# Undergraduate Research Long Term Grant Application

## Budget Worksheet

<table>
<thead>
<tr>
<th>BUDGET ITEM</th>
<th>Department or College Funds</th>
<th>Outside Agency Funds</th>
<th>Personal Funds</th>
<th>Undergrad. Research Funds</th>
<th>GRAND TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Materials</td>
<td></td>
<td></td>
<td>DNA sampling kits <em>Epicentre Biotech</em> ($425 for 100); $1275 for 300</td>
<td>$2,035</td>
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<td></td>
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<td>DNA primers <em>Sigma-Genosys</em> (approx. $20/primer pair x 3 different pairs): $60</td>
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<td>Laboratory costs for micropipette tips, gloves, cups, agarose, buffer solutions for PCR reaction and gels: approx. $600</td>
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<td></td>
<td></td>
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<td>Shipping costs: $100</td>
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<td></td>
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<tr>
<td>Equipment</td>
<td></td>
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<td>Gel Box: $750</td>
<td>$750</td>
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<tr>
<td>Research Scholarship (max request $2,500.00)</td>
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<tr>
<td>Mileage to gather Data (.36 per mile)</td>
<td></td>
<td></td>
<td></td>
<td>$2,785</td>
<td>$2,785</td>
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<tr>
<td>GRAND TOTAL</td>
<td></td>
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Project Description

Serotonin (5HT) is a monoamine neurotransmitter used throughout the central nervous system. It is implicated in mediating many behaviors such as feeding, sex, sleep, and learning, and is involved in particular brain disorders such as depression, Alzheimer’s, and autism (Muller et al., 2010). As serotonin molecules are released into the synaptic cleft, they exhibit their effect by binding to specific receptors. Their action is subsequently terminated via enzymatic breakdown by monoamine oxidase and via reuptake by serotonin transporters (5HTT). Thus, these transporters play an important role in modulating serotonin concentrations in the brain. The serotonin transporter gene, SLC6A4, is located on chromosome 17. A polymorphism in the serotonin transporter promoter region (SHTLPR) has been associated with psychological disorders, the harm avoidance personality type (see Pezawas et al., 2005; Sen et al., 2004), and a number of cognitive tasks (Baddeley, 2003). While the short allele seems to be negatively implicated with stress and emotionality, it has also been positively associated with cognitive tasks (Anderson et al., 2012). Working memory is essential in daily cognitive functioning because it allows individuals to temporarily maintain information necessary for ongoing tasks, thus facilitating reasoning, learning and comprehension. One component of working memory, the visuospatial sketchpad, associated with the ability to maintain and use visuospatial representations, is used as a measure of non-verbal intelligence and can predict success in careers such as architecture and engineering (Baddeley, 2003). Only one study to date has examined the impact of the SHTLPR polymorphism on working memory abilities in a healthy, young adult population showing that carriers of the short allele are able to store more items in visual working memory (VWM) than homozygous carriers of the long allele (Anderson et al., 2012). Moreover, numerous studies have demonstrated the separation between visual and spatial working memory (Baddeley, 2003). For example, neuroimaging studies generally
support the claim that object recognition is associated with the ventral pathway, whereas spatial recognition is associated with the dorsal pathway. The aim of this proposed study is to expand our knowledge on the relationship between genetic predispositions related to serotonin transport and working memory abilities, by incorporating a new component, spatial working memory, that has not been previously studied.

This research will be an interdepartmental project (Department of Psychology, Neuroscience Program, and Zoology Department) that is student-led, and which fulfills the Psychology Department PSY 4910 Capstone course and the departmental honors requirement for the Psychology Major. Dr. Matthew Schmolesky, Associate Professor in the Department of Psychology, and Director of the Neuroscience Program will supervise this project, and provide guidance regarding the research structure, data collection, and analysis. My role will be to design the research, collect and analyze data, write an article, and submit my results to be presented at a national or regional conference. On a continuum of dependent to independent, my participation will mostly be independent:

Dependent ______________________ X _____, Independent.

Three years of college experience have prepared me for this project. I have completed several courses including Introduction to Neuroscience (PSY 2810), Biological Psychology (PSY 2310), Principles of Zoology I (ZOOL 1110) with its accompanying laboratory, Research Methods in Psychology (PSY 3610), and Statistics in Psychology (PSY 3600 and 3605). Moreover, I am currently completing Genetics (ZOOL 3300), Cognition (PSY 3500), and Capstone Research Project (PSY 4910) in which I am conducting a behavioral genetics research with Dr. Schmolesky and Dr. Trask (Molecular Biologist). I am writing a paper on this research and will be giving an oral presentation at the end of the semester, and plan to present my results at NCUR in the Spring of 2014.
Three hundred participants will be recruited from Introductory Psychology classes and will receive extra credit for participation. Each participant will provide a DNA sample by rolling a cotton swap against his/her cheek, and complete several surveys (i.e. demographics, personality) followed by a spatial memory task administered on a computer. Participants’ DNA swab, survey, and memory task results will be tracked with a participant ID in order to keep participants’ identity anonymous. In the lab, DNA will be extracted, amplified, and analyzed by polymerase chain reaction and electrophoresis gel. A statistical analysis will be performed on participants’ genotype (homozygous for the short allele, heterozygous, or homozygous for the long allele) and results on the spatial memory task to determine if these two components are correlated.

