# Investigating Anti-bacterial Resistance for Developing Nanomedicines Using Citrate-Based Gold Nanoparticles and Urea-Derived Carbon Nanodots

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One promising solution to combat the rise of deadly anti-biotic resistant bacteria is nanoparticle medications. However, new studies have found that bacteria can develop resistance to silver nanoparticles, necessitating research on resistance for other nanoparticles. This experiment examined gold nanoparticles (AuNPs) and Urea-Carbon Nanodots (U-CNDs) to determine if E. coli could develop resistance to them and whether the two nanoparticle's resistance development would differ in intensity. For the experiment, AuNPs and U-CNDs were synthesized, E. coli was procured and diluted to a 10^-7 concentration, and 60 agar plates were created. Each day, 100 uL of diluted E. coli and 100 uL of one of the nanoparticles were spread on 5 plates respectively, and the colonies formed were counted the next day. Then, 3 colonies were taken from each plate, diluted again, and 100 uL of the dilution was spread onto 5 agar plates with 100 uL of one nanoparticle solution. This process was repeated for 6 days. The data were analyzed with a Kruskal-Wallis Ranks Sums Test, and at p=0.0004 for both nanoparticles, the number of days had a significant effect on the number of colonies, suggesting that the E. coli had developed resistance to both. At p=0.1205, there was no significant difference in the number of colonies between AuNPs and U-CNDs, suggesting no difference in the intensity of resistance development for E. coli between the nanoparticles. While this experiment suggested that E. coli may develop resistance to both nanoparticles, more research should be conducted at the microscopic level to determine what genetic and physical changes occurred during this adaption.

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