

Sample #1

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University of Colorado
Denver

Office of Undergraduate Experiences

Fall 2017 Undergraduate Research Opportunity Program (UROP)

UROP Mini-Grant Application

Deadline: Friday, September 22, 2017 - 5:00 p.m. MDT

E-mail completed application to: mary.baitinger@ucdenver.edu

The Undergraduate Research Opportunity Program (UROP) is a competitive grants program designed to financially support original faculty-mentored research, creative, and other scholarly activities undertaken by undergraduates outside the traditional classroom at the University of Colorado Denver and CU Anschutz Medical Campus.

The UROP Mini-Grant Program provides an alternative to the UROP Grants that are administered each spring by the Office of Undergraduate Experiences. Applications for UROP Mini-Grants requesting up to \$500 are now being accepted twice annually in September and in March. We expect to fund approximately 20 UROP Mini-Grants in Fall 2017.

Only degree-seeking undergraduate students on either campus at CU Denver who have completed a minimum of 15 semester hours of coursework with a cumulative CU GPA ≥ 2.5 are eligible to apply. UROP Grant recipients must be continuously enrolled as undergraduates at CU Denver over the Mini-Grant award period. Students entering a graduate or professional program during the Mini-Grant award period are not eligible to apply or receive funds. As part of their budget, students may request support to defray the cost of: materials, equipment, travel, and stipends, as well as dissemination, including travel to meetings. Costs of enrollment (e.g., tuition) are not covered, as a Mini-Grant is not a scholarship. With the exception of stipends, all incurred expenses will be reimbursed over the duration of the grant. All awardees, including those who graduate prior to May 2018, are required to present the results of their grant at the CU Denver Research and Creative Activities Symposium (RaCAS) on April 27, 2018 and complete a brief final report.

NOTE: Applications requiring Risk Management approval or human or animal subject protocols are not eligible for funding from the UROP Mini-Grant Program, unless previously obtained by the mentor from a project that is in progress.

For an in-depth discussion of all UROP application materials (including the evaluation rubrics), please visit the UROP main page at: <http://www.ucdenver.edu/student-services/resources/ue/urca/Pages/UROP.aspx>

Application Section I - Contact Information

Principal Investigator (PI):	
Proposal Title: Developing Circuitry to Test Auditory Pathway Function in Live Animals	
Amount of Proposed Mini-Grant Request (up to \$500): \$500	
PI Student ID #:	PI Major (required): Electrical Engineering
PI Employee ID # (if previously employed by the University of Colorado)	PI Minor (optional):
PI Primary Phone #:	PI CU Denver GPA: 3.64
PI CU Denver E-mail:	PI CU Denver Expected Graduation Date: Dec. 2017
Faculty Mentor Name, Title and Affiliation:	Mentor CU Denver E-Mail:
Optional questions (whether you answer or not, your application will still be eligible for consideration): Mark all those that apply:	
• Are you an ethnic minority undergraduate student <u>No</u> (but one of the only female students in my program)	

- Did you graduate from a high school in a rural community (rural communities outside of urban areas) No
- Are you a first generation college student (neither parent/legal guardian has received a baccalaureate degree) No

Application Section II – Project Description

Enter a one page summary (about 3250 characters including spaces) into this box that: 1) describes your research, creative, or other scholarly activity, including specific objectives and significance; 2) provides context for the scholarly activity supported by state-of-the-field references in a bibliography; 3) provides a timeline beginning with the award date and culminating with your presentation at RaCAS 2018; 4) specifies the full amount being requested along with an itemized list of expenditures with justification; and 5) describes how the project contributes to your professional development.

Recording action potential firings of neuronal circuitry in the brain is essential to understanding the brain. The objective of this study is to develop circuitry to simultaneously record action potentials and Auditory Brainstem Response (ABR) for humans and small animals.

ABR primarily functions in screening tests of hearing for newborns. Over 275 million people in the world have impaired hearing, making it the most prevalent sensory disability. ABR is an electrical potential signal that elicits a sound stimulus to assess auditory neuropathy function (Paulraj et al., 2015). The signal emanates from the scalp and uses electroencephalography, a non-invasive measurement of electrical activity in the brain (Olusanya et al., 2004), to collect many signals elicited from the brain stem in response to sound. ABR is used to diagnose brain diseases, conduct research, and various medical applications.

In vivo single-cell recording is used to observe changes in voltage in a single neuron. The technique offers greater insight into the brain's activation and allows surgeons to register one neuron in a living animal. However, it poses many difficulties. It's more invasive, requiring a screw be drilled into the skull to act as a ground and a hole be cut into the skull through which the electrode can be placed directly into the brain. Gathering meaningful data requires prolonged testing, lasting hours. Once a cell is located, the cell or electrode may drift, or the animal or human may move in their sleep and dislodge the electrode, terminating the income of data from that cell. Additionally, new techniques for decoding data from single cell probes are needed (Rossant et al., 2016). Using ABR simultaneously would help eliminate uncertainty.

It is currently impossible to record ABR and single cell data simultaneously. Single cell recording uses a high impedance electrode while ABR impedance is low. Their sensitivity to noise differs requiring different bandwidths and sampling frequencies. This study aims to 1) use two integrated circuits: TI OPA827 and ADI AD8429, to design a functional electronic circuit and build the circuit for gerbil ABR acquisition and simultaneous recording of single cell action potentials. 2) Test the circuit in the Laboratory for Electronic and Neuromorphic Systems (LENS). 3) Submit a paper for publishing by December 2017 including circuitry and results, if successful. The project will expand my skill set with circuitry design, manufacturing, and testing, and expand my knowledge of neuroscience to assist me in graduate school, while strengthening my technical writing skills.

