

2018.07.25

SPINOFF REPORT



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*“Don't always walk on the smooth roads, walk ways that no one has travelled
before, so as to leave behind traces and not only dust”*

Antoine de Saint-Exupéry

ABOUT SPINOFF.COM LTD

SPINOFF.COM is the Investment Information System (IIS) which utilizes free of cost AI-engine driven platform and off-line value-added service (VAS) with 25 in-house employees and 24 external professional syndicate members. Our goal is to create the complete portfolio of all the world's high potential scientific spinoffs in one place and provide the scientists with the fastest and the most convenient way of fundraising and identification, evaluation and signing distributors and partners. With over 5,000 publications per year, SPINOFF.COM is the largest platform that connects over 600 universities and research organizations with over 30,000 investors (venture capitals - VC, private equity companies - PE, family offices – FO, and multi-national corporations - MNC) and over 200,000 distributors globally. Also, over 2 million visitors use our multichannel platform monthly. SPINOFF.COM is incorporated as Ltd. (Limited) and is non-for-profit organization.

IIS AI engine automatically receives information and updates from over 600 universities and science organizations (e.g. NASA, European Space Agency, Indian Space Research Organisation) on daily basis as the first step. The second step - this information is classified according to the industry and is passed on to the related specialists in Science Department. Utilizing advanced AI driven engine spinoff evaluation system and in particular cases, external AI engines of SAS AI, SmartPLS, SPSS, each spinoff passes evaluation of commercial potential by our industry specialists leaving only spinoffs with the potential to be successfully commercialized. The third step: the spinoffs are passed to the team of professional journalists, which prepares the interview with the focus on information relevant for investors and distributors, sign necessary agreements (e.g. NDA), supply with additional documentation (e.g. technology due diligence, financial plan etc.). If needed, our Design Department prepares additional visual materials or upgrades the existing ones to the spinoff's portfolio (as VAS). Upon approval from spinoff founder, this information is uploaded to the IIS. In last step Investment and Syndication specialists help spinoff founder with Fundraising and Distribution Network Development.

Sincerely yours, SPINOFF.COM Team

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PRODUCTS



NEWEST WIRELESS HELMET FOR FIREFIGHTERS

The researcher's group from Korea developed an innovative helmet for firefighters with an integrated radio transceiver. Typically, firefighters are not able to communicate with each other in extraordinary circumstances, while the ability to communicate is an important component of a successful operation and an inherent element of firefighters safety. The embedded antenna and speaker have the ability to provide a reliable communication to firefighters in the most critical of moments.



Professor Wonbin Hong from the Department of Electrical Engineering at Pohang University of Science and Technology
source - postech.ac.kr

The innovative device was designed by the scientific group, led by Professor Wonbin Hong, from the [Pohang University of Science and Technology](#) in cooperation with the [Pohang Nambu Fire Station](#).

Usually, firemen are equipped with obsolete radio transceivers, which enable to provide the good-quality communication between firefighters. Nevertheless, there are existing **2 types of radio-technologies**, which are bulky and at worst cannot be applied during the dangerous situations when they are required. Until now, the firemen have clipped their hand-held 2-types radios to their fires suits. In the most dangerous and stressful moments, firefighters could not use radio receivers, because their hands will be occupied by other tools to combat the fire. Moreover, surrounding noise made incoming messages completely inaudible.

To solve this problem firemen began to use earphones. Despite this fact, it did not work. If the headphone falls out of the ears firefighter will not be able to pin it into the ear because of bulky gloves, the removal of which will take some time, which is dangerous in critical situations and is not always possible.



This achievement is even more notable due to its immediate real-world safety applicability through a collaborative foundation between POSTECH's outstanding research capacity and the local municipality source - adobe.com

The researchers' group defined these problems and take noted to the firefighting headpieces. The helmet is a crucial safety element, which is worn and nearest to the firemen' head. Scientists designed **an effective, simple and compact equipment' part whereby the firefighters will have a hands-free tool for communication, which is integrated into their headpieces**. After **2 months** of investigation, the group managed to design the wireless connecting helmet with an **inbuilt hands-free transceiver**. Moreover, the antenna and speaker are too **lightweight and waterproof**, consequently, they can be dissevered and gargled with water in order to maximize its effectiveness and versatility.

Mr. Hak-Soo Shim from the fire station mentioned that this newest development was designed as a tool, which will available to all firefighters in Korea and help to save the lives.

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Phone: -
Patent status: -
On market since: -
Regions: Korea
Industries: Creative Industries, Others
Source links: [Pohang University of Science and Technology](#)



A CAR MONITORING DEVICE CARSENSE

The Indian spinoff CarSense has developed a device, which connects a car and the user, remotely providing a wide range of information about the condition and location of the car. CarSense has the ability to send an SOS alert to your emergency contacts in case of an accident and even notifies the user in case of a rash driving or towing incident.

Furthermore, it can provide fuel efficiency report in order to reduce emissions and improve mileage that is based on driving style feedback.

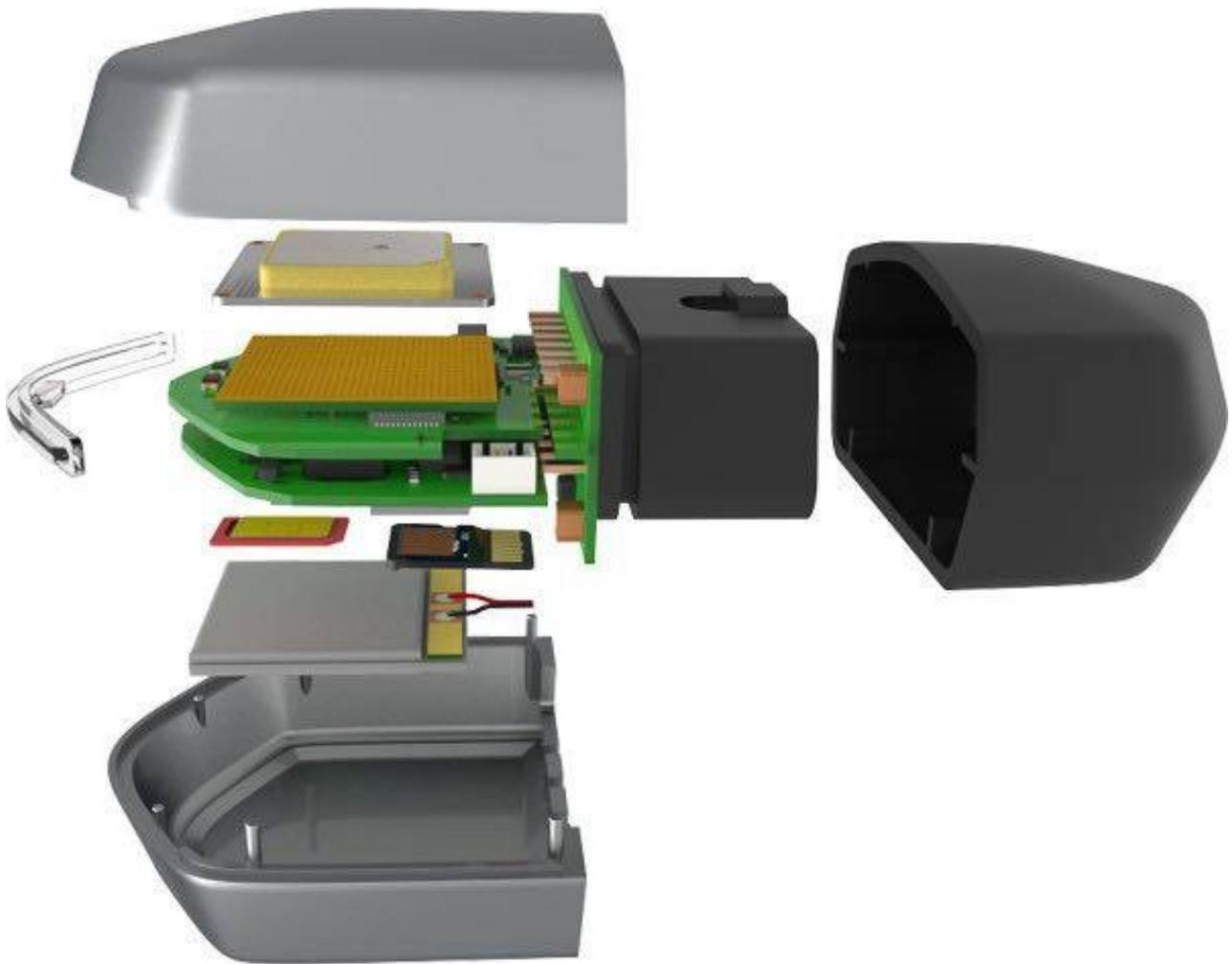


Built-in GPS: GNSS engine for GPS/QZSS, A-GPS support. Accurate location tracking, always source - carsense.in

With the rapid development and improvement of the field of machine building, the car has a fairly stable technology, in its essence, being a separate vehicle not attached to other systems, devices or the Internet. Most people rely on their vehicles, especially those whose everyday life and professional activities require constant moving. It is obvious that users require maximum comfort and versatility. Mr. Urmil Shah, co-founder, said that the designers' team wanted to provide the ability of **the connecting cars and owners in order to seamlessly monitor and control all aspects of their cars** with just a tap on their phone.

The company's main goal is based on building the seamless customer experience in order to come out on the market with a completely plug-and-play product. Consequently, the company has developed **a product that can be integrated into the car system easily without the need for the special modification or adding some tools**. CarSense can monitor the car **to ensure its safety, send alert signals in case repairs are required, give insights on the car's fuel economy** and even more. The owner simply needs to plug the CarSense into

the OBD port of the car, download the app on the phone and just sync the device with the app.



Built-in Accelerometer. Bandwidth: X,Y Axis-1600Hz; Z Axis-600Hz. Precision: 0.012G. Unmatched accuracy in motion detection and reporting
source - carsense.in

Furthermore, the device allows users to do a lot more than simply track the car. The **real-time speed monitoring and receiving towing and theft alerts** are provided by the system. **The device will notify owners if the vehicle is in need of repairs such as engine, battery or brakes problems.** All its functions make this invention emergency-alarming and safe. The device was tested at extreme temperatures **at -40 ° C to +70°C**. In addition, CarSense is the highly-comfortable device in many cases as it has the ability to note all trips that are made by the car, manage all car documents and monitor driving behavior and analyze the feedback.



Active Wireless Sync: built-in PIFA antenna for GSM and GPS; cellular 2G and Bluetooth 4.1 (BLE). Manage your car no matter how far you are
source - carsense.in

Company name: CarSense
Contact person: -
E-mail: urmil@carsense.in
Website: <https://www.carsense.in/>
Phone: 9029001409
Patent status: +
On market since: -
Regions: India
Industries: Creative Industries, Transport Systems and...
Source links: [CarSense](#)
[The Economic Times](#)



A WEARABLE NAVIGATION SYSTEM LECHAL

The next generation of wearable electronics was developed by the Indian company that is called Ducere Technologies. Lechal shoes with the navigation guidance, which is based on the system of vibration, is also suitable for visually impaired persons. In addition, this type of wearable electronics is washable and anti-bacterial. Lechal's battery can work about 15 days without charging and it is perfect for traveling. This product is innovative and massive as it is suitable for any user.



Lechal shoes are made of leather, suede or microfiber, depending on the style
source - bgr.in

Modern technology is developing at an incredible speed, making the everyday life much more comfortable. However, quite often this sphere ignores a rather large segment of people - physically disabled people who are unable to use most of these products.

Krispian Lawrence, Co-founder & CEO of the [Ducere Technologies Pvt Ltd](#), wanted the visually impaired people will have the ability to navigate the world better. The developers decided that haptic system, which is based on **the technology of reacting on the sense of touch by applying forces, vibrations or motions to the user**, can open a wide range of possibilities.

Despite this fact, Mr. Lawrence mentioned that when they started to work on the technology, it was a specific concept. The more the researchers' team worked on the idea and technology, the more they aware that this product could be massive and used by various users, and not just people with visual impairments. Their main strategy is that their technology must be intuitive, non-obtrusive, comfortable, easy to use, and easy on the pocket. The product should be engineered to suit people' needs.

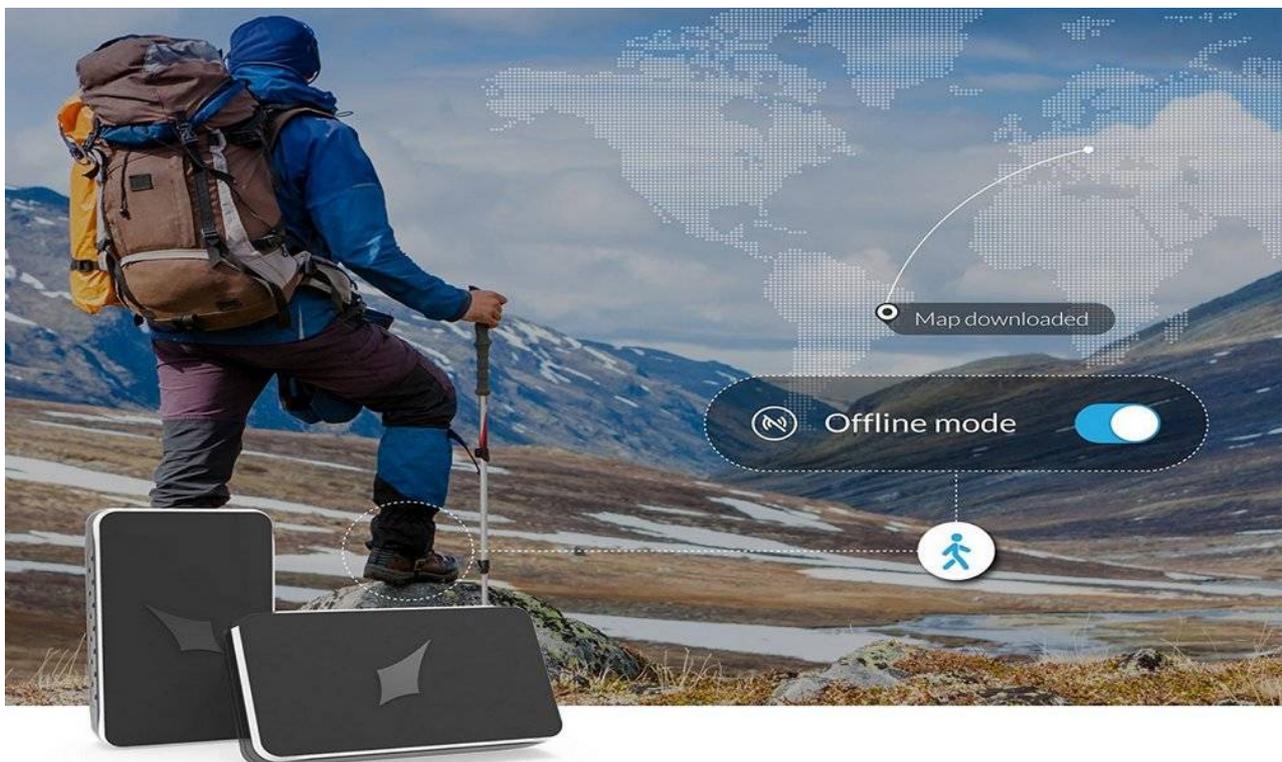
The team said that wearable technologies should feel like an extension of own body. Nevertheless, such products usually based on the audio and video technologies. Developing Lechal's technology, designers used the sense of touch, which is the most powerful and not widely used while creating such products.



The pods can be inserted into any shoe. The user can use the app to assign left, right or swap between the pods by a simple click of a button

source - newatlas.com

Lechal makes navigation a **hands-free, heads-up experience**. The technology includes **detailed route guidance**. The user will feel a slight vibration on the left or right foot at each upcoming turn. Furthermore, it contains **unique vibration patterns for different kinds of turns, rerouting**, and every other navigational need. The user just needs to connect the pods to the Lechal app, set a destination and let Lechal footwear 'show' the way. In addition, this innovative technology has the ability **to remind about the stops** en route to the final destination if there are any.



Lechal allows you to download maps beforehand and access and use them without a data connection

source - amazon.in

Company name: Ducere Technologies Pvt Ltd
Contact person: -
E-mail: contact@duceretech.com
Website: <http://www.lechal.com/#Home>
Phone: +91-40-27713000
Patent status: +
On market since: -
Regions: India
Industries: Creative Industries, Electronics
Source links: [Lechal](#)
[The Economic Times](#)



A NON-INVASIVE FORM OF DVT THERAPY VETAfit

Exclusive interview for SPINOFF.COM with Mr. Dominic Fritsche, the Inventor & Founder of VETAfit, about a novel and non-invasive form of therapy for deep vein thrombosis

VETA is the non-invasive type of treatment and therapy for both DVT sufferers and high-risk individuals through the integration of new technologies with existing garment design. It aims to tackle this issue within the realm of DVT through the application of low-energy sensors, that whilst integrated into a therapeutic garment, can relay information on the quality and quantity of physical exercise undertaken to the nearby connected smart device. Furthermore, technology can to further develop and enhance the effectiveness of different types of the DVT treatment.

VETA*fit.*

Forming habits for a more aware lifestyle.



VETAfit

source - freedom.co.nz

SOC: Dear Mr. Fritsche, we are so grateful for your generosity this day in spending time speaking with us and sharing your insights about the VETAfit project. Our investors and we would like to learn more about a vast experience of your academic endeavors and your professional background.

Mr. Fritsche: I am a Product Manager and UX experience designer. I have studied at the [University Of Design Schwäbisch Gmünd](http://www.udg.de), Germany. In that time when I was encountering real problems, I was fascinated trying to solve or improve existing products and

technologies. Currently, I am working full time as a UX designer.

SOC: It is so interesting to know more about the process of your technology creation. Please tell on which stage of commercialization your technology currently is? Was your project funded by any state financing or grants? Has it already received any honors or awards?

Mr. Fritsche: As for the [VETA project](#), it is very early. Currently, we are on the verge of a new ground which is basically redefined. We are planning to move ahead and fully commit it. Most of our work at the moment revolves around the software that keeps improving massively of the hardware. This invention aims to further develop and **enhance the effectiveness of non-invasive forms of treatment and therapy for both deep vein thrombosis sufferers** and high-risk individuals through the integration of new technologies with existing garment design.

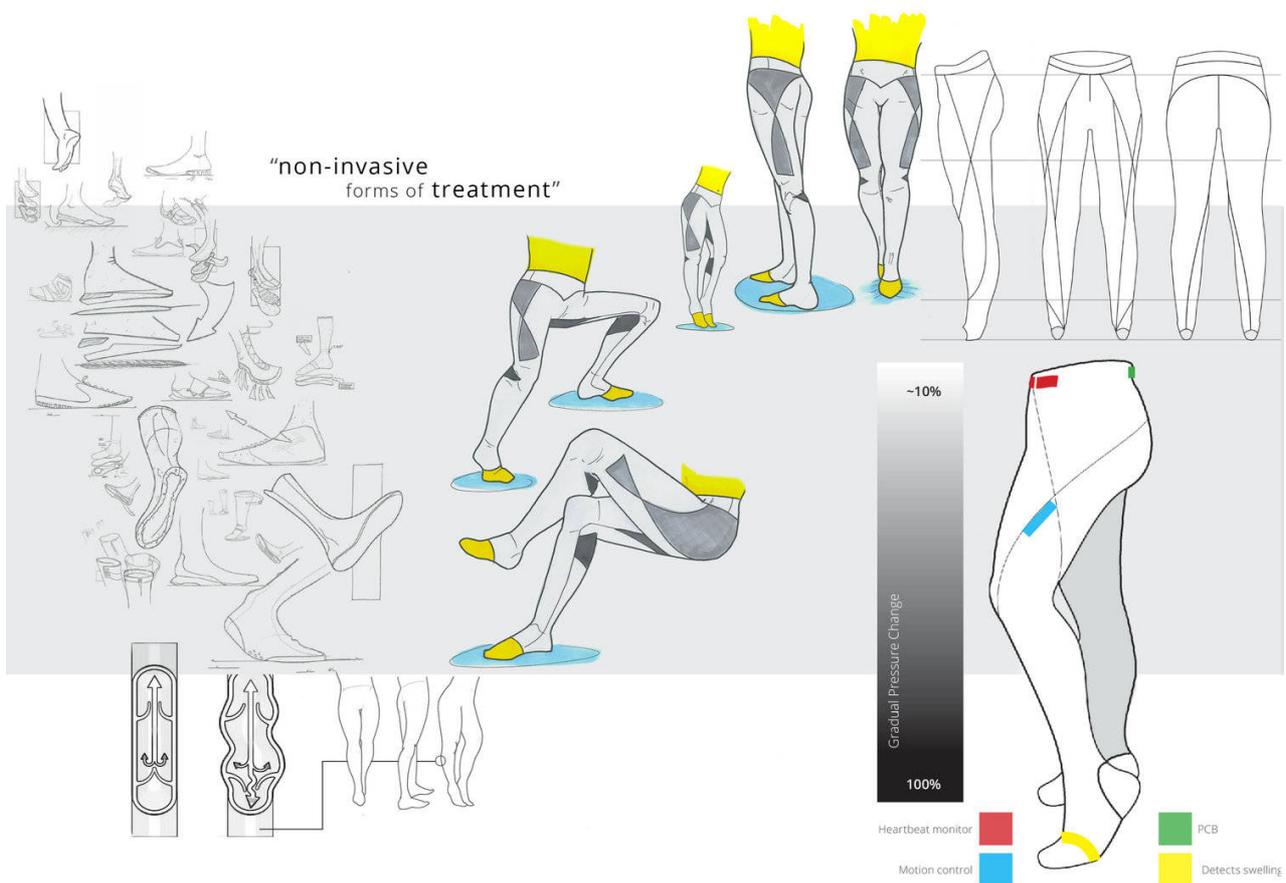
SOC: In the formation of every scientific spinoff, one of the most important keys to success is the team. For many potential investors, the management team is the most important element in deciding whether to invest in it or not. Could you please share some information about the team members who supported you and the project? What are the key additions to the team needed in the short term?

Mr. Fritsche: The team has their range of true professionals who are still working in this field and assist and adviser us, sharing their knowledge. I am very grateful for that. This kind of assists consists of the bunch of medical professionals, doctors, and material specialists. Furthermore, I found and documented all of these findings that we could use in order to continue going forward. The team is very dedicated due to the dealing with the real problem.

SOC: It is not a secret that the development of a new technology and its subsequent commercialization presupposes some problem and addresses unmet needs. Respectively, what problem did you intend to solve by creating your technology? What results did you plan to achieve?

Mr. Fritsche: First of all, we intended to solve one problem. It is a deep vein thrombosis (DVT). At that time, the only other kind of option for treating deep vein thrombosis was

either a pharmaceutical variant or a traditional form of compression. It made us start to work on the better method. We thought that must be the better way. The less invasive method that doesn't require injure the skin. The technology that has the ability to help you to improve your life and help you in the treating of the deep vein thrombosis. Currently, when we have got the deep understanding what the technology can do and who is affected by deep vein thrombosis. It is becoming more enlarging. Consequently, we have tried to garn and solve it with the skidding and fundamental research. VETA aims to tackle this issue within the realm of DVT through the application of **low-energy sensors, that whilst integrated into a therapeutic garment**, can relay information on the quality and quantity of physical exercise undertaken to the nearby connected smart device.



It can suggest therapeutic exercise regimes, whilst wearing compression garments
 source - fridom.co.nz

SOC: The problem which you targeted to solve was actual before. Probably someone has already tried to solve it. Is it right? Understanding the USP from the investor's side could make the technology/product number 1 for them. What are the USP of your technology/product and fundamental difference from other technologies/products that tried to solve this problem before you?

Mr. Fritsche: There are other players on the market as a rising tide lifts all boats. However, there are only a limited amount of people who have similar hardware, that we have. Despite this fact, **our hardware act in the more accurate** way than any other type of the hardware. As the result, we have already got maximum advantages. In addition, we are going in a different direction than the rest the people in this market, which are just 'playing' with the hardware. We are going into more of a medical approach. It is a kind of play and showcasing where you are and where we have an audience. We are trying to go in that direction. It makes me feel safer.

SOC: In order to understand the peculiarities of this particular spinoff our investors always ask what is the investment structure of the company? Do you still own the controlling stake in your spinoff?

Mr. Fritsche: We are limited liability company. That might change in the future. Currently, we are keeping growing at this point.

SOC: We wonder what is the actual addressable market currently for your invention and what are the current competitors there? Could you please share with us the results of the market studies, if there are any? What might be the barriers to entry?

Mr. Fritsche: VETA combines the common compression garment with a smart wear that is based on the smart technology. The hardware and software could be productively simultaneously applied. As the result, we have combined these two elements. For example, **it can be offered in professional sports**. At that point, no one does what we do.

SOC: We always need to paint a clear picture to the potential investors of the market opportunity of the spinoff that is meaningfully large and growing. Why in your opinion your company might have a high growth potential? Could you tell us all current industries and fields of your technology/product application and where do you think it could be successfully applied in the future?

Mr. Fritsche: On this stage, we were dealing with everyone who are relaxed about wearing a computer on themselves, such as [Apple Watch](#). Therefore, we thought that we can introduce the product, which **allows people to track, train, through and do all the thing by themselves just follow some instructions**. Now is the time for people to go further. It is a

new level that people are willing to experiment. For example, if you are a professional golf player or something like that, VETA will be able to help you improve your strung and swing.

SOC: The potential investors will be curious whether you already have the first clients and signed contracts? What was the feedback from your partner's markers and customers?

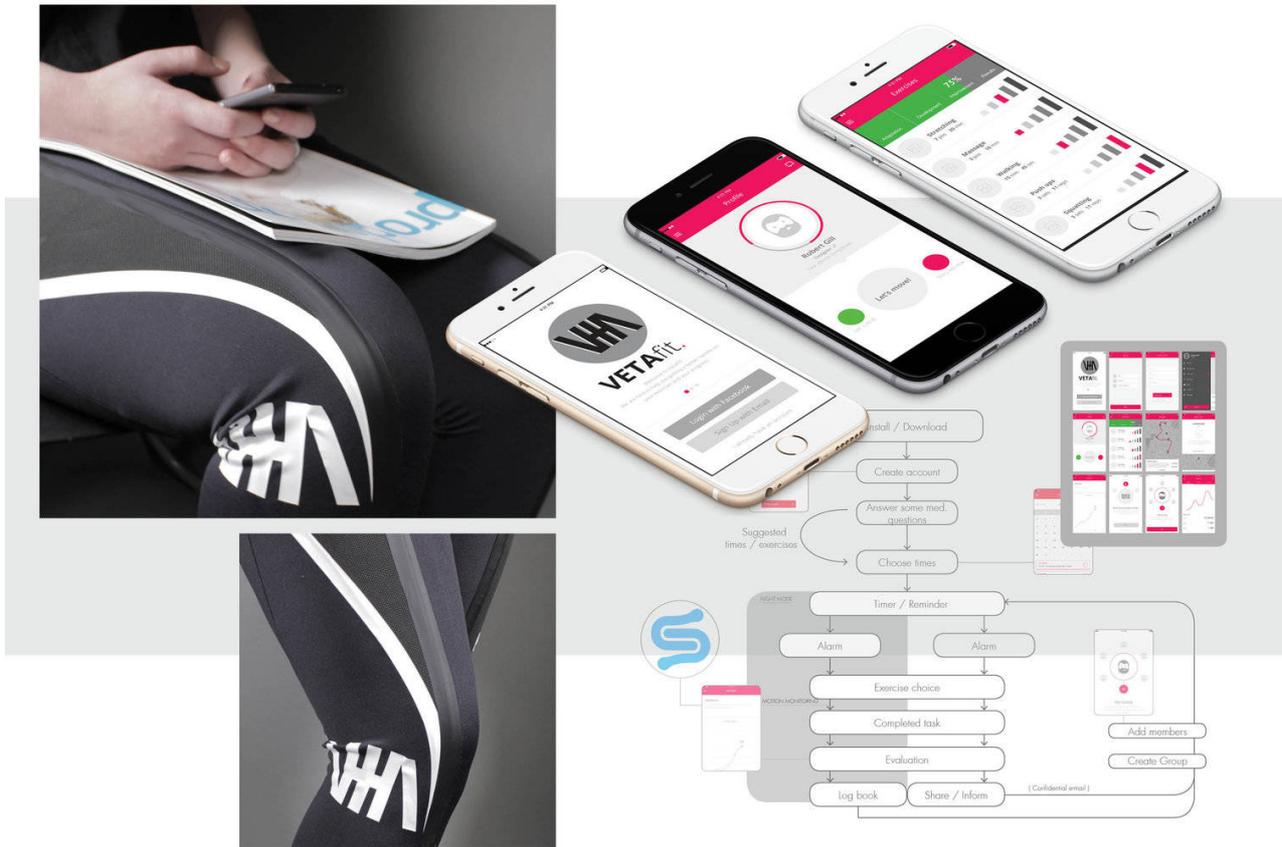
Mr. Fritsche: On this stage, we have shift orders and have to do an audit though. We have tried to cover all of the bases. We have interest from both operational, **the physio department and hospital-affiliated third party**. At that stage, we haven't stepped shifted. We are interested in this market and would like to refine our product more like the premium product.

SOC: It is very important to understand your particular vision about unique features of your company. Why do you consider the major market players might be interested in investing in a promotion of your technology/product on the addressable market?

Mr. Fritsche: It is a great question. I think that a big player in the market will be acquired or very interested in our technology. It would demonstrate that these companies operate in the field of wearable technology. We are heading into the future and trying to drive innovation.

SOC: Now we would like to refer to the next very crucial and we would even say essential aspect for spinoff companies' as the strategy of R&D, production, distribution, and marketing processes. Do you have your own unique strategy? Which of these processes do you consider your spinoff is strong at?

Mr. Fritsche: The process is agile and we lead it. It allows achieving to reach their goals in a short amount of time and to keep track of what is really important to us. We have used visual materials and have a great success.



The device can display information on the quality and quantity of physical exercise being connected to the device

source - freedom.co.nz

SOC: For spinoff companies, their intellectual property is a key to success. The investors pay particular attention to it. What key intellectual property does your company have (patents, patents pending, copyrights, trade secrets, trademarks, domain names)?

Mr. Fritsche: VETA was documented by us with a very meticulous betrayal. We **have a patent**. In addition, we have the mobile application and UX design name and the interface design with that application as well.

SOC: The investors will want to get a clear picture of how many rounds of investments have you completed? Are you seeking for the investments at the moment? What is the volume and time limits? What milestones will the financing get you to? What did you plan to use the invested funds for?

Mr. Fritsche: All the investments that were used were personal. These investments haven't been from outside of the country. Despite, we would like to make **product premium for the**

go on the market and or even further.

SOC: Could you please describe your ideal investor? What aspects are important for you, for instance, is it experience, country, the amount of own private capital or maybe some personal qualities? Will existing investors participate in the round?

Mr. Fritsche: Certainly, for me, personal qualities would be more important. I want to bring to the table as a leader. We would like to collaborate with someone who can help us to enter this market.

SOC: And the last question, could you specify the most convenient way you would like to receive inquiries from potential investors? Should it be by e-mail or personal phone call?

Mr. Fritsche: Both ways are convenient.

We would like to express gratitude for the time you have dedicated to this interview.

SPINOFF.COM will observe the development of your spinoff with great pleasure and interest.

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Phone: -
Patent status: -
On market since: -
Regions: Others
Industries: Creative Industries



A NEW MODULAR HEARING AID WAS DESIGNED

The innovational hearing device Facett is functional, rechargeable, modular and snapping together with magnets. The developers were inspired by the natural form of crystals. They made the device elegant and beautiful, hence, users were not forced to hide it and can get rid of the complexes associated with deafness and the need to use the appropriate device.

PhD researcher and a lecturer in the [Royal Melbourne Institute of Technology, Australia](#), Leah Heiss controlled all stages of the development of this device.

Ms Leah Heiss mentioned that during the development of the device, the original technology can be modified so that the device may have a form that can not be easily changed. She spent 37 weeks embedded with the company behind the device, [Blamey Saunders Hears](#). Ms Heiss spent there 9 months, cooperating with the engineers and the audiologists.



PhD researcher and a lecturer Leah Heiss with the Facett hearing aid
source - rmit.edu.au

The anticipated stigma of using hearing aids is a notable barrier for millions of people who have the untreated hearing loss. Million people don't use such devices because of physical, mental and social reasons. Consequently, It can cause bad health implications, such as dementia. Furthermore, it has the ability to cause the loneliness, depression and social isolation. The hearing loss can also lead to the brain restructuring as it tries to manage and respond on the limited sensory information.

During designing Facett, Ms Leah Heiss spent some time in the [Melbourne Museum's mineralogy](#) inspired by the natural forms of crystals. Most of the prototypes were 3D

printed at [RMIT's Advanced Manufacturing Precinct](#). Prototypes also were tested by a cross-disciplinary team, which consists of mechanical engineers, electronic engineers, audiologists and designers. During the test, the researcher's team used a special mannequin, noting all the issues.



Modules are a better alternative to the disposable batteries that many people struggle to change on their own. Simply hold the core and the module close together and watch them connect in an instant
source - rmit.edu.au

Facett is a revolutionary hearing aid that is self-fit, modular, beautiful and easy to use. The 'core' contains the sound processing chip and user settings. The module contains a **rechargeable battery** that lasts all day on a single charge and can be easily connected and disconnected from the core. The device works with a range of [Blamey Saunders Hears](#) telehealth tools that reduce the cost and service accessibility barriers to better hearing health.

In addition, **users can program Facett by themselves.** It doesn't require audiologist work. It is part of the award-winning **IHearYou system**, consequently, people can optimise their settings for their listening preferences on a smartphone, tablet or computer.



The “core” is the brains and contains your settings, and the “module” powers the core with its rechargeable battery. Facett works with IHearYou, so you have optional independent control over your settings
source - rmit.edu.au

Company name: Blamey Saunders Hears
Contact person: PhD researcher Leah Heiss
E-mail: leah.heiss@rmit.edu.au
Website: <https://www.blameysaunders.com.au/>
Phone: +61 3 9925 3494
Patent status: +
On market since: -
Regions: Australia
Industries: Healthcare, Others
Source links: [Facett](#)
[RMIT Australia](#)



ENZYMATIC GEL FOR NON-TRAUMATIC CARIES REMOVAL

Exclusive interview for [SPINOFF.COM](https://www.spinoff.com) with Mr. Juan Ignacio Zagari, the CMO & Business Manager of Brix Medical Science, about the enzymatic gel for non-traumatic caries removal

Brix 3000 is a dental product for non-traumatic caries treatment involving an enzymatic activity (3.000 U/mg*) in which the papain is bio-encapsulated by using EBE Technology (Encapsulating Buffer Emulsion) exclusive technology that immobilizes and confers stability, which increases the enzymatic activity of the final product exponentially with respect to current technology. Thus, the following is achieved: higher proteolysis effectiveness to remove collagen tissue in decayed tissue, less dissolution of active principle by oral fluids, greater resistance to storage even in unfavourable conditions, without requiring cold-chain preservation, and greater antibacterial and antifungal potency with an increase in antiseptic effect on tissue.



Juan Ignacio Zagari, CMO & Business Manager
Photo provided by Brix Medical Science

SOC: Dear Mr. Zagari, we are so grateful for your generosity this day in spending time speaking with us and sharing your insights about an amazing technology of Brix 3000. Our investors and we would like to learn more about a vast experience of your academic endeavours and your professional/scientific background.

Mr. Zagari: I studied communications and marketing business. In addition, I am a pilot. I

have marketing and an international business background. I started working 27 years ago in different kinds of companies: companies in the marketing areas, life insurance marketing companies and laboratories. During four years I work at [Brix Medical Science](#). I am CMO and global business manager. I am responsible for international cooperation of the company and business connections in Argentina too. It is a hard work because I must talk with representatives from different countries every day. I can talk with companies, which are located on the other side of the world. We communicate with countries that are very near, such as Brazil, Chile, Colombia, countries that are located in Latin America. Also, we speak with countries such as India, China, Mongolia or Europeans countries. At Brix Medical Science, we are all permanently trained in questions related to science and technology. We are several people who contribute knowledge, ideas and experiences when developing an innovative pharmaceutical or medical product. Our background is focused on the pharmaceutical industry. We all come from this field, in my particular case, having worked in multinational laboratories. The deep knowledge of the local and international market together with the vast experience of our scientists leads us to create and develop innovative products worldwide, such as our [Enzymatic gel Brix 3000](#).

SOC: Considering your tremendous experience, we would like to know whether you had other projects? Could you please share the story of their creation and success.

Mr. Zagari: Our laboratory is developing different innovative products with a great impact on a social and global level. Now we have just one product on the international market. This is Brix 3000. Soon we will be presenting to the local and international market a line of **products for the skin**, whose focus is on the healing of chronic wounds and all kinds of skin lesions. This is for other types of medicine segments, such as dermal products. The most important characteristic of these products is a high rate of healing all types of injuries, including ulcers. The product is suitable for all types of health. It is really amazing and will be available to the biggest laboratories for commercialization very soon. Also, we are in the middle of a research phase of **a cancer product** that promises results never before seen. Brix Medical Science specializes in research and development. We are constantly looking for effective applications that can be available to all people, as is the case with our Brix 3000 enzymatic gel. During the first semester of 2018, the **CropScience** division of Brix Medical Science will present to Argentina and the international market, an innovative and high impact product for the agricultural industry. Brix Medical Science, medics and

pharmaceutics, we all work just with innovations. We study a different kind of problems in the society, as a consequence, make innovative products.

SOC: It is so interesting to know more about the process of your technology/product creation. Please tell on which stage of commercialization your technology/product currently is? Was your project funded by any state financing or grants? Has it already received any honours or awards?

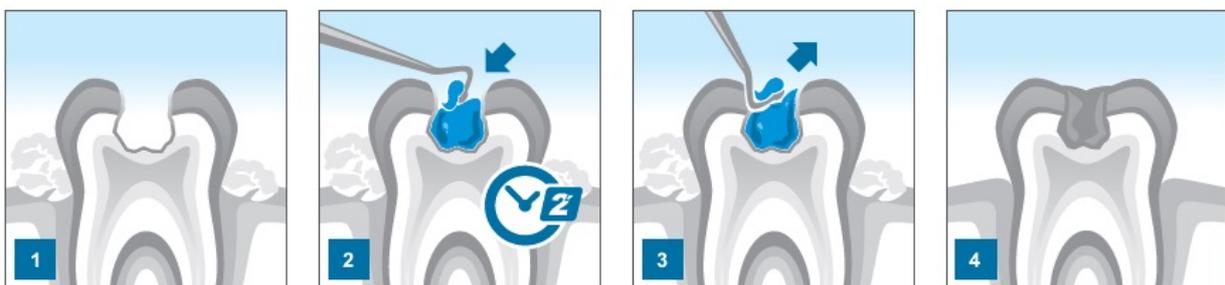
Mr. Zagari: Currently, we work with partners and investors around the world. Our enzymatic gel Brix 3000 with the exclusive and patented **Enzyme Bioencapsulation Technology (EBE Technology)** is sold in more than 40 countries around the world. Our goal for March 2018 is to have a presence in 70 countries in Latin America, Europe, Africa, the Middle East and Asia. We prefer to cooperate with dental companies and laboratories that have a lot of experience in this area and have their good products in the market. Brix 3000 is a gel for **non-traumatic** caries removal. Moreover, it is absolutely **non-toxic**. Therefore, distribution companies and importers from different countries usually make a request to offer the product to their dental professionals. We will have the same work policy with our future products and will work with big companies and international laboratories.

SOC: In the formation of every scientific spinoff, one of the most important keys to success is the team. For many potential investors, the management team is the most important element in deciding whether to invest in it or not. Could you please share some information about the team members who supported you and the project? What are the key additions to the team needed in the short term?

Mr. Zagari: In general, Brix Medical Science consists of a directors, doctors, scientists and lawyers. It is necessary the contribution of researchers or strategic partners for the stages of research and development. When it comes to medical products that require scientific and clinical studies in various stages of the investment in the short and medium term is extremely important. We are qualified in scientific research and develop innovative products, but when it comes to medical products, personnel that are more qualified and the material-technical base is required. This is how we work, we are developing and are looking for the implementation of the process of scientific and clinical research. Given the innovation and health impact of our developments, many companies are interested in investing and supporting our scientific developments.

SOC: It is not a secret that the development of a new technology and its subsequent commercialization presupposes some problem and addresses unmet needs. Respectively, what problem did you intend to solve by creating your technology/product? What results did you plan to achieve?

Mr. Zagari: All our scientific developments have a reason for being. We always strive to meet the specific needs. First of all, our specialists study and analyze these needs in the local and international markets. There are a lot of specific needs of patients and medical/dental professionals in medicine and dentistry. For example, the enzymatic gel Brix 3000 was present to the market after 5 years of studies and research. The purpose was to make a product, which is painless in the removal of dental cavities. Brix 3000, represents a new enzymatic technology that allows the dentist to remove the cavities of their patients without the need to apply anaesthetics and without using the drill. This represents a big trauma for many patients. Likewise, for the dentist who uses it, it is fast and secure technique as well, more economical for the removal of caries since the operating time is reduced 40% - 50% and the saving of supplies (anaesthesia and drill bit). Actually, it is easy to introduce our product in the market because we are presenting something new and completely innovative. In the case of Brix 3000, not all of the doctors said that product is amazing. Some doctors said that they don't believe that product can work in this way. But when they tried Brix 3000 they agreed that product is very good and innovative. This our commercial strategy, to work face to face. We cooperate with doctors after they tried the product. All our products are patented internationally.



Brix 3000 gel removes cavities painlessly, effectively, safely and fast
Photo provided by Brix Medical Science

SOC: The problem which you targeted to solve was actual before. Probably someone has already tried to solve it. Is it right? Understanding the USP from the investor's side could make the technology/product #1 for them. What are the USP

of your technology/product and fundamental difference from other technologies/products that tried to solve this problem before you?

Mr. Zagari: All our medical products have our EBE technology. The laboratory works with this technology. Other similar products, but not the same ones, tried to solve the problem of caries removal in an atraumatic way, but by composition or formula, they did not cover the needs of the professionals. As I mentioned before, our Brix 3000 product has the great and differentiating attribute of possessing the bio-encapsulated papain enzyme with our exclusive and patented EBE Technology. In addition, the high enzymatic concentration, the biocompatibility of our enzymatic gel, its presentation, the fact of being a safe gel for all types of patients of all ages and health conditions and other attributes, make it a unique product worldwide. At Brix Medical Science, we did not discover the attributes of papain. If we create the technology to considerably increase its concentration and, the enzymatic gel has an aqueous and innocuous medium, which makes it a **100% safe product** for patients, **without presenting any contraindication**. You can put it on your skin or in your eyes and nothing happens. In addition, Brix 3000 has international quality certifications such as [ISO 13.485](#) and health records in all countries where we are currently marketing our enzymatic gel for atraumatic caries removal. Using Brix 3000 dentists don't need water, lights or dental office, they can remove caries in 10 minutes. You can find on our [youtube-channel](#) a video when dentists visited places where people haven't any dental services and remove caries, not in dental offices.

SOC: In order to understand the peculiarities of this particular spinoff our investors always ask what is the investment structure of the company? Do you still own the controlling stake in your spinoff?

Mr. Zagari: All decisions about investors are made by all members of our laboratory. Among them, there are doctors, dentists, scientists, pharmacists and business people and lawyers. We would like to talk with investors personally. Also, we can work on projects of another company or investor. We had this experience.

SOC: We wonder what is the actual addressable market currently for your invention and what are the current competitors there? Could you please share with us the results of the market studies, if there are any? What might be the barriers to entry?

Mr. Zagari: The target market of enzymatic gel for atraumatic removal of caries (Brix 3000) is the dental market, both dental professionals and dental stores. This scheme works in all the countries of the world. As Brix 3000 is an innovative and patented product, it is a monopoly product considering its class (bio-encapsulated papain gel, innocuous and water-based). There are similar products in some countries, but for reasons of effectiveness, efficiency, selectivity, biocompatibility or price or perhaps even market strategy, they have not penetrated effectively. There was the similar product in Brazil but it has some problem with toxic effects. Our Brix 3000 product meets the needs of dentists in terms of what is mentioned (effectiveness, efficiency, biocompatibility, price, etc.). When representing a new technique, different from what the dentist is used to, such as the drill, they can be sceptical about the benefits of the product. The results are really positive in terms of the impact generated by Brix 3000 in dentists. That's when the purchase cycle begins and the repurchase begins.



It is absolutely non-toxic

Photo provided by Brix Medical Science

SOC: We always need to paint a clear picture to the potential investors of the market opportunity of the spinoff that is meaningfully large and growing. Why in your opinion your company might have a high growth potential? Could you tell us

all current industries and fields of your technology/product application and where do you think it could be successfully applied in the future?

Mr. Zagari: We are currently focused on the dentistry market. As I have mentioned before, we are going to present a dermal line for the healing of all kinds of wounds (ulcers, burns, cutting wounds, etc.), whose main characteristic is the high effectiveness and the great speed in healing. We are also working on a cancer product that will undoubtedly have a high impact on world markets due to its results. Our division CropScience will present during **the first months of 2018**, an innovative product and system to combat the drought of plantings.

SOC: The potential investors will be curious whether you already have the first clients and signed contracts? What was the feedback from your partner's markers and customers?

Mr. Zagari: We have **the best feedback about Brix 3000** in Argentina and in other countries. Daily, we get the great interest from different laboratories or dental companies around the world, who write us and want to make a request the exclusive representation of Brix 3000 in their different countries.

SOC: Dear Mr. Zagari, we both know that for you and the investor it is crucial to reach positive cash flow as soon as possible. Certainly, the market scaling cannot be achieved without proper distributors network and clients. Please tell us about your criteria of partners selection and which markets are open for spinoff activity.

Mr. Zagari: We work in the market around the world and our goal for March 2018 is to have a presence in 70 countries. We want to have covered around the world. When we will cooperate with investors or partners and we would like to make a request for marketing research about caries removing in and about using Brix 3000. The using of Brix 3000 is very **cheap**. Our selection criteria for distributors is based on their experience in the market, customer portfolio, products they market or exclusively represent, as well as their financial profile. Although the distributor receives a manual of commercial and marketing strategy to carry out the business in their country, we ask for feedback of the adaptation of our policies in the market, which could suffer alterations or modifications for different reasons.

SOC: Now we would like to refer to the next very crucial and we would even say essential aspect of spinoff companies' as the strategy of R&D, production, distribution and marketing processes. Do you have your own unique strategy? Which of these processes do you consider your spinoff is strong at?

Mr. Zagari: Undoubtedly, our R&D strategy of Brix Medical Science is a strong point. Likewise, we check it, commercial and marketing strategies are also one of our attributes.

SOC: As a rule, the majority of spinoffs outgrow into exits. How do you determine the market for your product/technology and estimate its volume and dynamics? What is your potential share on the market? How do you think what market cap your company plans to reach at the peak of its development and why? How long might this process take?

Mr. Zagari: Being a monopoly product, the market share is carried out in a simple way. We do not have direct competitors. If we consider that we compete with the traditional technique for caries removal, that is, with the use of the drill, but with our commercial and marketing strategies, in a short time, we achieve a penetration rate that grows every month. Dentists are adopting this new technology that allows them to do the dental operation faster, safer and more efficient. We would like that 70-75% of dentists use our product. The penetration rates are measured monthly in each country. Likewise, we also measure product rotation rates, the frequency of purchase related to the amount of dental caries that a dentist removes monthly (average) and other market indices that allow us to establish participation in the segment of dentists in each country.



Brix 3000 is an innovative product
Photo provided by Brix Medical Science

SOC: For spinoff companies, their intellectual property is a key to success. The investors pay particular attention to it. What key intellectual property does your company have (patents, patents pending, copyrights, trade secrets, trademarks, domain names)?

Mr. Zagari: All our products have the **intellectual property rights**. In the case of Brix 3000, like all our inventions, they have their respective **patents** granted in the main world's markets or at least, in those that we have as target markets. In addition, all our **trademarks** are also registered for the target markets for our company.

SOC: Could you please describe your ideal investor? What aspects are important for you, for instance, is it experience, country, the amount of own private capital or maybe some personal qualities?

Mr. Zagari: For us, the experience in the scientific area is ideal. Of course, financial support is important. We cooperate with the government in Argentina but we prefer **privet companies**. It is our focus today. We also consider the geographic coverage of the company important because, at the time of developing phases or clinical trials, we prefer it to be in different countries. Brix Medical Science is a company with global projection and we look for strategic partners that can accompany our business objectives worldwide.

SOC: And the last question, could you specify the most convenient way you would like to receive inquiries from potential investors? Should it be by e-mail or personal phone call?

Mr. Zagari: We prefer the first contact via my personal email jizagari@brix-lab.com

SOC: We would like to express gratitude for the time you have dedicated to this interview. SPINOFF.COM will observe the development of your spinoff with great pleasure and interest. Also, we are thankful for providing all the necessary materials. We are pleased to forward all potential investors the database of the spinoff supportive materials such as presentation materials, schedules, videos, pictures, figures, blueprints, text materials etc.

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Phone: +54 341 4943094
Patent status: patented
On market since: 2010
Regions: Argentina
Industries: Healthcare



THE WORLD'S FIRST HOLOGRAPHIC NAVIGATION SYSTEM

Exclusive interview for [SPINOFF.COM](https://spinoff.com) with Mikhail Svarichevsky, CTO at Wayray SA, about the first true augmented reality car navigation system

Navion is the first True Augmented Reality car navigation system that applies aeronautical principles to land navigation. Just like in a video game, the driver follows the green arrow, directions, trip details and a route overview in front of the car to reach the destination. It became possible due to the technology of True Holography. It allows Navion to display virtual indicators exactly where the driver needs them to be — on the road ahead. The system is smart, safe, and fit for almost any car. No headgear or eyewear required.



Mikhail Svarichevsky — CTO at Wayray SA
source - wayray.com

S.O.C.: Mikhail, [SPINOFF.COM](https://www.spinoff.com) team and I are so grateful that you agreed to spend this hour speaking with us and sharing your insights about WayRay. First of all, I would like to express my respect and admiration to your team. WayRay impressed us all. Your product is a breakthrough in the sphere of navigation systems. At first, I would like you to say a few words about your background, your previous experience, and how did you join the WayRay team?

Mikhail Svarichevsky: I'm a CTO in WayRay and I joined the team as it typically happens at the very beginning of the company. The founder of the company Vitaliy Ponomarev approached me when he had this **idea of creating the holographic head of display** for automobiles, but of course, he had this idea and I had to find out how to make this happen. We had a scientific advisor and we had to go from there.

S.O.C.: We deal with science spinoffs, which came out from the world leading universities. The scientific background is of great importance for us. Who is your scientific advisor?

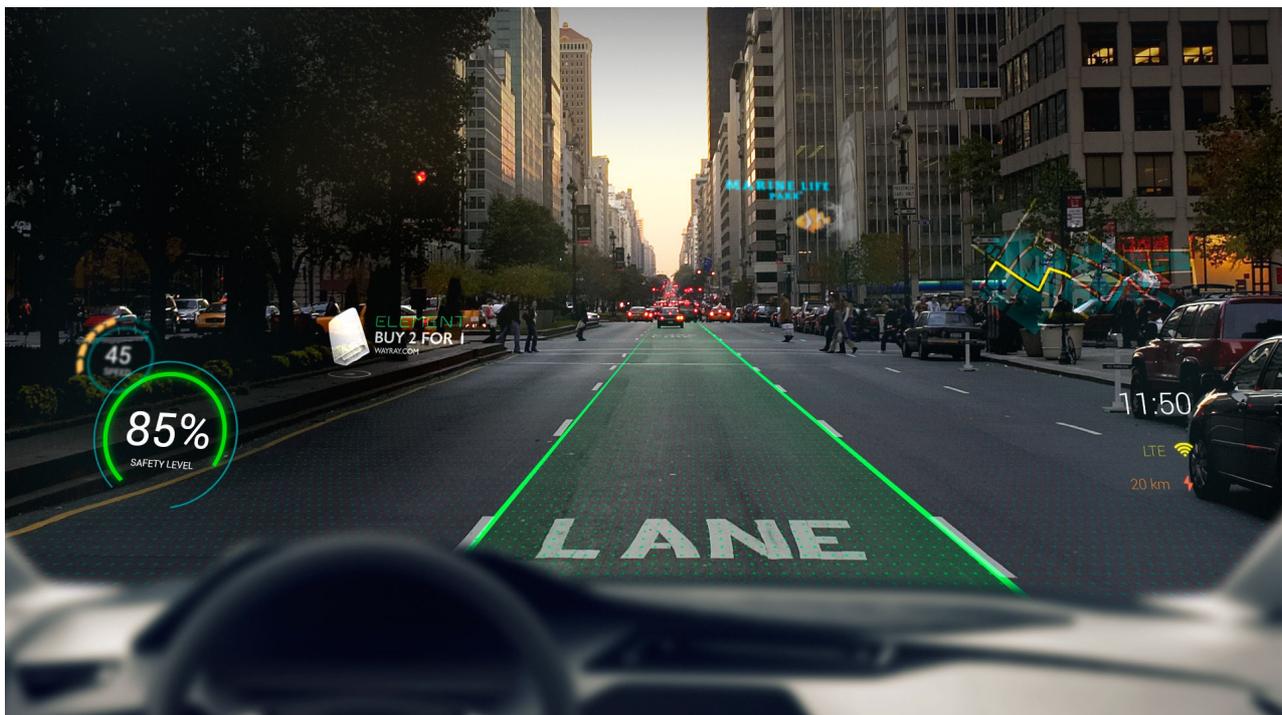
Mikhail Svarichevsky: Of course, at the very beginning, I had absolutely no background in holography and the same applies to every member of our optical team. There is a little demand for holography and especially with such requirement as we have. There is some market for security true augmented reality like the holograms you see in the passports or on money, but those are completely different types of true augmented reality, they have different requirements and in some sense, they are much simpler and you can't just go to the market and find someone who is making holographic optical elements. We found the consultants and after we had proven that this is working we managed to raise funds and grow the team quickly. It was the year of 2014. That was the first prototype, which used polymer true augmented reality what is similar to what we have right now. Earlier prototypes used conventional optics like mirrors and lenses. Those prototypes are much simpler and they can't represent the current technological idea.

S.O.C.: It is not a secret that the development of a new technology and its subsequent commercialization presupposes some problem and addresses unmet needs. Respectively, what problem did you intend to solve by creating your technology/product? What results did you plan to achieve?

Mikhail Svarichevsky: The idea of the head of display is that currently you have the car with the head of display, which is quite a bit of a premium, so the head of displays are not available for everybody. It is a very expensive option in very expensive cars. Regular users are rarely able to afford it. There are the reasons for that because the **commercial head of displays are expensive** to the manufacturers due to windshield differences and geometrical differences in different cars, so every car requires some customization of the commercial head of display. The other problem is that the head of displays you can buy

right now in the market have a rather small field of view, which means the image they display is quite small; they display rather small signs like “turn in 200 m.” Our goal was to display much larger field of view and relate the road, relate to the real objects, so you can display the **path you want to go right on the road** in the augmented reality mode. That was the idea. Four years ago that was unthinkable. Currently, we see that some manufacturers are trying to use the conventional optics, but the optical systems are really huge and it may be even more expensive and even less available for the end users.

Another problem is the distance to the visual image. Conventional head of displays are showing image quite close to the driver. Typically about 2 to 3 meters, sometimes even 1 meter, so the image you see is really close. If you want to display the augmented reality and to reduce the time needed to refocus your eye from different distances, because it always takes time, you have to display image quite farther away like about 7, 10 or 15 meters depending on the situation, so our **solution was the first offering large field of view and large projecting distance.**



AR systems will bring us one step closer to advanced connected cars
source - wayray.com

S.O.C.: What about the competitors? What are their results? What are the USP of your product and fundamental difference from other technologies that tried to solve this problem before you?

Mikhail Svarichevsky: There are numerous competitors making the conventional head of displays. So, what's the idea, how the head of display is constructed? The idea is that if you want to make it look like the object is far away from you, the rays of light from it should be almost parallel, so the optical device making those parallel rays of light is called collimator and in conventional head of displays the collimator is made of the lenses or mirrors, the curved mirrors. Those lenses are hidden in the dashboard and then the image is reflected off the windshield. There are some tricks like wedge PVB film required to avoid double imaging, but you cannot stick it in every car in every windshield and expect it to work, but it works and the problem is that the optical system is quite far away from the driver, that makes it really large or on the other side it limits the field of view, that is why those conventional head of displays typically have 5 by 2 degrees field of view, which is really small image and literally all the competitors making that kind of head of displays and there is slightly more modern approach, which uses the curved reflector, so instead of reflecting it off the windshield, which has form, which is not optimized for the head of display, they place additional piece of glass specifically designed for this head of display. So you look not only through the windshield but also through the combined glass. Sometimes those head of displays offer a slightly wider field of view, but still, they require looking through two glasses and this is not very convenient. There are **dozens of companies counting the Chinese ones** trying to make those head of displays, but they are **limited in the field of view** and the projection distance. If we turn to the technological difference, in our case the holographic optical element is embedded or glued to the windshield, which means that the last optical element doing the whole optical work is on the windshield that is the projection unit is much smaller. This holographic optical element has a very high transparency, so there is the requirement for the windshield transparency and we passed them with a really large margin because the holographic optical element is active for the only very specific angle of incidence for light.

S.O.C.: For spinoff companies, their intellectual property is a key to success. The investors pay particular attention to it. What key intellectual property does your company have?

Mikhail Svarichevsky: Of course, if there is no IP the technology will be worthless, so we work on protecting this. There is quite **a number or patents already applied**; few of them are public yet. It is a very long procedure and we have numerous patents on various stages.

S.O.C.: Our investors always ask what is the investment structure of the company? Do you still own the controlling stake in your company?

Mikhail Svarichevsky: As we are quite old start up, we are more than 4 years old, the structure is quite complex. Both I and the founder have shares and several investment funds and inventors have shares, but I cannot give you any specifics of course. The only public investment event we had last year when we received 18 million from Alibaba Group in China. That was the largest investment for today. The controlling stake is still inside our company.

S.O.C.: We wonder what is the actual addressable market for your invention and what are the current competitors there? This is very important to show the investors the uniqueness of WayRay.

Mikhail Svarichevsky: Of course, our main market is automotive and we have a tremendous amount of cars manufactured every year and we already preparing for self-driving cars of the future, for example, our CS 2017 prototype. In some 10-15 years from now, some optimists say even earlier no one will be really required to drive a car personally and for self-driving car you need a different kind of head of displays, more for entertainment and to bring some confidence to the passengers, like to show that the car is seen, the obstacles are seen, etc. There is a large market in the automotive industry that not ends with the conventional navigators for drivers when the drivers are gone. We are ready for that already. Another thing is that we are working on a number of ideas. That is obvious that the head of displays are used for airplanes and helicopters, but we are not going there as we are a commercial company and this area is military heavy and of course it's a no go for us. We are always thinking where we can apply this idea in the market and there are few ideas how to make it into home entertainment device or for advertisement or for a personal pocket device. So this technology has some applications in side areas. Maybe at this stage, these are less attractive commercially than the automotive industry, but still we are working on that and actually, this will give us some of the market.



Navion creates an augmented reality
source - wayray.com

S.O.C.: Have you started sales already? Do you have contracts signed with automobile manufacturers at this stage?

Mikhail Svarichevsky: There are **two approaches to make it into market**. One is after market and the second one is through car manufacturers. And we are going in both of them so our fraction product is NAVION, which we are working on right now, which is closing to the end of the development cycle. As for the car manufacturers, we have contracts with quite a number of them, so for every major car manufacturer you have ever heard we most likely have talked to them and have some sort of the relationships with them on making it into the car, but of course the work with the car manufacturers is quite a slow process. Sometimes they have really long time scales for the development. Now they might be working on the cars which will be sold in 2025, for example.

S.O.C.: Which markets do you plan to approach?

Mikhail Svarichevsky: Our very first priorities are USA and China. Initially, it was the USA, but now we see that China is growing really fast and now we have a lot of presence in China and we understand this market much better now and we see it's getting more attractive and of course Europe. That would cover most of our effort.



Navion responds to simple hand gestures and voice control
source - wayray.com

S.O.C.: Do you have some partners in these countries?

Mikhail Svarichevsky: We already have the sales team and we have **people working on the product in the USA and China** and of course as we are working with many car manufacturers, they are placed around the world in the USA, in Europe, China. So we have a lot of activity in all those regions.

S.O.C.: Do you have some strategy? Do you plan to work through the distributors or open your offices?

Mikhail Svarichevsky: We are already the multinational company, we have offices in many countries. we have people working for us, and we are always considering where we need the sales people, technical people to help with manufacturing and where we need to have engineering. Every country has its own strength and weakness and, for example, China is getting more expensive like 5 years ago it was a cheap country, cheaper than Russia in terms of labor cost. Now the cost is rising really fast and the highly skilled labor is getting more expensive. In the nearest future, we plan to grow the Chinese office, because our **product is going to be manufactured in China** and that requires a lot of over side and also the Chinese engineers have more experience in designing electronics just

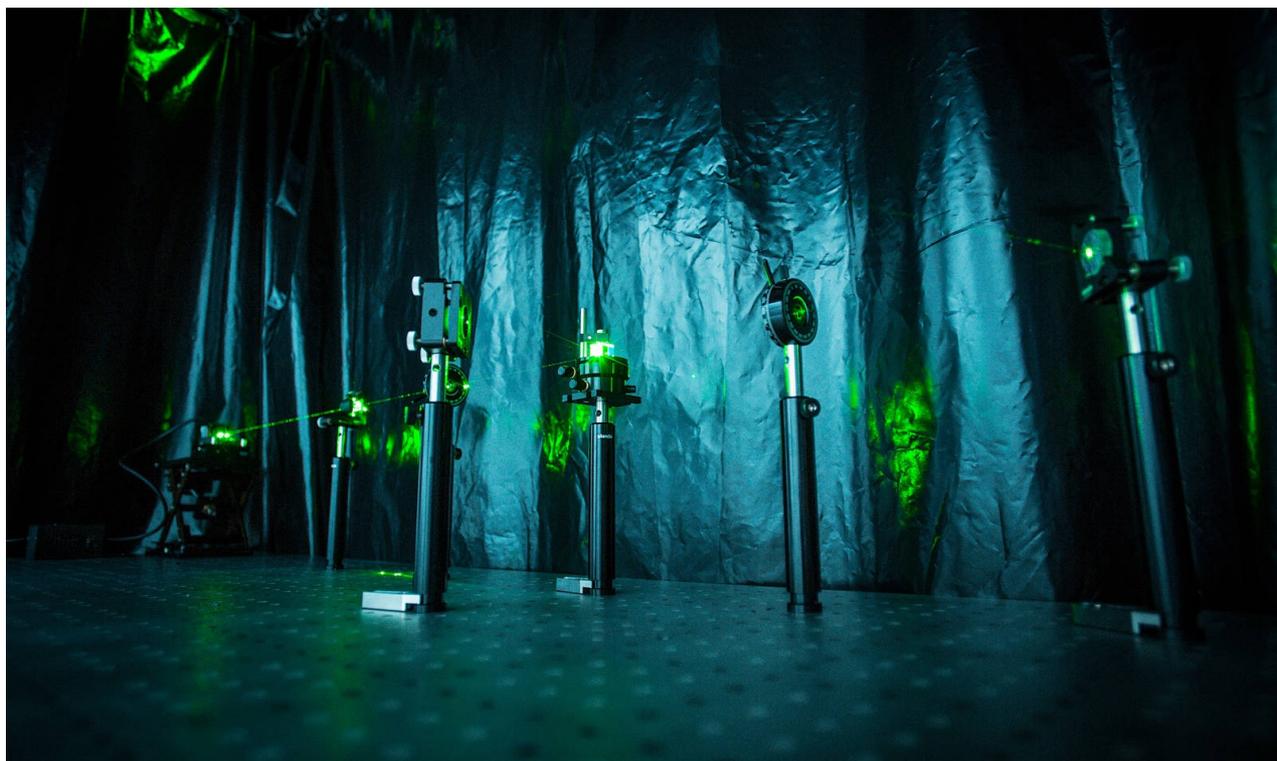
because they do it on a daily basis. There are a lot of design houses working on arm platforms making very complicated systems really fast. There is always some sort of a split: we did like more generic parts in China and more project tailored parts in Russia. We'll see how it goes, where is more efficient.



Navion displays virtual objects into the regular focal range
source - wayray.com

S.O.C.: By the way, I know you are originally from Russia, but you moved and created your main office in Switzerland. Now you are based there, right?

Mikhail Svarichevsky: Yes, and the idea is that any hi-tech company cannot be bound to one country. You cannot have all the manufacturing and engineering in one country, so that is why it was impossible to have it all in Russia and it was never an intention. We have the **main office in Switzerland**, R&D in Moscow and production plant in China. We are going to open office elsewhere as needed to support our day to day operations. Currently, the bulk of engineering is happening in Russia, but where is more efficient we do it in the specific country like USA or China.



Laser room

source - wayray.com

S.O.C.: The investors will want to get a clear picture of how many rounds of investments have you completed? Are you seeking for the investments at the moment? What is the volume and time limits? What milestones will the financing get you to? What did you plan to use the invested funds for?

