



# Lugar Center in Service of Public Health in Georgia – Challenges and Solutions



Gvantsa Chanturia, PhD

Virology and Molecular Biology Division,

R.G. Lugar Center for Public Health Research

National Center for Disease Control & Public Health of Georgia



# National Center for Disease Control and Public Health of Georgia (NCDC)

- 1937 - Establishment of the First **Plague Control Station** in Georgia
- 1992 - **Research Center of Especially Dangerous Pathogens (EDPs)**
- 1995 - **National Center for Disease Control**



# National Center for Disease Control and Public Health of Georgia (NCDC)

- 2003-2007 – Large-scale reorganization:
  - Integration of Medical Statistics Center and MoH Public Health Department into the NCDC



# NCDC-Lugar Center

- 2004 - project for construction of the reference laboratory funded by Defense Threat Reduction Agency, DoD, US
- August, 2013 – The new facility became fully operational after integration of R. Lugar Center for Public Health Research to NCDC



# Lugar Center Overview

- 2,551 m<sup>2</sup> of BSL-2; BSL-3 laboratories and ABSL-2 vivarium laboratory
- The BSL-3 – Bacteriology and Virology laboratories, and the National Repository of especially dangerous pathogens (EDPs)
- In BSL-2 – Bacteriology, Virology, Serology, Molecular Biology / Genomics, Cell culture, Parasitology, Entomology
- ABSL-2 Vivarium – not yet operational
- Lugar Center's laboratory spaces are also used by
  - Laboratory of the Ministry of Agriculture (LMA),
  - Eliava Institute of Bacteriophage, and
  - Walter Reed Army Institute of Research (WRAIR)





# Laboratory of NCDC – R. G. Lugar Center for Public Health Research



- BSL3 Facility
- Repository of EDP
- Bacteriology
- Serology
- Virology
- Molecular Biology/Genome Lab
- Parasitology
- Cell Culture
- Entomology
- Vivarium
- Walter Reed Georgia Project /Lab
- BSL3 designated area for LMA & Eliava

2 Zonal Diagnostic Laboratories –  
ZDLs

7 Local Surveillance Stations –  
LSSs

3 Labs accredited by WHO

- Polio
- Influenza
- Measles/Rubella

4 Laboratories connected to WHO  
Lab Network

- Rota viruses,
- Invasive Meningitis,
- Malaria and
- Salmonellosis



# Molecular Biology Tools at NCDC

- 1990s – PCR, PFGE typing, RAPD
- 2007 – MLVA typing (Lawrence Livermore National Lab)
- 2009 – SNP typing (Northern Arizona University)
- 2011 – Sanger Sequencing (Walter Reed Army Institute of Research)
- 2012, 2013 – Training on Next Generation Sequencing technique, DNA library preparation, Illumina MiSeq platform, by Los Alamos National Laboratory (LANL) team, Georgia
- 2013, 2014 – Next Generation Sequencing Data Analysis Workshop, LANL, NM, USA



# Sequencing Capacity at NCDC

- Illumina MiSeq platform
- ABI 3130XL Genetic Analyzer
- Data Analysis Workstations and Server
- CLC Genomic Workbench
- DNA library preparation equipment





# NCDC Local Cooperation

- National Food Agency / Laboratory of the MoA (NFA/LMA)
- G. Eliava Bacteriophage, Microbiology and Virusology Research Institute
- Public and Private Laboratories and Clinics
- Tbilisi State University
- Tbilisi State Medical University
- Georgian Agrarian University
- Ilia State University
- University of Georgia



# NCDC International Cooperation

- DTRA, USA
- CDC, USA
- WRAIR, USA
- LANL, USA
- LBNL, USA
- BIM, Germany
- PHE, UK
- WHO
- USAID
- University of Florida
- University of Oslo
- University of Maryland
- Emory University
- John Hopkins University
- Northern Arizona University

More than 160 International Collaborative Scientific Projects



# Biosafety and Biosecurity Projects Supported and Funded by EU\UNICRI

Two contracts:

- B1 – Establishment of Regional Training and Resource Centre in Biosafety, Biosecurity and Laboratory Management in the South Caucasus

## Projects Purpose:

Establishment of joint approach in Bio-safety and Bio-security (BioSS) within the region (Georgia , Turkey, Armenia, Azerbaijan)

- C4 – Biosafety and Biosecurity Risk Management for Georgia

## Projects Purpose:

Development and strengthen of Biosafety and Biosecurity management strategy at national level.



