University of Pittsburgh

Annual Progress Report: 2008 Nonformula Grant

Reporting Period

July 1, 2009 – June 30, 2010

Nonformula Grant Overview

The University of Pittsburgh received $2,978,656 in nonformula funds for the grant award period June 1, 2009 through May 31, 2013. Accomplishments for the reporting period are described below.

Research Project: Project Title and Purpose

Deciphering Altered Brain Connectivity in ASD to Improve Intervention - Recent scientific research has led to the understanding of autism spectrum disorder (ASD) as resulting from altered information processing by the brain and mind. Research has demonstrated alterations in social understanding, language comprehension, reasoning, emotion, motor movements, sensory processing, and learning related to alterations in brain connections. The goals of this research project are to: 1) develop a new intervention for ASD that enhances thinking capacity or meaningful integration of information and brain circuitry; 2) identify genetic and developmental neurobiologic mechanisms underlying the abnormal development of brain circuitry as these will provide the basis for long-term definitive intervention; and 3) conduct a pilot study of Cognitive Enhancement Therapy (CET) in Minority and Resource Poor Adults with ASD. CET targets two key underlying mechanisms of a number of signs and symptoms—the slow processing speed and the inability to understand one's own emotions and the emotions of others. CET is furthermore a comprehensive and long term program (18 months) with demonstrated efficacy at multiple levels in a similar clinical population with schizophrenia. Adaptions are being made in the pilot study for ASD.

Anticipated Duration of Project

6/1/2009 - 5/31/2013

Project Overview

The objectives of this research are to: 1) expand knowledge about the fundamental developmental neurobiologic and genetic mechanisms of autism that will lead to the next generation of discoveries, 2) translate recent scientific advances in ASD into a novel intervention, and 3) pilot a new intervention for adults with ASD that applies the cognitive and neural mechanisms identified as underlying major cognitive and behavioral issues with the aim of improving adaptive function in daily life. In "Neuropathology and Genetics of Connectivity: Altered Axonal Pathfinding in ASD," developmental neurobiological studies of gene expression

will be conducted in postmortem tissue to ascertain the pattern of temporal and anatomic involvement of brain structures to inform the search for genes in ASD. The selection of these axonal pathfinding genes is based on findings from a genome-wide association study in ASD families. In the study "Inducing Plasticity in Cortical Connectivity via a Novel Intervention in ASD," a novel-learning paradigm will be used to enhance multi-dimensional information integration and promote development of the supporting neural circuitry with the aim of secondary improvement in related cognitive and affective skills. Phenotypic markers of responders and non-responders will be identified so that the intervention can be refined to address individual variability in initial skill level and rate of response. Pre- and post-functional Magnetic Resonance Imaging (fMRI) will assess intervention effects on neural circuitry. In "Cognitive Enhancement Therapy (CET) for Minority & Resource Poor Adults with ASD," an established neurocognitive intervention for schizophrenia, head injury, and aging, has been demonstrated to increase information processing speed and the capacity for perspective taking. Improvement in these basic skills results in improvement in comprehension, thinking, and social-emotional function in comparable individuals with schizophrenia. Most interestingly, CET not only prevents but enhances cortical gray matter volume in individuals with schizophrenia. Health status and access will be addressed through a web-based, archived, and audiotaped Continuing Medical Education (CME)-accredited lecture program on ASD and related medical and behavioral issues created for a large established practice-based pediatric research network (Pediatric PittNet) that serves 115,000 families in 5 counties representing all racial and geographic segments of Western Pennsylvania. Collaboration with Programs for Living, Education and Advocacy (PLEA), a community organization serving minority and low income children and adults with ASD, will result in translation of research results to this community to improve intervention. PLEA staff will be trained in the national Autism Treatment Network medical guidelines, research administration of the Autism Diagnostic Observation Schedule (ADOS), and Cognitive Enhancement Treatment (CET) program for adults with ASD once pilot studies demonstrate efficacy.

