

**DEPARTMENT OF CHEMISTRY AND BIOCHEMISTRY
MENDEL UNIVERSITY IN BRNO (MENDELU)**

- 100 employees
- More than 750 m² of laboratories
- World-class instrumentation
- Part of the Central European Institute of Technology (CEITEC)

Research and development of advanced materials and approaches in physiology, biology, biochemistry and chemistry are the main vision of abovementioned team. There are several laboratories dedicated to key areas such as bioanalytical chemistry, experimental microbial and animal biochemistry and biology, and, last but not least, algae and plant biotechnology and their utilization in agriculture, environment, functional food and plant protection. The instrumental equipment available enables to the researchers to participate in a large number of grant projects at all levels – internal, national and international. Recent and current ongoing projects awarded by European Commission include:

- 2018-2022: ERC-2017-STG, “ToMeTuM”
- 2017-2020: H2020-GALILEO-GSA-2017, “GreenPatrol“
- 2017-2018: H2020-WIDESPREAD-04-2017-TeamingPhase1, Back4Future
- 2015-2017: H2020-JTI-IMI2-2014-02-single, “FILODIAG“
- 2009-2013: MAS, Nanoelectronics for mobile AAL-Systems, 7 FP ENIAC

Laboratory of Microbiology and Enzymology:

The research in the laboratory covers the identification of bacteria, fungi or yeasts and testing the effects of various materials on them. Particularly, we work with culture collection as well as wild strains. These microorganisms serve for testing the antimicrobial effects of various materials and also for the production of biotechnologically important enzymes, which are then characterized and immobilized by different methods and investigated their application potential. Our laboratory is also focused on testing of antimicrobial resistance to conventional antibiotics and looking for new ways of treating bacterial infections, especially with the use of antimicrobial properties of nanomaterials.

Project idea:

Use of advanced nanomaterials for ensuring sterility and antimicrobial properties of cover materials

Partnership/cooperation possibilities:

Early infections are the most common complication of chronic wound healing worldwide. European Wound Management Association (EWMA) continuously monitors and documents the treatment of non-wound infections. The effectiveness of treatment complicates the more frequent occurrence of resistant strains of bacteria that resist the treatments used so far. Antibiotic resistance is largely present in different environments and poses an emerging threat to health and the environment. The spread of antibiotic-resistant bacteria and resistance genes in the environment is a major problem in both veterinary and human medicine.

To solve the above problems, substances with antibacterial effects that are not harmful to the human organism are used. At present, the different types of nanoparticles, including those based on metal or semi-metal, are being of the greatest potential in this area. From the tested nanoparticles, those based on selenium, in which the central element has antimicrobial properties, are tested to treat surface infectious wounds. The enrichment of the surface of the cover material with these nanoparticles provides long-term sterility, accelerates tissue regeneration, and secondly reduces the cost of treating infections.

MENDELU has been dealing with the testing the polymeric substances as antimicrobial components for more than ten years. These antimicrobial agents are often polymeric materials which are also not only antimicrobial and biocompatible, but also stabilize the complex and allow it to be attached to the surface of cover materials used in a number of veterinary, human or biotech industries. The results from a series of studies of MENDELU with nanoparticle complexes with polymeric substances show that the use of polymeric substances actually leads to an increased antimicrobial activity of the test complexes, especially when using chitosan.

For the attachment of nanomaterials or complexes with polymers on the surface of the covering material, it uses the techniques of physical and chemical fixation by cold plasma. In this area, nanomaterials and complexes with polymers have promising results in terms of achieving excellent transparency of the applied films. At the same time, preliminary tests confirmed that this technique ensures the inhibition of the growth of bacterial pathogens not only in the contact area of the cover material but also in its vicinity across the spectrum of bacterial strains using very low concentrations of test substances.

Possible H2020 2020 call:

NMBP-21-2020 Custom-made biological scaffolds for specific tissue regeneration and repair

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