swiTT**report** 2020

SWISS TECHNOLOGY TRANSFER REPORT

swiTT
swiss technology transfer association

CASE STUDY

ADAPTIVE MODULATOR OF GUT MICROBIOTA FUNCTION

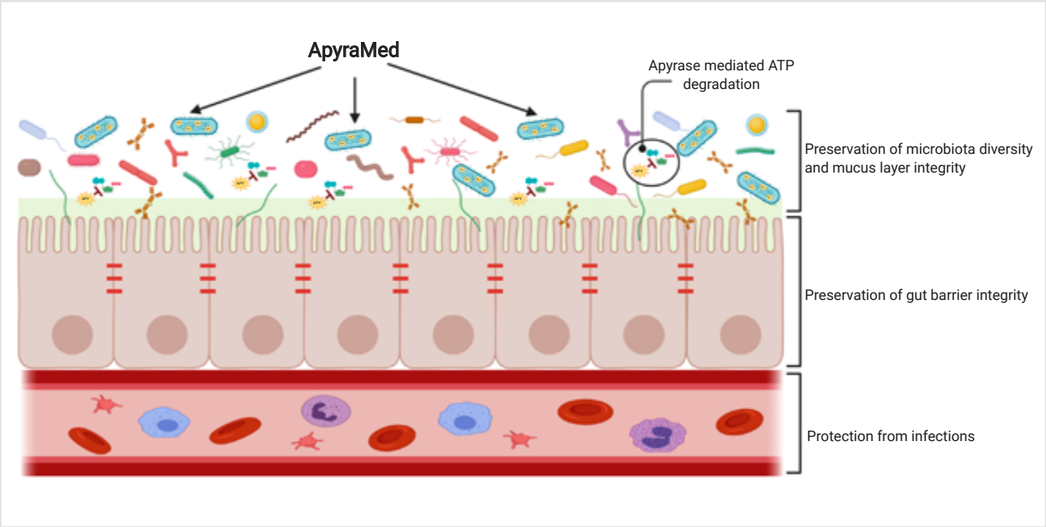
Problem – Challenge

Enteric infections affect up to 1 billion people leading to 2 million death per year worldwide. No effective vaccines exist against major enteric pathogens. In addition, the intestinal ecosystem conditions all aspect of organism's physiology and alterations of the microbiota, defined as dysbiosis, contribute to the pathogenesis of most clinical conditions.

Solution

MV BioTherapeutics is a Swiss microbiome biotherapeutics & live vaccines company, a spin-off of the Institute for Research in Biomedicine (IRB) in Bellinzona, affiliated to the Università della Svizzera italiana (USI), developing live attenuated vaccines and biotherapeutics. The company capitalizes on the discovery made at IRB that adenosine triphosphate (ATP) released by the microbiota modulates the secretory IgA response in the small intestine. This knowledge led to two technology platforms. The first, ApyraVax, is a "plug-and-play" live attenuated vector able to induce protective mucosal antibodies against enteric pathogens.

Bio Therapeutics aims at reducing enteric infections and cutting down the social costs of such infections by realizing high-value oral vaccines that address currently unmet medical needs. The second platform, ApyraMed, is based on a modified biotherapeutic that improves immune system competence and dysbiosis by adapting the intestinal ecosystem to different clinical conditions. The first ApyraMed-based product is a potent oral enhancer of the immune response against solid tumors in combination with immune checkpoint inhibitors (ICIs). In spite of unprecedented durable responses in different cancers obtained with ICIs, only a limited fraction of patients responds to these drugs. Therefore, combination therapy are needed to improve the therapeutic efficacy. The intestinal microbiota plays a crucial function in the outcome of ICIs therapy. The ApyraMed based biotherapeutic beneficially shapes the gut ecosystem and improves the immune response triggered by ICIs, extending survival in experimental models of solid tumors. Bio Therapeutics aims at translating these findings to ameliorate the therapeutic response to ICIs in oncologic patients.



CONTENTS

CASE STUDIES

SUMMARY

The annual survey "swiTTreport" is the most comprehensive analysis of the technology transfer activities of Swiss public research organisations (PRO). The report covers two main areas, a) research contracts of the participating institutions with private or public partners, and b) the activities for the economic exploitation of research results from these institutions. The Swiss PRO interact very actively with partners in the economy. These activities are collectively designated in the report as "technology transfer" (TT) activities.

Data on technology transfer activities from seven cantonal universities and the two Federal Institutes of Technology (collectively Universities), from five universities of applied sciences (UAS), and three research institutions of the ETH domain (RI) were available for this year's report.

Overall, the respondents reported the following indicators on technology transfer activities in 2019:

3877	New Research Contracts
631	Invention Disclosures
329	Priority Patent Applications
237	License & Option Agreements
102	Start-Ups founded

ZUSAMMENFASSUNG

Der jährlich publizierte "swiTTreport" ist die umfassendste Analyse der Technologietransfer-Aktivitäten öffentlicher Forschungsinstitutionen (PRO) in der Schweiz. Dieser Bericht umfasst zwei Hauptbereiche: Forschungsverträge mit privaten und öffentlichen Institutionen und die wirtschaftliche Verwertung von Forschungsergebnissen. Diese Aktivitäten werden häufig auch unter dem Begriff „Technologietransfer" zusammengefasst. Der Bericht zeigt, dass die schweizerischen PRO sehr aktiv und erfolgreich mit der Wirtschaft interagieren.

Der Bericht umfasst die Aktivitäten von sieben kantonalen Universitäten und der beiden ETHs (zusammengefasst unter Universitäten), von fünf Fachhochschulen (UAS) und von drei Forschungs-institutionen des ETH-Bereichs (RI).

Insgesamt rapportierten die teilnehmenden Institutionen die folgenden Kennzahlen über ihre Technologietransferaktivitäten im Jahr 2019:

3877	Neue Forschungsverträge
631	Erfindungsmeldungen
329	Patentanmeldungen
237	Lizenz- & Optionsvereinbarungen
102	Start-Ups gegründet

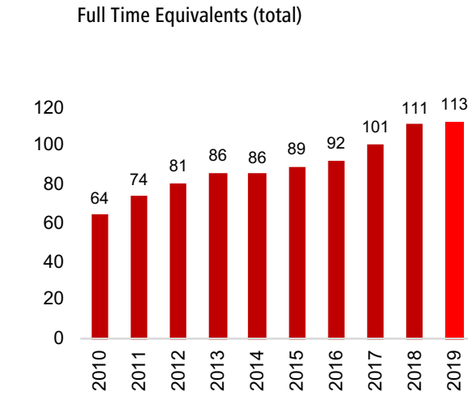
RÉSUMÉ

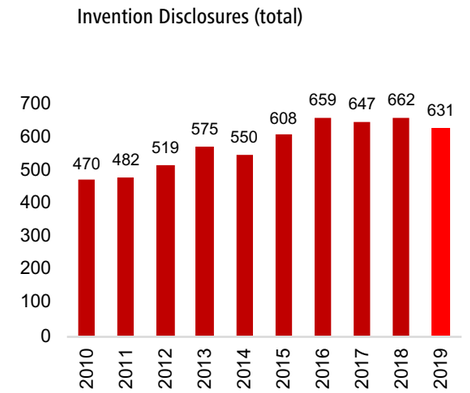
L'analyse présente est la plus exhaustive connue sur les activités de transfert de technologies réalisées par les institutions publiques de recherche suisses. Le rapport couvre deux aspects principaux: les contrats de recherche de ces institutions avec des partenaires privés ou publics et les activités liées à la valorisation des résultats de recherche obtenus par ces institutions. Ce rapport désigne collectivement ces collaborations et activités de valorisation sous les termes de transfert de technologies (TT).

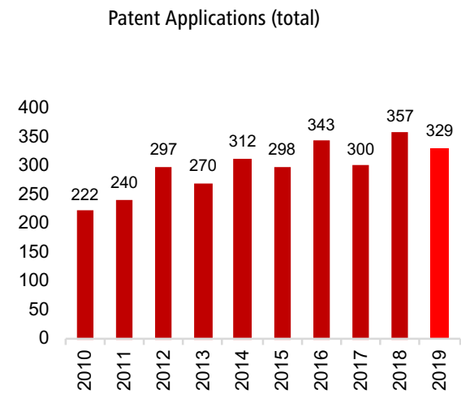
Ces données proviennent de sept universités cantonales et deux Ecoles Polytechniques fédérales (Universités), de cinq universités de sciences appliquées (UAS) et de trois institutions de recherche dans le domaine des Ecoles Polytechniques Fédérales EPF (RI).

