A PROPOSAL TO THE BAKER FUND COMMITTEE

TITLE OF PROJECT: Computer Modeling of Brainstem Responses to Voice Pitch in American and Chinese Neonates

NAME OF APPLICANT: Fuh-Cherng Jeng (PI) and Brandie Nance (co-PI)

STATUS: _____ Asst. Prof. __X__ Assoc. Prof. _____ Prof. _____ Administrator

DEPARTMENT: School of Rehabilitation and Communication Sciences: Division of Communication Sciences and Disorders
CAMPUS ADDRESS: Grover Center W224
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RE-SUBMISSION: ___ YES (Original Submission Date _______)
_X_ NO

BUDGET: Total Request $10,580
(May not exceed $12,000)

IRB AND IACUC APPROVAL:
To ensure that the University is in compliance with all federal regulations, complete the checklist below. Note: your proposal can be approved prior to IRB or IACUC approval, but funding will be withheld until notification of approval or exemption.

Yes	No	Office of Research Compliance	Policy #
	X	Human Subjects in Research (including surveys, interviews, educational interventions): Institutional Review Board (IRB) Approval #: Expiration Date:	19.052
	X	Animal Species: Institutional Animal Care & Use Committee (IACUC) Approval #: Expiration Date:	19.049

SIGNATURES

Applicant's Signature		Chair/Director's Signature	
Signature	Fuh Jeng / Brandie Nance	Signature	Gary Chleboun
Name	Fuh-Cherng Jeng and Brandie Nance	Name	Gary Chleboun
Dept/School	Rehabilitation and Communication Sciences	Unit	Rehabilitation and Communication Sciences
Date	10/6/14	Date	10/7/14
Dean's Signature			
Name	Randy Leite	Signature	Randy Leite
College	Health Sciences and Professions	Date	10/7/14

√ **Optional:**
If selected for funding, I give permission to the Office of the Vice President for Research and Creative Activity to use my proposal as an example during training and workshop exercises.

Signature: Fuh Jeng / Brandie Nance Date: 10/6/14

Baker Fund Proposal Checklist

Applicants **must** complete and sign the checklist. The checklist should be included as the second page of the application (following the cover page).

√	Cover page	use Baker form
√	Checklist	use Baker form
√	Abstract*	1 double-spaced page
☐	Introduction (*for continuations or resubmissions only*)*	1 double-spaced page
√	Discussion	10 double-spaced pages
√	Glossary/Definition of Terms* (*not required*)	2 double-spaced pages
√	Bibliography (*not required*)	3 pages
√	Biographical Information (*applicant(s) and key personnel*)	3 pages per person
√	Other Support (*applicant(s) and key personnel*)	1 page per person
√	Budget and Justification	no limit specified
√	Appended Materials	10 pages; no more than 10 minutes of footage
√	Recommended Reviewers	5 required
√	Electronic copy of proposal	Single Acrobat file, containing entire proposal and required signatures

* These sections should be written in language understandable by an informed layperson to assist the committee in its review.

****Please note: The committee has the right to return without review any proposals that do not conform to these format requirements.****

Applicant signature: Zuh-Meng Deng

ABSTRACT

Objective: The frequency-following response (FFR) to voice pitch has recently become a useful method for studying the signal-processing mechanisms and neural plasticity at the brainstem level for normal and pathological populations. The PI and his collaborators have successfully developed a computer model suitable to capture such a response in adults with normal hearing. However, an equivalent model suitable for newborns is still lacking. Specific aims of this project are to develop a computer model specifically designed for newborns, and compare to that obtained in adults. **Design:** Thirty American and 30 Chinese newborns (1-3 days old) will be recruited from O'Bleness Hospital in the US and China Medical University Hospital in Taiwan, respectively. The PI and his collaborators have established their laboratories using identical equipment and experimental protocols. In spring of 2015, both laboratories will submit IRB proposals. Upon approval, data collection will occur simultaneously at the two experimental sites. In summer, all data will be analyzed in the PI's laboratory. In fall, presentations and manuscripts will be made. The FFR trends obtained from both groups will be fit to the exponential model to determine the shortest amount of time possible to obtain a reliable response. Five objective indices, each represents a different perspective of pitch processing in the brainstem, will be included in the model. Specific response-threshold criteria will be identified to determine the presence of a response. Statistical goodness of fit (r^2) will be derived to indicate the quality of this model. **Significance:** Results and knowledge gained from this study not only will shorten the amount of time needed when testing newborns, but also will shed light on the nature of pitch processing in the human brainstem. This part of research is essential and critical, and must be completed prior to the development of diagnostic and therapeutic paradigms for newborns, infants and adults who speak non-tonal or tonal languages around the world.

A. SPECIFIC AIMS

The brain's processing of voice pitch is vital for language development. The use of scalp-recorded frequency-following response (FFR) to voice pitch provides a major breakthrough in the field of auditory electrophysiology because: FFR is an objective and non-invasive measure; FFR is an index of neural activation at the brainstem level; and FFR does not require alertness, conscious awareness, motor responsiveness, or other higher-order cognitive abilities. For these reasons, FFR is ideal for measuring processing of voice pitch at the brainstem level in newborns (birth to 3 days). Despite the demonstrated advantages of the FFR technique, an adequate computer model indicating the presence or absence of a response for newborns is still lacking.

In normal-hearing adults, Jeng and colleagues (2011a) have shown a general trend regarding the robustness of an FFR as a function of the number of recorded sweeps. A computer model has been successfully applied to fit the response trend and to derive a set of response-threshold criteria that can be used to determine if an FFR is present for adults with normal hearing. However, neural circuitry and functional organization of the brainstem in neonates are likely different from those observed in adults. Thus, a computer model specifically designed for newborns is a critical and much-needed component to shorten the testing time needed for newborns, to help us better understand the nature of pitch processing at the brainstem, and to develop useful diagnostic and therapeutic protocols down the line.

The proposed study is part of a long-term project in the Principal Investigator (PI)'s laboratory. In attempts to secure multi-year external funding, the PI submitted a grant proposal to National Institutes of Health (NIH) R01 mechanism in 2010 – did not receive the funding. The PI revised and resubmitted in 2011. The proposal received a priority score of 60, but was below the Institute's funding cutoff (see *Appended Materials*). The PI revised this proposal further and resubmitted to National Science Foundation (NSF) Cognitive Neuroscience section in 2012. Due to limited budget, the NSF can only support the portion of research (approximately 80% of the entire project) that seeks to better define the developmental trajectories of FFRs in American and Chinese newborns (see *Appended Materials*). However, the portion related to developing a computer model for detecting the presence of an FFR was not funded. Thus, the PI is requesting support from the Baker Awards to conduct this important portion of the research. Successful completion of this portion of research will not only supplement what we know about neonatal FFRs, but will also help us to develop a set of standards in designing an appropriate model for examining the FFR to voice pitch in neonates who are born in a non-tonal or tonal linguistic environment.

