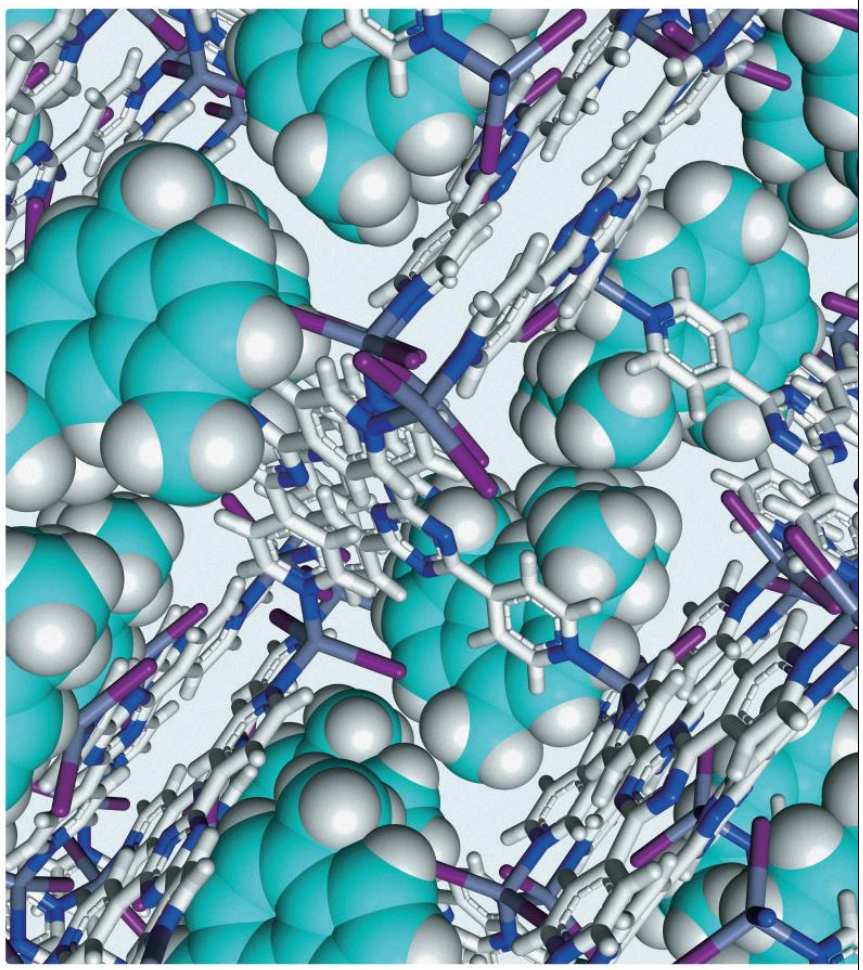


Intellectual Property Report 2022

--- Digest Version ---

Division of University Corporate Relations
University of Tokyo

Picture on the Front Page:
The picture represents a situation where molecules of compound sample, the three-dimensional structure of which is to be elucidated, arrange themselves in a fixed orientation in fine pores of a lattice-like porous crystal known as “crystal sponge.” The light blue and white spheres represent organic molecules for which X-ray structural analysis has been performed.
(Picture provided by Fujita Laboratory, Graduate School of Engineering)

Role of Intellectual Property in UTokyo

- ✓ Acquisition of **intellectual property rights (IPRs)** realizes an environment where **private companies can invest in social implementation of research results without concerns**.
- ✓ **IPRs are extremely important for fulfilling the university's mission** of social implementation of research results.

IP management in UTokyo

- ✓ **Universities should take responsibility for management and utilization of research results** obtained using public funds.
- ✓ Taking the opportunity of the incorporation of national universities and so on, UTokyo established the current **IPR management system which enables UTokyo to inherit IRRs** related to research results. (cf. In the US, IPRs of inventions created using governmental funds belong to universities under the Bayh-Dole Act enacted in 1980.)
- ✓ UTokyo is managing and utilizing IPRs in **cooperation with TODAI TLO, Ltd**..

【Special Topic】 Dissemination and Social Implementation of Nobel Prize Class Research Result Utilizing Patents - Crystalline Sponge Method -

Professor Makoto FUJITA (currently: Distinguished Professor) succeeded in arranging molecules of a compound sample in a fixed orientation by soaking a porous crystal known as "crystalline sponge" (CS) in a solution containing the interested compound sample. This is an epoch-making achievement that enables X-ray crystallography without the need for crystallization. Distinguished Professor FUJITA received the Clarivate Analytics Citation Honor Award in 2020, granted to researchers who are regarded as Nobel Prize class.

