IMMUNOLOGY
An innovation domain of the canton of Vaud
STATE-OF-THE-ART IMMUNOLOGY TECHNOLOGY

Immunology is an incredibly exciting and broad area of the biomedical sciences and the canton of Vaud boasts a deep pool of talent in this vital speciality.

Our knowledge of immunology has grown considerably since Dr. Jenner pioneered smallpox vaccines in the 18th century. From the search for new targeted drug development, to more effective immunotherapy design, numerous lines of research are battling to meet pressing real-world health challenges. The canton of Vaud plays an important role in this domain thanks to its renowned, state-of-the-art research institutes, a flourishing life sciences industry, and the emergence of innovative tech startups.

Switzerland’s famously high living standards and political and economic stability also help account for the high quality of research.

5,400

number of consultations held each year by the Immunology and Allergy Department at CHUV.
CUTTING-EDGE RESEARCH

From the establishment of the American Ludwig Institute to hosting the Swiss Cancer Center Lausanne, the canton of Vaud invests heavily in research to meet these modern, real-world challenges.

The immune system protects the body by fighting external pathogenic elements. When this natural protection system doesn’t work, serious diseases can occur.

Immunology is constantly changing, from those technologies that aim to modify the immune system (vaccines, therapeutic vaccines, immunomodulators, microbiota, and nutrition) to those that use immunoglobules (antibodies) to treat or diagnose disease.

Common diseases
Deficiencies, disorders or insufficiencies in the immune system are at the heart of a number of diseases, from the relatively benign to the most severe.

Autoimmune diseases are particularly challenging because the immune system turns against the body it is supposed to be protecting. Multiple sclerosis, lupus, rheumatoid pol- yarthritis, Crohn’s disease and diabetes are some of the common examples among roughly 50 recognized diseases. The ratios vary depending on the disease, but overall nearly 80% of people with an autoimmune disease are women.

Some viruses affecting the immune system, such as HIV, involve particularly complex public health challenges. Although the trend is in decline since its discovery and peak in the 1980s, AIDS remains a persistent challenge, especially in many developing countries.

+46%

increase in attendance of the departmental Diagnostics Laboratory of the CHUV Division of Immunology and Allergy (2016-2012) due to immune dysfunctions.
Allergies (cat hair, dust mites, foods, etc.), gluten intolerance and coeliac disease are constantly on the rise. It also seems that some skin diseases, such as psoriasis, long attributed to increased stress or psychosomatic causes, are in fact of genetic origin and linked to the immune system.

Finally, cancer is a significant problem in Western societies. In Switzerland, one in three people are affected by such a disease during their lifetime, and cancer is the second largest cause of death in our country.

Between therapy and prevention
In the field of vaccines, research is focused on developing prophylactic solutions that prevent disease. By contrast, when immunology relates to complex diseases such as cancer (where prevention is still a long way from reality), research is more focused on better and more personalized treatments for patients.

Between these two areas, the field of diagnostics is developing strongly. When improved and incorporated earlier, this makes it easier to characterize diseases, better monitor patients and determine treatment doses with greater efficiency. Finally, researchers are conducting studies into biomarkers to determine, for example, the precise reaction a patient may have to a specific compound.

A persistent challenge
A fascinating area of modern immunology research has emerged around the development and manufacture of biopharmaceuticals. These pharmaceutical products work by forming antibody fragments capable of interacting with specific targets, enabling more effective action than conventional medicine.

Biopharmaceuticals are developed using state-of-the-art pharmacology combined with innovations from the engineering sciences, such as molecular biology. These drug systems represent a large improvement in patient management enabling, for example, very precise drug administration schedules. These new care techniques require the development of complex technology for large-scale production; highly targeted treatments may therefore be more costly, and society must account for this challenge.
CLOSE LINKS BETWEEN THE INDUSTRY AND ACADEMIA

The canton of Vaud’s rich academic and economic environments provide fertile ground for important innovations in the field of immunology.

High-quality research in the region is enhanced by the presence of startups, fast-growing SMEs and large multinationals active in developing medicines, nutraceuticals, new therapies, and diagnostics.

