**“Relevance of plant secondary metabolites in the era of antimicrobial resistance”**

Marta Krychowiak-Maśnicka, PhD

Laboratory of Biologically Active Compounds IFB UG&MUG

 Antimicrobial resistance (AMR) comprise a serious public health problem that has been flagged for few decades. According to the Centers for Disease Control and Prevention a ca. 2.8 million of antibiotic-resistant infections is reported annually just in the USA resulting in 38,000 death cases [1]. AMR increases a death risk during the treatment of sepsis, after a surgery, as well as during chronic conditions. Nowadays microbial resistance to drugs is called “the silent pandemic” [2].

Secondary metabolites (SM) present in plant tissues, *i.e.* small molecules synthesized in secondary metabolism pathways, are a reflection of their adaptation to environment. Immobile nature of plants enforced development of other ways to manage attacks of pathogens and herbivores, as well as deal with adverse environmental conditions to improve survivor. It is estimated that plants produce around 200 000 different chemical structures which, besides their protective role in plant, comprise relevant reservoir of pharmaceuticals, *e.g.* antimicrobial agents.

For a long time my research has been focusing on carnivorous plants from Droseraceae family, *i.e.* a group of plants that developed a way to catch and digest a pray in order to acquire nitrogen and phosphorus. Carnivorous plants are source of variety of secondary metabolites among which are 1,4‑naphthoquinones (NQs). NQs are group of SM that like no other phenolic compounds from Droseraceae plants display synergistic antimicrobial potential with silver (Ag). This unique biological activity is highly relevant to antimicrobial therapy of burn wounds in order to improve silver formulations used in wound care. Firstly, we reported the synergistic interaction for gram-positive *Staphylococcus aureus* [3,4], but our recent study indicates significance of this phenomenon to combat gram-negative bacterial pathogens, *e.g.* intrinsically resistant *Pseudomonas aeruginosa* [5]. Ag-NQ interaction will be further studied to: i) define principles of Ag-NQ synergy and ii) determine therapeutic potential of Ag-NQ formulations with animal model.

Besides NQs there is a huge number of other phenolic compounds in carnivorous plant tissues. Unfortunately, structure and activity of many of them remains undefined due to extracts complexity and time-consuming process of phytochemical analyses. During the presentation I will explain the principle of our research on carnivorous plants as a source of new antimicrobials with one *Drosera* sp. as an example of species with unique composition and properties.

[1] CDC: Antibiotic Resistance Threats in the United States, 2019. In. Atlanta, GA: U.S. Department of Health and Human Services; 2019.

[2] Mahoney, Andrew R., et al. "The silent pandemic: Emergent antibiotic resistances following the global response to SARS-CoV-2." iScience (2021): 102304.

[3] Krychowiak, M., et al. "Combination of silver nanoparticles and *Drosera binata* extract as a possible alternative for antibiotic treatment of burn wound infections caused by resistant *Staphylococcus aureus*." PLoS One 9.12 (2014): e115727.

[4] Krychowiak, M., et al. "Silver nanoparticles combined with naphthoquinones as an effective synergistic strategy against *Staphylococcus aureus*." Frontiers in Pharmacology 9 (2018): 816.

[5] Krychowiak-Maśnicka, M., et al. "Potential of silver nanoparticles in overcoming the intrinsic resistance of *Pseudomonas aeruginosa* to secondary metabolites from carnivorous plants." International Journal of Molecular Sciences 22.9 (2021): 4849.