A series of technologies, which are related to the CS method, such as a porous crystal itself, a method to select a metal complex, and one to analyze X-ray crystallography data are protected by multiple patents.

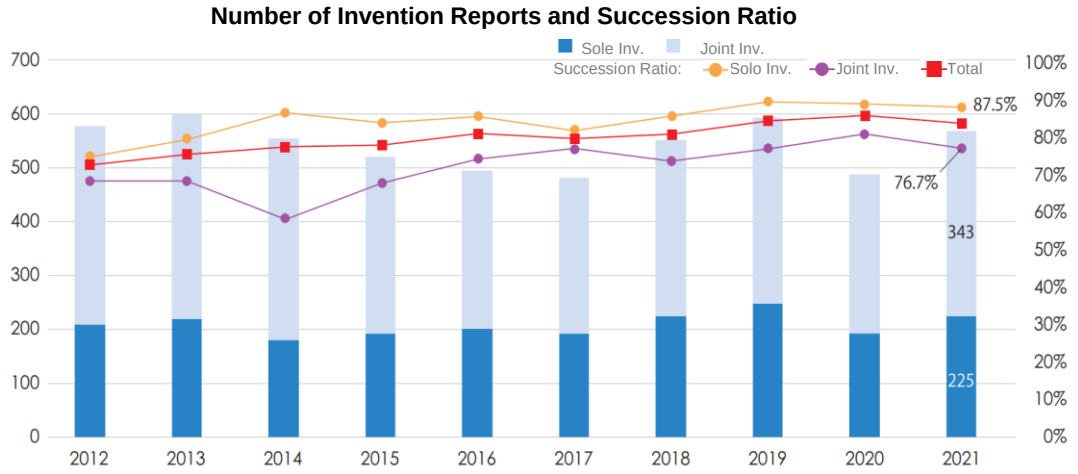
Outline of X-ray crystallography by CS method
(Picture provided by Fujita Laboratory, Graduate School of Engineering)

Non-alcoholic beer product using extract of matured hops
(Photo provided by Kirin Holdings Company Limited)

The CS method has been widely disseminated through the social cooperation program "Integrated Molecular Structure Analysis Laboratory," in which 19 companies currently participate. When participants utilize the CS method in their business activities, non-exclusive licenses are granted to them. Kirin Holdings has succeeded in elucidating the structure of an ingredient of matured hops using the CS method in combination with a conventional structure analysis method. It has established a method of extracting matured hops without either bitterness or astringency.

