MECHENGINEERING SEMINAR

"From Laser Dermatology to Medical Implants: the Union Between Biomedical Optics and Biomaterials"

Dr. Guillermo Aguilar

Professor, Mechanical Engineering
University of California, Riverside

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11:00 am, ECSS 2.412

Abstract

Since I started my tenure-track professor career at UCR in 2003, I founded the laboratory of Transport Phenomena for Biomedical Applications (LTPBA). Back then my group and I carried out studies aimed at understanding how lasers interact with biological tissue and how combined cooling and heating processes could improve diagnostics and therapeutics in dermatology. For example, we provided a better understanding of how cryogenic sprays could be used effectively to cool the skin during dermatologic laser therapy. Then, we looked at feasible ways to improve transdermal drug delivery by taking advantage of the thermal and mechanical property changes of tissue induced by cryogen liquid deposition on the skin surface. Later, another set of studies was aimed at using CW laser radiation to generate multiple vapor bubbles within a thin liquid layer, and to use the shockwaves these bubbles emit upon their collapse to perforate skin for enhanced drug delivery. Currently, the main research thrust in my group aims at developing a novel transparent polycrystalline Yttria-Stablized-Zirconia (YSZ) cranial implant ("window") that enables life-long, non-invasive delivery and/or collection of laser light into and from shallow and deep brain tissue on demand. Such an implant would allow for real-time and highly precise visualization and treatment of diverse brain pathologies, such as those resulting from traumatic brain injury (TBI) or brain tumors, without the need of highly-invasive craniotomies or trepanation procedures. Various projects involving in vitro, in vivo, and fundamental research have yielded interesting results in connection with this "window". Most of them involve various students working together across disciplinary boundaries. A summary of our approach, latest results, ongoing, and future studies will be presented during my talk.

Biography

Prof. Guillermo Aguilar received his B.S. in Mechanical and Electrical Engineering from the National Autonomous University of Mexico (UNAM) in 1993. He earned his M.S. and Ph.D. also in Mechanical Engineering at the University of California Santa Barbara (UCSB) in 1995 and 1999, respectively. In 1999, he received a Whitaker Postdoctoral Fellowship to join the Beckman Laser Institute and the former Department of Chemical and Biochemical Engineering and Material Sciences (CBEMS) at the University of California Irvine (UCI). In 2001 he was appointed as an Assistant Adjunct Professor at the then Center for Biomedical Engineering at UCI.

Since 2003 Prof. Aguilar joined the Department of Mechanical Engineering at University of California Riverside (UCR), where he was promoted to Associate Professor in 2007, Full Professor in 2012 and since 2013 serves as the Department Chair. Prof. Aguilar has co-authored more than 95 journal publications, advised more than 12 postdocs, 50 students, including 25 graduate students (MS and PhD) and several undergraduate students and interns.

Prof. Aguilar has received research funding from various sources, including NSF, ASLMS, AFOSR, Sandia National Labs, NIH, etc. He has also received various awards, including his recent induction to the Mexican Academy of Engineering in July 2019.

His current research interests include cryogen spray cooling, laser-tissue interactions, biomedical optics and medical lasers.