swiTTreport 2021

SWISS TECHNOLOGY TRANSFER REPORT

swiTT
swiss technology transfer association

CASE STUDY

adolphe merkle institute
excellence in pure and applied nanoscience

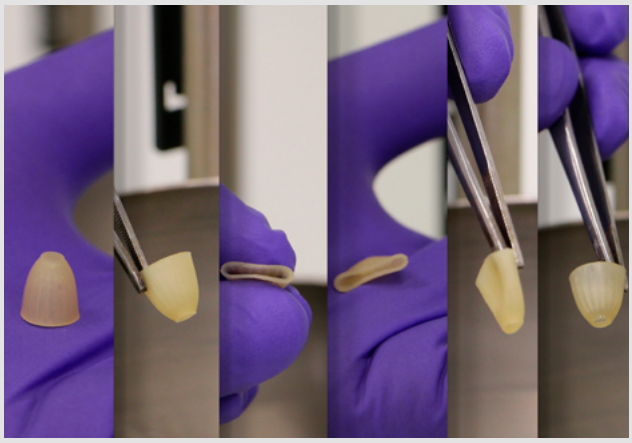
sonova
HEAR THE WORLD

NEW SHAPEABLE MATERIAL FOR CUSTOMIZATION OF EARMOLDS

Problem – Challenge

The Adolphe Merkle Institute (AMI) and Sonova AG have teamed up to develop a new polymer blend with shape memory characteristics. Heating the material allows it to take the shape of any object, at body temperature, which makes it interesting for the customization of biomedical applications. This process can be repeated many times, making the material easily adaptable when conditions change. The material can also be 3D printed. Sonova is currently creating prototypes with this newly developed material to validate the benefits of a novel customization approach for hearing aids. To bring the polymer to market, the Adolphe Merkle Institute partnered with Covestro GmbH, which is now upscaling production and can provide test samples to interested customers.

The project was funded by the Swiss Innovation Agency Innosuisse. (Project link: In-situ customization of hearing-aid parts with new shape memory polymers – Participants (admin.ch)



Solution

AMI is a competence center of the University of Fribourg that focuses on research in the field of soft nanomaterials. The institute is organized in four research groups with complementary expertise: Bio-Nanomaterials, Soft Matter Physics, Biophysics, and Polymer Chemistry & Materials. Additionally, the Institute offers high quality services for the analysis of nanomaterials through its Swiss NanoAnalytics platform (https://www.ami.swiss/en/nanoanalytics/).

This innovation was developed by AMI's Polymer Chemistry & Materials group. The group focuses on the design, synthesis, and investigation of structure-property relationships of novel functional polymers and has expertise in stimuli-responsive polymers (such as light-responsive polymers, debond-on-demand adhesives, and mechanically responsive polymers), nanocellulose based materials, biocompatible polymers, and bioinspired materials.

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 three 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 2020:

3431	New Research Contracts
634	Invention Disclosures
334	Priority Patent Applications
219	License & Option Agreements
90	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 drei Fachhochschulen (UAS) und von drei Forschungsinstitutionen des ETH-Bereichs (RI).

Insgesamt rapportierten die teilnehmenden Institutionen die folgenden Kennzahlen über ihre Technologietransferaktivitäten im Jahr 2020:

3431	Neue Forschungsverträge
634	Erfindungsmeldungen
334	Patentanmeldungen
219	Lizenz- & Optionsvereinbarungen
90	Start-Ups gegründet

RÉSUMÉ

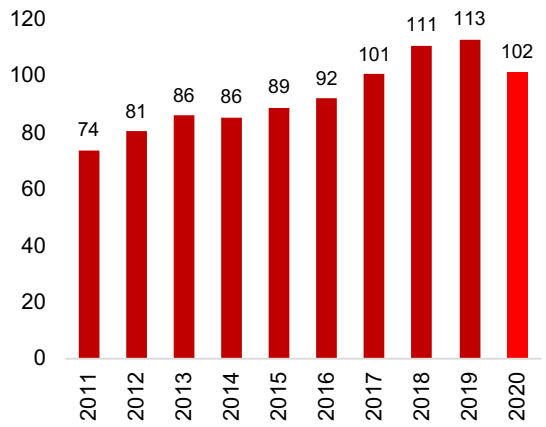
L'analyse présente est la plus exhaustive connue sur les activités de transfert de technologies réalisées par les institutions publiques de recherche suisses. Le rapport couvre deux aspects principaux: les contrats de recherche de ces institutions avec des partenaires privés ou publics et les activités 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 trois universités de sciences appliquées (UAS) et de trois institutions de recherche dans le domaine des Ecoles Polytechniques Fédérales EPF (RI).

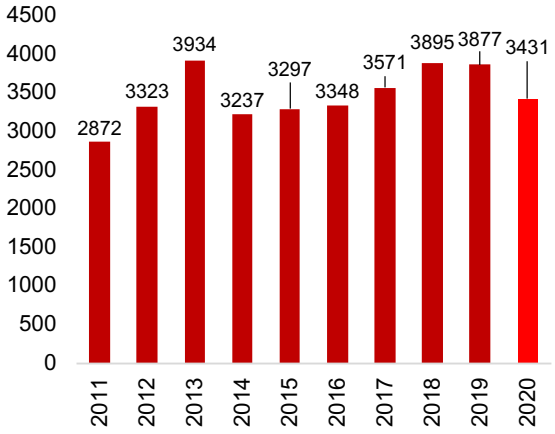
Dans l'ensemble, les personnes interrogées ont communiqué les chiffres clés suivants sur les activités de TT en 2020:

3431	Nouvelles contracts de recherche
634	Déclarations d'invention
334	Demandes de brevets
219	Contrats de licence et accords d'option
90	Créations de start-ups

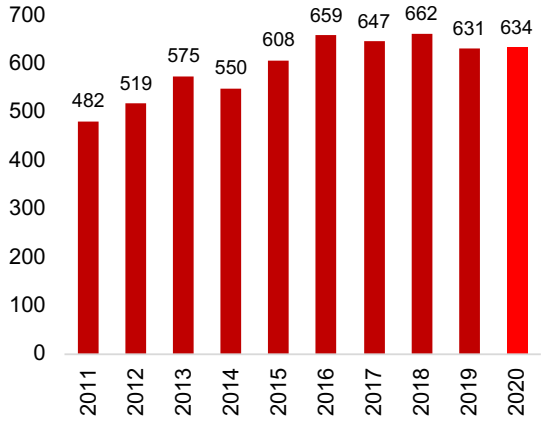
Full Time Equivalents (total)



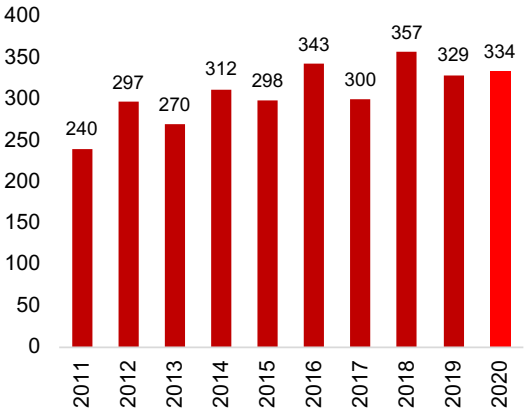
Research Contracts (total)



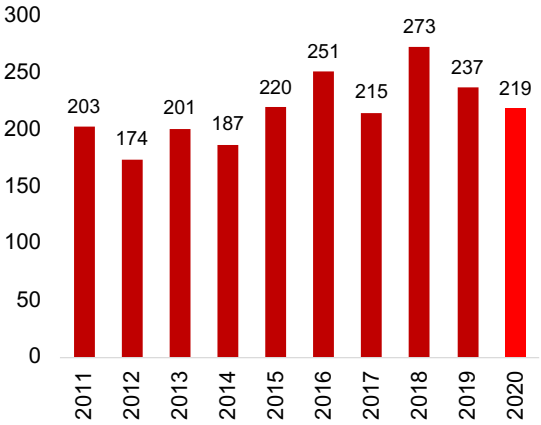
Invention Disclosures (total)



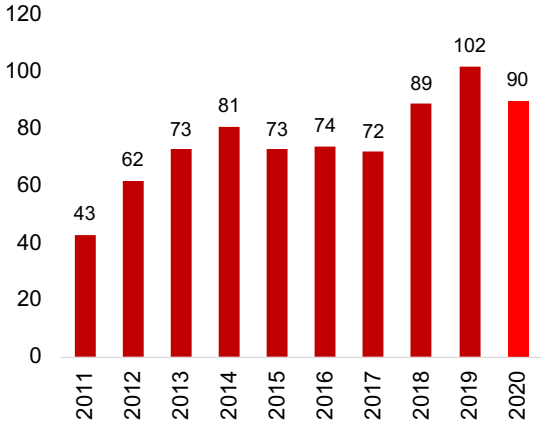
Patent Applications (total)



License Contracts (total)



Start-Ups (total)



Due to restructure of organizations and data acquisition two UAS could not report their 2020 data and some key numbers are not directly comparable. Comparing University and RI 2020 data with the same 2019 data sets show that TT activities have not decreased in 2020.