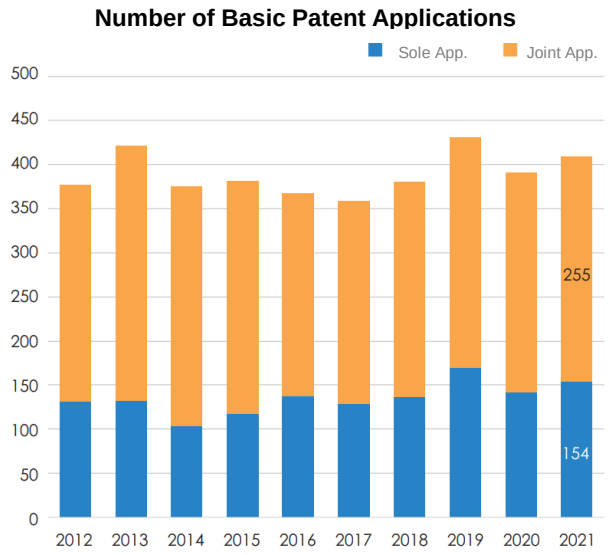
Invention Reports

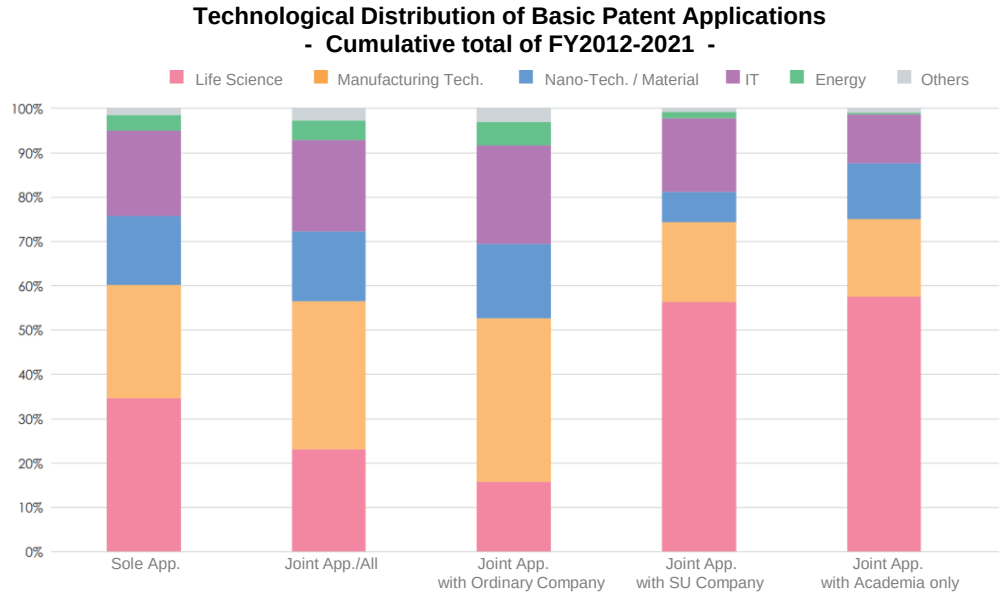
- ✓ After dropping to nearly 480 due to the COVID-19 pandemic, **the number of invention reports has recovered to 568 in FY2021**.
- ✓ **The ratio of sole inventions** (inventions of which inventors include UTokyo's researchers only) to the total number of invention reports has been **around 40%** for the past few years.



Patent Applications

- ✓ **The number of patent applications (basic applications)** has hovered **around 400** over the past 10 years.
- ✓ **The number of sole patent applications**, which had been on a slight upward trend since FY2015, has remained **almost flat for the past three years**.
- ✓ As for technical fields of **sole applications** (basic applications), **"Life Science" occupies the largest portion with 35%.**
- ✓ Regarding total joint applications (Joint App./All; basic applications), "Manufacturing Technology" accounts for the largest share at 33%. More than 50% of joint applications with startups belongs to "Life Sciences."



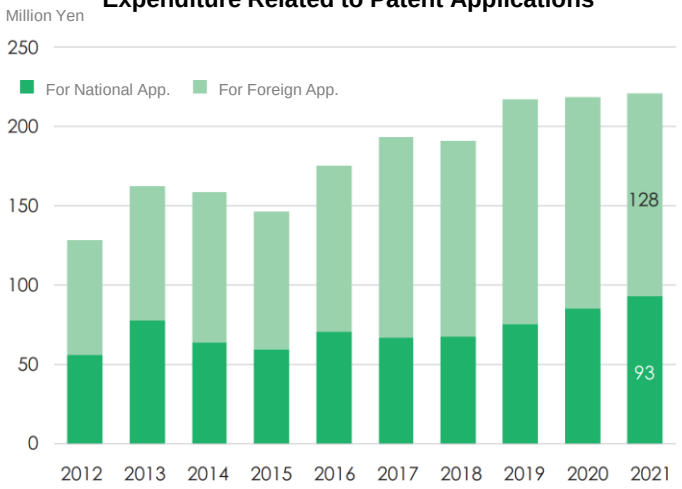


Expenditure related to Patents

- ✓ Expenditure related to Patents* behaves similarly to the total number of domestic and foreign sole applications. **The expenditure is 250 Million Yen in FY2021**.
- ✓ Taking the **globalization of the economy** into account, **it is necessary to secure a sufficient budget** to cover various costs including those for acquiring **foreign patents**, so as not to lose the possibility of global business development of partner companies.

＊ “Expenditure” includes fees that occur when filling applications, responding to offices actions and keeping patent rights and includes those to be paid to both patent offices and patent attorneys. Regarding a joint application with a private company, UTokyo has a policy to consult the joint applicant to understand contributions and roles of the university and accept bearing the costs that occur in relation to the joint application.

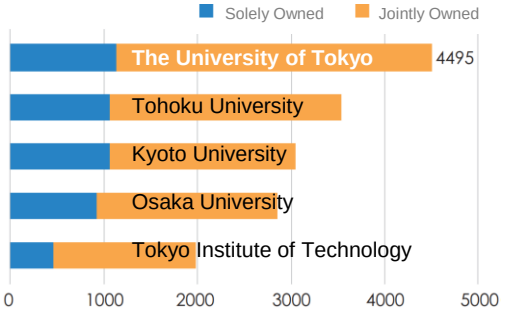
Expenditure Related to Patent Applications



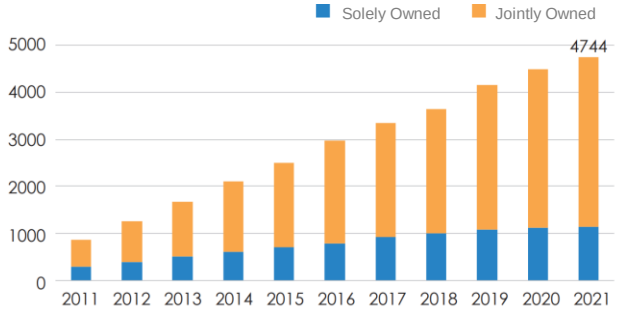
Top Class Patent Portfolio among Japanese Universities