Principal Investigator

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Isabel Gauthier, PhD - employed by Vanderbilt University
Deborah A. Ferraro, BS - employed by Programs for Living, Education and Advocacy (PLEA)

Expected Research Outcomes and Benefits

This research project is expected to produce: a model for advancing the discovery of common genes associated with autism and abnormal mechanisms of brain development that can eventually be targeted for corrective action; the first version of the new generation of interventions that will address the core cognitive and social impairments in ASD and enhance neural circuitry; an intervention for adults with ASD that addresses core deficits and adaptive function; publications that establish the three junior researchers as independent investigators qualified to successfully compete for NIH grants on their own; subsequent grants demonstrating refinement and expansion of the interventions and the discovery of genes; minority students who enter a health related or science field as a result of this and similar research experiences; and minority students who become ambassadors for students with ASD in the community and students who have disabilities of any kind and are of any age.

One of the primary sources of health disparities in ASD is related to the lack of training of providers, especially among those who provide services to the poor and those in rural areas. Those serving minority individuals have challenges related to how parents describe ASD symptoms and its differentiation from other behavior problems. This project will improve health disparities through: 1) a web based, archived and transportable lecture series on ASD and related issues for the 106 pediatricians in five counties serving 115,000 children (birth–21 years); and 2) training of staff at a minority and resource poor serving community organization for ASD on national assessment and medical practice guidelines for ASD and on a new intensive intervention for adults focusing on cognitive-social function.

Summary of Research Completed

Aim R1: Neuropathology and Genetics of Connectivity: Altered Axonal Pathfinding in ASD
Overview: Leucine-rich repeats (LRR) are protein-protein interaction motifs present in a number of proteins with diverse functions and cellular locations. A sizable subset of gene products putatively identified by the Autism Genome Project genome-wide association scan are members of this large group and exhibit almost exclusive brain-enriched expression. We hypothesize that alteration in the expression and/or function of at least a subset of LRR genes generates risk for autism by disrupting the mechanisms of axonal outgrowth and targeting. Therefore, the overall focus of Aim 1 is to assess biological plausibility of LRR genes in terms of a developmental neurobiological model of axonal dysregulation. Study 1 entails the use of immunohistochemistry and real time polymerase chain reaction (RT-PCR) to examine expression of these candidate genes in control and ASD human brain tissue, focusing on both the critical time periods of axonal outgrowth and remodeling and the brain areas that are most frequently affected clinically and anatomically in autism. Study 2 focuses on demonstrating the capability of the LRR candidate gene products to affect axonal outgrowth and/or guidance by performing standard neurite outgrowth assays.

Expected Outcomes: For each LRR of interest analyzed, there are three possible results: 1) selective brain expression or localization of the LRR changes only at one or more of critical developmental time points—in which case it is a candidate for more refined mechanistic studies, 2) the LRR is never expressed in the brain during development—in which case the genetic signal

may be a false positive and will not be pursued biologically, or 3) the LRR is expressed constitutively in the brain over the entire developmental time span—in which case it may be linked mechanistically to another protein that has more temporally selective action. These instances will not be pursued biologically at present. Evidence of abnormal expression of candidate LRRs in ASD brains relative to controls will be considered evidence of potential involvement by those genes in the etiology of autism and followed up with *in vitro* modeling.

Summary of Research Completed: From July 1–December 1, 2009, we focused mainly on optimizing antibodies to both paraffin embedded and frozen tissue (mainly control adult and fetal from our institution due to availability) as well as polyethylene glycol (PEG)-embedded tissue. The latter is derived from the Autism Tissue Project (ATP) Autism Celloidin Library (ACL) available for our study. It was, therefore, necessary to develop a protocol for free-floating staining of 200-micron tissue sections in order to perform the study 1 enhancement experiments as planned in the proposal. Antibodies for LRIG1 have not worked convincingly, and AMIGO2 appears to be overly ubiquitous in expression—this observation will be tested in-situ. However, a promising Slit 1 antibody became available and we added it to our test battery with excellent and interesting results. We also optimized three sets of RT-PCR primers (LINGO1, AMIGO1, LRRN1) and two in-situ probes (LINGO1 and AMIGO1). During the latter half of the reporting period, we initiated data collection on all successfully stained sections (Table 1 and Figures 1 and 2). SLIT1 protein appears to be concentrated in the cell bodies of lower (layers V and VI) cortical projection neurons in the adult cortex (Figure 1). This observation has interesting implications for the development of layer-specific connectivity. Expressed by cortical neurons, LINGO1 protein is concentrated in processes, with highest expression in an age-dependent manner in myelinating or myelinated fibers (Figure 2).

