IGERT: Biological and Computational Foundations of Language Diversity

Requested Amount: $3,195,802
Requested Starting Date: 07/01/08
Proposal Duration: 60 months

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**Certification for Authorized Organizational Representative or Individual Applicant:**

By signing and submitting this proposal, the Authorized Organizational Representative or Individual Applicant is: (1) certifying that statements made herein are true and complete to the best of his/her knowledge; and (2) agreeing to accept the obligation to comply with NSF award terms and conditions if an award is made as a result of this application. Further, the applicant is hereby providing certifications regarding debarment and suspension, drug-free workplace, and lobbying activities (see below), nondiscrimination, and flood hazard insurance (when applicable) as set forth in the NSF Proposal & Award Policies & Procedures Guide, Part I: the Grant Proposal Guide (GPG) (NSF 07-140). Willful provision of false information in this application and its supporting documents or in reports required under an ensuing award is a criminal offense (U. S. Code, Title 18, Section 1001).

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(If answer "yes", please provide explanation.)

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The undersigned certifies, to the best of his or her knowledge and belief, that:

1. No federal appropriated funds have been paid or will be paid, by or on behalf of the undersigned, to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with the awarding of any federal contract, the making of any Federal grant, the making of any Federal loan, the entering into of any cooperative agreement, and the extension, continuation, renewal, amendment, or modification of any Federal contract, grant, loan, or cooperative agreement.

2. If any funds other than Federal appropriated funds have been paid or will be paid to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with this Federal contract, grant, loan, or cooperative agreement, the undersigned shall complete and submit Standard Form-LLL, “Disclosure of Lobbying Activities,” in accordance with its instructions.

3. The undersigned shall require that the language of this certification be included in the award documents for all subawards at all tiers including subcontracts, subgrants, and contracts under grants, loans, and cooperative agreements and that all subrecipients shall certify and disclose accordingly.

This certification is a material representation of fact upon which reliance was placed when this transaction was made or entered into. Submission of this certification is a prerequisite for making or entering into this transaction imposed by section 1352, Title 31, U.S. Code. Any person who fails to file the required certification shall be subject to a civil penalty of not less than $10,000 and not more than $100,000 for each such failure.

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**Certification Regarding Flood Hazard Insurance**

Two sections of the National Flood Insurance Act of 1968 (42 USC §4012a and §4106) bar Federal agencies from giving financial assistance for acquisition or construction purposes in any area identified by the Federal Emergency Management Agency (FEMA) as having special flood hazards unless the:

1. Community in which that area is located participates in the national flood insurance program; and
2. Building (and any related equipment) is covered by adequate flood insurance.

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1. For NSF grants for the construction of a building or facility, regardless of the dollar amount of the grant; and
2. For other NSF Grants when more than $25,000 has been budgeted in the proposal for repair, alteration or improvement (construction) of a building or facility.

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**AUTHORIZED ORGANIZATIONAL REPRESENTATIVE**

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*Submission of Social Security Numbers is Voluntary and will not affect the organization’s eligibility for an award. However, they are an integral part of the information system and assist in processing the proposal. SSN Solicited under NSF Act of 1950, as amended.*
A. PROJECT SUMMARY
1. Title  IGERT: Biological and Computational Foundations of Language Diversity
   PI  Colin Phillips
   Lead Institution  University of Maryland
   Participating Inst  Central Institute for Indian Languages, Mysore, India; Hiroshima and Tohoku Universities, Japan; Universidade Federal do Rio de Janeiro, Brazil; Center for Advanced Study of Language (UMd.); VL2 Science of Learning Center, Gallaudet University; National Institute on Deafness and other Communication Disorders.

2. INTELLECTUAL MERIT. Human language is both universal within the species and highly variable across populations. This IGERT will train young scientists to understand language diversity by combining tools of behavioral, computational and biological research. The goal of the project is to create a model for sustainable change in the science of language. We argue that this requires change in the role of academic departments that focus on language, creating units that form the hub of a collaborative network, rather than attempting to simply remove traditional departmental boundaries. We also contend that sustainable change, i.e., change that will persist across time and across institutions, depends strongly on the pursuit of diversity, encompassing both language diversity and diversity of participation. The starting point for the project is a language research community at the University of Maryland that is perhaps uniquely well positioned to combine expertise from linguistic, computational, cognitive and neuroscientific approaches to language with clinical and pedagogical concerns, drawing upon an extensive network of existing connections that span nine departments in five colleges. The first goal of the IGERT is to build upon our existing interdisciplinary success to break down further barriers to collaboration and cross-training. The second goal of the project is more outward-looking. The aim is to promote sustainable change through local and international collaborations and outreach efforts that will build infrastructure for interdisciplinary work on diverse languages, build awareness of the science of language among younger and underrepresented groups of students through high school and undergraduate partnerships, while also training IGERT students to be effective agents of change in their own future careers.

The training program will create a framework that allows students to translate broad foundational training into innovative interdisciplinary research. The training plan provides coursework, research training, and environment that are all geared towards the goal of preparing students for interdisciplinary research projects and equipping them to build similar collaborative networks at other institutions in their future careers. Preparation for interdisciplinary research projects will be provided by broad coursework in language and cognitive (neo-)science, integrative pro-seminars and a post-candidacy lab rotation that pairs trainees with students from other disciplines. A central component of the IGERT is the Winter Storm, an intensive two-week workshop that provides foundational skills training, building student partnerships through research projects, review and updating of research goals, and professional development. In addition, the IGERT builds upon international connections that will advance interdisciplinary training in language in India, Japan, and Brazil, while providing IGERT trainees with access to broader multilingual perspectives. The IGERT will partner with an NSF-supported Science of Learning Center based at Gallaudet University, expanding local training opportunities for deaf students.

3. BROADER IMPACTS. This interdisciplinary training model developed in this IGERT will have a national and international impact. The project will create resources and train graduates that can promote the integration of psychological, neural, and computational tools with multi-lingual expertise at other institutions. The project will strengthen a series of international collaborations through which students can contribute to infrastructure for interdisciplinary research in countries where linguists have less ready access to experimental and computational expertise. The project will enhance the use of computational and neuroscientific techniques in studies of atypical language and second language learning. A program of outreach activities at the undergraduate and high school level, plus the partnership with Gallaudet University, will enhance participation of underrepresented groups in science.

4. KEYWORDS: Social Science: Behavioral and Cognitive Science; Computer Science/Information Technology; Biology; Linguistics
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*Proposers may select any numbering mechanism for the proposal. The entire proposal however, must be paginated. Complete both columns only if the proposal is numbered consecutively.
### C. PROJECT DESCRIPTION

#### 1. List of Participants

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<td><strong>Tom Allen †</strong></td>
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<td><strong>Allen Braun, MD †</strong></td>
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<td><strong>Aniela Impuţe França †</strong></td>
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<td><strong>Andrea Zukowski</strong></td>
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**PI** * Co-PI | † External partner |

CASL - Center for Adv Study of Lang; CIIIL - Central Inst for Indian Langs; ISR - Inst for Systems Res; UFRJ - Universidade Federal do Rio de Janeiro; UMIACS - U of Maryland Inst for Adv Comp Studies
2. **Vision, Goals, and Thematic Basis**

**Motive.** Linguists have long been consumed by a search for common principles underlying all human languages, and by an interest in the scope of cross-language variation. This leads them to search for commonalities and for dimensions of variation, not just descriptions of lots of languages. But for a long time there seemed to be little reason for other scientists and professionals to pay much attention. There was a time when language professionals in the clinical, educational, and information sciences could get by with focused expertise in one or just a few languages. But this is rapidly changing.

The first wave of the ‘global information economy’ was fueled by remarkable advances in natural language technologies in a small number of languages. This created huge wealth in some places, but contrary to initial expectations, technology has widened the ‘information divide’ for speakers of minority languages. A second wave of natural language technologies based on ‘portable’ solutions that can be adapted to any language may begin to roll back the divide. Meanwhile, language analysts in the defense sector now need rapid ramp-up strategies aided by language-general expertise: traditional strategies based on a small number of ‘critical’ languages are now hopeless, since little-known languages can become critically important almost overnight. This has led to fundamental re-thinking of strategies. They require technologies to leverage resources from well-resourced languages to minority languages.

In the clinical domain, a great deal of effort and funding has been invested in building detailed phenotypes for developmental language disorders in English, leading to tests of effective therapies, and we increasingly see the importance of early intervention. But it is impractical to repeat this effort for each language individually, whether in the US or abroad. Language-general solutions could allow results from a small number of languages to drive rapid and cost-effective development of diagnostic tools and therapies for any language, including spoken and signed languages. In language education, teachers encounter learners from a vast array of language backgrounds, and require language-general understanding in order to tailor diagnoses and curricula to a diverse student body. A Korean immigrant child who mispronounces *van* as *ban* likely has a very different problem than a French-speaking immigrant from West Africa who makes an identical error (a speech pathology referral would be relevant in one case, not the other).

All of these considerations provide a clear motive for the language-general concerns of linguists to be exported to neighboring fields, but they require experts in these fields to gain a better understanding of the basic science of language. At the same time, there is a rapidly growing need for expertise from computational, psychological, neurobiological, and clinical areas to be imported into (psycho-)linguistics. Linguists have long assumed that their concern with language-general models is driven by the desire to understand children’s prolific language learning ability (and adults’ corresponding frustrations) and its underlying neuroscientific causes. But these links have often remained as promissory notes. More recently, rapid advances in surrounding fields has impacted the desired synthesis in opposing ways. On the one hand, advances in neuroscience, machine learning, and cognitive development (among others) have greatly improved the prospects for models of language learning and processing that are computationally explicit and cognitively and neurally plausible. On the other hand, these advances have spawned new specialized skills that have made it increasingly difficult for researchers to take advantage of progress in fields other than their own. How can one possibly be expected to both understand the statistics or modeling techniques needed to be a language engineer and to master techniques of experimental or linguistic analysis?

**Opportunity.** The language research community at the University of Maryland already possesses an unusually rich set of resources that allow it to import expertise from such fields as neuroscience and computer science into the basic science of language, and to export insights from the study of language diversity to clinical, educational, and engineering settings. We have a Linguistics Department that is unusually outward-looking, and a multi-department Neuroscience & Cognitive Science Program that provides a framework for interdisciplinary courses and degrees. We have an established network of close connections between faculty across many departments engaged in language research (School of Languages, Psychology, Hearing & Speech, Linguistics, Computer Science, ElecCompEng, Philosophy). The psycholinguistics and natural language engineering groups happen to share a focus on multi-lingual research. The campus and Washington DC/Maryland suburbs are host to a wide variety of institutions that can support links between basic science and real-world applications. The U Md campus hosts the Center for Advanced Study of Language, which is the core of the DoD’s new language-general research strategy, and also the National Foreign Language Center, a center for language teaching expertise.
Nearby are the National Institutes of Health, and the Children’s National Medical Center, plus the Headquarters of the American Speech-Language-Hearing Association. All of these have direct ties to UMd and to members of our IGERT team. We also are members of a local consortium of universities with Gallaudet University, the nation’s preeminent university for the deaf, which provides the resources needed for Deaf students to participate in activities at UMd. With these foundations in place, it is perhaps not surprising that the U of Maryland President has designated language as a primary institutional focus area. We also have the benefit of being in an ethnically and linguistically vibrant metropolitan area.

MEANS. Although the motive and the opportunity are clear, putting them together is not as straightforward as one might imagine. Human language presents an easy-to-grasp unifying theme for an IGERT, and yet the challenges for interdisciplinary integration are unusually acute, because of the highly diverse skill-sets required for such projects as linguistic fieldwork, cognitive neuroscience, clinical interventions, automatic machine translation, and second language acquisition. The range of methods and data-types used in language-related research presents obstacles not just to individual researchers but also to collaboration, as the technical vocabularies of these different domains vary widely, often making it difficult for language scientists to collaborate even when working in related areas.

Therefore, our trainees must become language scientists who are equipped to be effective collaborators across multiple disciplines and across multiple research languages. This will require a rich understanding of the details of linguistic diversity in concert with awareness of techniques and results from research areas as diverse as machine learning, systems neuroscience, and cognitive development. While we cannot hope to provide trainees with expertise in all of the areas that may be useful in a career of language related research, we can give trainees the skills needed to recognize what methods are most appropriate to solving which kinds of problems, to know what languages provide the best research preparations for particular questions, and to know how to collaborate across disciplines and across oceans in order to realize their research potential.

Our plan is focused on 4 primary aims: (1) to develop collaborative and sustainable interdisciplinary graduate research opportunities; (2) to build on and enrich existing collaborative networks to foster sustainable multi-discipline research teams; (3) to implement a multi-national research and training network, enriching the trainees’ perspectives on the challenges facing higher education and research; and, (4) to increase access to language science and technology for underrepresented populations.

What is missing from current approaches?

A MULTILINGUAL PERSPECTIVE. The rich multilingual perspective that has proven so important in standard linguistics research has had only limited impact on developments in other areas of language study, where English and a very few other languages have reigned supreme. An account of language learning must explain how a child is equipped to learn any language. In the neuroscience of language, a multilingual perspective is crucial for understanding the balance between invariant brain mechanisms and mechanisms that are shaped by experience with a specific language. Models based on findings from a small number of Western European languages may not be robust enough to tackle the full range of linguistic diversity. Our multilingual investigations involve more than simply casting a wide net. Rather, this research is driven by detailed models of linguistic diversity and by the understanding that languages with different structures highlight different parts of the problem. Progress in understanding how, for example, memory is accessed during language comprehension will depend on comparing languages whose structures make different demands on memory. Identifying appropriate languages for comparison requires an understanding of the dimensions of linguistic variation.

Effective use of data from diverse languages also requires advanced computational techniques. The focus on a small number of languages can be attributed in part to the availability of study participants and electronic resources, and to a lack of training and motivation for multilingual perspectives for non-linguists. The narrow focus on a small number of languages is also due to the limited access worldwide to the methodological and technical advances that have transformed language research in the US.

HUMANS AS A MODEL FOR COMPUTERS; COMPUTERS AS A MODEL FOR HUMANS. Current engineering approaches to language technology do not take advantage of insights into language structure, or from the most successful known language acquisition device: the human child. At the same time, models of human language learning are typically built on relatively small amounts of experimental data from small numbers of languages and do not take advantage of insights from machine learning or the potential contribution of computer modeling in constructing robust theories. Developing better theoretical models, improved second language acquisition methods and automated language understanding and support tools will
require educating researchers and engineers with an appreciation for the mutual informativity of computational, experimental and linguistic data.

A related limitation is that the demands of natural language engineering projects (and the availability of grants and contracts!) can make it difficult for computational students and faculty to devote time and resources to human modeling projects. Our project therefore emphasizes the use of natural language engineering skills in modeling human cognitive and neural processes, providing greater common-ground between experimentalists and computationalists, and creating opportunities for computational students that are less readily available otherwise.
The Approach: What our IGERT has to offer

The solution to the problems identified above resides in a model of sustainable integration that outlives the individual trainees supported by this project, and extends beyond our own institution. We believe that sustainable change in this area requires redefining the role of a linguistics department as the hub of a collaborative network. For the foreseeable future, academic departments will continue to be the entities through which universities make long-term commitments (i.e., ‘hard’ budgets), and linguistics departments ought, in principle, to be best positioned to bring together linguistic, psychological, computational, clinical and neuroscientific expertise on language, whether through direct appointments or through collaborations. A neuroscience program will not recruit an expert on the African language Igbo, and a computer science department is unlikely to hire a clinician (although not without exception - our own Jim Reggia is a computational modeler and also a practicing neurologist).

We contend that the remedy for the ‘inward-looking’ nature of many traditional departments is not to eliminate department structures, as is sometimes suggested, but rather to create ‘outward-looking’ departments that take synergy as a primary responsibility and can serve as long-term advocates for language research in an institution. It is therefore unfortunate that no previous language-related IGERT project has been based in a linguistics department. We believe that this model stands the best chance of effecting long-term change.

Our IGERT will contribute to this model by providing an array of interdisciplinary research opportunities. Students will receive degrees from traditional departments and maintain disciplinary depth in their chosen fields. In addition to their disciplinary requirements, all students in our IGERT will benefit from the following activities: (1) participation in at least one of the 4 interdisciplinary thematic research clusters described below; (2) participation in a 2-week intensive Winter Storm workshop, focusing on expanding the technical skills of trainees while also providing concentrated exposure to the unifying research themes; (3) a required research rotation pairing students from different disciplinary backgrounds to work together to solve problems requiring multiple methodologies; (4) required participation in high-school or undergraduate training and mentorship; (5) on-going weekly IGERT proseminars and seminars; (6) a set of activities focused on career awareness, ethics, and professional development. Many trainees will also participate in international research and training activities.

These elements address the weaknesses in contemporary graduate education identified above in several ways. The intensely interdisciplinary character of the research themes breaks down barriers to cross-discipline communication by providing models of multi-scientist research projects and exposing trainees to the pragmatic difficulties of working across diverse methodologies. All students will be required to take courses from the Language Diversity track, ensuring that they acquire an appreciation for the full range of linguistic diversity and the challenges this diversity poses for neurobiological, cognitive, clinical, pedagogical and engineering approaches to language.

Our local and international collaborations also contribute to reaching our multilingual aims. These include a collaboration with the NSF-supported Science of Learning Center Visual Language Visual Learning (‘VL2’, Tom Allen, PI) at nearby Gallaudet University, which will provide access to sign language research for our IGERT students, while providing greater local training opportunities for deaf students involved in VL2 research projects. International activities export our expertise in and commitment to multilingual interdisciplinarity in the study of language to partners lacking access to recent technological and methodological advances. These activities also enrich our students’ understanding of the need for international collaboration and the challenges it presents.

Diversity issues are addressed through our collaboration with Gallaudet, the increased emphasis on computational modeling in cognitive and neuroscientific research, and via our outreach activities with high school and undergraduate students.

An ambitious interdisciplinary research and training agenda requires substantial foundations. The University of Maryland has a unique arrangement of language scientists, putting us in position to implement the educational initiatives described here.

The Foundations.

This IGERT takes advantage of a language research community at the University of Maryland that provides the foundations for genuine integration. The Linguistics Department has been built with interdisciplinary research as its focus, and it stands in the unusual position of having led the development of cognitive neuroscience and computational linguistics on campus. The department is the hub of a
network of connections with neuroscience, computer science, hearing and speech sciences, electrical engineering, second language acquisition, psychology, and philosophy, and most of its graduate students include experimental or computational methods in their research. The IGERT draws on existing connections that span nine departments in five colleges at Maryland. In addition, the IGERT builds upon international connections that will advance interdisciplinary training in language in India, Japan, and Brazil, while also providing our IGERT trainees with access to broader multilingual perspectives.

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Y = existing collaborations: co-authorship, co-teaching, co-supervision, ongoing research, grant proposals
L = likely collaborations (especially for recent hires)

Table 2: Matrix of collaborative connections among IGERT team members.

Maryland has arguably the best facilities in the US for psycholinguistic and neurolinguistic research with adults and children, and is a leader in cross-language approaches to language learning and processing. Recent experimental studies have covered Spanish, Japanese, Russian, Chinese, Korean, Basque, Portuguese, Kannada, Malayalam, Hindi, Gaelic, and American Sign Language (ASL), using a range of methods spanning traditional behavioral techniques to electrophysiology and functional brain imaging. Expertise in comparative linguistics is leveraged to identify particular languages that can be used to decide among competing hypotheses that are compatible with existing data. Our team of linguists, engineers, and computer scientists are also leaders in the development of automatic multilingual
tools for Automatic Speech Recognition and Machine Translation. Research has covered Chinese, Arabic, Hindi, Korean, and Cebuano, to name but a few. Collaboration between psychologists studying infant cognitive and linguistic development and developmental linguists provides the foundations for understanding human preparedness for language acquisition. Growing collaboration between 1st and 2nd language learning specialists is making Maryland a leading center for understanding language learning in adults and children alike. The computational neuroscience group, consisting of linguists, engineers, computer scientists, and psychologists, studies animal models of auditory processing that inform research on human speech processing. Ties to NIH strengthen research in atypical language development and neurocognitive disorders. Our expertise is enhanced by the new DoD-supported Center for the Advanced Study of Language (CASL), which is assembling a 100-strong team to investigate language learning and processing, language technologies, and expertise in less well-studied languages.

The groups that make up the IGERT team have the profile required to attract top students and to impact the development of the field. The Department of Linguistics is ranked #1 in the nation in the Faculty Scholarly Productivity Index (Chronicle of Higher Ed., 1/12/07); the computational linguistics group recently won a Center of Excellence award for Human Language Technology (joint with Johns Hopkins); the Artificial Intelligence specialization in Computer Science has a top 10 ranking, the Electrical and Computer Engineering Dept has a top 15 ranking, and Hearing & Speech Sciences has a top 25 ranking (US News & World Report); the combined strength of the new second language acquisition PhD program and CASL make Maryland an emerging powerhouse for research in second language acquisition. Maryland graduates are especially sought after in universities that aim to build interdisciplinary strength in the language sciences. There is no question that Maryland can recruit IGERT-eligible students with the talent to become interdisciplinary leaders: the past 5 years have seen dramatic growth in the number of top-notch US students seeking interdisciplinary training in language at Maryland.

3. Major Research Efforts

The research plan covers four themes that each combine expertise in comparative linguistics, computational modeling, and cognitive/neural sciences. The strength of the research lies in the close integration between researchers from diverse backgrounds. The integrative student projects associated with these themes could have transformative effects in a number of sub-fields.

a. Neurocomputational Models of Speech and Hearing: Poeppel (Bio/Ling); Iafrate, Phillips (Ling.); Newman, Ratner (HESP); Espe-Wilson, Shamma, Simon (ECE); Eckman, Iverson (SLLC, CASL), Harper (CASL), Braun (NIH).

A complete understanding of human speech perception will only be achieved when we are able to give a coherent explanation from basic auditory neural activity through to abstract mental representations. The UMD speech team is uniquely positioned to advance our understanding along this integrated research path, making a seamless connection from the study of phonological systems (including infant and adult language acquisition and speech disorders) through the cognitive neuroscience of speech perception to systems neuroscience research on auditory processing and automatic speech recognition. We accomplish this through overlapping interests between the sub-groups; the motto for these connections is “your black box is my mechanism.” Even though the team spans several departments (Biology; Electrical and Computer Engineering; Hearing and Speech; Languages, Literatures and Cultures; Linguistics; and the Center for the Advanced Study of Language) across four colleges (Arts and Humanities, Behavioral and Social Sciences, Chemical and Life Sciences, and Engineering) the members
already have a strong record of active collaboration in both teaching and research. The step-by-step connections From Neuron to Phoneme are illustrated in the diagram of the group activities (Figure 3):

The unifying theme of the group is the search for the minimal units of speech perception and production: the phonetic features [1,2]. The collaboration between Shamma and Simon has led to a neuro-computationally plausible and experimentally verified model of the peripheral portions of the auditory system (the basic auditory features), and their connection into the primary auditory cortex (in which more complex features amalgamate information from throughout the auditory spectrum) [3-5]. This work exploring the detailed neuro-physiology of the mammalian auditory system is continuing with current students, including Donaldson (NACS). Connecting to this foundational work, Simon, Poeppel and Braun have conducted detailed neuro-physiological studies of basic human auditory abilities which underpin the speech functions (such as pitch and timbre) [6], and together with Phillips and Idsardi have connected basic auditory findings to the human perception of speech, discovering neural correlates of phonological features and phonological contrasts [7]. This is a particularly active area of current research, involving several collaborative studies with students in Biology, Linguistics and NACS. Newman, Idsardi, Eckman and Iverson have shown the value of features and contrasts to the study of first and second language learning (including ASL) [8-12], and with the arrival of new faculty members Eckman and Iverson we are planning studies connecting neuro-physiological measures with the second language acquisition of featural contrasts (following up on [7]). Applying this approach to real-world problems, Ratner has shown that understanding crosslinguistic variation in phonological organization is crucial to correct diagnosis and remediation of speech disorders [13] and Espy-Wilson is the leading proponent of a feature-based approach to automatic speech recognition (ASR) [14,15], another lively area of current research. We envision several new connections between these areas, including neuro-physiological investigation of the computations identified in Espy-Wilson’s ASR research, such as the cross-linguistic parameters for nasalization examined by Pruthi in his dissertation research (and in [15]).

Three recent graduates (Elhilali (ECE), Chait (NACS), and Kazanina (LING)) were each involved in specific research projects that illustrate both the interdisciplinary nature of the specific projects, and the kinds of contributions that can be made by IGERT trainees. All of these projects are still continuing, and we expect IGERT trainees to further integrate research across the labs throughout the IGERT period and beyond. Using data collected from single-unit recordings, Elhilali (working with Shamma and Simon) was able to map the precise timing and the spectro-temporal receptive fields of individual neurons in the primary auditory cortex. This painstaking, foundational work establishes the actions of the individual detectors at the very beginning of auditory cognition. Chait (working with Simon and Poeppel) has discovered more abstract auditory feature detectors, akin to the edge-detectors in visual neuro-cognition. They were able to identify clusters of neurons that respond to the change between coherent and incoherent auditory stimuli—the edges of coherent sounds. We plan to investigate the enormous potential that these auditory edge detectors have as the building blocks for the phonetic feature detectors in the language system. As an example, the transition between the consonant and vowel in a syllable like “saw” is itself signaled by the transition from broadband noise in the consonant to coherent timbre in the vowel.

A multilingual perspective lies at the heart of work by Kazanina (in collaboration with Phillips and Idsardi), who was able to find a neural correlate of the contrastive features in different languages. Although both Russian and Korean have the sound ‘b’, only in Russian is this sound contrasted with the sound ‘p’; in Korean the two sounds form one category with positional variants: ‘b’ is used between vowels, ‘p’ is used in other positions. In a cross-group comparison, only the Russian speakers detected
(and showed a neural response to) a deviant ‘b’ in a stream of ‘p’s. This technique offers a more direct window into the process whereby speakers learn new speech sound feature contrasts in a second language, the question at the core of second-language feature research being conducted by Idsardi, Eckman and Iverson. Integrating the results obtained by these students, we see the beginnings of a coherent explanation (going from neurons to phonemes) of the perception of the transitions between consonants and vowels, which are the very building blocks of syllables.


A theory of learning necessarily includes a model of the domain to be learned, an uptake function specifying how information is taken in and related to the model, and an update function indicating how new information is used to change the representation of the domain. Language acquisition research in linguistics typically focuses on the nature of the model, while research in psychology and computer science typically focuses on the update function. Because researchers in these fields tend to ask about different aspects of learning, there is a widespread perception that the approaches are incompatible. Nothing could be further from the truth. This research project mends this rift through collaborative research addressing all three aspects of the language learning problem, with a special emphasis on language variation. Computational modeling, merged with analysis of linguistic diversity and experimentation with infants and children, plays a critical role in exploring alternative perspectives on all three aspects of the learning theory, adding insights from engineering approaches. (See Figure 4)

**Figure 4: Language Learning Connections**

The model of the domain must be provided by cross-linguistic comparisons of adult languages and child learners. In prior work, Lidz [16, 17] and Phillips [18] have used typological generalizations to develop hypotheses about learners’ initial syntactic and semantic representations and have shown that children approach very diverse languages with the same representational resources. Missing from this approach, however, is a clear specification of how the particular language being acquired leads to changes in these representations, and precisely what role the input plays in guiding development.

The representational space for language must also be informed by our understanding of the conceptual and cognitive resources that learners bring to the acquisition task. Work by Woodward [19], Pietroski [20], and Hacquard [21] addresses the relation between conceptual structure and linguistic semantics, though detailed models of how conceptual structure, in concert with linguistic experience, contributes to the acquisition of linguistic meaning remains unexplored. The role of conceptual structure in first language acquisition can also be examined through research on second language acquisition, where the cognitive limitations of early childhood are eliminated as a potential variable.

To address the interplay between input, uptake and output in language acquisition, trainees will focus on detailed ‘model domains’ rather than on coarse measures of overall development. Each linguistic preparation will include three features: (1) substantial, well-understood cross-linguistic variation, (2) a relevant adjacent cognitive domain, (3) a computational model of how experience can drive development.

One clear example domain comes from the interpretation of pronouns. Cross-linguistically, there are two kinds of pronouns: reflexives (*himself/herself*), which require antecedents in the same sentence, and non-reflexives (*him/her*), which do not. These can vary along morphological dimensions (mono vs. poly-
morphemic) as well as along syntactic dimensions determining the proper configurations for finding an antecedent. The two dimensions of variation interact, yielding a space of roughly 20 types of languages. This space is large enough to make learning non-trivial, but small enough to be modeled realistically, taking account of the linguistic and extra-linguistic contributions to learning.

A second preparation will involve the acquisition of speech sound categories in 6-12-month old infants. This is the age when infants transition from ‘universal listeners’ to showing only native language speech sensitivity [22]. Although it is understood what infants learn about sounds and when they learn it, it remains unclear how they do this, and why 8-10 months is a critical age. Two facts suggest that phonological learning depends on coordination of semantic and/or social knowledge. The onset of word-learning coincides with the acquisition of native phonological categories [23]; and, learners are more successful learning phonological contrasts in interactive experimental contexts than in non-interactive contexts [24]. Exploring and modeling this critical developmental change is an ideal challenge for our team (and a good candidate for an IGERT proseminar), since it brings together experts in infant speech (Newman) and word-learning (Woodward, Lidz), cross-linguistic phonological variation (Lidzard, Iverson), and computational analysis of speech (Resnik, Espy-Wilson). This research theme can also be related to work in second language acquisition, where phonological category learning is rather more difficult.

Work on language disorders can be used to examine the interplay of input and uptake in cases of arrested development [25]. Also, our group’s finding that early measures are predictive of later learning disorders [26] can be modeled in order to determine the mechanisms of typical and atypical development.

A complete understanding of the relation between input, uptake and output across development will require computational analysis of the input, experimental data to determine how children represent that input, and theoretical models of how representations can change over time, with results in one area guiding the construction of new hypotheses in the other. With this many variables, computational modeling may be the most effective tool for generating hypotheses and possible learning trajectories. We will also investigate the profound implications of this approach for language learning in machines, replacing direct statistical learning of output parameters with techniques that favor succinct representation of underlying grammatical descriptions, such as Minimal Description Length in the sense of [27]. These techniques will be applied to syntactic and morphological modeling needed for improved automatic stemming and parser development.

c. Temporal Dynamics of Language Processing. Collaborators: Phillips, Lasnik, Lidz, Hornstein, Resnik, Uriagereka, Zukowski (Ling.); Weinberg, Resnik (Ling./UMIACS); Poeppel (Ling./Bio.); Braun (NIH/NACS); Faroqi-Shah (HESP), Reggia (CS); DeKeyser, Eckman (SLLC); Dougherty (PSYC).

Successful language processing requires speaker/hearers to dynamically create richly structured representations within a few hundred milliseconds of encountering each new word. Our team asks how this feat is achieved, whether it is achieved in the same fashion across languages with varying word order and morphological markers, what are the possible neural encoding mechanisms for richly structured information, and how the dynamics of language processing differ in adult language learners or in atypical learners or stroke patients. The unusual features of the Maryland group include its expertise in cross-language research (e.g., recent studies on Japanese, Hindi, Portuguese, Basque, Russian, ASL, and Spanish; [28,29]); its use of diverse tools in the tracking of language-related processes (reading time, eye-movement measures, EEG and MEG measures of millisecond-grain brain activity, and fMRI measures of brain localization); and its work linking neuro-computational modeling of language processing and studies of developmental and atypical populations ([30]).

The connections between investigators make it feasible to try to seamlessly align insights from formal grammars with findings from psycho/neurolinguistics and computational neuroscience (Figure 5), something that we could not have imagined a few years ago.

Languages like English, Japanese, and ASL vary greatly in the order and the manner in which information is packaged for communication. A rich psycholinguistic tradition on English-type languages emphasizes the value of verbs [31], which canonically appear early in the sentence in these languages. But in Japanese all verbs must appear in sentence-final position. In spoken languages information is organized in a linear sequence, due to constraints on acoustic transmission, but in signed languages information may be organized spatially. This variation raises questions about the uniformity vs diversity of language processing mechanisms across languages. Phillips and Weinberg and their students have devoted much effort in recent years to investigating the impact of word order variation on language comprehension, and have found striking evidence for shared processing mechanisms across languages:
For example, experiments confirmed our prediction that a mechanism proposed to account for interpretation biases in English sentences with non-canonical word order (‘filler-gap dependencies’) would elicit the opposite interpretation biases in corresponding sentences in Japanese [32]. Poeppel and his student Diogo Almeida have begun to investigate related issues in the electrophysiology of word recognition in English and ASL, in collaboration with Gallaudet team member Deborah Chen-Pichler. These lines of work provide many opportunities for future student projects, particularly involving work with the local and international partners. Another promising direction for integrative research explores parallels between cross-language comprehension mechanisms and the concerns of the attention/memory group in psychology. In the area of decision-making, Dougherty’s group investigates the role of rough-and-ready heuristic strategies vs. more knowledge-intensive mechanisms [33]. This closely tracks controversies in language processing [34], although the literatures rarely overlap.

Figure 5: Language dynamics connections

A core understanding of language processing by adult native speakers can provide a basis for interpretation findings from aphasics patients (Shah, Braun), children with delayed or arrested language development (Ratner, Newman, Zukowski), or second language learners (Eckman, DeKeyser). Agrammatic aphasics have long been known to show deficits in the production of tense information in English, but Shah’s work has shown striking asymmetries that provide clues to the source of the deficit. When asked to complete a sentence containing a past-tense adverb (e.g., yesterday), patients fail to select an appropriate verb form (e.g., ate vs. will eat), but perform well in the opposite task, appropriately selecting a past tense adverb when presented with a past tense verb [35]. A student with clinical research interests could study the source and time-course of this contrast together with faculty and students in psychology and/or linguistics. In this way the collaborations will guide the development of new therapies. In the area of second language acquisition the use of fine-grained language processing measures may help to sharpen the question of whether there is a ‘critical period’ for language learning studies that test how information uptake in adult learners specifically impacts their learning abilities. This type of approach has the potential to have a transformative impact upon SLA research, and it is an area where the UMD program is well-positioned to attract highly talented students. Trainees from SLA and developmental science who gain expertise in dynamic processes are in great demand in the current job market.