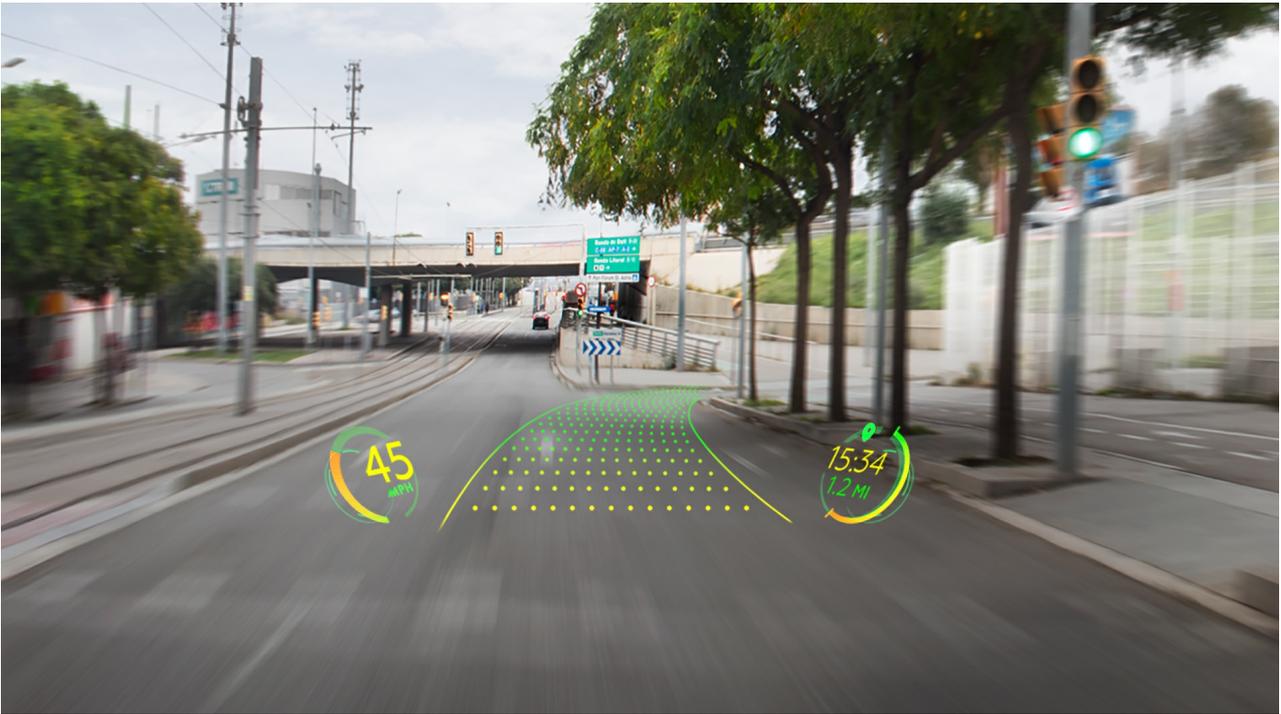
Mikhail Svarichevsky: We had several investors in the early stages at the time when the company was very small. Then we had a large round of 18 million with Alibaba Group. That allowed us to grow our team considerably to about 140 people right now and as every start up we are **looking for the next round in the foreseeable future**. The intention is that the next round might be the last one. We can look at something like **USD 50 million**. The idea is that high volume manufacturing is quite an expensive process if we go to really large contract manufacturer we cannot go to him and say: “Hey, we need 1 thousand units manufactured”. That’s never going to happen; your volume has to be down. That means that the volume should be high like hundred thousand units or more and if you multiply hundred thousand units by abstract USD 100 you’ll already have to spend USD 10 mln. not counting any taxes or logistics.

S.O.C.: And the last question, could you specify the most convenient way you

would like to receive inquiries from potential investors?

Mikhail Svarichevsky: We have e-mail for investor relations.

S.O.C.: Thank you for your time and sharing insights. I wish you success with your product and hope soon we'll see the way ray on the passing by cars.



source - wayray.com

Company name: Wayray SA
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Phone: +7 925 4255060
Patent status: pending
On market since: 2017
Regions: United States
Industries: Others
Source links: [Wayray SA.](#)



WORLD'S FIRST VOICE MASK

Exclusive interview for [SPINOFF.COM](https://spinoff.com) with Roman Sakun, CEO at Hushme company, one of the founders of Hushme device, which was invented for improving speech privacy

Hushme was invented by Ukrainian engineer Roman Sakun and his friends. It is a personal acoustic device that protects speech privacy in open space environments and public places. This innovative headset has such benefits as good audibility during a phone call, lower noise, portable speaker function and speech privacy. It has two modes of sound noise reduction and sound masking. The product made a splash all over the world.



Roman Sakun, CEO at Hushme
photo provided by Hushme company

S.O.C: Dear Mr.Sakun, we are so grateful for your generosity this day in spending time speaking with us and sharing your insights about your Hushme device. Roman, our investors and we would like to learn more about a vast experience and your professional background.

If I return on 20 years ago, I graduated from Kharkov Aviation Institute, where I got my first speciality as planning engineer. Without getting into details, in the mid-nineties, economic disciplines were fashionable in the higher educational institutions, so that's why many technical universities opened economic faculties. But in fact, there was 70 percent of similar information at the other faculties, such as the Theory of Strength of Materials, Business Economics and Finances, Accounting and others, as far as it could be possible in

the early 90's. I graduated from the Institute with all the regalia, but I could not find a very good job with the possibility of personal development in Kharkov. But still, I had some work. I worked as a sales representative for a year, earning good money at that time, but somehow this was not enough if to speak about knowledge, in fact, there was much more to grow somewhere further. In a year I moved to Kiev, where entered full-time education.

I graduated within a year, even considering an internship in the USA. I graduated from IMI Kyiv (International Institute of Management, which is the [representational office of Lazarski University](#)), where I received a [financial MBA](#), and after that I settled in Kiev and began my career development. I started with a foreign company Tetra Pak, where I ran customer service department of the Ukrainian network of [Tetra Pak](#). As a rule, this is all about logistics, orders, placement, manufacture support ... Not banking sector, but manufacturing (customers, orders, coordination with factories). Thereupon, in 6.5 years I reached the directorship. I was offered to leave Ukraine to land a job at other factories, but I did not want to. I accepted one proposal for which I moved to Odessa for 8 months to work at [Vitmark](#) (PJSC Odesa baby food cannery Jaffa) and there I worked as supply chain director. After 8 months of working there, my good friends persuaded me to return to Kiev, where I started working with them in the retail network [Novus](#). From the first day there I worked as an IT director. I built an inform system in its entirety, we implemented SAP there. How did it happen that I hold a position of supply chain on my previous work place and than I started working as director? So when I was still working in [Tetra Pak](#), we got rolling, [SAP deployment](#), and we, those who were key employees from each direction, were simply taken to the project and in such a way I actually spent a whole year in this project.

Generally speaking, I liked building business processes with modern information systems and working at manufacturing venture .You see, everything somehow fused pretty well on the one hand, because I like information systems and IT, and on the other hand I deal with real business and real manufacturing processes. Since then, anyhow, I have been doing this. I worked as an IT Director of Novus for 3.5 years. I built this system from scratch. Then headquarters changed the workplace in favor of the [Chumak](#) company and I left Novus with them. And for this very moment my main job is the IT director at Chumak-FMCG company. When I came there my main duties included information part and all business processes to be put right and promoted to a higher grade- to modern skis and SAP being deployed and completely the enterprise is being covered, all business processes are

covered. Many people come to us, and we show all kinds of our achievements and so on. Two years ago there was an idea with the guys on our device, in parallel with the work at the expense of its means we develop this process. Now I work in the company Chumak and in parallel as **CEO in our young company Hushme**, which is engaged in this project.

S.O.C: Your experience is invaluable! During your career path, you grew from sales administration assistant to the Head of Sales Administration department with Tetra Pak, then to Operations Director with a leading Ukrainian food manufacturing company. Later on, you got interested in convergence of software technologies and business processes and became a top expert in ERP systems adaptation and implementation. Considering your tremendous experience, maybe you can share with us some more of your success stories?

I was **awarded with the 2013 Best SAP Implementation Prize** for FMCG company in Ukraine by the global ERP platform developer SAP AG. Right now we are the team of 6 with vast experience in corporate management, R&D, and hardware startups.

S.O.C: I'm already amazed at the breadth of your talents! Share with us the story about Hushme, please! How did the idea of creation come?

In March 2016 three of us, good friends, Konstantin, Andrey and me were having lunch. We were sitting in a café, it was rather small and quiet place, with only a few visitors. Later on, a girl came, she had to make a skype call, so she put on earphones, which immediately made her talk louder. As a result, everyone started to stare and unintentionally tap the conversation. Though no one complained, she felt uncomfortable and decided to cut off an important conversation. Just then an idea came: what if she had the **possibility of 5-10 minute private talk without bothering people nearby**? How great and convenient it would be both for her and other visitors! After sharing this idea with future co-founders, who acclaimed it enthusiastically, we decided to set to work and implement it into life.

S.O.C: It is so interesting to know more about the process of Hushme creation. Please tell on which stage of commercialization your product currently is? Was your project funded by any state financing or grants? Has it already received any honors or awards?

Frankly speaking, we did not popularize the product in chase of the awards. We caused a real sensation all over the world without money and without something special. Numerous organizations wrote about us and shot journalistic stories. Fox News and BBC are among them! I just can't remember CNN in this list(laughs). I gave interviews online for both American and Asian channels. We held two international exhibitions. At the beginning of this year, we visited Las Vegas for CES and everybody started talking about us there, many of them started writing about us. Being in London, we made even greater sensation on the [Wearable Show](#) in March (March 7-9). There are fewer people there than at CES, but the specialists are narrowly focused, so they understood more, they looked at, asked questions and we noticed that many more authoritative publications wrote about us ([Mashable](#), for example). The process had been immediately grabbed and it had gone further in the world. However, we did not participate in a large number of exhibitions, but so many organizations started writing about us! We have a huge number of potential subscribers.

This stage is completely operational. The device consists of electronics, it is already milled and it is not printed on a 3D printer, we assembled it at the factory in a single copy, but it is still a prototype. We have accomplished [Kickstarter successfully](#). Our period of participating there was up to 30 days. We launched it on May 15 and finished on June 15. There we collected 73 000, although our target was set at 70000. Now there is a second crowdfunding campaign on [Indiegogo](#), but this is a campaign of additional financing without extra advertising and support ... Easy does it! One person a day, a couple of people ... they'll buy something. It goes on for ten days and we have already collected for about five thousand. At the moment, we conducted a questionnaire among our backers, there are about 250 of them. And we conducted it among those who were at Kickstarter and Indiegogo.



Hushme in Use

Photo provided by Hushme company

We conducted a survey about the wishes for the form, for color, for additional functionality and so on. So that is for us to know exactly whether there is a need to change a form. We wouldn't change something globally, but maybe some subtleties could be improved. In general, we received the results yesterday and started discussing the questionnaire. In the last analysis, we heard what we've been planning to hear. Some things, where we doubted or where we were sure were just confirmed by that details. Our backers confirmed everything. In principle, we understand that there's nothing to change globally, we need to make final tuning and iron out the kinks. Meanwhile, we keep going in a timely manner as we promised to the backers. The **production will start in October or November**. Actually, we **reckon upon November**, with the possibility of carrying out all the **shipment in December, before New Year and Christmas holidays**. Shipping will be held for the backers who have already bought the device.

Right now we are preparing a second questionnaire. Subscribers of our site, (we have several thousands of them) leave their addresses and information for the development of the project. We ask our subscribers about the moments which could frighten them and also we ask for advice because we would like to know how we can increase the sales now.

S.O.C: Roman, can you share with us the description of Hushme unique

technology?

There are **two modes of sound noise reduction** and so-called **sound masking: passive and active**. It is passive due to the most **modern noise-suppressing materials**. When you wear it, more than 60%, if not more, of the sound waves of your voice are suppressed by **passive noise canceling**. We conducted research ourselves and everything was confirmed by our colleagues, professors from Kiev Polytechnic Institute from the Acoustics Department. They also confirmed that at the moment the most effective sound suppression in percentage terms is still passive thanks to special insulating materials, which suppress the voice of much more than half. Being on three meters from a man, even in a quiet office, it will be possible to hear a whisper which is barely perceptible. For example, in our noisy offices, if someone is typing something on the computer, and if you are sitting at a nearby table while talking to someone, you definitely will not interfere with your neighbor, because only fragments of words will be heard. That is, if you do not intentionally listen to someone's talk, then you will not hear anything.

And the **active mode is to some extent our know-how** this is an active mode of voice masking because we were working on the issue of active noise cancellation. In practice, active noise cancellation removes such a negligible percentage of the wave that it does not matter to the human ear. Even with an expensive technology, the drop will be literally 2-3-4 decibels, when the human speech in a calm state, without a scream, is 70 decibels. After passive noise cancellation, it remains about 30-35 decibels. The rustle of paper in the library considered as a quiet whisper. And if you add here active noise reduction - you can remove 2-3 decibels, which will be indistinguishable to the human ear. Most likely a person with a musical ear will understand that the sound has become quieter, but globally it will not disappear. Therefore, we decided to use the technology of active sound masking. It implies that: when we talk into a microphone and use a mask, there are **two sensitive microphones on the inside of the mask: one microphone transmits a voice to your mobile phone, and the second microphone takes your voice, analyzes** and there we have hidden a special program that **puts a pre-recorded other sound signal on your voice**. It seems to be white noise, but the technical white noise itself grates on the ear, as it was in the old days, when the TV did not work, there was no signal and there were white noise and broadcast interference. Therefore, you can find a variety of sounds, including the noise of leaves, we even recorded the sounds of Star Wars characters (the robot named

R2D2, Darth Vader, and so on).



How Hushme looks like

source-www.insidehook.com/nation/hushme-silences-your-cell-phone-conversations

S.O.C: I just remembered Star Wars characters! That sounds funny!

Yes, it really is! These pre-recorded sounds are transformed and superimposed on the remains of your voice and with the same amplitude are given on the outside of the mask. If you are silent, then the mask is silent too, if you start to talk, then the mask starts talking with you. In this mode of the sound masking if people stand in 1-1,5 meters from you, if they listen to your telephone conversation, **they can snatch maybe some pieces of letters or syllables, but they won't understand the whole meaning** of the conversation. And instead of your speech, they will hear the sound of the wind or something else. In an open office, of course, it is better to use passive noise reduction to reduce the overall noise pollution and partially hide a private conversation. And if you are in an open space, if you go outside, you are at the bus station, at the airport, at the railway station, you go somewhere by transport, you can safely use active sound masking. You will not interfere with anyone, because of the noise that is added to the active masking.

S.O.C: Wow! That is really impressive! In the formation of every scientific spinoff,

one of the most important keys to success is the team. For many potential investors, the management team is the most important element in deciding whether to invest in it or not. Could you please share some information about the team members who supported you and the project? What are the key additions to the team needed in the short term?

At the beginning, I told you that an idea came to our minds two years ago. I tell about that two colleagues, who I work with in Chumak company. By the way, we are all about the same age, from 38 to 40 years. **Konstantin Shevchenko** is CEO of **Chumak company**. He is a good friend of mine.

Konstantin's areas of expertise in real business span Strategic Marketing, Lean Manufacturing, and Human Resources Management, as well as Business Development and General Management.

Over the last 15 years, Konstantin gained invaluable experience with international and local businesses. He started his path as a Management Trainee and Marketing Manager with the multinational food packaging giant **Tetra Pak**, and then he worked as Marketing and HR VP with the big Ukrainian grocery retailer **Novus** at its start-up phase, that grew from 20 to 2000 employees in the first three years. Over the last 6 years, Konstantin has been serving as the CEO of a leading Ukrainian food company Chumak.

Konstantin holds Master's degree in International Business Administration from National Economic University (Ukraine) and he graduated from Kyiv-Mohyla Academy with Bachelor's degree in Political Science.

So, as I have mentioned above he also went a long way in sales, marketing and manufacturing. He reached his CEO position from the modest beginnings.



Konstantin Shevchenko and Andrey Levchuk (from left to right)
photo provided by Hushme company

Our third partner; **Andrey Levchuk**, is CFO of **Chumak**. He has been working in Chumak for about 15 years, since that time when he graduated from his Institute. This was also his first job. He was a student when he came to the company for an internship and now he is the CFO. In our Hushme company he is also responsible for finance. And Konstantine is responsible for marketing. At this moment the project is at the level of a hobby. When there is free time, we develop this process, invest our money to make our idea fully realized.

Strictly speaking, there were three of us when we came to the guys in the [ARTKB bureau](#) with this idea. We talked about the idea and initially, our relationship was built in the order of a customer (we were customers) and a supplier (they were suppliers). They worked on the idea and they really liked it, so they also turned on the heat! After the first stage of working out the idea and the first sketches drawn, they became our partners with a slight share for the first time. But then after the **exhibition in Las Vegas**, when our invention made such a sensation and our expectations were confirmed that the device, although it is unusual, is very much in demand, because this is a very urgent problem and there is no technological solution for it. This is the first attempt at a technological solution, so there is the great hope, including the certainty that the device will be sold and popular. After the exhibition, we became meaningful partners.

Three members from ARTKB bureau joined our Hushme company. Alexander Nesterenko delivers complete product design and engineering solution/manufacturing processes. Alexander was engaged in it all his life, that's why he is responsible for this in Hush Me. Vladimir Khyliuk is in charge of production and logistics, shipment, etc., so he is responsible for the same in Hush me. When our device will be transferred to production, Vladimir's duties are to follow production, quality, punctual shipping, further support and so on. Working at ARTKB bureau, Yaroslav Romashko is responsible for sales, the same he does at our project. At this moment he begins to communicate with concerned parties and potential distributors. Literally two weeks ago we were reached by the future distributor from Japan. He issued the suggestions about launching an advertising campaign on the Internet and in newspapers, in order to sell more when we will be ready to ship.



ARTKB and Hushme Team
photo provided by Hushme company

S.O.C: Roman, it is not a secret that the development of Hushme and its subsequent commercialization presupposes some problem and addresses unmet needs. Respectively, what problem did you intend to solve by creating your device? What results did you plan to achieve?

With Hushme, we aim to address the problem of speech privacy protection and noise pollution in open space environments. Alexandra, you see, there is a big problem, it needs to be solved. Yes, this device is really unusual. Some people are embarrassed, some are frightened. Some people confirm that the main thing is that the device of top-quality should be functional. I remember the times for about 15 years ago when the first headset appeared, it was not even wireless, but wired. When I visited Sweden for business the Swedes told me they would never wear such a device! It looked stupid. Alex, imagine the picture: there is a girl with long hair, she walks waving her arms. The device is invisible, because of her hair and unfamiliar people could perceive this process as an oddity! And now there is a huge variety of harnesses! And no one pays attention, everyone is easy-going about people passing by and talking like this!



Girl with hidden earpiece
source-www.aliexpress.com

S.O.C: As far as we understand from the video on your product, the problem which you targeted to solve was actual before. Probably someone has already tried to solve it. Is it right? Understanding the USP from the investor's side could make the product N°1 for them. What are the USP of Hushme and fundamental difference from other technologies that tried to solve this problem before you?

We are the first wearable device for smartphones in the form factor of a wireless headset with add-on functions of voice muffling using cushion muffs and proprietary voice masking technology. When we started the project we surfed the internet a lot. Initially, we did not hear that someone invented such a device. The Call Centers and large open spaces try to

make a general sound isolation. The separate rooms are made where one person sits down so that he can talk quietly and not disturb anyone else. But we didn't find any information about the individual, personal device, which can only be yours - portable and relatively cheap in comparison with stationary solutions. We googled and found nothing, honestly. Up to now, nothing was seen and we positioned ourselves as the world's first voice mask for mobile phones.

And no one paid our attention to something like that. But just a couple of months ago we accidentally found some **device and called it our direct competitor**. You know, this device is similar from one side and unlike from another side. There is an **American company** that has been working since 1945-1950 years. The company has a similar mask, but it is more like a mask for breathing – it is stationary and huge, and it's not a Bluetooth headset that can be worn with hands-free and so on. It connects to the phone through the cable and you can speak directly into it. They still exist and are sold, they have customers. By and large, they are sold only in the USA, because they have a choice among the main customers, this is the military sphere, ships, etc. and American courts. It is forbidden to talk on the phone in American courts, and when the judge says something - he can not be interrupted, so when someone dictates something, then he speaks directly into the mask for others to write down. And it is true. Several people from America contacted me. I talked with a journalist accredited in the American court, who said that our device is super and it fits the bill. It was in the spring when we were just preparing Kickstarter campaign. This journalist said that he will buy our device and test it, also he told there will be a huge market for HushMe. He as an accredited journalist in a court always has a situation when he can not talk on the mobile phone on the one hand, and on the other hand the judge tells interesting things or pronounces judgement and a journalist would have to transfer it right now to the editorial office to be the first one, but he has to either leave the courtroom and lose some additional information, or he risks to be removed from the courtroom, because going in and back is inappropriate. This journalist told me how he risks sometimes diving under a chair and hiding while he is whispering into the phone and he always fears the judge will turn him out of doors until the end of the process without the permittance to come in. And if this device also frees up hands for the possibility of writing, it is really great!



Stenomask
source-www.talktech.com

S.O.C: In order to understand the peculiarities of this particular spinoff our investors always ask what is the investment structure of the company? Do you still own the controlling stake in your spinoff?

The company is currently owned by **6 founders**. **Legally we are in Delaware**, an American company. And here in Kiev, we position ourselves as R & D office. In America, we also have accounting service and we are taxpayers there. Our account is opened in Washington. Everyone from our company invests their own money. Everyone has a different share. Konstantine, as the CEO of Chumak, can invest more, the rest of us invest smaller amounts, but in general, everything is being promoted exclusively with our own money and our proper work. ARTKB bureau helps more with work than with money, because they can bring to life all the projects.

S.O.C: We wonder what is the actual addressable market currently for your invention and what are the current competitors there? Could you please share with us the results of the market studies, if there are any? What might be the barriers to entry?

We have the orientation towards multimillion markets, and in general, our aim includes **white-collar workers, people on the move, those, who travel a lot and move a lot** for use on the street, at the airport; the **youngsters** also, who can use the device for fun. A couple of big call centers reached us out, where the problem is a very noisy office, employees are constantly talking on the phone and bother each other. The leadership put crazy money into stationary soundproofing, which costs a lot! Heaven forbid if the equipment can be thrown out while moving to a new office and thereby they bury all investments. One American said that he bought the device for himself and he will show it to his colleagues because he also works in the call center. The sole biggest barrier is social perceptance of a muzzle-like voice mask when you lock it over your mouth for voice muffling.

S.O.C: We always need to paint a clear picture to the potential investors of the market opportunity of the spinoff that is meaningfully large and growing. Why in your opinion your company might have a high growth potential? Could you tell us all current industries and fields of Hushme application and where do you think it could be successfully applied in the future?

Companies spend thousands of dollars on arranging privacy booths in their open space offices. Hushme, being a wearable device, can serve the same need at a fraction of the cost of a specially insulated booth.

There are 2 billion smartphones and more than 200 million portable hands-free devices in the world: Potentially, we can talk about a million-dollar market. We position ourselves as a Bluetooth hands-free headset with additional voice masking capabilities, separately you can use it as a Bluetooth speaker. It's a device market which is measured by millions. Even considering the consumer point of view, not to mention the military markets!

Besides, as for the **military market, we see a great potential** there. This field could be in for a treat if it is possible to say. There is a need there, for example, starting from the noise in the tank or on the battlefield. **We are ready to communicate on this topic.** When we finish the first batch and start selling it to our backers, we really want to contact the military officers. For example, Americans. We see such a perspective for ourselves but have not yet communicated with such people.



Wind



Ocean



Rain



Birds



Monkey



Squirrel



Darth Vader



R2D2



Minion

Pre-recorded sounds

photo provided by Hushme company

S.O.C: The potential investors will be curious whether you already have the first clients and signed contracts? What was the feedback from your partner's markets and customers?

There are **many potential contacts, distributors from different countries** (US, Europe, Middle East and Japan) who ask to send a price list and sign a contract. They say that they want to be our distributors and resellers and so on. People had already confirmed that they are ready to buy a dozen or more. Someone asks for at least one copy, but not a prototype, they want the ready-to-use product. Those moments are already commercial ones, when it is necessary to have a party which is already manufactured so that it can be shipped to distributors for sales.

S.O.C: Dear Mr. Sakun, we both know that for you and the investor it is crucial to

reach positive cash flow as soon as possible. Certainly, the market scaling cannot be achieved without proper distributors network and clients. Please tell us about your criteria of partners selection and which markets are open for spinoff activity.

Hushme is a **one-of-a-kind wireless headset** and as a gadget, it is open for sale globally using the existing channels to end consumers. We also count on professional customers like co-working centers, call-centers, etc. Here we are knocked at the door with a request to give a price list and we are ready to trade. We are still leaving contacts, thanking and saying that we will contact them later when there will be a fully functioning device and we can really discuss the price policy. There is an understanding of what the price should be on the retail shelf, this is about \$ 249, at least for America. This is the price that was formed on the basis of point polls at an exhibition in Las Vegas.

When people say they want to buy right now, we ask the question: how much could you pay for it, and people fluctuate to 220 dollars and within these limits. We asked for about a couple of dozen people. The price does not scare them because it's a hands-free c with additional features, it can still be **used as a Bluetooth speaker**. We see such a price after all the campaigns on the site, on the shelves in the stores. Hence, accordingly to the situation, we must build on the gross profit that distributors and we would like to receive. When I've been to one of the exhibitions, one American tried to teach me how to lead a business, he told that there shouldn't be any action without prepayment and overcautiousness. But we went through a good school taking into account the experience of the whole team and we can say that we do not work without prepayment.

Look, for instance: we were contacted by one Arab call center, where they have 4000 phones. They said that they were ready to order 4000 copies when production would begin. By signing such contracts we will definitely take a 50% prepayment, and then we will start working.

All the things, such as price list for distributors, working conditions, exclusivity for sales will be worked out in September or October when we will be closer to the real date of production start.

S.O.C: It is very important to understand your particular vision about unique features of your company. Why do you consider the major market players might be interested in investing into a promotion of your product on the addressable market?

Hushme is very unconventional and weird, yet useful as it serves the need of speech privacy protection, and thus it could become a trendsetter for the global tribe of gadget geeks.

We are the first in the market. No one invented such a device before us, except Americans, of course. They experience their device since the year 1945 working together with the courts and government structures. If to pay attention to the design of American device, since that time almost nothing has changed. Though the device is personal but is still stationary. And we are the first, considering that we have designed a Bluetooth hands-free headset. We are the first who raised this problem. We have granted the patent for the brand and for form factors all kinds. We have not yet made sales, but **we are already recognizable as Hushme brand**, many people have heard about us, many people have written. We finished Kickstarter campaign, but so many people around the world heard about us and seen in the news!

S.O.C: Now we would like to refer to the next very crucial and we would even say essential aspect for spinoff companies' as the strategy of R&D, production, distribution and marketing processes. Do you have your own unique strategy? Which of these processes do you consider your spinoff is strong at?

Hushme co-founders from ARTKB have **vast experience in hardware development and commercialization** from idea to final product. Other 3 founders have a strong background in **corporate management, distribution and marketing**. So we believe we have quite balanced areas of expertise on board. I believe that our device has succeeded in marketing and advertising. We still haven't launched the production as such, there is only a factory that will produce this gadget. We have extensive experience in manufacturing from small batches to very large ones. This is also important. We do not need to freeze a lot of money to produce a few thousand pieces. We also have a lot of experience in logistics, in distribution, because our guys from ARTKB bureau have passed through more than one such project. They helped their clients to make shapes and organize the first steps of logistics, while the guys got to their feet. It can not be said that this is specifically the experience of Hushme as a separate company, but it is the **experience of people who represent this company**. And if we talk about the brand Hushme as a device, then here I can repeat, this is a really marketing thing. Without actually spending a penny on marketing the whole world writes about us, talks and does not forget. There are a lot of

live contacts in our base. They are more than 25. We participated in various European, American shows with multi-million ratings. A large number of the audience are waiting for prototypes and they ask monthly about the successes and the date of the start of sales. Everyone wants to be the first in line to show in their TV shows and so on.



Replaceable cushion muffs
photo provided by Hushme company

S.O.C: As a rule, the majority of spinoffs outgrow into exits. How do you determine the market for your product/technology and estimate its volume and dynamics? What is your potential share on the market? How do you think what market cap your company plans to reach the peak of its development and why? How long might this process take?

We can benchmark versus the market of earphones and headsets, which is hundreds of millions of units annually. So being a unique device on this market, even gaining a tiny market share will mean tens of millions in revenues.

We will start in September or October, with the money that we got from Kickstarter, we may add our own money as well. Until the end of September we have to finish the device and in October we will receive several ready-made devices that can be sent to different

programmes to be shown. And mass production is expected in November so that we could address our backers around the world at the end of November or beginning of December to fulfill our obligations. By the way, we have already received **confirmation from CES 2018**. Now they will give us a personal stand. We expect to sign the first serious contracts for about hundreds of devices in the same place. The exhibition will be held in early January.

S.O.C: For spinoff companies, their intellectual property is a key to success. The investors pay particular attention to it. What key intellectual property does your company have (patents, patents pending, copyrights, trade secrets, trademarks, domain names)?

Well, we owe Trademark Hushme, the website www.gethushme.com, and proprietary voice masking technology.

S.O.C: For both of us, as well as for thousands successful spinoffers, it's not a secret that a new technological breakthrough may become obsolete very fast. Respectively, patent validity period becomes shorter. It is interesting to know the perspectives and protection plan of your technological advancement and leadership in a medium- and long-term prospectives.

We realize that patents do not guarantee you will be not passed by quicker competitors. Thus we strongly emphasize the brand value of Hushme, which since its inception has already made a lot of noise in the consumer electronics world.

S.O.C: The investors will want to get a clear picture of how many rounds of investments have you completed? Are you seeking for the investments at the moment? What is the volume and time limits? What milestones will the financing get you to? What did you plan to use the invested funds for?

We are looking for investors and **we are open for investment**. The money that we got from Kickstarter will be enough to bring the product to the mind, this will enable us to finalize the electronics and fine-tune the hardware and make it ready for production. We seek investments for the establishment of the organization, full market launch and further R&D, especially if it is said about large parties from 500 pieces. Therefore, we are open to cooperation.

S.O.C: Could you please describe your ideal investor? What aspects are important for you, for instance, is it experience, country, the amount of own private capital or maybe some personal qualities? Will existing investors participate in the round?

If we consider the issue in the global plan, the company is done in order to sell it to a major player from the industry in the future. It can even be said, the company's strategic goal. But in any case, all the way must be passed and everything will be seen. At the moment we understand that the ideal investor for us is someone who has smart money. An investor who is definitely not from the post-Soviet space. We value our reputation. We would like to work with **well-known investors** so that later it does not become a burden when selling the company. This is what I put into the concept of smart money: money should be honest and white, that will not spoil our reputation, I want him to be a profile investor with his connections possibly with the defense industry or with large call centers. We need an investor who will believe in us, who will allow us to work quietly without strict weekly control and a desire to make money from this as much as possible. Otherwise, in this case, it will be easier to invest our own money or go to the bank and take a loan. Besides, we are **ready to share 30% of the company**.

S.O.C: And the last question, could you specify the most convenient way you would like to receive inquiries from potential investors? Should it be by e-mail or personal phone call?

For everyday communication, mail is the best, and if there is something urgent we are open to communication by phone, too.

Publications and television broadcasting on the device you can find by the links below.

We would like to express gratitude and we appreciate the time you have dedicated to this interview. **SPINOFF.COM** will observe the development of your spinoff with great pleasure and interest. Also, we are thankful for providing all the necessary materials. We are pleased to forward all potential investors the database of the spinoff supportive materials such as presentation materials, schedules, videos, pictures, figures, blueprints, text materials etc.

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Website: <http://gethushme.com/>
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Files: [HushMe_up-to-date](#)
[Daily Mail](#)
[The Telegraph](#)
[CNET](#)
[CNET](#)
[CNET](#)
[Engadget](#)
[Time](#)
[BBC](#)
[City News](#)
[The Memo](#)
[Citya.M.](#)
[Newstalk.com](#)
[Evening Standard](#)



EXOSKELETON FOR THE REHABILITATION

Exclusive interview for [SPINOFF.COM](https://spinoff.com) with Mrs. Ekaterina Bereziy - co-founder and head of business development and Mrs. Elena Pismennaia - project manager of ExoAtlet company

[ExoAtlet](#) company is developing exoskeletons allowing people with muscle-skeleton disorders to move freely and enjoy life. ExoAtlet is a medical exoskeleton designed for the rehabilitation of patients with locomotive impairments to their lower limbs sustained as the result of an accident, an operation or illness of the locomotive system or nervous system. ExoAtlet is a motor-operated skeleton fixed on a body helping to walk, sit and rise up independently. For those who have been recently injured and partially have lost the sensitivity of legs it is the way to completely restore the motion functions, and for the disabled in a wheelchair it is an opportunity to visit earlier inaccessible places and an effective means of rehabilitation: usual walking significantly improves health indicators and brings back the feeling of freedom and happiness.



Ekaterina Bereziy - co-founder and head of business development
www.exoatlet.com

S.O.C.: Ekaterina, SPINOFF team and I are grateful that you agreed to spend this hour speaking with us and sharing your insights about ExoAtlet. At first, I would like you to say a few words about your background and experience.

Ekaterina Bereziy: I graduated from [Moscow State University](#) in 2002 and became the Head of the Department of Industrial Design at [Lebedev's Studio](#). I made many projects,

among them microwave [Samsung](#), which they sold in the quantity of 150 thousand pieces. I left Studio in 2007 and started working for one of the clients of Lebedev's Studio, who was developing the dealer network of cars. Within 4 years we launched different brands: Mazda, GM, Ford. Four years ago I joined the team of ExoAtlet.

S.O.C.: Tell us about the scientific basis of ExoAtlet. It is important for us because we work only with science spinoffs.

Ekaterina Bereziy: Our scientific base is the Faculty of Mechanics and Mathematics at Moscow State University. The topic of my diploma was a bipedal walking machine. Elena Pismennaia, our project manager, is the founder of the festival Mobile Robot named after her husband Evgeny Devyanin. In the eighties, Devyanin created the first-ever six-legged walking machine with solo operation, which had to fly to Mars. It is a very serious base. All our team and I graduated from Moscow State University. In this sense we are spinoff, but legally we have no relation to it.

S.O.C.: Elena, considering your tremendous experience, we would like to know whether you had other projects? Could you please share the story of their creation and success.

Elena Pismennaia: I have higher education in the development of automatic and adaptive control systems and all the time was engaged in scientific work in the field of robotics, worked as the associate professor, and created scientific groups. When I understood that everything needs to be transferred to a practical level, we arranged the scientific and practical festival of mobile robots, which became a great motivation to study robotics for the students of Moscow State University, they understood how can it be put into practice. We created the models of mobile robots, developed regulations, which were very close to real life. Since 1998 our robots were able to move both on beacons, along the line, drive round the obstacles, and make the joint synchronous movements. During the interaction with the Ministry of Emergency Situations of the Russian Federation, we have come up with the idea to make the exoskeleton, which would help to carry heavy tools, to perform some works without any harm for human backbone and joints. Then in 2011 we applied for the grant from the Ministry of Education and Science of the Russian Federation and started making the exoskeleton for carrying heavy loads. Later we understood that it is necessary to create a useful product for the disabled people suffering

from injuries. We understood that we are able to do it, but it is necessary to develop compact drives and create correct movement pattern. Our previous practices allowed us to acquire the experience, which was useful while the creation of ExoAtlet. The complexity consisted in the fact that all the people move in different ways. The patients have different symptoms: foot turns in the wrong direction, half of a body does not work, legs do not work, besides everybody has a different bodily constitution. There are lots of modifications to be considered. We have developed the system of settings, which allows modifying the exoskeleton for every person with the height from 1,55 m. up to 1,9 m. Our brain is very flexible, it has a reserve, but this reserve needs to be awakened and our task is to force the healthy parts of the brain to undertake functions, which were not peculiar to them. We cope up with this task and there are the results already.



Elena Pismennaia - project manager of ExoAtlet
www.exoatlet.com

S.O.C.: We monitor the whole market and analyze spinoffs. There is a huge number of companies successfully working in this sphere in the market. It is important for us to understand the uniqueness of your product.

Ekaterina Bereziy: We are the fastest startup from those available in the market at the moment. Currently, there are two startups with venture investment in the sphere of exoskeletons: we and [ReWalk](#). ReWalk began their studies 15-20 years ago and they already reached the IPO stage. They are the only analog of a classical example with venture investment, all the other exoskeletons are the institutional stories, which started in the laboratories of large universities, developed their product within 20 years, then were separated into a company, when they already had a ready-made product.

Our story is different. The core of the scientific team is Moscow State University. More than 30 years every member worked in the sphere of robotics in their narrow specialization: electronics engineering, programming, etc. In 2013 me and Mikhail Krundyshev, who for a long time headed the Russian representative office of BBK Electronics, joined the team as manager and marketing specialist and decided to work with medical exoskeletons, created the legal entity, became Skolkovo residents, in 2014 we won start-up and in 2015 involved the first large investments from Biofund [RVC](#). We made 6 generations of prototypes during 2,5 years and in 2016 we completed the certification in Russia, i.e. 2 versions of exoskeletons are already the certified medical products. We have sold about 40 exoskeletons during one year. Last summer we completed medical certification and also opened the [representational office in South Korea](#). Together with our Korean partners, we have completed the certification in South Korea, that is we are already a semi-medical device in the market of South Korea.

Elena Pismennaia: Human body is a very complex multilinked dynamic system. We had to create the control law for such multilinked system, and it was necessary to do so that legs were carried over correctly along the trajectory close to those made by a healthy person. In fact, we train the brain to make movements anew, and proceeding from the fact that we move in the Cartesian space in the systems of coordinates x, y, z , we allow the doctors to modify the movement trajectory. Some patients need to take longer steps, some need to raise their hips higher, others need to start walking quicker. We have solved all these complex tasks by means of mathematics and issued in the form of the patent, which gained [FIPS](#) diploma. It was made for the first time in the world. We do not deprive the

patients of this very important function of balance maintenance. It is one of the main functions, which coordinates brain with hands, legs and the whole body. We always say to the patients: "Remember, here you have the right foot up, and then the left one...", and the brain and muscles are being gradually trained. But for the exoskeleton creation, we carry out a lot of scientific researches and work in the quality of scientific institute. It allows us to understand further directions for our progress. We carry out the researches with the pilots, who have various disorders and receive feedback from everyone. We are trying to implement their recommendations.

S.O.C.: The potential investors will be curious whether you have already signed the contracts and how many rounds of investments have you completed?

Ekaterina Bereziy: After more than 20 presentations we have collected 10 pre-orders. We have already localized the production in South Korea since it is important to our Korean partners to sell in their clinics the products made in Korea, not made in Russia, and there we have **already raised about USD 2 million**: USD 1,2 million of private investments and more than USD 700 thousand of grant money. That money is intended for the development of the Asian market. We plan to go to China from our Korean daughter. There is already the understanding with whom we are going to open the office there and this year we will open it and will start the certification process because the Chinese certification is very complicated similar to FDN. Currently, we are in the process of signing the distribution agreement with the Singapore partners from our South Korean company. We are going to have a distributive model in small markets there, which implies that the distributors will be completing the medical certification themselves. In the large markets, we will create our own representative offices and move to the distributive model. By the end of 2017, we plan to open the representative office in Europe and apply for CE Mark. We are going to open it for this purpose.

S.O.C.: Do you require investment at the moment?

Ekaterina Bereziy: In terms of financing the Asian market is closed. USD 2 million there will be enough to open the clinic in Korea and offices in China. For Europe and USA, we respectively need investments and the figure is about USD 5 million, but we already have the investor for the half of this sum. It is the same Biofund RVC, and they are ready to provide further financing. We are their portfolio company. They have the mandate for

50x50 financing. They are ready to give USD 2,5 million. Russian Venture Corporation (RVC) has created several affiliated funds and Biofund is the subsidiary of RVC. Biofund is a non-state money. There state money of RVC is already mixed with the private funds. RVC created Biofund for venture investments with the involvement of participants with private capital, therefore, this fund is under RVC control, but money there is not absolutely state. We are **independent of politics**. The current investor is non-political structure. It is Russian Venture Corporation. They are ready to be set not in Russia. Therefore we also have opened the company in South Korea. One of the key investors there is one of 4 owners of GS (Gold Star). He owns a large-scale business in Japan and China and we are going to use their resources to make such speed up. It is also important that the founders of ExoAtlet still own the share of about 72%.



The exoskeleton is a new level of freedom
www.exoatlet.com

S.O.C.: Let's talk then about the contracts in Europe and North America.

Ekaterina Bereziy: We already have the contacts in the USA. There we have a different strategy for an exit. We have been there and started the relations with the biggest private hospital MedStar in Washington. There is the understanding whom we are going to involve. Our strategy consists in spending a little money for opening the office, application for FDA and easy start of the pre-licensure trial, and then we want to raise investment for scaling after we complete FDA. Speaking about the USA, there we need USD 1,5-2 million. That would be great to find an investor there, who will be able to complete FDA and start

distribution through the existing infrastructure. Our **sales model is distributive** and the marginality allows us to let the distributors in, and at the same time to remain competitive in comparison with the existing exoskeletons. It gives us the chance to develop the market quickly. In case the investor has his own infrastructure, then it is possible to recalculate the financial model, to open the office there and to give them an opportunity to do it independently. In case we receive the money from people, who aren't able to complete FDA for medical devices and to undertake the sales, then we will open the office in the USA, start FDA and we will look for the **partners, who are able to give us the distributive network**. The same situation is in Europe. In Europe, we have already decided to apply for CMart and we are going to look for partners, with whom we will be developing the market because the key story on evaluation will happen after the reimbursement, when the rehabilitation with exoskeletons is included in the obligatory insurance.

S.O.C.: Do you complete FDA in the USA as a semi-medical device?

Ekaterina Bereziy: There is no the concept of a semi-medical device for FDA. In the United States, it is called class 2A. It is just a medical device. We most likely won't need to pass the full clinic, because ReWalk and [BioniX](#) have already completed FDA. There are many analogs, consequently, we'll need to provide the existing results of the clinical trials in Russia and in Korea to confirm that we have similar results. It will take us a year.

S.O.C.: For spinoff companies, their intellectual property is a key to success. The investors pay particular attention to it. What key intellectual property does your company have (patents, patents pending, copyrights, trade secrets, trademarks, domain names)?

Elena Pismennaia: We have already patented all the engineering solutions in this design and continue the patenting process of the techniques. We already have the patents for several solutions and have applied for the patents for other solutions. We consider the exoskeleton not just as a product. In order that the exoskeleton was used correctly, we have created the techniques for its use by doctors and instructors. It is one of the most important directions of our activity. We try to use all the known rehabilitation techniques and add the rules of effective exoskeleton usage.



The main applications of ExoAtlet are for the restoration of impaired locomotive functions and the compensation of lost functions
www.exoatlet.com

S.O.C. What are the time limits for the investments?

Ekaterina Bereziy: For the next 2-3 years we need about USD 5-6 million. Biofund will participate, by all means, they are going to invest half of the sum, respectively at most USD 3 million is required from the investor. For Biofund we are the top-of-the-line project, so they support us. We won't need the whole sum at once. **We plan to enter Europe** by the end of the year and we are ready with technical files to apply for [CE Mark](#). In fact, there is nothing to wait for, we will need the investments as soon as we apply for CE Mark. For the Middle East, we are going to need the investments as soon as we find a partner there. We have entered into relations with the Minister of Economic Development of Dubai. In Dubai, they have big rehabilitation centers, but there is only pure distribution. There is no partner for the technology development. We are interested in the large-scale model, where we might create new techniques and convey them in other markets.

In the Russian market, we create aftertreatment from scratch within our project, because it gives the possibility to continue the aftertreatment in the polyclinics, that is called the third stage aftertreatment. The global problem is that the person, who has lost the ability to walk, needs to be urgently put on the legs and start walking. This problem is solved by the exoskeleton and it has to be solved during one or two years. It implies regular exercises. The patients, who regularly walk in exoskeletons, restore the sensitivity, their muscles begin to work and some of them return their own physical activity and start walking without exoskeleton with the support of walkers or crutches. I'm talking about the patients with spine injuries. In case of **strokes**, there are fantastic results. They **start walking without support after 4-5 days**. If to come back to what differs us from other exoskeletons, we have a fantastic mathematics. We own the patent for the control algorithm with a very steady control along the trajectory. We invented the law of control, which steadily returns on the trajectory at any external deviations. Thus we can repeat the most natural step of the person with any anthropometric data and it is very important for brain neuroplasticity because at the stroke it is important to walk with the legs of the patient the way he would walk on his feet on the same trajectories. No one of our competitors has this mathematics. We became one of 100 best inventions according to FIPS patent. It is a very good patent. We have an engineering solution, which allows reducing the costs for production at the expense of what there appears the marginality, wherein the distributors go with their 50% of margin. In the next version we start now we have a phase muscle toning, there is a **built-in electric muscle stimulator** and the muscles, which must place one foot in front of the other are stimulated with electric current. That is the picture of walking is recreated completely. We have engineering solutions allowing to make the version for teenagers with cerebral palsy, and we will make the next version for children suffering cerebral palsy. We plan to create children's models and the models for elderly people. It will be not so much the medical gadget as the exoskeleton allowing them to walk independently.

Elena Pismennaia: One of the major problems are sick children. If the child has problems with their motion function, then the whole life of the family is regulated by their visits to medical institutions. We want to help all these children with cerebral palsy and injuries, but the approach must be absolutely different. It is an absolutely different project because kids walk in different ways at a different age. Currently, we are studying the features of their walking at a different age in order to consider it while the project implementation.



ExoAtlet brings back the feeling of freedom and happiness to people with locomotive impairments
www.exoatlet.com

S.O.C.: Robotics is a very competitive environment and many laboratories conduct researches. According to the information, we have at the moment there is no finished product, where a person can walk without an additional support. In your case are people walking without additional standing point or not?

Ekaterina Bereziy: You know, there is some delusion because the standing point while walking in an exoskeleton is an indispensable condition from the point of view of rehabilitation. Rehabilitation begins when the person is responsible for his/her vertical orientation and holds the balance. In order, the person learned to hold the balance while he/she doesn't feel anything from the waist down, for example, and he/she needs the third standing point and uses crutches to learn to hold the balance and this third point is securing the person from falling. Speaking about the rehabilitation, one should consider crutches as a certain security measure, which gives the chance to walk on the surface, respectively the person is developing a clear understanding of the distance to the objects, the pectoral muscle sling is getting involved reflexively and a crutch is the way to secure him\her from falling, it is one more tool to feel like the full-fledged person and in this sense the crutches shouldn't confuse anybody, it is rather a bonus. If we make an exoskeleton

where crutches won't be necessary, then we will give it the function of holding a vertical position and deprive the person of an opportunity to be actively restored and take away his/her basic function. When we walk, we hold our vertical position. It is the task of our brain. In order the person learned to walk, he/she needs, first of all, to learn to solve the task to keep vertically and not to fall. Therefore the crutch is for the support and it helps to learn to do it.

Elena, our project manager is working with [dynamic balance systems and stabilization](#), therefore, we understood how to write this control law. We can make so that the exoskeleton provided vertical orientation, but we should not solve this problem if we want that the patients started walking independently. In the next versions, we make possible the regulation of the extent of help. The exoskeleton makes the movement of the legs, and if the person shows own physical activity, we need to reduce the extent of help the exoskeleton provides in order that the patient didn't relax. The person very quickly gets used that his legs are walking as if on their own, and it is actually necessary to learn to make the independent movements at some moment and the extent of exoskeleton's help needs to be reduced. Our task is to create a certain robotic complex, which doesn't perform patient's function for him/her, but helps when the function is absent. The exoskeleton is not a substitute of a wheelchair, but the device, which [allows refusing from the wheelchair](#).

ExoAtlet made 6 generations of prototypes during 2,5 years
www.exoatlet.com

S.O.C.: Could you tell us all current industries and fields of your product application and where do you think it could be successfully applied in the future?

Ekaterina Bereziy: In general we know how to make an exoskeleton for the military sphere, it is obvious. Many times we received the inquiries and we answered that we won't do it, though we understand how to make military exoskeleton. We want to bring the rehabilitation on the international level and to reach the IPO. We consider that it is a very big risk for us to start military development. It is possible to create exoskeletons for industrial use. Exoskeletons may be used for those works, where the loading machines can't be used. It is the same story with active and passive exoskeletons. We need a year and a half to turn the exoskeleton into the product necessary for big retailers and on the assembly lines. We just need to write the design specification and negotiate with the end user. The exoskeletons for elderly people is also a separate story. We might cover the whole Asian market. It is not medicine, it is a gadget the seniors would use with pleasure. Honda and [Panasonic](#) look in this direction too, they have already made the prototypes. [CYBERDYNE](#) (Japan) have already come to IPO. They have the highest capitalization in the world. Besides, in Japan, they already have the reimbursement. They give the exoskeletons to the patients for the exercises and have already included this service into the insurance compensation. In the USA there are private insurance companies, which buy exoskeletons for their clients and ReWalk (Israel) now promise that in the autumn they will involve the market of Germany and the reimbursement will start there. Their capitalization makes USD 200 million.

S.O.C.: What is the price of ExoAtlet?

Ekaterina Bereziy: It will be an available gadget. **It will cost USD 2-3 thousand at most.** Elderly people can walk, so they won't need the most expensive parts: powerful drives and engineering design, which lifts the person weighing 100 kg. from a sitting position. To lift a person we need powerful drives in femoral joints and rather rigid design made of expensive materials. As soon as we refuse from the task to make 100% movements for the paralyzed person, we can create a light design with less powerful drives and the price will be several times smaller. At the moment our version for private individuals in Russia costs

USD 20 thousand while we produce dozens of exoskeletons. If the production volume makes hundreds of pieces, the price will decrease by 30 percent and the exoskeleton will cost around USD 10 thousand. Respectively if we redesign and replace electronics, sensors and all the rest, then the price will fall up to USD 5 thousand.



The exoskeleton carries over the patient's legs correctly along the trajectory close to those made by a healthy person

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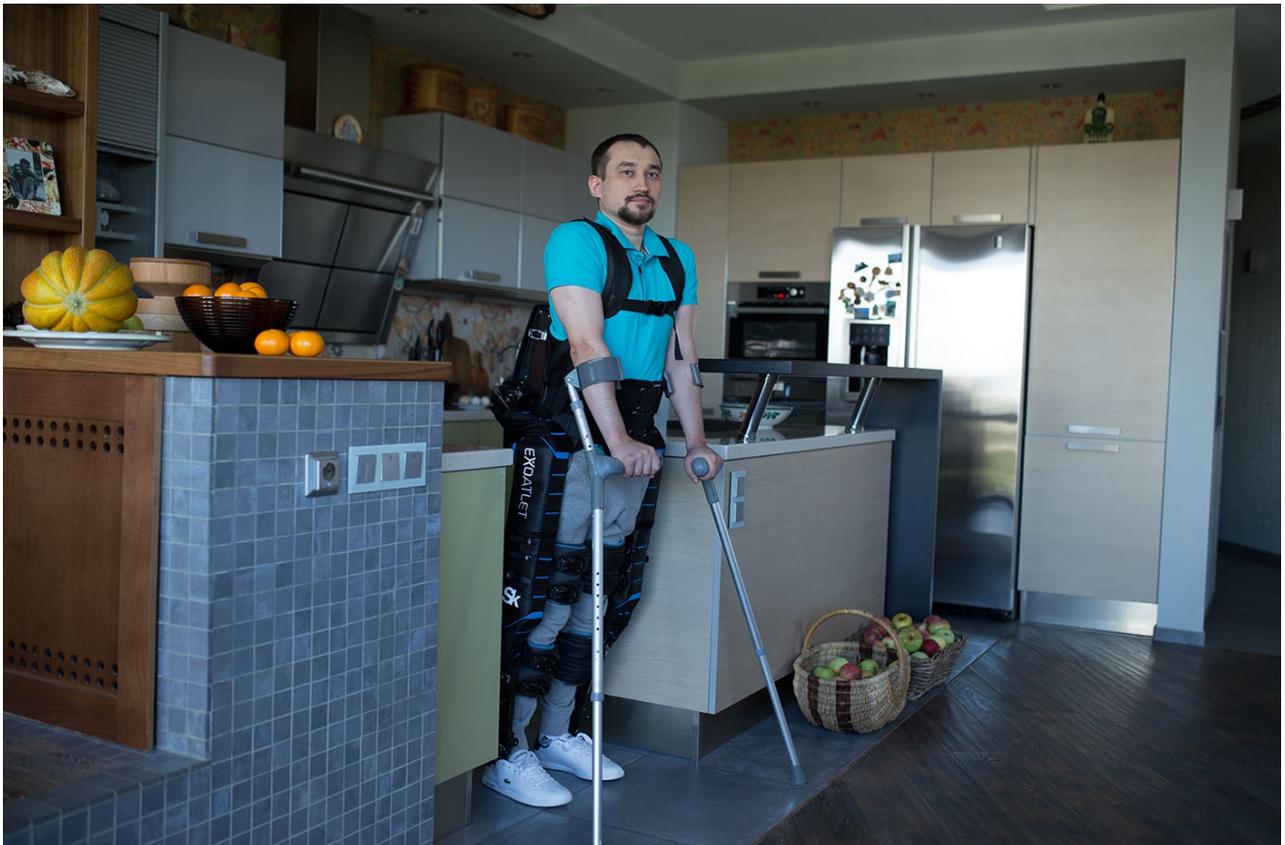
S.O.C.: Could you please describe your ideal investor? What aspects are important for you, for instance, is it experience, country, the amount of own private capital or maybe some personal qualities?

Ekaterina Bereziy: The **partner in the Arab world** be of great interest for us because it is impossible to enter this market without partners there. We need a partner to create the company, develop it and render rehabilitation services there. Rather rich people live there and state funding isn't necessary for them, they are able to pay for their rehabilitation. This market is very interesting and we need the partner in medicine owing a network of hospitals. The exoskeleton is a wonderful product, which may be scaled. There is no necessity to build a hospital to develop it. We can use fitness and wellness centers or create mini clinic for rehabilitation in the territory of a hospital. We need only simple space in the form of wide corridors with mirrors or even pavilions in parks, where people will be able to exercise regularly. In Japan, for example, they have rented a half of the floor in the shopping center, put exercise machines and exoskeletons there and created such mini-club for people, who need rehabilitation.

S.O.C.: Do you mean there is the possibility to make additional franchise model?

Ekaterina Bereziy: Absolutely, we have the teaching techniques about the usage of the exoskeleton. These techniques and certain additional toolkit: bars, mirrors, paths with suspensions allow involving a smaller quantity of instructors. It is an interesting franchising model for those countries, where the patients can pay for their rehabilitation. The Middle East is one of such territories.

S.O.C.: To crown it all, **SPINOFF.COM** team and I would like to express our gratitude for the interview. I would like to express my respect and admiration to your team. The exoskeleton improves the quality of life of paralyzed people and also makes the emotional and psychological effect, which is no less important. The attitude to the world of the disabled people changes once they can socialize again. I have great respect to the idea of your project and I wish you success!



www.exoatlet.com

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Industries: Others
Source links: [ExoAtlet](#)
Files: [ExoAtlet Presentation](#)



DRUG DETECTING STRAWS

"Smart Straws" are drinking straws designed to detect common date rape drugs by turning blue when placed in both nonalcoholic and alcoholic drinks. The straws were invented by three teenage students Susana Cappello, Carolina Baigorri and Victoria Roca of Gulliver Preparatory School, Miami, FL. The straws target a massive problem of teenagers – a date rape. Sometimes people secretly slip drugs into other people's drinks in order to take advantage of them sexually.



Susana Cappello, Carolina Baigorri and Victoria Roca - the co-founders of Smart Straws
www.boredpanda.com

It all started when three teenagers, Susana, Carolina, both 17, and Victoria, 18, decided to enter their preventative product in the [Miami Herald's 2017 Business Plan Challenge](#) and earned first place. But they didn't just want to win a contest.

Victoria, a senior, has been accepted into Babson College and is looking forward to taking her first university course on entrepreneurship. Entrepreneurship is in her blood; her grandfather founded Digitel in Venezuela; her mother also is an entrepreneur. She also helps her cousins as an ambassador for their app business.

Susana, a junior, also comes from entrepreneurial stock. Her father, Juan Pablo Cappello, was one of the founding investors for [The LAB Miami](#) and has been involved in numerous ventures as an entrepreneur or investor. She has worked at The LAB, a hub for entrepreneurs, and has developed a business called Sketch Your Home.

Carolina, also a junior, watched her aunt and uncle, Ed and Crissi Boland, as they launched their [HeroBoys](#) toy line in the past year and learned about the process of starting

a business. "If you are really passionate about it, it is so much better," she said. She and her teammates are part of Gulliver's International Business and Entrepreneurship Program and are in the school's Business Club, which has hundreds of members.

Date rape is a serious problem - especially on college campuses. The use of so-called club drugs to facilitate rape is a decades-old problem that seems to have intensified in recent years, particularly in college towns, as the drugs are easier to obtain. A survey the team conducted at Northwestern University found that 85 percent of respondents said they would use such a straw. Half of them knew someone who had been drugged at a party. The college-age demographic would be the team's target market. If the drinks are found to be safe, they can be consumed because the tests would not contaminate the drink.

Sex with an unconscious victim is considered rape in most jurisdictions and some assailants have committed "rapes of convenience" whereby they assaulted a victim after he or she had become unconscious from drinking too much. Many times people (usually girls or women, but not always) who have been drugged are unable to remember what happened to them.



The drinker is usually not aware that the drug was slipped into the drink
www.youtube.com

Various studies have concluded the following:

- on average, at least 50% of college sexual assault cases are

associated with alcohol use;

- on college campuses, 74% of the perpetrators and 55% of the victims had been drinking alcohol;
- in 2002, more than 70,000 students between the ages of 18 and 24 were victims of alcohol-related sexual assault in the U.S;
- in violent incidents recorded by the police in which alcohol was a factor, about 9% of the offenders and nearly 14% of the victims were under age 21.

Initially they considered putting the tests in some form of jewelry. Fellow students didn't like the idea, so they pivoted to straws that incorporated a test for the drugs. Straws are easy to carry, inexpensive to make and something that bars, sororities, fraternities and other student organizations that host parties could easily stock and hand out. Campus health clinics could also distribute them, along with literature about ways to stay safe. They also want to make the straws eco-friendly.

While drug test kits already exist, the student team had doubts about how widely they are being used by college students. The idea comes at an important time: a 2016 study by the Bureau of Justice Statistics found that 21 percent of undergraduate women across nine schools experienced sexual assault since entering college, and most incidents involve the consumption of alcohol and drugs.



The straw signals date rape drugs in drinks
www.wsbradio.com

Through research, the students found out that GHB and Ketamine are overwhelmingly the most common club drugs, so they set out to develop a first product that can test for those two; tests for other drugs could be added later, Victoria said. Ketamine causes unconsciousness, hallucinations, loss of body control and numbing. Overdose can be fatal. Ketamine is found in a white powder or a liquid and has a horrible, strong bitter flavor. It works very quickly, so if you tasted it in your drink you would only have a few seconds before losing consciousness.

GHB is a depressant that is chemically similar to a substance that is found in every cell of the human body. GHB was used in the past to treat childbirth problems and anxiety. It was made illegal in the 90's as GHB slows the brain and body and is easy to overdose and cause addiction. In small doses it produces mild sedation, slowed heart and breathing rates. In large doses it can cause seizures, coma, or death. GHB is easily procured at some gymnasiums, popular bars, discos, and rave clubs, as well as over the Internet.

Perpetrators choose these drugs because they act rapidly, produce disinhibition and relaxation of voluntary muscles, and cause the victim to have lasting anterograde amnesia for events that occur under the influence of the drug.

Because of the amnesic effects of some of the more newsworthy date-rape drugs and the

nature of the crime of rape, the victim may not report the crime for days, weeks, or even longer. The general medicine physician may be the first person receiving the report. In many of the reported cases, a young woman reports that she visited a bar or party and was offered a mixed drink containing alcohol or a soft drink such as fruit punch. Distracted for a moment, she paid no attention to her drink. The woman recalls that she became strangely lightheaded and that memory for further events was lost. Awakening in strange surroundings with disheveled clothing, the victim realized that she had been sexually violated.



When the Smart Straw detects either GHB or Ketamine, the tip of the straw turns blue
www.dailymail.co.uk

On restoration of consciousness and orientation, the victim may have multiple symptoms, including drowsiness, confusion, dizziness, impaired memory and judgment, reduced inhibition, impaired motor skills, "rubbery legs," weakness, and unsteadiness. If some memory of the event remains, the victim may describe a strange sensation of being paralyzed, powerless, and unable to resist and a disassociation of mind and body. Vital signs, particularly pulse rates and blood pressure, if obtained within 6 to 8 hours after the incident, are often depressed.

Sex with an unconscious victim is considered rape in most jurisdictions and some assailants have committed "rapes of convenience" whereby they assaulted a victim after he or she had become unconscious from drinking too much.

"We know it's not a solution because it can't end rape," Baigorri told Inside Edition. "But we were hoping to lower the amount of rape and dangerous situations you might be in through drugs."

The overall concept of the straw hasn't changed, Cappello says, but the team has continued to brainstorm ways to make it better - like opting to produce various straw sizes to accommodate different types of drinks.



www.more.com

"A glass of Coke may need a longer straw compared to a mojito," Baigorri said in an interview.

The judges liked the simplicity of the concept — one judge called it brilliant — because the straws could be distributed by school organizations and campus health clinics, for example, and students could carry them in their purses. The team is in the process of speaking with a large manufacturer to bring [Smart Straws](#) to the market, Baigorri said, and plan to make it "very affordable and cheap enough to dispose." They are also consulting intellectual property lawyers to protect their product.

Acknowledging the product could be easily copied, the judges also liked that the girls were looking into patent protection. They also encouraged the team to think beyond their first product and consider what other related products or services could complement the straws and further the company's social impact mission. The three plan to launch a Kickstarter campaign ahead of the official release of the Smart Straws, and Roca said the

team is also currently "strategizing ways" to make the launch as successful as possible. Smart Straws may still be in its early stages, but these three teenagers are determined to make their mark on the business world.



The three are passionate about their invention
www.twentytwowords.com

FEEDBACK IN MEDIA:

"Every 98 seconds, someone is sexually assaulted in the United States, according to the Rape, Abuse & Incest National Network (RAINN). One in six women will be a victim of sexual assault (some studies suggest even more), and as reported by the Department of Justice, 4.2 percent of victims receive date rape drugs. In the face of these heartbreaking statistics, though, three high school students from Miami are doing what they can and have invented drug-detecting straws to help combat the problem", [More](#)

"The Smart Straw was initially created as part of a school project, but soon became a labor of love for the three students, who quickly became known as 'the straw ladies' throughout their high school. Their work paid off, though, as the invention soared to first place in the

Miami Herald's Business Plan Challenge competition, which invites entrepreneurs to submit ideas for products, apps, and companies to potential investor", [Daily Mail](#)

"To support the project, the girls conducted a survey at Northwestern University in the states, and alarmingly, half of the survey respondents said they knew someone who had been drugged at a party."Rapes assisted by drugs or alcohol are all too common. We just want to give any gender a simple tool to protect themselves," Susanna Cappello, one of the three students a part of the project, told APlus. "We would also like to lower the rapes that occur in general with the involvement of alcoholic or non-alcoholic drinks," she continued", [Cosmopolitan](#)

Company name: Smart Straws

Contact person: Susana Cappello, Carolina Baigorri, Victori...

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Website: <https://smartstraw.co/>

Phone: -

Patent status: No

On market since: Under development

Regions: United States

Industries: Others

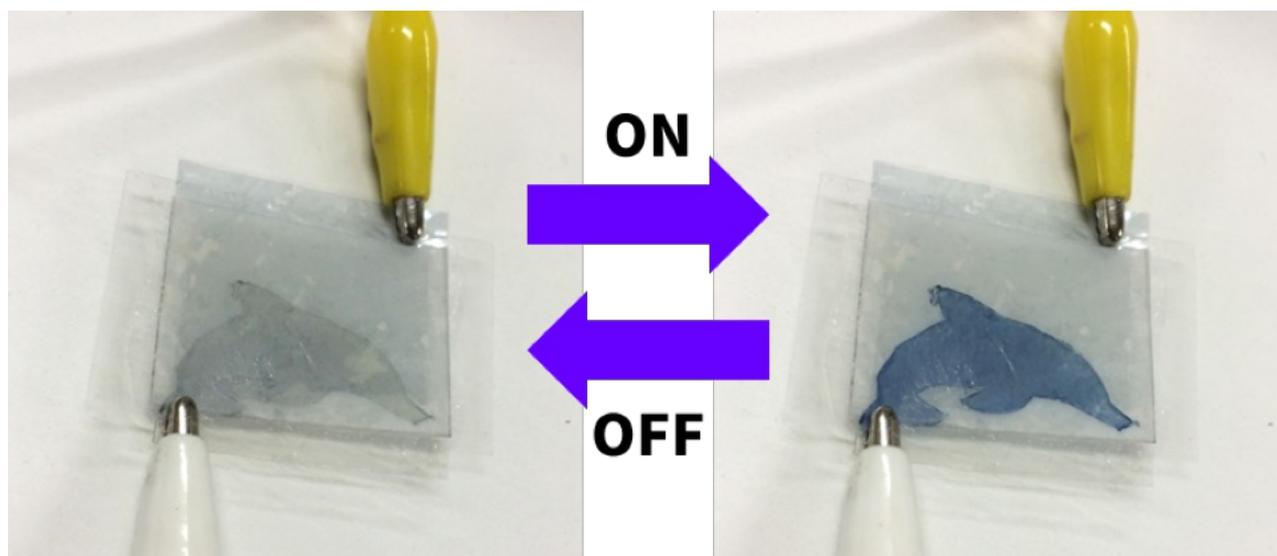
Source links: [Pop Sugar](#)
[MC Well](#)
[AJC](#)
[CNet](#)
[Miami Herald](#)
[Refinery 29](#)
[Axon](#)
[Medscape](#)
[Wikipedia](#)

TECHNOLOGY



AN INNOVATIVE ELECTRONIC PAPER WAS DEVELOPED

The scientific group from Japan managed to create electronic paper from a simple paper. The novel technology is based on the combining of the transparent paper with the clarity about 90%, which is produced from cellulose nanofibers, and a simple paper that is produced from cellulose pulp fibers. As a result, combining a highly transparent electrode and a white electrolyte with high transparency, they managed to create paper-based electrochromic (EC) displays. Furthermore, with the help of this technology, scientists have already made various paper-based electronic devices, for example, memory, supercapacitors, and transistors. They hope this newest development will provide the ability to create paper-based electronic books.



