

NEVADA SPACE GRANT CONSORTIUM HIGHLIGHT By Joy Immak, UNLV

MULTIPLE REGULATORY INPUTS CONTROL TYPE THREE SECRETION IN THE BACTERIAL PATHOGEN SHIGELLA FLEXNERI

PI: Helen J. Wing (University of Nevada, Las Vegas)

Despite rigorous attempts to maintain a clean room for spacecraft assembly, Shigella flexneri and other bacterial pathogens have been found in air samples obtained at the Johnson Space Center. The goal of this project is to understand transcriptional regulation used by the bacterial pathogen, Shigella flexneri, to control the secretion of effector proteins via the type three secretion system (T3SS) needle. This analysis is important because



Shigella flexneri (shown in red) can spread from host cell to cell using actin-based (shown in green) motility. Image provided courtesy of Dr. Marcia Goldberg, Harvard Medical School.

many bacterial pathogens use the T3SS to inject effector proteins into a human host cell to cause disease. I hope that my findings can be used to develop novel therapeutics and/or a more effective live-attenuated S. flexneri vaccine.



Joy Immak, PhD Candidate, UNLV



This project peaked my interest in how bacterial pathogens respond to external signals found within the host environment. The NASA funding provided me with the rare opportunity to focus solely on my research. Altogether, this experience has reinforced my drive to continue academic research pursuits after I graduate.

RETURN ON INVESTMENT (ROI) TO DATE

- New proposals/scholarships awarded: 5
- Publications/presentations: 6
- Students impacted, research experience and expertise: 4

2018 IMPACTS SUMMARY

STUDENT IMPACT



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Internships: 2 students; summer internships Jet Propulsion Laboratory & **Johnson Space Center**

Fellowships: 4 graduate students funded at a significant level for a full academic year

Scholarships: 9 undergraduate students at a significant level for a full academic vear

Community College Scholarships: 24 undergraduate students, 6 each at the 4 colleges

STEM EDUCATION IMPACT



Informal Education: 5 faculty received awards to provide STEM hands-ontraining to pre-college students

Pre-College: 1 faculty received an award to provide teacher training on STEM



~130 COLLEGE AND ~1250 PRE-COLLEGE STUDENTS BENEFITED FROM NEVADA SPACE **GRANT PROGRAMS IN 2018**



NASA EPSCoR **NEW RRR CAN AWARD**

A Rapid Research Response (RRR) Cooperative Agreement Notice (CAN) has been awarded to Nevada NASA EPSCoR for \$100k federal for one year. PI Dr. Elisabeth Hausrath, UNLV, in collaboration with NASA scientist Dr. Elizabeth Rampe (JSC) will address high priority NASA research to examine the interaction of minerals found in Mars, and the resources available during these reactions. "Rock, H2O, and H2: Energy from water-rock interactions on Mars" (2019).

ADVANCED ELECTROACTIVE POLYMER ACTUATORS AND SENSORS FOR AEROSPACE ROBOTIC APPLICATIONS

Kwang Kim (UNLV), Yantao Shen (UNR), Woosoon Yim (UNLV), Dong-Chan Lee (UNLV) and Ted Plaggemeyer (TMCC)

This project focused on

development of ionomer materials with improved thermal properties and good ion-conductivity for space applications. This was achieved by blending of Nafion®, a high ion-conductivity ionomer, with Polyimide (PI), which is known for its superior thermal and mechanical properties. Several factors were found to be significant Live demonstration of UNLV's in producing homogenous blends, such as concentration ratio and casting temperature.



electroactive polymers materials. Dr. Kwang Kim (UNLV), center.

The accomplishments in this project demonstrated the incorporation of PI in Nafion® with a bottom-up approach for the first time. The developed blend films show improved thermal and mechanical properties while maintaining good ion conductivity. This research is of great importance to the further development of advanced materials, and is expected to facilitate research and development in fields of smart materials, robotics, aerospace and other industrial applications.

RETURN ON INVESTMENT (ROI) TO DATE

- 11 new proposals/scholarships awarded with 8:1 ROI
- 1 patent for ionic/polyimide membranes and blends
- 24 publications and 34 presentations
- 11 students impacted through research experience
- PI induction into National Academy of Inventors



2018 IMPACTS SUMMARY

RESEARCH INFRASTRUCTURE



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Research CAN: 3 awards ending in 2018 or 2019 and 1 new award all funded for 3 years at a total of \$1,125,000 each (\$750K Federal and \$375K State Match)

Research Infrastructure Development Seed Grant: 4 awards for one year at a total of \$50,000 each (\$25K Federal and \$25 State Match)

Travel: 2 awards for multiple faculty to travel to NASA Centers (Ames and Jet Propulsion Laboratory) resulting in a minimum of three new proposals under development with NASA collaboration

TOTAL RETURN ON INVESTMENT

New Proposals: 21 funded for a total of \$10,670,000 (4:1 ROI); 5 additional proposals in review

- Patents: 1 for fabricating ionic/polyimide membranes and polyimide blends
- Publications: 32 peer review; 1 book, 2 book chapters
- Presentations: 118
 - Students receiving research experience: 42 undergraduate and graduate students

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