The EU Framework Programme for Research and Innovation

HORIZON 2020

AI for Genomics and Personalised Medicine

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Policy Context

- A coordinated European approach to the human and ethical implications of AI.
- Creating the right environment that can promote data-driven systems;
- Establishing requirements for robust and safe AI;
- Stimulating the development of AI driven by the users needs;
- A proper legislative including privacy framework.
- Health and digitalization as priorities of the new Commission, “a Europe fit for the digital age”.
- Future investment in Research and Innovation through Horizon Europe.
The signatory Member States commit to collaborate on the secure and authorised access to national and regional banks of genetic data and other data relevant for health.

The declaration foresees to:

• Bring together fragmented infrastructure and expertise supporting a shared and tangible goal: At least one million genomes accessible in the EU by 2022;

• Leverage and maximise the investments already made by Member States at national and EU level, particularly in sequencing, biobanking and data infrastructure;

• Reaching a larger cohort that will provide a sufficient scale for new clinically impactful research.
European Council conclusions on Personalised Medicine (PM) for patients (2015/C 421/03)

"Personalised medicine refers to a medical model using characterisation of individuals’ phenotypes and genotypes (e.g. molecular profiling, medical imaging, lifestyle data) for tailoring the right therapeutic strategy for the right person at the right time, and/or to determine the predisposition to disease and/or to deliver timely and targeted prevention"

Definition developed by the Advisory group for the H2020 Health, demographic change and well-being challenge
COVID-19 Research Data Platform

Accelerating research through data sharing

**Sequences**
Raw and assembled sequences related to the COVID-19 outbreak, including outbreak isolates and records relating to coronavirus biology. Includes extensive sampling information.

**Expression data**
Gene and protein expression data of human genes implicated in the virus infection of the host cells. Identifying cell types and genes with highest expression in SARS-CoV-2 infections.

**Proteins**
Curated functional and classification data on the SARS-CoV-2 protein entries and associated protein receptors.

**Structures**
SARS-CoV-2 protein structures, highlighting important structural features to support the development of treatments and vaccines.

**Literature**
Search for the latest literature about SARS-CoV-2.

**Other resources**
A range of other resources for studying the SARS-CoV-2 coronavirus and the COVID-19 disease

**About this portal**
The COVID-19 Data Portal was launched in April 2020 to bring together relevant datasets for sharing and analysis in an effort to accelerate coronavirus research. It enables researchers to upload, access and analyse COVID-19 related reference data and specialist datasets as part of the wider European COVID-19 Data Platform.

**Share new COVID-19 data**
Contact our curator teams, who will assist you with submitting your data to EMBL-EBI repositories.
COVID-19 Horizon2020 projects

Rapid interaction profiling of 2019-nCoV for network-based deep drug-repurpose learning (DDRL)

Objective

We aim to identify approved drugs that can be repurposed for the treatment of 2019-nCoV using interactome profiling and deep-learning. We will deploy rapid high-throughput protein-protein interaction mapping and computational protein-RNA interaction predictions to chart the coronavirus host interactome network (Co-HIN), which will become a public resource for translational and basic coronavirus research. Few months after project start, Co-HIN will serve as input into an existing deep-learning model to identify approved drugs that are likely effective against 2019-nCoV, which will be validated in in vitro and in vivo systems. In the second stage we will experimentally determine the matrix of viral protein alleles vs. variants of the interacting human proteins to understand how human and viral natural variations jointly mediate disease severity in different individuals. These data will be integrated with epidemiological and human genomics data to improve risk management and improve preparedness for future coronavirus outbreaks. Overall, we aim to achieve the following objectives: - Map the protein interactome of 2019-nCoV and related Coronaviridae with their human host - Generate the allelo interaction matrix and relate differences to epidemiological data - Develop a microarray-based patient screen to detect exposure to 2019-nCoV and identify immunogenic epitopes - Identify 10 approved drugs that are most likely efficient against 2019-nCoV using network integration and deep-learning - Validate drug candidates in in vitro and in vivo systems

Programme(s)

H2020-EU.3.1.3 - Treating and managing disease

Topic(s)

SC1-PHE-CORONAVIRUS-2020 - Advancing knowledge for the clinical and public health response to the 2019-nCoV epidemic

Project information

RiPCoN
Grant agreement ID: 101003633
Status
Ongoing project
Start date 1 April 2020
End date 31 March 2023
Funded under:
H2020-EU.3.1.3
Overall budget: € 1 230 635
EU contribution € 1 230 635
Coordinated by:
HELMHOLTZ ZENTRUM MUNICH DEUTSCHES FORSCHUNGSENZTRUM FUER GESUNDHEIT UND UMWELT GMBH
Germany
COVID-19 Horizon2020 projects