Aim R2. Inducing Plasticity in Cortical Connectivity via a Novel Intervention in ASD
We have made significant progress toward our aims. We delayed further scanning pending the July opening of the new scanner at Carnegie Mellon University and the PI's return from maternity leave.

Specific Aim R2.1: Can high-functioning autism (HFA) adolescents acquire visuoperceptual expertise for Greebles (3D object recognition)?
This aim required the design of a large battery of visual stimuli and experimental protocols, including the creation of more than 300 stimuli in each visual category, 18 testing experiments, standard tests of basic visuoperceptual processing and of face recognition, the *Cambridge Face Memory Test* (CFMT), and 90 behavioral experiments for the training intervention.

Our first pilot participant, a 14-year-old adolescent HFA male (5221), acquired visuoperceptual expertise for 10 Greebles. He acquired sensitivity to the holistic properties of Greebles, which did not interfere with his face processing abilities. However, he exhibited extreme tradeoffs between response time (RT) and accuracy. As a result, we implemented several changes in the paradigms to curtail this trade-off in the second pilot subject, a 15-year-old HFA male (#5222) who also acquired visuoperceptual expertise with the Greebles (Figs. 3a-b). We also implemented a mid-training testing battery and introduced the CFMT. We found *no evidence of a decrease in holistic processing or in recognition memory performance for faces at this point in training*. In fact, results indicated even stronger holistic processing of faces and *more accurate* recognition for upright, but not inverted, faces across all conditions of the CFMT (Fig. 4b).

These results show, unequivocally, that the Greeble training *did not* interfere with 5222's face processing abilities and may have actually contributed to improved face recognition, particularly for upright faces. Together, these results suggest that adolescents with autism can: 1) tolerate the training paradigm, 2) acquire visuoperceptual expertise with novel objects, reflected in an emerging sensitivity to holistic properties, and 3) maintain or even improve face recognition skills in the process.

Specific Aim R2.2: Can visuoperceptual expertise training induce plasticity and reorganization in the functional topography of the ventral visual pathway in HFA adolescents?
We scanned subjects 5221 and 5222 at both baseline and following the intervention. 5221 showed very little selectivity for any category at baseline and, therefore, we will focus on describing the data from 5222, which were much more functionally organized topographically and revealed interesting changes following Greeble training. Figure 5 shows the selectivity for faces (red), objects (blue), houses (green), and Greebles during the baseline scan and for the same categories following the intervention (orange). At baseline, 5222 exhibited bilateral activation in the fusiform face area (FFA), right occipital face area (OFA), and right superior temporal sulcus (STS) for faces. Importantly, there was a large degree of overlap in the left FFA and right OFA activation across the two scans, indicating that the newly acquired expertise for a small set of Greebles did not disrupt 5222's functional topography for face selectivity. A similar set of results is evident for objects in the medial fusiform gyrus bilaterally and right lateral occipital area (LO) and for houses bilaterally in the PPA across the two scans. These results provide clear evidence of the reliability of our scanning procedures across time within a single individual. There was also reliability in the activation patterns for Greebles in 5222 across the two scanning sessions, but there were also *increases* in the size of Greeble-related regions as well (Fig. 5), including the OFA as has been observed in training studies with typical adults. Although these results are quite preliminary, they provide further support for our hypothesis that an intensive training program at a critical time in development can alter the functional topography of the ventral visual pathway in HFA adolescents.

Aim 3. Cognitive Enhancement Therapy for Minority and Resource Poor Adults with ASD
The goal of this project is to begin to adapt and pilot a novel cognitive rehabilitation approach—Cognitive Enhancement Therapy (CET)—for resource-poor and minority adults with ASD. This intervention consists of a comprehensive, 18-month neurocognitive and social-cognitive rehabilitation program that targets the core cognitive deficits of ASD. CET has previously been shown to be highly effective in remediating cognitive impairments in schizophrenia, and because of the shared neurobiologic and cognitive deficits between ASD and schizophrenia, its use in verbal adults with ASD is expected to similarly improve cognitive and adaptive skills necessary for employment, independent living, and interpersonal success.