Companies based in the region cover all areas of immunology: Novigenix and Lunaphore focus on diagnostics; ADC Therapeutics on treatments for oncology; AC Immune for Alzheimer’s; Anergis for allergies; Mymetics and Vaccine Formulation Services are experts in vaccines.

The field includes startups founded in the canton of Vaud and international companies attracted by the scientific reputation of French-speaking Switzerland, as well as the quality of life and working conditions in the canton.

Many of these companies are located in EPFL Innovation Park, stimulating constant knowledge exchange with academia. Others have invested in Biopôle, a technology park dedicated to life sciences in Epalinges. Biopôle offers close connection to the clinicians at the university hospital of the canton of Vaud (CHUV). Though open to all therapeutic areas, the site aims above all to develop innovative solutions in oncology, nutrition, personalized medicine and immunology. An incubator called Startlab has been launched in January 2018 to welcome young professionals active in these fields.
**STRONG POLITICAL INVOLVEMENT**

The canton of Vaud is determined to strengthen its position as a Center of excellence in new anti-cancer therapies.

One of the region’s goals is to offer immuno-oncology treatments to patients. The canton has allocated significant sums to support research and develop clinical environments to better understand how the immune system can be stimulated to specifically target cancerous cells. Government support has been crucial both to attracting key academic actors in the canton, such as the Ludwig Institute for Cancer Research, and launching the Swiss Cancer Center Lausanne.

On the occasion of its founding in Vaud in 2015, the American Ludwig Institute pledged to invest USD 100 million over 10 years, while the State Council of Vaud announced its intention to invest CHF 90 million to develop the Dorigny site and the Biopôle at Epalinges, where a dedicated building will host the Lausanne branch of the Ludwig Institute of Cancer Research.

**Assistance and networking**

Along with state support, immunology researchers also benefit from assistance from various Swiss-based institutions.

**The ISREC Foundation** has supported experimental cancer research for more than 50 years. It dedicates financial resources to developing new forms of therapies for the future and encourages knowledge transfer between fundamental research and clinical applications. The Foundation also supports students, doctoral students and scientists working in immunology and oncology. Its location at the same site as CHUV enabled the opening of the AGORA cancer research Center in 2017.

**The Swiss Biotech Association**, based in Zurich, provides services to Swiss companies active in the biotechnology sector or fields connected with life sciences. Its portal was created in 2005 and offers a wide range of resources.

**BioAlps** is the life science cluster in French-speaking Switzerland. It offers knowledge, expertise and contacts with other actors in the sector. It promotes the growth of life sciences regionally, nationally and internationally, and ensures the conditions required for long-term development.

“We are extremely enthusiastic about the idea of opening a branch of the Ludwig Institute in Lausanne. We have been highly impressed by the scope and depth of scientific and IT expertise found there, not only in its academic institutions, but also in its biotechnology firms. I am convinced that our partnership will be of great benefit for patients with cancer everywhere.”

EDWARD MCDERMOTT
CEO of the Ludwig Institute

500,000 people with diabetes in Switzerland.
A POWERFUL ACADEMIC ENVIRONMENT

The close links between academic partners involved in this field has created a dense network of highly qualified people gifted with international visibility.

The proximity between fundamental sciences, applied sciences and hospitals creates a unique environment capable of providing major innovations in the field of immunotechnologies that are clinically applicable.

Specialized institutes

The EPFL Global Health Institute, the Biochemistry Department at UNIL, the Immunology and Allergy Department at CHUV, as well as the Fundamental Microbiology Department at UNIL are key actors in the development of new therapeutic products that target and fight infectious diseases and other pathogens (such as HIV, tuberculosis, and leishmaniasis).

Two major projects are helping produce antibodies capable of neutralising numerous HIV stem cells – a programme subsidized by the Gates Foundations – and developing solutions aimed at targeting cells that contain viruses.

The canton of Vaud also boasts a wealth of research associated with vaccinology; specifically in the field of active immunity which involves developing strategies aimed at stimulating the patient’s immune system to better protect itself.

Within CHUV’s Oncology Department, the experimental cancer treatment center is equipped with one of the largest GMP cell manufacturing facilities to produce lymphocyte T-based therapies for clinical use.

