Arizona Telemedicine Program's Dr. Ronald S. Weinstein Receives Distinguished Service Award from the Association of Pathology Chairs

Ronald S. Weinstein, MD, FCAP, professor of pathology at the **University of Arizona College of Medicine**, professor of public policy at the **UA Mel and Enid Zuckerman College of Public Health** and founding director of the **Arizona Telemedicine Program**, has received the annual Distinguished Service Award from the Association of Pathology Chairs at its National Meeting in Monterey, California, on July 13, 2011.

Dr. Weinstein served as an academic pathology department chair for 32 years (15 years at Rush Medical College in Chicago, Illinois and 17 years in the University of Arizona College of Medicine). At the APC Awards Ceremony, Dr. Weinstein was cited for making major contributions in the fields of cell biology and experimental pathology, for his contributions to organized medicine through his presidencies of six professional organizations, for his invention of telepathology, and for his work as an innovator in medical education.

About Dr. Weinstein

Dr. Weinstein received his M.D. degree at Tufts University School of Medicine in 1965. He was the first graduate of Tufts, ever, to successfully compete for a residency position at the MGH. At the end of his intern year, he achieved a second breakthrough by becoming the first MGH resident to be appointed director of a named laboratory at the MGH, at age 27.

In the late 1960s, while serving dual roles as director of the Mixter Laboratory for Electron Microscopy and as a pathology resident at Massachusetts General Hospital (MGH) in Boston, Dr. Weinstein did independent research on the application of computer modeling to the interpretation of freeze-fracture replicas of gap junctions in normal human tissues and in cancers. He and Stanley Bullivant, PhD, DSc, a biophysicist and Harvard faculty member, and Adelbert Ames, III, MD, Harvard professor of neurophysiology, developed the first ultra-high resolution electron microscopy freeze-fracture method. This technology could be used to visualize, for the first time, critical features of intra-membrane structures less than two nanometers (approximately one billionth of an inch) in size. Their freeze-fracture tissue preparation method achieved a five-fold increase in electron microscope resolution of intra-membrane proteins. This was a breakthrough in the field of cell membrane ultrastructure.

Using this technology, then-MGH pathology residents Dr. Weinstein and N. Scott McNutt, MD, produced carbon-platinum replicas of frozen fractured human epithelial cell membranes. They examined the replicas and photographed them at high resolution (exceeding 250,000 times magnification) in an electron microscope. Their paper on the three-dimensional supra-molecular structure of mammalian gap junctions (gap junctions house minute transmembrane conduits that mediate electronic and metabolic coupling between epithelial cells and also between heart cells), published in the *Journal of Cell Biology*, caused quite a stir, especially in the highly competitive Harvard medical research community. Two MGH pathology residents who were entry-level Harvard Medical School faculty members as clinical and research fellows had beaten out two distinguished Harvard professors who were working on the same problem.

Drs. Weinstein and McNutt were the first investigators to visualize, in three dimensions and at the near-molecular level, the structural basis for cell-to-cell communications. They extended their findings in normal human tissues to cancers of the human uterine cervix and identified potential roles of cell junction deficiencies in the progression of human cervical cancer. Dr. Weinstein found himself – in his late 20s and still a MGH pathology resident (and the first MGH resident to be an NIH-funded independent laboratory director at the same time) – on the international circuit lecturing on the molecular structure and function of normal and cancer cell membranes. The pathology community took note, and several years later he became the youngest academic pathology chair in the United States.

Dr. Weinstein spent the 1970s pursuing research in the pathobiology of various types of intercellular junctions in human diseases. While a major in the U.S. Air Force Medical Corps, he took coursework in computer programming and computer system design at the Air Force Institute of Technology at Wright Patterson Air Force Base in Dayton, Ohio. He studied quantitative electron microscopy methods at the University of Berne in Switzerland as part of a program directed by Professor Ewald Weibel, the leading

expert in the tissue morphometrics (quantitative electron microscopy) field. Dr. Weinstein also was a visiting professor at the Max-Planck-Institute of Immunobiology in the laboratories of Professor Dr. Herbert Fischer, in Freiburg, Germany, where he worked on improving the performance of advanced freeze-etch techniques, and at the laboratory of Professor David Danon, MD, and Yehuda Marikovsky, PhD, at the Weizmann Institute in Rehovot, Israel, where he studied red cell membrane ultrastructure. He then applied those technologies to the examination of intercellular deficiencies of cell junctions in human cancers, producing a stream of papers in the cancer cell junction field.

