



Peter J. Soltys



# MEMS Devices for Minimally Invasive Medical Procedures

## Cornell-Ithaca Engineers Develop Sensors and MEMS Devices for WCMC Urologists

### Examining Testicular Tissue

Our team of Cornell engineers and urologists, Amit Lal and Rajit Manohar, Electrical and Computer Engineering, and Darius A. Paduch and Peter N. Schlegel, Urology, WCMC, create various sensors and MEMS devices that can be used for minimally invasive evaluation of the testis, including testicular cancer detection. Lal's laboratory has fabricated a silicon probe integrated with an ultrasonic actuator and polysilicon strain gauges. This probe could be used for detection of rare sites of sperm production as part of male fertility treatments in order to improve the microdissection testicular sperm extraction (TESE) surgical procedure. The probe technology is also being used to investigate its applicability for identifying prostate cancer tumors within the prostate gland. Manohar's lab is developing a low-power microcontroller that can be used for the digital electronics.

### Promising Technologies for Diagnoses

These promising new technologies may have tremendous impact on diagnosis and management of male infertility and testicular cancer. They may also have an immediate application

for studying the structure of tissues in live animal models. Infertility affects one out of ten couples in the United States. The currently available clinical imaging and biochemical studies do not provide adequate structural information within the testis to differentiate between various forms of male infertility. Thus, patients often need to undergo more invasive surgical procedures such as testis biopsy for diagnosis. In our laboratories at WCMC, Schlegel and I have tested these novel probes, developed in Lal's Cornell-Ithaca laboratory, on testicular tissue. The probes have proven to be very sensitive and reliable tools for measuring physical properties of the testicular tissue.

Since different medical conditions—like cancer or problems with sperm production—alter the mechanical properties of tissues at the cellular level through fibrosis and result in a change of the three-dimensional structures of tissues, we believe that these probes will be able to localize the altered tissues and precisely deliver treatment either in the form of chemotherapeutic agents or direct gene therapy delivery, or they will be able to specifically heat tissues, thus avoiding systemic side effects of cancer treatment and gene therapy.

