Customized 3D Printing of Live Cells for Novel Bio-circuitry

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The revolutionized biomedical industry has a deep connection with the utilization of synthetic biology, to create multi-functional, complex but minimalistic, non-invasive biomedical devices. Bioelectronics have constructed new methods to monitor activity of cells and tissues that will likely advance the medical field to monitor the human body. As a new industry, bio-circuits are faced with emerging problems, this research is focused on the inability to construct and test circuits. This research proposes the implementation of a 3D printer to accurately produce the complexity of a biosensor. The engineering goal was to print 3 dimensional algal biological circuits that would conduct electricity at a 0.4% recovery rate of the controlled circuits voltage. The controlled group data will be statistically compared to the experimental group data using a two-tailed t-test. Also, an R^2 will be used to determine the correlation between the data sets. Petroleum based ink cartridges represented the controlled group while being compared to algal bio-ink representing the experimental group. Each ink was printed onto a transparent film sheet and tested for electrical conductivity using a multimeter. The controlled data averaged 28.16mV, 26.77mV, and 5.57mV for one layer and the experimental data averaged 0.1mV, 0.1mV, and 0.0mV for one layer. The experimental data had an average numerical increase of y=3E-5x. With an equalization point at 28.16mV. The algal bio-ink will need 933 layers creating a 2.8mm algal layer, and the engineering goal was met.