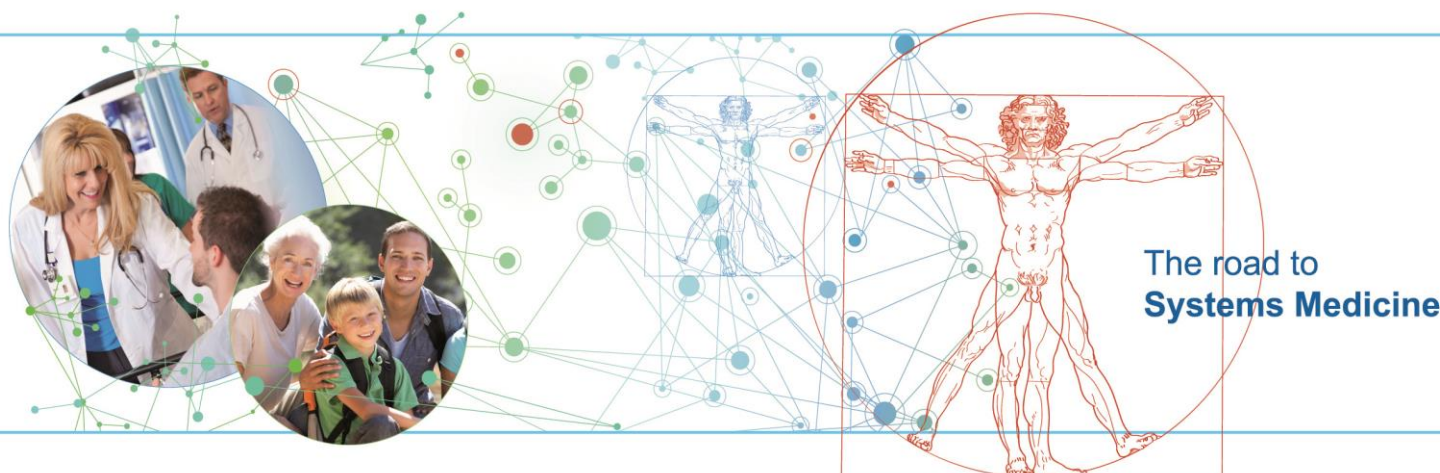




THE CASyM ROADMAP

Implementation of Systems Medicine across Europe

A short roadmap guide



The road toward Systems Medicine



A new paradigm for medical research and practice

There has been a data generation revolution in modern life science technologies and we need a revolution in using that data to drive forward health and develop a revolutionized new medicine (David Harrison).

The nation states of the European Union face unprecedented challenges as a result of an ageing population, re-emergence of infection as a global threat, increased needs for social care and a growing burden of curing and caring for patients with chronic diseases such as cancer, diabetes and neurodegeneration. As well as the health of European citizens being at stake there is a huge economic challenge in making rapid, affordable and effective interventions widely available. The concept of P4 Medicine has grown in stature; encompassing personalised, predictive,

obesity, needs some method to predict and choose the best intervention, rather than having to wait for 10 or 15 years to assess outcomes. Participation of patients in health must be more fundamental than simply personalizing medicine; it must be about empowering citizens to be responsible and engaged in protecting their own health and the health and well-being of the communities where they live and work. Research has thrived; technology has revolutionized laboratory, clinical and community based research. Data abounds, but we urgently

Systems Medicine is a way of thinking, a conceptual framework, **focused on outcome and impact**, rather than a theoretical discipline; it aims at a measurable **improvement of patient health** through systems approaches.

participatory and preventive medicine. Most emphasis has perhaps been put on personalized medicine, because it is readily understood and appeals to patients' desire for highly customized treatment. However, it would be a mistake to believe that personalized medicine alone can meet all the needs of Europe's health economy: the development of new drugs for cancer, cardiovascular disease and dementia must be made faster, cheaper and more effective before personalizing them: The design of effective interventions, for example to control

need to be able to take these data and turn them into information that is useful for the personalization of medicine, prediction of new interventions that will work, participation of citizens in taking responsibility for their own health, and design and implementation of efficient preventive measures to preserve wellbeing based on rationally designed strategies. The need is pressing to implement methods and approaches, and in particular to close the gap between data generation and storage and real impact in the clinic and community. We have had a revolution in the