I am requesting a stipend of \$500 to support me in my research. I estimate that I will need to dedicate at least 50 hours (\$10/hr.) to this research over the course of this semester to complete the circuit design, test it, and make corrections.

Dates	Activity	Estimated Hours
September	Get familiarized with circuit design tools	10
October	Design electronic circuit	15
November	Build electronic circuit	15
December	Test circuit, make re-designs, publish findings	10
April 27, 2018	Present Results at RaCAS	NA

References

1. B. O. Olusanya, L. M. Luxon, and S. L. Wirz, "Benefits and challenges of newborn hearing screening for developing countries", *Int. J. Pediatr. Otorhinolaryngol.*, vol. 68, pp. 287-05, 2004.

2. Paulraj, M., Subramaniam, K., Yaccob, S., Adom, A. and Hema, C. (2015). *Auditory Evoked Potential Response and Hearing Loss: A Review*. NCBI.
3. Rossant, C., et al. (2017). *Spike sorting for large, dense electrode arrays*. *Nature Neuroscience*, vol. 19, num. 4.

Application Section III – Mentor’s Letter of Support

Separately, your mentor should submit a one page letter of support to Mary.Baitinger@ucdenver.edu that: 1) assesses your proposed research, creative, or other scholarly activity, including efficacy; 2) describes how the activity contributes to your professional development; 3) assesses your academic preparation; 4) clarifies their role as mentor and 5) provides a timeline throughout the academic year when the mentor will meet with you.

Application Section IV – UROP Award Agreements and Required Signatures

If your project is selected for funding, the following agreements will be enforced. Enter your handwritten initials in the boxes next to the following statements that indicate you agree to honor their intent.

	EXPENSES I will use all awarded UROP funds only for the stipend and/or expenses as detailed in the original Budget Request. I will contact the Office of Undergraduate Experiences prior to making any equipment purchases or incurring any travel expenses to ensure that University policies and procedures are followed.
	STIPEND If I receive a stipend, I must become a CU Denver University employee, provide my Social Security card, driver’s license, bank account information, undergo a criminal background check, and know that stipends are reported to the IRS as income. A stipend will be paid after my RaCAS 2018 presentation.
	MENTOR APPROVAL My mentor has read and approves this grant proposal and all aspects of the proposed grant-supported research or creative activity.
	MENTORSHIP PARTICIPATION If I receive an award, my faculty mentor has agreed to mentor my project, which includes meeting with me on a regular basis, providing budget oversight, and working with the Office of Undergraduate Experiences, as needed, regarding adhering to university policies and procedures.
	EQUIPMENT/SUPPLIES All equipment and supplies purchased with UROP funds become the property of the University of Colorado Denver. Items having a use beyond the grant project (e.g., video equipment, computer hardware, geologists’ hammers, binoculars) must be returned to the department of the Faculty Mentor.
	NON-TRANSFERABLE FUNDING AND CHANGES IN BUDGET/PROJECT UROP funds are not transferable and must be used prior to graduation or May 31, 2018. If there is a change in my student status (graduation, disenrollment, etc.) or I am unable to expend the UROP funds, I will <u>immediately</u> notify the Office of Undergraduate Experiences to review the impact on my budget.
	ENROLLMENT I will enroll for a minimum of 3 credit hours per semester during the time the proposed project is conducted. I will complete my project prior to graduation or <u>May 31, 2018</u> . If I am entering a graduate program during the length of the Mini-Grant award, I understand that I am not eligible to receive funding.
	ACKNOWLEDGEMENTS I will acknowledge financial support received from CU Denver UROP in any articles published, papers presented, exhibits, recitals given, etc. that result from UROP funding.
	RaCAS I will present the results of the UROP-funded project at the 2018 Research and Creative Activities Symposium (RaCAS) to be held in late April 2018, as a stipulation of UROP grant funding.
	FINAL REPORT Upon completion of my UROP project, I will submit to UE a faculty mentor-approved final report, outlining my project’s goals, process, and accomplishments. I understand that UROP final reports are due on or before <u>May 31, 2018</u> . If I graduate early, the report is due before finals in the semester I graduate.

Principal Investigator Signature: _____

Date: 9/22/17

Faculty Mentor Signature: _____

Date: 9/22/17



College of Engineering and Applied Science
UNIVERSITY OF COLORADO DENVER | ANSCHUTZ MEDICAL CAMPUS
Department of Electrical Engineering

Department of Electrical
Engineering

1200 Larimer Street, NC-3502
Campus Box 112
P.O. Box 173364
Denver, CO 80217-3364
Office: 303-556-8516
Office Fax: 303-556-6371

September 22, 2017

Dear UROP Mini-Grant Committee,

I am writing this letter to indicate my enthusiastic support to _____ or her UROP Mini-Grant Application in the title of "Developing circuitry to test auditory pathway function in live animals". She will be working in my Laboratory for Electronic and Neuromorphic Systems (LENS) at Room 105 of the Boulder Creek Building under my direct supervision.