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

CASE STUDY

8PHOTONICS: MODULAR FIBRE-OPTIC PROTOTYPING

Problem – Challenge

A fibre optic assembly usually consists of several 10 meter long optical fibres with micro-optic elements between the individual sections of the fibre. In addition, laser diodes and detectors are always required, together with electrical drivers and electrical temperature controllers.

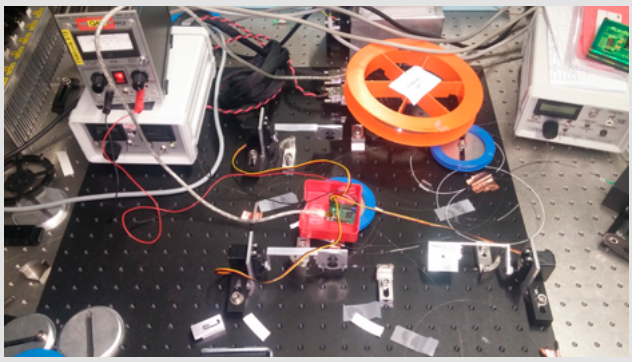
The picture shows on the right a fibre laser setup as conventionally assembled in a research lab:

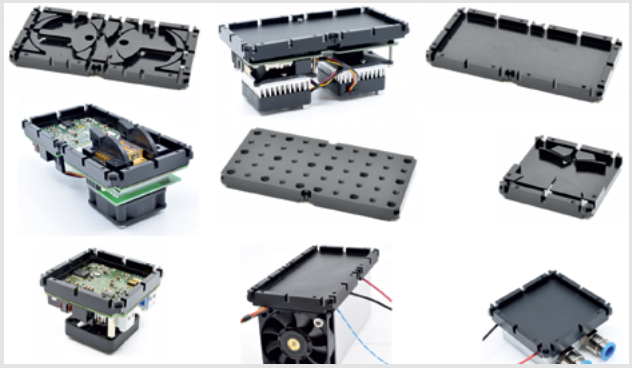
- *Home-made reels to wind up fibres are screwed on an optical table/breadboard*
- *Fibre optic components are placed between the reels and scotch-taped to the breadboard*
- *Electronics drivers from various manufacturers stand freely around the setup*

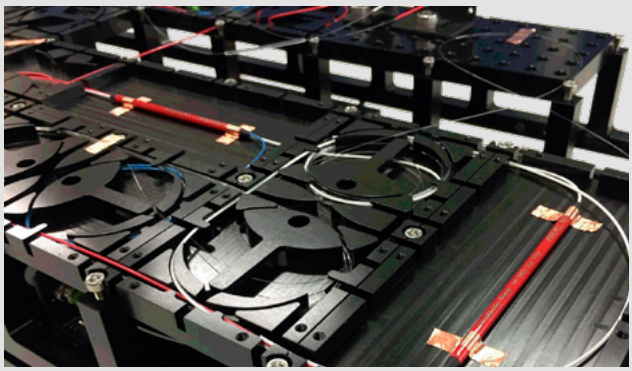
Solution

Next generation modular innovation platform to build fibre optic systems 8photonics' offers a range of rectangular building blocks that can be freely combined on a modular framework.

With 8photonics' innovative platform, many different tidy and transportable fibre laser prototypes/demonstrators become feasible within a much shorter development time.







Application area: Fibre Laser Physics, Rapid Prototyping

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 2021 and asked to provide data on their technology transfer (TT) activities for the year 2020. 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 three 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 TTO 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 centralized TTO and are able to provide comprehensive data. At other departments or schools, no centralized support functions exist and data are fragmentary or completely lacking. In addition, this year two UAS could not supply data due to reorganizations hence the decrease in numbers.

RI

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

CASE STUDY

Bern University of Applied Sciences

FAGUS SUISSE

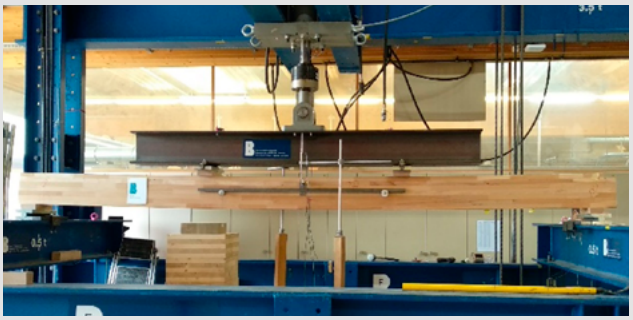
BEECH GLULAM: INCREASED YIELD OF RAW MATERIAL AND HIGHER STRENGTHS

Problem – Challenge

In Central Europe hardwoods are native to the non-alpine regions and will again displace the spruce. This process is favoured by the efforts to return from spruce monocultures to natural mixed forests and by climate change. Hardwood, and beech in particular, has a higher strength than spruce, which is used in the majority of timber constructions. Despite this advantage, glulam made of hardwood is rarely used, partly because of the higher unit price. Therefore, beech is known to most people only as good firewood. In order to change this situation, Fagus Suisse SA, together with researchers from the Bern University of Applied Sciences BFH, have developed beech glue double laminated timber.

Solution

With the innovation of double laminated beech wood, beams with a bending strength of over 60 megapascals (MPa) will be possible. For comparison: glue laminated timber (glulam) made of spruce currently available on the market has a strength of 24 to 32 MPa, and with the currently known processes, a strength of 48 MPa is achieved for hardwood glulam. This envisaged increase in strength from 25 to 150% to 60 MPa creates new market opportunities for wood from Swiss forests. Because the length of the raw material is limited, boards have to be finger jointed in a glulam beam. In contrast to normal glulam, these joints are controlled and staggered in high-strength double laminated beams. This reduces the negative influence of the joints on the strength to a minimum and higher strength can be guaranteed. A great advantage of glulam is the so-called lamination effect, which leads to a homogenisation of the properties and at the same time limits the size of individual wood characteristics. In the case of double laminated glulam, this effect is even exploited in two directions. In addition, this double lamination causes the required raw material to have a smaller cross-section. This results in a greater yield with higher strengths. The gluing of the double laminated timber is done by means of a high-frequency press. This technology makes it possible to reduce the pressing time from hours to minutes. The process has not yet been used for gluing beech wood for load-bearing elements. Within the framework of the research project, various adhesives were evaluated by means of a parameter study and the parameters for standard-compliant bonding were defined. Wood is a natural product whose properties vary greatly, this also applies to the strength and stiffness (modulus of elasticity). It is therefore important to grade the wood and to know the influence of the wood characteristics on the strength. Within the framework of the project, the necessary parameters were worked out that allow the economic partner to sort the raw material according to strength classes, taking into account the yield.



With the innovation of laminated beech wood, beams with a bending strength of over 60 megapascals (MPa) are possible.

Parallel to the research work at BFH, Fagus Suisse SA has set up the production plant in Les Breuleux in the Jura.

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.

