Popping Bubbles: Relationship between Cell Surface Area and Ultrasound Microbubble Mediated Toxicity

Satyawadi, Ananya

Ultrasound targeted microbubble destruction (UTMD) has become a widely researched method of drug delivery. This method utilizes the behavior of gas filled microbubbles in response to targeted ultrasound and has been shown to cause localized and efficient delivery of targeted therapeutics in animal models of cancer and heart disease. UTMD causes sonoporation in membranes of target cells allowing for delivery of local payloads. However, too many pores can cause cytotoxicity. For a given microbubble dose, cells with larger surface areas are expected to interact with more microbubbles, resulting in greater sonoporation and increased cytotoxicity. To better understand the relationship between cell surface area and UTMD mediated cytotoxicity, we artificially attempted to increase surface areas of three cell types by culturing on them on fibronectin, an extracellular matrix protein. An increase in surface area was observed with increasing fibronectin concentrations, which correlated with reduced cell viability following UTMD. Comparison between cell types showed that cells with higher surface areas are characterized by reduced viability following similar UTMD treatment. The applications of ultrasound microbubble destruction are wide and varied. Understanding the effects of various cell characteristics on microbubble/cell interactions is an important part of empirical optimization of experimental techniques leading to new and improved research methods.