Critical milestones for our first project year were to: 1) hire and train CET staff, 2) set up clinical infrastructure for providing CET and training at the University of Pittsburgh, 3) begin adapting CET treatment materials for adults with ASD, and 4) recruit 14 resource poor and/or minority adults to participate in the first CET pilot group. We have successfully achieved all four milestones. We have hired a part-time clinical nurse specialist who has extensive training in CET, have obtained a clinic suite adjacent to our NIH Autism Center of Excellence to conduct the pilot CET groups for adults with ASD, and have purchased computers for neurocognitive

training and evaluation assessments. We have recruited and begun the project with 16 adults with ASD (12 of whom are resource-poor whites and four of whom are resource poor minorities [two African American, one Hispanic, and one Asian]) by working with Programs for Living, Education, and Advocacy (PLEA) and other community providers that serve impoverished adults with ASD. Baseline assessments have been completed for the majority of participants, and most (n = 15) have begun receiving CET treatment. One is completing initial consent and recruitment forms.

Pre-treatment results of neuropsychological assessments have indicated significant cognitive impairment in the ASD group (mean percentile ranking = 37%), with nearly half (47%) performing below the 25th percentile (see Table 2). *Despite being characterized as "high" functioning, clearly these individuals have marked disability*. We have also found that minority participants do not have family supports to assist them in organizing an appointment schedule that fits with the rest of their life activities or to ensure transportation to get to appointments. As a result, clinicians have taken on a more active role as problem solvers, and we have arranged transportation for participants.

Finally, we have begun to adapt CET treatment materials for adults with ASD, and these materials have been collated as a supplement to the existing CET manual. Computer exercises have been adjusted to accommodate the auditory sensitivity of this population, and schizophrenia psychoeducational materials have been replaced with materials specific to ASD. Our initial treatment experiences have been very positive. Individuals are engaging well in the treatment, which is thus far reflected in a 0% attrition rate. *Processing speed is improving* in these individuals, which is a key to improvement in core abilities. The first individuals have moved on to group skills, focusing on perspective-taking and gistful thinking. In the next year of the project, we will continue to treat the first CET cohort and recruit an additional cohort (n = 14) of minority and resource poor adults. In addition, we will conduct post-treatment (18-month) neuropsychological, social, and functional assessments to begin to assess the potential benefits of CET for verbal ASD adults. If successful, this will be the first intervention specifically developed to address core symptoms of ASD in adults.

Table 1 Study 1 Data Collection Immunohistochemistry, In Situ/RT PCR	Mid-gestation	Infancy	Late Childhood/ Adolescence	ASD Adult	Control Adult
Slit1	6	2	0	1	4
Lingo1	6	2	0	1	4/2
Lingo2	6	2	0	0	4
AMIGO1	4	2	0	0	4/2
LRRN1	4	1	0	0	4/2
LRRN3	4	1	0	0	3
LRRTM3	3	1	0	0	3

Figure 1. *SLIT1 Protein in Adult ASD Dorsolateral Prefrontal Cortex* SLIT1 protein appears to be concentrated in the cell bodies of lower (layers V and VI) cortical projection neurons in the adult cortex. This finding has interesting implications for the development of layer-specific connectivity.