Our efforts in human language processing have natural links to the team’s expertise in resources and algorithms for multilingual natural language technology models [36], and an important goal for this project will be to seek closer connections between these two areas of strength. A related area that offers rich opportunities for collaboration between students with cognitive (neuro-)science and computer science skills involves the deployment of existing neuro-computational models of low level linguistic processes for use in understanding the dynamics of syntactic and other higher level computation at the neuro-biological level. Work by trainee Whitney (in collaboration with Reggia and Weinberg) has already shown parallels between models of letter position encoding and models of syntactic comprehension [37,38].

d. Multi-domain Investigations of Action-Perception Relations. Collaborators: Woodward (Psych.); Idsardi, Lidz, Phillips (Ling.); Poeppel (Bio/Ling.); Newman, Ratner (HESP); Reggia (CS); Espy-Wilson, Simon, Shamma (ECE); Weinberg (CASL, Ling.); Allen (Gallaudet). Questions about the relation between perception and action lie at the very root of psychology, the neurosciences, and especially the cognitive neuroscience of language. In one of the core historical documents of neurobiology [39] Sherrington in 1906 discussed mechanisms that may be shared between
perception and action. And, even more strikingly, the origins of neurolinguistic research derive explicitly from the attempt to account for the intuitively compelling link between speaking and hearing. Carl Wernicke’s 1874 work [40], in particular, anticipated many of the issues now at the forefront of experimental and theoretical research in psycho- and neurolinguistics.

Notwithstanding such prominent historical precedents, perception and action (in language research as well as in other domains) have been studied more or less independently. But recent efforts in psychology to explain aspects of human behavior in the context of embodied cognition, on the one hand, and recent neurophysiological findings concerning mirror neurons, on the other, have reignited interest in investigating the links between doing and observing (e.g. 41-3). While our team is also enthusiastic about the prospects for considering close action-perception connections, we take a more circumspect approach, on the view that the popular notion of single neuron solutions to linking perception and action fails to do justice to the complexity of relating these foundational domains of experience. In the research program pursued across different UMd labs, we build on the important insight that action-perception links must be viewed as critical, but aim to explore this idea by designing experiments and models that incorporate more abstract concepts, going beyond the simple sensory-neuron-to-motor-neuron links as the basis for explanation in cognition. In particular, neuronal mechanisms such as predictive coding, algorithms such as analysis-by-synthesis, and Bayesian statistical-probabilistic approaches are employed to test how internal forward models may form the basis for the computations linking perception and action. There is, in this perspective, not an unmediated connection between sensory and motor activity that lies at the basis of cognition, but intermediate stages of computation that operate on internal representations.

This research focus for the IGERT is in many ways a (conceptual and methodological) synthesis of projects developed independently by our constituent groups that approach action-perception relations using diverse tools at multiple levels of analysis. The cross cutting focus of this theme involves deploying research methods and techniques developed in the other thematic sections to these issues, and in enriching work in the other thematic areas with computational models developed to address these issues directly. The speech and audition group [theme (a)] is interested in action-perception relations due to their search for basic representational units that putatively underlie both speech articulation and perception in the brain, due to their interest in audio-visual integration processes that implicate analysis-by-synthesis in AV speech, and due to their investigation of Bayesian models of native and non-native phonological learning [44]. The language learning group [theme (b)] is interested in production-perception relations because forward models (based on learners’ knowledge of language at a given state) may allow learners to extract more informative data from the language input. Moreover, important work on pre-linguistic infants investigates how babies’ developing motor skills impact their understanding of events and intentions in the world around them, providing a critical precursor to language learning [45]. The language processing group [theme (c)] approaches action-perception relations from the perspective of predictive models of language comprehension, which may play a crucial role in explaining the speed of normal language understanding [46], and the challenges of non-native comprehension. Action-perception relations also play a key role in explaining why language impairments that more transparently impact language production (non-fluent aphasia, stuttering [47]) are also associated with specific comprehension deficits.

These investigations of perception-action relations in language learning and processing will be informed by a broader research focus across campus on perception-action relations in motor learning and development. Woodward’s group investigates the role of self-produced actions in the development of infants’ action perception. Using visual habituation, eye-tracking and imitative learning techniques, this group has discovered that the acquisition of a new motor skill influences infants’ perception of others’
goal-directed actions. For example, 3-month-old infants trained to apprehend objects with velcro-covered mittens subsequently view others’ mittened actions as goal-directed ([48]; see Figure 7). A broader collaborative project, including Woodward, Contreras-Vidal and Clark (in Kinesiology), Fox (Hum Devel) and Aloimonos (CompSci) investigates perception-action relations in motor skill learning throughout the lifespan, using both behavioral and electrophysiological techniques. In addition to providing a parallel line of investigation for comparison with work in language, the IGERT team will investigate the interaction between acquired knowledge in these domains and the development of event representations, a critical foundation for verb learning, and into intention concepts, a foundation for acquiring linguistic symbols.

STUDENT PROJECTS. (i) Recent work in auditory cognition has focused on audiovisual speech perception, and it is now widely accepted that visual information from the face/articulators has a facilitative effect on perception (e.g. 49). In a series of experiments combining psychophysics and EEG recording, a former trainee (NACS), Virginie van Wassenhove (now post-doc at Caltech), was able to show a precise, articulator-specific predictive relation between the information contained in the face (visemes) and the auditory evoked signals elicited by speech. She was able to show that the more predictive a viseme is, the more temporal savings one observes in auditory cortex ([50], see Figure 6). These data are most naturally interpreted as supporting an analysis-by-synthesis operation in audiovisual speech perception. We intend to investigate the numerous new experimental, computational, and theoretical questions, for example about ecologically natural AV speech. Moreover, this will allow us to link to our colleagues, as incorporation of data on visual signals provides a natural link to studies in ASL, where it is possible to explore the predictive value of hand and face information for online comprehension. (ii) Work by current trainee Ellen Lau (LING) grounds internal forward models and perception-comprehension processes at the level of sentence processing. By recording EEG data while participants read English sentences with carefully crafted ellipsis constructions, Lau et al. [46] showed that readers generate nuanced structural (grammatical) expectations that are tested against the input so rapidly that very early (~200 ms latency) brain responses provide an index of whether such structural predictions are met or not. Because of the extreme rapidity, the most plausible account assumes that an internal forward model of the grammar/parser continuously updates its forward expectations. This research, central to the aims of theme (c), opens a host of new possibilities to study how listeners/viewers/readers construct moment-by-moment representations by generating forward models. This work also provides an example of how theoretical linguistics, cognitive neuroscience, and computational modeling can converge to yield fuller descriptions of online language processing. (iii) A more explicitly computational project is exemplified by the work of a current trainee Hyuk Oh (NACS). Current functional-anatomic models of speech (e.g. [51]) suggest that there must be an intermediate stage in which coordinate transformations are computed that translate between auditory (time-frequency) and motor (time-articulator joint space) coordinate systems. To tackle this issue from a computational perspective, Oh is merging a computational model of auditory cortical neurons and their contribution in the analysis of speech sounds [52] with a detailed model of speech production [53]. Each model provides a sophisticated account of how perception or production may be mediated, but neither engages in detail how the information is transformed to permit effective recoding of information, as is typical in human cortex. By testing computational hypotheses about coordinate transformations and what representational primitives lie at their basis, this type of project directly addresses the question of how perception and production may be linked in the vocabulary of the brain.

Cumulatively, this research theme provides a foundation for merging insights from the different research themes of the IGERT, while also drawing upon the varied experimental and computational tools that trainees will learn to use.
4. **Education and Training**

**EDUCATIONAL VISION. WHY MARYLAND?** Our training program aims to prepare our students for their future based on lessons learned from our past. Many of us have had the privilege of training in multiple disciplines through graduate or postdoctoral work, and have trained students with multiple backgrounds. We know what it is like to try to master multiple paths related to the study of language. We have discussed at length the skill-sets required to solve the problems discussed in the previous sections. We have also discussed with groups of students the structural or psychological barriers that we or they have had to overcome, with the goal of providing a more programmatic and long-lasting solution.

Our IGERT will stretch the boundaries of our multidisciplinary approach to training. We have already created an environment in which it is second nature for some students to combine theoretical, behavioral, and neuroscientific research. We have experience in offering courses to diverse audiences through teaching in the Neuroscience & Cognitive Science (NACS) Program, which provides foundational coursework in cellular, systems, computational and cognitive neuroscience to students from 14 feeder departments. And, since we have already trained many students in this model, we know how to translate this approach into terms that can be understood by traditional conference committees, journal editors, and department hiring committees, and by industry. Our experience, however, has also provided us with an understanding of the remaining challenges, which the current IGERT plan addresses. We have identified 4 key challenges that our training program aims to overcome.

1. **Linking computational and linguistic expertise.** To date, we have had good success in pairing experimental and theoretical training. Students in our program routinely merge analytic techniques used in cross-linguistic description and theory construction with those of the behavioral sciences. Training in thinking computationally, for students with formal aptitude but limited background is far less attested. Conversely, expertise in analyzing diverse human languages demands knowledge-intensive training, and is often underestimated by students with computational or experimental backgrounds. **Action Items:** Winter Storm; new and modified coursework; integrative seminars. (see below)

2. **Interdisciplinary communication.** We and our students have dealt with the difficulty of getting multidisciplinary work into single-focused venues, but these venues are still the norm. Our plan emphasizes writing and communicating across disciplines, especially crafting research proposals and writing for journals and reviewers that retain a primarily disciplinary focus, and presenting work to broad, possibly non-expert audiences. **Action Items:** co-mentoring; IGERT fellowship application; writing and speaking workshops; outreach and international partnerships; IGERT pro-seminar.

3. **Building effective collaborators.** No-one can realistically have independent expertise in all of these disciplines. We want our trainees to attain a rich enough understanding of the modes of inquiry and ways of problem solving to know when they need help and who to get it from. **Action Items:** Winter Storm; courses emphasizing collaborative projects; advanced rotations.

4. **Finding frontiers.** Our students must be prepared not just to address the substantial challenges that we have targeted, but to tackle the challenges they will face in 10 years. Students must therefore be experienced in stepping outside their comfort zones to forge new connections across departmental, disciplinary and political borders. How does one become a secure neophyte after working hard to be “the expert” in a home discipline? **Action Items:** Outreach and international partnerships; advanced rotations. Collaboration with Gallaudet colleagues.

**WHAT TYPES OF STUDENTS WILL WE PRODUCE?** We consider three possible successes for our program. The first is the savant: a student who gains sufficiently deep expertise in more than one area of the IGERT to be an independent investigator in multiple fields. For example, we could expect a student with previous programming experience to leave UMD with sufficient expertise to be hired as a computationalist, or a theoretician in a linguistics or CS department, or in a research institute or industrial setting. The second type of student is the broad collaborator; a student with primary expertise in one area and sufficiently deep multidisciplinary experience to engage in diverse collaborative research. These students will be well suited to building their own collaborative networks after graduation, leading to sustainability of our goals. The third type of student is the broadened collaborator; a student with attributes of the broad collaborator, perhaps to a lesser degree. We want to be flexible enough to attract the best students from departments where recruitment and employment variables militate against tackling all of the skills offered.
Our Plan

The program is geared towards preparing students for interdisciplinary dissertation projects and for building similar collaborative networks at other institutions in their future careers. These new initiatives build upon a number of pieces that are already in place.

Foundations: Application. Students’ applications for IGERT support will be a part of their training. Our students have benefitted from working closely with mentors on NSF Graduate Research Fellowship proposals, and we will extend this to the IGERT program. Applications will be open to UMD PhD students, not only those working with faculty listed in C1. Applicants will be strongly encouraged to specify co-mentors from diverse departments in their application. Sponsoring faculty will be expected to outline their own contributions to IGERT training activities as a part of the application, and should describe how co-mentoring the student will move their own research in new directions. (Additional details in C5, C7.)

Foundations: Winter Storm. There will be a highly intensive (morning to late-night) two-week Winter Storm every January for all new IGERT participants, along with other trainees and faculty. The Winter Storm focuses on hands-on skill building, interdisciplinary communication, and collaborative team-building. The Winter Storm is inspired by a successful ‘Boot Camp’ initiative in a computer vision IGERT at UCSD. What is distinctive in our plan is the great diversity in skill-sets represented by the students and faculty at this event.

The Winter Storm will include intensive workshops for developing key foundational skills, e.g., computing with MATLAB, statistical analysis with R, speech analysis with Praat, simple linguistic problem solving, or electrophysiological data acquisition. “Hands first” learning enables students to step outside of their comfort zones to build an appreciation for diverse methods and data-types. An SLA student may be encouraged to take a computational course following success with basic statistical analysis, or may benefit simply from using “proxy” off the shelf tools with expert guidance. A student with no background in formal linguistics will gain the skills and confidence for the language diversity track. The workshops also allow basic foundational courses to concentrate on content, rather than teaching basic tools of the trade.

A second activity of the Winter Storm is a set of presentations of research by IGERT groups, with a focus on relating specific projects to the big-picture challenges. These provide models of interdisciplinary communication. These are not progress reports, however. Presenters will also identify manageable problems of their research agenda for other students to work on collaboratively. The aim will not be for students to solve the problems, but to propose detailed approaches, identifying methods and data-analysis techniques. These exercises help to build student relationships across disciplines.

Winter Storm will also include social activities for ‘decompression’ and team-building. This activity and the proseminar (below) will also serve as an “icebreaker” for our collaborators from Gallaudet and their students. It provides an intensive response to the question of “what’s in this for you”. It also puts Gallaudet students in the same position as others; entering new territory, feeling less like outsiders.

Our key faculty have already signed on to contribute to the Winter Storm, and a number have also expressed enthusiasm in participating as learners. In addition, when we presented this plan to student groups, they enthusiastically supported expanding the role of students as peer instructors in these events. We expect the Winter Storm to be exhilarating for students, and to play a pivotal role in IGERT activities. This and participation in foundational courses and obligatory seminars serves to build a student cohort.

Foundations: Coursework. Coursework that takes a student away from his/her home department sets the stage for subsequent interdisciplinary research projects. The default ‘tracks’ shown in the table below provide guidelines, but students may design individualized tracks in the application process. Students must take at least one track outside their home department. Students can receive formal recognition for the additional coursework through the new Certificate Program in NACS that the PI helped to develop (approved summer 2007). Importantly, a Washington area consortium allows Gallaudet students to take our courses with ASL interpretation or other services provided free of charge (see attached letter from Ms Evalyn Hamilton of UMD Disability Support Services).

The Language Structure and Diversity track provides students with essential background for multilingual studies. We will continue the ongoing modification of linguistics courses to better serve non-linguistics students. In particular, after taking Syntax I (Lasnik) students can take a new IGERT course on language diversity and language learning (Hornstein/Lidz). This course emphasizes multilingual linguistic analysis and relates these results to research questions in first and second language acquisition.

The Phonology sequence relates formal linguistic analysis to problems of categorization in learning, speech recognition, and the neural encoding of speech. The unifying research theme, the search for the minimal units of speech perception and production also serves as the unifying principle of the phonology
course sequence. The phonology sequence emphasizes the importance of drawing on data from multiple disciplines and the interdisciplinary consequences of any one data type. The course will help students to understand phonetic features as the phonological primitives of human languages, to demonstrate their connection to the neural coding of auditory signals in humans and other mammals, and to explicate how features inform models of automatic speech recognition and speech disorders.

The Semantics sequence (Pietroski, Hacquard) will emphasize multidisciplinary perspectives. Both semanticists are experienced experimentalists, and they will integrate formal approaches to meaning with novel experimental approaches. Because the semantic content of linguistic expressions partly derives from independently existing cognitive systems, semanticists must find points of contact with cognitive psychology. For example, we can expect that an understanding of infants' representations of events can provide important boundary conditions on how they learn the meanings of words referring to events. By contextualizing traditional semantic theory with adjacent areas of cognition, the semantics curriculum can be made more meaningful to students coming from other departments (e.g., psychology) and can help students in linguistics to see how to turn formal questions into psychological and neuroscientific ones.

The Cognition and Neuroscience track includes courses that already have substantial hands-on and teamwork components and that have spawned a number of successful cross-cutting research projects in recent years. Students will take foundational courses offered by two programs (LING, NACS), with electives from other departments. Psycholinguistics I & II offer a focused introduction on using behavioral methods to answer questions posed by linguistics. What is the trade-off between statistical tuning from data and the deployment of innate knowledge? How is language comprehension impacted by linguistic variation? Lectures are reinforced with labs (many designed by the PI as part of an NSF CAREER award) that allow students to "get their hands dirty". These courses have prepared many linguistics and SLA students with no background to be effective experimentalists. A notable feature of the Cognitive Neuroscience course (Poeppel) is that it has built cross-discipline student partnerships by pairing students from different fields for hands-on research projects, some of which have led to publications.

The Computational/Neural/Cognitive Modeling track spans two areas of computational research relevant to language. The computational linguistics courses focus on application areas such as multilingual search and summarization, machine translation, or development of machine-aided language tutoring applications. The neural modeling courses emphasize the link between computer models and testable neuroscientific predictions. The biological signal processing course (Simon) is already highly popular among students from NACS, Linguistics, Kinesiology etc. who seek a deeper understanding of data analysis techniques. Courses for each track are currently taught by IGERT faculty (e.g., Reggia, Simon, Dorr, Resnik, Weinberg). In addition (see letters by Deans Harris and Montgomery), the University is committed to hiring an additional computational modeler who specializes in modeling language and other higher cognitive processes.

Experience has taught us that computational training often presents a real challenge for students who enter graduate school with technical aptitude but a traditional language/psychology/clinical background. Nonetheless, Weinberg and Resnik have trained linguists to become successful computational researchers; Reggia has combined his talents as a computational modeler and practicing neurologist to develop computational training for MDs. Based on our experience, we see the keys to success in this area as: (i) preparatory training (via the Winter Storm); (ii) a new "gateway" course to introduce students with limited programming expertise to underlying computational methods and modes of inquiry. This course will discuss suitable language application (e.g., "parsing") designed to introduce basic concepts such as search, constraint satisfaction, problem reduction, and the use of first order predicate logic. We will combine this with a language learning application to introduce concepts from basic statistics and machine learning (rule induction, decision trees), elementary linear algebra and the corresponding basic 'neural' learning models. We intend to illustrate these basic concepts with "off the shelf" tools in order to divorce computational thinking from extensive programming, while presenting students with lab exercises. We have experimented with this technique in our current signal processing course. (iii) Cross-discipline student partnerships will be modeled on our current LING647/CMSC723 where we have designed problems that require the combined skills of linguists and computer scientists.

ETHICS TRAINING: We are fortunate to be able to offer programs staffed by experienced scientific ethics educators to our faculty and students. Ethics education for science and engineering was initiated more 12 years ago at UMD by our colleagues Robert Dooling (Psych/NACS), Arthur Popper (Biology/ NACS) and Sandra Greer (ChemEng). Using funds provided through an NSF-EESE special solicitation "Ethics Education in Science and Engineering" (SES-062929), our colleagues are revising their courses
to produce a single three-hour/week course for graduate students and postdocs entitled Research Ethics. The course will address bias, use of human and animal subjects, attribution, plagiarism, intellectual property and the issue of under-represented groups in science; using domain specific material in relevant disciplines. We will require this course for IGERT fellows. Our colleagues are also developing a 4-6 hour Research Ethics Workshop, to be part of the orientation of newly appointed Assistant Professors. Our faculty plans to attend the course and share our personal experiences.

The program is intentionally flexible and allows multiple navigation paths. For example, in order to become a savant capable of advancing the state of the art in linguistics and computation, a linguistics student with basic programming experience might supplement our computational modeling track with additional computer science courses. The new gateway course makes it possible for a broad collaborator without programming background to eventually take a machine learning course. Finally, a student not interested in adding a computational component could refrain from taking the courses in Track 3, while still being exposed to computational thinking through Winter Storm and the proseminar activities.

<table>
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<tr>
<th>Students complete two of the three tracks; all students must take courses from the Lang. Diversity Track; students may petition to substitute courses that better serve their interdisciplinary preparation</th>
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<tr>
<td><strong>Language Diversity Track</strong></td>
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<td><strong>Three of:</strong></td>
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<td>Syntax I/II (LING 610-611)</td>
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<td>Phonology I/II (LING 620-621; modified course)</td>
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<td>Semantics I/II (LING 660-661; modified courses)</td>
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<td>Language Diversity and Learning (new course)</td>
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<td><strong>All students also enroll in:</strong></td>
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<tr>
<td>Proseminar: Biological &amp; Computational Foundations of Language Diversity (new course)</td>
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<tr>
<td>IGERT Lunch Seminar (new 1-credit course, continuing participation)</td>
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**Research Integration: Translational Activities.** At the core of the IGERT are four components that help students with the crucial step from foundational training into innovative research programs.

**Translational Activities: Proseminar.** A team-taught IGERT pro-seminar will focus on questions in cross-language research that require a convergence of theoretical, experimental and computational tools. For example, *From Ferrets to Phonemes* will relate research on the neurophysiological encoding of complex acoustic spectra to the task of representing the sound systems of individual languages. Another pro-seminar, *From Cells to Semantics,* will engage computational modelers, linguists, and psycholinguists in the problem of encoding richly structured representations. Co-PI Lidz piloted such a seminar in Spring 2007 along with a developmental psychologist and a philosopher, focusing on number and quantification. This course drew on research from animal behavior, cognitive development, cognitive neuroscience, linguistic theory, logic and mathematics, psycholinguistics and psychophysics, addressing the question of how cognitive mechanisms for representing quantity shape the lexical representation of quantification in natural language. Because the mechanisms for representing quantity are evolutionarily ancient (found in insects and primates), their role in linguistic representations can be assessed from an evolutionary and developmental perspective. Second, findings about the neuroanatomical structures implicated in quantity representations offer an initial foothold on the problem of neural encoding of semantic representations. The course was a success, serving as a springboard for several new research projects and illustrating how to integrate research from different disciplines. Critically, some of the students in that course, while not explicitly working on number and quantification, have begun projects that use techniques learned in that course, illustrating the benefit of having students step outside their methodological comfort zones.

**Translational Activities: Research Proposal.** By the end of the first year of IGERT support students will develop a formal interdisciplinary research proposal, building upon the experience gained through the IGERT fellowship proposal, and drawing on the interdisciplinary coursework. The proposal
will be developed under the close supervision of the primary advisor and the co-advisor, and will be evaluated like a research grant proposal. We require the integration of ideas from multiple disciplines and a clear communication of how the multidisciplinary approach will enable the proposer to solve questions that are not addressable from a single disciplinary perspective. The process of proposal development will build the trainee’s ability to communicate across disciplines and also strengthens research ties among the faculty, providing the basis for sustainable research projects and future training opportunities.

**TRANSLATIONAL ACTIVITIES: ADVANCED ROTATION.** Following advancement to PhD candidacy the student will carry out the research project in a non-home department host group for at least half a year. In contrast to traditional lab rotations in physical sciences, where beginning students carry out assigned research in similar lab environments, our trainees will be ‘advanced rotators’ who take primary responsibility for developing their project and will use the rotation to shape their dissertation research. Advanced rotators will be paired with beginning students in the host lab, providing experience to both students in cross-disciplinary collaboration and providing valuable mentoring experience to the trainee.

**TRANSLATIONAL ACTIVITIES: RESEARCH SEMINAR.** A lunchtime IGERT Research Seminar will focus on student research presentations to the whole IGERT group. The research seminar will alternate ‘background’ and ‘news’ weeks, and will develop students’ ability to move comfortably between the details of their specific projects and the broader issues that they bear on. As an antidote to internal parochialism we expect students to present a seminar explaining why “their field” considers a problem to be important. Presentations also serve as models for students writing their initial IGERT admission or research proposals and will develop the skill of pitching a talk to the interests of different fields; this is a key component of tailoring a body of research to a specific journal audience as discussed above.

**BROADER IMPACTS: OUTREACH.** The undergraduate and high school outreach activities already underway or being developed (see C7 for details) serve multiple goals. They address acute minority under-representation in cognitive science research at an earlier level (i.e., the PhD application stage is recognized as too late); they provide models of ‘problem solving across the curriculum’ for high school students. In addition, they will provide IGERT trainees with experience in developing broadly accessible instructional materials and in mentoring students from diverse backgrounds. For example, in collaboration with Northwood High School, a 60%-minority population high-school in Silver Spring, MD, the IGERT trainees will participate in bringing their cutting edge research on language to students who would otherwise not be exposed to the language sciences. Interactions with the AP psychology class will consist of laboratory demonstrations coupled with problem-based learning sessions. Trainees will develop interactive instructional materials which help students to pair appropriate research methods to problems (see attached letter from Mr Carlos Montalvan of Northwood HS).

In addition to the diversity-focused outreach activities (see C7), many undergraduate students already gain research experience in the participating laboratories. For example, in just the 3 labs in the Infant Studies Consortium (Woodward, PSYC; Newman, HESP; Lidz, LING) around 40 undergraduates are engaged in research each semester.

We also envision significant outreach to the Deaf community in partnership with colleagues at the NSF sponsored Science of Learning Center ‘VL2’ (‘Visual Language and Visual Learning’). This center is devoted to understanding visual languages such as ASL from neural, developmental, behavioral and instructional perspectives. The Center is staffed by researchers from across the country, but the focal campus is Gallaudet University in Washington DC. Gallaudet currently does not have programs in either cognitive psychology or in computational areas that can support the VL2 program. In collaboration with the PI of VL2, we plan to make our course offerings, Winter Storm, and the other translational offerings of the IGERT available to Gallaudet students. (See supporting letter from Dr. Thomas Allen)

**BROADER IMPACTS: INTERNATIONAL PARTNERSHIPS.** The international partnerships with India, Brazil, and Japan play an important role in expanding the reach of interdisciplinary research on language to underrepresented and low-density languages. These partnerships also allow trainees to develop valuable skills in building new connections and working in unfamiliar environments. The different partnerships present different kinds of challenges to collaboration, but all offer the same potential for building international communication skills across disciplines.

The particular language groups chosen reflect a reasonable sample of the variability in human languages and a cline of similarity to English and to each other. Brazilian Portuguese (BP) is a Romance language, which is relatively similar to English. The particular differences between English and BP in morphological structure and in morphosyntax enable examination of relatively fine-grained differences across languages. Japanese and the Dravidian languages spoken in South India represent the other
extreme. These languages are globally quite different from English, but are about as similar to each other as English is to BP. Hence, research here enables us to identify the psychological consequences of large scale differences (from English and BP) in addition to fine-grained differences (e.g., between Japanese and Kannada). The North Indian languages are more closely related to English (they are Indo-European) and so can provide another dimension along which small scale differences can be manipulated. In addition, these languages differ along a scale of documentation and availability for computational tools. Whereas Japanese is both well studied and well represented in electronic media, BP and the Indian languages are considerably less well understood. While there is, of course, a rich tradition of grammatical description on Indian languages, there is virtually nothing reflecting the cognitive science perspective on these languages (other than what we ourselves have produced). With respect to electronic representation, materials in Indian languages are considerably less available on the Internet. Consequently, there is a significant need for tools that can build corpora, translation tools, electronic dictionaries, etc. from small amounts of data, presenting a clear and addressable challenge (see C9).

**Broader Impacts: Multi-institution Impact.** Our goal of sustainable change in the science of language across institutions is supported in a number of ways. (i) Students and faculty from other universities will be invited to IGERT activities, as discussed above in reference to our collaboration with the VL2 Center. (ii) There is high demand for graduates with the hybrid skills provided by this IGERT, especially in SLA, speech pathology, and linguistics departments. Trainees will be well prepared to extend our strategies to their new employers. (iii) The Maryland language community already enjoys high visibility, due to its reorganization of the role of the Linguistics Department and the growth of CASL and the SLA PhD. We will use the IGERT to further publicize “the Maryland model” by presenting a series of 4 interdisciplinary symposia at major professional meetings, related to the topics of our proseminars. We will also make teaching materials and course syllabi available through our web portal.

**Environment.** The success of a project like this depends on a conducive intellectual and physical environment. There is a vibrant intellectual community with collaborations across five colleges. We already have space for multidisciplinary proseminars and the Winter Storm. The physical environment has been designed with collaboration in mind. For example, the Cognitive Neuroscience of Language Laboratory (LING) is a 5000 sq. ft. facility where all resources are shared across 6 faculty members. Students are mixed across specialties, with generous space for small meetings that is in constant use, and space is explicitly set aside for researchers from other departments who come to work with the brain recording facilities. The Computational Linguistics Laboratory is a state of the art computing facility that already co-locates students from Arts and Humanities and the Computational and Information Sciences. These spaces have extra capacity for collaborators from other departments. We are requesting funds for an SLA laboratory, equipped for behavioral experimentation and a variety of analysis methods, which will allow these colleagues to supplement the facilities already afforded by the infant and child language development laboratories in the Linguistics and Psychology departments.

5. **Organization, Management, and Institutional Commitment**

**PI and Staff.** The organizational structure of the project is outlined above in Figure 1 (p. 4). Dr Colin Phillips will direct the project. His responsibilities include liaison with NSF, coordinating student, faculty and staff activity, and supervising recruitment. He will coordinate with each student’s home department to report on student progress, and to ensure a smooth funding stream during each student’s career. He is also the primary point of contact for the evaluation consultant, who will also report to the Executive Committee. Dr Phillips has extensive administrative experience as the co-director of the Cognitive Neuroscience of Language Laboratory, which houses approximately 40 students, faculty, and research staff. He is also well placed within relevant administrative units, serving on the Executive Committee and chairing the Curriculum Committee of the NACS Program, and serving on the UMd Research Council. The PI will be assisted by staff support, consisting of an administrator, a lab technician, a post bachelor fellow, and our evaluation consultant. The administrator is responsible for student record keeping, course, seminar, rotation and meeting scheduling, and financial management. The post BA student supervises general IRB accounting as well as serving as a ‘roving’ technical support person, while the lab technician is primarily responsible for supporting our major research instruments. Information coordination and collaborative management will be supported by an on-line portal for the project (through Blackboard), which we have successfully piloted during the development of this proposal.

**Executive Committee.** The PI will be supported by an Executive Committee (EC) consisting of 8 members: the PI, 1 further Linguistics co-PI, 1 SLLC co-PI, 1 Psychology co-PI, 1 member for CompSci or
ElecCompEng, 1 member for HESP, and 2 students in rotation across departments. The composition of the committee ensures inclusion and fair distribution of resources. The EC will meet monthly. Each member of the EC will also be assigned responsibility for the smooth functioning of specific aspects of the program. The PI will be the point of contact between the NSF, and relevant UMD departmental and upper administrative bodies. One member will head the Recruitment and Admissions Committee. One EC member will be responsible for ensuring adequate staffing for the proposed courses. A faculty/student dyad will be responsible for coordinating topics and student/faculty leaders for the Winter Storm. The final format of Winter Storm will be approved by the entire EC. One EC member will ensure the smooth running of laboratory rotations and adequate outreach participation, and another faculty/student dyad will be responsible for the proseminar. The international partnerships will initially be coordinated by the primary initial contacts for each country, but the aim is to broaden responsibility as the partnerships develop. The EC members will coordinate activities with team-leaders for the individual research themes, who will be chosen annually.

Recruitment & Admissions. A 5-member committee representing multiple disciplines will be responsible for recruitment and admissions activities. This committee is charged with implementing the general and unit-specific recruitment plans (see C7 and C10 for details), securing ever-improving pools of applicants to the participating programs, and fairly allocating IGERT stipend support. This committee will aim for departmental and ethnic diversity among IGERT trainees, weighing these factors in funding decisions, in combination with the other ways in which a student contributes to the project’s goals.

Student Committee: a representative committee of 6 students will assist in the planning of major project activities, including outreach, Winter Storm, and symposia, and will provide student input on potential obstacles to the success of the project.

Student Progress. Two mentors will agree to supervise each IGERT student from the proposal writing stage through laboratory rotation, at which point they may be joined by the head of the non-host laboratory, if different. The PI and the home advisor will ensure consistency between IGERT progress and the requirements of each student’s home department. Student progress for all IGERT fellows will be tracked semi-annually against a series of milestones, and continued IGERT support will depend on successful attainment of milestones (e.g., complete rotation research proposal proposal prior to 2nd year of IGERT support). Student progress will be reviewed annually at faculty meetings that are open to all faculty, but must be attended by the Executive Committee and the student’s IGERT advisors. This yields evenhanded oversight and provides a general picture of how all students are doing which can lead to retrofitting the program to better serve student needs.

An IGERT-wide council will meet at the beginning of each semester to discuss policy and the ongoing progress of the project. One meeting will be held after the Winter Storm, with another at the beginning of the academic year. The Winter Storm meeting is devoted to evaluating the last season’s courses and the Winter Storm, setting the topic for the next year’s proseminar, proposing and ratifying the course roster, and reviewing evaluation tasks for the coming semester. The beginning of academic year meeting will address recruitment goals and action plans, will discuss topics for the upcoming Winter Storm, and will review program objectives for the year. We will invite the PI and faculty from Gallaudet’s VL2 Science of Learning Center to participate in these semi-annual meetings (and we have budgeted funds for sign language interpreters.)

