

## **Study Questions: Discussion 7 - Auditory Nerve Response**

**Review: Kiang NYS (1984) Peripheral processing of auditory information. Handbook of Physiology – The Nervous System.**

**7a. Liberman, M. C. (1978). "Auditory-nerve response from cats raised in a low-noise chamber," J Acoust Soc Am 63, 442-455.**

1. At the time this paper was written, it was thought that central axons type-II spiral ganglion neurons were myelinated, and therefore that both type-I and type-II fiber types should be included in any exhaustive sampling of auditory nerve response. Thus, this study started as a search for the elusive type-II response type. According to present day understanding, what do high-, medium- and low-spontaneous rate fibers correspond to?
2. The important point of this paper is that there are large sensitivity differences among auditory nerve fibers with similar CFs. Are the insensitive fibers normal or might they reflect some sort of common pathology? What are the arguments the author presents on this issue.
3. Given that the ear is so sensitive to sound, how do we know that the “spontaneous activity” we record is not actually a response to sounds not under experimental control, e.g. internal to the living animal?

**7b. Sachs, M. B. and Young, E. D. (1979). "Encoding of steady-state vowels in the auditory nerve: representation in terms of discharge rate," J. Acoust. Soc. Am. 66, 470-479.**

1. What is meant by a rate-place code? What is the alternative mechanism by which information about vowel spectrum could be carried to the central nervous system?
2. The authors were interested in the role of two-tone suppression in shaping the auditory nerve response to steady state vowels. What do they conclude about its effect?
3. Why do the rate-place profiles flatten as stimulus sound pressure increases?
4. What do the authors conclude as to whether rate-based information in auditory nerve fibers can code vowel spectrum over the full dynamic range? What are the differences in contributions of high- vs. low-SR fibers?

**7c. Young ED and Sachs MB (1979) "Representation of steady state vowels in the temporal aspects of the discharge patterns of populations of auditory nerve fibers". J. Acoust. Soc. Amer. 66:1381-1403.**

1. What is the ALSR and how is it measured?
2. What is meant by synchrony suppression and how does it shape the responses of auditory nerve fibers to vowels?
3. What do the authors conclude about as to whether information about vowel spectrum is coded in the temporal patterns of auditory nerve discharge? Does the answer differ as stimulus sound pressure increases?
4. A thought question (the authors don't address this): Auditory nerve fibers project to the cochlear nucleus, where the process of signal analysis begins. How would you build a central neural circuit to extract spectral information, e.g. the pitch of pure tone, from the spike trains coming down the auditory nerve?