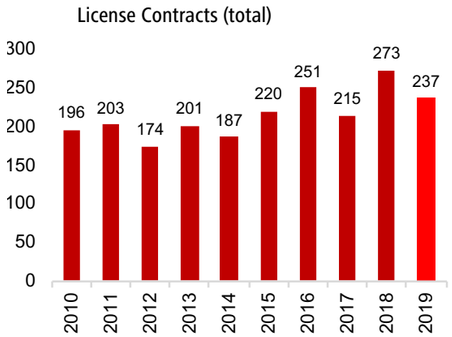
Dans l'ensemble, les personnes interrogées ont communiqué les chiffres clés suivants sur les activités de TT en 2019:

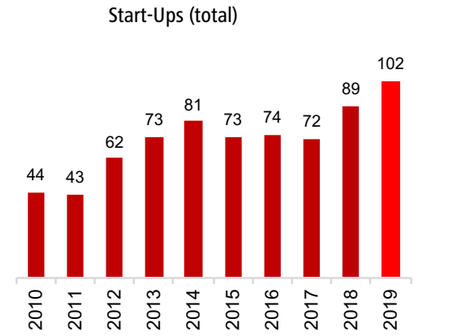
3877	Nouvelles contracts de recherche
631	Déclarations d'invention
329	Demandes de brevets
237	Contrats de licence et accords d'option
102	Créations de start-ups











Data of the last ten years show a solid outcome of the TT activities in Switzerland.

CASE STUDY

OXYPREM: UNCOVERING BRAIN OXYGEN IN HIGH-RISK PATIENTS

Problem – Challenge

Pre-term babies often require early oxygen therapy to survive and avoid chronic disabilities; however, existing devices for monitoring oxygen supply often struggle to achieve the necessary precision for these special patients. OXYPREM has developed a novel sensor for measuring oxygen levels in the brain of neonates.

Solution

OXYPREM 1.4 is a CE marked, non-invasive, reusable sensor which continuously measures the oxygen level in human tissue in real time. Clinicians can monitor at-risk body parts such as the brain and consider this information when they decide on the treatment of their patients. It uses harmless light and has been specifically designed to work well in preterm children, resulting in independence of blood volume and perfusion. Currently, OXYPREM is used in over 25 European hospitals, contributing to the "SafeBoosC-III" trial.

With its soft and flexible silicone design, OXYPREM can be applied smoothly to the skin, using bandages or CPAP caps. So no adhesives are needed, which would cause further stress on the patient's sensitive skin. A small bending aid accessory provides support to fixate the sensor on very tiny heads. Simple disinfection of the reusable sensor with alcoholic wipes enables cost-efficient routine use.

No preparation or calibration is needed before use, providing immediate information. OXYPREM readings are shown on an accompanying "OXYPREM Monitor" tablet PC, making it feasible also for professional medical environments outside hospital units.

OXYPREM is a spinoff of the University of Zurich, with a strong background at the University Hospital Zurich and support by renowned institutions such as Wyss Zurich and Venture Kick.

Application area: MedTech
Partners: University of Zurich, Wyss Zurich, OxyPrem AG

1. PARTICIPATING INSTITUTIONS AND DATA COLLECTION

Two Swiss Federal Institutes of Technology (ETH) and eight cantonal universities (collectively "Universities"), seven universities of applied sciences (UAS), and three research institutes (RI) in the ETH domain were contacted in spring 2020 and asked to provide data on their technology transfer (TT) activities for the year 2019. The expression "technology transfer" used in this report covers the activities of these institutions with regard to research collaborations with partners from the economy and the commercialization of research results for the benefit of the economy and society overall.

The questionnaire was returned by nine members of Universities, all members of the RI as well as individual departments of five UAS. The data show that the handling of research collaborations with economic partners and other technology transfer activities varies substantially among different institutions. Of note: not all of them were able to provide a comprehensive overview and hence all aggregated data showed in this report represent the lower boundary of the actual situation. Appendix 1 shows the institutions that participated in the survey and comments on the comprehensiveness of the data provided.

The report mostly provides aggregate data for the three types of institutions covered in this survey. For those institutions that agreed to disclose individual data some key figures are listed in Appendix 3.

Comments on data received by the different types of institutions:

Universities:
At several universities, only contracts for collaborative research projects with economic partners above a certain threshold need to be signed by university management. Therefore, not all collaborative projects can be reported by such institutions. Activities in research and technology transfer at university hospitals are usually closely linked to the respective university, hence the services of these TTOs are also available to researchers at the hospitals.

UAS:
The management of technology transfer activities at the UAS varies widely among institutions and individual departments. Some departments or schools have professionals working in a TTO function and are able to provide comprehensive data. At other departments or schools, no centralized support functions exist and data are fragmentary or completely lacking.

RI:
The research institutions that participated in the survey have centralized support functions providing technology transfer services for the researchers.

CASE STUDY

UNIVERSITÉ DE GENÈVE

IDQ

QUANTUM RANDOM NUMBER GENERATOR FOR MOBILE PHONE SECURITY

Problem - Challenge

With the advent of ubiquitous internet browsing, purchasing and banking, personal data security is becoming more and more critical.

Solution

Press Release, 14 May 2020: « ID Quantique and SK Telecom Announce the Word's First QRNG-Powered 5G Smartphone ».
With its new Quantis QRNG (quantum random number generator) chip, developed by Geneva based ID Quantique, the Samsung Galaxy A Quantum smartphone will allow users to more safely use services like authentication and online payments.
This technology was invented by researchers at the Group of Applied Physics of University of Geneva. In 2014, with the help of their Technology Transfer Office, the researchers filed a patent entitled "Method and Device for Optics Quantum Random Number Generation". The patent family was then licensed to ID Quantique SA.
The working principle of the technology is the following: a light beam is a flow of light particles called photons. The number of photons emitted by a LED in a given time interval is random, by nature.

This fundamental property of the light field is also called "shot noise" or "quantum noise". These photons are captured by a CMOS image sensor which generates a numerical signal. Finally, a "randomness extractor" can then generate perfectly unpredictable random numbers out of this input data.
"This is truly the first mass market application of quantum technologies" said Grégoire Ribordy, CEO of ID Quantique. "With its compact size and low power consumption, our latest Quantis QRNG chip can be embedded in any smartphone. It will bring a new level of security to the mobile phone industry."
To bring this technology to market at this scale, ID Quantique had to industrialize the production significantly. This was achieved with the help of Korean investor SK Telecom.

Id Quantique SA was formed in Geneva in 2001 as a spin-off of the University of Geneva.

2. INSTITUTIONAL RESOURCES FOR TECHNOLOGY TRANSFER

2.1 Services Provided

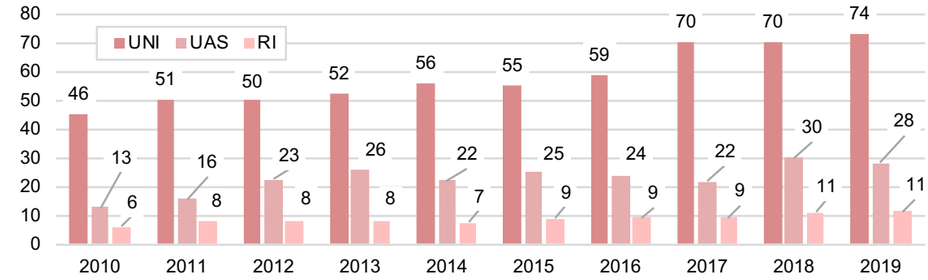
All University TTO are handling contracts for research collaborations. However, at several Institutions the finalization of research agreements with the support of a centralised administrative department (e.g. TTO) is not mandatory, or not all contracts are covered (e.g. contracts for EU project or contracts <50 kCHF not included). All University TTO deal with the handling and commercialization of intellectual property (IP), which includes the evaluation of the commercialization potential of products or services based on research results, the protection and management of IP, and the licensing or sale of IP to industrial partners. Seven of ten TTO at Universities also provided support for the coaching of start-up projects.
Four of five UAS TTO and all RI TTO offer support for research collaborations. Four out of five UAS TTO and all TTO of RI deal with the management of IP. The commercialization of IP is supported by all RI TTO and by four of five UAS TTO. Coaching of start-up projects is offered by four UAS TTO and one RI TTO.

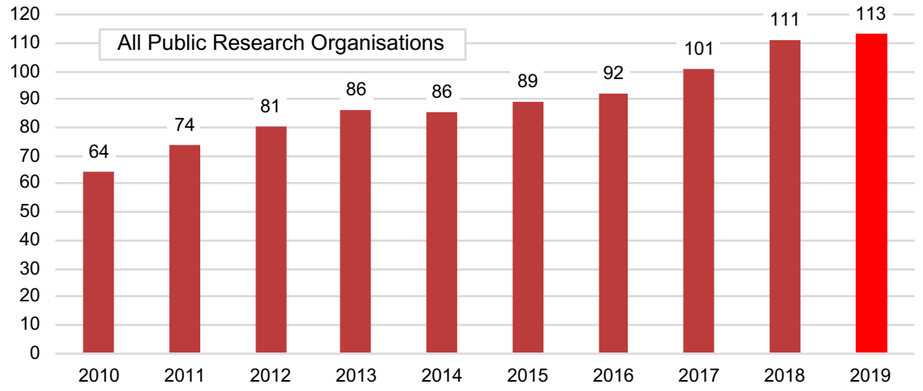
2.2 Staffing

Staffing refers to the number of full-time equivalents (FTE) employed for TT activities at an institution. These are professionals such as licensing, intellect-tual property, technology or research contract managers and administrational staff, whose main occupation is in the area of technology transfer. Their activities cover the drafting and negotiating of research and cooperation agreements, intellectual property management, patent portfolio management, patent, technology licensing and other technology transfer activities. Part of the staff may also be involved in the coaching of start-up projects.

