Tinnitus as a result of gain adaptation

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This project will test the hypothesis that tinnitus is the result of a central gain adaptation mechanism, which, when confronted with reduced or degraded peripheral input elevates neuronal sensitivity to the point of generating spontaneous hyperactivity. Modeling results besed on this hypothesis are consistent with a variety of current human and animal data and predicted the facilitation of the Zwicker percept in tinnitus subjects – a prediction borne out in a subsequent experiment. According to this model the key parameters leading to tinnitus are elevated hearing thresholds and loss of compression of the cochlear amplifier. If confirmed, this suggests that tinnitus can be treated by compensating the specific deficits across individual frequency bands, a concept that is consistent with a number of treatment paradigms, which are currently under investigation. The overall goal of the research program is to confirm the present gain adaptation hypothesis of tinnitus and to develop and test an auditory stimulation paradigm that reduces central gains and thus eliminates the tinnitus percept. The specific aims for which we currently seek support are: (1) Determine a link between psychophysical measures of gain adaptation and cochlear compression as measured by distortion product otoacoustic emissions. (2) Confirm empirically the predicted link between elevated hearing thresholds, reduced compression, and tinnitus. Future research will (3) test the proposed gain adaptation hypothesis using animal electro-physiology; (4) develop physiologically accurate models to predict the effect of compensatory auditory stimulation; and (5) design a treatment paradigm to compensate hearing loss and loss of compression and test on a clinical population of tinnitus subjects.

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