Who we are

Wyss Zurich is a unique accelerator, embedded within the ETH Zurich and the University of Zurich, dedicated to the emerging fields of Regenerative Medicine and Robotics, and hybrid technologies thereof.

We unite world-leading experts to form multidisciplinary teams, pooling their knowledge and expertise.
Our Wyss Zurich projects

Our unique all-in-one approach

Wyss Zurich provides its members with:

- Funding to cover personnel expenses and translational R&D, notably early phase clinical trials
- Access to world-class infrastructures, including a dedicated facility to produce compounds that can be used in humans
- Support in the design, analysis and business strategy of the projects by subject-matter experts

Our mission

We drive the translation of outstanding scientific discoveries into new therapies for patients and breakthrough innovations.

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Regenerative Medicine Technologies

Certified state-of-the-art technology platform to support Wyss Zurich projects to meet regulatory standards
The Regenerative Medicine Technologies Platform of Wyss Zurich is a fully certified state-of-the-art technical and scientific platform dedicated to manufacturing clinical grade products. The Platform provides the expertise to respond to the unique and diverse challenges of Wyss Zurich projects in the field of Regenerative Medicine. It aims to support Wyss Zurich projects in the efficient translation of basic biomedical research to applied regenerative therapies, and to accelerate entry of their innovative treatments into clinical trials.

In addition, Wyss Zurich has recently established product development processes in alignment with the international standard ISO 13485 to support and accelerate the growing number of medical device projects. Support is provided through the following departments, infrastructure and services:

**Production**
- 800 sqm total footprint; thereof a total area of about 200 sqm with grade A, B, C, D and E pharmaceutical clean room
- Qualified equipment for the production of drugs and ATMPs
- Continuous monitoring of critical parameters (particle, differential pressure, temperature, CO₂ concentration)
- Swissmedic manufacturing license (GMP) and distribution license (GDP)

**Quality Management**
- Certified Quality Management System (e.g. Master Standard Operating Procedures, Deviation Management, Change Control Management, Risk Management, etc.)
- Review and approval of documents for development, production, quality control and shipment
- Initial and continuous training of personnel

**Quality Control**
- QC lab with qualified equipment
- Microbiological monitoring of surfaces, airborne particles and airborne microorganisms

**Biobank**
- Qualified storage tanks for storing cells in liquid nitrogen
- -80°C freezers for sample storage
- Cryogenic workbench
- Validated database for sample management

**ISO 13485 for Medical Devices**
- Quality Management processes according to ISO 13485 for development of medical devices
- Training and support in Quality Management and regulatory issues

**Entrepreneurship**
- Product and process development
- Providing regulatory expertise to enable early clinical trials
Robotics Technologies

State-of-the-art technology platform to support Wyss Zurich projects in their transfer to the market
The translation of technologies into products, within the available time and resources, is one of startups’ major challenges.

The Robotics Platform’s mission is to support and accelerate Wyss Zurich projects in their transfer to market by providing multidisciplinary expertise and services, covering a range of core competences such as engineering, prototyping, product development, and entrepreneurship.

Through an interdisciplinary team, state-of-the-art mechatronic prototyping facilities, and a network of external partners, the Robotics Platform supports Wyss Zurich projects in their industrialization towards market-ready products. The Robotics Platform collaborates with the Regenerative Medicine Platform in supporting Wyss Zurich Regenerative Medicine projects, as well as Medical Device projects according to ISO 13485.

The Wyss Zurich Robotics Platform provides a range of services in the following topics:

**Engineering & Prototyping**
- Mechanics, electronics, embedded software engineering
- State-of-the-art 3D Printing and Laser-cutting
- Mechatronic fabrication and testing

**Product Development**
- Development strategy and planning
- Product design and usability
- Manufacturing and procurement
- Regulatory/Certification

**Entrepreneurship**
- Business coaching and Network
- Product management
CeNeReg

Enhancing the regeneration of the injured central nervous system
Nerve fibers in the adult central nervous system (i.e. spinal cord and brain) fail to regenerate after injury, and to date there are no therapies for enhancing their repair. Spinal cord injuries affect people’s lives in a dramatic and long-term fashion, and the social and economic burden of life-long care is enormous.