Advisory Board. In addition to our internal management, we have formed an Advisory Board that will meet once per year in the spring. The team will be furnished with written research materials including publications, and results from all internal assessment activities. They will listen to a morning’s worth of research presentations and then spend the afternoon interviewing students, faculty, and our executive committee. They will write report to be presented to the executive committee and shared with the UMd senior administration. The following distinguished scientists from across our disciplines have all agreed to serve: (i) Mark Johnson (Professor, Brown U), a computational linguist who has directed an IGERT; (ii) Susan Gass (Univ Distinguished Professor, Michigan St U), an expert on cognitive aspects of SLA; (iii) Greg Hickok (Professor, UC Irvine), a cognitive neuroscientist with expertise in sign language research; (iv) Maria Polinsky (Professor, Harvard U), an expert on language diversity and fieldwork, with additional expertise in psycholinguistics and heritage languages; (v) Mabel Rice (Distinguished Professor, U Kansas), a leading figure in research on neuro-cognitive disorders and language acquisition.

Institutional Commitment: The U of Maryland has a strong record of supporting interdisciplinary research on language, and has made language and cognition an institutional priority at the highest level. The President of the University has designated Language, Cognition, & Culture as one of the University’s
strategic priorities, the Vice President of Research has appointed co-PI Weinberg to lead the effort to translate this strategic plan into additional programs and centers, and this IGERT is seen as part of this effort. In addition to targeted faculty appointments, the College of Arts and Humanities (ARHU) and the Graduate School have supported a series of facilities enhancements and reconfigurations that have fostered far greater collaboration among research groups. Dean Harris has committed to securing space enhancements for the personnel and research activities of the IGERT, and will also support a new cross-departmental faculty line in computational modeling in connection with the IGERT, in addition to existing commitments to new positions in Second Language Acquisition and a new Language and Logic focus area that spans Linguistics and Philosophy. Dean Montgomery of the College of Behavioral and Social Sciences has committed to fund at least 50% of a computational neuroscience position (the other 50% will come from a NACS member department). He is supporting vigorous growth in the Psychology Department, with resources already committed for 6 new hires this year, and strong support of continued aggressive hiring (adding up to 12 more faculty) over the next 5 years. Among these, 2 in the coming year and likely more in future will be dedicated to the cognitive or neural sciences. He has also allowed the program in Neuroscience and Cognitive Science to hire a half-time administrator to support group initiatives involving faculty members from the program. The University will additionally support two new graduate student lines for non-citizens who will be ineligible for NSF support. More specifics can be found in the Deans’ attached support letters.

**Potential Obstacles.** Faculty in this IGERT are well funded and busy, and their home departments make many demands on their time. Although the project is based upon a network of connections that has been developed over a number of years, we recognize that full commitment from all participants cannot be taken for granted. Two main features of our plan address this concern. (i) As we have done throughout the planning of this project, the PI and other project leaders will devote much effort to fostering personal connections with all participating units and individuals, emphasizing two-way communication: we are advocates for the project’s benefits to individuals and departments, but we have also learned much by listening, e.g., leading to unit-specific variants on our recruitment plan. (ii) In order to maximize the impact of IGERT funds, no funds will be committed to individuals, units, or projects in advance. Requests for funds will be tied to commitments to contribute to project activities. These efforts set the stage for the continued feasibility of the program at the departmental level, and for the development of future initiatives. This is why we have specified departmental relations as one of the major duties of the PI and EC.

A second potential obstacle is that the IGERT has so many moving pieces. Our antidote to this problem is an active executive committee, with each member having a specific coordinating assignment and regular opportunities for advice and monitoring in terms of monthly meetings.

6. **Performance Assessment/Project Evaluation**

**Objectives.** The assessment plan stems directly from the goals of this proposal. We claim that we can train students capable of high-quality multidisciplinary research through a combination of new and revised courses and seminars plus hands-on experiences supervised by researchers from multiple disciplines. A further claim is that this type of training will fill an obvious need and be appealing to both students and employers from inside and outside of academia, enhancing recruitment and job placement. Three levels of evaluation are required. We need to monitor whether we did what we promised in terms of implementing the required elements of the program, e.g., offering courses, organizing rotations. This is documented by a quantitative evaluation. We must also document the impact of our programs. An external measure of success at producing students trained across the disciplines could be the number of papers presented at conferences or papers written for journals in multiple fields by a given student. We also want to document correlation or causation between what we are doing and these outcomes. For example, did students benefit from the multidisciplinary courses? Were the courses accessible to a diverse population, without diluting the experience for specialists? Were these courses helpful in preparing for hands-on work or did students only “get it” once they had had these experiences? Understanding these factors will help us to more finely tune the program. In order to enhance prospects for sustainability, we will also make these evaluations available as part of a yearly report to our upper administration, to keep them aware of and excited about our accomplishments. We will use both qualitative and quantitative methods as discussed below.

**Implementation.** The evaluation will be carried out by a 7-member evaluation committee consisting of the PI, 2 co-PIs (rotating), 2 non co-PI faculty on the project, and 2 students. This committee will be supported by Ms. Sharon La Voy and a graduate student in her office. Ms. La Voy is the Director of
Assessment in the University’s Office of Institutional Research, Planning & Assessment (OIRPA), and has extensive experience in designing assessment projects in higher education settings. She has designed numerous surveys and focus group protocols, and has implemented them in diverse settings. We have selected an evaluation practitioner rather than a faculty member whose focus is in advancing the theory of evaluation. We also want someone with university-wide standing, again with an eye to the sustainability of the program. The evaluator will compile independent reports to the evaluation committee. Results of the report with additional recommendations by the evaluator and the evaluation committee will be disseminated to the IGERT groups as a whole on a semester-by-semester basis. These evaluations will also form the basis for reports to NSF, and will be used by the Advisory Board. The first step in the evaluation, at the very beginning of the project, will involve creation of a baseline dataset, that can be used as a point of comparison for subsequent evaluations.

I. Documenting Implementation: Doing what we promised
   a. Did we provide activities to prepare students for multidisciplinary thinking and collaboration?
      - Which multidisciplinary courses did we offer?
      - How broad was participation in proseminars? Did the instructors reflect disciplinary diversity?
      - Did we track formulation, acceptance, or completion of projects for advanced rotations?
      - Did students participate in seminars beyond their home departments?
      - What was offered during each Winter Storm? Who participated and how?
      - How many international collaborations were formed and completed?
   b. Did we recruit a cohort of diverse, highly talented students to the program?
      - How does the caliber of incoming students (GPA, GRE, etc.) compare to baseline data?
      - Are numbers of IGERT-relevant applicants increasing in participating programs?
      - What specific outcomes resulted from targeted recruiting efforts, e.g., minority recruitment? Have our deaf colleagues remained with us?
      - Are students reaching project milestones on time? Are students productive (presentations and caliber of venues; papers submitted or published, a more delayed measure)?

DATA SOURCES: Implementation evaluations force researchers to think about measurable outcomes from the outset and to document those outcomes as the projects proceed. EC members will provide the team members with lists of specific plans with milestones to be met on a semester-by-semester basis. Much data collection and tracking will be done using our web portal.

ANALYSIS STRATEGY: Data will be compared to the planned and scheduled activities. The outside evaluator will compile a comparison report to be distributed to the evaluation team and project administrators. They will also compile recruitment and productivity tables.

II. Documenting Impact
   a. Did we produce researchers with multidisciplinary focus?
      - Does student and faculty work cite papers from multiple disciplines?
      - Are students and faculty presenting or publishing in multiple fields?
      - Do IGERT participants publish with faculty outside their home department?
   b. Does our program fulfill a recognized need inside and outside academia?
      - How is our program affecting recruitment? (see above)
      - Who is hiring our students? Is placement positively influenced by students’ training?
   c. Are we training international citizens?
      - What types of activities did students engage in while partnering in foreign labs?
      - Did lasting collaborations follow these experiences (e.g., papers co-authored)?
      - Did the project broaden the scope of cross-language research among team members?
      - Did foreign students apply to, visit, or join departments in the US?
   d. Are we changing models of “business as usual” at Maryland and across the nation?
      - Did the IGERT encourage further university investment in similar projects? (E.g., investment in faculty, seed money for center proposals, changes in departmental requirements.)
      - Do we see hiring trends related to IGERT goals. (E.g., Linguistics departments now commonly seek candidates with both experimental and theoretical linguistics training. This was not the case 15 years ago. Will we see calls for natural language engineers with linguistics training?)
III. Correlating Impacts with Programmatic Features

Given the small number of students and relatively small number of faculty participants, we have been advised that we can draw a richer picture from focus groups, exit interviews, and other qualitative measures. These will consist of questions like the following:

a. Assessments of transformational aspects of the program (for both students and faculty)
   - Were innovations introduced into classroom and lab offerings? Present evidence that students were thinking in different ways, that proposals were translational.
   - Did students feel prepared for the challenges of the program? Could they follow the courses outside the home department? Was the sequencing of activities appropriate?
   - How was the task of producing challenging courses for a mixed audience met?
   - Did faculty provide models for collaboration? Was new collaborative research undertaken?
   - Where are the knowledge gaps?
   - Were students able to absorb/provide expertise from areas outside their home discipline when working on advanced rotations or overseas on extramural projects?

Qualitative data from these methods will be analyzed for common themes across participants, and reported in a narrative. Special attention will be paid to themes that cut across participants (faculty, students) and that diverge among participants. For example, has the program had a strong impact on the students in the program, but little impact with faculty? Or did it impact certain programs more directly than others? We will use the results of both the quantitative and qualitative data provided to refocus the program as needed as well as to report on success. This will be facilitated by the expectation that the co-PIs serve on the evaluation committee, and that evaluation lessons will guide program planning.

7. Recruitment, Mentoring, and Retention

   General Recruitment - Promoting ‘Language at Maryland’. Recruitment is an important component of the plan for our IGERT, both because of the need to attract talented US students to all participating programs, and also because of the goal of promoting our model for integration in the language sciences. In our experience, most of our students and also our colleagues at other institutions are aware of a part of the language community at Maryland, but have less awareness of the breadth of connections among areas. In order to address this shortcoming we will devote particular attention at the start of the IGERT project to developing unified recruitment materials (electronic and print) that promote ‘Language at Maryland’ and can be used across all participating units to leverage the strengths of other units. At the same time, extensive discussions during the planning of this project have shown us that the different participating units each face different recruiting challenges that require variations on the unified strategy. The specific contexts in each unit are discussed in the recruitment history pages in C10 below. The Baggett Fellowship Program, an endowment from a satisfied former undergraduate that the Linguistics Department has designated entirely for supporting intensive undergraduate and post-baccalaureate research training, also supports undergraduate research involvement as a recruiting tool.

In addition to our overall graduate recruitment strategy and our efforts to engage younger students (below), we have an opportunity for targeted recruitment of minority students through the recently developed Atlanta Recruitment Day organized for the College of Arts & Humanities (ARHU) by Prof. Heather Nathans, in conjunction with the Atlanta University Center (a consortium of Clark, Morehouse, and Spelman). Prof Nathans’ team makes literally hundreds of individual phone calls to AUC faculty and students each fall in advance of this event, which takes a dozen UMd faculty to Atlanta. The event has yielded tangible recruitment results for a number of ARHU departments, and we aim to extend this to cover additional IGERT-associated departments. The university also provides matching funds to support recruitment of minority graduate students.

At the undergraduate level the University of Maryland has a large pool of talented minority students, which provides a valuable opportunity to inspire students to pursue STEM careers. In recent years more minority PhD recipients earned their bachelor’s degree at Maryland than at any other non-HBCU in the nation (#1 Harvard, #2 Maryland, NSF-data). The program will benefit from a partnership being developed with Maryland’s McNair Scholars Program, which prepares highly qualified minority students for doctoral education, in programs lasting from one summer to 2 years (Director, Dr Wallace Southerland). A number of IGERT team members already participate in summer internship programs targeted at minority students, such as one that is under the auspices of the Atlantic Coast AGEP program in the College of Behavioral & Social Sciences, and another organized by the NACS program. IGERT
is a summer statistics workshop held at U of N Carolina. In addition, the Office of Recruitment, Retention and Diversity in the Graduate School (see attached letter from Assoc Dean Davis) sponsors PhD Completion Project events for all graduate students, which present bi-monthly workshops to up to 300 students on various aspects of thesis writing and professional development.

MORE ON OUTREACH AND DIVERSITY. Our team has begun to implement a series of undergraduate and high school outreach activities that are designed to address the acute underrepresentation of minorities in cognitive science. We recognize that by the time students reach their senior year of college it is likely too late to excite them about a career in science, and so we are targeting students at an earlier stage.

At the high school level, IGERT team members are already extending existing UMd partnerships with two local high schools with 60-70% minority enrollments (Northwood HS, Silver Spring; Eleanor Roosevelt HS, Greenbelt), providing curriculum enhancement and internships. Team members have designed outreach activities with Ms Asewe Onyango and Mr Carlos Montalvan of Northwood HS (see attached letter), aimed initially at integrating language science into the AP Psychology curriculum, including field trips in Spring and Fall ’07 and school visits starting in Fall ’07. In the longer term, the aim is to use language as a model of ‘teaching across the curriculum’, as an antidote to the fractionation of much high school learning. Student interns from Roosevelt HS have begun yearlong internships in a number of IGERT labs, following initial successes in co-PI Woodward’s lab in 2006-2007. Graduate trainees have played critical leadership roles in all of these activities, which we have used to provide valuable experience in teaching and mentoring. Numerous team members are also involved in community outreach activities through UMd’s annual Maryland Day, which attracts up to 70,000 visitors to campus each spring, such as through a Hear the Turtle! tent that showcased research in hearing and speech.

8. Recent Traineeship and Results from Prior NSF Support

This IGERT project does not attempt to create a rich training environment from scratch. Rather, it builds upon two major initiatives that have been a decade in the making, and upon some more recently arrived faculty with rich training experience from other institutions.

(i) A number of the IGERT faculty in sound/speech are also members of the Center for Comparative and Evolutionary Biology of Hearing (C-CEBH), an auditory neuroscience research center that has been supported by an NIH training grant since 1994 (PI, A. Popper, Biology) and by an NIH P30 ‘core’ award since 1997 (PI, R. Dooling, Psychology). C-CEBH not only provides a fine model for collaborative training, it also led the creation of the interdepartmental NACS program. NACS provides many valuable components for this IGERT, in a sustainable fashion: a flexible PhD program, a series of core courses, an innovative ethics training program, frequent talks and workshops, increased opportunities for faculty interaction, and more recently a Certificate Program that provides IGERT trainees with official recognition of their additional coursework. NACS has also demonstrated the importance of individual partnerships at the student level, such as a recent project comparing word and face perception involving students from linguistics, engineering and psychology.

(ii) Maryland’s Linguistics PhD program is an experiment in reorganizing a traditional program to focus on interdisciplinary training and outward-looking collaboration, with changes ranging from course requirements to office space configurations. This reorganization was viewed with a mix of enthusiasm and skepticism around the country, but it has led to dramatic gains in recruitment, retention, productivity, and placement among students (see C10), and also coincided with a growing demand for graduates with the broad training provided here. It has also fostered the growth of language research groups in other departments, and the formation of the Center for Advanced Study of Language. An important lesson from these efforts is the value of creating support networks for students who are relative newcomers to computational or experimental research. A number of the program’s recent PhDs are students who entered with minimal background in experimentation or computation and went on to become successful independent scientists in those areas.

(iii) Two co-PIs of this project are relatively recent senior appointments who have substantial experience in training or program building at their previous institutions. Mike Long heads the School of Languages and created the SLA PhD program at Maryland. Prior to this he was a founder and chair of the SLA program at Hawaii, which has long been recognized as the leading program in that field. Amanda Woodward is the Graduate Director for NACS and is the creator of the interdepartmental Developmental Science Field Committee at Maryland. In her previous position at the U of Chicago she trained a cadre of highly successful PhDs who now hold positions in leading research universities.
9. **International Collaboration**

The team has strong international partnerships with groups in India (Central Institute for Indian Languages, Mysore: CIIL), Brazil (Universidade Federal do Rio de Janeiro: UFRJ, Museu Nacional), and Japan (Hiroshima and Tohoku Universities). These partnerships fulfill a number of important goals for the project. (i) They provide students with access to the wealth of linguistic diversity represented by these partners, with languages varying in different dimensions and to different degrees from English. This allows students to provide a broad linguistic context for generalizations that they might reach about learning or processing mechanisms. (ii) They serve the important goal of broadening the worldwide reach of integrative research on language. It is essential to expand interdisciplinary research on language to countries with limited access to relevant expertise (India, Brazil) or more rigid institutional structures (Japan). Our research problems cannot be solved in the US alone, due to the importance of cross-language testing. (iii) Students will be directly involved in training faculty and students at the partner sites, providing valuable experience of working outside one’s comfort zone, and of developing interdisciplinary links. These skills will serve them well after graduation, when they will be responsible for creating their own integrative networks. Team members have experience with each of these components, which the current project aims to expand.

**INDIA.** The partnership with CIIL in Mysore, India, is especially well suited for the IGERT. Indians speak hundreds of languages, with 24 spoken by more than 1 million people. CIIL is charged by the Indian government to coordinate scientific research on the many languages of India and to promote interdisciplinary research on language. It is engaged in documenting major, minority, and tribal languages, teaching 15 languages to non-native learners, creating content and corpora, and developing machine translation tools for all 23 official languages of India. Co-PI Lidz has worked with CIIL researchers for ten years on first language acquisition in Kannada. Kannada has proven to be an excellent testing ground for hypotheses about language acquisition because it appears on the surface to be highly distinct from English, yet has provided a variety of evidence for parallel learning mechanisms across these diverse languages. Other recent student research projects have involved the Indian languages Hindi (Indo-European) and Malayalam (Dravidian family). Expanded collaboration through this IGERT presents rich opportunities for new infrastructure and psycholinguistic training in India.

An important target for new collaboration with CIIL involves bringing together UMD expertise in computational linguistics with the specific linguistic challenges found in India. Current efforts at CIIL in creating dictionaries, tutoring systems, and machine translation tools could be rapidly advanced by drawing on UMD innovations in these areas. UMD is a leader in Machine Translation and its team has a particular focus on using a technique (‘annotation projection’) that allows for migration of resources (e.g., morphological analyzers, parsers) developed on well studied, ‘high density’ languages like English to less well-resourced languages, given a corpus of direct translations (parallel texts) [54, 55]. An IGERT student and either Amy Weinberg or Philip Resnik will visit India to give a mini-course in foundations of statistical language processing, emphasizing applications to any of the above areas. The UMD team also hopes to engage in joint research on cross-dialectal annotation projection using the extensive corpus resources developed by CIIL. Taken together, these efforts could help to advance computational linguistics research in India, while providing a fertile testing ground for flexible multilingual tools for low-density languages, a major current research interest in UMIACS and CASL.

**BRAZIL.** Our partners at UFRJ are engaged in two very interesting initiatives. The Linguistics program at UFRJ has partnered with the Biomedical Engineering Dept (with help from UMD’s David Poeppel, see attached support letter) to establish neurophysiological studies on language in Brazil. Second, our partners are leaders in Brazil both in experimental psycholinguistics and in research and outreach involving members of Brazil’s many indigenous language communities, particularly in Amazonia. Marcus Maia (see biosketch) has long-standing connections to these communities, and now through the Museu Nacional at UFRJ he is involved in a project that provides college education to members of these groups who have completed high-school level education within their communities. These efforts have already led to a series of undergraduate theses by indigenous students that document their own native languages.

The connection between UMD and UFRJ has developed over a number of years, since one of the UFRJ team leaders was a visiting scholar at Maryland in 2000. UMD researchers and their students have continued to provide guidance as the UFRJ has built its psycho/neurolinguistics research program. In 2006 a group of 6 Maryland students visited UFRJ, where they led an intensive 1-week workshop on topics in linguistics, psychology and cognitive neuroscience together with the UFRJ team. We view this as a model for the kind of training activity that IGERT students will help to lead at our other partner sites. In
the future, we anticipate that IGERT students will travel to UFRJ to conduct experimental research on Brazilian Portuguese, and we also envision that students will be able to gain valuable experience in linguistic fieldwork from UFRJ experts. Students who take advantage of both of these lines of inquiry into their research will have an enviable skill-set that will make them attractive candidates for faculty positions.

JAPAN. Our two partner groups in Japan, at Hiroshima University and at Tohoku University (in Sendai City) are led by linguists who are attempting to create the same kind of collaborative networks in Japan that our team has built in Maryland. Although Japan has strong infrastructure in STEM disciplines, the language sciences have not traditionally been a part of this (a large proportion of Japanese linguists earn their keep by teaching English), and our partners face institutional and cultural challenges to interdisciplinary work that make their task more difficult than ours. Nevertheless, our partners Hiromu Sakai and Masatoshi Koizumi have made impressive progress, and have been very active in organizing interdisciplinary workshops on language that bring together researchers from diverse fields, and in writing grant proposals to support collaborative research. They are emerging as leaders in psycho/neurolinguistics in Japan. Our group has built ties with Japan over a number of years, has supported student exchanges and collaborative research, and Maryland students have contributed to the training of Japanese researchers. In one example, UMD student Robert Florentino (now an Asst Prof at U of Kansas) spent a summer at Hiroshima U, supported by a small grant from NSF’s EAPSI program, where he developed a series of studies that contributed to his PhD thesis. In another recent example, UMD student Takuya Goro spent much of 2006-2007 at Tohoku U, supported in part by an NSF doctoral dissertation improvement grant, where he conducted ground-breaking studies on cross-language semantic development, while also working to build infrastructure for language acquisition research in Sendai, in the form of close partnerships with preschools and methods training for Tohoku U students and research staff. In the context of this IGERT project we are keen to broaden the scope of the collaborations with Japan to include more UMD research groups, particularly the Second Language Acquisition group. Both Japanese partners provide an environment where our students will be well supported (see support letters).

A notable feature of the Japanese partnerships is that both groups are actively seeking funding for reciprocal support, through the Japanese counterpart of IGERT awards. The Hiroshima group already submitted a proposal this year, which narrowly missed out on funding, and will try again next year.

PREPARATION. One faculty member will visit each partner in the first year of the project (2 to India - 1 experimentalist, 1 computationalist), to lay the groundwork for subsequent student visits, which will include preparatory and longer visits (details in Budget Justification). IGERT trainees will compete for the opportunity to visit foreign partner sites. Trainees will write a 3-4 page proposal describing the particular research they hope to conduct. This proposal must include a discussion of how the project meets the broader goals of the IGERT, especially what expertise will be exported and what new scientific knowledge will be imported, and must also describe the educational benefit to the trainee and to collaborators at the partner institution. Finally, the proposal must include a discussion of the Broader Impact of the proposal, using NSF’s criteria for this category. The application must also include a letter of support for the project from the US and Foreign mentor, detailing how the project can be feasibly completed in the time allotted. Proposals will be selected for funding by the IGERT Executive Committee.

All IGERT trainees will be strongly encouraged to apply for international research experience, and students will be encouraged to articulate ideas conducive to international research and training experiences in their initial application to the IGERT program. As such, interest in the international partnerships will be taken into consideration in admissions decisions. Because all aspects of the program are focused on finding solutions that are robust to cross-linguistic variation, we do not anticipate difficulty in finding trainees who are interested in participating in these experiences.

Students will be well prepared for international visits. On the cultural side, trainees will be encouraged to consult with faculty and students who are from or have visited the relevant countries (such people are in abundance in the Maryland language community), and we will help to locate language tutors for trainees whenever possible. Because we are located in the Washington D.C. metropolitan area, this should not be difficult (the Amazonian languages of Brazil are an obvious exception). On the logistical side, all experiments will undergo piloting or role-playing simulations in the US, prior to the trainees’ departure for the host institution. Back-up plans will be formulated in case of equipment failure or other logistical difficulties.
Recruitment and Retention History - LINGUISTICS

**Totals for 2005-2007 (3 years)**

<table>
<thead>
<tr>
<th></th>
<th>All / US-only</th>
<th>Women</th>
<th>Minorities</th>
<th>Other</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td># applicants</td>
<td>152 / 72</td>
<td>15</td>
<td>133 / 56</td>
<td>289 / 132</td>
<td></td>
</tr>
<tr>
<td># applicants accepted</td>
<td>14 / 11</td>
<td>2</td>
<td>24 / 13</td>
<td>39 / 25</td>
<td></td>
</tr>
<tr>
<td># applicants matriculated</td>
<td>9 / 6</td>
<td>2</td>
<td>11 / 5</td>
<td>21 / 12</td>
<td></td>
</tr>
<tr>
<td># students who withdrew</td>
<td>2 / 1</td>
<td>0</td>
<td>3 / 2</td>
<td>5 / 3</td>
<td></td>
</tr>
<tr>
<td># PhDs awarded</td>
<td>11 / 4</td>
<td>0</td>
<td>9 / 3</td>
<td>20 / 7</td>
<td></td>
</tr>
<tr>
<td># currently enrolled (Sep 07)</td>
<td>17 / 10</td>
<td>2</td>
<td>15 / 7</td>
<td>33 / 18</td>
<td></td>
</tr>
</tbody>
</table>

**CONTEXT STATEMENT:** The Dept of Linguistics underwent major changes in faculty, facilities, and program organization in 1998-2005, which led to dramatic gains in the number and quality of PhD applicants starting around 2001, and equally dramatic improvements in the placement of graduates starting around 2006. The changing profile of the department also led to substantial increases in the number of top-notch US applicants. The student body had 10% US citizens in 2001, and currently has 55% US citizens. The department currently competes for the very best PhD applicants in Linguistics, and is most successful in attracting students who seek interdisciplinary training in linguistics, cognitive (neuro-)science, or computer science.

**Placement Data for US Citizens & Permanent Residents:**

<table>
<thead>
<tr>
<th>Name</th>
<th>Year</th>
<th>Institution/Position</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stephan Greene</td>
<td>2007</td>
<td>ATG Inc. (Reston, VA) Natural Lang. Tech. Engineer</td>
</tr>
<tr>
<td>Lisa Pearl</td>
<td>2007</td>
<td>UC Irvine Assistant Professor (Cognitive Science)</td>
</tr>
<tr>
<td>Jon Sprouse</td>
<td>2007</td>
<td>UC Irvine Assistant Professor (Cognitive Science)</td>
</tr>
<tr>
<td>Robert Fiorentino</td>
<td>2006</td>
<td>U Kansas Assistant Professor (Linguistics)</td>
</tr>
<tr>
<td>Scott Fults</td>
<td>2006</td>
<td>U Maryland Postdoc (Computer Science)</td>
</tr>
<tr>
<td>Yeongmi Jeong</td>
<td>2006</td>
<td>Harvard U. Visiting Scientist (Linguistics)</td>
</tr>
<tr>
<td>Utako Minai</td>
<td>2006</td>
<td>RIKEN Brain Sci (Japan) Research Scientist (Psychology)</td>
</tr>
<tr>
<td>Ilhan Cagri</td>
<td>2005</td>
<td>U Maryland Research Scientist (Middle Eastern Langs)</td>
</tr>
<tr>
<td>John Drury</td>
<td>2005</td>
<td>McGill U (Canada) Postdoc (Communication Sci &amp; Disorders)</td>
</tr>
</tbody>
</table>

Placement data for non-US citizens is also relevant for this department, since most recent graduates were foreign students who entered the program in 2000-2002. Four students obtained tenure-track faculty positions (at Northwestern U., Baylor U., Middlebury College, U. of Ottawa), five obtained research scientist or postdoc positions at research universities in the UK and Japan, including a Marie Curie fellowship at UC London, and two took non-permanent teaching positions at Pusan National U in Korea and Nehru University in Delhi, India.

In comparison to NSF’s national data on Linguistics PhDs, the UMd program has a more even gender balance (US average: 65% female), a more even balance of US/international students (US average: 29% foreign), and a similar percentage of minority enrollment (US black/Hispanic average: 7%). Retention rate is 75-80%, and median time to degree is 5.0 years, which is significantly better than national averages.

**EVIDENCE OF SUCCESS IN GRADUATE TRAINING:** Students in the Linguistics Dept have become prolific in research, in 2003-2006 generating 220 refereed and invited presentations, 50 published or submitted journal articles, and 85 chapters and proceedings papers. Many students pursue interdisciplinary training, e.g., 10 are currently pursuing the new Certificate in Neuroscience & Cognitive Science, which requires additional coursework outside the department. Many graduates are employed in positions where they are expected to bridge different areas or departments.

**EVIDENCE OF POTENTIAL IGERT APPLICANTS:** The department attracts a large and highly qualified pool of potential IGERT trainees. In recent years a majority of the ~30 finalists for admission have been US students who are specifically attracted by Maryland’s interdisciplinary strengths and by the possibility of additional training through the NACS Program. Among US students entering the program in the past 3 years median GRE scores are 710/750/5.5, and median undergraduate GPA is 3.90.

**MAIN CHALLENGES AND ACTION PLAN:** The main recruiting and retention challenges for the Dept of Linguistics are: (i) attracting well-qualified minority applicants; (ii) competing successfully with traditional linguistics program with long-standing cachet; (iii) fuller integration of computational efforts with other focus areas. Plans for addressing these challenges are integral features of the IGERT project.
Recruitment and Retention History – PROGRAM IN NEUROSCIENCE AND COGNITIVE SCIENCE

<table>
<thead>
<tr>
<th>Totals for 2005-2007 (3 years)</th>
<th>Women</th>
<th>Minorities</th>
<th>Other</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>All / US-only # applicants</td>
<td>127/77</td>
<td>17</td>
<td>112/67</td>
<td>248/151</td>
</tr>
<tr>
<td># applicants accepted</td>
<td>21/17</td>
<td>5</td>
<td>23/19</td>
<td>48/40</td>
</tr>
<tr>
<td># applicants matriculated</td>
<td>8/8</td>
<td>3</td>
<td>10/6</td>
<td>19/16</td>
</tr>
<tr>
<td># students who withdrew</td>
<td>3/1</td>
<td>1</td>
<td>4/3</td>
<td>8/5</td>
</tr>
<tr>
<td># PhDs awarded</td>
<td>7/3</td>
<td>1</td>
<td>4/3</td>
<td>12/7</td>
</tr>
<tr>
<td># currently enrolled (Sep 07)</td>
<td>21/9</td>
<td>3</td>
<td>19/12</td>
<td>41/22</td>
</tr>
</tbody>
</table>

**CONTEXT STATEMENT:** NACS is a cross-disciplinary doctoral program involving 81 faculty from 14 U Maryland departments as well as affiliated faculty at NIH and Children’s National Medical Center. NACS offers interdisciplinary training in several broad areas: systems neuroscience, molecular and cellular neuroscience, computational and cognitive neuroscience, and cognitive science. Within and across these areas are faculty with internationally renowned research programs in vision, audition, sensorimotor integration, synaptic plasticity, language and communication, learning, memory and decision making, and neuromorphic engineering. NACS is a relatively new program, having granted its first degree in 1999. Current students represent 9 diverse disciplines (Psychology, Linguistics, Computer Science, Biology, Kinesiology, Animal Science, Electrical & Computer Engineering, English, and Human Development).

Each student has a home disciplinary department (generally the department of their mentor), but each student completes the NACS curriculum and earns a NACS degree. Students take a series of core courses designed to provide broad training in neuroscience, cognitive science, and computational neuroscience so that they learn to appreciate the breadth of the field, as well as specialized training required to pursue their research interests. The NACS curriculum would dovetail readily with the proposed IGERT training program.

NACS also serves as scientific community for faculty, fostering collaborative research as well as collaborative graduate training. The NACS community meets weekly for a colloquium and lunch, works together at an annual faculty and student retreat, and hosts an annual research day at which students present their work to the broader community.

**Recent Placement Data for US Citizens & Permanent Residents:**

<table>
<thead>
<tr>
<th>Name</th>
<th>Year</th>
<th>Field</th>
<th>Institution</th>
<th>Position</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kelvin Oie</td>
<td>2006</td>
<td>Kinesiology</td>
<td>US Army Research Lab</td>
<td>Post Doc</td>
</tr>
<tr>
<td>Mary Howard</td>
<td>2005</td>
<td>Comp. Sci.</td>
<td>U Maryland</td>
<td>Post Doc</td>
</tr>
<tr>
<td>Shiva Sinha</td>
<td>2005</td>
<td>Psychology</td>
<td>Indiana University</td>
<td>Post Doc</td>
</tr>
<tr>
<td>Kyle Vick</td>
<td>2005</td>
<td>Biology</td>
<td>Shawnee State University</td>
<td>Assistant Professor</td>
</tr>
<tr>
<td>Brenda Benson</td>
<td>2005</td>
<td>Biology</td>
<td>NIH</td>
<td>Psychologist</td>
</tr>
<tr>
<td>Lewis Wheaton</td>
<td>2005</td>
<td>Biology</td>
<td>Johns Hopkins University</td>
<td>Post Doc</td>
</tr>
<tr>
<td>Carol Whitney</td>
<td>2004</td>
<td>Comp. Neuro.</td>
<td>Computational neuroscience research</td>
<td></td>
</tr>
</tbody>
</table>

Placement data for non-US citizens is also relevant for this department, since a significant proportion of recent graduates were foreign students. These students were placed in post docs at major research universities (Boston U, University College London, Harvard Medical School, U Michigan, and Cal Tech).

**EVIDENCE OF POTENTIAL IGERT APPLICANTS:** There is a strong faculty and student presence in NACS from the cognitive, developmental and linguistic sciences. Current students include 10 in Psychology, 2 in Linguistics, 1 in Human Development, 1 in English, and 1 in Computer Science. Faculty and students from these disciplines benefit from the opportunity to integrate this work into the broader context of both cognitive science and neuroscience. Given their cross-disciplinary focus, NACS students would be natural candidates for the IGERT training program, and the NACS training program is a natural complement to the IGERT program.