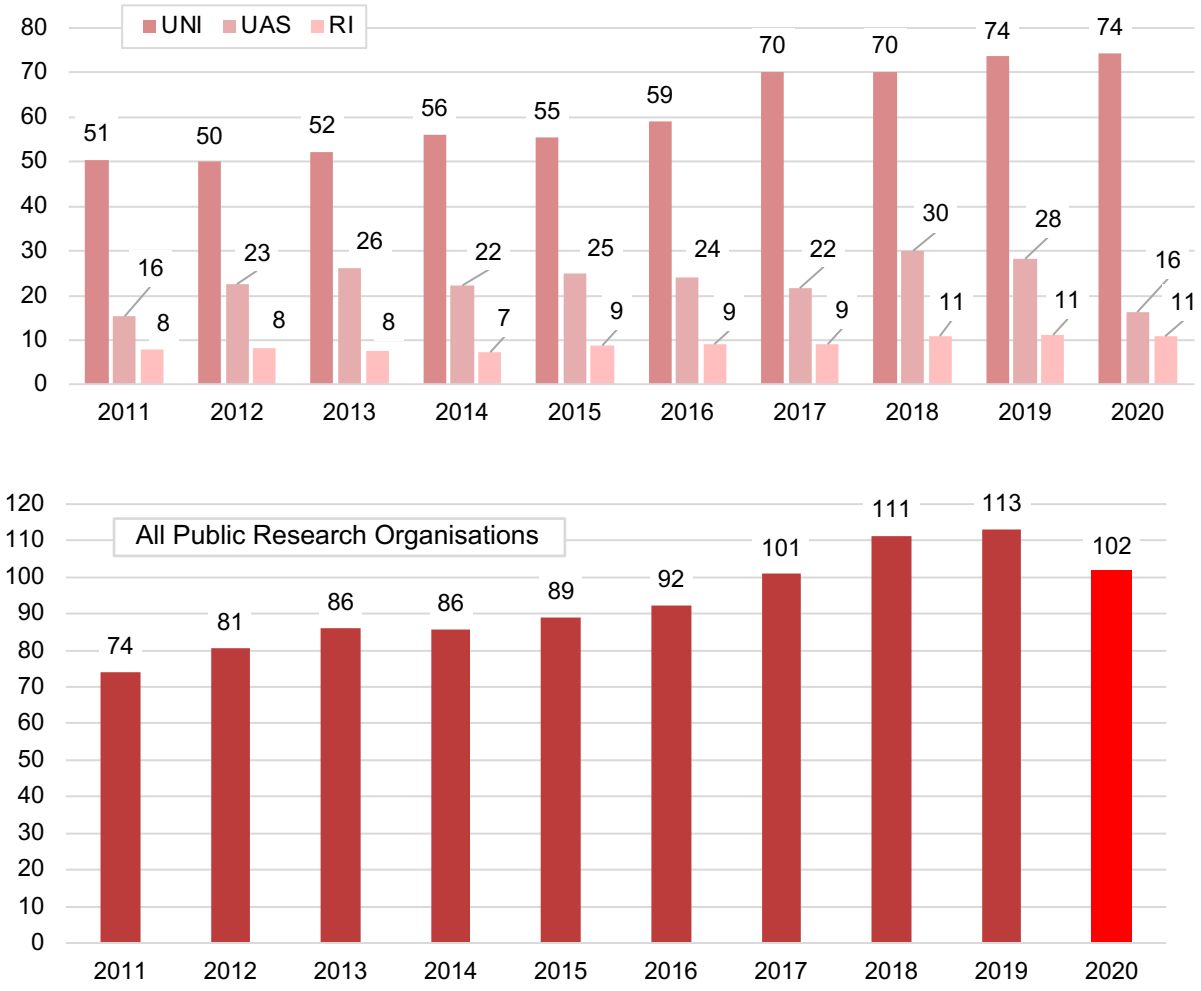
Two of three UAS TTO and all RI TTO offer support for research collaborations. All UAS TTO and all TTO of RI deal with the management of IP. The commercialization of IP is supported by all RI TTO and by all UAS TTO. Coaching of start-up projects is offered by two of three UAS TTO and one RI TTO.

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, intellectual 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

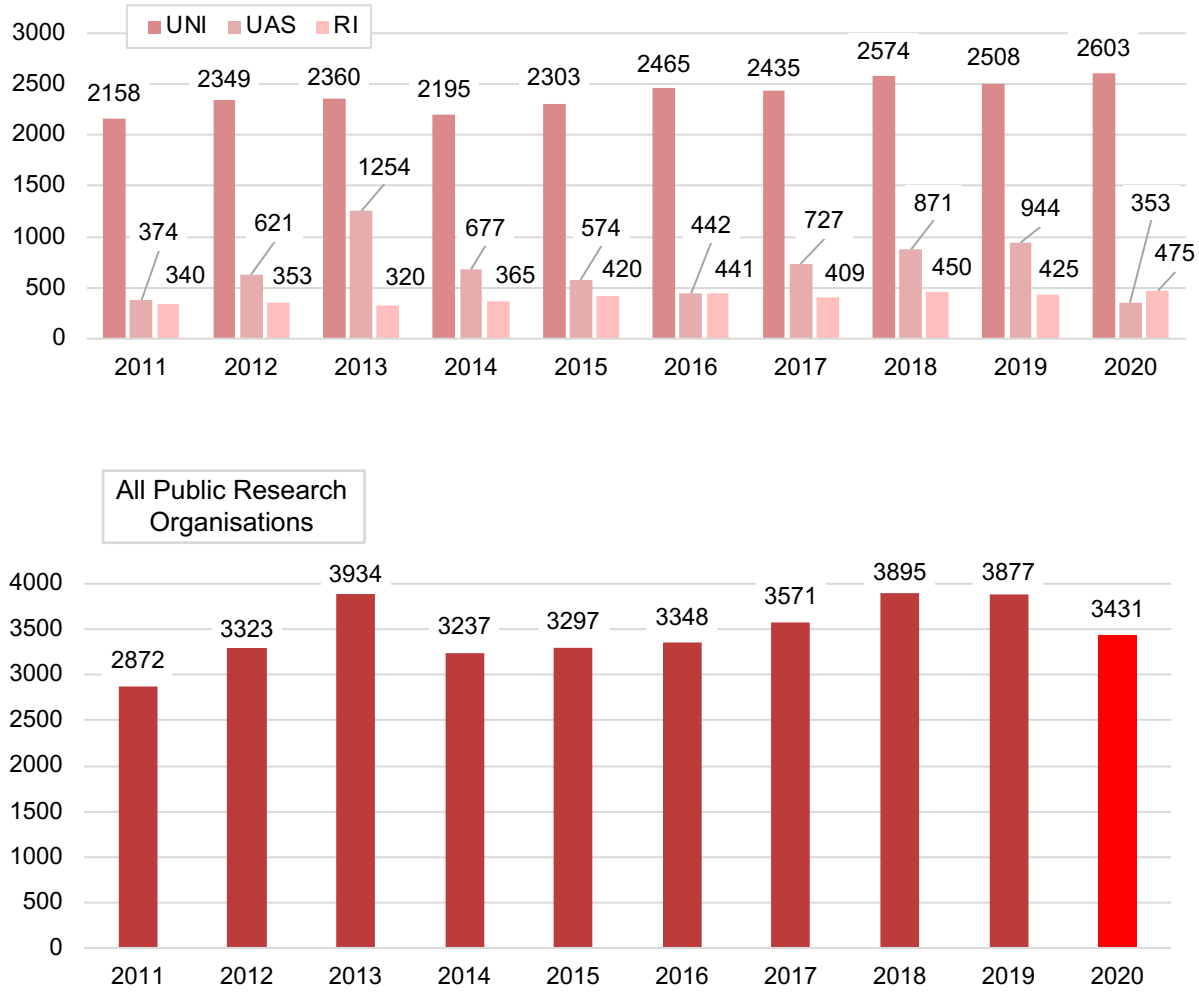
In 2020, the TTO handled a total of 3431 research contracts with economic and public partners. Research contracts handled by UNI and RI have increased by 5%, the overall decrease is due to the fact that 2 UAS were not able to report 2020 data. This number includes collaboration agreements, clinical trial 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 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 2020, the institutions reported altogether 3154 such other types of TT agreements.

