

## GUEST EDITORIAL PREFACE

*Eric McAdams, Institut des Nanotechnologies de Lyon, Villeurbanne Cedex, France*

*Claudine Gehin, Institut des Nanotechnologies de Lyon, Villeurbanne Cedex, France*

*Chris Nugent, University of Ulster, Newtownabbey, Co. Antrim, Ireland*

*Norbert Noury, Institut des Nanotechnologies de Lyon, Villeurbanne Cedex, France*

It was our pleasure to welcome the pHealth community to the beautiful and dynamic city of Lyon and host the very stimulating and productive 8th International Conference on Wearable Micro and Nano technologies for Personalised Health, pHealth'2011, 29th June – 1st July 2011.

### WHAT IS pHEALTH?

Modern healthcare systems have generally evolved around the treatment of acute disease and are therefore largely organised to cope with patients' episodic and acute needs. Chronic conditions have now overtaken acute problems, constituting the major, and growing, healthcare burden. Unfortunately, using a reactive acute care model to address the needs of a population that now suffers primarily from chronic conditions, i.e. waiting until something goes seriously wrong rather than optimally managing the chronic condition on an ongoing basis,

leads to excessive, inefficient and ineffective use of secondary care services. As a consequence, chronic conditions, such as cardiovascular disease, cancer, diabetes and obesity, now consume up to 75-85% of health and social care expenditure in developed countries, causing a growing economic strain on the world's healthcare systems. For example, France presently spends an estimated 3,600 USD per person per year on healthcare. This is an estimated 11% of its GDP.

It is widely agreed (by, for example, the World Health Organisation and the European Commission) that it is imperative that healthcare leadership implement a more sustainable form of care, improving healthcare quality whilst reducing unnecessary costs. This is to be achieved by shifting away from today's reactive model of care to an integrated approach which enables, encourages and supports individuals and their families to continuously monitor and manage their health from the comfort of their homes,

cars and even work place, avoiding, to a great extent, costly acute intervention. The emphasis now is therefore on “self-management”, “personalised health”, “pervasive healthcare” and “preventative healthcare”; terms reflecting key aspects of the new approach.

It has been shown that Ambient Assisted healthcare delivery, where appropriate, is much less costly and the patient’s perceived quality of life is generally much higher. It is interesting to note that, even in cases where the elderly know that they are more at risk, when given the choice, they prefer to continue to live at home, even on their own, rather than opting for some form of institutionalised care .

Home-based care is less expensive on a ‘per day’ basis and more appreciated by the patient. More importantly, it is generally more effective, therapeutically and financially, to encourage and support the patient to manage their chronic condition at home; to detect and act on symptoms as early as possible.

The (European) Commission has been supporting research and development activities for the application of Information and Communication Technologies (ICT) in health since the 1990s. Over the last decade, it has promoted person-centric healthcare systems -so-called ‘Personal Health Systems’ (PHS) -the aim of which is not to replace but rather support health professionals via monitoring and diagnostic data which can help them to make accurate decisions. PHS is a relatively new concept. It is centred on the use by patients of wearable or implantable systems, such as body sensors that measure physiological information like heart or respiratory rate as people do their normal activities. The systems process the information automatically and send it to health centres where physicians can remotely evaluate the individual’s health status. According to the Commission, the aim of these personalised systems is “to help health professionals and individuals monitor more efficiently chronic conditions like diabetes and heart failure outside the ordinary hospital environment .

There is therefore an urgent need of novel monitoring systems which include new sensor technologies, mobile technologies, embedded systems, wearable systems, ambient intelligence and pervasive solutions which are capable of conveniently, discreetly and robustly monitoring patients in their homes and whilst performing their daily activities without interfering significantly with their comfort or lifestyle.

## **WHAT ARE THE CHALLENGES TO PERSONALISED HEALTH?**

It is interesting to note that, in contrast to many of the Healthcare advancements in the past, the present (r)evolution is due more to governmental-pull than to (solely) technological-push.

Although early trials, pilot studies and a few major programs have had promising results, the widespread adoption and commercialisation of such personalised Health systems has to date been very slow – much too slow to radically improve health and quality of life and dramatically reduce healthcare costs. This can be attributed to a number of reasons; technology costs, complexity of integrating with existing practice, interoperability challenges and the lack of full support from the clinical domain.

The problem with the ‘disruptive’ approach sought for by the EC and WHO is that no single organization or group has the resources needed to address the complex public health issues that must be resolved to facilitate the introduction and implementation of effective and efficient management of chronic disease and the ageing. New ‘Connected Health’ coalitions will need to be established between the various sectors involved to ensure that the advancements in prevention, control, and treatment of chronic diseases benefit all. Fortunately, the critical mass of interest and political will is now coming together in many countries, including in the EU

– with the goal of connecting the various elements of Healthcare provision required for this potentially advantageous ‘disruptive’ approach.

The pHealth Forum seeks to bring together the key players (largely by invitation) in the healthcare provision chain to help identify and tackle the remaining challenges to successful "pHealth" provision.

## WHAT ARE THE EU'S PHEALTH FORUMS?

Organised since 2003 at the request of the personalised Health community and with the support of the EU, the pHealth forums seeks to identify and tackle the key challenges to successful "pHealth" provision, challenges which hinder the commercialisation and clinical uptake of viable healthcare solutions. This is achieved through the strategic bringing together of key players (largely by invitation) in the healthcare provision chain – patient groups, medical doctors, industrialists, hospital administration, healthcare policy makers, researchers and other interested bodies. pHealth is therefore not just another conference of academics but rather an arena for interaction, discussion and action. Its goal is to identify solutions to the challenges of pHealth and hence to move one step closer to a large scale implementation of real industrially backed and clinically supported service provision.