TTO typically collaborate with external patent firms for the drafting, filing and prosecution of patent applications and may address specific legal issues to external attorneys. Several TTO also outsource legal issues to external attorneys. At some institutions, start-up projects are handled by dedicated organizations such as business incubators.

Fig.1: Development of Staffing Level / Full Time Equivalents FTE





3. RESEARCH CONTRACTS WITH PARTNERS

3.1 Research Contracts Handled by the TTO

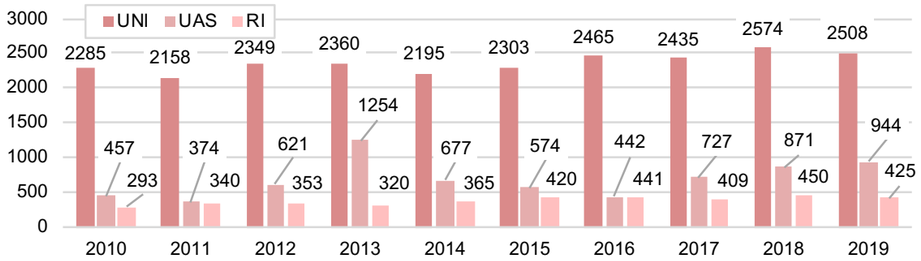
In 2019, the TTO handled a total of 3877 research contracts with economic and public partners, almost exactly the same number as in the previous year. This number includes collaboration agreements, clinical trial agreements, Innosuisse IPR and EU collaboration agreements. SNSF projects (with funding provisions) are only included in these numbers if they involve multiple partners and therefore require a collaboration agreement.

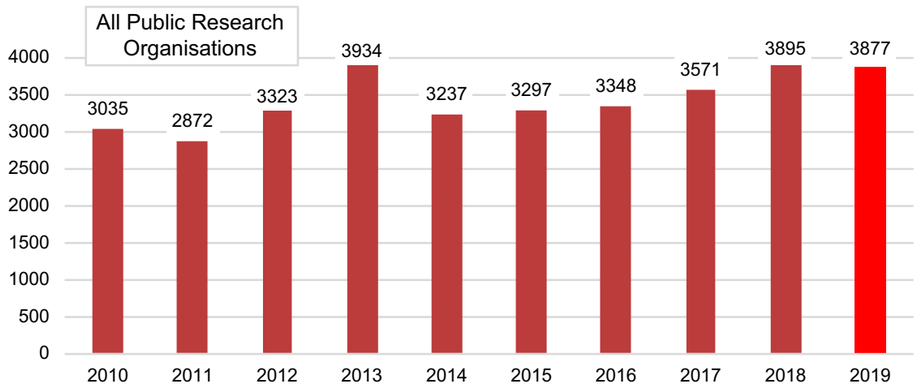
Research collaborations between academia and industry are a key aspect of TT, they do indeed represent various possible benefits to academia and the economy. They not only allow industry to access the know-how and infrastructure of academia, companies also gain access to academic talents through such collaborations.

Likewise, academic labs can also benefit from the know-how and infrastructure of the industrial partners. In addition, the funding of joint projects by partners from the economy may account for a significant contribution to the research budgets of certain PRO. Such collaborations are also a great opportunities to feed and enrich each other in cutting edge innovation areas. In this context, research collaborations are most important for TT.

In addition to research collaborations, TTO handle other types of agreements which foster the cooperation between academia and economic partners, such as consulting agreements, material transfer agreements (MTA), and non-disclosure agreements (NDA). In 2019, the institutions reported altogether 3239 such other types of TT agreements.

Fig. 2: Number of Research Agreements and EU Contracts Handled by TTO



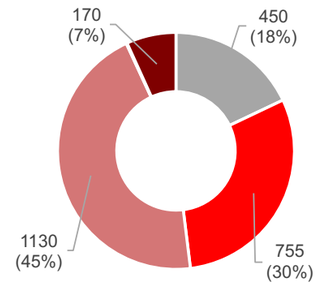


3.2 Type of Collaboration Partners

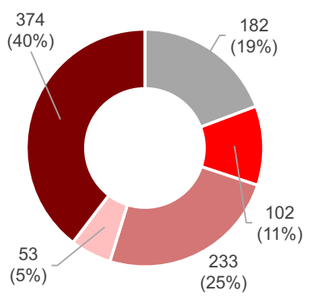
With regard to the type of collaboration partner, the small- and medium-sized enterprises (SME), i.e. companies with fewer than 250 employees, account for 19.2% of total research contracts reported for 2019.

If one considers only reported collaborative projects with the private sector (SME plus large Companies), SME account for 45 % of all projects with commercial partners.

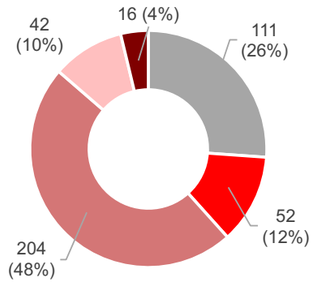
Fig.3: Partners in Research Contracts



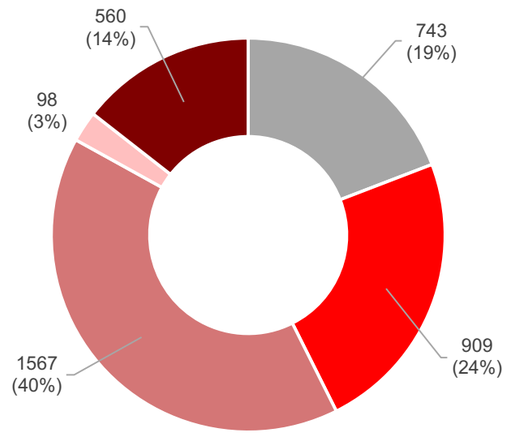
Partners in Research Contracts of Universities in 2019



Partners in Research Contracts of UAS in 2019



Partners in Research Contracts of RI in 2019



Partners in Research Contracts of All Public Research Organisations in 2019

CASE STUDY

Empa
Materials Science and Technology

re-fer.eu
strengthening solutions

SHAPE MEMORY STEEL FOR STRUCTURAL REINFORCEMENT

Problem – Challenge

Ancient civil works such as bridges, tunnels or buildings often suffer from material aging, cracks and deformations or other damages, and therefore require reinforcement to guarantee structural safety for their future use. Modernizing residential or industrial buildings may come along with removal of walls, to enlarge available spaces, or to create a more generous appearance of the interiors. Current solutions are known to be bulky or expensive, or both, such as a support beam inserted under the ceiling, creating an obstacle to industrial overhead installations, and an insult to the architect's eye. The desirable alternative are integrated, flat, and yet robust structural elements to retrofit the constructions.

Solution

Iron-based shape memory alloys (SMA) are a material class that can solve this problem. In more than 15 years of research work, experts from Empa and the start-up re-fer AG have readied a precise method for series production: SMA steel, which strives to contract during heating and thus permanently pre-stresses the concrete structure. Since 2018, the new building material is available on the market under the name "memory steel". To strengthen an old building, for instance, a strip of this special steel ("re-plate") is fastened under the ceiling using dowels and then heated with electricity, an infrared radiator, or gas. Alternatively, the reinforcement can also be set in the concrete: a groove is milled into the concrete slab, then a ribbed reinforcement bar ("re-bar") is inserted and anchored to the substrate with a levelling mortar. Finally, the memory steel bar is heated with the aid of direct current or gas and thus pre-stressed. Another variant is a full-surface application using re-bar in combination with self-levelling or sprayed mortar. re-bar is particularly interesting and efficient in infrastructure constructions such as bridges and tunnels. With memory steel, bulky beams and wretched retrofit are just a stale memory!

.