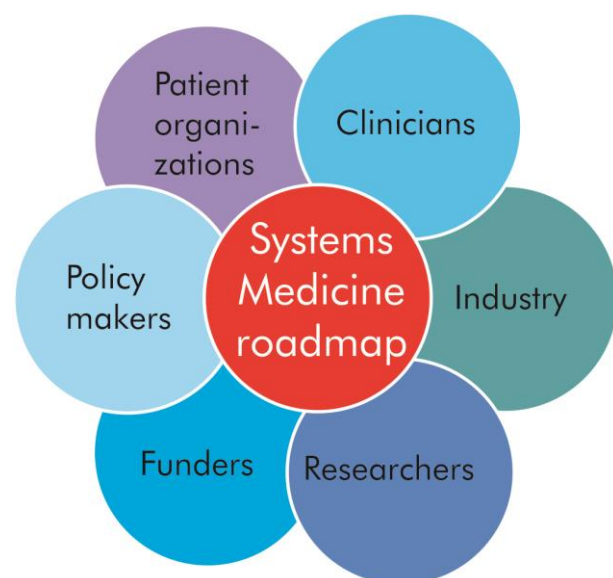
generation of data; we need a revolution in using these data to drive health forward. *The roadmap to Systems Medicine* offers the means to that end; to change how we engage our citizens to use data of both the healthy and unhealthy; to think about prediction and prevention; and ultimately to

journeys may be short and simple, whilst others may be full expeditions requiring extensive preparation, commitment and expense. But, whatever the destination or the journey is, the roadmap can help to navigate roads are new and scarcely travelled. So rather than being prescriptive, the CASyM

The CASyM roadmap represents a **practical implementation guide** for Systems Medicine – it offers an **overarching conceptual framework** through which Systems Medicine can be implemented as a holistic methodological approach in practice.

improve the lives of individuals. Already progress has been made, for example in development of predictive tests that allow the personalisation of new anti-cancer drugs, but arguably this is personalization for a disease type rather than a person, and this incremental, case-by-case approach will become unaffordable for the big challenges facing us. When discussing Systems Medicine a common question is its definition. Is it simply systems biology applied to medicine? Is it an overarching term to describe the advent of high throughput -omics, the era of functional genomics? Does it require computational modelling; are we trying to model *in silico* what will happen in real life? Is it static or is it dynamic, recognising that the course of patient's life changes, and that disease itself changes and adapts over time? Our response is that whilst we can define it as an academic subject, it is much more important to appreciate that systems medicine is an approach, a way of thinking, a conceptual framework, focussed on how a holistic view of patient and disease can change outcome and impact. A roadmap is intended for use when the intended destination is known: it describes a route, or possibly several different routes, to arrive at the destination. Perhaps just as importantly, a good roadmap allows the traveller to join or leave the highway at different points: some

Roadmap for Systems Medicine is an invitation to citizens, policy makers, funders, scientists, clinicians and industry to specify a destination and set out on a journey with a new over-arching conceptual framework to turn information into action, to inform the future of healthcare and medicine, drawing upon the participation of the healthy and unhealthy, to prevent disease in populations as well as individuals, to predict the effectiveness of drug development and improve drug trials and other therapeutics interventions, and to truly personalise medicine to the needs of a person, not just a disease.



David Harrison is chair of the CASyM Steering Committee and professor of pathology at the University of St Andrews, Scotland.