Robust partners

In 2007 the Swiss Vaccine Research Institute (ISRV), unique in Europe, was created within CHUV. It aims to promote the development of vaccines in three major fields of infectious diseases: aids, tuberculosis and malaria.

Finally, EPFL is a world-renowned institute which combines various skills in protein and cell engineering and generates major innovations in the production of antibodies. Furthermore, microtechnologies in optics and fundamental engineering are crucial in the development of new diagnostic devices.

This vast academic network is also at the heart of numerous successful spin-offs.

“...university hospitals benefit from an extraordinary concentration of research and specialization projects in the field of immunology, which is unique. This is explained by strong political choices, the decision by the institution’s management to focus on future medicine, and by a series of important supports. For years, efforts in immunology, infectiology, and more recently oncology, have involved continuous investment in fields that evolve at an impressive speed. We have to keep up with competition from the rest of the world.”

PR. GIUSEPPE PANTALEO

Head of the Immunology and Allergy Department, CHUV

Source: FID 2017

Source: CHUV

100

employees are working for the immunology department at the CHUV.
# Main Actors of Immunology Ecosystem

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<th>Industry drivers</th>
<th>Key factors</th>
<th>Key actors</th>
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<td>Alzheimer's</td>
<td>AC Immune</td>
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<td>Oncology</td>
<td>Lunaphore</td>
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<td>Novigenix</td>
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<td>Allergies</td>
<td>Abionic</td>
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<tr>
<td><strong>Treatment</strong></td>
<td>Alzheimer's</td>
<td>AC Immune</td>
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<td></td>
<td>Allergies</td>
<td>Anergis</td>
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<tr>
<td></td>
<td>Oncology</td>
<td>ADC Therapeutics</td>
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<td></td>
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<td>Glenmark</td>
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<tr>
<td><strong>Vaccines</strong></td>
<td>Virosomes</td>
<td>Cellestia Biotech</td>
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<td>Mymetics</td>
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<td>Phi Pharma</td>
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<td></td>
<td>Adjuvants</td>
<td>UNIL – Vaccine Formulation Laboratory</td>
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<td><strong>R&amp;D</strong></td>
<td>Research products</td>
<td>Nestlé Health Science</td>
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<td></td>
<td>Animal models</td>
<td>Preclin Biosystems</td>
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<tr>
<td></td>
<td>Clinical, fundamental and translational research</td>
<td>CHUV-UNIL – Immunology and Allergy Department</td>
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<td></td>
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<td>CHUV-UNIL – Oncology Department</td>
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<tr>
<td></td>
<td></td>
<td>Ludwig Institute for Cancer Research</td>
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<td>Swiss Institute for Experimental Cancer Research</td>
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<td></td>
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<td>Swiss Cancer Center Lausanne</td>
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<td></td>
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<td>UNIL – Biochemistry Department</td>
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</table>
RESEARCH AND DEVELOPMENT

CHUV – Immunology and Allergy Department
Immunological characterization, diagnostics and therapeutic monitoring of immune-deprived patients.
chuv.ch/fr/ial/ial-home

CHUV – Oncology Department
Fundamental, translational and clinical research in oncology, including immunotherapy research.
chuv.ch/oncologie/onc_home

CHUV – Swiss Cancer Center Lausanne (SCCL)
Fundamental and translational cancer research, focusing on personalized molecular therapies and immunotherapy in order to develop multidisciplinary care.
scl.ch

EPFL – Global Health Institute (GHI)
The Global Health Institute (GHI) contributes to understanding, diagnosis, prevention and treatment of infectious diseases.
sv.epfl.ch/GHI

EPFL – Innate immunology laboratory (UPABLASSER)
Research into how immune system cells detect the presence of pathogens. Exploration of fundamental mechanisms that help to defend the host.
ablasserlab.epfl.ch

EPFL – Intestinal immunology laboratory
Research aimed at understanding how intestinal bacteria and helminth parasites interact with the immune system, both to provide the host with adequate protection against excessive colonization of these organisms and understand how their presence influences intestinal functions, immune homeostasis and heterologous immune responses.
harris-lab.epfl.ch

