ISHR Research Achievement Award

The purpose of this Award is to recognize a prominent scientist (1) who has a distinguished track record of innovative scientific contributions that have had a major impact on our understanding and/or treatment of cardiovascular disease and (2) who is likely to continue to make major contributions in the future. The main criteria for selecting awardees are scientific excellence and potential for future research contributions. While both the Outstanding Investigator Award (OIA) (awarded annually) and the Research Achievement Award (RAA) recognize established investigators, the OIA is targeted at more junior individuals (at least Assistant/Associate Professor or the equivalent), while the RAA is targeted at more senior individuals (full Professors or the equivalent).

The Research Achievement Award is presented at the triennial ISHR World Congress or, in non-Congress years, at the annual meeting of the ISHR Section to which the winner belongs. The Award consists of a plaque and a monetary prize of $3,000, which will be used to support the research program of the awardee. An announcement of this Award, along with a photograph and a biosketch, will be published in *Heart News and Views*, and posted in the ISHR website.

ISHR

International Society for Heart Research

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The Research Achievement Award 2016

Award Winner

Dr. Heping 'Peace' Cheng

"Protons trigger mitochondrial flashes for ATP homeostasis in heart"

Heping Cheng, Ph.D.

2016 Award Winner
Buenos Aires, Argentina

After receiving multidisciplinary training in mathematics, physics, biology, and electronic engineering at Peking University (China), Heping (Peace) Cheng received his PhD degree in Physiology in 1995 from the University of Maryland at Baltimore (USA). He then spent a decade at the laboratory of Cardiovascular Science in the National Institute on Aging, NIH (USA), progressing from Senior Staff Fellow to Tenure-track Investigator, and becoming a Senior Investigator with tenure in 2004. Since then, he co-founded the Institute of Molecular Medicine at Peking University and, as a Chair Professor, has headed the Laboratory of Ca^{2+} Signaling and Mitochondrial Biomedicine at the Institute. He was elected to the Chinese Academy of Sciences in 2013.

Peace's scientific motivation is to decipher physiological principles underlying cellular functions and signaling. During his PhD study, Peace discovered "calcium sparks" – elementary events of excitation-contraction coupling in heart cells. Individual sparks arise when tiny packets of Ca^{2+} are released from the sarcoplasmic reticulum through clusters of ryanodine receptors. The summation of thousands of discrete sparks results in an intracellular Ca^{2+} transient that activates the cell to contract. In a flurry of discoveries made with many collaborators, Peace demonstrated that Ca^{2+} sparks in blood vessels negatively regulate vascular tone; subsurface Ca^{2+} sparks in dorsal root ganglion sensory neurons trigger vesicle secretion; and spark-like events from TRPM7 and IP_3 receptors, called "calcium flickers", steer cell migration in fibroblasts. These findings have revolutionized our view of cellular Ca^{2+} regulation and signaling, its hierarchical organization, dynamism, and design principles to simultaneously achieve signaling versatility, specificity, and efficiency.

Through two-decades of vigorous innovation, Peace and collaborators have uncovered a molecular trilogy at cardiac dyads, the smallest units of cardiac excitation-contraction coupling. Ca^{2+} sparklets arise from the opening of single L-type Ca^{2+} channels and trigger Ca^{2+} sparks *via* the Ca^{2+}-induced Ca^{2+} release mechanism; at the same time, Ca^{2+} blinks, the reciprocal Ca^{2+} signal in the sarcoplasmic reticulum, develop and reveal a surprisingly large local Ca^{2+}depletion that helps to terminate the ongoing spark. More recently, by re-engineering a new generation of genetically-coded Ca^{2+} indicators and by devising a nanodomain-targeting strategy, he has further characterized Ca^{2+} nanosparks in the dyadic clefts. This trilogy is deranged in the failing heart, where ryanodine receptor clusters are orphaned from their L-type Ca^{2+} channels, such that systolic Ca^{2+} release and hence cardiac contractility are compromised; Ca^{2+} sparks often occur in diastole, contributing to cardiac arrhythmogenesis. In the course of this work, Peace has also gained a reputation for his quantitative and analytical style. He has developed mathematical models of Ca^{2+} sparks and blinks, and devised the first automated spark detection algorithm for the research community.

While investigating the mitochondrial Ca^{2+} response to sparks, Peace and his collaborators made the serendipitous discovery of mitochondrial "flashes", which reflect bursts of superoxide production entangled with many other signals at the single-organelle level. Attracted to the beauty and complexity of the flash, in recent years Peace has dedicated himself to this new research direction. Emerging evidence indicates that the flash is much more complex than sparks, and constitutes another type of elemental and ubiquitous signaling event that participates in vital physiological processes from metabolism to cell-fate regulation, and from stress responses to aging. To further this quest into flash biology, he is currently leading an effort to develop a miniaturized two-photon microscope with superior resolution and sensitivity that would make it possible to image mitochondrial flashes as well as Ca^{2+} signals in live animals under natural conditions.

Peace serves an Associate Editor for *Cardiovascular Research* and is on the editorial boards of a number of journals including the *Journal of Molecular and Cellular Cardiology*, the *Journal of General Physiology*, and *AJP-Heart and Circulatory Physiology*. He is also Vice-president of the Biophysical Society of China.

Past Award Winners…

Mark Anderson, M.D., Ph.D.
2015: Seattle, WA, USA

Eric Olson, Ph.D.
2013: San Diego, CA, USA

Jeffrey Robbins, Ph.D.
2010: Kyoto, Japan

Martin Lohse, M.D.
2007: Bologna, Italy

Roberto Bolli, M.D.
2004: Brisbane, Australia

Eduardo Marban, M.D.
2001: Winnipeg, Manitoba