The project _____ will be working on is to create a multifunctional neural amplifier that will simultaneously record extracellular action potentials from neurons in the brain stem and the auditory brain stem response EEG signal from the outside of the head. The basic design of the amplifier is finished and _____'s responsibility is to further design the circuit diagram and simulate the circuit using standard circuit design simulation software. She will also implement the circuit using printed circuit board design tools to create a printed circuit board and then solder the circuit components on to the board. Finally she will be testing the amplifier to confirm its functionality. Since the basic design of the amplifier is available to her and _____ is a Senior Electrical Engineering student that has learned all the circuit design skills, I estimated that the project is highly feasible for her to complete.

This research activity is highly valuable to her future career success as an electrical engineer. During class, we taught her how to analyze a circuit and also how to design a circuit to suit the application requirements. However, all of the trainings are mostly on the paper and she needs more practical experiences to put these knowledge into an actual device. This opportunity will allow her to gain some actual real-world design experiences to further advance her training to be a competent industrial and research engineer. She will also be working with and learning from my PhD students in the lab and that will give her experiences working with other team members. _____ is currently joining our weekly lab meeting and I will be available for her to discuss the project and other questions. She will also have plenty of opportunity to interact with other students, both graduates and undergraduates, in the laboratory.

Conclusively, _____ is an excellent student in Electrical Engineering and this opportunity will further advance her career in the field. In my opinion, she is well deserved of this support and I hope the committee will see the same. Should you have any questions, please feel free to contact me.

Sincerely,

Department of Electrical Engineering
University of Colorado Denver

Sample #2



Office of Undergraduate Experiences

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Fall 2017 Undergraduate Research Opportunity Program (UROP) UROP Mini-Grant Application

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Application Section I - Contact Information

Principal Investigator (PI):

Proposal Title: Sex Differences in Endotoxin-Induced Neonatal Lung Injury: Insights into the Pathogenesis of Bronchopulmonary Dysplasia

Amount of Proposed Mini-Grant Request (up to \$500): \$500

PI Student ID #:

PI Major (required): B.S. Public Health

PI Employee ID #

(if previously employed by the University of Colorado)

PI Minor (optional): Biochemistry

PI Primary Phone #:

PI CU Denver GPA: 3.1

PI CU Denver E-mail:

PI CU Denver Expected Graduation Date: May 2020

Faculty Mentor Name, Title and Affiliation: (

Mentor CU Denver E-Mail:

University of Colorado Anschutz Medical Campus
School of Medicine –Section of Neonatology

Optional questions (whether you answer or not, your application will still be eligible for consideration): Mark all those that apply:

- Are you an ethnic minority undergraduate student: YES
- Did you graduate from a high school in a rural community (rural communities outside of urban areas) NO
- Are you a first generation college student (neither parent/legal guardian has received a baccalaureate degree) YES

Application Section II – Project Description

Enter a one page summary (about 3250 characters including spaces) into this box that: 1) describes your research, creative, or other scholarly activity, including specific objectives and significance; 2) provides context for the scholarly activity supported by state-of-the-field references in a bibliography; 3) provides a timeline beginning with the award date and culminating with your presentation at RaCAS 2018; 4) specifies the full amount being requested along with an itemized list of expenditures with justification; and 5) describes how the project contributes to your professional development. Enter text directly into this box or paste from another source. Use Calibri 12pt font.

Bronchopulmonary Dysplasia (BPD) is a chronic lung disease affecting ~10,000 babies annually in the U.S. Lung development occurs in five main stages: embryonic, pseudoglandular, canalicular, saccular, and alveolar. Most babies who develop BPD are born in the saccular stage (<28 weeks gestation). In a newborn mouse, the lung remains in the saccular stage for 5-7 days after birth. Using the newborn mouse as our model allows us to make predictions about what is going on in the neonatal human lung.

It is known that males are at an increased risk for BPD, but the mechanism is unknown². Endotoxemia in the neonatal period leads to abnormal lung development in mice, similar to human BPD. It is unknown if neonatal male mice demonstrate worse lung injury following endotoxemia when compared to female mice. We hypothesize that abnormal lung development induced by endotoxemia will be attenuated in female compared to male mice. To test this hypothesis, we propose the following aim:

- Demonstrate differences in key objective measures of lung development between male and female neonatal mice following endotoxemia.

Newborn mice will be exposed to endotoxemia (LPS 5 mgc/g, IP). On DOL7, mice will be sacrificed and lung tissue sent to the Morphology and Phenotyping Core lab for H&E staining. Sex will be determined by performing PCR for the *SRY* gene, found on the Y chromosome. We anticipate sending about 25 samples to the lab for staining. After receiving the slides, images will be captured at 40X magnification on a microscope, and morphological assessments will be performed on the images using MetaMorph analysis software. This program lets us quantify lung injury by analyzing lung architecture. Quantifiable measures to be performed include:

- Radial alveolar count (RAC)
- Mean linear intercept (MLI)
- Airspace Area
- Surface Area

These quantifiable measures will allow us to determine if differences exist in lung development. This project represents the initial pursuit of the long-term goal of finding sex differences in the inflammatory response and customizing treatments to address these differences. It is of great importance to me to share these results at RaCAS 2018 with other professionals interested in this field. Obtaining this mini-grant will

help me develop professional skills in a research setting, enhance my knowledge in the sciences, and apply this knowledge in the world of medicine.