To fulfill our research objectives and to complete the remaining portion of this research (i.e., the remaining 20%), the proposed study will involve a cross-linguistic comparison of the FFRs recorded from newborns in two distinct language environments – American English and Mandarin Chinese. Newborns will be examined during their immediate postnatal days. Specific aims and hypotheses are listed as follows.

Specific Aim 1: Develop a computer model suitable to fit the data obtained from American and Chinese newborns. *Hypothesis 1:* Based on the Biological Capacity Theory (which indicates that we are born with the ability to process speech sounds existing in any human language), there will be no difference in the modeling coefficients and growth characteristics between the responses obtained in the American and Chinese neonates.

Specific Aim 2: Identify similarities and differences of the response characteristics and modeling coefficients between newborns and adults. Data obtained from this current study will be compared to those that the PI has reported for adults with normal hearing (see *Preliminary*

Studies of Applicant). *Hypothesis 2:* According to the Linguistic Experience Theory (which indicates that linguistic experience shapes neural circuitry of the brain), newborn FFRs will possess less well-defined response characteristics and a shallower growth function when compared to those obtained in normal-hearing adults.

B. SIGNIFICANCE

Voice pitch carries important supra-segmental and emotional cues for speech perception in human languages (Deroche *et al.*, 2014). Objective measures of the brain's processing and ability to detect and track changes in voice pitch are particularly important because auditory comprehension and language acquisition occur very early in life. Whereas adult listeners' processing of voice pitch can be examined through behavioral testing, examination of individuals who are unable to provide reliable behavioral feedback, such as newborns and infants, poses a great challenge.

Traditional studies investigating infant ability to process differences in voice pitch were achieved through subjective interpretations of infant behavior. Studies (He *et al.*, 2007; He & Trainor, 2009) have also provided electrophysiological evidence supporting the early emergency of infant ability to detect changes in voice pitch. However, none of the studies provide a method that can be used to examine infant ability to follow the changes in voice pitch. Recent success in developing new techniques needed to record the FFR to voice pitch in newborns (Jeng *et al.*, 2011d) and infants (Jeng *et al.*, 2010) not only demonstrates the feasibility of FFR as an objective and non-invasive way to assess the processing of voice pitch, but also opens a window to help elucidate the pitch-processing mechanisms and language-acquisition theories that are associated with the acquisition of voice-pitch processing during the early stages of life. These findings support the notion that FFR to voice pitch can be a viable, objective, and non-invasive neurophysiological index of the brain’s processing and tracking of the changes in voice pitch. Our contribution is likely to be significant relative to basic science as well as clinical and therapeutic applications.

From the *basic scientific point of view*, data obtained from this study will fill a current gap in our knowledge regarding newborns’ processing and tracking of changes in voice pitch. This research will also identify signal-processing mechanisms that are associated with the development of the brain’s responses to stimuli differing in voice pitch. In addition, development of a computer model for neonates will provide researchers with important data about listeners’ abilities to perceive and track the changes in voice pitch for normal and pathological populations

From the standpoint of *clinical science and therapeutic applications*, our findings are expected to add to current knowledge needed to develop preventive and therapeutic strategies for individuals with hearing loss and communication disorders. Development and evaluation of a computer model is particularly important when clinicians and researchers try to apply such a technique on populations such as newborns, infants, children, and difficult-to-test patients who cannot provide reliable behavioral feedback. When testing newborns, time is of essence. Thus, results of this study will have potentials to shorten the amount of time needed when testing newborns. It is also important to note that with short-term training on specific linguistic pitch contours, listeners not only improve their behavioral response correctness but also express enhanced pitch-tracking accuracy reflected through scalp-recorded FFRs (Song, *et al.*, 2008, Anderson & Kraus 2013; Skoe *et al.*, 2014).

Results of this study will be disseminated in two distinctive forms: oral presentations and journal articles. Data obtained from this study will be presented at a national/international conference in 2015 and Ohio University (OU) Research Exposition in 2016. The targeted national/international conference is the 170th Meeting of the Acoustical Society of America scheduled to take place in Jacksonville, Florida from November 2-6, 2015. Based on the feedback from presenting data in this conference, the PI and student will finalize and submit at least one manuscript for publication purposes. The targeted journal is the International Journal of Neuroscience with a targeted submission deadline of December 30, 2015. For OU Research Exposition, because it takes place only in April each year, the PI won't be able to make it for 2015. However, we plan to make a presentation at OU Research Exposition in April, 2016.

C. PRELIMINARY STUDIES OF APPLICANT

During the past 10 years, the PI has published 23 papers in high-impact, peer-reviewed, scientific journals in the fields of electrophysiology and pitch-processing of speech sounds. Selected results of these papers that are directly related to the proposed activity are summarized as follows.

Study 1: Recording FFRs in American and Chinese Newborns. We have published pilot data from 12 American and 12 Chinese newborns in a separate study. Our pilot data indicates that American and Chinese newborns exhibit similar responses to voice pitch. Most importantly,

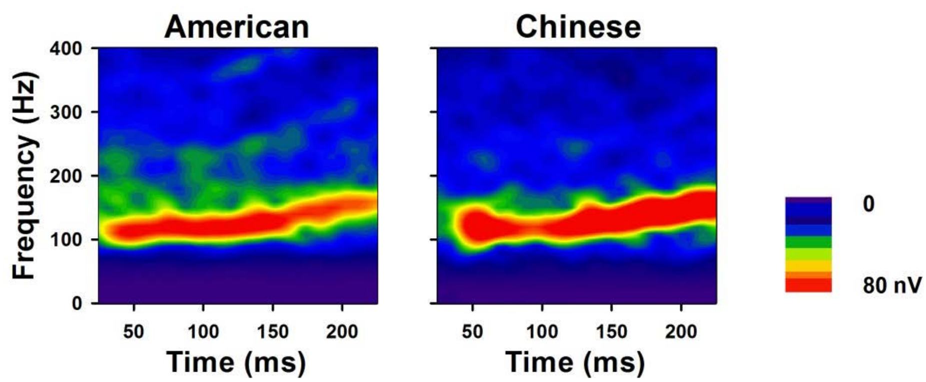

Figure 1 Grand-averaged spectrograms obtained from 12 American and 12 Chinese newborns. A color gradient scale on the right indicates the spectral amplitudes in nV. Spectrograms are obtained using a Hanning window of 50 ms in length; overlap = 47.5 ms in length; and a frequency step = 1 Hz. **(Jeng et al., 2011d)**

our pilot data herein demonstrate that our team is capable of recording the FFR to voice pitch from individual newborns.

<u>*Study 2: Exponential modeling in normal-hearing adults.*</u> To better quantify the increasing and decreasing trends of pitch processing in the human brainstem as a function of number of recorded sweeps, we have published data obtained from 23 normal-hearing adults using a computer model that is suitable to capture the ascending or descending trends of the FFR. For clarity, this figure shows only the exponential curve that best fits the ascending trend of *Pitch Strength*, which indicates the amplitude of FFR (Jeng *et al.*, 2011a). Note the amplitude of FFR increases with increasing number of recorded sweeps. And from here, a response-threshold criterion can be made to determine the presence of a response, and therefor will shorten the amount of time needed to test a newborn participant.