An electrochromic display based on transparent paper electrodes and a paper electrolyte source - resou.osaka-u.ac.jp

The technology was developed by the scientific team, led by Ph.D. Hirotaka Koga, from the [Osaka University](http://www.osaka-u.ac.jp).

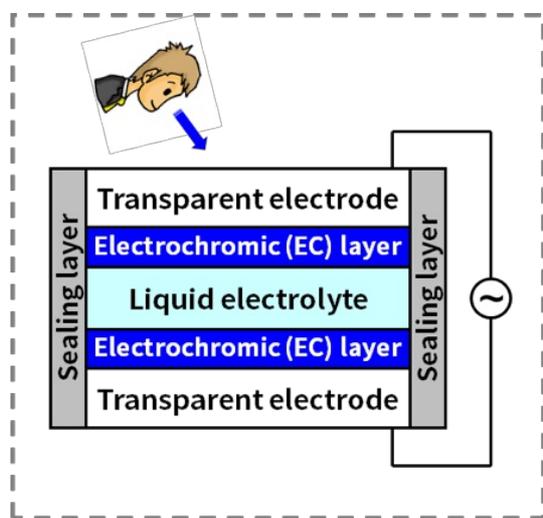
Functional molecules are the highly important element in the producing of high-performance composite materials. In EC devices, when a voltage is applied to a transparent EC electrode, ions or electrons transfer into the EC layer in the ionic liquid or electrolyte. As the result, the coloration or decoloration happens. Nevertheless, current EC devices have some problems. The sealing was required in order to prevent the outflow of the electrolyte. Consequently, the effectiveness of EC device depends on the evaporation of the electrolyte.

Scientists decided to combine the nonvolatile ionic liquid and an easy-to-handle cellulose paper substrate in order to solve this problem. The paper electrolyte is supported by the non-volatile electrolyte on the surface of cellulose pulp fibers with the help of the hydrogen connections. The photochromic molecule was attenuated in the ionic liquid 1-butyl-3-methylimidazolium bis(trifluoromethanesulfonyl)imide. The produced paper composites demonstrate reversible, rapid, uniform and vivid coloration and bleaching upon ultraviolet and visible light irradiation. Consequently, this innovative EC device has the ability to solve these problems, which were previously mentioned, but it is flexible and easily curve due to its paper-basis. Furthermore, the white paper electrolyte with high optical reflectance increases the visibility of the device.

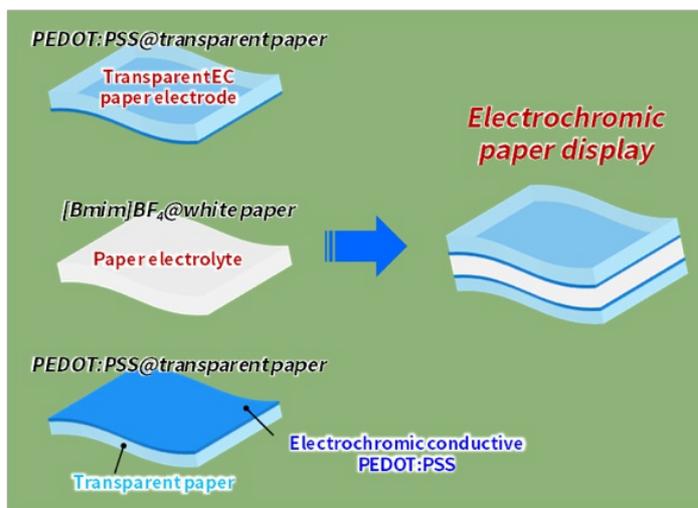


These findings are expected to further the development of composite materials with high functionality and practicality
 source - adobe.com

In additions, with the help of this innovational technique, they have already produced various paper-based electronic devices such as supercapacitors and transistors. This technology will allow researchers to create paper-based electronic books.



Conventional electrochromic display

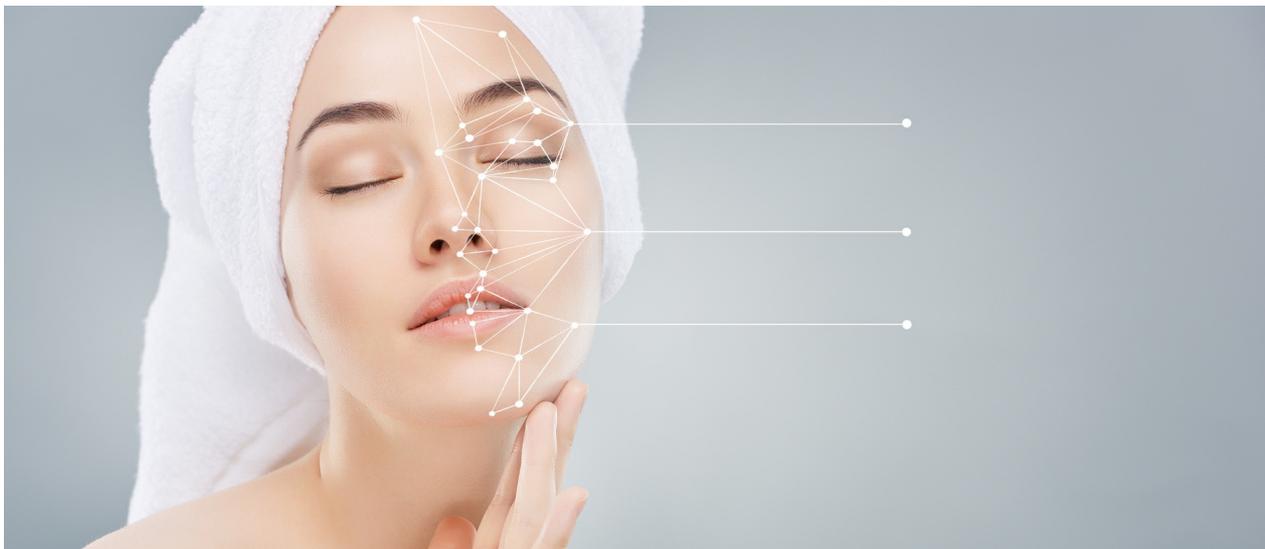


Electrochromic paper display

Schematic of conventional electrochromic display (left) and electrochromic paper display (right)

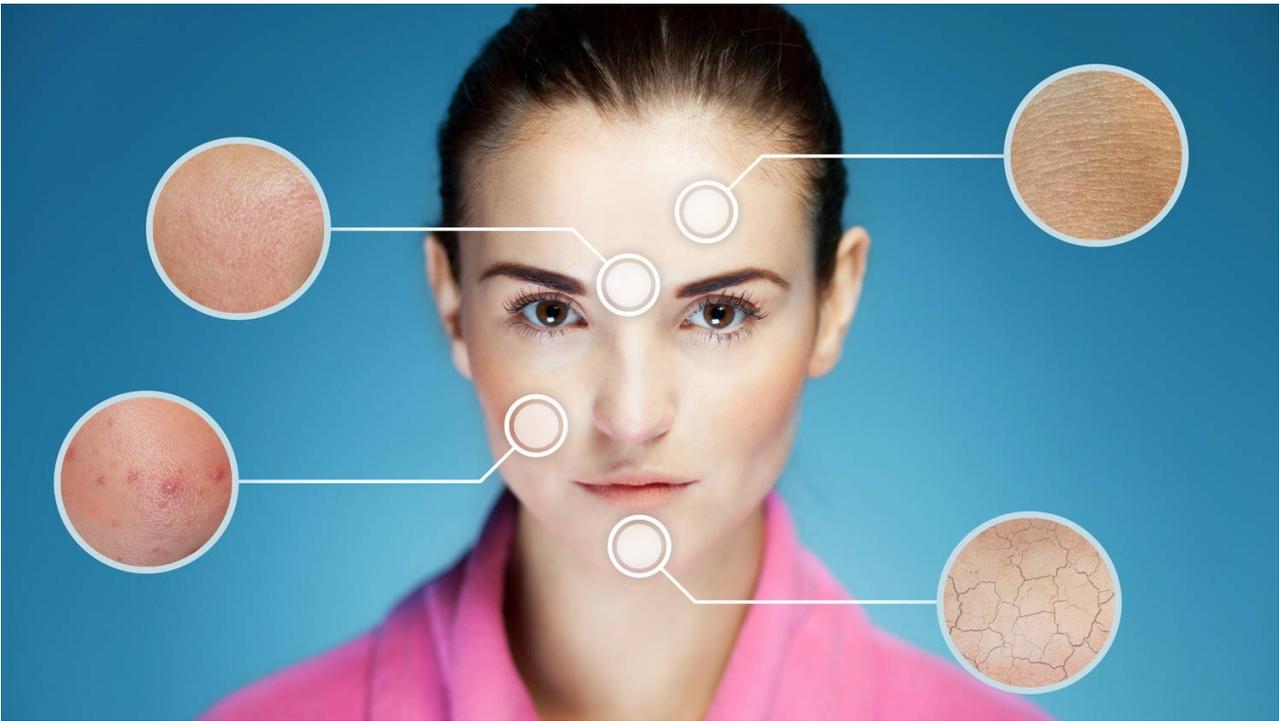
source - resou.osaka-u.ac.jp

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Patent status: -
On market since: -
Regions: Japan
Industries: Chemicals, Electronics
Source links: [ACS Applied Materials & Interfaces](#)
[Osaka University](#)



BREAKTHROUGH IN TREATMENT FOR RARE SKIN CONDITION

Recently, the Japanese government has approved the first therapy of skin lesions in tuberous sclerosis complex (TSC) that was developed by the scientific group from the Osaka University. Current methods of therapies for this disease are surgical interventions that are difficult to execute on small children and patients with intellectual disabilities, which are caused by the tuberous sclerosis complex, without general anesthesia. Comparing to the existing method, the topical gel can be locally applied to skin lesions in TSC without any operations.



The SAKIGAKE system and industry-government-university collaboration worked extremely well in the approval of the drug, which will be helpful in developing drugs for treating other intractable diseases in the future source - adobe.com

TSC is an autosomal dominant inherited disorder that is characterized by systemic hamartomas, epilepsy, cognitive impairment, and hypopigmented macules. It caused by mutations in **TSC1 (hamartin)**, **TSC2 (tuberin)** genes and the constitutive activation of **mammalian target of rapamycin complex (mTORC1)** through the dysfunction of products encoded by TSC1. This disease includes such symptoms: epilepsy, learning disabilities, developmental delays, and autism spectrum disorder in addition to hamartoma and facial angiofibromas. This type of skin problem is developed in about **90% of patients**, which is also accompanied by pain, hemorrhage, secondary bacterial infection. All these symptoms cause not only huge physiological discomfort accompanied by pain, but also significantly impair the standard of living, because it is also a cosmetic problem. Furthermore, the typical method of therapy for TSC is **the surgical intervention** that is difficult to execute on small children and patients with intellectual disabilities, which are also the result of TSC, without general anesthesia.

mTORC1 inhibitors, such as **sirolimus** can be therapeutic agents, which have the ability to act for skin lesions. Despite this fact, the systemic application of mTORC1 inhibitors can cause different side effects. Therefore, the scientific team led by **Ph.D. Mari Wataya-Kaneda** created **the topical gel of mTORC1 inhibitors**. Its types of treatment are **easy and**

painless with less toxic effects than the systemic cure. The clinical study included 36 patients aged 6 to 47 years. This medicine is the first cure, which was designated by the SAKIGAKE system. Of the 36 patients, 18 were 18 years or younger (child group), and 18 patients were 19 years or older (adult group). Concentrations of 0.5 mg, 1 mg, and 2 mg of GMP-level sirolimus bulk powder were mixed with a 100-mg gel (main ingredients are ethanol and carboxyvinyl polymer) to form 0.05%, 0.1%, and 0.2% concentrations of sirolimus gel in a GMP-level [pharmaceutical department in the Osaka University Hospital](#). This gel showed the best absorption of sirolimus compared with other vehicles. The optimal concentration of sirolimus was 0.2%.



Photographs of Facial Angiofibromas in TSC Before and After Treatment with Sirolimus gel
source - osaka-u.ac.jp

General improvement and patient satisfaction were also examined as secondary endpoints. The general improvement was evaluated using the following 5 stages: remarkable improvement, moderate improvement, slight improvement, unchanged, and worse. Patient satisfaction was evaluated in 5 grades as extremely satisfied, satisfied, slightly satisfied, dissatisfied, and quite dissatisfied. At each patient visit, a blood test was performed, and the blood sirolimus concentration was examined. The double-blind clinical trial study was performed using a web-response system for all patients. As a result, topical sirolimus gel is safe and effective for facial angiofibromas caused by TSC, especially for children.

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Patent status: -
On market since: -
Regions: Japan
Industries: Healthcare
Source links: [JAMA Dermatology](#)
[Osaka University](#)



MAKE BUILDINGS STRONG USING WOOD WASTE

The researchers' group from Singapore has managed to develop an innovative technology in order to improve building structures. It based on the mixing of biochar from saw dust with cement that makes concrete, which used in buildings, stronger at 20% and watertight at 50%. The novel development is absolutely eco-friendly as biochar is recycled. Furthermore, the method will allow reducing of a large amount of wood waste.



Kua Harn Wei, Mr. Souradeep Gupta, Mr. Manikandan Jayaraj, Associate Professor Kua Harn Wei from the Department of Building at NUS School of Design and Environment
source - nus.edu.sg

The technology of improving buildings constructors reusing wood waste was developed by the scientific group, which is led by [Associate Professor Kua Harn Wei](#), from the [National University of Singapore](#).

A well-known fact that wood was the main source of energy until the mid-1800s. Furthermore, wood continues to be a significant part of the natural source and even fuel in many countries, especially in developing countries. Furthermore, there are many technologies of wood reused were invented. The quality of recovered wood in different waste streams varies considerably and different end uses can utilize different types depending on their technical and commercial capabilities. Biomass facilities can consume a variety of different biomass feedstock, including wood waste. Despite the presence of various methods of wood waste reused, the significant part of which is disposed of in landfills or burnt.

Scientists discovered that [biochar, which was generated from wood waste, is the suitable material for buildings improvement](#). It is a carbon-rich material that has the ability to [effectively absorb and keeps the water](#). Biochar is produced from the biomass and often applied in the field of agriculture as an alternative soil to enhancement crop yield.



The use of biochar technology in concrete construction, therefore, offers an innovative approach to store large amounts of carbon in buildings while enhancing the building structures
source - adobe.com

The scientific group mentioned that a small amount of produced **biochar has the ability to make concrete structures stronger at 20% and impermeable to water at 50%**. The technology is based on the using of the porous and fibrous structure of the biochar and its absorption and keeping characteristics. It significantly increases the **solidification of the concrete that provides the improvement of the buildings' strength**. Using this technology, up to **50kg** of wood waste can be utilized for each tonne of concrete production. In other words, about **6 tonnes** of wood waste can be reused for each house unit with a **100sqm** floor area.



The NUS team is currently in discussion with a local firm to explore the commercialization of this technology and is also leveraging this technology to develop other high-performance cement composites with a wide range of applications

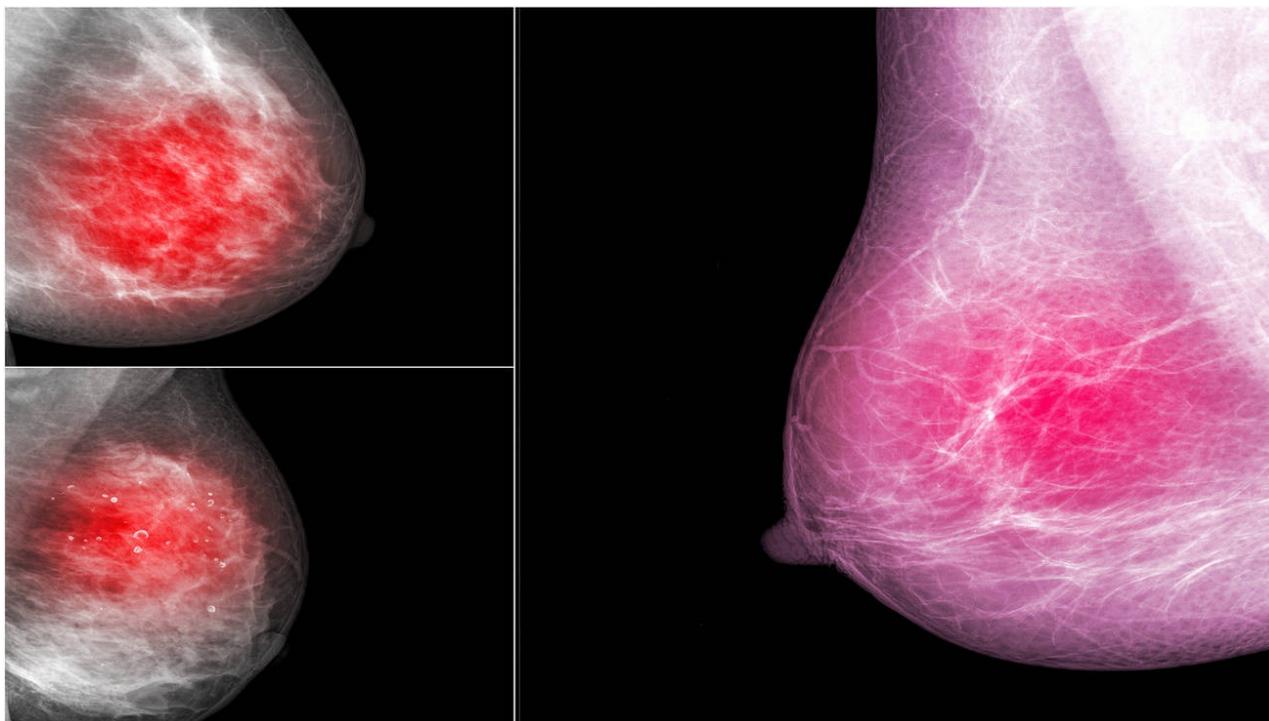
source - adobe.co

Company name: National University of Singapore
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Patent status: -
On market since: -
Regions: Singapore
Industries: Construction, Environment
Source links: [National University of Singapore](#)



NEW AND COST-EFFECTIVE BREAST CANCER SCREENING TOOL

The Indian spinoff NIRAMAI provides a highly-accurate, automated, portable and non-invasive cancer screening tool that is easily operated. In contradistinction to mammography, this novel technology is radiation-free and unpainful. It does not require any touches and pushes. Furthermore, this method is suitable for women of all ages. Developers hope that this novel technology can be applied in the cancer diagnostic test in usual hospitals for regular preventive health checkups, and, moreover, for large-scale screening in village and semi-urban areas.



Thermography can detect breast cancer in ways that are non-invasive, non-ionizing and non-traumatizing. This innovation can bring breast cancer screening to the doorsteps of women all over the world

About **95%** of breast cancers are curable if detected early. In countries with advanced care, the rate is **80% - 90%** for those with a first-stage diagnosis, and **24%** if diagnosis occurs at a later stage. There are **76,000** women die in India. [NIRAMAI](#) that was founded by two women **Dr. Geetha Manjunath** and **Nidhi Mathur**, which are represents over **25** years of investigations and innovation expertise in different fields. Consequently, this technology performs the non-invasive risk assessment with machine learning. It is the cost-effective, accurate, safe and easy to use screening method that is suitable both for medics and patients. Developers tried to create **a universal cancer screening technique that can save lives by identifying breast cancer at an early stage.**

The basic technique of this solution is **an artificial intelligence diagnostic platform SMILE**. The device is based on **the high-resolution thermal sensing technology and a cloud-hosted analytics solution for analyzing and determining via thermal images**. The data is decomposed using their **Termitex** technology, which was recently patented, for analyzing the condition of the breast. After that, it has the ability to automatically produce a report about the particular parameters that were received with the help of this device. Consequently, the automated report generation with unique parameters, which were generated by thermolytic, make potential abnormalities. These innovative techniques have led to multiple US patents. Furthermore, their new algorithms have been peer-reviewed in

different international scientific conferences. The device has been tested on 300 patients data from 2 hospitals and 1 diagnostic center. The clinical study results determine highly-accuracy that is more precise mammography. The spinoff provided 2 clinical trials with established hospitals to perform large-scale, statistically significant clinical trials.



Unlike mammography, this imaging method is radiation free, non-touch, not painful
source - adobe.com

There were in 2017, the company has been selected to be a part of [Google Launchpad Accelerator](#), [Philips HealthWorks Accelerator Programme](#), and [Axilor Accelerator Programme](#).



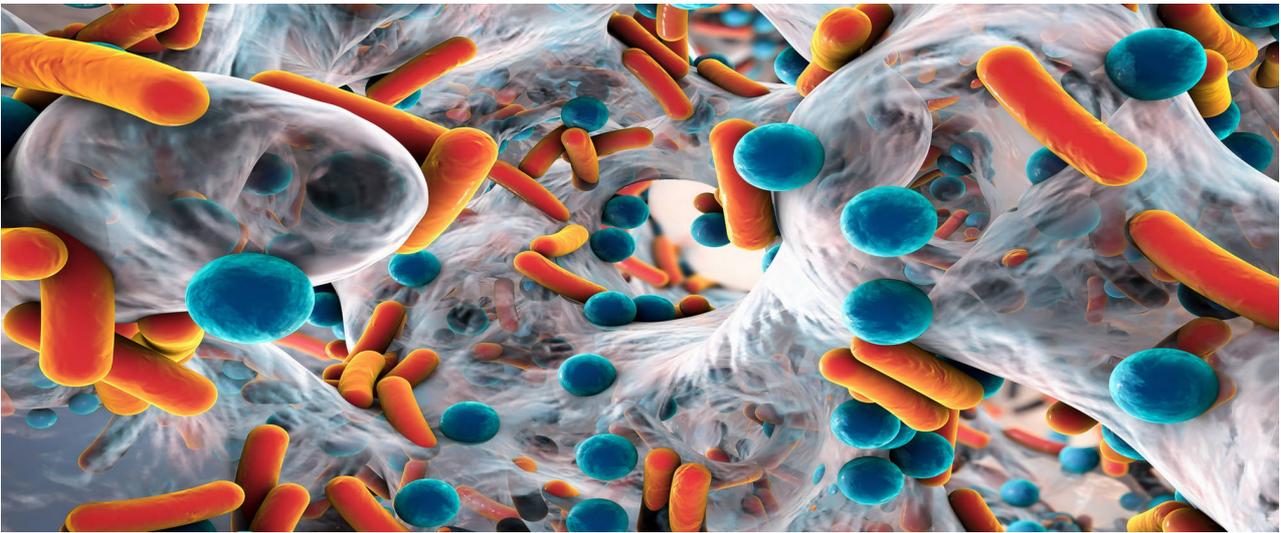
Breast Cancer is the leading type of cancer in women. According to WHO, one in every 8 women in US is at the risk of developing a breast abnormality in her life time
source - adobe.com

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Website: <http://niramai.com/>
Phone: -
Patent status: +
On market since: -
Regions: India
Industries: Healthcare
Source links: [NIRAMAI](#)
[Inc42](#)



NEW HEALTHCARE PLATFORM DEVELOPS UNIQUE DIAGNOSTIC TESTS

iGenetic Diagnostics spinoff, which is based in Mumbai, provides and creates a wide range of unique medical test in order to maximize coverage of a patient's pathology needs. The spinoff offers differential diagnosis panels in addition to a highly precise range of individual laboratory tests in various medical areas such as oncology, gynecology, and infertility. iGenetic has the ability to perform many in-house tests and products that, currently, are not accessible on the market today and others different innovative tests, which have been just commercialized.



iGenetic has in-house assays for molecular detection of pathogen and antibiotic resistance. These assays are done directly from the samples and have been verified by CAP proficiency testing (PT)
source - adobe.com

Usual microbiology technologies are time-consuming. It can take **2 - 3 days** to grow different types of bacteria and much more time to grow fungi and other dangerous pathogens, which cause various diseases. Furthermore, if the patient had antibiotic treatment, the pathogen cannot be grown using these technologies. Beforehand and accurate diagnosis of serious health risks can not only save people's lives but also decrease the time that patient need to stay in the hospital. [iGenetic](#) uses molecular technologies, which are considerably faster, to detect hazardous infections and drug resistance. Moreover, it has the ability to report within 24 hours even in the case when the patient has started antibiotic cure.

According to a data, as of **March 2017**, the spinoff provides **1,400 tests** such as leading analyzes for cancer, infertility, infectious diseases and other types of typical laboratory tests. Recently, the spinoff has raised \$20.48 million, with major **\$19.5 million** secured in **March 2017** from [CDC Group Plc](#). Earlier in **2015**, they had raised **\$1.5 million**. The company is housed in an ICH, NABL, and CAP compliant laboratory with its central processing laboratory spread over a **10,000 sq ft** facility in Mumbai with satellite labs in different India' cites such as Delhi, Nagpur.

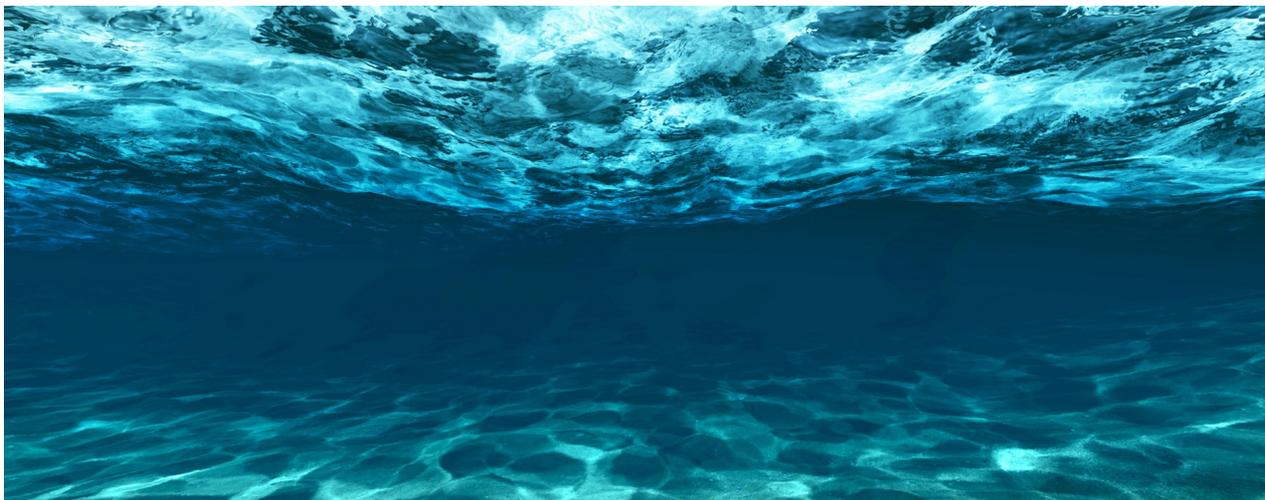
The company applies a massively parallel sequencing technology called **Next Generation Sequencing (NGS)** that allows doctors to sequence DNA and RNA much more quickly. The main goal is to provide patients and **clinicians better therapeutic options based on the patient's molecular profile** of clinically actionable mutations and enable improved

progression-free survival and quality of life, especially during treatment. They detect the pathogens such as Spirochete, Chlamydia, Helminths that cause various infectious diseases involves direct and indirect methods of detecting. Furthermore, using new sequencing and array technologies such as NGS the company has the ability to diagnose neurological disorders and rapidly identify genetic disorders.



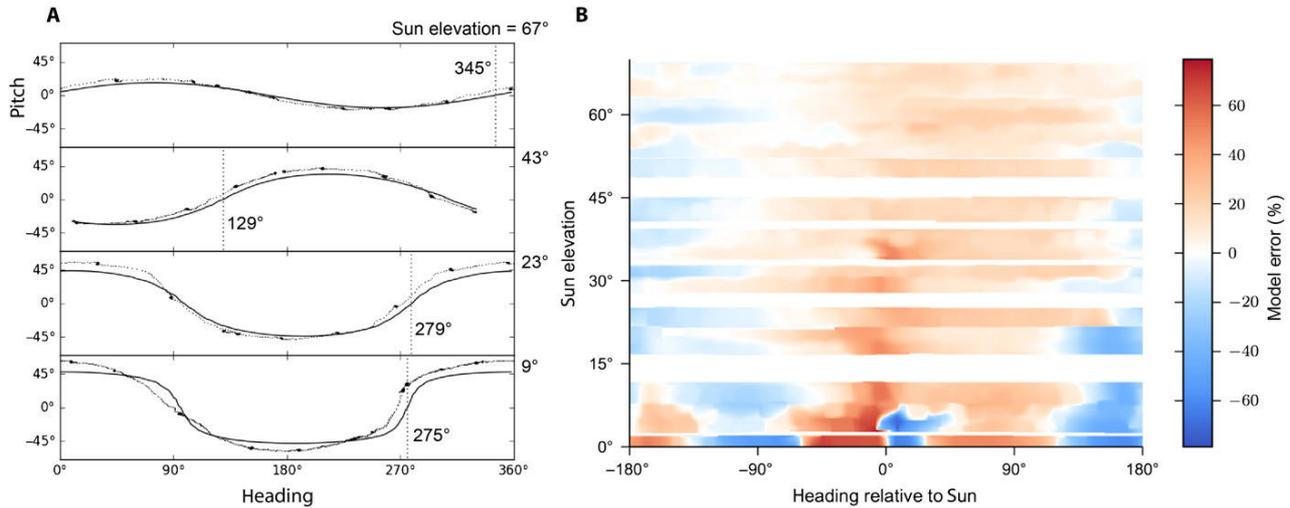
Lab equipped with high-end machines like Next Generation Sequencing, PCR etc. Well qualified and experienced pathologists and doctoral laboratory scientists
source - adobe.com

Company name: iGenetic Diagnostics
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Website: <http://www.igenetic.com/>
Phone: -
Patent status: +
On market since: -
Regions: India
Industries: Healthcare
Source links: [iGenetic](#)



A NOVEL UNDERWATER GEOLOCATION METHOD

Scientists inspired by mantis shrimps and squid have managed to develop a highly-accurate technique of underwater navigation. The technology based on the using of the imaging equipment that is sensitive to polarising light. Currently, scientists built polarisation sensors, which were able to define the position of the sun in the sky based on patterns of light underwater. Furthermore, this innovative technology will provide more accurate and cost-effective navigation for a long distance.



Polarization angle measurements from four experiments at varying Sun elevations. Measurements are indicated by dots; model predictions, by solid lines; the heading to the Sun, by the vertical dotted lines
source - advances.sciencemag.org

Dr. Samuel Powell noted that most current navigation systems cannot perform underwater. For example, satellite-based GPS has the ability to operate to a depth of about 20 cm. The visibility underwater is also limited, consequently, old methods such as lighthouses cannot operate, because the ultimate distance people can see is around 100 m. Today, submarines use GPS at the surface of the water. This is not only an inexact method but also dangerous because they rely on dead data when determining their position. It means that mistake is inevitable. The longer team works without GPS, the more erroneous calculation will be.

The technology was created by the scientific group from the [University of Queensland](#) in cooperation with the [Washington University in St. Louis](#) and the [University of Illinois at Urbana-Champaign](#).

Furthermore, the team showed that **underwater polarization light patterns not only are highly structured and dependent on the position of the Sun but also can be used for geolocalization purposes**. It is much more complicated and complete task than performed by a compass when it comes to navigation in underwater environments.

The Sun's heading and elevation angles can be determined and hence **the position of the observer can be estimated with accurate knowledge of time and date**. To test this hypothesis, the team collected data for inferring the Sun's position from underwater polarization angles using **a bioinspired, visible-spectrum imaging polarimeter**. Scientists

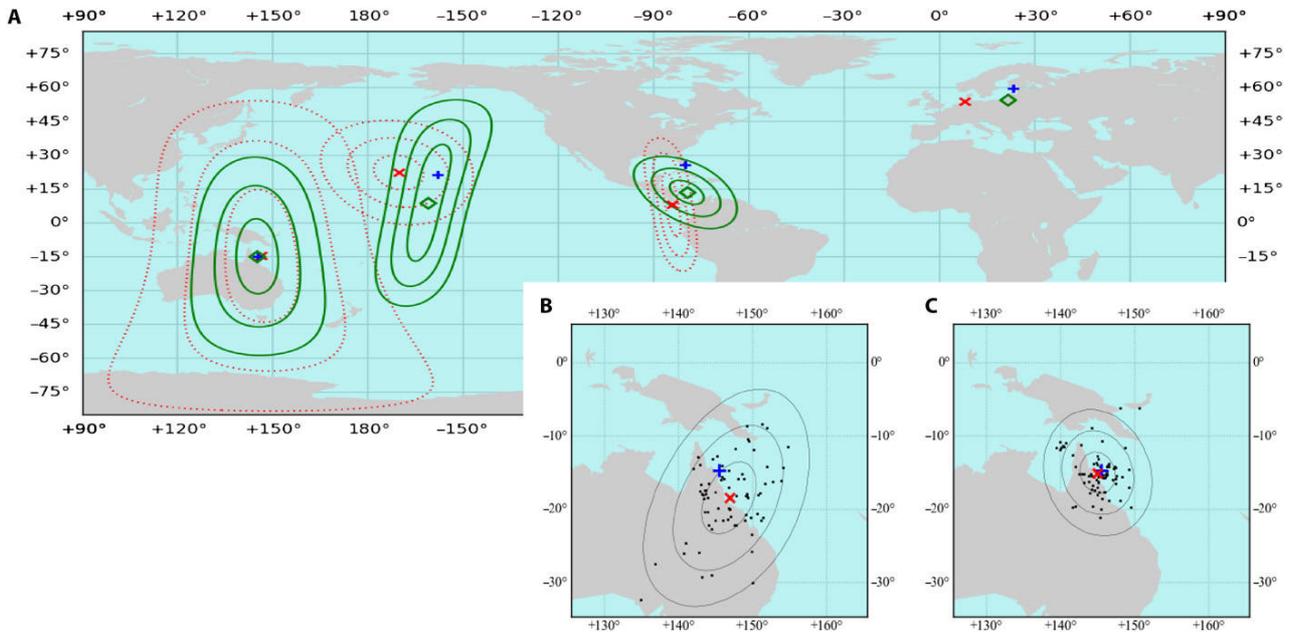
paired bioinspired polarization camera with an electronic compass and tilt sensor within an underwater housing to measure the underwater polarization angles versus heading at a variety of sites, depths, and times of the day. Researchers wanted to determine the minimum distance between two sites required for the camera to detect significant differences in their underwater polarization patterns. The Sun's elevation varied from 30° to 71° over the course of the experiment, which indicates that the noise characteristics of the polarization signals are stable over long periods and under a variety of solar elevations.



Scientists studied marine animals that use polarisation to communicate. They mentioned that some species use the polarisation of light to navigate

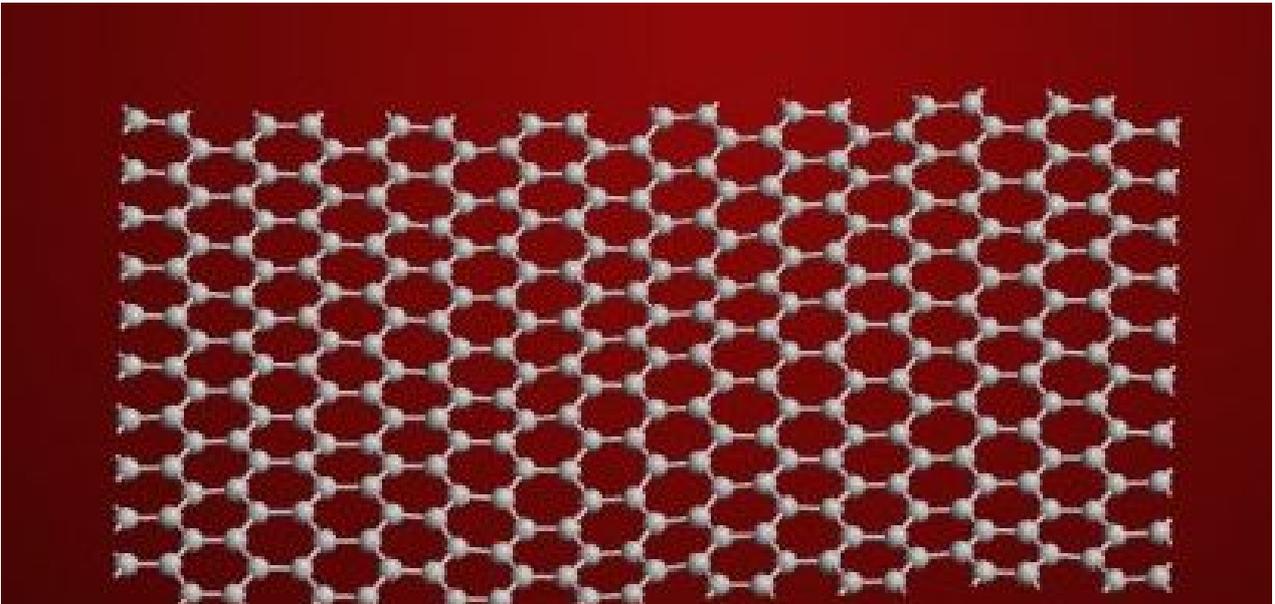
source - adobe.com

The sensor mimics the polarization-sensitive vision system of the mantis shrimp by integrating various polarization optics within individual pixels of a camera. More specifically, polarization filters composed of parallel aluminum nanowires (140 nm thick × 70 nm wide) are aligned and deposited onto each pixel of a low-noise, 2-megapixel charge-coupled device image sensor. Similar to its biological counterpart, the pixelated polarization filters are oriented at set angles of 0°, 45°, 90°, and 135° in a repeating 2 × 2 patterns across the focal plane. This enables the polarimeter to capture intensity, partial polarization, and polarization angle images. Consequently, using polarisation sensors, this novel technology allows the real-time geolocalisation underwater with more precise long-distance results, without the require resurfacing periodically such as with GPS.



The blue pluses show the location of the collection site, black dots are individual position estimates, and the red exes show the mean position estimate. The concentric curves are at 1, 2, and 3 SDs from the mean source - advances.sciencemag.org

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Patent status: -
On market since: -
Regions: Australia
Industries: Aerospace, Defence and Marine, Others
Source links: [Science Advances](#)
[University of Queensland](#)



A COST-EFFECTIVE TECHNOLOGY FOR MASS MANUFACTURING OF HIGH-QUALITY GRAPHENE

The international group of researchers developed an economical and industrially viable technique to produce graphene. The innovative technology solves the long-standing challenge of the efficient process of large-scale manufacturing of graphene and opens the way for the sustainable synthesis of this material. Furthermore, it is an environmentally friendly technique.



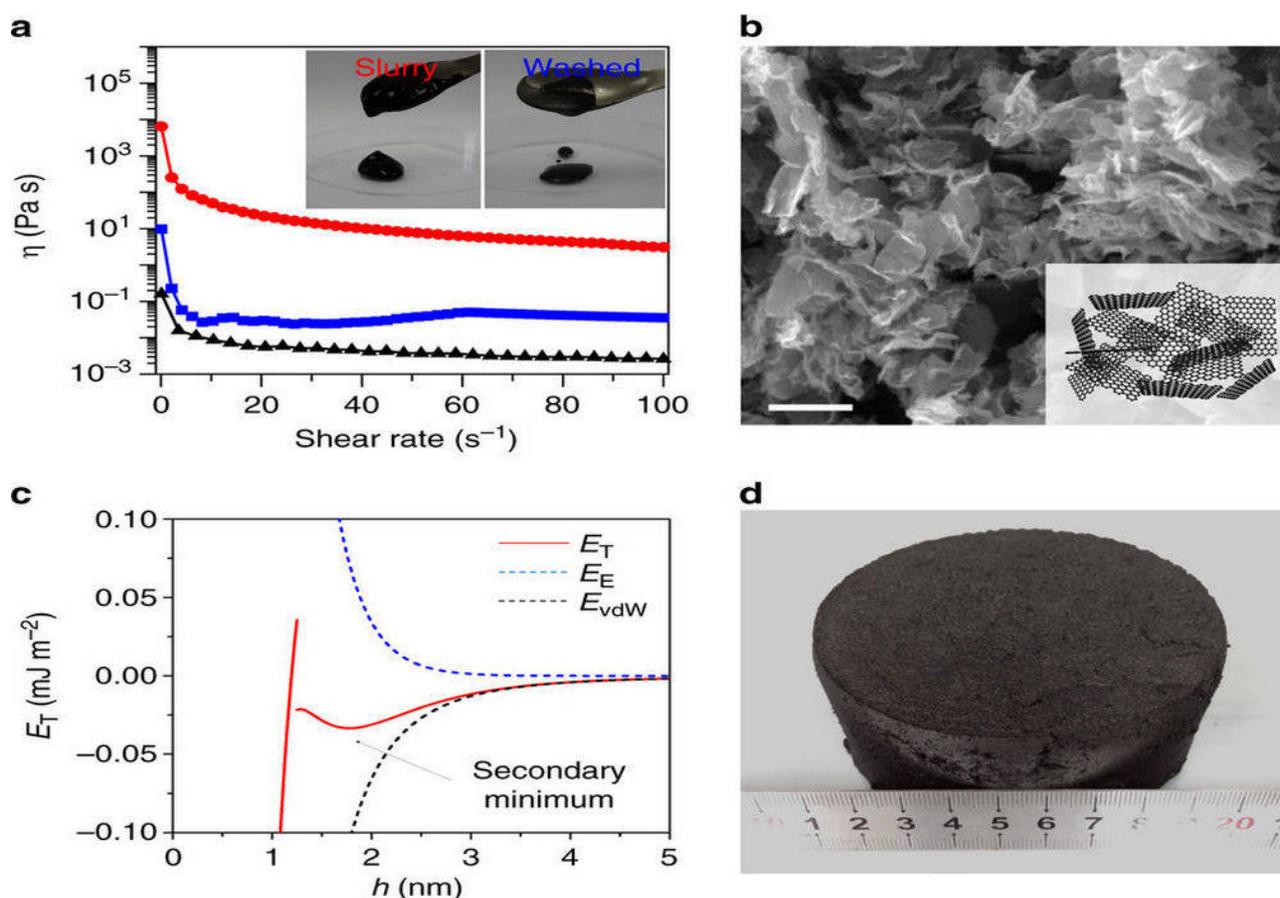
Professor Loh Kian Ping (left)
source - nus.edu.sg

The development was made by the scientific team from the [National University of Singapore](#) in cooperation with the [Fudan University](#).

The biggest advantage of the graphene, except for its extra solidity and ultra-small thickness, is its unique electronic characteristic that can potentially be used for a wide range of applications. Despite this fact, the difficultness of its production on a large scale prevents its wide implementation in various industries. Liquid-phase exfoliation is a promising technique to realize the scalable production of high-quality graphene or graphene oxide. Nevertheless, it requires extensive quantities of solvent in order to purify and dispersion. Only a very small amount of graphene can be dispersed in common solvents. Disperse agents can improve this process at a minimum. To produce 1 kg graphene by such method requires at least 1 ton of solvent. As a result, this technology is extremely harmful to the environment, moreover, it is environmentally inaccessible.

The international team of scientists developed a **non-dispersion technique in which graphene is produced and stored as a flocculated aqueous slurry with concentrations as high as 50 mg mL⁻¹ (5 wt%)**. The adsorbed ions have the ability to prevent the re-stacking of graphene flakes. Previously, the oxidized graphite is used as the predecessor that is flake off by high-rate shearing in an alkaline aqueous solvent of pH = 14. In this case, graphene flakes, which were flaked off, are capable to create low-viscosity, flocculated

slurry.

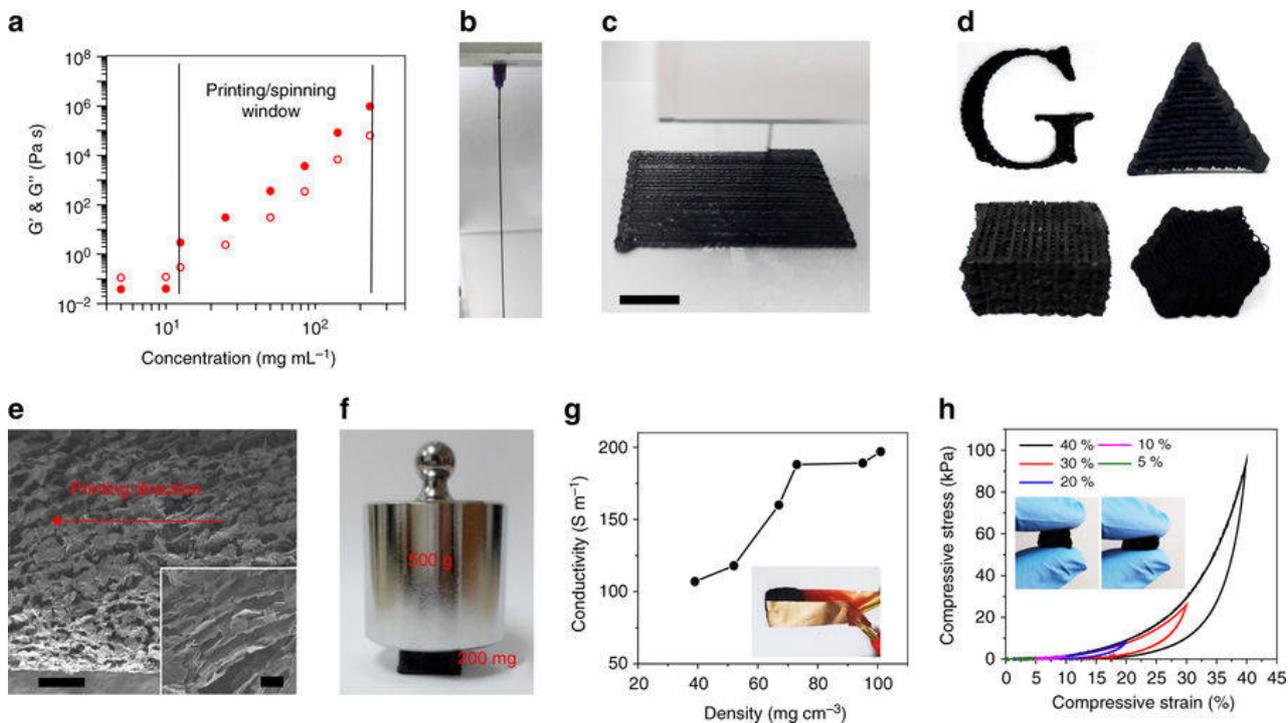


Graphene slurry was filtered through a G4 filter funnel, obtaining a wet graphene cake with a solid content of 23 wt%. Scale bar: b 20 μm
source - nature.com

Such graphene slurry possesses a **three-dimensional (3D)**, which was freely formed microstructure with tunable modulus and viscosity. High-concentration of these slurries are highly requested in order to fabricate different functional materials, for instance, printing or spin-coating typically requires a work window of high solid contents. During the exfoliated at pH = 13 or 14, flakes rapidly flocculate due to the compressed EDL, which **reduces the system viscosity and facilitates exfoliation**. The flocculated graphene flakes are unable to form π - π stacking due to the presence of adsorbed ions and the loose stacking, as the result, that they can be re-dispersed in NMP or alkaline solutions. Furthermore, it can be **directly used for 3D printing to form graphene aerogels and conductive polymer materials, without any supplementary processes**. The printed graphene aerogels can be used as 3D templates for in-situ polymerization that are perspective for energy harvest devices developing and durable absorbent materials.

Consequently, the international group of researchers showed an industrially viable water-

phase shelling technique for creating high-quality graphene. In contradistinction to typical current oxidation-reduction methods, this non-dispersion exfoliation technology provides the economical, extensive manufacturing, storage and transport of graphene in the aqueous medium.



Fabrication of graphene composites by the 3D printing of concentrated slurry. a Log-log plots of the modulus at 1 Hz versus the concentration of graphene slurry
source - nature.com

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Patent status: -

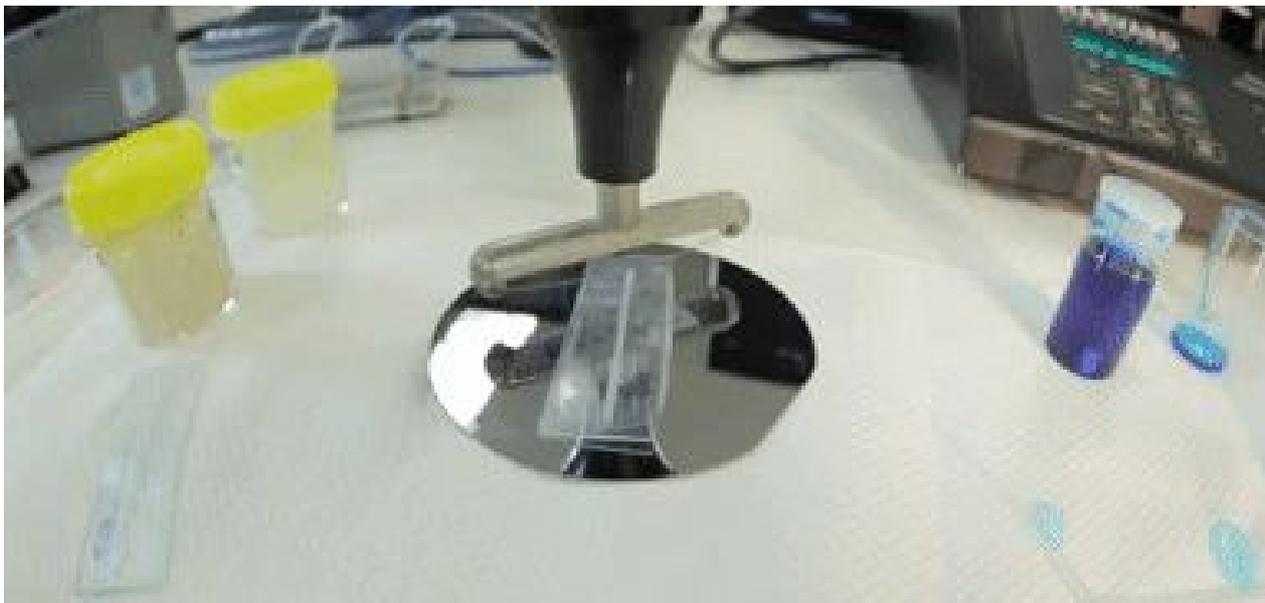
On market since: -

Regions: China, Singapore

Industries: Chemicals, Electronics, Energy

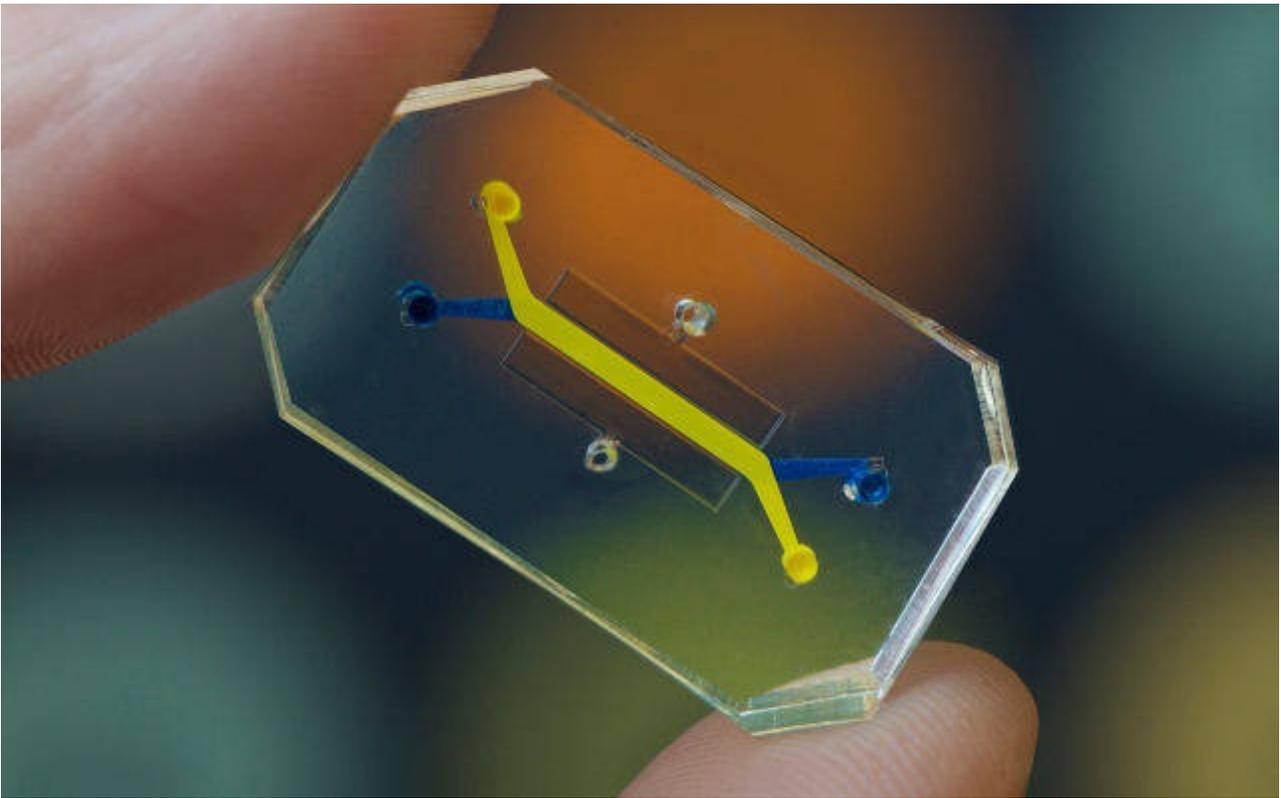
Source links: [Nature Communications](#)

[NUS](#)



A COST-EFFECTIVE METHOD TO DETECT A DISEASE USING A NOVEL CHIP

The group of scientists has managed to create a fluorescent label-free quantitative chip that can detect different diseases in a high-accurate and cost-effective way. This technology is based on measuring changes in size and/or electrostatic charges of 1 μ m polymer beads due to the capture of target bioparticles on the surface. The method provides wide opportunities for various types of medical diagnosis such as liquid biopsy, detection of biologically relevant DNA, RNA, viruses, proteins, and exosomes.

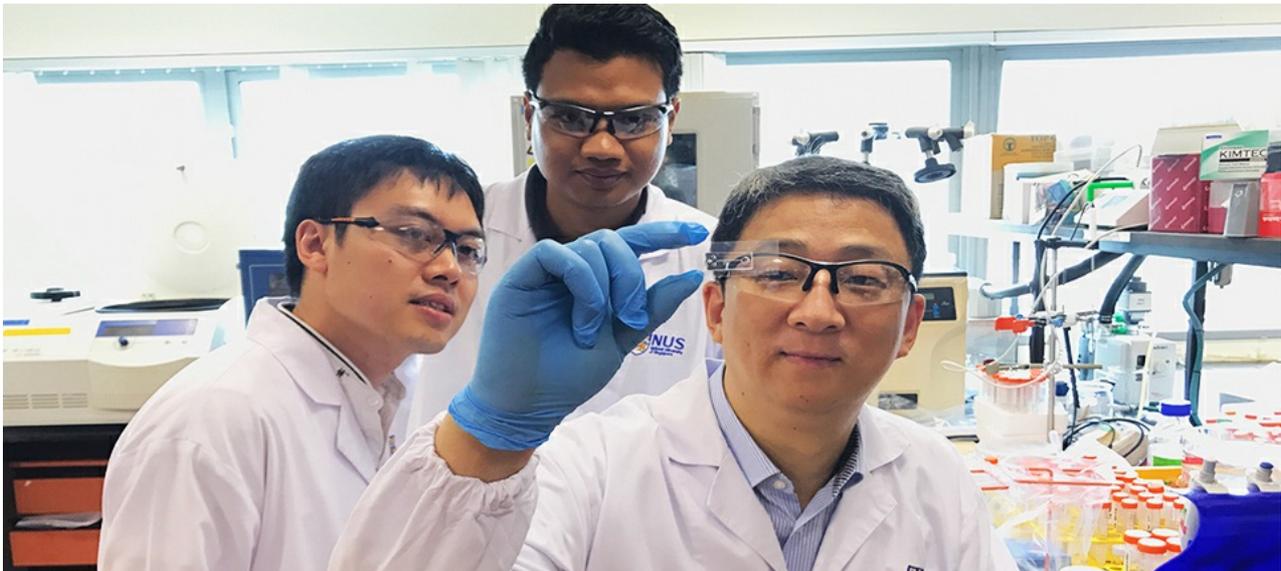


The low-cost microfluidic chip that can quickly and accurately detect and quantify nano-bioparticles
source - the-scientist.com

The invention was made by the scientific group that includes [Dr. Kerwin Kwek Zeming](#), [Ph.D. student Mr. Thoriq Salafi](#) and [Ph.D. student Ms. Swati Shikha](#), led by [Professor Zhang Yong](#) from the [NUS](#).

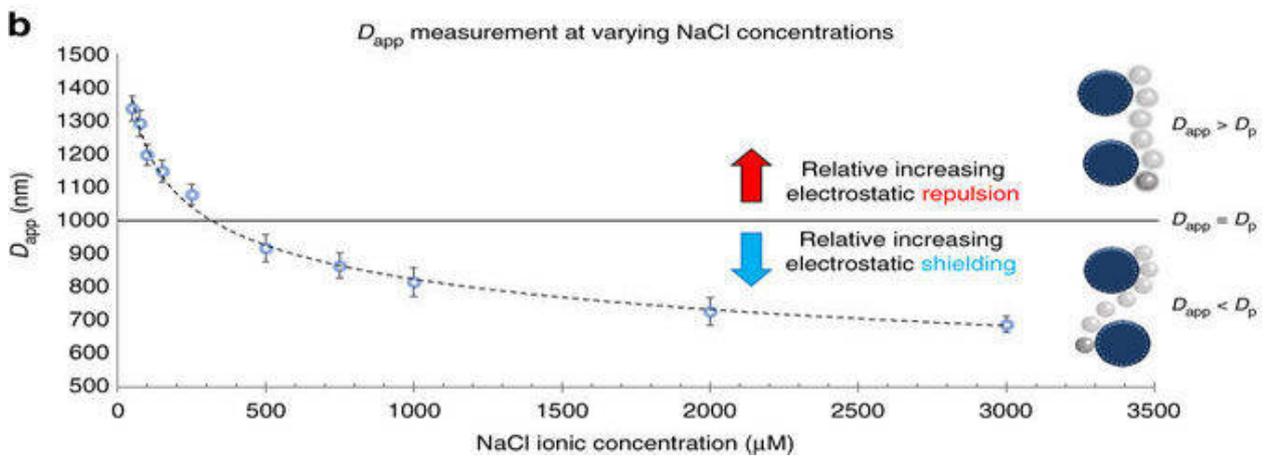
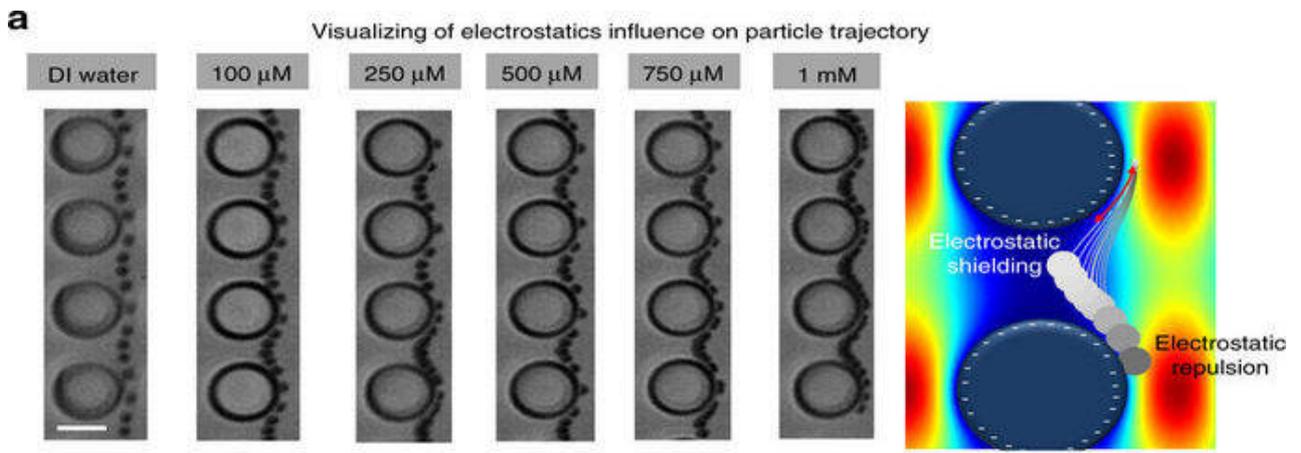
To diagnose certain illnesses doctors need to identify and classify various bioparticles such as DNA, RNA, proteins, virus, exosomes, and bacteria. Typical medical laboratories use determined sandwich assay, PCR, gel electrophoresis, and flow-cytometry technologies for identifying these bioparticles. Despite this fact, these technologies use the fluorescent label. It significantly increases the cost and complicity due to the expensive optical systems using and applying of multiple sample processing steps, which require minimum sample contents.

The label-free technique can be a suitable alternative to decrease the cost and difficultness. Nevertheless, this unique method requires accurate engineering of nano-features in the detection chip. Furthermore, such technique needs intricate optical equipment, nano-probes or supplementary enhancement steps in order to achieve sensitive detection of biomarkers.



Professor Zhang Yong and the team
source - nus.edu.sg

Consequently, scientists developed a fluorescent label-free method for sensitive detection of bioparticles using a micrometer-sized pillar array in a **deterministic lateral displacement (DLD) device**. The technology is based on the measurement of changes in size and electrostatic charges of 1 μm polymer beads catching target bioparticles on the surface. DLD pillar array platforms were used for size-sensitive separation of circulating tumor cells to bioparticles such as DNA and exosomes. The botanicals displaying is operated through lateral displacement changes as a result of the modulation of microbead surface charge or size induced by the adsorption of bioparticles. This innovational device has the ability to provide **wide opportunities for different types of medical diagnostics methods** such as liquid biopsy, detection of biologically relevant DNA, RNA, viruses, proteins, and exosomes.



Visualization of electrostatic dominant lateral shift phenomena
 source - nature.com

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Patent status: -

On market since: -

Regions: Singapore

Industries: Healthcare

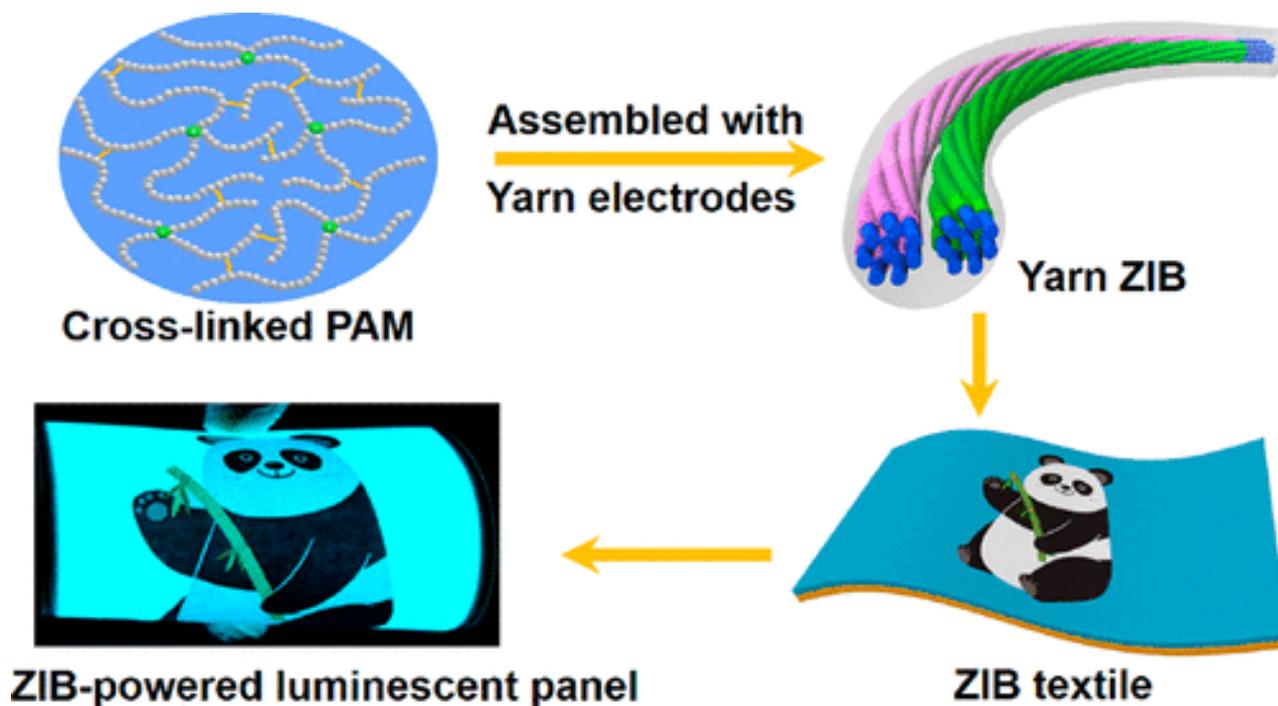
Source links: [Nature Communications](#)

[NUS](#)



A FLEXIBLE AND WATERPROOF YARN BATTERY

A novel development will bring new possibilities in the sphere of wearable electronics creating the next-generation flexible electronic devices. Chinese scientists have managed to create a waterproof and tailorable elastic rechargeable yarn zinc ion battery using a cross-linked polyacrylamide electrolyte. Furthermore, this innovational type of battery can be cut keeping its high-performance characteristics.