Data will be collected on the third floor of the Social and Behavioral Sciences Building between January 20, and March 14, 2014. Data will be analyzed by April 18, 2014. Upon completion of the project and data collection, results will be submitted to a local or national conference.

Budget Explanation

DNA sampling kits (Epicentre Biotech) are required in order to obtain DNA from each participant. A kit for one hundred samples cost $425, thus we request $1275 for 300 samples.

DNA primers (Sigma-Genosys) are needed to amplify the polymorphic region of the gene of interest. Each primer pair costs approximately $20 dependent upon length, thus three primers equate $60.

Laboratory equipment such as Erlenmeyer (a laboratory flask with a flat bottom, conical body, and cylindrical neck), micropipettes, centrifuge, vortex, gel box, refrigerator, fridge, etc. will be available and provided by the zoology department. However, funding for
approximately $600 will be needed for micropipette tips, gloves, cups, agarose, and buffer solutions for PCR reactions and gels.

Shipping costs will be minimized by group orders. However, dry ice for reagents will be needed and shipping will require $100.

Finally, a bigger gel box ($750) is requested in order to run more samples at once.

**Undergraduate Research Long Term Grant Application**

**Additional Questions**

1. What funding have you received from OUR in the past? Where has your previous project been disseminated?

I have received a travel grant to present my research at NCUR Spring 2014.

2. Is this project part of a required course? If so, please indicate the support (monetary and in-kind) provided for this project by the academic department.

This project is required for Departmental Honors Capstone Project. Funds equating approximately $1000 were provided by Dr. Schmolesky (from his Psychology Department discretionary account and a RSPG grant) and the Zoology Department for the materials used in my training, via Dr. Schmolesky’s behavioral genetics project.

3. What additional sources of funding have been solicited? Is your department willing/able to fund any equipment they will be retaining?

The Psychology Department, Zoology Department, and Neuroscience Program are already funding the vast majority of the equipment and some of the materials needed for this project.
4. Where do you plan to disseminate the results of this project?
I plan to submit this work for presentation at the Sigma Xi (the National Science Honors Society) Conference or the Society for Neuroscience Conference and will present the work at the WSU Research Symposium as well. If the results warrant it, Dr. Schmolesky and I will draft a manuscript for publication (e.g. Journal of Cognitive Neuroscience).

5. If you are requesting a Research Scholarship, please list all significant time commitments (5+ hours per week) that you expect to maintain over the duration of your project including, for example, class and work schedules.
UN Undergraduate Research Long Term Grant Application
Faculty Mentor Recommendation Form

Student Name (last, first): Nizam, Houda

Project Title: The impact of a serotonin transporter genetic polymorphism on spatial working memory

1. How long and in what capacity have you known this student?

I have known Houda Nizam since Spring 2010, when she approached me to seek advice on graduate school, to declare her Neuroscience Minor, and to seek out research opportunities. I have had the pleasure of having Houda in two my courses (E.g., NEUR 4810 Cognitive and Behavioral Neuroscience; PSY 4900 Environmental Neurotoxins) in which she excelled. Over the last 4 months I have served as her research mentor for the first semester of PSY4910, a two semester senior project capstone course.

2. Briefly describe the proposed project. Is this part of a larger research project? Is this part of a course? If so, how is the project apart from the nature and scope of activities normally taken for the course (Please attach a copy of your course syllabus)?

This study is designed to test, for the first time, the role of a genetic polymorphism in a crucial serotonin transporter gene on diverse cognitive abilities in healthy, young adult humans. Human genes that encode proteins critical for neural function (e.g., those for neurotransmitter receptors or transporters) are not identical from one individual to another. Instead, recent research has shown that there is extensive variability in many of these genes, suggesting the protein products themselves will differ, and this difference could have functional significance (Eibstein, 2006; Zuckerman, 2007). Early behavioral genetics research into personality traits has focused upon the dopamine D4 receptor (DRD4) gene and the promoter region of the serotonin transporter gene (5-HTTLPR), which are expressed in key brain regions such as the frontal cortex and limbic system (Dulawa et al., 1999). While a number of studies have demonstrated a significant relationship between the short form of the 5-HTTLPR gene and personality traits or psychological symptoms (e.g. anxiety, depression), very little is yet known about the effect of 5-HTTLPR polymorphisms on cognitive abilities. A recent study found that the short form of the gene is related to enhanced memory in an elderly population (Salminen et al., 2013) but it is unclear if the polymorphism confers benefits on healthy, young adults, which is the primary focus on the proposed study.

