UCI Samueli School of Engineering | Department of Biomedical Engineering

2022-2023 Seminar Series

"Nanobubble Induced Reduction of Calcified Plaque in Ex Vivo Arteries"

Friday, April 7, 2023
12:00 – 1:00 p.m.

McDonnell Douglas Engineering Auditorium (MDEA)

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UCI Dept. of Materials Science & Engineering

Abstract: Nanobubbles of various forms have been investigated for several biomedical applications. However, there has been much skepticism regarding the stable existence of bulk nanobubbles due to the observation of microbubble shrinkage driven by the surface tension pressure which increases as the bubble becomes smaller. Despite this phenomenon, stable nanobubbles from 20 nm to 1 μm in diameter have been reported by several teams of investigators. We recently proposed a theory that explains the stability of nanobubbles based on first principles physics and chemistry. This theory shows that microbubble shrinkage is in fact partially responsible for not only nanobubble size stability but also their remarkable longevity. We have also shown that nanobubbles can bind to embryonic nanoparticles just below their solubility limit, thus making them stable so that they do not dissolve back into solution. Observed dissolution of salts such as calcium phosphate can be attributed to this nanobubble/nanoparticle cluster formation phenomenon. We obtained further experimental evidence for this mechanism using intravascular optical coherence tomography in an investigation of calcified plaque volume in the presence of flowing Ringer's solution both with and without the addition of nanobubbles. This evidence and its implications for new medical treatments of atherosclerosis will be presented.

Biography: James Earthman is a Professor of Materials Science and Engineering and Biomedical Engineering at the University of California, Irvine. He received his B.S. degree in Materials Science from Rice University and his M.S. and Ph.D. degrees in Materials Science and Engineering from Stanford University. Prof. Earthman's research activities include studies of a broad range of deformation and damage mechanisms in both man-made and biological materials, the development of systems for novel quantitative diagnostics of material characteristics and integrity, and the dissolution of deleterious materials using nanobubbles. He has authored and co-authored over 120 peer-reviewed research publications including two chapters on biomaterials and tissue engineering and two chapters in materials handbooks published by ASM International. He is an inventor on eleven issued US patents, several international patents, and two pending US patents. He is also co-founder of Perimetrics, Inc., a diagnostic device company located in Seattle, WA and Newport Beach, CA. He has also served as editor for three books in the fields of Materials Science and Biomedical Engineering.

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