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

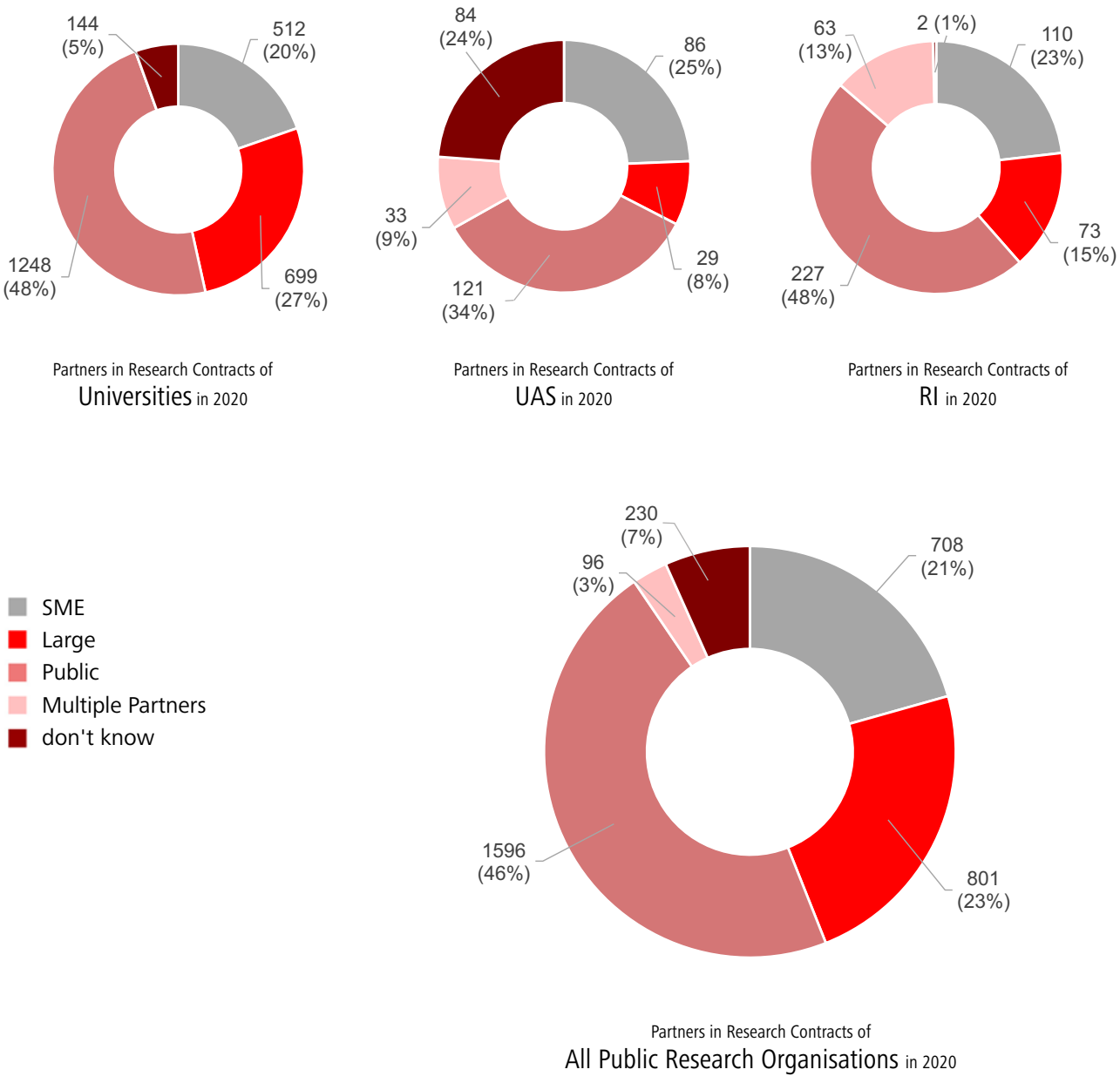


3.2 Type of Collaboration Partners

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 20.6% of total research contracts reported for 2020.

If one considers only reported collaborative projects with the private sector (SME plus large Companies), SME account for 47 % of all projects with commercial partners.

Fig.3: Partners in Research Contracts



CASE STUDY

Empa
Materials Science and Technology

sympheny
urban energy. optimized.

SOFTWARE FOR OPTIMIZED PLANNING OF SUSTAINABLE ENERGY SYSTEMS

Problem – Challenge

The convergence of the energy transition and digitalisation has driven a proliferation of new technologies, new business models and new data streams. For energy planners and facility managers – who are responsible for translating the energy transition into on-the-ground reality – this creates enormous challenges. They must navigate a seemingly endless range of potential supply solutions when (re)developing any given site, taking into account numerous uncertainties and complexities.

Solution

Since 2017 the Urban Energy Systems laboratory at Empa develops strategies to transform building and urban, sub-urban and rural neighbourhoods into energy efficient and decarbonized systems.

In 2020, researchers out of the laboratory founded the Empa spin-off "Sympheny" that offers a software to support optimized energy planning of sites, from a building to a neighborhood to an entire city. The software is a combination of digital twin technology and intelligent algorithms, integrated in a software-as-a-service (SaaS) platform.

Trough this subscription based SaaS platform, Sympheny aims to enable their customers to quickly, comprehensively and effectively navigate through the range of available technological options and to identify a set of optimal design solutions tailored to the specific constraints and objectives of a given site and customer. This will enable energy planners, facility managers and site owners to meet new knowledge needs within the context of the emerging energy landscape.

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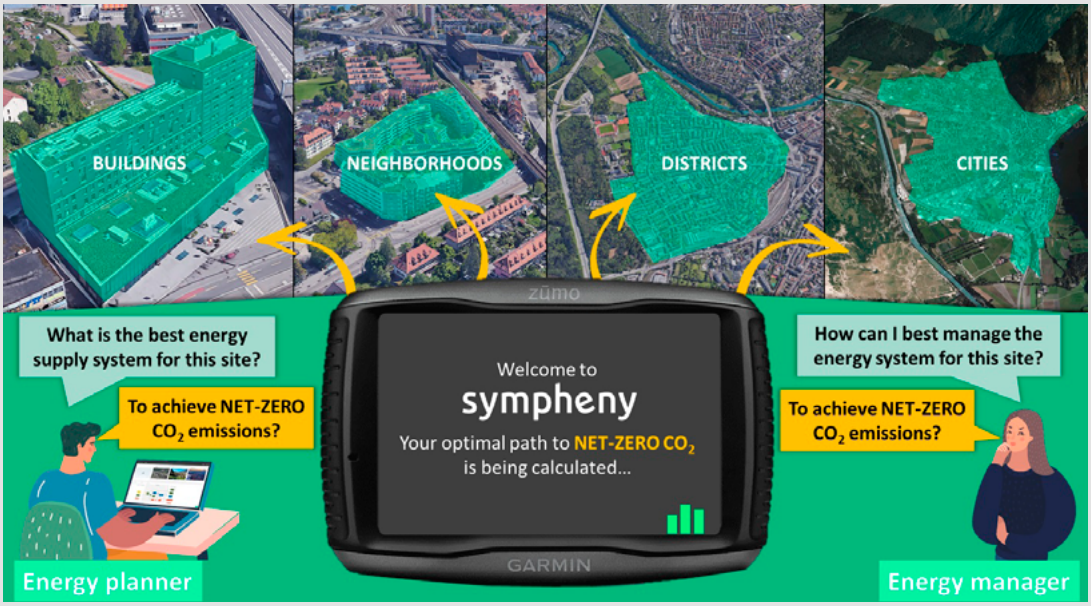


CASE STUDY

adolphe merkle institute
excellence in pure and applied nanoscience

UNI FR
UNIVERSITÉ DE FRIBOURG
UNIVERSITÄT FREIBURG

REDUCED PESTICIDE USE WITH NANOPARTICLES

Problem – Challenge

One of the biggest challenges facing agriculture today is the extensive use of fertilizers and pesticides. With an increasing number of products banned or considered dangerous for human and animal health, the need for substitutes is acute. One approach is to stimulate plants' own immune response to pathogen attacks. Silicic acid, which naturally occurs in soil, is known to provoke such responses in plants, and amorphous silica nanoparticles can release this substance in small amounts. With this in mind, Dr. F. Schwab from the Adolphe Merkle Institute (AMI) has developed an environmentally safe nano-agrochemical for the targeted delivery of silicic acid and to stimulate plant defense.

Solution

In a collaboration with the biology department of the University of Fribourg this nano-agrochemical was shown to serve as an inexpensive, highly efficient, safe, and sustainable alternative for plant disease protection. The study was published in the top-ranking journal Nature Nanotechnology.

Starting this year, with support from Innosuisse, the Swiss Innovation Agency, Schwab form AMI and her partners at the University of Applied Sciences and Arts Western Switzerland – Fribourg and the Bern University of Applied Sciences' School of Agricultural, Forest and Food Sciences have been performing field trials and upscaling the production of the nanoparticles.

The AMI is a competence center of the University of Fribourg that focuses on soft nanomaterials. The Institute is composed of four main research groups with complementary expertise: BioNanomaterials, Soft Matter Physics, Biophysics, and Polymer Chemistry & Materials. Additionally, the Institute offers high-quality services for the analysis of nanomaterials through its Swiss NanoAnalytics platform (https://www.ami.swiss/en/nanoanalytics/), which was established by the BioNanomaterials group. The group, coled by Prof. Rothen-Rutishauser and Prof. Fink, focuses on nanoparticle synthesis, characterization, and analysis, as well as the assessment of their interactions with humans and the environment. The group has immense expertise in hazard assessment of nanomaterials, nanoparticle design, characterization, and development for biomedical applications. The group has also developed several representative 3D cellular models to be used in predictive biomedical research.

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 634 invention disclosures were reported for 2020, almost the same number as for the previous year. The vast majority of invention disclosures were reported by Universities (92.9%). The three RI accounted for 6.0% of the invention disclosures.

