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Efficacy Testing of Nanotherapeutic Against Multi Drug Resistant Psuedomonas

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Efficacy Testing of Nanotheraputic Against Multi Drug Resistant Pseudomonas aeruginosa

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Project Description

In the US alone, antibiotic-resistant superbugs currently cause 2 million cases of illness and 23,000 deaths a year, according to the Centers for Disease Control. *Pseudomonas aeruginosa,* a gram negative opportunistic pathogen is one of the leading cause of deaths in nosocomial respiratory tract infections.[1] An estimated 51,000 *P. aeruginosa* infections occur in the United States each year. More than 6,000 (13%) of these are multidrug-resistant (MDR), with roughly 400 deaths per year attributed to these infections.[2] The constant rise in the number of MDR species calls for attention to look more into pathogen selective (targeted) anti-infective treatment. One such targeted anti-infective treatment is to have a nanocarrier to carry a payload of antibiotics to be delivered to the cell surface of a select pathogen.[3] The project involves looking at the in-vitro efficacy of a developed a targeted nanotherapeutics agent against multi drug resistant *P. aeruginosa.*

Student Duties, Contributions and Outcomes

I. Growth of MDR *P. aeruginosa* –Maintenance of liquid culture, agar plates and -80 ^{o}C stock. (1-2 weeks)

II. Antibacterial nanotheraputic efficacy testing method 1 – Determination of minimum inhibitory concentration (MIC) of material the material using colony forming units. (3-10 weeks)

III. Antibacterial nanotheraputic efficacy testing method 2 - Determination of minimum inhibitory concentration (MIC) of material the material using live/dead bacterial assay. (3-10 weeks)

IV. Mammalian cell culture – Human lung epithelial cells (adherent) cell line culture maintenance and harvest. (5-10 weeks)

V. Infection of lung epithelial cells with *P. aeruginosa* and antibacterial efficacy testing - Lung epithelial cells would be infected with *P. aeruginosa.* (8-10 weeks)

Manuscript/Poster Preparation – Participating student would be strongly encouraged to write up their research project results in the format of Journal of American Chemical Society (JACS) or least have the results in form of a poster presentation for ACS regional meeting. A successful project would be strongly considered for publication with additional data where the student could be a co-author or combined first author along with a graduate student of the group.

Faculty Requirement and Mentorship

Expected Student Background – Students should have a background in Biology having Microbiology would be an added advantage. Students major in Biology and or Chemical Engineering would be benefited. *Expected results and deliverables* – Participating student would be exposed to sterile techniques marinating stocks of both bacterial pathogens, mammalian cell culture and antibacterial efficacy testing. Students would be encouraged to maintain standard laboratory notebooks and would be exposed to good laboratory practices. They would be expected do a scientific presentation each week and hence be exposed to a peer review setting where their work would be critically analyzed. *Faculty Supervision and Mentoring* – Dr. Jayawardena will supervise all the steps in nanoparticle preparation and application. Including final manuscript preparation. Group meeting would be held weekly where the student will present his/her progress or problems of the project with the entire group. The student will have access to the instructor at least once a day.

Prior Awardees

RCEU 2018 - Quantification of the Limit of Detection of Pathogenic Bacteria Using a Glyconanomaterial Based Rapid Point-of-Care Diagnostics System – James Johnson

RCEU 2018 - Functionalized Nanomaterial as a Tool for Rapid Point-of-Care Diagnostics – Melinda Mustain

RCEU 2018 - Synthesis of Multivalent Glyco-Magnetic Nanoparticles for Rapid Point-of-Care Diagnostics System – Veer Deverasetty

Student contribution: all students work surmounted to a provisional patent submitted by UAH, data for two SERMACS poster presentations, *manuscript in preparation* Rapid Point-of-Care Diagnostic of Mycobacteria using Multi-Core Shell Magnetic Silica Nanoparticles

References

(1) Klevens, R. M.; Edwards, J. R.; Gaynes, R. P.; National Nosocomial Infections Surveillance, S. The Impact of Antimicrobial-Resistant, Health Care–Associated Infections on Mortality in the United States. *Clinical Infectious Diseases* **2008**, *47*, 927-930.

(2) Bassetti, M.; Vena, A.; Croxatto, A.; Righi, E.; Guery, B. How to manage Pseudomonas aeruginosa infections. *Drugs in Context* **2018**, *7*, 212527.

(3) Nathan, C. Fresh Approaches to Anti-Infective Therapies. *Science Translational Medicine* **2012**, *4*, 140sr142-140sr142.