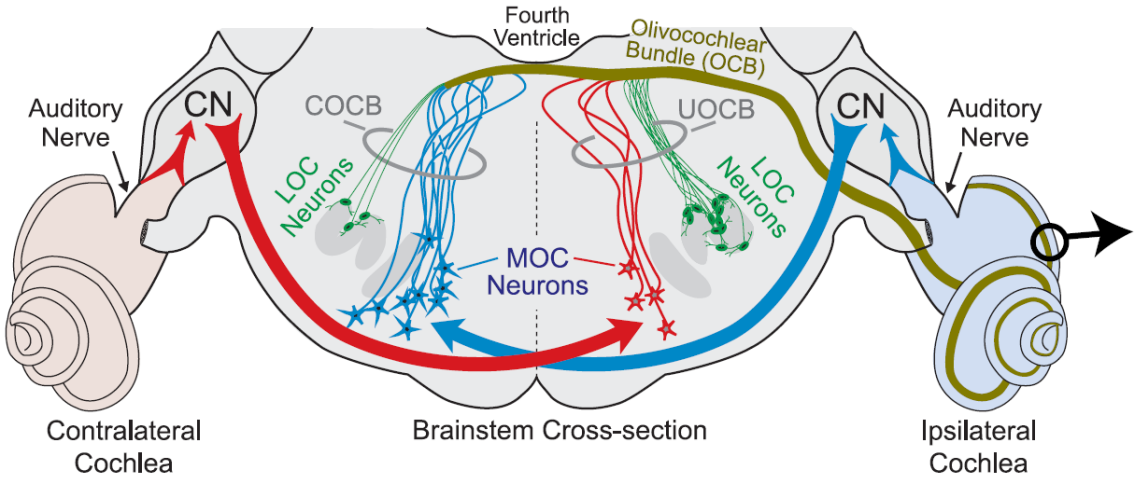
afferent & efferent
innervation at all stages



Zenner, 1994

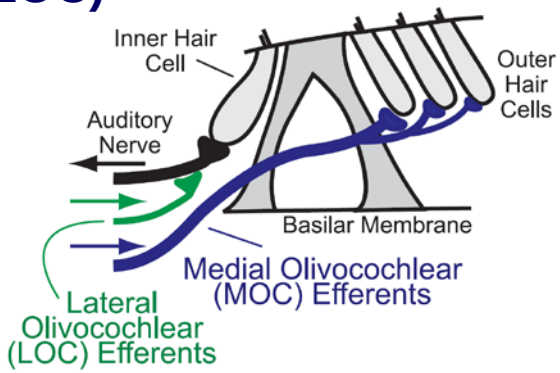
Recording from afferent/efferent fibers

Efferent feedback network



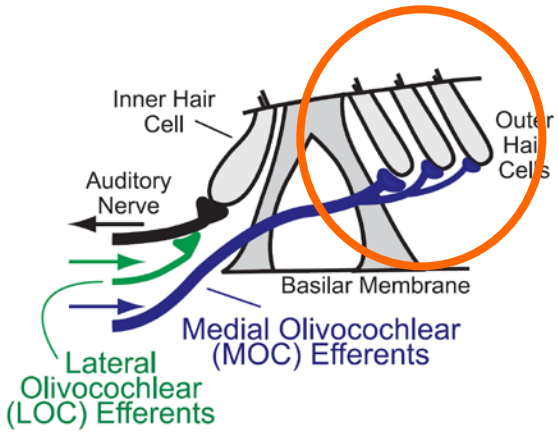
Medial olivocochlear reflex (MOC)

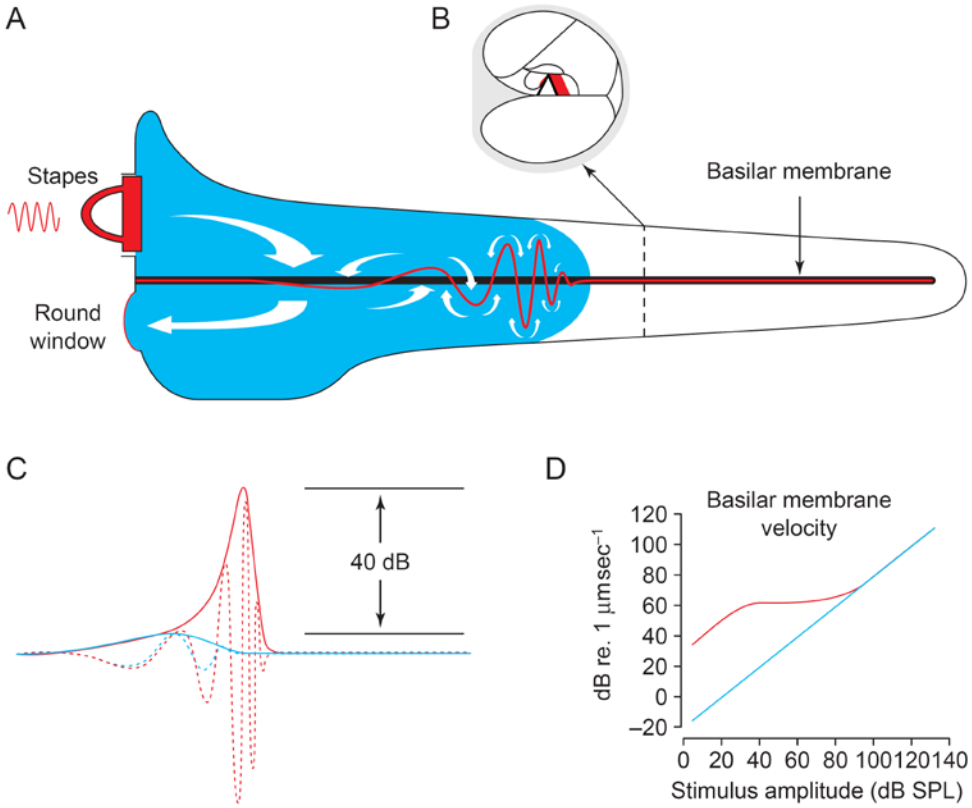
Lateral olivocochlear reflex (LOC)



Guinan, 2006

Repetitorium I: Cochlear Function

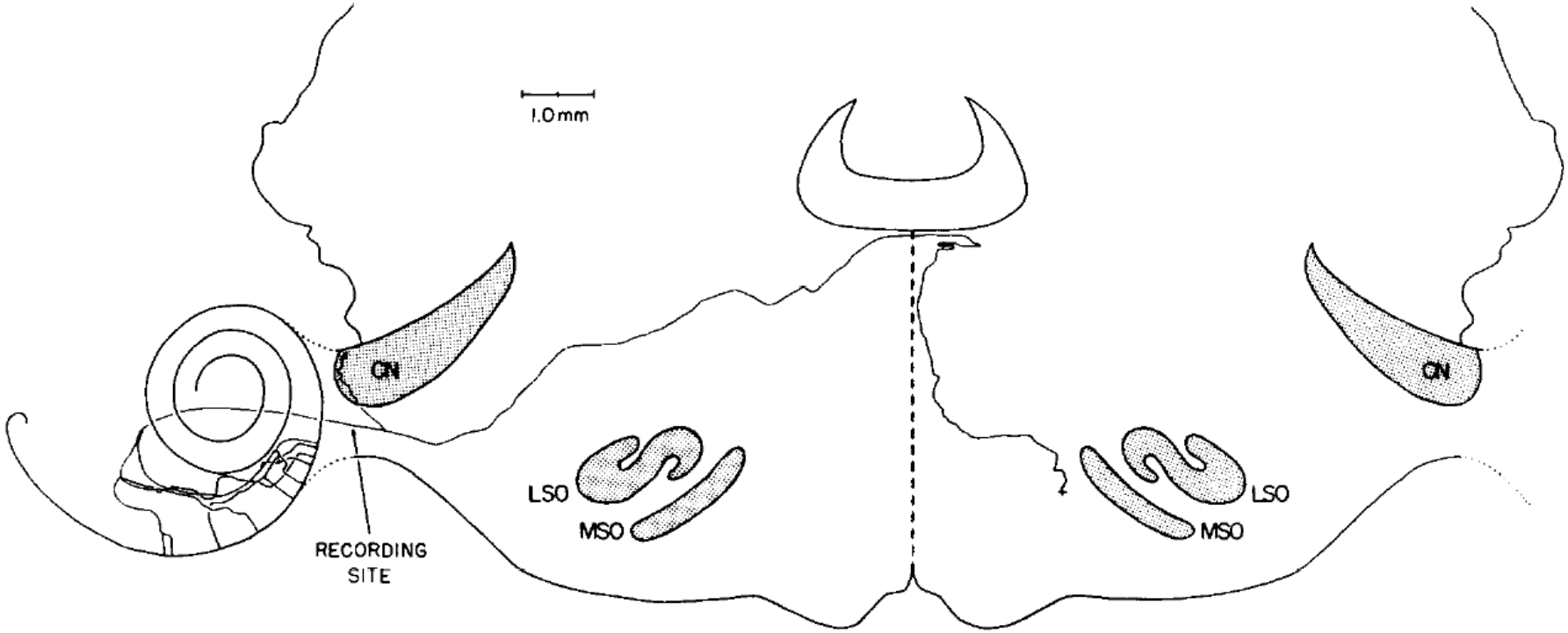




Cochlear amplifier (CA)

