University of Illinois at Chicago, Electrical and Computer Engineering Department
IEEE Antennas and Propagation & Microwave Theory and Techniques Societies

# Electromagnetic Sensing and Treatment of Living Things: Using Microwaves to Detect and Treat Disease in Humans and Trees


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**11:00 am, Friday October 26, 2012**

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Because of their ability to penetrate and heat, electromagnetic waves have found use in several unusual applications, specifically in interaction with biological tissue. Microwave radar has been used as an anatomic imaging modality for detecting breast cancer, and THz radiation is being proposed for vulnerable plaque identification. Using a simple conformal antenna, microwave sensing of trees can alert arborists if there is an otherwise undetectable infestation of Asian Long-Horned beetle. By depositing microwave power at depth, cancerous or otherwise diseased tissue can be non-invasively heated and inactivated or ablated while sparing healthy surrounding tissue. This survey presentation will touch on a variety of life science electromagnetic applications, discussing feasibility, advantages, efficacy, and limitations of the proposed approaches.

**Carey Rappaport** received five degrees from the Massachusetts Institute of Technology: the SB in Mathematics, the SB, SM, and EE in Electrical Engineering in June 1982, and the PhD in Electrical Engineering in June 1987. He has been a professor of Electrical and Computer Engineering at Northeastern University since 1987. He was Principal Investigator of the Army Research Office sponsored Multidisciplinary University Research Initiative on Humanitarian Demining, is Co-PI of the NSF sponsored Center for Subsurface Sensing and Imaging Systems (CenSSIS) Engineering Research Center, and Co-PI of the Dept. of Homeland Security Awareness and Localization of Explosives Related Threats (ALERT) Center of Excellence, working on portal and standoff detection of suicide bombers. Prof. Rappaport's interests are in the areas of microwave antenna design, ground penetrating radar system design and analysis, computational modeling of electromagnetic wave propagation and scattering in complex environments, and biomedical applications of electromagnetics, including cardiac treatment device design, non-invasive tumor detection, and cell phone exposure health effects.