CASE STUDY

adolphe merkle institute
excellence in pure and applied nanoscience

HEMOLYTICS

BIO-INSPIRED MATERIALS
NATIONAL CENTER OF COMPETENCE IN RESEARCH
FNSNF
Swiss National Science Foundation

HEMOLYTICS: SENSITIVE AND EASY TO USE DIAGNOSTIC FOR MALARIA

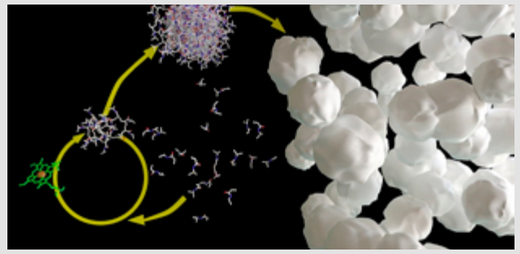
Problem – Challenge

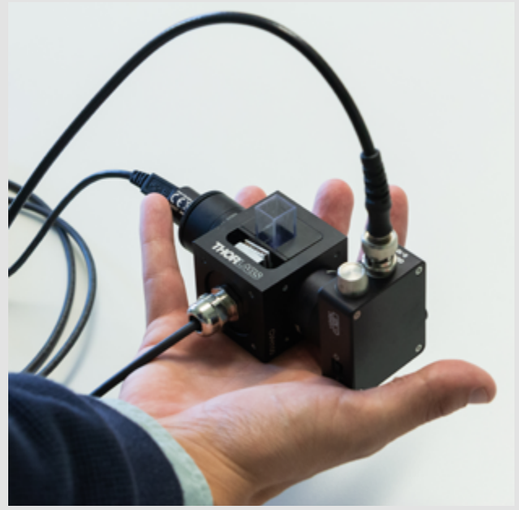
Malaria is a life-threatening disease that impacts both the public health and the economy. According to the WHO, there are more than 219 million cases and 400'000 deaths annually. Individuals infected with malaria but display no symptoms act as reservoirs for the parasite, leading to further infections. These individuals need to be identified and cured to stop malaria transmission, and ultimately eradicate the disease. However, rapid diagnostic tests and microscopy have failed to efficiently detect these asymptomatic infections due to their low sensitivity.

Solution

Hemolytics' malaria diagnostic is based on a patented and published amplification of a pan-malarial biomarker, hemozoin. The chemical reaction leverages the catalytic properties of the biomarker to trigger a dual amplification resulting in turbidity that can be optically monitored. This new tool, which detects the biomarker in the bloodstream at extremely small concentrations, could lead to fewer false-positives, subsequently improve treatment protocols for patients, and help reduce healthcare costs, but also fill a market niche in the diagnostic sector. The test is specifically designed to discover asymptomatic carriers at risk of transmitting the disease.

The project stems from research carried out by Prof. Nico Bruns´group at the Adolphe Merkle Institute, in collaboration with the Swiss Tropical and Public Health Institute, and the University of Fribourg's Department of Medicine. The researchers investigated hemozoin, which is generated by the malaria parasite when it digests hemoglobin, a vital oxygen-carrying protein found in red blood cells. To observe the presence of this biomarker, the scientists chose a polymerization reaction. The solution passes from a transparent state to a cloudy one upon formation of the polymer. The speed of the reaction is directly correlated to the concentration of the malarial biomarker.





4. COMMERCIALIZATION ACTIVITIES

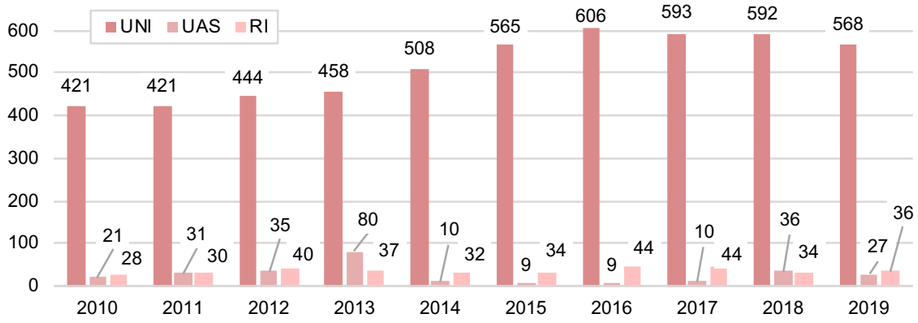
Research results of Universities, UAS and RI do have potential to form the basis for innovative products and services which are developed and later commercialized by companies. The public institutions strive to make research results with a potential for socio-economic impact available to the private sector. Usually this is done through licensing of technologies to companies. To raise the attractiveness of academic TT and licensing for industry, research results with socio-economic potential need to be screened and identified, and the corresponding intellectual property rights need to be secured. While software is usually protected by copyright, protection of most new technologies is sought in form of patent applications. Without an appropriate protection of the intellectual property, industrial or financial investors in many industry sectors will not consider investing for the research and development of products that are then free to be copied by competitors.

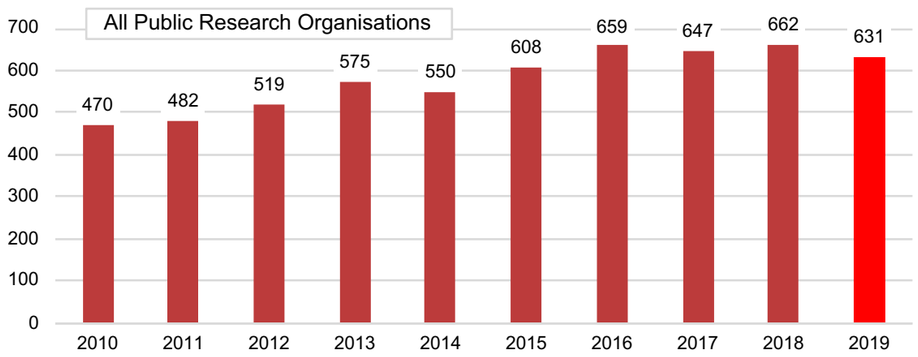
With regard to patentable inventions, this process involves the following main steps: identification and evaluation of research results through invention disclosures, filing of patent applications, identification of suitable licensing partners, negotiating and concluding license agreements with existing companies or newly created start-up companies. Within many institutions, the creation of such start-up companies is supported by various additional services. Sections 4.1 - 4.4. of this report describe the key TT indicators in relation to start-up activities from the participating institutions.

4.1 Invention Disclosures

A total number of 631 (-4.7%) invention disclosures were reported for 2019. The vast majority of invention disclosures were reported by Universities (90.0%). The three RI accounted for 5.7% of the invention disclosures, the UAS for 4.3%.

Fig.4: Number of Invention Disclosures





4.2 Patenting Activities

4.2.1 Priority Patent Applications

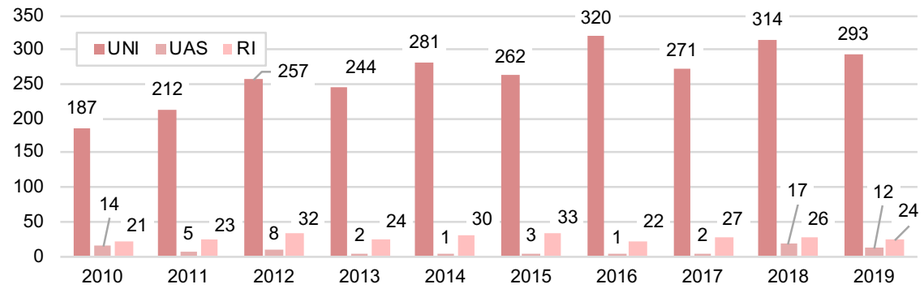
The protection of intellectual property in the form of patents is of great importance in many industry sectors. This is particularly true for industries with high product development costs and long product lifecycles, e.g. biotechnology and pharmaceuticals. The TTO at PRO must decide at an early stage about filing patent applications because patenting of an invention is no longer possible after the results have been rendered public in scientific journals or through other channels. Moreover, many companies will not consider evaluating a new technology if it is not protected by a patent. Thus, patenting activities of PRO can be a prerequisite for entering into a partnership with an industrial partner.

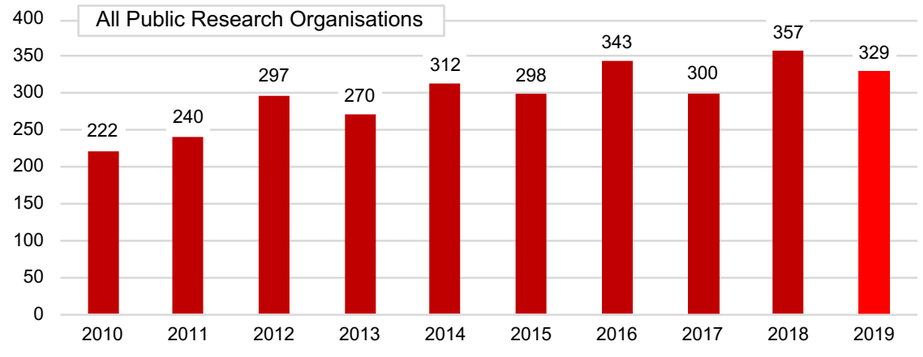
In total 89% of all 329 patent applications were filed by Universities.

4.2.2 Patent Portfolio – Active Patent Cases End of 2019

At the end of 2019, the institutions participating in the survey reported 2744 (+5.1%) active patent cases which were either licensed to a company or for which they were searching for a licensee. Marketing of such technology opportunities is done by the PRO through various channels. Identifying the responsible person within the organization of a potential licensee is a challenge, and often existing contacts of researchers are used to approach companies. To support the research institutions in their technology marketing efforts, swiTT runs the searchable national technology portal swiTTlist (www.switt.ch/swittlist). swiTTlist provides industry with a quick and easy, up-to-date overview of current technology opportunities from Swiss PRO. TTO regularly upload new technologies on this searchable portal. With the help of an automatic alert system, company representatives are informed immediately each time a new technology is available in their field of interest.