- ✓ Based on a survey of FY2020, **the number of registered patents UTokyo holds is No. 1** among Japanese universities, and the number has increased more in FY2021. **UTokyo’s patent portfolio consists of 7,300 patents** including rights to obtain patents.
- ✓ **Solely owned patents** are intended to be used for commercialization of research results by private companies. Recently, the focus has also been on **utilization by startups** also.
- ✓ **Jointly owned patents** are results of collaborative research and considered important to **promote co-owner private companies’ businesses**.

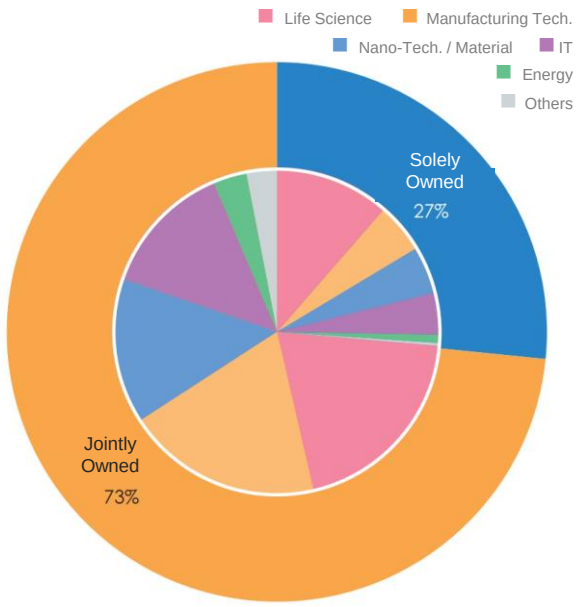
Ranking of Japanese Univ. Holding most Registered Patens -FY2020-



Number of Registered Patents of UTokyo



UTokyo’s Patent Portfolio -FY2021-

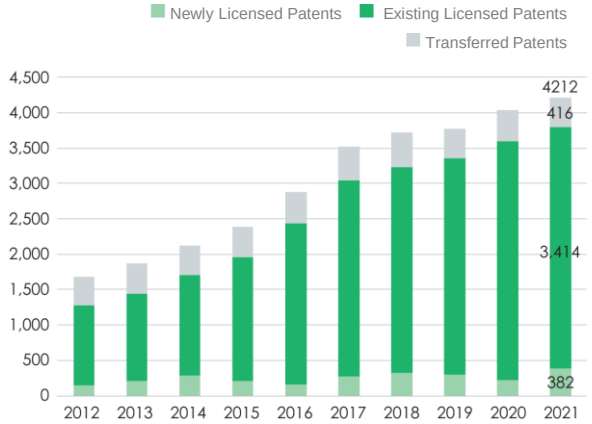


Complete View of Utilization of Patents

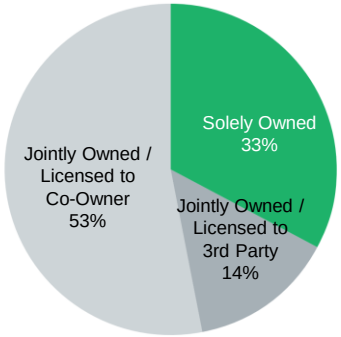
- ✓ The number of licensed patents* is steadily increasing year by year, reaching 4,212 in FY2021. The number of **newly licensed patents hit a record high of 382** in FY2021.
- ✓ **TODAI TLO provides consistent support** from an invention consultation stage before invention reports to a licensing stage, and this realizes many patent licenses.

＊ In this report, regarding statistical data related to license of patents, "license" also includes transfer or partial transfer. "Number of licensed patents" is the total patents of which concrete payment conditions (amount of money, royalty rate, trimming) for utilization are specified in contracts.