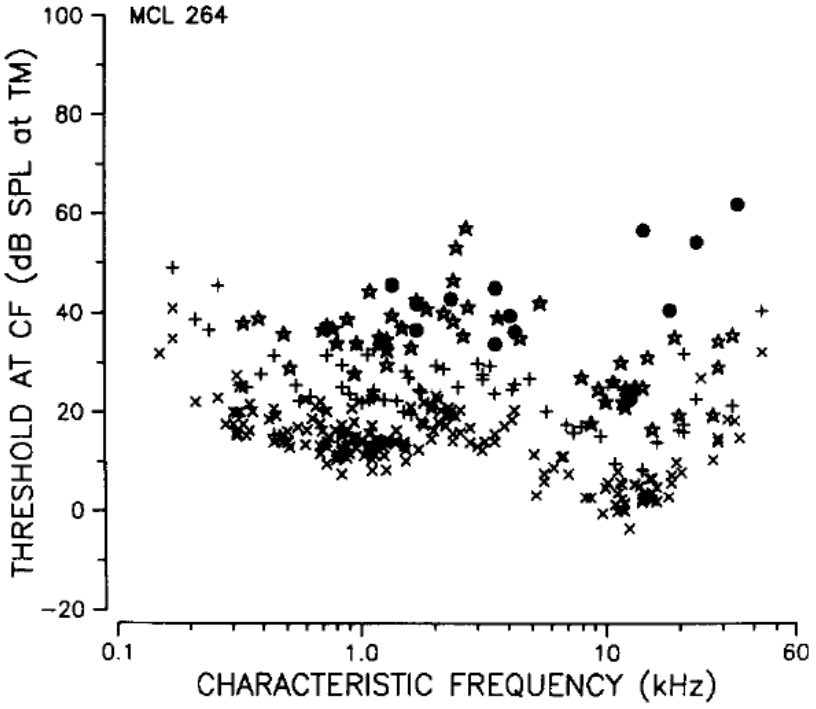
- **Electrical stimulation of the OCB**

Recording from afferent/efferent fibers



MOC threshold

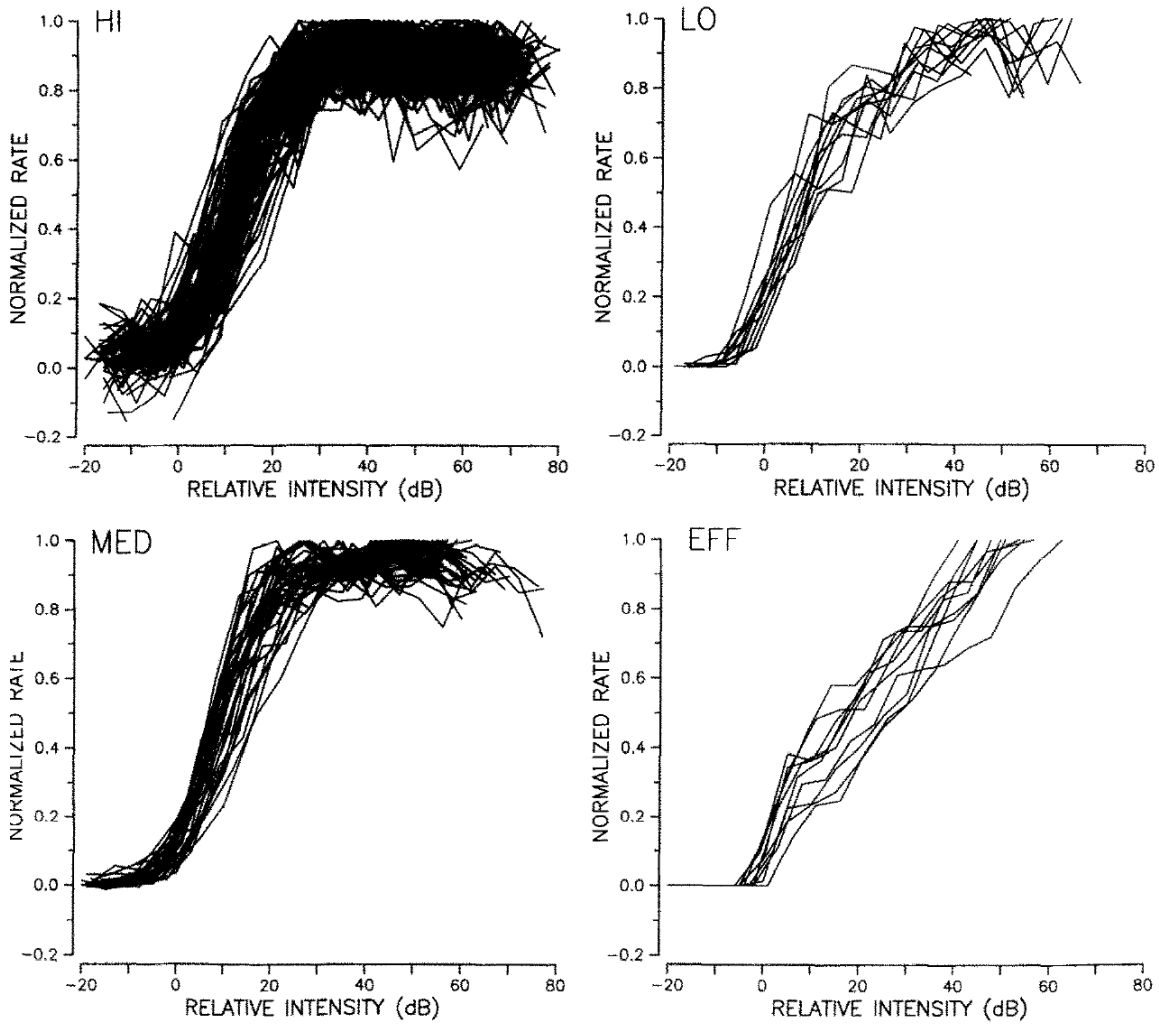
Threshold of efferent fibers is ~20 dB above neural threshold



Liberman, 1988

afferent & efferent rate-level functions

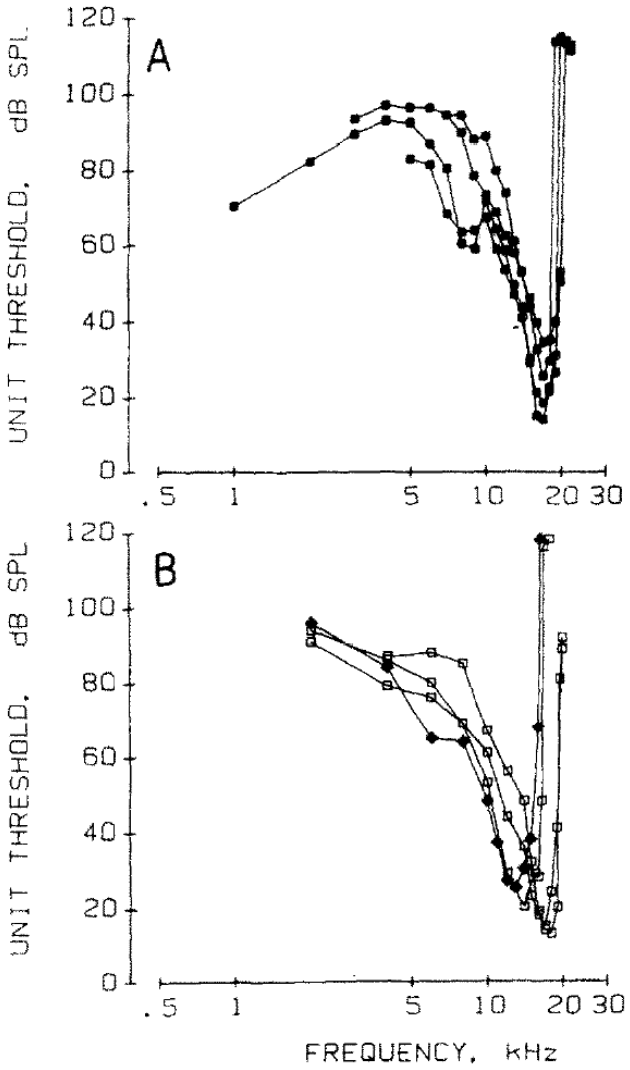
Efferent fibers resemble Low-SR afferent fibers



