

Laboratory of Stereocontrolled Organic Synthesis



HEAD:

Prof. Rafał Siciński*, PhD DSc

GROUP MEMBERS:

prof. Tomasz Bauer, PhD DSc;
prof. Janusz Jurczak, PhD DSc (emeritus);
Piotr Kwiatkowski, PhD DSc; Anna Piątek, PhD DSc;
Piotr Piątek, PhD DSc; Jan Romański, PhD DSc;
Katarzyna Sęktas, PhD; Krzysztof Ziach, PhD

RESEARCH PROFILE:

Academic staff in our Laboratory are engaged in a broad array of research activities, primarily in the field of stereocontrolled organic synthesis. Our studies cover a variety of research fields, such as multi-step target synthesis of biologically active compounds of potential therapeutic application, design and preparation of molecular receptors, high pressure organic synthesis or investigation of supramolecular and dynamic combinatorial chemistry. We also engage in the development of asymmetric catalytic methods, especially based on metal-free organic molecules and Lewis acids as chiral catalysts. Since many of our research projects are motivated by the biological functions and medicinal relevance of the developed compounds, we use molecular modeling and docking experiments to design promising drug candidates. We closely collaborate with Polish and foreign scientific institutions to perform biological testing of the synthesized compounds.

CURRENT RESEARCH ACTIVITIES:

1. Synthesis of steroid hormones agonists and antagonists
2. Design, synthesis and evaluation of cytotoxic properties of structurally modified vitamin D compounds
3. Synthesis of steroid transition metal complexes as potential anticancer drugs
4. Design, synthesis and binding studies of heteroditopic receptors capable of simultaneous binding of cations and anions (salts)
5. Design, synthesis and investigation of binding properties of ion pair sensors and supramolecular polymers
6. Synthesis and application of new chiral Lewis acids
7. High-pressure activation of enantioselective organocatalytic reactions
8. Asymmetric synthesis of fluoroorganic compounds
9. Development of enantioselective methods for the construction of quaternary stereogenic center
10. Asymmetric hydrogenation and tetrasubstituted alkenes synthesis as tools in preparation of biologically active compounds
11. Achmatowicz rearrangement of optically active α,β -unsaturated alcohols and amines as a tool in the synthesis of biologically active compounds
12. Dynamic combinatorial chemistry of imines
13. Supramolecular systems of "molecular walkers"
14. Photochemistry of polyenes
15. Spontaneous emergence of solid state chirality in achiral systems

SELECTED PUBLICATIONS:

1. M. Zakrzewski, D. Załubiniak, P. Piątek, An ion-pair receptor comprising urea groups and N-benzyl-aza-18-crown-6: effective recognition and liquid-liquid extraction of KCl salt, *Dalton Trans.* 47 (2018) 323-330.
2. P. Brzeźmiński, A. Fabisiak, K. Sętkas, K. Berkowska, E. Marcinkowska, R.R. Siciński, Synthesis of 19-norcalcitriol analogs with elongated side chain, *J. Steroid Biochem. Mol. Biol.* 177 (2018) 231-234.
3. M. Biedrzycki, A. Kasztelan, P. Kwiatkowski, High-pressure accelerated enantioselective addition of indoles to trifluoromethyl ketones with low-loading of chiral BINOL-derived phosphoric acid, *ChemCatChem*. 9 (2017) 2453-2456.
4. M. Karbarz, J. Romański, Dual sensing by simple heteroditopic salt receptors containing an anthraquinone unit, *Inorg. Chem.* 55 (2016) 3616-3623.
5. A. Piątek, Ch. Chapuis, Grignard 1,4-additions to para-substituted (2R)-N-cinnamoylbornane-10,2-sultam derivatives: Revised configuration for the N,OAc-keteneacetal formation in the presence of Cu(I), *Helv. Chim. Acta.* 99 (2016) 573-582.
6. U. Kulesza, L.A. Plum, H.F. DeLuca, A. Mouriño, R.R. Siciński, A new suprasterol by photochemical reaction of $1\alpha,25$ -dihydroxy-9-methylene-19-norvitamin D₃, *Org. Biomol. Chem.* 14 (2016) 1646-1652.
7. U. Kulesza, L.A. Plum, H.F. DeLuca, A. Mouriño, R.R. Siciński, Novel 9-alkyl- and 9-alkylidene-substituted $1\alpha,25$ -dihydroxyvitamin D₃ analogues: Synthesis and biological examinations, *J. Med. Chem.* 58 (2015) 6237-6247.
8. M. Majdecki, J. Jurczak, T. Bauer, Palladium-catalyzed enantioselective allylic substitution in the presence of monodentate furanoside phosphoramidites, *ChemCatChem*. 7 (2015) 799-807.
9. T. Bauer, Enantioselective dialkylzinc-mediated alkynylation, arylation and alkenylation of carbonyl groups, *Coor. Chem. Rev.* 299 (2015) 83-150.
10. K. Ziach, J. Jurczak, Mirror symmetry breaking upon spontaneous crystallization from a dynamic combinatorial library of macrocyclic imines, *Chem. Commun.* 51 (2015) 4306-4309.