Emerging research toward next-generation flexible and wearable electronics has stimulated the efforts to build highly wearable, durable, and deformable energy devices with excellent electrochemical performances
source - pubs.acs.org

When people think about knitting, they usually image a lot of warm sweaters, cute gloves, and nice hats. Certainly, people can't even imagine that their scarf could power a watch and a new shirt demonstrates medical indicators. The group of scientists from the [City University of Hong Kong](#) in collaboration with the [Shenzhen University](#), [Harbin Institute of Technology](#) and [Tsinghua University](#) have developed a waterproof yarn battery, which has the ability to be carved saving its effectiveness.

Most users are acquaintanced with smartwatches. In order to make the wearable electronics more common type of products, researchers need to make it more universal and sturdy keeping its flexibility. They must overcome some issues making the device resistance, versatile, waterproof saving its flexible characteristics, which allow this type of electronics to be deformed without losing its features. Consequently, the team decided to use dimensional fiber or yarn due to its small thickness, elasticity, and lightweight.

The scientific group has developed the **waterproof, tailorable, and stretchable yarn zinc ion battery (ZIB)** with high efficiency using double-helix yarn electrodes and a cross-linked polyacrylamide (PAM) electrolyte. This type of electrolytes and helix structured electrodes have high ionic conductive characteristics. The yarn zinc ion battery provides a high specific capacity and volumetric energy stiffness (302.1 mAh g⁻¹ and 53.8 MWh cm⁻³). In

addition, it keeps good cycling stability that is about 98.5% permittance retention after 500 cycles. Furthermore, the quasi-solid-state yarn batteries show preferable knittability, high stretchability (up to 300% deformation). It has the excellent waterproof characteristic.



Pieces of flexible, rechargeable yarn batteries can be connected in series to power electroluminescent panel displays

source - techxplore.com

In addition, the innovational development can be cut into short pieces, and each part will operate well. Scientists have managed to cut 1.1 m long part into 8 pieces and woven into a fabric, which was used to feed the elastic belt embedded with 100 LEDs and a 100 cm² flexible electronic panel.

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Patent status: -

On market since: -

Regions: China

Industries: Electronics

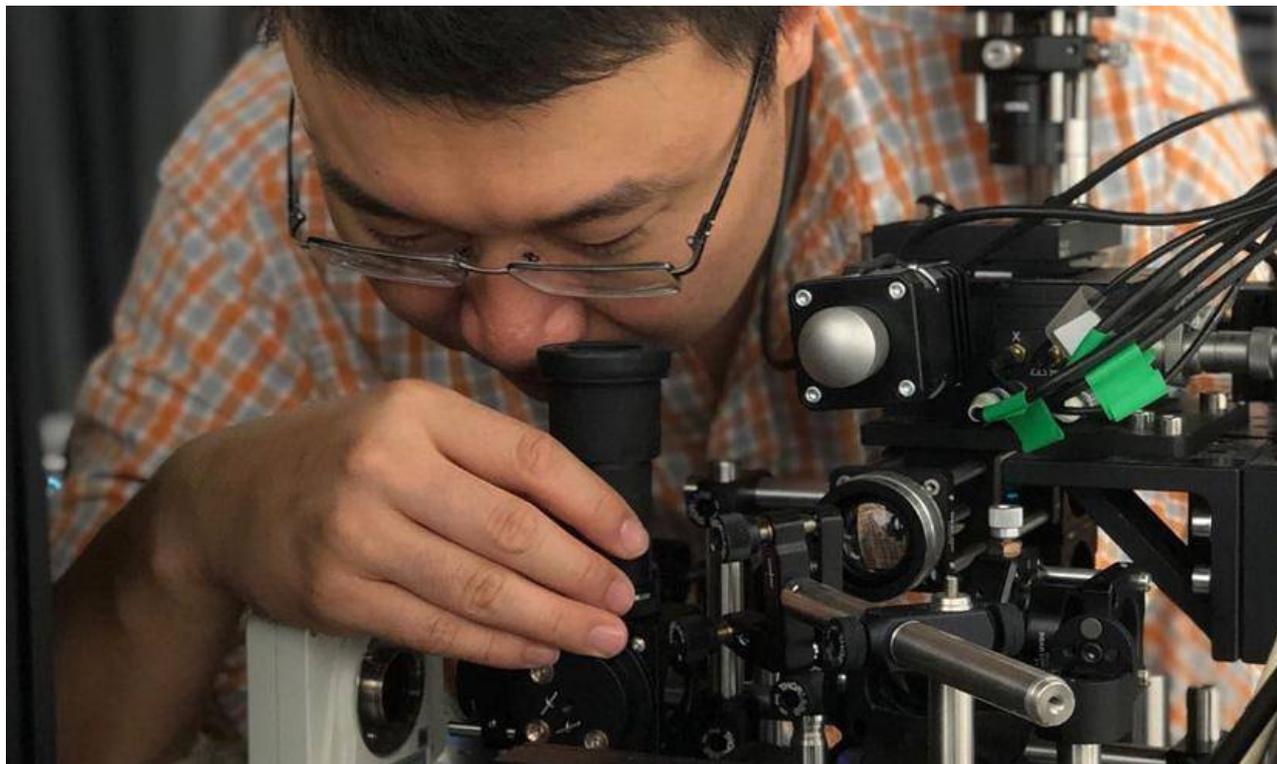
Source links: [ACS Nano](#)

[Lab Manager](#)



AN INNOVATIVE MICROSCOPIC SENSOR

Scientists have developed a new microscopy technique that is aimed to improve the resolution and sensitivity of nanoscale imaging. The discovery provides the ability for the human eye to monitor a single molecule and inspect its behavior inside a living cell. It means that this novel technology can observe the individual cell in real time. Scientists mentioned that it will provide the fundamental understanding of how cancer cells spread or how a particular treatment works.



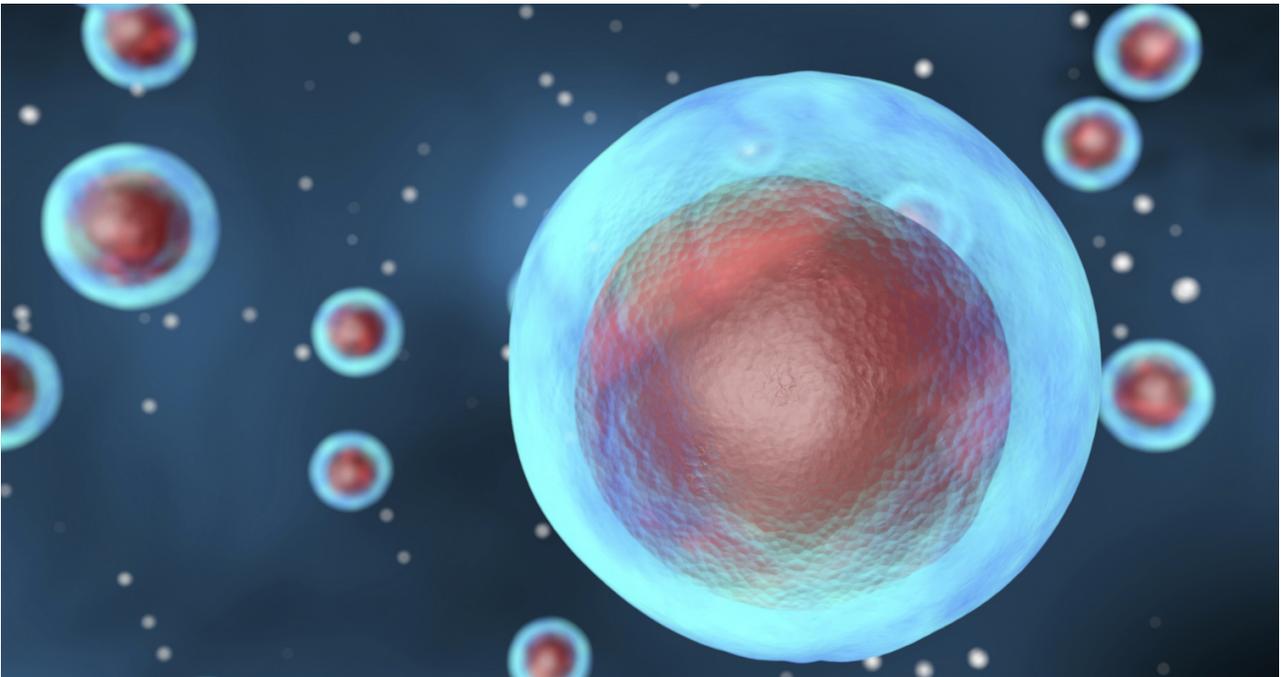
Dr. Fan Wang's pioneering bio-photonics research means the human eye can track a single molecule and inspect its behavior inside a living cell

source - uts.edu.au

The innovational device was created by the researchers' team, led by [Dr. Fan Wang](#), from the [University of Technology Sydney](#).

Nanoparticles have become new tools for cell biology imaging, sub-cellular sensing, super-resolution imaging and drug delivery. Long-term 3D tracking of nanoparticles and their intracellular motions have advanced the understanding of endocytosis and exocytosis as well as of active transport processes. The sensitive operation ability of correlative optical-electron microscopy and scientific-grade cameras are often used to study intercellular processes.

Notwithstanding, most of the current investigations are still limited by the insufficient sensitivity for separating a single nanoparticle from a cluster of nanoparticles or their aggregates. Scientists have used a new class of nanoparticle sensors, [upconversion Super Dots](#), which has the ability to transform low-energy near-infrared photons into high-energy visible emissions. They made series of monodispersed [upconversion nanoparticles \(UCNPs\)](#) with a brightness that already meets the requirement for human eyes to observe single nanoparticles through a microscope.



The research was funded by the Australian Research Council and National Health and Medical Research Council source - scimex.org

The team performed a definitive vision test in order to test **14 volunteers** to determine the number of emitted photons from single nanoparticle required to be distinguished by a human eye. As the result, they found that at least **4186 photons per 100 ms** are required for all tested eyes to see 2 separate blue nanoparticles.

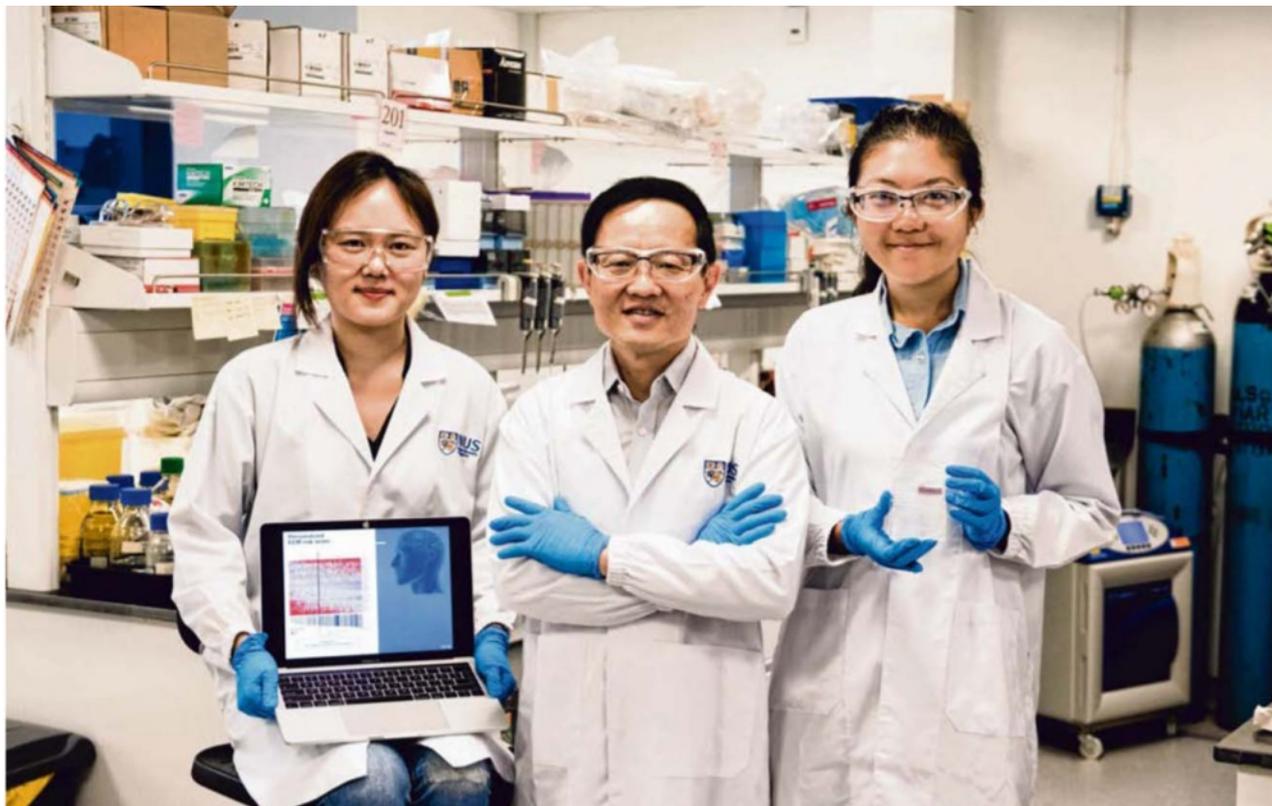
Such accurate device will provide the ability to study what is happening inside the cellular compartments responsible for how the human body operates and responds to treatments for disease and infection. Furthermore, scientists can monitor individual cells **in real time**. The importance of the real-time observation of single cellular event comes from the detection of sub-cellular vesicles and protein movements and understanding their interactions in the complex cellular function. It means that they will be able to **understand how cancer cells spread and how a particular treatment performs**.

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On market since: -
Regions: Australia
Industries: Healthcare
Source links: [University of Technology Sydney](#)
Files: [Nature journal Light: Science & Applications](#)



THE NOVEL DEVICE CAN PROVIDE TESTING OF CANCER DRUGS

Scientists have managed to develop a novel device that has the ability to grow cancer cells extracted from the blood of patients into tumor clusters, and which allows drugs to be tested on these tumors in different doses and combinations. Furthermore, it means that this invention will allow doctors to create personalized treatment for individual patients. This novel method is more effective and less time-consuming.



Ph.D. students Lim Su Bin, Professor Lim Chwee Teck, Dr. Khoo Bee
source - news.nus.edu.sg

The device was developed by the scientific group, led by [Professor Lim Chwee Teck](#), from the [National University of Singapore](#).

Due to this novel technology scientists are a step closer to developing cancer treatments tailored for individuals patients. They will be able to extract cancer cells from the patient, growing them in the laboratory and then testing different medications on them. The biggest advance of this method is that it operates outside the human body. This process enables researchers to find out **which drug or combinations of drugs will work best to kill the cancer cells in each patient** and potentially short the time of the treatment and decrease side effects.

Professor Lim Chwee Teck mentioned that the main goal is to give the right drug to the right patient, at the right time and right dosage.

The procedure starts with the prick of a needle all the need is **7.5 ml of blood** which is about 1/2 of teaspoons. The patient's blood sample is then put through a device where circulating tumor cells, which are cancer cells that have been broken away from primary tumors to form secondary tumors, as well as, white blood cells are separated from red

blood cells, plasma and platelets. Cancer cells and white blood cells are placed into another device where they are inserted into microwells, which to the naked eye look like dots made by a pen. After this, the device, containing rows of microwells, is placed in an incubator which simulates the conditions of the human body.



The specially made device can be used to extract cancer cells from blood and grow them in the laboratory source - news.nus.edu.sg

Furthermore, the researchers' team have managed to **grown tumor clusters in 2 weeks** that is much faster than other methods, which usually take between 2 and 6 months. They tested more than **400 samples**, largely from breast cancer patients. Some of them were taken from patients suffering from the lung cancer as well as head and neck cancer. A personalized risk assessment tool has also been developed. The team sifted through genetic data of tumors from more than **2,000 early-stage** lung cancer patients, identifying **29 genes** that could predict how well cancer patients will respond to treatment. By looking at the amount of these genes produced, the team was able to predict the survival outcomes of cancer patients.

Eventually, the device could help doctors to come up with treatment customized for separate patients. The group is in discussions with companies which are interested in commercializing this innovative device. The next step would be to get approval from regulatory bodies to provide clinical trials.

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Patent status: -
On market since: -
Regions: Singapore
Industries: Healthcare, Biotechnology
Source links: [National University of Singapore](#)



A SEA DEFENSE SYSTEM TETRAPOT

The researchers' group designed a novel system that can protect the seaside from landslides and destruction. This technology is based on the natural growth of trees, whose roots grow considerably and interweave forming a natural defense structure. Moreover, this system does not require high costs for materials and ongoing support thereby creating a symbiosis of the artificial and natural marine defense frame and also forms an ecosystem.



TetraPOT researchers' team consists of Sheng-Hung Lee, Wan Kee Lee, Tony Wong, Tasos Karahalios, Elyssa He, Terrence Zhang, Shu-Yan Wang, Lin Shun Kuang, Ji Ke and King Kong
source - shenghunglee.wixsite.com

The innovational development was created by the researchers' group, led by [Sheng-Hung Lee](#) from the [National Cheng Kung University](#).

Usually, structures that have been established in order to prevent landslides of the soil on the shores, with time, cease to work. The constant pressure of water destroys them, as well as they spoil coastal landscapes. Natural protective structures, such as mangrove forests, have decreased by 35% due to inevitable climatic changes. Therefore, researchers have decided to create technology combining natural and artificial methods by creating a reliable, long-lasting and efficient design.

TetraPod means four-legged in Greek. These four-legged tetrapods are the concrete structures, which are intended to **prevent coastal erosion**. The design structure is used as the armor part against breakwaters. The shape is constructed to scatter the pressure of incoming waves providing the water to flow around the frame rather than against it. Furthermore, it has the ability to decrease the displacement by providing the random distribution of units in order to mutual cooperation.

TetraPOT applies **mangrove seeds**, which is kept by organic layers along the seaboard in a connecting method. When the sea level rises, a certain amount of water will be

harvested in the cross section inside the TetraPOT. When the tree grows, the organic layers begin to lay, and the roots reach the bottom of the water. The roots begin to come out of constructed grooves and surround TetraPOT during some period of time. Then the roots will capture the earth, forming a natural marine defense. This technology does not require much time and materials to be manufactured. It has such dimensions:

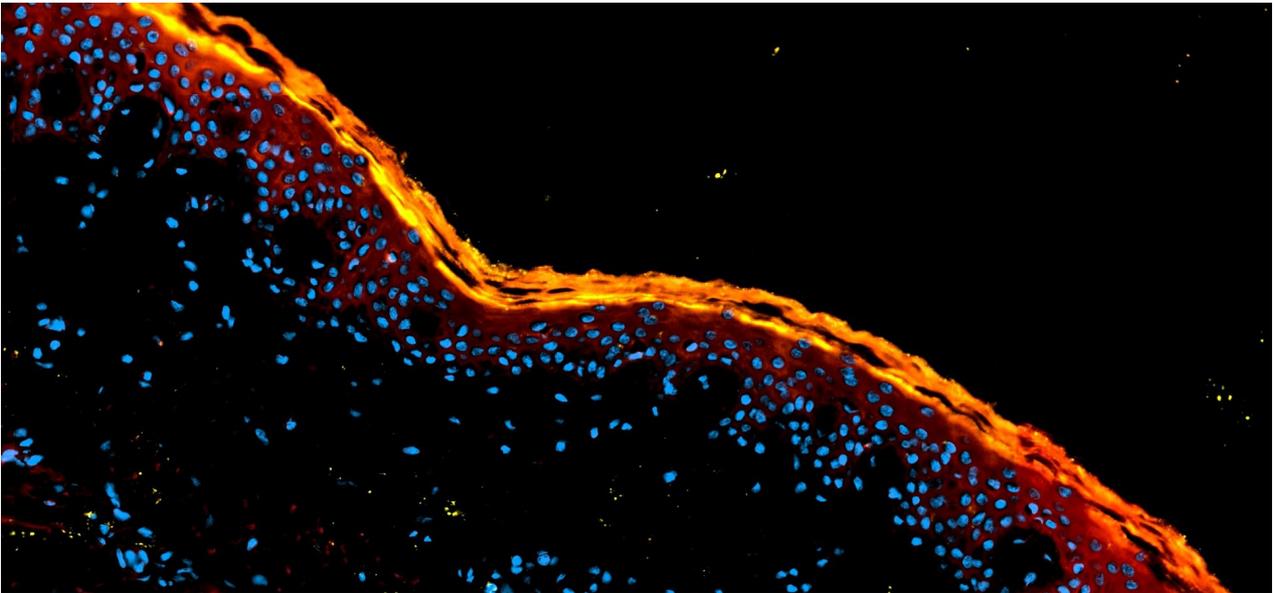
1.5m*1.5m*1.5m (L*W*H). Its weight is about 1 ton. To manufacture it researchers have used copper, concrete, soils and decomposable material. Since this technology involves a combination of artificial and natural, it increases the esthetic view of landscapes appearance being fully functional.



Zero maintenance no need to artificially maintain sea defense, because plants will eventually grab TetraPOTs and hence sustain stronger sea defenses

source - shenghungleee.wixsite.com

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Phone: -
Patent status: -
On market since: -
Regions: Others
Industries: Environment
Source links: [Sheng-Hung Lee](#)
[James Dyson Award](#)



AN ARTIFICIAL SKIN TECHNOLOGY

Exclusive interview for SPINOFF.COM with Mr. Daniel Tan, the CEO & Co-founder of DeNova Sciences Pte Ltd, about the best range of artificial skin models

The company provides artificial skin model as well as tissue scaffolding suitable for use in rigorous clinical testing. They offer services for product testing, validation or co-development using our own established range of in vitro DNSkin™ skin models, all of which are of human origin. Our DNSkin™ models are carefully cultured in a serum-free environment with our chemically defined DNMedia™ formulated for optimal growth. In vitro human skin substitute serves as a flexible and powerful platform that caters to a wide range of test methods. DeNova is also receptive towards the co-development of novel skin prototypes using our expertise and technology.



photo provided by Mr. Daniel Tan

SOC: Dear Mr. Tan, we are so grateful for your generosity this day in spending time speaking with us and sharing your insights about DeNova project. Our investors and we would like to learn more about a vast experience of your academic endeavors and your professional background.

Mr. Tan: Primarily, my professional background was received by myself. I studied genetic engineering at the [University of New South Wales](#), Australia. Currently, I am working at [DeNova Sciences Pte Ltd](#) where I do business development market. Mostly, I am focused on the development and financing activity of the company.

SOC: Considering your tremendous experience, we would like to know whether

you had other projects? Could you please share the story of their creation and success.

Mr. Tan: I don't have other projects. Mainly, I am focused on DeNove. We have started the DeNova project about 5 years ago, in 2012. We have been fully operational since 2014. We spanned out from the Nanyang Technological University, Singapore. In addition, we received some government grants that were used to obtain equipment and hire staff. It is how we started. In the beginning, my partners and I also used our own money to start the DeNova project. After that, we have got some MNC customers such as local research institutes. Using our in vitro artificial skin models, as well as renewed generated technology and experimental investment money, we brought De Nova here as we are now today.

SOC: It is so interesting to know more about the process of your technology creation. Please tell on which stage of commercialization your technology currently is? Was your project funded by any state financing or grants? Has it already received any honors or awards?

Mr. Tan: We have started the DeNova company with our product, which was ready for the market. It is our in vitro human skin models. Currently, we have 5 different models: normal skin, compromised skin, adipogenic skin (skin with an extra layer of fat), melanistic skin (for cancer research) and melanocytes skin, that is intended for changing of the colour and tone of different skin types in order from very light to very dark skin. The government grant that was received is intended for R&D. That is, in order to help us develop new upcoming skin models one of which is age an skin model and another one is a hair skin model.



photo provided by Mr. Daniel Tan

SOC: In the formation of every scientific spinoff, one of the most important keys to success is the team. For many potential investors, the management team is the most important element in deciding whether to invest in it or not. Could you please share some information about the team members who supported you and the project? What are the key additions to the team needed in the short term?

Mr. Tan: The team consists of 5 people, me and my partners. Mr. Tan Ming Jie, CSO & COO, is mostly specializing in in-vitro skin modeling. All team members are graduates of the [Nanyang Technological University](#). One member specializes in biology, one in chemistry and one assists me in business and development.

SOC: It is not a secret that the development of a new technology and its subsequent commercialization presupposes some problem and addresses unmet needs. Respectively, what problem did you intend to solve by creating your technology? What results did you plan to achieve?

Mr. Tan: We decided to spin off from the university with this technology. At that point in time, we saw the gap in the market. As the European Union has decided to ban the use of animals for the testing of cosmetic and related products. Consequently, there was a niche that we wanted to cover. Since without animal testing, the biggest companies require

another platform in order to R&D and make products safe for the consumers. In vitro skin models allow doing all the tests that used to do on animals.

SOC: The problem which you targeted to solve was actual before. Probably someone has already tried to solve it. Is it right? Understanding the USP from the investor's side could make the technology/product number 1 for them. What are the USP of your technology/product and fundamental difference from other technologies/products that tried to solve this problem before you?

Mr. Tan: There are some companies that provide artificial skin models. Most of them sell skin models directly to pharmaceutical and cosmetic-or related companies. As the result, these companies have to do the testing in vivo or, in other cases, they need to buy skin and send it to another contribution organization to do the testing there. We offer one stuff solution. DeNova does all the testing, all R&D and all the claims validation with artificial skin models. We can provide every offer for all these cosmetics companies to receive all results they need. Because at the same time we can see the global trail that companies don't want to do R&D, they want the health source. DeNova Sciences can offer services for product testing, validation or co-development using our proprietary range of in vitro skin models. That's how the company is positioning itself. Many companies that want to be targeted on the Asian market don't have the ability for Asian human skin to create products specifically for the Asian market.

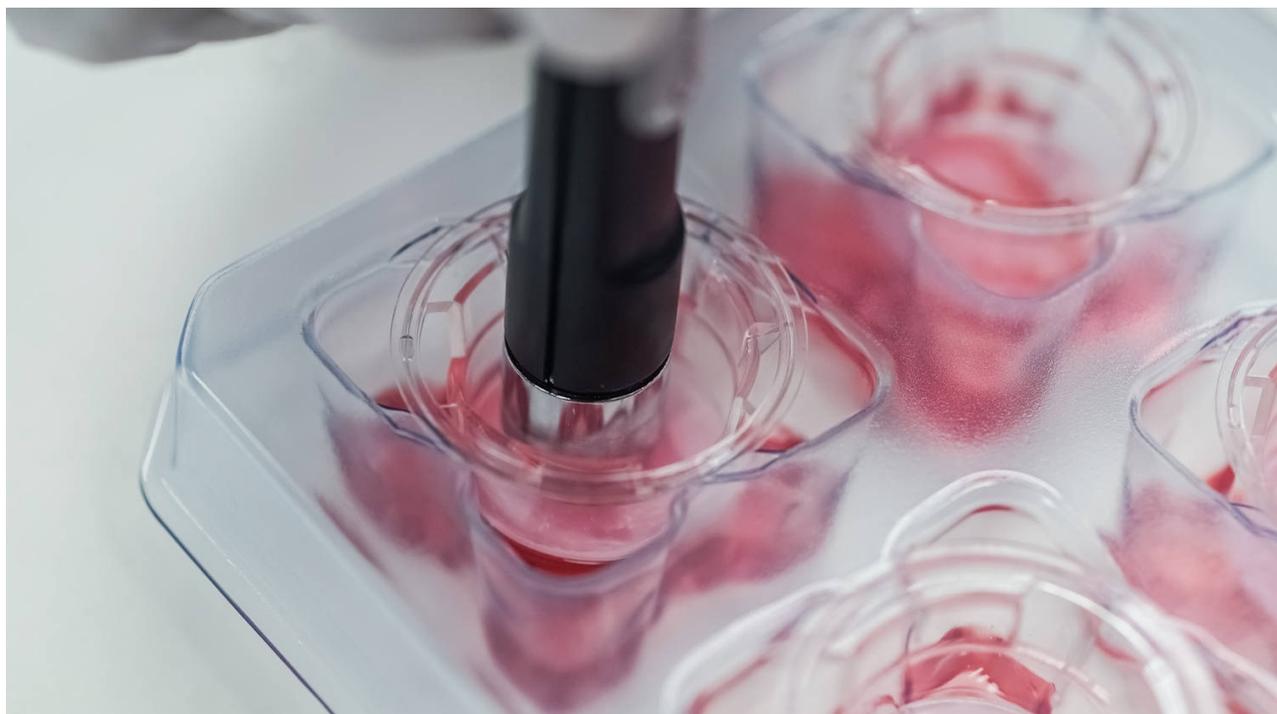


photo provided by Mr. Daniel Tan

SOC: In order to understand the peculiarities of this particular spinoff our investors always ask what is the investment structure of the company? Do you still own the controlling stake in your spinoff?

Mr. Tan: My partner and I have the controlling stake in the company. Our investors are relatively friendly. They tick a very minority share in the company right now. We do the controlling majority.

SOC: We wonder what is the actual addressable market currently for your invention and what are the current competitors there? Could you please share with us the results of the market studies, if there are any? What might be the barriers to entry?

Mr. Tan: In terms of market size, this is something that is difficult to figure out, because this market is relatively new. This market was created quite recently, around 2013 when [the European Union has implemented the animal testing ban](#).

SOC: We always need to paint a clear picture to the potential investors of the market opportunity of the spinoff that is meaningfully large and growing. Why in your opinion your company might have a high growth potential? Could you tell us

all current industries and fields of your technology/product application and where do you think it could be successfully applied in the future?

Mr. Tan: Currently, our company is limited to cosmetics and pharmaceuticals products and frequently pharmaceutical R&D testing and dermatological related work. Everything that is related to the skin. We are positioning as a company that should always look for. Currently, we are researching and developing different organoid models. For example, we can provide cornea models for eye drops or for contact lenses and stuff like this.

SOC: The potential investors will be curious whether you already have the first clients and signed contracts? What was the feedback from your partner's markers and customers?



photo provided by Mr. Daniel Tan

Mr. Tan: I think the feedback from our customers is that the one-step solution is something that they are looking for. Many cosmetic companies are mainly outsourcing in R&D. Consequently, they are satisfied that someone can complete this. When they go to the market and have a partner that provides the whole necessary work without requires building the facility and hiring specialist.

SOC: We both know that for you and the investor it is crucial to reach positive

cash flow as soon as possible. Certainly, the market scaling cannot be achieved without proper distributors network and clients. Please tell us about your criteria for partners selection and which markets are open for spinoff activity.

Mr. Tan: We are mainly targeting China market, Japan market, and Indonesia market. Furthermore, we are interested in the French market because there are a lot of cosmetic and cosmetic-related companies. If we will cooperate with big French cosmetics companies, it will provide some benefits.

SOC: Now we would like to refer to the next very crucial and we would even say essential aspect for spinoff companies' as the strategy of R&D, production, distribution, and marketing processes. Do you have your own unique strategy? Which of these processes do you consider your spinoff is strong at?

Mr. Tan: Our company is currently located in Singapore and we serve our Singapore clients directly in the country. We intend to work with the Chinese government to serve the China market to have a very secure base there. Typically, most companies in China cooperate only with other companies that have a presence in China. Therefore, we are looking to open a branch in China ourselves. For other Asian countries such as Indonesia, Thailand, Taiwan, Korea, Japan, DeNova is looking for a distributor that is currently active in their respective country. Currently we have an active distributor in Malaysia, Indonesia, and France.

SOC: As a rule, the majority of spinoffs outgrow into exits. How do you determine the market for your product/technology and estimate its volume and dynamics? What is your potential share of the market? How do you think what market cap your company plans to reach the peak of its development and why? How long might this process take?

Mr. Tan: This market cap for DeNova is directly correlated with cosmetics R&D market. This kind of the market cap is quite high because each cosmetic company comes with a new product every year consistently. That is directly related to the renovating, that was generated by these cosmetic companies. Furthermore, DeNova company doesn't want to limit itself just with cosmetics. For example, we are looking for different medical types of equipment because it also extends into many other further markets.



photo provided by Mr. Daniel Tan

SOC: For spinoff companies, their intellectual property is a key to success. The investors pay particular attention to it. What key intellectual property does your company have (patents, patents pending, copyrights, trade secrets, trademarks, domain names)?

Mr. Tan: We provided the market research and found companies, which are related to the in vitro organoids market. They don't have patents on any of the ideas that keep us to house trade secrets. We do a technology in-house trade secret and this a rapid process of formulation in which we have created in vitro skin models.

SOC: For both of us, as well as for thousands of successful spinoffers, it's not a secret that a new technological breakthrough may become obsolete very fast. Respectively, patent validity period becomes shorter. It is interesting to know the perspectives and protection plan of your technological advancement and leadership in a medium- and long-term prospective.

Mr. Tan: Our company intends to keep the methodology of creating in vitro organoids as a basis. From there, we expanded to develop other technologies in order to global trends of R&D. Currently, 3D printing is very popular and we are looking for the way to 3D print such organoids models and replace the older method which has been the use of the manual

labor.

SOC: The investors will want to get a clear picture of how many rounds of investments have you completed? Are you seeking for the investments at the moment? What is the volume and time limits? What milestones will the financing get you to? What did you plan to use the invested funds for?

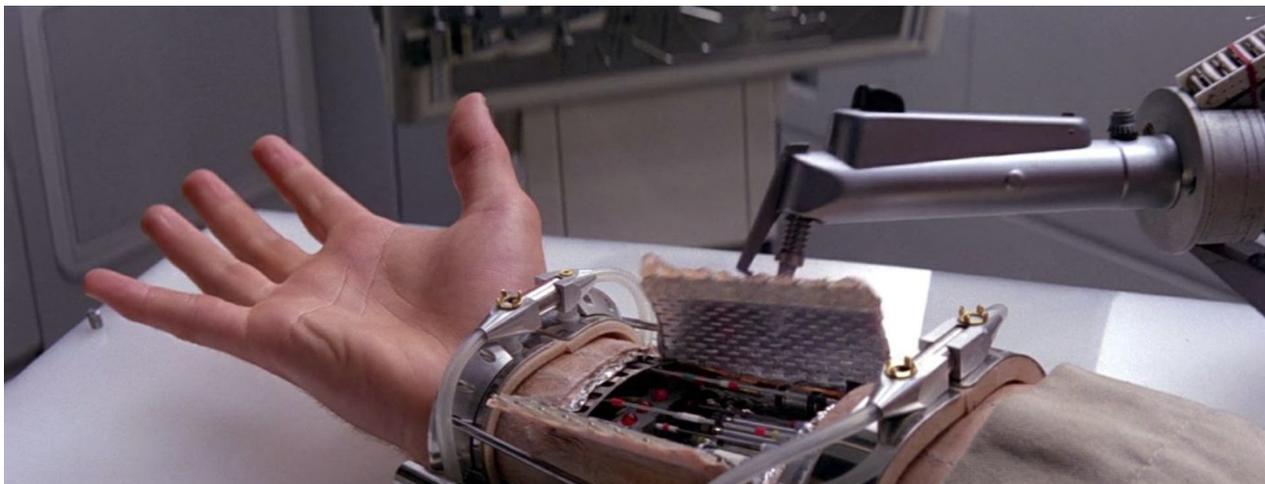
Mr. Tan: We have just closed the seed round. It includes 3 different individual investors groups. Currently, we are looking for **Series A funding in 2019 for around 2 million Singapore dollars.**

SOC: And the last question, could you specify the most convenient way you would like to receive inquiries from potential investors? Should it be by e-mail or personal phone call?

Mr. Tan: Both ways are convenient.

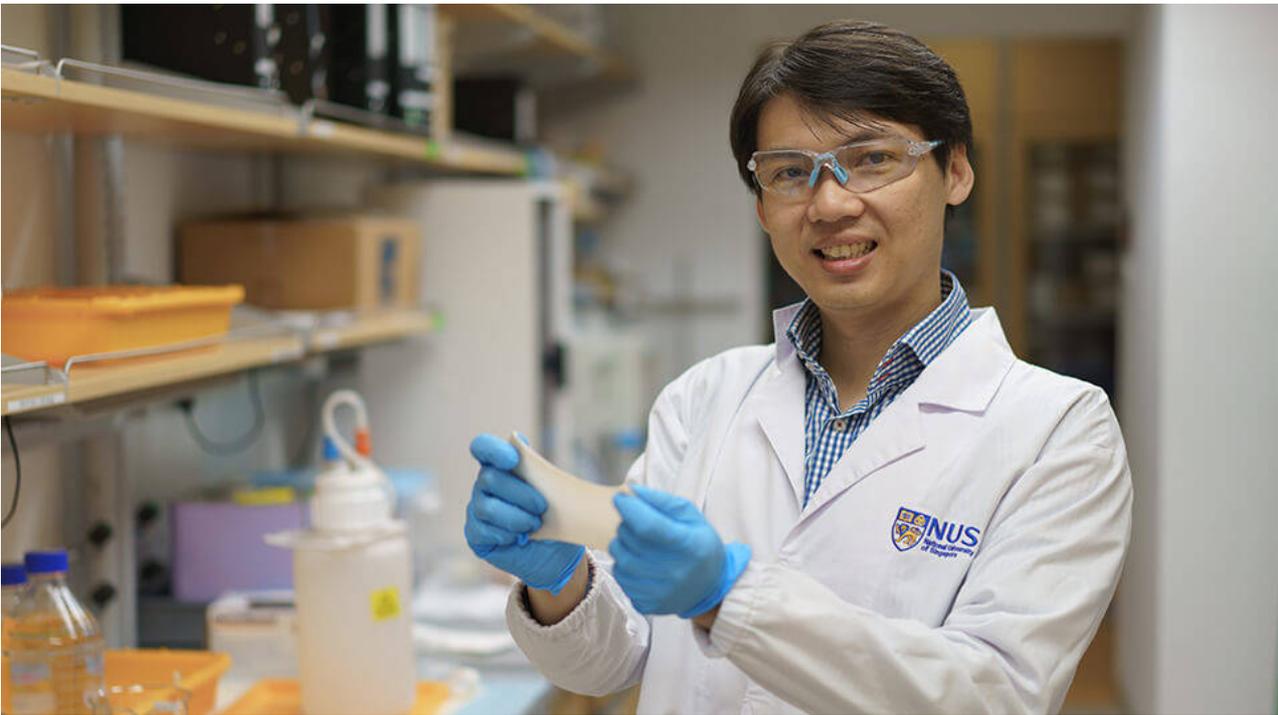
We would like to express gratitude for the time you have dedicated to this interview. **SPINOFF.COM** will observe the development of your spinoff with great pleasure and interest. Also, we are thankful for providing all the necessary materials and we are pleased to forward the information on DeNova Sciences to all potential investors.

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Patent status: +
On market since: 2012
Regions: Singapore
Industries: Healthcare, Biotechnology



THE MOST ADVANCED ELECTRONIC SKIN THAT CAN RESPOND TO A STIMULUS

The inventor, inspired by 'Star Wars' especially Luke Skywalker and his lost hand, is developing an artificial electronic skin, which has the ability to heal itself and reduce the time required for it to respond to a stimulus. President's Assistant Professor Benjamin Tee, watching the movie while being a child, drew his attention to the prosthetic that Luke Skywalker received and its form and characteristics: mechanics combined with biological tissue.



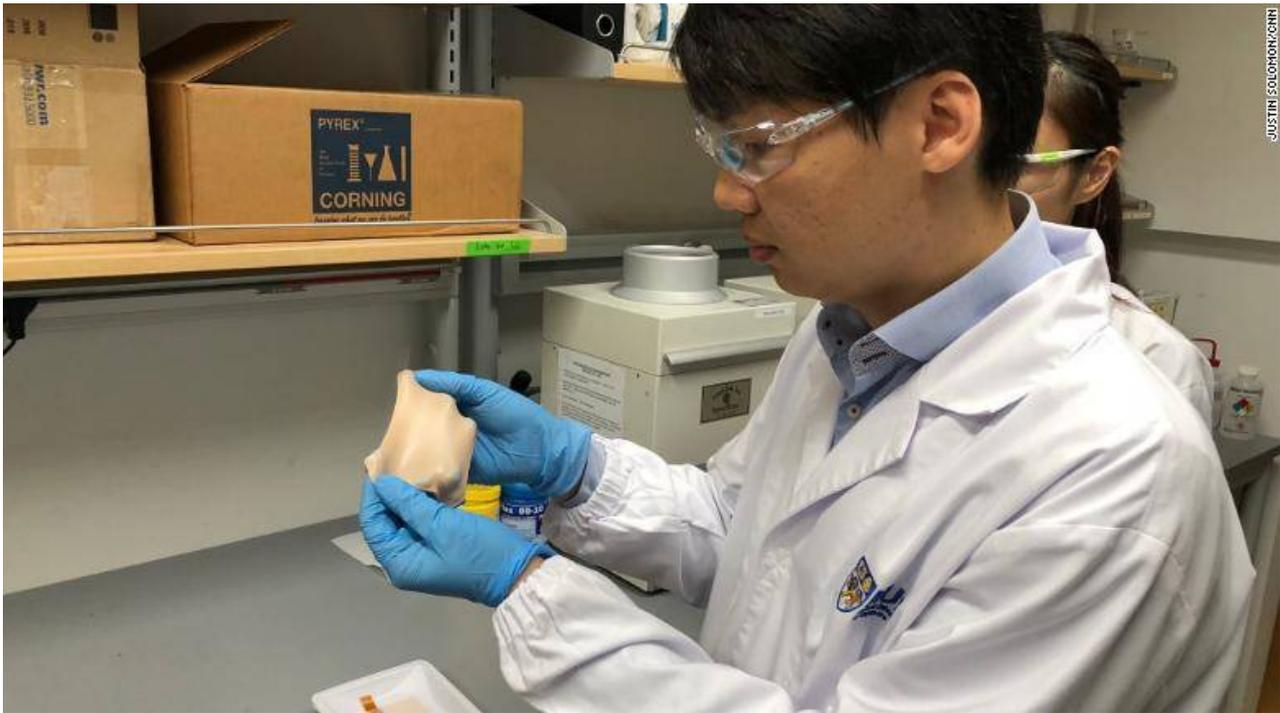
President's Assistant Professor Benjamin Tee from NUS Materials Science & Engineering
source - NUS

Asst Prof Benjamin Tee from the [National University of Singapore](#) mentioned that this Luke Skywalker's prosthetic was like a normal human hand but inside it had mechanics with small pistons and circuit boards. The most important moment is that **this prosthetic hand has complete sensation**. The inventor noted that when the robot touches the skin, it is capable to respond. This moment formed the concept of an ideal prosthetic hand. Despite this fact, even the most advanced developments are inappropriate.

Modern medical technologies in the field of medicine, engineering, and electronics allow creating high-tech, safe and cost-effective prosthetics. Furthermore, 3D printing technologies provide the development of the most varied prosthetics, such as superheroes-prosthetics, in a very short period. However, they can not replace the real parts of the human body at the sensory level. Consequently, developing and manufacturing of lifelike legs and hands prosthetics, which will have the ability to operate like human's own is an important issue.

The scientific group, led by Asst Prof Tee, has developed **a platform technology, which is able to produce sensors of various scales**. This invention provides the capacity to produce 'the most advanced electronic skin' as scientists said. Asst Prof Tee mentioned that scientists can make the skin that is **capable to recover itself and decrease the time**

required for it to respond to a stimulus.



Benjamin Tee in research facilities working on stretchable materials for his team's electronic skin
source - edition.cnn.com

Researchers mentioned that this novel technology can be applied in manufacturing and even robotic assistance just **in the next 5 years**. Furthermore, this development will have significant implications in the medical sphere. For example, there are working robots-assistant in the surgical medicine, but they have no ability to feel what's really going on and respond to certain actions.

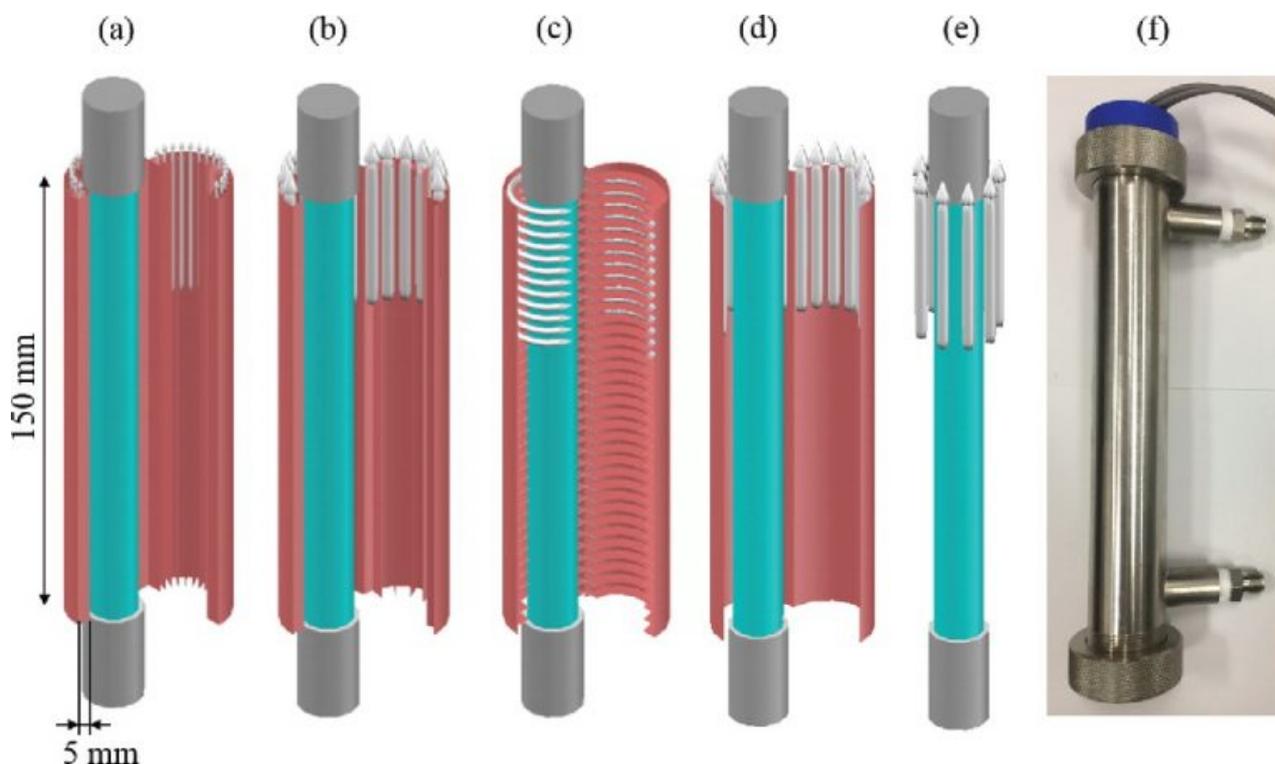
Mr. Tee said if to put the sensitive electronic skin on the robot's surgical tools will increase its abilities to 'feel' body tissues and respond accordingly. This technology will make possible not only remote surgical treatment but also significantly increase the possibilities of prosthetic, surgical medicine and other areas.

Company name: National University of Singapore
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E-mail: msetck@nus.edu.sg
Website: <http://news.nus.edu.sg/>
Phone: 66015166
Patent status: -
On market since: -
Regions: Singapore
Industries: Healthcare, Biotechnology
Source links: [National University of Singapore](#)
[CNN](#)



A NOVEL AIR PURIFICATION CAN KILL AIRBORNE VIRUSES

Scientists managed to create a novel air cleaning technology, which has the ability to inactivate airborne viruses. Since most UV-based purification devices require a lot of time for disinfection, researchers from the Ulsan National Institute of Science and Technology have developed UV-based disinfection technology with a short irradiation time. This novel development has a big potential for an alternative to traditional UV-based air purifiers due to its fast and effective operates.



Shown above are four types of catalyst frames with an illustration of the gas flow patterns: 2 mm pleated catalyst, 5 mm pleated catalyst, spiral type catalyst, and lat sheet type catalyst
source - UNIST

The innovational cleaning technology was developed by Professor Jaesung Jang and Dr. Jeonghyun Kim from [UNIST](#).

Different **ultraviolet (UV)-based** indoor disinfection devices, which have the ability to inactivate adverse airborne biological agents, such as spores, bacterias, viruses, have been developed. Despite this fact, these mechanisms usually use the recirculating mode or require a long period to irradiate agents due to its low photon power. To develop novel cleaning system, scientists used the vacuum ultraviolet (VUV), which was determined as a hopeful light source, despite its ozone generation and photocatalysis to create the photocatalyst.

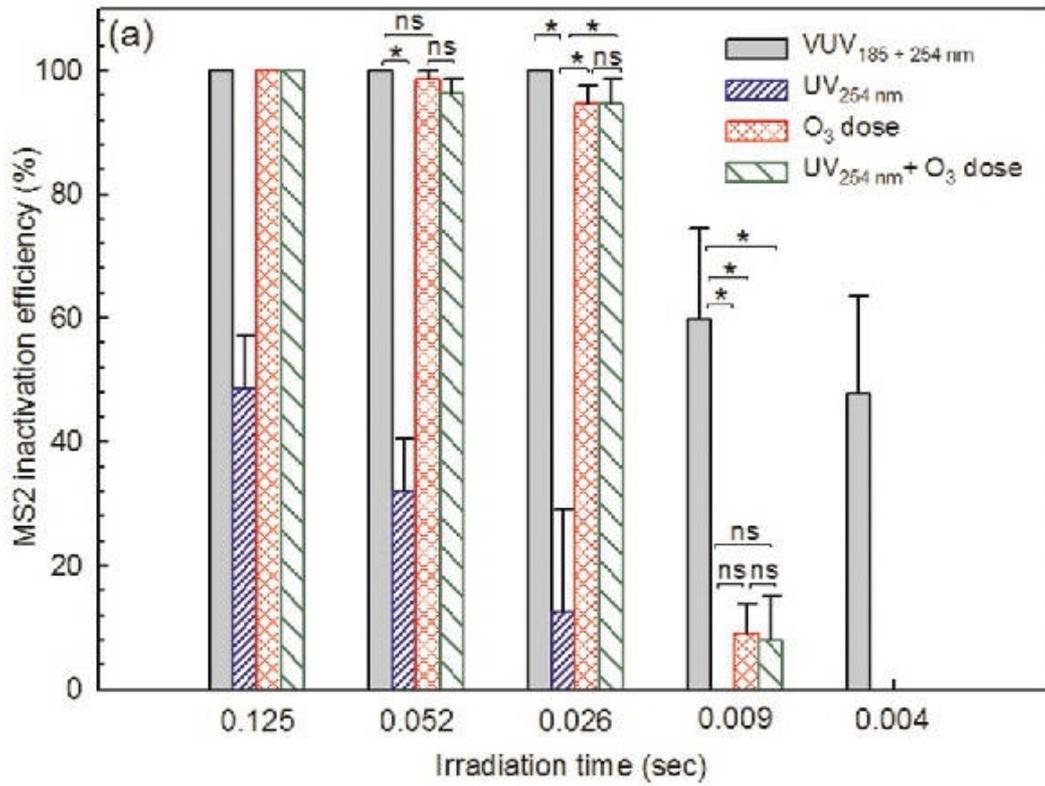
The ultraviolet radiation, less than **200nm**, is an effective technology for decontamination of airborne disease viruses. Nonetheless, the application of VUV light has been limited due to the capacity to create of toxic ozone. Consequently, scientists decided to add the supplementary UV photocatalysis system. They studied photocatalysis reactions by VUV with short irradiation times (**0.004–0.125 s**) for simultaneous decontamination of airborne MS2 viruses and decreasing of the toxic ozone formation to create air disinfection technology with high flow-rates.



Professor Jaesung Jang
source - UNIST

Researchers have created 3 effective shapes for the catalyst frame: 2 mm and 5 mm pleated, and spiral-type Pd-TiO₂ catalysts. The 2 mm pleated Pd-TiO₂/VUV photocatalyst have demonstrated the highest capacity of simultaneous decontamination of viruses and inability to ozone formation. Furthermore, the catalytic operation was effective in spite of relative moisture. These photocatalysts can activate the chemical reaction with the help of the VUV light and, in this manner, killing various viruses.

As the result, this technology has demonstrated more than 90% of the overall decontamination efficiency with residual ozone of 35 ppb at an irradiation time of 0.009 s (flow-rate: 33 l/min). Accordingly, most UV-based cleaning systems require much more time for disinfection. This innovational air purification technology can significantly improve the indoor air quality such as hospital chambers where there is a large number of bacteria and viruses in the air.



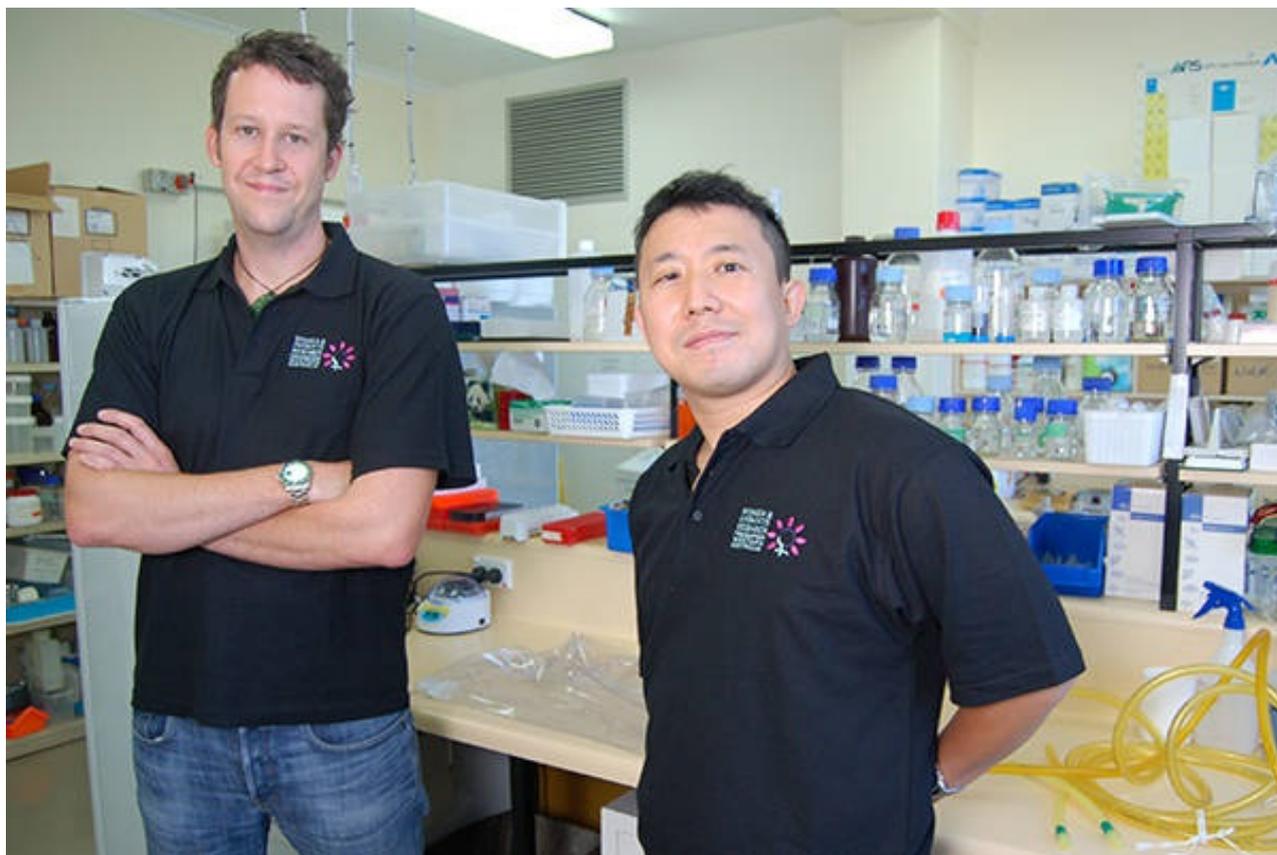
A bar graph, showing the MS2 inactivation efficiency with irradiation time for all four treatments between VUV light, UV light, ozone dose + UV light combination, and ozone dose source - UNIST

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On market since: -
Regions: Korea
Industries: Creative Industries, Electronics, Others
Source links: [Aerosol Science and Technology](#)
[Ulsan National Institute of Science and Technology](#)



AN ARTIFICIAL WOMB FOR EXTREMELY PREMATURE NEWBORNS

The international researcher's team have developed the special incubator for extremely premature infants. The novel technology, using ex-vivo uterine environment (EVE) therapy, provides the healthy and suitable environment. Furthermore, scientists mentioned that babies, which were grown in such conditions, have no risks to have various infections or severe diseases, which are inherent in premature newborns.

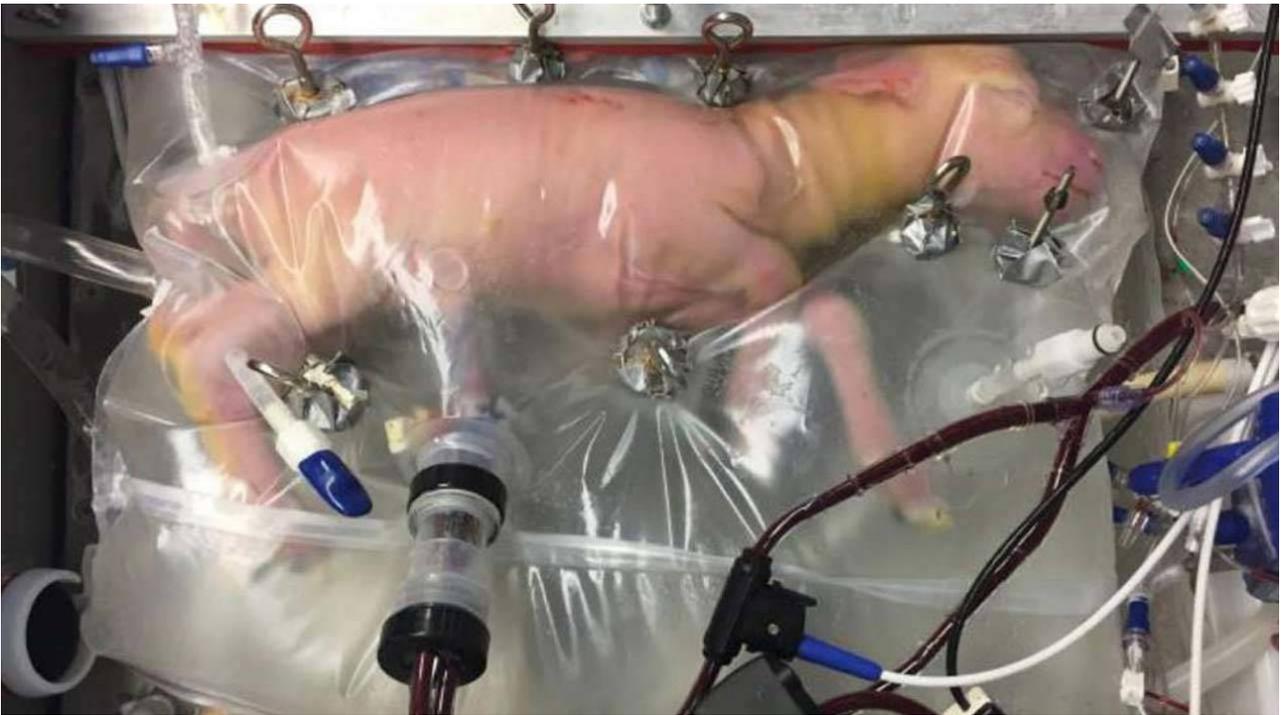


Associate Professor Matt Kemp and Dr Haruo Usuda from the University of Western Australia
source - tohoku.ac.jp

A premature birth is a birth that takes place more than 3 weeks before the estimated due date. In other words, a premature birth is one that occurs before the start of the 37th week of pregnancy. Such birth usually causes various complicated medical problems. Typically, complications of prematurity vary. But the earlier the infant was born, the higher the risk of difficulties. Furthermore, extremely preterm babies born at the border of viability (22-24 weeks' gestation) have high rates of death and lasting disability. The prematurity can cause problems throughout whole life.

The international scientific group managed to successfully use this innovational technology to incubate healthy baby lambs for a period of one week. They hope that [this method can be used for extremely premature infants](#) too.

The scientific team have used [an ex-vivo uterine environment \(EVE\) therapy](#), which provides healthy conditions. This therapy is an experimental neonatal intensive care strategy, which has the ability to ensure gas exchange using parallel membranous oxygenators connected to the umbilical vessels, sparing the extremely preterm cardiopulmonary system from ventilation-derived injury.



The long-standing collaborative Western Australian-based program, involving researchers from the Women and Infants Research Foundation, the University of Western Australia, and Tohoku University Hospital made a development

source - DAILYMAIL.UK

Scientists have tried to refine the EVE therapy platform to eliminate fetal infection and inflammation, while simultaneously extending the duration of hemodynamically stable ex vivo uterine environment therapy to **1 week**. They were able **to control the process of fetal formation**, such as the length of the hip and shoulder bones. 5 of 6 fetuses in the treatment group completed the 1-week study period with key physiological parameters, blood counts remaining within normal ranges, and no bacteremia detected. There were no significant differences in arterial blood oxygen content or lactate levels between ex vivo uterine environment therapy and control groups at delivery. There was no significant difference in birthweight between control and ex vivo uterine environment groups.

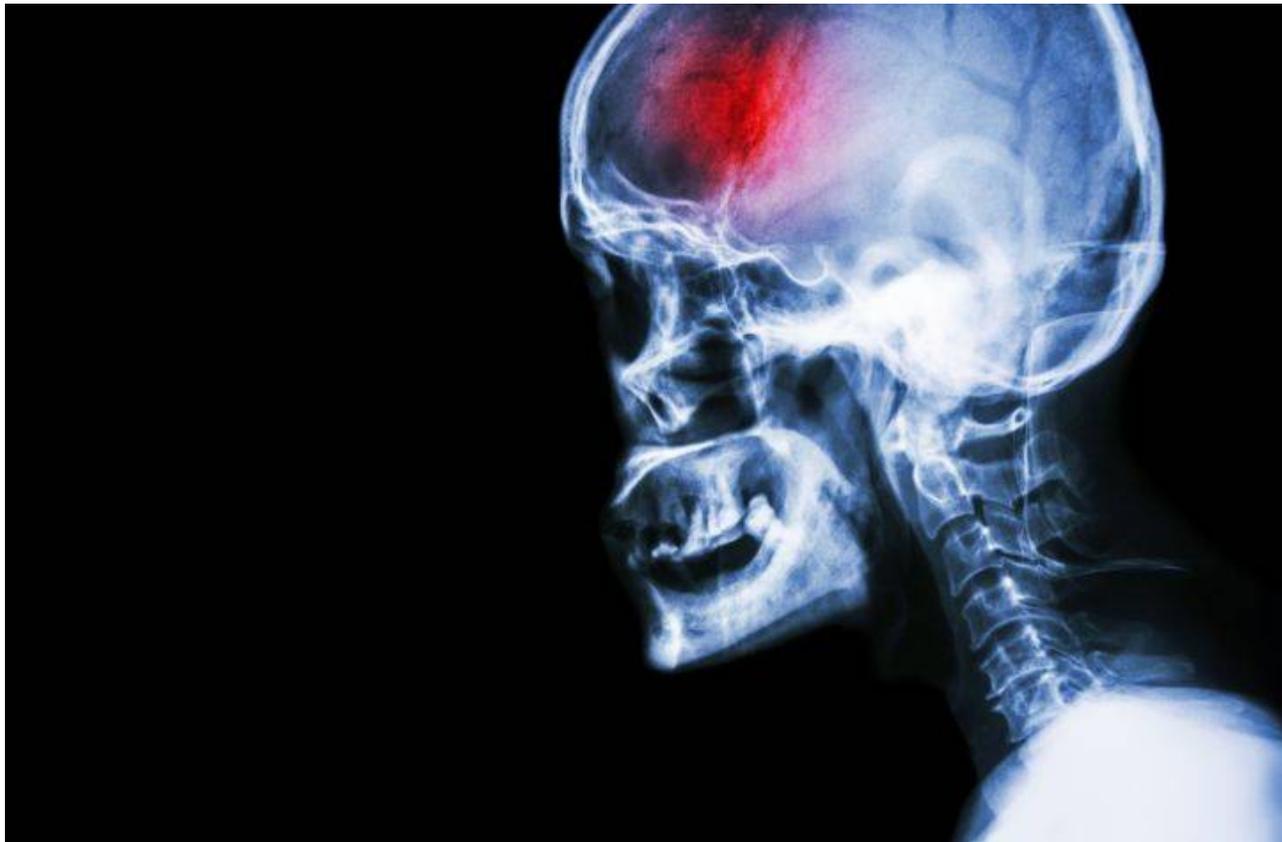
5 preterm lambs were maintained in a physiologically stable condition for 1 week with significant growth and **without clinically meaningful bacteremia or systemic inflammation**. Despite the fact, that this technology is required further elaboration, it can be used for extremely preterm infants.

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Source links: [The American Journal of Obstetrics & Gynecology](#)
[Tohoku University](#)



THE SPECIAL TYPE OF STEM CELLS CAN HELP IN TREATING STROKE PATIENTS

To reduce the brain damage and its recovery, stroke patients need the injection of human amniotic cells, which are rejected after the birth. This innovative discovery can improve patient treatment since it reduces inflammation of the nerve cells preventing their death, as well as provides their rapid restoration.