**MAIN CHALLENGES AND ACTION PLAN:** Challenges for NACS include (1) continuing to recruit well-qualified minority students, (2) increasing representation of students in the cognitive, developmental and linguistic sciences; (3) retaining students and supporting their training despite the distributed nature of the program. The IGERT contributes to each of these needs. IGERT staff will assist in recruiting to NACS strong students with interests in cognition and language, as well as providing focused recruitment for minority students. Some IGERT students will find that NACS offers the flexibility to take best advantage of the IGERT. The IGERT program would also provide a center of mass in fostering a cohort of students, many of whom will likely be in NACS, and thereby contribute to cohesion in the training program.
Recruitment and Retention History - COMPUTER SCIENCE

<table>
<thead>
<tr>
<th>Totals for 2005-2007 (3 years)</th>
<th>Women</th>
<th>Minorities</th>
<th>Other</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>All / US-only</td>
<td>300/58</td>
<td>75</td>
<td>1184/248</td>
<td>1556/373</td>
</tr>
<tr>
<td># applicants accepted</td>
<td>51/27</td>
<td>23</td>
<td>198/90</td>
<td>268/136</td>
</tr>
<tr>
<td># applicants matriculated</td>
<td>17/4</td>
<td>6</td>
<td>72/32</td>
<td>95/42</td>
</tr>
<tr>
<td># students who withdrew</td>
<td>UMd data unavailable; minimal AI Group attrition</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td># PhDs awarded</td>
<td>15/5</td>
<td>4</td>
<td>75/14</td>
<td>95 / 24</td>
</tr>
<tr>
<td># currently enrolled (Sep 07)</td>
<td>32/12</td>
<td>14</td>
<td>150/58</td>
<td>198/86</td>
</tr>
</tbody>
</table>

**Context Statement:** The UMd Computer Science Department is ranked 13th in the country by US News and World Report, and the Artificial Intelligence Group 9th. The Department thus competes for the very top candidates nationally and internationally. Figures are for the total department. The AI group is 16% of the department and is the most likely recruitment pool. As is the norm, UMd CS students have to take a substantial load of additional courses, many of which may have minimal relevance to their training in computational modeling. However, the focus of this IGERT is supported by the department’s affiliation with the Institute for Advanced Computer Studies (UMIACS) and with the Program in Neuroscience and Cognitive Science. The NACS program serves a crucial role: students with a “cognitive science” leaning can enroll in NACS and receive a NACS degree, choosing an affiliated advisor from the CS department. This allows them to take a core of cog/neuro courses, including computational neuroscience. They then add a significant component of additional computer science courses and work in the advisor’s laboratory. An alternative is CS affiliation with work on projects through UMIACS. Since its inception, UMIACS was formed to build strong interdisciplinary research programs and cutting-edge infrastructure. UMIACS houses 10 interdisciplinary labs. 3 students listed here are affiliated with the NACS program or UMIACS.

**Placement Data for US Citizens & Permanent Residents: (Students of Dorr and Reggia)**

- Rebecca Green 2005 University of Maryland (Inf. Science) Assistant Professor
- Mary Howard 2005 University of Maryland Postdoc (Linguistics)
- Stacey P. Hobson 2007 IBM Research Scientist
- Shaun Gittens 2007 Auburn University Postdoc (Computer Science)
- Ransom Winder 2007 MITRE Technical Position

It is of note that half of these graduating students are women, which is unusual for a CS program. We also note that Gittens and Hobson are African American. Recruitment rates for both women (42%) and African Americans (9.5%) are above the NSF-reported national averages of 16.7% and 3% respectively.

**Evidence of Success in Graduate Training:** The department has graduated approximately 95 PhD students in the last 3 years. 8 AI students are working in language at companies such as Google and SRI. Another works on computational modeling at the new Howard Hughes Center at Janelia Farms.

**Evidence of Potential IGERT Applicants:** IGERT faculty already have a history of training US students with interest in relevant subjects. For example, Dr. Howard completed a dissertation on brain lateralization and now works on lateralization in auditory processing. Gittens worked on computational models of the development of speech perception. Reggia and Weinberg (Linguistics/UMIACS) co-advised Dr. Suzanne Stevenson who is currently an Associate Professor at the U. of Toronto working on linguistic variables in computational modeling. Among US students entering the program in the past 3 years median GRE scores are (V) 534, (Q) 784, (A) 4.35, and median graduate GPA is 3.63. Students from multiple backgrounds (Linguistics, Computer and Information Science) regularly apply to the Computational Linguistics and Information Processing (CLIP) laboratory in UMIACS and NACS.

**Main Challenges and Action Plan:** The main recruiting and retention challenges for the Dept of Computer Science are: (i) attracting more well-qualified minority applicants; (ii) incorporating a cognitive science focus into the public profile of the department (iii) fuller integration of computational efforts with other focus areas. IGERT related work is a natural recruitment tool for minority populations. The recent addition of a bio-informatics group and publicity around the IGERT should help us to generalize the cognitive and biological focus beyond individual labs to the department as a whole.
Recruitment and Retention History – ELECTRICAL AND COMPUTER ENGINEERING

<table>
<thead>
<tr>
<th>Totals* for 2005-2007 (3 years)</th>
<th>Women</th>
<th>Minorities</th>
<th>Other</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>All / US-only # applicants</td>
<td>839</td>
<td>198</td>
<td>3546 / 309</td>
<td>3744 / 507</td>
</tr>
<tr>
<td># applicants accepted</td>
<td>187</td>
<td>81</td>
<td>910 / 188</td>
<td>991 / 269</td>
</tr>
<tr>
<td># applicants matriculated</td>
<td>97</td>
<td>81</td>
<td>478 / 184</td>
<td>559 / 265</td>
</tr>
<tr>
<td># withdrew</td>
<td>Data not available; no significant attrition in IGERT-related labs</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td># PhDs awarded</td>
<td>12</td>
<td>6</td>
<td>79 / 10</td>
<td>85 / 16</td>
</tr>
<tr>
<td># currently enrolled (Sep 07)</td>
<td>62</td>
<td>35</td>
<td>329 / 84</td>
<td>364 / 119</td>
</tr>
</tbody>
</table>

* includes both doctoral and masters students in Electrical and Computer Engineering

CONTEXT STATEMENT: The close involvement in this IGERT of faculty from the Clark School of Engineering links the project to one of the University of Maryland’s main areas of strength. UMd graduate programs in engineering collectively rank 16th in the nation and 10th among all public universities, according to the 2008 U.S. News & World Report study, and are ranked 6th in The Princeton Review’s 2007 graduate rankings. The programs in electrical and computer engineering both rank among the top 10 among public universities nationwide and 1st among public universities in the Northeast. The Electrical and Computer Engineering program (unlike other participating IGERT departments) includes a substantial number of non-PhD graduate students, and across both masters and doctoral programs US students represent a small fraction of the total enrollment (e.g. 19% of PhD’s awarded).

Students with a desire to do work in neuroscience and cognitive science can enroll in the NACS program but choose their advisor and receive their degree from the Electrical and Computer Engineering department. This arrangement allows such students to take a core of neuroscience and cognitive science courses, including computational neuroscience and signal processing. The students would add to this core a significant number of additional courses in Electrical and Computer Engineering and they would also work in the advisor’s laboratory. Thus they have the benefit of a professionally recognized and accredited engineering degree while still actively pursuing research in neuroscience and cognitive science. One of the currently enrolled US PhD students (Donaldson) is in the NACS program.

EVIDENCE OF SUCCESS IN GRADUATE TRAINING: All of the PhD students supervised by Espy-Wilson, Shamma and Simon have been successfully placed as professors or postdocs or in industry.

Placement Data for US Citizens & Permanent Residents: (Students of Espy-Wilson, Shamma and Simon)
Mounya Elhilali Ph.D. (2004), Assistant Professor, Johns Hopkins U (woman and minority)

Placement Data for International Students (Students of Espy-Wilson, Shamma and Simon)
Maria Chait Ph.D. (2006), Postdoc, CNRS/Ecole Normale Supérieure, Paris. (woman)
Om Deshmukh PhD (2006). Senior Research Engineer, IBM India Research,

EVIDENCE OF POTENTIAL IGERT APPLICANTS: The IGERT faculty in ECE (Espy-Wilson, Shamma, Simon) have a strong track record of training students with interest in relevant subjects. Elhilali and Chait work on auditory encoding in neurons and neuronal assemblies; Juneja, Deshmukh and Pruthi developed computational models for the computer recognition of speech features and landmarks. Thus, there are, and will continue to be, students with relevant interests in the ECE program, although the vast majority of these students are not US citizens. Therefore, the main potential source of relevant IGERT applicants will come (as with Donaldson) from non-traditional sources—students interested in combining computational and systems neuroscience, an important and unusual feature of the UMD ECE group. The international students who will work and study alongside the IGERT trainees will also be an important resource for the IGERT trainees, enlarging and enriching the experience for the trainees and for the international students.

MAIN CHALLENGES AND ACTION PLAN: The main recruiting and retention challenges for Electrical and Computer Engineering are: (i) increasing the number of well-qualified US applicants, and (ii) increasing the number of well-qualified women and minority applicants. The IGERT faculty have a strong record of working with women and minority students, and NACS provides an excellent forum through which to recruit non-traditional engineering students from the U.S—a novel source of graduate students in engineering. One current NACS/ECE student (Donaldson) is an excellent example of this kind of recruitment, his NACS advisors include two IGERT faculty (Shamma, Idsardi). The IGERT admissions group will identify likely sources of crossover students and inform and entice potential applicants into the ECE IGERT group, building on the existing successful model of the NIH-UMd C-CEBH training grant.
Recruitment & Retention History - HEARING AND SPEECH SCIENCES

<table>
<thead>
<tr>
<th>Totals for 2005-7</th>
<th>Women</th>
<th>Minorities</th>
<th>Other</th>
<th>Disabled</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>All/US-only</td>
<td>32/16</td>
<td>7/6</td>
<td>4/2</td>
<td></td>
<td>37/19</td>
</tr>
<tr>
<td># applicants</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td># applicants accepted</td>
<td>7/3</td>
<td>0/0</td>
<td>3/2</td>
<td></td>
<td>10/5</td>
</tr>
<tr>
<td># students who withdrew</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1/1</td>
<td>1</td>
</tr>
<tr>
<td># PhDs awarded</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td></td>
<td>1</td>
</tr>
<tr>
<td># currently enrolled</td>
<td>10/8</td>
<td>1/1</td>
<td>1/7</td>
<td>1/1</td>
<td>11/9</td>
</tr>
</tbody>
</table>

† Matriculated students also include transfers from the clinically-oriented AuD (Doctor of Audiology) degree to the research PhD; these students are not admitted through an additional application process. This is why there are more matriculated students than accepted students.

CONTEXT STATEMENT: Hearing and Speech Sciences (HESP) has 8 tenure track faculty members, and a large cadre of stable adjunct faculty at local research institutions such as the NIH and National Children’s Medical Center. It serves approximately 200 undergraduates, 80 graduate students in clinical education programs (MA in speech-language pathology, AuD in clinical audiology) and 11 PhD candidates. PhD students come through one of three tracks: a traditional PhD program, a clinical PhD program for students who wish to gain a research PhD in addition to a clinical AuD, and the program in NACS. Its last PhD graduate was Celia Bassich, now an Assistant Professor at Towson University.

EVIDENCE OF POTENTIAL IGERT APPLICANTS: HESP programs are ranked by US News; HESP at Maryland ranks within the top 10% of programs nationwide. Like communication sciences and disorders (CSD) programs nationwide, HESP is experiencing a shortfall in applications to the research doctorate. This decline in doctoral applications has been identified as a targeted focus of strategic planning by the NIH, the American Speech-Language and Hearing Association, and the Council of Graduate Programs in CSD (see http://www.capcsd.org/reports/JointAdHocCmteFinalReport.pdf). This shortage has emerged in part, through the increased attractiveness of salaries and positions for clinically-oriented students. However, HESP at UMCP has seen a resurgence of interest in the research PhD in recent years (in 2004 there were only 4 doctoral students in HESP), and the focused research mentoring efforts have led a number of students who entered clinical programs to transfer to research degree programs. Despite the success in attracting such students, many talented, admitted students did not choose to enroll in HESP over the time frame surveyed, in large part due to a lack of attractive and sufficient long-term funding for doctoral students. Thus, the IGERT offers an important means of attracting more talented students to the field, and helping to solve this critical shortage. It is important to note that other ventures that support doctoral students in HESP, such as the NIH-supported training program in Comparative and Evolutionary Biology of Hearing (C-CEBH), have successfully attracted candidates to the department. Finally, faculty position prospects for graduates of HESP are exceptionally promising, given both the program's reputation and the critical nationwide shortage. We note that HESP attracts a large number of female applicants, and thus IGERT support is likely to result in an increase in the proportion of women in the language sciences. Student research productivity at all levels of training in HESP is high, given its clinical focus. In the past five years, students have authored more than two dozen publications and national conference presentations. Productivity of students even within the clinical education tracks is at a level that exceeds that typically seen in research doctoral programs elsewhere. Thus, with appropriate funding, it is likely that HESP could “grow its own” doctoral candidates with excellent further research potential.

MAIN CHALLENGES AND ACTION PLAN: Previous experience shows that the strongest PhD applicants in HESP tend to be students who are mentored through research experiences during clinical programs; the roughly two dozen programs nationwide with visible student research productivity are easily identified. We will therefore target recruitment efforts at these institutions to identify a large pool of potential applicants. Clearly, a targeted need is an increase in the diversity of talented applicants. The department is currently developing and implementing an action plan to attract a broader as well as larger applicant base. We will continue to use HESP’s active and growing participation in diversity initiatives such as the summer research institute for minority students supported by the SBE-AGEP to identify and foster applications from historically under-represented populations. In sum, the integrated Language at Maryland recruitment strategy plus the prospect of attractive IGERT support promises to have a substantial impact upon PhD recruitment in HESP.
Recruitment and Retention History - PSYCHOLOGY

<table>
<thead>
<tr>
<th>Developmental and Cognitive Psychology Programs Totals for 2005-2007 (3 years)</th>
<th>Women</th>
<th>Minorities</th>
<th>Other</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>All / US-only</td>
<td>95/66</td>
<td>14</td>
<td>28/24</td>
<td>124/90</td>
</tr>
<tr>
<td># applicants</td>
<td>10/10</td>
<td>1</td>
<td>1/0</td>
<td>11/10</td>
</tr>
<tr>
<td># applicants accepted</td>
<td>6/6</td>
<td>0</td>
<td>0/0</td>
<td>6/6</td>
</tr>
<tr>
<td># students who withdrew</td>
<td>1/1</td>
<td>0</td>
<td>0</td>
<td>1/1</td>
</tr>
<tr>
<td># Ph.Ds awarded</td>
<td>5/3</td>
<td>0</td>
<td>3/3</td>
<td>8/6</td>
</tr>
<tr>
<td># currently enrolled (Sep 07)</td>
<td>8/7</td>
<td>0</td>
<td>2/1</td>
<td>10/8</td>
</tr>
</tbody>
</table>

Recent Placement Data for US Citizens & Permanent Residents:

- Amber Sprenger 2007 Johns Hopkins Univ. Post Doc
- Matthew Dykas 2006 SUNY Oswego Assistant Professor
- Lisa Murphy 2006 York Comm. Coll. (Maine) Faculty
- Petra Sheck 2006 Center for Adv St of Language Assistant Research Scientist
- Ty Boyer 2005 Indiana U Post Doc
- Timothy Plesak 2004 U Basel, Switzerland Post Doc

The two non-US students earning Ph.Ds in 2005-07 also took scientific jobs, one as a post doc at NIH, the other as post doc at UC San Diego. More recently, recruitment of talented students in the Cognitive area has been augmented by Michael Dougherty’s NSF CAREER Award. Amanda Woodward joined the Psychology Dept. in 2005 and has not yet graduated Ph.D students at UMD. However, her prior record at U Chicago indicates successful placements. Of her 6 doctoral and post-doctoral students (5 women, 1 minority), 3 are now Assistant Professors at research-intensive universities (U Washington, U Illinois, U Minnesota), 1 is a post doc (U Chicago), and 2 have research positions in the corporate sector.

**Context Statement:** In the years reported here, The Psychology Dept. was comprised of 8 diverse doctoral programs. Data are reported for the two that are most relevant to the proposal, Developmental and Cognitive. These programs have been small, with 3 active faculty in Cognitive, and 2 in Developmental. However, strength in these areas is slated to grow along with a vigorous program of rebuilding in the department following a change of leadership. In the past year, the department has undergone a thorough reorganization, and with the strong support of the dean it has embarked on an aggressive initiative to rebuild strength in core areas and interdisciplinary integration alike. As part of this, the department anticipates growing dramatically in size. The department has just hired a developmental cognitive neuroscientist and has 6 additional faculty searches in 2007-2008. A further 12 hires are anticipated in the next five years. Among the current 6 searches are two in cognitive science and neuroscience. In addition, Psychology is active in the search for a shared NACS hire in computational neuroscience, a position that is integral to both the Psychology Dept. and the IGERT proposal. There is focused interest in building in ways that strengthen the department’s connections to the strong existing cognitive science and language communities on campus. The foundations of this initiative are already well established. All of the faculty and many of the students in the cognitive and developmental programs participate in the interdisciplinary NACS graduate program, and engage in collaborations across campus that will both support and benefit from this IGERT.

**Evidence of Potential IGERT Applicants:** Students currently working with Psychology faculty have strong interdisciplinary interests and would be attracted by this IGERT training program. Indeed, 10 current students in the interdisciplinary NACS Program work with Psychology faculty. Woodward trained students at U Chicago in a program intensive in language and cognition, and, given the presence of an IGERT training program, would attract such students at Maryland.

**Main Challenges and Action Plan:** As the department grows, the challenge will be to recruit increasing numbers of students in cognitive, developmental and neural sciences. As part of this, it will be critical to increase recruitment of students from underrepresented minorities. Targeted recruitment efforts will include publicizing the departmental transformation and cross-disciplinary training opportunities, as well as leveraging the broader cognitive and linguistic strengths on campus. The IGERT administrator will provide support for recruitment in these areas, working with program faculty to effectively draw on their professional connections in identifying and recruiting talented doctoral students.
Recruitment and Retention History – SECOND LANGUAGE ACQUISITION

<table>
<thead>
<tr>
<th>Total for 2005-2007 (3 years)</th>
<th>Women</th>
<th>Minorities</th>
<th>Other</th>
<th>Total</th>
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<tbody>
<tr>
<td>All/US-only</td>
<td>All/US-only</td>
<td>All/US-only</td>
<td>All/US-only</td>
<td>All/US-only</td>
</tr>
<tr>
<td>#applicants</td>
<td>82/17</td>
<td>3</td>
<td>28/8</td>
<td>110/25</td>
</tr>
<tr>
<td>#accepted</td>
<td>18/6</td>
<td>1</td>
<td>5/4</td>
<td>23/10</td>
</tr>
<tr>
<td>#applicants matriculated</td>
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<td>#students who withdrew</td>
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<td>0</td>
</tr>
<tr>
<td>#PhDs awarded</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>#currently enrolled (9/07)</td>
<td>11/4</td>
<td>1</td>
<td>3/3</td>
<td>14/7</td>
</tr>
</tbody>
</table>

**Context Statement:** The new PhD program in Second Language Acquisition (SLA) is psycholinguistically and experimentally oriented, its faculty and students focusing primarily on theory and research in adult language learning from a cognitive science perspective. The program aims to produce graduates who are equipped for faculty and research positions in leading universities, research institutes, and government language facilities. The first students were admitted in Fall 2005, just weeks after the program’s approval. Numbers of applicants have risen steadily ever since, totaling 49 for Fall, 2007, of whom six were accepted, four of them US citizens, with four of the six entering the program, two of them US citizens. As the table shows, while applications run approximately 4:1 non-US/US, of the total of 14 students now enrolled, a healthy 50% are US citizens, with an overall 3:1 ratio of women to men. Based on current trends and data from peer programs, total applications are expected to top out at 80-100 per year by 2010, with acceptances still limited to 6-8 per year, i.e., under 10% of applicants, and roughly equal numbers of US and non-US citizens, for a steady state total of 20-25 full-time students in residence.

Despite its brief history, the Maryland program already has a high profile and is attracting applications from the best students within the US and overseas. Those admitted are mostly those also accepted at the current leading program in SLA at the University of Hawai‘i, with roughly half of that subset already opting for Maryland. The Maryland program continues to add tenure-line faculty and relative to its peers it is unusually well placed to leverage close connections with neighboring fields, as reflected in the number of affiliate faculty drawn from Linguistics, Psychology, Philosophy, Hearing and Speech Sciences, Communication, and Evaluation, Measurement and Statistics (EMS), as well as from two major research centers, the Center for Advanced Study of Language (CASL) and the National Foreign Language Center (NFLC). No placement data exist as yet, but second and third-year students are already receiving attractive offers from surrounding institutions. The program anticipates close to 100% placement in research-active universities and in government programs. SLA is a field where the demand for well-trained PhDs currently far exceeds supply, and Maryland graduates are expected to be sought-after.

**Evidence of Success in Graduate Training:** Once again, the newness of the program means that few data are available. However, second and third-year students are already presenting empirical papers at international conferences and starting to submit papers to books and journals. The primary indicators of success will be placement, publication, and research prizes. Current hiring trends indicate high and increasing demand for SLA experts with strong interdisciplinary training in such areas as psycholinguistics or cognitive science, which bodes well for the program’s success.

**Evidence of Potential IGERT Applicants:** Largely due to its research and cognitive science orientation, plus the encouragement provided for students to take coursework in other departments (Linguistics, EMS, and Philosophy being especially popular so far) the program currently has at least four potential IGERT trainees in residence. A steady supply of qualified new IGERT applicants should be readily available. Median GRE scores for US students currently in the program are 655/625/50; the median undergraduate GPA is 3.78.

**Main Challenges and Action Plan:** The main weakness in the program’s recruitment efforts to date (retention has not been a problem) is its relative failure to attract suitably qualified minority applicants. It is hoped that the coordinated recruitment efforts planned by the IGERT will address this concern, including the comprehensive plan for involving minority students in research internships and participation in targeted recruitment efforts (see section C7 and the letter from Assoc Dean Johnetta Davis). The SLA lab that the IGERT will help to build will lead to more opportunities for internships in SLA for undergraduates and high-schoolers. More broadly, the Language at Maryland recruitment strategy will further leverage the strengths of the SLA program’s interdisciplinary connections, driving continued growth in applications.
D. References Cited

<table>
<thead>
<tr>
<th>Boldface</th>
<th>IGERT team member</th>
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</thead>
<tbody>
<tr>
<td>Italics</td>
<td>Trainee supervised by IGERT team member</td>
</tr>
</tbody>
</table>


Thomas E. Allen  
Biographical Sketch

(i) Professional Preparation

Kenyon College  Psychology  A.B., 1973  
University of Minnesota  Educational Psychology  Ph.D., 1979

(ii) Professional Appointments

Gallaudet University  Education, Assistant Professor  1980-1984  
Gallaudet University  Researcher, GU Research Institute  1980-1985  
Gallaudet University  Education, Associate Professor  1984-1988  
Ctr for Assessment and Demogr. St.  Director  1985-1986  
Gallaudet University  Education, Professor  1988-present  
Gallaudet University  Director, GU Research Institute  1996-1998  
Gallaudet University  Dean, Grad Sch & Research  1998-2001  
Gallaudet University  Dean, Grad Sch & Prof Progs  2001-2007  
Gallaudet University  Professor, PI of VL2 Sci. of Learning Ctr 2007-present

(iii) Selected Publications (selected from 214 publications)

5 recent publications related to the current proposal:


5 Additional recent publications:


(iv) Synergistic Activities

- Principal Investigator of NSF funded Science of Learning Center on Visual Language and Visual Learning (VL2). VL2 brings together an international team of researchers and educators to study the acquisition of visual languages among individuals who are deaf, the development of English
literacy for individuals who have no access to auditory input, and the mapping of visual languages to print language. This interdisciplinary research effort is organized around three disciplinary strands: cognitive neuroscience, language structure and the visual modality, and developmental and social processes of language acquisition.

• As Dean of graduate programs at Gallaudet University, oversaw the expansion of graduate degree and certificate programs, including the implementation of new Ph.D. programs in Linguistics and Audiology, new Masters programs in Deaf Studies, Education, and International Development, and new graduate certificate programs in Deaf History, Multiculturalism for Human Service providers, and International Development.

• Led 2 national achievement-testing projects with the population of deaf and hard of hearing students to develop national achievement norms with the Stanford Achievement Test (7th and 8th editions). The development of norms, based on administering a standardized test to a large national sample of deaf and hard of hearing students enables educators to make appropriate comparisons for their students within a national context.

• For 11 years, directed the Annual Survey of Deaf and Hard of Hearing Children and Youth, a project that has contributed to educational policies at the national, state, and local levels regarding educational policy for deaf and hard of hearing students. Since 1968, the Annual Survey has been the only nationally conducted survey that focuses on the educational needs of a subgroup of students with a particular disability.

• Directed a national longitudinal study of deaf students and their school-to-work transitions. This study led to a broader understanding of the difficulties faced by deaf and hard of hearing students as they make the transition from school to work, and described the kinds of services and inter-agency collaborations that facilitated effective transitions.

• Conducted over 50 workshops with teachers, discussing the proper interpretation of standardized test scores for their deaf and hard of hearing children. These workshops presented concepts of validity and reliability to users of achievement test data, and better enabled teachers to understand the limitations of standardized test results for their deaf and hard of hearing students.

(v) Collaborators

a. Collaborators in Past 48 months:

David Corina UC Davis, Linguistics/Ctr for Mind & Brain (VL2 Scientific Management Team)
Guinevere Eden Georgetown Univ., Neuroscience (VL2 Scientific Management Team)
Peter Hauser Natl Tech Inst Deaf, Rochester, NY (VL2 Scientific Management Team)
Marlon Kuntze San Jose State U (VL2 Scientific Management Team)
Jenny Singleton U of Illinois, Urbana-Champaign (VL2 Scientific Management Team)
Jill Morford U of New Mexico (VL2 Scientific Management Team)
Paul Dudas Gallaudet Univ. (VL2 Scientific Management Team)
John McLaughlin Managing for Results Inc. (VL2 Scientific Management Team)
Diane Clark Gallaudet University (VL2 Scientific Management Team)
Corine Bickley Gallaudet University (VL2 Scientific Management Team)
David Boen Delmarva Foundation
Jeffrey Braden University of Wisconsin
Michael A. Karchmer Gallaudet University

b. Own Graduate Advisors

David W. Johnson University of Minnesota
Gregory Maruyama University of Minnesota

c. Advisees:

None. As a faculty member in the Department of Educational Foundations and Research, Dr. Allen’s dissertation advisement was limited to providing methodology advice, and he has never served as thesis advisor. As Dean, by University policy, he does not serve as a member of dissertation committees.
Allen Braun
Biographical Sketch

(i) Professional Preparation
Washington University  English/Biology  B.A., 1968
Rush Medical College  Medicine  M.D., 1980

(ii) Professional Appointments
NIH  Therapeutics  Medical Staff Fellow, 1984-1986
NIH  Nuclear Medicine  Senior Staff Fellow, 1986-1988
NIMH  Nuclear Medicine  Head, Nuclear Medicine, 1988-1991
NIDCD  Voice/Speech  Medical Officer, 1991-1994
NIDCD  Language  Acting Chief, Language, 1994-2003
NIDCD  Language  Chief, Language, 2003-
University of Maryland  Neuroscience  Adjunct Professor, 2003-

(iii) Selected Publications (selected from 75 publications):

5 recent publications related to the current proposal:

5 Additional recent publications:

(iv) Synergistic Activities

- Conducting translational research evaluating pharmacological augmentation of neuroplastic changes in a rodent model of stroke, stroke recovery. Developed a program for MRI imaging of a rodent model for stroke in which patterns of BOLD activity are correlated with immunocytochemical indices of neuronal repair.
• Conducting ongoing studies of American Sign Language processing in deaf subjects and in hearing offspring of deaf parents.
• Language Section provides scientific liaison and support to patient advocacy/stroke recovery groups.
• Conducted neuroimaging research evaluating responses to auditory stimuli in awake behaving monkeys.
• Reviewer: Brain, Science, NeuroImage, Human Brain Mapping, Brain & Language, etc.
• Editorial Board: Neuropsychoanalysis.

(v) Collaborators

a. Collaborators in the last 48 months (selected)
Jose Contreras-Vidal University of Maryland
David Corina UC Davis
Alex Dromerick Georgetown U
Guinevere Eden Georgetown U
Karen Emmorey Salk Inst./San Diego St U
Yasmeen Faroqi-Shah University of Maryland
Susan Goldin-Meadow U. Chicago
Mark Hauser Harvard
Peter Herscovitch NIH
Alan Koretsky NIH
Husseini Manji NIH
Alex Martin NIH
Colin Phillips University of Maryland
David Poeppel University of Maryland
Betsy Quinlan University of Maryland
Nan Ratner University of Maryland
Lalith Talagala NIH
Steven Warach NIH

b. Own graduate and postdoctoral advisors
Harold L Klawans, MD Neurology Residency Director, Rush Medical Center, Chicago
Thomas N Chase, MD Neuropharmacology Staff Fellowship, NINCDS, NIH
Ronald Neumann, MD PET/Nuclear Medicine Residency/Fellowship, DNM, CC, NIH

c. Graduate thesis and postdoc supervision
PhD Student Supervision:
Michele Costanzo PhD Candidate, NACS, Kinesiology, U of Maryland
Trent Bradbery PhD Candidate, Kinesiology, Engineering, U of Maryland
Nuria AbdulSabur PhD Candidate, NACS, Linguistics, U of Maryland
Joe McArdele PhD 2006, Virginia Tech, Postdoc, Language Section, NIDCD
Bruce Swett Predoctoral Fellow 2005-2007, Postdoctoral fellow, Language Section, NIDCD
Omar Ali, Ph.D. PhD 2004, Psychology, American U, Drug Devt Scientist, Cato Research, MD
Lucila San Jose, M.A. Predoctoral Fellow 2002-2004, Ph.D. Candidate, Psychology, Howard University

Postdoctoral Fellow Supervision:
Jiang Xu, MD, PhD Research Fellow (Visiting)
Jed Meltzer, PhD Postdoctoral IRTA Fellow
Chunmiao Wang, PhD Research Fellow (Visiting)
Bruce Swett, PhD Postdoctoral IRTA Fellow
Joe McArdele, PhD Postdoctoral IRTA Fellow
Charles Limb, MD Fellow (2003-2006), Asst Prof, Otolaryngology, Johns Hopkins Sch of Medicine
Stefan Kemeny, MD Fellow (2001-2005), Resident, Neuroradiology, Aachen, Germany
Vladimir Nechaev Fellow (2002-2004), Inst of the Hum Brain, Rus. Acad of Sci, St. Petersburg
Grace Park Postdoc (2002-2005), Private practice (aphasiology), Rockville, MD
Dennis MacLean Postdoc (2003-2004), Assistant Professor, Psychology, Cameron U
Whitney Postman Postdoc (2004-2007), Staff Fellow, Comm Sci and Disorders, Temple U
Biographical Sketch

(i) Professional Preparation
Katholieke Universiteit Leuven  Romance Philology  B.A. 1979
Stanford University  Foreign Language Education  MA 1982
Stanford University  Foreign Language Education  PhD 1986

(ii) Academic Appointments
University of Maryland  Second Language Acquisition  Professor, 2005-
University of Pittsburgh  Linguistics  Associate Professor, 1997-2005
University of Pittsburgh  Linguistics  Assistant Professor, 1991-1997
University of Pittsburgh  Linguistics  Visiting Asst Prof 1988-1991

(iii) Selected Publications (selected from 40 publications)
5 recent publications related to the current proposal:

5 additional publications:

(iv) Synergistic activities
- Editor of the journal Language Learning (since May 2005). Language Learning is one of the premier journals in applied linguistics, founded in 1948.
Modern Language Review, ITL Review of Applied Linguistics …), book series (Erlbaum, Benjamins), and grant agencies (NEH, NSF, agencies in the UK, Netherlands, Belgium, Canada)

- Organizer or co-organizer of conferences or conference symposia (SLRF, AAAL, PacSLRF); discussant at other symposia (AAAL, EUROSLA)
- Frequent external examiner for PhD dissertations at foreign universities
- Presentations on the science of language for high school career day events.

(v) Collaborators and other affiliations (past 48 months)

a. Collaborators and co-editors

Iris Alfi-Shabtay, Tel Aviv University
Michael Harrington, University of Queensland
Alan Juffs, University of Pittsburgh
Jenifer Larson-Hall, University of North Texas
Dorit Ravid, Tel Aviv University
Peter Robinson, Aoyama Gakuin University, Tokyo
Rafael Salaberry, Rice University

b. Graduate and postdoctoral advisors

Robert Politzer (deceased)
Shirley Bryce Heath, Stanford University

c. Graduate Theses and Postdoctoral Supervision

Recent Graduate Supervision (total = 23):

Marina Saiz, Ph.D. (2007) University of Pittsburgh; Hispanic Linguistics
Sonia Lenk, Ph.D. (2007) University of Pittsburgh; Hispanic Linguistics
David Libber, M.A., University of Maryland (exp. 2008): French and SLA
Tamar Bernfeldt, M.A., University of Pittsburgh (2004): Linguistics
Nicole Garcia, M.A., University of Pittsburgh (2005): Linguistics
Veronica Lifrieri, M.A., University of Pittsburgh (2005): Linguistics

Postdoctoral Supervision; (total = 1):

Cornelia de Jong, Post-doc at NSF Science of Learning Center (U of Pittsburgh/CMU)
(PhD University of Amsterdam)
Bonnie J. Dorr
Biographical Sketch

(i) Professional Preparation
Boston University Computer Science B.A., 1984
Massachusetts Inst of Technology Computer Science S.M., 1987
Massachusetts Inst of Technology Computer Science Ph.D., 1990

(ii) Professional Appointments
University of Maryland UMIACS Research Associate 1990-1992
University of Maryland Comp Sci Assistant Professor 1992-1998
University of Maryland Comp Sci Co-director, CLIP lab 1995-present
University of Maryland Comp Sci Associate Professor 1998-2005
University of Maryland Comp Sci Professor 2005-present

(iii) Selected Publications (selected from 214 publications)
5 recent publications related to the current proposal

5 Additional recent publications

(iv) Synergistic Activities
• President of the Association for Computational Linguistics, 2007-2008; Vice Pres. from 2006-2007.
• Editorial advisory board member of: Machine Translation, Journal of Artificial Intelligence Research.
• Active in promoting the interests of women in Computer Science: featured in Voice of America, Maryland Outlook Online, Washington Techway Magazine, Business Week Magazine, and various
workshops on the subject. Outreach work to middle school audiences: Briggs Chaney Middle School, “Melding Technology with History and Language”.