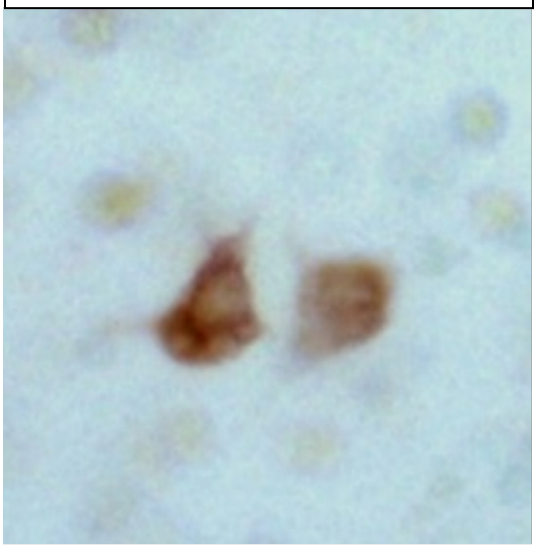
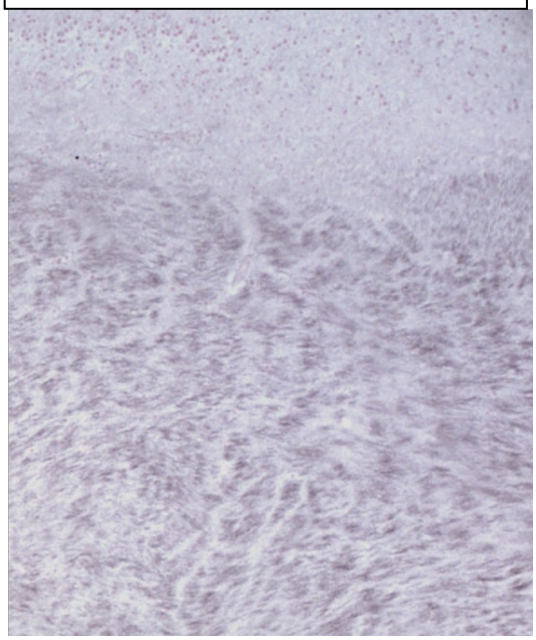


Figure 2. *LINGO1 Protein in 28-week Fetal Cortex* Expressed by cortical neurons, LINGO1 protein is concentrated in processes, with highest expression in an age-dependent manner in myelinating or myelinated fibers.



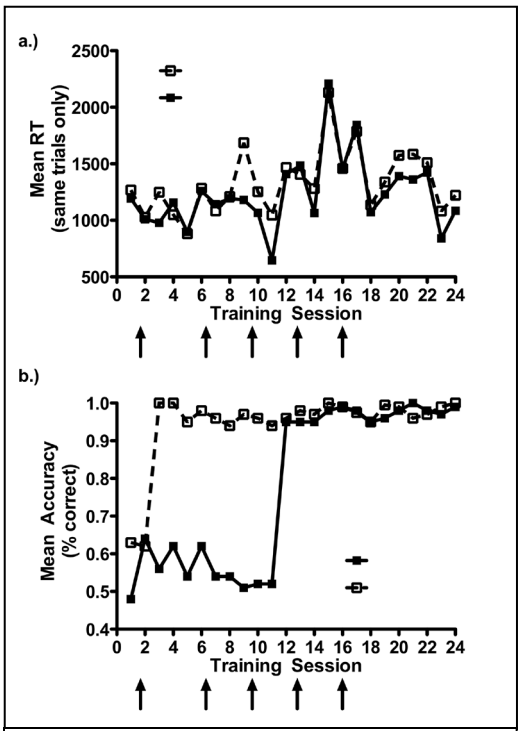


Figure 3. 5222 Reaction Time and Accuracy Data from All Sessions of Greeble Training Intervention. Note: Arrows represent the introduction of new Greebles (2 per session).

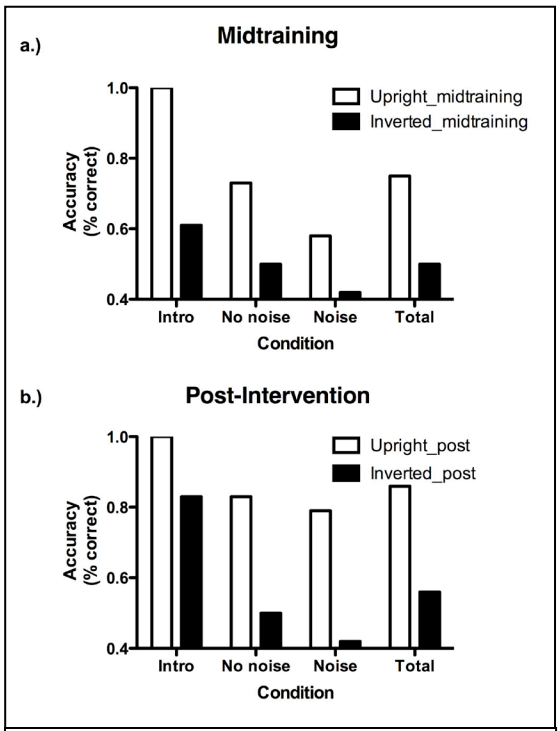


Figure 4. 5222 Accuracy Data from Cambridge Face Memory Test at Midtraining and Post-Intervention