For a long time there was a dogma that damaged fiber tracts of the central nervous system could not regenerate. However, there is accumulating evidence that specific inhibitory molecules found in myelin (protective layer around nerve fibers) are responsible for the absence of nerve fiber regeneration and the poor functional recovery after injury. This concept, as well as the most potent currently known growth inhibitor, the membrane protein Nogo-A, were discovered in Zurich by Professor Martin Schwab and his group. His team also demonstrated that antibodies blocking the function of Nogo-A led to long-distance regeneration of injured nerve fibers in the spinal cord of monkeys and rats, and greatly improved their functional recovery.

Based on these promising preclinical results, a phase I (first-in-man) clinical trial in patients with spinal cord injury was conducted, proving excellent safety and tolerability of a human anti-Nogo-A antibody. This antibody will enable the critical transition to phase II clinical trials, aimed to determine clinical efficacy of the anti-Nogo-A antibody in patients with spinal cord injury.

Beyond the field of spinal cord injury, these clinical studies will serve as a model for other disorders where nerve fibers of the central nervous system become injured, and may thus have a broad impact for the treatment of neurological diseases in general. A positive outcome of the planned clinical trials would be a real breakthrough in neurology, neuroscience and the field of tissue regeneration and repair.
denovoSkin

Personalized skin grafts to treat skin defects
AnyDrive

denuvoSkin is a Wyss Zurich project
www.wysszurich.uzh.ch

After severe wounding, human skin fails to regenerate and physiologically heals by scar formation. Worldwide, millions of people suffer from severe skin defects or diseases requiring surgical interventions to restore skin function.

Existing therapies frequently leave these patients with permanent, painful, disfiguring, and debilitating scars. Scars may impair movement and growth, and often require several follow-up surgeries, intense homecare and psychosocial rehabilitation. Severe skin defects significantly affect quality of life in the long term, along with the economic burden for the healthcare system.

Human skin is composed of an outer epidermis, a dermis and a hypodermis. The components of the dermis control and regulate scarring. Today, standard of care consists in harvesting a thin layer of healthy patient’s skin, which contains the epidermis but only remnants of the dermis. Since sufficient dermis is missing, these grafts often develop into scars. Furthermore, in severe cases, where most of the skin has been destroyed (e.g. burns), the shortage of healthy skin represents a real clinical challenge.

In 2001 a team of the University-Children’s Hospital Zurich led by Professor Reichmann pursued the vision of bio-engineering personalized dermo-epidermal skin grafts, using patients’ own cells. One of the developed products, denovoSkin, is the result of fifteen years of research. A first-in-man safety study was completed with denovoSkin with very promising results. denovoSkin has obtained Orphan Drug Designation for a treatment of burns (by Swissmedic, EMA, and FDA). With the support of the Regenerative Medicine Technology Platform of Wyss Zurich the team will now proceed with product development, testing denovoSkin’s efficacy in pivotal phase II multicentric studies and preparing for market authorization in terms of regulatory and reimbursement activities.

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Dutch Burn Center
VUMC Amsterdam
University Hospital Zurich
University Hospital Birmingham
Voisin Life Science Consulting

Personalized skin grafts
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ETIMSred

Establishing immune tolerance in multiple sclerosis with peptide-coupled red blood cells
With approximately 2.5 million patients worldwide, Multiple Sclerosis (MS) is one of the most common causes of permanent neurological disability in young adults. It is a chronic autoimmune disease that induces severe inflammation within the central nervous system, causing a wide variety of symptoms, including loss of balance, extreme fatigue and blurred vision. The symptoms occur when immune cells mistakenly destroy myelin, the protective covering surrounding the nerve cells in the brain and spinal cord.

