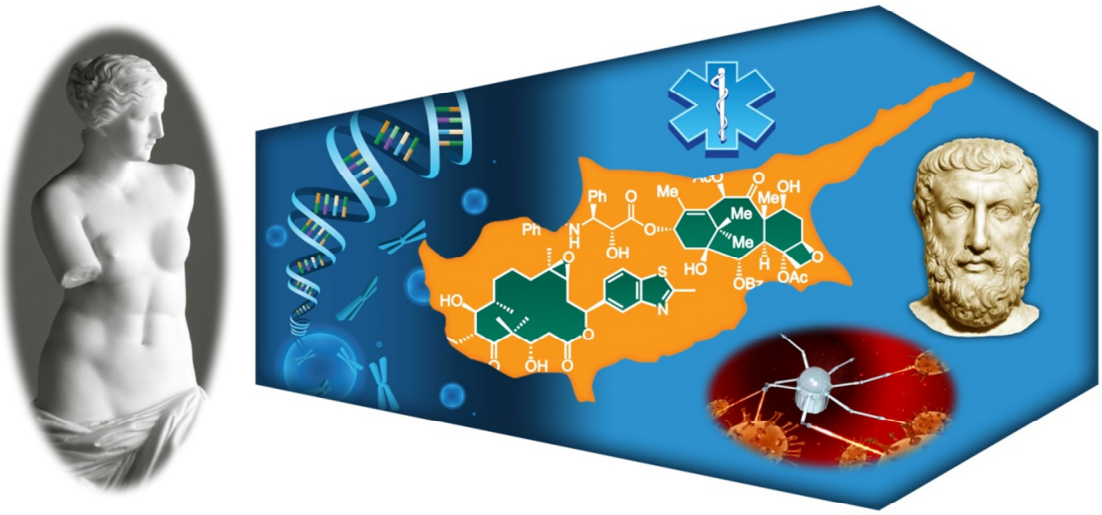
COST Conference | Personalised Medicine: Better Healthcare for the Future

17 to 22 June 2012, Larnaca, Cyprus

Conference Summary

Provided by Sheryl R Torr-Brown



Meeting Summary

Personalised medicine (PM) is currently in a *trans*-disciplinary phase where the variety of players are communicating across boundaries about prevention, diagnosis, treatment and access to quality health, with their focus firmly on the patient at the centre. The next phase will require an *inter*-disciplinary approach where these diverse players will collaborate on joint projects to harness, understand, and leverage the significant knowledge bases mounting as a result of several years of focused activity in each specialty. The task is not insignificant and was the topic of the recent COST - Cooperation in Science and Technology - conference in Personalised Medicine that took place in Larnaca, Cyprus from 17 to 22 June 2012.

COST opened up the field of personalised medicine with the first COST Action in biomedicine in 1986 to recruit clinical trial subjects based on differences in metabolic capacity. At the June conference this year, attendees listened to over 40 presentations from disciplines as diverse as engineering and philosophy. Policy makers, industry specialists, molecular and systems biologists, chemists, physicians and philosophers discussed the opportunities, notable successes to date, and the immediate actions necessary to progress personalised medicine to the next level. It was truly a trans-disciplinary experience with the diversity of attendees and the richness of the discourse revealing clear themes and shared agreements. Conference Chair Soulla Louca, Chair of the COST Domain Committee for Information and Communication Technologies (ICT) and Associate Professor, University of Nicosia, CY, introduced the gathering as a forum to acknowledge the goals of personalised medicine as challenging but surmountable. Vassillios Tsakalos, Director General of the Research Promotion Council in Cyprus continued the introduction by stressing networking and research promotion as rationale for the conference, supporting a central part of COST's mission to enhance science and technology.
The Personalised Medicine Coalition in the US has highlighted the progress made in PM over the last 8 years, from 13 prominent examples in 2006 to 72 such examples in 2011. Given these early signs of success, much of the conference addressed the question of what is preventing wider implementation. Mr António Fernando Correia de Campos, Member of European Parliament and Chair of its Science and Technology Options Assessment (STOA) Panel wisely reminded the audience that being busy is not a quality and that we must be selective in the research we undertake. Eighty billion euro have been allocated to Horizon 2020, the next Framework initiative, and the STOA will be requesting 10 billion of that for high quality research and assessments.

Mr Correia de Campos cautioned that while we have made huge investments in science and technology for PM, we must conduct vigorous outcomes research to prevent misplaced hope and unrealistic expectations. Primož Pristovšek, Vice President, COST Committee of Senior Officials described COST as a 'widening instrument' that has survived 40 years because it is adaptable.

