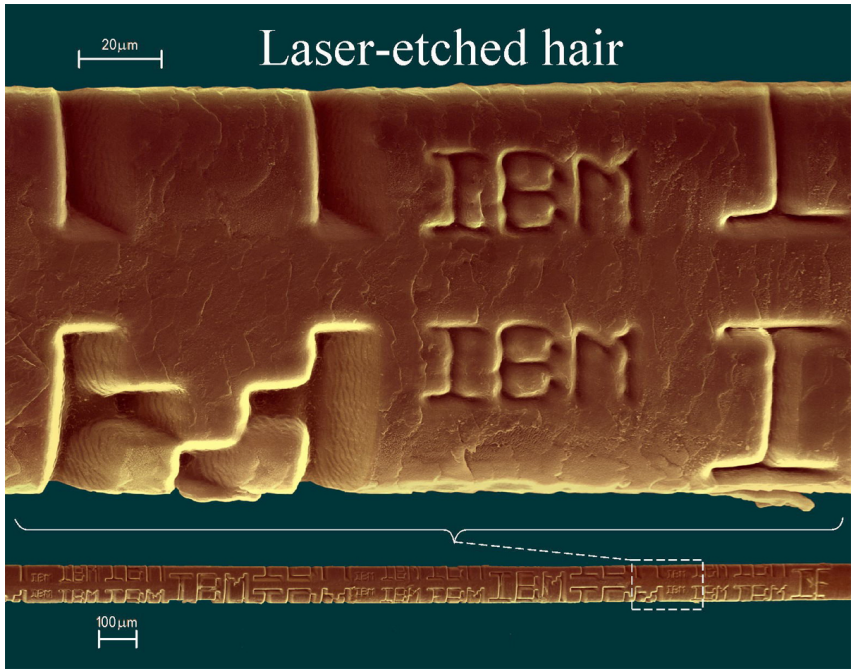
The Institute of OPTICS

Colloquium

UNIVERSITY OF ROCHESTER

Excimer Laser Surgery: Applications to Laser Refractive Surgery and Debridement of Necrotic Lesions of the Skin



Dr. James J. Wynne
IBM T. J. Watson Research Center
BA Physics, PhD Applied Physics, Harvard
IBM 1969 -

3:00 pm, November 14, 2011
Sloan Auditorium, Goergen 101
Refreshments served

The talk will describe a "smart scalpel," enabled by the intrinsic advantage afforded by non-thermal absorption of 6.4 eV ultraviolet light by aqueous chloride ions to debride necrotic tissue associated with burns, decubitus, stasis, and neuropathic ulcers, without causing collateral damage

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Excimer Laser Surgery: Applications to Laser Refractive Surgery and Debridement of Necrotic Lesions of the Skin

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Abstract: Surgical debridement is a treatment indicated in the management of deep second and third degree burn injuries. Severe burn injuries result in necrotic tissue which hampers wound recovery and leaves the surrounding healthy tissue vulnerable to infection. Removal of the necrotic tissue through debridement facilitates and encourages a healthy wound healing response. Currently, debridement of necrotic tissue is performed surgically through the use of a scalpel or dermatome. Successful debridement can thus optimize natural wound healing or, in more extensive injuries, provide a platform conducive to skin grafts. This technique can also aid in the treatment of chronic wounds, since a precise and controlled removal of necrotic tissue from wounds, which leaves healthy underlying and adjacent tissue intact, will promote wound healing.

In 1981, my IBM colleagues and I discovered excimer laser surgery, laying the foundation for the laser refractive surgical procedures, LASIK and PRK. In 1983, while irradiating the skin of live guinea pigs, my colleagues and I discovered that 193 nm (6.4 eV) radiation from an ArF excimer laser failed to remove (ablate) tissue after bleeding commenced. In contrast, 248 nm (5.0 eV) radiation from a KrF excimer laser continued to ablate tissue, despite bleeding. The explanation is that 193 nm radiation is strongly absorbed by an aqueous salt solution, as found in blood, through the process of electron photodetachment from hydrated chloride ions, with a characteristic resonance absorption maximum at 190 nm. Such an electronic excitation does not produce heat. This process depletes the laser fluence sufficiently to suppress further ablation of protein and lipids in tissue and/or blood. We now apply this knowledge to propose a novel technique to debride necrotic tissue associated with burns, decubitus, stasis, and neuropathic ulcers, without causing collateral damage to adjacent and underlying viable tissue. We envision a “smart scalpel,” enabled by the intrinsic advantage afforded by non-thermal absorption of 6.4 eV ultraviolet light by aqueous chloride ions.

Biography: Dr. Wynne serves in the Office of the Director of Research of IBM, where he pursues medical/surgical applications of lasers, manages the T. J. Watson Research Center's outreach to local schools, and coordinates IBM’s global participation in the annual Engineers Week campaigns of technical education outreach. He earned a B. A. degree in physics in 1964 and a Ph. D. degree in applied physics in 1969 at Harvard University. He subsequently has spent his entire career with IBM Research. His research contributions have been in nonlinear optics of semiconductors and insulators, nonlinear spectroscopy of atomic and molecular vapors, laser etching and fluorescence studies of human and animal tissue, and cluster science. He and two of his IBM colleagues discovered excimer laser surgery in 1981. Their discovery laid the foundation for the development of techniques for changing the shape of the human cornea, thereby surgically correcting the common vision abnormalities of myopia, astigmatism, and hyperopia. Two such techniques, LASIK (laser *in-situ* keratomeliusus) and PRK (photorefractive keratectomy) are widely practiced throughout the world, having improved the vision of more than 22 million people. For their discovery and related US Patent, Dr. Wynne and his colleagues were inducted into the US. National Inventors Hall of Fame (NIHF) in 2002, won the R. W. Wood Prize of the Optical Society of America in 2004 (presented to them at the OSA annual meeting in Rochester), and were awarded the Rank Prize for Opto-Electronics in 2010.