Preface

Measurement of dissolved oxygen concentration in biological samples by luminescence quenching method has been introduced by the pioneering work of German scientists Dietrich Lubbers and Norbert Opitz who developed in the mid-1970s first solid-state fluorescence-based O_2 sensors called 'optodes', and by the group of David Wilson in the US who introduced the phosphorescence-based probes and O_2 imaging technique in the mid-1980s. High application potential of this technique has been recognised back then, however its use was rather limited, mainly by research groups who had access to or developed themselves dedicated materials and instrumentation for O_2 sensing and possessed special skills.

In the last decade we have witnessed a major change in the uptake of optical O_2 sensing techniques, with many new materials, measurement formats, detection and imaging platforms, analytical methodologies and accessory tools developed and tested. O_2 sensing systems have been adapted for use with standard laboratory equipment such as time-resolved and lifetime-based luminescent readers, live cell imaging systems, liquid handling equipment (microplates, biochips). They have been applied to various measurement tasks and mechanistic studies with complex biological models demonstrating high utility for biomedical research and new insights into cell and tissue function. O_2 sensor technology has now become much more accessible and affordable for ordinary users working in various disciplines of life and biomedical sciences.

On the other hand, the existence of many probes, measurement formats, and detection platforms make it difficult for the user to select optimal combination to address their particular biological problem or measurement task. Also, distinctive features of these probes compared to other fluorescent probes, and general conditions of their use for O_2 monitoring are not always assessed comprehensively by their end-users. This often leads to experimental artifacts, failures, or incorrect interpretation of data. Critical literature describing their practical uses is also in short supply.

This book is aimed to address these aspects and provide a general overview of existing and emerging O_2 sensing probes, detection platforms, and applications in their various modifications, based on authors' long-standing experience in this

area. In the first chapter, the most popular phosphorescent probes based on Pt-porphyrin dyes are described and cross-compared. Subsequently, core biological applications of these probes with different in vitro models (in vivo applications such as imaging of tissue oxygen are outside the scope) are described. For these applications, which are divided into two main groups and chapters—plate reader analysis and O_2 imaging—key technical details are provided on how to set them up, conduct the measurements, extract the analytical and physiological information, interpret the results, and perform troubleshooting. Altogether, this gives potential users a fair representation of merits and limitations, analytical capabilities of the different probes, O_2 sensing and imaging platform(s), and a comprehensive practical guide for their rational selection. The book is expected to facilitate a broader use of the probes and development of new applications.

Dmitri B. Papkovsky

http://www.springer.com/978-3-0348-0524-7

Phosphorescent Oxygen-Sensitive Probes

Papkovsky, D.; Zhdanov, A.V.; Fercher, A.; Dmitriev, R.I.; Hynes, J.

2012, VIII, 101 p. 39 illus., 17 illus. in color., Softcover
ISBN: 978-3-0348-0524-7