So far, there is no cure for MS. Current treatments only reduce disease relapses and carry the risk of severe side effects caused by inhibiting the patient’s immune system. What is needed is a long-lasting therapy, which will specifically target the harmful autoimmune response without affecting the rest of the immune system.

A team led by Professor Roland Martin already developed an innovative therapy known as ETIMS (Establish Tolerance in MS). This therapy employs the patient’s white blood cells and chemically couples them with myelin peptides. These altered blood cells now target the immune cells responsible for the inflammation and stop the autoimmune process by educating the immune system to tolerate structures such as myelin. This approach has been successfully tested in a first-in-man trial in MS patients.

With the ETIMSred project, the Wyss Zurich team is now advancing this therapy further by using red instead of white blood cells to induce immune tolerance. Since it is easier to collect a high number of red blood cells from patients, this approach will substantially improve the feasibility of the treatment and enable its widespread application. Treatment efficacy will probably be also improved. The key objective of the ETIMSred project is to establish the safety, tolerability and efficacy of this new approach in a phase I/II clinical trial in MS patients.
hemotune

Restoring immune balance in sepsis
Despite all progress in medicine, sepsis is still one of the Top 10 leading causes of death and is associated with mortality rates above 30%.

Sepsis (blood poisoning) is a life-threatening organ dysfunction caused by a dysregulated immune response to infection. Currently there are 19 million cases of severe sepsis with more than 5 million deaths every year. Moreover, sepsis is the single most expensive condition in hospitals.

After many failed attempts to develop sepsis drugs during the last 30 years, there is now a shift towards extracorporeal blood purification in order to remove sepsis-causing toxins or inflammatory mediators directly from the patient’s blood. One of the target substances that needs to be removed is endotoxin, a very potent toxin that is present in the blood circulation of about 50% of septic patients. So far, removing endotoxin has been very challenging due to physical limitations of classical blood purification filters.

hemotune is developing a radically new approach for therapeutic blood purification that allows to remove endotoxins in a way that is much more efficient and biocompatible compared to state-of-the-art methods. In contrast to using rigid blood filters, hemotune applies tiny, strongly magnetic beads that offer a much larger accessible surface area as well as superior mobility and induce no shear stress on the blood.

Restoring immune balance in sepsis

The whole procedure is carried out in an add-on device to dialysis machines that is connected to the patient’s blood circulation. There, the nanomagnets are administered to the blood, capture the endotoxin and are finally separated from the blood by magnetic forces. Thus, only purified endotoxin-free blood without nanomagnets will flow back to the patient.

After successful pre-clinical proof of principle and safety studies in animal models, the team now focusses on the development of a medical device for human application and prepares a first-in-man clinical trial.
HYLOMORPH

Improving the biocompatibility of implantable medical devices
Improving the biocompatibility of implantable medical devices

It is estimated that more than 10 million medical implants are implanted in patients each year worldwide, notably for cardiovascular and plastic surgery.

Due to sub-optimal biocompatibility of existing medical implants, every time one is placed in a patient by a surgeon, fibrosis occurs in the surrounding tissue: the patient’s immune system responds with the so-called foreign body reaction, in which the hosting tissue recognizes the implant as foreign and covers it with a thick layer of fibrotic tissue, in the attempt of isolating, destroying and expelling it.

Fibrosis is among the primary causes for malfunction and failure of implantable medical devices. In addition, fibrosis is associated with infections and can cause pain to the patients. Consequently, revision surgeries are often required post-implant, leading to a costly and lengthy recovery process. It has been reported that up to 20% of all implanted patients need correcting intervention and implant replacement due to fibrosis.

To address this critical medical need, the HYLOMORPH team has developed a unique surgical membrane that optimizes the interface between implants and human tissue. Preparation of the membrane consists of a patented biotech process, in which a non-pathogenic bacteria is cultured in combination with micro-engineered silicone surfaces to produce thin films of biosynthesized cellulose, featuring a finely controlled surface topography. In pre-clinical studies conducted by the team, micro-structured biosynthesized cellulose membranes led to an 80% reduction in fibrotic tissue formation at three months after surgery.

