**EB 2014 | Data Diuresis**

Water and electrolyte homeostasis brings balance to physiology

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¹Cardio-Renal Physiology and Medicine, Division of Nephrology, University of Alabama at Birmingham, Birmingham, Alabama; ²Department of Physiology and Biophysics, University of Mississippi Medical Center, Jackson, Mississippi; ³Department of Pharmacology and Physiology, St. Louis University, St. Louis, Missouri; and ⁴Business Development and Licensing, Janssen Pharmaceutical Companies of Johnson & Johnson, Spring House, Pennsylvania

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Pollock JS, Ryan MJ, Samson WK, Brooks DP. Water and electrolyte homeostasis brings balance to physiology. *Am J Physiol Regul Integr Comp Physiol* 2014; R481–R483. First published July 16, 2014; doi:10.1152/ajpregu.00246.2014.—The American Physiological Society officially recognized the focused area of research in Water and Electrolyte Homeostasis (WEH) over 30 years ago when the Section of WEH was established. This minireview illuminates the importance of WEH research to the physiology community. By the narrowest definition, WEH research studies the regulation of body fluids; however, this research area is much broader and more relevant today than when this subdiscipline was first recognized because of the translational and systemic “point of view” of WEH research. This minireview highlights how WEH research serves as a balanced force between the full range of other more traditional organ-based physiological and pathophysiological concepts. The breadth of research in which WEH investigators engage is on full display with the publication of minireviews from the annual Data Diuresis session at Experimental Biology.

**What is the Study of Water and Electrolyte Homeostasis?**

Most scientists would agree that physiology is the study of function in living organisms and is the science of medicine. Today physiology encompasses the fields of biochemistry, pharmacology, genomics, and most any other areas of investigation that enhance our understanding of living organisms. Within the field of physiology, the APS recognizes areas of research that are organized into subdisciplines or sections such as cardiovascular; cell and molecular; central nervous system; comparative and evolutionary; endocrinology and metabolism; environmental and exercise; gastrointestinal and liver; neural control of autonomic regulation; renal; respiration; and teaching; and WEH. In addition, the APS recognizes subsets of sections and cross-disciplines that are organized into interest groups such as epithelial transport, history of physiology, hypoxia, muscle biology, physiological genomics, physiologists in industry, and translational physiology. While it is intuitive to understand the areas of research in most of these sections and interest groups, WEH is not as easily defined and thus deserves some clarification.

Within the context of physiology, as the fundamental basic science, WEH research is defined as the regulation of body fluids. The study of water and electrolyte homeostasis includes concepts such as a cell regulating the secretion or absorption of K⁺ or Na⁺, or tissues and organs regulating water absorption and elimination, or signals from one part of the body regulating a separate part of the body to maintain strict K⁺ homeostasis, or many other regulatory schemes not described or yet to be discovered. As examples of WEH research, recent reports from several laboratories have revealed novel mechanisms for how the immune system regulates Na⁺ homeostasis in the skin (3, 8), ischemia mediates hypertension via activation of auto-antibodies (6), hypertension in systemic lupus erythematosus is dependent on renal inflammation (5), or how neurohumoral mechanisms regulate responses to osmolality (1), preautonomic neurons and neurosecretory neurons maintain water balance (7), and how vasopressin mediates hypertension in mice with activation of the brain renin-angiotensin system (2). Thus WEH research is not restricted to one system or organ, one set of hormones, or a particular set of mechanisms that were known when the section was established. Homeosta-
sis of body fluids is critical in many physiological and pathophysiological states, thus WEH research is not limited to only a few mediators, one organ, or one function. One of the very positive aspects of work within the WEH research area is the continued evolution of ideas and concepts that have no boundaries.

Why Recognize the Study of WEH as a Subdiscipline of Physiology?

The concept of recognizing WEH research as a subdiscipline or section within the APS was initiated by Dr. Leonard Share at the University of Tennessee with Dr. David Ramsay at the University of California at San Francisco as well as other colleagues within the APS. Dr. Share’s vision of distinguishing WEH research began with acknowledging that none of the other subdisciplines incorporated viewpoints that included “cross-talk” among organs and systems in the regulation of body fluids. In the early 1970s, research in the mechanisms of how mediators from the brain influenced Na\(^+\) and water homeostasis via Na\(^+\) and water excretion by the kidney was extremely active with recognition by the pharmaceutical industry and the National Institutes of Health (NIH). Yet, very little recognition was given by existing sections within the APS. Thus Dr. Share and Dr. Ramsay initiated the recognition of WEH research by the APS in the form of a subdiscipline or section. The section began in 1982 and has sustained recognition of WEH research by the APS in the form of a subdiscipline or section. These section began in 1982 and has sustained recognition of WEH research by the APS in the form of a subdiscipline or section. These section began in 1982 and has sustained recognition of WEH research by the APS in the form of a subdiscipline or section. These section began in 1982 and has sustained recognition of WEH research by the APS in the form of a subdiscipline or section. These section began in 1982 and has sustained recognition of WEH research by the APS in the form of a subdiscipline or section. These section began in 1982 and has sustained recognition of WEH research by the APS in the form of a subdiscipline or section. These section began in 1982 and has sustained recognition of WEH research by the APS in the form of a subdiscipline or section. These section began in 1982 and has sustained recognition of WEH research by the APS in the form of a subdiscipline or section. These section began in 1982 and has sustained recognition of WEH research by the APS in the form of a subdiscipline or section. These section began in 1982 and has sustained recognition of WEH research by the APS in the form of a subdiscipline or section. These section began in 1982 and has sustained recognition of WEH research by the APS in the form of a subdiscipline or section. These

### How the Study of WEH Balances the Study of Physiology

Physiology is the study of function in living organisms. The regulation of water and electrolytes is integral to all functional aspects of physiology.
aspects of all living organisms. Many of the investigators that study WEH are committed to understanding how the cardiovascular, renal, and neuroendocrine systems as well as ingestive behaviors integrate and interact with one another to maintain water and electrolyte balance and other homeostatic systems such as blood pressure. An appropriate analogy would be that WEH is the homeostatic balance to the other research areas within physiology and is required for proper regulatory control. Work by WEH investigators serves as a balanced force between the full range of other more traditional organ-based subdisciplines of physiology.

Data Diuresis Mini-Reviews: WEH Research in the Spotlight

Initiated in 2011, the Data Diuresis Session, sponsored annually at Experimental Biology by WEH, serves as a preview of some of the most exciting WEH research being presented at the meeting. The format is that of a data blitz and typically opens the podium to brief presentations by young investigators chosen based on their submitted abstracts to WEH-sponsored topic categories. In 2012, AJP-Regulatory, Integrative and Comparative initiated a plan to publish brief reviews from selected presentations at the sessions (4). In the current issue of the journal, six of the presenters at Experimental Biology 2014 accepted the opportunity to publish minireviews of their work. These reviews represent the breadth of work that WEH encompasses and highlights the importance of taking an integrative approach to physiology. In summary, the regulation of water and electrolytes is integral to all functional aspects of all living organisms, and WEH research is more relevant today because of the translational and integrative approaches utilized by this research area.

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DISCLOSURES

J. S. Pollock discloses that she is the current chair of the WEH Section in APS. M. J. Ryan discloses that he is the current secretary/treasurer of the WEH Section in APS. W. K. Samson discloses that he is the current Editor-in-Chief of the American Journal of Physiology-Regulatory, Integrative, and Comparative Physiology. D. P. Brooks discloses that he is the former chair of the WEH Section in APS and a former Councilor of APS.

AUTHOR CONTRIBUTIONS


REFERENCES