A roadmap for Systems Medicine



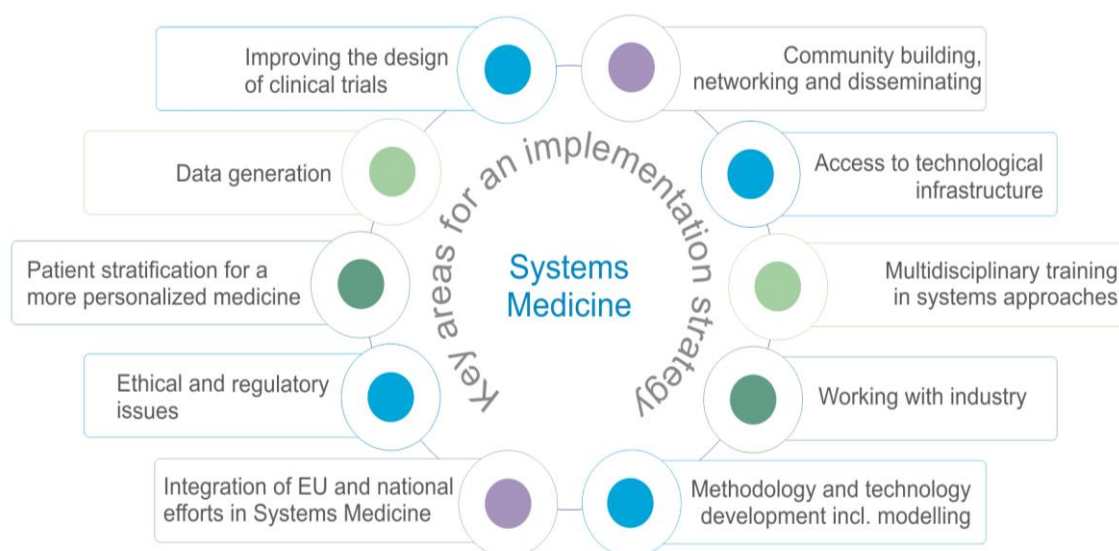
The CASyM roadmap is the result of a broad cross-disciplinary stakeholder consultation process. It identifies four core priority actions (1) community building, (2) investment in

These areas, including patient stratification, the design of clinical trials, and clinical data access, -sharing and -standardization, involvement of industry, development of the necessary technical infrastructure and multidisciplinary training. They are set out along with cross-cutting priority actions and recommendations over a period of 2, 5 and 10 years. The roadmap asserts that investment in proof of concept/pilot studies will help to precipitate a paradigm shift in the way medicine is practiced. This shift will be supported by a strong Systems Medicine community, new multidisciplinary training programmes and the development of new European-wide practices in clinical data access, sharing and standardisation. By building on current national and

Clinical needs are the driver for Systems Medicine and the roadmap aims to identify areas where a systems approach can **solve clinical problems**.

proof of concept/pilot studies, (3) cross-disciplinary training and (4) European-wide practices in clinical data access, sharing and standardisation as well as ten key areas necessary to the successful implementation of Systems Medicine in Europe.

international efforts in Systems Medicine, and the coalescing of the many stakeholder groups, it is anticipated that this coordinated action will bring significant and sustained benefits to the European citizen, both in sickness and in health.



How do we get there?



The crucial point for a general acceptance of the Systems Medicine approach is a common understanding of its breadth and clinical applicability. CASyM aims to translate this understanding into a guide for the development and implementation of Systems Medicine. The roadmap does not seek a prescriptive focus on specific diseases; rather it promotes any systems medical work that shows the clinical utility of Systems Medicine.

Links to the European Commission, a core stakeholder straddling the spheres of funding and policy, are vital to ensure that the road map can effectively lead the new way to a new thinking about medicine and medical research. The road map aims to build on the existing strong relationships between the EC and key actors within Systems Medicine. Cooperation with other initiatives, patient interest groups as well as regulatory agencies and health care organizations are crucial for the successful implementation of Systems Medicine. Accompanying initiatives and projects that initiate, fuel and sustain the implementation of Systems Medicine across are the ERA-Net ERACoSysMed, the first Systems Medicine oriented ERA-NET under the EC Horizon2020 framework program, that is based in part on the CASyM roadmap and the European Association of Systems Medicine, which will be launched by CASyM in the fall of 2015.



Further readings

- ▶ An actual copy of the complete CASyM roadmap can be downloaded at:
<https://www.casym.eu/index.php?index=90>
- ▶ Information about the ERA-NET ERACoSysMed can be found at:
<https://www.eracosysmed.eu>



Imprint

Responsible work package

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