EPFL – Protein design and immune engineering laboratory
The laboratory designs new functional proteins to be used in practical contexts such as therapies, vaccines, biocaptors, and more.
lpdi.epfl.ch

Ludwig Institute of Cancer Research (LICR) – Lausanne branch
The Institute is mainly involved with tumor immunology and immunotherapy, as well as the mechanisms by which tumors fend off immune attacks and on the development of new immunotherapies, particularly those with which treatment is adapted to a cancer patient, such as dendritic cell-based vaccines or therapies that require the manipulation and reinjection of T lymphocytes. The Institute develops technologies aimed at standardising and rationalising these personalized therapies, an essential step for wider deployment.
ludwigcancerresearch.org/location/lausanne-branch

In 2016, the total of technical points of laboratory tests of the list of analyses.

9.6 million
Nestlé Institute of Health Sciences
Researchers at this institute are studying nutritional solutions to counter the progression of diabetes, obesity and Alzheimer’s disease. Located on the EPFL campus, the Nestlé Institute of Health Sciences is part of (and therefore benefits from) Nestlé’s global R&D network.

Swiss Institute for Experimental Cancer Research (ISREC)
The ISREC Foundation has supported experimental cancer research for more than 50 years by assisting with projects that encourage the transfer of knowledge and cooperation between fundamental research and clinical applications. It supports undergraduate and doctoral students and scientists in the fields of biology, technology and medicine whose work focuses on immunology and oncology. Finally, it manages a high-quality infrastructure on the site of Lausanne University Hospital (CHUV) (CHUV).

UNIL-CHUV – Immunology and Allergy Department
Main research areas: antiviral immunology, HIV, mucous immunity, neuro-immunology, immunity and tolerance for T cells, tuberculosis, transplantation, design and development of vaccines.

UNIL – Biochemistry Department
Research and teaching relating to immune system disorders, parasite infections and cancer.

UNIL – Fundamental Microbiology Department
UNIL's Fundamental Microbiology Department explores microbiology in all its diversity.

UNIL – Vaccine Formulation Laboratory (VFL)
VFL specializes in the production of adjuvants.
## ESTABLISHED BUSINESSES AND STARTUPS

<table>
<thead>
<tr>
<th>Company</th>
<th>Description</th>
<th>Website</th>
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</thead>
<tbody>
<tr>
<td>Abionic</td>
<td>A biomedical screening platform making it possible to test a patient using a drop of blood.</td>
<td>abionic.com</td>
</tr>
<tr>
<td>AC Bioscience</td>
<td>AC Bioscience focus on the development of innovative therapies to fight infectious and inflammatory diseases, as well as complementary products for the treatment of tumor and immunological diseases.</td>
<td>ac-bioscience.com</td>
</tr>
<tr>
<td>AC Immune</td>
<td>Personalized treatment for neurodegenerative diseases.</td>
<td>acimmune.com</td>
</tr>
<tr>
<td>ADC Therapeutics</td>
<td>Antibody Drug Conjugates (ADCs) for the treatment of solid and blood cancers.</td>
<td>adctherapeutics.com</td>
</tr>
<tr>
<td>AdipoGen</td>
<td>Research into food products for obesity and diabetes, inflammasomes, immuno-oncology and inflammatory diseases.</td>
<td>adipogen.com</td>
</tr>
<tr>
<td>Anergis</td>
<td>Ultra-rapid allergy immunotherapy.</td>
<td><a href="http://www.anergis.ch">www.anergis.ch</a></td>
</tr>
<tr>
<td>Anokion</td>
<td>Anokion develops antigen-specific immune tolerance technology to reduce the immunogenicity of therapeutic proteins and treat autoimmune diseases.</td>
<td>anokion.com</td>
</tr>
<tr>
<td>ECS-Screening</td>
<td>ECS-Screening provides an early cancer screening platform called Decode Lab (<a href="http://www.decode-lab.net">www.decode-lab.net</a>), capable of detecting progastin, a cancer-specific biomarker.</td>
<td>ecs-screening.ch</td>
</tr>
<tr>
<td>Fresenius-Kabi SwissBioSim</td>
<td>Fresenius Kabi markets pharmaceutical products and medical devices for the treatment and care of acute and chronic patients.</td>
<td>fresenius-kabi.com</td>
</tr>
<tr>
<td>Gene Signal International</td>
<td>Development of innovative therapies for angiogenesis disorders based on a new class of oligonucleotides, proteins and monoclonal antibodies.</td>
<td>genesignal.com</td>
</tr>
<tr>
<td>Incyte Biosciences Internati</td>
<td>Incyte Biosciences works on new cures for advancement in the treatment of various forms of chronic and acute leukemia, lung cancer and other cancers that are difficult to treat.</td>
<td>incyte.com</td>
</tr>
<tr>
<td>Lunaphore</td>
<td>Tumor analysis platforms for immunohistochemistry based on microfluid technology.</td>
<td>lunaphore.ch</td>
</tr>
<tr>
<td>Merck</td>
<td>New therapies based on medicines that modulate pathogenic mechanisms in rheumatological diseases and auto-immune diseases.</td>
<td>merckgroup.com</td>
</tr>
<tr>
<td>Mymetics</td>
<td>Development of a new generation of preventive vaccines against virosome-based infectious diseases.</td>
<td>mymetics.com</td>
</tr>
</tbody>
</table>
NeoGenomics
Pioneering company in the field of cancer diagnostics and pharmaceutical services.
neogenomics.com