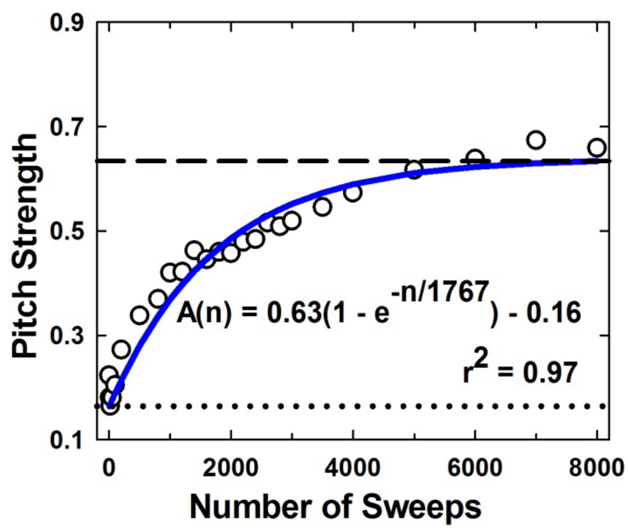

Figure 2 Modeling of an FFR trend using exponential curve-fitting. In this example, data were fit to an exponential model with an ascending trend (solid blue curve). The fitted equation, along with its goodness of fit (r^2), is shown. The high value of goodness-of-fit ($r^2 = 0.97$) indicates a good quality and usefulness of the proposed modeling on FFRs. **(Jeng et al., 2011a)**

D. METHODS

We will examine newborns during their first 3 days of life because most newborns stay in a birth center for about 3 days. Recruitment of participants and data collection will be performed simultaneously at two experimental sites: O'Bleness Hospital in Athens, Ohio and China

Medical University Hospital in Taichung City, Taiwan. For the experimental site in Taiwan, residents and staff at China Medical University Hospital will provide full complementary support and assist in participant recruitment as well as data collection (see *Letters of Support*). For consistency and quality of data analysis, all recordings will be analyzed at the PI's Auditory Electrophysiology Laboratory at Ohio University.

Participants: The proposed study requires recordings from neonates who are born in two different countries (United States and Taiwan). All American newborns will be recruited from the Birth Center at O'Bleness Hospital in Athens, Ohio from native English-speaking households. All Chinese newborns will be recruited from China Medical University Hospital in Taichung City, Taiwan from native Chinese-speaking households. Both genders will be included. All newborns will be full-term at birth and have no known neurological or syndromic disorders. Normal hearing for all newborns is defined by passing an automated hearing-screening test (using ALGO 3i). This hearing screening test is used for mandatory newborn hearing-screening in the state of Ohio (USA) and Taiwan, and therefore is an acceptable test for normal hearing in newborns.

Experimental Protocol: There will be one test session required for each newborn participant. The test session will start by determining if the newborn has normal hearing and will take approximately 90 minutes (30 minutes for hearing screening and 60 minutes for FFR data collection). If normal hearing is confirmed, three recording pads will be placed on the scalp to record the brain activities and the evoked responses.

Stimulus Presentation: A monosyllabic Mandarin tone that mimics the English vowel /i/ will be used. Stimulus presentation and data collection will be controlled by custom-made software written in LabView (National Instruments, Austin, TX). The stimulus token will be presented monaurally through an electromagnetically-shielded insert earphone (Etymotic, ER-3A) at a stimulus level of 45 dB nHL. This sound intensity is similar and maybe a bit softer than those observed in a daily conversation for normal-hearing adults.

Recording Parameters: Three gold-plated recording pads will be applied to the midline of the forehead at the hairline, left or right mastoid, and low forehead. Recordings will be amplified using an electrically isolated, high impedance head stage amplifier (Intelligent Hearing Systems, OptiAmp 8002), filtered with a bandpass at 10–3000 Hz (6 dB/octave), and digitized at a rate of 20000 samples/sec. To better delineate a response trend in the computer modeling, each recording will contain up to 8000 accepted sweeps. Continuous data will be obtained through the custom-built software and stored on a computer for offline analysis.

Data Analysis: Procedures for data analysis are reported in our recent publications (Jeng *et al.*, 2010, 2011a, 2011b, 2011c, 2011d; Li & Jeng 2011). Briefly, each recording will be band-pass filtered (cutoff frequencies 100-1500 Hz, 500th order), segmented, baseline corrected, artifact rejected (reject criterion: ±25 μV) and averaged. The fundamental frequency (f0) contour of each averaged recording will be extracted using a short-term spectrogram algorithm (Krishnan *et al.*, 2004; Russo *et al.*, 2008; Skoe and Kraus, 2010; Jeng *et al.*, 2010, 2011a, 2011b, 2011c).

Computer modeling on the FFR trends of pitch-encoding: Measurements of each of the five objective indices (i.e., *Frequency Error*, *Slope Error*, *Tracking Accuracy*, *Pitch Strength* and *RMS Ratio*) [see *Glossary* for definitions and explanations of these objective indices] of the FFR to voice pitch will be analyzed using the formula:

$$A(n) = A_{noise}\left(e^{-n/\tau}\right) - A_{AS}, \qquad (1)$$

where A is an objective measure of the FFR to voice pitch; n is the number of sweeps included in the averaging process; A_{noise} represents the amplitude of noise and is derived from the fitted curve of the FFR trend of a specific objective index when the number of sweeps equals 1 (i.e., units of A_{noise} remain the same for each of the five objective indices); A_{AS} represents the asymptotic amplitude of the response and is computed from the fitted curve of the exponential model with the number of sweeps being 8000; e is Euler's number: 2.7182; τ is the "time" constant of the fitted curve that denotes the number of sweeps needed to reach its 63% asymptotic amplitude. Statistical goodness of fit (r^2) will be derived to indicate the quality of curve fitting.

Statistical Analysis: A repeated-measures analysis of variance (*ANOVA*) and *student t* test will be used to determine the significance between the response indicators (*Frequency Error*, *Slope Error*, *Tracking Accuracy* and *Pitch Strength*) and groups of participants (i.e., American versus Chinese newborns). A p value of less than 0.05 will be considered statistically significant.

Timeline: Throughout the entire funding period, biweekly Skype internet meetings and frequent email communications will take place between the two experimental sites to ensure proper progression of the proposed study.

