3D Printing Away Catheter-Associated Urinary Tract Infections

Sampson, Mitchell (School: Northview High School)

In the U.S., catheter-associated urinary tract infections (CAUTIs) are attributed to 49,334 CAUTIs/year, 13,000 deaths/year, and sum expenses of over $340 million/year. The objective of this project was to use mass-producible, custom nylon 3D-printing to create novel catheter designs that could be mass-manufactured and would prevent bacterial biofilm formation, lessening the risk of CAUTIs; furthermore, initial trials of the prototypes were done. Each of those three java-scripted prototypes were uniquely designed: one was a smooth control, another was created with fluid dynamic principles, and the last was a biomimetic design. The prototypes were tested with an Escherichia coli inoculated broth. In the first test, the broth was poured over the prototypes, and, a minute later, petri dishes were cultured. The control design had an average of 14 colony forming units (CFU) per cm2, the fluid dynamic design had an average of 14.5 CFU per cm2, and the biomimetic design had an average of 16 CFU per cm2; according to a t-test statistical analysis, there was no distinguishable variance. In another experiment, culturing was not done until 36 hours after the initial administration; with a prolonged amount of time, the results deviated. The control had an average of 2 CFU per cm2, the fluid dynamic design had an average of 0.3 CFU per cm2, and the biomimetic design had an average of 1 CFU per cm2. Those results show that for medical devices used for prolonged periods of time, such as catheters, 3D-printing has a remarkable outlook.

Awards Won:

Patent and Trademark Office Society: Second Award of $500