



Whether searching for the root of epithelial stem cells or the solution to the puzzling question of why some highly intelligent students fail as researchers, this biologist has a boundless curiosity that has led to unexpected answers.

Getting to the Root of the Matter

Shown magnified here behind Dr. Sun, the surface structure of the bladder epithelium consists of numerous 2D crystals of hexagonally-packed 16-nm uroplakin particles that provide a remarkably impermeable barrier. Among the findings of Dr. Sun's team: uroplakins are useful markers for metastatic bladder cancer; uroplakins may serve as the urothelial receptor for uropathogenic *E. coli*, which causes over 90 percent of urinary tract infections; and urinary bladder cells can be converted into a novel bladder bioreactor. This image was generated using electron microscopic techniques by Dr. Sun's collaborators, Dr. Xiangpeng Kong, Associate Professor of Biochemistry, and Dr. Bechera Kachar of NIH.

Tung-Tien Sun, Ph.D.

Professor of Cell Biology; Rudolph L. Baer Professor of Dermatology; Professor of Pharmacology and Urology

Dr. Tung-Tien Sun's curiosity is as diverse as the epithelial cells to which he has devoted a lifetime of study. By grappling with fundamental questions about the biology of the epithelial cells covering many of the body's organs, Dr. Sun has made discoveries that have contributed to dermatology, ophthalmology, and urology. These findings have translated into clinical areas ranging from corneal transplantation to urinary tract infections to cancer diagnostics.

His early research revealed that keratins—a group of proteins once thought to exist only as a tough fiber in hair and nails—are actually present in all epithelial cells. At NYU, Dr. Sun has used keratin expression to find answers to previously unsolved puzzles such as the location of corneal stem cells, and the location of stem cells for hair follicles. Each of these groundbreaking findings has had substantive clinical impact. The discovery of stem cells in the cornea's limbus led to a new surgical technique called “limbal stem cell transplantation” used to restore sight in patients suffering from severe corneal damage due to burns or other trauma. The discovery that hair and skin cells both originate from the common stem cell in the hair follicle may provide new therapeutic approaches to various skin diseases, and also has broad implications for our understanding of certain types of skin cancers.

In recent years, Dr. Sun turned his inquiry to the bladder epithelium (see caption, left), and to another riddle: why some straight-A students are lost when it comes to research. In a paper in *Nature Reviews: Molecular and Cell Biology*, Dr. Sun links excessive trust in authority to faulty experimental design and decision-making. He has also developed a series of lectures offering practical ways to overcome these problems.