Period	Activities
Jan-March	• Grant funding begins; equipment necessary for this study are already in place in the US and Taiwan. • Submit IRB proposals: Note the main experimental protocols are identical to those that have been approved by the IRBs in the US and Taiwan for the PI's current NSF grant. However, for clarity, the PI will submit a new IRB proposal to Ohio University and our collaborator will submit a separate IRB proposal to China Medical University Hospital in Taiwan. Once both proposals have been approved, the PI will submit an amendment to OU IRB asking for permission to merge the data obtained in the American and Chinese newborns.
April-May	• Dr. Jeng, Dr. Nance, and students collect data from American newborns in O'Bleness Hospital in Athens • Dr. Lin and staff collect data from Chinese newborns in China Medical University Hospital in Taiwan • Data collection will occur simultaneously at both experimental sites
June-Aug	• Dr. Jeng and student analyze all the data obtained in both the American and Chinese newborns. • Generate time waveforms and frequency spectrograms for each recording

	• perform computer modeling on all data • Conduct statistical analyses (ANOVA, *t* test, and goodness of fit)
Sept-Dec	• Wrap up the research project and prepare manuscript • Present data at the 170^{th} Meeting of the Acoustical Society of America • Submit a manuscript to International Journal of Neuroscience by Dec. 30, 2015 • Make a presentation at OU Research Exposition in April, 2016.

F. COLLABORATIONS

While the PI's team at Ohio University collects data from American newborns at O'Bleness Hospital, another team led by Dr. Chiader Lin will collect data from Chinese newborns at China Medical University Hospital. Dr. Lin and his staff are familiar with the procedures proposed in this study and have been involved in the collection of electrophysiological data from newborns during our previous collaborative research projects.

Please note that China Medical University Hospital has an FFR system that is identical to the system the PI has at O'Bleness Hospital. Both systems will be used to record FFRs in American and Chinese neonates in the US and Taiwan simultaneously. This approach will not only ensure quality data recording at both experimental sites, but will also make the data collected from the Chinese newborns in Taiwan comparable with those obtained in the US. In addition to the equipment available for this research project, China Medical University Hospital has also agreed to provide full complementary support for the portion of this project that will take place in Taiwan (see *Letters of Support*).

G. CONFIDENTIALITY

All experimental protocols will be approved by the Institutional Review Board at Ohio University and China Medical University Hospital. Any identifiable information on the participant will not be shown in any presentation or publication of the results obtained from this study. All plans for data management and storage will meet all federal and state regulatory requirements, including the HIPAA standards.

GLOSSARY (items below are listed by the order in which they appear in the main text)

Biological Capacity Theory: This theory states that it is our innate capacity that allows us to acquire language.

Linguistic Experience Theory: This theory indicates that it is the environment (not our innate ability) that shapes the neural circuitry of a human brain.

Fundamental Frequency (i.e., *f0*): The lowest frequency produced by the oscillation of an object. For example, if a sound consists of the frequencies 100, 200, 300, 400 and 500 Hz, the fundamental frequency of this sound is 100 Hz.

Harmonics: Integer multiples of the fundamental frequency. For example, if the fundamental frequency of a sound is 100 Hz, its second harmonic will be 200 Hz, third harmonic 300 Hz, fourth harmonic 400 Hz, and so on.

Spectrogram: A visual representation of the frequency components of a sound or sampled signal.

Curve-fitting: A process that uses a specific model (e.g., an exponential model) to fit all the sampled data points, with the least amount of errors.

Frequency Error: This index represents the accuracy of pitch-encoding of the brain. To compute this index, we first estimate the fundamental frequencies (*f0*s) of the stimulus sound. We then perform the same procedure and estimate the *f0*s of a recording. Once we have the two sets of *f0*s, we then subtract the *f0*s of the stimulus from those of the recording. The average of all these differences between the stimulus and recording *f0*s is then defined as *Frequency Error* of the recording.

Slope Error: For this index, we first estimate the *f0*s of a stimulus and a recording. We then plot the *f0*s of the stimulus as a function of time (remember, the *f0* of the stimulus sound varies over time). We then estimate the slope of the *f0*s of the stimulus. We then repeat the same procedure and estimate the slope of a recording. The difference between the slopes estimated from the stimulus and a recording is then defined as *Slope Error* of the recording.

Tracking Accuracy: For this index, we first estimate the *f0*s of the stimulus and a recording. We then plot the *f0*s of the recording (i.e., on the Y axis) against *f0*s of the stimulus (i.e., on the X axis). We then perform a linear regression of the recording against the stimulus *f0*s plot. The derived regression value (i.e., the regression *r* value) is defined as the *Tracking Accuracy* of the recording.

Pitch Strength: This is a measure of the robustness of phase-locking in the brainstem. You can think of this as an equivalent measure to the amplitude of a response. However, the algorithm we use includes not only the amplitude of the fundamental frequency, but also amplitudes of its harmonics.

Root-Mean-Squared (RMS) Amplitude: For a sampled signal (e.g., a stimulus waveform or a recorded brain wave), we do the following steps to calculate *RMS Amplitude*:

1. Take a square of each data point
2. Add all the values derived from step 1 and divide by the number of data points
3. Take the square root of the value derived in step 2.
4. The number obtained during step 3 is the *RMS amplitude* of a sampled signal

Root-Mean-Squared (RMS) Ratio: Ratio of the *RMS Amplitude* of a recording (where a response is expected to occur) to that of a prestimulus time waveform (where no response is expected to happen).

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BIOGRAPHICAL INFORMATION (for Dr. Jeng)

Name
Fuh-Cherng Jeng

Highest academic degree

Ph.D.	2006	Speech and Hearing Sciences, The University of Iowa, USA
M.D.	1992	Medicine, China Medical University, Taiwan

Academic appointment
Associate Professor at Ohio University, September 2006 – present

Relevant Experience
I have worked with electrophysiological responses of the auditory system for nearly 15 years. While completing my PhD at the University of Iowa, my research primarily focused on the electrically evoked potentials of cochlear-implantation patients. After completing my PhD in Speech and Hearing Sciences, I became a professor and researcher at Ohio University. Since my arrival at Ohio University in 2006, my research focuses on investigating the frequency-following response to voice pitch in newborns, infants and adults who speak tonal and non-tonal languages. My laboratories at Ohio University and O'Bleness Hospital, as well as the laboratory that my collaborators have established in China Medical University Hospital, have collectively initiated and completed many important projects. In the past, I have been successful collaborating with intramural and international professionals to conduct research, and our efforts have come to fruition. Details about the Dr. Jeng's research can be found on his university website http://www.ohio.edu/people/jeng/

Publications in refereed journals (within the last five years only)

1. Chou, M.-S., Lin, C.-D., & Wang, T.-C., & **Jeng, F.-C.** (2014). Recording frequency-following responses to voice pitch in guinea pigs – preliminary results. *Perceptual and Motor Skills, 118*(3), 681-690. [Note: Jeng F.-C. is the corresponding author of this paper.]
2. **Jeng, F.-C.**, Peris K. S., Hu, J., & Lin, C.-D. (2013). Evaluation of an automated procedure for detecting frequency-following responses in American and Chinese neonates. *Perceptual and Motor Skills 116(2)*, 456-465.
3. **Jeng, F.-C.** & Hu, J. (2013). An automated procedure for detecting human frequency following responses to voice pitch. *Proceedings of Meetings on Acoustics, 19*, 1-7.
4. Chung, H.-K., Tsai, C.-H., Lin, Y.-C., Chen, J.-M., Tsou, Y.-A., Wang, C.-Y., Lin, C.-D., **Jeng, F.-C.**, Chung, J.-G., & Tsai, M.-H. (2012). Effectiveness of theta-burst repetitive transcranial magnetic stimulation (rTMS) for treating chronic tinnitus. *Audiology and Neuro-otology, 17*, 112-120.
5. **Jeng, F.-C.**, Chung, H.-K., Lin, C.-D., Dickman, B. M., & Hu, J. (2011). Exponential modeling of human frequency-following responses to voice pitch. *International Journal of Audiology, 50*, 582-593.
6. **Jeng, F.-C.** & Warrington, R. P. (2011). Effects of silent interval on human frequency-following responses to voice pitch. *Proceedings of Meetings on Acoustics, 14*, 2-1 – 2-8.

