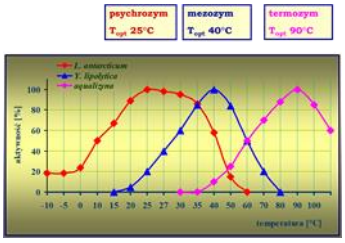
name of the unit:		symbol:
LABORATORY OF INDUSTRIAL BIOTECHNOLOGY Institute of Molecular and Industrial Biotechnology, Lodz University of Technology		I-51 https://www.binoz.p.lodz.pl/pl/instytut-biotechnologii-molekularnej-i-przemyslowej/o-instytucie
head of the unit:	**potential promoters:**	**contact person:**
Dr hab. inż. Aneta Białkowska, prof. uczelni	Aneta Białkowska, PhD, DSc, TUL Prof. Katarzyna Struszczyk-Świta, PhD	Aneta Białkowska tel: 42 631 34 29 aneta.bialkowska@p.lodz.pl

Scope of activities:

1. Nature search and selection of technologically useful microbial enzymes (including extremophilic ones) using efficient methods including omics techniques
2. Molecular identification of microorganisms that produce enzymes and useful bioproducts
3. Development of efficient bioprocesses (biosynthesis, biocatalysis, biotransformation): isolation and purification of enzymes and bioproducts; mathematical optimization and scale-up of biotechnological processes under different culture conditions or reaction environments
4. Production and characterization of various forms of biocatalysts (including immobilized): kinetics and mechanism of action, stability, stabilization
5. Construction of recombinant enzymes using genetic engineering techniques: selection of vectors and expression systems; optimization of expression of target gene(s) in a heterologous host, purification of recombinant enzymes
6. Engineering native and recombinant enzyme proteins by recombinant DNA technology: rational mutagenesis and directed enzyme evolution
7. Developing strategies for using enzymes to produce compounds previously obtained only by chemical synthesis

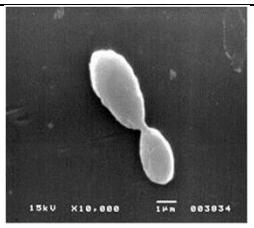


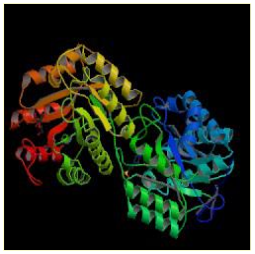
Present activities:

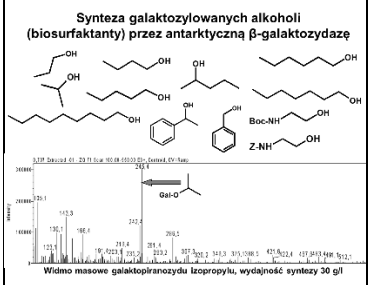
The Industrial Biotechnology team conducts research in the discipline of Food and Nutrition Technology. Currently, most of the work is in the areas listed below:

1. Selection and kinetic, biochemical and structural characterization of biocatalysts from extreme environments
2. Bioprocess improvement by engineering the biocatalyst form, reaction environment, and genetic modifications
3. Application of extremophilic enzymes in selected biotechnological processes.

The demands of today's global marketplace are forcing the search for new, low-cost technologies that will enable the efficient production of goods and commodities with low prices and competitive quality. The solution is now found in the development of modern biotechnologies that use enzymes isolated from microorganisms or their entire living cells for industrial catalysis. The most common are enzymes isolated from mesophilic organisms, which are so far the best understood, however, not all industrial processes can use them. In cases where it is advantageous to use specific technological conditions, e. g. low or high temperature, pH other than neutral, increased salt concentration, the enzymes of mesophilic microorganisms do not show full activity. For this reason, interest in microorganisms living in extreme environments and their enzymes, often referred to in the literature as extremozymes - next generation enzymes - has been growing for several decades. In the field of food and nutrition technology, this is one of the important research directions.







Future activities:

1. Search for unique and biotechnologically interesting enzymes and homologs of commercial enzymes widely used in industry today
2. Rational waste management and design of competitive processes for obtaining value-added compounds
3. Creating new technologies based on energy-efficient and environmentally friendly biotechnologies.

Keywords:

biocatalyst, bioprocess, extremophilic enzyme, cloning and expression, bioeconomy

List of internship proposal in this research team:

Extremophilic microbial communities: biocatalysts and biomolecules applicable in industry

List of attachments:

Publications

1. Ludwicka K., Kaczmarek M., Białkowska A. Bacterial nanocellulose - a biobased polymer for active and intelligent food packaging applications: recent advances and developments. *Polymers* 2020, Vol. 12, no. 2209, p.1-23. doi:10.3390/polym12102209
2. Białkowska A, Majewska E., Olczak A., Twarda-Cłapa A. Ice binding proteins: diverse biological roles and applications in different types of industry. *Biomolecules* 2020, Vol. 10, no. 274, doi: 103390/biom100020274
3. Otlewska A., Migliore M., Dybka-Stępień K., Manfredini A., Struszczyk-Świta K., Napoli R., Białkowska A., Canfora L., Pinzari F.. When salt meddles between plant, soil, and microorganisms. *Frontiers in Plant Science* 2020, Vol. 11, no. 553087, p. 1-23. doi:10.3389/fpls.2020.55087

4. Wiśniewska K., Twarda-Cłapa A., Białkowska A. Screening of novel laccase producers - isolation and characterization of cold-adapted laccase from *Kabatiella bupleuri* G3 capable of synthetic dye decolorization. *Biomolecules* 2021, Vol. 11, no. 828, p. 1-22. doi:10.3390/biom11060828
5. Wiśniewska K., Twarda-Cłapa A., Białkowska A. Novel cold-adapted recombinant laccase KbLcc1 from *Kabatiella bupleuri* G3 IBMiP as a green catalyst in biotransformation. *International Journal of Molecular Sciences* 2021, Vol. 22, no. 9593, p. 1-25. doi:10.3390/ijms22179593.
6. Jodłowska I., Twarda-Cłapa A., Szymczak K., Białkowska A. Green oxidation of amines by a novel cold adapted monoamine oxidase MAO P3 from psychrophilic fungi *Pseudogymnoascus* sp. P3. *Molecules* 2021, vol. 26(20), no. 6237. doi.org/10.3390/molecules26206237
7. Sypka M., Jodłowska I., Białkowska A. Keratinases as Versatile Enzymatic Tools for Sustainable Development. *Biomolecules* 2021, vol. 11(12), no. 1900. doi.org/10.3390/biom11121900

Project

1. Białkowska A (wykonawca), projekt Canaletto (NAWA), Bioróżnorodność mikrobiologiczna i potencjał biotechnologiczny gleb zasolonych o różnych cechach pedoklimatycznych, 2019-2021.

Patent

1. Wanarska M, Krajewska E, Wicka-Grochocka M, Cieśliński H, Pawlak-Szukalska A, Filipowicz N, Turkiewicz M, Białkowska A, Florczak T, Gromek E, Krysiak J. Patent Europejski 3530739 Expression system for production of a heterologous protein, plasmid expression vectors, method of construction of a recombinant strain of psychrotolerant yeast *Debaryomyces macquariensis* and method of protein production by the recombinant yeast strain, 2020