Timeline of project:

September-October: Litter of mice expected to be born	November-December: Exposure to LPS and SRY genotyping	December-January: Histology slides to be prepared and morphological assessment	January-February: Data analyzing and creating data graphs on GraphPad Prism	February-March: Prepare presentation for RaCAS 2018
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The cost of this project will be around \$500 including the staining cost, PCR materials, and any other miscellaneous lab materials (i.e. pipette tips, sample tubes, etc.):

Slide staining (\$6.50/slide) 25 slides	\$163.00
Ethidium Bromide (Essential for PCR and acts as a fluorescent tag)	\$39.00
Pipette tips	\$80.00
QIAquick PCR Purification Kit (50) (Allows for DNA purification and protein extraction from samples)	\$115.00
Agarose Gel	\$71.00
Sample Tubes	\$30.00

1. Hilgendorff, Anne, and Michael A. O'Reilly. "Bronchopulmonary Dysplasia Early Changes Leading to Long-Term Consequences." *Frontiers in Medicine* 2 (2015): 2. PMC. Web. 15 Sept. 2017.
2. Klein L. Sabra, and Flanagan L. Katie. "Sex differences in immune responses." *Nature Reviews Immunology* (2016): Web. 15 Sept. 2017.

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- STIPEND** If I receive a stipend, I must become a CU Denver University employee, provide my Social Security card, driver’s license, bank account information, undergo a criminal background check, and know that stipends are reported to the IRS as income. A stipend will be paid after my RaCAS 2018 presentation.
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- RaCAS** I will present the results of the UROP-funded project at the 2018 Research and Creative Activities Symposium (RaCAS) to be held in late April 2018, as a stipulation of UROP grant funding.
- FINAL REPORT** Upon completion of my UROP project, I will submit to UE a faculty mentor-approved final report, outlining my project’s goals, process, and accomplishments. I understand that UROP final reports are due on or before May 31, 2018. If I graduate early, the report is due before finals in the semester I graduate.

Principal Investigator Signature: _____
Date: 09/15/17

09/15/17

Faculty Mentor Signature: _____

Date: 9/15/17



16 September 2017

To Whom It May Concern:

It gives me great pleasure to provide this letter of recommendation for _____, an M.D. neonatologist at the Children's Hospital Colorado and Associate Professor of Pediatrics at the University of Colorado School of Medicine. In addition to my clinical duties, I run a basic science laboratory where we study how the innate immune response to inflammatory stimuli affects the developing lung. I met _____ in the fall of 2016, and I have worked with her over the past year. She has worked in my lab, twice a week, every week during the school year, and daily over the summer. She is a delightful young woman with wonderful strengths, is incredibly motivated and committed to a career in biomedical science.

_____ is a motivated young woman who is extremely focused on pursuing a career in medicine. _____ introduced herself to me via email during the fall of 2016. Being proactive and looking for rewarding summer opportunities, she found my name listed as a student mentor on the Children's Hospital of Colorado website. In a very polite email, she asked if we could meet and discuss clinical medicine and research opportunities. I was impressed by how proactive she was – she was only a first semester freshman at the time. She visited my lab, and I learned that she was working ~30 hrs/wk at the dental clinic reception desk. Stressing the importance of her classes, and the benefits of a flexible work schedule, I recommended that she start to work in the lab to see if she liked it. She jumped on that offer, and has been coming to lab twice a week for the past 6 months, and daily over the summer. She is enjoying it very much, and has quickly learned many laboratory skills including DNA extraction, reverse transcription, cell culture, genotyping, RT-qPCR and assessing lung morphometrics using a complex computer program. The whole lab staff looks forward to an "_____ day" - she brings an energy and a curiosity to lab that is infectious! These innate qualities will serve her well in her pursuit of a career in the biomedical sciences.

I have no doubt that _____ will be successful in this pursuit. Firstly, she is insightful to a degree that is far beyond that of many of her peers. She speaks quite eloquently about how her own experiences with difficulty in accessing health care has motivated her to pursue a career in medicine. Furthermore, she applied for and was awarded a position as a MARC U-RISE (Maximizing Access to Research Careers - Undergraduate Research in Interdisciplinary Sciences Experience) scholar at the University of Colorado. This program allows provides a stipend to support her work in my lab this summer, as well as a scholarship to provide school credits for work she will continue to do in my lab over the school year. Despite having just finished her freshman year, she "gets" what it takes to be successful and has demonstrated nothing but hard work in determination in pursuing these goals.

_____ very much deserves, and would benefit greatly from, a UROP Grant. She has demonstrated a commitment to the lab, and has impressed me with her diligence and reliability. I believe that she is ready to engage in a project that she has some ownership. Writing this grant is the first step in that process. She will be looking at whether there is a difference between lung injury induced by systemic inflammatory stress between male and female mice. This question is clinically relevant, and will allow _____ to further develop her laboratory skills. I will continue to meet with _____ every visit to that lab – which is currently scheduled for twice weekly during the fall semester.

University of Colorado School of Medicine

Perinatal Research Center
AK32-108, Mail Stop F441
13243 East 23rd Ave
Aurora, CO 80045
Office: 303-724-6564

Department of Pediatrics
Section of Neonatology
Mail Stop 8402
13121 E. 17th Ave, Room 4304
Aurora, CO 80045
Office: 803-724-2840

Sample #3



University of Colorado
Denver

Office of Undergraduate Experiences

Fall 2018 Undergraduate Research Opportunity Program (UROP) UROP Mini-Grant Application

Deadline: Friday, March 2, 2018 - 5:00 p.m. MDT

E-mail completed application and unofficial transcripts to: mary.baitinger@ucdenver.edu

The Undergraduate Research Opportunity Program (UROP) is a competitive grants program designed to financially support original faculty-mentored research, creative, and other scholarly activities undertaken by undergraduates outside the traditional classroom at the University of Colorado Denver and CU Anschutz Medical Campus.