7. **Jeng, F.-C.**, Hu, J., Dickman, B. M., Montgomery-Reagan, K., Tong, M., Wu, G., & Lin, C.-D. (2011). Cross-linguistic comparison of frequency-following responses to voice pitch in American and Chinese neonates and adults. *Ear and Hearing, 32*(6), 699-707.
8. **Jeng, F.-C.**, Costilow, C. E., Stangherlin, D. P., & Lin, C.-D. (2011). Relative power of harmonics in human frequency-following responses associated with voice pitch in American and Chinese adults. *Perceptual and Motor Skills, 113*(1), 67-86.
9. **Jeng, F.-C.**, Hu, J., Dickman, B. M., Lin, C.-Y., Lin, C.-D., Wang, C.-Y., Chung, H.-K., & Li, X. (2011). Evaluation of two algorithms for detecting human frequency-following responses to voice pitch. *International Journal of Audiology, 50*(1), 14-26.
10. Li, X. & **Jeng, F.-C.** (2011). Noise tolerance in human frequency-following responses to voice pitch. *Journal of Acoustical Society of America, 129*(1), EL21-26. (note the first author Ximing Li was a Ph.D. student under Dr. Jeng's mentorship)
11. **Jeng, F.-C.**, Schnabel, E. A., Dickman, B. M., Hu, J., Li, X., Lin, C.-D., & Chung, H.-K. (2010). Early maturation of frequency-following responses to voice pitch in infants with normal hearing. *Perceptual and Motor Skills, 111*(3), 765-784.

Selected presentations within the past five years

1. Mitchell, K. & **Jeng, F.-C.** Frequency-following responses to voice pitch in Chinese neonates: Representation of innate processing. Student Research Exposition, Ohio University, April 10, 2014. [<u>Awarded the first place in the RehabCommSci-2 session, graduate level</u>]
2. Davis, J., Looney, K., & **Jeng, F.-C.** Noise tolerance and the frequency-following response. Student Research Exposition, Ohio University, April 10, 2014.
3. **Jeng, F.-C.** & Hu, J. An automated procedure for detecting human frequency-following responses to voice pitch. In: Abstracts of the 21st International Congress on Acoustics, pages 3285-3286 (#1pPPb14), Montréal, Québec, Canada, June 2-7, 2013.
4. Costilow, C., **Jeng, F.-C.**, & Hollister, G. Effects of sweep rate on the experience-dependent brainstem responses. Student Research Exposition, Ohio University, April 11, 2013. [<u>Awarded the first place in the RehabCommSci-2 session, graduate level</u>]
5. Davis, A. & **Jeng, F.-C.** Binaural interaction of experience-dependent brainstem responses to frequency sweeps in normal-hearing Chinese adults. Student Research Exposition, Ohio University, April 11, 2013. [<u>Awarded the first place in the RehabCommSci-1 session, undergraduate level</u>]
6. Groeber, A., & **Jeng, F.-C.** Frequency-following responses to voice pitch: a comparison of familiar vs. stranger's voices in normal-hearing adults. Student Research Exposition, Ohio University, April 11, 2013.
7. Davis, A. & **Jeng, F.-C.** Binaural interaction of experience-dependent brainstem responses to frequency sweeps in normal-hearing Chinese adults. In: Abstracts of 67th Annual Ohio Speech-Language-Hearing Association Convention, page 63 (#16), Columbus, Ohio, March 14-16, 2013.
8. Chou, M.-S., **Jeng, F.-C.**, Wang, C.-Y., Chung, H.-K., Lin, C.-D. & Tsai, M.-H. The animal model of frequency following response. In: Abstracts of the 93th Annual Meeting of Taiwan Otolaryngological Society, page 22 (#C37), Taipei, Taiwan, Nov. 10-11, 2012.
9. Hu, J. & **Jeng, F.-C.** An automated response detection procedure for human frequency following response elicited by voice pitch. In: Abstracts of International Hearing Aid Research Conference, page 63-64 (#B5), Lake Tahoe, California, August 8-12, 2012.

10. **Jeng, F.-C.**, Peris, K. S., & Hu, J. Evaluation of an automatic procedure for detecting frequency-following responses to voice pitch in American and Chinese neonates. In: Abstracts of International Hearing Aid Research Conference, page 66-67 (#B10), Lake Tahoe, California, August 8-12, 2012.
11. **Jeng, F.-C.** & Warrington, R. P. Effects of silent interval on human frequency-following response to voice pitch. In: Abstracts of the 162nd Meeting of the Acoustical Society of America, page 2545 (#4pPP5), San Diego, California, October 31-November 4, 2011. [selected for a podium presentation]
12. Warrington, R. P. & **Jeng, F.-C.** Human frequency-following responses to voice pitch: Effects of silent interval. Student Research Exposition, Ohio University, May 13, 2011.
13. Li, X. & **Jeng, F.-C.** Noise tolerance in human frequency-following responses to voice pitch. Student Research Exposition, Ohio University, May 13, 2011.
14. Costilow, C. E. & **Jeng, F.-C.** Contributions of fundamental frequency and its harmonics on frequency-following responses. Student Research Exposition, Ohio University, May 13, 2011.
15. J**eng, F.-C.**, Hu, J. & Dickman, B. M. Cross-Linguistic Comparison of Frequency-Following Responses to Voice Pitch in Neonates. In: Abstracts of American Auditory Society Annual Meeting, page 17, Scottsdale, Arizona, March 3-5, 2011. [*Selected for a podium presentation*]
16. Costilow, C. E., **Jeng, F.-C.**, Stangherlin, D. P., Li, X. & Hu, J. Contributions of fundamental frequency and its harmonics on frequency-following responses. In: Abstracts of American Auditory Society Annual Meeting, page 33 (#4), Scottsdale, Arizona, March 3-5, 2011. [Received "*Resident and Graduate Student Poster Session Grant*" (formally known as the "*Mentored Research Poster Session Grant*") from the National Institutes of Health and the American Auditory Society]
17. **Jeng, F.-C.** Frequency-following responses to voice pitch: fundamentals and clinical implications. *Invited podium presentation* at the Research Colloquium, Communication Sciences and Disorders, Ohio University, Athens, Ohio, November 12, 2010.
18. Chou, M.-S., Chung, H.-K., Wang, C.-Y., **Jeng, F.-C.**, Lin, C.-D. & Tsai, M.-H. Early maturation of frequency-following response to voice pitch in normal-hearing infants. In: Abstracts of The 89th Annual Meeting of Taiwan Otolaryngological Society, page 139 (#B15), Taipei, Taiwan, November 13-14, 2010. [Received "*Outstanding Research Award*" at the meeting].
19. Hu, J. & **Jeng, F.-C.** Frequency-following responses to voice pitch in Chinese
20. **Jeng, F.-C.**, Lin, C.-D., Wang, C.-Y., Hu, J., Li, X. Frequency-following responses to voice pitch: How many sweeps are enough? In: Abstracts of American Auditory Society Annual Meeting, page 58 (#37), Scottsdale, Arizona, March 4-6, 2010.
21. Hu, J. & **Jeng, F.-C.** Frequency-following responses to voice pitch in Chinese neonates. In: Abstracts of American Auditory Society Annual Meeting, page 57 (#35), Scottsdale, Arizona, March 4-6, 2010.
22. Li, X. & **Jeng, F.-C.** Effects of broad-band noise on frequency-following responses to voice pitch. In: Abstracts of American Auditory Society Annual Meeting, page 61 (#53), Scottsdale, Arizona, March 4-6, 2010.

