Within ImaGene, researchers developed new methods and techniques to link genetic characteristics of diseases and individual patients to medical imaging. This programme aimed at three different categories of diseases that swallow a large part of healthcare costs: breast cancer, dementia and cardiovascular diseases.

Facilitating prevention
Programme leader Wiro Niessen from Erasmus MC: 'With the help of medical imaging such as MRI scans and CT scans, we can observe with increasing accuracy how a disease in a specific patient manifests. At the same time, we know that both genetic factors and environmental factors play a role in various diseases. By combining these different types of information, we can acquire a better insight into this relationship. For example, we can obtain insights into who has an increased risk for a certain disease and with that information, we can facilitate prevention. Or we can examine how an individual patient with his or her specific characteristics can best be treated and which treatment will probably have little benefit.'

Cause and effect
Within the ImaGene programme, 41 researchers within eight projects worked on the development of new technologies to recognise patterns in large collections of diverse data and to find cause and effect relationships between genetic characteristics and medical images. The researchers subsequently applied these technologies, for example, to make the early detection of cardiovascular disease possible, to obtain an insight into which breast tumours are sensitive for hormone therapy, and to unravel the genetic causes underlying diseases such as Duchenne muscular dystrophy and Alzheimer’s disease.
Aim

The ImaGene programme ran from 2012 to 2018. It consolidated the strengths of data mining, machine learning, pattern recognition, medical imaging, genetics, epidemiology, visualisation and statistics to recognise diseases as early and accurately as possible, to identify which patients will benefit most from preventive measures or therapeutic treatments, and to make individualised treatment possible.

What was investigated?

The researchers investigated new methods and tools to combine medical images with genetic information and to visualise and analyse relevant relationships. Furthermore, they demonstrated how this combination of data leads to new insights into the progression of, and possible treatments for various diseases.

What has the programme yielded?

Besides knowledge about the development of specific diseases, the research resulted in various open software packages that can recognise patterns and relationships in large quantities of dissimilar data. One of those platforms is BrainScope, which reveals which genes at which moment and at which locations are expressed during the development of the brain.

Within the research programme, BrainScope was used, amongst other things, to make brain scans of patients with Duchenne muscular dystrophy and to compare these scans with those of healthy people to itemise which genetic mutations occur when in which areas of the brain.

‘With the ImaGene programme we have really put the discipline of population imaging genetics on the map’, says programme leader Niessen. ‘We have demonstrated that combining genetic data and medical scans in various fields has clear added value. To realise individualised care in the clinic, the genetic and clinical data must be made accessible on a much larger scale and in the correct manner. If we manage to do that, then I am convinced that within several years, we will see applications in medical practice that can be traced back to this research programme.’

Facts & figures

- **Research institutions**
  - Delft University of Technology
  - Maastricht University
  - University of Amsterdam

- **University medical centres**
  - Amsterdam UMC
  - Erasmus MC
  - Leiden UMC
  - Radboudumc
  - UMC Utrecht

- **Research platforms**  5

- **Companies**  15

- **Top Sector**
  - High Tech Systems and Materials
  - Life Sciences & Health

- **Total budget**  5.9 million euro

- **Co-funding**  1 million euro

- **Spin-offs**
  - The discovery of two previously unknown genes that play a role in Alzheimer’s disease
  - Follow-up studies within the NWO Zwaartekracht project Brainscapes and a Dutch Cancer Society research project

More information about the Perspectief programme? Visit nwo.nl/perspectief