The research was part-funded by the Heart Foundation, CASS Foundation and National Health and Medical Research Council
source - latrobe.edu.au

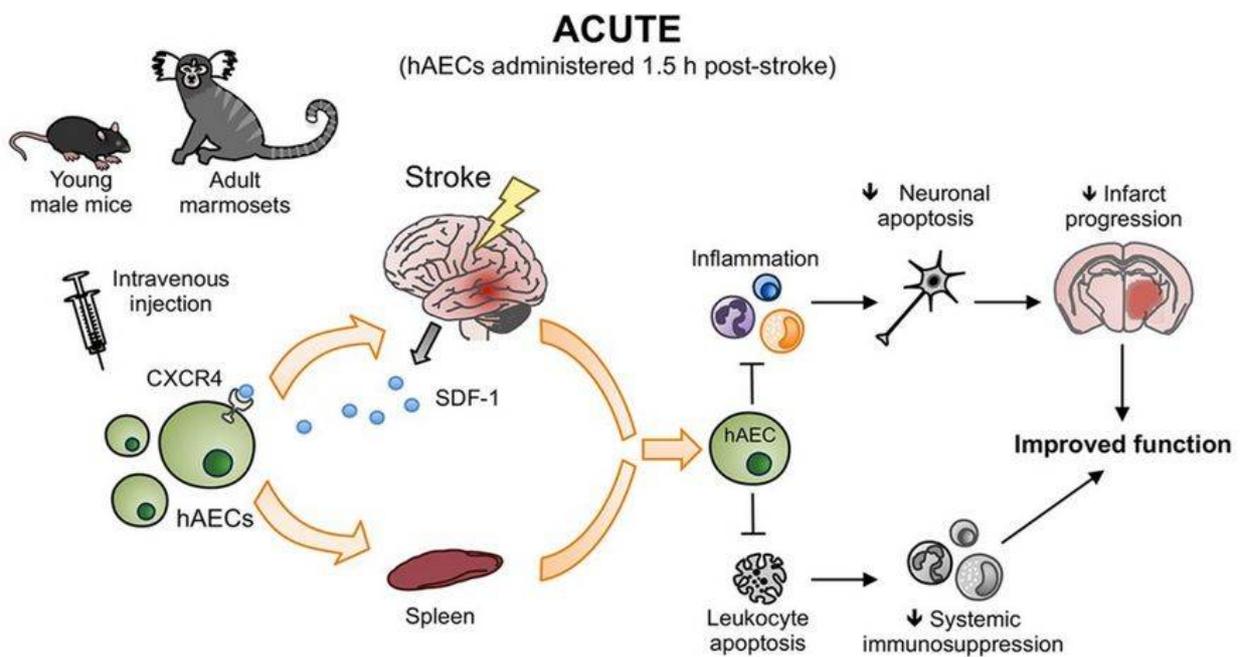
The stroke is an acute cerebral circulatory disorder characterized by a sudden (within a few minutes, hours) the appearance of focal and/or cerebral neurological symptoms that persists for more than 24 hours or leads to the patient's death in a shorter period of time due to cerebrovascular pathology.

The researcher's team, led by Professor Chris Sobey from the Monash University in collaboration with the La Trobe University, have discovered that if to insert **human amnion epithelial cells (hAECs)** into the stroke patient, it will help mitigate the impacts by reducing inflammation of damaged cells and intensifying their restoration.

These type of stem cells are nonimmunogenic, nontumorigenic, anti-inflammatory cells normally discarded with placental tissue. They have some of the same markers as embryonic stem cells, more specifically, Oct-4 and Nanog. hAECs have **the capacity to form into any of the 3 germ layers: endoderm, mesoderm, and ectoderm**. Furthermore, they are able to generate into various organ tissues specific to these germ layers such as heart, brain, and liver. Using these type of cells as the recovering material doesn't cause

any ethical, religion or socio-cultural limitations. Consequently, scientists have determined their use as a therapy in ischemic stroke.

Prof. Chris Sobey mentioned that these type of cells are plentiful and doesn't require any processing before being applied. The most important advantage of this therapy is that hAECs include natural immune-suppressants that mean **the patient's body will not deny them and they will not lead to the tumours creation**. As the result, the researcher's team decide to use it.



Animals included young (7–14 weeks) and aged mice (20–22 months) of both sexes, as well as adult marmosets of either sex

source - stroke.ahajournals.org

Scientists tested the efficacy of acute (1.5 hours) or delayed (1–3 days) poststroke intravenous injection of hAECs in 4 established animal models of cerebral ischemia. They found that hAECs administered 1.5 hours after stroke in mice migrated to the ischemic brain via a CXC chemokine receptor type 4-dependent mechanism and reduced brain inflammation, infarct development, and functional deficits. In other words, if injects hAECs during 90 minutes after stroke, they will **decrease the inflammation of damaged cells preventing their death and improve the restoration process**. If inject cells during 1-3 days they will accelerate healing and recovery. Consequently, this discovery can lead to the implementation of the completely new and effective therapy.

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Industries: Healthcare
Source links: [Stroke](#)
[La Trobe University](#)



A NOVEL OXYGEN THERAPY FOR CHILDREN WITH BRONCHIOLITIS

Scientists have developed a new high-flow oxygen therapy for babies, which have bronchiolitis. This novel therapy that was previously intended for the specialist hospital wards such as intensive care units (ICUs), can be occupied in emergency departments or in general pediatric sections of the hospital. It can change conventional practice for caring for infants with bronchiolitis.



The research was funded by the National Health and Medical Research Council, the Emergency Medicine Foundation, the Mater Foundation and several Australian hospital foundations
source - parenting.firstcry.com

The therapy has developed by the researcher's group from the [University of Queensland](#) in collaboration with [Lady Cilento Children's Hospital](#).

The bronchiolitis is an acute viral infection of the lower respiratory tract that has an impact on children. It is characterized by respiratory distress, wheezing and creping in the lungs. The diagnosis is based on anamnesis. The main reason of cause is the respiratory syncytial virus. **High-flow oxygen therapy (O₂ therapy)** with the use of a nasal cannula has been frequently applied for children's treating. Despite this fact, the effectiveness of this type of therapy was not approved. Furthermore, the efficacy of the use of high-flow O₂ therapy through a nasal cannula not in ICUs is unknown. The high-flow nasal O₂ therapy operates by delivering a higher volume of air and oxygen into the nasal passages to improve breathing.

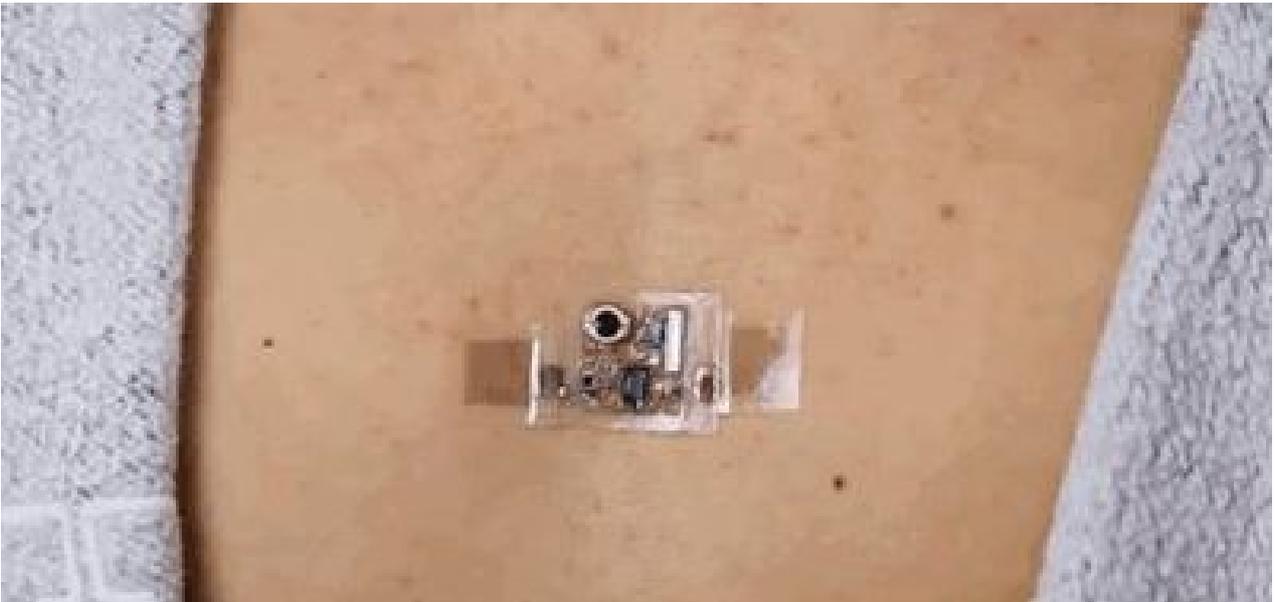
Children younger than 12 months of age were eligible for inclusion on presentation to an emergency department or inpatient unit if they had clinical signs of bronchiolitis and a requirement for further O₂ therapy to keep the oxygen-saturation level in the range of 92

to 98%. The study involves 1472 patients. The escalation of care was allowed if clinically warranted in the judgment of the treating clinician. This was important as a safeguard. Consequently, given that this trial tested an intervention that had been previously performed only in ICUs. The percentage of children receiving escalation of care was 12% (87 of 739 infants) in the high-flow group, as compared with 23% (167 of 733) in the standard-therapy group. The results showed no major differences when patients were observed in the lasting hospital stay or in the lasting O2 therapy.

Scientists have managed to determine that significantly fewer infants in the high-flow group than in the standard-therapy group received escalation of care. In other words, a significantly lower rate of escalation of care due to treatment failure when high-flow O2 therapy was used early during the hospital admission than when regular oxygen therapy was used.

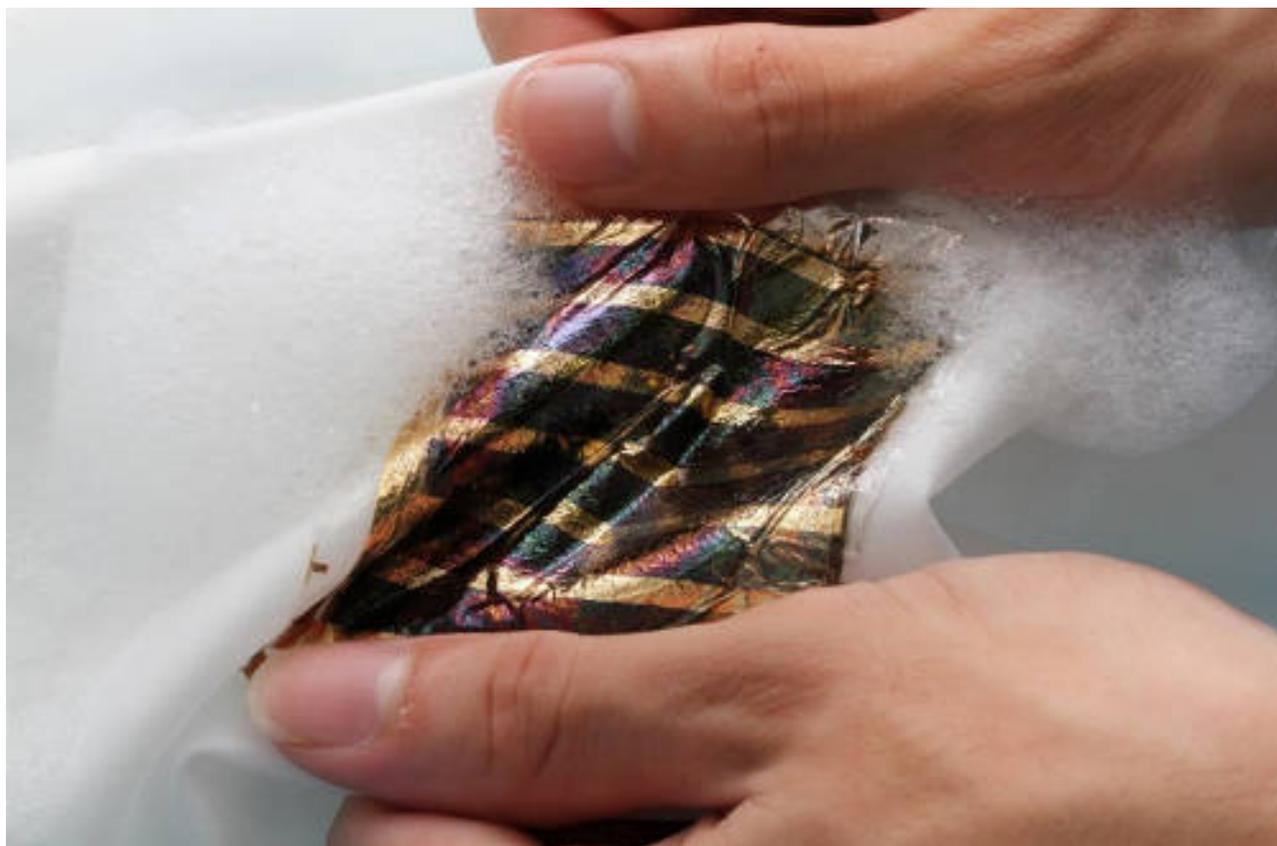
PhD student Donna Franklin mentioned that this development will change standard practice for caring for children with bronchiolitis due to the possibility to make the efficient therapy in general pediatric sections but not in ICUs.

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Industries: Healthcare
Source links: [New England Journal of Medicine](#)
[University of Queensland](#)



WATERPROOF WEARABLE ELECTRONICS

Scientists have managed to develop a new type of ultra-thin photovoltaic device, which is covered with the stretchable and waterproof layer that provides the ability to generate electricity from sunlight even in the case of stretching and compressing. It can be put in the water without losing its characteristics and effectiveness. This novel technology can provide the production of wearable electronics, which has the ability to maintain long-term stability and durability with multiple compression-stretching.



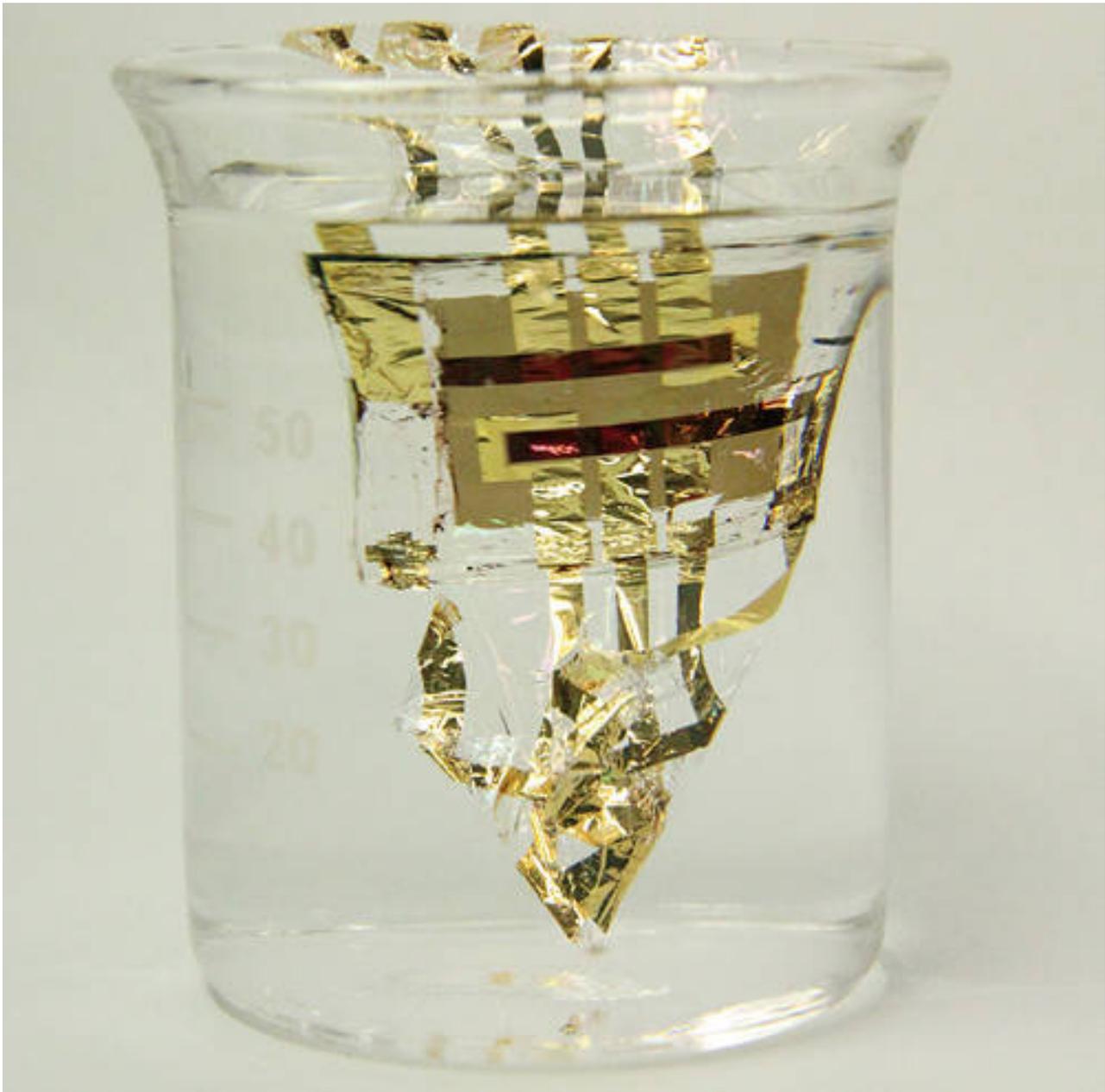
The device has a strong energy efficiency of 7.9 %, producing a current of 7.86 milliwatts per square centimeter source - RIKEN

The innovational development was made by the scientific group from the [University of Tokyo](#) in collaboration with the [RIKEN](#).

To harvest and generate energy from the environment has attracted a big attention in the application to the Internet of Things, in which a large number of sensors individually transfer and process signals. Wearable devices, which collect data such as medical health monitoring patches, require energy supply of several mill watts or even more. Power sources, which are combined with textile, can be suitable for power wearable devices because the area of the power source can be maximized by utilizing the textile itself as the platform and designed to match the energy consumption of the wearable sensors.

These robust and textile-compatible power sources must have 3 important characteristics: sufficient energy efficiency, a stability in air and water conditions, including harsh environments, and mechanical robustness including high stretchability. **Photovoltaic cells** are highly promising textile-compatible power sources that can continuously supply sufficient electricity to wearable sensors requiring the power of the order of milliwatts or larger. Nevertheless, to achieve these characteristics remain difficult due to the low gas

barrier properties of ultrathin superstrates and substrates.



To test its resistance to water, scientists soaked it in water for two hours, and found that the efficiency decreased by just 5.4 %

source - RIKEN

They deposited the device onto a 1-um-thick parylene film. The device was put on the [acrylic-based elastomer](#) and the upper part was covered with the same elastomer, providing a cover on both sides to block water entering. The elastomer, enabling light to enter, blocked water and air entering the cells, making them more durable than current devices. The study results showed that the efficiency of these devices reduces only by [5.4%](#) after putting into the water for [120min](#). Moreover, the device keeps [80%](#) of its initial efficiency after [52%](#) mechanical compression for [20 cycles with 100min](#) of water

exposure.

Scientists hope that this innovational photovoltaics that can be washed will provide new opportunities for wearable electronics and health-monitoring sensors.

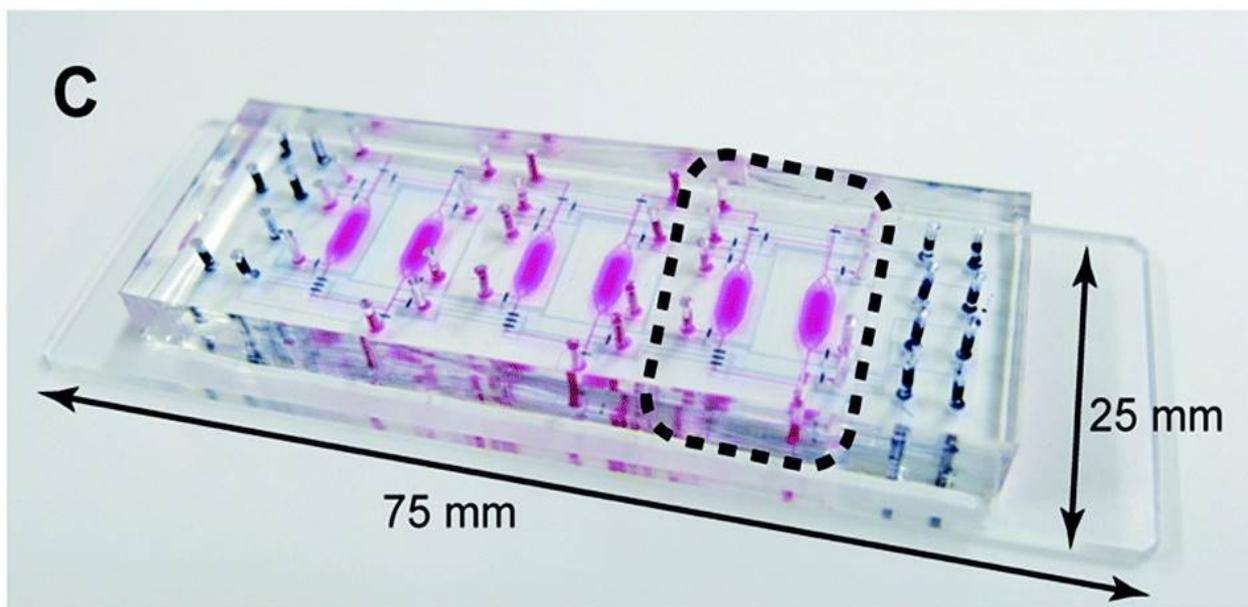
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Regions: Japan
Industries: Electronics, Energy
Source links: [Nature Energy](#)
[RIKEN](#)



A NOVEL CHIP CAN TEST POSSIBLE SIDE EFFECTS OF DRUGS

Researchers have designed an innovative 'body-on-a-chip' device that has the ability to test possible side effects of various drugs. This type of device used more than one type of the cell tissue to provide accurate testing results. The scientific team has already developed a special chip, using human healthy heart cells (hCMs) and cells of liver cancer (HepG2) to test different negative consequences of anti-cancer drugs.

The innovational technology was developed by the scientific group, led by Ken-ichiro Kamei, from the [Kyoto University](#).



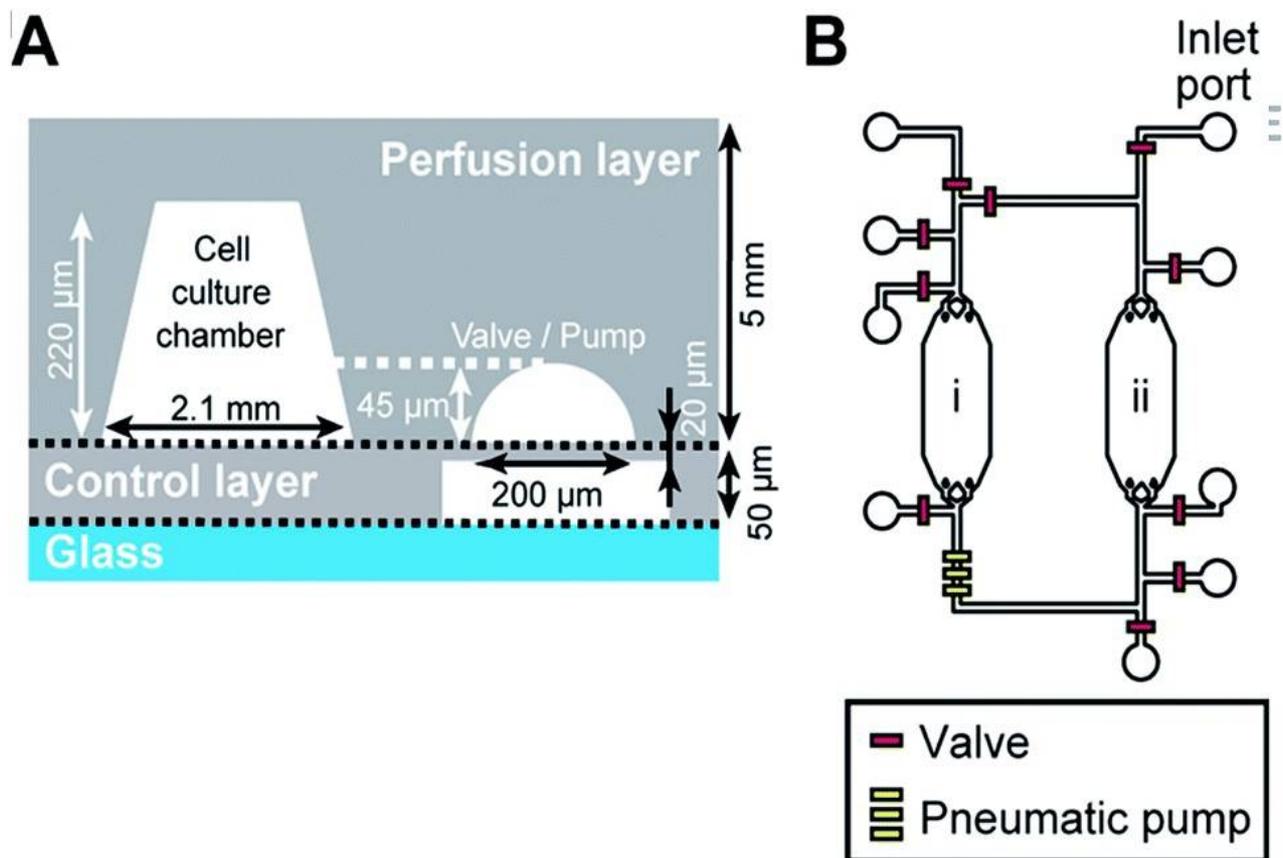
Picture of an actual iHCC fabricated on a glass slide (25 mm - 75 mm)
source - pubs.rsc.org

The testing of various drugs in animals causes many ethical and moral issues that create certain limitations and barriers. Moreover, the reaction of animals and humans to the medicines is significantly different due to certain biological characteristics. Therefore, there is a great need for alternative drug testing methods at the preclinical stage in the scientific, medical and pharmacological spheres.

To address these problems, scientists tried to develop 'Body on a Chip' (BoC) technology that can imitate human physiological conditions in a microfluidic device. It can lead to the creating of the next generation of preclinical testing mechanisms, which will be not only highly-effective but not cause any ethic issues. BoC technology allows **providing in vitro preclinical drug tests** that capable of assessing absorption, distribution, metabolism, excretion processes (ADME) for chemical compounds, which have an impact on the production and pharmacological activity of a compound. BoC includes different tissues in a single device that give the possibility to monitor the interaction between different tissues.

Consequently, scientists have managed to develop the BoC, which is called **the Integrated**

Heart/Cancer on a Chip (iHCC), which contains different types of cells, the artificial blood circulatory system in the form of a closed circulation loop without using of an external pump and 3 sets of loops, which can be applied in different conditions.



The device consists of a perfusion layer and a control layer, and was constructed from polydimethylsiloxane (PDMS) as shown in grey
source - pubs.rsc.org

The iHCC was constructed from polydimethylsiloxane, consisting of a perfusion layer and a control layer. PDMS was selected because it has good biocompatibility, gas permeability, and light transparency. The perfusion layer contained two cell culture chambers, sufficient to supply the required growth factors, the anti-cancer drug, and allowing for reduced shear stress. The pneumatic control setup consisted of 2 sets of eight-channel manifolds. The device was controlled using a controller board, which is connected to the computer via the USB port.

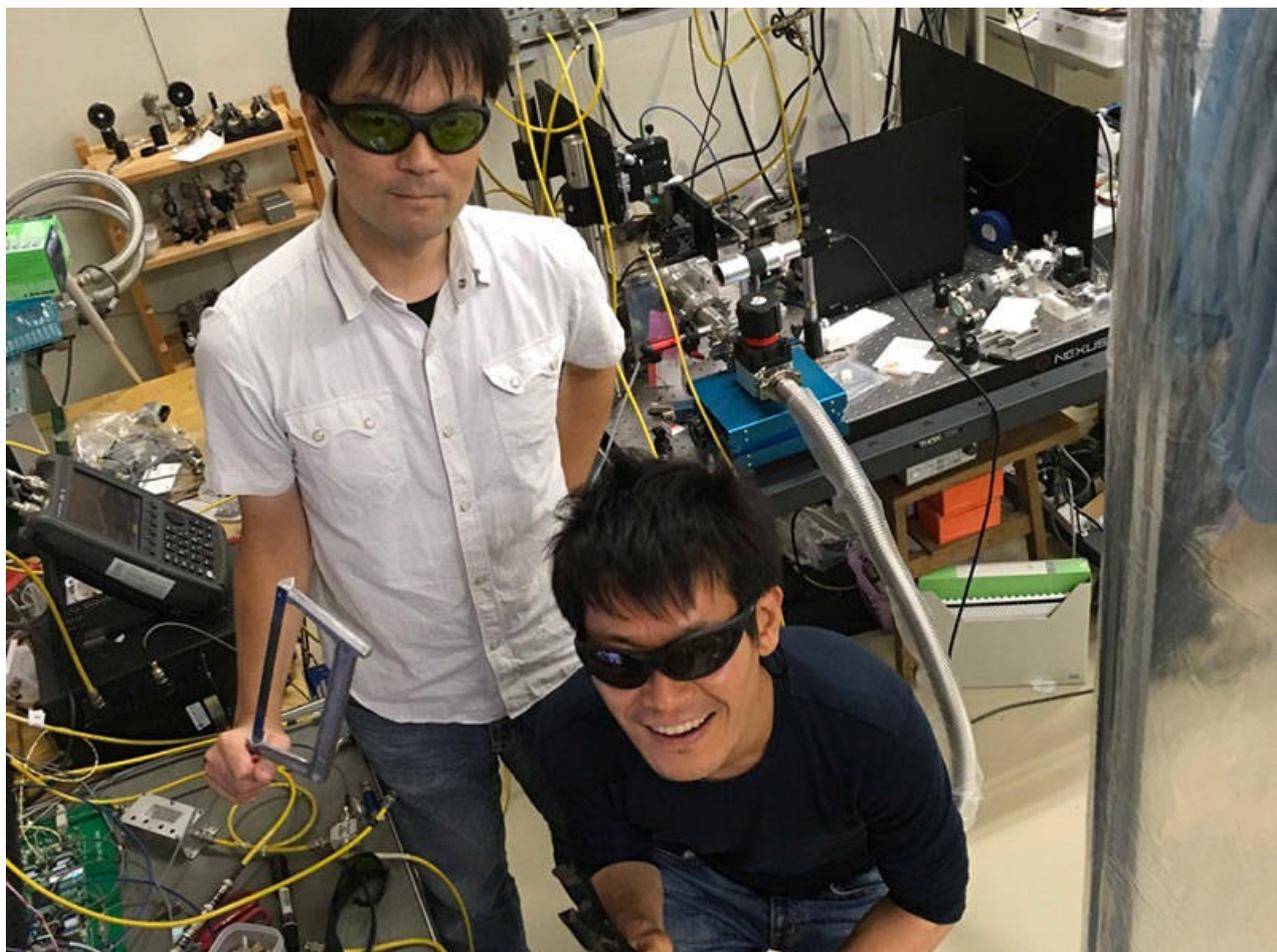
The scientific group tested the anti-cancer drug **Doxorubicin** and its effects on heart cells and cancer cells. They found that the drug has the toxic effect not only on the cancer cells but also on the heart cells due to its metabolite.

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On market since: -
Regions: Japan
Industries: Healthcare
Source links: [RSC Advances](#)
[Kyoto University](#)
Files:



A HIGHLY-SENSITIVE NMR DETECTION

The first radio frequency-to-light up-conversion of nuclear magnetic resonance (NMR) signals was developed by the group of scientists from Japan. This innovational technology has the ability to provide more sensitive analysis compared with standard NMR. Furthermore, it can be applied for the higher-accuracy chemical analysis and magnetic resonance imaging (MRI).



Associate Professor Kazuyuki Takeda (left) and Associate Professor Koji Usami (right) with their experimental system
source - Kyoto University

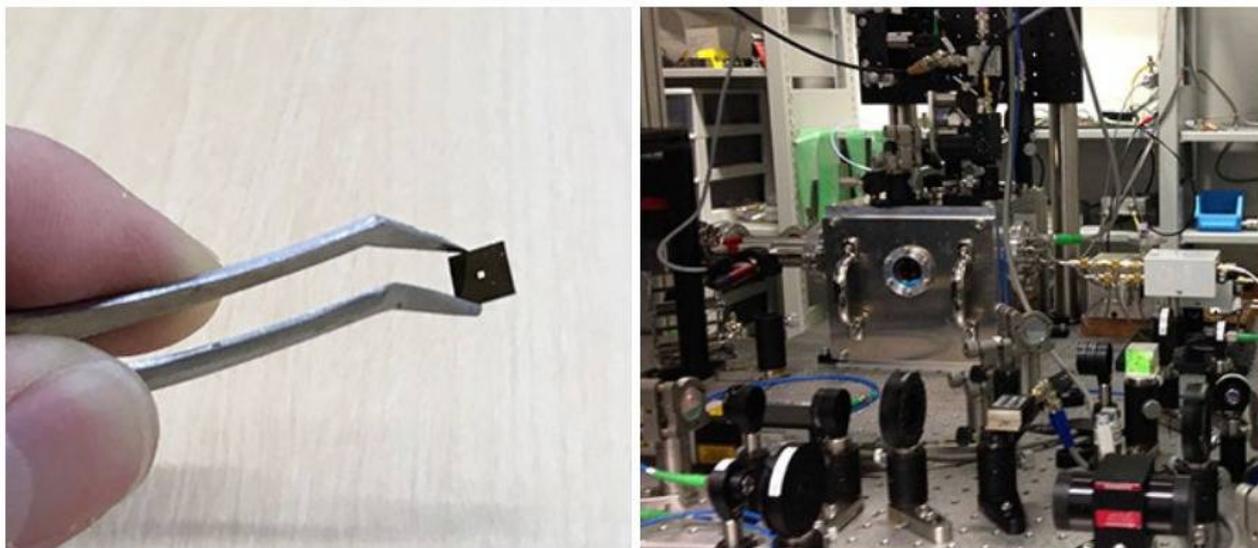
The innovational development was made by the scientific group from the [Kyoto University](#) in cooperation with the [University of Tokyo](#).

The **nuclear magnetic resonance (NMR)** is a powerful analytical tool, which provides the structure and dynamics analyzes in liquid and solid materials for physical, chemical, biological proposes. Typically, NMR signal reception relies on nuclear induction causing an electromotive force across the detection coil, followed by electrical amplification of the RF signals. Since various atoms provides signals at various frequencies, researchers have the ability to use this data to define the elements, which are included in a sample. This technology is applied in MRI.

Associate Professor Kazuyuki Takeda mentioned that NMR measurements ability depends on radio-frequencies. These factors create an extra noise and limit the sensibility of this method. Consequently, the researcher's team has invented **the NMR system that**

transforms radio-frequency signals into optical signals.

The effect of the phase noise of the drive can be made negligibly small by increasing the mechanical oscillation frequency and thereby the difference. The reducing of the weight of the metal layer deposited on the membrane will also decrease the phase noise. Some filters can also be used to prevent the phase noise of the drive from exciting the mechanical oscillator.



This is the material linking the three electro-mechano-optical systems (left). Constructed from multiple optical devices, and electrical detection circuits (right)

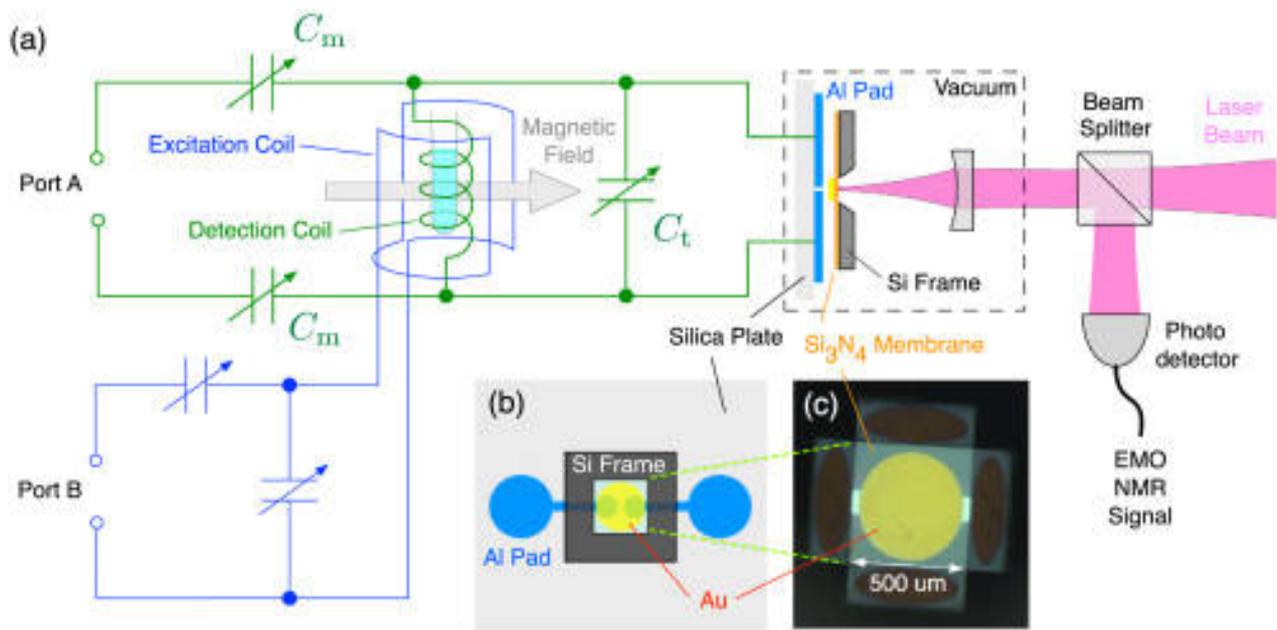
source - Kyoto University

Scientists developed a **new hybrid quantum transformation technology** to create the NMR system. The method applied for chemical analysis by using the membrane signal transducer system, which was created and produced to satisfy the requirements for pulsed NMR spectroscopy. The group has managed to develop the device, which connects electronics with mechanics and after this with optics. They have demonstrated that the electro-mechano-optical (EMO) NMR technique provides **the higher sensitivity** compared to the standard systems with real improvements in the experimental parameters.

The EMO approach is compatible with traditional continuous-wave NMR as well as recently reported field-sweep NMR, where the frequency of interest is fixed throughout measurement and the external magnetic field is varied instead. The important moment is that the aforementioned enhancement of the electromechanical coupling would cause damping of the membrane's oscillation, and thereby increase the accessible bandwidth.

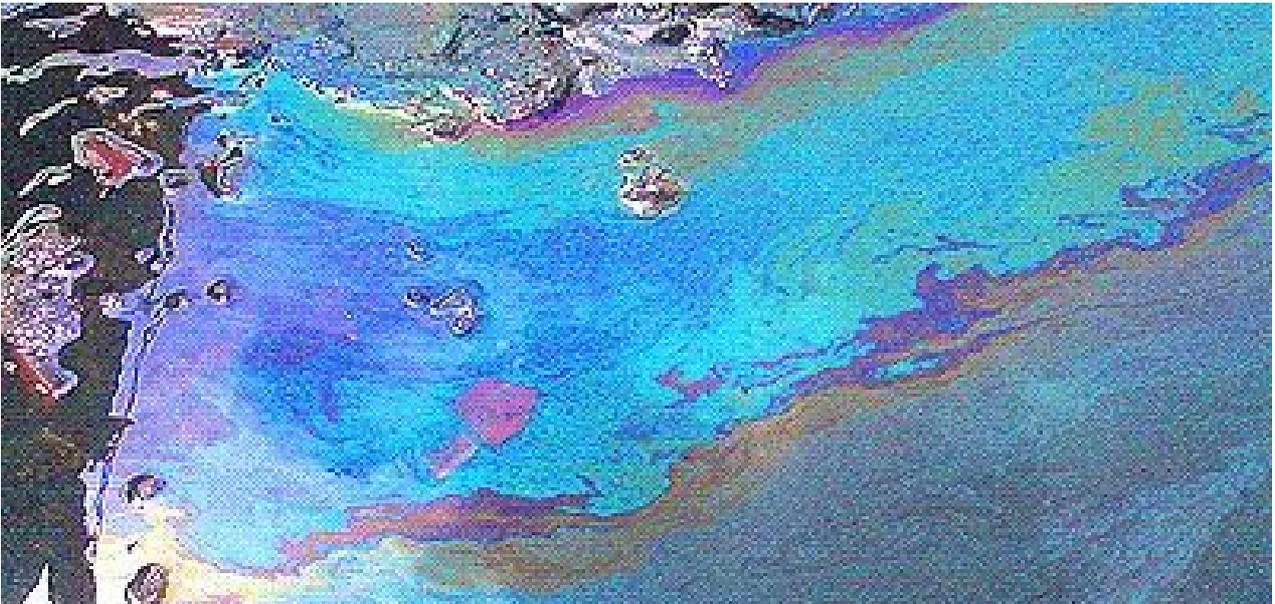
The EMO method has the ability to mechanically increase the NMR signal and even laser cooling nuclear spins to improve the sensitive ability of NMR.

Researchers mentioned that this optical defining technology causes the development and widespread use of the spectroscopy due to the high precision in defining of materials. It can be applied in different scientific fields.



Experimental setup for EMO NMR composed of an orthogonal pair of coils tuned at the NMR frequency, a membrane put inside a vacuum chamber, an optical cavity, and a photodetector
source - osapublishing.org

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Regions: Japan
Industries: Healthcare, Others
Source links: [Optica](#)
[Kyoto University](#)



A MEMBRANE SEPARATES OIL FROM WATER

Scientists have developed an innovational method, which has the ability to quickly separate oil from the compound that contains water and oil. This technology is based on the use of cellulose material that can clean industrial oily wastewater. Furthermore, the novel technology can help to create an effective technique to prevent expansion of marine oil pollution.

The innovational development was made by the scientific group, led by Professor Lim Geun-bae from the [Pohang University of Science and Technology](#) in cooperation with the group of researchers, lead by Professor Cho Sung-jin, from the [Chungnam National University](#).



Geunbae Lim



Seongkyung Hong



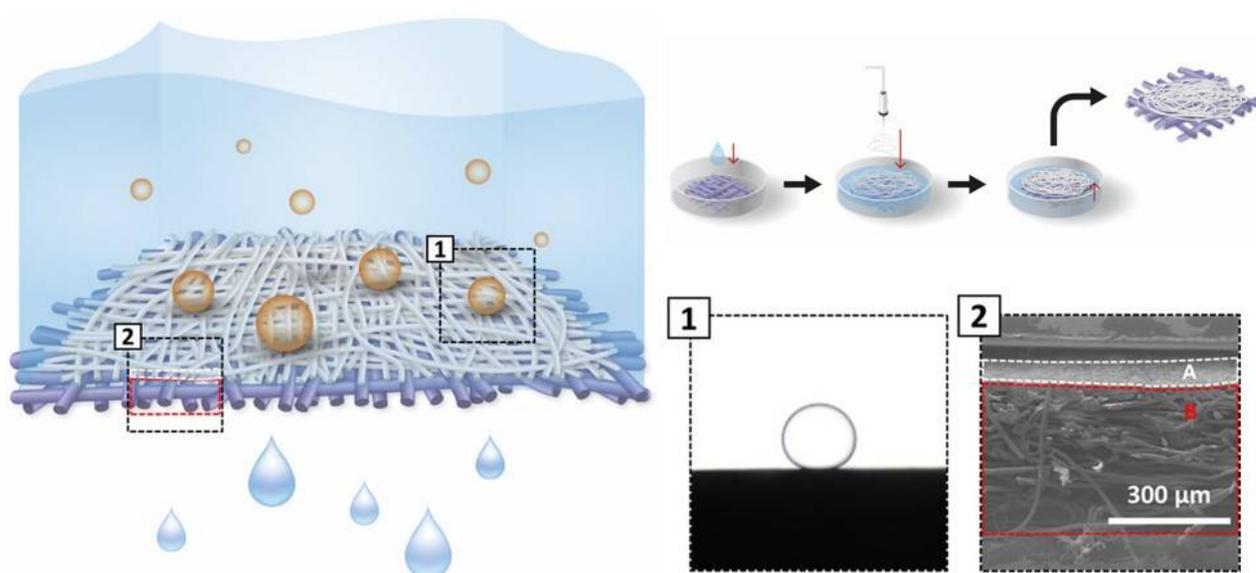
Sungjin Cho

Seong Kyung Hong and Lim Geun-bae are from the Mechanical Engineering Department, Cho Sung-jin is from the School of Mechanical Engineering
source - postech.ac.kr

Oil spill pollution is the negative polluting influence that oil spills have on the environments and living organisms, including humans. Pollution of the oceans with oil and oil products is one of the global environmental problems. Oil is a viscous oily liquid that has a weak fluorescence. The oil consists predominantly of saturated aliphatic and hydro-aromatic hydrocarbons. The main components of the oil are hydrocarbons (up to 98%), which are divided into four classes. For example, cycloparaffins are very stable and poorly biodegradable. Consequently, a big demand for the processing of industrial oily wastewater cause the crucial need for various large-scale oil/water detachment technologies.

Scientists have managed to develop **the nanofibrous cellulosic membrane (NFC membrane)** for the continuous high-flux separation of large amounts of oil/water compounds. The NFC membrane was produced using wet electrospinning, that is an effective method for the imposition of nanofibrous membranes, which have similar porous structures, on a lining.

The membrane has high underwater **superoleophobicity** due to its cellulosic origin. It has a **sturdy chemical stable ability**.



Underwater superoleophobic separation membrane. Concept diagram of separation of water and oil from NFC membrane (left). Manufacturing process of NFC membrane (top left)
source - etnews.com

Scientists have managed to successfully separate more than **99%** of water–oil compound by using this technology. One membrane can be used for repetitive oil/water divisions during which the oil concentration in the filter is notably low, about **29 ppm**. The nanofibrous membrane has the great porous structure, which is connected throughout the whole structure. It leads to the high oil intrusion pressure, about **30 kPa**, and which is carried out not only due to the force of gravity but also through pressure. The group were able to easily separate water from oil with just gravity by manufacturing porous NFC through underwater electric radiation method.

The study results demonstrated **the detachment of 2,000 litres of water–oil substance in just 1 minute** by combining the technique with the supplementary mechanical pressure of **30kPa**. The technology is suitable for large-scale use for the cleaning of industrial waste as well as to **prevent the spread of sudden oil leaks** that lead to environmental disasters. It is a great advantage.

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Patent status: -

On market since: -

Regions: Korea

Industries: Environment, Water, Others

Source links: [Nanoscale](#)

[Pohang University of Science and Technology](#)



AN EFFECTIVE METHOD OF DECOMPOSING PLASTIC WASTE

A scientific team developed a novel catalyst that breaks resistant chemical bonds, making the technology of recycling of plastic waste more effective and fast. This innovational technology will cope even with nylon, which is characterized by strong bonds and requires high-energy consumption. Furthermore, this development can be used in the field of pharmaceuticals.

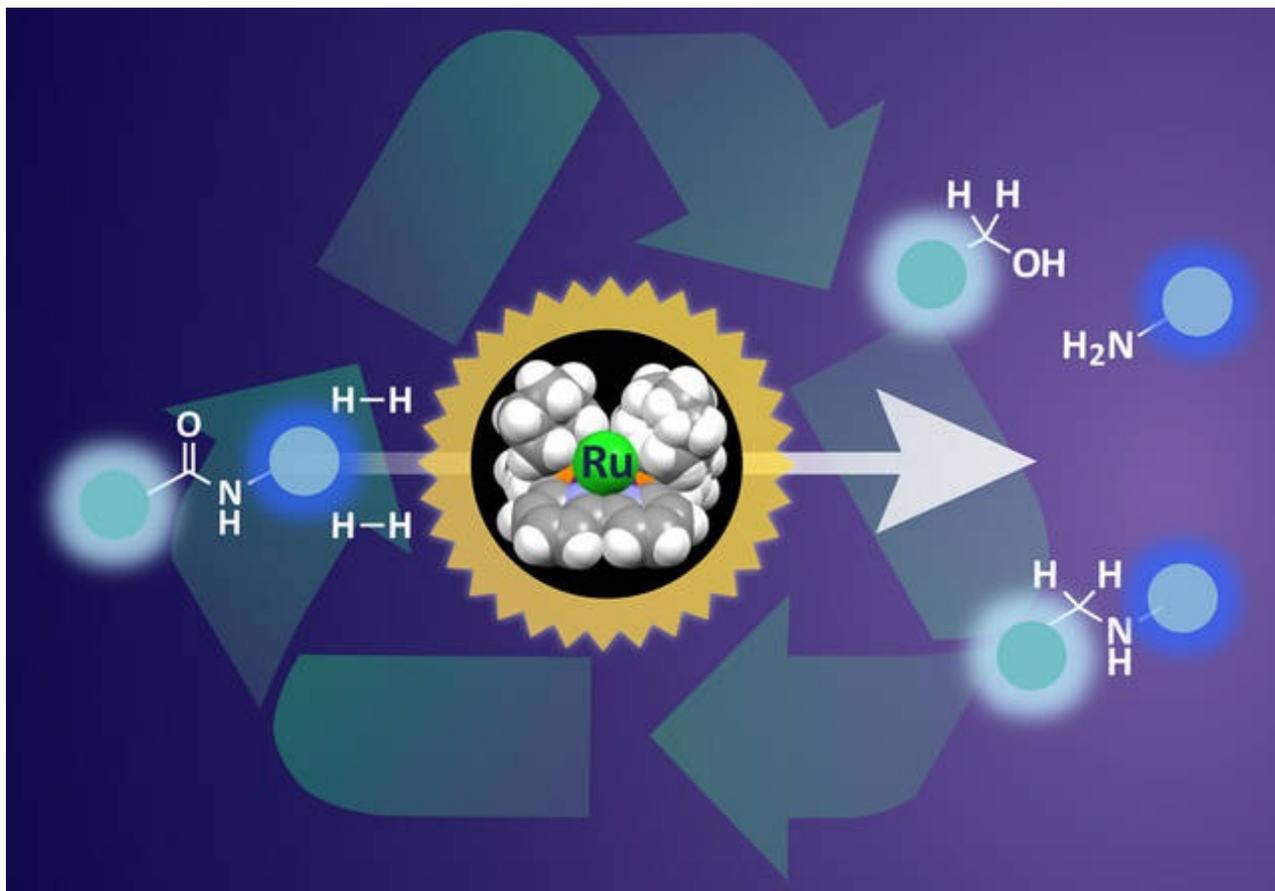


Plastic bottles and other types of plastic waste at the Thilafushi waste disposal site
source - goodnet.org

The production of plastic has increased every year by **8%**. More plastic was produced over [the last 10 years than during the entire 20th century](#). The technology of decomposing plastic waste was made by the group of scientists from the [Nagoya University](#).

Long chain molecules are characterized by powerful chemical bonds, which are common to various natural molecules, synthetic pharmaceuticals and artificial plastics. Amides are ubiquitous and abundant in the world but are very stable and reluctant to salt-free, catalytic chemical transformations. As a result of high thermodynamic stability and kinetic inertness amides have been found in natural systems for millennia, as the repeating units of functional polypeptides (proteins), and have more recently become a valuable commodity as the monomer units of synthetic polymers including poly(acrylamide), nylons, and Kevlar produced on an enormous scale.

Despite the fact, that amide bonds provides plastics with the great strength, when the recycling at a later point occurs, the problem of laceration usually prevents recovery of useful products. Typically, catalysts are used in chemistry to accelerate chemical reactions. To break the amide bonds in plastics requires rigid conditions and a lot of energy. Scientists created **a series of organometallic ruthenium catalysts to destroy even the strongest amide bonds** under mild conditions in a very effective way.



Design of a sterically confined bipyridine-ruthenium (Ru) framework allows controlled confinement of adsorbed H₂ and delivery to inert amides enabling catalytic hydrogenation of a wide range of amide bonds
source - Nagoya University

Hydrogenation is the most significant process of the destruction. Scientists studied functions of hydrogen on the catalyst in the reaction pathway and modified the form of the supporting framework. This ruthenium atom can adsorb hydrogen and bring it into the amide bond to make the destruction. Through the activation of a sterically confined bipyridine–ruthenium (Ru) framework of a precatalyst, catalytic hydrogenation of formamides through polyamide is achieved under a wide range of reaction conditions. Both C=O bond and C–N bond cleavage of a lactam became also possible using a single precatalyst.

Takashi Miura mentioned that this novel catalyst has the ability to hydrogenate various elements under mild conditions. Professor Susumu Saito mentioned that this technology can be used in **pharmaceuticals** and, furthermore, it can **restore materials from waste plastics to perform an anthropogenic chemical carbon cycle**.

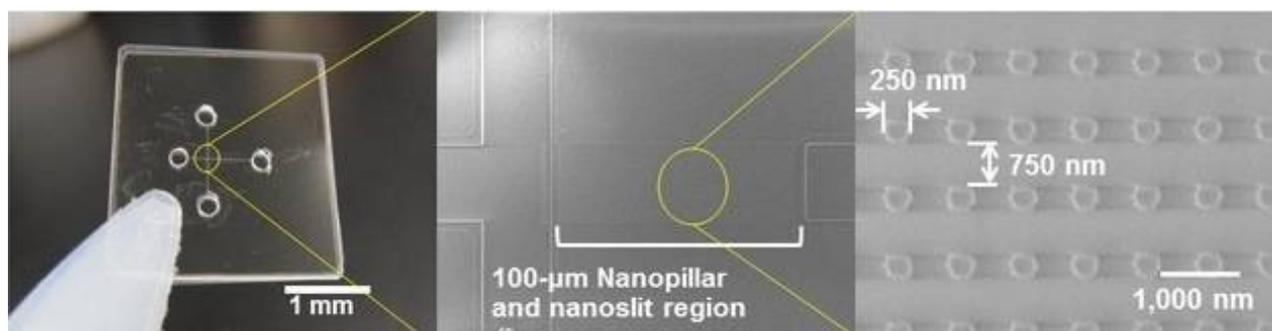
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Patent status: -
On market since: -
Regions: Japan
Industries: Chemicals, Environment
Source links: [Scientific Reports](#)
[Nagoya University](#)



A NOVEL SEPARATING DEVICE CAN QUICKLY DETECT CANCER

Scientists developed an innovative nanodevice, which based on the technology of cancer biomarkers isolating. It has the ability to detach microRNA as cancer biomarker from DNA/RNA mixtures received from cells in less than 100 ms. Due to the speed of separation and resolution, it will provide the fast diagnostic of different types of cells.

The innovational device was developed and designed by the group of scientists from the [Nagoya University](#) in cooperation with the [Kyushu University](#), [Hokkaido University](#) and [Osaka University](#).



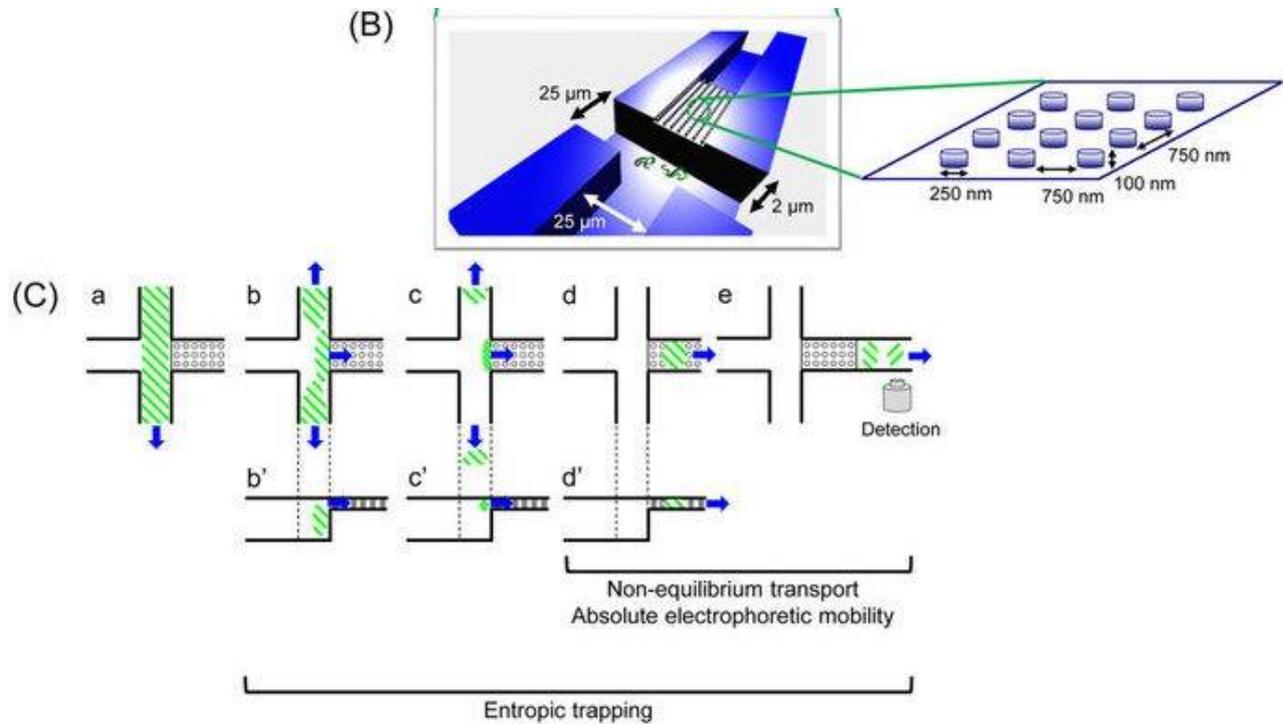
Quartz-made Nanopillars of 250-nm diameter were arrayed inside nanoslit region of 100-nm high and applied for ultrafast microRNA extraction from nucleic acids mixture
source - Nagoya University

The ribonucleic acid (RNA) is one of the 3 basic macromolecules that are found in the cells of all living organisms and play a significant role in coding, reading, regulation and expression of genes. Short parts of RNA, which are called **microRNA (miRNA)** are more durable than RNA chains and are situated in body' liquids. It is characterized by stability, resistance to mechanical and enzymatic degradation, and ability to circulate in bodily fluids for an extended time. The amount of microRNA in body' liquids including blood, saliva, and urine is correlated with the appearance and progression of cancer. In other words, **miRNA can be as the biomarker of cancer**, which provides fast, effective and non-invasive method of diagnostic.

To use microRNA in the process of cancer detection scientists need to **isolate** it. They found the way **to detach miRNA from RNA in less than 100 ms**. Selective binding and purification of small RNA molecules on the membrane is achieved by using an optimum ethanol concentration. The process of extracting miRNA is significant for the consequent steps of quantification and single-chip sequencing, and ultimately determines the quality of the obtained data.

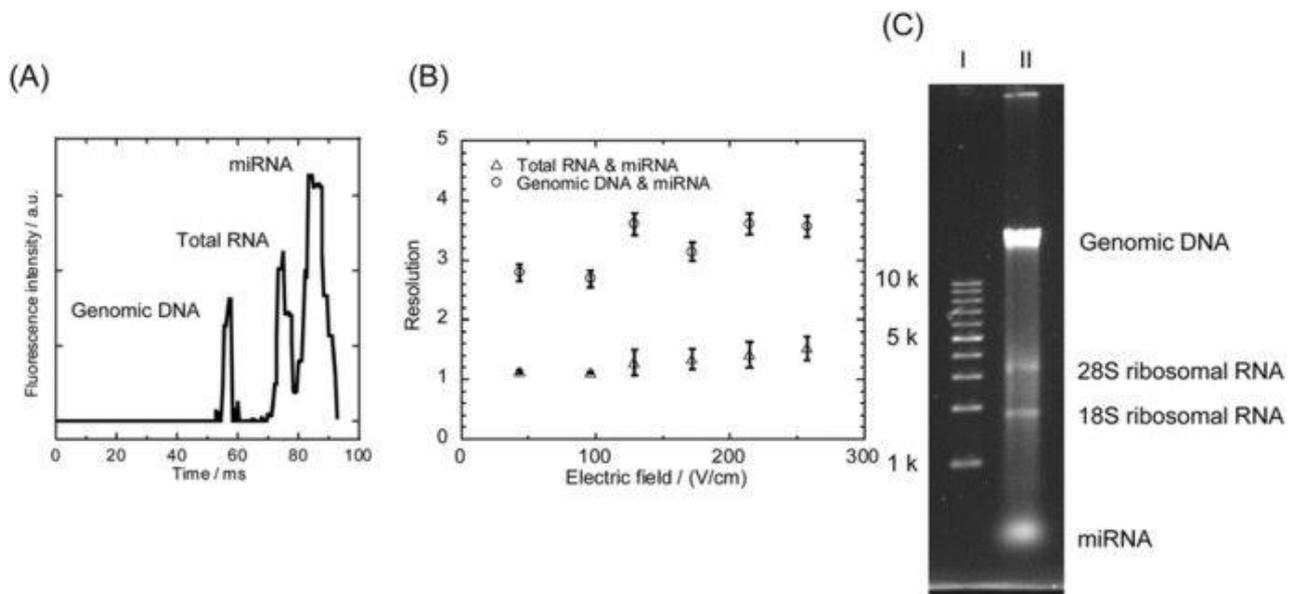
The novel nanodevice consists of **a quartz substrate**, which includes a **25×100 µm** array of nanopillars (nanometer-scale pillar structure of **250-nm in diameter and 100-nm in height**) in shallow nanoslits (**100-nm in height and 25-µm in width**). The researcher's group managed to optimize the separation performing almost total separation of microRNA from

DNA in just 20 ms. Currently, it is the fastest result. The separation with the high resolution was realized in 100 ms. The nanodevice has the ability to divide it due to the different mobilities of these materials within the nanopillar that was fabricated inside microchannels.



Schematic of the hybrid structure of nanopillars and nanoslits around the cross injector. Diagram showing the scheme of sample injection
source - nature.com

Consequently, this new device, which provides fast detachment, will allow doctors to identify cancer in the fast, effective and non-invasive way.



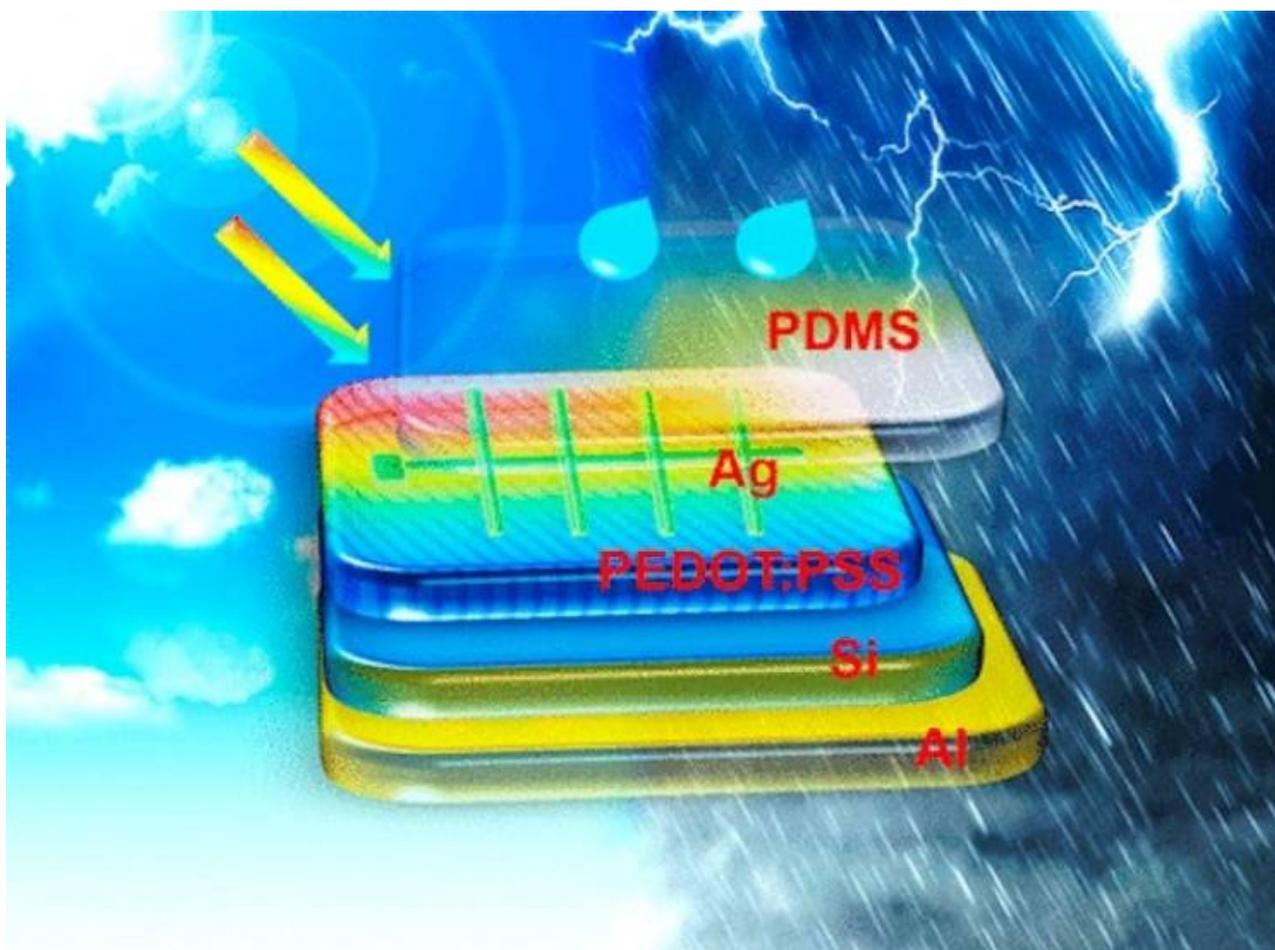
Millisecond separation of a mixture consisting of miRNA, total RNA, and genomic DNA
 source - nature.com

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On market since: -
Regions: Japan
Industries: Healthcare
Source links: [Scientific Reports](#)
[Nagoya University](#)



NOVEL HYBRID SOLAR CELLS CONVERT RAINDROPS INTO ELECTRICITY

Scientists managed to develop a new type of solar cells, which based on the use of the triboelectric nanogenerator or TENG. This novel technology has the ability to generate electricity during various weather conditions. When it rains at night the solar farm is also working, which makes it functional all day. Therefore, this method of solar cells producing provides a big potential for renewable energy.