Fig. 5: Number of Priority Patent Applications Filed





CASE STUDY

ETH zürich skope

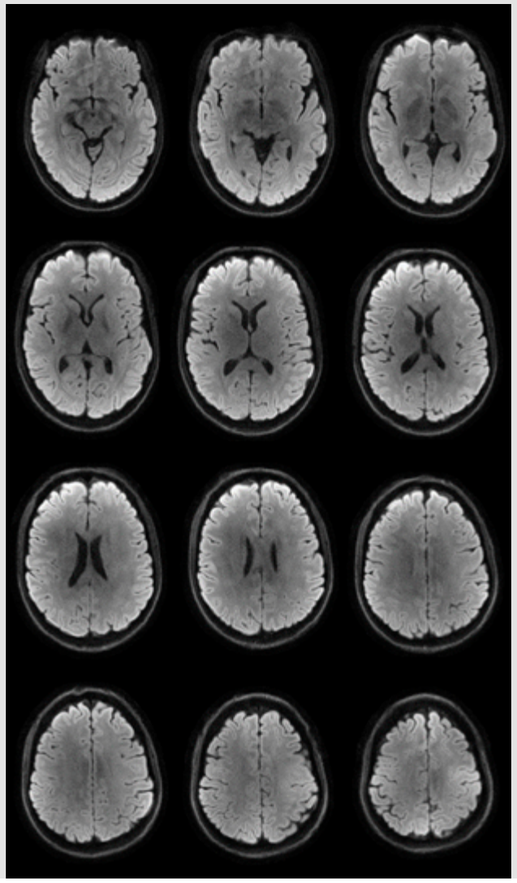
HIGH-PRECISION BRAIN SCANS WITH THE NEURO-CAM

Problem – Challenge

MRI – magnetic resonance imaging – is a widespread diagnostic tool. The MRI scan yields a 3D image of the body, allowing to diagnose disease in its structure and function. During an MRI scan, radiofrequency waves probe the tissue, while the patient is lying in a strong magnetic field that is slightly modulated to encode the signal. In practice the accuracy of MR image datasets is affected by spatiotemporal perturbations of these dynamic magnetic fields applied for encoding. As a result, relatively robust yet slow imaging techniques are being used instead of the ones offering best contrast-to-noise results. With this conservative approach some of the image errors are reduced, yet not removed, while limiting the scans in resolution and speed.

Solution

The NeuroCam by Skope is an MRI coil array for imaging the brain. Different from conventional coils, the NeuroCam is equipped with magnetic field sensors that measure the actual magnetic field dynamics present during the scan. This information on the slight imperfection of the encoding can be used to correct the image at the signal processing stage, where the acquired radiofrequency signals are turned into images. As a consequence, images can be acquired fast while their accuracy is preserved, eventually enabling more powerful automated image analysis tools to support diagnostics.
One of the challenges is the operation of the magnetic field sensors with the required accuracy in nanotesla in a magnetic background field of several tesla and fluctuations on the order of tens of millitesla. Several measures are needed to achieve this like blocking sheath wave currents on cables, which are used in the NeuroCam.



Top figure: NeuroCam by Scope
Bottom figure: Series of ultafast diffusion images acquired with the NeuroCam

CASE STUDY

DARIX Bullard EPFL

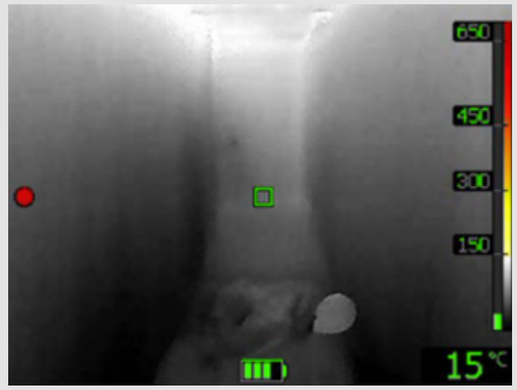
AUGMENTED REALITY FOR FIREFIGHTERS

Problem – Challenge

All firefighters, volunteers and professionals alike, have to learn how to deal with flames. But fire is not the only risk they face. Toxic, impenetrable smoke and darkness add to the dangers and slow the firefighters' progress. Clad in protective gear weighing over 20 kilos, firefighters may also be dragging a firehose behind them and carrying a thermal imaging camera to help orient them, analyze their surroundings and locate victims.

Solution

Adrien Birbaumer and Martijn Bosch, two engineers at the Image and Visual Representation Lab (IVRL) of Prof. S. Süsstrunk came up with a solution that frees up the firefighters' hands. Their solution consists of placing a mini infrared camera on the helmet and incorporating a transparent screen in the oxygen mask.
Thus equipped, firefighters see two images in their field of view: what their eyes see and what the thermal imaging camera records and displays in real time. This allows firefighters to move around more easily and avoid obstacles without having to interrupt the search process.
This solution allows in particular to have the best representation of hot and cold zones using red and blue but with the right tones that would be visible on a transparent surface.
This technology has been patented by EPFL and licensed to Darix sarl a spinoff created by the two engineers.
Recently Darix has been acquired by Bullard a global leader in personal protective equipment.



4.3 Licensing

4.3.1 Licenses and Sales of Intellectual Property (IP)

In 2019, overall 237 (-13%) new IP agreements, usually licenses, were reported, in a few cases the agreements involved a sale of the IP rather than a license. In total 86.9% of all agreements were handled by Universities.

4.3.2 Type of Licensing Partners

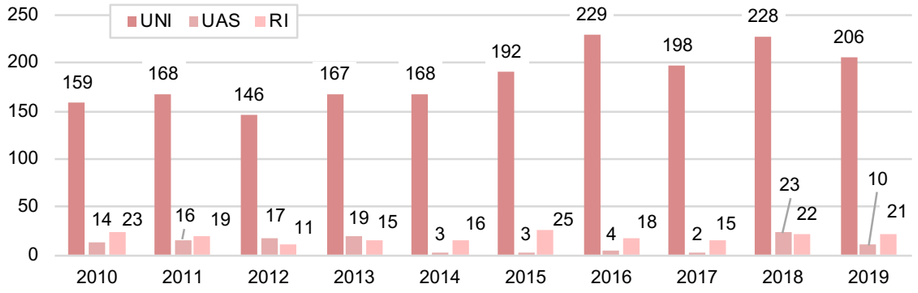
PRO regularly license technologies to their start-up companies, that are included in the SME share. Thus, start-up companies play an important role in developing university technologies. Depending on the industry segment and on the particular product these companies will either market the final products themselves or will sublicense the technologies to larger companies that have the necessary know-how and resources to bring the product successfully on to the market.

Frequently, projects or start-ups are acquired by larger companies once their products or services have reached sufficient maturity.

4.3.3 License Portfolio and License Income

The number of active licenses under management at the end of 2019 was reported as 1663 (+6.7%) cases. Thereof, 92.8% of active licenses were handled by the Universities, 6.2% by the RI and 1.0% by the UAS.

Of these active licenses 25.0%, namely 415 cases resulted in license income to the institutions and the researchers involved. This figure has increased continuously in the past years in line with the growing number of products sold on the market that are based on research results of PRO. In the other cases income resulted from other type of license fees, e.g. license issue fees or milestone payments for products still in the development process.



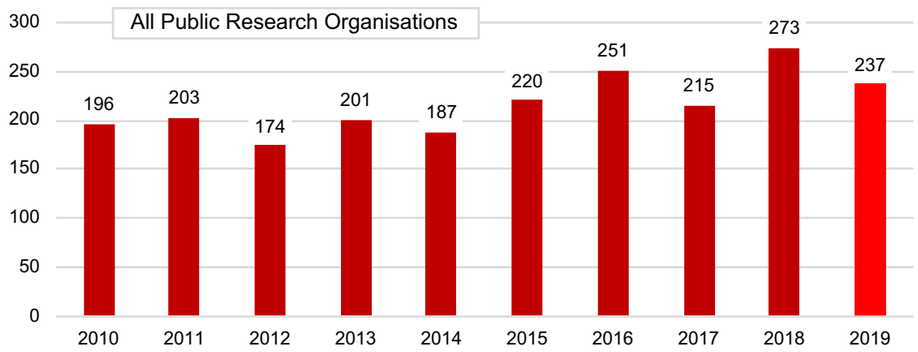


Fig. 6: Number of new License, Option or Sales Agreements for Intellectual Property Rights (IPR)

These figures reflect the typical situation of licenses granted to industry by PRO. Many of the licensed technologies are at an early stage and require extensive development by the licensee. It often takes several years until a product reaches the market. Moreover, the development risk is often high for these early stage technologies, and a significant number of projects are stopped before a marketable product is ready.

