Inventure Prize Prototype Proposal

Take a moment to think about the people in your life: your friends, your neighbors, and your family. Chances are you know someone who has had cancer or is battling cancer right now. Cancer affects all of us. In 2012, estimates show there was approximately 1.6 million cases of newly diagnosed cancer and 577,190 cases of death due to cancer in US alone. This number is projected to grow despite today's technological advances.

Battling cancer is difficult both for patients and their families. The treatment takes a physical and financial toll on the patient. However, battling cancer doesn't have to be a losing battle. We are an undergraduate team called "The BioBots" working under the supervision of Dr. Todd Sulchek. Our invention is a novel method for delivering drugs to fight cancer more effectively. We will achieve this by creating a microrobot that can traverse through biological systems, deliver specifically to cancer cells, and allow delivery to sites that have not been accessible by traditional methods such as chemotherapy.

Our microrobot combines nanotechnology with ideas inspired from biology. The biology we are mimicking is the actin-based motility seen in the bacteria, Listeria monocytogenes. Our microrobot will be composed of microparticles with different functionalities for targeting specific cellular components as well as incorporated with the ActA protein that Listeria uses to propel itself, using the freely available actin monomer inside our bodies as a fuel. The advantages of using our invention over chemotherapy lies in its specificity and unique method of delivery. (1) Specificity reduces the side effects of because the drug is focused on cancer cells unlike chemotherapy, which can also attack the healthy cells. (2) Specificity allows for a more concentrated dose that would otherwise be too toxic for the patient to handle. (3) The microrobot, using it's unique method to propel itself with the ActA protein, can penetrate through and directly deliver drugs inside the tumor.

Our team has successfully cultured genetically engineered strain of Listeria that expresses an easily purifiable form of the protein ActA as well as having a reliable method to give multiple functionality to the microparticles. However, we are having issues with procuring funds to purchase necessary supplies for the protein purification. Our expected cost is about $700 and this will allow our team to buy tools to purify ActA protein from the bacterial strain, as well as materials to make necessary biological buffers, characterize obtained protein with basic tools such as SDS-PAGE, and purchase protease inhibitors for maintaining the integrity of the purified proteins. Once we have obtained the necessary materials, we will be prepared to follow through with our experiment which is the only way we will be in the running for the InVenture prize. Without the funds to complete our project, it will be nearly impossible to successfully obtain the protein from Listeria, with the overarching goal of coating microparticles with ActA protein.

Bill of Materials

Description	Quantity	Supplier	Product #	Cost
Bis-Tris	1	Sigma Aldrich	B9754	$32.00
Polypropylene Columns	1	Qiagen	34964	$160.00
8% Precise Tris-HEPES Protein Gels	1	Thermo Scientific	25200	$125.00
Pierce SDS-PAGE Sample Prep Kit	1	Thermo Scientific	89888	$160.00
PMSF Protease Inhibitor	1	Thermo Scientific	36978	$62.00
Benzamidine hydrochloride hydrate	1	Sigma Aldrich	12072	$20.00
Ammonium Sulfate	1	Sigma Aldrich	A4418	$15.90
Polyacrylamide Spin Desalting Columns, 7K MWCO, 0.7mL	1	Thermo Scientific	89849	$134.00
			Total:	$708.90