Laboratory of Antibiotic Resistance and Applications of Mass Spectrometry in Microbiology

Offer

- DNA sequencing, including capillary and whole-genome sequencing, and metagenomic analysis
- Molecular typing of Gram-negative bacteria
- Detection of resistance mechanisms in Gram-negative bacteria (?-lactamases, mechanisms of resistance in fluroquinolones, aminoglycosides, colistin, etc.)
- Applications of mass spectrometry in microbiology
- Applications of Raman spectroscopy in microbiology

Expertise

- The research projects aim to execute molecular epidemiology of factors affecting dissemination of multi-drug resistance among nosocomial pathogens.
- Methodological approaches, also, include analysis of genetic carriers of resistance determinants and whole-genome sequencing.
- The second main objective of the research projects is intending in the development of new techniques for the detection and study of resistance mechanisms using MALDI-TOF mass spectrometry and Raman spectroscopy.

Research Area & Excellence

Scientific activities of Laboratory of Antibiotic Resistance and Application of Mass spectrometry in Microbiology (ARAMM) are mainly focused on mechanisms of resistance to antibiotics, especially to expanded-spectrum cephalosporins and carbapenems, in Gram-negative bacteria (Enterobacteriaceae, Pseudomonas spp.). In 2011, the members of our group demonstrated that MALDI-TOF mass spectrometry can directly detect carbapenemase activity. Also, recently, we patented a method for the identification of ?-lactamases in clinical isolates by MALDI-TOF mass spectrometry, based on their molecular weight.

Members

- Assoc. Prof. Jaroslav Hrabák, Ph.D., M.Sc.– Research Group Leader
- Constantinos C. Papagiannitsis, Ph.D.
- Kateřina Chudějová, M.Sc.
- Anna Skálová, M.D.
- Dana Králová, DiS.
- Tamara Bergerová, M.D.
- Ibrahim Bitar, Ph.D.
- Miroslava Chalupová, M.D.
- Vladislav Jakubů, M.Sc.
- Helena Janouškovcová, M.D.
- Lucie Kraftová, B.Sc.
- Veronika Pašková, M.Sc.
- Radka Walková, M.D.
- Assoc. Prof. Helena Žemličková, M.D., Ph.D.

Selected Publications

- Hrabák J., Papagiannitsis C.C., Chudáčková E.: *Detection of carbapenemases in Enterobacteriaceae: a challenge for diagnostic microbiological laboratories.* Clinical Microbiology and Infection 20, 2014: 839–853. DOI: 10.1111/1469-0691.12678
- Papagiannitsis C.C., Kotsakis S.D., Tuma Z., Gniadkowski M., Miriagou V., Hrabak J.: *Identification of CMY-2-type cephalosporinases in clinical isolates of Enterobacteriaceae by MALDI-TOF MS*. Antimicrobial Agents and Chemotherapy 58 (5), 2014: 2952–2957. DOI: 10.1128/AAC.02418-13
- Hrabák J., Papagiannitsis C.C., Študentová V., Jakubů V., Fridrichová M., Žemličková H. and Czech Participants of European Antimicrobial Resistance Surveillance Network: *First outbreaks of carbapenemaseproducing Klebsiella pneumoniae in the Czech Republic in 2011*. Eurosurveillance 2013: 18(45): pii=20626

- Papagiannitsis C. C., Studentova V., Hrabak J., Kubele J., Jindrák V., Zemlickova H.: *Isolation from a nonclinical sample of a Leclercia adecarboxylata producing a VIM-1 metallo-?-lactamase*. Antimicrobial Agents and Chemotherapy 57, 2013: 2896– 2897. DOI: 10.1128/AAC.00052-13
- Hrabák J., Studentová V., Walková R., Zemlicková H., Jakubu V., Chudácková E., Gniadkowski M., Pfeifer Y., Perry J.D., Wilkinson K., Bergerová T.: *Detection of NDM-1, VIM-1, KPC, OXA-48, and OXA-162 carbapenemases by MALDI-TOF mass spectrometry*. Journal of Clinical Microbiology 50, 2012: 2441–2443, DOI: 10.1128/JCM.01002-12
- Hrabák J., Walková R., Študentová V., Chudáčková E., Bergerová T.: *Carbapenemase Activity Detection by Matrix-Assisted Laser Desorption/Ionisation Time-of-Flight Mass Spectrometry*. Journal of Clinical Microbiology 49, 2011: 3222–3227; DOI: 10.1128/JCM.00984-11

Patent

- PV2013-473 / Nr. 304833 Method of Detection of Gram-negative Bacteria Periplasmic Space and Cell Wall Outer Membrane Proteins by Mass Spectrometry – Czech National Patent
- PV2015-847 / Nr. 307243 A method of wet deposition of a microbial culture to a solid surface intended for the taxonomic identification of cultures by means of desorption-ionization techniques of mass spectrometry
- US Patent 9,803,229: Method of detection of Gram-negative bacteria periplasmic space and cell wall outer membrane proteins by mass spectrometry

Are you interested in this expertise?

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Experts and their department

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