

# Siemens Competition

## Math : Science : Technology

### National Finalist

**Names:** Daniel Chae, Alan Tan & Sidharth Bommakanti

**High Schools:** Thomas Jefferson High School of Science and Technology, Irvington High School & Amador Valley High School

**Mentor:** Adriana Pinkas-Sarafova, Stony Brook University

**Project Title:** *A Novel Study on the Effect of Surface Topography of 3D Printed Polylactic Acid Scaffolds on Dental Pulp Stem Cell Proliferation and Differentiation in vitro*

In the field of medicine, 3D printers offer a promising approach to the creation of customized dental implants. This study evaluated the extent to which 3D printed devices are equivalent to traditional molded scaffolds, which are already FDA approved products. Polylactic acid (PLA), an effective material for cell scaffolds and one of the most popular filaments used in commercial 3D printers, was used to create the scaffolds. Scanning Electron Microscope (SEM) showed significant differences in surface topography between 3D printed and spuncast (ideal molded) scaffolds. Surprisingly, differences were also observed between scaffolds produced by different 3D printers. When dental pulp stem cells (DPSCs) were plated onto 3D printed and spuncast surfaces, it was found that there were significant differences in attachment, morphology, proliferation, and expression of extracellular matrix proteins, indicating that the cells underwent differentiation. The 3D printers created scaffolds that induced higher levels of differentiation, but maintained similar level of proliferation compared to those of spuncast scaffolds. These findings are of great importance in respect to the applications of 3D printed devices for tissue regeneration.