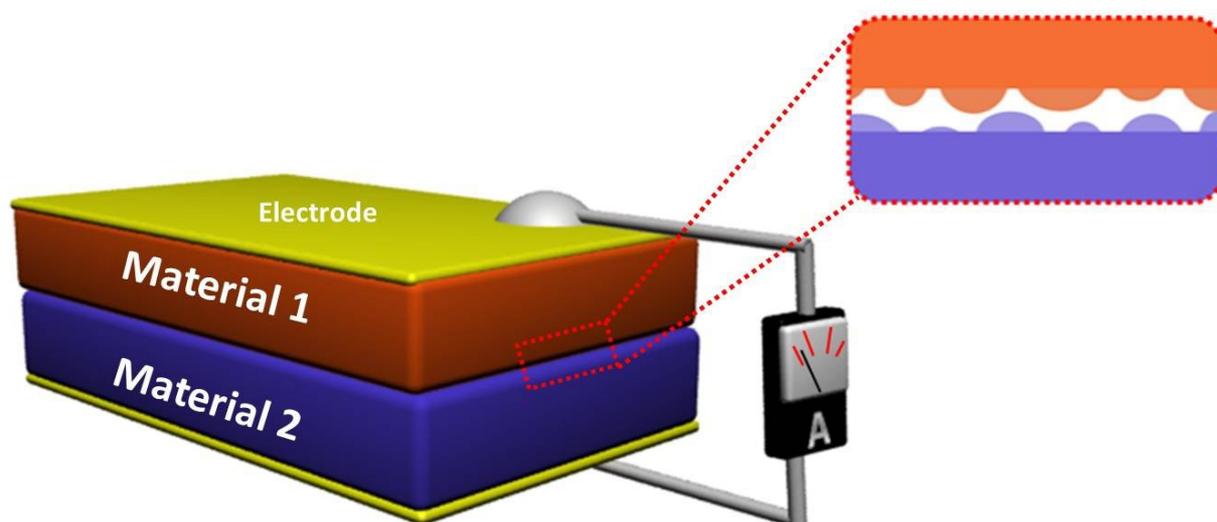
A transparent PDMS nano-generator integrated with a silicon solar cell by sharing a mutual electrode made of PEDOT:PSS film
source - ACS NANO

The development was made by scientists from the [Soochow University](#).

Despite the fact, that solar cell is able to convert sunlight into electricity, it has a critically reduced performance on rainy days. Consequently, scientists have developed a novel harvesting technology, which combines the solar cell and a **triboelectric nanogenerator (TENG)** device to realize the possibility to **generate electricity generation from both sunlight and raindrops**.

The idea of using TENGs is not completely new but it had some limits due to its size and complicated producing. The triboelectric nanogenerator is a new power-generation technology, which has the ability to use mechanical energy from the living environment transforming it into electricity and sustainably managing of portable devices. The novel method can make **an electric charge from the abrasion of 2 materials that rub together**. It operates as the static electricity, but in this case, electrons move. TENGs can produce the power from different processes, for example, car wheels driving on the road and abrasion

occurs, or textile rubbing each other. Therefore, scientists used the force of movement of droplets on the surface.



A triboelectric nanogenerator (TENG) based on organic materials that is used to convert mechanical energy into electricity

source - interestingengineering.com

Silicon-based heterojunction solar cells are combined with a TENG by an alternate electrode of a polystyrenesulfonat (PEDOT:PSS) film. 2 polymer sheets were used to put a TENG over of a photovoltaic cell. The researcher's group used PEDOT:PSS to decrease light reflection that causes an enhanced short-circuit current density. A single-electrode-mode water-drop TENG is made by combining imprinted PDMS (the most widely used polymer in siloxane elastomers) as a triboelectric material connected with a PEDOT:PSS sheet as an electrode.

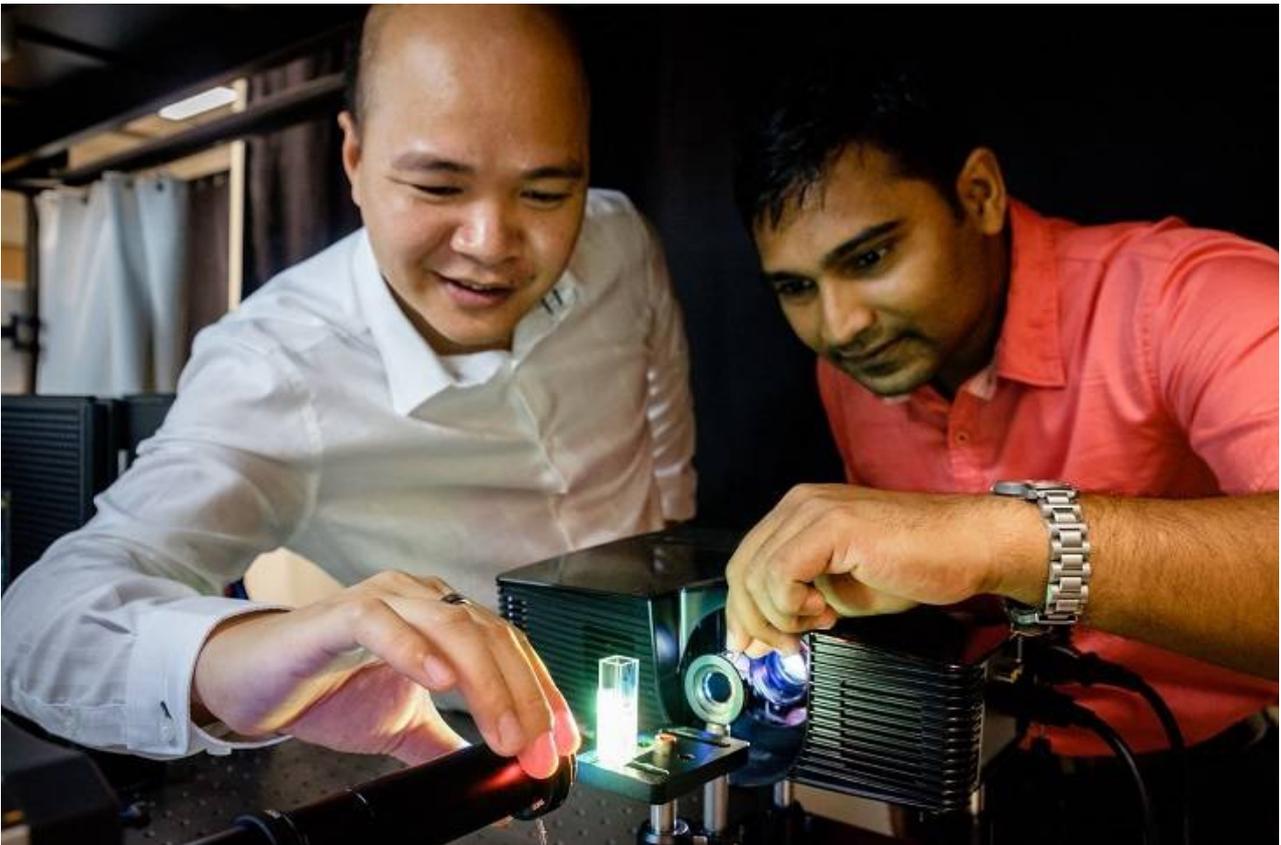
Scientists applied simple DVDs imprints to add slits to one polymer to increase the possibility to harvest energy. The big contact area between the imprinted PDMS and water drops considerably enhance the TENG voltage output with a maximum short-circuit current of 33.0 nA and a maximum open-current voltage of 2.14 V. Furthermore, this novel development is not only cost-effective and simple in produce, it performs a dual function: provides a high effectiveness transforming light and the high voltage of a TENG converting raindrop. It makes this type of solar cells multipurpose.

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Regions: China
Industries: Energy
Source links: [ACS NANO](#)
[Interesting Engineering](#)



A NOVEL MONOCHROMATIC CAMERA CAN TAKE MULTI-COLOURED PICTURES

Scientists have developed an innovative technic that can take sharp, colour images without using a lens and colour filters. This single-shot multispectral imaging technology can provide flexibility with a simple optical setup, due to the spatial correlation and spectral decorrelation of speckle patterns. Furthermore, it can be used in various medical spheres such as vision correction, chemical sensing and even in the food safety sphere.



From left: Asst Prof Steve Cuong Dang with Dr Sujit Kumar Sahoo doing an experiment with the ground glass camera

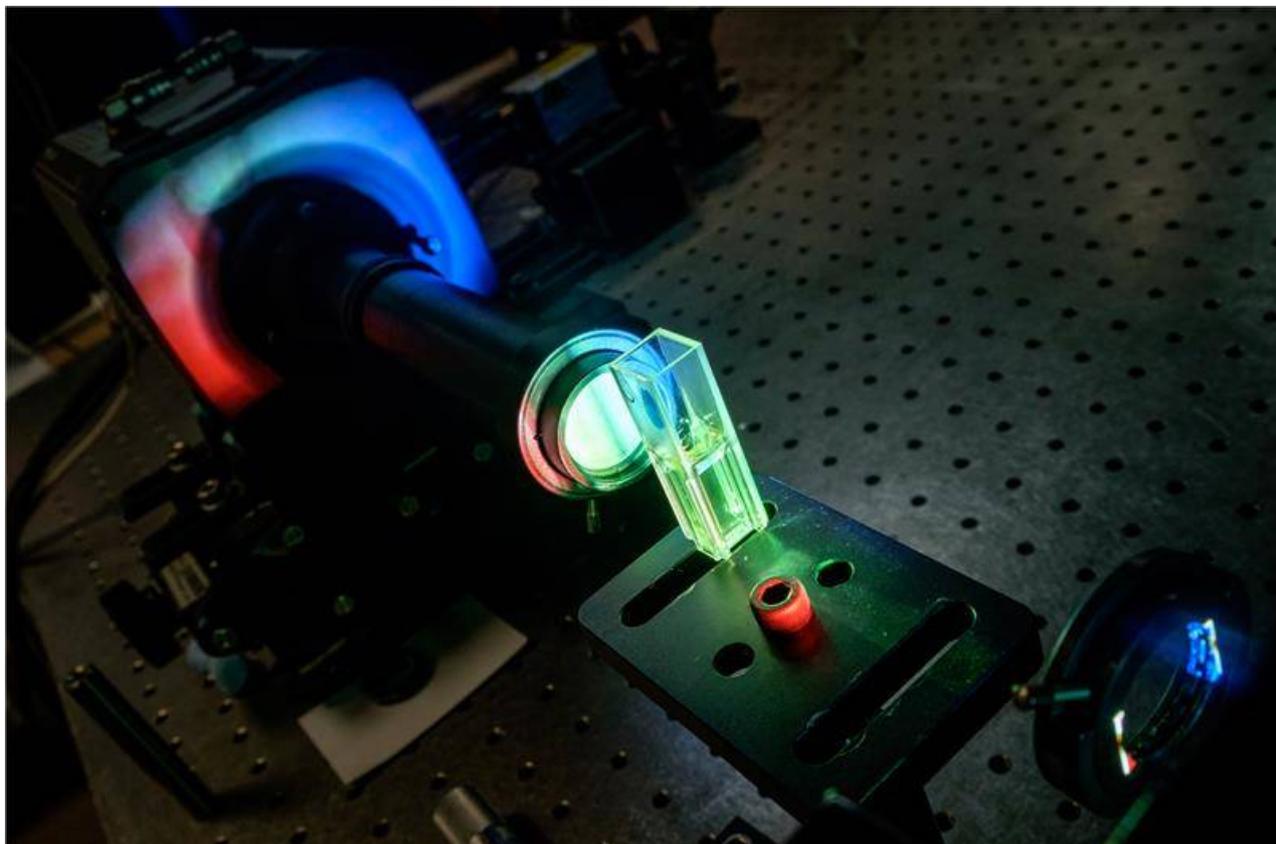
source - media.ntu.edu.sg

The unique development was made by scientists, led by Assistant Professor Steve Cuong Dang, from the [Nanyang Technological University](https://www.ntu.edu.sg).

Multispectral imaging has been developed rapidly and becomes an important technology for various applications because, in addition to the spatial domain, the spectral domain contains the significant amount of information about objects. One can do it simply by taking multiple shots (time multiplexing) with multiple filters in front of a monochromatic camera. With the development of high-resolution cameras, it is practical to trade off the spatial resolution to gain spectral information in a single shot imaging technique (space multiplexing). One version of multispectral imaging devices is the colour camera where the multiple spectral filters are spatially distributed on a 2D detector array. One can even rid of the spatial resolution to achieve higher spectral resolution with a large number of spectral filters to use as a compact spectrometer. Fabricating these different spectral filters is difficult and therefore high spectral resolution is challenging.

Multispectral imaging can be used in various spheres, from astronomical imaging and

earth observation to medical applications. Nevertheless, modern technologies are complex with multiple alignment-sensitive components and spatial and spectral parameters predetermined by manufacturers. As the result, researchers designed the **single-shot multispectral picture technology, which based on the spatial correlation and spectral decorrelation of speckle patterns.**

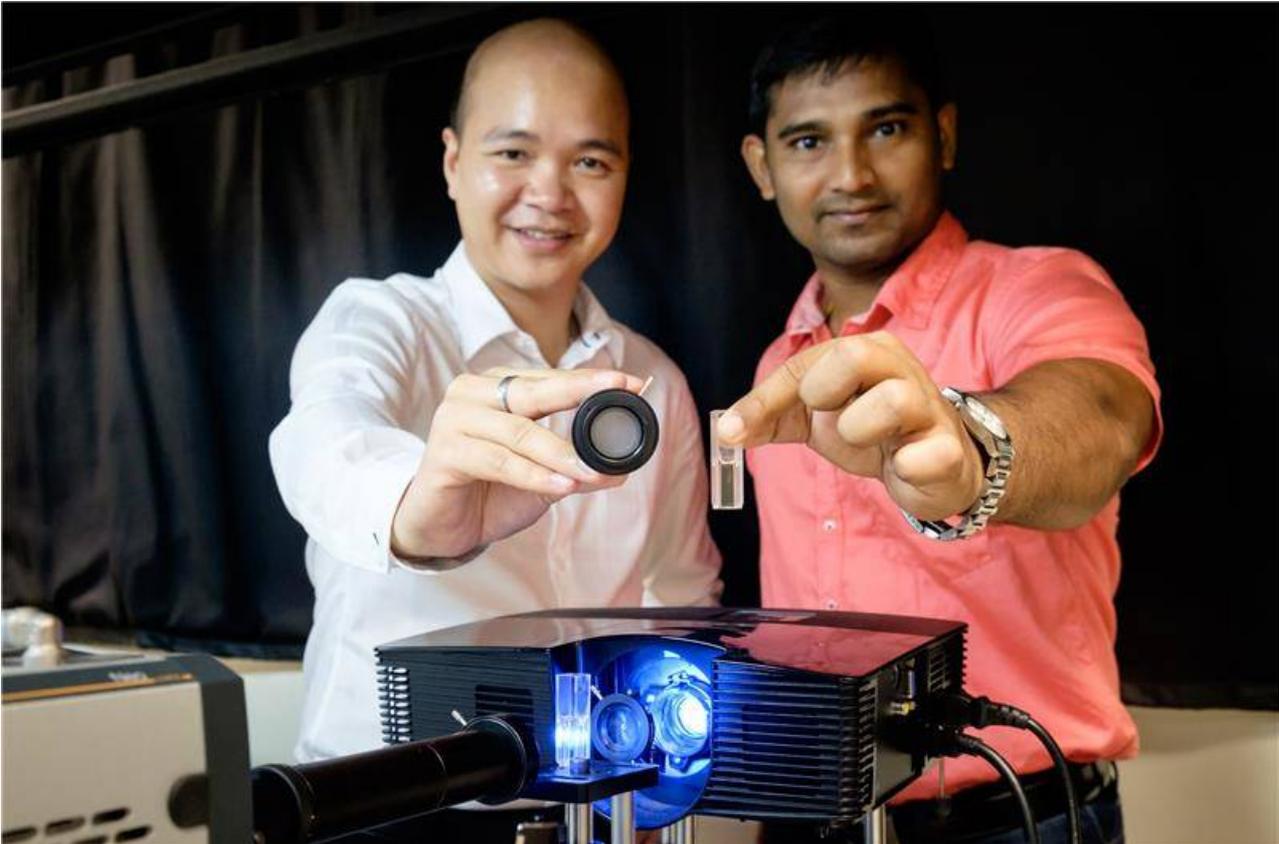


NTU ground glass camera can take images in multispectrum, with potential uses in chemical sensing and food safety
source - alphagalileo.org

They created multi-coloured images using a **piece of ground glass and method of 'reverse engineering' the light**, which has the ability to scatter by the translucent matt surface of the ground glass. Due to this process the original picture, which was projected before, can be received. Researchers developed an algorithm to reconstruct the image. To do this they created a library of **'speckle patterns'** linked to each wavelength of light, including those in the infrared and ultraviolet spectrums which are not visible to the eye. As lens and colour filters were removed and replaced with ground glass, this technology can be used for **producing compact cameras and smartphones** to make them thinner.

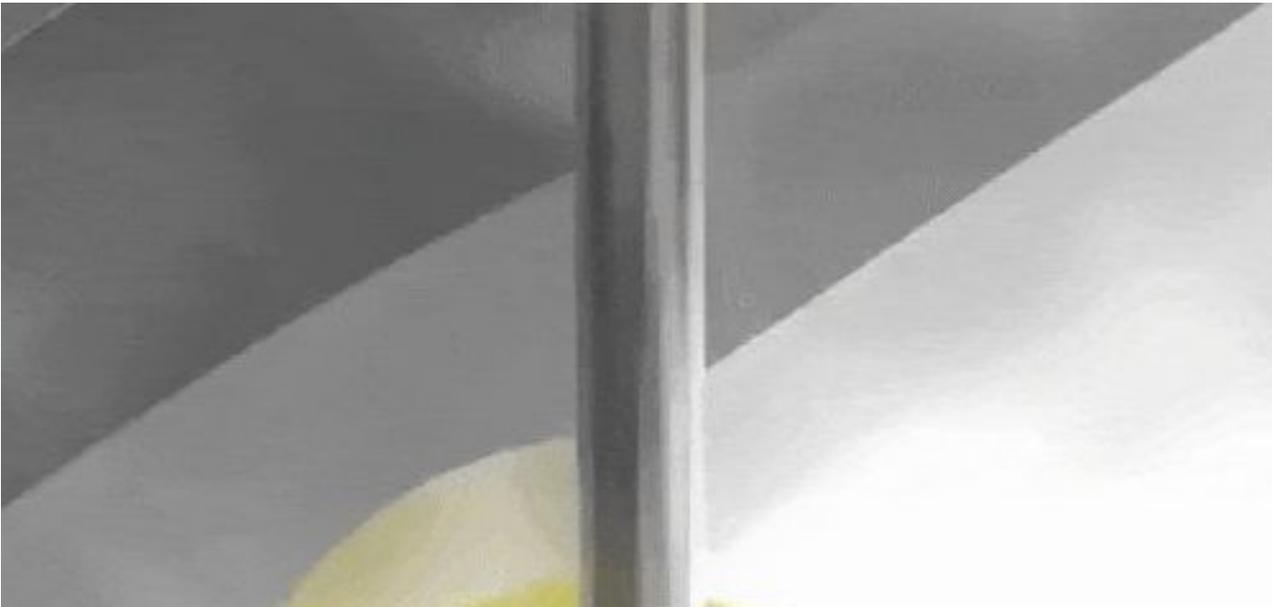
Furthermore, Assist. Prof. Steve Cuong Dang mentioned that this development can

improve imaging **uses in biomedical and scientific spheres**. The most significant advanced of this camera is that it can catch any range of the light spectrum, unlike modern cameras on the market.



Asst Prof Steve Cuong Dang holding a tube with ground glass that can detect the difference in objects and Dr Sujit Kumar Sahoo holding a vial of apple juice
source - alphagalileo.org

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On market since: -
Regions: Singapore
Industries: Creative Industries, Others
Source links: [Nanyang Technological University](#)
[Optica](#)
[ARXIV](#)



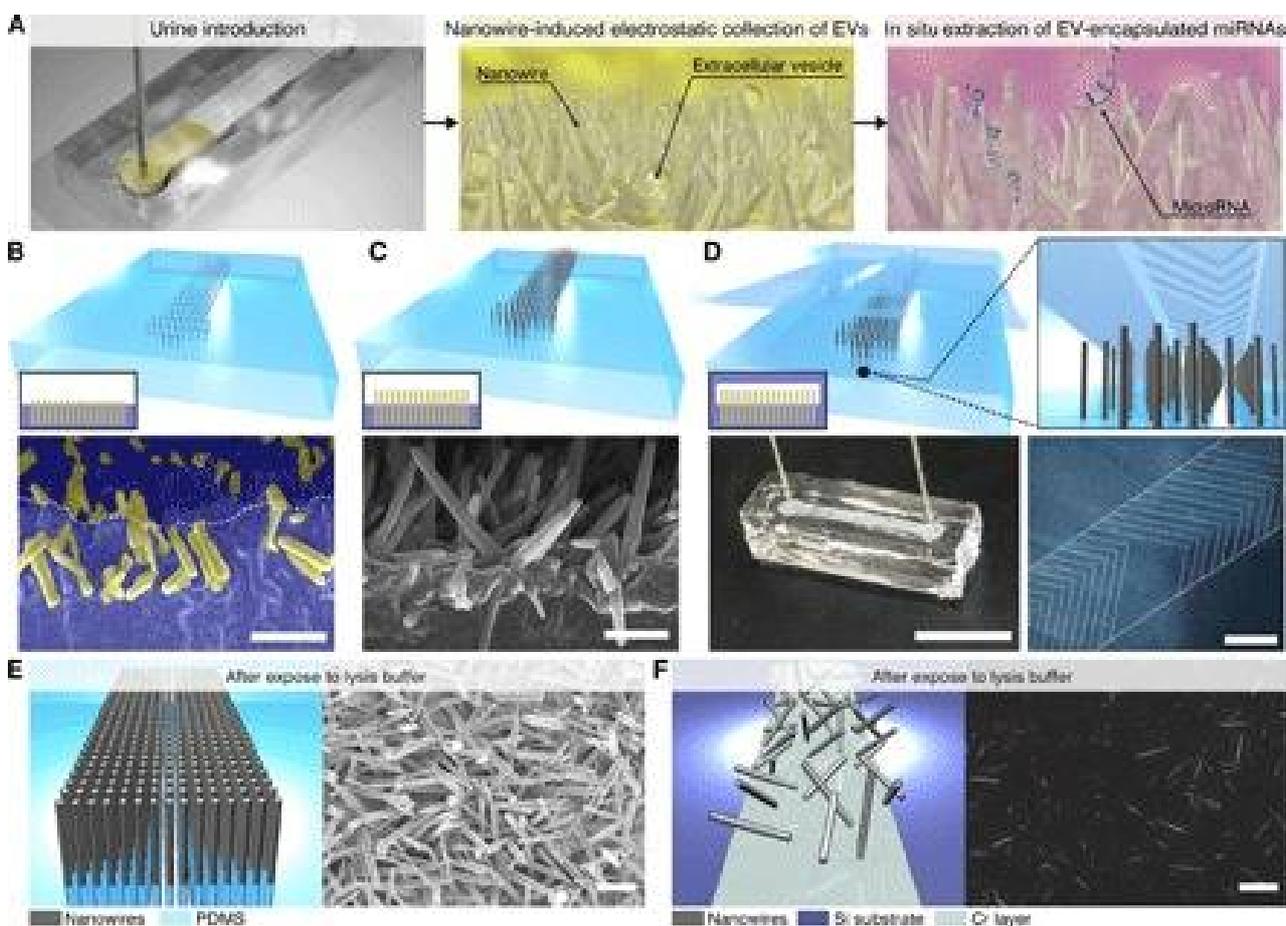
A NOVEL DEVICE CAN DETECT CANCER

Scientists developed nanowire device that has the ability to detect cancer making the urine test. It based on the technology of identifying microscopic levels of urinary markers potentially associated with cancer. This novel device will provide a foundation for getting a long-term goal of the early diagnosis of cancer in a non-invasive way.

The innovative development was made by scientists from the [Nagoya University](#).

The extracellular vesicle (EV) are mediators of cell-to-cell communication. Takao Yasui mentioned that **EVs are highly valuable as clinical markers**. The composition of the molecules contained in an EV can provide a diagnostic signature for various diseases.

Analyzing microRNAs (miRNAs) within urine extracellular vesicles (EVs) provides the non-invasive method of early-stage disease diagnoses. It means that the presence of certain microRNAs in urine can be a sign of serious diseases such as bladder and prostate cancer. Nevertheless, the inherent difficulty in collecting dilute concentrations of EVs (<0.01 volume %) from urine has hindered the development of these diagnoses. Despite this fact, there are a lot of technological barriers that need to be overpassed.



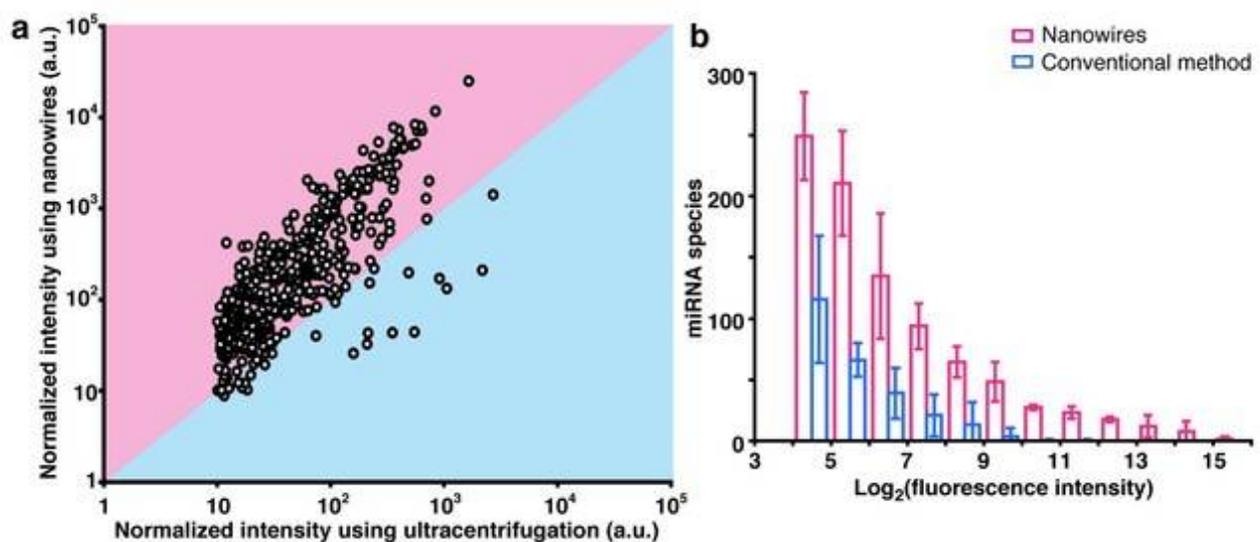
Nanowire-induced electrostatic collection of urine EVs followed by in situ extraction of EV-encapsulated miRNAs
source - ncbi.nlm.nih.gov

Takao Yasui noted that the amount of EVs in urine is very low, at **less than 0.01%** of the whole fluid volume. It makes diagnostic difficult. Consequently, scientists decided to put zinc oxide nanowires into a specialized polymer to produce the effective material. The

study results demonstrated that invention is very efficient. The speed of collection is over 99%, exceeding ultracentrifugation as well as other techniques, which were used in this field. In additions, this method allows scientists to perform EV-encapsulated miRNA analysis with a small sample volume and short treatment time: to collect the EVs requires **1 ml of urine and 20 min**. The mechanical stability of nanowires anchored into poly(dimethylsiloxane) (PDMS) during lysis buffer flow is effective for efficient in situ extraction of the urine EV-encapsulated miRNAs within **20 min**; more species of miRNAs of different sequences (around 1000 types) can be extracted from collected EVs than using standard methods.

The nanowire-anchored microfluidic device for in situ extraction of urine EV-encapsulated miRNAs was fabricated by bonding the nanowire-embedded PDMS substrate and a herringbone-structured PDMS substrate. The device consists of **nanowires anchored into a microfluidic substrate**. The mechanical stability of nanowires, which are secured into substrates during buffer flow and the electrostatic collection of EVs onto the nanowires are the 2 key techniques that provide the effectiveness of this device.

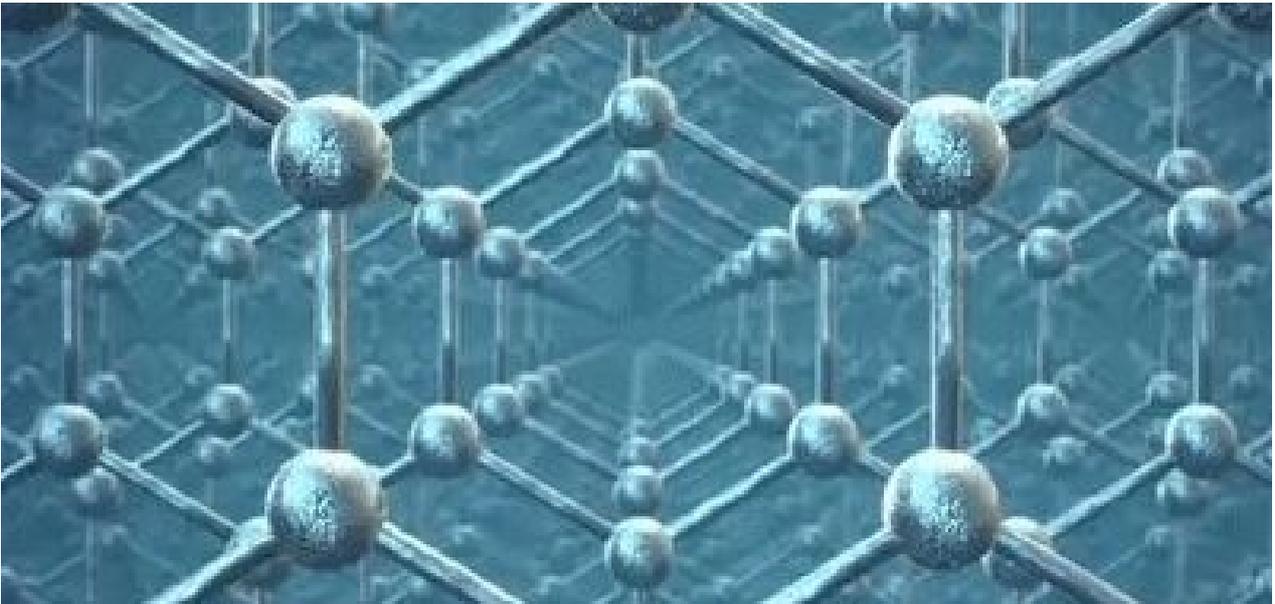
Furthermore, the development **can identify not only urologic malignancies such as bladder and prostate but neurological, for example, cancer of lung, pancreas and liver**.



Comparison of microRNA extraction using nanowires versus conventional collection

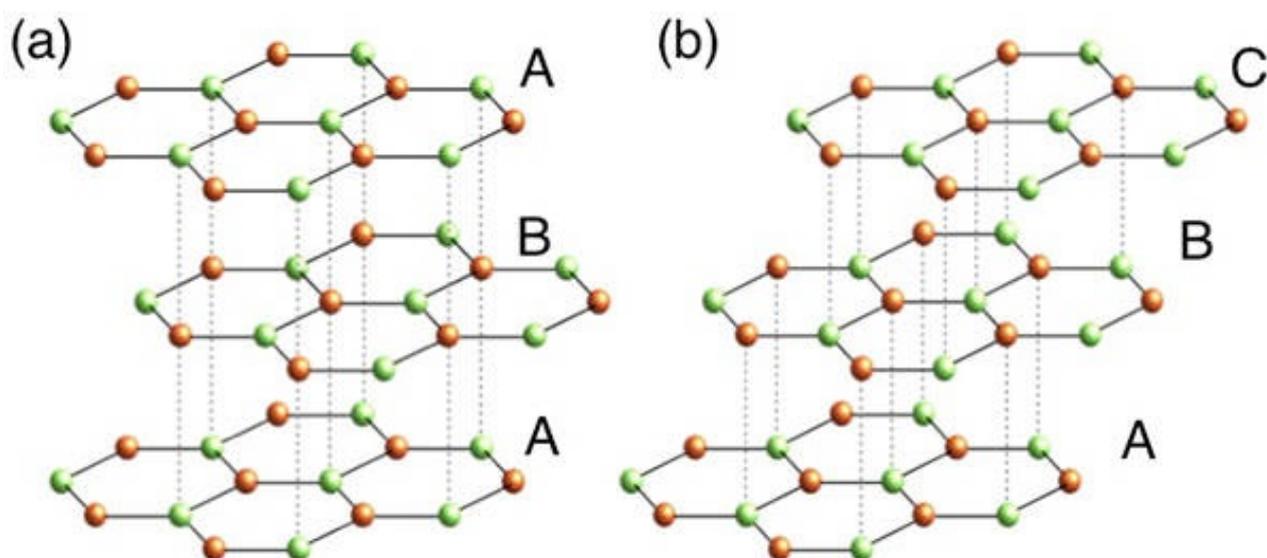
source - nagoya-u.ac.jp

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On market since: -
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Industries: Healthcare, Biotechnology
Source links: [Science Advances](#)
[Nagoya University](#)



TWO TYPES OF TRILAYER GRAPHENE THAT HAVE DIFFERENT ELECTRICAL FEATURES

Scientists have managed to develop a method to produce two materials that have three layers of graphene. They developed a quasi-free-standing trilayer graphene (TL) with ABA or ABC stacking and different unique electrical possibilities. This innovational discovery can lead to the creation of novel electronic devices, for example, a photo sensor, which has the ability to transform light into electricity.

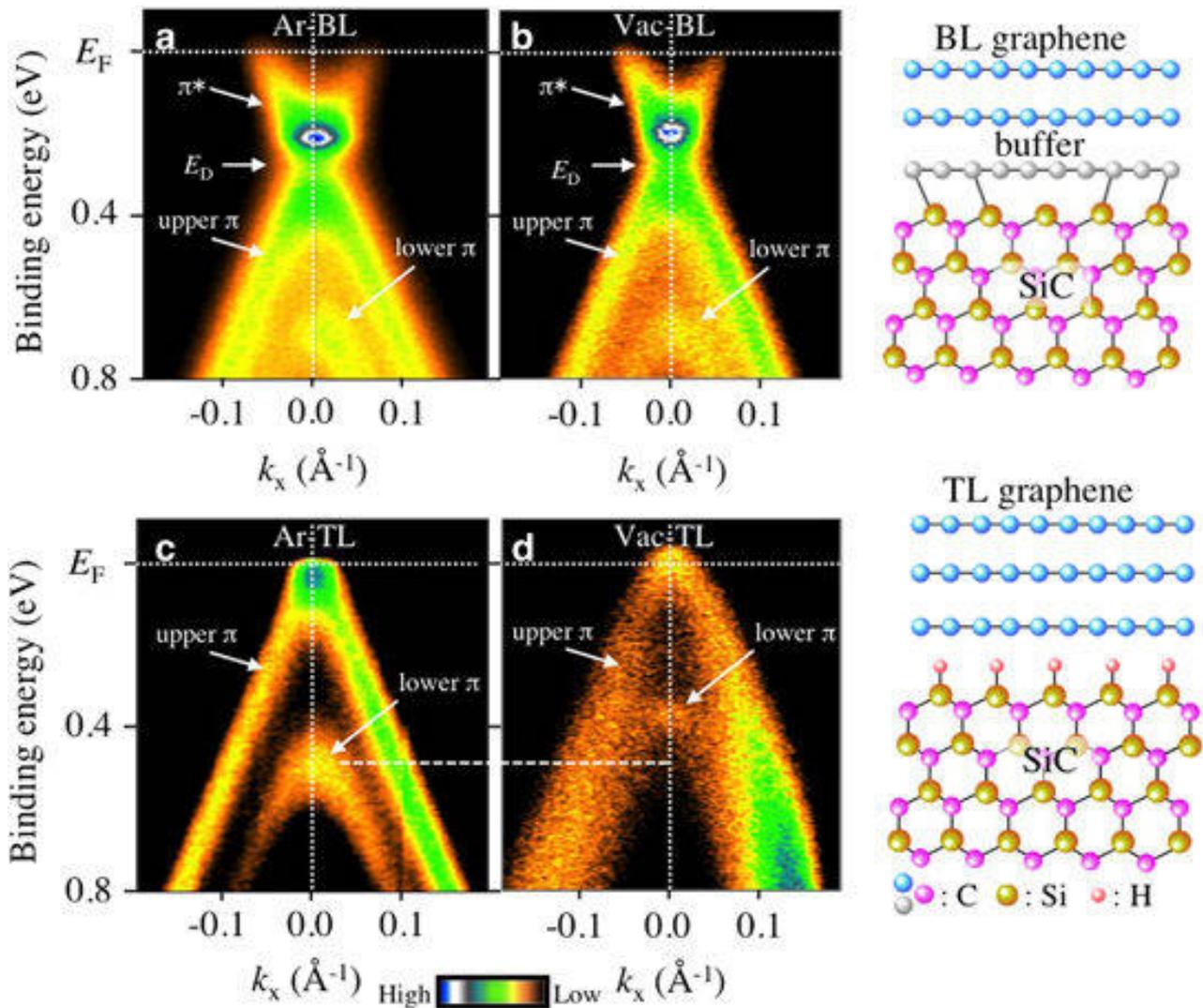


The schematic crystal structures of (a) ABA- and (b) ABC- stacked three layer graphene
source - tohoku.ac.jp

The development was made by the group of scientists from the [Tohoku University](#) in cooperation with the [Nagoya University](#).

Graphene is one of the allotropic forms of carbon, a monoatomic layer of carbon atoms with a hexagonal structure. It is stronger than steel at **200 times**, flexible, furthermore, it is an excellent conductor of electricity. The bilayer graphene consists of two graphene layers with AB stacking. The sheets can be put in one of two positions: AA-stacking is based on the formation of the centres of hexagons of each sheet above one another; AB-stacking is based on the placement forward the centre of the hexagon when one sheet is above a carbon atom below it. In TL graphene, the third graphene layer has 2 possible stacking consistencies - A or C, when it is put on bilayer graphene. The TL graphene has a great potential for developing various the electronic devices. Despite this fact, it has some difficulties during the manufacturing process.

Scientists successfully **fabricated the quasi-free-standing TL graphene with ABA or ABC stacking** grown epitaxially on hydrogen-terminated silicon carbide. The team has used 2 methods, which are based on the silicon carbide (SiC) heating, to achieve this goal. The first method is the heating of SiC up to **1,510°C** under pressurized argon (under a 0.1MPa Ar atmosphere). The second way - SiC was heated up to **1,300°C** in the high vacuum (1.0×10^{-7} Torr). The most important moment is that **the temperature and pressure control is the key to producing ABA and ABC phases**.



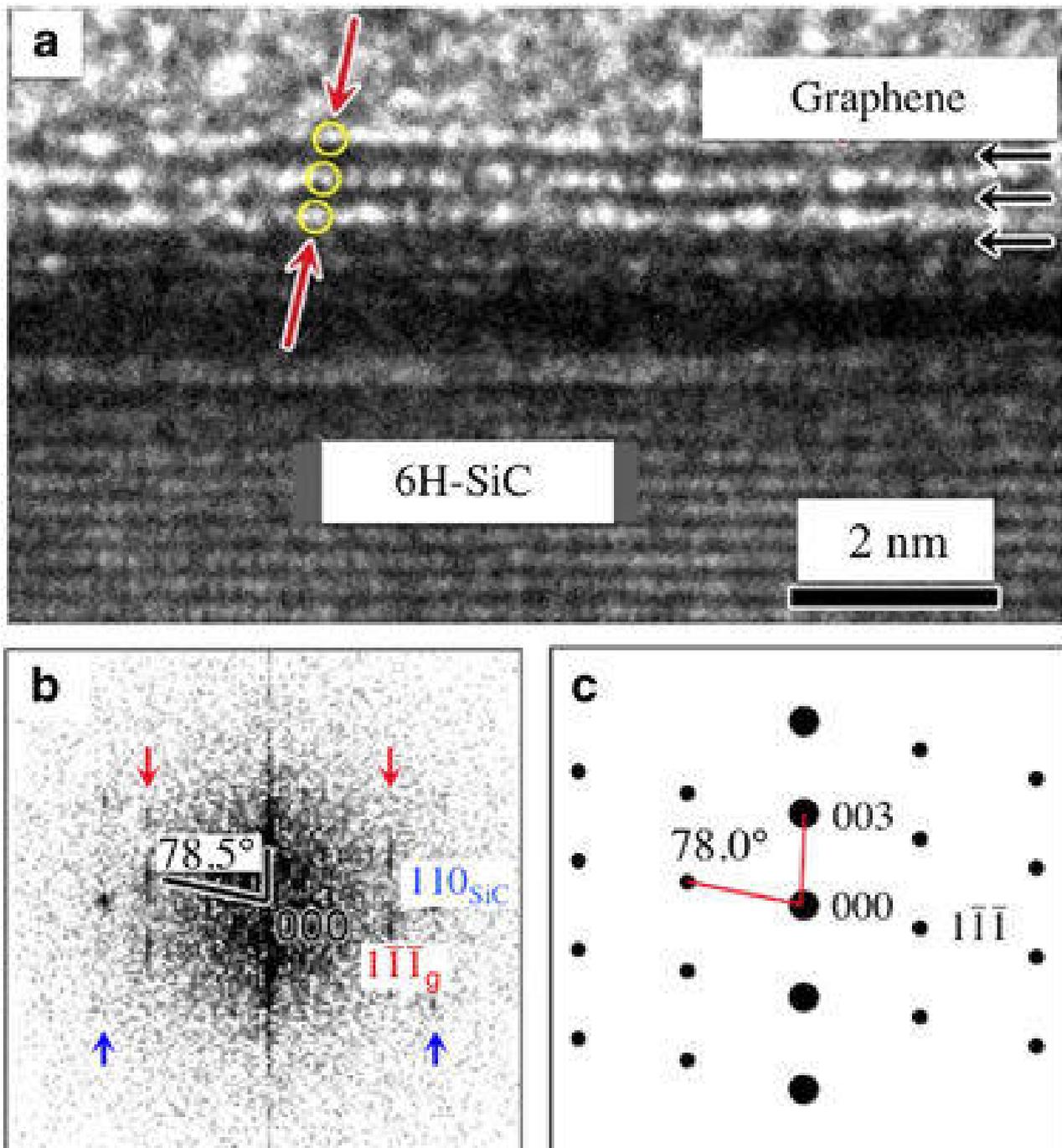
Dirac and non-Dirac dispersions in ABA and ABC trilayer graphene
source - nature.com

Scientists sprayed 'cracked' hydrogen gas onto the as-grown BL graphene film in a vacuum of 1.0×10^{-3} Torr by keeping the substrate at 500°C . The duration of hydrogen gas flow was 120min. The cracking of hydrogen molecules into hydrogen atoms was performed by a tungsten filament heated to 1600°C ^{22, 23} in front of the BL graphene sample. This hydrogenation process terminates chemical bonding from the SiC substrate and simultaneously converts the buffer layer into a single graphene layer, leading to the formation of quasi-free-standing G graphene.

Scientists applied the same hydrogenation procedure to both Ar-BL and Vac-BL graphene but obtained two different types of TL graphene with ABA and ABC stacking. This finding indicates that hydrogenation is not related to selective fabrication, and more importantly, the buffer layer is already arranged in the ABA or ABC stacking sequence before hydrogenation. Other parameters observed to control the sample-growth conditions in the

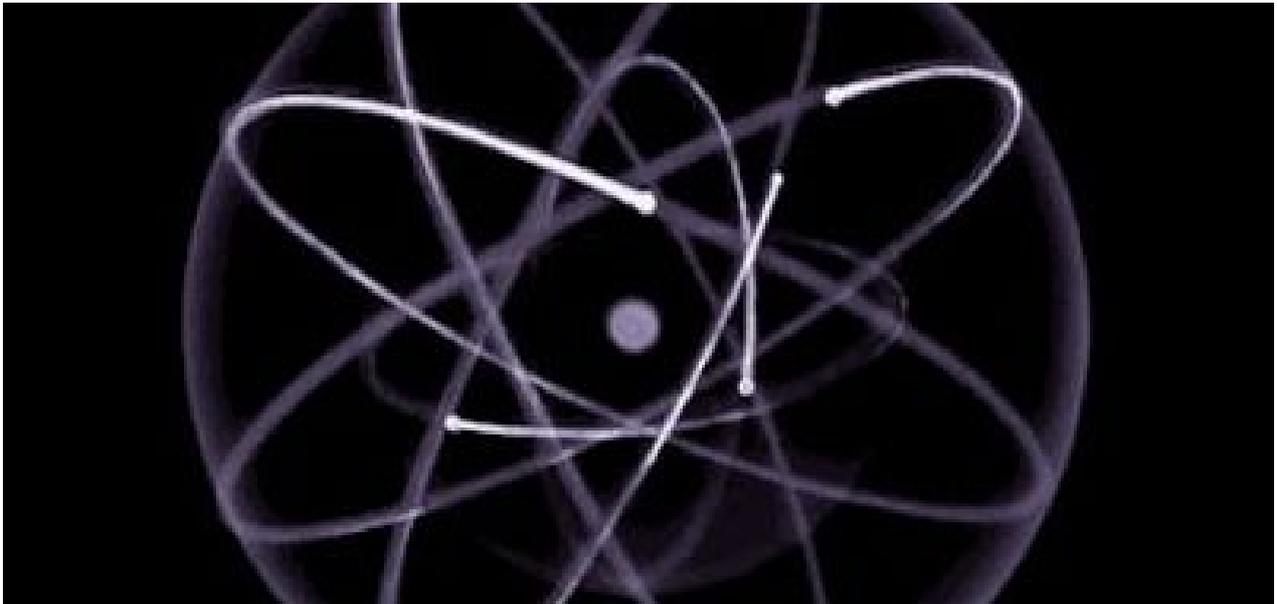
present study are temperature and pressure (atmosphere).

The group have tested the physical features and discovered that electrons operate in different ways. The ABA graphene was a perfect electrical conductor, alike the monolayer graphene. The ABC grapheme has semiconductor features. Consequently, this **innovative development can lead to the creation of modern electronic devices.**



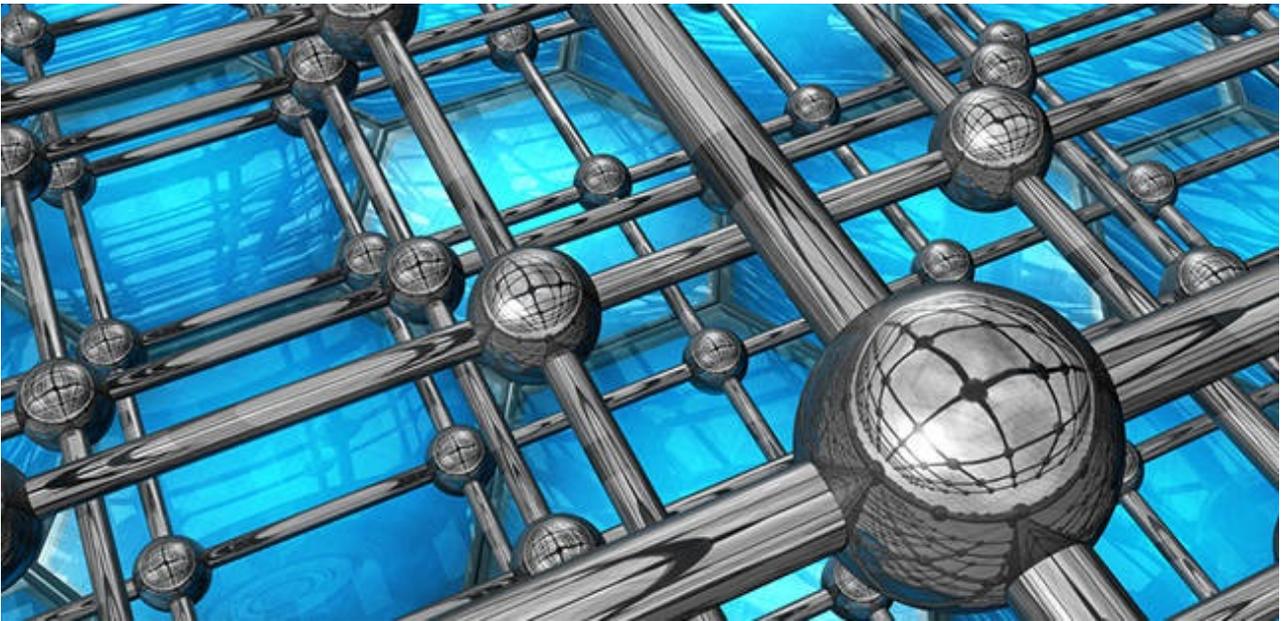
Characterization of stacking order in ABC trilayer graphene by TEM
source - nature.com

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On market since: -
Regions: Japan
Industries: Electronics, Energy
Source links: [NPG Asia Materials](#)
[Tohoku University](#)



A METHOD TO CREATE 2D ELECTRICAL CONDUCTING MATERIAL

The international group of scientists will be able to realize the two-dimensional (2D) electrical conductivity from a bulk material, using the method of segmentation of a 3D conductor into a stack of 2D conducting thin layers. This innovational discovery will provide the development of 2D electrical conducting materials and devices.



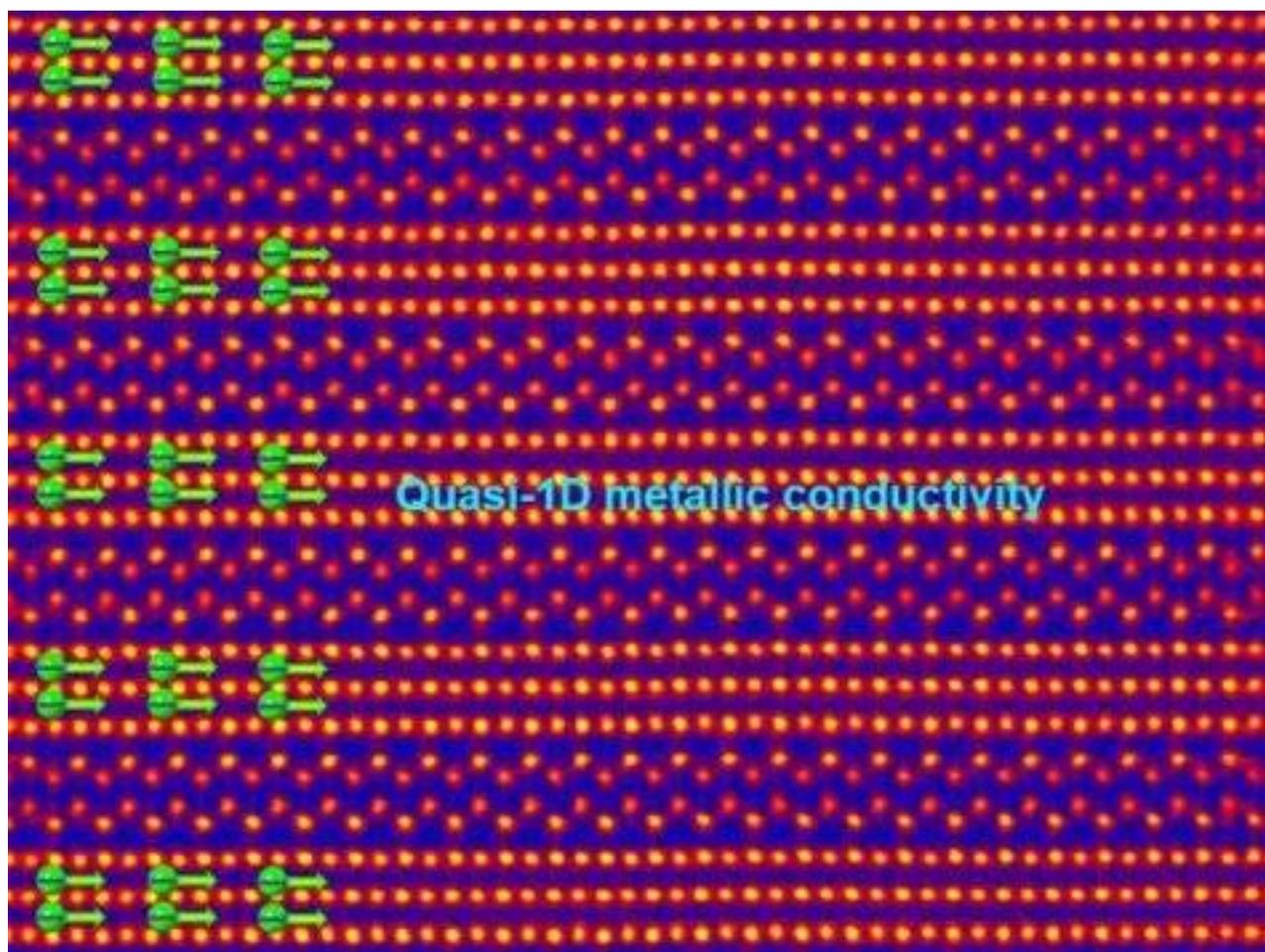
source -

The international team of scientists from the [Tohoku University](#) in cooperation with [Zürich Research Laboratory](#) managed to identify **the atomic structure of a group of perovskite-related materials, which demonstrate perspective 2D conductive characteristics.**

If add oxygen atoms to a perovskite-like crystal material, it will lead to the splitting it into layers. This process gives it unique electrical features. **2D electron gas (2DEG)**, which is free to move in 2 dimensions, but tightly confined in the third, has unique characteristics. Furthermore, the main its advantage is that it can be used for producing fast and innovational electronic devices.

The group have been researching the 2DEG that was found in **2004**, to check how it can be applied in the manufacturing of superconductors and etc. However, the quasi-one-dimensional (1D) metallic conductance of the **perovskite-related $\text{Sr}_n\text{Nb}_n\text{O}_{3n+2}$ compounds can be used for developing high-fast electronic devices.** The $\text{Sr}_n\text{Nb}_n\text{O}_{3n+2}$ compounds can be derived by introducing additional oxygen into the SrNbO_3 perovskite.

Scientists decided to apply the scanning advanced transmission electron microscopy and atomistic principles calculations to define the atomic and electronic structures of the $\text{Sr}_n\text{Nb}_n\text{O}_{3n+2}$ compounds and explain the mechanism of the quasi-1D metallic conductance. In other words, the team managed to determine **in which way adding oxygen atoms to strontium niobates can change the conductance.**



The scanning transmission electron micrograph shows that the atomic structure was alternately arranged in the three-layer and the zig-zag two-layer thick chain-like slabs, showing quasi-1D metallic conductivity in the former source - tohoku.ac.jp

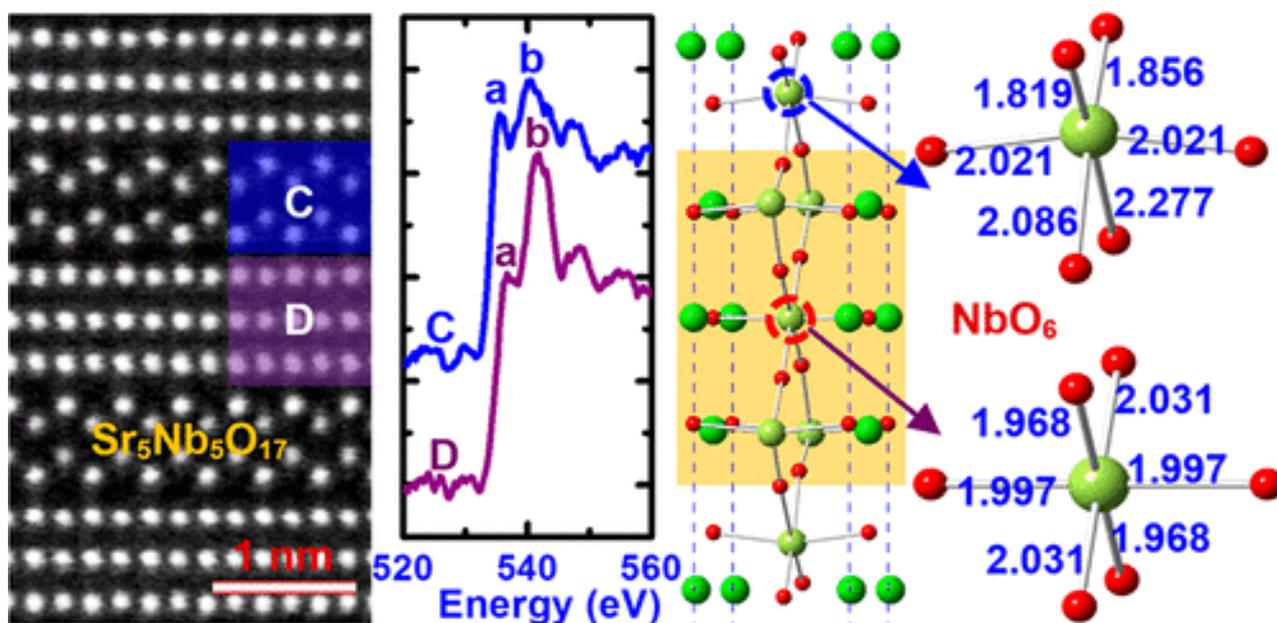
As the result, there are 4 different materials created depending on the intensity of oxygen atoms. The scientific team found that 3 of them were conductors of electricity but the 4th was an insulator. Scientists managed to find the local electrical conductance in the $\text{Sr}_n\text{Nb}_n\text{O}_{3n+2}$ compounds directly depends on the configuration and shapes of the NbO_6 (niobate) octahedra in local regions.

The zigzag-like slabs in all these structures as well as the chain-like slabs in the 2-2-2-2 type structure are electrically insulating because the NbO_6 octahedra in these slabs are significantly distorted with a large displacement of Nb from the octahedral centers and the Nb valence is Nb^{5+} .

The $\text{Sr}_n\text{Nb}_n\text{O}_{3n+2}$ quasi-1D conductors are composed of alternately stacked chain-like conducting slabs and zigzag-like insulating slabs, which can be derived by intercalating the insulating zigzag-like slabs into the 3D conducting SrNbO_3 perovskite along $\{110\}$

planes. Such a concept of segmenting a 3D conductor into a stack of quasi-2D conducting thin layers by inserting insulating layers in between them should be applicable not only to SrNbO_3 / $\text{SrNbO}_{3+y} = \text{Sr}_n\text{Nb}_n\text{O}_{3n+2}$ but also to **other materials**.

This innovational method will allow **creating 2D electrical conducting materials and electronic devices**.



The $\text{Sr}_n\text{Nb}_n\text{O}_{3n+2}$ compounds can be derived by introducing additional oxygen into the SrNbO_3 perovskite source - pubs.acs.org

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On market since: -
Regions: Germany, Japan
Industries: Electronics, Energy
Source links: [ACS Nano](#)
[Tohoku University](#)



A NOVEL TECHNOLOGY CAN TRANSFORM A TYPICAL GLASS INTO 'SMART' GLASS

Australian scientists have developed an innovational coating, which has the ability to transform existing glass into 'smart' glass without using electricity. The self-regulating Vanadium dioxide (VO₂) film is 50-150 nanometers thick that is at 1,000 times thinner than a human hair. The most significant advantage of this technology is that it can reduce the cost of air-conditioning and heating systems.



PhD student Mohammad Taha with a sample of coated glass
source - newatlas.com

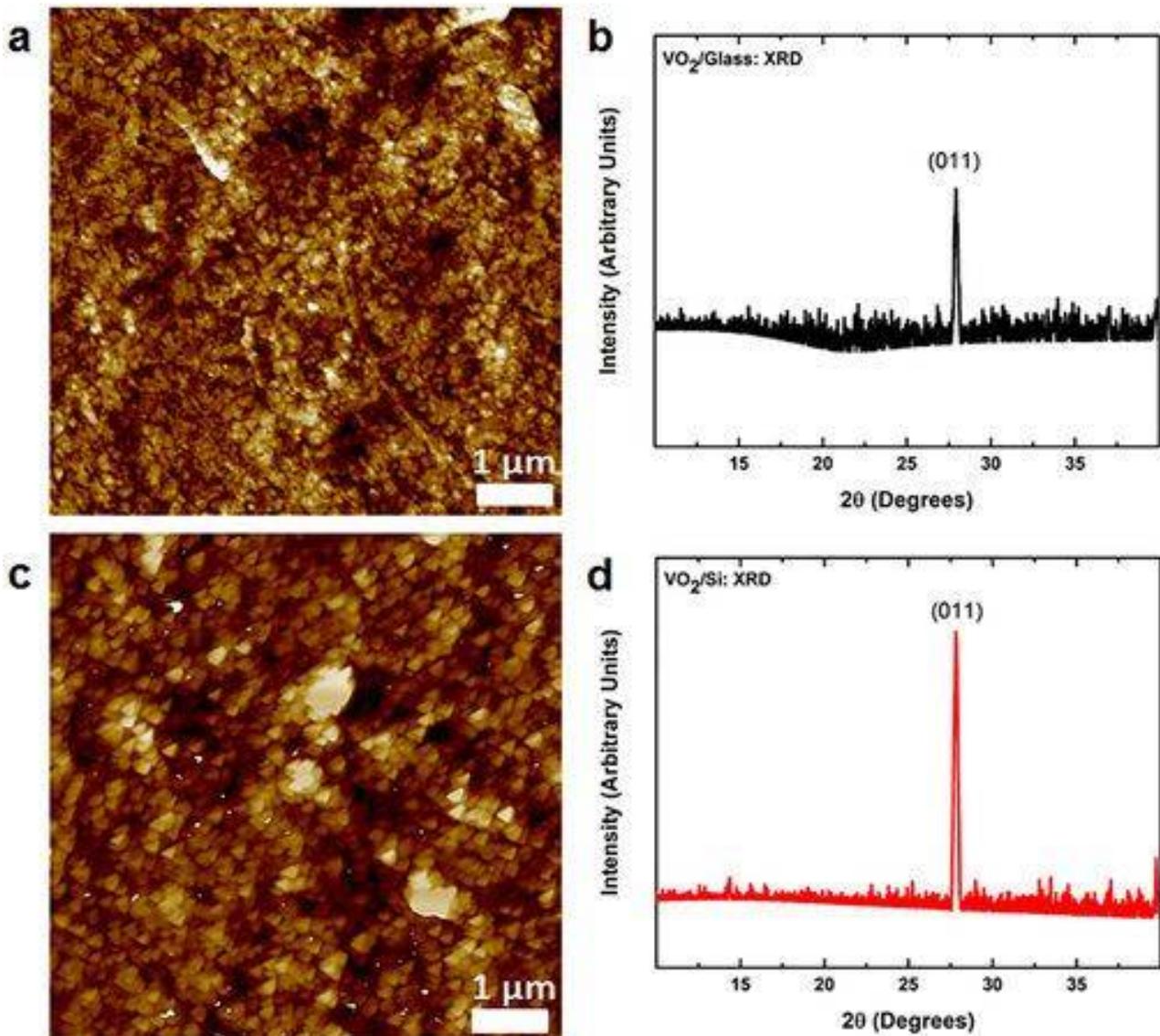
The group of scientists from the [Royal Melbourne Institute of Technology Australia](#) have created a film that allows users to get by without electricity during using 'smart' glass.

On the market, there are already many examples of 'smart' glass, which is darkened depending on the intensity of ambient light and temperature. Therefore, it is possible to reduce the cost of heating or air conditioning of the premises. However, electronic toning requires electricity, which also spends some costs.

At surface temperatures below 67°C , vanadium dioxide acts as an insulator, helping to keep heat inside the room. At the same time, it allows penetrating the whole spectrum of sunlight through the window. An elevated temperature induces an insulator-to-metal transition (IMT) as the crystal reorients from a monoclinic state (insulator) to a tetragonal arrangement (metallic). This transition is accompanied by a simultaneous change in optical properties making VO_2 a versatile optoelectronic material. Hence, it blocks the penetration of thermal infrared solar radiation.

The ability to change in electrical characteristics is accompanied by a simultaneous transition in optical properties, wherein the material changes from being transparent to nearly opaque at infrared (IR) wavelengths. Consequently, this material is perfect for

application in various devices such as 'smart' windows.

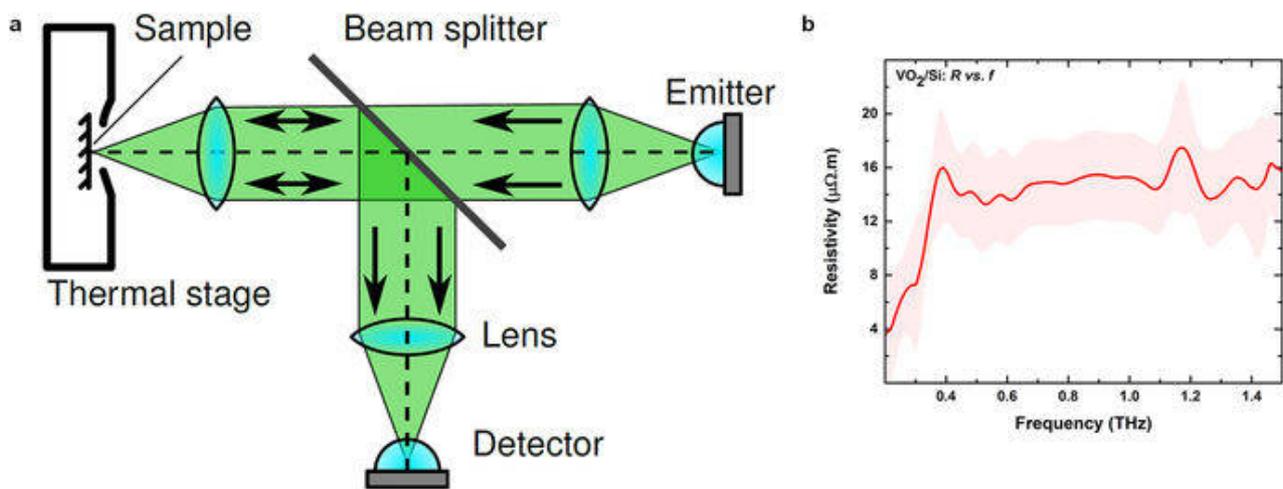


Characterisation of VO₂ thin films: Atomic force micrographs for post-deposition annealed VO₂ thin films on glass high resistivity silicon and quartz
source - nature.com

During the scientific investigation, researchers tested surface morphology and crystallinity using atomic force microscope (AFM) topography scans and X-ray diffraction (XRD) studies. 'Smart' glass windows, compared to standard dual-pane glass, are about **70% more energy-efficient during summer and 45% more efficient in the winter.**

The most of energy in buildings is loose because of windows. People maintain their houses at a certain temperature in the very wasteful way. Associate Professor Madhu Bhaskaran mentioned that this novel technology provides the ability to manufacture smart windows, which block heat during summer and retain heat inside when the weather cools.