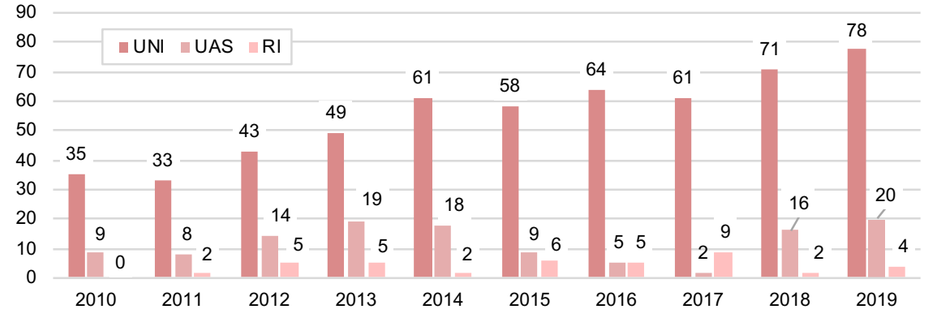
When licensing to start-up companies, some institutions may accept equity in such companies as a partial compensation for the licensing of technology. Such equity transactions usually replace down-payments or early milestone payments in order to avoid any cash drain from the start-up at the early stage of development. This results in a deferral of license revenues from such licenses until the shares in such start-up companies are sold by the institutions.

In the past years more institutions started to accept equity as part of their license deals, thus reducing the annual licensing income and adding the management of an equity portfolio to their services.

4.4 Start-up Companies

The trend seen in 2018 with growing start-up numbers continued in 2019.

In 2019 the institutions reported a total of 102 new start-up companies (+14.6%), whereby 63 of these companies (61.8%) relied on a license or a contractual transfer of intellectual property from a PRO. The remaining companies were created on the basis of know-how developed at the research institutions without a formal license.



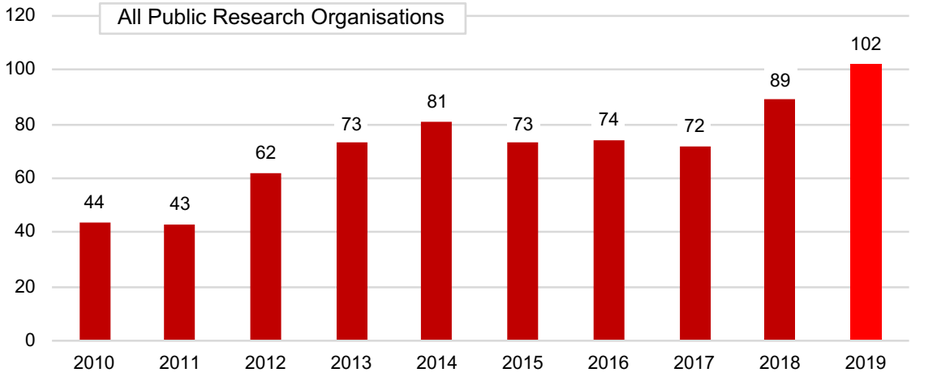


Fig. 7: Number of Start-up Companies Founded

CASE STUDY

Universität Basel

Universität Zürich

botticelli

INSPIRED BY NATURE – THE BOTTICELLI IMPLANT

Problem – Challenge

Conventional implant manufacturers, which number in the hundreds, have been marketing dental fixtures for over 30 years with basically the same design. As a result two recurring issues keep the scientific community debating: (1) the ocurrence of a marginal bone loss around its implant shoulder and (2) periimplantitis.

Solution

The discovery of a Mayan mummy, or rather an implanted sea shell, serving as a tooth replacement in her jaw, showed a researcher from the University of Basel the way to a structure that preserves the morphology of the bone surrounding the implant. Encouraged by this idea a group of Swiss start-up entrepreneurs recreated this structure, by mimicking nature's perfection with its vertical groves. Thus the BOTTICELLI implant system was born.

Typically, designed like a common screw with threads running horizontally all the way up to its shoulder, this shape in traditional dental implants prevents bone to grow up again. While the lower part of the BOTTICELLI implant needs to anchor in the bone and therefore maintains the usual screw construction, it resembles a patented shell structure on the neck, allowing for surrounding bone growth.
Though bacterial infection, causing periimplantitis cannot not be prevented by its novel design, cleaning of affected areas with a brush is considerably easier with the BOTTICELLI implant and might in some cases even avert an extraction.

All BOTTICELLI implants are available in titanium; a next generation solution in ceramic is already in the pipeline.

Its value proposition of innovation and simplification, paired with competitive pricing, makes it the choice of changing demographics.

APPENDIX 1 – INSTITUTIONS WITH TECHNOLOGY TRANSFER ACTIVITIES CONTACTED FOR THE SURVEY AND COMMENTS ON THEIR DATA PROVIDED

Universities	TT-Office	Comments on data provided
Ecole Polytechnique Fédéral (EPF) Lausanne	TTO	Complete data, research contracts <50 kCHF only partly
Eidgenössische Technische Hochschule (ETH) Zürich	ETH transfer	Complete data, research contracts <50 kCHF only partly
Universität Basel / Universitätsspital Basel	Unitectra	Only aggregated data, data only for the Medical, Natural Sciences and Psychology Faculties, partial data for hospital
Universität Bern / Inselspital	Unitectra	Only aggregated data, data only for the Medical, Vetsuisse and Natural Science Faculties, no data for research agreements of other faculties
University of Fribourg, including Adolphe Merkle Institute	Tech Transfer Fribourg	Partial data, not all contracts pass through TTO, especially SNSF or EU-grants are treated separately
Université de Genève / Hôpitaux universitaires de Genève	Unitec	Complete data for commercialization activities, research contracts
Université de Lausanne / Centre Hospitalier Universitaire Vaudois Lausanne	PACTT	Complete data for commercialization activities, research contract
Université de Neuchâtel	TTO	No data (complete data supplied for 2018)
Università della Svizzera italiana (USI) / Institute for Research in Biomedicine (IRB) / Institute for Oncology Research (IOR)	SRIT	Complete data
Universität Zürich / Universitätsspital	Unitectra	Only aggregated data, data only for the Medical, Vetsuisse and Natural Science Faculties, no data for research agreements of other faculties

Universities of Applied Sciences	TT-Office	Comments on data provided
Berner Fachhochschule (BFH)	TTO	Partial data from several departments (AHB,TI,WGS,HKB,HAFL)
Fachhochschule Nordwestschweiz (FHNW)	TTO	Data available from School of Life Sciences (HLS)
OST - Ostschweizer Fachhochschulen	TTO	Data available from Campus Buchs
Zürcher Hochschule für Angewandte Wissenschaften (ZHAW)	Ressort F&E	Only data on TT FTEs within President's Office of ZHAW
Lucerne University of Applied Sciences and Arts (HSLU)	Ressort F&E	No data
Haute Ecole Spécialisée de Suisse occidentale (HES-SO)	Tech Transfer Fribourg	Partial data from several departments
Scuola Universitaria Professionale della Svizzera Italiana (SUPSI)	Fond. AGIRE	No data (complete data supplied for 2018)

Research Institutes	TT-Office	Comments on data provided
Swiss Federal Institute for Materials Science and Technology (Empa)	Empa-Eawag TT-Office	Complete data
Swiss Federal Institute of Aquatic Science and Technology (Eawag)	Empa-Eawag TT-Office	Complete data
Paul Scherrer Institut (PSI)	PSI TT-Office	Complete data

Following universities with main scope in humanities were not contacted:
University of Lucerne, University of St. Gallen, FHS St. Gallen – University of Applied Sciences.

APPENDIX 2 – DETAILED DATA 2010 – 2019

Institution	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Full-time equivalents (FTE)	64	74	81	86	85.7	89.2	92.4	100.9	111.2	113.2
Research contracts (incl. EU contracts)	3035	2872	2349	3924	3237	3297	3348	3571	3895	3877
Invention disclosures	470	482	519	575	550	608	659	647	662	631
Priority patent applications	224	240	297	270	312	298	343	300	357	329
Active patent cases end of the year	1573	1606	1818	1951	1969	2191	2429	2519	2611	2744
License agreements	196	203	174	201	187	220	251	215	273	237
Active license agreements end of the year	1237	1249	1307	1351	1437	1474	1591	1413	1558	1663
License agreements with revenues in resp. year	288	299	308	386	376	406	463	451	389	415
New start-ups on basis of formal license	44	43	62(29)	73(45)	81(49)	73(47)	74(53)	72(52)	89(44)	102(63)

Universities	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Full-time equivalents (FTE)	45	50.5	50	52.3	56.1	55.5	59.2	70.2	70.3	73.7
Research contracts (incl. EU contracts)	2285	2158	2348	2360	2195	2303	2465	2435	2574	2508
Invention disclosures	421	421	444	458	508	565	606	593	592	568
Priority patent applications	187	212	257	244	281	262	320	271	314	293
Active patent cases end of the year	1358	1450	1664	1779	1839	2008	2202	2318	2376	2492
License agreements	159	168	146	167	168	192	229	198	228	206
Active license agreements end of the year	1135	1459	1167	1213	1320	1352	1487	1313	1438	1543
License agreements with revenues in resp. year	258	257	270	337	339	203	410	429	357	373
New start-ups	34	33	43(23)	49(35)	61(38)	58(41)	64(44)	61(44)	71 (38)	78(54)