Liberman, 1988

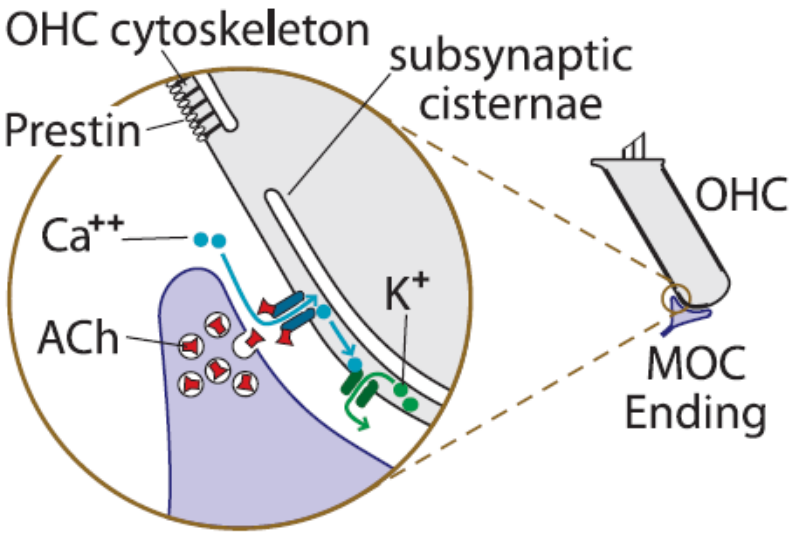
MOC tuning curves

guinea pig



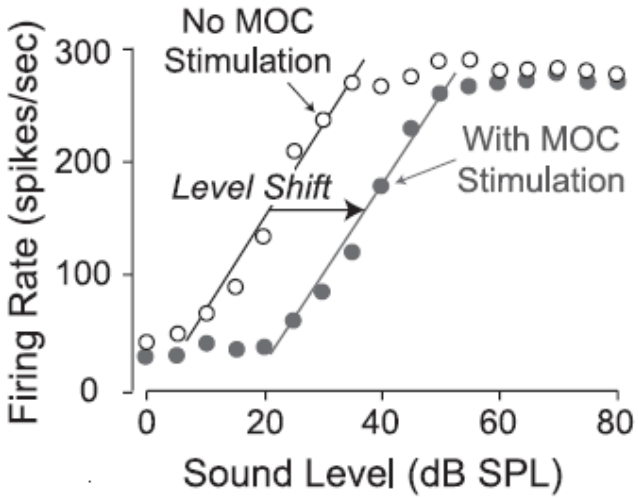
Robertson, 1985

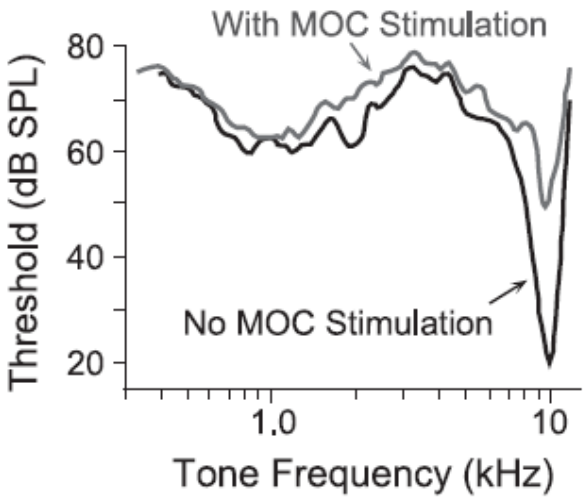
MOC synapse



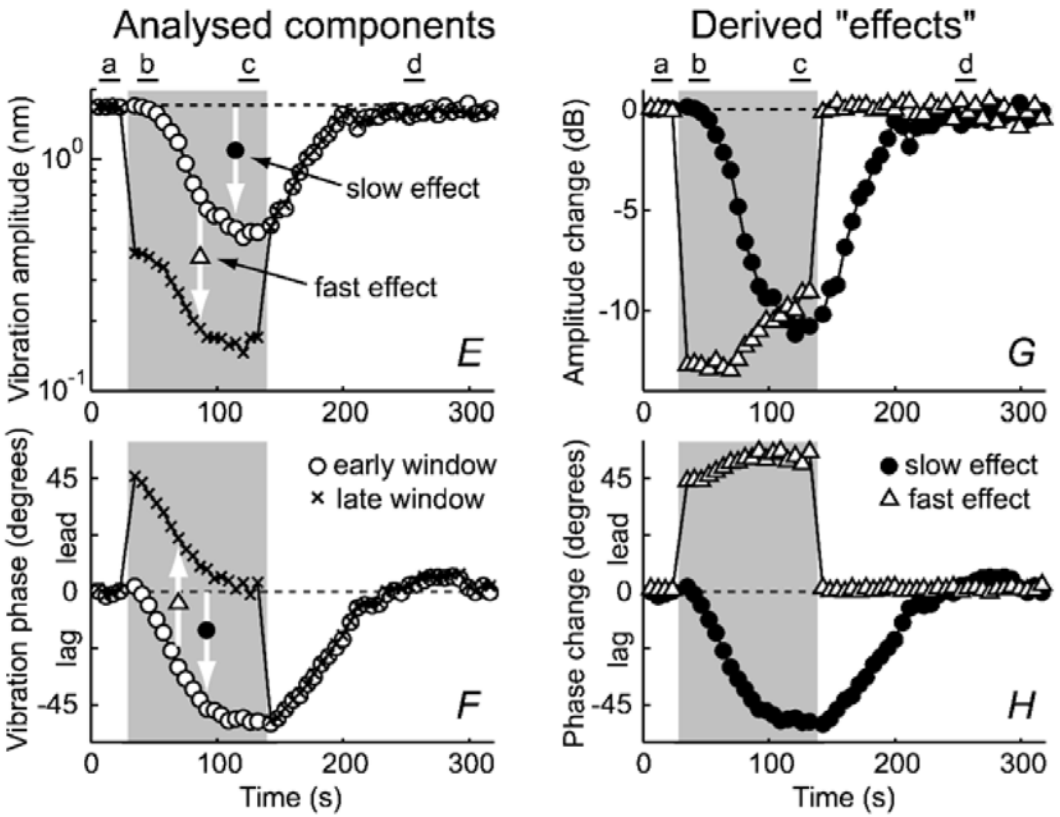
Guinan, 2006

MOC-induced threshold shift



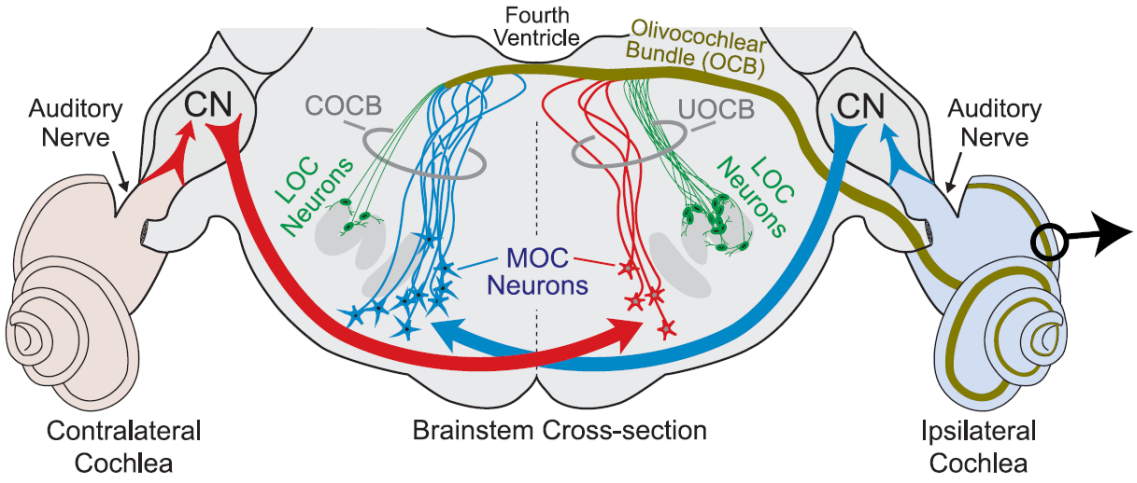


