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**Biomimetic Scaffolds with Three-dimensional Undulated Microtopographies**Jonelle Z. Yu<sup>1</sup>, Emrullah Korkmaz<sup>1</sup>, Philip R. LeDuc<sup>1,2,3,4\*</sup>, O. Burak Ozdoganlar<sup>1,2,5†</sup><sup>1</sup>Department of Mechanical Engineering, Carnegie Mellon University, Pittsburgh, PA, United States<sup>2</sup>Department of Biomedical Engineering, Carnegie Mellon University, Pittsburgh, PA, United States<sup>3</sup>Department of Biological Sciences, Carnegie Mellon University, Pittsburgh, PA, United States<sup>4</sup>Department of Computational Biology, Carnegie Mellon University, Pittsburgh, PA, United States<sup>5</sup>Department of Material Science and Engineering, Carnegie Mellon University, Pittsburgh, PA, United States**Abstract**

Many human and animal tissues naturally possess three-dimensional (3D) micro-scale geometries enabling certain physiological functions. Absence of these microgeometries in engineered tissues may undermine the effectiveness of corresponding tissue repair and regeneration. This paper introduces a novel approach to create tissue scaffolds with biomimetic 3D undulated microtopographies. The mechanical micromilling technology is used for precise and reproducible fabrication of poly(methyl methacrylate) (PMMA) master molds with 3D undulated microtopographies. Poly(dimethylsiloxane) (PDMS) production molds are then created using the master molds through elastomer molding. Next, gelatin-chondroitin-6-sulfate-hyaluronic acid (Gel-C6S-HA) is filled into the PDMS molds in its gel form, lyophilized to obtain solid porous scaffolds, and covalently cross-linked to control biodegradability. The utility of the final porous scaffolds with undulated microtopographies mimicking dermal papillae of skin is demonstrated *in vitro* by culturing

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