

The Osteoporotic Virtual Physiological Human

Integrated project #FP7-223865

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At the end of the second year of its activities, the Osteoporotic Virtual Physiological Human – VPHOP- research project has made crucial steps upfront for the achievement of the project’s objectives. The involvement of patients, the use of advanced ICT resources and the collaboration of important clinical centres are only few of the reasons, which have made these successful accomplishments possible.

The main goal of VPHOP is the creation of a patient-specific “**hyper-model**”, a complex

model of the human body, which will be able to simulate the interaction of important physiological events that happen at different scale levels. This hyper-model, applied to osteoporotic patients, will predict their personalised risk of bone fracture and the progress of their disease, in relation to selected pharmaceutical or interventional treatments.

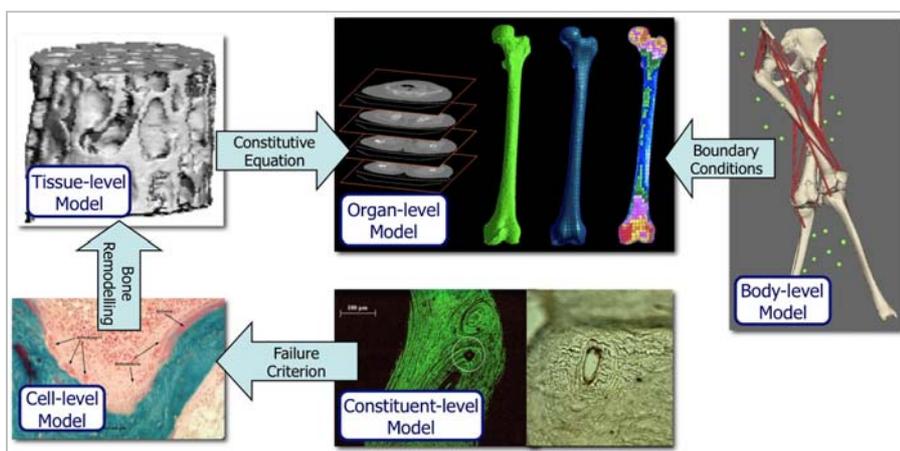


Fig.: schematization of the VPHOP hyper-model

The personalised-predictive approach applied to the osteoporosis disease is becoming of great interest among the scientific community. This was confirmed by the large attendance at the [VPHOP satellite symposium](#) organised during the opening day of the most important clinical convention on osteoporosis worldwide, the IOF World Congress on Osteoporosis & 10th European Congress on Clinical and Economic Aspects of Osteoporosis and Osteoarthritis. More than 400 qualified clinical experts, from all over the globe, were actively present at the event.

During 2010, the project has started the collection of clinical data that will be used to assess the value of its technology in a real-life clinical setting. This was made possible thanks to the collaboration of four leading clinical centres at the European level, [Université de Genève](#), [Istituto Ortopedico Rizzoli](#), [Charité - Universitätsmedizin Berlin](#) and [Institut National de la Santé et de la Recherche Médicale](#), which recently started to enrol patients in the VPHOP clinical data collection protocol.

This protocol defines which parameters should be taken into consideration for patient selection, such as age, sex, and the presence of antecedent fracture in the patient’s clinical record. It also identifies the most appropriate tests that the patients have to undertake in order to obtain a complete scenario of the individual specifications: blood samples,



physical activity tests, DEXA and optional radiographic examinations such as CTs. During this first stage of the clinical assessment, we developed an *ad hoc* system based on the Open Source software Open Clinica and on the biomedical data management and sharing service [Physiome Space](#), to exchange the data resources among the different clinics involved in the validation process. The data can now be saved in a secure on line database in which the information of the patients are stored in an anonymous and easily exchangeable format.

As a preliminary step towards the creation of the VPHOP hyper-model, the definition of the five different sub-models on which the hyper-model will be based was completed. The sub-models correspond to the various scale levels of reference: body, organ, tissue, cell and interventional treatment levels. The validation of the five sub-models is now ready to start and will be performed using the patient data supplied by the VPHOP clinical centres.

The VPHOP project is also progressing thanks to the strong involvement of the ICT part of the project. The Italian partner [SCS](#) has supplied the CINECA supercomputer to drive the first bone-fracture-prediction test. The supercomputer available to the project purposes effectively works with the power of about 2500 normal personal computers all together, allowing the processing of patients' data much faster.

With the conclusion of the second year of the project, the current state of the research is perfectly in line with the schedule, ready to face the future challenges, in particular the first bone-fracture-prediction test planned for the next few months. As soon as the results are ready, it will be possible to fully comprehend not only the value of VPHOP technology, but also its likely impact in the real-life clinical setting.

More information on the VPHOP:

VPHOP or Osteoporotic Virtual Physiological Human is a European osteoporosis research project within the framework of the Virtual Physiological Human initiative. The project is co-funded by the European Union under the 7<sup>th</sup> Framework Programme of the Directorate General for Research. Until August 2012, the VPHOP research project will develop, validate and deploy the next generation of technology to predict the absolute risk of fracture in patients with low bone mass, thereby enabling clinicians to provide better prognoses and implement more effective treatment strategies (both pharmacological and interventional).

The aim of VPHOP is to develop a multiscale modelling technology based on conventional diagnostic imaging methods that makes it possible, in a clinical setting, to predict for each patient the strength of his/her bones, how this strength is likely to change over time, and the probability that he/she will overload his/her bones during daily life. With these three predictions, the evaluation of the absolute risk of bone fracture will be much more accurate than any prediction based on the external and indirect determinants used in current clinical practice.

Useful links:

<http://www.vphop.eu/>

[http://www.biomedtown.org/biomed\\_town/vphop/reception/media/](http://www.biomedtown.org/biomed_town/vphop/reception/media/)

[http://en.wikipedia.org/wiki/Virtual\\_Physiological\\_Human](http://en.wikipedia.org/wiki/Virtual_Physiological_Human)