BIOGRAPHICAL INFORMATION (for Dr. Nance)

Name
Brandie Nance, AuD, CCC-A

Highest academic degree

Au.D.	2006	Clinical Doctorate of Audiology, Salus University
M.A.	2002	Masters of Audiology, Ohio University
B.A.	2000	Communication Sciences and Disorders, Marshal University

Academic appointment
Clinical Supervisor of Audiology from August 2006 to present

Relevant Experience
As the clinical supervisor of audiology for the Ohio University Hearing, Speech and Language Clinic, I have provided and supervised Au.D. students providing infant newborn hearing screenings at O'Bleness Hospital since August 2006. I provide this service at O'Bleness Hospital 1 to 2 days a week. At O'Bleness, we use auditory brainstem response screening equipment to serve as a hearing screening for newborns that are at least 6 hours old. This involves reviewing risk factors with the parents, placing recording pads on the infant and earphones, monitoring for impedance and noise factors throughout testing, follow-up paperwork for the hospital and state records, and communicating results to families. We also see many infants who fail the newborn hearing screening within our clinic for follow-up diagnostic evaluations.

I have worked with Dr. Fuh-Cherng Jeng on various projects at O'Bleness during the past several years. My role in this study is to assist with hearing screening and inform parents about the opportunity of this study. I look forward to collaborating with Dr. Jeng on this important project.

OTHER SUPPORT (for Dr. Jeng)

A. Previous University Funding (within the past three years)

1. *Principal Investigator*: travel to collect data needed for an NSF research project in Taiwan. **Faculty International Travel Fund,** *Ohio University– Office of the Vice President for Research*. ($750) (7/7/2014 – 8/18/2014)
2. *Principal Investigator*: Obtaining and utilizing the Intelligent Baby Simulator (Named Isao). College of Health Sciences and Professions, **Technology Fee Request**, *Ohio University*. ($7,570) (1/30/2014)
3. *Principal Investigator*: travel to present a research poster in the 165nd Meeting of the Acoustical Society of America in Canada. **Faculty International Travel Fund,** *Ohio University– Office of the Vice President for Research*. ($395) (6/2/2013 – 6/7/2013)
4. *Principal Investigator:* Development of Experience-Dependent Brainstem Responses to Voice Pitch in Newborns and Early Infancy. **Research Challenge Award,** *Ohio University – Office of the Vice President for Research*. ($5,000) (9/1/2012 – 8/31/2013)
5. *Principal Investigator*: Development of Brainstem Responses to Voice Pitch from Birth to 6 Months of Age. **Faculty Summer Research Award**, *Ohio University – College of Health Sciences and Professions*. ($10,000) (7/1/2011 – 6/30/2012, no-cost extension to 12/31/2012).
6. *Principal Investigator*: travel to present an invited speech and conduct a one-week workshop in Taiwan. **Faculty International Travel Fund,** *Ohio University– Office of the Vice President for Research*. ($500) (11/23/2011 – 12/26/2011)

B. External Funding (within the past three years)

1. *Principal Investigator*: Development of Experience-Dependent Brainstem and Cortical Responses to Voice Pitch in Newborns and Early Infancy. National Science Foundation (**NSF)**, *Directorate for Social, Behavioral & Economic Sciences (SBE): Behavioral and Cognitive Sciences (BCS):* **Cognitive Neuroscience**. ($166,624 including indirect costs, **Award #: BCS-1250700**, This award is made in accordance with the provisions of NSF Solicitation 09-563 in Cognitive Neuroscience) (7/15/2013 – 6/30/2015).
2. *Principal Investigator*: Cross-linguistic comparisons of frequency-following responses to voice pitch in neonates. **2011 Lessons for Success Research Conference: Developing Emerging Scientists,** Conference Fellowship-Travel Award from *American Speech-Language-Hearing Association*. (~$3,000 to support travel, lodge and meal) (4/27/2011 – 4/29/2011)

C. Sustainability Note the proposed study is the last portion of a relative big-scale project. After this project has been completed, a multi-year grant proposal will be submitted to an external agent seeking further support of this line of research. The targeted mechanism is National Institutes of Health (NIH) R15 Academic Research Enhancement Award (AREA) mechanism with a deadline of February 25, 2016.

OTHER SUPPORT (for Dr. Nance)

None

BUDGET AND JUSTIFICATION

A. Consumable Supplies = $980

A certain amount of conductive gel will be applied on the recording pads to facilitate the tests. It is estimated that 3 tubes of skin preparation paste (NuPrep), 3 tubes of conductive gel (Ten20), and 30 disposable newborn ear tips (Etymotics ER3-14D2) will be needed for the total of 30 American newborn participants. Other consumable supplies include: cotton-tipped applicators, medical 3M tapes, 2"x2" sterilized gauges, alcohol wipes, various adaptors for connecting newborn ear tips, and jumper cables.

• Skin preparation paste (NuPrep, $60/tube x 3 tubes = $180)	$180
• Conductive gel (Ten20, $60/bottle x 3 tubes = $180)	$180
• Disposable newborn ear tips (Etymotic, $40/pack x 3 packs = $120)	$120
• Cotton-tipped applicators, medical 3M tapes, 2"x2" sterilized gauges, and alcohol wipes	$250
• Adaptors for connecting newborn ear tips	$150
• Jumper cables	$100
Total:	$980

Experiments and recordings of the brain activities will be impossible without the purchase of the consumable supplies.

Note the Principal Investigator's colleagues in China Medical University Hospital will provide complimentary support for the portion of this project that will take place in Taiwan (see *Letters of Support*). As a result, the Principal Investigator is not requesting any funds for consumable supplies for Chinese newborns.

B. Travel

None requested

C. Student Wages = $9,000

$10/hour x 20 hours/week x 15 weeks/semester x 3 semesters = $9,000

One graduate student (Ph.D. or Au.D. student) will be employed to assist with the proposed study. Responsibilities and major tasks of the graduate student are outlined as follows.

