

To: Dr. Peteris Zilgavis  
Head, ICT for Health Unit

cc: Jean Marie Auger  
PO, VPH-FET project  
Joël Bacquet  
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Rima Sondaite Van Soest  
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ICT for Health Unit

Brussels, 26 November 2010

**Subject: reply to your letter protocol INF/SO/H1/JB Ares dated 5 November 2010**

Dear Dr. Zilgavis:

With reference to your letter in subject addressed to Profs. Coveney, Clapworthy and de Moor, respectively coordinators of VPH NoE, VPH-FET, and ARGOS, regarding the research agenda for VPH research development, we would like to clarify the following points.

In comparison to other research endeavours, the VPH initiative is a well-coordinated action, steered by an open, lively and committed community that meets on multiple occasions each year, including at least once per year in plenary form during the annual meeting of the VPH Network of Excellence. This formal and informal coordination both ensures that we, as a community, stay abreast of the development in related initiatives, and enables us to foresee and avoid potential duplication of effort.

With respect to the research agenda of the VPH initiative, the primary reference document for scope and vision is the VPH Research Roadmap that was elaborated under the coordination of the STEP action at the end of FP6; to ensure its continued relevance in the face of rapid change, it is updated and extended every year by the VPH NoE. In particular, during the Strategic Consensus Meetings that this year preceded the VPH 2010 conference, the whole community discussed the strategic actions required to further develop the VPH vision, and to ensure that it is maximally deployed and exploited.

During the STEP support action, it became evident that the VPH vision included some low-hanging fruits, which could be central to the research funded by the ICT for Health Unit, to achieve significant clinical and industrial translation in relatively short time. Examples are the applications of integrative modelling technology to the diagnosis, prognosis and treatment planning of important diseases such as cancer, heart failure, osteoporosis, Alzheimer's disease, etc. However, it was also evident that the same vision raised some long-term challenges that required more fundamental, blue-skies technological research. The STEP officers explored with various European research-funding programmes the opportunities that

could be given in this direction, and found some interest in the FET Proactive unit. Since the VPH Research Roadmap and subsequent updates have not specifically focused on this perspective, we submitted a proposal to the FET Proactive programme, for a VPH-FET Support Action specifically aimed at identifying the most interesting technical challenges posed by the VPH vision, according to two main criteria:

- a) grand challenges in ICT research that, if solved, could dramatically enhance the full realisation of the VPH vision (ICT for VPH);
- b) new technologies that could have an impact beyond the VPH domain (VPH for ICT).

These criteria support the objectives of the FET Programme to be “*the ICT incubator and pathfinder for new ideas and themes for long-term research in the area of information and communication technologies*”. The VPH-FET proposal targets visionary ideas, that are not yet sufficiently mature to be fully explored in applied programmes, but which require some incubation and fundamental research.

The approach of VPH-FET is coherent with the FET Proactive programme, which “*aims at focusing resources on visionary and challenging long-term goals that are timely and have strong potential for future impact. These goals provide a common strategic perspective and a focal point around which a critical mass of research can be assembled and synergies developed*”. In particular, we hope to establish the VPH as a foundational technological research topic, similar to robotics or telecommunications, with a breadth of study and impact not only on human health, but also in other contexts in which VPH innovations can be applied effectively.

Another element that emerged previously in the original VPH Research roadmap was the need for infrastructures entirely devoted to the VPH. The ICT for Health Unit has recognised the need for VPH-specific infrastructures, and recently funded two large projects (VPH-Share and P-Medicine) that specifically target this aspect. However, these are not physical infrastructures, but organised clouds of databases, services, collections, portals, simulation engines, etc., accessible via the Internet; similar initiatives have been funded in the USA. They are collectively known as *VPH Infostructure* in Europe [this is a term coined by MV, but it is not current in EU-wide infrastructure circles so it could easily be thought of as a typographical error – most of us use the more common terminology “e-infrastructure” to subsume both the software **and** the hardware needed to realise this: without the latter, the entire undertaking would be stillborn], and *VPH Cyberinfrastructure* in the USA. As implied by the difference in names, we need an international strategy to ensure that various pieces of the VPH cyberinfrastructure that are developed worldwide are designed to be interoperable.

A significant problem of international relevance is the long-term sustainability of such cyberinfrastructures, with respect to maintenance, operations, and outreach toward clinical and industrial users. An absolutely central requirement is that the infrastructure, which has many **physical** components including computers, networks and storage that have all been provisioned by the European Commission in conjunction with nation states, should be made available to those active in this field in a manner that is suitable to meet the needs of their work.

