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Living Toroids - Cells on Toroidal Surfaces YA-WEN CHANG, Georgia Institute of Technology, THOMAS ANGELINI, University of Florida, SAMANTHA MARQUEZ, Maggie L. Walker Governor's School for Government and International Studies, HAROLD KIM, ALBERTO FERNANDEZ-NIEVES, Georgia Institute of Technology — Cellular environment influences a multitude of cellular functions by providing chemical and physical signals that modulate cell behavior, dynamics, development, and eventually survival. Substrate mechanics has been recognized as one of the important physical cues that governs cell behavior at single cell level as well as in collective cell motion. Past research has suggested several contact-guided behaviors to be the result of surface curvature. However, studies on the effect of curvature are relatively scarce likely due to the difficulty in generating substrates with well-defined curvature. Here we describe the generation of toroidal droplets, which unlike spherical droplets, have regions of both positive and negative Gaussian curvature. Additionally, the range of curvatures can be controlled by varying the size and aspect ratio of the torus. Cells are either encapsulated inside toroidal droplets or located on toroidal hydrogel surfaces where oxygen and nutrient limitation is minimal. Preliminary studies use B. Subtilis to study the organization of bacteria as they develop into biofilms. When confined in droplets surrounded by yield-stress fluid, bacteria self-organize into heterogeneous biofilm at fluid- substrate interface, forming toroidal shaped-celloidosome® structures. It is found that the surface curvature in the sub-millimeter scale has little effect on biofilm architecture.

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