Any degree-seeking undergraduate student on either campus at CU Denver who has completed a minimum of 15 semester hours of coursework with a cumulative CU GPA ≥ 2.5 is eligible to apply. UROP Grant recipients must be continuously enrolled as undergraduates at CU Denver over the Mini-Grant award period. Students entering a graduate or professional program during the UROP Grant award period are not eligible to apply or receive funds. As part of their budget, students may request support to defray the cost of: materials, equipment, travel, and stipends, as well as dissemination, including travel to meetings. Costs of enrollment (e.g., tuition) are not covered, as a Mini-Grant is not a scholarship. With the exception of stipends, all incurred expenses will be reimbursed over the duration of the grant. All awardees, including those who graduate prior to May 2019, are required to two UROP workshops over the academic year, present the results of their grant at the CU Denver Research and Creative Activities Symposium (RaCAS) on April 26, 2019, complete a brief final report, and participate in program assessment.

NOTE: Applications requiring Risk Management approval or human or animal subject protocols are not eligible for funding from the UROP Mini-Grant Program, unless previously obtained by the mentor from a project that is in progress.

For an in-depth discussion of all UROP application materials (including the evaluation rubrics), please visit the UROP main page at: <http://www.ucdenver.edu/student-services/resources/ue/urca/Pages/UROP.aspx>

Application Section I - Contact Information

Principal Investigator (PI):

Proposal Title:

Amount of Proposed Mini-Grant Request (up to \$500):

PI Student ID #:

PI Major (required): Biochemistry

PI Employee ID #
(if previously employed by the University of Colorado)

PI Minor (optional): N/A

PI Primary Phone #:

PI CU Denver GPA: 3.733

PI CU Denver E-mail:

PI CU Denver Expected Graduation Date: May 2019

Faculty Mentor Name, Title and Department:

Mentor CU Denver E-Mail:

Optional questions (whether you answer or not, your application will still be eligible for consideration): Mark all those that apply:

- Are you an ethnic minority undergraduate student Yes No
- Did you graduate from a high school in a rural community (rural communities outside of urban areas) No Yes
- Are you a first generation college student (neither parent/legal guardian has received a baccalaureate degree) No Yes

Application Section II – Project Description

During the events of egg fertilization, lipids and proteins involved in cell signaling regulate the fusion of cell membranes.² In *Xenopus* fertilization, the protein phospholipase D1b (PLD1b) is activated by sperm to produce the lipid phosphatidic acid (PA) which binds and activates the Src tyrosine kinase protein (Src).² Both PA and Src levels increase during *Xenopus* fertilization events.² PA is a unique signaling lipid with a small head group consisting of a negatively charged phosphate group (about -1.5 net charge), it is produced during certain signaling events and is the precursor for the biosynthesis of many other lipids. It has been shown that PA activation of inositol 1,4,5-trisphosphate (IP₃) causes the release of intracellular calcium [Ca²⁺]_i from the endoplasmic reticulum, and recent studies show that PA has a role of binding and activating Src tyrosine kinase during fertilization. PA is produced by phospholipase D which catalyzes the breakdown of phosphatidylcholine to PA and choline. PA levels have been shown to increase during insemination, which in turn increase the activity and levels of Src.¹

Src exists inactive in lipid rafts and is partially unfolded and has 5 domains, SH1, SH2, SH3, SH4 and a unique lipid binding region (ULBR). PA would mimic Src activating proteins which lead to Src domains becoming loosely connected to each other while bound to PA in the plasma membrane.² Src phosphorylates Tyrosine 845 in phospholipase Cγ (PLCγ) which is a catalyst that breaks down phosphatidylinositol 4,5-bisphosphate (PI45P2) to IP₃ and 1,2-diacylglycerol (DAG). DAG is responsible for stimulating protein kinase C (PKC) which plays a role in embryo development.¹

Both PA and Src have other roles besides cell proliferation during fertilization, such roles are autophagy, neurodegenerative disease, and platelet aggregation. The study of the binding of PA to Src could help us understand other diseases such as cancer, metastasis, and autophagy-related diseases like Parkinson's and Crohn's, Alzheimer and stroke.²

The purpose of this project is to visualize the binding of Src to PA in artificial membranes using single-molecule tracking and to quantify the amount of lipids binding to Src (specifically, SH3 and ULBR) in the plasma membrane using total internal reflection fluorescence microscopy (TIRFM) technique.³ The hypothesis of this project is that the negatively charged PA binds tighter and forms more intermolecular bonds to a specific region in Src that is positively charged thus spending more time attached and resulting in a slower diffusion rate. The diffusion constant *D* and the dissociation rate constant will be determined for Src in three lipids that showed the highest affinity to Src: PA, phosphatidylinositol 4-phosphate (PI4P) and PI45P2.²

This is a collaborative project between _____, research lab that has expertise in proteins purification and tracking techniques and _____ lab which is investigating the role of the interaction between PA and Src. Working on this project will expose the investigator to lab techniques pertaining to biochemistry that will increase the investigator's practical techniques, and to gain experience in scanning and writing primary research articles.

