

## Study Questions: Discussion 8 - Efferent Control

**Review:** Guinan, JJ (1996) Physiology of Cochlear Efferents. In "The Cochlea", eds. P Dallos, AN Popper and RR Fay. New York, Springer, pp 435-500

*Elgoyhen, A.B., Johnson, D.S., Boulter, J., Vetter, D.E. and Heinemann, S. (1994) "α9: An acetylcholine receptor with novel pharmacological properties expressed in rat cochlear hair cells." Cell: 79-705-715.*

- 1) How were nicotinic and muscarinic acetylcholine receptors originally defined? What do we now understand about their fundamental differences?
- 2) Describe the basic molecular strategy the authors used to find this novel member of the acetylcholine receptor family.
- 3) How did the authors functionally characterize the α9 cholinergic receptor they had identified? How did they infer its ionic permeabilities? What evidence do they present that this novel molecule is the receptor mediating cholinergic transmission at the outer hair cell?

*Russell, I. J. and Murugasu, E. (1997). "Medial efferent inhibition suppresses basilar membrane responses to near characteristic frequency tones of moderate to high intensities," J Acoust Soc Am 102, 1734-1738.*

- 1) Early investigations of shock-evoked MOC effects used round-window CAPs as the measure of cochlear response and concluded there were very small effects of MOC feedback at high SPLs. Guinan and Stankovic revisited the issue looking at single-fiber responses and concluded that effects could also be large at high SPLs. How do you explain the discrepancy?
- 2) The authors adopt the " $\Delta L$ " metric to quantify the magnitude of efferent effects. How is this defined?
- 3) If you used an alternative metric to quantify MOC efferent effects, such as the percentage (or dB) reduction in BM vibration at each input SPL, how would the graph of effect size vs. SPL (Figure 5) differ? Which is the "right" way to describe the effect? Why?

*Maison, S. F. and Liberman, M. C. (2000). "Predicting vulnerability to acoustic injury with a non-invasive assay of olivocochlear reflex strength," J. Neuroscience 20, 4701-4707.*

- 1) What observations in the earlier scientific literature inspired the authors to ask whether they could predict vulnerability to acoustic injury by looking at the strength of the MOC reflex?
- 2) In what way does post-onset adaptation of the DPOAE reveal MOC reflex strength and what is the evidence that it does?
- 3) How could the relatively small change in BM vibration (e.g. 5- 10 dB as reported by Russell and Murugasu) which might result from increased MOC feedback cause such a large (30 - 40 dB) difference in noise-induced permanent threshold shift?