Fig.4: Number of Invention Disclosures

4.2 Patenting Activities

4.2.1 Priority Patent Applications

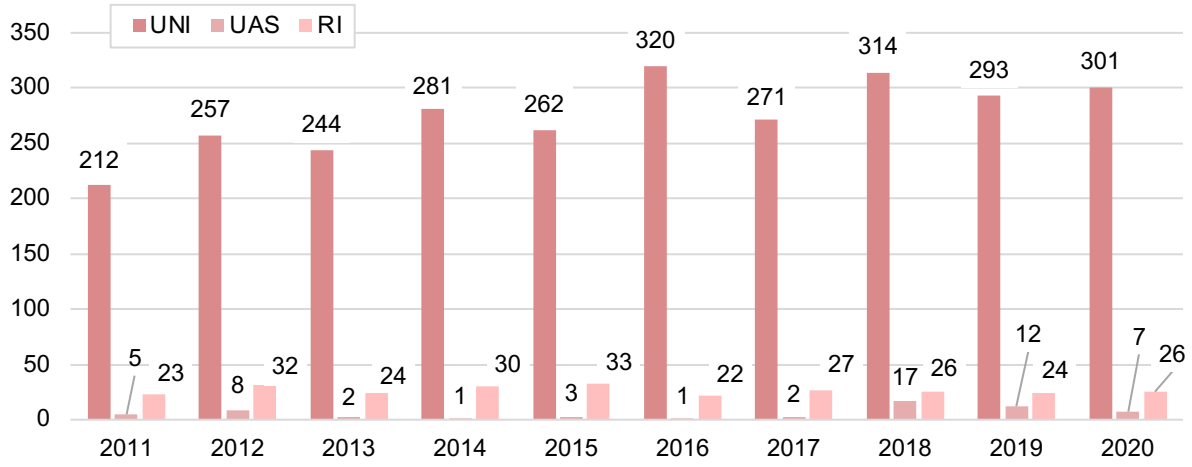
The protection of intellectual property in the form of patents is of great importance in many industry sectors. This is particularly true for industries with high product development costs and long product lifecycles, e.g. biotechnology and pharmaceuticals. The TTO at PRO must decide at an early stage 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.

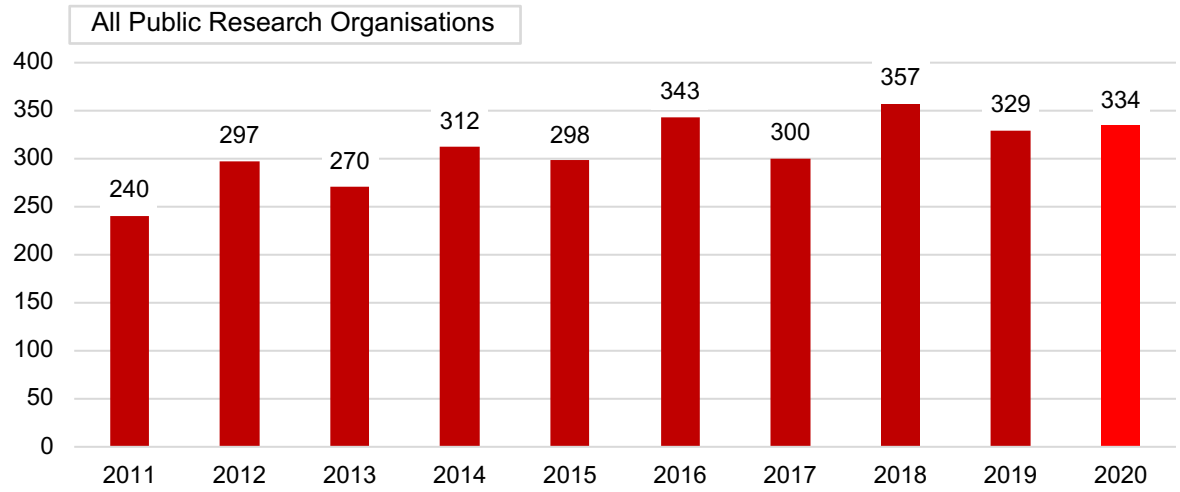
In total 90 % of all patent applications were filed by Universities.

4.2.2 Patent Portfolio – Active Patent Cases End of 2020

At the end of 2020, the institutions participating in the survey reported 2798 (+2.0%) 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 BATTRION

BATTRION: FAST CHARGING ELECTRODES FOR LITHIUM BATTERIES

Problem – Challenge

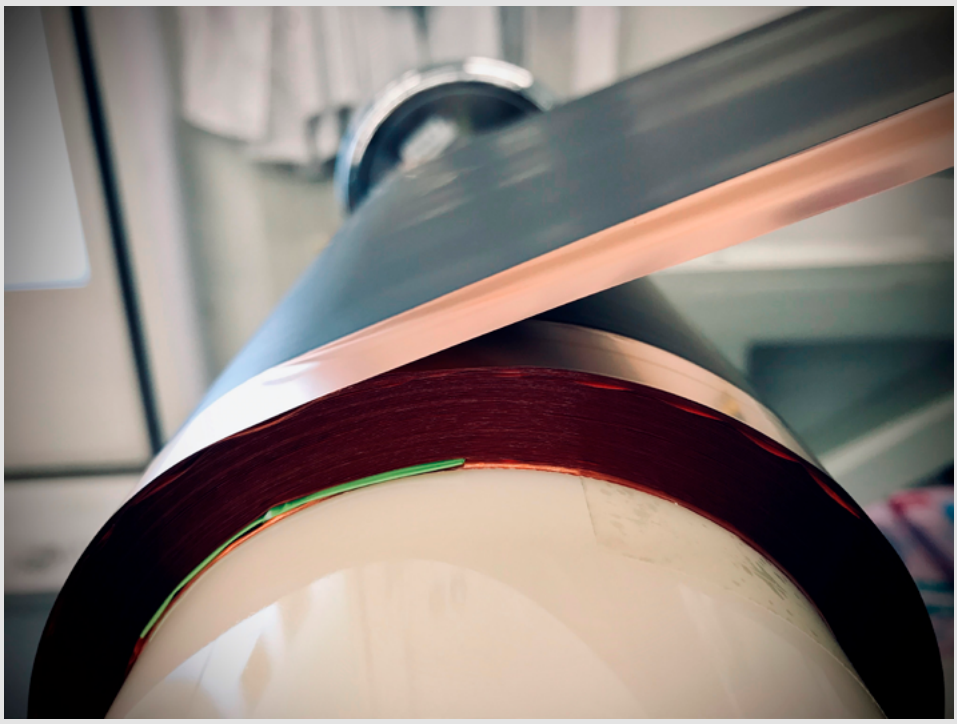
The performance of lithium-ion batteries depends strongly on the microstructure of the employed porous electrodes and more specifically on how well it enables the flow of charges through its structure. An important aspect is the tortuosity – or "wiggliness" – of the structure. The fewer bends and turns are present in the material, the faster the charges can flow and the battery charges.

Solution

Graphite particles are aligned during the fabrication process of porous lithium ion battery electrodes using a magnetic field. This method allows the orientation of the micrometer-sized particles in a way that reduces the tortuosity of the porous electrodes while allowing increased packing density. This way, the charging time of lithium-ion batteries can be significantly reduced.

Founded in 2015, Battrion is a spin-off of the Swiss Federal Institute of Technology (ETH Zurich). Battrion operates a research lab and production facility in Dübendorf, Zurich where it develops its Aligned Graphite® technology, a fabrication technology for lithium-ion batteries that improves the microstructure of negative electrodes. The technology significantly increases the charge- and discharge performance of lithium-ion batteries and is particularly suited for electric vehicles and high-performance applications. Battrion produces and markets standardized and customized negative electrodes with Aligned Graphite® and additionally offers its technology on a license basis.

More information can be found at: http://www.battrion.com



CASE STUDY

THE EYEWATCH FOR GLAUCOMA

Problem – Challenge

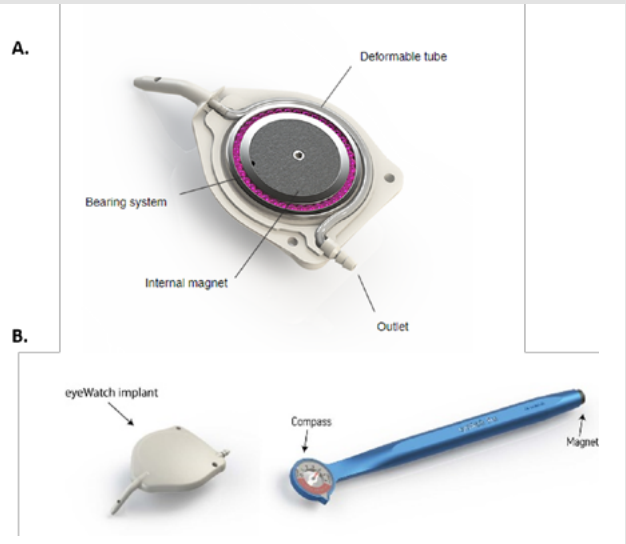
Glaucoma is one of the leading causes of blindness, afflicting more than 75 million people worldwide. The disease most often occurs due to an increase in a patient's intraocular pressure (IOP). The optic nerve can be damaged when this pressure gets too high, and, if left untreated, result in vision loss.