I joined _____'s research group in February 2018, and I'm currently learning protein purification techniques. I will learn single molecule tracking techniques in the summer of 2018. If our findings supported our hypothesis I will continue working on this project with _____. If not, I will test the binding of Src to different lipids. I will present my work at the RaCAS symposium in 2019.

The requested amount of money is \$500, I wish to receive it as a stipend. The stipend serves as an incentive to

continue research and support cost of living expenses such as food and transportation over the summer and fall semesters.

References

1. Bates, R. C., Fees, C. P., Holland, W. L., Winger, C. C., Batbayar, K., Ancar, R., ... & Stith, B. J. (2014). Activation of Src and release of intracellular calcium by phosphatidic acid during *Xenopus laevis* fertilization. *Developmental biology*, 386(1), 165-180.
2. Stith, B. J. (2015). Phospholipase C and D regulation of Src, calcium release and membrane fusion during *Xenopus laevis* development. *Developmental biology*, 401(2), 188-205.
3. Knight, J. D., & Falke, J. J. (2009). Single-molecule fluorescence studies of a PH domain: new insights into the membrane docking reaction. *Biophysical journal*, 96(2), 566-582.

Application Section III – Mentor’s Letter of Support

Application Section IV – UROP Award Agreements and Required Signatures

If your project is selected for funding, the following agreements will be enforced. Enter your handwritten initials in the boxes next to the following statements that indicate you agree to honor their intent. No typed initials are allowed.

	EXPENSES I will use all awarded UROP funds only for the stipend and/or expenses as detailed in the original Budget Request. I will contact the Office of Undergraduate Experiences prior to making any equipment purchases or incurring any travel expenses to ensure that University policies and procedures are followed.
	STIPEND If I receive a stipend, I must become a CU Denver University employee, provide my Social Security card, driver’s license, bank account information, undergo a criminal background check, and know that stipends are reported to the IRS as income. A stipend will be paid after my RaCAS 2019 presentation.
	MENTOR APPROVAL My mentor has read and approves this grant proposal and all aspects of the proposed grant-supported research or creative activity.
	MENTORSHIP PARTICIPATION If I receive an award, my faculty mentor has agreed to mentor my project, which includes meeting with me on a regular basis, providing budget oversight, and working with the Office of Undergraduate Experiences, as needed, regarding adhering to university policies and procedures.
	EQUIPMENT/SUPPLIES All equipment and supplies purchased with UROP funds become the property of the University of Colorado Denver. Items having a use beyond the grant project (e.g., video equipment, computer hardware, geologists’ hammers, binoculars) must be returned to the department of the Faculty Mentor.
	NON-TRANSFERABLE FUNDING AND CHANGES IN BUDGET/PROJECT UROP funds are not transferable and must be used prior to graduation or May 31, 2019. If there is a change in my student status (graduation, disenrollment, etc.) or I am unable to expend the UROP funds, I will <u>immediately</u> notify the Office of Undergraduate Experiences to review the impact on my budget.
	ENROLLMENT I will enroll for a minimum of 3 credit hours per semester during the time the proposed project is conducted. I will complete my project prior to graduation or May 31, 2019 . If I am entering a graduate program during the length of the Mini-Grant award, I understand that I am not eligible to receive funding.
	ACKNOWLEDGEMENTS I will acknowledge financial support received from CU Denver UROP in any articles published, papers presented, exhibits, recitals given, etc. that result from UROP funding.
	RaCAS I will present the results of the UROP-funded project at the 2018 Research and Creative Activities Symposium (RaCAS) to be held in late April 2019, as a stipulation of UROP grant funding.

FINAL REPORT Upon completion of my UROP project, I will submit to UE a faculty mentor-approved final report, outlining my project's goals, process, and accomplishments. I understand that UROP final reports are due on or before **May 31, 2019**. If I graduate early, the report is due before finals in the semester I graduate.

Principal Investigator Signature: _____

Date: 3/2/18

Faculty Mentor Signature: _____

Date: 3/2/18

NOTE: All applicants must submit a copy of unofficial transcripts, which will be used by the Office of Undergraduate Experiences to assess eligibility and academic preparation for the proposed activity.



University of Colorado
Denver

College of Liberal
Arts and Sciences

Department of Integrative Biology
Campus Box 171
P.O. Box 173364
Denver, CO 80217-3364
Office: 303-556-8440
Office Fax: 303-556-4352

March 1, 2018

Dear UROP evaluation committee:

I am writing in support of [redacted] application for a 2018 mini UROP grant under the mentorship of [redacted]. [redacted] project is a collaborative effort between my lab group and that of [redacted], and is supported by my NIH AREA grant on lipid activation of a cancer-causing protein called Src tyrosine kinase. Supplies needed for the project will be provided from this grant, but, as I have other projects in my lab not involving TIRF, this UROP funding will help ensure the completion of this collaborative work (and provide recognition to [redacted] work, helping career development).