(v) Collaborators

a. Collaborators in Past 48 months (excluding students)

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<th>Name</th>
<th>Institution</th>
<th>Name</th>
<th>Institution</th>
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<tr>
<td>David Farwell</td>
<td>New Mexico State U</td>
<td>Keith Miller</td>
<td>MITRE</td>
</tr>
<tr>
<td>Terry Gaasterlich</td>
<td>UC San Diego</td>
<td>Teruko Mitamura</td>
<td>Carnegie Mellon</td>
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<tr>
<td>Rebecca Green</td>
<td>U of Maryland</td>
<td>Douglas Oard</td>
<td>U of Maryland</td>
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<tr>
<td>Steve Helmreich</td>
<td>New Mexico State U</td>
<td>Martha Palmer</td>
<td>U of Colorado</td>
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<tr>
<td>Ed Hovy</td>
<td>U of S California</td>
<td>Owen Rambow</td>
<td>Columbia</td>
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<tr>
<td>Pamela Jordan</td>
<td>U of Pittsburgh</td>
<td>Florence Reeder</td>
<td>MITRE</td>
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<tr>
<td>Greg Kondrak</td>
<td>U of Alberta</td>
<td>Philip Resnik</td>
<td>U of Maryland</td>
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<td>Lori Levin</td>
<td>Carnegie Mellon</td>
<td>Richard Schwartz</td>
<td>BBN</td>
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<td>Dekang Lin</td>
<td>U of Alberta</td>
<td>Amy Weinberg</td>
<td>U of Maryland</td>
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<td>Antonia Marti</td>
<td>U of Barcelona</td>
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b. Own Graduate Advisor

Robert C. Berwick  Massachusetts Institute of Technology

c. Advisees:

Graduate Supervision; total = 14:

- Sungki Suh  PhD (1994), Professor, Seoul National University
- Yahui Chang PhD (1995), Assoc. Professor, National Chiao Tung University
- Mine Ulku Sencan PhD (1996), Researcher
- Doug Oard PhD (1996), Assoc. Professor & Assoc. Dean for Research, U. Maryland
- Wade Shen PhD (1998), Research Scientist, MIT Lincoln Labs
- Scott Thomas PhD (2002), Researcher, Naval Research Laboratory
- Maria Katsova PhD (2002), Researcher, Microsoft Research
- Clare Voss PhD (2002), Researcher, Army Research Laboratory
- Rebecca Green PhD (2004), Asst Professor of Library & Information Science, U. Maryland
- David Zajic PhD (2007), Asst Research Scientist, U of Maryland Ctr Adv Study of Language
- Nate Waisbrot PhD candidate, Computer Science
- Stacy President PhD candidate, Neuroscience & Cognitive Science
- Calandra Tate PhD candidate, Applied Mathematics
- Matt Snover PhD candidate, Computer Science

Postdoc Supervision; total = 9

- Douglas Jones Postdoc. 1997, Senior Researcher, MIT Lincoln Labs
- Mari Olsen Postdoc. 1999, Senior Researcher, Microsoft Natural Language Group
- David Traum Postdoc. 2000, Research Scientist, Inst. for Creative Technologies, USC
- Gina-Anne Levow Postdoc. 2001, Assistant Professor, U. of Chicago.
- Rebecca Hwa Postdoc. 2003, Assistant Professor, U. of Pittsburgh.
- Nizar Habash Postdoc. 2004, Research Scientist, Columbia U.
- Christof Monz Postdoc. 2005, Lecturer, Queen Mary, University of London, UK
- Necip Fazil Ayan Postdoc. U. Maryland. 2006-
- Saif Mohammad Postdoc. U. Maryland. 2007-
Michael Dougherty
Biographical Sketch

(i) Professional Preparation

Kansas State University        Psychology         BA, 1993
Oklahoma University           Psychology         PhD, 1999

(ii) Academic Appointments

University of Maryland        Psychology         Associate Professor, 2005-present
University of Maryland        Psychology         Assistant Professor, 1999-2005

(iii) Selected Publications (selected from 29 publications):

5 recent publications related to the current proposal:


5 additional recent publications:


(iv) Synergistic Activities

- As part of an NSF CAREER award, developed graduate seminars in Memory and Decision Making and Attention and Memory, and undergraduate courses in Experimental Methods. In addition, in the process of starting new professional society whose purpose is to disseminate knowledge on the emerging field of Cognitive Decision Theory.
- Served on 2007 NSF Committee of Visitors (COV) for the purposes of providing advice and recommendations concerning NSF science and education activities within the Directorate for Social and Economic Sciences.
• Editorial Board: Journal of Experimental Psychology, Learning Memory and Cognition. Reviewer for 10+ journals, funding agencies, and publishers in psychology. External reviewer for Israeli Science Foundation, National Science Foundation, and Air Force Office of Scientific Research.
• Frequently invited for new student and freshman orientations on the Maryland campus, for purposes of providing an overview of research in psychology.
• Served as Panel Discussant on “Building a CV”, a graduate student seminar sponsored by Center for Teaching Excellence, 2005.
• Organizer of a weekly speaker series (Cognitive seminar) since 2001.

(v) Collaborators and other Affiliations

a. Collaborators in Past 48 months (graduate students and postdocs are listed in (c) below)

Eddy Davelaar Psychology, University of London, Birkbeck
Michael Bunting Center for Advanced Study of Language, University of Maryland
David Huber Psychology, U of California, San Diego
Rick Thomas Psychology, U of Oklahoma
Cleotilde González Social and Decision Sciences, Carnegie Mellon
Thomas Wallsten Psychology, University of Maryland
Tim Pleskac Psychology, Michigan State University

b. Own Graduate & Postdoctoral Advisor

Scott Gronlund University of Oklahoma

c. Graduate Theses and Postdoc Supervision

Graduate Supervision (*indicates co-advisor); total = 6:

Ana Franco-Watkins PhD, U of Maryland (2004). Assistant Professor, Auburn University
Jennifer Hunter MS, U of Maryland (2003). US Census Bureau
Amber Sprenger PhD, U of Maryland (2007). Post Doc, Johns Hopkins University
Tracy Tomlinson PhD, expected 2009, U of Maryland: Psychology
Sharona Atkins PhD, expected 2011, U of Maryland: Neuroscience and Cognitive Science
Erika Hussey PhD, expected 2012, U of Maryland: Neuroscience and Cognitive Science

Postdoc Supervision; total = 1:

J. Isaiah Harbison Postdoc, U of Maryland (PhD, Louisville U.) 2005-2008
Fred R. Eckman
Biographical Sketch

(i) **Professional Preparation**

<table>
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<tr>
<th>Institution</th>
<th>Major</th>
<th>Degree</th>
<th>Year</th>
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<tbody>
<tr>
<td>Johns Hopkins University</td>
<td>Romance Languages</td>
<td>B.A.</td>
<td>1966</td>
</tr>
<tr>
<td>Indiana University</td>
<td>Linguistics</td>
<td>M.A.</td>
<td>1969</td>
</tr>
<tr>
<td>Indiana University</td>
<td>Linguistics</td>
<td>Ph.D.</td>
<td>1972</td>
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(ii) **Professional Appointments**

<table>
<thead>
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<th>Position</th>
<th>Years</th>
</tr>
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<tbody>
<tr>
<td>Indiana University</td>
<td>Linguistics Visiting Asst Prof</td>
<td>1972-73</td>
</tr>
<tr>
<td>Mass. Inst. of Technology</td>
<td>Linguistics Visiting Scientist</td>
<td>1973-74</td>
</tr>
<tr>
<td>U Wisconsin–Milwaukee</td>
<td>Linguistics Lecturer</td>
<td>1974-77</td>
</tr>
<tr>
<td>U Wisconsin–Milwaukee</td>
<td>Linguistics Assistant Professor</td>
<td>1977-80</td>
</tr>
<tr>
<td>U Wisconsin–Milwaukee</td>
<td>Linguistics Associate Professor</td>
<td>1980-89</td>
</tr>
<tr>
<td>U Wisconsin–Milwaukee</td>
<td>Linguistics Professor</td>
<td>1989-Present</td>
</tr>
<tr>
<td>Heinrich Heine University, Duesseldorf, Germany</td>
<td>Eng. Linguistics Guest Professor</td>
<td>Fall 1995</td>
</tr>
<tr>
<td></td>
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<td>Summer 2000</td>
</tr>
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<td></td>
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<td>Fall 2002</td>
</tr>
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<td></td>
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<td>Summer 2006</td>
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</tbody>
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(iii) **Selected Publications** (selected from 59 publications):

5 recent publications related to the current proposal:


5 Additional recent publications:


(iv) **Synergistic Activities**

- Editorial advisory board member of *Studies in Second Language Acquisition*
- Principal Investigator, NIH Research Grant R01 HD46908-01A2 "Markedness and Learnability in Second Language Phonology", $1,390,654, 2006-11, Co-investigators: Gregory Iverson, University of Wisconsin-Milwaukee; Robert Fox, The Ohio State University; Ewa Jacewicz, The Ohio State University
- Principal Investigator, NIH Academic Research Enhancement Award R15 HD34233-01, Learnability in Second Language Pronunciation, $106,774, 1997 – 2000, Co-investigator: Gregory Iverson. (AREA grants are for conducting pilot studies for the purpose of applying for R01 funding)

(v) **Collaborators**

**a. Collaborators in Past 48 months (excluding students)**

<table>
<thead>
<tr>
<th>Name</th>
<th>Institution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Robert Fox</td>
<td>The Ohio State University</td>
</tr>
<tr>
<td>Ewa Jacewicz</td>
<td>The Ohio State University</td>
</tr>
<tr>
<td>Gregory Iverson</td>
<td>University of Wisconsin–Milwaukee</td>
</tr>
<tr>
<td>Abdulla El Reyes</td>
<td>Center for Documentation and Research, Abu Dhabi, United Arab Emirates</td>
</tr>
</tbody>
</table>

**b. Own Graduate Advisors**

<table>
<thead>
<tr>
<th>Degree</th>
<th>Name</th>
<th>Institution</th>
</tr>
</thead>
<tbody>
<tr>
<td>M.A.</td>
<td>Andreas Koutsoudas</td>
<td>Indiana University (deceased)</td>
</tr>
<tr>
<td>Ph.D.</td>
<td>Andreas Koutsoudas</td>
<td>Indiana University (deceased)</td>
</tr>
</tbody>
</table>

**c. Graduate Supervision (previous ten years, all at U. of WI-Milwaukee)**

**Ph.D Chair of Committee**

<table>
<thead>
<tr>
<th>Name</th>
<th>Institution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fatemi Zohra Hilali</td>
<td>Mohammed V University, Rabat, Morocco</td>
</tr>
<tr>
<td>Minsook Kim</td>
<td>University of California, Berkeley</td>
</tr>
<tr>
<td>Wendi Halstead</td>
<td>Milwaukee Area Technical College</td>
</tr>
<tr>
<td>Abdulla El Reyes</td>
<td>Center for Documentation and Research, Abu Dhabi, United Arab Emirates</td>
</tr>
<tr>
<td>Olesya Ostapenko</td>
<td></td>
</tr>
<tr>
<td>Sooho Song</td>
<td></td>
</tr>
</tbody>
</table>

**Ph.D. Member of committee**

<table>
<thead>
<tr>
<th>Name</th>
<th>Institution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Doreen Krueger</td>
<td>Concordia University, Mequon, Wisconsin</td>
</tr>
<tr>
<td>Emiko Kaneko</td>
<td></td>
</tr>
<tr>
<td>Haeil Park</td>
<td></td>
</tr>
<tr>
<td>Claire Hicks</td>
<td></td>
</tr>
</tbody>
</table>

**MA (degrees completed)**

<table>
<thead>
<tr>
<th>Name</th>
<th>Institution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lindsey Butler</td>
<td>Barbara Schulz</td>
</tr>
<tr>
<td>Abigail Goezler</td>
<td>Hyowon Song</td>
</tr>
<tr>
<td>Anastasia Kasprzyk</td>
<td>Brita Swenson</td>
</tr>
<tr>
<td>Mijo Kim</td>
<td>Hie-Jung You</td>
</tr>
<tr>
<td>Ayumi Sawad</td>
<td>Hyo-Seung You</td>
</tr>
</tbody>
</table>
Carol Y. Espy-Wilson
Biographical Sketch

(i) Professional Preparation
Stanford University  Electrical Engineering   BS, 1979
MIT  Electrical Engineering   MS, 1981
MIT  Electrical Engineering   EE, 1984
MIT  Electrical Engineering   PhD, 1987
MIT  Postdoctoral Fellow 1987-1988

(ii) Academic Appointments
University of Maryland  Electrical Engineering Professor, 2007-
University of Maryland  Electrical Engineering Associate Professor, 2001-2007
Boston University  Electrical Engineering Associate Professor, 1999-2001
Boston University  Electrical Engineering Assistant Professor, 1990-1999

(iii) Selected Publications (selected from 147 publications):
5 recent publications related to the current proposal:

5 additional publications:

(iv) Synergistic activities

- Developed a Digital Speech Processing course for advanced graduate students that includes lab work and requires that the students conduct a research project. A junior-level undergraduate engineering course “Signals and Systems” also includes many examples of how the techniques being taught in the class are applied in research in speech processing.
- Outreach activities include keynote addresses at high schools including Woodward Academy (2001), Newton North High School (1993), Southwest Dekalb High School (1996); served variously as a mentor, keynote speaker or workshop panel member in the New England Board of Higher Education Science and Engineering Network (1991-1999); other speeches for special programs include the Massachusetts Pre-Engineering Program (1991), MIT Minority Summer Research Program (1992), “Black Women in the Academy: Defending our Name, 1894-1994” Conference (1994), Alpha Kappa...

- Developed tools that have been made available to other researchers: (a) formant trackers used at Ohio State and MIT, and (b) a computer vocal tract modeling program (VTAR) available at http://www.isr.umd.edu/Labs/SCL/vtar/index.html and used by many colleagues for teaching and research. Recent MRI data collected from 20 speakers (as part of an NIH grant) will be processed and put in a format that others can use (http://lara.haskins.yale.edu). Lead-PI on an NSF collaborative grant which will result in many tools being developed and shared with the larger community.

- Member of the Editorial Board for Acoustics Today, a publication by the Acoustical Society of America; external advisory board for the Next Generation Localisation Center between four universities and several companies in Dublin, Ireland; chair of the Speech Technical Committee of the Acoustical Society of America; member of the NIH Language and Communication Study Section, 2001-2004.

- Lab engages numerous undergraduate and women students in engineering research, including participants in summer internship programs. Graduate student Om Deshmukh won the Best Student Paper Award at ASA for presentations made in 2003 and 2004; undergraduate student Paul Young received the Best Presentation Award in the MERIT program at UMD, Summer 2003.

- PI or co-PI on several multi-institution or multi-investigator projects: “Landmark-based Robust Speech Recognition Using Prosody-Guided Models of Speech Variability”, a joint effort between 5 sites: UMD, USC, UCLA, UIUC, BU (NSF, 2007-2010); “Joint Institute for Knowledge Discovery”, A center for massive knowledge management (with VS Subrahmanian, Rama Chellapa, Jim Hendler, Doug Card, Bonnie Dorr (DoD, 2005-2008) and an ONR grant: “Center for Auditory and Acoustics Research” between 10 faculty at Boston University and five at UMD (ONR, 1997-2000).

(v) Collaborators and Other Affiliations:

a. Collaborators in Past 48 months (graduate students and postdocs are listed in (c) below):

<table>
<thead>
<tr>
<th>Name</th>
<th>Affiliation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dr. Suzanne Boyce</td>
<td>University of Cincinnati</td>
</tr>
<tr>
<td>Laurel Carney</td>
<td>Syracuse University</td>
</tr>
<tr>
<td>Mark Tiede</td>
<td>MIT</td>
</tr>
<tr>
<td>Zhaoyan Zhang</td>
<td>UCLA Medical School</td>
</tr>
<tr>
<td>Shihab Shamma</td>
<td>University of Maryland</td>
</tr>
<tr>
<td>William Idsardi</td>
<td>University of Maryland</td>
</tr>
<tr>
<td>Ray Liu</td>
<td>University of Maryland</td>
</tr>
<tr>
<td>Min Wu</td>
<td>University of Maryland</td>
</tr>
</tbody>
</table>

b. Own Graduate Advisor:

Ken Stevens

MIT

c. Graduate Theses:

<table>
<thead>
<tr>
<th>Name</th>
<th>Degree, Institution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nabil Bitar</td>
<td>Ph.D., (1997), Principal member of technical staff, Verizon Inc.</td>
</tr>
<tr>
<td>Venkatesh Chari</td>
<td>MS, (1992), Systems Applications Manager, Analog Devices Inc.</td>
</tr>
<tr>
<td>Om Deshmukh</td>
<td>Ph.D. (2006). Senior Research Engineer, IBM India Research,</td>
</tr>
<tr>
<td>Sandeep Manocha</td>
<td>MS, (2007). Microsoft Research</td>
</tr>
<tr>
<td>Xinhui Zhou</td>
<td>PhD expected 2008, University of Maryland: Electrical &amp; Computer Eng</td>
</tr>
<tr>
<td>Shrikanth Vishnubhotla</td>
<td>PhD expected 2009, University of Maryland: Electrical &amp; Computer Eng</td>
</tr>
<tr>
<td>Daniel Garcia-Romero</td>
<td>PhD expected 2009, University of Maryland: Electrical &amp; Computer Eng</td>
</tr>
<tr>
<td>Vikramajit Mitra</td>
<td>PhD expected 2010, University of Maryland: Electrical &amp; Computer Eng</td>
</tr>
<tr>
<td>Jaime Hernandez</td>
<td>PhD expected 2011, University of Maryland: Electrical &amp; Computer Eng</td>
</tr>
</tbody>
</table>
Yasmeen Faroqi Shah
Biographical Sketch

(i) Professional Preparation

All India Institute of Speech & Hearing, India
Speech & Hearing
B.S., 1995
All India Institute of Speech & Hearing, India
Speech & Hearing
M.S., 1997
Northwestern University
Comm. Sc. & Dis.
Ph.D., 2004

(ii) Academic Appointments

University of Maryland
Asst Prof., Hearing & Speech Sciences 2005-

(iii) Selected Publications

5 recent publications related to the current proposal:

Faroqi-Shah, Y. (2007). Are regular and irregular verbs dissociated in nonfluent aphasia? A meta-
Cortical activation during word processing in late bilinguals: Similarities and differences as revealed
Faroqi-Shah, Y. & Thompson, C. K. (2004) Semantic, lexical, and phonological influences on the

5 additional publications:

American Speech Language and Hearing Association’s Division on Issues in Higher Education].
*Handbook of adult language disorders: Integrating cognitive neuropsychology, neurology, and
Marian, V., Faroqi-Shah, Y., Sheng, L., Shildkrot, E., & Hirsch, J. (2002). One Brain, Two Languages:
Cortical Similarities and Differences in Bilinguals. Proceedings of the American Psychological
in Wernicke’s aphasia. Abstract of the presentation at the Annual Meeting of the Academy of Aphasia.
Brain & Language, 74, 535-538.

(iv) Synergistic Activities

- Invited member of the Multicultural Issues Board (MIB) of the American Speech-Language and
  Hearing Association (2008-2010). The MIB recommends and monitors policies related to
  linguistic and culturally diverse individuals with communication disorders, including bilinguals and
  English as a second language learners.
- President of the Asian Indian Caucus (AIC), one of the multicultural constituent groups of the
  of the AIC is to develop and compile language development norms, language tests and linguistic
  materials in Indian languages to be used for communication disorders assessment and
  intervention with speakers of Asian Indian languages residing in the United States. Some of these
activities will be conducted in collaboration with the All India Institute of Speech and Hearing in Mysore, India.

- Mentor for Speech-Language clinicians and students as part of the Maryland Speech-Language and Hearing Association’s mentoring program (2005-2006).
- Member of the Maryland Speech-Language Hearing Association’s Adult Service Delivery Committee involved in clinical service issues to adults with communication disorders.
- Invited panelist for a webinar on mentoring in the profession of Speech and Hearing, American Speech Language and Hearing Association (August 2006).
- Reviewer for conferences in adult language disorders
- Invited as speaker on topics related to neural plasticity and language rehabilitation:
  - *Neural Plasticity in Aphasia Therapy* (March 2006). Keynote speaker at the annual convention of the Maryland Speech-Language and Hearing Association
  - *Neurobiological correlates of theoretically-driven aphasia therapy* (January 2007). Invited talk at the All India Institute of Speech and Hearing, Mysore, India.
- As director of the Aphasia Research Center, research mentor for 29 undergraduate students.

(v) Collaborators and other Affiliations

a. Collaborators in Past 48 months (excluding students):

- Michael Dickey
  Northwestern University
- Allen Braun
  National Institutes of Health
- Arpita Bose
  University of Windsor, Canada
- Colin Phillips
  University of Maryland
- David Poeppel
  University of Maryland

b. Own Graduate Advisors:

- Cynthia K. Thompson
  Northwestern University
- James Booth
  Northwestern University
- Viorica Marian
  Northwestern University

c. Graduate Supervision (chair of committee)

- Monica Sampson
  PhD expected in 2009 (Area of study: aphasia and bilingualism)
Norbert Hornstein  
Biographical Sketch

(i) Professional Preparation

McGill University  Philosophy  B.A., 1975  
Harvard University  Philosophy  Ph.D., 1979  

(ii) Professional Appointments

Columbia University  Assistant Professor, Philosophy  1979-1983  
University of Maryland  Assistant Professor, Linguistics  1983-1986  
University of Maryland  Associate Professor, Linguistics  1986-1990  
University of Maryland  Professor, Linguistics  1990-2003  
University of Maryland  Dept. Chair, Linguistics  2003-

(iii) Selected Publications (selected from 93 publications):

5 Recent publications related to the current proposal:


5 Additional recent publications:


(iv) Synergistic Activities

- Co-founded (1992) the annual "Mayfest" at UMCP. This is a yearly spring two-day workshop that brings scholars in the world over to discuss topics of interest to the language and cognition community. The workshop generally includes both tutorials to educate the community as a whole on the accepted wisdom in each sub area and recent novel research that builds on this foundation. Topics have included: “Parameter Setting,” “The acquisition of semantics,” “Natural Language Parsing,” “The empirical and conceptual bases of minimalism.”  
• Generated alumni contributions to fund 5 summer fellowships and two year-long post baccalaureate fellowships to allow students to pursue research in language and cognition. This is intended to allow undergraduates interested in linguistics, cognition and neuroscience to work with UMCP faculty in a collaborative fashion. The program will have a two-year pilot status in 2006-2008, with the intent of making it permanent if successful.
• Associate Director of Neuroscience and Cognitive Science (NACS) Program, 2005-8.
• PI of NSF-funded project “Islands and Linearization”, with H. Lasnik & J. Uriagereka, 2007-2010, $300,000.

(v) Collaborators

a. Collaborators in the last 48 months (Graduate students listed in (c) below):

<table>
<thead>
<tr>
<th>Name</th>
<th>Institution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cedric Boeckx</td>
<td>Harvard University</td>
</tr>
<tr>
<td>Howard Lasnik</td>
<td>University of Maryland</td>
</tr>
<tr>
<td>Andrew Nevins</td>
<td>Harvard University</td>
</tr>
<tr>
<td>Jairo Nunes</td>
<td>Universidade de Campinas, Brazil</td>
</tr>
<tr>
<td>Paul Pietroski</td>
<td>University of Maryland</td>
</tr>
<tr>
<td>Juan Uriagereka</td>
<td>University of Maryland</td>
</tr>
</tbody>
</table>

b. Own thesis advisor:

Hilary Putnam          Harvard University

(c. Graduate Supervision ; total = 31 supervised; 17 supervised as chair of committee:

<table>
<thead>
<tr>
<th>Name</th>
<th>Degree Year</th>
<th>Institution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alan Munn</td>
<td>PhD (1993)</td>
<td>Associate Professor, Michigan State University</td>
</tr>
<tr>
<td>Spiridoula Varlokosta</td>
<td>PhD (1994)</td>
<td>Associate Professor, University of Rhodes, Greece</td>
</tr>
<tr>
<td>Qiming Chen</td>
<td>PhD (1996)</td>
<td>Lecturer, University of Maryland University College</td>
</tr>
<tr>
<td>Akemi Matsuya</td>
<td>PhD (1999)</td>
<td>Associate Professor, Yokohama City University, Japan</td>
</tr>
<tr>
<td>Kleanthes Grohmann</td>
<td>PhD (2000)</td>
<td>Assistant Professor, University of Cyprus</td>
</tr>
<tr>
<td>Acrisio Pires</td>
<td>PhD (2001)</td>
<td>Assistant Professor, University of Michigan</td>
</tr>
<tr>
<td>Mitsue Motomura</td>
<td>PhD (2004)</td>
<td>Assistant Professor, Kyoto University</td>
</tr>
<tr>
<td>Cilene Rodrigues</td>
<td>PhD (2004)</td>
<td>Postdoc, Federal University, Brasilia</td>
</tr>
<tr>
<td>Ilhan Cagri</td>
<td>PhD (2005)</td>
<td>Research Scientist, University of Maryland, Languages</td>
</tr>
<tr>
<td>Soo Min Hong</td>
<td>PhD (2005)</td>
<td>Assistant Professor, Pusan National University</td>
</tr>
<tr>
<td>Heather Taylor</td>
<td>PhD expected 2008</td>
<td></td>
</tr>
<tr>
<td>Rebecca McKeown</td>
<td>PhD expected 2009</td>
<td></td>
</tr>
<tr>
<td>Alex Drummond</td>
<td>PhD expected 2012</td>
<td></td>
</tr>
</tbody>
</table>
William J. Idsardi
Biographical Sketch

(i) Professional Preparation

University of Toronto Mathematical Linguistics BA (Hons, w/ distinction), 1988
MIT Linguistics PhD, 1992

(ii) Academic Appointments

University of Maryland Linguistics Associate Professor, 2005-present
York University Languages, Lit. & Ling. Fulbright Distinguished Chair, 2006
University of Delaware Linguistics Chair, 2002-2005
University of Delaware Linguistics Acting Chair, 2000-2002
University of Toronto Linguistics Visiting Associate Professor, 1999
University of Delaware Linguistics Associate Professor, 1998-2005
University of Delaware Linguistics Assistant Professor, 1992-1998

(iii) Selected Publications (selected from 45 publications)

5 recent publications related to the current proposal:

Poeppel, D., Idsardi, W., & van Wassenhove, V. (2007, in press). Speech perception at the interface of
Kabak, B. & Idsardi, W.J. (2007) Speech perception is not isomorphic to phonology: The case of

Sign Language. Memory & Cognition, 33: 887-904

5 additional recent publications:

Contemporary Views on Architecture and Representations in Phonological Theory, Cambridge: MIT
Press.
Linguistics 51: 119-126.

Purnell, T.C., Idsardi, W.J. & Baugh, J. (1999). Perceptual and phonetic experiments on American

(iv) Synergistic Activities

- Co-teach the core course in Cognitive Science for the interdisciplinary Neuroscience & Cognitive
Science Program, joint with Rochelle Newman (Hearing & Speech Sci.)
- Dissertation committee member for graduate students throughout the interdepartmental speech and
hearing community at Maryland, including students in Neuroscience & Cognitive Science, and
students in Electrical and Computer Engineering.
- Fulbright awards in 1999 and 2006

• Member of NSF Linguistics Panel, 2003-2006.

• Program committee: Linguistic Society of America 2001-2004; Program Committee Chair, 2003-2004.

(v) Collaborators and other Affiliations

a. Collaborators in Past 48 months (graduate students are listed in (c) below)

Peter Avery York University
Carol Espy-Wilson University of Maryland
Roberta Golinkoff University of Delaware
Nina Kazanina University of Bristol, UK
Jeffrey Lidz University of Maryland
Colin Phillips University of Maryland
Laura-Ann Petitto Dartmouth College
David Poeppe University of Maryland
Jerzy Rubach University of Iowa and University of Warsaw
Bert Vaux University of Cambridge
Matthew Winn University of Maryland

b. Own Graduate Advisor

Morris Halle Massachusetts Institute of Technology

c. Graduate Theses Supervision

PhD Supervision (*indicates co-advisor); total = 17:

Son, Sun-Ah PhD, U. of Delaware, (2005) Lecturer, Chung-Ang University, Korea.
Baker, Stephanie* PhD, U. of Delaware. (2002) Post-doc, University of British Columbia
Zhang, Guangsheng* PhD, U. of Delaware. (1996)

Monahan, Philip* PhD expected 2009, U. of Maryland, Linguistics
Cogan, Gregory* PhD expected 2011, U. of Maryland, Neuroscience & Cognitive Science
Rhone, Ariane* PhD expected 2011, U. of Maryland, Linguistics.
Riley, Joshua* PhD expected 2011, U. of Maryland, Linguistics.
Gregory K. Iverson  
Biographical Sketch

(i) **Professional Preparation**

<table>
<thead>
<tr>
<th>Institution</th>
<th>Department</th>
<th>Degree</th>
<th>Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Concordia College, Moorhead</td>
<td>Political Science, German</td>
<td>B.A.</td>
<td>1968</td>
</tr>
<tr>
<td>Rice University</td>
<td>Germanics</td>
<td>M.A.</td>
<td>1970</td>
</tr>
<tr>
<td>University of Minnesota</td>
<td>Linguistics, Scandinavian</td>
<td>Ph.D.</td>
<td>1974</td>
</tr>
</tbody>
</table>

(ii) **Professional Appointments**

<table>
<thead>
<tr>
<th>Institution</th>
<th>Department</th>
<th>Position</th>
<th>Years</th>
</tr>
</thead>
<tbody>
<tr>
<td>University of Minnesota</td>
<td>Linguistics</td>
<td>Instructor/Asst Prof</td>
<td>1974-1975</td>
</tr>
<tr>
<td>U Wisconsin–Milwaukee</td>
<td>Linguistics</td>
<td>Assistant Professor</td>
<td>1976-1978</td>
</tr>
<tr>
<td>University of Iowa</td>
<td>Linguistics</td>
<td>Assistant Professor</td>
<td>1978-1979</td>
</tr>
<tr>
<td>University of Iowa</td>
<td>Linguistics</td>
<td>Associate Professor</td>
<td>1979-1990</td>
</tr>
<tr>
<td>U Wisconsin–Milwaukee</td>
<td>Linguistics</td>
<td>Associate Professor</td>
<td>1990-1991</td>
</tr>
<tr>
<td>U Wisconsin–Milwaukee</td>
<td>Linguistics</td>
<td>Professor</td>
<td>1991-2007</td>
</tr>
<tr>
<td>University of Maryland</td>
<td>Linguistics/CASL</td>
<td>Research Professor</td>
<td>2007-</td>
</tr>
</tbody>
</table>

(iii) **Selected Publications** (selected from 126 publications):

5 recent publications related to the current proposal:


5 Additional recent publications:


(iv) **Synergistic Activities**


Developed Integrated Linguistics Track M.A. Program between Ajou University, Suwon, Korea and University of Wisconsin–Milwaukee (trained and supported 30+ Korean students in past 5 years).

Primary Collaborator with Fred Eckman (PI), NIH RO1 Research Grant (“Markedness and Learnability in Second Language Phonology”), $1,390,654, 2006-11.


Co-Investigator with Joseph Salmons (PI) and Thomas Purnell, Joan Hall, Luanne von Schneidemesser, UW–Madison, and Erica Benson, UW–Eau Claire, Wisconsin Humanities Council Follow-On Grant (“Wisconsin Englishes”), $10,000, 2006-07.