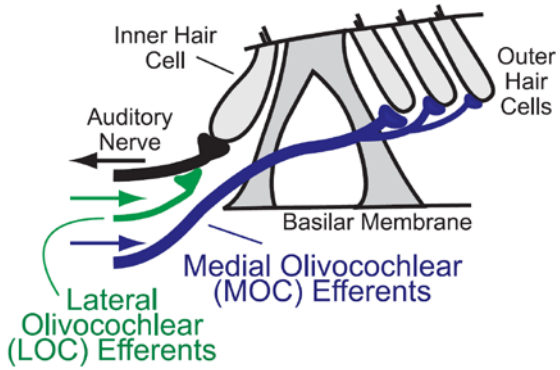
fast & slow MOC effect



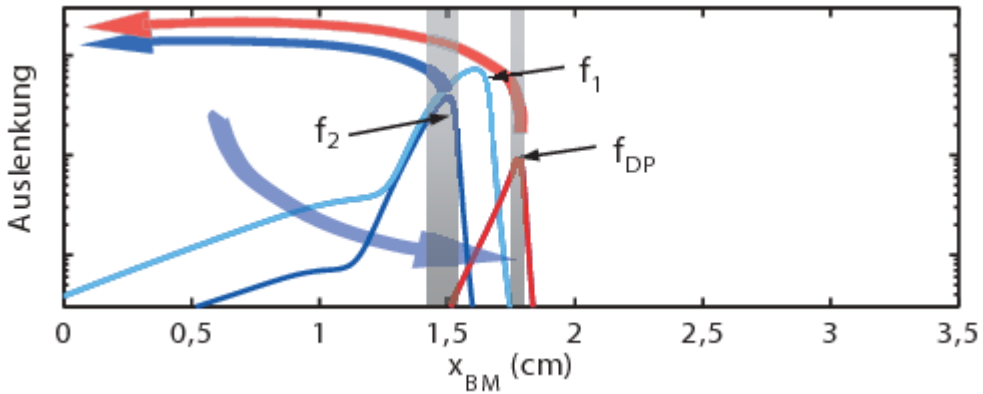
Cooper, 2003

efferents & OAE

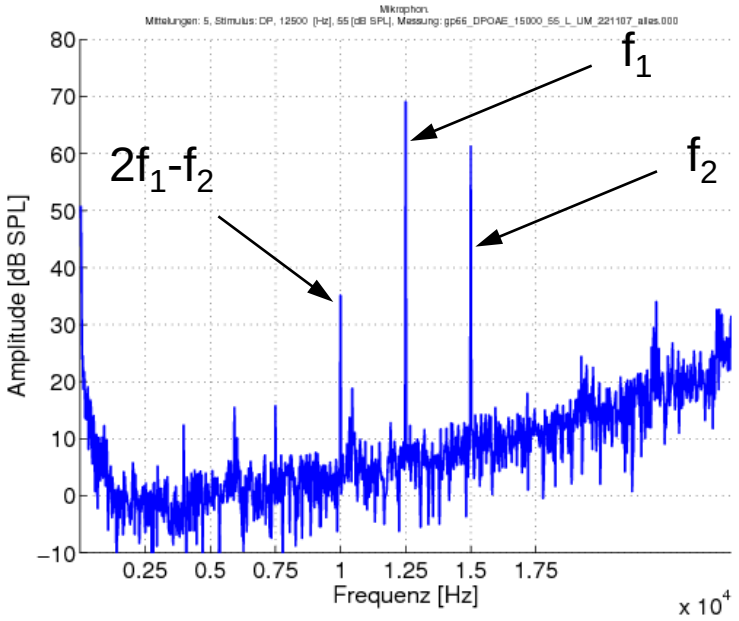




Repetitorium: DPOAE



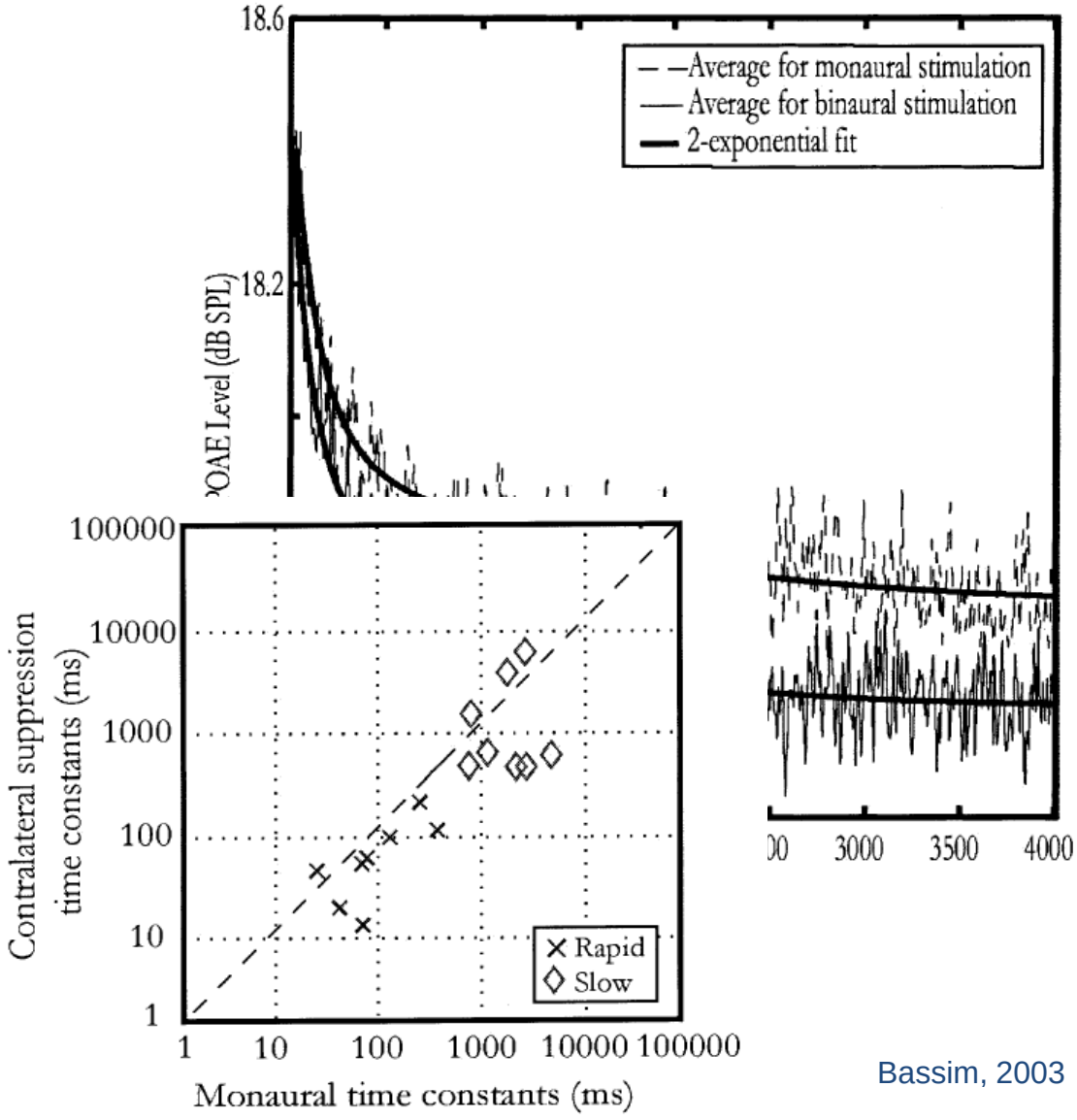
$f_2/f_1=1.2$



Contralateral suppression / ipsilateral adaptation

Adaptation in human:

