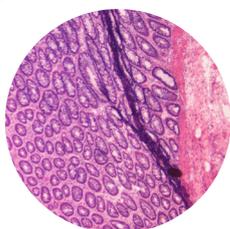


## THE LIFE SCIENCES RESEARCH UNIT (LSRU)

# SIGNALING NETWORKS IN CANCER AND INFLAMMATION



### IMMUNE CELLS AND INFLAMMATORY DISEASES

Research at the University's Life Sciences Research Unit (LSRU) seeks fundamental understanding of human diseases to help us detect, prevent and treat illness. Combining molecular, cellular and computational approaches we look deeply into how cells communicate, differentiate, migrate, renew themselves and function.

Central to this is gaining knowledge of the signals cells receive from their environment. Many high impact diseases are caused by abnormal cell communication and behaviour, including cancer and inflammatory diseases. The Life Sciences Research Unit was established in 2008 and is organised in six different laboratories or research groups:

Chronic inflammation can occur when the body seeks to defend itself, but finally gets out of control. Our multidisciplinary approach aims at better understanding the cellular mechanisms of (mis)regulation in such inflammatory diseases.

### SIGNAL TRANSDUCTION

We study the transmission path of signals through cells and how this changes cell function. This "signal transduction" research is helpful for the design of more effective drugs. Of particular interest to us are signaling proteins called cytokines, protein kinases and non-coding RNAs in various cancers.

[The miRNA team](#) particularly focuses on their suitability as biomarkers and their functional roles in drug resistance of cancer (melanoma).

### CANCER CELL BIOLOGY AND DRUG DISCOVERY GROUP

We aim at understanding the specific roles of the highly mutated HRAS, NRAS and KRAS in cancer. Our particular interest is in understanding how specificity emerges within plasma membrane nanodomains. Moreover, we are developing assays and conducting chemo/genetic-screens to identify novel Ras associated cancer targets and Ras drugs.

### NEUROINFLAMMATION

Our group is investigating the molecular mechanisms of inflammation, differentiation and de-differentiation of central glial cells that are relevant during neurodegenerative and inflammatory events of the brain. Of particular interest to us is the plasticity of astrocytes, the most abundant glial cell population of the central nervous system.

### MOLECULAR DISEASE MECHANISMUS

Our group is interested in molecular mechanisms that govern cellular communication and signaling in the healthy organism as well as in pathological conditions such as inflammation and cancer. Understanding these cellular events is a prerequisite for the development of targeted therapeutic interventions.

### SYSTEMS BIOLOGY

We are developing modeling and data integration techniques to generate suitable computational models of biological systems. Analysing these gives us insight into the dynamics of disease-specific molecular networks of metabolism, signaling and gene regulation.



The future research focus of the LSRU will be set on Tumour Biology.

#### Research Questions

“How is Inflammation linked to various pathologies?”

“Why are some cancers resistant to most used therapies?”

“How can biomarkers help to detect cancer earlier?”

## LSRU MEMBERS

Our research unit is composed of ~65 members, including:

- 25 PhD level scientists including three core positions:
  - > Advanced Light Microscopy
  - > Bioinformatics
  - > Biosafety
- 20 PhD students
- 10 technical and administrative support positions

## FACTS AND STATS

Our research is funded by the Fonds National de la Recherche (FNR), the Fondation Cancer, the European Union and by the University of Luxembourg. We have received over the period 2012 to 2017 over 6 Million € of competitive grants.

We regularly collaborate with our national partners at the Luxemburg Centre for Systems Biomedicine (LCSB / uni.lu), the Luxembourg Institute of Health (LIH) and the Integrated BioBank Luxembourg (IBBL) and other national institutions. LSRU members participate in working groups of the “Plan National Cancer” and of the “Personalised Medicine Consortium”.

Moreover, we have international collaborations e. g. with the DKFZ (Heidelberg, Germany), Ghent University (Belgium), Université Joseph Fourier (Grenoble, France), Saarland University Medical School (Homburg, Germany), TU Dresden (Germany) and the Institute of Systems Biology (Seattle, USA).

Since 2008, LSRU members published more than 190 peer-reviewed articles in refereed scientific journals.

### FUNDING

### COLLABORATIONS

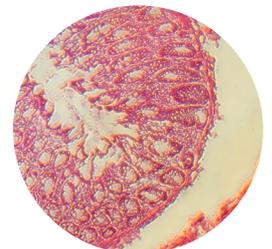
### PUBLICATIONS

## TEACHING PROGRAMS UNDER LSRU COORDINATION

- Bachelor in Life Sciences – including first year in Medicine – with a total of around 3400 hours per year
- Master in Integrative Systems Biology with a total of 1460 hours per year
- Doctoral School in Systems and Molecular Biomedicine – a partnership with the Luxembourg Centre of Systems Biomedicine (LCSB) and the Luxembourg Institute of Health (LIH), currently around 70 PhD students
- “Formation spécifique en Médecine Générale”
- European Master and Certificate of Small Animal Veterinary Medicine

## A GLIMPSE INTO OUR RESEARCH...

Colorectal cancer is still one of the most frequent and deadliest cancers worldwide. But diagnosed in time it can be cured in 9 out of 10 cases. Thus it is highly important to improve early diagnosis as well as therapeutic strategies. One of our projects led to the discovery of new biomarkers for this cancer. Those are molecules whose increased presence or absence in tissue can indicate the development of tumorous cells. With the help of a detailed bioinformatical analysis and an original analysis of patient material, our team was the first one to see a significant reduction of the proteins SOCS2 and SOCS6 in pre-cancerous and cancerous colorectal cells. They could help detect colorectal cancer earlier, predict its severity or even offer new therapies. In different projects we are now further working on finding biomarkers for the early detection of various types of cancers.



From: „Identification of SOCS2 and SOCS6 as biomarkers in human colorectal cancer”; British Journal of Cancer (2014) 111, 726-735

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