Genetics Day Poster Submission

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Title: 3D-PRINTED BACILLUS NRRL B-14911 FOR THE DEGRADATION OF BIOPLASTICS IN MARINE ENVIRONMENTS

Abstract: Marine ecosystems and coastal economies are harmed irreversibly and severely by plastic pollution. Our project seeks a solution to the plastic pollution problem while retaining plastic's durability, versatility, and affordability. Recently, scientists have developed biodegradable plastics to solve environmental problems. However, these biodegradable plastics have limited decomposition in cold, dark marine environments. To tackle the problem of plastic waste in marine environments, we are applying our laboratory's revolutionary 3D bioprinting technique to create engineered living material containing bioplastic degrading bacteria. Bacteria are deposited in specific three-dimensional patterns through direct alginate chemistry. This innovative printing strategy allows bacteria-containing bio-ink to be deposited onto the printed substrate. After printing, the bacteria are immobilized in a solidified hydrogel matrix. 3D printed biomaterials of marine bacteria can repeatedly adhere to and degrade the plastic structures surrounding them. To quantitatively examine the survivability of microorganisms in 3D-printed bio-ink over time, colony forming unit assays revealed that printed microorganisms can endure for two weeks or more without significant loss of viability. To tune PHB degradation, the spatial patterning of nutrient levels and bacteria concentrations and the printing matrix polymer concentrations and chemistry are altering. Clear-zone analysis revealed that the amount of microbial degradation of a print is directly affected by biomass, PHB concentration, and incubation temperature. Placing these bacteria strategically within or on the bioplastic gives users control over when and how quickly the biopolymer degrades. In the near future, we will integrate marine biodegradable polymers into the blue economy.