# Biology and Control of Vector-Borne Infections in Europe

- Funding Organization: European Union
- Participating organizations: 46 international partners from 22 countries
- PhBD – Phlebotomus borne diseases group

# Biology and Control of Vector-Borne Infections in Europe - Main Goals

- *Phlebotomine* species identification and study of their roles in transmission of phleboviruses and leishmaniasis
- Study of mosquito spread in new geographical zones
- Study of mosquitos and pathogens species abundance changes
- Database and risk mapping for mosquito and their disease for Europe and the surrounding regions
- Testing of the new diagnostic methods
- Establishment of a universal approach for the prediction, monitoring and early notification system of vector-borne diseases



# Discovery of a Novel Orthopox: The Reality of Emerging Zoonotic Pathogens in Georgia

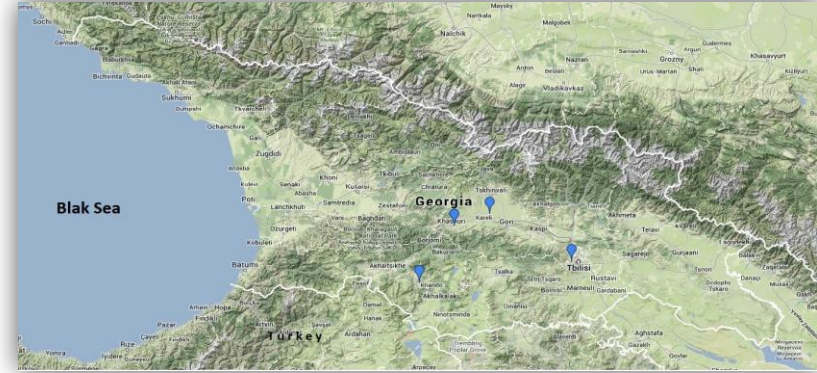
- June 2013 – outbreak of febrile rash illness in two herders in the Akhmeta region, east part of Georgia
- NCDC contacted CDC-Georgia office requesting assistance in diagnostic evaluation
- Transfer of the samples to CDC Atlanta
  - ✓ Positive on Orthopoxvirus
  - ✓ Negative on OPXV species level tests
  - ✓ Whole genome sequencing



# Planned Activities

- Long term research project based on One Health concepts
  - collaboration between NCDC with US-CDC Poxvirus Team, CDC-Georgia office and LMA
- Further characterize the new OPXV
- Develop and enhance detection, diagnosis and surveillance of OPXV in humans and animals
  - Proliferation of surveillance and prevention training to
    - Front-line medical personnel in public health centers and
    - Primary health care units

# CCHF Outbreaks in Georgia



- In 2009, for the first time in Georgia, a case of Crimean–Congo Hemorrhagic Fever (CCHF) was registered in the suburban area of capital city – Tbilisi
- In 2012 several more CCHF cases occurred in different regions of Georgia
- 13 laboratory confirmed CCHF cases registered in 2013 from the central (Shida Kartli) and southern (Samtskhe-Javakheti) parts of country
- 23 laboratory confirmed CCHF cases in 2014 in the same regions





# CCHF Outbreaks in Georgia – Response and active surveillance

- Field works - sampling of environmental (ticks) and clinical samples
- Laboratory confirmation of clinical and environmental samples:
  - CCHF RT–PCR
  - ELISA for the detection of IgG /IgM antibodies against CCHF virus
- Genetic characterization by sequencing

# Whole Genome Sequencing of Ten *Bacillus anthracis* Strains from the Country of Georgia

## Anthrax Foci in Georgia

- Active and Non-active anthrax foci registered throughout the Georgia
- Since 1881 have been registered 1683 affected points, of which 65 (3.8%) are active
- During the last decade about 30 new affected points have occurred
- The increasing number of affected areas is an important problem for the country





