

ORGANOPHOSPHORUS TEAM

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SCIENTIFIC INTERESTS:

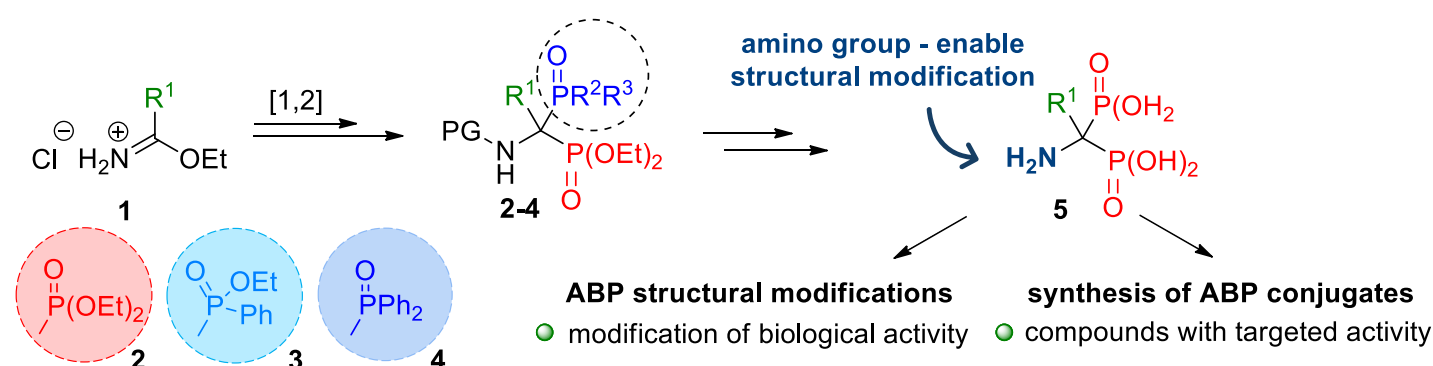
- ✓ Synthesis and characterization of organophosphorus compounds using modern, eco-friendly methods;
- ✓ Structural modifications (including conjugation) of bioactive motifs using phosphorus compounds;
- ✓ Isolation of active compounds from plant material, along with their characterization;
- ✓ Use of spectroscopic methods (NMR, IR, MS) for the analysis of samples of various origins.



ONGOING RESEARCH:

AMINOBISPHOSPHONATES synthesis, modifications and biological properties

In recent years, we have developed a novel 3-step procedure for the synthesis of structurally diverse ABPs **2-4**. Our current work focuses on investigating their biological properties (cytotoxicity, antibacterial effects) as well as performing further structural modification of these compounds, including the synthesis of their conjugates with other bioactive molecules.

