



Visiting Faculty Lecture
Sponsored by the C. M. Colver Lectureship

12pm Thursday, November 6, 2014
George Auditorium, Rhode Island Hospital

Thomas P. Ryan, MS

**Thermal Therapy for Cancer Treatment using Microwaves:
A Review of Physics, Innovation, Robotics, and the Future**

Abstract

Success using Microwaves (MW) to treat cancer dates back to the 1970s, although with continuous development, innovation, and commercialization, is leading to present day clinical improvements. MW physics is reviewed to demonstrate the inherent performance advantages due to significant tissue penetration and time-savings compared to historical and competing energy sources, which have pioneered contemporary ablation therapy. A review of current antenna designs and their performance is covered, as well as historical designs that provide much of the basis of current clinical use. To address ever larger tumors, the transition from single to multiple antennas is discussed, including antenna arrays that may be powered either synchronously, and the advantages. The progression from low power (5-15 W) in the beginning to high power (60-200 W) in the present day systems is discussed, as well as the differentiation among frequencies, including antenna designs and dimensions and practicality in relation to various treatment target sites. The utilization of numerical modeling is shown both for power deposition patterns, temperature distribution predictions, and predictions of ablation coverage. Experimental work to verify model predictions is demonstrated. To optimize MW thermal therapy, several aspects of localization and treatment are discussed, which are slowly evolving to aid in more precise treatment, guided by real-time assessment. Evolutionary aspects of treatment include treatment planning, image guidance, co-registration, navigation, robotics, and treatment assessment. Many of these features are presently being developed and integrated and will provide the new capabilities necessary for future systems incorporating imaging, guidance, and ablation tools for the physician in the quest to ablate cancer targets in real time.

Keywords

Thermal therapy, microwave ablation, navigation, treatment planning, image guidance, robotics.

Speaker Biography

Thomas Ryan has degrees in Electrical Engineering and Biomedical Engineering and spent 12 years in academics at Stanford Medical School and then Dartmouth Medical School as a Clinical Assistant Professor of Medicine. He developed microwave and ultrasound thermal therapy systems for cancer treatment that were used in clinical trials with over 200 patients across anatomic sites from brain, to breast, to inner ear, to pancreas and liver. He has over 20 years experience creating and commercializing energy-based systems for cancer ablation, plasma medicine, and vision correction. He has over 110 published papers and book chapters and 45 patents. He has organized and hosted a conference on Energy-Based Treatment of Tissue and Assessment at SPIE since 1998.



Hosts

Derek Merck and Damian Dupuy, Rhode Island Hospital Diagnostic Imaging
Benjamin Kimia, Brown University Engineering