Based on these promising results, the team is now working in close collaboration with the German Heart Institute Berlin (Deutsches Herzzentrum Berlin, DHZB) and the University Hospital Zurich to prepare for the first-in-man application of cellulose membranes on implantable loop recorders (electrocardiographic monitoring devices). If the results are confirmed in humans, micro-structured biosynthesized cellulose membranes could be the first anti-fibrotic solution for medical implants for the prevention of associated surgical complications.

The HYLOMORPH project was started at Wyss Zurich as a collaboration (“HeartOne”) with the Zurich Heart, a research initiative of Hochschulmedizin Zürich that aims at revolutionizing ventricular assist device technologies based on a variety of novel approaches.
LifeMatrix

Tissue-engineered matrices to regenerate the human heart
Globally, one out of 100 children is born with a heart defect. In some severe cases, a heart valve or blood vessel functions poorly or may even be missing.

Such congenital heart defects are commonly treated today by replacing the missing or damaged part with synthetic prosthetic materials. Unlike direct transplant of tissue from human donors, such artificial materials are not rejected by the recipient’s immune system. However, a major drawback of these materials is that these grafts need to be replaced regularly as the child grows, thus requiring repeated surgery and lifelong medical treatment.

A multidisciplinary team from Wyss Zurich has developed a unique tissue engineering technology to grow replacement tissue in the laboratory, which will be compatible with every patient, regenerate and grow with the recipient. To create this tissue, cells of human origin are first grown in culture on a scaffold in the shape of a heart valve or blood vessel. In a process called decellularization, the cells are then removed, leaving behind a perfectly shaped, biologically neutral human tissue matrix called LifeMatrix. After implantation, the recipient’s own cells will repopulate the LifeMatrix, replacing the biodegradable scaffold; and this tissue will continue to grow with the child. Such grafts will avoid repeated major surgeries and their associated risks.

Previous work on autologous and personalized cellular tissues (patients receive tissue grown from their own body), which already obtained approval for a pilot clinical study by the German authority (PEI), is the basis for this next generation tissue engineering technology. The aim of the Wyss Zurich project is to bring the LifeMatrix technology into the clinic with a first-in-man clinical trial.
Liver4Life

Regeneration of the human liver outside of the body
Liver4Life is a Wyss Zurich project
www.wysszurich.uzh.ch

It is well known that the liver has the ability to regenerate. Liver resection (surgical removal of the diseased part of the liver) for the treatment of liver cancer has been carried out for a few decades, but many tumors are inoperable, notably because the removal of a too large piece of liver is fatal.

The Wyss Zurich project will develop a novel therapeutic strategy for liver regeneration consisting of: i) surgical resection of a small healthy piece of the liver from the patient; ii) growth of this piece outside of the body in a perfusion machine until a sufficient size is reached; iii) retransplantation of the regenerated liver to the original patient while removing the remaining diseased part. Current perfusion systems are not able to keep a liver alive outside of the body for a sufficient time to allow growth and regeneration to occur. The challenging aim of the project is to extend the viability of liver tissue outside of the body up to five days and allow its growth. To this end, a perfusion machine will be developed, which will provide necessary nutrients and oxygen supply, and be equipped to monitor growth, as well as assess the functional capacity of the liver.

This technological advance will allow patients with formerly inoperable liver cancers to gain access to surgical resection. Additionally, performing autologous transplantation (patients receive liver tissue from their own body) will avoid the need for life-long immunosuppression and its associated severe side effects. This novel regeneration strategy could also be used in allogenic liver transplantation (patients receive liver tissue from a donor) for end-stage chronic liver diseases, where an organ transplant is the only treatment option. In this second approach, a healthy donor liver will be split into a couple of parts that will be grown in the perfusion machine, yielding more than one transplantable organ. With this approach, the organ donor pool would be increased, which would help to alleviate current donor organ shortage.
OxyPrem

The new way of measuring brain oxygen levels of preterm infants
Preterm birth and its direct consequences are the leading cause of death worldwide for children under five years of age. There are around 15 million infants born prematurely every year and about 1 million deaths associated with prematurity. Globally operating organizations such as UNICEF, the Bill & Melinda Gates Foundation, Save the Children, and many more are currently tackling this problem.