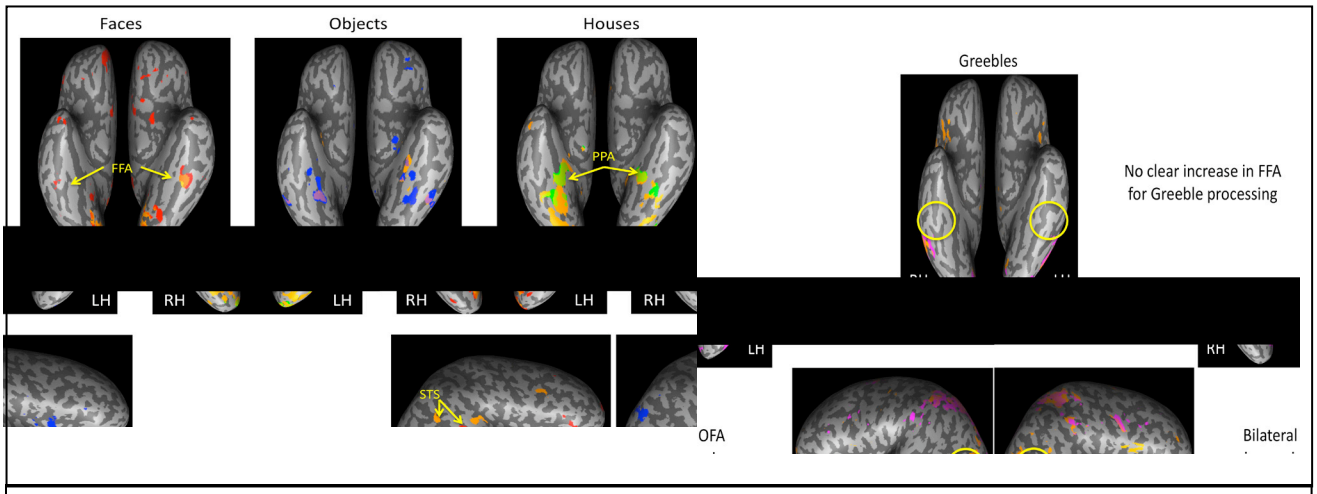


Figure 5. 5222 Functional Topography for Faces, Objects, and Houses at Baseline and Post-Intervention. Note: Red, blue, green, and magenta represent selectivity for faces, objects, houses, and Greebles at baseline. Orange represents the same selectivity contrast at post-intervention. The maps are corrected at $p < .01$. FFA = fusiform face area, OFA = occipital face area, STS = superior temporal sulcus, LO = lateral occipital area, PPA = parahippocampal place area.

Table 2 Cognitive and Demographic Characteristics of Adults with Autism Spectrum Disorders Currently Enrolled in CET Treatment.				
Variable	*M* / *N*	*SD* / %	Low	High
Demographics				
Age	25.94	5.64	19.00	38.00
% Male	13	87%	-	-
IQ	116.40	16.94	92.00	157.00
Diagnosis				
% Autism	8	53%	-	-
% Autism Spectrum	7	47%	-	-
Neurocognition Composite [a]	36.60	27.66	.80	81.60
Processing Speed	36.61	29.80	.40	88.50
Vigilance	52.17	28.17	8.10	90.30
Working Memory	46.13	39.97	.80	99.90
Verbal Learning	48.67	31.44	2.30	94.50
Visual Learning	40.93	26.32	8.10	90.30
Reasoning	46.13	34.69	2.30	93.30
Wisconsin Card Sorting Test				
Perseverative Errors	15.20	10.74	5.00	38.00
Non-Perseverative Errors	13.80	10.58	3.00	37.00
Social Cognition				
Emotional Intelligence [b]	90.50	11.32	67.25	103.63
Emotion Regulation [b]	87.81	10.90	68.03	104.87
Emotion Perception [c]	30.87	4.21	22.00	37.00