Number of Licensed Patents



Breakdown of Licensed Patents -being Licensed in FY2021-

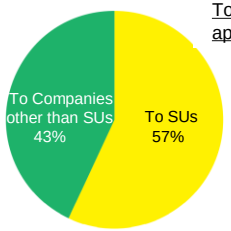


License of Solely Owned Patens

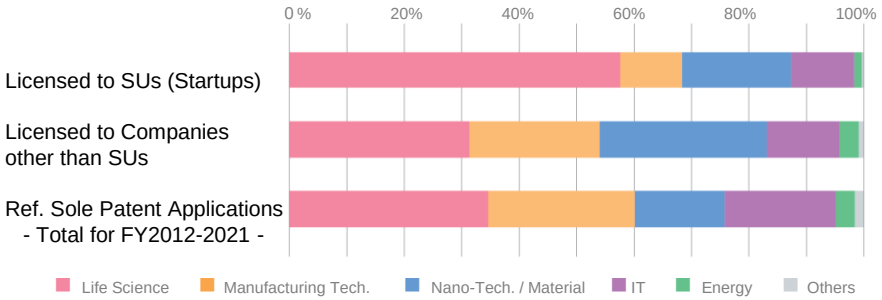
- ✓ **57% of the licenses of solely owned patents are those to startups**. While their number is still small, a few **oversea startups** are included in licensees.
- ✓ Regarding technical fields of solely owned patents licensed to startups, **"Life Science" occupies more than 50%.**

Breakdown of Licensing of Solely Owned Patents - being Licensed in FY2021 -

Total： approx. 1400



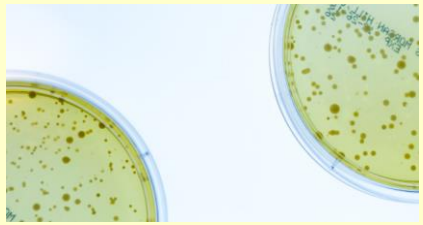
Technological Distribution of Licensed Patents - Solely owned patents/ being Licensed in FY2022 -



Social Implementation of Research Results by Oversea Startup

Kenya HONDA, Associate Professor of UTokyo (at that time; currently Professor of Keio University) succeeded in identifying intestinal commensal bacteria that induces the proliferation or accumulation of regulatory T cells.

Patents related to this research results are licensed to VEDANTA Bioscience, Inc., which is a startup company based in Cambridge, U.S. VEDANTA is now developing an oral drug, which consists of clonal intestinal commensal bacteria strains, for treatment of inflammatory bowel disease.

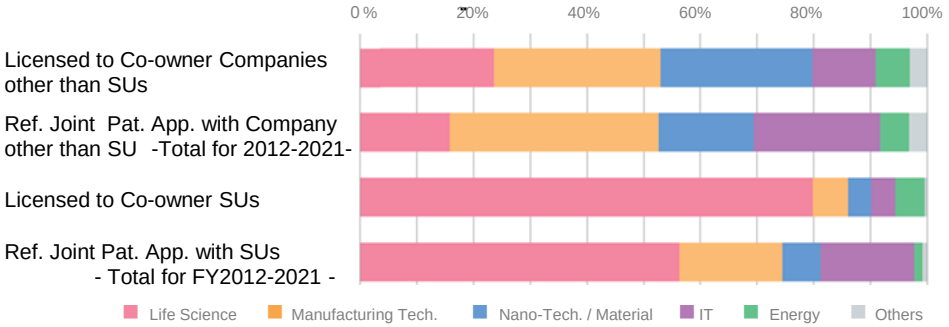


A variety of bacterial species are being isolated from stool of healthy donors. (Photo provided by VEDANTA Biosciences, Inc., ©Bearwalk Cinema)

Licenses of Jointly Owned Patents

- ✓ **The number of jointly owned patents licensed to co-owners is approximately 2,200**. Of these, **68% are patents jointly owned with companies other than SUs and licensed to the co-owners**.
- ✓ As for the technical fields of these jointly owned patents licensed to the co-owners, **"Manufacturing Technology" and "Nano-Technology / Material"** account for **almost the same proportion as "Life Science."**

Technological Distribution of Licensed Patent
Jointly Owned Patents Licensed to Co-owners -Being Licensed in FY2021-



Example: Utilization of UTokyo's Patents

Epoch-Making Method to Prepare Cellulose Nanofibers

A team lead by Akira ISOGAI, Professor of UTokyo succeeded in preparing individualized cellulose nanofibers (CNFs), which are 3−4 nm in width and a few microns in length, by having native celluloses TEMPO-Mediated Oxidized in water and then fibrillating them.

Several companies have put this invention into practical use. In 2015, the Marcus Wallenberg Prize, called the "Nobel Prize for Forestry," was awarded to Prof. ISOGAI's Team, recognizing that this invention has contributed to the development of commercial applications of CNFs.

Left: Care product for light incontinence and paper diaper for adults using CNFs
Right: Tire using CNFs (Photos provided by Nippon Paper Industries Co., Ltd.)