An opportunity to address these issues was provided by the ARGOS observatory on eHealth, funded by the DGRELEX and coordinated by Dr. Georges de Moor. Currently, Dr. Marco Viceconti and a US colleague (Prof. Andrew McCulloch, UCSD) are coordinating the VPH working group of the ARGOS action. This working group has elaborated a position paper that highlights the importance of developing a fully interoperable and *integrable* cyberinfrastructure worldwide, and the need for international governance model for such a

global service that will ensure its long-term sustainability. The working group met recently in Washington, DC, and is now starting to elaborate a policy brief on these arguments, that will be presented at the ARGOS Finale, to be held in April 2011 in Brussels. The policy brief will be concerted with the coordinators of two VPH infrastructure projects (VPH-Share and P-Medicine), and with the leaders of related European initiatives such as the European Bioinformatics Institute.

Thus, the VPH community's roadmap exercises conducted under the VPH NoE and as part of the ARGOS and VPH-FET actions, are well coordinated and complementary.

In your letter you also mention the "Digital Patient" roadmap in Call 7. The work programme describes this term as *"a digital representation of the integration of the different patients-specific models for better prediction and treatment of diseases in order to provide patients with an affordable, personalised and predictive care, and requires that in the support action "a roadmap should be developed i) to consolidate the research so far, ii) to capture and quantify the needs and iii) to develop a vision and a sound ICT research agenda around the Digital Patient"*. Such a definition is sufficiently broad to allow fairly different declinations; but ultimately the review process will select the best proposal, which will enable us to define the scope of this new roadmap action.

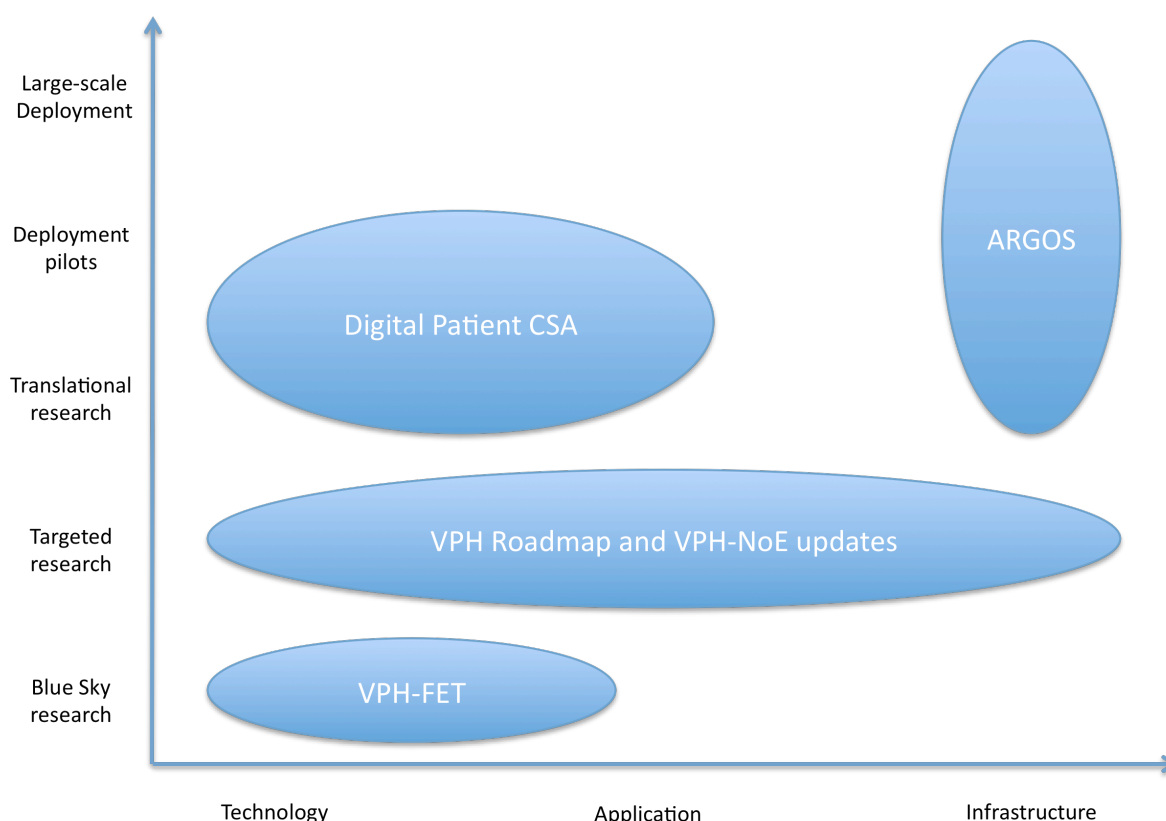
Here, we can only refer to what emerged from the VPH community during our periodic consensus processes. In particular, the 2009 update of the VPH research roadmap elaborated by the VPH NoE includes a description of "The 'Digital Me' Vision": *"The vision we have is of a "DIGITAL ME", a coherent digital representation of each patient that is used as an integrative framework for the consolidation within the European research system of fundamental and translational Integrative Biomedical Research and the provision to European Citizens of an affordable Personalised, Predictive, and Integrative Medicine"*. Later on in the same document, we wrote: *"The vision of a "digital me" that contains all my healthcare information, safely managed for access by the various biomedical professionals with my approval, communicated with all my wearable and implanted technology to constantly monitor my health status and informing me, my family and friends, or my healthcare providers of alarming events, supporting the collaboration of various specialists around my complex systemic diseases, and used with all my data to predict the future development of my health in order to facilitate disease prevention and a fully self-aware lifestyle, is a powerful vision. But the challenges are huge"*.

