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Testing the Efficacy of Novel Nanotherapeutics to Lung Tissue Infected with Drug Resistant Clinical Strains of *Pseudomonas*

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Project Description

Pseudomonas aeruginosa (PA), a gram-negative opportunistic pathogen is one of the leading cause of deaths in nosocomial respiratory tract infections.¹ An estimated 51,000 PA 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 trigger –released 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 nanotherapeutic that has a laser triggered drug delivery system to colistin resistant clinical strain PA14. PA14 will be infected to lung tissue and the project will involved proliferation of the infection over time and the would evaluate the efficacy of this novel anti-infective treatment.

Student Duties, Contributions and Outcomes

Student Duties: **a)** Growth of colistin resistant PA14 –maintenance of liquid culture, agar plates and - 80 °C stock. (1-2 weeks); **b)** Mammalian cell culture – Human lung epithelial cells (adherent) cell line culture maintenance and harvest. (5-10 weeks); **c)** Antibacterial nanotherapeutic efficacy testing– determination of minimum inhibitory concentration (MIC) of material the material using colony forming units and cell viability assays. (3-10 weeks); **d)** Infection of lung epithelial cells with PA and antibacterial efficacy testing - Lung epithelial cells would be infected with PA. (8-10 weeks). All experiments should be recorded in laboratory notebook (provided) and also should be duplicated on Google slide deck in the laboratory data drive.

Tangible Contributions - A successful project would be strongly considered for Material Research presentation done by the tri-campus research program held in January the following year. A positive outcome in the project (e.g. Successfully treated

PA infected lung tissue), will lead to the student been awarded co-authorship in high-impact factor journal publication.

Specific Outcomes – skill based *a)* bacterial and mammalian cell culture - sterile techniques, cell proliferation, harvesting and storage *b)* antibacterial assays – cell viability and colony counts *c)* bright field and fluorescence/confocal microscopy *d)* fluorescence and absorbance plate reader; **knowledge based** *a)* antibacterial resistance mechanisms *b)* novel techniques to combat resistance

Student Selection Criteria – Students who have taken introductory Biology (Principles of Biology) or students that major in Biology will be favorably considered. Having taken microbiology course will be an added advantage but is not a requirement. This project is open to students from any academic rank.

Faculty Mentorship – Student will be under the guidance and the overall supervisions of the PI. A graduate student (Ph.D. candidate) will be assigned as the immediate mentor (graduate mentor) and the student will always work along side with their graduate mentor. The graduate mentor will do the initial training in sterile techniques where the student will first observe/shadow and learn the techniques, once the training is completed student will work while been observed by the mentor. The student will train under the supervision of the PI and graduate mentor to manage different prokaryotic and eukaryotic cell lines each, which require different culture procedures. The PI will teach the critical techniques necessary for sterile culture, fluorescence microscopy and assay. These techniques skills are \ invaluable for students going in for graduate programs or industry careers in areas of molecular biology, biotechnology, biomedical engineering, chemical engineering, biochemistry and pharmacy. Individual meeting would be held once/twice a week where the student will present his/her progress or problems of the project. Group meetings will be held twice a week where they will present their work to the entire group.