Autotaxin as Novel Biomarker

Autotaxin (ATX) was considered as one of the biomarkers for cancers and chronic liver diseases. In 2006 and 2007, UTokyo (Professor Yutaka YATOMI et al.) and TOSOH corporation filed patent applications jointly on inventions that could be a basis for development of ATX measuring reagent.

After filing these joint patent applications, UTokyo and TOSOH had been conducting collaborative research for a long time toward social implementation of research results. Finally, in 2018, TOSOH started selling reagents for diagnosing the progression of liver fibrosis.

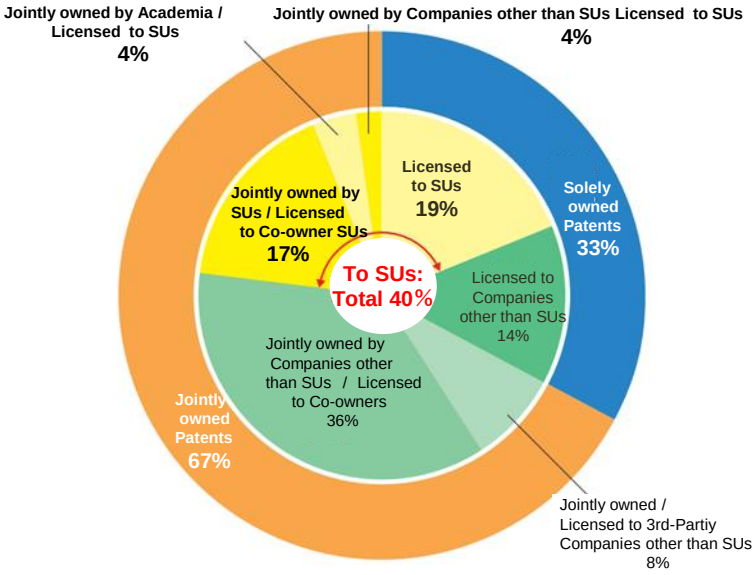
While the usefulness of ATX as a biomarker for liver fibrosis has already established, expansion of its applications as other biomarkers such as that for malignant lymphoma is expected.

TOSOH corporation's Eテスト「TOSOH」® II (Autotaxin)
(Photo provided by the TOSOH corporation)

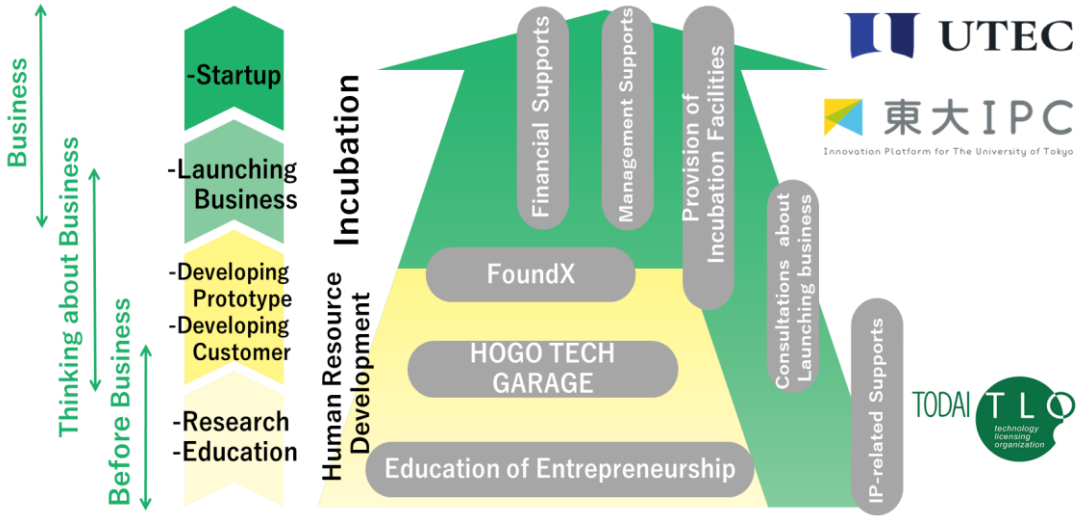
Startups utilizing UTokyo's Patents and other IPRs

- ✓ **More than 40% patents licensing is to startups.**
- ✓ Division of University Corporate Relations of UTokyo, TODAI TLO, UTEC and UTokyo IPC are **collaborating to provide seamless supports to startups**.
- ✓ **UTokyo's mid-term objectives** aim to create 650 UTokyo-related startups and have **160 of these utilize UTokyo's IPRs.**
- ✓ The number of **startups utilizing UTokyo's IPRs reached 132** at the end of FY2021. About 10 of these became listed by March 2022. The market capitalizations at the time of listing were tens of billions yen, and that of one company exceeded 100 billion yen. Utilization of **UTokyo's IPRs by startups has been contributing to creation of significant economic impacts**.