UAS	2010	2011	2012	2013	2014	2015	2016	2017	20181	2019
Full-time equivalents (FTE)	13	15.5	23	26.1	22.2	24.9	24	21.6	30.0	28.4
Research contracts (incl. EU contracts)	457	374	621	1254	677	574	442	727	871	944
Invention disclosures	21	31	35	80	10	9	9	10	36	27
Priority patent applications	16	5	8	2	1	3	1	2	17	12
Active patent cases end of the year	56	35	42	39	9	9	41	14	44	48
License agreements	14	16	17	19	3	3	4	2	23	10
Active license agreements end of the year	12	15	17	19	2	2	18	1	17	16
License agreements with revenues in resp. year	13	23	17	18	3	3	1	1	9	15
New start-ups	9	8	14(5)	19(8)	18(10)	9(6)	5(2)	2(1)	16(4)	20(5)

RI	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Full-time equivalents (FTE)	6	8	8	7.7	7.4	8.8	9.2	9.1	10.9	11.2
Research contracts (incl. EU contracts)	293	340	353	320	365	420	441	409	450	425
Invention disclosures	28	30	40	37	32	34	44	44	34	36
Priority patent applications	21	23	32	24	30	33	22	27	26	24
Active patent cases end of the year	141	112	112	133	121	174	186	187	191	204
License agreements	23	19	11	15	16	25	18	15	22	21
Active license agreements end of the year	90	103	123	119	115	120	110	99	103	104
License agreements with revenues in respective	17	19	21	31	34	43	51	21	23	27
New start-ups	0	2	5(1)	5(2)	2(1)	6(0)	5(2)	9(7)	2(2)	4(4)

Note (i): For new start-ups the numbers in parentheses refer to start-ups on basis of a formal license
Note (ii): The number of the institutions that participated in the survey varies between years

APPENDIX 3 – KEY PARAMETERS FOR INDIVIDUAL INSTITUTIONS FOR 2019

Institution	Name TTO	Start TTO	# of TTO FTE	Total # research contracts	# of invention disclosures	# of priority applications	# of IP agree-ments	# of start-ups
Universities								
Ecole Polytechnique Fédéral (EPF) Lausanne	EPFL-TTO	1993	15.0	257	148	97	50	23
Eidgenössische Technische Hochschule (ETH) Zürich	ETH transfer	1995	25.8	674	185	102	62	30
Universität Basel / Universitätsspital Basel Universität Bern / Inselspital Universität Zürich / Universitätsspital Zürich	Unitectra	1999	11.9	1098	141	70	66	18
Université de Genève / Hôpitaux universitaires de Genève	Unitec	1998	9.3	107	51	16	15	4
Université de Lausanne / Centre Hospitalier Universitaire Vaudois Lausanne	PACTT	2000	8.5	314	29	4	6	2
Università della Svizzera italiana (USI) / Institute for Research in Biomedicine (IRB) / Institute for Oncology Research (IOR)	SRIT	2018	1.0	41	9	3	6	1
UAS								
Berner Fachhochschule (BFH)	TTO	1999	13.9	288	3	3	3	1
Fachhochschule Ostschweiz FH OST–NTB	TTO	2000	2.6	13	2	1	1	10
Haute Ecole Spécialisée de Suisse occidentale (HES-SO)	TT Fribourg	n.a.	10.9	604	21	8	5	9
RI								
Swiss Federal Institute for Materials Science and Technology (Empa)	Empa-Eawag TT-Office	2005	4.2	193	22	12	12	1
Swiss Federal Institute of Aquatic Science and Technology (Eawag)	Empa-Eawag TT-Office	2001	1.7	95	0	0	0	0
Paul Scherrer Institut (PSI)	PSI TT-Office	1999	5.3	137	14	12	9	3

Note: The table lists individual data only of those institutions that agreed to publish it.

GLOSSARY

EPF	Ecoles Polytechniques Fédérales
ETH	Swiss Federal Institutes of Technology
EU	European Union
FTE	Full Time Equivalent (for the number of employees)
IP	Intellectual Property
MTA	Material Transfer Agreement
NDA	Non-Disclosure Agreement
PRO	Public Research Organisation
RI	Swiss Federal Research Institutions in the ETH domain
SME	Small- and Medium-sized Enterprises (<250 employees)
SNSF	Swiss National Science Foundation
Start-up	Newly established company founded or co-founded by researchers from the respective institution and which either relies on a formal license of IP or on know-how developed at the institution
swiTT	Swiss Technology Transfer Association
TT	Technology Transfer
TTO	Technology Transfer Office(s)
UAS	Universities of Applied Sciences
Universities	Cantonal Universities and Swiss Federal Institutes of Technology

APPENDIX 4 – THE QUESTIONNAIRE

swiTT Technology Transfer Survey 2019 (online survey)

Preliminary Notes:
- ► All questions refer to the previous calendar year. Please make your statements accordingly.
- ► If no answer is available for certain questions, please indicate with "**-1**". Questions for which your office or your institution does not collect data should be as well indicated with "**-1**" and should not be answered by giving an estimate.

1. Confidentiality

Do you agree to the publication of your individual data collected in the questions marked [pub] under your institution name? ☐ Yes ☐ No

Note: In case you tick "Yes", your input for the questions marked [pub] will be published both in aggregated format as well as related to your institution (in the Appendix 3). In case you tick "No", your input for the questions marked [pub] will be published in aggregated format only.

2. Background Information

2.1 Name of the academic institution

2.2 Is your institution associated with a university hospital? ☐ Yes ☐ No
Note: If "Yes", all figures given below should include the numbers of the hospital(s).

2.3 Does your institution have a dedicated office (TTO) / responsible person for TT activities? ☐ Yes ☐ No

If "Yes", in which year did the TT program start? [pub]

2.4 Name of the responsible contact person for the survey

2.5 Contact information of the TTO (or the responsible person for TT activities)

Name Institution:
Name TTO:
Street:
Postal Code:
City:
Telephone (1):
Telephone (2):
E-Mail:

3. Activities and Human Ressources

3.1 What are the activities of your TTO?

(A) Research contracts (drafting, negotiating, controlling) ☐ Yes ☐ No
(B) Evaluation, protection and management of IP ☐ Yes ☐ No
(C) Commercialisation of IP (licensing, marketing) ☐ Yes ☐ No
(D) Support and/or Coaching of start-up projects ☐ Yes ☐ No
(E) Financial administration of research projects ☐ Yes ☐ No

3.2 Full time equivalents FTE employed in your TTO on Dec. 31st of last year [pub] FTE

Note: Please consider staff with main occupations (> 20%) in the area of technology transfer, such as 'Licensing Officers', 'Intellectual Property Managers', 'Technology Managers', or 'Research Contract Officers'. Please do not include project managers carrying out transfer projects.

3.3 Of these FTE, how many were employed to work on

(A) Technology transfer activities FTE
(B) Administration and general management FTE

Comment 3.1 - 3.3
(e.g.if additional people outside your TTO but inside your institution are also working in technology transfer activities according to 3.1, special organisation with specific faculties, centralized/decentralized organisations)

4. Research and Development

4.1 Total number of new research contracts handled by your TTO [pub]
Note: The number should include collaboration agreements, service agreements, clinical trial agreements, Innosuisse complementary and EU agreements. The number should not include MTAs, NDAs, other TT contracts (see 4.3) and SNSF contracts.

Of these research contracts, how many were executed with small and medium enterprises (SME), how many with large companies and how many with public partners?
Note: Companies with 250 or less employees should be considered as SME.

SME:
Large Company:
Public Institution:
Multiple Partners:
Don't know:

4.2 Amount of cash payments due to your institution from research contracts that were handled by your TTO according to 4.1 CHF

Note: Please give the amount of cash due to your institution, without any material assets e.g. for machinery. Please consider not the total amount of research projects, e.g. if an EU project adds up to 3 Mio. EUR but your institution gets only 200'000 thereof, the latter shall be given. Please do not split the amount if the contract is covering several years but report the full amount in the year the contract is signed.

4.3 Number of other technology transfer contracts handled by your TTO

Note: Please consider non-disclosure agreements (NDA), Material Transfer Agreements (MTA), consulting contracts, inter-institutional contracts, sponsoring, donations. Please do not include the contracts already considered for 4.1 and do not include license, optioan and sales agreements.

Comment 4.1 - 4.3
(e.g. restrictions/regulations of your institution. Knowledge of ALL contracts or only contracts above a certain amount)

5. Patent-Related Activities

5.1 Number of invention disclosures received by your TTO [pub]

5.2 Number of priority applications filed by your TTO
Note: Priority application being the very first application in any patent office.

5.3 Overall number of active patent cases at the end of last year managed by your TTO
Note: Active patents cases are pending patent applications or granted patents on an invention (patent family). Applications in various countries on one invention (claiming the same priority date) count as one patent case.

6. Patenting Costs and Legal Fees

6.1 Amount spent by your TTO / institution on patenting costs and external legal fees CHF
Note: Amount should include all external costs for patent filing, prosecution, maintenance, litigation, expenses or costs for drafting or support in negotiation of contracts.

