

e:Med – establishing systems medicine in Germany

Systems medics meet in Heidelberg to found a new network

by Silke Argo

e:Med has set its sights on no less a goal than establishing a systems medicine network in Germany. e:Med is a new “child” of the Federal Ministry of Education and Research (BMBF) and involves a host of participants: clinicians, biologists, mathematicians and IT specialists. Gathering for the kick-off meeting in November 2014, they formed a shifting pattern of people in the “glasshouse” foyer of the DKFZ Communication Center in Heidelberg. Partners of many years’ standing congregated in clusters and closely-knit groups, scientists in new research partnerships introduced their teams and their projects, while researchers moved between groups, posters and the buffet. These people are part of a highly motivated community that is setting out to open up a new scientific field.

But what is systems medicine exactly? What is its objective? And why is systems medicine so important that an entire funding concept is dedicated to it?

Systems medicine – Putting Big Data to work for the patient

The swift pace of technical progress and increasingly precise methods of conducting analyses with digital data processing are helping to generate larger and larger amounts of medical data from genetic material, proteins or metabolic products. In current high-throughput approaches, sophisticated technical methods are used to investigate enormous numbers of samples simultaneously and at very high speeds. The amount of resulting data is gigantic, and it is increasing day by day.

To ensure that this inundation of Big Data can actually benefit the patient, medics and biologists are joining forces with experts in computer science and mathematics. Their aim is to quantitatively and chronologically record the complex molecular processes that determine bodily functions and the development of diseases. The systems biology approach – using a combination of laboratory experiments and computer models to analyse data – plays a central role in this. That is not all, however: increasingly, scientists are also aiming to gain an understanding of pathological processes that encompass a whole range of different diseases. With this approach, systems medicine is a chance for offering improved treatment and prevention to the patient.



e:Med – Modular, flexible, future-oriented

The hall was full as Andreas Weller of the DLR project management agency that is supporting the BMBF project funding presented the structure and objectives of e:Med at the official opening. Emphasising the importance of systems medicine for understanding many diseases, he voiced his belief that e:Med would provide a crucial stimulus for a systems medicine network throughout all of Germany. Markus Nöthen of the University of Bonn, one of the speakers of the e:Med Project Committee, stressed that e:Med, as a modular funding concept, had come at the right time and that further funding was urgently needed to ensure that Germany developed an internationally competitive systems medicine network.



The e:Med community at the Kick-off Meeting in November 2014, DKFZ Heidelberg (Photo: e:Med).

e:Med consortia get off a good start

The more than 230 participants had a welcome opportunity to gain an overview of projects at this internal e:Med meeting. Fourteen consortia and the first of nine junior research alliances were presented and described by their coordinators. Only a few aspects can be taken up here...

Using an integrated approach, the e:Med consortium **PANC-STRAT** aims to personalise treatment of pancreatic cancer. Computer-assisted modelling is being combined with patient-based tumour models. Roland Eils of the DKFZ and the University of Heidelberg explained the Omics-based approach to investigating pancreatic tumours and their liver metastases by means of parallel research into individual patients' tumour-initiating cells.

Transplantation and cancer medicine are the focal points of **SYSIMIT**. Friedrich Feuerhake of the Hannover Medical School (MHH) said that they had in common an immune response visible under the microscope. Until now, however, these responses have been insufficiently recorded. Now, the consortium is using the latest methods in automated image processing and mathematical modelling for dynamic processes to include temporal and spatial factors in the assessment of microscopic findings – and make use of them for early detection (see **SYSIMIT** article on page 28).

CAPSyS scientists deal with serious cases of pneumonia. Markus Löffler of the University of Leipzig explained how systems medicine will be used to analyse data and patient

e:Med – A new research and funding concept

e:Med is a new research and funding concept established by the Federal Ministry of Education and Research (BMBF). e:Med stands for the electronic processing, mathematical modelling, and integration of medically relevant data from various knowledge levels in systems medicine. The concept consists of five modules, and the ministry is providing €200 million in funding for an initial eight years. In module I, fourteen systems medicine research consortia are working on specific issues at 42 research facilities in 28 German cities and three universities in other countries. In Module II eight “demonstrators for an individualised medicine” started their work in 2015. These pilot projects of systems medicine are investigating different diseases and preventive measures by close interaction of life sciences and information sciences. The demonstrator projects aim to show how data from high-throughput research can directly enhance individualised prevention, diagnosis and therapy. In nine “junior research alliances” of Module III, three to five young scientists interdisciplinary work on medical questions of different diseases. e:Med module IV, Future-oriented and Cross-cutting measures, will facilitate a flexible response to innovative requirements and currently constitutes an interface with other BMBF initiatives such as de.NBI and i:DSem. Module V, Internationalisation, deals with participation in important international projects such as ICGC, IHEC, ERA networks and CASyM. At the same time, the BMBF is funding projects on ethical, legal and social aspects of systems medicine.

material from three German study groups to identify new signatures that indicate an impending failure of the barrier between the lung and the blood vessels.

More than 50 new genetic loci and lifestyle factors that are associated with heart attacks or strokes have been recently identified. Jeanette Erdmann of the University of Lübeck and spokesperson for the e:Med Project Committee reported on how **e:AtheroSysMed** is analysing genetic and lifestyle data by means of various Omics technologies. The objectives of this consortium are to discover therapeutic target structures, develop better forecasts of personal risk and put newly developed algorithms and tools into clinical use.

Hepatocellular carcinoma (HCC) patients are the focus of **Multiscale HCC**, said Bernd Pichler of Tübingen University Hospital. This interdisciplinary consortium combines the results of multiparametric imaging and Omics methods with the findings of clinical examinations, and it develops or refines mathematical models of tumour development. They are used to examine and optimise dosage regimens for combination therapies.

Systems medicine – An innovative field for lateral thinkers

Networking is of tremendous importance. Full of enthusiasm and dedication, e:Med members attend inaugural meetings of project groups to discuss methods, technologies and scientific content with colleagues and to launch initiatives. The poster session, followed by the evening get-together, is an event that encourages scientists to take part in relaxed, lively discussions with one new group after another. While some ideas are shelved, others are born. More and more, this community of lateral thinkers does interlink, and we can expect a lot from it in the years ahead.

Contact:



Dr. Silke Argo

e:Med Management Office
c/o German Cancer Research Center
Heidelberg
s.argo@dkfz.de

www.sys-med.de

meeting.sys-med.de

www.dkfz.de