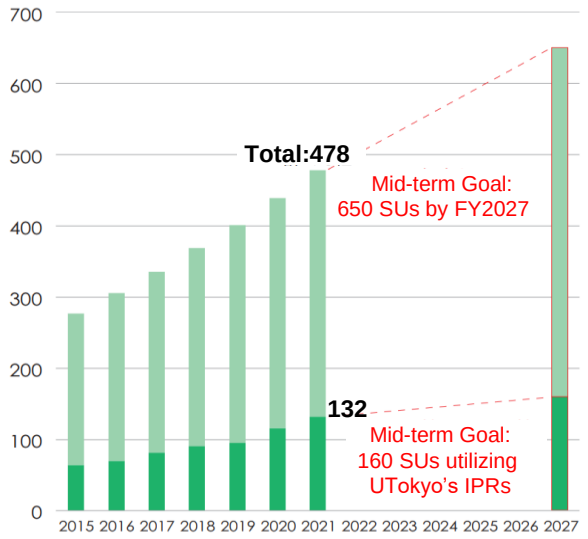
Share of Licensing to SUs in all Patent Licensing - Being licensed in FY2021 -



Whole Picture of UTokyo's Supports for Startups



Cumulative Total of UTokyo-related Startups



Example: Startups utilizing UTokyo's IPRs

ヒラソル・エナジー株式会社 GIRASOL ENERGY INC.

Girasol Energy Inc. was established in February 2017 aiming to socially implement the power line communication technology invented by Hideya OCHIAI, Associate Professor (Assistant Professor at that time).

Girasol Energy provides IoT platforms for solar power plants. By using patented power line communication technologies, the company enables power plant operators to monitor their solar panel modules remotely. Monitoring is a major problem for the operators since the degradation of a single solar panel among hundreds causes a significant performance loss of the entire Photovoltaic (PV) system. Using the company's technology, the operators can detect the degradation of each panel and significantly reduce maintenance costs of their plants.

UTokyo licensed its patent to Girasol Energy when it was established. After the establishment, the company moved into UTokyo's incubation facility, and this enables the company to conduct collaborative research with UTokyo smoothly.

UTokyo IPC has been supporting the Girasol Energy from various aspects including financing and management before its establishment. UTokyo IPC invested 190 million yen in the company's Series A funding in August 2021.

PPLC IoT system installed in the mega solar power plant in Kofu, Yamanashi prefecture.
Succeeded in demonstration experiment with 1MW.
(Photos provided by Girasol Energy Inc.)

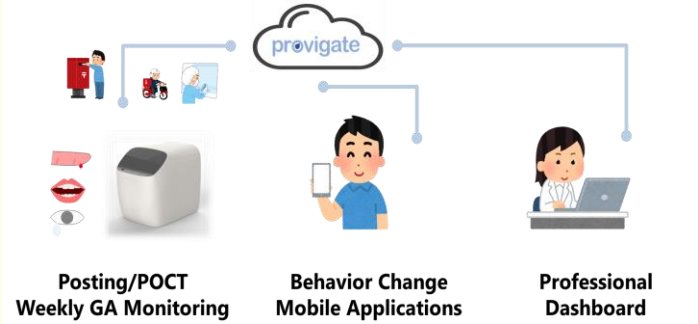
provigate

Provigate, Inc. was established in March 2015 aiming to socially implement biosensor technologies developed in the Sakata Laboratory of Graduate School of Engineering (Toshiya SAKATA, Associate Professor).

Focusing glycoalbumin (GA) as a biomarker that reflects average blood glucose, Provigate is developing a device that enables users to measure GA by posting or at home. The company is also developing a mobile application that monitors blood glucose levels on a weekly basis and supports users to change their lifestyle behavior. By monitoring blood glucose levels weekly, it becomes easier for people with diabetes and those in the pre-diabetic group to recognize the effects of their efforts to improve their lifestyle behaviors over the past week.

Several of UTokyo's patents were licensed to Provigate and many foreign patent applications were filed before and after the license, with a view to global development of the business.
Provigate ensured an environment to conduct experiments by being housed in the UTokyo's incubation facility.

In September 2021, Provigate raised funds of 910 million yen.



Conceptual diagram of services provided by Provigate (Picture provided by Provigate, Inc.)

Succession and Utilization of Copyrights

- ✓ Under the UTokyo's IP management system, as for software and data base works, reports are to be submitted only when it becomes necessary to license them for profit.
- ✓ In FY2021, a total of 22 works such as software works have been reported and those copyrights are inherited by UTokyo.
- ✓ The number of copyright license contracts* in FY2021 is 67, an increased of approximately 10 from the previous year.