1. Spring semester
    - Assist in preparation of the proposed study
    - Assist in calibration of existing equipment in the PI's laboratory
    - Participate and proofread in the generation of necessary documents (e.g., flyers and consent forms) for IRB proposals.
    - Assist in data collection in the Newborn Center at O'Bleness Hospital,

2. Summer semester
    - Data analysis of the data obtained from both the American and Chinese neonates
        - Measure the response in the time and frequency domains
        - Generate time waveforms and spectrograms for each response
    - Assist in computer modeling and statistical analysis
        - Assist in performing exponential curve-fitting (using MATLAB) for the data obtained from the two different countries
        - Assist in running necessary statistical procedures (using SPSS) to determine the significance between the data obtained from the two groups of neonates
3. Fall semester
    - Wrap up the research project
        - Make sure all IRB documents and signed consent forms are properly stored
        - Perform routine maintenance on the equipment and store them in proper locations
    - Poster presentation
        - Assist in the creation of graphical representations of the results of this study
        - The PI and/or student present results at the 170^{th} Meeting of the Acoustical Society of America that is scheduled to take place in Jacksonville, Florida from November 2-6, 2015.
        - Report results of this study at OU Student Research Exposition in April 2016. Please note that due to the starting date of the proposed study, presentation in the spring semester of 2015 is not realistic. However, we plan to present results of this study at OU Student Research Exposition in the early spring of 2016.
    - Manuscript preparation
        - Assist in the various stages of preparing and submitting a manuscript.
        - This student will receive a co-authorship of the manuscript/publication

I have a specific student in mind for this position. This student has already received all necessary training to perform the above-mentioned tasks and has expertise in MATLAB programming and SPSS statistical analysis software. These skills deserve a pay rate higher than the minimum wage. Also, this pay rate is commensurate to the above-mentioned high-end skills and is comparable to those that are commonly used in various laboratories at Ohio University and related disciplines. Due to the nature of the proposed study, this student will assist in various activities that are either time-consuming or labor-intensive. It takes much longer time than most people think to get everything prepared for conducting experiments on newborn infants. As a result, we are requesting a total of 20 hours per week for the graduate assistantship. The amount of time reflects the volume of work and the difficulty and complexity of each task. This amount of time is also needed to ensure quality of work and timely completion of the proposed study.

D. Equipment
None requested

E. Faculty Stipend
None requested

F. Other

F.1. Participant costs = $600
We request funding to provide a $20 participation fee for each newborn. This is considered adequate compensation for the participants' time. Participant compensation is an important factor in gaining enough number of newborn participants for this study, as relying on parents to volunteer their newborns and receive no monetary compensation will make completing the project even more difficult. The total for participant costs requested is $600 ($20/newborn x 30 newborns) for the American newborns.

Note our collaborator in China Medical University Hospital will provide full complimentary support for the Taiwan portion of this project. As a result, we are not requesting any funds for participant compensation for Chinese newborns. Our collaborator will submit a separate IRB proposal to China Medical University Hospital to initiate the Taiwan portion of this project (see *Letters of Support*). The Principal Investigator will also submit an amendment to OU IRB asking for permission to merge the data that will be obtained from both the O'Bleness Hospital and China Medical University Hospital. All data will then be analyzed at the Principal Investigator's laboratory in Athens, Ohio.

G. Total = $10,580
The total amount of funding requested for the proposed study is $10,580. This amount reflects $9,000 which is the necessary amount to cover the student wages (20 hours/week) for the spring, summer and fall semesters, $980 to purchase consumable supplies, and $600 for participant fees.

OhioHealth

September 29, 2014

Dear Fuh-Cherng,

I am writing this letter to express our willingness to assist with the study entitled "Computer Modeling of Brainstem Responses to Voice Pitch in American and Chinese Neonates." As a clinical research site for the project, we will assist in informing parents of our newborn babies the opportunity to participate in this research and hosting your clinical research team for data collection. We will assure that all the parents of our newborn participants that their willingness to participate will not in any way affect the quality, quantity or type of services available to them. Our Birth Center has successfully delivered more than 400 newborns each year. I am confident that at least 10 newborns each month will meet the inclusion criteria for the experiment as outlined in the proposal. I am also confident that a large portion of them will be interested in participating, as many of them find it truly meaningful to contribute to research on the health care of newborns, infants and their families.

I look forward to collaborating with you on this project.

With Warm Regards,

Kelly Gammon BSN, RNC, IBCLC

Kelly Gammon, BSN, RNC, IBCLC
Birth Center unit manager
OhioHealth O'Bleness Hospital
55 Hospital Drive
Athens, Oh. 45701

OhioHealth

September 29, 2014

Fuh-Cherng Jeng
Grover Center W224
Communication Sciences and Disorders
Ohio University
Athens, Ohio 45701-2979

Dear Dr. Jeng,

The purpose of this letter is to let you know that I would be more than happy to assist with your proposed study on "Computer Modeling of Brainstem Responses to Voice Pitch in American and Chinese Neonates." Your proposal is timely. It deals with a recently described physiological potential that is likely related with the listener's ability to perceive the changes in voice pitch. We at the Center are excited to be part of the project you have proposed, as it is central to our mission to better diagnose and treat neonates and infants and to improve their quality of life.

I believe that this line of research could be very promising and I look forward to working with you.

Best Regards,

Karen Montgomery-Reagan, D.O.
Chief of Pediatrics
O'Bleness Memorial Hospital

中國醫藥大學附設醫院
CHINA MEDICAL UNIVERSITY HOSPITAL
台中市北區育德路2號
2 Yude Road, Taichung, 40447, Taiwan (R.O.C.)
TEL : 886-4-22052121

September 29, 2014

Fuh-Cherng Jeng
Grover Center W224
Communication Sciences and Disorders
Ohio University
Athens, Ohio 45701-2979

Dear Fuh-Cherng,

I am writing this letter to let you know that I will be glad to assist with your study entitled "Computer Modeling of Brainstem Responses to Voice Pitch in American and Chinese Neonates." We at the Department of Otolaryngology-HNS (your ala mater hospital and department) are very excited about the opportunity to collaborate with you on this project. We believe that this line of research will yield fruitful results and will have an important impact on advancing our knowledge about the development of voice-pitch perception during the early stages of life. Our staff at the Department of Otolaryngology-HNS will provide full complimentary support to this study as outlined in your proposal.

We look forward to working with you on the next steps in this important project.

