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Activities -2023

I. Scientific activity

1. Matrix-Assisted Laser Desorption/Ionization Time-of-Flight Mass Spectrometry (MALDI-TOF-MS) for rapid detection and typing of high-risk bacterial pathogens with potential for bioterrorist application and/or epidemic spread - ongoing project Project BG05M2OP001-1.002-0001, NCIPD, led by Assist. Prof. Iskra Tomova, MD, PhD.
2. A study of the species diversity of genus *Vibrio* and genus *Aeromonas* with clinical significance in drinking, sewage and sea waters - ongoing project BG05M2OP001-1.002-0001, BFSA and NCIPD, led by Assoc. Professor Petya Orozova, PhD.

3. National Research Program "VIHREN" funded a project 'Advances in the unknown aetiology of sarcoidosis'. For more than 100 years the causative agent of sarcoidosis is unknown and enigmatic. Our objective is to progress towards a deep understanding of the infectious aetiology of sarcoidosis through innovative approaches. Detailed microbial diversity analysis will be produced and investigated. To achieve the objective we aim to prove three hypotheses: i. we assume that sarcoidosis is a latent/persistent chronic infection and the causative agent could be resuscitated and identified in blood and affected tissues; ii. Hamazaki-Wesenberg bodies, observed in lymph nodes, have microbial origin and could be the causative agent of sarcoidosis; iii. next generation sequencing methods and bioinformatic analysis could identify in blood, lung tissue and lymph node microbiota associated with sarcoidosis.

4. Scientific Project financed by the National Science Fund "Caves as a reservoir for novel and reoccurring zoonoses - ecological monitoring and metagenomic analysis in real time". Bulgaria has one of the highest bat diversity in Europe and 93 significant underground habitats. Bats could be a reservoir of viral, bacterial, and fungal pathogens. Caves offer an environment with extreme conditions. There is a lack of detailed studies of Bulgarian caves to describe the metagenomic diversity of cave dwellings. Our project aims to develop and test an innovative approach for monitoring and predicting epidemic outbreaks of new and emerging pathogens in the environment in real-time, by applying genome sequencing and bioinformatics analysis. Three Bulgarian caves will be studied - Orlova Chuka, Devetashka, and Parnitsite.

II. Application of new methods

- Whole genome sequencing of Bulgarian isolates *Brucella melitensis, Francisella tularensis* and *B anthracis*.

- MALDI-TOF-MS analysis of *Brucella melitensis*, *Francisella tularensis* and *B anthracis* profiles and elaboration of a national database.

- Whole genome sequencing of complex samples (biopsy, blood, water, soil) and bioinformatic analysis for species identification.

- Application of MALDI-TOF-MS for analysis of blood microbiome.

- Application of electronic microscopy for Hamazaki bodies and Heinz bodies and their relation to infectious processes.

- Monitoring of endemic regions and environment for spread of bacterial pathogens.

Analysis of soils, water, death animals, etc.

- Application of MALDI-TOF-MS for analysis of blood microbiome.

- Bioinformatic analysis of sequenced complex samples and genomes.

- Investigation of the relation between gut and oral microbiome. Investigation of dysbiotic oral microbiome in cases with periodontitis.

- Analysis of bone materials for past epidemics (plague, cholera, tuberculosis, brucellosis, etc.).

- Microbiome analysis of extreme ecological niches (caves, salt mines).

V. Diagnostic and reference activities

- Primary and reference diagnosis of high-risk bacterial pathogens zoonoses (anthrax, brucellosis, tularemia), as well as cholera and Legionnaires' disease.

- Etiological clarification of communicable diseases outbreaks

- Molecular diagnostics of highly pathogenic bacteria – *F. tularensis, B. anthracis, Brucella spp, Vibiro cholera*, etc.

- Annual participation in EQAEs

- *F. tularensis, B. anthracis, Brucella spp* - INSTAND
- Legionnaires' disease and legionnaires - ELDSNet

VI. Participation in European networks and other international programs and projects for the surveillance of infectious diseases and dangerous substances:

- European Region Laboratory Task Force for High Threat Pathogens
- European Legionnaires' Disease Surveillance Network (ELDSNet)
- Joint Action to Strengthen Health preparedness and response to Biological and Chemical terror attacks. — JA TERROR'

VII. Training activities

Post graduate training at the "Microbiology" department, NCSPB for:

- „Microbiome analysis and bioinformatics" with international participation
- Microbiological diagnosis of highly pathogenic bacterial infections",
- "Legionella, Legionnaires' disease and other legionnaires - current state of the problem"