[a] Composites are given in percentile scores
[b] Scores are normed with a mean (*SD*) of 100 (15)
[c] Scores range between 0 and 40

Minority training aim: Establish a research training program for racial minorities that are underrepresented in biomedical, health services, and clinical research. Two programmatic initiatives are in place to support this aim: 1) short-term summer training and 2) nine-month post baccalaureate training.

1. Summer Training

One training component of the project is a seven-week research program, the goal of which is to expose underrepresented and disadvantaged students to biomedical research in autism. To support this programmatic aim, students funded by this grant were recruited from the applicant pool of and participated in the University of Pittsburgh School of Medicine's Summer Premedical Academic Enrichment Program (SPAEP), Level II.

Program Structure (SPAEP)

The training curriculum requires each student to:

- Spend 4.5 days each week in an assigned laboratory performing mentored research
- Engage in medical school application skills seminars taught by staff and faculty in the School of Medicine's Offices of Admissions, Diversity Programs, and Medical Education
- Receive reading and study skills assessment (and remediation, if needed)
- Attend test preparation workshops
- Spend one to two afternoons shadowing clinicians
- Attend weekly Brown Bag Lunch seminars given by underrepresented School of Medicine faculty, residents, and community physicians
- Participate in social activities held in conjunction with other School of Medicine summer programs
- Participate in a "mock interview" with a School of Medicine faculty member and receive feedback on performance
- Present her/his research to an audience of peers and mentors
- Complete a preceptor-reviewed/approved research paper

The $4,000 stipend allotted for each trainee provides supervised housing in a University of Pittsburgh dormitory, meals, student health insurance, travel, and expenses. Several social activities are hosted to allow students to become familiar with cultural resources in the city and to network with underrepresented professional role models.

All curricular materials and faculty are supported/provided by the School of Medicine. Staff from the Offices of Admissions and Financial Aid and Student Affairs/Diversity Programs serve as the faculty for the admissions skills workshops, and a medical student or former program participant serves as the student coordinator. Richard Levitt, the School of Medicine's academic development coordinator, provides the study and reading skills assessment and meets individually with each student to discuss his/her approach to learning as it relates to each student's future goals.

The student coordinator encourages bonding within the group, manages the social dynamic, and helps the students to become comfortable within the School of Medicine and the City of Pittsburgh. The coordinator also works with other summer staff to ensure interaction with

students in SPAEP Level I (a seven-week classroom-based program for early premed students) and the entering medical students in the Summer Prematriculation Program.

Admission Procedures

Students apply for admission to the School of Medicine's summer premedical programs through an on-line application portal, submitting transcripts, letters of recommendation, and a goal statement as supporting documentation. For summer 2009, 173 students submitted the basic application and 114 completed their applications with all required documentation. For summer 2010, 271 submitted the basic application and 161 submitted complete applications.

Students for the non-formula grant training program were selected according to the grant requirements (underrepresented, attention to Pennsylvania historically black colleges and universities [HBCUs]). The non-formula trainees to date for the autism project have been:

2009		
Student	**Home Institution**	**Preceptor**
Derrick Johnson	University of Pittsburgh	Kate McFadden, MD
Kene Ukeje	University of Pittsburgh	Paula Monahan-Nichols, MD
2010		
Derrick Johnson	University of Pittsburgh	Kate McFadden, MD
Olivia Beaubrun	University of Pittsburgh	Kate McFadden, MD

Outcomes

Our goal for the first summer was to recruit an excellent class and engage the students with cutting-edge research and preceptors who would truly mentor them. We were highly successful in meeting that goal. The ability to engage students at increasing levels of complexity is important to developing their curiosity and critical thinking ability, as well as maintaining their interest in careers in health and/or biomedical science.