# Probes Developed in Lal's Cornell-Ithaca laboratory

Provided

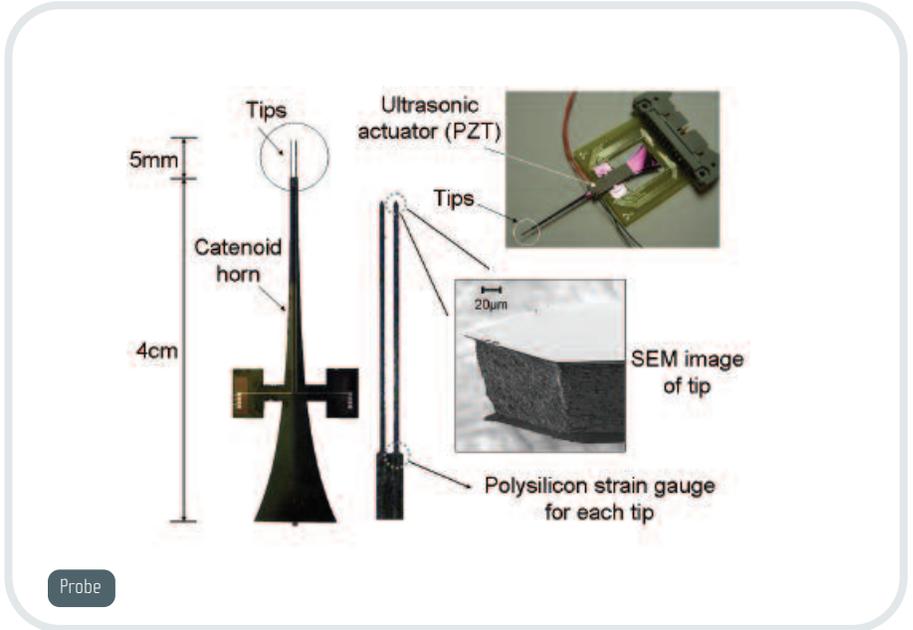


Darius Paduch, Urology, WCMC

Provided



Peter Schlegel, Urology, WCMC



## MALE INFERTILITY AND TESTICULAR CANCER

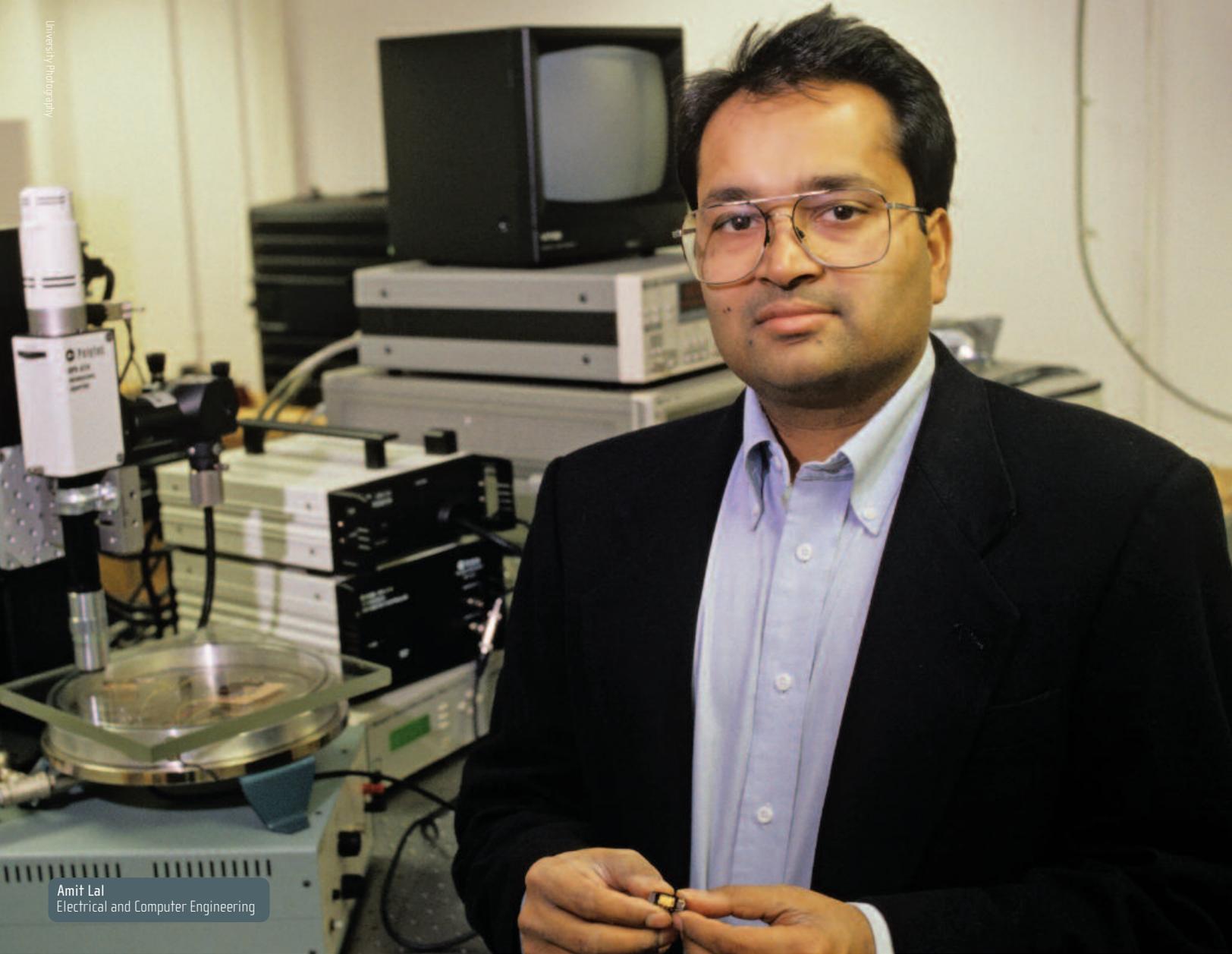
- Infertility affects one out of ten couples in the United States.
- Available clinical imaging and biochemical studies do not provide adequate structural information within the testis to differentiate between various forms of male infertility.
- Probes—developed in Lal's Cornell-Ithaca laboratory and tested on testicular tissue in Schlegel's and Paduch's WCMC laboratories—have proven to be very sensitive and reliable tools for measuring physical properties of the testicular tissue.

We believe that these probes will be able to localize the altered tissues and precisely deliver treatment.

This unique project brings together teams of scientists in bioengineering and clinician-scientist experts in male infertility, urological oncology, and biomaterials, allowing a tremendous opportunity to bring nanotechnology to the daily practice of medicine.

*Darius A. Paduch, Urology, Weill Cornell Medical College*  
*Amit Lal, Electrical and Computer Engineering*  
*Peter N. Schlegel, Urology, Weill Cornell Medical College*

**For more information:**  
Paduch, [Dap2013@med.cornell.edu](mailto:Dap2013@med.cornell.edu)  
Lal, [lal@ece.cornell.edu](mailto:lal@ece.cornell.edu)  
Schlegel, [pnschleg@med.cornell.edu](mailto:pnschleg@med.cornell.edu)  
Manohar, [rm92@cornell.edu](mailto:rm92@cornell.edu)



Amit Lal  
Electrical and Computer Engineering



Rajit Manohar  
Electrical and Computer Engineering