



POLISH NATIONAL AGENCY  
FOR ACADEMIC EXCHANGE



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PROGRAMME

<b>name of the unit:</b> <b>LABORATORY OF BIOMEDICAL CHEMISTRY</b> Institute of Applied Radiation Chemistry, Lodz University of Technology		<b>symbol:</b> <b>I-34</b> <a href="http://www.mitr.p.lodz.pl">http://www.mitr.p.lodz.pl</a>
<b>head of the unit:</b>  Prof. Andrzej Marcinek, PhD, DSc	<b>potential promoters:</b>  Adam Sikora, PhD, DSc, TUL Prof.	<b>contact person:</b>  Adam Sikora PhD, DSc, TUL Prof. phone: 48-42-631-30-97 <a href="mailto:adam.sikora@p.lodz.pl">adam.sikora@p.lodz.pl</a>
<b>scope of activities:</b> Our current research interests focus on the development of detection methods of cellular oxidants and signalling molecules. This includes the design, synthesis and characterization of novel fluorogenic probes for selective detection of peroxynitrite (ONOO <sup>-</sup> ), superoxide radical anion (O <sub>2</sub> <sup>-</sup> ), hydrogen peroxide (H <sub>2</sub> O <sub>2</sub> ), hypochlorous acid (HOCl), nitric oxide (NO), nitroxyl (HNO) and hydrogen sulfide (H <sub>2</sub> S). Our second scientific interest focuses on the biological chemistry of NO and HNO and the synthesis and characterization of their donors. We also conduct research devoted to the search for new myeloperoxidase inhibitors and novel mitochondria-targeted anticancer agents with antiproliferative activity.		
<b>present activities:</b> <ul style="list-style-type: none"><li>• Synthesis and characterization of luminescent probes for detection of biological oxidants (O<sub>2</sub><sup>-</sup>, H<sub>2</sub>O<sub>2</sub>, ONOO<sup>-</sup>, HOCl);</li><li>• Design, synthesis and characterization of novel fluorescent probes for detection of signalling molecules: nitric oxide (NO), nitroxyl (HNO) and hydrogen sulfide (H<sub>2</sub>S);</li><li>• Design and synthesis of fluorogenic probes for detection of NADH and NADPH;</li><li>• Synthesis and characterization of novel HNO donors;</li><li>• Detection and quantitation of peroxynitrite generated from nitric oxide in chemical models of biological systems;</li><li>• NO/H<sub>2</sub>S "crosstalk";</li><li>• Search of specific and redox activated inhibitors of myeloperoxidase;</li><li>• Search of novel mitochondria-targeted compounds as anticancer and antiproliferative agents.</li></ul>		
<b>Future activities:</b> <ul style="list-style-type: none"><li>• Towards the understanding of thiols redox switches in biological systems - molecular mechanisms of thiols persulfidation, nitrosation and glutathionylation.</li></ul>		
<b>Publications/patents, awards, projects:</b> <ul style="list-style-type: none"><li>• Michalski, R. <i>et al.</i> (2020) Oxidation of ethidium-based probes by biological radicals: mechanism, kinetics and implications for the detection of superoxide. <i>Scientific Reports</i> 10(1),18626;</li><li>• Sikora, A. <i>et al.</i> (2020) Boronate-based probes for biological oxidants: A novel class of molecular tools for redox biology. <i>Frontiers in Chemistry</i> 8, 580899;</li><li>• Zielonka, J. <i>et al.</i> (2017) Mitochondria-targeted triphenylphosphonium-based compounds: Syntheses, mechanisms of action, and therapeutic and diagnostic applications. <i>Chemical Reviews</i> 117(15), 10043-10120;</li></ul>		



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- Smulik-Izydorzyc, R. *et al.* (2017) A kinetic study on the reactivity of azanone (HNO) toward its selected scavengers: Insight into its chemistry and detection. *Nitric Oxide*. 69, 61-68.

We conduct the following research projects:

- "From selective detection of cellular oxidants and small molecule signalling agents towards better understanding of their biological chemistry" (Polish National Science Center, SONATA BIS program, grant number 2015/18/E/ST4/00235), 04.2016-04.2022;
- "In search of specific inhibitors of myeloperoxidase, from mechanistic studies to application in enzymatic and cellular systems" (National Science Center, SONATA program, grant number 2018/31/D/ST4/03494), 06.2019-06.2022.

**Keywords:**

biological oxidants, redox signalling, gasotransmitters, fluorogenic probes, mitochondria-targeted compounds, NO, HNO, H<sub>2</sub>S, peroxynitrite, hypochlorous acid, myeloperoxidase,

**List of internship proposal in this research team:**

- Detection and quantitation of peroxynitrite generated from nitric oxide in chemical models of biological systems