Novassay
New treatments for neuropathic pain.
novassay.com

Novigenix
A new generation of blood tests for the early detection of colon cancer.
novigenix.com

Preclin Biosystems
Platform for in vivo preclinical tests to identify and validate treatments.
preclinbiosystems.com

Vaxeal Holding
Advanced anti-cancer immunotherapies.
vaxeal.net

Zestagen
New monoclonal antibodies for the treatment of cancer.
zestagen.com
NETWORK OF SUPPORTING PARTNERS

**BioAlps**
BioAlps is the life sciences cluster in western Switzerland. Your gateway to a wealth of contacts, knowledge and expertise, for all individual and institutional support.

[biopole.ch](http://biopole.ch)

**Economic Development – Canton of Vaud (DEV)**
The DEV is the main contact for foreign companies looking to set up in the region. To fulfill its role, the DEV works with both private (banks, notaries, lawyers, etc.) and public partners (various government departments). It provides advice on administrative procedures and financing, and allows newly established companies to benefit from its vast network.

[dev.ch](http://dev.ch)

**EPFL Innovation Park**
EPFL Innovation Park hosts companies focusing on technology in an inspiring environment, with access to state-of-the-art research, a wide network of dynamic entrepreneurs and long-established companies.

[epfl-innovationpark.ch](http://epfl-innovationpark.ch)

**Inartis Network**
The mission of the Inartis Network is to create value and jobs in the Swiss life sciences economy via innovation.

[inartis-network.ch](http://inartis-network.ch)

**Innovaud**
As a gateway to innovation in the canton of Vaud, Innovaud supports and provides networking opportunities for startups and SMEs, particularly those in life sciences, to develop solutions with them in the area of hosting, promotion, funding and/or coaching. Innovaud is firmly established in a vast network of partners, enabling it to redirect requests to the organizations most suited to the needs of each party.

[innovaud.ch](http://innovaud.ch)

**Office for Economic Affairs and Innovation (SPEI)**
The SPEI supports companies established in the canton of Vaud, and more specifically those active in the sectors of industry and advanced technologies. SPEI advises and informs entrepreneurs, particularly by putting them in touch with the appropriate organizations according to their specific needs. SPEI can also provide direct financial support.

[invest-vaud.swiss](http://invest-vaud.swiss)

**Swiss Biotech Association**
Provision of resources, services and contacts for biotechnology companies and related fields of life sciences.

[swissbiotech.org](http://swissbiotech.org)

**Swiss Vaccine Research Institute (ISRV)**
Exploration, scientific discovery and translation of discoveries in preventive vaccine strategies and therapeutic interventions of vaccinations for infectious diseases and cancer.

[swissvaccineresearchinstitute.ch](http://swissvaccineresearchinstitute.ch)