

# Researchers map your route from illness to illness

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Researchers from the University of Copenhagen and the Technical University of Denmark have followed six million Danes for 15 years through patient and disease registers. Studies in the complex data landscape now enable researchers to pinpoint very busy routes for widespread diseases such as cancer, arthritis and diabetes. The findings have been published in *Nature Communications* and pave the way for more personalized medical treatment.

This is the first time that researchers have analysed big data relating to an entire country's disease development. The new ground-breaking results are based on data from 6.2 million Danes who were followed for 14.9 years – using state-of-the-art systems biology, researchers have boiled down the massive amount of data to 1,171 so-called thoroughfares with central information on the course of diabetes, chronic [obstructive pulmonary disease](#), cancer, arthritis and [cardiovascular disease](#). The researchers are, in other words, able to forecast whether you are driving on a risky highway to hell with an acute need for rerouting to improve your health.

## Data unveiling an entire life story

We can see clear correlations that have not previously been explained; a disease like gout, for example, is strongly linked to cardiovascular diseases when we look at the large data volumes and the disease networks that appear. It is a surprising correlation that researchers have

been debating previously. The quicker we identify an inappropriate pattern, the better we can prevent and treat critical diseases. In the future, we will be able to predict many diseases using simple tests in combination with known disease progression patterns, says Søren Brunak, Professor at the Technical University of Denmark and the Novo Nordisk Foundation Center for Protein Research, University of Copenhagen.

The large data volumes have been obtained from, e.g. , electronic patient records. In the long term, the clinical data can be combined with molecular data, where the researchers will map the correlations between DNA and proteins in the body and specific diseases using state-of-the-art computer technology:

Our results make it possible to view diseases in a larger context. Instead of looking at each [disease](#) in isolation, you can talk about a complex system with many different interacting factors. By looking at the order in which different diseases appear, you can start to draw patterns and see complex correlations outlining the direction for each individual person, says Anders Boeck Jensen, postdoc at the Novo Nordisk Foundation Center for Protein Research, University of Copenhagen.

## **The days of 'one size fits all' are over**

In the future, individualised treatment will be gaining ground, i.e. treatment that takes into account the individual patient's entire genome and proteome. Denmark is at the forefront of tailored [medical treatment](#). Danes are a homogeneous population, and the country's unified healthcare sector, including the civil registration system, is a unique setup that makes it possible to follow patients over a lifetime:

The perspective is that your genetic profile or the total network of associated proteins in your body, your proteome, can be mapped in a few

years' time, enabling you to suddenly learn things about yourself which can be used to forecast the progress of diseases over an entire lifetime. I believe in a bright future, because we can improve the quality of life and extend life in the long run – as well as save money as a society – if we offer people a more effective and targeted treatment, says Professor Lars Juhl Jensen from the Novo Nordisk Foundation Center for Protein Research.

Professor Søren Brunak adds: – Your genetic data might find their way to your health insurance card or a database which your doctor can access. This requires, of course, thorough analysis of the data obtained from DNA and protein sequencing in the coming years.

Provided by University of Copenhagen

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