In the 1980s, Dr. Weinstein turned his attention to several challenges in diagnostic pathology that had direct implications in the diagnosis and treatment of urinary bladder cancer patients. In 1982, he was appointed director of the Central Pathology Laboratory (CPL) for the National Cancer Institute-funded National Bladder Cancer Group. This laboratory was responsible for reviewing the histopathology slides of all patients entered into bladder cancer clinical trials at a consortium of ten major cancer centers in the United States, including Massachusetts General Hospital, Roswell Park Cancer Institute in Buffalo, N.Y., and Case Western Reserve University in Cleveland, Ohio. The CPL was housed at Rush Medical College in Chicago, where Dr. Weinstein was the Harriot Blair Borland professor and chair of pathology and a recognized authority in the area of uropathology (genitourinary pathology).

When Dr. Weinstein took over the operations of the CPL and began comparing the diagnostic accuracy of individual pathologists and group practices at leading cancer centers, he was both surprised and concerned with differences in the diagnostic accuracy of uropathologists, even at these world-class cancer centers. To address this problem, he introduced an innovative approach to verifying the diagnosis of urinary bladder cancer before patients were entered into clinical trials. He envisioned the creation of large video-enabled network of pathologists in "virtual" call centers who would provide second opinions for cancer patients, using remote video imaging of histopathology slides. In 1986, he coined the term "telepathology," published the first scientific paper on telepathology with two collaborators, and was issued the first two U.S. patents for dynamic telepathology systems and telepathology networks. Today, more than 700 telepathology papers are listed in the National Library of Medicine database and 64 telepathology patents have been issued. Dr. Weinstein has been acknowledged by many as the "father of telepathology." Telepathology systems, patterned after the system developed by Dr. Weinstein's group in Chicago, have been deployed in dozens of countries and have benefited tens of thousands of patients.

The development and implementation of better technologies for the identification of early urinary bladder cancer and monitoring the effects of chemotherapy and immunotherapy also were challenges confronting the Urinary Bladder Cancer Group's CPL. Dr. Weinstein successfully lobbied the National Cancer Institute (NCI) on multiple trips from Chicago to Bethesda, Md., to support translational research on tools used for the early diagnosis and monitoring of the effectiveness of chemotherapies for urinary bladder cancer. In the mid-1980s, the NCI had shown little interest in translational research. After selling the idea of supporting translational research in the urinary bladder cancer arena, Dr. Weinstein then organized the NCI-funded National Cancer Institute Flow Cytometry Network and served as director, headquartered at Rush Medical College in Chicago, from its creation in 1984 until 1990. This network carried out important clinical research on urinary bladder cancer flow cytometry and successfully brought urine flow cytometry into urology clinical practice as a standard of care.

In recent years at the UA, Dr. Weinstein has worked on telemedicine and the development of virtual slide telepathology systems, in collaboration with faculty members at the UA College of Optical Sciences. He was co-inventor of an innovative array microscope which was used to establish a throughput speed record for digitizing the video image of a human histopathology glass slide. The UA microscope design teams' innovations received international recognition. Dr. Weinstein also was the co-designer of the international award-winning T-Health Amphitheater on the Phoenix Biomedical Campus.

Dr. Weinstein has authored or co-authored over 500 professional publications, including monographs, book chapters, scientific publications, and published abstracts. He has served on over a dozen editorial boards.

Dr. Weinstein has received many awards and honors, including the James A. Campbell, MD, Alumni Service Award from Rush Medical College (1988), a Distinguished Visiting Professorship at Johns Hopkins Medical School (1998), the Kash Mostofi Distinguished Service Award from the International Society for Urological Pathology (1998), the Leopold Koss Medal from the International Society for Urological Pathology (2003), the American Telemedicine Association President's Leadership Award (2008), the Arizona Medical Association's Distinguished Service Award (2010) the Eliphalet Nott Medal (Distinguished Alumnus Award) from Union College, Schenectady, N.Y. (2010), and the Lifetime Achievement Award of the Association for

Pathology Informatics (2010). Dr. Weinstein is one of three pioneers in the field of telemedicine to be recognized as "founders of modern telemedicine" by being awarded the title of "President Emeritus" of the American Telemedicine Association. He is also a recipient of the UA College of Medicine's Basic Science Teacher-of-the-Year Lifetime Teaching Award and has been honored at five UA College of Medicine graduation ceremonies.

About the Association of Pathology Chairs.

Pathology is the study of disease. Pathologists are medical doctors who are responsible for running laboratories and rendering diagnoses on human specimens. The Association of Pathology Chairs was founded in the 1960s. Its members are the chairs of academic pathology departments in the United States. Pathology chairs, residency program directors, and pathology department business departments participate in the activities of the Association of Pathology Chairs. There are 135 US academic pathology departments that are members of the Association of Pathology Chairs. Annual meetings of the Association of Pathology Chairs have been held since 1986. A Distinguished Service Award has been presented at each of these annual meetings. The award is presented to "an individual who has made distinguished contributions in the field of pathology". Previous awardees include the Director of the National Library of Medicine, Deans of Colleges of Medicine, and an Editor-in-Chief of the Journal of the American Medical Association.