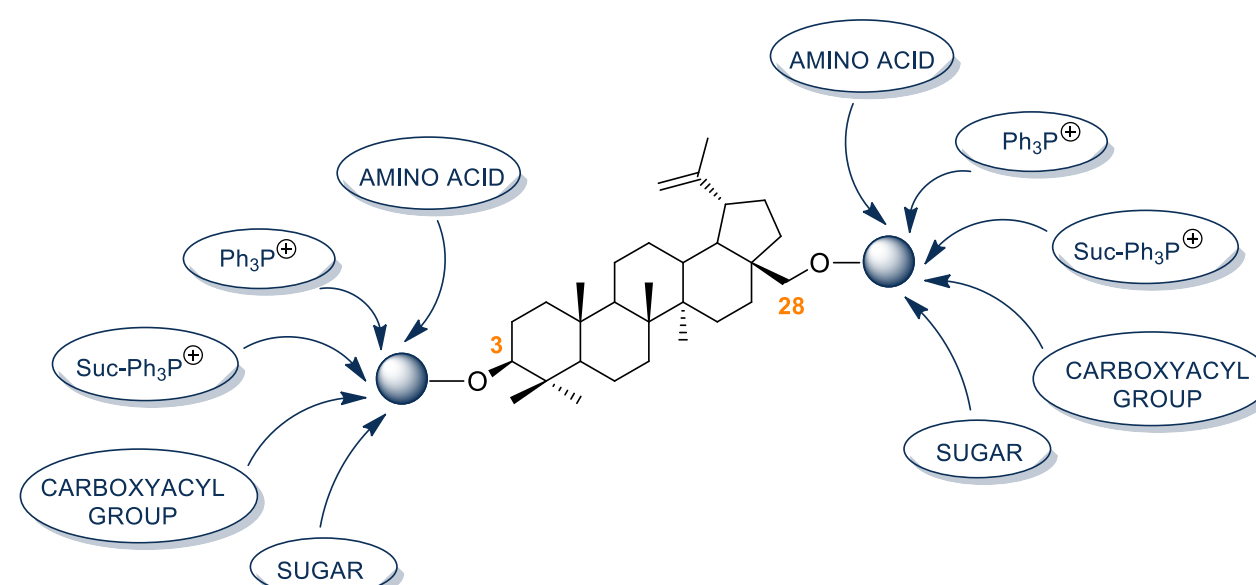


Strategy for the synthesis, modifications and conjugations of aminobisphosphonates.

- [1] A. Kuźnik, D. Kozicka, W. Hawranek, K. Socha, K. Erfurt, *Molecules*, **2022**, 27, 3571.
[2] A. Kuźnik, D. Kozicka, A. Październiak-Holewa, et al., *RSC Adv.*, **2023**, 13, 1890.
[3] A. Kuźnik, A. Październiak-Holewa, et al., *Eur. J. Pharmacol.*, **2020**, 866, 172773.

BETULIN multi-purpose natural bioactive substance

The multidirectional bioactivity of betulin (BN), its widespread occurrence in plants, relatively low toxicity, and acceptable safety profile make it an attractive scaffold for scientific research and potential therapeutic applications.

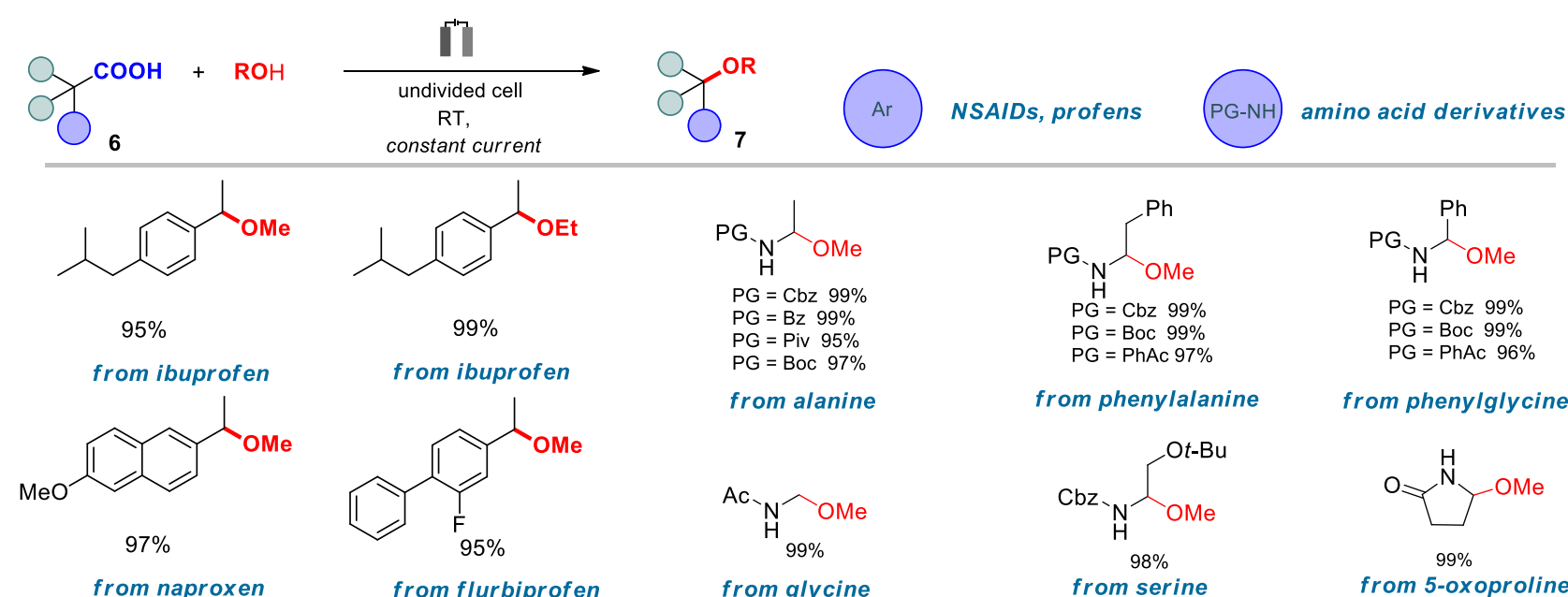


New betulin molecular hybrids - synthesis, structure and pharmacological potential [1-3].