# Whole Genome Sequencing of Ten *Bacillus anthracis* Strains from the Country of Georgia

- Characterization of Georgian *B. anthracis* strains from NCDC repository by SNP subtyping (NAU, WRAIR)
- Ten *B. anthracis* strains from different SNP subclades chosen for WGS
- pXO1 and pXO2 plasmid composition study
- SNPs specific to Georgian isolates discovered and used to design molecular assays



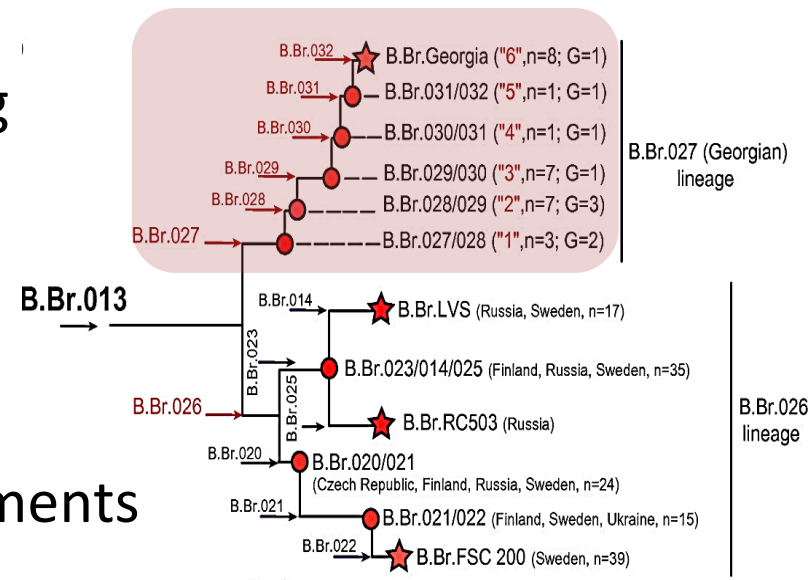
# Genetic Characterization of Extended-Spectrum $\beta$ -Lactamase Genes of *Escherichia coli* in Georgia

- Two Extended Spectrum  $\beta$ -Lactamase (ESBL) *Escherichia coli* strains isolated from the post-surgical gallbladder of the patients with chronic cholecystitis
- WGS on Illumina MiSeq Platform and Data analysis, NCDC-Lugar Center
- Sequence types identified based on seven housekeeping genes from the *E. coli* database
- Virulence and resistance gene study
- Need for epidemiological surveys to monitor outbreaks, study prevalence and track the nosocomial spread



# Comparison of Six *Francisella tularensis* Draft Genomes from country of Georgia

- Six *F. tularensis* strains from NCDC collection from different SNP and MLVA profiles (NAU, WRAIR)
- Sequence on Illumina MiSeq platform at NCDC-Lugar Center
- Data processing and read mapping
- Evolutionary analyses
- The new set of SNPs and InDels
- Difference in SNP-groups arrangements



# Where we are going – Future Plans

- To become WHO Collaborative Center in GHS and Emerging Diseases
- Bring the vivarium facility to full operational capability
- Establish a regional training center in Biosafety and Biosecurity
- Establish a regional laboratory training center
- To have more laboratories of Lugar Center involved in international external quality control (EQC) system
- Provide EQC to other laboratories

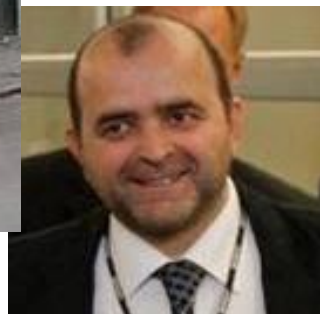
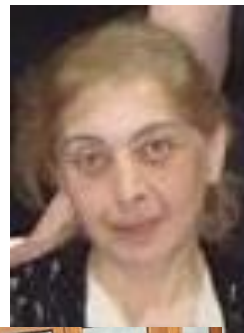


# Research Projects – future directions

- Molecular Ecology
- AMR
- Transcriptomics
- Phylogeography and Population Genomics
- Microbial forensics
- Host Response
- Wound Ecology
- Environmental Metagenomics



# Acknowledgements to NCDC team



National Center for Disease Control  
and Public Health

[www.ncdc.ge](http://www.ncdc.ge)



*THANK YOU FOR ATTENTION*