(v) Collaborators

a. Collaborators in Past 48 months (excluding students)

Robert Fox The Ohio State University
Ewa Jacewicz The Ohio State University
Fred R. Eckman University of Wisconsin–Milwaukee
Soyoun Lee University of Wisconsin–Milwaukee
Joseph C. Salmons University of Wisconsin–Madison
Thomas Purnell University of Wisconsin–Madison
Joan Hall University of Wisconsin–Madison
Luanne von Schneidemesser University of Wisconsin–Madison
Sang-Cheol Ahn Kyungee University, Seoul, Korea
Hae-Jeong Park Yonsei University, Seoul, Korea
Sang-Oak Lee Seoul National University, Seoul, Korea
Abdulla El Reyes Center for Documentation and Research, Abu Dhabi, UAE

b. Own Graduate Advisors

M.A.: James Copeland Rice University
Ph.D.: Gerald Sanders University of Minnesota

c. Graduate Advisees (current)

M.A.: Kyoung Ea Han, Songhee Lee, Sooyeon Lee, Haiyun Lu, Andrew Olson, John Olstad, Ryoko Osada, Ayumi Sawada, Moonyoung Son
Ph.D.: Younghyon Heo, Emiko Kaneko, Ahrong Lee, Haeil Park

d. Graduate Advisees (past 48 months)

M.A.: Anastasia Kasprzyk, Sueyoon Seo, Hyowon Song, Yeonsoo Kim, Eunsil Bae, Corrine Occhino, Matthew Boeke, Suyong Yi, Myunghee Kang, Kookhee Yang, Young Joo Yang, Jimi Kim, Byron Thigpen, Eiko Ishioka, Kasumi Kato, Min Sook Kim, Bouchra Kmihi, Jung-Eun Lee, Eun-Sun Park, Ji-Yeon Lee, Ho-Yeon Ihm, Eun-Hee Lee, Byung-Geun Kim, Mose Kim, Gi-Young Kim, Ju-Sung Kim, Young-Hyon Heo, Ahrong Lee, Eun-Ju Ma, Veronica Lundbäck, Rosemarie Rogers
Howard Lasnik
Biographical Sketch

(i) Professional Preparation

Carnegie Institute of Technology
Mathematics and English  B.S., 1967
Harvard University  English  M.A., 1969
MIT  Linguistics  Ph.D., 1972

(ii) Professional Appointments

University of Connecticut  Linguistics  Assistant Professor, 1972-1976
University of Connecticut  Linguistics  Associate Professor, 1976-1981
University of Connecticut  Linguistics  Professor, 1981-2000
University of Connecticut  Linguistics  Distinguished Professor, 2000-2002
University of Maryland  Linguistics  Professor, 2002-2003
University of Maryland  Linguistics  Distinguished University Professor, 2003-

(iii) Selected Publications (selected from 123 publications):

5 recent publications related to the current proposal:


5 Additional publications:


(iv) Synergistic Activities

- Reviewer for many journals in linguistics and cognitive science, and for proposals to granting agencies in these areas.
- Author or co-author of 3 textbooks in syntactic theory; author of 15 encyclopedia and handbook entries making syntactic theory and/or specific portions of syntactic theory accessible to a broader audience, especially cognitive scientists.
- Major on camera and advisory role in the 3-hour PBS series *The Human Language.*
• NSF grant (with Norbert Hornstein and Juan Uriagereka) “Islands and Linearization” (a theoretical and cross-linguistic study of locality constraints on syntactic movement), 2007-2010, $300,000.

(v) Collaborators

a. Collaborators in the last 48 months (Graduate students listed in (c) below)

Cedric Boeckx Harvard University
Zeljko Boskovic University of Connecticut
Danny Fox MIT
Robert Freidin Princeton University
Randall Hendrick University of North Carolina
Norbert Hornstein University of Maryland
Carlos Otero UCLA
Colin Phillips University of Maryland
Myung-Kwan Park Dongguk University
Juan Uriagereka University of Maryland

b. Own thesis advisor

Noam Chomsky Massachusetts Institute of Technology

c. Graduate Supervision; total = 54:

Sandra Stjepanovic PhD, U of Connecticut (1999): Associate Professor, West Virginia University
Masao Ochi PhD, U of Connecticut (1999): Osaka University
Satoshi Oku PhD, U of Connecticut (1999): Hokkaido University
Asako Uchibori PhD, U of Connecticut (2000): Nihon University
Adolfo Ausín PhD, U of Connecticut (2001): Assistant Professor, Michigan State University
Arthur Stepanov PhD, U of Connecticut (2002): Universität Potsdam
Mariana Lambova PhD, U of Connecticut (2004): Assistant Professor, Central Conn. State U.
Masashi Nomura PhD, U of Connecticut (2005): Chukyo University
Bum-Sik Park PhD, U of Connecticut (2005): Dongguk University
Lydia Grebenyova PhD, U of Maryland (2006): Assistant Professor, Baylor University
Hajime Ono PhD, U of Maryland (2006): Postdoc, Hiroshima University
Tomohiro Fujii PhD, U of Maryland (2006): Postdoc, Nanzan University
Jon Sprouse PhD, U of Maryland (2007): Assistant Professor, UC Irvine

Chizuru Nakao PhD expected 2009
Atakan Ince PhD expected 2010
Shiti Malhotra PhD expected 2010
Maki Kishida PhD expected 2011
Ilknur Oded PhD expected 2011
Alex Drummond PhD expected 2012
Jeffrey Lidz
Biographical Sketch

(i) Professional Preparation

Northwestern University  Journalism  B.S.  1990
University of Delaware  Linguistics  M.A.  1992
University of Delaware  Linguistics  Ph.D.  1996
University of Pennsylvania  Psych/Linguistics  Postdoc, 1997-2000
Centre National de la Recherche Scientifique  Psycholinguistics  Postdoc, 1999
University of Pennsylvania  Psych/Linguistics  Postdoc 1999-2000

(ii) Appointments

University of Maryland  Linguistics/NACS  Associate Professor, 2005-present
Northwestern University  Linguistics  Assistant Professor, 2000-05

(iii) Publications (selected from 55 publications)

5 Publications most closely related to current proposal:

5 Selected Additional Publications:
Halberda, J., L. Taing, and J. Lidz (in press) The age of onset of “most” comprehension and its potential dependence on counting ability. Language Learning and Development.

(iv) Synergistic Activities

- Co-director, University of Maryland Infant Studies Consortium. 2005-. Collaborative effort between the departments of Linguistics, Psychology, and Speech and Hearing Sciences, towards the recruitment of infants to participate in experiments in cognitive and linguistic development. The consortium also publishes an annual newsletter, directed towards parents and nonacademic readers, that reports on its scientific activities.
- Extensive Fieldwork on Kannada from 1994 to the present. In affiliation with the Central Institute of Indian Languages, Mysore, India.
- Reviewer for 30+ journals, funding agencies, and publishers in linguistics and psychology. Editorial Board, Journal of South Asian Linguistics; Consulting Editor, Child Development; Brief Articles editor, Language Acquisition.
- Mentor, Eleanor Roosevelt High School Science and Technology Program, 2007-08. Working with two high school students on research projects in developmental linguistics.

(v) Collaborators and Other Affiliations

a. Collaborators within the last 48 months
Anne Christophe CNRS, Paris
Henry Gleitman University of Pennsylvania
Lila Gleitman University of Pennsylvania
Justin Halberda Johns Hopkins University
Chung-hye Han Simon Fraser University
William Idsardi University of Maryland
Christopher Kennedy University of Chicago
Jessica Maye Northwestern University
Julien Musolino Rutgers University
Lisa Pearl University of California, Irvine
Colin Phillips University of Maryland
Janet Pierrehumbert Northwestern University
Paul Pietroski University of Maryland
Sandra Waxman Northwestern University
Alexander Williams University of Maryland

b. Own Graduate and Postdoctoral Advisors
Peter Cole University of Delaware
Lila Gleitman University of Pennsylvania
Henry Gleitman University of Pennsylvania
Emmanuel Dupoux Laboratoire de Sciences Cognitives et Psycholinguistique, CNRS, Paris

c. Graduate Theses and Postdoc Supervision

Graduate Supervision (*indicates co-advisor), total = 12:

Steven Fix* PhD, Northwestern Univ. 2006. Postdoc, Northwestern Univ.
Erin Leddon PhD, Northwestern Univ. 2006. Postdoc, Northwestern Univ.
Ann Bunger PhD, Northwestern Univ. 2006. Postdoc, Univ. of Pennsylvania
Jessica Hicks PhD, Northwestern Univ. 2006. Computational Linguist, Versay Speech Solutions
Utako Minai PhD, Univ. of Maryland. 2006. Research Scientist, RIKEN Brain Institute, Tokyo.
Kristen Syrett PhD, Northwestern Univ. 2007. Postdoc, Rutgers Univ.
Joshua Viana PhD, Northwestern Univ. 2007. Postdoc, Johns Hopkins Univ.
Elisa Sneed PhD, Northwestern Univ. 2007. ESL Coordinator, Northwestern Univ.

Chunyuan Jing PhD expected 2008, Univ. of Maryland: language acquisition
Stacey Conroy PhD expected 2009, Univ. of Maryland: language acquisition, psycholinguistics
Eri Takahashi PhD expected 2009, Univ. of Maryland: language acquisition
Annie Gagliardi PhD expected 2012, Univ. of Maryland: language acquisition, morphosyntax
(i) Professional Preparation

University of Birmingham  Law  LL.B. (honors), 1966
University of London  Education (EFL)  P.G.C.E., 1970
University of Essex  Linguistics  M.A. (distinction), 1974
UCLA  Applied Linguistics  Ph.D., 1980

(ii) Appointments

University of Maryland  Second Language Acquisition, Professor & Chair 2003-present
University of Hawai‘i  Second Language Acquisition, Professor  1990-2003
University of Hawai‘i  Second Language Acquisition, Assoc. Professor  1985-1990
University of Hawai‘i  Second Language Acquisition, Asst Professor  1982-1985
University of Pennsylvania  Educational Linguistics, Asst Professor  1980-1982

(iii) Publications (selected from over 100)

Five publications most closely related to the current proposal:


Five additional recent publications:


(iv) Synergistic activities

- Founding member/designer and later chair of U. of Hawai‘i Ph.D. program in Second Language Acquisition, recognized in three surveys between 1996 and 2002 as the world's leading SLA program (surveys organized by committee of chairs of SLA programs).
- Designer of new Second Language Acquisition PhD program at the U. of Maryland.
• Designer and original PI for three National Flagship Language programs, in Korean (at U of Hawaii) and Arabic and Persian (at U of Maryland). DoD (NSEP)-sponsored Flagship programs take leadership roles nationally for innovative curriculum design and teaching in the languages concerned, especially at advanced proficiency levels. PI for federally-sponsored research on the acquisition of advanced L2 abilities in four less commonly taught languages: Arabic, Korean, Persian (Farsi), and Russian.
• Plenary speaker at over 50 national and international conferences, and co-chair or organizer of three conferences (Second Language Research Forum in 1978 and 1988, and Pacific Second Language Research Forum in 1998)

(v) Collaborators and other affiliations

a. Collaborators in past 48 months

Kazue Kanno  University of Hawai‘i
Catherine J. Doughty  University of Maryland
Jack C. Richards  Regional Language Center, Singapore
Peter Robinson  Aoyama Gakuin University, Tokyo
Lourdes Ortega  University of Hawai‘i
John Norris  University of Hawai‘i
Kira Gor  University of Maryland

b. Own graduate and postdoctoral advisor

Evelyn Hatch  (Emeritus, UCLA)

c. Graduate and Postdoctoral Supervision

Graduate Supervision; (total advisees = 40+):

Graham Crookes  Ph.D. U. of Hawai‘i (1988). Associate Professor, U. of Hawai‘i
Rhonda Oliver  Ph.D. U. of Western Australia (1995). Professor, Edith Cowan U.
Katherine Spadaro  Ph.D. U. of Western Australia (1996). Lecturer, UBC, Vancouver
Lourdes Ortega  Ph.D. U. of Hawai‘i (2000). Assistant Professor, U. of Hawai‘i
Leslie Ono  M.A. U. of Hawai‘i (2003). Lecturer, Kwansei University, Osaka
Rochelle Newman
Biographical Sketch

(i) Professional Preparation

Northwestern University    Communication Sci. & Dis.    BSS (BS in Speech, honors), 1991
SUNY at Buffalo    Psychology    M.A., 1995
SUNY at Buffalo    Psychology    Ph.D., 1997

(ii) Academic Appointments

University of Maryland    Hearing & Speech Sciences    Associate Professor, 2007-present
University of Maryland    Ctr. Adv. Study Language    Research Asst. Prof., 2005-present
University of Maryland    Hearing & Speech Sciences    Assistant Professor, 2001-2007
University of Iowa    Psychology    Assistant Professor, 1997-2001

(iii) Selected Publications (selected from 29 publications)

5 recent publications related to the current proposal:


5 additional recent publications:


(iv) Synergistic Activities

- Associate editor for the *Journal of the Acoustical Society of America*, the leading journal on the general topic of sound, covering the entire range from physical acoustics, neural representations of sound, phonetic structure/speech perception, and human communication.
- Reviewer for 20 different journals and funding agencies in the past 5 years;
- Research mentor for over 75 undergraduate students (currently 15 per semester) through a variety of research experience programs and mentor for high school interns from local science magnet school
• Regular mentor for 3 different programs designed specifically to broaden the participation of groups underrepresented in science.
• Development of infant participant database used by a variety of researchers, and Co-director, University of Maryland Infant Studies Consortium, which includes researchers from three departments and two colleges (all involved in this IGERT proposal)

(v) Collaborators and other Affiliations

a. Collaborators in Past 48 months (graduate students and postdocs are listed in (c) below)

Anthony Boemio National Institutes of Health
Kathryn Dow University of Maryland
Diane German National-Louis University
David Gow Massachusetts General Hospital
Prahlad Gupta University of Iowa
George Hollich Purdue University
Ann Marie Jusczyk Johns Hopkins University
Peter Jusczyk late of Johns Hopkins University
Nina Kazanina University of Bristol, UK
Paul Luce SUNY at Buffalo
Nan Bernstein Ratner University of Maryland
Shannon Ross-Sheehy University of Iowa
Froma Roth University of Maryland
Larissa Samuelson University of Iowa
Jim Sawusch SUNY at Buffalo
Ruth Tincoff Harvard University
Bruce Tomblin University of Iowa
Jane Tsay National Chung Cheng University
Amanda Woodward University of Maryland
Grace Yeni-Komshian University of Maryland

b. Own Graduate Advisors

Jim Sawusch (primary) SUNY at Buffalo
Peter Jusczyk late of Johns Hopkins University
Paul Luce SUNY at Buffalo

c. Graduate Thesis Supervision

Brittan Barker MA, University of Iowa (1999), Asst Prof, Louisiana State Univ.
Andrea Krecmar MA, 2006, University of Maryland
Lisa Loder MA 2006, University of Maryland
Stephanie Weinberg MA 2007, University of Maryland
Peizhu Tsai MA 2007, University of Maryland
Sofia Vallilia MA expected, 2008, Georgetown University
Emily Singer MA expected 2008, University of Maryland
Sarah Haszko MA expected 2009, University of Maryland
Sarah Stimley MA expected 2009, University of Maryland
Elizabeth Blaney MA expected 2009, University of Maryland
Audry Singh MA expected 2009, University of Maryland
Sarah Michael MA expected 2009, University of Maryland
Jillian Parry MA expected 2009, University of Maryland
Jessica Bauman MA expected 2009, University of Maryland
Colin Phillips
Biographical Sketch

(i) Professional Preparation

Oxford University  Modern Languages  BA (Hons, 1st class), 1990
MIT  Linguistics  PhD, 1996
MIT  Cognitive Neuroscience Postdoc, 1996

(ii) Academic Appointments

University of Maryland  Linguistics & NACS  Associate Professor, 2002-present
University of Maryland  Linguistics & NACS  Assistant Professor, 2000-2002
University of Delaware  Linguistics  Assistant Professor, 1997-2000

(iii) Selected Publications (selected from 58 publications):

5 recent publications related to the current proposal:


5 additional recent publications:


(iv) Synergistic Activities

- As part of an NSF CAREER award, developed teaching materials for hands-on lab-based courses in psycholinguistics and introductory linguistics courses; freely available on the internet, and used at numerous other universities; on-line course materials named to “Top 100 Open Courseware Projects” in 2007 (Online Education Database, oedb.com)
- Reviewer for 40+ journals, agencies, and publishers in linguistics, psychology, cognitive neuroscience. Member of review panels and study sections at NIH and NSF (2003-2007), Editorial Board: Syntax, Language Acquisition, Journal of Linguistics; Brief Articles editor, Language Acquisition
- Frequently invited for ‘synergistic’ role as speaker/lecturer, for the purpose either of making psycholinguistics or cognitive neuroscience more accessible for linguists, or for representing linguistics to cognitive neuroscientists, including mini-courses in Japan, Spain, Norway and US.
• Organizer of numerous conferences and workshops (CUNY 2004 at Maryland; MEG symposium at Maryland, 2002; NELS at Delaware, 1998; Morphology-Syntax Connection at MIT, 1995; L2 Acquisition at MIT, 1993).
• In role as co-director of Cognitive Neuroscience of Language Lab at Maryland, frequently give presentations and demos of cognitive neuroscience for broader audience (undergraduates from other institutions, high school students, educators-in-training, media, e.g., BBC Radio 4’s Leading Edge science documentary, 7/19/07).
• As part of a Human Frontiers Science Program award, worked with Japanese researchers on bridging linguistic and neuroscientific models of language.

(v) Collaborators and other Affiliations

a. Collaborators in Past 48 months (graduate students and postdocs are listed in (c) below)

William Idsardi University of Maryland
Jeffrey Lidz University of Maryland
Andrew Nevins Harvard University
David Poeppe University of Maryland
Kuniyoshi Sakai University of Tokyo
Amy Weinberg University of Maryland

b. Own Graduate & Postdoctoral Advisor

Alec Marantz New York University

c. Graduate Theses and Postdoc Supervision

Graduate Supervision (*indicates co-advisor); total = 17:

David Schneider PhD, U. of Delaware (1999). Comp. Ling. at Cycorp Inc., Austin, TX
Meesook Kim PhD, U. of Delaware (1999). Associate Professor, Sangji University, Korea
Sachiko Aoshima* PhD, U. of Maryland (2003). Assistant Professor, American University
Ana Gouvea* PhD, U. of Maryland (2003). Assistant Professor, Florida International University
Nina Kazanina PhD, U. of Maryland (2005). Lecturer, University of Bristol, UK
Leticia Pablos PhD, U. of Maryland (2006). Postdoc, University of Reading, UK
Masaya Yoshida PhD, U. of Maryland (2006). Assistant Professor, Northwestern University
Takuya Goro PhD, U. of Maryland (2007). Postdoc, Tohoku University, Sendai, Japan
Douglas de Lorenzo MA, U. of Delaware (1999). Rhodes Scholarship, Oxford University

Matthew Wagers PhD expected 2008, U. of Maryland: psycholinguistics, comp. neuroscience
Clare Stroud PhD expected 2008, U. of Maryland: cognitive neuroscience
Ellen Lau PhD expected 2009, U. of Maryland: psycholinguistics, neurolinguistics
Akira Omaki PhD expected 2010, U. of Maryland: psycholinguistics, language acquisition
Brian Dillon PhD expected 2012, U. of Maryland: neurolinguistics, computational ling.
Pedro Alcocer PhD expected 2012, U. of Maryland: psycholinguistics, neurolinguistics

Postdoc Supervision; total = 3:

Silke Urban Postdoc, U. of Maryland (PhD, U. of Leipzig) 2002-2004
Ryuichiro Hashimoto Postdoc, U. of Maryland (PhD, U. of Tokyo) 2003-2004
Ming Xiang Postdoc, U. of Maryland (PhD, Michigan State U.) 2005-2007
David Poeppel
Biographical Sketch

(i) Professional Preparation
MIT    Cognitive Science  B.S., 1990
MIT    Cognitive Neuroscience  Ph.D., 1995
UC San Francisco Functional brain imaging  Postdoc, 95-97

(ii) Professional Appointments
UC San Francisco Radiation  Adjunct Assistant Prof., 1997-1998
University of Maryland Linguistics/Biology  Assistant Professor, 1998-2002
University of Maryland Linguistics/Biology  Associate Professor, 2002-2006
University of Maryland Linguistics/Biology  Professor, 2006-
Kanazawa Inst. of Tech.  Visiting Professor, 2001-
Inst. for Advanced Studies Berlin  Fellow, 2003-2004
American Academy Berlin  Fellow, 2004
Ecole Normale Superieure, Paris  Guest Professor In Residence, 2006

(iii) Selected Publications (selected from over 80 publications):

5 recent publications related to the current proposal:


5 Additional recent publications:

(iv) Synergistic Activities

• Organization of Workshop 2001 Annual Meeting of the Cognitive Neuroscience Society (New York) “Brain mechanisms of auditory language processing: from sounds to sentences”.
• Editor of special section of journal Cognitive Science; “Neural basis of speech perception: contributions to cognitive science of speech” (vol 25 (5), September 2001).
• Co-editor (with G. Hickok) of special issue of journal Cognition “Towards a new functional
anatomy of language” (vol 92 May-June 2004).
• Development and teaching of new graduate courses on Cognitive Neuroscience that incorporates large-scale EEG/ERP and MEG practica for graduate and advanced undergraduate students.

(v) Collaborators

a. Collaborators in the last 48 months (Graduate students listed in (c) below)

Alan Beretta Michigan State U
Allen Braun NIH-NIDCD
David Embick U Pennsylvania
Nathan Fox U Maryland (Human Development)
Anne-Lise Giraud Ecole Normale Superieure, Paris
Kenneth Grant Walter Reed Army Medical Center
Brad Hatfield U Maryland (Kinesiology)
Greg Hickok UC Irvine
Bill Idsardi U Maryland (Linguistics)
Alec Marantz NYU
Sandeep Prasada Hunter College
Jonathan Simon U Maryland (Elec Comp Eng)
Lutz Trahms PTB Berlin

b. Own graduate and postdoctoral advisors

Alec Marantz MIT, now NYU Linguistics
Kenneth Wexler MIT Brain & Cognitive Sciences
Timothy Roberts UCSF, now U Penn Medical School

c. Graduate and Postdoc Supervision in the last five years

Graduate Supervision (*indicates co-advisor); total = 17:

Anthony Boemio PhD, U. of Maryland (2003). Post-doc, NIH (NIMH)
Ana Gouvea* PhD, U. of Maryland (2003). Asst Professor, Florida International Univ
Maria Chait PhD, U. of Maryland (2006). Marie Curie Fellow, Univ College London
Robert Fiorentino PhD, U. of Maryland (2006). Asst Professor, Univ Kansas
Huan Luo PhD, U. of Maryland (2006). Researcher, Chinese Acad Science Beijing
Diogo Almeida PhD expected 2008, U. of Maryland, psycholinguistics, neurolinguistics
Philip Monahan* PhD expected 2009, U. of Maryland, psycholinguistics, neurolinguistics
Julian Jenkins PhD expected 2010, U. of Maryland, auditory neuroscience
Greg Cogan* PhD expected 2011, U. of Maryland, speech, auditory neuroscience
Joshua Riley* PhD expected 2011, U. of Maryland, speech, phonology, neuroscience
Ariane Rhone* PhD expected 2011, U. of Maryland, speech, psycholinguistics
Nuria Ablbsubur* PhD expected 2012, U. of Maryland, neurolinguistics
Yue Zhang PhD expected 2012, U. of Maryland, auditory neuroscience, computation

Postdoc Supervision; total = 8:

Silvia Gennari PhD Brown Univ, post-doc 2000-2002. Lecturer (Psychology), Univ of York, UK
Martin Hackl PhD MIT, post-doc 2000-2002. Asst Prof (Linguistics), Pomona College CA
Lisa Sanders PhD Univ Oregon, post-doc 2002-2003. Asst Prof (Psychology), UMass Amherst
Anita Bowles PhD Univ Colorado, post-doc 2003-2006. Researcher, CASL, UMD
Mary Howard PhD Univ Maryland (computer science), post-doc 2006-
Minna Lehtonen PhD Univ Turku, Finland, post-doc 2007-.
Nan Bernstein Ratner
Biographical Sketch

(i) Professional Preparation
Tufts University       Child Studies       B.A., 1974
Temple University      Speech-Language Pathology  M.A., 1976
Boston University       Applied Psycholinguistics  Ed.D., 1982

(ii) Academic Appointments
University of Maryland  Hearing & Speech Sciences  Assistant Professor, 1983-1989
University of Maryland  Hearing & Speech Sciences  Associate Professor, 1989-1992
University of Maryland  Hearing & Speech Sciences  Associate Prof. & Chair, 1993-1999
University of Maryland  Hearing & Speech Sciences  Professor & Chair, 1999-present

(iii) Selected Publications (selected from 79 publications):

5 recent publications related to the current proposal:


5 additional recent publications:


(iv) Synergistic Activities
- Co-editor-in-Chief, Seminars in Speech and Language
- Editorial Board, Applied Psycholinguistics, Journal of Communication Disorders. Member of study sections at NIH (1994-). Reviewer for more than 20 different journals and publishers in speech-language pathology, applied linguistics, acoustics and psychology.
- Founder of LEAP Program (Language-Learning Early Advantage Program), an innovative communication enrichment program for preschoolers at risk of speech/language delays. Program received a Distinguished Program award in 1997 from Maryland Higher Ed Assoc for...
contributions to children and to student training; selected in 2002 as a model preschool reading program by the American Speech-Language-Hearing Association.

- Consultant to 2 recent interdisciplinary grants: RO1 NS44280-01 NINDS: Plasticity of Language Networks in Childhood Epilepsy (PI: William Gaillard, MD; 2002-7), and R41-DC006970 NIDCD: Virtual reality environments for stuttering treatment (PI: Shelley Brundage, PhD.; 2004-6)
- Frequently invited speaker (60 courses/workshops since 2000) on “synergy” among linguistic and fluency variables in typical and atypical children’s speech production (e.g., NSF KidTalk workshop, October 2005, numerous national and international meetings; Distinguished Researcher award from International Fluency Association).
- Development of evidence-based practice assessment protocol for speech-language pathologists (with Barbara Nail-Chiwetelu U. of Maryland).

(v) Collaborators and other Affiliations

a. Collaborators in Past 48 months (graduate students are listed in (c) below):

Jean Berko Gleason          Boston University
Oliver Bloodstein           Brooklyn College
Frank Wijnen                University of Utrecht
Stacy Silverman Wagovich    University of Missouri, Columbia
Nancy Hall                  University of Maine
William Gaillard            Children’s Hospital National Medical Center
Mark Onslow                 University of Sydney, Australia
John Tetnowski              University of Louisiana, Lafayette
Barry Guitar                University of Vermont
Leslie Rescorla             Bryn Mawr College
Barbara Nail-Chiwetelu      University of Maryland
Kathryn Dow                 University of Maryland
Ann Marie Jusczyk           Johns Hopkins University
Peter Jusczyk               late of Johns Hopkins University
Rochelle Newman             University of Maryland
Bruce Tomblin               University of Iowa
Amanda Woodward             University of Maryland
Grace Yeni-Komshian         University of Maryland (emerita)

b. Own Graduate Advisors:

Jean Berko Gleason          Boston University (emerita)
Paula Menyuk                Boston University (emerita)
Victor Zue                  Massachusetts Institute of Technology
Lise Menn                   University of Colorado

(c. Graduate Thesis Supervision:

Supervised graduate training for large numbers of speech-language pathologists currently in clinical practice.
James A. Reggia
Biographical Sketch

(i) Professional Preparation

University of Maryland, College Park  Physical Sciences  B.S., 1971
University of Maryland, Baltimore  Medicine  M.D., 1975
University of Maryland Hospital  Neurology  Residency, 1975-1978
University of Maryland, College Park  Computer Science  Ph.D., 1981

(ii) Academic Appointments

University of Maryland, Baltimore  Neurology  Assistant Professor, 1979-1984
University of Maryland, Coll. Pk.  Comp. Sci.  Assistant Professor, 1982-1987
University of Maryland, Baltimore  Neurology  Associate Professor, 1984-1989
University of Maryland, Baltimore  Neurology  Research Assoc. Prof., 1989-1993
University of Maryland, Coll. Pk.  Comp. Sci.  Associate Professor, 1987-1993
University of Maryland, Coll. Pk.  Comp. Sci.  Professor, 1993-
UM Inst. for Advanced Computer Studies  Professor, 1986-
Center for the Advanced Study of Language  Research Professor, 2005-

(iii) Selected Publications (selected from approximately 240 publications)

Five recent publications related to the current proposal:


Five additional recent publications:


(iv) Synergistic Activities

- Design and introduction of three new courses into graduate computer science curriculum: CMSC 726: Machine Learning; CMSC 727: Neural Computation; CMSC 828: Artificial Life and Evolutionary Computation
- Primary organizer, First (1995) and Second (1998) International Workshops on Neural Models of Brain and Cognitive Disorders; supported by NIH, Whitaker Foundation, and several Universities.
- Mentor, Gemstone Group, 2002-2004: mentor to 14 honors undergraduates on a three year group research and thesis project using genetic programming.
- Mentor, several undergraduate computer science students, summer research internships.
- Mentor, several high school student projects in Computer Science (one a Finalist in Maryland Science and Humanities Symposium)
- Ongoing funded research projects on evolution of neural networks (NASA), neurocognitive models (CTNS STARS program), and self-organizing collective intelligence (NSF ITR).

(v) Collaborators

a. Collaborators in the last 48 months (Graduate students listed in (c) below)

Rita Berndt University of Maryland, Baltimore
Jose Contreras-Vidal University of Maryland, College Park
Judy Frels University of Maryland, College Park
David Jacobs University of Maryland, College Park
John Salasin University of Maryland, College Park
Malle Tagamets University of Maryland, Baltimore
Juan Uriagereka University of Maryland, College Park
Jerry Wilkinson University of Maryland, College Park
Eran Zaidel University of California, Los Angeles

b. Own thesis advisor

Charles Rieger Currently in Industry; formerly of University of Maryland, CP

c. Graduate and Postdoc Supervision in the last five years

Graduate Supervision; total = 34:

Yuri Shkuro PhD, 2001, Senior Software Developer, Morgan Stanley
Mary Howard PhD, 2005, Postdoc (Linguistics), University of Maryland
Alejandro Rodriguez PhD, 2007, NIH Bioengineering Position
Shaun Gittens PhD, 2007, Postdoc, Computer Science, Auburn University
Alex Grushin PhD, 2007, Research Scientist, Intelligent Automation Inc.
Ransom Winder PhD, 2007, Technical Position, MITRE
JaeYoon Jung PhD, 2007, Postdoc, Computer Science, Queen’s University, Ontario

Postdoc Supervision in the last five years; total = 6:

Scott Weems U. of Maryland, (PhD, UCLA) 2003-2005
Philip Resnik
Biographical Sketch

(i) Professional Preparation

Harvard College    Computer Science   A.B. (magna cum laude), 1987
University of Pennsylvania  Comp and Inf. Sci. M.S.E., 1990
University of Pennsylvania  Comp and Inf. Sci. Ph.D., 1993

(ii) Professional Appointments

Bolt Beranek and Newman Inc.    Associate Scientist, 1987-1989
IBM TJ Watson Research Ctr    Graduate student intern, summer 1991
Sun Microsystems Laboratories    Scientist, 1993-1996
University of Maryland  Linguistics    Assistant Professor, 1996-2002
University of Maryland  Comp. Sci.    Affiliate Assistant Prof., 2001-2002
University of Maryland  Linguistics    Associate Professor, 2002-
University of Maryland  Comp. Sci.    Affiliate Associate Prof., 2002-

(iii) Selected Publications (selected from 81 publications)

5 recent publications related to the current proposal:


5 additional recent publications:


(iv) Synergistic Activities


- DARPA TIDES program. UMD lead-PI in machine translation, collaborating with Dorr, Weinberg at UMD and colleagues at IBM, JHU, CMU, and Stanford (2005-2010, $3,054,000). Supervising a team of computer scientists and linguists in developing a state-of-the-art system for automatic translation from Chinese and Arabic to English, combining linguistic analysis with statistical tools.

- As UMd's lead investigator for an ONR multi-university research initiative (MURI) project with Johns Hopkins U, supervised development of techniques to exploit parallel text, i.e., text in parallel translation
to acquire information about sentences in a second language from their English translations (2001-2006, $1,829,970).

- Collaboration with new UMd/JHU Center of Excellence in Human Language Technology, focusing the development of a rich grammatical formalism to connect syntactic and ontological knowledge sources, to be applied in the problem of identifying when the same entity is being referred to using different descriptions, across multiple documents in multiple languages.
- Linguist's Search Engine (http://lse.umiacs.umd.edu). The LSE makes it possible for the "ordinary working linguist" to do sophisticated searches for naturally occurring data on the Web by specifying structural and lexical search criteria. Collaborated with Center for Advanced Study of Language to develop Chinese extension of LSE, in order to support CASL's efforts in Chinese language pedagogy.

(v) Collaborators

a. Collaborators in the last 48 months (Graduate students listed in (c) below)

Bill Byrne, Cambridge University
Chris Callison-Burch, Johns Hopkins University
David Doermann, University of Maryland
Bonnie Dorr, University of Maryland
Jason Eisner, Johns Hopkins University
Rebecca Green, University of Maryland
Sanjeev Khudanpur, Johns Hopkins University
Jimmy Lin, University of Maryland
Douglas Oard, University of Maryland
Juan Uriagereka, University of Maryland
Amy Weinberg, University of Maryland
David Yarowsky, Johns Hopkins University

b. Own thesis advisor

Aravind Joshi, University of Pennsylvania

c. Graduate and Postdoc Supervision in the last five years

Graduate PhD Supervision, total = 9
Mona Diab, PhD, U of Maryland, Linguistics (2003). Columbia University
Okan Kolak, PhD, U of Maryland, Computer Science (2005). Google
Stephan Greene, PhD, U of Maryland, Linguistics (2007). ATG Inc.
Adam Lopez, PhD expected 2008, Computer Science
Michael Subotin, PhD expected 2009, Linguistics
Yuval Marton, PhD expected 2009, Linguistics
Chris Dyer, PhD expected 2010, Linguistics
Tim Hunter, PhD expected 2010, Linguistics
Tim Hawes, PhD expected 2011, Linguistics

Postdoc Supervision, total = 5
Gina Levow, U. of Maryland, (PhD, MIT) Asst. Prof, University of Chicago
Rebecca Hwa, U. of Maryland, (PhD, Harvard), Asst. Prof., U. Pittsburgh
Smaranda Muresan, U. of Maryland, (PhD, Columbia) Current postdoc
Mari Broman Olsen, U. of Maryland, (PhD, Northwestern U.), Microsoft
Daniel Zeman, U. of Maryland, (PhD, University of Prague) Charles University, Prague

Undergraduate supervision, total = 7
Greg Marton, 1999-2000 (now PhD student at MIT)
Noah Smith, 1999-2001 (PhD at JHU, now Asst. Prof. at CMU)
Jessica Stevens, 2001 (now researcher at BBN)
Aaron Ekiiss, 2001-2003 (now PhD student at Univ of Michigan)
Shihab A. Shamma  
Biographical Sketch

(i) Professional Preparation
Imperial College, London  Electrical Engineering    B.S. 1976  
Stanford University  Electrical Engineering    M.S. 1977  
Stanford University  Slavic Languages & Literature    M.S. 1980  
Stanford University  Electrical Engineering    Ph.D. 1980
(ii) Academic Positions
University of Maryland  Professor, Electrical and Computer Engineering  1995-  
University of Maryland  Joint Appointment, Inst for Systems Research  1990-  
University of Maryland  Associate Professor, Electrical Engineering,  1989-1995  
University of Maryland  Institute for Advanced Computer Studies  1987-1992  
University of Maryland  Assistant Professor, Electrical Engineering  1984-1989  
National Institutes of Health  Postdoc, Section on Brain and Behavior, NICHD 1981-1983  
(iii) Selected Publications (selected from over 70 journal publications)
Five recent publications related to this proposal:
Five additional recent publications:
(iv) Synergistic activities
• Fellow of the Acoustical Society of America, Senior Member of the Institute for Electrical and Electronic Engineers, Association for Research in Otalaryngology, and Society for Neuroscience.
• Co-organizer and Director of numerous workshops and symposia, including most recently the Annual Telluride Workshops on Neuromorphic Engineering (1997-2012 and continuing, partially funded by NSF, ONR, DARPA, and the Whitaker and Gatsby Foundations), and NiPS workshops on Neural Mechanisms of Music Perception (1999), and Thalamocortical Processing (2002).