OxyPrem is the first medical device that reliably monitors the oxygen levels of preterm infants’ brains in real time. Using harmless, noninvasive near-infrared light, it continuously measures local oxygenation. Clinicians can set a target level and receive immediate notification if values move above or below that level. Several simple measures can then be taken to increase or decrease the oxygenation level, for example via the incubator atmosphere or through CPAP breathing support, a commonly used method.

OxyPrem is reusable and sturdy, and its use requires only a PC or tablet. It is therefore a feasible solution even for difficult environments. It will also be compatible with frequently used standard hospital monitors in the near future.

At Wyss Zurich, the next steps are being taken so that OxyPrem can be used in the hospital setting. The first goals are to manufacture an initial batch of OxyPrem systems and obtain CE certification. The systems are to be introduced to hospitals throughout Europe in a large-scale, pan-European study running from 2019 to 2021. At the same time, efforts are being made to gain CE mark certification under the new MDR regime. Market entry is envisioned for 2022.
Seervision

Changing the broadcast industry with adaptive motion control technology
As machine vision and robotic automation evolve towards new levels of intelligence, broadcast production systems will advance as well. This will pave the way for new approaches to production, with multi-camera robot and drone setups collaborating to segment and understand unexplored scenes, and then executing all of the operational tasks handled by traditional camera crews in the past – leaving creative storytelling to humans.

At Wyss Zurich, the Seervision team of engineers, programmers and broadcasters is developing a radically new technology called “adaptive motion control.” The project is the result of years of research at ETH Zurich’s automatic control laboratory, one of the world’s top three laboratories of this kind.

The software, which is both camera- and robot-independent, incorporates image recognition, artificial intelligence, model predictive control techniques and high-speed dynamics to make autonomous video production possible. Seervision has analyzed the motion sequences of cameramen working in a variety of applications and converted them into algorithms that allow for real-time object recognition and scene segmentation. Moreover, these algorithms are continually enriched through a machine learning process, resulting in multiple robot camera setups in which each robot can not only autonomously perform all the tasks of traditional camera work, but also exchange information with other robot cameras. The final product is indistinguishable from what is produced by a team of human beings. However, the production is now controlled by a single operator, who is free to focus creatively on the big picture.

The technology developed by Seervision represents a revolutionary change in studio and sports production. It makes it possible to achieve consistently high quality with significantly lower production costs and allows for innovative production techniques.

The team’s mission is clear: to ensure that in the future, every robotic camera system will use Seervision’s adaptive motion control software.
Sevensense
Visual navigation for the next generation of service robots
Visual navigation for the next generation of service robots

Service robots have the potential to drastically increase efficiency in various industries by taking over repetitive tasks. However, the abilities of such systems are limited by today’s navigation technologies.

Robots have become a crucial tool in many industries. Robotic manipulators are efficient at manufacturing and assembling all kinds of goods. Yet their use is limited to very constrained and static surroundings. The evolution of robotic tools for a broader range of applications requires more versatile technologies if they are to be used not only in highly structured factories, but also in more dynamic and busy environments that are shared with humans.

The fundamental technology needed to propel this evolution provides for autonomous mobility in unfamiliar and changing environments. It makes it possible to employ service robots in a wide range of applications, including industrial cleaning, material handling, delivery, surveillance and inspection.

Particularly in indoor spaces, where global positioning systems (GPS) are unavailable, the solutions currently on the market are either not sufficiently accurate or too expensive.

At Wyss Zurich, the Sevensense team develops solutions that enable robots to measure their position with a high level of accuracy and to navigate precisely and safely in dynamic environments. Similar to the human eye and inner ear, these systems process images from cameras and an inertial measurement unit to construct a map of the surroundings and pinpoint their position on the map.