ipsi: 0.8 dB,
+contra: +0.1 dB

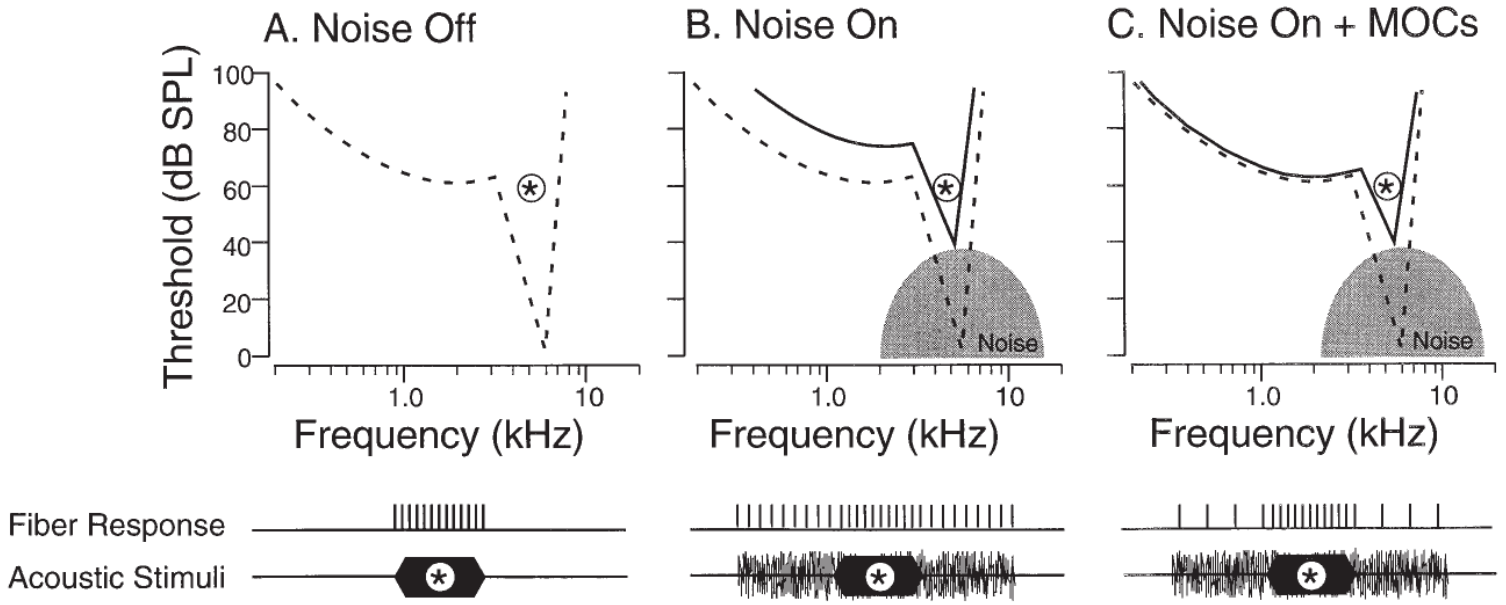


Bassim, 2003

function of the MOC-reflex

- detection of signal in noise
- protection against acoustic trauma

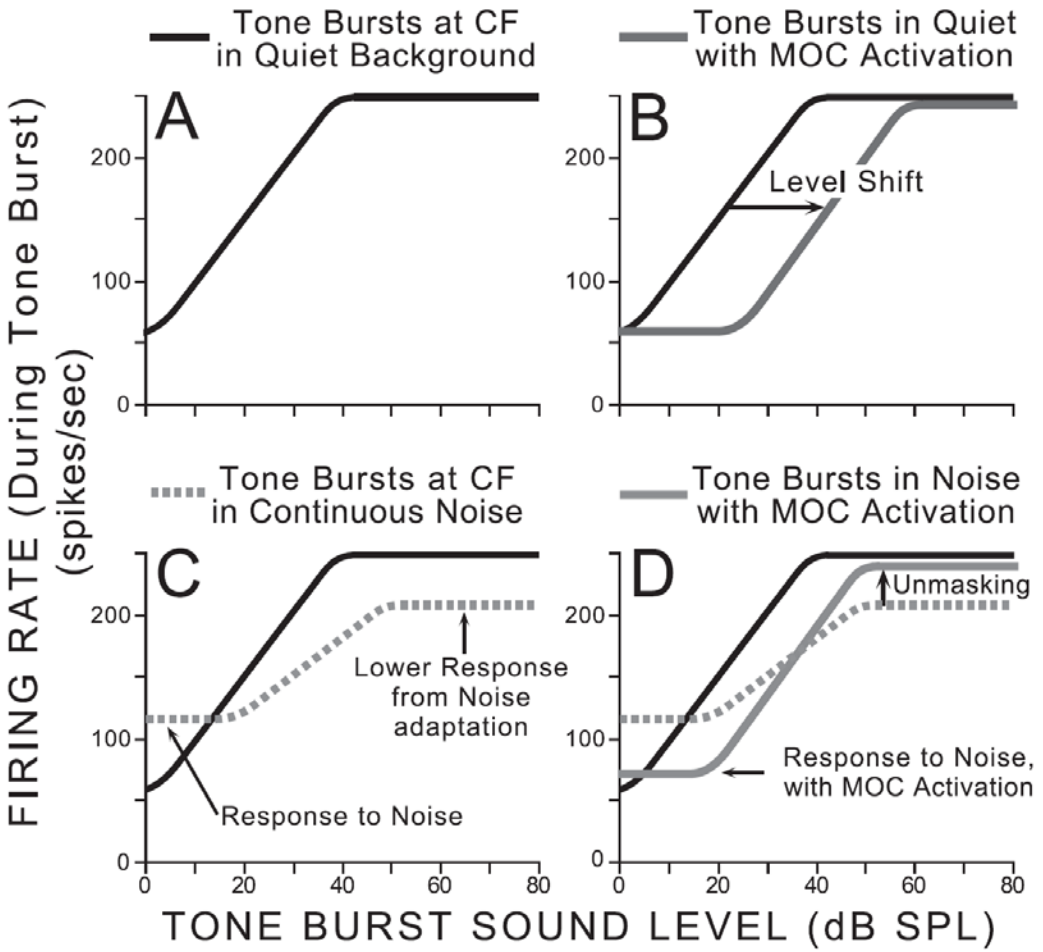
detection in noise



MOC unmasking

Liberman, 1998

detection in noise



Guinan, 2006

Effect on speech recognition in humans?

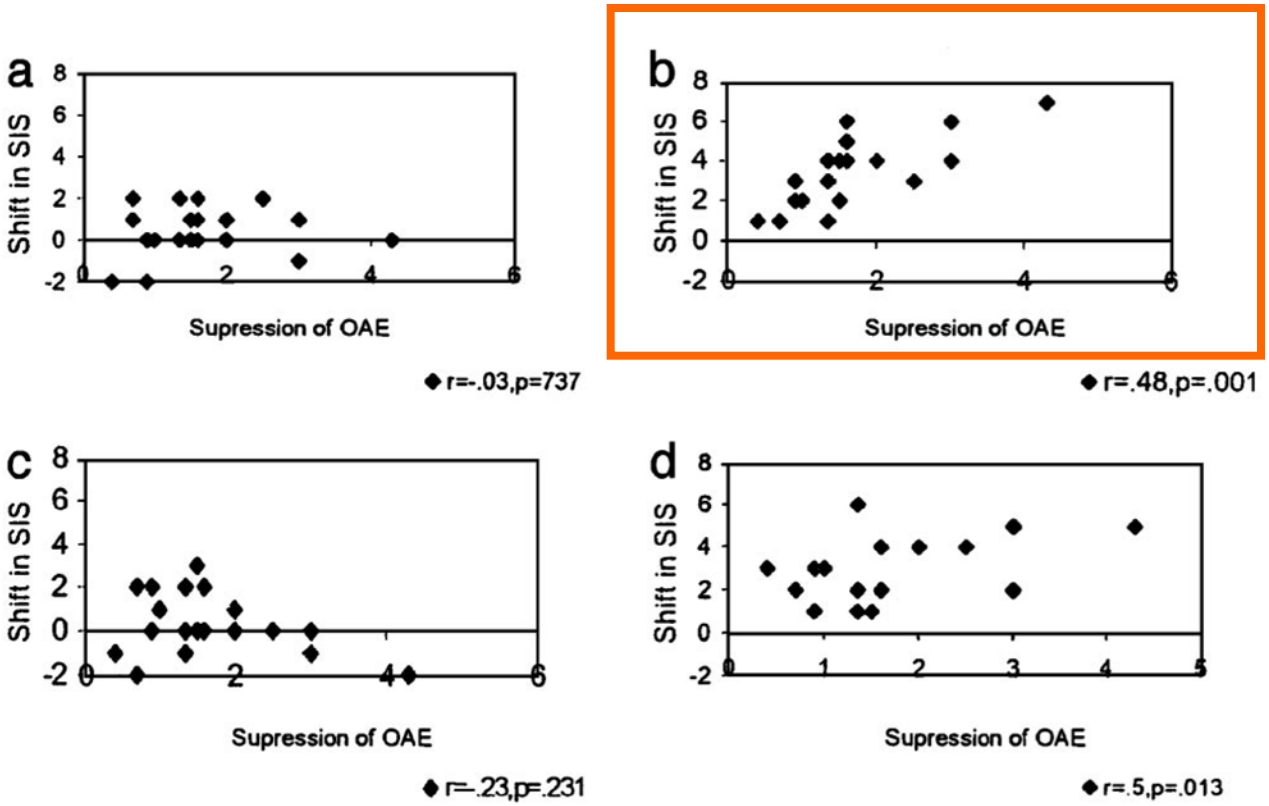
shift in speech identification score (SIS)...

...in quiet (a)

...with 10 dB SNR (b)

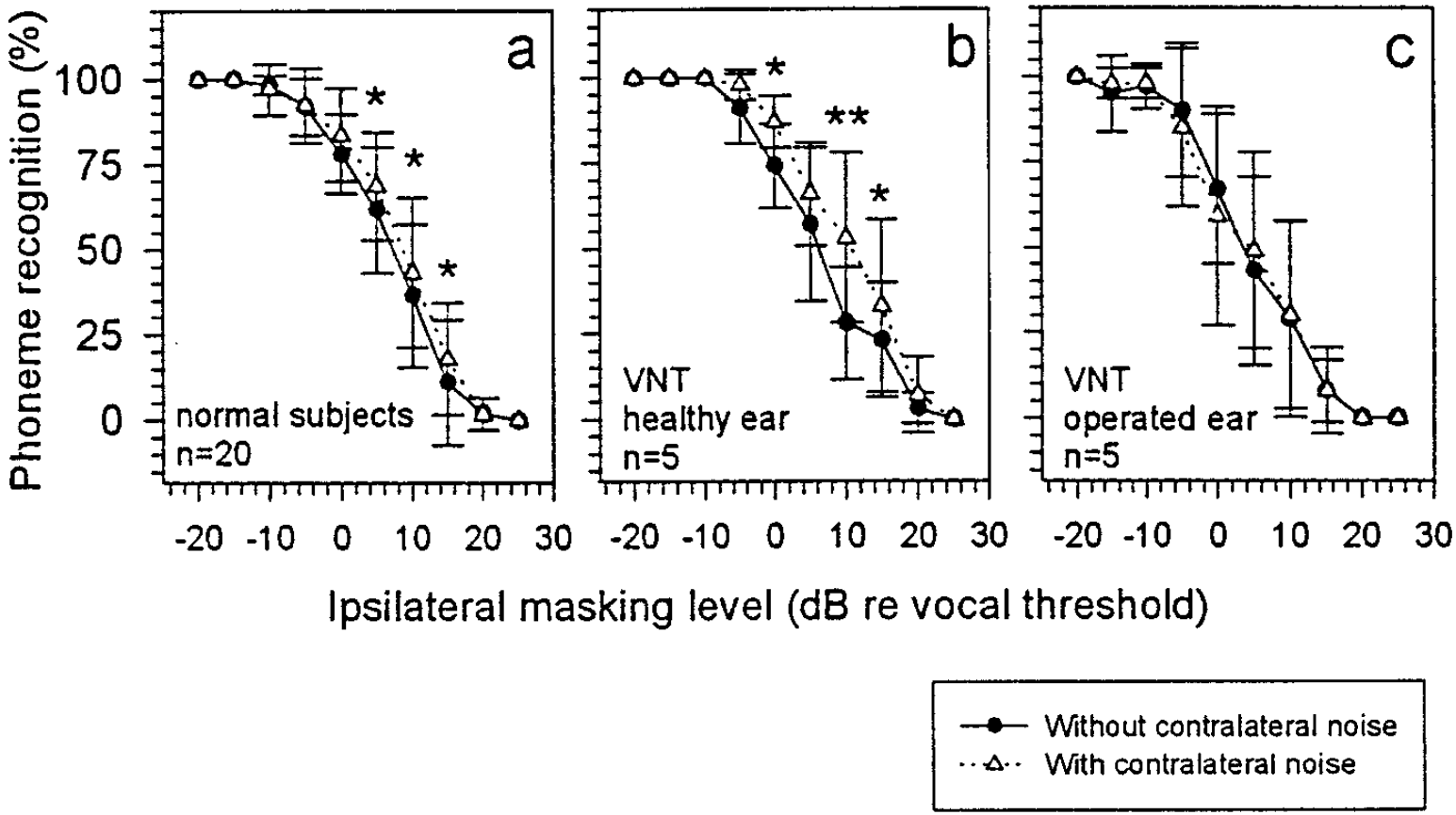
...with 15 dB SNR (d)

...with 20 dB SNR (c)



Kumar, 2004

Effect on speech recognition in humans?