This project is designed to present cognitive tests on WSU student subjects to examine visual attention and memory. Houda will also assess personality traits using Cloninger’s Temperament and Character Inventory, and will collect DNA using standard cheek swabs. In previous studies, we have focused exclusively on how the genotypes might relate to personality traits, physical risk taking behavior, and the assessment of physical risks. Thus, Houda is expanding this behavioral genetics project in new directions, quantifying cognitive abilities for the first time.

3. Give an assessment of the project’s significance to the student’s discipline and of the project’s educational and/or professional benefit to the student.
Houda is a remarkably motivated and intelligent student who has actively pursued education and research experience in neuroscience and psychology over the last two years. She intends to apply to Neuroscience Ph.D. programs in Fall 2014 and enter into a career in research and education. If given the opportunity to carry out this research project (which she herself proposed and designed based upon my existing behavioral genetics work), I am confident that the benefits to her education and career-advancement would be extraordinary. This project would give Houda the chance to collect and analyze data on her own project, write a detailed research report, and present at a national or regional conference. All of these experiences are critical for a successful application to graduate school.

4. Comment on the qualifications of the student to successfully complete this project, both in terms of the project’s scope and its time frame.

Houda is a devoted and highly inquisitive student who has all of the characteristics necessary to become an extraordinary scientist and educator. She is passionate about her education and about achieving excellence and, in this regard, is an extremely impressive student, easily competing with the best I have met in my twenty years of working with undergraduates from multiple universities (Furman, Wake Forest, University of Utah, Erasmus University, and WSU). In this Fall 2013 semester she has shown great self-motivation and dedication to this research. First working on my existing behavioral genetics research project (and in service of her first semester PSY 4910 Captstone work) Houda has spent the last four months reading articles on the topic and training on DNA collection, isolation, amplification, and genotyping using polymerase chain reaction and electrophoresis gels. Her work on this project provided enough valuable data and insight to permit a travel grant application for NCUR via OUR (which was awarded) and will submit her NCUR abstract on that project by the December 5th deadline. Houda clearly has the talents, training, and determination to carry the proposed study (which is of her own design) out to a successful conclusion. She has also excelled in many courses in diverse areas (e.g. genetics, statistics, research methodology, psychology, neuroscience) that give her a solid background for this project. Her overall GPA is currently an outstanding 3.95. For these reasons, I am confident that, if funded, Houda will carry out the project successfully and acquire meaningful data. The study design is suitable for a one year project and offers a very high likelihood to provide meaningful data as multiple dependent variables will be assessed (e.g. demographics, cognitive abilities, personality, and genotype).

5. Comment on the justification and appropriateness of the project budget, including the necessity of a Research Scholarship (if requesting one).

The budget for this project is appropriate. The major goals of the study require a) the collection and isolation of DNA from each subject), b) the amplification of the DNA using polymerase chain reaction (which requires primers and other reagents), and c) running the DNA on an electrophoresis gel to identify the genotype (which requires agarose and other reagents). All of the line items requested are suitable, and necessary, for the project completion.

6. Describe your role in the project.

As Houda’s research mentor for her Senior Capstone Project, I have regular one-hour weekly meetings with her and am available to her at all other times via email or phone. I intend to help and guide Houda through each step of the research process, from study design and
data collection, to analysis and presentation. As the PSY4910 Senior Capstone Project involves a research committee of three faculty members, Houda also has Dr. Barbara Trask (molecular biologist; Dept. of Zoology) and Dr. Shannon McGillivray (cognitive psychologist, Dept. Psychology) to offer advice and guidance on this project.

7. Include anything else that you think will be helpful to the committee in evaluating this application.

Houda’s passion for learning and ability to excel has impressed me. She will make a remarkable scientist and educator following graduate work; this grant will help her to achieve her career goals.

Regarding IRB approval, Houda’s project does include novel cognitive testing, but there are no associated psychological or physical risks to the subjects. Therefore, we plan to write an addendum to the existing IRB protocol which has already been approved regarding DNA collection and analysis. Houda has also already obtained her human subjects training certificate and so the project is ready to begin first thing Spring 2014, dependent solely upon the requested funding.

This project _X_ DOES ____ DOES NOT require review by the WSU Institutional Review Board for Human Subjects or the WSU Animal Care and Use Committee.

_________________________________________  __________________________
Project Mentor Signature                       Date

_________________________________________  __________________________
Campus Mail Code                               Phone Extension