



p-medicine

From data sharing and integration via VPH models to personalized medicine

The **p-medicine** project aims at developing a secure IT infrastructure, innovative tools, and VPH models for decision support to accelerate the progression and implementation of personalized medicine. All services, models and tools are clinically driven. They will be validated in pilot cancer trials within the project's lifetime and will be adaptable to other clinical settings thereafter.

Objectives of the project

Medicine is undergoing a revolution transforming the nature of healthcare from reactive to preventive. This change is catalyzed by a new systems approach to disease which focuses on integrated diagnosis, treatment and prevention of disease in individuals.

p-medicine aims at creating innovative and integrated technological solutions that will facilitate the translation from current practice to personalized medicine by addressing the following objectives:

- Combine clinical, molecular biological and genomic data in individual patients
- Create a collaborative environment facilitating clinically driven multi-scale VPH modelling
- Deploy clinical trials for VPH adaptation and validation purposes leading to decision support
- Build a data warehouse and a p-medicine workbench to run VPH simulations
- Exploit the potential of high performance computing and cloud storage
- Improve semantic interoperability and data integration
- Increase the quality of data mining in biomedical research
- Establish a service framework for accessing biomaterial resources
- Empower patients through respective tools
- Establish a legal & ethical framework
- Link the p-medicine environment with important European Research Infrastructure Initiatives
- Develop training and educational e-Learning tools
- Develop a business plan to further develop p-medicine into a self-sustaining entity

Project Description

Information arising from post-genomic research and combined genetic and clinical trials on the one hand, and advances from high-performance computing and informatics on the other, are rapidly providing the medical and scientific community with an enormous opportunity to improve prognosis of patients with cancer by individualizing treatment and moving forward to personalized medicine. At the same time the concept of the Virtual Physiological Human (VPH) seeks to develop a scientific methodological and technological framework within which it will be possible to construct models of the human body as a single complex dynamical system.

In p-medicine our emphasis lies on formulating an open, modular framework of tools and services that can be adopted gradually including:

- Efficient and secure sharing and handling of large personalized data sets, enabling demanding VPH multiscale simulations (in silico oncology)
- Building standards-compliant tools and models for VPH research, drawing on the VPH Toolkit
- Providing tools for large-scale, privacy-preserving data and literature mining

The p-medicine tools and technologies will be validated within concrete clinical settings. Pilot cancer trials have been selected based on clear research objectives, emphasising the need to integrate multilevel datasets, in the domains of Wilms tumour, breast cancer and leukaemia.

SCENARIOS

In p-medicine three scenarios in which data need to be accessed and shared will be addressed:

1. the composition of large, pseudonymized/anonymized datasets from multiple sources including clinical trials, used to perform inductive reasoning,
2. the collaborative development and validation of new VPH models and simulators, and
3. the use of data obtained from a single patient to run a simulation workflow in support of a clinical decision making process.

Three cancer types (Wilms Tumour, Breast Cancer, Acute Lymphoblastic Leukaemia) are chosen that will serve as use cases to validate the proposed p-medicine environment.

In connection with the scientific/technical dimension of the work, p-medicine will develop a data warehouse and a workbench with a tools repository. Heterogeneous pseudonymized/anonymized data from different origins will be stored in the data warehouse for further use by the scientific community. Clinical data will be exploited coming from hospital information systems and clinical trials. The legal framework of the project, which is based on the results of the former EU-project ACGT, will be further developed and guarantee data privacy and security.

VPH models and IT tools within a secure infrastructure pave the way towards personalized medicine

Most important for p-medicine are validated tools and services that provide interfaces to allow interoperability with biobanks, genetic databases, medical imaging systems and the data warehouses. These tools have to meet requirements to be used in large international multicentre GCP-conform clinical trials. They will be integrated into existing systems used by ECRIN (European Clinical Research Infrastructures Network) and other Research Infrastructures. Moreover, there is a close cooperation with the project VPH-Share. R&D work done in other European funded projects like ACGT, ContraCancrum, TUMOR, CONTRACT and ECRIN will be exploited as much as possible to guarantee complementary and additional benefits. It is the final goal of this project to develop the p-medicine environment to a self-sustaining entity fostering further the vision of personalized medicine

Expected Results & Impacts & Preliminary results

In developing an innovative and integrated technological solution to enable personalized medicine, the project is expected to have significant and far-reaching implications:

- On the patient level: Improved life expectancy and quality of life through individualization of treatments.
- On the basic science level: Advancement of the multi-scale formulation of living matter dynamics and extension of knowledge to generate more precise VPH models.
- On the technology level: Integration of heterogeneous data generated in life science research and their pertinent use in multi-scale VPH models within a newly developed user friendly technological platform in compliance with legal requirements.
- On the educational level: researcher, medical practitioner and interested patient education through multi-dimensional visualization of tumour dynamics and treatment response.
- On the societal level: better and rationalized health services for the citizen
- On the financial level: lowering of the treatment cost per patient by avoiding non effective treatment schemes and/or schedules through the utilization of the expectedly rational predictions of the VPH multi-scale and patient individualized models.



p-medicine
From data sharing and integration via VPH models to personalized medicine

Project co-ordinator:
Saarland University, Germany

Contact person:
Norbert Graf
Tel: +49 6841 1628397
Fax: +49 6841 1628302
Email: graf@uks.eu
Website: www.p-medicine.eu/

- Partners:**
- Universität des Saarlandes (Germany)
 - European Research and Project Office GmbH (Germany)
 - Foundation for Research and Technology – Hellas (Greece)
 - University College London (United Kingdom)
 - Fraunhofer-Gesellschaft zur Förderung der angewandten Forschung e. V. (Germany)
 - Gottfried Wilhelm Leibniz Universität Hannover (Germany)
 - Custodix NV (Belgium)
 - Philips Electronics Nederland B.V. (the Netherlands)
 - European Clinical Research Infrastructures Network (ECRIN) represented by Heinrich-Heine-Universität Duesseldorf (Germany)
 - Institute of Communication and Computer Systems (Greece)
 - Universidad Politécnica de Madrid (Spain)
 - Christian-Albrechts-Universität zu Kiel (Germany)
 - Istituto Europeo di Oncologia SRL (Italy)
 - ecancermedicalsecience AG (Switzerland)
 - University of Oxford (United Kingdom)
 - Biovista (Greece)
 - Swiss Institute of Bioinformatics (Switzerland)
 - National University Corporation Hokkaido University (Japan)
 - Poznan Supercomputing and Networking Center (Poland)

Timetable: from February 2011 to January 2015

Total cost: € 18,481,405

EC funding: € 13,329,908

Instrument: IP

Project Identifier: FP7-ICT-2009-6-270089

KEYWORDS

Personalized medicine, VPH (models & simulation), IT-infrastructure and tools, Clinical decision support, Data mining, Biobanking, Legal & ethical framework, Patient empowerment