The conference was truly a trans-disciplinary experience with the diversity of attendees and the richness of the discourse revealing clear themes and shared agreements. There was striking concordance of views on the intended outcomes of PM, namely the redefinition and reclassification of disease, the reduction in cost of healthcare while improving effectiveness, and a focus on the patient as an individual with full participation in their health and wellbeing.

Investment in Interdisciplinary Science and Medicine is growing

Europe is well positioned to lead PM forward according to Irene Norstedt from the European Commission who presented the audience with an iterative model that aligns clinical definitions of disease with molecular definitions of health and disease. Stephane Berghmans from the European Science Foundation laid out a 4 to 5 year plan to transition genomic medicine, through stratified medicine to precision medicine and finally to 'P4' medicine which is predictive, preventative, personalised and participatory. Morag Park, Institute of Cancer Research, Canadian Institutes of Health Research, revealed that Canada has also made a significant investment in genomic medicine with 13 institutes and 6 genome centres across the provinces. Canada's approach includes important initiatives such a GE3LS that complements genome research with ethical, environmental, economic, social and legal aspects of PM. With the increasing disease stratification Dr Norstedt asked if common diseases might eventually become rare. Mary Baker, President of the European Brain Council, extended this reasoning to suggest that good health is just an incomplete diagnosis.

Redefining and Reclassifying Disease

Rare diseases appear to be taking centre stage in most large initiatives, partly as a result of new databases and tools, but also due to the overwhelming realisation that many diseases will be subdivided into several less common forms as our analyses of genetic, epigenetic and phenotypic subtypes gain momentum.

Aleksandar Dimovski, University St Cyril and Methodius, F.Y. Republic of Macedonia, and Jonathan Knowles from Ecole Polytechnique Fédérale de Lausanne (EPFL) in Switzerland/Institute for Molecular Medicine Finland (FIMM), Finland, called for the necessity of collecting and archiving inclusive data from patients. Genomic data has little value without its phenotypic correlates. Other opportunities are lost by viewing symptoms as diseases as Michael Strupp from Ludwig-Maximilians-University in Munich pointed out using vertigo as an example. At the new German Vertigo Centre - one of 8 Integrated Research and Treatment Centres (IFBs) in Germany, Professor Strupp diagnoses and treats vertigo based on underlying causes. In addition, through their interactive environment, a bedside to bench observation has shed light on the mechanisms of one cause of dizziness, up-down nystagmus. This shift in translational directionality challenges the accepted bench to bedside notion, and requires that we now acknowledge translational approaches as inherently bi-directional and dynamic.

Harald Schmidt from Maastricht University, Netherlands, also pointed to hypertension as not one disease, but a symptom that may one day yield a number of more rare causative diseases. Dr Schmidt further suggested that with no real innovation in cardiovascular medicine in the past 20 years, reclassification of disease based on biomarker clustering within systems may yield promising new targets. Richard Frackowiak, from Le Centre Hospitalier Universitaire Vaudois, Switzerland, discussed misdiagnosis as a hurdle to PM. If we cannot accurately diagnose, we cannot accurately treat. He is using imaging and machine learning tools to determine what methods most accurately predict or identify Alzheimer's' disease, currently misdiagnosed about 20% of the time. A major challenge to the redefinition of disease will be creating a reimbursement system that will be flexible enough to account for new disease classifications as they occur.

Focus on the Epigenome

The epigenome is the subject of intense research and epigenomic mapping underway in several labs. Maria Berdasco from Bellvitge Biomedical Research Institute presented on the effects of lifestyle on the epigenome and the rise of the methylome as a potential target for therapy.

A common notion throughout the meeting was that an individual and their environment should be considered as one. Mira Marcus-Kalish, from Tel Aviv University, Israel, suggested that we need to be as inclusive as possible with data collection because we do not yet know what is important. Diet may be our most important risk factor according to Wim Vanden Berghe from the University of Antwerp, Belgium. He pointed out that only 5 to10% of cancer is explained by genetics with the rest being likely due to the effect of the environment on the epigenome. Many speakers cautioned against the use of averaged data alone, since differences between sub populations can only be revealed by studying individuals or subgroups of data.

Participatory Health

Most agreed that the potential of participatory medicine remains largely untapped. Barbara Prainsack of Brunel University, United Kingdom, described the current data load as a 'tsunami' and pointed to online patient profiling initiatives as ways to allow patients to be more engaged in their own health.

Data sharing and equal access to tools remain difficult issues to address. Stephane Berghmans and Anne Bruinvels both suggested that health literacy will encourage patients to be more vocal about their needs and that this will help 'pull' PM from the ground up. Jacques Haiech, from the University of Strasbourg, France, noted that preparing physicians for systems thinking and integrated team approaches will require significant changes in education and practice for new and established physicians.

