The Biology of Subcellular Nitric Oxide
Tamás Rőszer

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Springer
If one part suffers, every part suffers with it; if one part is honored, every part rejoices with it.

1 Corinthians 12:26
It is with great pleasure that I write this Foreword for the book by Dr. Tamás Rőszer in which every aspect of the intracellular biology of nitric oxide is comprehensively reviewed.

The biological activity of nitric oxide was originally recognised when it was discovered to be the mediator of vascular endothelium-dependent relaxation. As its actions in a variety of other biological systems were unravelled, nitric oxide became known as a mediator of cell-to-cell communication. In the last fifteen years, however, its role as an orchestrator of communication between intracellular organelles has become apparent, opening up an increasingly exciting area of research.

This book provides an elegant overview of current knowledge of the biology of subcellular nitric oxide, not only in mammalian cells but also in plants and fungi. I have no doubt that it will become a reference point, not only for teaching but also for the development of future research.

The Wolfson Institute for Biomedical Research, University College London

Prof. Sir Salvador Moncada, FMedSci, FRS
The latest progress in the field shows that NO is generated within distinct cell compartments, including specific plasma membrane regions, mitochondria, chloroplasts, peroxisomes, the Golgi-complex and intracellular membrane systems. NO synthesis plays specific roles in these compartments and, in turn, cell organelles also control intracellular NO levels. NO is an important biological signal, but a highly reactive molecule as well; thus its biological effects depend on its concentration and the chemical microenvironment of NO synthesis. A key determining factor of cellular NO effects is the subcellular compartmentalization of NO synthesizing enzymes.

To understand the role of cell compartments in NO biology, we may make an everyday analogy: the energy of fire, which can be used for heating in a fireplace or for lighting with a candle. The same factor (the energy of the fire) is required in different quantities in a fireplace and in a candle, to serve different needs. Organelles determine the effects of NO in a similar way, since they produce and tolerate different levels of NO in spatially separated locations in the cell. Organelles effectively control and maintain NO levels within a physiological range and orchestrate temporal and spatial patterns of NO synthesis. Disturbances of this organelle-specific NO homeostasis evoke cellular degeneration.

The rapid development and complexity of subcellular NO biology made it timely to produce a book dedicated to the better understanding of NO in organelle biology and the molecular mechanisms by which cell compartments give home to NO-signaling microdomains and ensure balanced NO production.

I would like to thank the Senior Editor of Springer Life Sciences, Dr. Meran Owen. I am also grateful for the help Tanja van Gaans provided in this project. Valuable image contributions provided by Dr. Madhu Dikshit (Central Drug Research Institute, CSIR, Lucknow), Dr. Mateusz Kolanczyk (Max Planck Institute for Molecular Genetics, Berlin), Dr. Jason E. Lee and Dr. Pravin B. Sehgal (New York Medical College, Valhalla), Dr. Justin Percival (University of Washington, Seattle) and Dr. Iván Schmelczer (Debrecen University, Hungary) are acknowledged. I also wish to thank Dr. Gáspár Bánfalvi (Debrecen University, Hungary) for his support in carrying out my NO-research; the many colleagues at Debrecen University and research groups.
of the Hungarian Academy of Sciences, with whom I have worked for years; and
Dr. Mercedes Ricote (Spanish National Cardiovascular Research Center, Madrid)
for support in my current scientific work. Livia I. Lelkes provided valuable editorial
assistance; her careful and timely work is highly appreciated.

Madrid, Spain
15 August 2011

Dr. Tamás Rőszer
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Abbreviations

ATP: Adenosine triphosphate
BH₄: Tetrahydrobiopterin
cAMP: Cyclic adenosine monophosphate
CAT: Catalase
CcO: Cytochrome-c oxidase
cGMP: Cyclic guanosine monophosphate
DAF-2: 4,5-diaminofluorescein diacetate (NO-indicator)
FAD: Flavin adenine dinucleotide
FMN: Flavin mononucleotide
GSH: Reduced glutathione
H₂O₂: Hydrogen peroxide
L-NAME: Nω-nitro-L-arginine methyl ester
L-NMMA: Nω-nitromethyl-L-arginine
L-NNA: Nω-nitro-L-arginine
NADPH: Reduced nicotinamide adenine dinucleotide phosphate
NiR: Nitrite reductase
NO₂⁻: Nitrite
NO₃⁻: Nitrate
NR: Nitrate reductase
O₂: Oxygen
O₂⁻: Superoxide
OH⁺: Hydroxyl radical
OH⁻: Hydroxide ion
ONOO⁻: Peroxynitrite
PKG: Protein kinase G (cGMP-dependent protein kinase)
SEM: Scanning electron microscopy
SOD: Superoxide dismutase
TEM: Transmission electron microscopy