(v) Collaborators and other Affiliations

a. Collaborators in the past 48 months (selected):
R. Carlyon University of Cambridge
C. Espy-Wilson Electrical & Computer Engineering, University of Maryland
C. Michyel Department of Psychology, University of Minnesota
A. Oxenham Department of Psychology, University of Minnesota
D. Poeppel Linguistics Department, University of Maryland
J. Z. Simon Department of Biology & ECE, University of Maryland
C. Moss Department of Psychology, University of Maryland
P. S. Krishnaprasad Electrical & Computer Engineering, University of Maryland
Brian Zook Southwest Research Institute, TX.

b. Own Graduate and Postdoctoral Advisors
Robert White Stanford University
David Symmes NIH
John Rinzel NIH

c. Graduate and Postdoctoral Advisor
Completed PhD Supervision; total = 12, 33 additional completed MS degrees supervised
X. Yang Ph.D. (1988), Industry, MD
A. Teolis Ph.D. (1991), Industry, DC
D. Lin Ph.D. (1992), Industry, CA
W. Byrne Ph.D. (1992), Lecturer, Cambridge University, UK
S. Vranic Ph.D. (1993), Industry, IL
K. Wang Ph.D. (1995), Microsoft Research, WA
N. Kowalski Ph.D. (1996), Industry, MD
T. Owens Ph.D. (1997), Industry, MD
P. Ru Ph.D. (1998), Industry, MD
N. Kanlis Ph.D. (2000), Research Scientist, U. of Thessaloniki, Greece
T. Chi Ph.D. (2003), Assistant Professor, Taiwan
M. El-Hilali Ph.D. (2004), Assistant Professor, Johns Hopkins University

Current Graduate Ph.D. Students: total = 4
N. Mesgarani Ph.D. Expected 2008, Electrical and Computer Engineering
S. Atiani Ph.D. Expected 2010, Neuroscience and Cognitive Science
L. Ma Ph.D. Expected 2011, Biomedical Engineering

PostDoc Supervision; total = 16:
J. Fleschman Postdoc, 1985-1988 (PhD University of Virginia)
X. Yang Postdoc, 1988-1989 (PhD University of Maryland)
H. Versnel Postdoc, 1989-1993 (PhD University of Utrecht)
S. Vranic Postdoc, 1994-1995 (PhD University of Maryland)
J. Lin Postdoc, 1994-1995 (PhD University of Maryland)
K. Wang Postdoc, 1995-1997 (PhD University of Maryland)
P. Ru Postdoc, 1998-1999 (PhD University of Maryland)
J. Simon Postdoc, 1999-2002 (PhD UC Santa Barbara)
D. Depireux Postdoc, 1998-2002 (PhD University of Liege, Belgium)
E. Grassi Postdoc, 2000-2003 (PhD Boston University)
S. Callori Postdoc, 2002-2005 (PhD MIT)
J. Fritz Postdoc, 2003-2007 (PhD Washington University)
T. Chi Postdoc, 2003-2006 (PhD University of Maryland)
S. David Postdoc, 2005-2008 (PhD University of California Berkeley)
P. Ying Postdoc, 2004-2008 (PhD University of Beijing)
M. El-Hilali Postdoc, 2004-2007 (PhD University of Maryland)
Jonathan Z. Simon
Biographical Sketch

(i) Professional Preparation
Princeton University Physics A.B. 1985
University of California, Santa Barbara Physics M.A. 1987
University of California, Santa Barbara Physics Ph.D. 1990
University of Wisconsin, Milwaukee General Relativity Postdoc 1990–1992
University of Maryland Auditory Neuroscience Postdoc 1996–2001

(ii) Academic Appointments
University of Maryland Electrical & Computer Engineering (ECE) Assistant Professor 2001
University of Maryland Biology (50%) / ECE (50%) Assistant Professor 2002-

(iii) Publications (selected from 44 publications)

5 Related Publications


5 Other Significant Publications


(iv) Synergistic Activities

- New Curriculum Development
  - Quantitative Analysis of Biological Data (Graduate Level Biology), 2002–present;
  - Mathematical Biology (Undergraduate Level Biology), 2005–present.
  - Data Analysis and Modeling component of Neural Systems & Behavior course, Marine Biological Laboratory, Woods Hole, 2001–present.
- Interdepartmental collaborations leading to peer-reviewed journal articles or shared federal grants
  - David Poeppel (Linguistics/Biology, UMCP)
  - Shihab Shamma (Electrical & Computer Engineering, UMCP)
  - Cynthia Moss (Psychology, UMCP)
  - Catherine Carr (Biology, UMCP)
• Instructional videos for new teaching assistants
  o Getting Past Those First Quarter Blues: Interacting With Your Students.
  o Approaches to Problem Solving: The Good & Bad.

(v) Collaborators and other Affiliations

a. Collaborators in past 48 months
T. Arai             Sophia U.  
M. Aytekín         U. Maryland  
C. E. Carr          U. Maryland  
T. Chi              U. Maryland  
A. de Cheveigné     CNRS, Paris  
D. A. Depireux      U. Maryland, Baltimore  
G. Eden             Georgetown U.  
M. Elhilali         U. Maryland  
D. L. Flowers       Georgetown U.  
J. B. Fritz         U. Maryland  
S. Greenberg        Silicon Speech  
D. F. Hill          Georgetown U.  
S. Iyer             Johns Hopkins U.  
S. Kalluri          Starkey Research  
D. J. Klein         U. Maryland  
J. Le Roux          CNRS, Paris  
H. Luo              Chinese Academy of Sciences  
L. Ma               U. Maryland  
K. MacLeod          U. Maryland  
C. Moss             U. Maryland  
D. Poeppel          U. Maryland  
S. A. Shamma        U. Maryland  
D. Soares           U. Maryland  

b. Own Graduate and Postdoctoral Advisors

Ph.D.:            J. B. Hartle       U. California, Santa Barbara  
Postdoc          J. L. Friedman    U. Wisconsin, Milwaukee  
                B.-L. Hu          U. Maryland  
                S. A. Shamma     U. Maryland  

(c. Student and Postdoc Supervision

Graduate Students; total = 9; (* indicates co-advisor)

Maria Chait*              PhD, U. Maryland (2006). Auditory Processing in the Human Brain
Juanjuan Xiang            PhD expected 2007, Auditory Processing in the Human Brain
Claudia Bonin*            PhD expected 2009, Brain-Computer Interface
Jiachen Zhuo              PhD expected 2010, Auditory Processing in the Human Brain
Kim Drnec*                PhD expected 2010, Somatosensory processing in awake animals
Nai Ding                 PhD expected 2012, Auditory Processing in the Human Brain

Postdocs Supervision; total = 1; (* indicates co-advisor)

Yadong Wang*        Postdoc, U. of Maryland (PhD, U. of Rhode Island)       2003-2006
Juan Uriagereka
Biographical Sketch

(i) Professional Preparation

Universidad de Deusto (Bilbao, Spain)  Philology  Licenciatura, 1983 (magna cum laude)
University of Connecticut  Linguistics  Ph.D., 1988

(ii) Professional Appointments

University of Maryland  Linguistics  Assistant Professor, 1989-1994
Georgetown University  Linguistics  Adjunct Professor, 1991-1994
University of Maryland  Linguistics  Associate Professor, 1994-2000
University of the Basque Country  Philology  Visiting Research Chair, 2002-2005
University of Maryland  Linguistics  Professor, 2000-

(iii) Selected Publications (selected from 88 publications)

5 recent publications related to the current proposal:


5 Additional recent publications:


(iv) Synergistic Activities

- Founding Member of the Basque Academy of Arts and Sciences (Jakiunde).
- Think-tanks: Member of the G2 Advisory Group to the Basque Presidency, Spain.
- Editorial Boards: Syntax, Probus, Biolinguistics, Linguistic Variation Yearbook, LICOM (Germany), Knowledge of Language Series (Spain), ReVEL (Brazil), Signos Linguísticos (Mexico), Anuario del Seminario Julio de Urkijo (Spain).
- Scientific Boards/panels: Institució Catalana de Recerca i Estudis Avançats (Spain), Center for Complex Dynamic Systems (Postdam, Germany), Asymmetry Project (Universiéd du Québec à Montréal, Canada), ASG Arbeitsstelle für Strukturelle Grammatik (Humboldt University, Berlin, Germany).
the Generative Linguistics of the Old World Symposium, the Hispanic Linguistic Society Symposium, the Linguistic Symposium of Romance Linguistics, the North Eastern Linguistic Symposium, the Western Conference on Linguistics, the West Coast Conference on Formal Linguistics, National Science Foundation, European Science Foundation, SSHRC (Canada), the Rockefeller Foundation, Blackwell, Cambridge, MIT Press, Oxford, etc.

- Co-PI in three team-based NSF awards at U of Maryland (1996-1999, 1999-2002, and 2007-2009, $600,000 total), and two European collaborative projects in Spain (~$150,000).
- Director of the Graduate Program in Linguistics (1999-2003) (recipient of Outstanding Graduate Director Award from U of Maryland in 2004).
- Organizer of several workshops on language/cognition in several countries, lectures on various topics ranging from biolinguistics to politics, several interviews in the media, collaborator of cultural ensemble)musica(aperta (Washington D.C.).

(v) Collaborators

a. Collaborators in the last 48 months (Graduate students/post-docs listed in (c) below)

Cedric Boeckx Harvard University
Wolfram Hinzen University of Amsterdam
Norbert Hornstein University of Maryland
Howard Lasnik University of Maryland
Massimo Piattelli-Palmarini University of Arizona
Eduardo Raupo University of California at Santa Barbara
Douglas Saddy University of Reading

b. Own thesis advisor

Howard Lasnik University of Maryland

c. Graduate and Post-doc Supervision

Doctoral Supervision (* indicates co-advisor), total = 20, including:

A. Martins* PhD, University of Lisbon (1994): University of Lisbon, Portugal
J. Nunes PhD, University of Maryland (1995): University of Sao Paulo, Brazil
C. Schmitt PhD, University of Maryland (1995): Michigan State University
E. Thompson PhD, University of Maryland (1996): Florida International University
R. Ebepare PhD, University of Maryland (1997): CNRS, France
K. Muromatsu PhD, University of Maryland (1998): Takushoku University, Japan
J.C. Castillo PhD, University of Maryland (2001): University of Northern Iowa
E. Murgia* PhD, University of Maryland (2003): University of Toulouse, France
M. Guimaraes PhD, University of Maryland (2004): Universidade do Parana, Brazil
I. San Martin PhD, University of Maryland (2004): University of Basque Country, Spain
J. Drury PhD, University of Maryland (2005): McGill University
L. Pablos* PhD, University of Maryland (2006): University of Reading
A. Gallego* PhD, University of Barcelona (2007): University of Barcelona
U. Soltan PhD, University of Maryland (2007): Middlebury College
I. Ortega PhD, expected 2008, University of Maryland
S. Hoerner PhD, expected 2012, University of Maryland

Postdoc Supervision; total = 2:

M. Camps Postdoc, University of Maryland (PhD Oxford, 2004)
J. Gutierrez Postdoc, University of Maryland (PhD U. Basque Country, 2005)
Amy S. Weinberg
Biographical Sketch

(i) Professional Preparation:
McGill University Linguistics/Philosophy BA 1976 (1st cl., joint hons)
MIT Linguistics PhD, 1988

(ii) Academic Appointments:
University of Maryland Center for Adv. Study of Language Area Director Technology
University of Maryland Linguistics/UMIACS Associate Prof. 1992-
University of Maryland Linguistics/UMIACS Assistant Prof. 1987-1992
University of Maryland Linguistics Lecturer 1984-1987

(iii) Selected Publications

5 recent publications related to the current proposal:
annotation projection. Proceedings of the 40th Meeting of the Association for Computational
Linguistics (ACL-02).
using telicity as a cue for tense structure in a Chinese to English MT system. Proceedings of the MT-
Summit VIII.

5 additional recent publications:
Somerville, MA: Cascadilla Press.
Proceedings of the Third International Conference on Language Resources and Evaluation (LREC-
2002).

(iv) Synergistic Activities

- Area Director for Technology in the Center for Advanced Study of Language (2004-2007).
  Supervised technology and linguistics research at UMD’s DoD funded University- Affiliated
  Research Center (UARC). Founded in 2003, CASL currently employs approximately 60
  researchers in second language acquisition, language technology, psychology, anthropology and
  linguistics to improve performance of US government foreign language professionals.
• Leader for U of Maryland Initiative in Language, Cognition, and Culture: the U of Maryland has embarked on a university-wide initiative to enrich its research and teaching potential in this area. Currently working with the Vice President for Research to formulate university wide strategy and programs, and to assist individual groups in strategic planning and proposal development.

• University Lead Investigator in the DoD Center of Excellence in Human Language Technology. Subcontract from Johns Hopkins U provides funding for a jointly staffed research center to provide basic research to improve language technology for DoD applications.

• Associate Director, Neuroscience and Cognitive Science Program (2002-2004).

• Reviewer for 25 journals in psycholinguistics and computational linguistics.

• Co-organizer of CUNY Conference on Human Sentence Processing, University of Maryland, April 2004 (primary annual conference devoted to psycholinguistics; joint with Colin Phillips).

• Frequently asked to be panel expert for DoD on matters related to Human Language Technology

• Co-director, Language and Media Processing Laboratory and Co-director, Computational Linguistics and Information Processing Laboratory, both in UM Inst for Advanced Computer Studies.

(v) Collaborators and other Affiliations:

a. Collaborators in Past 48 months (graduate students are listed in (c) below):

Sachiko Aoshima American University
Rebecca Hwa University of Pittsburgh
Thomas Keenan Department of Defense
Colin Phillips University of Maryland
Mari Olsen Microsoft Corporation
Philip Resnik University of Maryland
David Traum University of Southern California
Carol VanEss Dykema Department of Defense

b. Own Graduate & Postdoctoral Advisor

Noam Chomsky Massachusetts Institute of Technology

c. Graduate Theses and Postdoc Supervision

Postdoctoral Supervision; total =4:
David Chiang 2004-2005 (PhD, UPenn), Research Asst Prof., U of Southern California
Rebecca Hwa 2000-2003 (PhD, Harvard), Asst Prof, U of Pittsburgh.
Mari Olsen 1998-2000 (PhD, Northwestern), Senior scientist, Microsoft Research.
David Traum 1998-2000 (PhD, Rochester), Research Sci., U of Southern California

Graduate Supervision; total = 10 (* = co-advisor)

Paola Merlo PhD, Linguistics (1993). Assoc. Professor, Universite de Geneve (Ling)
Suzanne Stevenson PhD, Comp Sci (1994). Assoc. Professor, University of Toronto (CS)
Margaret Antonisse PhD, Linguistics (2000). Lecturer, University of Maryland (Ling)
Sachiko Aoshima* PhD, Linguistics (2003). Asst. Professor, American University (Langs)
Elixabete Murguia* PhD, Linguistics (2003). Postdoc, University of Deusto (English)

Asad Saeed PhD expected 2009: Computer Science
Yuval Marton* PhD expected 2009: Linguistics
(i) Professional preparation
Swarthmore College  Psychology  BA, 1987
Stanford University  Psychology  PhD, 1992
Cornell University  Psychology  Postdoctoral Researcher, 1992-1993

(ii) Academic Appointments
University of Maryland  Psychology/NACS  Professor, 2005-present
University of Chicago  Psychology/Human Devel.  Associate Professor, 2003-2005
University of Chicago  Psychology  Assistant Professor, 1993-2000.

(iii) Publications (selected from 40 publications)

Five most closely related to the current proposal:


Five other significant publications:


Cognition.


(iv) Synergistic activities

- Extensive peer review and editorial service in experimental psychology, cognitive science, and general science. Current activities include Associate Editor of Developmental Psychology (APA); editorial board member for the Journal of Experimental Psychology: General (APA) and Language Learning and Development; Reviewer for numerous journals in developmental and experimental psychology as well as cross-disciplinary outlets (e.g., BBS, Science, TICS); Standing member of the NIH Cognition and Perception Review Panel, College of Reviewers for the Canada Research Chairs Program, grant reviewer for the National Science Foundation.

- Development of cross-disciplinary doctoral training via academic leadership. Current activities include: founder and director of the Field Committee in Developmental Science (devsci.umd.edu); head of the graduate program in Developmental Psychology within the Psychology Department;
and Graduate Director for the interdisciplinary doctoral Program in Neuroscience and Cognitive Science (nacs.umd.edu).

- Activities to support synergistic communication among developmental scientists include: Co-organizer of an NSF sponsored conference on New Approaches to Infant Learning and Infant Cognition, 2005; Co-editor of the resulting book (to be published by Oxford University Press); and organizer of invited symposia at international meetings, including the International Society for Infant Studies, the American Psychological Association, and The Jean Piaget Society.
- Research mentor in programs to encourage the pursuit of scientific careers for high school and college students, including members of underrepresented minorities. Current activities include: mentor in the Research Practicum program at Eleanor Roosevelt High School, a public science magnet program in Prince George’s County, MD (3 current students, 3 students in prior years); Mentor in the University of Maryland NACS Summer Internship Program for Undergraduates (http://nacs.umd.edu/program/summer.html) (2 students).
- Outreach activities to communicate the goals and achievements of developmental science include: Co-director of the UMD Infant Studies Consortium (infantstudies.umd.edu), appeared in the documentary television series The Baby Human (Discovery Health Channel); Interviews for parent-directed outlets (e.g. Parenting Magazine); appearances in local news programs.

(v) Collaborators and other affiliations

a. Collaborators in Past 48 months (graduate students and postdocs are listed in (c) below)

<table>
<thead>
<tr>
<th>Name</th>
<th>Affiliation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jane Clark</td>
<td>University of Maryland</td>
</tr>
<tr>
<td>Jose Contreras-Vidal</td>
<td>University of Maryland</td>
</tr>
<tr>
<td>Nathan Fox</td>
<td>University of Maryland</td>
</tr>
<tr>
<td>Jane Kiley Hamlin</td>
<td>Yale University</td>
</tr>
<tr>
<td>Susan Levine</td>
<td>University of Chicago</td>
</tr>
<tr>
<td>Jeff Lidz</td>
<td>University of Maryland</td>
</tr>
<tr>
<td>Amy Needham</td>
<td>Duke University</td>
</tr>
<tr>
<td>Rochelle Newman</td>
<td>University of Maryland</td>
</tr>
<tr>
<td>Nan Ratner</td>
<td>University of Maryland</td>
</tr>
<tr>
<td>Beate Sodian</td>
<td>Ludwig Maximillian University of Munich</td>
</tr>
</tbody>
</table>

b. Own Graduate and Postdoctoral advisors

<table>
<thead>
<tr>
<th>Name</th>
<th>Affiliation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ellen Markman</td>
<td>Stanford University</td>
</tr>
<tr>
<td>Elizabeth Spelke</td>
<td>Cornell University (now at Harvard University)</td>
</tr>
<tr>
<td>Frank Keil</td>
<td>Cornell University (now at Yale University)</td>
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</tbody>
</table>

c. Graduate Theses and Postdoctoral Supervision

<table>
<thead>
<tr>
<th>Name</th>
<th>Affiliation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jose Guajardo</td>
<td>Ph.D, University of Chicago (2002): Researcher, Microsoft</td>
</tr>
<tr>
<td>Jessica Sommerville</td>
<td>Ph.D, University of Chicago (2002): Asst. Professor, Department of</td>
</tr>
<tr>
<td>Camille Wilson-Brune,</td>
<td>PhD, University of Chicago (2004): Research Assistant Professor,</td>
</tr>
<tr>
<td>Jessica Heineman Pieper</td>
<td>PhD, University of Chicago (2005).</td>
</tr>
<tr>
<td>Amrisha Vaish,</td>
<td>MA, University of Chicago (2006): doctoral student at the Max Planck</td>
</tr>
<tr>
<td>Jennifer Buress</td>
<td>PhD, University of Chicago (2007), Post doctoral researcher, University</td>
</tr>
<tr>
<td>Melissa Koenig</td>
<td>post doctoral 2004-2007: Assistant Professor, Institute for Child</td>
</tr>
<tr>
<td>Sarah Gerson</td>
<td>PhD expected 2011, University of Maryland</td>
</tr>
</tbody>
</table>

Postdoctoral Supervision; total = 2:

<table>
<thead>
<tr>
<th>Name</th>
<th>Affiliation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Erin Cannon</td>
<td>(PhD 2006, University of Mass., Amherst), 2006 - present</td>
</tr>
<tr>
<td>Annette Henderson</td>
<td>(PhD 2007, Queens University, Canada), 2007 - present</td>
</tr>
</tbody>
</table>
Aniela Improta França
Biographical Sketch

(i) Professional Preparation

Faculdade da Cidade Language BA, 1992
Federal U. of Rio de Janeiro Linguistics PhD, 2002

(ii) Academic Appointments

Federal U. of Rio de Janeiro Linguistics Assistant Professor, 1992-1994
Federal U. of Rio de Janeiro Linguistics Associate Professor, 1994-present
Federal U. of Rio de Janeiro Linguistics-Graduate School Core Professor, 1996-present

(iii) Selected Publications (selected from 24 publications)

5 recent publications related to the current proposal:


5 additional recent publications:


(iv) Synergistic Activities

- Head of Linguistics Department of the Federal University of Rio de Janeiro
- Vice Director: Linguistics Workgroup of ANPOLL (Language, Literature and Linguistic Society of Brazil).
- Organizer of numerous conferences and workshops (e.g. UFRJ-UMD Workshop on Neuroscience of Language; Laboratory Phonology; Interfaces of Syntax). Frequently invited
speaker (26 courses/workshops/conferences since 2002) on “synergy” among linguistics, psychology and neuroscience in several universities all over Brazil and in International events such as the 7th Sao Paulo Research Conference.

- Development and teaching of a new undergraduate course on Cognitive Neuroscience offered by the Advanced Program on Neuroscience from the Medical School of the Federal University of Rio de Janeiro.

(v) Collaborators and other Affiliations

a. Collaborators in Past 48 months (graduate students and postdocs are listed in (c) below)

<table>
<thead>
<tr>
<th>Name</th>
<th>Affiliation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Miriam Lemle</td>
<td>Linguistics, Federal University of Rio de Janeiro</td>
</tr>
<tr>
<td>Marcus Maia</td>
<td>Linguistics, Federal University of Rio de Janeiro</td>
</tr>
<tr>
<td>Leonardo Azevedo</td>
<td>Fundação Oswaldo Cruz – Hospital Fernandes Figueira</td>
</tr>
<tr>
<td>João da Franca</td>
<td>Medical School, Federal University of Rio de Janeiro</td>
</tr>
<tr>
<td>Rogério Panizutti</td>
<td>Medical School, Federal University of Rio de Janeiro</td>
</tr>
</tbody>
</table>

b. Own Graduate Advisor

<table>
<thead>
<tr>
<th>Name</th>
<th>Affiliation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Miriam Lemle</td>
<td>Federal University of Rio de Janeiro</td>
</tr>
</tbody>
</table>

c. Graduate Thesis Supervision

<table>
<thead>
<tr>
<th>Name</th>
<th>Affiliation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fernanda Botinhao</td>
<td>Medical School - PhD, (started Aug, 2007) – Federal U. of Rio de Janeiro</td>
</tr>
</tbody>
</table>
Masatoshi Koizumi
Biographical Sketch

(i) Professional Preparation

International Christian U.        Linguistics        BA, 1988
Ohio State University            East Asian Lang & Lit   MA, 1991
MIT                                Linguistics        PhD, 1995

(ii) Academic Appointments

Tohoku Gakuin University         English           Assistant Professor, 1995-1996
Tohoku Gakuin University         English           Associate Professor, 1996-2000
Tohoku University                Linguistics        Associate Professor, 2000-present

(iii) Selected Publications (selected from 58 publications):

5 recent publications related to the current proposal:


5 additional recent publications:


(iv) Synergistic Activities

• Editorial board: Journal of East Asian Linguistics. Reviewer for many journals in linguistics and cognitive science, and for proposals to granting agencies in these areas.
• Member of the executive committee: Linguistic Society of Japan
• Frequently invited speaker (20 courses/workshops/conferences since 2000) on “synergy” among linguistics, psychology and neuroscience
• Unit leader in the Tohoku University 21st Century Center of Excellence Program in Humanities (2002-2007), a large training grant from the Japanese Ministry of Education, Culture, Sports, Science and Technology, which is a counterpart of NFS’s IGERT program.
• Organizer of numerous conferences and workshops (e.g. CBL Seminar at Tohoku University, Japan, 2005; An International Workshop on Language, Brain and Cognition in Cambridge, UK, 2004; Formal Approaches to Japanese Linguistics 1 at MIT, 1993)
• Development and teaching of a new graduate course on Developmental Cognitive Neuroscience that incorporates a large-scale behavioral as well as ERP and NIRS practicum with preschoolers.

(v) Collaborators and other Affiliations

a. Collaborators in Past 48 months (graduate students and postdocs are listed in (c) below)

Jiro Gyoba Tohoku University
Hiroko Hagiwara Tokyo Metropolitan University
Kaoru Horie Tohoku University
Miwa Isobe Tokyo National University of Fine Arts and Music
Jun’ichi Kawahara Hiroshima University
Ryuta Kawashima Tohoku University
Yayoi Miyaoaka Hiroshima University of Economics
Hiromu Sakai Hiroshima University
Kuniyoshi Sakai University of Tokyo
Shigeru Sato Tohoku University
Koji Sugisaki Mie University
Katsuo Tamaoka Hiroshima University
Kei Yoshimoto Tohoku University
Noriaki Yusa Miyagi Gakuin Women’s University

b. Own Graduate & Postdoctoral Advisor

Noam Chomsky MIT

c. Graduate Theses and Postdoc Supervision

Graduate Supervision:

Masahiko Nose PhD, Tohoku U. (2002). Postdoc, Tohoku University
Ken’ichi Mihara PhD, Tohoku U. (2005). Professor, Osaka University of Foreign Studies
Eun-mi Song PhD, Tohoku U. (2007). Part-time Lecturer at several universities in South Korea

Postdoc Supervision:

Jungho Kim Postdoc (PhD, Tohoku U.), Tohoku U. & Japan Society for the Promotion of Science 2006-present
Mikihiro Tanaka Postdoc (PhD, U. of Edinburgh), Tohoku U. & Japan Science and Technology Agency 2007-present
Takuya Goro Postdoc (PhD, U. of Maryland), Tohoku U. & Japan Science and Technology Agency 2007-present
(i) Professional Preparation
University Gama Filho (Brazil)    Portuguese    B.S., 1976
University of Southern California   Linguistics    Ph.D., 1994
City University of New York    Sentence Processing    Visiting Scholar, 2003-2004

(ii) Professional Appointments
The Indian Museum (Brazil) Language Documentation    Researcher 1986-1990
University of Southern California Portuguese    Teaching Assistant, 1992-1994
Federal University of Rio de Janeiro Linguistics    Assistant Professor 1994-1996
Federal University of Rio de Janeiro Linguistics    Associate Professor 1997-

(iii) Selected Publications (selected from over 50 publications):

5 recent publications related to the current proposal:


5 additional recent publications:


(iv) Synergistic Activities

- Currently one of the coordinators of the Linguistics Sector within the Anthropology Department of the National Museum (Museu Nacional/UFRJ), operating under the auspices of the Federal University of Rio de Janeiro. Active in research on Brazilian indigenous languages since 1981, and in the area of
education for indigenous people since the mid 1980s. Affiliated with the Museu do Indio (Brazilian Indian Museum), which operates under the umbrella of the Brazilian Indian Foundation (FUNAI), where he investigated the educational situation of the Karaja people in central Brazil. Ongoing work in education initiatives of indigenous peoples, helping in the production of educational material such as dictionaries and school textbooks in different indigenous languages.

- Served since 2001 as a consultant and a professor in the Higher Education Project for Indigenous Peoples (Projeto do 3º Grau Indígena), where students of several indigenous groups that have been able to complete high school education within their communities are now seeking a university degree. In 2006 three students from two different groups (Kaingang and Karajá) completed undergraduate degrees under his supervision, with the following theses: Marcia Nascimento Kaingang. (2006). Yes/no interrogative sentences in the Kaingang language [Frases interrogativas Sim-Não na língua Kaingang]. Wadoi Karajá. (2006). Karajá Syntax [Sintaxe Karajá]. Woubedu Karajá. (2006). The linguistic invasion in the Hâwalo camp. [A invasão linguística na aldeia Hâwalo].
- General Coordinator of the Psycholinguistics work group at ANPOLL (the Brazilian national association in graduate research on linguistics and literature). Established the first psycholinguistics lab to use eye-tracking technology in Brazil.
- Organizer of national conferences and workshops (e.g. 1st Language Processing Workshop at UFRJ, 2005 and the national meeting of the Psycholinguistics work group at ANPOLL, 2007).

(v) Collaborators and other Affiliations

a. Collaborators in Past 48 months (graduate students and postdocs are listed in (c) below)

- Eva Fernandez CUNY Graduate Center
- Armanda Costa U. of Lisbon
- José Olimpio Magalhães Federal University of Minas Gerais, Brazil
- Miriam Lemle Federal University of Rio de Janeiro
- Aniela Impota França Federal University of Rio de Janeiro
- João Moraes Federal University of Rio de Janeiro
- Filomena Sândalo Campinas State University
- Bruna Franchetto Federal University of Rio de Janeiro
- Luciana Storto São Paulo State University

b. Own Graduate & Postdoctoral Advisors

- Yonne de Freitas Leite Federal University of Rio de Janeiro
- Joseph Aoun USC, currently President, Northeastern University, Boston
- Maryellen MacDonald USC, currently at U of Wisconsin/Madison

c. Graduate Theses and Postdoc Supervision

Graduate Supervision (*indicates co-advisor); total = 9:

- Maria de Fátima B. de Melo* PhD, UFRJ (2003). Asst Professor, Federal U. of Paraíba
- Marcio Leilão PhD, UFRJ (2005). Asst Professor, Federal U. of Paraíba
- Paulo Antonio P. Correa PhD, UFRJ (2007). Asst Professor, Federal U. of Sergipe
- Rosana C. de Oliveira PhD, UFRJ (2007). Visiting Professor, Mato Grosso State University
- Cirineu C. Stein* PhD expected 2008, UFRJ, psycholinguistics
- Eduardo K. Areas PhD expected 2008, UFRJ, psycholinguistics
- Guiomar Albuquerque PhD expected 2008, UFRJ, psycholinguistics
- Mª do Carmo Lourenço-Gomes PhD expected 2008, UFRJ, psycholinguistics
- Katia Abreu* PhD expected 2010, UFRJ, linguistics

Postdoc Supervision; total = 1

- José Olimpio Magalhães Postdoc (PhD, UFRJ), 2006-present
Hiromu Sakai
Biographical Sketch

(i) Professional Preparation
Kyoto University, Japan Linguistics BA, 1984
Kyoto University, Japan Linguistics MA, 1988
UC Irvine Social Science PhD, 1996

(ii) Academic Appointments
Hiroshima University, Japan Linguistics Assistant Professor, 1995-2002
Hiroshima University, Japan Linguistics Associate Professor, 2002-present

(iii) Selected Publications (selected from 34 publications):

5 recent publications related to the current proposal:


5 additional recent publications:


(iv) Synergistic Activities

- Director of Project Center for Brain Science of Language Acquisition and Language Learning, Hiroshima University (2002-current)
Research), English Linguistics, etc. Reviewer for Japan Society for Promotion of Science Research Fellowship for Young Scientists (2005-2007).

- Member of the research group of Priority Areas <Higher-Order Brain Functions> by the Japanese Ministry of Education, Culture, Sports, Science and Technology; Unit leader of the RISTEX 'Brain Science and Education' project (An Integrated study of language learning, brain development, and language education: Project Leader, Hiroko Hagiwara, Tokyo Metropolitan University) by the Japan Science and Technology Agency.
- PI for 'Cross-Border Training Program for Second Language Studies' in the Graduate School of Education, Hiroshima University. Submitted for the ITP (International Training Program for Younger Researchers) from the Japanese Society for Promotion of Science and Technology (counterpart of NSF’s IGERT program), ranked as 'A (highest)' among unsuccessful programs in 2007. To be revised and resubmitted.

