BioPreparedness BioBank core activity: a service hub providing access to high consequence pathogens with pandemic potential and their synthetic genomes

Summary

The core activity described here is designed to underpin the project activities supported by the MCID research program and other research activities at UniBe. Up to date there is no curated repository for high consequence pathogens with pandemic potential in Switzerland that allows access to such bacterial, fungal and viral pathogens. This service package aims to fill that gap via implementation of a state-of-the-art BSL-3 biobank contained in the Biosafety Laboratory at sitem-insel as the core activity of the microbiology cluster of MCID. Moreover, within the core activity synthetic genomics will allow to access the genomes of high consequence viral pathogens via tapping into the resource of synthetic genomics-based viral genomes stably maintained in the yeast *Saccharomyces cerevisiae*. The core activity is based on a close collaboration between the Faculties of Medicine and Vetsuisse.

Background information

Biomedical research on infectious diseases of high-consequence depends on access to pathogens stored in a well-curated biobank. Access to such pathogens is highly restricted, tightly regulated due to stringent biosecurity rules and in cases impossible e.g. as experienced with the recent SARS-CoV-2 pandemic.

Overall aims and objectives

Research of the MCID on high-consequence pathogens will be facilitated by the service provided by the proposed core activity "bio-preparedness biobank". Access to viral pathogens with pandemic potential that are not available or cannot be imported will be facilitated by provision of synthetic genomes of the latter via a synthetic genomics pipeline. These genomes will allow downstream application such as virus rescue. This service will foster research on pathogenesis, diagnostics, prevention and therapies by all MCID clusters.

Resources requested

A quarter of the capacity of a fully automated robotized storage system i.e. space for 10,000 samples will be purchased for the core activity and implemented along with a digital biobank information system at the biosafety laboratory at sitem-insel. This system will ensure compliance with standards of the Swiss Biobank platform for storage and quality, comparability, accessibility, the Nagoya-protocol and interoperability of data. Since it is integrated in the BSL-3 laboratory, this biobank will ensure compliance with legal and regulatory requirements and specifications for biosafety and biosecurity.

Implementation of the activities

The activities include systematic sampling via existing diagnostic units at the University of Bern in partnership with the Spiez Laboratory (BSL-4 biobanking), and trough integration in the SwissBiobankingPlatforms, the SwissPathogenSurveillancePlatform, and the SwissStrain-Collection.

Isolates will be systematically collected and curated in coordination with the clusters/projects, requests from center members and according to WHO recommendations; we will use our network to acquire isolates according to the select agent list by the CDC and USDA. Isolates will be collected in the framework of

systematic sampling from migrants and travelers at the University emergency center Inselspital and in by systematic sampling from veterinary and human reference laboratories at UniBE.

Services to the MCID Members and UniBe scientists:

- Access to the isolates and synthetic genomics-based *S. cerevisiae* clones, harbouring genomes of high consequence pathogens; biobank isolates management by BIMS, handling of deposition requests, freezing of samples / isolates, due diligence on sample / isolate requests including MTA, etc. Ecogen applications and permits from relevant authorities for new organisms, sequencing coordination for isolates of interest, build-up and maintenance of network, quality control & transport/shipment of samples.
- Consultation service to MCID members on biobanking and synthetic genomics-based solutions
- The activities further include management and picket organization, logistics including packaging, dangerous goods shipment and/transport.
- Up to 10 isolates / year can be fully sequenced based on scientific need and/or upon request.
- Additionally, we will store synthetic genomics-based *S. cerevisiae* clones harbouring genomes of current pandemic virus isolates and viruses with pandemic potential, which is a new avenue for long term storage and subsequent rescue of high consequence viruses. The generation of viral genomes will be done according to the needs of the MCID members and as a core activity will ensure the swift generation of clones at any time.

Impact and potential for promoting scientific innovation, both inside and outside the field

The service provision laid out here will allow researchers to access pathogens with pandemic potential to facilitate research projects in the field of pandemic preparedness including development of diagnostics, experimental models, vaccine studies, susceptibility testing etc. and prevent time-consuming endeavors to get hold of isolates and to confirm the latter freeing up time to focus on their scientific projects. The management of administrative paperwork and harmonized legal documents associated with the isolates will provide an unambiguous way forward with regards to upcoming intellectual property rights of the MCID and the University of Bern.

Management of the project

The proposed service activities will be coordinated by Microbiology members Jörg Jores and Stephen Leib, who are heading institutes with diagnostic service units within the Faculties of VetSuisse and Medicine respectively. They will get support from their scientific and administrative staff. The staff involved in the activities will hold monthly meetings to discuss the progress and the further course of action. Further, annual project reports highlighting the achievements and the financial state of the project will be submitted.