



**5th Annual
Arthur C. Guyton Lectureship**

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“Potassium Channels Find Their Way in Membrane Traffic”

Paul A. Welling is Professor of Physiology at the University of Maryland Medical School. As an undergraduate and medical student at the University of Kansas, Paul became fascinated with kidney physiology, membrane transport, and fluid and electrolyte disorders. Seeking a deeper understanding of the cellular mechanisms underlying the physiology, Paul added a full year to his medical school curriculum, working on a pre-doctoral research project in the laboratory of Dr. Roger O’Neil at the University of Texas Health Science Center at Houston. The experience proved to be highly rewarding, and pivotal to Dr. Welling’s decision to devote his professional life to biomedical research. After medical school, Dr. Welling joined the laboratory of Gerhard Giebisch at Yale University to study renal potassium channels. Inspired by the rich intellectual environment within the Department of Molecular and Cellular Physiology and the promise of the emerging molecular era, Paul moved his post-doctoral investigations toward elucidating the molecular nature of these channels, and the molecular underpinnings of potassium balance. After his fellowship, Dr. Welling moved to the Department of Physiology at the University of Maryland Medical School, where he has continued to probe into the molecular bases of electrolyte transport. A major thrust of the Welling laboratory involves molecular physiological dissections of inherited disorders of membrane transport, so-called “channelopathies” or “transporteropathies.”

His group is especially interested in understanding the regulatory mechanisms which control the number, location and activity of transport molecules and that go awry in human disease. They employ a multidisciplinary approach, combining tools of molecular genetics, cellular biology, biochemistry, and physiology with state-of-the-art imaging and electrophysiological techniques. A key strategy involves defining regulator or localization signals that are embedded within the structures of ion channels and salt-transporters; discovering the intracellular machinery that decodes the signals; and understanding the molecular signaling pathways that influence the interaction between the two. Genetically modified animal models are used to translate their discoveries about fundamental mechanisms to higher-level systems in vivo.

Following Dr. Guyton’s research on the role of kidney in hypertension, Dr. Welling and his co-workers have made process in unraveling the mechanisms that control salt balance and blood pressure in health and contribute to electrolyte disorders and hypertension in kidney disease. In recent years, their

studies helped illuminated a role of multi-gene kinase network, altered salt-transport and a specific environmental trigger--dietary salt--in the genesis of hypertension. The work provides a new insight into the scientific basis for the beneficial effects of the high potassium/low sodium DASH diet on blood pressure, and reveals new therapeutic targets.

In recent years, Dr. Welling began to expand his interest beyond the kidney to other channelopathies that are born out of alterations in membrane trafficking. Again, his group is revealing new fundamental biological mechanisms with direct translational impact. For example, his work with a cardiac potassium channel bucked the popular textbook view of how newly synthesized membrane proteins are delivered to the cell surface, and provided new insights into Golgi sorting mechanisms. In doing so, their studies in the heart are leading to a molecular understanding of certain hereditary arrhythmias.

Dr. Welling serves on the Editorial Boards of the American Journal Physiology, Renal, The Journal of Biological Chemistry, and the Journal of Physiological Sciences. He received the Established Investigator Award from the American Heart Association, and is currently a Fellow in that organization. He has also received many awards for teaching, including Teacher of the Year Award from the Graduate Program in Life Sciences, University of Maryland.

Previous ACDP Arthur C. Guyton Distinguished Lectureship Awardees

- 2010 Ferid Murad
University of Texas, Houston
- 2009 Helen Hobbs
University of Texas Southwestern Medical Center
- 2008 Eric Olson
University of Texas Southwestern Medical Center
- 2007 H. Lee Sweeney
University of Pennsylvania