

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