Glaucoma is first treated with eye drops but at some point, the eye drops are no longer enough and surgery is needed to lower the patient's IOP by using glaucoma drainage devices called aqueous shunts. The problem with these shunts is that they have a fairly high rate of post-surgical complications and often lead to surgical failures when the patient's IOP is not sufficiently controlled.

Solution

EPFL's Laboratory of Hemodynamics and Cardiovascular Technology (LHTC), headed by Prof. Nikos Stergiopulos developed the first non-invasive pressure-adjustment system in the world for treating glaucoma. The idea stemmed from the meeting of an ophtamologist studying at the LHTC and the strong expertise of the laboratory in mechanics and medical devices. The patented technology relies on a rotatable magnetic disk (see Figure A.), which is controlled by an outside control unit (see Figure B), that selectively compresses the drainage tube so that the fluidic resistance can be adjusted to maintain intraocular pressure (IOP) within the optimal clinical-targeted range. The first prototypes were developed at the EPFL-LHTC: an implantable tiny curved device that was only 0.7 mm thick and named the eyeWatch.

Rheon Medical was incorporated on 24 March 2010, licensed the patented technology and raised funds to carry out the clinical trials needed for market approval. In 2019, Rheon obtained the CE mark and in 2021 from the US Food and Drug Administration (FDA) the Breakthrough Device Designation for the eyeWatch. Today, the eyeWatch has been used successfully in over 250 patients across Europe, and the number of centers adopting the device is rising. Centers in Italy, Germany, Spain and the UK have recently started using Rheon's technology, and distribution agreements with firms in the United Arab Emirates, Turkey, Greece, Israel and Hong Kong have also been secured.



A. eyeWatch device
B. eyeWatch and external control unit ("eyepen")

4.3 Licensing

4.3.1 Licenses and Sales of Intellectual Property (IP)

In 2020, overall 219 (-7.6%) 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 86.3% 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.

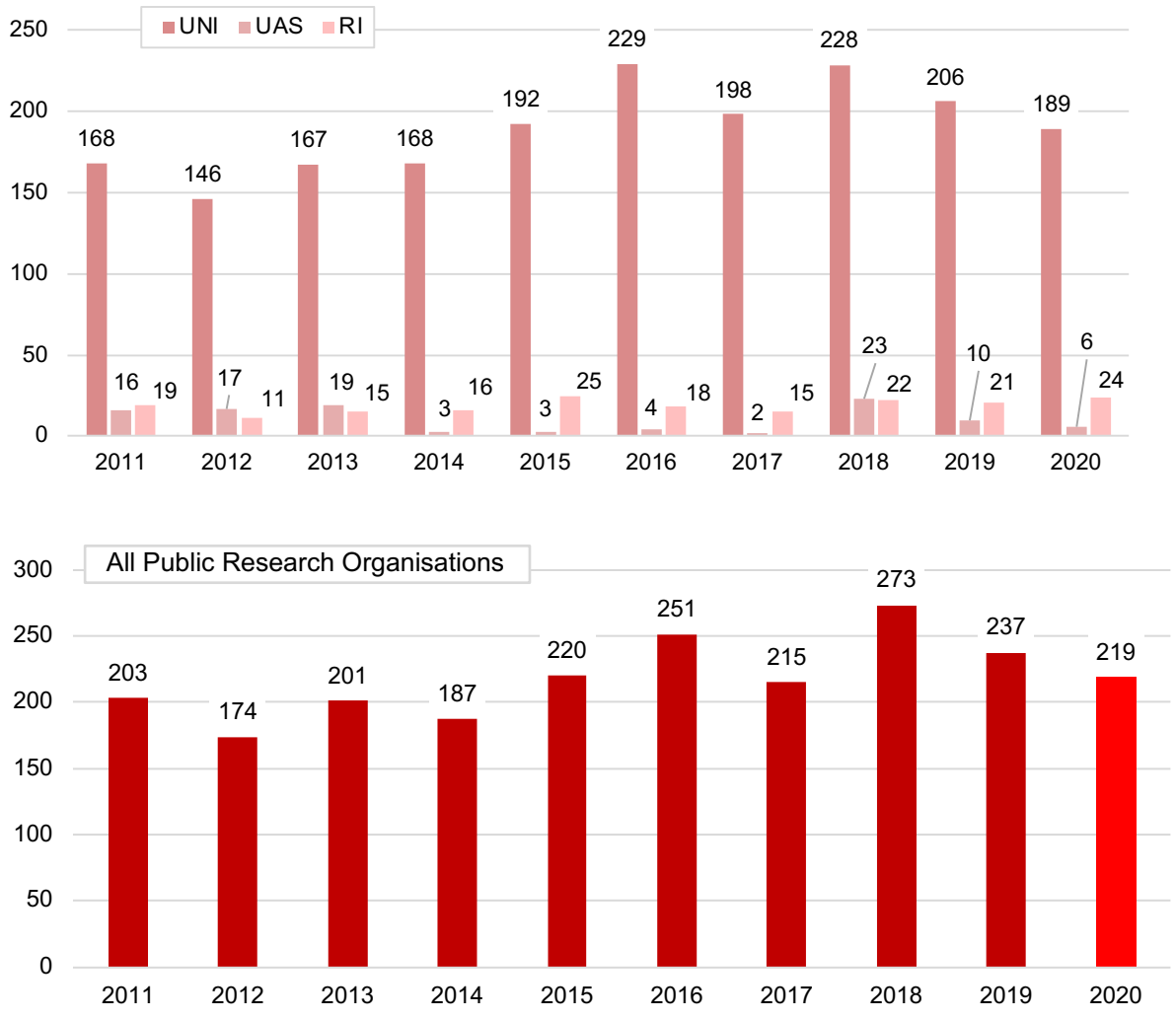
Frequently, projects or start-ups are acquired by larger companies once their products or services have reached sufficient maturity.

4.3.3 License Portfolio and License Income

The number of active licenses under management at the end of 2020 was reported as 1467 (-11.8%) cases. Thereof, 95.0% of active licenses were handled by the Universities, 4.7% by the RI and 0.3% by the UAS.

Of these active licenses 30.2%, namely 443 cases resulted in license income to the institutions and the researchers involved. This figure has increased continuously in the past years (25 % resp. 415 cases in 2019) 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.

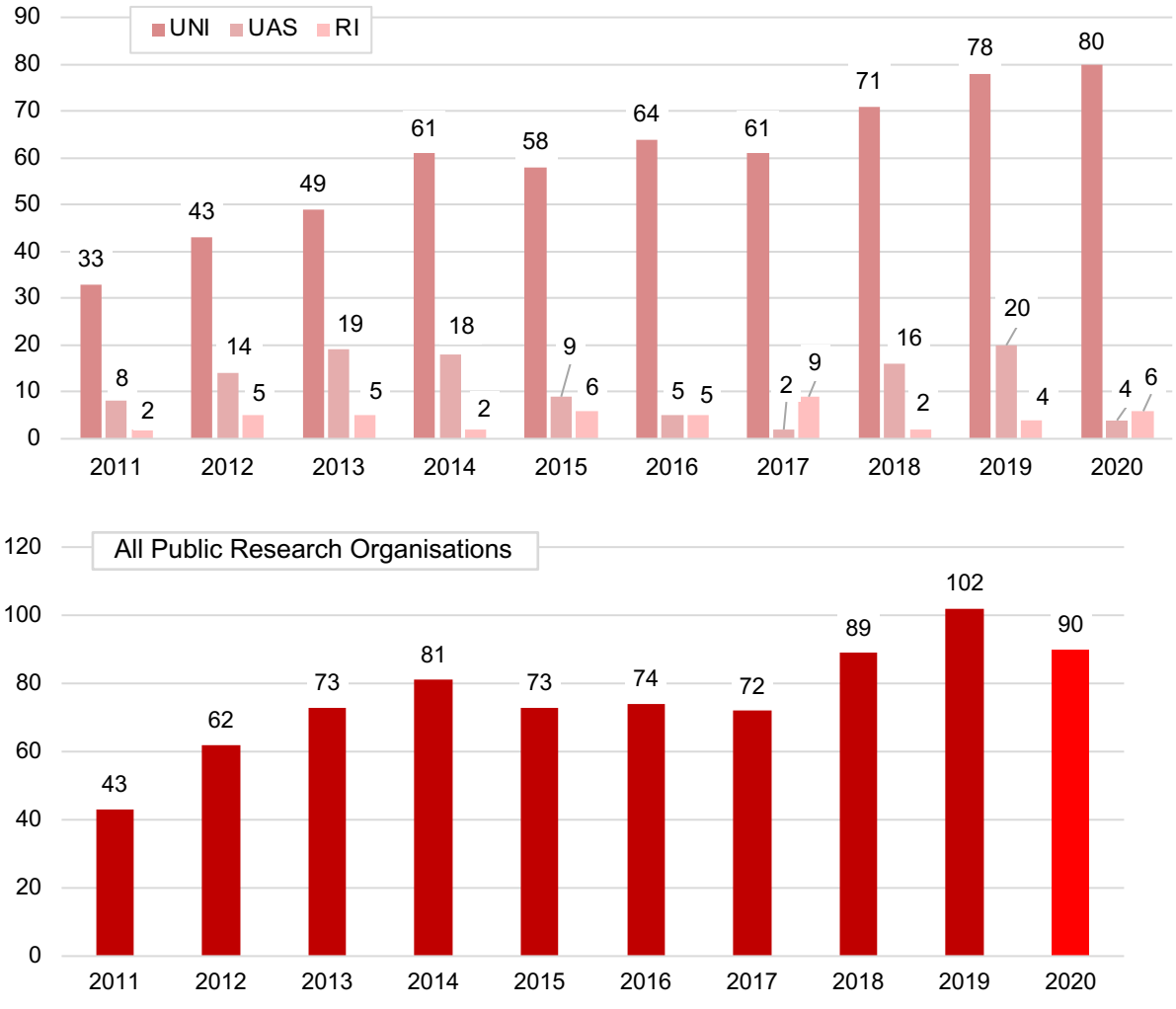
When licensing to start-up companies, some institutions may accept equity in such companies as a partial compensation for the licensing of technology. Such equity transactions usually replace down-payments or early milestone payments in order to avoid any cash drain from the start-up at the early stage 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