Giraud, 1997

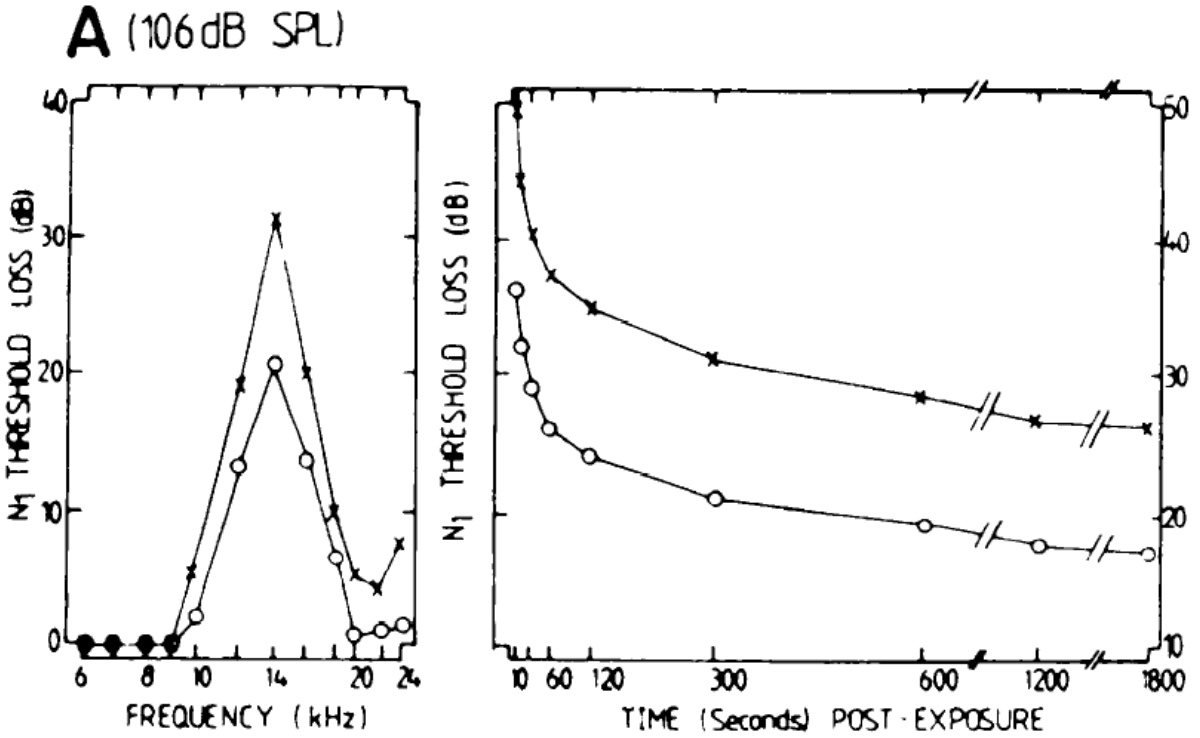
function of the MOC-reflex

- detection of signal in noise
- protection against acoustic trauma

MOC-reflex strength vs. acoustic injury

TTS

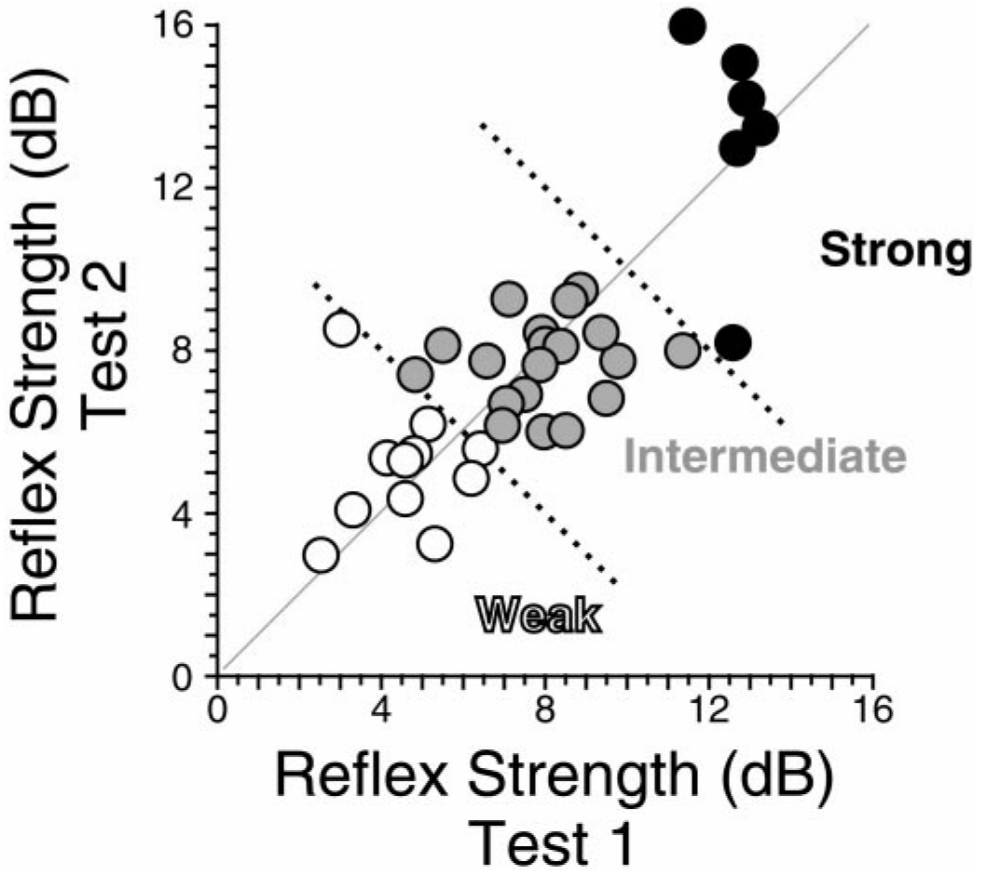
guinea pig



Rajan, 1988

MOC-reflex strength vs. acoustic injury