EXasScale smArt Platform Against paThogEns for Corona Virus

Objective

The EXSCALATE4CoV (E4C) project aims to exploit the most powerful computing resources currently based in Europe to empower smart in-silico drug design. Advanced Computer-Aided Drug Design (CADD) in combination with the high throughput biochemical and phenotypic screening will allow the rapid evaluation of the simulations results and the reduction of time for the discovery of new drugs. Against a pandemic crisis, the immediate identification of effective treatments have a paramount importance. First, E4C will select through the EXSCALATE platform, the most promising commercialized and developing drugs safe in man. Second, select from >500 billion molecules new pan coronavirus inhibitors. The huge computational resource, therefore the activities will be supported and empowered by three of the most powerful computer centers in Europe: CINECA, BSC and JÜLICH. The Swiss Institute of Bioinformatics (SIB) will provide the homology 3D models for the viral proteins. The Fraunhofer IME will provide the BROAD Repurposing Library and biochemical assays. Phenotypic screenings will be run by KU LUEVEN to identify molecules capable of blocking virus replication in in vitro models. IIMCB and ELECTRA will determine the crystal structure of at least one coronavirus functional proteins to evaluate the structural similarities with other viral proteins. EXSCALATE4CoV consortium will identify safe in man drugs repurposed as 2019-nCoV antiviral and will propose to the EMA innovation task force (ITF) to define a preliminary development strategy and a proposal for a registration path. The E4C project will share promptly its scientific outcomes with the research community by using established channels: ChEMBL portal for the biochemical data, the SWISS-MODEL portal for the homology models of viral proteins WT and mutants, the Protein Data Bank for the experimentally resolved protein structures, the EUDAT for the data generated by in-silico simulations and the E4C project website.

Programme(s)

H2020-EU.3.1.3. - Treating and managing disease

Project information

EXSCALATE4CoV

Grant agreement ID: 101003551

Status

Ongoing project

Start date: 1 April 2020
End date: 30 September 2021

Funded under:
H2020-EU.3.1.3.

Overall budget: € 2,970,875
EU contribution: € 2,970,875

Coordinated by:
DOMPE FARMAEUTICI SPA
Italy
Thank You
Articles and videos on our activities

- Perspective for the Journal Personalised Medicine: 'Enabling personalised medicine in Europe by the European Commission’s funding activities'


- Video 'How co-operation paves the way for personalised medicine', issued by the American Society for Human Genetics (ASHG) for the ASHG conference in Orlando, October 2017: https://youtu.be/vSpSwLZ54nY

- Personalised Medicine and the regional dynamic session of EU Research and Innovation Days
AI in Genomics: delivering personalized medicine

Dr N.S. Hekster
IBM Watson Health
May 5th, 2020
What are companies doing to support personalized medicine by means of AI?

- Research
  - Medical literature syntactic/semantic search
  - Smart cohort selection for clinical trials
  - In silico simulations and predictions
  - Repurposing of drugs

- Pharmaco-, nutrigenomics
  - Individualized drugs or food prescription
  - Predicting adverse drug or food interactions and reactions
  - Pharmacovigilance
  - Precision dosing

- Diagnosing rare diseases
  - E.g., helping pediatricians – AI and physical features

- Digital twins (early stage)
  - Future drug prescription, geno/phenotyping, epigenetic research
  - AI helps in the design of digital twins to weave together organs' physiological data to output a 3D image.
How easy is for patients to access those new technologies?

- **We need to build trust and show evidence**
  - Sound scientific research in real clinical environments
  - Prospective testing, which takes time
  - FDA clearance
  - Include the whole ecosystem of health stakeholders

- **DNA testing companies do exist**
  - E.g. 23andMe/GSK, Dante Labs, AffinityDNA, ... and many more
  - Opportunities for AI

- **Development of lifestyle or disease coaches in an app**
  - E.g. diabetes type 2
MedTech Europe’s views on Artificial intelligence

Angel Martin (Johnson & Johnson)
Chair of MedTech Europe Working Group on AI
Precision medicine

Predictive

Preventive

Personalized

Participatory

Figure 1. Role of artificial intelligence in traditional healthcare data analytics, and in precision medicine. Addressing key issues in healthcare (e.g. misdiagnoses, overtreatment, one-size-fits-all approaches, repetitive, decreased productivity, under-utilized data, significant cost & spending), and finding key biomarkers to provide economic and personalized treatment by intelligently analyzing heterogeneous data.

Our view

Promise in the medtech sector

- Earlier disease detection, more accurate diagnosis, new patterns on human physiology, personalised diagnostics and therapeutics
- Ability to learn from real-world use and experience, and its capability to improve its performance

Challenges

- Data access and fragmentation
- Literacy and skills
- Trust

Incentivizing AI

- Building data ecosystem and infrastructure for AI
- Skills for healthcare professionals, citizens and data scientists
- Enabling sectoral regulatory framework based on MDR/IVDR
An ethical framework for AI

Our commitment to supporting the building of ethical and trustworthy AI systems

- HLEG’s Ethical AI principles deliver a solid framework

While all are important, there are few principles which stand out for healthcare

1. Accountability
2. Human agency & oversight
3. Transparency
4. Technical robustness & safety

Regulating ethical AI in healthcare

- A patient-centric risk-based approach for AI and consider a governance framework that would address intended oversight, proportionality and risk management mechanisms.