Furthermore, it will significantly reduce the carbon emissions of buildings.



Reflective terahertz time-domain spectroscopy setup, where the sample is heated using a thermal stage source - nature.com

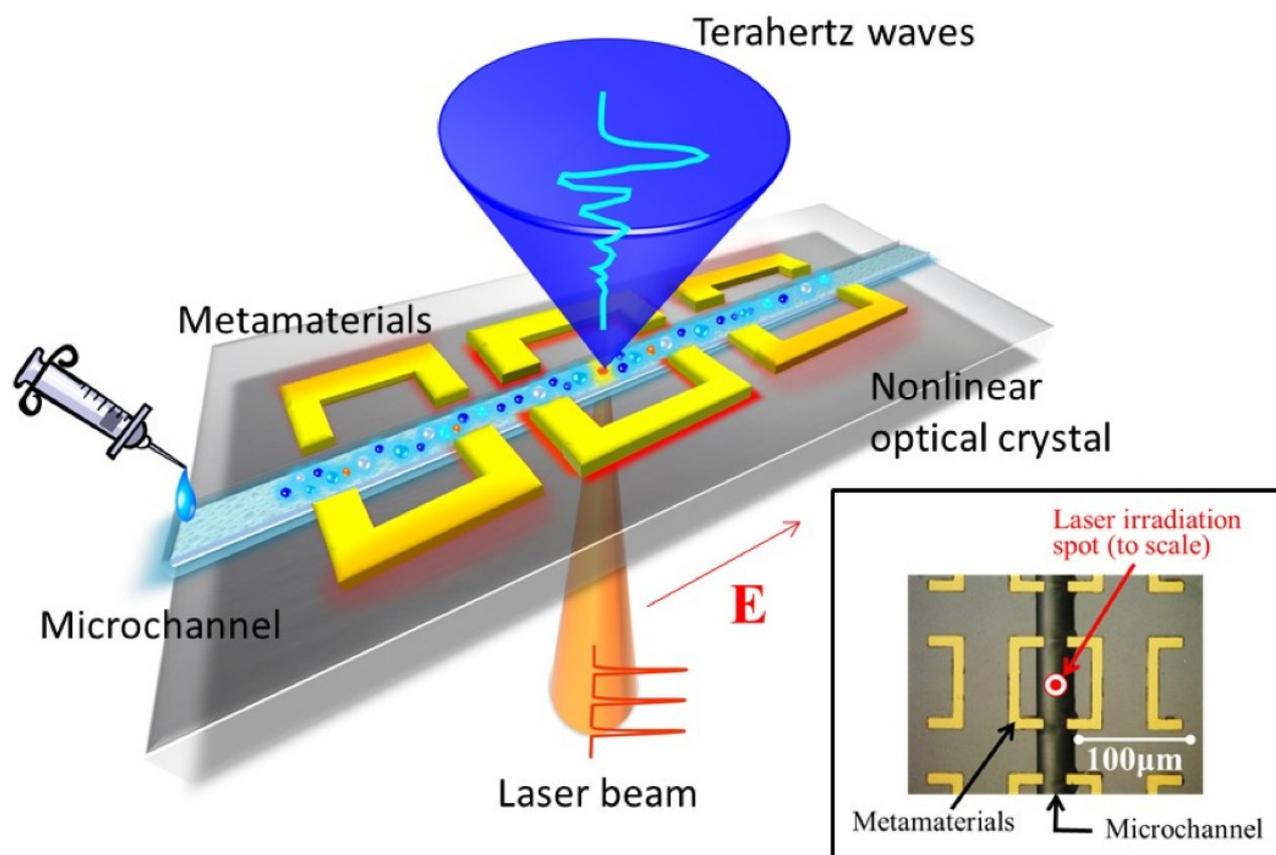
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Patent status: -
On market since: -
Regions: Australia
Industries: Energy, Others
Source links: [Scientific Reports – Nature](#)
[RMIT Australia](#)



AN INNOVATIVE CHIP CAN DETECT CANCER AND DIABETES

Japanese scientists have created the nonlinear optical crystal (NLOC) chip combining THz waves and the microfluidic device, which has the ability to detect influenza virus, diabetes and even cancer. This method can analyze living cells in a non-destructive way and detect solution concentrations in volumes of less than a nanoliter. The technology is highly sensitive.

The innovational development was made by the researcher's group from the [Osaka University](#).



A schematic drawing of solution measurement by using fabricated terahertz microfluidic chip
source - aip.scitation.org

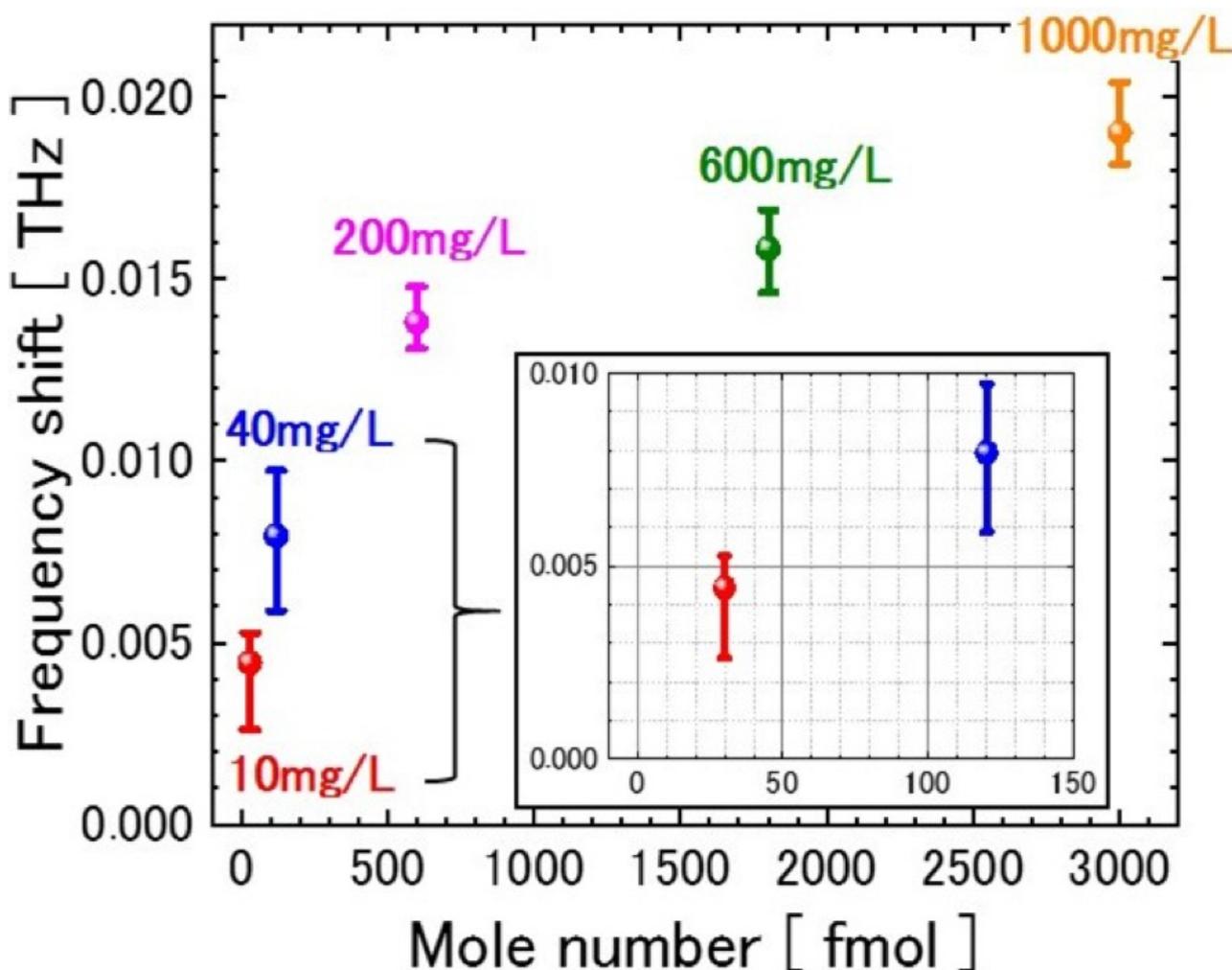
The **nonlinear optical crystal (NLOC) chip** is based on **terahertz (THz) waves** and **microfluidic device** with a few arrays of split ring resonators (SRRs) for ultra-trace and quantitative measurements of liquid solutions.

THz waves have the capability to identify molecular vibrations and rotations, without using any labels that can change the characteristics of the substances. Nevertheless, the diffraction limit of THz waves and their absorption property by water have limited the use of this technology. Microfluidic devices can be also used as analytical systems due to its low sample volumes required for sample measurement.

The chip consists of a **THz radiation point source**, a single microchannel, and a few arrays of meta-atoms, elementary units of metamaterials. The THz radiation is generated by optical rectification in the NLOC close underneath the microchannel and couples to the meta-atoms. After this, the chip determines the solution concentrations based on changes

in the resonant frequency and peak attenuation of the THz transmission spectrum.

The microfluidic chip was evaluated by using distilled water and commercial mineral water with different hardness, and scientists were able to detect **31.8 fmol** of the mineral in a **318 pl solution**. This sensitivity is comparable to a standard commercial fluorescence-based systems and it can be improved by further optimization of the structure and the periodic arrangement of meta-atoms such as Fano or toroidal resonant types.

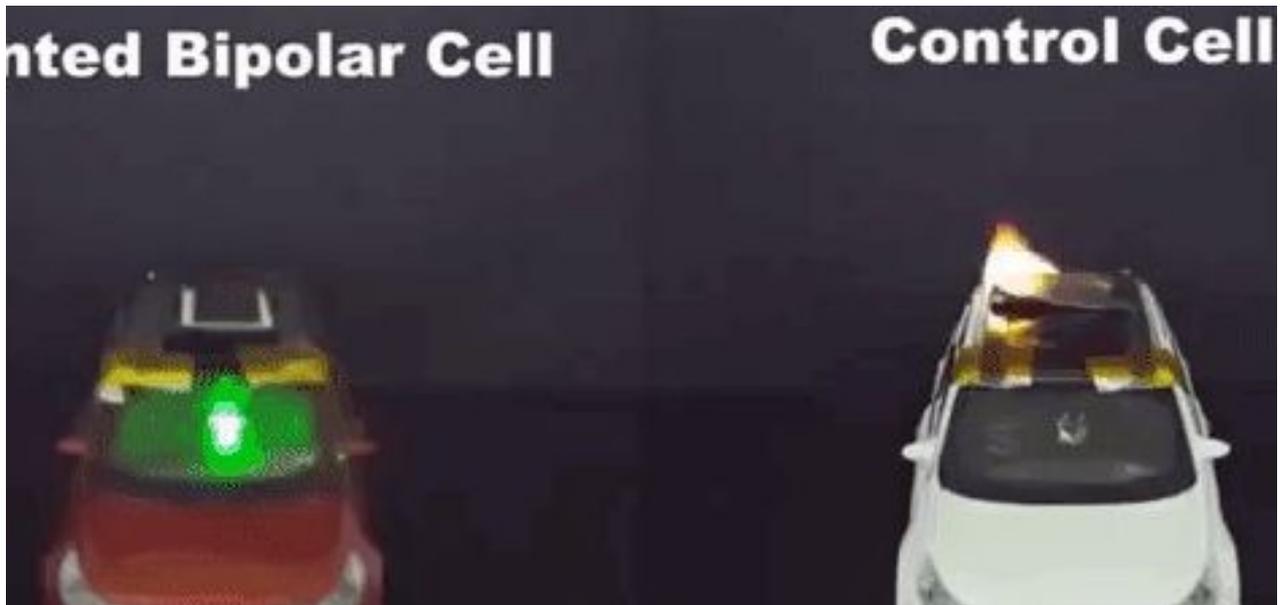


Plots of the resonance frequency shift with respect to the mineral concentration in the actual amount of 318 picoliters of mineral water
source - aip.scitation.org

Professor Masayoshi Tonouchi mentioned that such device without the requirement for labelling moieties can be used for creating new **low-invasive methods of detection**. The main advantage of this technology is that **various diseases can be identified with small volumes of bodily liquid**. Furthermore, the method is comfortable for patients due to the possibility to reduce the pain of various clinical procedures.

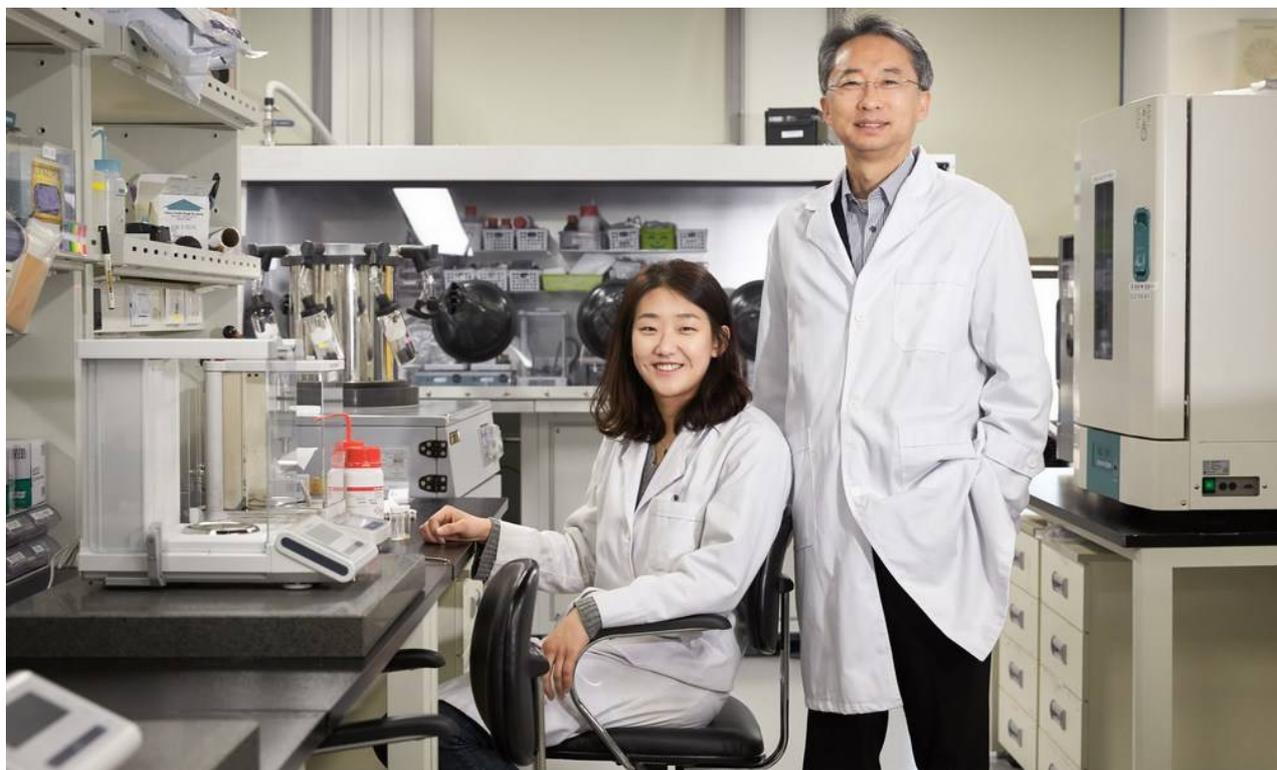
The THz intensity by using this technique is certainly weaker than that by THz quantum cascade lasers (THz-QCLs), but it is easy to control resonance frequency by a simple structural change and also has a function of positioning excitation laser beam. It is possible to obtain two-dimensional information such as chemical reaction process that is observed in micro-total analysis systems. This innovational technology can be applied in various fields such as [clinical medicine](#), [biochemistry](#) and [cell biology](#).

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Patent status: -
On market since: -
Regions: Japan
Industries: Healthcare, Biotechnology
Source links: [APL Photonics](#)



A FLEXIBLE AND FIRE RESISTANT BATTERY WAS DEVELOPED

The scientific research has presented a new type of highly flexible battery, which has great thermal stable property and fire resistance. The study results showed that such battery has high performance even in the case when it cut with scissors or twisted excessively. Furthermore, this innovational technology can lead to the developing of electric vehicles (EVs) and the Internet of Things (IoT).



This breakthrough has been led by Professor Sang-Young Lee and his research team in the School of Energy and Chemical Engineering at UNIST
source - unist.ac.kr

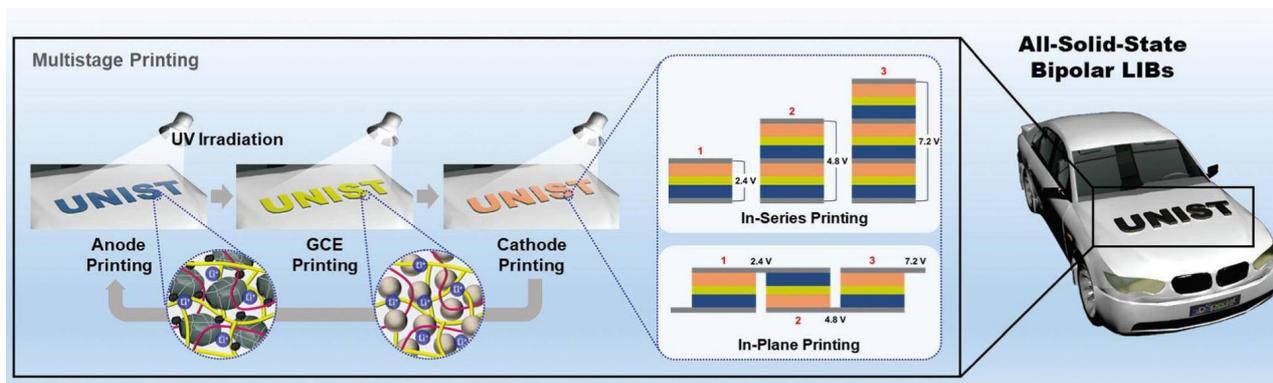
This unexpected invention was made by the researcher's group, led by Professor Sang-Young Lee from the [Ulsan National Institute of Science and Technology](http://unist.ac.kr).

Lithium-ion batteries, which consist of the cathode, anode and electrolyte, always widely used. Despite this fact, LIBs with liquid electrolytes have some limits due to its safety problem because of the use of highly-flammable organic solvents. Consequently, the development of solid electrolytes is actively made in order to decide **the problem of flammable electrolytes**. Solid electrolytes have been proposed as a suitable and safe alternative to liquid electrolytes for batteries.

Nevertheless, the use of sulfide- or oxide-based inorganic solid electrolytes also have some limitations of the mechanical flexibility and form factors in addition to their longstanding problems, for example, chemical instability, interfacial contact resistance and manufacturing processability.

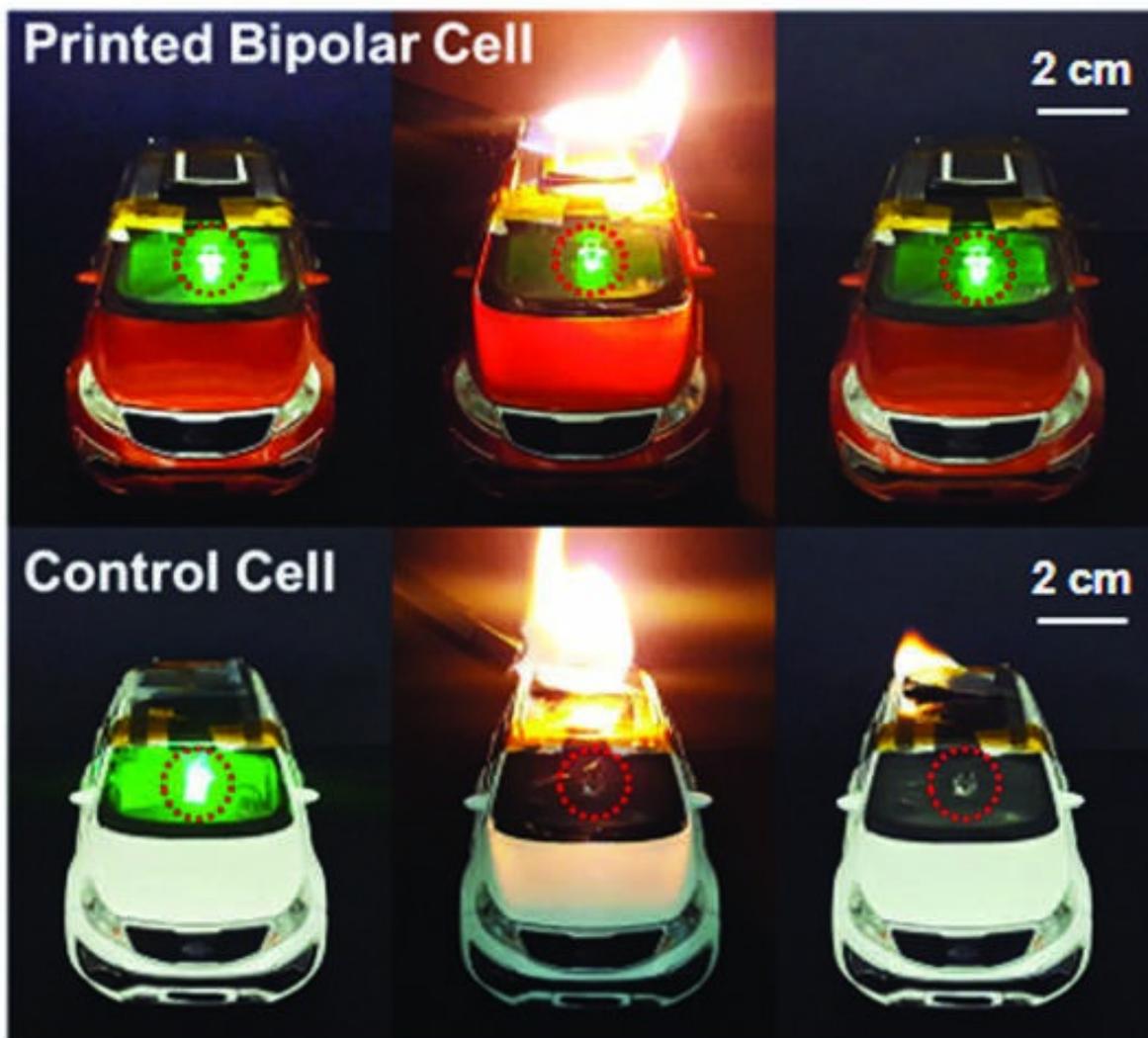
In the study, the research team introduced **a new class of flexible/shape-versatile bipolar all-solid-state LIBs via ultraviolet (UV) curing-assisted multistage printing**, which does not require the high-pressure/high-temperature sintering processes adopted for typical

inorganic electrolyte-based all-solid-state LIBs. Scientists have used a **flexible/nonflammable gel electrolyte**, which includes the electrolyte that based on the sebaconitrile and a semi-interpenetrating polymer network skeleton as the main element of electrodes. The gel composite electrolytes act as an ion-conducting separator membrane.



Bipolar all-solid-state LIBs via ultraviolet (UV) curing-assisted multistage printing
source - unist.ac.kr

The rheology tuning of the electrode and GCE pastes, using solvent-drying-free multistage printing, provides the monolithic integration of in-series/in-plane bipolar-stacked cells onto complex-shaped objects. Consequently, the printed bipolar LIBs demonstrate **high flexibility, form factors, charge/discharge capacity and nonflammability** due to the material and technology. This method far exceeds those achievable with inorganic-electrolyte-based standard bipolar cell technologies.



This study has been supported by Basic Science Research Program through the National Research Foundation of Korea (NRF)
source - unist.ac.kr

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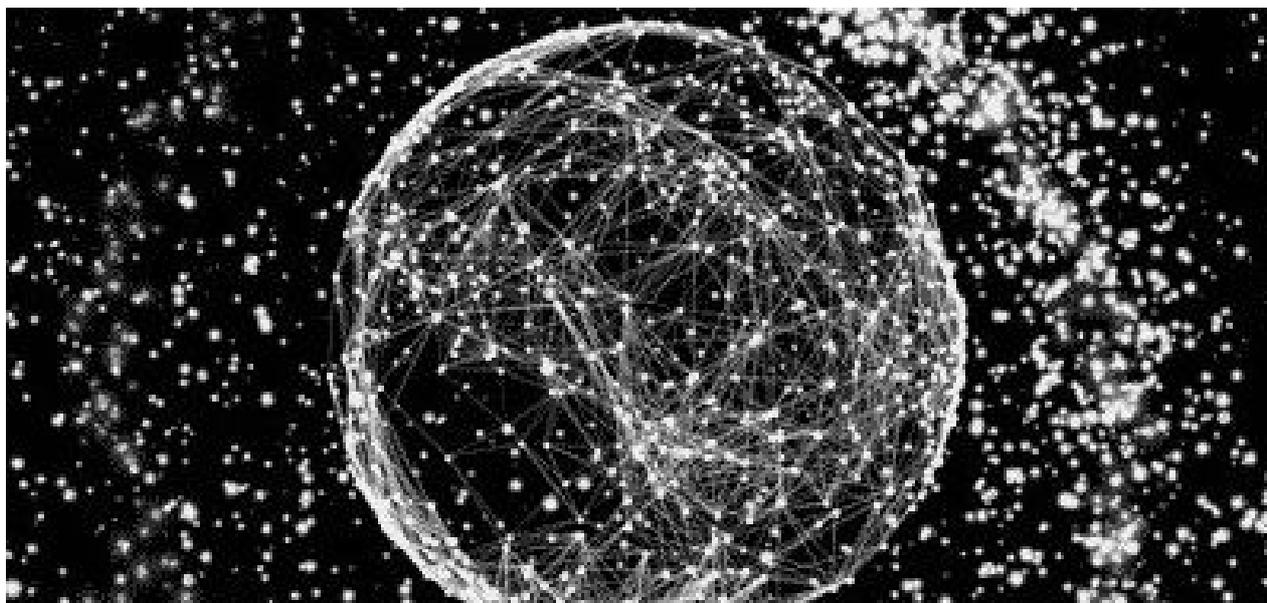
Patent status: -

On market since: -

Regions: Korea

Industries: Chemicals, Electronics

Source links: [Energy & Environmental Science](#)
[Ulsan National Institute of Science and Technology](#)



METALLIC AND SEMICONDUCTING TRANSISTOR AT THE SAME TIME

The scientific team managed to create a completely novel transistor device that is metallic and partially semiconducting on the same atomic layer. The innovational electronic device is based on a transition metal dichalcogenide (TMD) that is similar in shape and thickness to graphene. It has great transparent and flexible properties. This novel development will be able to help mobile phones, computers and other devices to keep their performance even after size reduction.



Moon-ho Jo



Ji Ho Sung



Hoseok Heo



Saerom Si

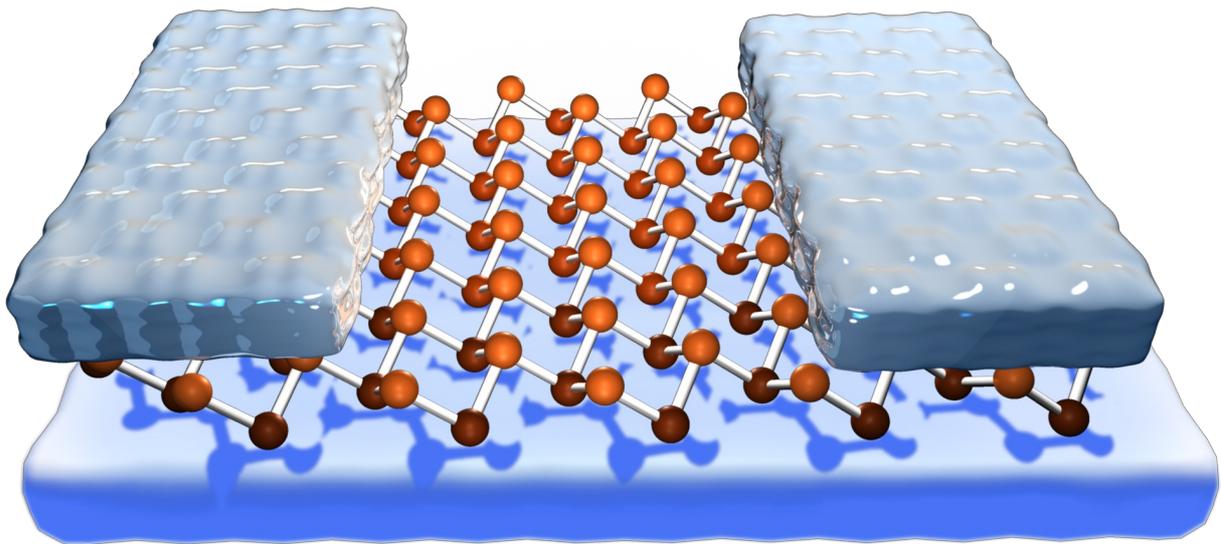
Professor Moon-ho Jo and the researcher's team
source - postech.ac.kr

The innovational device was developed by the group of scientists, led by Professor Moon-ho Jo from the [Pohang University of Science and Technology](#).

Current silicon semiconductors have various barriers at joints due to its physical connection between metals and semiconductors. The contact resistant, which is caused by the potential barrier prevents the flow of currents, negatively affecting semiconductor device production. Furthermore, these aspects have decelerated the creation and production of ultra-performance electronic micro gadgets.

The innovative device that was created by the group is based on a **transition metal dichalcogenide (TMD)**. Crystal polymorphism selectively stabilizes the electronic phase of atomically thin transition-metal dichalcogenides (TMDCs) as metallic or semiconducting. It leads to the integrations of polymorphs as circuit components in two-dimensional electronic circuitry. TMD is similar in shape and thickness to graphene. Furthermore, the material is characterized by **being semiconducting at a low temperature and metallic at a high temperature**. It is transparent and flexible.

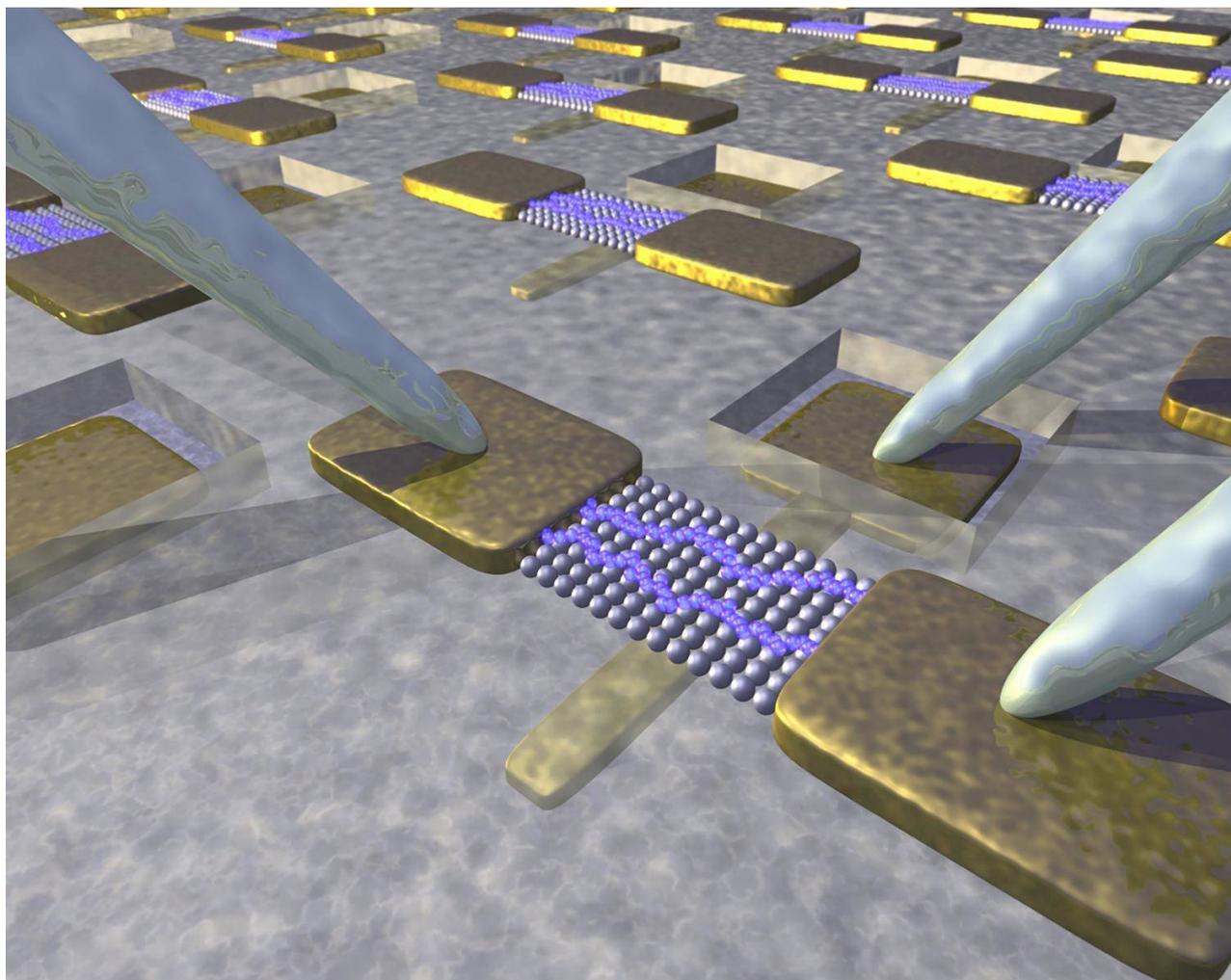
The unique material was developed by the method of the **chemical vapour deposition**. The TMD was vaporized at a high temperature and sprayed with a uniform thickness onto a substrate for synthesis. Creating a selective and sequential growth strategy for such two-dimensional polymorphs in the vapour phase is a very important step in this endeavour.



Coplanar semiconductor–metal circuitry defined on few-layer MoTe₂ via polymorphic heteroepitaxy
source - Phys.org

The polymorphic integration of **distinct metallic (1T')** and **semiconducting (2H) MoTe₂ crystals** have the same atomic planes using heteroepitaxy. The obtained polymorphic coplanar contact is atomically coherent, and its barrier potential is spatially tight-confined over a length of only a few nanometres, with a lowest contact barrier height of **25 meV**.

Moreover, the device has the ability to allow within large-area semiconductors to be produced in quantity and with uniformity. In other words, this material can **help mobile phones, computers and others electronic devices to maintain their production even after size reduction**.



Scientists have demonstrated the generality of the synthetic integration approach for other TMDC polymorph films with large areas
source - Phys.org

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Patent status: -

On market since: -

Regions: Korea

Industries: Electronics, Others

Source links: [Nature Nanotechnology](#)
[Pohang University of Science and Technology](#)



LIFE BALL EMERGENCY RESCUE PRODUCT

Exclusive interview for [SPINOFF.COM](https://spinoff.com) with Prof. Ahmad Abedini, the inventor of Life Ball and the Founder & CEO of [idiran Award](#) about the Life Ball Emergency Rescue Product that can be used during and after disasters such as the earthquake

Life Ball is a modular life capsule designed for disaster. It's a truncated icosahedron, which is based on a stainless steel rod skeleton, which makes it a strong structure that has the ability to resist the high weight and saves people who are inside it. Furthermore, it can be assembled anywhere. This innovational development consists of panels, which are made of double sheet steel plates that are fireproof and have cushions on the other side. These panels are connected together using screws and installed on the skeletal structure. This creates a strong fort, which can resist the high weight of rubble. The technology is novel and cost-effective.

SOC: Dear Mr. Abedini, we are so grateful for your generosity this day in spending time speaking with us and sharing your insights about an amazing technology of Life Ball. Our investors and we would like to learn more about a vast experience of your academic endeavours and your professional/scientific background.

Mr. Abedini: I have got a PhD degree in the industrial design at the [University Putra Malaysia](#).

SOC: Considering your tremendous experience, we would like to know whether you had other projects? Could you please share the story of their creation and success.

Mr. Abedini: I have just participated in competitions and won two of them. The first project is a **Kitchen Train**. It won the [Golden A' Design Award Winner for Home Appliances Design Category](#) in 2012. This development contains various kitchen appliances such as blender, coffee machine, toaster, juicer, microwave oven and vacuum cleaner. The main goals of this device are the pleasant appearance, united form and comfortable using. Kitchen Train was very successful in Iran. Many companies were eager to work with me on this project. Despite this fact, I don't have enough money to invest in this technology. Nevertheless, I'm really eager to work on this project.

SOC: It is so interesting to know more about the process of your technology/product creation. Please tell on which stage of commercialization your technology/product currently is? Was your project funded by any state financing or grants? Has it already received any honours or awards?



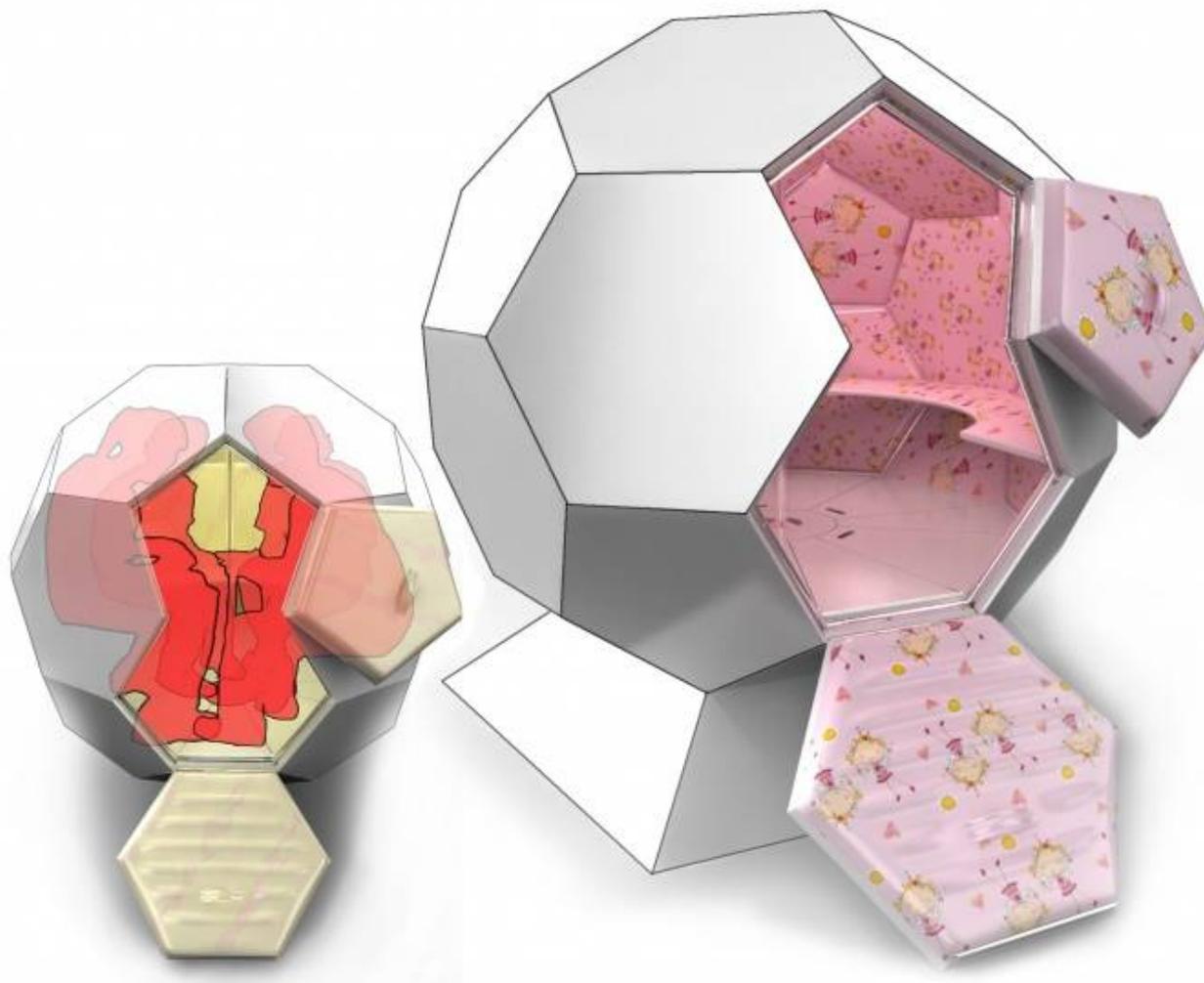
Prof. Ahmad Abedini, the inventor of Life Ball
source - adesignaward.com

Mr. Abedini: **Life Ball** is a runner-up for [A' Design Award in Social Design Category, 2013 - 2014](#). Unfortunately, we don't have such investments in Iran. It requires a lot of money to implement Life Ball, **a modular, easy-assembly life capsule designed for disasters**. Regrettably, I could not find any investor to cooperate with them.

SOC: In the formation of every scientific spinoff, one of the most important keys to success is the team. For many potential investors, the management team is the most important element in deciding whether to invest in it or not. Could you please share some information about the team members who supported you and the project? What are the key additions to the team needed in the short term?

Mr. Abedini: Unfortunately, I don't have any team. It is my own idea. I work on this project

individually.



12 pentagonal and 20 hexagonal panels are made of double sheet steel plates which is fireproof and have cushions on the other side
photo provided by Prof. Abedini

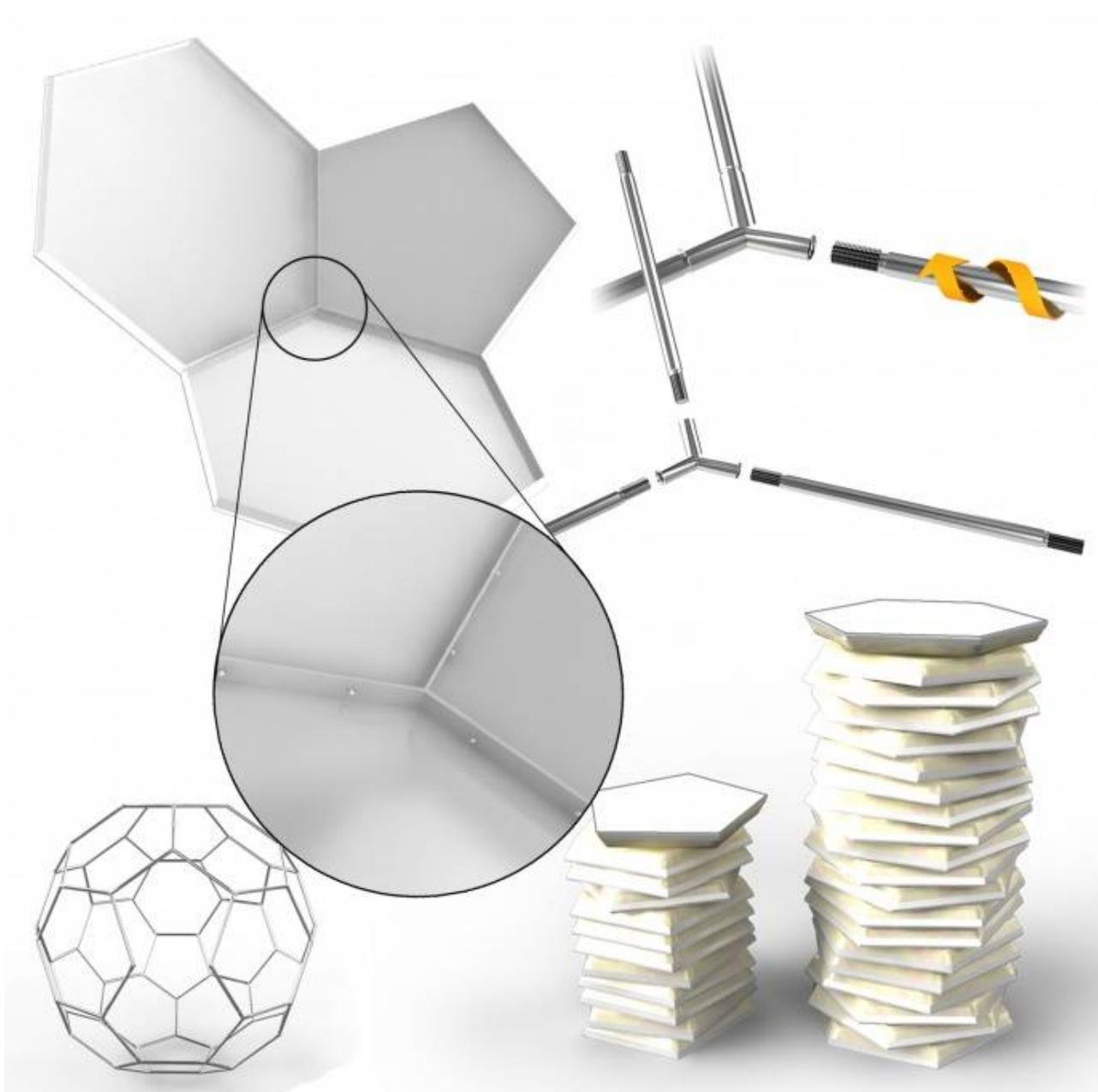
SOC: It is not a secret that the development of a new technology and its subsequent commercialization presupposes some problem and addresses unmet needs. Respectively, what problem did you intend to solve by creating your technology/product? What results did you plan to achieve?

Mr. Abedini: There were a lot of earthquakes in Iran. Asia is a place where many earthquakes happen. We lost a lot of lives. Consequently, this idea just came to my mind to make the place in order to save people's lives. As soon as this happens, the houses are destroyed, which leads to the death of many people. The most important aim is saving people's lives. The technology is designed to save lives. During the earthquake, you can keep the people inside the globe and then inside this box. After the earthquake, there are

no police to keep the people safe. Life Ball can be used during and after the earthquake.

SOC: The problem which you targeted to solve was actual before. Probably someone has already tried to solve it. Is it right? Understanding the USP from the investor's side could make the technology/product #1 for them. What are the USP of your technology/product and fundamental difference from other technologies/products that tried to solve this problem before you?

Mr. Abedini: I don't have any information about it. We live in buildings that were made 50 years ago. Such buildings cannot be so strong and sturdy to withstand the earthquake. To rebuild and construct buildings will be very expensive for the government. Life Ball can help with it. It is a modular self-assembly life capsule designed for disasters. It's a truncated icosahedron (like a soccer ball) based on **a stainless steel rod skeleton**, which makes it a strong structure that **can resist the high weight of rubble** and saves people who are inside it. **It can be assembled anywhere.**



The skeleton is made of 90 rods and 58 simple joints and 2 special joints of the door. Joints have the exact angle of one 138 and two 142 degrees
photo provided by Prof. Abedini

SOC: We wonder what is the actual addressable market currently for your invention and what are the current competitors there? Could you please share with us the results of the market studies, if there are any? What might be the barriers to entry?

Mr. Abedini: I think this project will be very successful in the market, especially in Asia.

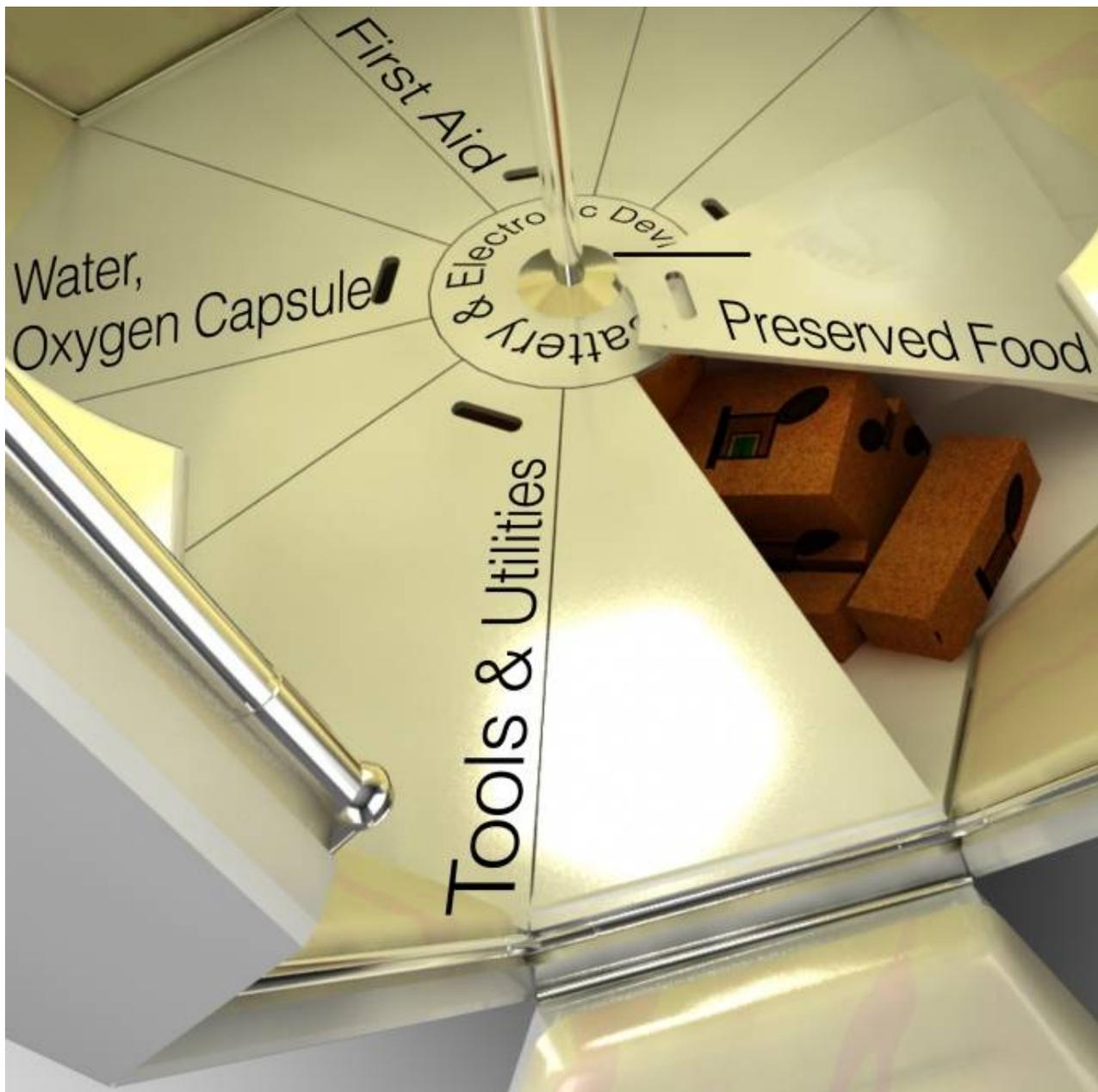
SOC: We always need to paint a clear picture to the potential investors of the market opportunity of the spinoff that is meaningfully large and growing. Why in

your opinion your company might have a high growth potential? Could you tell us all current industries and fields of your technology/product application and where do you think it could be successfully applied in the future?

Mr. Abedini: Currently, I don't have the company. I am planning to start from the beginning. When I will find a good investor, it will be possible to create the company in the future.

SOC: It is very important to understand your particular vision about unique features of your company. Why do you consider the major market players might be interested in investing into a promotion of your technology/product on the addressable market?

Mr. Abedini: Until now, nobody has not work with it. It is a totally brand new idea. Furthermore, the technology is **cost-effective**.



The floor is divided to 6 containers + a cylindrical cage for the battery. Each part is assigned for a branch of goods required in life saving kits
photo provided by Prof. Abedini

SOC: As a rule, the majority of spinoffs outgrow into exits. How do you determine the market for your product/technology and estimate its volume and dynamics? What is your potential share on the market? How do you think what market cap your company plans to reach at the peak of its development and why? How long might this process take?

Mr. Abedini: To achieve the mass production, it is necessary to make the project known to other companies and governments. I think, within **2 or 3 month** it can be possible.

SOC: For spinoff companies, their intellectual property is a key to success. The investors pay particular attention to it. What key intellectual property does your company have (patents, patents pending, copyrights, trade secrets, trademarks, domain names)?

Mr. Abedini: I have not registered the technology up to now. **I don't have a patent.**

SOC: For both of us, as well as for thousands successful spinoffers, it's not a secret that a new technological breakthrough may become obsolete very fast. Respectively, patent validity period becomes shorter. It is interesting to know the perspectives and protection plan of your technological advancement and leadership in a medium- and long-term prospectives.

Mr. Abedini: I think the most important thing in the world is saving the people's life. Life Ball has very good perspectives in the future due to its possibility to save people's lives during disasters.



It has a place for connectivity and electronic solutions to help rescue teams find the trapped people in at LifeBall photo provided by Prof. Abedini

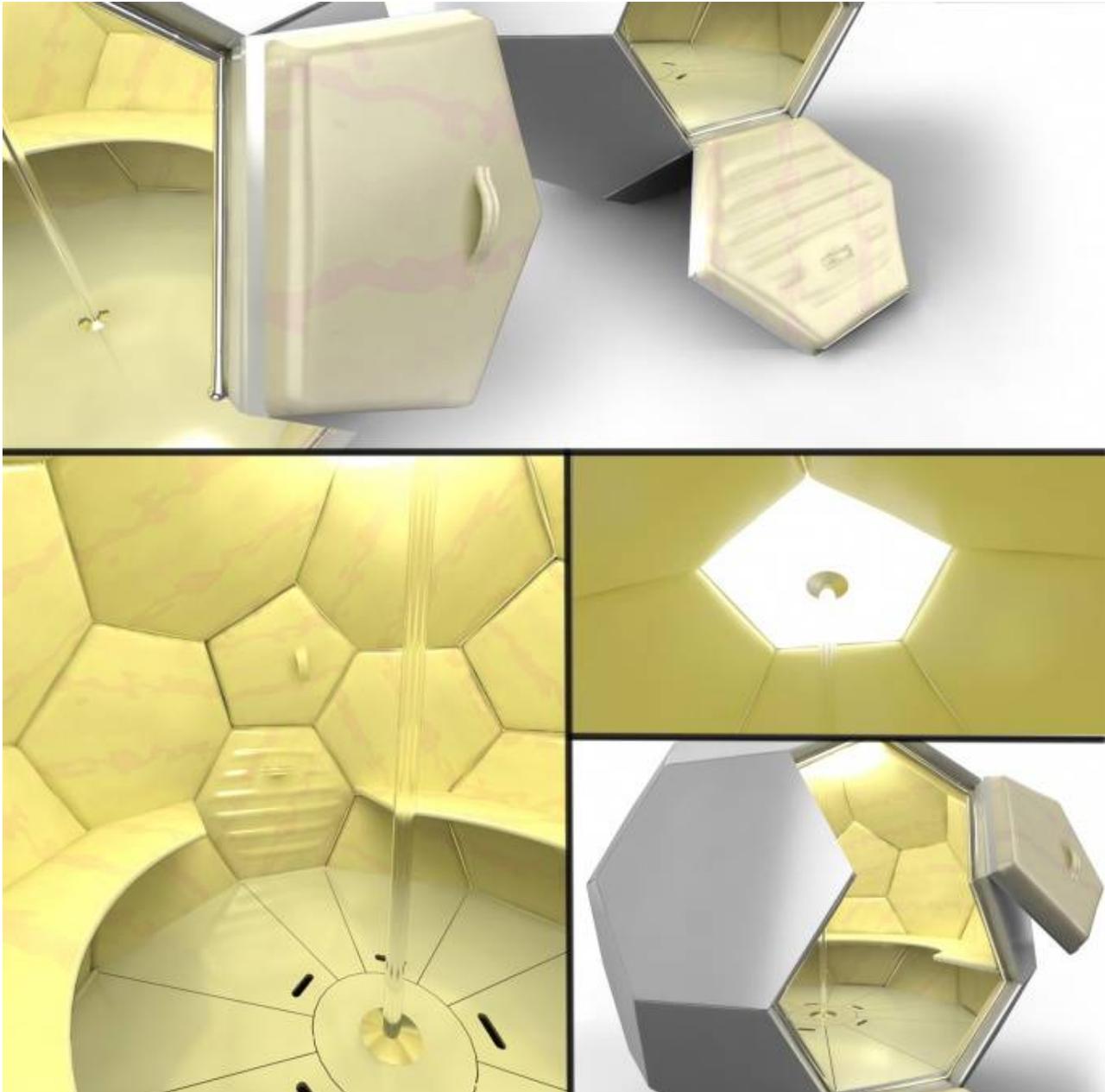
SOC: Could you please describe your ideal investor? What aspects are important for you, for instance, is it experience, country, the amount of own private capital or maybe some personal qualities?

Mr. Abedini: They must be loyal to me and can trust me. I hope the good cooperation will be possible and they will help me. It will be good to share everything equally with each other.

SOC: And the last question, could you specify the most convenient way you would like to receive inquiries from potential investors? Should it be by e-mail or

personal phone call?

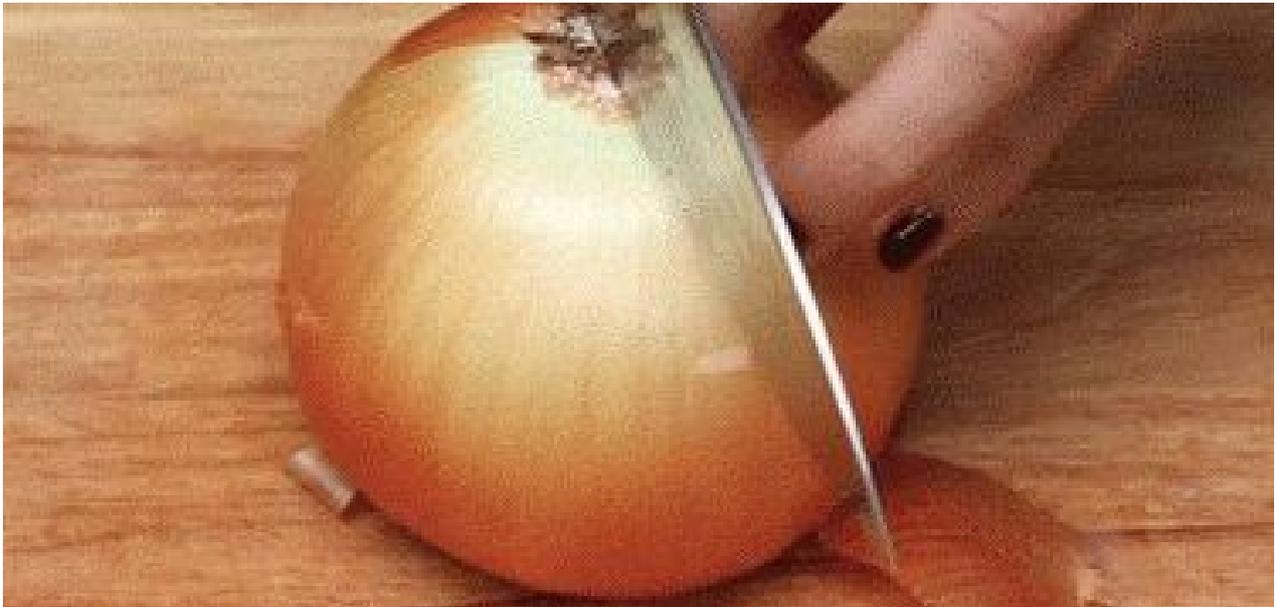
Mr. Abedini: The most convenient way is via e-mail.



4 adults can sit comfortably in the side seats and still there is some place for another person to sit tight. LifeBall can send data to rescue teams letting them know that people are trapped
photo provided by Prof. Abedini

We would like to express gratitude for the time you have dedicated to this interview. SPINOFF.COM will observe the development of your spinoff with great pleasure and interest. In addition, we are thankful for providing all the necessary materials and we are pleased to forward the information on Life Ball to all potential investors.

Company name: -
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Phone: -
Patent status: -
On market since: -
Regions: Islamic Republic of Iran, Singapore
Industries: Construction



A NOVEL GENERATOR CAN CONVERT VIBRATION INTO ELECTRICITY

Korean scientists have developed a nanogenerator that has the ability to harvest energy and convert kinetic energy produced from vibrational and mechanical sources into electricity using onion skin. This unusual technology doesn't require to use external circuits or batteries for electronic devices.



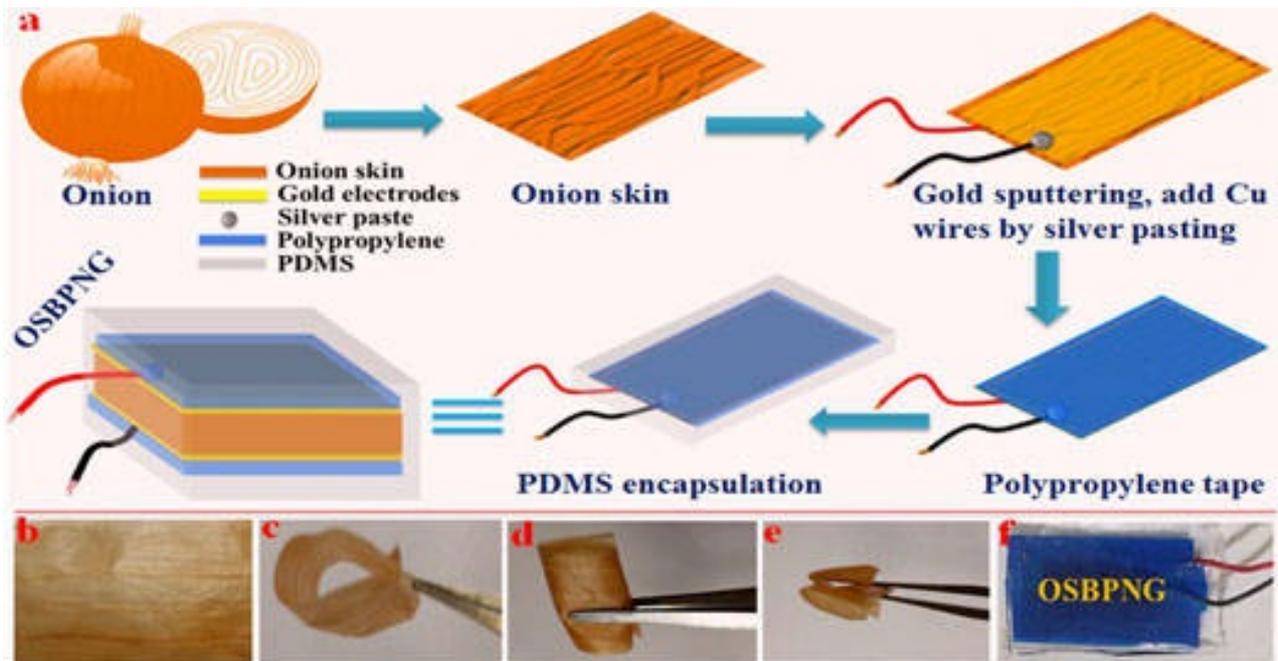
Scientists have used abundant self-aligned cellulose fibrous untreated onion skin (OS) to harvest energy source - bbcgoodfood.com

This innovational discovery was made by the group of scientists led by Professor Jin Kon Kim from the [Pohang University of Science and Technology](http://www.pohang.ac.kr) and Professor Bhanu Bhusan Khatua from the [Indian Institute of Technology Kharagpur](http://www.iitkgp.ac.in).

This innovational discovery is based on the self-powered nanotechnology that is environment-friendly method due to its possibility to harvest energy using organic and inorganic materials. It is the **piezoelectric nanogenerators (PNGs)**, the main purpose of which is to supply energy to nanodevices and ultramodern systems by storing and converting energy from the environment.

Professor Jin Kon Kim mentioned that there is a great need for non-toxic and flexible nanogenerators that can convert energy, especially in the field of medicine and biomedicine. Many nano-generators using biomaterials are unsuitable because of their toxicity, fragility and complex manufacturing process. Consequently, such devices are usually used to monitor the health by attaching to the body, in some cases, even

implanted in the body. That is why devices should be absolutely non-toxic, reliable and flexible.

