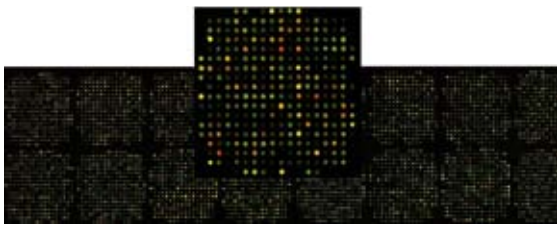
Success Stories

DNA Chips - Creation of a New Competence in Bio-Informatics and of a Technical Platform for Large-Scale Genomic Analysis

One of the first projects funded by the FNR was the "Creation of a New Competence in Bio-Informatics and of a Technical Platform for Large-Scale Genomic Analysis". Started in early 2002, within the BIOSAN programme, the Microarray Centre team (headed by Evelyne Friederich and coordinated by Laurent Vallar) has spent the last six years building expertise in microarray technology to advance scientific research in areas as diverse as health, food tracing and environmental issues. The microarray centre provides support to academic and industrial laboratories from Luxembourg and the surrounding regions.

The advent of the microarray has led to a major methodological advance in scientific research and allows scientists to analyse the expression of thousands of genes quickly and efficiently in a single experiment; before the introduction of the microarray, traditional methods meant that researchers were only able to study a relatively small number of genes at any one time. This technology gives the scientist the necessary tools to understand the fundamental aspects of development and to examine underlying causes of many human diseases, such as cancer, immunological disorders, cardio-vascular and neuro-degenerative diseases. Although still in its infancy, microarray technology is a significant step towards understanding and cataloguing the human genome.



Retchip microarrays were designed and produced by the Microarray Center. These are thematic arrays representing a limited number of genes involved in specific biological functions (e.g. biology and diseases of the retina for Retchip).

The first part of the project aimed at setting up the microarray technology and to gather a team of experts who could work together in this highly specialised field. The grant enabled them to purchase expensive equipment (€ 120,000 for one of the machines) and gave them time to develop the necessary expertise. The project was conducted in partnership with the Santec department of the CRP Henri Tudor for the development of specific software packages (ImageQualityQuantificator) designed for quality assessment of microarray images for further analysis. With thousands of data spots being on each microarray sampling, this is an important part of the microarray analysis process.

Particularly useful in the oncology field, the initial research aim of the project was to gain better understanding of a key step of tumour progression through which epithelial cancer cells become invasive, and give rise to life threatening secondary tumours; the metastases. Using a specific cellular model developed in Friederich's lab, the Microarray Centre mapped the genes expressed at different time points of this process and gathered important new information on the underlying molecular mechanisms.

Microarray genome analysis also makes it possible to look at the genetic DNA makeup of a tumour, as well as the expression of proteins within the tumour cell and gain a full picture of what is going wrong. In the future this approach could lead to recognising the potential outcome of a tumour, i.e. how the tumour is at the present time and a prognosis of how it could develop in the future; thereby allowing tailoring a more personalised and well adapted treatment for cancer patients.

The Microarray Centre team collaborated with the Institut de Génétique, Biologie Moléculaire et Cellulaire, Strasbourg, and within this cooperation developed several bioinformatics tools for the design of thematic DNA microarrays that are produced by the team. Competences gained within this cooperation were applied to one of the projects the research team have participated in on a European level; the 2006 European Integrated project Evi-Genoret, where approximately 60 laboratories from 12 countries were involved in studying the retina. Based on a list of about 2,000 genes that are important in the degeneration of the retina as identified by members of the Evi-Genoret consortium, the Microarray Centre developed and produced a microarray (Retchip) that can investigate key transitional changes in retinopathies – vision-related diseases. This chip is now being used by research laboratories throughout Europe to understand and study diseases of the retina.

"Without the FNR it would not have been possible to bring this advanced technology to Luxembourg," says Vallar. Friederich added, "The grant from the FNR was extremely important, as we gained the skills and competence in this field and learnt how it could evolve over time." The goal of the team is to be the national platform for microarray in Luxembourg; they already work on diagnostic analysis with doctors from the Centre Hospitalier, environmental scientists from Gabriel Lippmann and researchers from the University. Having such advanced technology also puts Luxembourg firmly on the map as a serious player in the research and technology field.

The microarray chip heralds a huge advancement on the technology of scientific and medical research, which to most people conjures up an image of a lone scientist peering down a microscope; with the microarray, data can be accessed and analysed by multiple people at any one time and it can also be stored and retrieved at a later stage, without the possibility of accidental or age-related damage.

The project came to an end at the beginning of 2007 and the Microarray Centre team are now running primarily under the auspices of the CRP Santé.