The data of life science research has become a focal point of European science policy in the 21st century. International research uses and produces enormous amounts of data. The confidential storage and further use of the constantly expanding and increasingly complex life science data raise questions.

How and where should the data be stored? How can the data, such as genetic databases, be stored securely? How is the data distributed? The international ELIXIR project is tackling these issues.

ELIXIR provides solutions for how to open up research data in a way that promotes science, and who has access to the data. Finland has been at the core of the ELIXIR project since its inception in 2007. In small European countries, cooperation in data storage and distribution is a prerequisite for competitiveness in life sciences. Small countries should share their once generated materials, rather than producing them repeatedly at different research universities. Life science research requires reference materials, and ELIXIR is a channel for distributing them.

For example, if a Finnish research group studies the heritability of Parkinson’s disease, it is vital that they have access to the genetic material produced by other European research laboratories. Discovering mechanisms is demanding, and research-
ers need at least a reference point on how a healthy human genome works.

When materials produced by Europeans are available, Finns do not have to build reference material in addition to research sample material. That would be extremely expensive and delay the research results for a decade.

However, using international genetic materials at a Finnish university does not just happen instantly like that. Similarly to when people travel from one country to another, moving data requires infrastructures and agreements between countries. Foreign research universities need to be certain of the identity of the party using the data. Life science data is often associated with information security provided by law. There must also be efficient communications links between the countries through which the huge masses of data can be transmitted. The open Internet broadband is not enough. Furthermore, the recipient must have access to storage space and software with which it can process the material.

Data storage and distribution are prerequisites for science

The management, storage and distribution of data do not always invoke the same passion and enthusiasm as scientific breakthroughs. Bureaucratic language is deceiving, however. The slowly built network enables scientific breakthroughs, but is also in itself a project comparable to scientific innovation.

The antithesis of international cooperation and data sharing is the huge waste of resources of competing European universities conducting the same basic research. The end result would benefit society significantly less; if everyone was reinventing the genome, research would cost more and produce less. Europeans would drop out of the international competition in life sciences and the bio-industry.

Finland is represented in ELIXIR by CSC – IT Center for Science in cooperation with the Institute for Molecular Medicine Finland (FIMM) of the University of Helsinki and the National Institute for Health and Welfare.

“ELIXIR is a big deal for Finnish life sciences, and it will become even bigger in the future”, says head of the Finnish ELIXIR node Tommi Nyrönen from CSC.

“Through ELIXIR, Finnish biomedicine has access to huge data sets. In future, we will gain more precise information on the rare aberrations in the Finnish genome, for example, as we can compare it to international reference material. This will also allow us to prepare more accurate treatment plans.”

The guiding light of ELIXIR is that research data is the capital of science. Reliable storage and distribution of materials are prerequisites for scientific productivity.

Building and maintaining the infrastructure actually only costs a fraction of the cost of the research itself. Moreover, as for the scientific results that the infrastructure yields – according to Nyrönen – the same party that finances science also benefits from it: society.

Information on the mechanisms of disease and health

“When European genetic researchers are able to use each other’s materials back and forth, the result is more accurate information on the mechanisms of disease and health. In cooperation, the scientific results will also circulate to treatments faster”, says Tommi Nyrönen.
Opening the genome of the Finnish silver birch can be beneficial, for example, in curbing the birch plague epidemic in England. Comparison can be used to identify, for example, why the defence mechanisms of English birches are weaker than those of the silver birch.

The serious illness of a Finnish child acquires a more precise description from a combination of gene mapping and comparative data. When the defective gene is known, planning the treatment can begin. European countries that export wine can cooperate in investigating the genetics of grape diseases and, through breeding, gain competitive advantages in relation to wine producers elsewhere in the world.

ELIXIR also benefits businesses. The project has shared, for example, the canine genome, based on which researchers from the University of Helsinki have developed a commercial application. It allows dog breeders to select the healthiest of their breeder dogs and only breed those that do not carry disease genes, for example, for articular diseases.

Even though ELIXIR encourages cooperation, sharing and openness, the openness of data materials is nonetheless limited. Some of the material is public, some is not. In any case, we are not talking about the open web.

ELIXIR balances between high information security and openness. The most sensitive data in the network is open to those with rights for research purposes. Separate practices have been created between ELIXIR countries for the identification of researchers and granting of “access passes”.

Elina Kuorelahti

FURTHER INFORMATION:
CSC – IT Center for Science is a non-profit, state-owned company administered by the Ministry of Education and Culture. CSC maintains and develops the state-owned, centralised IT infrastructure.
http://www.csc.fi
https://research.csc.fi/cloud-computing

ELIXIR builds infrastructure in support of the biological sector. It brings together the leading organisations of 21 European countries and the EMBL European Molecular Biology Laboratory to form a common infrastructure for biological information.
CSC – IT Center for Science is the Finnish centre within this infrastructure.
http://www.elixir-finland.org
http://www.elixir-europe.org