In 2020 the UNI and RI reported a total of 90 new start-up companies, whereby 55 of these companies (61.1%) 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

TERRARAD TECH

SPIN OFF WSL

TERRARAD TECH: HIGH RESOLUTION ENVIRONMENTAL MONITORING

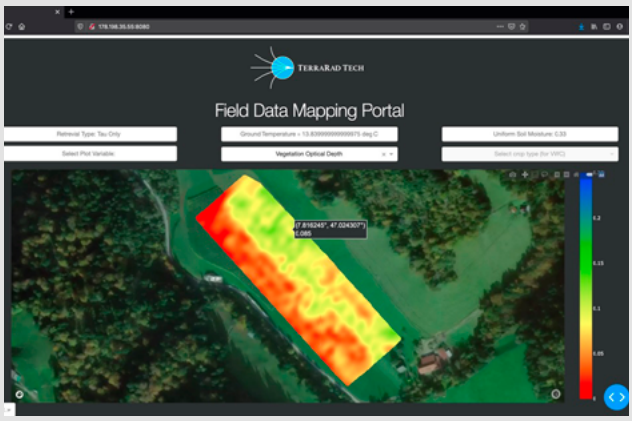
Problem – Challenge

Climate change is causing a scarcity of fresh water, melting glaciers, and changes to the global water cycle. Changes are occurring faster than the technological developments required to accurately monitor them. Impacts are being seen from drying farms, melting glaciers, increasing wildfires, to coastal cities experiencing sea level rise. Satellite-based remote sensing can help to quantify and monitor our changing planet, but there is a limit to what can be done from 500 km away. Additionally, ground-based single-point sensors can only provide a limited amount of data with their inability to capture spatial information. How can we achieve high resolution data of farms, glaciers, wildfires, and coastal infrastructures that are directly sensitive to water?

Solution

The answer is a drone-borne instrument that measures microwaves naturally emitted from the earth. The microwave remote sensing group at the Swiss Federal Institute for Forest, Snow, and Landscape Research (WSL) has developed, and patented, a compact microwave 'radiometer' capable of high-resolution drone-borne mapping of water. The specific 'L-band' electromagnetic frequency is highly sensitive to liquid water, and can detect water deep within soil, snow, and ice. Use cases of the sensor include: optimizing irrigation and yield prediction for agriculture, monitoring glacier hydrology, mapping and risk assessment for wildfire, and identification of leaks within levees and dams.

TerraRad Tech AG, the first ever spin-off from WSL will commercialize the drone-borne microwave radiometer. It uses the same technology so far only used on large ground-based radiometers and on NASA and ESA satellites (SMAP and SMOS). With a broad range of applications and use cases, TerraRad Tech sees the AgriTech market as the highest potential and highest value business case. In arid regions such as Australia, the Western US, Israel, and high-value irrigated crops globally, optimal use of irrigation and increased yield-per-area will be required to feed the growing population.



CASE STUDY

XRnanotech

PAUL SCHERRER INSTITUT PSI spin-off

NANOSTRUCTURED OPTICS WITH WORLD-RECORD RESOLUTION

Problem – Challenge

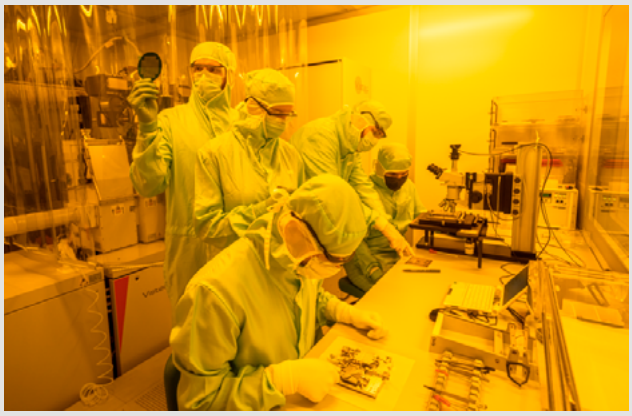
X-ray microscopy provides new and more detailed insights than conventional light microscopy and helps researchers to understand the complex nano-world. However, every microscope is just as good as its optics and there is a true challenge for applications in the X-ray regime. Normal glass lenses that are typically used for visible light microscopy do not work in the X-ray range at all. Thus, they have to be replaced by a completely new approach to optical instrumentation by using nanostructured diffractive optics that have features at the sub-10-nm level.

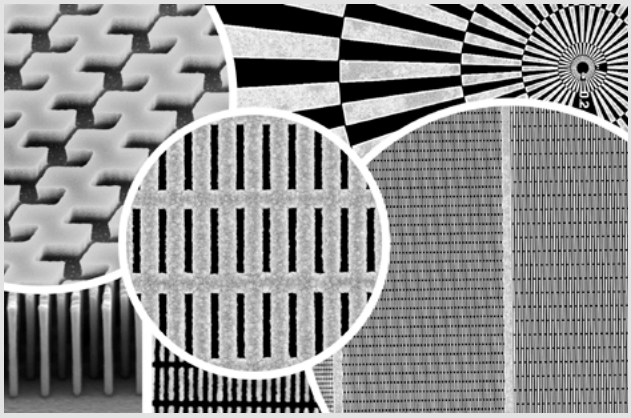
Solution

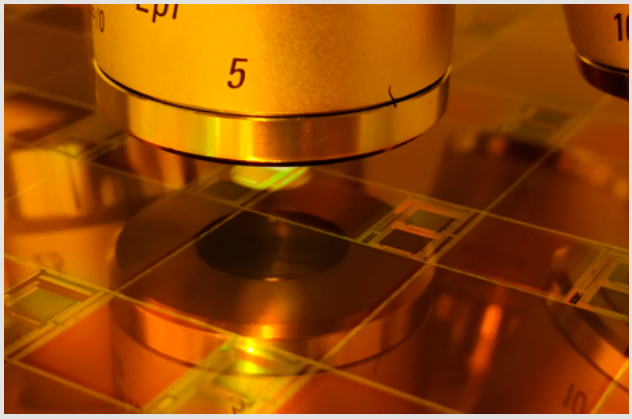
XRnanotech is a spin-off company from the Paul Scherrer Institute that was founded in 2020. The company develops and fabricates X-ray optics of the highest quality based on the smallest nanostructures. With its patented nanofabrication technology, the company has the possibility to extend the capabilities of optical systems into the extreme ultraviolet and X-ray range.

XRnanotech's nanostructured optics overcome the shortcomings of conventional technologies and push the resolution of microscopes to world-record levels enabling access to smallest structures by making the nano-world visible.

In recent months, the start-up has received numerous honors and awards. It was recognized as "Deep Tech Pioneer" by the Hello Tomorrow Global Challenge, making it one of the most promising deep tech projects. Furthermore, XRnanotech received financial support and funding from VentureKick, the "Swiss Business Incubation of CERN Technologies", the Gebert Rüf Foundation and the start-up funding program "ESA (European Space Agency) BIC Switzerland", amongst others. These enabled XRnanotech to successfully grow its business and create an initial network of international customers in France, the UK, Germany, Sweden, the USA, China and Korea.