6.2 Amount of patenting costs and legal fees invoiced to commercialization partners CHF
Note: Amount should not include patenting costs or legal fees paid directly by licensees or external partners to patent attorneys, patent offices or other service providers.

7. License, Option and Sales Agreements

7.1 Number of license / option / sale agreements of protected or unprotected IP your TTO did execute [pub]

Note: Please count only the agreements for different technologies, i.e. 30 licenses for the same software library count as one agreement. If a license agreement is combined with a research agreement (e.g. advanced sale of the results of a research project), this contract shall count only as research contract and should not be included in this question unless the invention / software that is licensed / sold exists already at the execution date of the research contracts (background IP).

Of these license / option / sale agreements, how many were licensed to SME, how many to large companies or public institutions?
Note: Companies with 250 or less employees should be considered as SME.

SME:
Large Company:
Public Institution:
Multiple Partners:
Don't know:

7.2 Number of license / option / sale agreements including equity?
Note: Equity shall mean the ownership of interest in a company such as shares, options, warrants, etc. in consideration for granting a license or sale of IP.

7.3 Overall number of license/option/sale agreements active as of December 31 last year

Comment 7.1 - 7.3
(e.g. large variations to previous years, special situation, i.e. with free software licenses, openBSD, etc)

8. Number of License Agreements

8.1 Total number of license / option / sale agreements yielding revenues

8.2 Total number of license / option / sale agreements yielding running royalties
Note: Running royalties are based on product sales and are only due after the launch of a product in the market.

9. Start-up companies (*)

9.1 Total number of start-up companies formed at your institution [pub]

(A) Of these start-up companies, how many are dependent on license / option / sale agreement(s) with your institution?

(B) Of these start-up companies, how many are dependent on unprotected know-how or technology of your institution (without formal agreement)?

9.2 Number of new start-up companies in which your institution holds equity

(*) As "Start-up company" all enterprises should be considered, that had their first entry in the trade registry in the previous year and that have a business case dominantly based on research of your organisation and that have at least one (co-)founder with affiliation to your organisation (employee, graduate, alumnus).

10. Post-Licensing Activities

Number of your institution's licensed technologies that became available for consumer or commercial use last year
Note: If you have success cases for publishing in the report, please use the template sent to you or contact swiTT.

Comments

(if you want to bring additional comments or suggestions to the attention of the team of the swiTTreport, please post them here)

CASE STUDY

MOBILE MASS SPECTROMETER FOR ON-SITE GAS ANALYTICS

Problem – Challenge

Gaseous species play an important role in chemical, physical and biological processes. Observing concentrations of gases helps to unravel the relevant dynamics. Usually, analytics of environmental gases focus on a small set of substances and need expensive, highly specialized instrumentation and techniques for their sampling, analyses and quantification. Until recently, such demanding work would require a well-equipped lab and was not suited for field studies.

Solution

To be able to measure gases on-site and even in remote places, Eawag developed a portable mass spectrometer which is now commercialized through its spin-off Gasometrix GmbH. So called "mini-Ruedi" is able to quantify nitrogen, oxygen, carbon dioxide and methane as well as trace gases like helium, argon and krypton, with a remarkable precision of one to three per cent analytical uncertainty. mini-Ruedi operates autonomously and in real time, even on long term operation, taking very small samples so as not to interfere with the natural dynamics of the environment and analyzing the various gases in less than a minute .

This 13 kg rugged device is already widely used, for applications in Eawag research projects around the world, as for example, for water analyses to assess groundwater systems or to investigate anthropogenic effects on waterbodies. In a project in the Czech Republic, soil samples were analysed to study gas exhalations from springs. A Norwegian oil and gas company monitored gas flows, in order to detect methane or carbon dioxide leaks. Dr. Matthias Brennwald, CEO of Gasometrix, sums it up in short: "Analyses which in the past would have been inconceivable – partly for financial reasons, as they'd have involved months of laboratory work – are now suddenly possible."

Photos & Text: Eawag

CASE STUDY

ARARIS: NOVEL ANTIBODY-DRUG CONJUGATE (ADC) LINKER TECHNOLOGY

Problem – Challenge

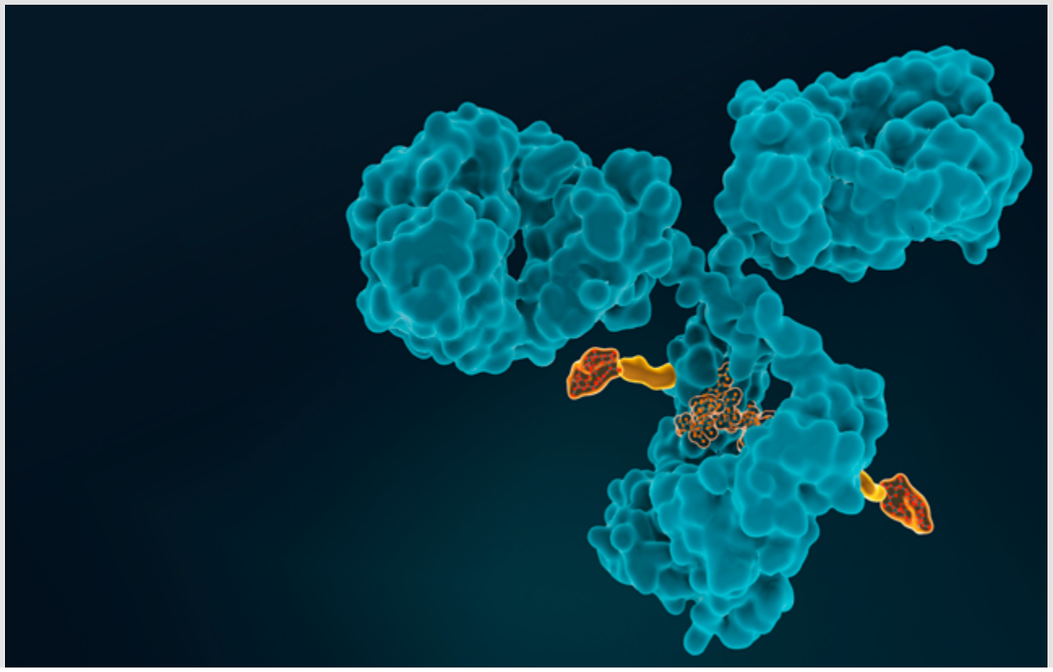
Antibody Drug Conjugates (ADCs) are the combination of highly potent cytotoxic agents conjugated to antibodies through a specific linker allowing the highly selective delivery of any therapeutic to diseased tissue within a patient, while the healthy parts of the human body are spared. ADCs generated with conventional methods face technical challenges such as the premature loss of the linked drug from the antibody before delivery at the diseased tissue; limited linker solubility, causing diligent and expensive optimization processes and very time- and cost-consuming development and production process.

Solution

Araris Biotech AG is a spin-off company from the Paul Scherrer Institute (PSI) and ETH Zurich focusing on the commercialization of a novel ADC-linker technology.

The innovative platform licensed out to Araris by PSI allows for the attachment of any payload to 'off the shelf' antibodies without the need of prior antibody engineering. The resulting ADCs have a well-defined drug-to-antibody ratio, are stable and monomeric. All these favorable properties contribute to the high efficacy and low level of toxicity observed so far. In summary, the straightforward drug conjugation, versatility of the technology and high in vivo efficacy enable the generation of ADC compounds for the treatment of patients with a high unmet medical need.

Within the first 6 months of its foundation Araris was able to raise a first round of CHF 2.5M seed capital and has received recognition by Venture Leaders and Venture Kick, and was a Finalist to the Swiss Technology Award. Let's keep Araris on our watchlists, we will definitely hear from them again…



swiTT
swiss technology transfer association

swiTT, the Swiss Technology Transfer Association, is the association of the professionals in Switzerland dealing with the interaction between public research and industry. swiTT currently has more than 100 members from all parts of Switzerland. Most of them work in technology transfer at public esearch institutions, others are employed in the private sector. For further information about swiTT, please refer to **www.swiTT.ch.**

Among other services, swiTT operates swiTTlist, a unique portal with current technology opportunities from Swiss public research institutions available for licensing and development by industry. To search this opportunity database please visit **www.swiTTlist.ch.**

Supporting Members

swiTT MISSION

- COOPERATION
- DEVELOPMENT
- SERVICES
- DIALOGUE

Facilitates and strengthens COOPERATION and technology transfer between Swiss public research institutions and the private sector;

Offers professional DEVELOPMENT to its members and other practitioners involved in technology transfer within public institutions and the private sector;

Provides SERVICES of common interest to its members, their institutions and other stakeholders involved;

Maintains an active DIALOGUE with research institutions, the private sector and the authorities to foster optimal processes and regulatory framework/regulations.

IMPRESSUM

Editor
swiTT – Swiss Technology Transfer Association
3000 Bern
switt@switt.ch I www.switt.ch I https://www.linkedin.com/company/switt

Printed by
Druckerei Lutz AG, 9042 Speicher, Switzerland