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Preface

Radical species, mitochondria and cardiac function

Mounting evidence is emerging that *reactive oxygen species* (ROS), rather than being just unwanted by-products of the aerobic biome, are also essential components of signal cascades important in sensing change in the extracellular environment and orchestrating a variety of tightly regulated responses. At the sub-cellular level, mitochondria play a major role in coordinating these responses, including the activation of cell survival programs. Several oxidant-sensitive transcription factors, able to activate gene expression in response to oxidative stressful conditions, are implicated in the cross talk between nucleus and mitochondria. Due to its very nature the heart, as an aerobic continuously contracting organ, is an extremely challenging conceptual model for exploring the complexity and wonder of these homeostatic cascades. It also epitomizes how physiology and pathology can be two facets of the same issue. In fact, ROS research is gaining momentum in basic and clinically oriented cardiovascular investigations. Central players are Janus-faced endogenous ROS producing gases, i.e., nitric oxide, hydrogen sulfide and carbon monoxide. Although being physiological signaling agents in cardiac cells, their misregulation can lead to oxidative stress and free radical damage, requiring the activation of protection programs to prevent mitochondrial dysfunction and myocardial injury or death. The reviews collected in this volume arise from a special scientific session on this topic held at the Society for Experimental Biology Annual Meeting in Marseille, July 2008. The papers focus on different biological and physio-pathological aspects which underlie the interplay between ROS producing gases, mitochondria and cardiac biology in vertebrates. Examples from different organisms illustrate the unity and diversity of fundamental homeostatic processes, as well as the power of the comparative approach. The goal is to provide an interdisciplinary overview and open new perspectives to stimulate interest in this exciting and expanding area of research.

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Professor Bruno Tota is a full Professor of General Physiology, specialising in comparative cardiovascular physiology. He graduated in Medicine and Surgery from the University "Federico II" in Naples, where he then completed a master's degree in cardiology. Professor Tota is currently head of the Department of Cell Biology at the University of Calabria, Italy. His expertise lies in comparative cardiovascular physiology with particular interests in the evolutionary morpho-functional design of the heart, cardiac hormones, nitric oxide and signalling, cardio-circulatory adaptations to extreme habitats and Antarctic fish biology.

Professor Richard Handy is a comparative physiologist and toxicologist based at the University of Plymouth, U.K. His laboratory is a strong advocate of the comparative approach in understanding the normal functions (physiology) and dysfunction (pathophysiology/toxicology) of body systems in vertebrate animals, including fish, mammals and humans. The city of Plymouth also has an international reputation for hyperbaric and diving medicine. The Hyperbaric Medical Centre in Plymouth uses hyperbaric oxygen (HBO) therapy to treat many types of patients. In the contribution to this volume, Handy and co-authors from the Diving Diseases Research Centre (DDRC) have combined their expertise to use HBO as a tool to investigate nitric oxide release (among other things) from blood vessels. This work is part of ongoing research into understanding, not only the fundamental biology of oxygen and ROS in organisms, but also the cellular basis for the beneficial effects of HBO therapy in patients.

Professor Maria Carmela Cerra is Associate Professor of General Physiology and chief of the Laboratory of Cardiovascular Physiology at University of Calabria, Italy. Her major research interest is in the field of the endocrine heart, with particular attention in understanding the mechanisms that contribute to cardiac morpho-functional plasticity. Her studies carried out on natriuretic peptides, angiotensin II and Chromogranin-A-derived peptides have provided insights into the functional networks involved in the autocrine-paracrine control of cardiac performance in vertebrates, from fish to mammals. Her scientific effort has pointed out the fundamental role played by nitric oxide-activated cascades in relation to cardiac humoral modulation.

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