We are interested in discovering how the signaling lipid phosphatidic acid (PA) binds and localizes the cancer causing protein Src. We utilize an animal model system to study Src activation, and believe this work relates to cancer (both Src and PA are known to be elevated in most cancers). Previously, my lab has demonstrated that PA elevates as Src is activated, that inhibition of PA production inhibits Src activation and that addition of artificial PA stimulates Src. However, TIRF microscopy will quantify the binding of PA to Src, and, if PA forms clusters, that Src movement on the membrane surface is regulated (corralled). As the mechanism of Src activation is not clearly defined, we suggest that this information would lend insight into the cause of certain cancers. [redacted] single-molecule microscopy technique is the best method to test the hypothesis that Src directly interacts with membranes containing PA in vitro under controlled conditions. If we observe that Src binds PA, and localizes Src to certain areas of the membrane, this would provide strong support for a new pathway for cancer. Furthermore, this finding would allow us to measure the extent of Src-PA interaction and open the door for future studies examining the effects of PA on Src enzymatic activity.

I am happy to provide co-mentorship of [redacted] in this collaborative project, particularly during the 2018-2019 academic year which [redacted] has planned for sabbatical. During that time I will be available to meet with [redacted] at least every other week to discuss his progress and the overall scientific direction of the project. If the single-molecule experiments produce negative results or appear not to be useful for future studies, then I will talk with [redacted], about possible other directions of the project at that time. Overall, I am committed to success of this collaborative project and look forward to working with [redacted].

University of Colorado Denver, Downtown Denver

PO Box 173364, Denver, CO 80217
FEDEX: 1201 Fifth St., Denver, CO 80204
Tele: [redacted] FAX: [redacted] Lab: [redacted]
Office: [redacted] Lab: [redacted]

Sample #4

A10



Office of Undergraduate Experiences

Fall 2017 Undergraduate Research Opportunity Program (UROP) UROP Mini-Grant Application

Deadline: Friday, September 22, 2017 - 5:00 p.m. MDT

E-mail completed application to: mary.baitinger@ucdenver.edu

The Undergraduate Research Opportunity Program (UROP) is a competitive grants program designed to financially support original faculty-mentored research, creative, and other scholarly activities undertaken by undergraduates outside the traditional classroom at the University of Colorado Denver and CU Anschutz Medical Campus.

The UROP Mini-Grant Program provides an alternative to the UROP Grants that are administered each spring by the Office of Undergraduate Experiences. Applications for UROP Mini-Grants requesting up to \$500 are now being accepted twice annually in September and in March. We expect to fund approximately 20 UROP Mini-Grants in Fall 2017.

Only degree-seeking undergraduate students on either campus at CU Denver who have completed a minimum of 15 semester hours of coursework with a cumulative CU GPA ≥ 2.5 are eligible to apply. UROP Grant recipients must be continuously enrolled as undergraduates at CU Denver over the Mini-Grant award period. Students entering a graduate or professional program during the Mini-Grant award period are not eligible to apply or receive funds. As part of their budget, students may request support to defray the cost of: materials, equipment, travel, and stipends, as well as dissemination, including travel to meetings. Costs of enrollment (e.g., tuition) are not covered, as a Mini-Grant is not a scholarship. With the exception of stipends, all incurred expenses will be reimbursed over the duration of the grant. All awardees, including those who graduate prior to May 2018, are required to present the results of their grant at the CU Denver Research and Creative Activities Symposium (RaCAS) on April 27, 2018 and complete a brief final report.

NOTE: Applications requiring Risk Management approval or human or animal subject protocols are not eligible for funding from the UROP Mini-Grant Program, unless previously obtained by the mentor from a project that is in progress.

For an in-depth discussion of all UROP application materials (including the evaluation rubrics), please visit the UROP main page at: <http://www.ucdenver.edu/student-services/resources/ue/urca/Pages/UROP.aspx>

Application Section I - Contact Information

Principal Investigator (PI):	
Proposal Title: Examining the Individual Differences Between Priming of Pop-out and Working Memory Capacity	
Amount of Proposed Mini-Grant Request (up to \$500): \$500	
PI Student ID #:	PI Major (required): B.S Psychology
PI Employee ID # (If previously employed by the University of Colorado)	PI Minor (optional): Biology
PI Primary Phone #:	PI CU Denver GPA: 3.1
PI CU Denver E-mail:	PI CU Denver Expected Graduation Date: May 2018
Faculty Mentor Name, Title and Affiliation:	Mentor CU Denver E-Mail:

Optional questions (whether you answer or not, your application will still be eligible for consideration): Mark all those that apply:

- Are you an ethnic minority undergraduate student Y
- Did you graduate from a high school in a rural community (rural communities outside of urban areas) N
- Are you a first generation college student (neither parent/legal guardian has received a baccalaureate degree) Y

Application Section II – Project Description

Humans rely on priming and working memory to collect, store, and recall information that was processed through the visual cortex (Roediger, 1990). Our current behavior can be unconsciously influenced by implicit memory of these past experiences (known as priming). For example, a person who is walking on a familiar path starts to prefer one side of the sidewalk because of the amount of rocks on the other side. The person did not make a conscious effort to avoid rocks, but it was implicitly picked up. On the other hand, we also use explicit memory to influence our behavior (known as working memory). A person may make the decision to move on the sidewalk based on an explicit memory of a sign that said 'danger, rocks ahead on the left'. Our goal of this project is to investigate how individual differences in implicit priming correlate with working memory.