CASE STUDY

Universität Basel

matterhorn BIOSCIENCES

PAN-CANCER-TARGETING UNIVERSAL T-CELL THERAPIES

Problem – Challenge

T cell therapies have transformed the cancer landscape due to their effective killing of cancer cells and their continued persistence within the patient's body. Current cell therapies such as CAR-Ts have shown dramatic survival improvements in liquid cancers but have severe limitations in solid tumors due to the lack of cancer-specific targets against which to direct the T cells.

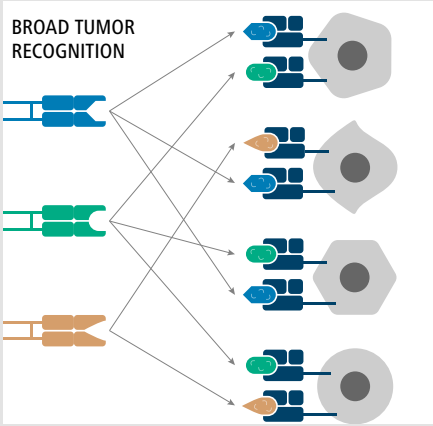
Solution

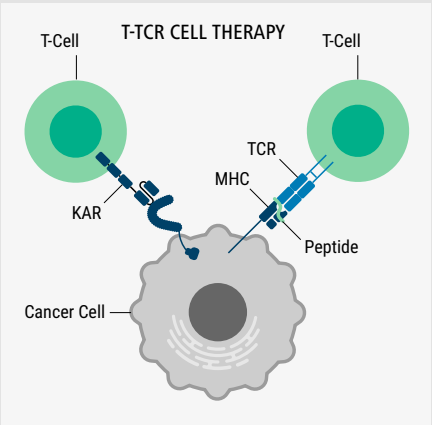
TCR therapies overcome some of these limitations by targeting cancer-specific peptides presented on the cell surface by human leukocyte antigen (HLA) molecules. However, HLAs are highly polymorphic and current TCR therapies need to be matched to the patient's HLA, significantly limiting the eligible patient population.

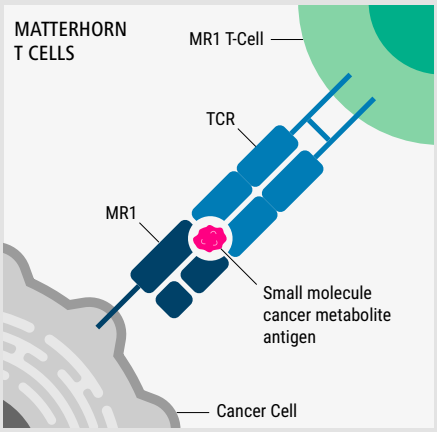
MR1 (MHC class I-related molecule 1) is monomorphic and is therefore the same in all patients. Since MR1 binds small metabolite antigens that are highly specific to cancer cells and are shared across liquid and solid tumors, it creates the opportunity for pan-cancer-targeting, off-the-shelf T cell therapies.

Dr. Lucia Mori and Prof. Gennaro De Libero from the Department of Biomedicine of the University of Basel have investigated MR1 specific TCR sequences for years and have brought their technology into Matterhorn Biosciences AG, a spin-off backed by 30 Mio CHF seed capital from Versant Ventures.

Matterhorn Biosciences AG benefits greatly from the Versant-backed Discovery Engine Ridgeline in Basel, which provides development know-how as well as laboratory infrastructure and trained personnel.







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
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)
Ostschweizer Fachhochschulen (OST)	TTO	No data due to reorganization
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)	HES-SO	No data due to reorganization of data acquisition
Scuola Universitaria Professonale della Svizzera Italiana (SUPSI)	Fond. AGIRE	No data

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

APPENDIX 2 – DETAILED DATA 2011 – 2020

All Public Researh Organisations	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Full-time equivalents (FTE)	74	81	86	85.7	89.2	92.4	100.9	111.2	113.2	101.6
Research contracts (incl. EU contracts)	2872	2349	3924	3237	3297	3348	3571	3895	3877	3431
Invention disclosures	482	519	575	550	608	659	647	662	631	634
Priority patent applications	240	297	270	312	298	343	300	357	329	334
Active patent cases end of the year	1606	1818	1951	1969	2191	2429	2519	2611	2744	2798
License agreements	203	174	201	187	220	251	215	273	237	219
Active license agreements end of the year	1249	1307	1351	1437	1474	1591	1413	1558	1663	1467
License agreements with revenues in resp. year	299	308	386	376	406	463	451	389	415	443
New start-ups	43	62(29)	73(45)	81(49)	73(47)	74(53)	72(52)	89(44)	102(63)	90(55)

Universities	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Full-time equivalents (FTE)	50.5	50	52.3	56.1	55.5	59.2	70.2	70.3	73.7	74.5
Research contracts (incl. EU contracts)	2158	2348	2360	2195	2303	2465	2435	2574	2508	2603
Invention disclosures	421	444	458	508	565	606	593	592	568	589
Priority patent applications	212	257	244	281	262	320	271	314	293	301
Active patent cases end of the year	1450	1664	1779	1839	2008	2202	2318	2376	2492	2560
License agreements	168	146	167	168	192	229	198	228	206	189
Active license agreements end of the year	1459	1167	1213	1320	1352	1487	1313	1438	1543	1393
License agreements with revenues in resp. year	2257	270	337	339	203	410	429	357	373	414
New start-ups	33	43(23)	49(35)	61(38)	58(41)	64(44)	61(44)	71 (38)	78(54)	80(49)

UAS	2011	2012	2013	2014	2015	2016	2017	20181	2019	2020
Full-time equivalents (FTE)	15.5	23	26.1	22.2	24.9	24	21.6	30.0	28.4	16.2
Research contracts (incl. EU contracts)	374	621	1254	677	574	442	727	871	944	353
Invention disclosures	31	35	80	10	9	9	10	36	27	7
Priority patent applications	5	8	2	1	3	1	2	17	12	7
Active patent cases end of the year	35	42	39	9	9	41	14	44	48	22
License agreements	16	17	19	3	3	4	2	23	10	6
Active license agreements end of the year	15	17	19	2	2	18	1	17	16	5
License agreements with revenues in resp. year	23	17	18	3	3	1	1	9	15	1
New start-ups	8	14(5)	19(8)	18(10)	9(6)	5(2)	2(1)	16(4)	20(5)	4(2)

RI	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Full-time equivalents (FTE)	8	8	7.7	7.4	8.8	9.2	9.1	10.9	11.2	11
Research contracts (incl. EU contracts)	340	353	320	365	420	441	409	450	425	475
Invention disclosures	30	40	37	32	34	44	44	34	36	38
Priority patent applications	23	32	24	30	33	22	27	26	24	26
Active patent cases end of the year	112	112	133	121	174	186	187	191	204	216
License agreements	19	11	15	16	25	18	15	22	21	24
Active license agreements end of the year	103	123	119	115	120	110	99	103	104	69
License agreements with revenues in respective	19	21	31	34	43	51	21	23	27	28
New start-ups	2	5(1)	5(2)	2(1)	6(0)	5(2)	9(7)	2(2)	4(4)	6(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 2020

Institution	Name TTO	Start TTO	# of TTO FTE	# research contracts	# of invention disclosures	# of priority applications	# of IP agree-ments	# of start-ups
Universities								
Ecole Polytechnique Fédéral (EPF) Lausanne	EPFL-TTO	1993	14.0	219	122	69	53	25
Eidgenössische Technische Hochschule (ETH) Zürich	ETH transfer	1995	27	606	183	115	43	34
Universität Basel / Universitätsspital Basel Universität Bern / Inselspital Universität Zürich / Universitätsspital Zürich	Unitectra	1999	12.5	1337	161	86	66	16
Université de Genève / Hôpitaux universitaires de Genève	Unitec	1998	9.8	132	78	21	13	5
Université de Lausanne / Centre Hospitalier Universitaire Vaudois Lausanne	PACTT	2000	9.5	247	31	4	7	0
Università della Svizzera italiana (USI) / Institute for Research in Biomedicine (IRB) / Institute for Oncology Research (IOR)	SRIT	2018	1.0	51	11	6	5	0
UAS								
Berner Fachhochschule (BFH)	TTO	1999	15.2	269	3	7	4	3
RI								
Swiss Federal Institute for Materials Science and Technology (Empa)	Empa-Eawag TT-Office	2005	4.0	208	21	15	14	3
Swiss Federal Institute of Aquatic Science and Technology (Eawag)	Empa-Eawag TT-Office	2001	1.7	70	1	0	0	2
Paul Scherrer Institut (PSI)	PSI TT-Office	1999	5.3	197	16	11	10	1

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 2020 (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)

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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 120 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.**

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- SERVICES
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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

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