- [1] M. Grymel, A. Lalik et al., *Int. J. Mol. Sci.*, **2026**, 27, 1-22.
[2] A. Kuźnik, M. Grymel, D. Kozicka, J. Adamek, PL249381 - 20.06.2024.
[3] M. Grymel, A. Lalik, A. Kązek-Kęsik, PL 247708 - 09.06.2025.

ELECTROORGANIC SYNTHESIS application of eco-friendly methods in organic synthesis

Electroorganic methods are employed for the preliminary modification of biologically relevant compounds, such as amino acid derivatives and non-steroidal anti-inflammatory drugs (NSAIDs). This approach enables the generation of versatile building blocks for the incorporation of biologically significant motifs into more complex molecular architectures.



- [1] A. Walęcka-Kurczyk, J. Adamek, K. Walczak, M. Michalak, A. Październiak-Holewa, *RSC Adv.* **2022**, 12, 2107-2114.
[2] J. Adamek, R. Mazurkiewicz, A. Październiak-Holewa, M. Grymel, A. Kuźnik, K. Zielińska, *J. Org. Chem.* **2014**, 79, 2765-2770.
[3] J. Adamek, A. Październiak-Holewa, *patent application* P.452918 - 13.08.2025.



Acknowledge

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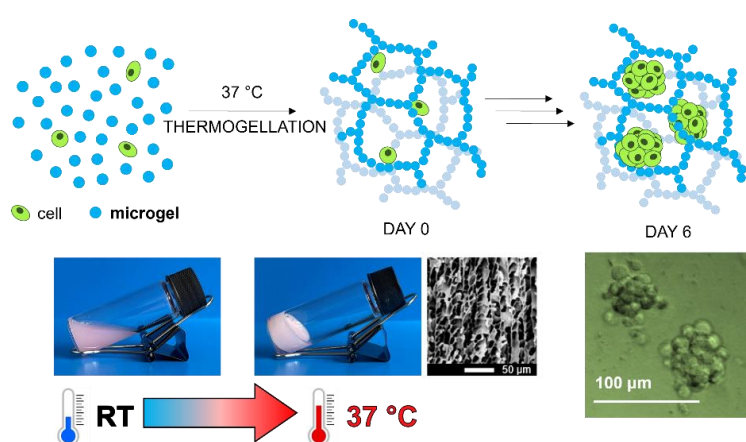
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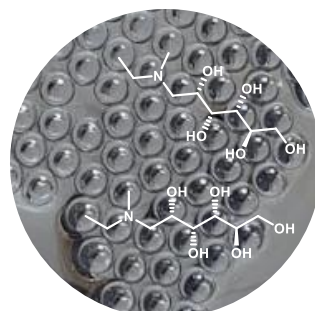
Hydrogel Materials Group

- Thermogellable matrices for cell culture
- Trehalose-releasing nanogels for autophagy stimulation
- Oligonucleotides-integrating nanocarriers
- Functional hydrogel materials (materials capable of selective carbohydrate-directed interactions; enzyme-integrated materials; selective sorbents)

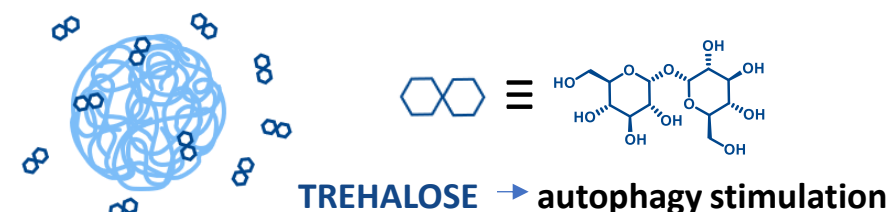
THERMOGELLABLE MATRICES FOR 3D CELL CULTURE