(v) Collaborators and other Affiliations

a. Collaborators in Past 48 months (graduate students and postdocs are listed in (c) below)

Kuniyoshi Sakai  Tokyo University, Japan
Katsuo Tamaoka  Hiroshima University, Japan
Makoto Miyatani  Hiroshima University, Japan
David Poeppel  University of Maryland
Robert Fiorentino  University of Kansas
Nina Kazanina  University of Bristol, UK

b. Own Graduate & Postdoctoral Advisor

C.-T. James Huang  Harvard University
Naoki Fukui  Sophia University, Japan

c. Graduate Theses and Postdoc Supervision

Graduate Supervision; total = 18:
Harold Kusters  PhD, Hiroshima University (2003). Mazda Inc., Hiroshima, Japan
Chizuko Matsuoka  PhD, Hiroshima University (2004). Lecturer., Pusan U. of Foreign Studies, Korea
Chao Zhang  PhD, Hiroshima University (2005). Assistant Prof., Shanghai Maritime University
Adrian Ivana  PhD, Hiroshima University (2006). Japanese Syntax, Syntactic Theory
Gundogdu Gengiz  MA, Hiroshima University (2004). Sociolinguistics, Pragmatics
Chiu Rosalynn S.  PhD expected 2010, Hiroshima University, Psycholinguistics
Deng Ying  PhD expected 2010, Hiroshima University, Psycholinguistics, L2 Acquisition
Young-Jie Kim  PhD expected 2010, Hiroshima University, Japanese Syntax & Semantics
Baris Kahraman  MA expected 2008, Hiroshima University, Psycholinguistics
Sheng-Yan Long  MA expected 2008, Hiroshima University, Psycholinguistics
Luo Wei  MA expected 2008, Hiroshima University, Psycholinguistics
Atsushi Sato  MA expected 2008, Hiroshima University, Psycholinguistics
Kyoko Sakamoto  MA expected 2009, Hiroshima University, L2 Acquisition

Postdoc/Research Fellow Supervision; total = 2:
Hajime Ono  Postdoc, Hiroshima University (PhD, U. of Maryland)  2006-current
Megumi Yoshimura  Research Fellow, JST (MA, Kyushu University)  2005-current
Udaya Narayana Singh
Biographical Sketch

(i) Professional Preparation

University of Calcutta  Linguistics  B.A.  1972
Delhi University  Linguistics  M.A.  1975
Delhi University  Linguistics  Ph.D.  1979

(ii) Appointments

Central Institute of Indian Langs, Mysore, India.  Director.  2000-present
Centre for Applied Ling & Transl Studies, U of Hyderabad.  Professor  1987-2000
Dept of Linguistics, Delhi University  Reader  1985-1987
Dept of Linguistics, South Gujarat U.  Reader  1981-1985
Dept of Linguistics, U of Baroda  Lecturer  1979-1981

(iii) Publications (selected from 150 publications)

5 Publications most closely related to current proposal


5 Selected Additional Publications:


(iv) Synergistic Activities

• Organized numerous conferences and summer institutes on machine translation, psycholinguistics, language policy and general linguistics.
• Director of Linguistic Survey of India, a national project to document all of the languages of India.
• Director of major project on documenting and promoting endangered and less well-documented languages of India.
• Past editor in chief: Indian Linguistics.
• Worked with UNESCO on global multilingualism policy.
• Director of Longman-CIIL Dictionaries project, geared towards creation of comprehensive dictionaries for Indian Languages.

• Director of Linguistic Data Consortium of Indian Languages, geared towards creating electronic corpora of Indian Languages.

(v) Collaborators and Other Affiliations

a. Collaborators within the last 48 months

P. Mohanty University of Hyderabad
Probal Dasgupta University of Hyderabad
B.R. Bapuji University of Hyderabad
P.P. Giridhar Central Institute of Indian Languages
Rajiv Sangal Indian Institute of Technology

b. Own Graduate and Postdoctoral Advisors

P.B. Pandit

c. Graduate Theses and Postdoc Supervision

Graduate Supervision (*indicates co-advisor), total PhD=12; total MPhil=21

D. Gunasekaran. PhD, University of Hyderabad. 1992
P. Rekha Abel* PhD, University of Hyderabad. 1997
Jayaraj Awasthi* PhD, University of Hyderabad. 1997
S.K. Singh* PhD, University of Hyderabad. 1998
M.K. Pandey* PhD, University of Hyderabad. 1998
S.K. Pattanayak* PhD, University of Hyderabad. 1998
K. Rajya Rama* PhD, University of Hyderabad. 1998
G.P. Bhattacharai PhD, University of Hyderabad. 1999
Bal Mukund Bhandari PhD, University of Hyderabad. 2000
G.V.K.S. Narayan Reddy* PhD, University of Hyderabad. 2000
Abdullah Al-Hamzii PhD, University of Hyderabad. 2001
M. Radhika PhD, University of Hyderabad. 2001
Aparupa Dasgupta PhD, University of Hyderabad. 2002
Rifaat Ara-Awad PhD, University of Hyderabad. 2004
16 pages of budget information removed
G. Facilities, Equipment and Other Resources

Laboratory
(i) The Cognitive Neuroscience of Language Lab (CNL: Linguistics) is a central facility for this project, with 5000sf of office, laboratory and meeting space shared between 40 faculty, staff, and students.
(ii) A consortium of 3 infant laboratories (Amanda Woodward, Psychology; Jeff Lidz, Linguistics; Rochelle Newman, Hearing & Speech) supports testing of infants aged 2-24 months, with coordinated recruitment efforts.
(iii) 3 computational linguistics labs are housed in the U of Maryland Institute for Advanced Computer Studies (UMIACS), with close ties to computational labs at the Center for Advanced Study of Language (in the M-Square Research Park) and the Center of Excellence in Human Language Technology (Johns Hopkins U).
(iv) The Institute for Systems Research (Elec. Comp. Eng.) has a cluster of labs for speech and hearing.
(v) Hearing & Speech lab facilities include an anechoic chamber.
(vi) Additional testing space is available in the Psychology department and the School of Languages.

Clinical
(i) Drs Shah (UMd) and Braun (NIH-NIDCD) conduct research with aphasic patients. Braun’s lab is in the main NIH Clinical Center in Bethesda, MD (~8 miles from UMd), and has access to a large regional patient population.
(ii) Dr Ratner directs the LEAP preschool program for children with developmental language delays and works extensively with children who stutter.
(iii) Dr Zukowski conducts basic research on children with Williams Syndrome, a rare genetic disorder characterized by fluent but arrested language development.

Animal
Dr Shamma’s Neural Systems Laboratory (Elec. Comp. Eng.) conducts neurophysiological research on auditory cortex in the ferret.

Computer
All participating labs have computer equipment suitable for their research activities.

Office
In addition to faculty offices, most participating units provide office space for all doctoral students, and the CNL Lab has dedicated space for students visiting from other units or institutions. The NACS program also has central meeting space for graduate students.

Other
5 dedicated parking spaces for families and patients visiting for studies, and for visiting speakers.

Major Equipment
(i) 160-channel magnetoencephalography (MEG) brain recording facility (Linguistics)
(ii) 32-128 channel EEG brain recording facility (Neuroscan, Linguistics)
(iii) Brain imaging using functional MRI, 1.5T and 3T scanners (NIH)
(iv) PET brain imaging (NIH)
(v) Free-head eye-tracker (Tobii, Psychology)
(vi) Head-mounted eye-tracker (IScan, Linguistics)

Other Resources
Technician/manager in CNL MEG Lab. Technical support for imaging, computer and instrumentation through NIH-P30 ‘Core’ facility in hearing and auditory neuroscience (funded 2002-7, renewal through 2012 pending). Secretarial support committed to the Developmental Science Field Committee and the Neuroscience & Cognitive Science Program. Long-standing relationship with Center for Young Children for research with preschoolers.
September 25, 2007

To whom it may concern:

I am writing to express the strong support of the College of Arts and Humanities for the IGERT proposal "Biological and Computational Foundations of Language Diversity". This initiative is shared by five colleges: ARHU (Linguistics, School of Languages, Literatures, and Cultures); CMPS (Computer Science, UMIACS); BSOS (Psychology, NACS, Hearing & Speech); LFSC (Biology); and ENGR (Electrical Engineering). The project will train graduate students in interdisciplinary methods needed to pursue advanced research involving language, and will engage students in international and local outreach activities designed to enhance the diversity of languages and diversity of participation in the language sciences. The project builds upon dramatic changes in curricula, infrastructure, and cross-college connections that I have helped the language community to implement in recent years, and it is a part of a broader institutional priority to make the University of Maryland a leading center for research on language, culture, and cognition (articulated by President C.D. Mote, Terp Magazine, Winter 2007).

The College of Arts and Humanities (ARHU) will work with the Office of the Vice President for Research and other participating units to support the goals of the IGERT in a number of ways, including the following resources. (i) Two new faculty lines in language, both likely cross-departmental appointments: a computational modeling expert, ideally split between Linguistics and UMIACS or NACS; a semanticist, split between Philosophy and Linguistics. (ii) Space for the IGERT administrative assistant, students, and international visitors and collaborators. (iii) High-level support for removing administrative barriers to cross-college collaboration, such as teaching credit for co-taught courses, formation of cross-departmental PhD committees, etc.

ARHU is committed to the goal of broadening participation in research, and a number of its efforts are relevant to the IGERT. (i) Matching travel support for recruiting minority graduate students. (ii) ARHU initiated the partnership with Northwood High School that the Linguistics group is using as a model for integrating language research into the HS psychology curriculum. (iii) ARHU will work with participating units to secure two new fellowships to allow non-US citizens to be integrated into the IGERT program (since NSF funds only US citizens). (iv) Campus-level support for students with disabilities provides sign-language interpreting for deaf students from Gallaudet University who can register for IGERT-related courses.

The University of Maryland will help to sustain the goals of the IGERT after the award is ended. (i) The new faculty lines will be maintained. (ii) The IGERT-related space will continue to be available. (iii) University and college-level support for diversity and students with disabilities is ongoing, as is the commitment to outreach programs. (iv) The university and colleges will use the IGERT as a catalyst for their long-term development efforts related to language, including sustaining international partnerships.

In sum, ARHU commits to investing its own resources in this IGERT project. I believe strongly that this project will serve as a crucial step forward in the University's efforts to further enhance its existing strengths in the study of language.

Sincerely,

James F. Harris
Dean, College of Arts and Humanities
To Whom It May Concern:

As Dean of the College of Behavioral and Social Sciences (BSOS), I want to express my strongest support for the IGERT proposal: “Biological and Computational Foundations of Language Diversity.” This initiative involves three BSOS units—the Department of Psychology, the Department of Hearing and Speech Sciences, and the Program in Neuroscience and Cognitive Science (NACS)—as well as units in four other colleges (ARHU, CMPS, LFSC and ENGR). This project will develop innovative interdisciplinary training for doctoral students across campus and it will engage students and faculty in new international collaborations and new outreach initiatives to increase diversity in language research. This proposal will become a key mechanism for furthering the University’s and College’s longstanding goal of promoting interdisciplinary research and training. The University has recently committed to becoming a leading national center for research on language, culture and cognition.

I look forward to working with the Office of the Vice President for Research and other campus units to support the goals of this IGERT. Here are some examples of the kind of support the College will provide:

(1) An aggressive hiring plan currently underway in the Department of Psychology that will bring to campus new faculty in cognitive science, cognitive neuroscience and developmental science, areas that are integral to this IGERT. Two new faculty members in cognitive and neuroscience will be recruited in the coming year and I will work with the department to continue building in these areas over the next five years.

(2) As lead Dean for the interdisciplinary NACS program, I have committed 50% of a faculty line for a position in Computational Neuroscience to be shared as a joint appointment by NACS and a NACS-participating department. The search for this position is now underway.

(3) In coordination with the Vice-President for Research and the Provost, I have committed resources for a new staff position for NACS to assist specifically on extending and developing new interdisciplinary research initiatives in neuroscience. These efforts will help us fulfill our vision of this IGERT proposal as a catalyst for long-term enhancement of interdisciplinary research on this Campus which will lead to additional integrative research programs that intersect with the IGERT.

(4) The College of BSOS is committed to maintaining and enlarging resources to support the scientific careers of minority students. A number of programs, such as the Summer Research Initiative (SRI) program, can function as an effective recruiting mechanism for IGERT program applicants.

(5) BSOS recognizes the challenge that HESP faces in attracting strong students to research careers when the majority of applicants seek clinical training. As such BSOS will provide supplemental or matching fellowship support to doctoral students admitted to study in Hearing and Speech Sciences supported by this IGERT as part of our effort to increase the number of doctoral students in HESP.

(6) Finally, I will work to eliminate administrative barriers to cross-college collaboration, for example by supporting mechanisms for teaching credit for co-taught courses, and facilitating funded collaborations with other colleges.

These activities will extend beyond the term of this IGERT because of our commitment to the type of cross disciplinary research embodied in the grant. BSOS is also committed to building and sustaining a diverse and high quality faculty and student body in the area of cognitive sciences and neurosciences. In closing, BSOS strongly supports this application for an IGERT and is happy to provide the above listed resources to further this project.

Sincerely,

Edward Montgomery
Professor and Dean
September 28, 2007

To Whom It May Concern:

I am writing this letter to express the support of the Center for Advanced Study of Language (CASL) for the research agenda to be pursued under the proposed IGERT entitled “Biological andComputational Foundations of Language Diversity.” CASL is a Department of Defense research facility dedicated to improving the language training and on the job performance of United States Government professionals whose work involves foreign language. The Center conducts research relevant to many of the project areas identified in this IGERT, including the underpinnings of cross-linguistic language learning and processing using behavioral, neuro-cognitive, and computational methods, and the development of technologically enhanced tools for cross language applications such as Machine Translation, and Language and Dialect identification.

Concrete support from the Center will include participation by our researchers in training activities relevant to their areas of expertise and participation in seminars, colloquia, and other Center activities. The Center has developed a Fellowship program for U.S. citizens who are willing to apply their expertise to our problems during the course of their graduate career. The background of IGERT trainees makes them very attractive candidates for this fellowship program, and provides a venue for IGERT traineeship to serve the nation in a very direct way. In addition, we would expect IGERT trainees to make very attractive job candidates for the Center at the end of their traineeships, and the relationships established through interaction with our researchers will serve to enhance this relationship.

This IGERT proposal has my very strong support. I believe it will enhance the University’s already strong commitment to basic research in language and its dedication to application of this work to practical training and applications.

Sincerely,

Richard D. Brecht
Executive Director
Colin Phillips  
Department of Linguistics  
1401 Marie Mount Hall  
University of Maryland  
College Park, MD 20742

Dear Colin,

I’m writing to express my support for your training grant on “Biological and Computational Foundations of Language Diversity”, and my hope that this initiative will help to strengthen the ties between NIDCD and the neuroscience and cognitive science community at the U of Maryland.

I am currently Chief of the Language Section at NIDCD, and my group is involved in cognitive neuroscience research with normal and clinical populations, with a particular interest in functional recovery in post-stroke aphasia. Our work combines neuropsychological studies using our extensive patient population with multi-modal brain imaging studies using hemodynamic methods (PET and fMRI) complemented by electrophysiological (EEG/MEG) and PET radiochemical tracer techniques.

Our group has ongoing collaborations with a number of members of your team (Poeppel, Shah, Phillips, Ratner, and their students), and the NACS PhD program at the U of Maryland provides a formal training framework for students in my lab that is not available at NIH. One recent outcome of this connection is that David Poeppel and I were able to jointly recruit Ms Nuria Abdulsabur to our labs, a talented African-American student who will divide her time between my lab at NIH and the NACS Program and CNL Lab at Maryland, supported in part by an NIH fellowship.

Previous student exchanges between our labs have been mutually beneficial: members of our group have consulted with U of Maryland researchers on linguistic issues and electrophysiological analyses, and U of Maryland students have gained experience with imaging methods that are not available to them in their home labs. Last week our group met with UMd students at NIH to discuss the set-up for a simultaneous MEG-EEG study of sentence comprehension. In the past UMd students such as Susannah Hoffman and Ellen Lau have benefited from fMRI workshops available at NIH. Your project’s partnership with Gallaudet University also overlaps with my own interests, as my group is involved in ongoing brain imaging studies of ASL speakers in collaboration with Drs. Karen Emmorey and David Corina, both VL2 team members.

I hope that the IGERT project, if successful, will allow us to strengthen the collaborations between our labs, particularly through expanded opportunities for intensive student internships. Good luck with the proposal!

Sincerely,

Allen R. Braun, M.D.  
Chief, Language Section  
National Institute on Deafness and Other Communication Disorders  
National Institutes of Health
Dr. Colin Phillips  
Department of Linguistics  
1401 Marie Mount Hall  
University of Maryland  
College Park, MD 20742

Dear Dr. Phillips:

I am writing this letter of support for your IGERT initiative at the University of Maryland. I am the Principal Investigator of our NSF sponsored Science of Learning Center (VL2) which conducts research on Visual Language and Visual Learning. VL2 is an international center uniting scholars from many disciplines working in locations around the US. Gallaudet is the focal campus for the center. We believe that the activities discussed in your proposal will enhance both our research and educational missions.

Independent collaborations (Chen-Pichler (Gallaudet)/Poeppel (UMd) and their students) already exist between researchers working on the neural underpinnings and parallels between lexical access in visual (ASL) and spoken language. There are also many points of contact for future synergy. Our work on “phonological awareness” in ASL speakers can benefit from contact with your research program that correlates phonological primitives with their neurobiological counterparts, and our efforts in the visual modality will help yours by teasing apart which features of the phonology are grounded in the auditory system, and which are matters of more abstract “segmentation” processes. Your multilingual work on both linguistic and nonlinguistic factors underlying online reading comprehension can inform our work, which aims at providing a baseline profile of a proficient ASL reader. In return, our comparative work can provide you with a richer basis for hypotheses about the relationship between “listening” and reading comprehension, and the influence of multilingual input on the development and final form of reading comprehension strategies. We see many other possible connections in other research threads, but as these are enumerated in your proposal, I will not repeat them here.

We expect to derive real benefit from your training opportunities. Our Center is dedicated to training a new cohort of deaf and hearing researchers who can sustain and advance progress in our Center’s research areas, and we would like our current students to become full partners in center-wide research efforts. Gallaudet does not currently have programs in cognitive psychology, neuroscience, or the computational areas outlined in your proposal, and our students currently learn these integrative skills through training with individual researchers on our faculty. We believe that participation in the courses you plan to offer can be of great assistance to us in filling current gaps in our training program. In addition, opportunities like your “Winter Storm”, your proseminar, and your weekly colloquia can reinforce our own educational aims by providing a graceful and “fear eliminating” introduction to the multiple disciplines currently deployed across our partner sites. We believe that providing opportunities for your students to work with ours on problems related to our respective research agendas will also help both groups to escape from their comfort zones, a goal that you mention in your proposal. The flexibility of your offerings will allow us to adapt your program to our research agenda and the educational background of our current cohort of students. We already have a mechanism for participation and support of our students in courses at UMd through the Washington area Consortium of Universities. Membership in the consortium allows students to take courses at other institutions and have the credits apply at their home universities. The consortium also provides services such as ASL interpretation. A small number of our linguistics students have used the consortium to take courses at UMd in recent years.

I look forward to the success of your proposal and to working closely with you on collaborations in the future.

Sincerely yours,

Thomas E. Allen, Ph.D.  
PI and Director, Science of Learning Center on Visual Language and Visual Learning
September 26, 2007

Dr. Colin Phillips  
Linguistics Department  
University of Maryland  
College Park MD 20742

Dear Dr. Phillips:

I am writing to confirm that Gallaudet students participating in the training associated with your IGERT proposal would be eligible to receive support such as Deaf and Hard of Hearing Services, including Interpreting Services, and Captioning FM Systems needed to participate in UMD course offerings through Disability Support Services at the University of Maryland. As members of the Consortium of Universities of the Washington Metropolitan Area, Gallaudet students are entitled to the same range of services as our own students, which we supply as needed.

In order to be eligible to receive services through DSS, a student, faculty or staff person with a documented disability must make themselves known to DSS. This involves meeting with one of the staff members of DSS, providing appropriate medical or psychological documentation and completing the registration process. The type of documentation necessary will vary depending on the type of disability and accommodations being requested (please refer to our website at www.counseling.umd.edu/DSS). During the registration interview, students receive an accommodations letter (to give each of their instructors) detailing the services appropriate to their disability.

Sincerely yours,

Evalyn R. Hamilton
Evalyn Hamilton  
Coordinator, Disability Support Services
September 25, 2007

Professor Colin Phillips  
Department of Linguistics  
1401 Marie Mount Hall  
College Park, MD 20742

Dear Colin:

It was a pleasure to meet with you to discuss your plans for recruitment, retention, and diversity related to your IGERT proposal on *Biological and Computational Foundations of Language Diversity*. I am happy to provide this letter to confirm the many programs already in place at the University of Maryland that can support your efforts (most of which you appear to have already contacted before we met). This University has a long-standing commitment to recruitment and retention of all graduate students, including students from URM, and your team offers one of our most interconnected, cross-departmental research communities. Taken together, this bodes well for a successful integrative project.

UM has a number of programs in place that serve recruitment objectives. We recognize that the deadline for the graduate school application process is too late to start recruiting for fall 08, however, we have a number of programs designed to educate and cultivate interest in research among undergraduate students from URM groups. The McNair Scholars program offers a 2-year program of research and career development experience for first-generation college students already at UM. Programs such as this one contributes to UM's achievement of graduating more minority students who go on to take a Ph.D. than almost any non-HBCU in the nation (NSF data). The College of Behavioral & Social Sciences (in connection with one of our AGEP programs) offers the Summer Social Sciences Research Initiative and the NACS Program offers a Neuroscience Summer Internship Program, both targeted at members of URM groups. I was pleased to hear that members of your team have hosted a number of students from these programs in the past. Each fall my office organizes Graduate School Preview Day for 300 to 400 students from around the state and the country, targeted primarily at sophomores and juniors who are uncertain of what graduate school holds. For graduate school recruiting in the College of Arts & Humanities, Professor Heather Nathans coordinates an event in Atlanta each fall with the Atlanta University Center Consortium, targeted at HBCUs in the Atlanta area (e.g., Morehouse, Spelman, Clark-Atlanta). I gather that you have discussed including your project in with her most effective recruitment efforts.

Once students are at Maryland a number of programs are available to support their successful completion of the Ph.D. We have two NSF-supported AGEP programs for which I serve as Co-PI. One is the PROMISE -- Maryland's AGEP that spans three University System of Maryland campuses (UMB, UMBC and UMCP). This highly successful program has been in operation since 2002 and was recently renewed until 2012, and offers workshops, peer-mentoring, a Summer Success Institute (for new and continuing URM students), a Dissertation House for intensive work on developing dissertations, and currently involves several hundred students. The other is the Atlantic Coast AGEP for the Social, Behavioral and Economic Sciences that consists of five institutions (Howard, Florida, Miami, UNC and UMCP), was funded 2005-2007, and renewal is pending. A feature of that program that is particularly useful for your project is a summer workshop on analytical tools in the behavioral sciences held at the UNC, Chapel Hill. Our campus also hosts another NSF-funded program under the Louis Stokes Alliance for Minority Participation (LSAMP), including 'Bridge to the Doctorate' which may be most relevant for students in the computer science/engineering areas of your IGERT. Finally, my office has in place the Ph.D. Completion Project that consists, in part, of a series of bi-monthly student development and dissertation preparation workshops for graduate students across the campus. In 2006-2007, we sponsored 11 events on such topics as proposal writing, preparing for the academic job search, presenting at professional meetings, and writing for publication -- drawing more than 300 students per event. We wish you every success with your proposal, and look forward to working with your students.

Sincerely,

Johnetta Davis, Ph.D.
Associate Dean of the Graduate School  
Director, Office of Recruitment, Retention and Diversity
October 2nd 2007

Mr. Jeff Lidz,

I want to thank you for efforts in establishing an ongoing relationship with Northwood High School Social Studies Department and the Linguistics Department at the University of Maryland, College Park.

As a teacher of AP Psychology, I look forward to exposing my AP Psychology students (college bound juniors and seniors at Northwood HS) to the multitude of research conducted in your labs—in particular to your Cognitive Neuroscience of Language Lab, which will make unit 3 (Biological Bases of Behavior) more tangible for my AP students. In addition, our trip to Maryland’s Project on Children’s Language Learning Lab will also increase student’s awareness in proper research methodology as well as developmental psychology. Furthermore, we greatly anticipate a guest lecture from you on language acquisition this upcoming academic year.

Northwood HS is demographically diverse—thus, our collaboration will expose a great deal of Northwood HS student body to higher education (that would not otherwise have access to such great academic opportunities). Through these opportunities, it is my hope that students will continue to pursue the fields of psycho-linguistics in their future.

Sincerely,

[signature on hardcopy]

Carlos Montalvan, M.A.T
Northwood High School
Social Studies Department
AP Psychology Instructor
Honors Modern World History Instructor
Class of 2009 Co-Sponsor
Girls Varsity Soccer Head Coach
September 26th 2007

Dear Friends,

This is to confirm that our group at Hiroshima University enthusiastically supports its participation in the proposed training program in “Biological and Computational Foundations of Language Diversity” at the University of Maryland. Our group consists of Hiromu Sakai and colleagues and students of the Project Center for Brain Science of Language Acquisition and Language Learning and the Program in Language and Culture Education in Graduate School of Education at Hiroshima University. We have found our recent collaborations with University of Maryland faculty and students to be quite valuable, and we are eager to continue these collaborations. We have made a number of visits to the University of Maryland, and students from the University of Maryland have spent time conducting research at our university, such as the summer research program in 2005 by Robert Fiorentino (now an Assistant Professor at the University of Kansas) that was supported by an NSF-EAPSI award. As collaborators in your program, our group can provide opportunities for internships lasting from a week to a semester in duration. We can provide testing space and Japanese language expertise, with the possibility of access to eye-tracking and brain recording facilities. We will aim to pair students from Hiroshima with students from Maryland for collaborative projects on native and non-native speaking populations. In the past, visiting students have been housed in Hiroshima University residences, and we anticipate that this should continue to be possible.

It is fortunate that there is a pre-existing university-level partnership between Hiroshima University and the University of Maryland, which provides a framework for student exchanges. In addition, our group has already received a small grant from the Japan Society for the Promotion of Science that provides some support for Hiroshima/Maryland collaborations, and we are working to secure the JSPS International Training Program, a larger training grant from the Japan Society for Promotion of Science that is a counterpart of NSF's IGERT program. An important part of this project will be support for Hiroshima students to make reciprocal visits to Maryland for further training and collaboration. Our first submission to this program was unsuccessful, but since it was positioned in the highest rank among the unsuccessful proposals we plan to submit a revised proposal next year.

We have enjoyed having University of Maryland students as visitors in our lab, and we have appreciated the exchange of ideas that this has created. We hope that this new training grant will help to further our partnership.

Sincerely,

Hiromu Sakai
Associate Professor, Linguistics/Education
(PhD, University of California Irvine, 1996)
Dear colleagues,

This is to confirm that the linguistics laboratories at the Federal University of Rio de Janeiro, Brazil, strongly support UMD's IGERT-related efforts to strengthen and extend graduate education and research cooperation between UMD and UFRJ. In fact, there is a long-standing relation between the two universities dating back to 2000, when I spent some months at the Cognitive Neuroscience of Language Lab-UMD under Professor David Poeppel's supervision, working on crucial aspects of the methodology and technology that made up my Doctoral Thesis' main experiment.

In 2001, David Poeppel gave a one-week course in Rio on neurolinguistics, attracting a good number of professors and graduate students from several departments at UFRJ, including medicine, biophysics, psychology and linguistics. Furthermore, Professor Poeppel took the right steps in helping us establish interface between the Linguistics and the Biomedical Engineering Departments, so that neurophysiology studies could start being conducted here at UFRJ.

In February 2002, UFRJ Professor Miriam Lemle visited UMD to obtain further expertise in language acquisition methodologies. With this knowledge, she reformatted undergraduate and graduate course syllabuses we offer. In 2003 and 2004 we had courses and lectures by Ana Cristina Gouvea, Acrísio Pires, Cilene Rodrigues and Max Guimarães, all UMD alumni. In 2005 we had the visit of UMD Professor Norbert Hornstein for syntax lectures. More recently, in January 2006, we organized the UMD-UFRJ Workshop on Theoretical and Experimental Linguistics. Twenty-one participants from both universities discussed topics from syntax to language acquisition, sentence processing and neurolinguistics. These efforts were led, in the main, by the two institution’s Ph.D. students. UMD students also had the opportunity to follow work being done at our labs. It was an extremely beneficial exchange and we plan to make it into a regular event.

Important future possibilities of UMD-UFRJ partnerships are very much in the spirit of the IGERT grant - Biological and Computational Foundations of Language Diversity. Our group, which consists of four researchers and a good number of graduate students, is primarily focused on syntax, psycholinguistics and neuroscience of language research. We have a productive research line on morphology of Romance Languages. We are also conducting a series of ERP and eye-tracking studies on morphological and semantic lexical decomposition of Portuguese, some of which we presented at the Cognitive Neuroscience Meeting in 2007.

Finally, there are exciting perspectives related to Indigenous Languages. One of our most active researchers, Professor Marcus Maia, is also a professor in the first Indigenous College in Brazil, gathering students from over thirty Indigenous nations, and he is involved in providing high level graduate education to young Indian Linguists who graduate from this college. Maia is extremely excited about the possibility of sending some of these students to UMD and foresees the linguistic wealth it might bring to the linguistic community in Maryland. Maia is also interested in developing experimental field work which would consist in obtaining neuropsychological measurements related to linguistic stimuli being presented to Brazilian Indians. Thus, with the IGERT grant, students working here would have ampler access to the behavioral and ERP lab at UMD, and UMD students would have access to rich resources relating to Brazilian Indigenous languages.

Considering the longstanding close cooperation we have established and the exciting perspectives we have for future work, we support UMD’s IGERT proposal with great enthusiasm.

Aniela Improta França
Head of the Linguistics Department / Language School - UFRJ
Researcher of the Advanced Program on Neuroscience / Medical School - UFRJ
Dear Colleagues,

This letter indicates the support of CIIL for the University of Maryland's efforts to improve graduate education and international collaboration in the cognitive science of language through the project "Biological and Computational Foundations of Language Diversity". CIIL welcomes continued collaboration with the UMD group in the areas of psycholinguistics and language acquisition in addition to new collaboration in the areas of machine translation and electronic language resource creation.

CIIL has assisted Professor Lidz in his research on the acquisition of Kannada by providing research assistants and infrastructure support during his 4 research visits to Mysore spanning the last 8 years. During these visits, Professor Lidz has given lectures on his research on language acquisition. We welcome a larger collaboration in which UMD psycholinguists bring their methodological expertise together with CIIL researchers' language expertise to developing new research on language acquisition and processing in Indian languages.

CIIL is also charged by the Central Government of India with the goal of creating electronic resources and automatic translation tools for all 23 of the official languages of India. We recognize that UMD is a leader in the automatic creation of electronic language resources and in the field of Machine Translation. We also welcome a collaboration in which our language expertise can be combined with the technological and engineering insights coming from the UMD computational linguistics group.

We hope that this collaboration can come to fruition.

Sincerely Yours,

(UDAYA NARAYANA SINGH)

To
Jeff Lidz
jlidz@umd.edu
Dept of Linguistics
University of Maryland, 301-405-8220
Colin Phillips  
Department of Linguistics  
University of Maryland  
College Park, MD 20742 USA

Dear Colin:

I am happy to confirm my interest in being an international partner in your NSF-IGERT project on ‘Biological and Computational Foundations of Language Diversity’. Our group at Tohoku University consists of myself and my colleagues and our students in the Departments of Linguistics, Psychology, and Applied Japanese Linguistics. Tohoku University is located in Sendai City and is one of the most prominent universities in Japan. Most relevant for the current project, we currently host a large training grant on cognition and language as a part of the 21st Century Center of Excellence Program of the Japanese Ministry of Education, Culture, Sports, and Technology. This program is a counterpart of NSF’s IGERT program. We are currently preparing to apply for the successor of this program, the ‘Global CoE’ in the coming year. I am one of the team leaders of the program.

Our group has access to facilities for fMRI brain imaging with adults, NIRS imaging with children, and an infant testing suite equipped with EEG and an eye-tracker. We also have close ties with 3 preschools in Sendai City, which were strengthened by the efforts of Takuya Goro, a U of Maryland graduate student who spent 10 months in our group as part of his PhD research, funded in part by an NSF dissertation award and in part by a grant that I secured from the Japan Science and Technology Agency. Students from your project who visit our labs will be able to pair with students from Tohoku U for collaborative projects that use these and other facilities. Visiting students can receive additional mentoring through lab meetings and workshops in our lab and in the Cognitive Neuroscience Research Center. Tohoku University has 3 dormitories for international students, which may provide suitable housing for visiting students from your project. In addition, I have received a small grant from the Japan Society for the Promotion of Science that supports collaborations between Tohoku University and Hiroshima University, another partner in your project (our universities are at opposite ends of Japan’s main island).

As somebody who was initially trained in theoretical linguistics and then later became involved in psychological and cognitive neuroscience approaches to language I am well-aware of the challenges that students face in learning to master techniques in diverse fields, and we are eager to create an environment that allows students to gain broad skills. In Fall 2006 I visited your group at the U of Maryland with a small group of my students and I very much enjoyed the interaction with your students. I hope that your project will allow us to expand this connection.

Best wishes,

Masatoshi Koizumi  
Associate Professor of Linguistics