Future Medicines

Mary Baker acknowledged that the pipeline is very slow, and may be too slow for our vast aging population. Christos A. Nicolaou from Lilly, USA, talked about refocusing on multi-target drugs, while Maurizio Botta from the University of Siena, Italy, discussed gatekeeper mutations that cause resistance to cancer drugs as potential new drug targets. Natural products continue to be targets for therapies; as Jef De Brabander, from UT Southwestern Medical Center, country, reminded us, natural products have evolved alongside humans and 65% of drugs are derived from them. Professor Knowles was clear that the immune system will be a critical target for future cancer therapies and K.C. Nicolaou, Chairman of the Department of Chemistry, The Scripps Research Institute, US, suggested novel approaches to cancer could include cytotoxic agents linked to antibodies against cancer cells.

For tracking biomarkers in the future, wearable devices are likely according to Kamran Sayrafian from National Institute of Standards and Technology, USA. Engineer Paul Mitcheson from Imperial College

London, United Kingdom, is working on several novel concepts to power such devices. Dr Bruinvels talked about the regulatory and reimbursement changes that will be necessary to facilitate broader use of diagnostics in Europe. Ursula Gundert-Remy from the Federal Institute for Risk Assessment, Germany, gave the audience an excellent overview of progress in drugs for PM since the mid-70s.

A step forward in predictive pharmacology was presented by Andreani Odysseos from EPOS-lasis R&D in Cyprus who discussed label-free photoproteomics as a tool to dissect out molecular mechanisms. There was resounding support for the redesign of clinical trials to reflect increasing patient stratification and new knowledge of targets. With 300 cancer drugs on the market and a thousand more in development, clinical trials must be designed to look at resistance as well as initial efficacy. Several speakers implored the audience to listen to the patient and to include patient reported outcomes in clinical trials.

ICT is evolving

While challenges still exist, information and communication technologies (ICT) are critical enablers of PM. There was common agreement that living biobanks are required for long-term data collection, and that better *in silico* models of disease are required. Professor Frackowiak presented the Human Brain Project that will map 370 neuronal ion channels in an effort to understand the rules that govern their behaviour in health and disease.

Adriano Henney presented on the virtual liver project while Christos Kannas from the University of Cyprus presented his collaboration with the Virtual Physiological Human workspace of the 7th Framework Programme to create a virtual screening tool for cancer. There is clearly a need to promote the use of genetic information in the public health decision process according to Cristiana Pavlidou, from the Golden Helix Institute of Biomedical Research, Greece. She described PGENI and FINbase, two public databases cataloguing ethnic variation in genes that represents the beginning of global pharmacogenetics.

A Return to Philosophy

The bottlenecks in personalised medicine have shifted from the costs of sequencing and the difficulties of managing data, to the cognitive appreciation of what the data mean and how to implement emerging insights. Albrecht von Müller, founder of the Parmenides Foundation in Munich, Germany, suggested we are approaching the limits of our cognition with PM and introduced constellatory thinking as a way to deal with the complexity.

We must adopt a ‘zooming out’ approach that facilitates the breaking down of the system with subsequent reassembly into a new and more appropriate framework. Redefining disease and developing new legal and ethical frameworks are two examples discussed at this conference. ICT tools are being tested for constellatory-enabled diagnosis across centres in Europe.

The time is now

Soulla Louca along with Conference Vice Chairs, Roland Pochet, Chair of the COST Domain Committee for Biomedicine and Molecular Biosciences (BMBS) and Professor, Université libre de Bruxelles, Belgium, and Dieter Schinzer, Chair of the COST Domain Committee for Chemistry and Molecular Sciences and Technologies and Professor, Otto-von-Guericke University Magdeburg, Germany, wrapped up the meeting with the additional observation that most tools we need are here today but that we need to use them: through training, inter-disciplinary communication, sustainable resources, and cultural change.

Dr Baker and Dr Marcus-Kalish both made a passionate plea for acting now. The potential for the interaction between tools and human intuition is unprecedented, diseases are being redefined and reclassified, the patient is ready to participate, and regulators and policy makers are in the conversation. Thousands of years ago the original Greek thinkers also found themselves in an era of relative complexity and opportunity. That era laid the foundations for our current health and social systems and it is now time to step back and once again let philosophy lead to way to a re-framing of the opportunity; to turn overwhelming complexity into personalised medicine, and perhaps, personalised wellness, for all.

About COST

COST (European Cooperation in Science and Technology) is Europe's longest-running intergovernmental framework for cooperation in science and technology funding cooperative scientific projects called 'COST Actions'. With a successful history of implementing scientific networking projects for over 40 years, COST offers scientists the opportunity to embark upon bottom-up, multidisciplinary and collaborative networks across all science and technology domains.

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