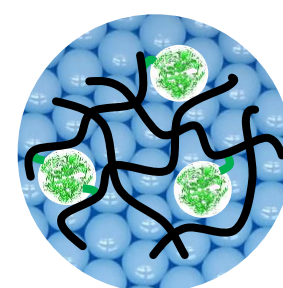
CARBOHYDRATE-FUNCTIONALIZED SELECTIVE SORBENTS



TREHALOSE-RELEASING NANOGELS

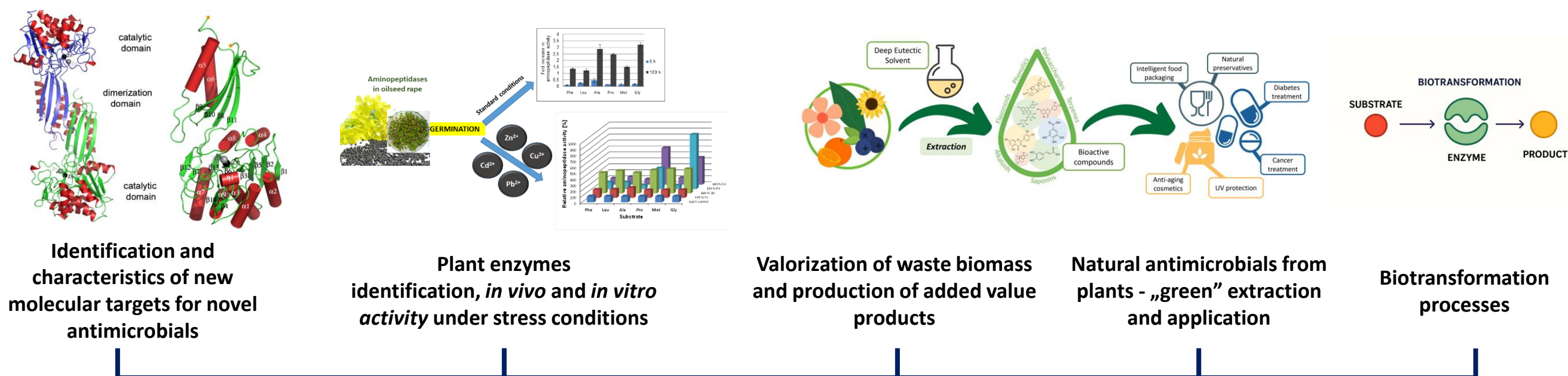


ENZYME-INTEGRATED HYDROGELS



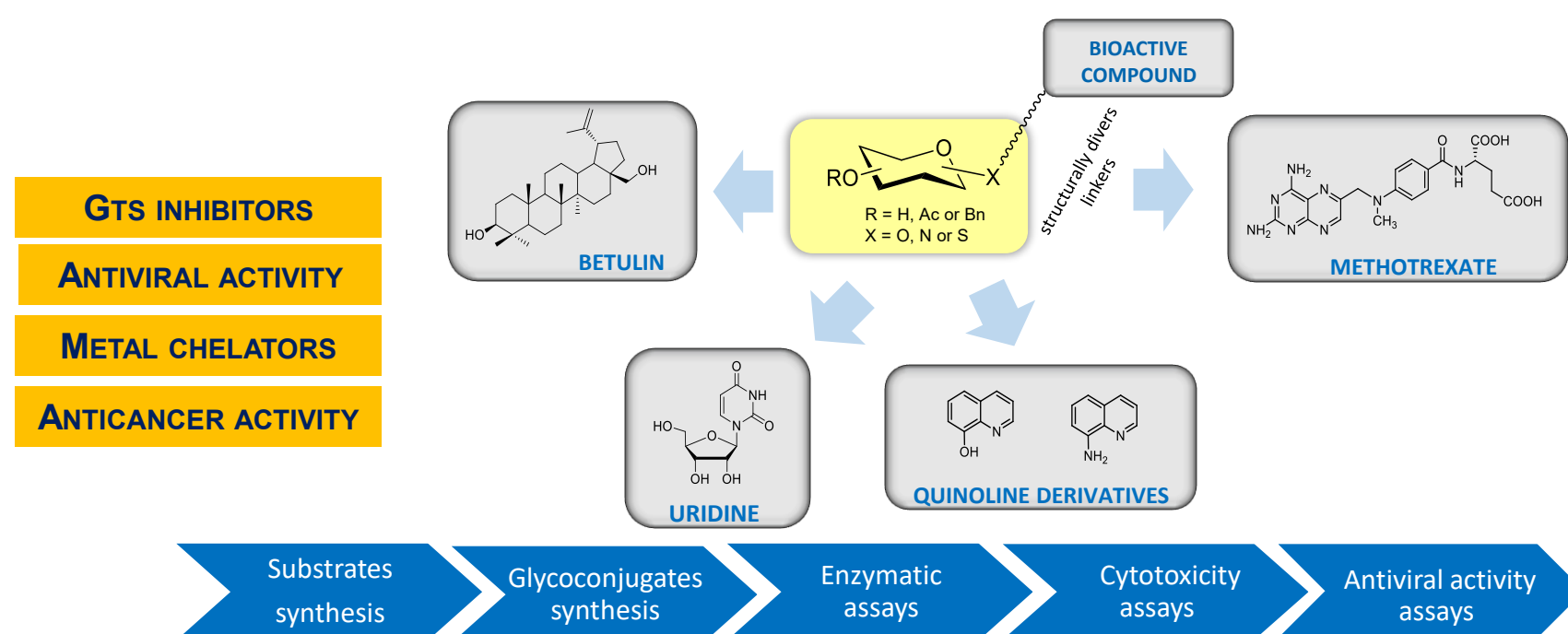
Danuta Gillner

BioActive Transformations Lab



Gabriela Pastuch-Gawołek

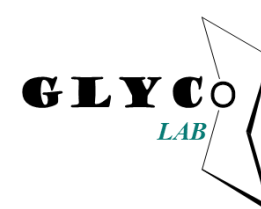
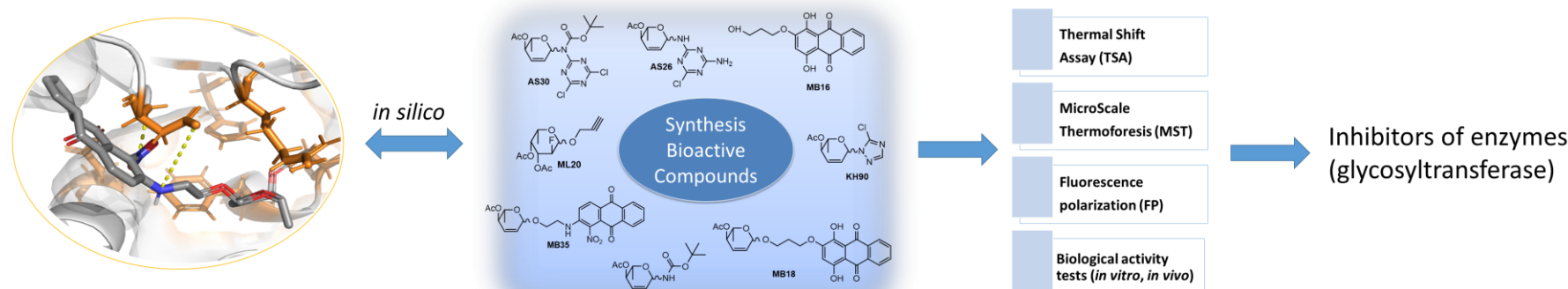
Glycoconjugation of biological active compounds as a way for improving their bioavailability and selectivity



Anna Kasprzycka; Katarzyna Żurawska; Kinga Plasa; Aleksandra Gulec

GlycoLab

- Design and synthesis of biologically active compounds (enzyme inhibitors)
- Obtaining the prodrug form of drugs used in clinical therapies
- Targeted transport to cancer cells
- Chemistry of sugars, synthesis of sugar derivatives (glycoconjugates)
- Synthesis of organosulfur compounds
- Synthesis of terpenoid derivatives
- Study of anticancer and antimicrobial activity



GEMCITABINE PRODRUGS

Gemcitabine - sites of conjugation with derivatives of sugar

- increase bioavailability,
- reduce systemic cytotoxicity,
- GLUT receptor-mediated targeted transport.

Patent PL (granted decision of 18.03.2025)
Prodrug - Gemcitabine-derived glycoconjugate as a new compound with anticancer activity, method of preparation and application, A. Kasprzycka, W. Szeja, K. Żurawska, M. Woźniak, S. Makuch, J. Wiśniewski, T. Cichoń, E. Pilny, Patent application P.442924 23.11.2022.