The students' completed projects were:

Student	Paper/Presentation	Mentor
Derrick Johnson	"Developmental Brain Expression of Lingo2 and Amigo2; Leucine-rich Repeat Proteins Implicated in Autism"	Kate McFadden, MD
Kene Ukeje	"Developmental Brain Expression of Lingo-1; a Leucine-rich Repeat Protein Implicated in Autism"	Kate McFadden, MD
Olivia Beaubrun	"Effects of the Absence of SALL4 in the Dorsal Cortex"	Kate McFadden, MD

2. Post Baccalaureate Training

To meet the goals of the post-baccalaureate training aim, we created the University of Pittsburgh Intramural Research Training Award (UPIRTA) program http://www.healthdiversity.pitt.edu/programs/upirta.php, a nine-month to one-year post-baccalaureate experience for underrepresented students who are interested in biomedical graduate training. UPIRTA includes two research pathways: autism (Minshew lab) or antibiotic resistant infectious disease (Harrison lab). This report addresses the former. Experiences begin in fall of each award year.

All students are eligible to apply; however, as funding comes from the Commonwealth of Pennsylvania, preference in admission is given to:

- Students from Lincoln and Cheyney Universities (Pennsylvania's two HBCUs)
- University of Pittsburgh, and
- Pittsburgh-area and Pennsylvania natives

Students are recruited through presences at minority pre-health and graduate opportunity fairs (such as the Annual Biomedical Research Conference for Minority Students, the Society for the Advancement of Chicanos and Native Americans in Science, and the Chaka Fattah Graduate Opportunities Conference). In addition, the program is marketed through the Honors Programs of Lincoln and Cheyney Universities and through the membership of the National Association for Advisors of the Health Professions.

Year 1: 2009-10

Aggressive marketing of this new program brought us 11 applicants. As the goal of UPIRTA is to encourage students to consider careers in biomedical research, applicants were vetted by training director Paula Davis and John Horn, PhD, graduate dean of the School of Medicine. It was vital to select students who had the interest and potential for success (as judged by GPA and prior research activity).

The students attended orientation along with the entering graduate students since their daily lives would more closely resemble graduate students' routines. In addition to their research, the students followed a comprehensive schedule of enrichment activities. They were included in all lab meetings and group-wide, comprehensive PA Department of Health progress meetings. To foster their growth and development as prospective graduate students, they were enrolled/participated in:

- The University of Pittsburgh's "Survival Skills and Ethics" program, which is designed to teach graduate students and early career researchers key professional "survival" skills such as making effective presentations, navigating career paths, and obtaining funding
- The University of Pittsburgh/Carnegie Mellon University "Graduate Students of Color" dinner series, an opportunity for graduate students of color across the two institutions to learn about each other's work, form a support system, and network with key mentors. http://www.as.pitt.edu/graduate/diversity/dinner_schedule.php
- Sessions for the Career Education and Enhancement for Health Career Research Diversity (CEED) program. Administered by the University of Pittsburgh's Clinical and Translational Science Institute, CEED exists to jump-start the careers of underrepresented researchers by

providing them with mentoring, leadership and management skills, and research skill enhancement. http://www.icre.pitt.edu/ceed/index.aspx

- "Celebrating Diversity," the Schools of the Health Sciences' annual diversity reception, where all members of the Health Sciences' (Medicine, Dental Medicine, Nursing, Public Health, Pharmacy, and Health and Rehabilitation Sciences) diversity community have an opportunity to meet
- GRE preparation at Kaplan or Princeton Review
- Lunch meetings with a variety of motivated role models and peer mentors

To encourage social integration, staff made an effort to engage the students with any and all social events planned in the various Schools of the Heath Sciences.

From a pool of 15 applicants for 2010–11, six met our criteria and have been selected. Two of the six trainees have elected to work on the autism project. They will be:

Trainee	Undergraduate Institution	Research Area
Chizelle Rush	Northwestern University	Autism
Justin Ellis	Case Western Reserve University	Autism

These two students will be joined in enrichment programming by another class of PA DOH non-formula trainees who will be working in autism research. We expect that the cohort will bond and support each other through training into their professional careers.