A previous study from the Faculty mentor's lab explored differences in schizophrenia patients. Implicit priming was measured using a visual search task paradigm called priming of pop out (Malkjovic & Nakayama, 1994), where the target shape and color "pops" out amongst distractors of a different color but same shape. The target and distractor colors can stay constant between trials or they can be switched. The goal is to measure the reaction time between repeat and switch trials, to see if exposure to previous trial content influences the subjects' decision when searching for the target in the proceeding trial. Participants were faster when the target color happened to repeat between trials. Working memory capacity was estimated for each participant using a change detection task (Luck, 2013). Results from the study showed individuals who had a higher working memory had lower implicit processing (Leonard, 2016). We will replicate this finding in the typical population and manipulate the pop-out search task.

For our study, we will use the same priming of pop out paradigm and working memory task to analyze individual differences, but will change the probability of occurrence of a target color repeat. In the first block it will be 50/50, replicating the previous design. In the second block it will be 75/25, meaning that the target color is more likely to repeat. This change can help us understand if individuals can implicitly pick up the repetitive color and respond faster between target trials. Would individuals with higher working memory capacity show increased priming if color repetition was beneficial?

The UROP will allow me to grow as a researcher by enhancing my writing skills through the grant process, and gain more experience presenting in conference poster sessions. I will become more resilient and confident through independent research, which are important qualities that I can carry on and improve throughout my scientific career.

Date	Goal
September-November 2017	Run participants in experiment
October-December 2017	Develop analysis code and analyze data (MatLab)
January 26 th 2018	Submit abstract for Rocky Mountain Psychological Association (RMPA) conference
March 2018	Submit abstract for RaCAS
April 12-14 th , 2018	Present poster at RMPA conference
April 27 th , 2018	Present poster at RaCAS

Project Timeline

All \$500 will be needed for the following expenses:

Cost	Reason
\$100	Registration for Rocky Mountain Psychological Association conference
\$75	Three- day travel expense to conference
\$25	Poster printing
\$300	Stipend for additional research hours \$10/hr for 30hrs

References

Leonard, C. J., Robinson, B., Hahn, B., Gold, J. M., & Luck, S. J. (2016). Increased influence of previously attended features in people with schizophrenia. Poster presented at the annual meeting of the Vision Sciences Society in St. Pete's Beach, FL.

Luck, S. J., & Vogel, E. K. (2013). Visual working memory capacity: from psychophysics and neurobiology to individual differences. *Trends in cognitive sciences*, 17(8), 391-400.

Maljkovic, V., & Nakayama, K. (1994). Priming of pop-out: I. Role of features. *Memory & cognition*, 22(6), 657-672.

Roediger, H. L. (1990). Implicit memory: Retention without remembering. *American psychologist*, 45(9), 1043

Application Section III – Mentor's Letter of Support

Separately, your mentor should submit a one page letter of support to Mary.Buitinger@ucdenver.edu that: 1) assesses your proposed research, creative, or other scholarly activity, including efficacy; 2) describes how the activity contributes to your professional development; 3) assesses your academic preparation; 4) clarifies their role as mentor and 5) provides a timeline throughout the academic year when the mentor will meet with you.

Application Section IV – UROP Award Agreements and Required Signatures

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Principal Investigator Signature: _____

Date: 9/22/17

Faculty Mentor Signature: _____

Date: 9/22/17

The project that [redacted] has proposed for her UROP grant is an effort to replicate and extend a previous study of mine on individual differences in priming and working memory. The experiment could potentially yield interesting, publishable results that would contribute to the field. I have worked closely with [redacted] during its development, and I feel confident that we will be able to move forward with this work in this proposal this year.

In terms of professional development, [redacted] would gain a great amount of experience that would set her apart from other graduate school applicants. Moreover, this project is ideal for someone new to this area of research, because it builds on a previous study that uses very similar paradigms. This means that [redacted] will be able to clearly see how her project pushes forward our scientific knowledge. Practically, she will also gain the experience of running human participants in an experiment. She has already had some experience working at CU Anschutz in a rodent lab over this past summer, and her work on this project would offer her another perspective of what psychological research can be. In addition, she has learned some Matlab programming over the summer and we will work together for her to develop these skills in her analysis of this dataset. With the Rocky Mountain Psychological conference happening here in Denver this year, she will also get to present her work at a regional meeting in addition to RACas, which will be great academic experiences for her.

I met [redacted] last spring when she first became involved with the lab. Before we even began discussing this project, [redacted] already had a firm sense of the themes we study in our lab. In terms of specific preparation for this project, I began talking with [redacted] at the end of the summer. I've provided her with related articles and a PDF of my poster that this work is based on. We've already met multiple times to discuss this. I believe that [redacted] is prepared to move forward with this project and am looking forward to continuing working with her on this.

First and foremost, I believe my role as a mentor is to help students gain useful experiences for their future. Since [redacted] wants to go to graduate school, research experience will be essential. I've just recently established the Laboratory for Integrative Vision here at CU Denver on the 5th floor of the North Classroom building. We already have a community of undergrads involved with the lab, and I hope to be able to give them all a true research experience.

I meet with all the undergraduate students I work with frequently. Conveniently, my office is directly across the hall from the testing spaces in the lab. This means that in addition to formal meetings, I have a large amount of informal interaction with students who work with me. I definitely have an open-door policy, and my other UROP student stops by quite frequently. Additionally, I hold lab meetings on most Fridays where we discuss either a research paper or new data. This semester, in addition to [redacted] these meetings include two students who are formally registered for Directed Research and one other who attends informally, with the plan of pursuing Directed Research credits in the Spring. With regard to this project, I would be meeting with [redacted] multiple times per week to ensure her forward progress.