Institute of Medical Biology
A*STAR

Seminar Announcement

- All Are Welcome -



Speaker: **Dr Jens Marc Titze**

Associate Professor (Tenured),
Division of Clinical Pharmacology,
Vanderbilt University Medical Center, Nashville, TN

Title : "Rethinking skin and muscle function"

Date : 20 March 2017 (Monday)
Time : 11.00pm – 12.00pm
Venue : Creation Theatrette, Matrix Level 4, Biopolis
Host : Prof Birgit Lane
(Tel: 6407 0151, email: birgit.lane@imb.a-star.edu.sg)

Abstract of the Seminar:

The internal environment and its regulation have drawn rapt attention since the 19th century. The basic tenet of electrolyte balance has been that extracellular bodily fluids readily equilibrate, allowing the kidney to achieve strict constancy in body Na^+ content. Led by discrepancies in human Na^+ balance studies, we encountered findings causing us to question the fundamental assumption that electrolyte concentration in the interstitium does not substantially deviate from plasma. We subsequently initiated a research program that identified interstitial tonicity gradients, outside of the renal medulla. In contrast to firmly held beliefs, we find that salt is stored inside and outside cells, without commensurate water retention.

Our recent findings suggest that Na^+ metabolism could be alternatively viewed as an important component of biological barrier function. Typical body barriers are the kidney, the gut, and the skin. These barriers are characterized by hyperosmolality – meaning high osmolyte concentration compared to blood plasma and the outside environment. The biophysical nature of Na^+ storage in these barrier microenvironments seems advantageous. The high osymolte concentration under the surfaces attracts water and thus prevents body water loss. This biological feature, which is a prerequisite for life on arid land, is not restricted to kidney function, but also a physiological key function of skin and gut. Changes in barrier osmolyte composition trigger multiple compensatory regulatory patterns which could be summarized as "alarm responses" for body fluid conservation.

Expanding the barrier principle to Na^+, K^+, and urea osmolyte metabolism, we are beginning to understand that the physiological master plan of salt and osmolyte accumulation is water conservation in the biological barriers, even at the expense of major reprioritization of body fuel and energy metabolism. Osmolyte-driven barrier formation triggers multiple compensatory regulatory patterns which could be summarized as "alarm responses" for body fluid conservation.

In the skin, Na^+ accumulation in the barrier is not only a component of immunological host defense across the species, but also closely coupled with systemic blood pressure regulation by homeostatic immune cells in experimental animals. In humans, skin Na^+ occurs with essential hypertension and left ventricular hypertrophy, suggesting that skin osmolyte metabolism contributes to cardiovascular risk.

The process of dietary salt elimination requires careful urea production and reabsorption to maintain the osmotic strength of the biological barrier and prevent otherwise salt-driven body water losses. Our most recent work indicates that body water homeostasis in achieved by concerted skin, liver, muscle, and renal action. Body water conservation at states of high intake requires energy-intense urea production by liver and skeletal muscle, which couples increased salt consumption with increased food intake, reprioritization of energy metabolism in liver and skeletal muscle, changes in body composition, and a hormone profile which predisposes to muscle loss, fat accumulation, insulin resistance, and diabetes mellitus.

About the Speaker:

Jens Titze is a clinician-scientist from Germany. He currently works as an Associate Professor at Vanderbilt University Medical Center in Nashville, TN, USA, and as a Professor for Electrolyte and Circulation Research at the University Clinic of Erlangen/Nuremberg, Germany.

His main preclinical research focus is discovery of extrarenal regulation of salt and water balance. The main goal of his patient-oriented research activity is transfer of these findings into clinical practice in 23NaMRI imaging studies.

Jens is an elected member of the American Society of Clinical Investigation and of the European Academy of Sciences and Arts. His research is funded by the National Institutes of Health, the American Heart Association, the German Research Council, and the Federal Ministry of Economy and Technology in Germany.