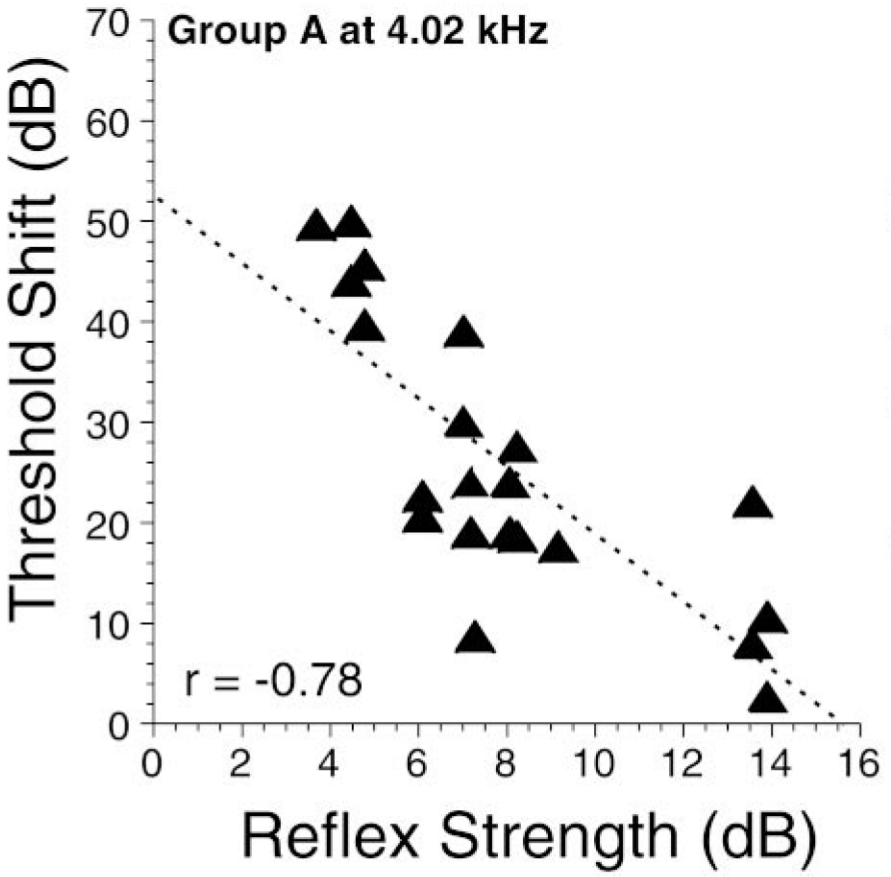
PTS



Maison, 2000

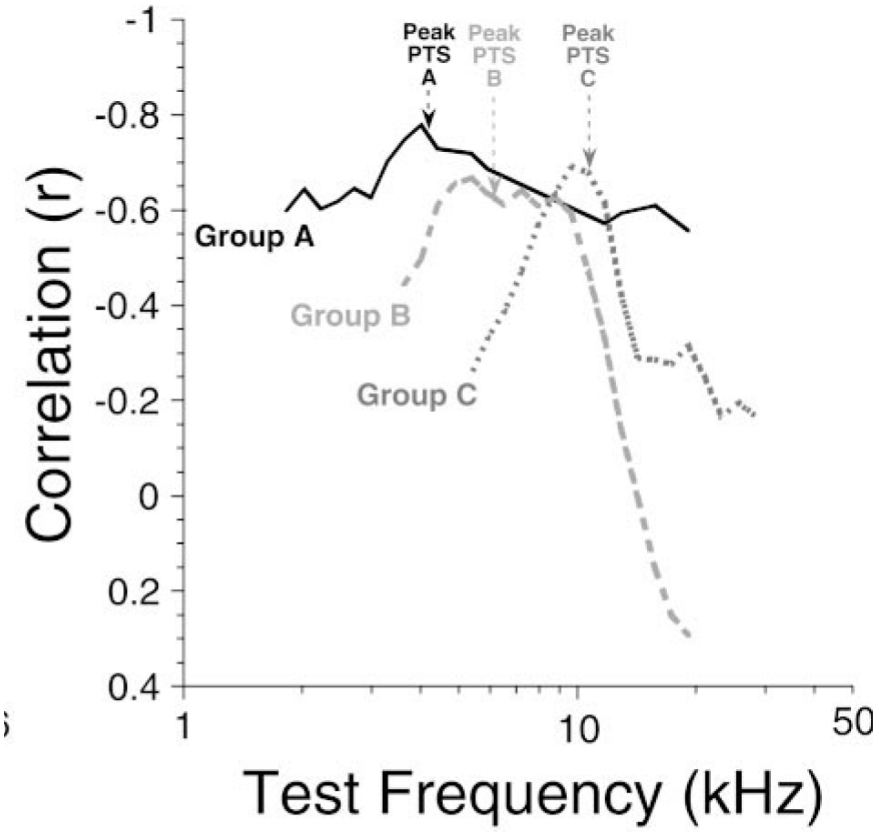
MOC-reflex strength vs. acoustic injury

PTS



Maison, 2000

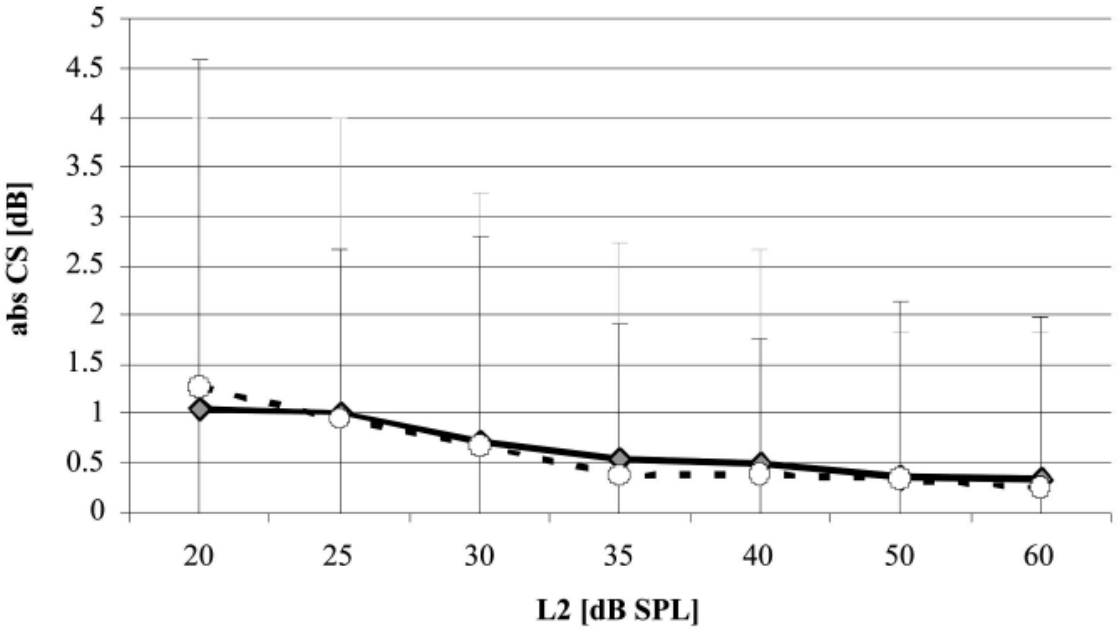
function of the MOC-reflex



Maison, 2000

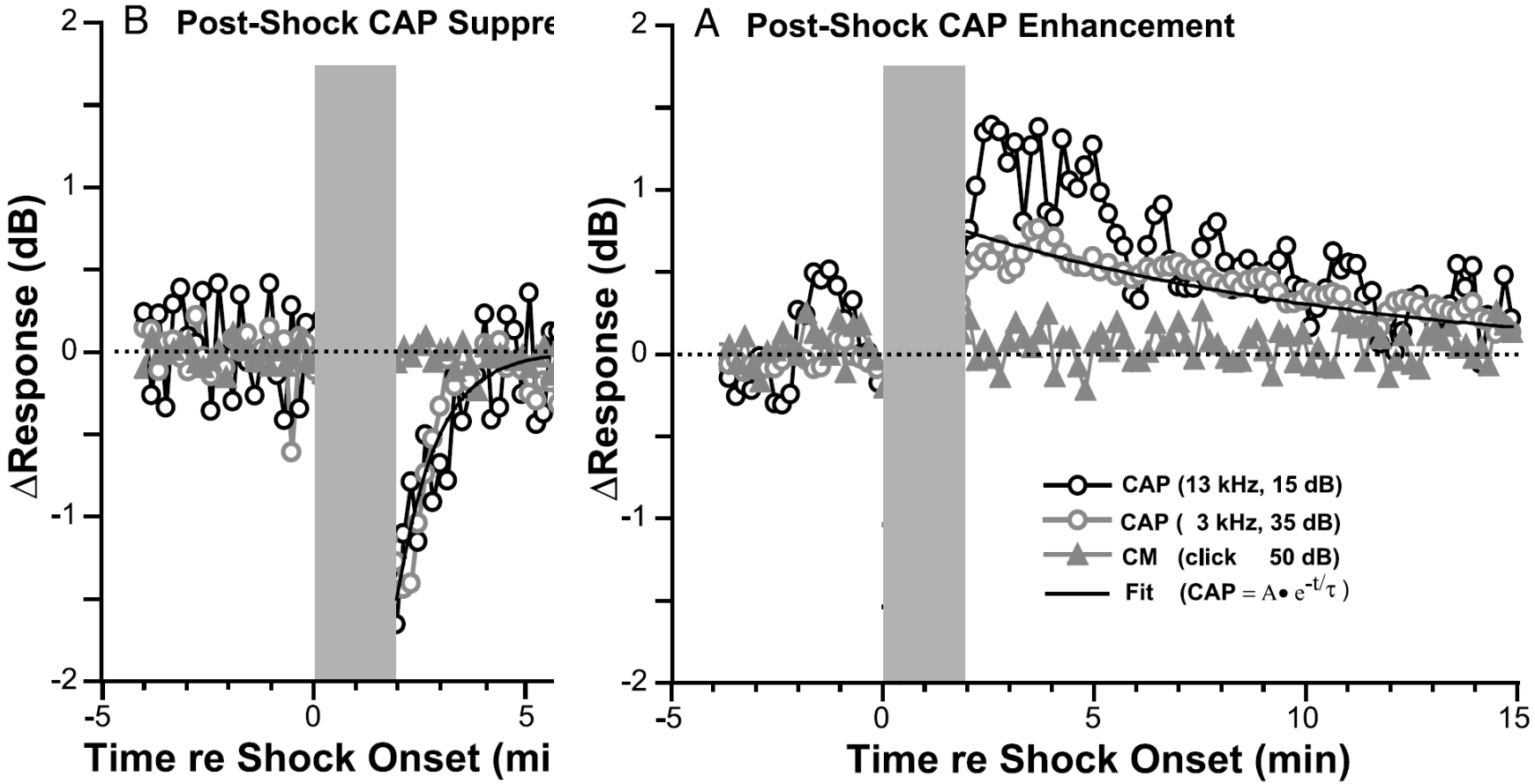
protective role in humans?