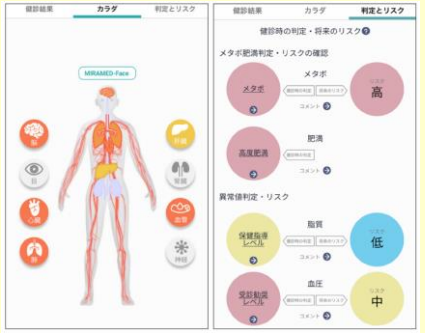
* Contracts that had a valid period in the relevant fiscal year are counted.

Mobile App to improve users' lifestyle behaviors and health literacy for lifestyle-related diseases

A research project team, led by Akiko KISHI, Project Assistant Professor, in the COI* of UTokyo have developed a mobile application to encourage changes in lifestyle behaviors to reduce risks of metabolic syndrome and other lifestyle-related diseases.

UTokyo has obtained a patent to this technology and inherited copyrights of software related to the app and is managing and utilizing them. These IPRs are being licensed to several companies.

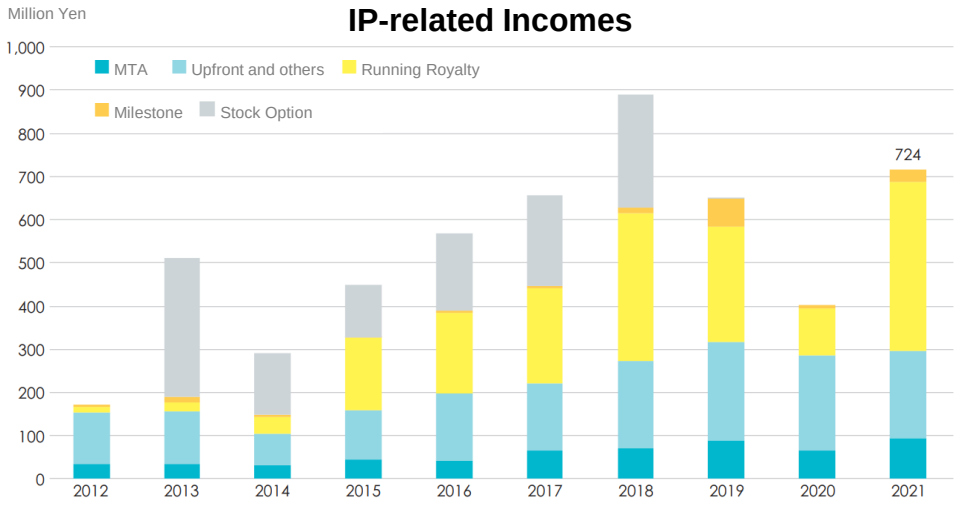
* "COI (Center of Innovation)" is one of industry-Academia R&D programs lead by MEXT and JST. The program finished in March 2022 and the COI research project has been taken over by the Research Institute for Biomedical Science and Engineering of UTokyo.



Screen of mobile app "MIRAMED®" provide by Hitachi Systems, Ltd..(Picture provided by Hitachi Systems, Ltd. https://www.hitachi-systems.com/solution/s0310/miramed/ ("MIRAMED" is a registered trademark owned by UTokyo.)

IP-related Incomes

- ✓ **IP-related incomes of FY2021 is 724 million yen**.
- ✓ The level of IP-related incomes in recent years has been higher than that in the early 2010s, although there is fluctuation in the amount every year owing to heteronomous factors. The decline in FY2020 was a temporary decrease due to the change in the accounting period of a certain licensee company.
- ✓ The total amount of income of **"Upfront and others" and "MTA" has been stable in recent years** despite the pandemic.



Toward Realization of More Social Contributions through IP Activities

Current Situation:

- ✓ The number of sole and joint inventions and that of sole and joint patent applications have remained stable even under the circumstances of the pandemic. However, strictly speaking, these numbers have not exhibited a growth trend in recent years.
- ✓ The level of interest in IP activities differs from department to department and from researcher to researcher.
- ✓ A certain number of patent applications were filed after publication of academic papers.

Actions for the Future:

- ✓ Conducting **IP awareness raising activities**, **broaden the base of IP activities** and **raise the quality of IP activities**.
- ✓ Securing adequate financial resources for IP activities, **establish a larger and more fulfilling UTokyo's IP portfolio** than the present one.
- ✓ By maximizing the use of IP as one of the strategic assets for the management of the university, **strive to achieve the UTokyo's mission of social implementation of research results**.

For inquiries, please contact: info@ducr.u-tokyo.ac.jp