Hearing Research Laboratory at Smith College
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The Hearing Research Lab has several ongoing projects related to biomedical engineering, and we would like to involve some undergraduate students in these projects. If you are interested in learning more, please come to a lab meeting on Monday January 24th at 7pm, Ford 020. The project are described briefly below.

If you are interested in any of these projects, after the meeting we will ask you to send us paragraph or two, via email, that outlines your preferences and why you are interested. All projects are well suited for special studies projects, and any of them could evolve into additional special studies, summer research, or thesis projects.

1. **Using energy reflectance to detect middle-ear fluid in newborn babies** Newborn babies are generally screened at birth for hearing loss. When an ear does not pass the screening, it is said to "refer". When ears refer on the newborn hearing screening test, the baby must return for more thorough follow up measurements to determine if a hearing loss exists. One to three percent of newborns are referred for further audiological assessment; of these referrals, 90% are false-positives that can occur as a result of transient fluid or debris. This project seeks to use the measurement of energy reflectance to determine when a newborn ear is filled with fluid. Currently, measurements are being taken on newborn and month-old ears through a collaboration with the Massachusetts Eye and Ear Infirmary and the Massachusetts General Hospital, both in Boston. Data are analyzed here at Smith College. Participation in this project would include maintaining a data base, learning about energy reflectance and basic acoustics, and participating in discussions related to data analysis and collection.

2. **Using auditory responses to detect changes in intra-cranial pressure** The long-term goal of this project is to use a noninvasive auditory measure called distortion produce otoacoustic emissions (DPOAE) to monitor changes in intracranial pressure. Our group, including many Smith undergraduates, has done substantial work in this area. Currently, we are interested in exploring the intrasubject variability in the DPOAE measure over a short time. Specifically, DPOAEs are measured as a time average of several repeated measurements – we want to look at the variability within the measurements that produce the average, both in the time and frequency domains. This work will inform future work in regards to the best measures for the intra-cranial monitoring work, and also has larger applications in auditory monitoring in general. This project will likely start with substantial work with Susan Voss on getting a new data acquisition system working and will eventually lead to making measurements

and substantial work analyzing these measurements with a variety of time and frequency domain approaches. Taking EGR 320 during the spring of 2011 would be a good co-requisite for this project.

3. **Development of a measurement system to measure sound exposure with MP3 players** This is a broad project that will include many topics, ranging from background research to experimental design to product design. Experience with the propeller chip will be helpful but not required. The plan is to develop a system that uses a small probe microphone embedded within an earbud for an MP3 player to measure noise exposure while listening to music; the parallax or other processor will be used to record the microphone's response and convert the voltage to sound pressure levels. The initial part of the project will be to develop the system and design an experimental protocol, with an ultimate goal of making measurements on human subjects to determine the actual range of noise exposure that occur for various age groups. Typically, such research has been done via survey methods and well-controlled lab settings. The addition of the probe tube to the earbud will allow measurements in the living situation of MP3 listeners.