- **156 dB SPL**
- **mild TTS in 7/81 subj.**



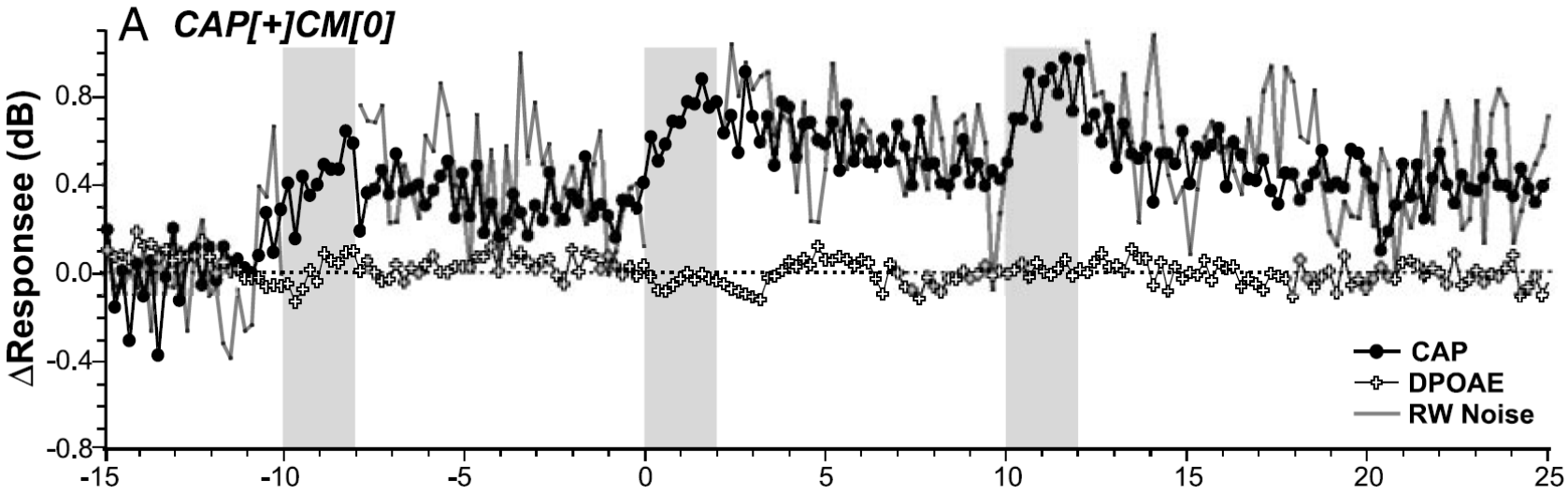
Wagner, 2005

LOC-reflex



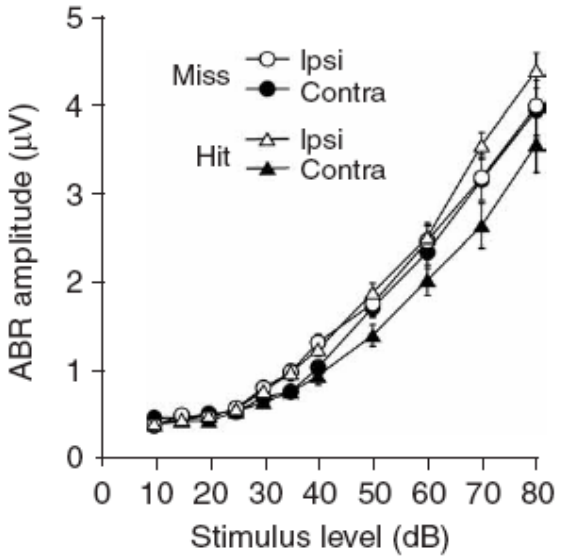
Groff, 2003

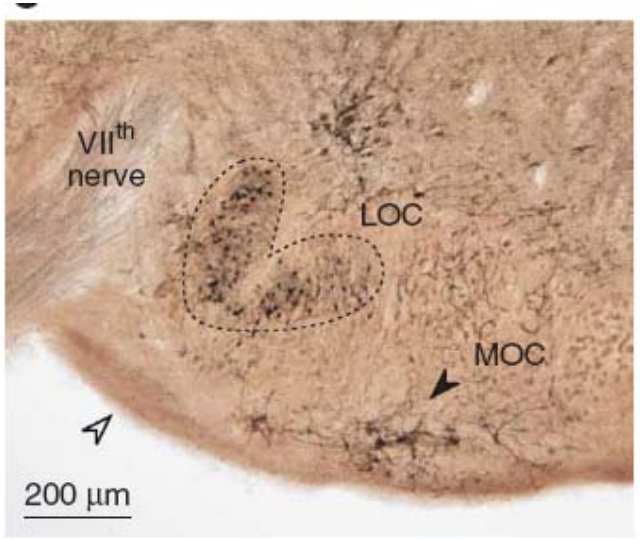
LOC-reflex



Groff, 2003

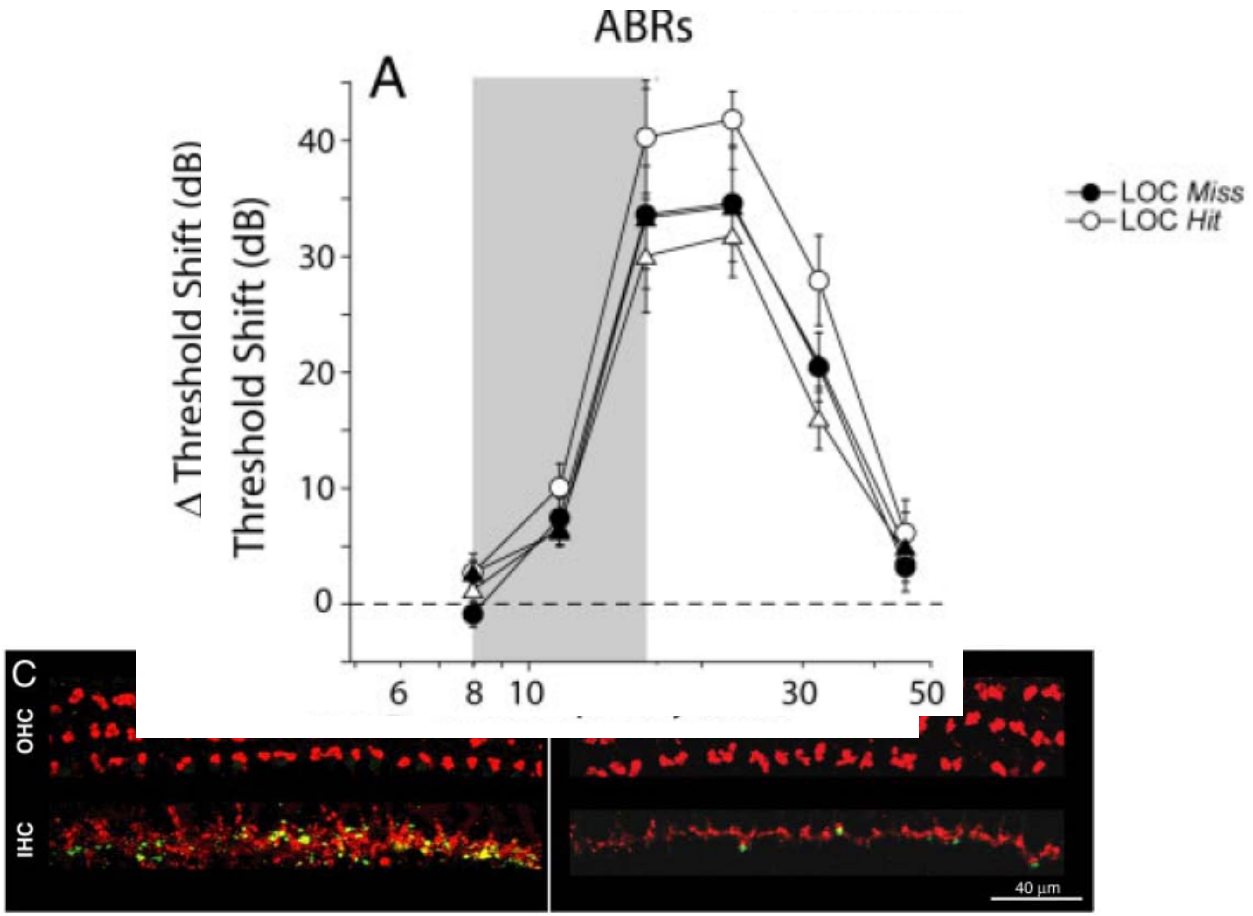
LOC: binaural adjustment?





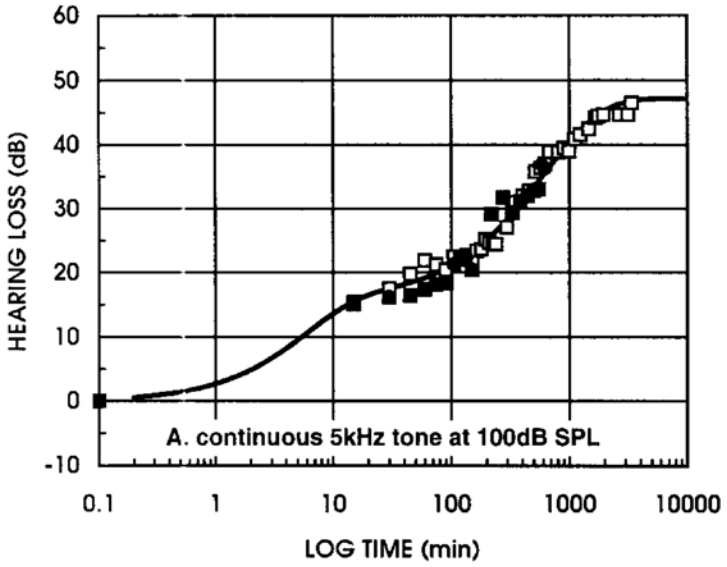
Darrow, 2006

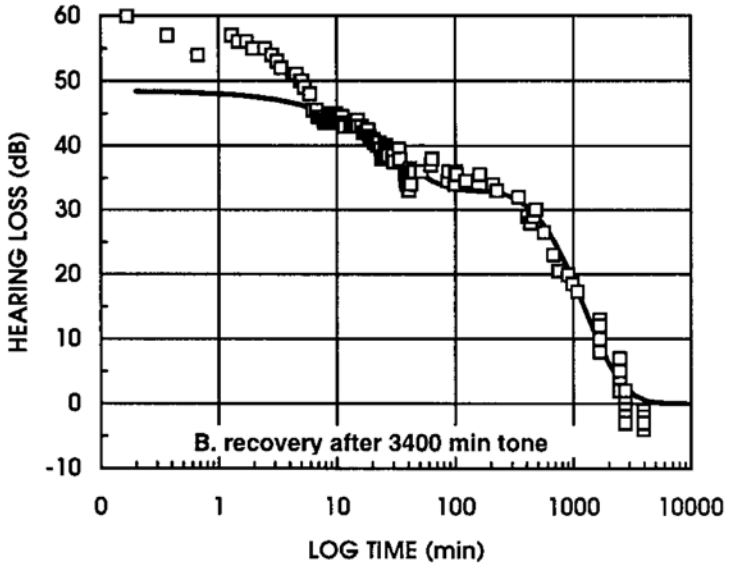
LOC: protection?



Darrow, 2007

acoustic trauma in a single human subject





Patuzzi, 1998

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questions

1. From where obtain the MOC-efferent fibers input under physiologic situations?

2. Where terminate the MOC-efferents and what transmitter do they use?

3. What is the effect of electrical stimulation of the MOC-efferents on rate-level functions of afferent cochlear fibers?

4. What do you know about the frequency properties of the MOC-efferents?

5. What is the primary functional effect of MOC-activation?

6. Can the functional effect of MOC-activation be measured non-invasively?

7. What are the both effects on hearing that have been established by experiments in animals?

8. Where terminate the LOC-efferents?

9. What functional effects have been shown so far?

10. What is the difference between MOC- and LOC-effects with respect to their time response?