As the event addresses converging technologies (NANO-BIO-ICT) in addition to the other non-technological issues that are critical for EU innovation & industry and for the EU citizen, the pHealth conference has emerged as the leading international meeting on wearable micro and nano technologies for personalized medicine. It has given visibility to the tremendous potential of micro and nano technologies, not only for the future of medicine, but also for the improvement of healthcare processes today.

## PREVIOUS PHEALTH FORUMS

- Luca, Italy. December, 2003;
- Belfast, Northern Ireland. December, 2004;
- Luzern, Switzerland. February, 2006;
- Thessaloniki, Greece. June, 2007;
- Valencia, Spain. May, 2008;
- Oslo, Norway. June, 2009;
- Berlin, Germany. May, 2010.

## Sensors and Wearables

“Converging technologies and smart systems integration enabling pHealth solutions: R&D in the ICT program and the road to innovation”, Andreas Lymberis, Program Officer at the EC, Brussels

Micro-nano systems and smart system technologies targeting the heterogeneous integration of technology and the implementation of multiple functionalities (e.g. sensing, processing, communication, energy and actuation) into miniaturised systems, are key in achieving the required ability to sense, detect, analyse, communicate, respond and monitor phenomena from macro to nano scale. Furthermore, interfacing with the living world is leading to a new class of systems able to detect the pre-disposition to disease or the earliest possible signatures of emerging disease and to support immediate, specific and highly targeted intervention.

The two major areas of research and development supported by the EC's ICT program within the "Microsystems" arena are driven by the vital biomedicine and personalised health (pHealth) applications: Micro-Nano-Bio systems (MNBS) and Smart Wearable Systems (SWS). These two groups of activities have delivered promising results, requiring further validation and improvements. Several issues, technical as well user-oriented, societal and business, remain to be solved. Some of these issues are the focus of ongoing and future calls for proposals (e.g. latest ICT call on MNBS).

This second issue of IJEHMC on pHealth presents 6 papers selected from the international conference pHealth'2011, on the topic of Wearables and Sensors:

- “Personalized Mobile Applications for Remote Monitoring”, Miguel A. Laguna and Javier Finat;
- “A Wearable Technology Revisited for Cardio-Respiratory Functional Exploration: Stroke Volume Estimation from Respiratory Inductive Plethysmography”, Julie Fontecave-Jallon et al;
- “Ambient intelligence for monitoring Alzheimer Patients”, Walid Bourennane et al;
- “Flexible Heat Flux Sensor for Fire-Fighters Garment Integration”, Christelle Navone et al;
- “Evidential Network-based Multimodal Fusion for Fall Detection”, Paulo A. Cavalcante Aguilar et al;
- “Robust Heartbeat Detector Based on Weighted Correlation and Multichannel Input-Implementation on the ECG recorded with textile electrodes”, Linda Rattfält et al.

*Eric McAdams  
Claudine Gehin  
Chris Nugent  
Norbert Noury  
Guest Editors  
IJEHMC*

## ENDNOTES

- <sup>1</sup> Health problems which require ongoing management over a period of years or decades
- <sup>2</sup> Continua Health Alliance
- <sup>3</sup> Diane J. Cook and Sajal K. Das. How smart are our environments? An updated look at the state of the art. *Pervasive and Mobile Computing* Volume 3, Issue 2, March 2007, Pages 53-73
- <sup>4</sup> <http://www.euractiv.com/en/health/personalised-healthcare-links dossier-188461>
- <sup>5</sup> A disruptive technology or innovation is one that, when introduced, either radically transforms markets, creates wholly new markets or destroys existing markets for other technologies/strategies.

*Claudine Gehin is a associate professor at INSA Lyon (France), her area of speciality is the research and design of novel, non-invasive biomedical sensors dedicated to thermal, neuro-vascular and bio-mechanical (interface pressure) measurements. These methodologies are used for the study of vigilance, stress, emotional reactivity, and used during the monitoring of performances while undergoing cognitive tasks, the driving of cars, planes etc.; of responses to sensorial stimuli and to thermal discomfort.*

*Eric McAdams is a professor at INSA Lyon (France) since 2008 and Head of the Biomedical Sensor Group, is widely recognised as a leading specialist in the study and modelling of the linear and non-linear electrical properties of materials and interfaces for electrophysiological measurements. Based on the fundamental aspects of his research, he has successfully designed, developed, patented and commercialised a wide range of Biomedical Sensors and Electrodes.*

*Chris Nugent is a professor in Biomedical Engineering at the University of Ulster (Ireland). His research within biomedical engineering addresses the themes of the development and evaluation of Technologies to support independent living and Medical Decision Support Systems and artificial intelligence. From a technological perspective his work has focused on the integration of mobile devices within smart environments coupled with the development of activity recognition systems. He has published extensively in these areas with work which spans theoretical, clinical and biomedical engineering.*

*Norbert Noury is a professor in Electronics and Biomedical sensors at University of Lyon (France), is widely recognized as an expert in smart sensors and systems, with applications to Ubiquitous Health monitoring systems and Health Smart Homes. He patented and developed several wearable health sensors, and involved in a Start Up to commercialize his fully integrated and connected “fall sensor”.*