Under this perspective we believe the Digital Patient research roadmap should look at three distinct but related challenges:

- a) To provide to medical professionals and biomedical researchers an advanced user interface based on the digital patient metaphor, that makes it easier to cope with large amounts of information related to different organ systems, different space-time scales and different modalities.
- b) To provide healthcare providers with an ICT environment capable of recovering and integrating all of the health information available for each patient into a coherent whole.
- c) To provide to biomedical researchers and to clinical research settings the technology to capture existing knowledge into digital artefacts in the form of predictive models, and to compose such digital *quanta* of knowledge into integrative models of complex systemic mechanisms, producing new knowledge from existing data.

While the VPH is, and will remain, a strategic research challenge for eHealth in the coming years, it is clear that any deployment scenario will have to see a convergence of biomedical informatics, personal health systems and the early outputs of VPH research. In our opinion, the Digital Patient CSA should liaise with the adjacent communities and, thereby, “reach out” to develop a common vision of eHealth 2020 in which the concept of *integrability* of data and information, and the possibility to capture knowledge into reusable and integrable digital artefacts, will make the idea of the Digital Patient possible and deployable.

In order to make it clearer the relative positioning of each roadmapping project, the following illustration might be helpful, especially to visualise where are the gaps.



From this representation, it is evident that, besides the gap in the area of large-scale deployment, for both technologies and applications, which would follow a phase of deployment pilots, the biggest gaps are at the level of blue skies research for applications (which will only be partially addressed by the VPH-FET action) and for infrastructure. For the first, it is important to work closely with the DGRTD Health directorate which, while not itself funding ICT research, should accept that research projects on medical technology that focus on biomedical applications may include technologies that incorporate ICT, possibly developed in projects funded by the ICT programme.

For the infrastructure aspect, the need for a blue-skies research roadmap that explores what radical innovations could be made at the level of eInfrastructures to boost the VPH agenda should probably be endorsed by ESFRI.

With respect to FP8, we delegate to the VPH Institute, the not-for-profit organisation that is being established as a permanent representative of the VPH community, the responsibility for elaborating a formal recommendation relative to the continuation of VPH research, possibly in collaboration with industrial and professional organisations. Here, we would like to stress that after five years it is now clear that the concept of the Virtual Physiological Human is a revolutionary one, of such breadth and depth that its potential impact is not yet fully charted. Thus, we hope that the VPH will be seen as a transversal theme for the FP8 work programmes. In particular, we propose that:

- the “H1 - ICT for Health” and “H3 - ICT for Inclusion” units promote research related to the deployment of the VPH vision to the solution of healthcare and quality of life challenges; ideally, this should be done in coordination with Directorate F (DGRTD Health) that could promote research programmes for the clinical evaluation of VPH-based technologies;
- the “F1 – FET Proactive” unit promotes technological research around some fundamental challenges to the VPH vision;
- the next ESFRI Roadmap includes a specific reference to the VPH Cyberinfrastructure, and the “F3 – Infrastructures” unit promotes the development and deployment of such an infrastructure (large parts of which will be real, with other components being “virtual”);
- the “G2 – Microsystems” unit promotes micro and nano systems that embed, or are controlled remotely by, simulation components, to develop next-generation systems for biomedical data acquisition and advanced nano systems for treatment;
- the “E5 - Cognitive Systems, Interaction, Robotics” promotes a broader programme on *embodied intelligence* where the modelling of the neurosensory and neuromotor systems, à la VPH, are combined with cognitive modelling.

We hope that this information is clear and sufficient but, if not, please feel free to contact us for further details. If it is seen appropriate and useful, we could consider organising a physical meeting in Brussels in the New Year, where we could present in much greater detail the VPH vision and how it is being articulated in the various actions and roadmaps.

Yours sincerely,

Gordon Clapworthy, coordinator of the VPH-FET project

Peter Coveney, coordinator of the VPH NoE project

Georges de Moor, coordinator of the ARGOS project

Marco Viceconti, Executive Director of the VPH Institute