With Warm Regards,

Ming-Hsui Tsai

Ming-Hsui Tsai, M.D.
Chair and Professor of the Department of Otolaryngology-HNS
China Medical University Hospital
Taichung, Taiwan

中國醫藥大學附設醫院
CHINA MEDICAL UNIVERSITY HOSPITAL
台中市北區育德路2號
2 Yude Road, Taichung, 40447, Taiwan (R.O.C.)
TEL：886-4-22052121

September 29, 2014

Dear Dr. Jeng,

We look forward to collaborating with you on your project entitled "Computer Modeling of Brainstem Responses to Voice Pitch in American and Chinese Neonates." This research deals with a newly discovered response that is likely related to the perception of voice pitch during the early stages of life. As a collaborative research site in this project, we will help inform parents of our newborn patients the opportunity to participate in this study. Our unit treats hundreds of newborn babies per year. We believe that the majority of the parents of the neonates will be interested in participating in the proposed study, because they often find it meaningful to help improve the quality of life of newborns, infants, and their families. We are aware of critical IRB and HIPAA compliance policies related to the proposed research and will ensure compliance with all such policies in terms of our role in any work done in our unit. We will inform all the parents of our potential newborn participants that their willingness to participate in this project will have no effect on any of their medical services at this unit and the hospital.

During the past four years, our team in Taiwan has successfully collaborated with Dr. Jeng's team in the USA and has co-authored several papers with Dr. Jeng in high-impact scientific journals. All these papers are directly related with the brainstem responses to voice pitch in newborns, infants and adults. We feel that this line of research is worthwhile doing and will yield fruitful results.

We believe this is an important project and look forward to working with you.

Sincerely Yours,

Chia-Der Lin, M.D., Ph.D. Chia-Der Lin

Vice Superintendent of Education
China Medical University Hospital
Taichung, Taiwan

Appended Materials - Summary Statement of my NIH grant proposal

SUMMARY STATEMENT
(Privileged Communication)

PROGRAM CONTACT:
LANA SHEKIM
301 496-5061
shekiml@nidcd.nih.gov

Release Date: **02/17/2011**

Application Number: **1 R01 DC011030-01A1**

Principal Investigator

JENG, FUH-CHERNG MD, PHD

Applicant Organization: OHIO UNIVERSITY ATHENS

Review Group: **LCOM**
Language and Communication Study Section

Meeting Date: **02/07/2011**
Council: **MAY 2011**
Requested Start: **07/01/2011**

RFA/PA: **PA10-067**
PCC: **VS02**
Dual IC(s): **HD**

Project Title: **Development of Brainstem Responses to Voice Pitch from Birth to 6 Months of Age**
SRG Action: **Impact/Priority Score: 60 Percentile: 47**
Human Subjects: 30-Human subjects involved - Certified, no SRG concerns
Animal Subjects: 10-No live vertebrate animals involved for competing appl.
Gender: **1A-Both genders, scientifically acceptable**
Minority: **3A-Only non-minorities, scientifically acceptable**
Children: **2A-Only Children, scientifically acceptable**
Clinical Research - not NIH-defined Phase III Trial

Project Year	Direct Costs Requested	Estimated Total Cost
1	250,000	359,554
2	250,000	359,554
3	250,000	359,554
4	250,000	359,554
5	250,000	359,554
TOTAL	1,250,000	1,797,770

ADMINISTRATIVE BUDGET NOTE: The budget shown is the requested budget and has not been adjusted to reflect any recommendations made by reviewers. If an award is planned, the costs will be calculated by Institute grants management staff based on the recommendations outlined below in the COMMITTEE BUDGET RECOMMENDATIONS section.

EARLY STAGE INVESTIGATOR, NEW INVESTIGATOR

Appended Materials - Award letter of my NSF grant that supports part of the study

Jeng, Fuh-Cherng

From:	Zulia, Eleni
Sent:	Wednesday, July 17, 2013 11:48 AM
To:	Jeng, Fuh-Cherng
Subject:	FW: Award Notification

Dear Fuh:
Congratulations on your NSF award! I hope that you are having a great summer.
-Eleni

****

Eleni Zulia
Grant Development Coordinator
Offices of Research and Government Relations
Ohio University
RTEC 101

740-593-0929
zulia@ohio.edu

From: Greenwood, Linda (Portman) [mailto:Linda_Greenwood@portman.senate.gov]
Sent: Thursday, July 11, 2013 10:57 AM
To: Zulia, Eleni
Subject: FW: Award Notification

NATIONAL SCIENCE FOUNDATION
4201 WILSON BOULEVARD, ARLINGTON, VA 22230
OFFICE OF LEGISLATIVE AND PUBLIC AFFAIRS

Award Date: Jul. 11, 2013
Award No.: 1250700

We are pleased to notify you regarding a recent National Science Foundation (NSF) award made to Ohio University with an intended total amount of $166,624.00.

This project, entitled "Development of Experience-Dependent Responses to Voice Pitch in Newborns and Infants," is under the direction of Fuh-Cherng Jeng. The award is effective Jul. 15, 2013.

The abstract and other information regarding this award will soon be publicly available via the NSF Award Abstracts database at http://www.nsf.gov/awardsearch/showAward.do?AwardNumber=1250700 .

RECOMMENDED REVIEWERS

1. Nina Kraus

Professor, Northwestern University
Frances Searle Building Rm 2-233, 2240 Campus Drive, Evanston, IL 60208
Telephone: (847) 491-2457
Email: nkraus@northwestern.edu
Website: http://www.soc.northwestern.edu/brainvolts/
Dr. Kraus is a world-class scholar in electrophysiology and cognitive neuroscience.

2. John Durrant

Professor, University of Pittsburg
4033 Forbes Tower, Pittsburgh, PA 15260
Telephone: (412) 383-6546
Email: durrant@pitt.edu
Website: https://www.shrs.pitt.edu/durrant/
Dr. Durrant is a nationally/internationally recognized scholar and researcher. He is the author of a widely used textbook in Hearing Science. He is also an associate editor of the International Journal of Audiology.

3. Brenda M. Ryals

Professor, James Madison University
Communication Sciences and Disorders, HHS 1145, MSC 4304, Harrisonburg, VA 22807
Telephone: (540) 568-3871
Email: ryalsbm@jmu.edu
Website: http://www.csd.jmu.edu/phd/people/ryals.html
Dr. Ryals is a nationally and internationally renowned scholar who has years of expertise in the anatomy and physiology of the auditory system, auditory plasticity, and hair cell regeneration. She is the Chief Editor of a high-impact scientific journal: *Ear and Hearing*.

4. Samira Anderson

Assistant Professor, University of Maryland
0119b, Lefrak Hall, University of Maryland, MD 20742
Telephone: (301) 405-4224
Email: sander22@umd.edu
Website: http://www.hesp.umd.edu/facultyprofile/Anderson/Samira
Dr. Anderson is a famous clinician researcher who has developed a theme of research focusing on neural correlates of auditory function and training in infants, children and adults.

5. Monita Chatterjee

Director of Auditory Prostheses & Perception Laboratory
Boys Town National Research Hospital, 555 N. 30th St., Omaha, NE 68131
Telephone: (402) 452-5069
Email: monita.chatterjee@boystown.org
Website: http://www.boystownhospital.org/research/Faculty/Pages/MonitaChatterjee.aspx
Dr. Chatterjee is a nationally recognized researcher in auditory electrophysiology, speech perception and voice-pitch processing in normal-hearing and cochlear-implanted children.