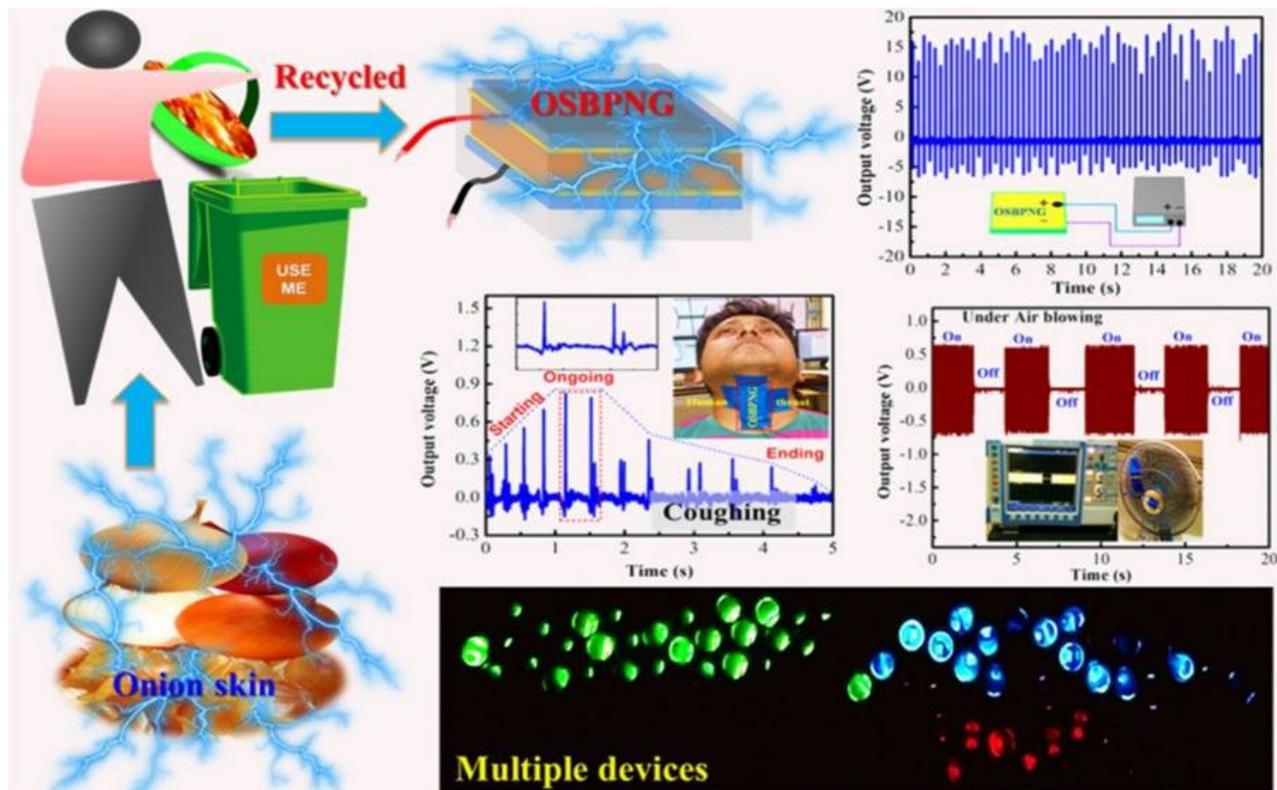


Schematic of fabrication of OSBPNG with cross-section view. (b) Photograph of onion skin. The demonstration of flexibility of OS during (b) bending, (d) rolling, and (e) twisting, respectively. (f) Photograph of OSBPNG source - nanowerk.com

The scientist decided to use naturally abundant self-aligned cellulose fibrous untreated onion skin (OS) as the efficient piezoelectric material having the piezoelectric strength of 2.8 pC/N.

The prefabricated onion skin BPNG (OSBPNG) has the ability to harvest few types of mechanical energies, for example, the flow of winds, movements of the body and even machine vibrations. It can produce the output voltage with the efficiency of 18 V, current with the efficiency of 166 nA, immediate power frequency with the efficiency of 1.7 $\mu\text{W}/\text{cm}^2$ and high piezoelectric energy transformation with the efficiency of 61.7%. Furthermore, OSBPNG has the ability to turned on 30 green LEDs using just a single device.

Many commercialized materials used in such technologies are toxic. However, onion is a convenient material that can be found anywhere in the world to produce energy and use it in the manufacturing of medical devices. In additions, the OSBPNG produces high energy frequency and high power transformation efficiency compared to other traditional bio-piezoelectric materials.



Bio-waste and biocompatible onion skin base piezoelectric nanogenerator with high output performance and high energy conversion efficiency have been fabricated through simple homespun device fabrication method source - sciencedirect.com

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Phone: -

Patent status: -

On market since: -

Regions: Korea

Industries: Energy

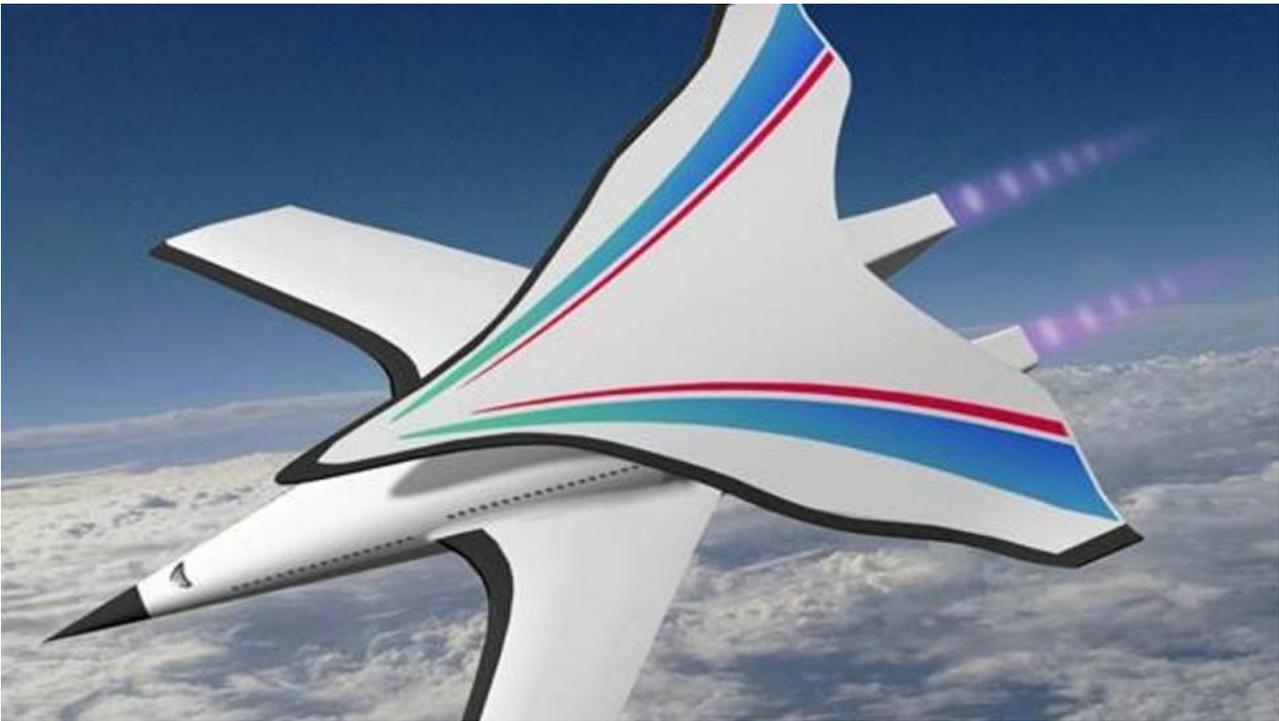
Source links: [Nano Energy](#)

[Pohang University of Science and Technology](#)



I-PLANE FLIES FASTER THAN THE SPEED OF SOUND

Chinese scientists have presented the concept of a hypersonic passenger aircraft, which can overcome the distance between Beijing and New York in just 2 hours. This invention can be the fastest passenger aircraft of the present day. The technology is based on using the double layer of wings that reduces the turbulence increasing the aircraft's overall lift potential.



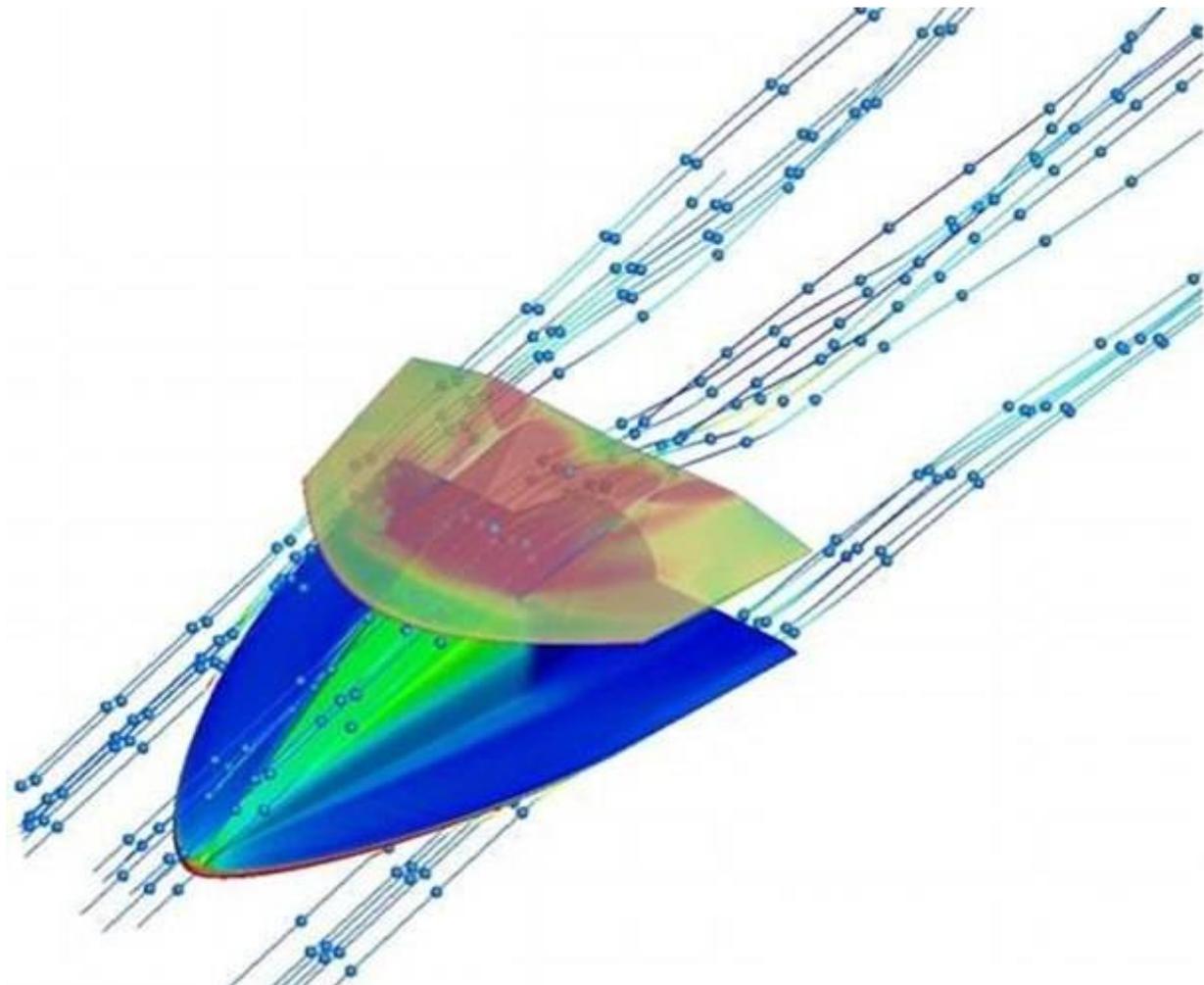
All known hypersonic vehicles being developed worldwide are still in the experimental stage because of the many technological challenges that exist

source - scmp.com

At present day, the travel by plane between New York and Beijing takes about **14 hours**. According to the scientific team led by Cui Kai from the [Chinese Academy of Sciences](#), the speed of the aircraft will be **6,000km/h**, which is at **five times higher than the speed of sound (1,235 km/h)**. This is several times faster than the speed of the **Concorde** plane.

HV, which flight at **Mach numbers greater than 5**, will serve as a more convenient and efficient transport tool than present subsonic aeroplanes for long-distance flights in future. Recent interest in these vehicles has grown intensively, and various types of innovative designs have been proposed and studied. Despite this fact, there is still exist many problems, which need to solve, to create ultrasonic passenger plane.

Cui Kai and his scientific group tested the reduced model of the aeroplane in a wind tunnel that was applied to evaluate the aerodynamics of the latest samples of ultrasonic weapons. The group dispersed the model aircraft to **8,600 km/h** and found that it acts surprisingly well. The wing design is something like a biplane or an aeroplane, like what NASA uses to launch the shuttles. Scientists mentioned that the design of the biplane will give the possibility to carry the heavier payload than existing projects of HVs that have a inswepted form and triangular wings. Consequently, scientists have developed a model, which is called '**I-plane**'.

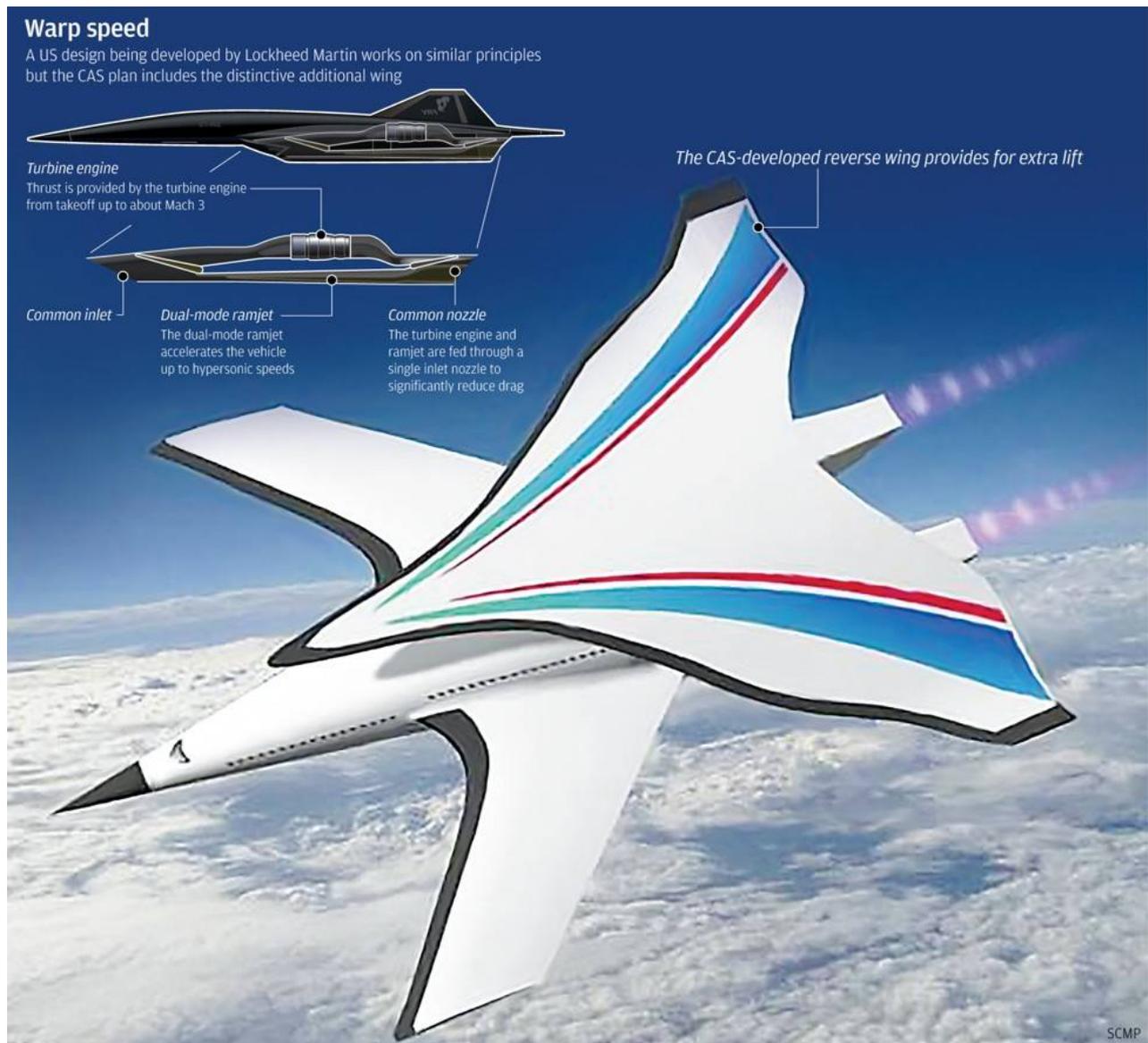


The I-plane could be a game changer, according to the designer working on military research projects who declined to be named because of the sensitivity of the subject
source - dailymail.co.uk

The invention uses the technology of **double layer wings that reduces the turbulence making the plane's overall lift potential better**. Nevertheless, compared to the **Boeing 737**, a similarly-sized HV will be able to carry only **5 tons of cargo or 50 passengers but Boeing can take 20 tons of cargo and 200 passengers**.

A new type of HV I-shaped aerodynamic configurations, derived from the **high-pressure capturing wing concept**. Furthermore, the advantages of high L/D, high volumetric efficiency, and high lift are clearly demonstrated. In the present study, only the profiles of the leading edges were taken as design variables of the optimization. The aerodynamic performances of the configuration may be further enhanced if the surface shape of the HCW is considered as optimization variables. Scientists hope that this invention will promote further research in the aerodynamic design of high-speed configurations, which

may ultimately offer a new candidate for HVs.



This design has provided an answer to the aerodynamic configuration problem encountered by previous hypersonic plane models
source - scmp.com

Company name: Chinese Academy of Sciences
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Phone: -
Patent status: -
On market since: -
Regions: China
Industries: Aerospace, Defence and Marine, Construct..
Source links: [Science China Physics, Mechanics & Astronomy](#)
[South China Morning Post](#)



AUTONOMOUS OFF-THE-GRID 3D-PRINTED SMART HOUSE

Exclusive interview for [SPINOFF.COM](https://spinooff.com) with Mr. Maxim Gerbut, the CEO & Founder of PassivDom Ukraine LLC, about PassivDom - Autonomous Off-the-grid 3Dprinted Smart House.

PassivDom is the off-grid house that uses only solar energy for all inhabitants' needs: climate control (heating and cooling), water generation from air humidity, air quality and carbon dioxide control. House produces PV electricity for all household appliances by itself. All components are naturally safe and easy to recycle. House is fully equipped by all engineering systems: air recuperation system, heat pump for heating and cooling with distance-controlled thermostat hub, air quality medic HEPA system, the photovoltaic off-grid system with LiFePO₂ battery, water filtration system with heat recovery, heat energy storage, water tank.

SOC: Dear Mr. Gerbut, we are so grateful for your generosity this day in spending time speaking with us and sharing your insights about PassivDom project. Our investors and we would like to learn more about a vast experience of your academic endeavors and your professional background.

Mr. Gerbut: My team and I have over 15 years background in residential and housing construction design and the energy-efficient system. We produced energy-efficient windows in Ukraine. We have a design company in Germany, Dusseldorf. Personally, I have PhD in physics. The team consists of 11 engineers from different fields, including power engineering, 3D printing, construction and different others fields. In addition, the team is very strong in the design. That is why we can collect a lot of ideas during last years of the construction business. 2 years ago, we selected ideas for different projects, and after customer and marketing researches, we decided to create a new product, an autonomous house [PassivDom](#). Currently, nobody in the world doesn't produce autonomous residential houses.



Mr. Maxim Gerbut, the CEO & Founder of PassivDom Ukraine LLC
photo provided by Mr. Gerbut

SOC: Considering your tremendous experience, we would like to know whether you had other projects? Could you please share the story of their creation and success.

Mr. Gerbut: Nowhere in the world trying to build autonomous residences. Usually, when you try to build something autonomous and off-the-grid you must pay much more extra budget costs for construction because of a lack of energy-efficient solutions. Therefore we need to connect in one product various and efficient solutions. Only after that can get

power management control, software and IT network to make distance separation control. In this case, we create the **affordable off-the-grid** solution. This is the most significant factor of our product.

SOC: It is so interesting to know more about the process of your technology creation. Please tell on which stage of commercialization your technology currently is? Was your project funded by any state financing or grants? Has it already received any honors or awards?

Mr. Gerbut: We have already had some investments, seed funding. We have got a [Horizon 2020](#) Grant. Furthermore, we invested our own money. These funds led us to exist and increase our technological abilities for two years. Now we have just started reservation requests system. During last 5 months we got over **10 000 reservation requests** from all over the world. We started the similar facility in Reno, the United States and producing first test drive units. First units will be a shift in May this year. Moreover, we started to certificate and make permission for houses in the United States: California, Nevada, Washington, New York etc. In addition, we are in the process of certification. **In May, the first unit will be presented in California.**



PassivDom is the first in the world mobile transportable house with PassiveHouse parameters
photo provided by Mr. Gerbut

SOC: In the formation of every scientific spinoff, one of the most important keys to success is the team. For many potential investors, the management team is the most important element in deciding whether to invest in it or not. Could you

please share some information about the team members who supported you and the project? What are the key additions to the team needed in the short term?

Mr. Gerbut: Our team is very strong and consists of different people from various fields: engineers, financiers, designers. As I mentioned before, we already have own production of energy efficient systems and windows. Therefore, the team is strong in construction and production processes. We **use 3D-printing technology**.

In **2007**, almost 10 years ago, we began to use robots in manufacturing. Robots were used for wood carving and decorating. Now, this technology and algorithms are used to create houses. Obviously, we are proud of our team because these people are professionals. Moreover, some of them have over 20 years experience in this field. The **team members are from Ukraine and Europe** because, previously, we had business in Europe and Germany. Therefore, nobody from the United States yet. We are starting hiring people and **planning to higher more than 14 people during next 3 months**.

SOC: It is not a secret that the development of a new technology and its subsequent commercialization presupposes some problem and addresses unmet needs. Respectively, what problem did you intend to solve by creating your technology? What results did you plan to achieve?

Mr. Gerbut: We tried to find an idea to create the most energy-effective and the warmest house in the world. At first, we wanted to participate in [Business World Records](#) and [Guinness World Records](#) and it was like a joke. Suddenly, we found that our experiment was successful. **The technology has revolutionary thermal characteristics**. The first problem that we tried to solve is to create the affordable off-the-grid house solution. It is very easy to build something thermal-effective, off-the-grid or autonomous with the huge budget such as 1 million dollars. However, it is very complicated to do this having in 10 times less budget. The most important moment is that we managed to solve this problem. We invited **an affordable technology to create energy-efficient houses**. After that, we have got unusual side effects. It is the first world's solution with **absolutely zero carbon emission building**. If you build a house with using our technology, **you will not need to burn any fuel to heat this house even in a very cold climate. These houses will not emit any carbon into the air**. Consequently, it is a very clean tech technology. When we started manufacturing we had decided to use very strong materials such as **carbon fibre, fiberglass,**

polyurethane, resins. The next problem that was solved is to make robust houses. We created the house as one piece or one detail. There was no connection like in exists houses. **This house is one construction that is produced by using 3D-printing technology.** Decoration and engineering systems are installed. The next task that we wanted to solve with our technology is to make the transportable off-the-grid house. Consequently, we created small form and size houses, which are **strong enough to be transportable and, at the same time, absolutely autonomous. There is no similar solution in the world.**

SOC: In order to understand the peculiarities of this particular spinoff our investors always ask what is the investment structure of the company? Do you still own the controlling stake in your spinoff?

Mr. Gerbut: PassivDom LLC is owned by Maxim Gerbut and Julia Gerbut.

SOC: We wonder what is the actual addressable market currently for your invention and what are the current competitors there? Could you please share with us the results of the market studies, if there are any? What might be the barriers to entry?

Mr. Gerbut: We have big market research in Europe and the United States. We have competitors report and **3 important segments** of what we want to start. First of all, it is the **Backyard House** which has such characteristics: **no construction, gadget-house, transportable, low utility consumption, zero carbon emissions.** It is a small house as an accessory unit or second house for backyard as a guesthouse, house for children or retired people. Furthermore, it can be a home office. The next one is the **Vacation House** that can be used as **transportable hotels, off-the-grid hotels in mountains or seaside.** It is a good solution for islands because it doesn't require any infrastructure to be installed in any village or somewhere else. The **Airbnb unit** can be used for rent and if you have any free space, you can get this house just making the pre-agreement. It has remote access. This house doesn't require any permits or management. **We plan to start sales of these 3 products.**

SOC: We both know that for you and the investor it is crucial to reach positive cash flow as soon as possible. Certainly, the market scaling cannot be achieved without proper distributors network and clients. Please tell us about your criteria

of partners selection and which markets are open for spinoff activity.

Mr. Gerbut: We have a huge interest from any kind of developers, resellers or partners worldwide. Every day we receive calls from different countries from Asia Europe, the United States, Latin America, and Africa. Moreover, we have a strategy to attract our partners. We are looking for **3 ways of partnership: sales agents, logistics partnership and after cell service**. All partners will have exclusive rights connected to their field to avoid competitors in the same area from one company.



PassivDom modulTwo
photo provided by Mr. Gerbut

SOC: Now we would like to refer to the next very crucial and we would even say essential aspect for spinoff companies' as the strategy of R&D, production, distribution and marketing processes. Do you have your own unique strategy? Which of these processes do you consider your spinoff is strong at?

Mr. Gerbut: We understand that a lot of competitors and building companies would like to build something similar because it is very attractive to customers. **We have a huge interest from B2B segments and real customers**. Therefore, we understand that maybe after 1 or 2 years a lot of competitors will try to do something similar. That is why we start preparing for this. We have already had **PassivDom the Second Generation** with more efficient features such as more powerful energy-efficient system and improving engineering system. Nevertheless, we didn't start assembling houses of the second generation because we were waiting for competitors. When competitors will try to create

something like our first product [PassivDom the First Generation](#) we will start to produce the second one. The company has a strong R&D department in Ukraine. Furthermore, to determine the most promising directions of PassivDom development the company partnered with [Ernst & Young LLC](#) – leading multinational professional services firm in the field of finance.

SOC: For spinoff companies their intellectual property is a key to success. The investors pay particular attention to it. What key intellectual property does your company have (patents, patents pending, copyrights, trade secrets, trademarks, domain names)?

Mr. Gerbut: We have [trademarks and patents pending application in the United States](#). Furthermore, we are partners with [NASA](#) and [Bradley University](#) in the United States. We are [taking part in NASA Mars 3D-printing habitant challenge](#). That is why we [develop technology for 3D-printing using melting rocks and melt basalt](#). We have some [patents in this field](#) also.



photo provided by PassivDom LLC

SOC: For both of us, as well as for thousands successful spinoffers, it's not a

secret that a new technological breakthrough may become obsolete very fast. Respectively, patent validity period becomes shorter. It is interesting to know the perspectives and protection plan of your technological advancement and leadership in a medium- and long-term prospective.

Mr. Gerbut: The construction industry is very competitive. In some cases, if we will stop our R&D work we will not be able to spread our technology worldwide. Consequently, we improve our technology every single day.

SOC: The investors will want to get a clear picture of how many rounds of investments have you completed? Are you seeking for the investments at the moment? What is the volume and time limits? What milestones will the financing get you to? What did you plan to use the invested funds for?

Mr. Gerbut: We already have some commitments from investors from the United States and Europe. We are planning to attract \$5 million in May and approximately \$18 - 20 million in November this year. In addition, the project received the €50,000 grant within [Horizon 2020](#).

SOC: Could you please describe your ideal investor? What aspects are important for you, for instance, is it experience, country, the amount of own private capital or maybe some personal qualities? Will existing investors participate in the round?

Mr. Gerbut: Our ideal investor should have something special, some protecting technologies to connect with our technology. For example, if [TESLA](#), which has the [Lithium Iron Phosphate battery patent](#), will invest in such solution like PassivDom it will be ideal for our team. It is not very complicated to find financing for the regular business like us, but we are looking for something unique in this industry.

SOC: And the last question, could you specify the most convenient way you would like to receive inquiries from potential investors? Should it be by e-mail or personal phone call?

Mr. Gerbut: Both way are convenient.

We would like to express gratitude for the time you have dedicated to this interview. [SPINOFF.COM](https://www.spinoff.com) will observe the development of your spinoff with great pleasure and interest. Also, we are thankful for providing all the necessary materials and we are pleased to forward the information on PassivDom to all potential investors.

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On market since: -
Regions: United States, Ukraine
Industries: Construction, Energy
Source links: [PassivDom](#)

PROTOTYPES



A SMOKING MONITORING RING CAN HELP A USER TO QUIT SMOKING

Two inventors from India developed an innovative wearable device QuiSmo, which is intended for people that want to stop smoking. The device has the ability to monitor smoke intake. It operates as a smoke controller stimulating piezoelectric sensor. This is the first class of device that not only has the ability to resemble quitting smoking but also measures the amount of direct and passive smoke, which is produced by a smoker person or that is around the user. Furthermore, QuiSmo notifies about the use of critical inhalation smoke on the basis of the user's biological profile.



The device is a ring-shaped wearable electronic gadget with inbuilt smoke sensors, which are synced to the mobile

source - jamesdysonaward.org

The device was developed by [Madhu Priya](#) and [Anshumala Mishra](#) from the [CEPT University, formerly the Centre for Environmental Planning and Technology](#), and can be synced to the phone that determines the amount of smoke.

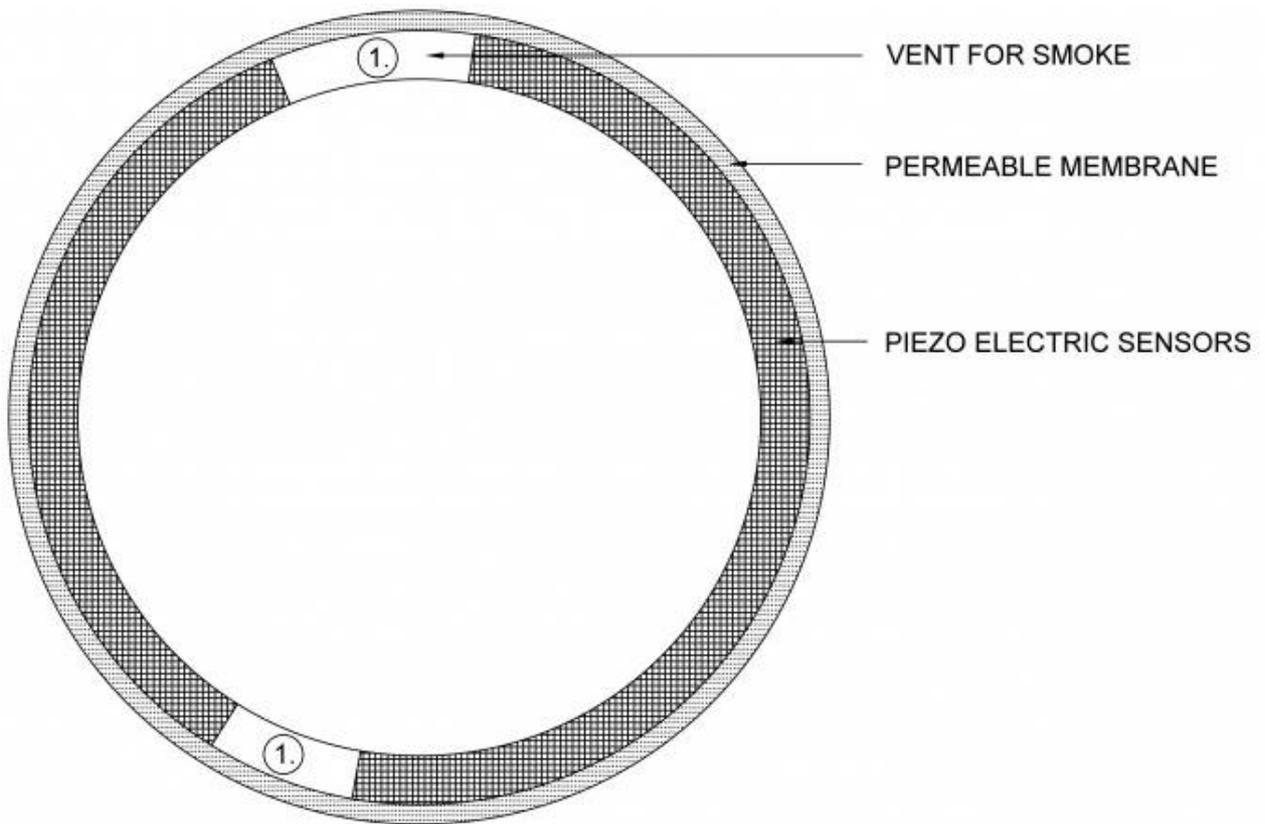
Smoking is one of the greatest threats to health due to its mass and the number of side effects and diseases it causes. According to the [World Health Organization statistic](#) tobacco kills up to half of the users. Furthermore, it kills more than 7 million people each year. More than **6 million** of those deaths are the result of direct tobacco use while around **890 000** are the result of the passive smoke. As the result, developers decided to create a **device targeting to avoiding the risks caused by cigarette smoke by controlling the owner's nearness to the smoke and compare it to the dangerous level of smoke.**

Originally, the concept was based on the creation of the wearable device, which will signalize about potentially dangerous quantities of smoke was consumed. The prototype was redesigned to be the most imperceptible part of wearable accessory. Consequently, developers decided to use the form of a ring. The final prototype includes of a **piezoelectric sensor** that is fine-tuned to respond to mechanical push of the cigarette smoke and generates impulses that are transformed into calculable quantities of smoke, which is depended on the periodicity and the continuance of the impulse.



The technology offers real time as well as the cumulative danger posed to a person due to active as well as passive inhalation of smoke
source - jamesdysonaward.org

The device has tiny parallel apertures that provide the entering of the smoke into the ring and stimulate the piezoelectric sensor. The sensor sends impulses that can be converted into the quantity of smoke using the previously developed algorithm. The converted information is sent to the app that transforms it into the clear data, which **interprets the harm that was done to different organs in real time**. It makes a statistic throughout the week.



Developers are conducting further research to sensitize the smoke sensors to differentiate between the different pollutants and measure the content of each individual air pollutant source - jamesdysonaward.org

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On market since: -
Regions: India
Industries: Electronics, Healthcare
Source links: [James Dyson Award](#)



A NEW CAMERA FOR GLAUCOMA DIAGNOSIS

The researchers' group developed the innovative 'pen camera' that can help doctors to provide the fast and accurate diagnosis of glaucoma. GoniPEN has the ability to detect glaucoma making images of the eye's drainage canal. This technology is cost-effective. Furthermore, the device doesn't require the direct contact with the eye that is much more comfortable for the patient. Scientists hope that this novel development will be integrated into the process of the routine eye check.



It was developed over the last two years by a joint research team, which includes NTU researchers Dr. Sandeep Menon P, Dr. Shinoj VK and Mr. Hong Xun Jie, Jesmond source - NTU

The device was invented by the group of scientists, led by [Associate Professor Murukeshan Vadakke Matham](#), from the [NTU](#) in cooperation with researchers, led by [Professor Aung Tin](#), from the [SERI](#).

The increased intraocular pressure causes the destruction of retinal cells and the atrophy of the optic nerve. The brain stops to receive visual signals. A certain pressure in the healthy eye is constantly maintained due to the balance of inflow and outflow of the fluid. The circulation is disturbed that is lead to the fluid accumulating and increasing of the intraocular pressure. The blood supply to the eye is impaired. It is a progressive disease leading to irreversible blindness. To identify the onset of glaucoma, a simple measurement of intraocular pressure is not enough. It is necessary to study in detail the ocular fundus and the optic nerve disk, and also to investigate the fields of vision, that is, to conduct a thorough diagnostic inspection.

During the process of diagnosis of this disease, scientists usually use gonioscopy, which is glass scope. It should be pressed against the patient's eyeball in order to provide medics look into the drainage channel to identify causes. The process takes about 15 minutes and requires a proficient expertise to detect the problem on the spot. This is not performed within the standard medical examination.



The research is supported by grants from the National Medical Research Council and the National Research Foundation Singapore
source - newatlas.com

The most significant advantage of **GonioPEN** is that it has the ability to provide more detailed photos of the eye drainage canal with the minimal contact with the cornea. The specially designed software is used to analyze pictures, assisting medics with the process of diagnosis. The researches result demonstrated that **20 patients**, which was diagnosed by the device, noted that it is more comfortable than current methods. The GonioPEN is able to capture it in just **3 minutes** high-resolution digital pictures. Images, which can be analyzed by the eye specialist, curtailment the time when the patient needs to be under the microscope.

The GonioPEN device includes a camera and LEDs in order to take a high-quality picture. The prototype costs **\$5,000**. Therefore, this device is convenient for physicians providing a **quick and accurate detection and analysis of the eye**, and for the patient, because it does not bother much time and does not create mental and physical discomfort. Furthermore, scientists have mentioned that this device, due to its characteristics such as compactness, precision, speed, and ability to integrate with other medical devices, **can be used as part**

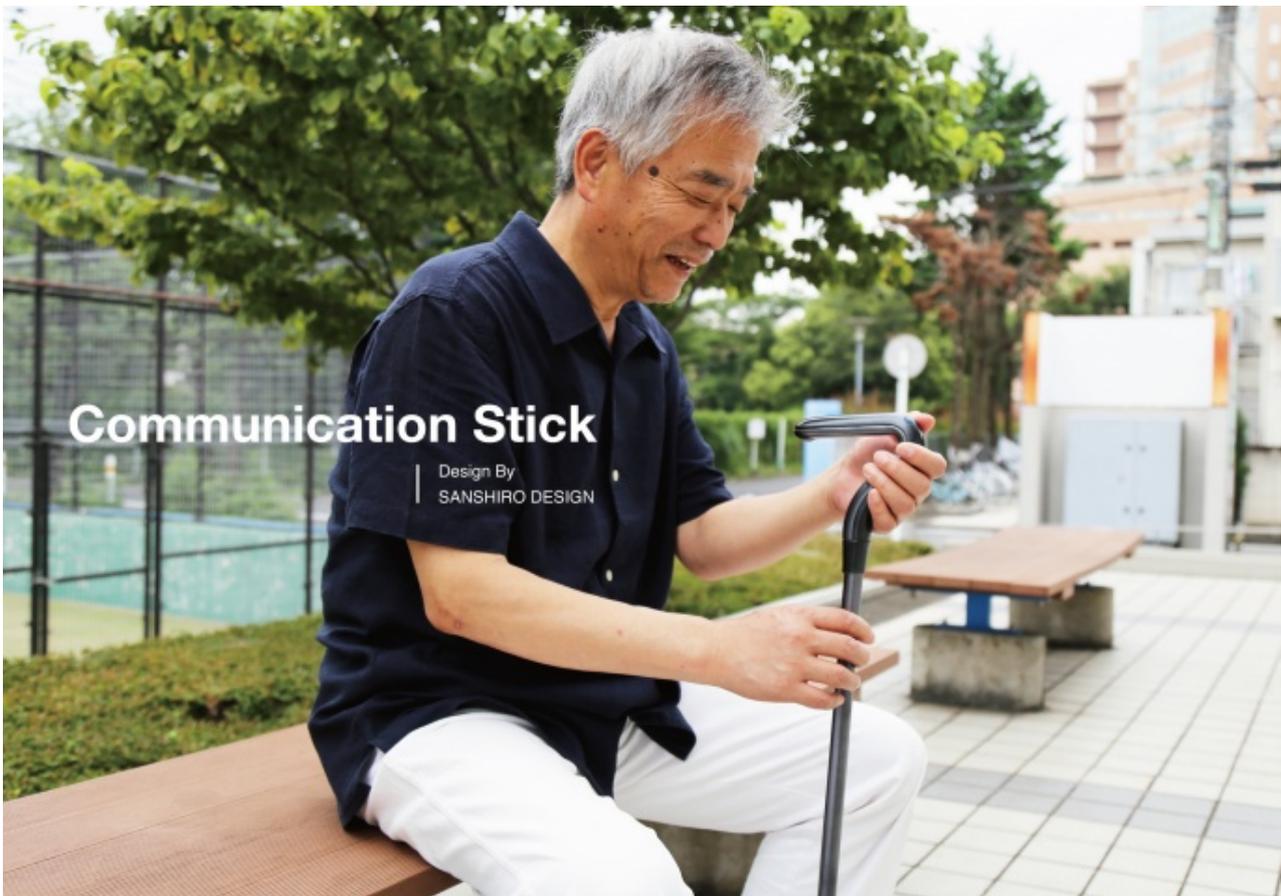
of standard medical examinations, making them accessible to all people due to its low cost.

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Patent status: +
On market since: +
Regions: Singapore
Industries: Electronics, Healthcare
Source links: [Nanyang Technological University](#)



A COMMUNICATION STICK

The inventor from Japan has developed a communication stick that has the ability to connect elderly people with medical workers from institutions for the elderly or nursing. The main goal of this novel invention is to provide elderly people the ability to be safely located outside their houses or specialized institutions. The device can send text messages from speech, read received text messages, and inform about the location of the person during stumbling.



Communication Stick
source - jamesdysonaward.org

The device was invented by [Tomohito Saigusa](#) and the researchers' team from the [Kuwasawa Design School](#).

They made a market research in order to R&D, visiting specialized institutes for elderly. Therapists and medical workers mentioned that if elder people will have the opportunities to spend more outside simply by walking it will have a positive impact on their mental and physical health. Despite this fact, they worry that elder people can be injured or sustain bodily injuries without supervision due to stumbling and falling. Furthermore, elderly are also pessimistic about going outside due to the decreasing of physical abilities.

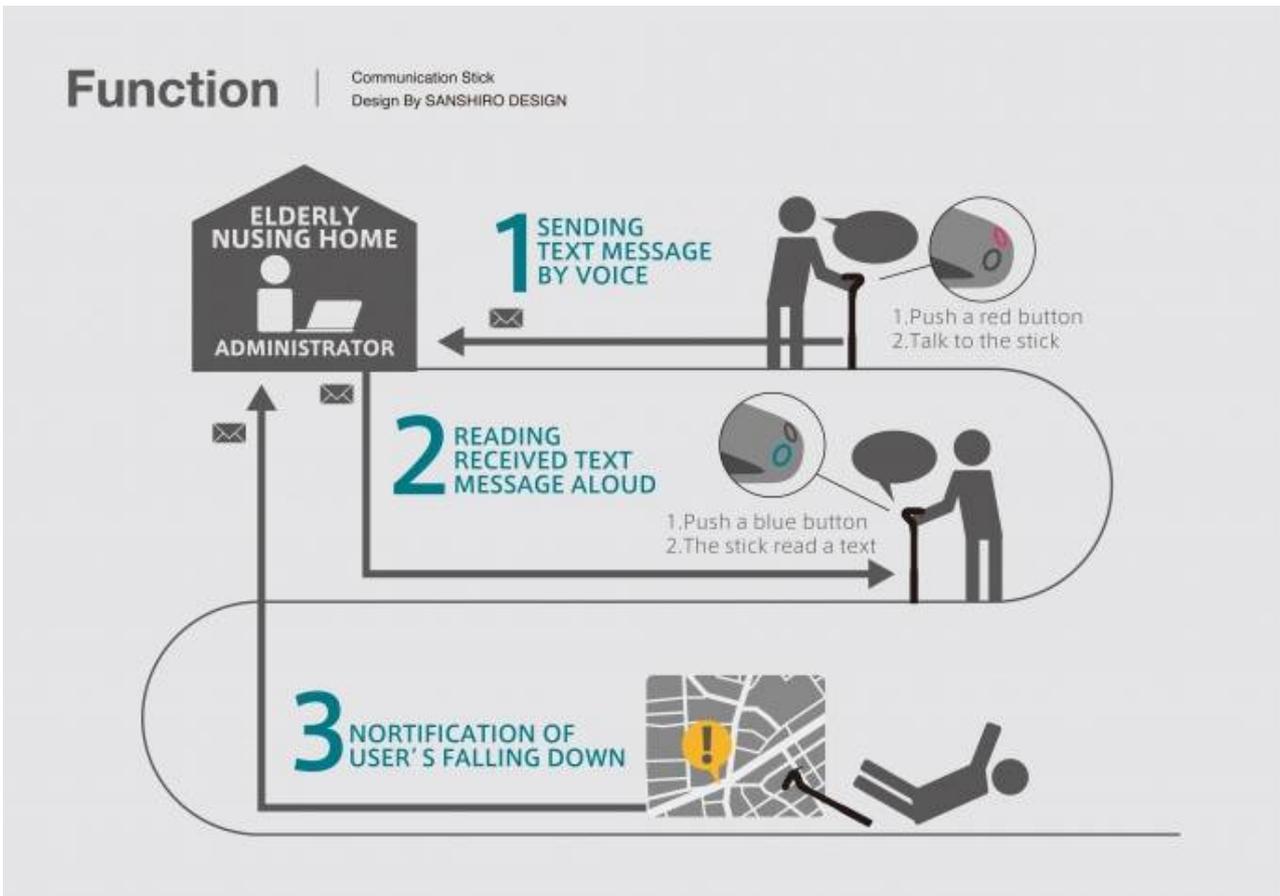
Consequently, the researchers' group made a concept of [the device that will provide an interactive communication between healthcare workers and users being simple and comfortable in use for elderly](#). They made the tool that provides a communication anytime when the elder is outside. There are a lot of mobile apps that can be used to solve this problem. Nevertheless, older people often can't use them or have some problem with using. The device with simple usability and low risk of loss was required.



Audio detected from the USB microphone is converted into text data by Google Speech API. Linux mail command sends that data to any mail address
source - jamesdysonaward.org

Researchers have created 2 prototypes. The first one is a hardware prototype with communication functions, the second one is a design prototype for structure development. The hardware prototype included Raspberry Pi, GPS, a USB microphone, USB 3G module, a speaker, an amplifier module and 9 –axis inertial motion sensor. These elements provide the functional using. The second prototype considers also functions of typical stick such as grip comfort, tensile strength, and the length adjustment. Furthermore, designers considered materials that are suitable for mass manufacturing, for example, polystyrene.

As the result, the device has the function of sending **text messages from speech**, transforming the voice into text information and **sending to any mail address**. The speech recognition function is activated when the button on the stick is pressed. To send message user need to release the button. The algorithm provides **the notifying location information during stumbling** making the device simple, half-autonomous and comfortable for use allowing elderly being outside without any limits.



When the user stumbles a notice with location information is automatically sent to any mail address, allowing immediate care

source - jamesdysonaward.org

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Patent status: -

On market since: -

Regions: Japan

Industries: Creative Industries

Source links: [James Dyson Award](#)



THE CICADA-INSPIRED ANTI-BACTERIAL COATING CAN KILLS BACTERIA UPON CONTACT

Scientists have developed the anti-bacterial nano-coating for disinfecting of various oftentimes touched surfaces such as tables, door handles and lifts buttons. They have found that wings of dragonflies and cicadas have the ability to prevent bacterial growth and kill them due to their natural structure. Their physical structure breaks down the cell membrane leading to the death of the bacterium. Furthermore, this innovational discovery can be applied in water disinfection.



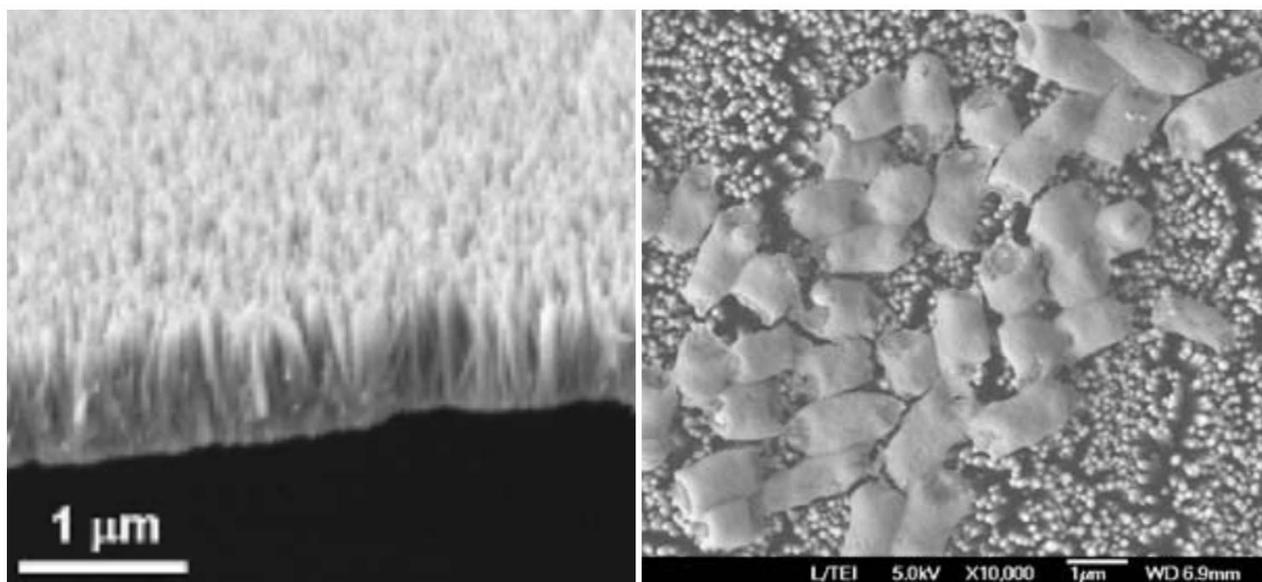
Wings of dragonflies and cicadas can prevent bacterial growth
source - mnn.com

The researcher's group, led by Dr. Yugen Zhang, from the [Agency for Science, Technology and Research \(A*STAR\)](#) has found that their wings are protected with special **ZnO nanopillars** such as nails covered with varnish. When the bacteria come in contact with these surfaces, their cell membranes are immediately torn and they die.

About **80%** of most common infections are spread through hands. The disinfection of surfaces, which are usually touched, can decrease the spread of dangerous microorganisms by hands. Despite this fact, it requires manual and re-disinfection as microorganisms grow fast. Most of the disinfectant includes chemicals such as triclosan, which is not determined as unsafe and ineffective. Furthermore, it can cause bacterial resistance and environmental defilement.

The researcher's team grew nanopillars using **zinc oxide**, which is characterized by anti-bacterial, and non-toxic properties. The Zinc foil and galvanized steel surfaces with ZnO nanopillar coatings show an excellent remote bacteria-killing property. To test it scientists selected the E. coli, P. aeruginosa, S. aureus, and C. albicans bacteria. 500 μ l of bacterial suspension was added to the nanopillars surface in a 24-well plate, and incubation **at 37**

°C for 24 hours. The surfaces were washed 3 times with phosphate-buffered saline (PBS) and then fixed in 2.5% glutaraldehyde PBS solution for 2 hours, then soak each sample in 30%, 50%, 70%, 85%, 90% ethanol, and 100% ethanol twice. Each concentration treats for 20 mins. The treated surface was placed in a fume hood and leave for 24-48 hours, which was further coated with platinum before electron microscope scanning (SEM).



E. coli bacteria destroyed by the anti-bacterial coating made from zinc oxide nanopillars
source - nanowerk.com

The morphologies of the bacteria before and after treatment were observed using SEM. The growth of bacteria was monitored by the microplate reader. The MIC was recorded as the lowest concentration of sample that inhibited 99% microbial growth of the test organism. Microbial cells cultured in broth medium were used as negative control. Each test was carried out in four replicates. Their effectiveness in bacterial killing is several orders higher than ZnO nanopillars coated on other surfaces as well as ZnO nanoparticles themselves.

The study results have demonstrated that the nanostructure surface kills adhered microbial cells by rupturing the cell wall. The superoxide gotten from the ZnO coating with electrons donated from zinc via the Zn/ZnO interface rather than photoirritation is responsible for the superior remote killing. The development can be highly used in hospitals, infirmaries and other medical facilities where sterilization is crucial in controlling the infections spread.

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On market since: -

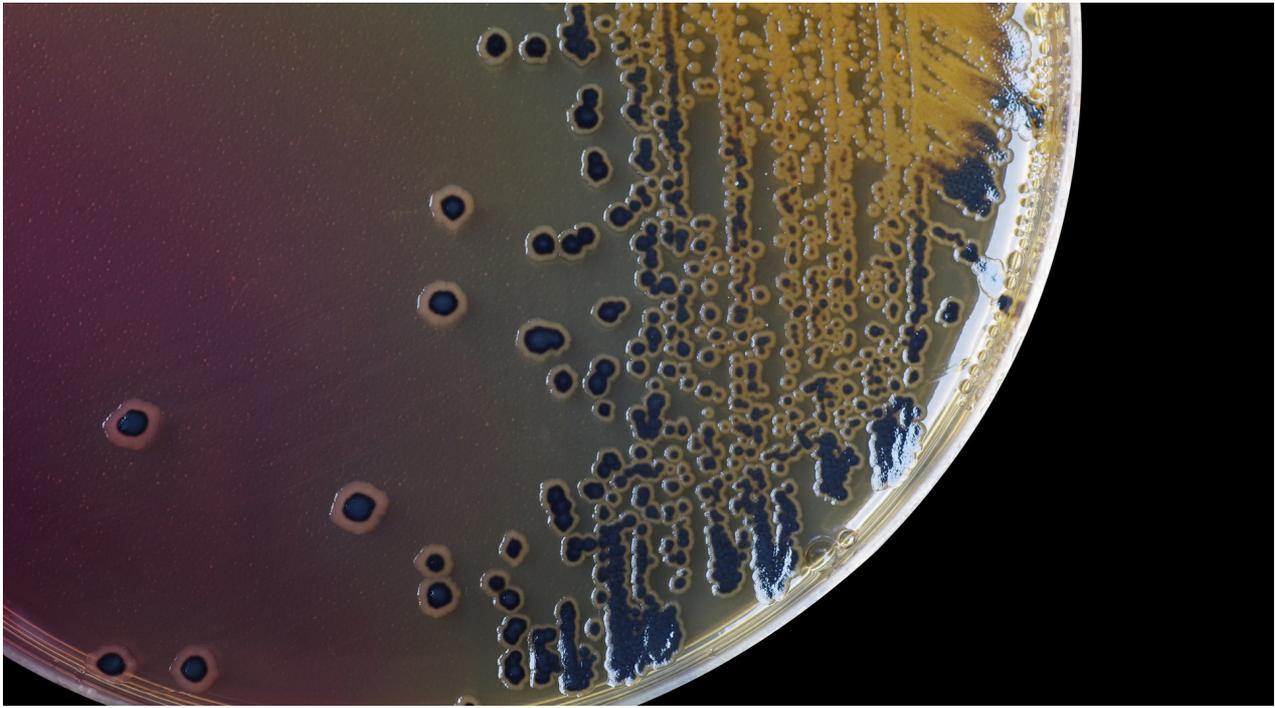
Regions: Singapore

Industries: Chemicals, Healthcare

Source links: [Small](#)

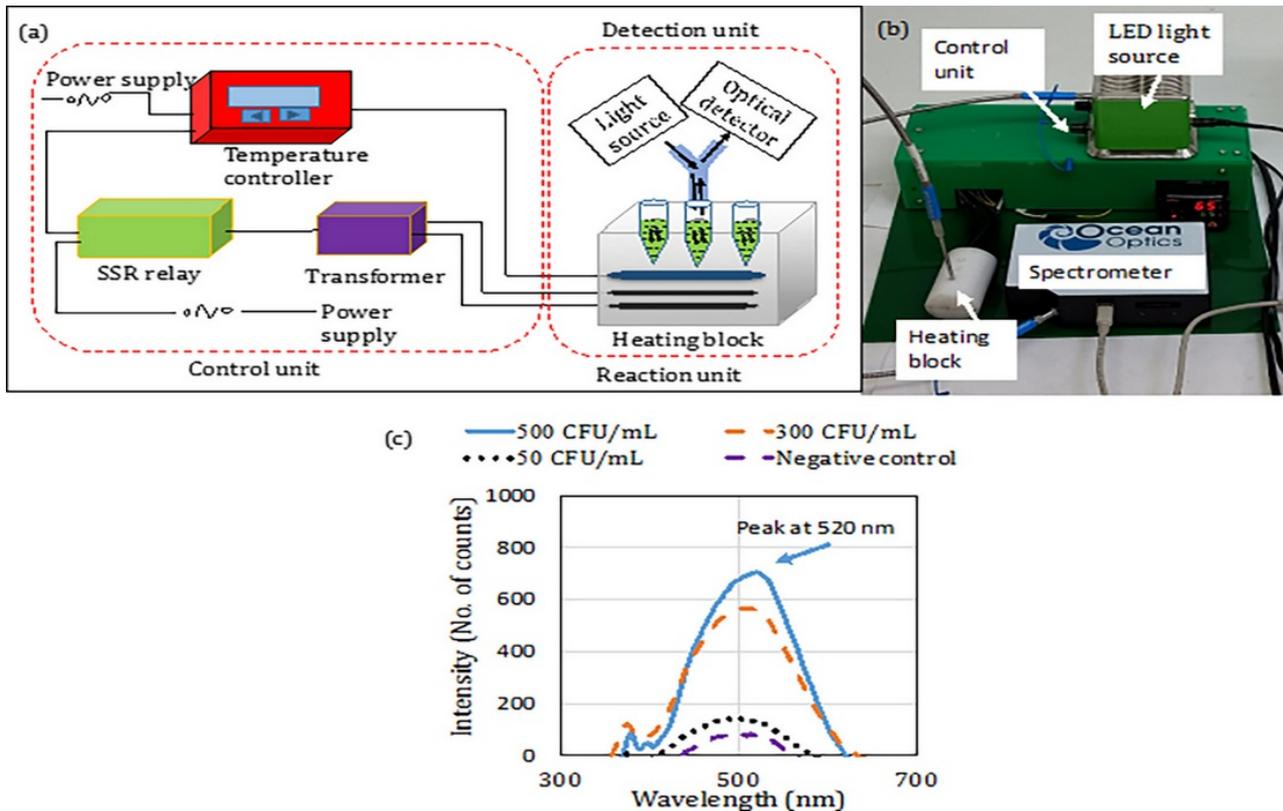
[Agency for Science, Technology and Research \(A*STAR\)](#)

RESEARCH



NOVEL TECHNOLOGY OF TYPHOID DIAGNOSIS

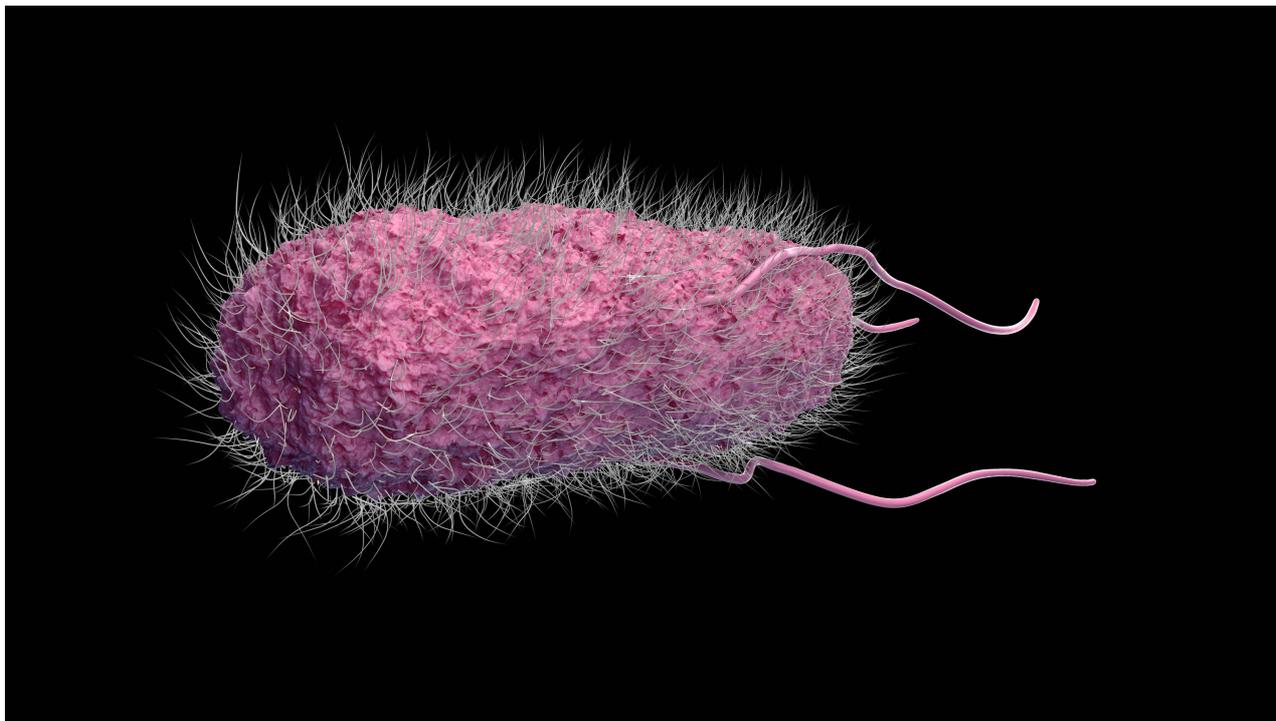
The group of scientists from India developed a precise and rapid technique for diagnosis of *Salmonella typhi* bacteria that cause enteric fever and typhoid. Current blood-based methods for typhoid diagnosis takes a lot of times and demand qualified medical workers and costly instruments. Furthermore, these methods sometimes cannot correctly detect and identify bacteria. This innovative technology requires the minimal blood sample to provide precise detection. In addition, it is relatively cost-effective.



Schematic and actual view: isothermal amplification and detection assembly (c) signal at the detector at various bacterial concentrations
source - journals.plos.org

The innovative test was developed by the group of scientists from the [Indian Institute of Technology Delhi](#), in collaboration with scientists from the [All India Institute of Medical Sciences](#), New Delhi.

The *Salmonella typhi* causes the enteric fever that leads to the thousand of death worldwide, especially, in the poor resource circumstances. The lack of fast and accurate methods of diagnostic is one of the main issues during the treatment. Furthermore, typhoidal *Salmonella* types have become resistant to current treatment techniques and antibiotics. The death rate can increase by 30% without proper diagnosis and effective therapy. Current diagnosis technologies such as serological methods have a low sensitivity that makes them indefensible. Moreover, the lack of affordable diagnostic methods leads to inappropriate use of antibiotics in all fevers cases. Another crucial issue is that these technologies require **up 20 to 30 mL of blood** in order to identify blood-related infections. The demand for such volumes of blood makes these tests threatening for geriatric and neonatal patients.



The study was funded by the Naval Research Board, Department of Science and Technology (DST) and Indo-German Science and Technology
source - adobe.com

The novel, rapid, precise and highly sensitive method ‘Miod’ includes a magnetic nanoparticle-based enrichment of target bacterial cells, followed by cell lysis and loop-mediated isothermal amplification (LAMP) of nucleic acids for signal augmentation along with concurrent measurement of the signal via an in-situ optical detection system. The study results demonstrated that over 65% of bacteria cells got bound to nanoparticles within 30 minutes. The cells were warmed-over at 100°C for 5 minutes to break through the membrane of bacteria to recover the genetic material.

This characteristic greatly decreases the complexity of the device and therefore the cost. Hence, isothermal based techniques have the potential for easy implementation in different countries, especially in developing economies. This method confirms the existence of bacteria in 6 hours providing the ability to rapid start of the therapy, which leads to the better effectiveness and even less mortality.

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Patent status: -

On market since: -

Regions: India

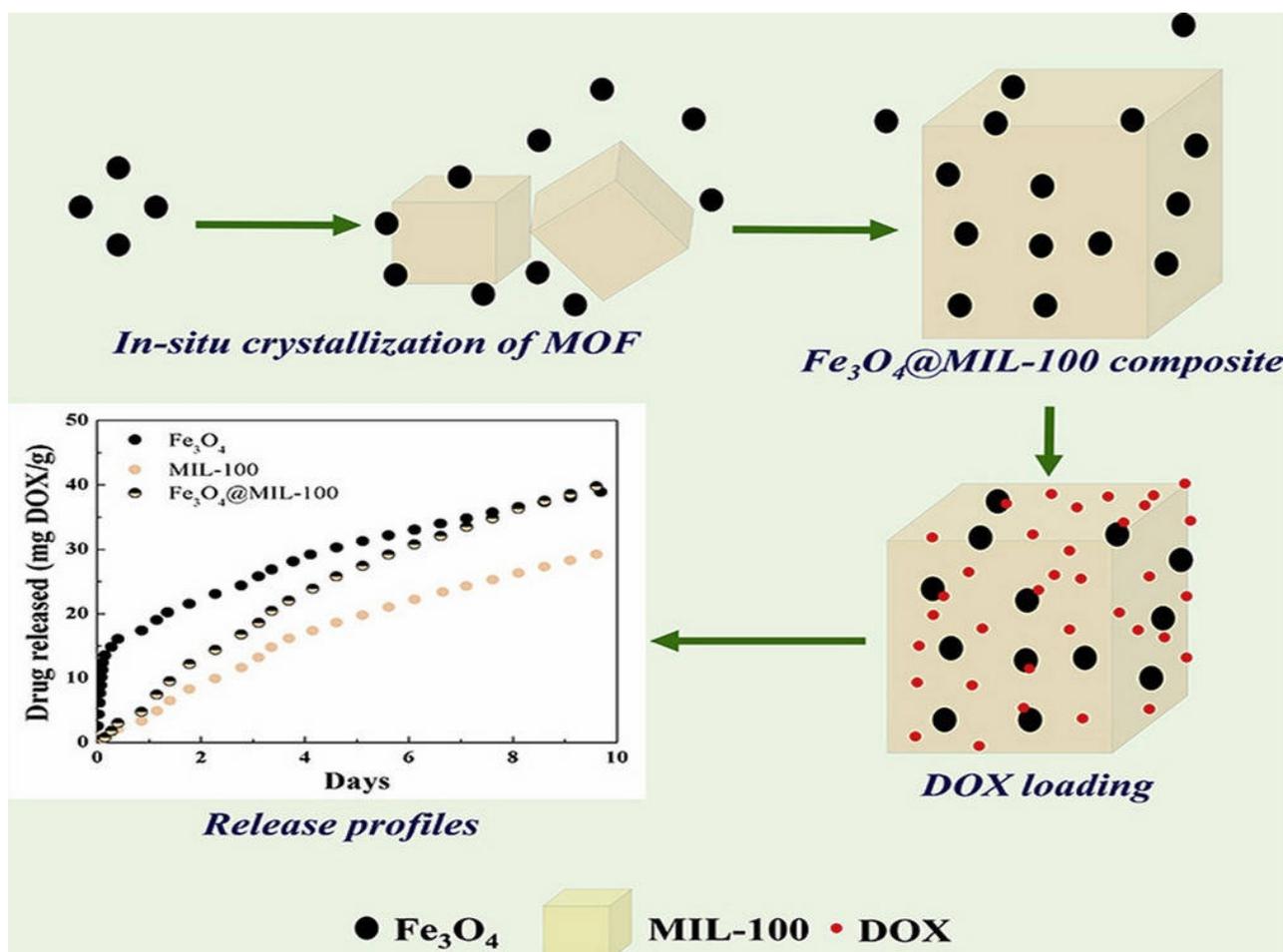
Industries: Healthcare

Source links: [PLOS One](#)
[Business Line](#)



A METHOD OF ACCURATELY DELIVERING THE ANTICANCER DRUG

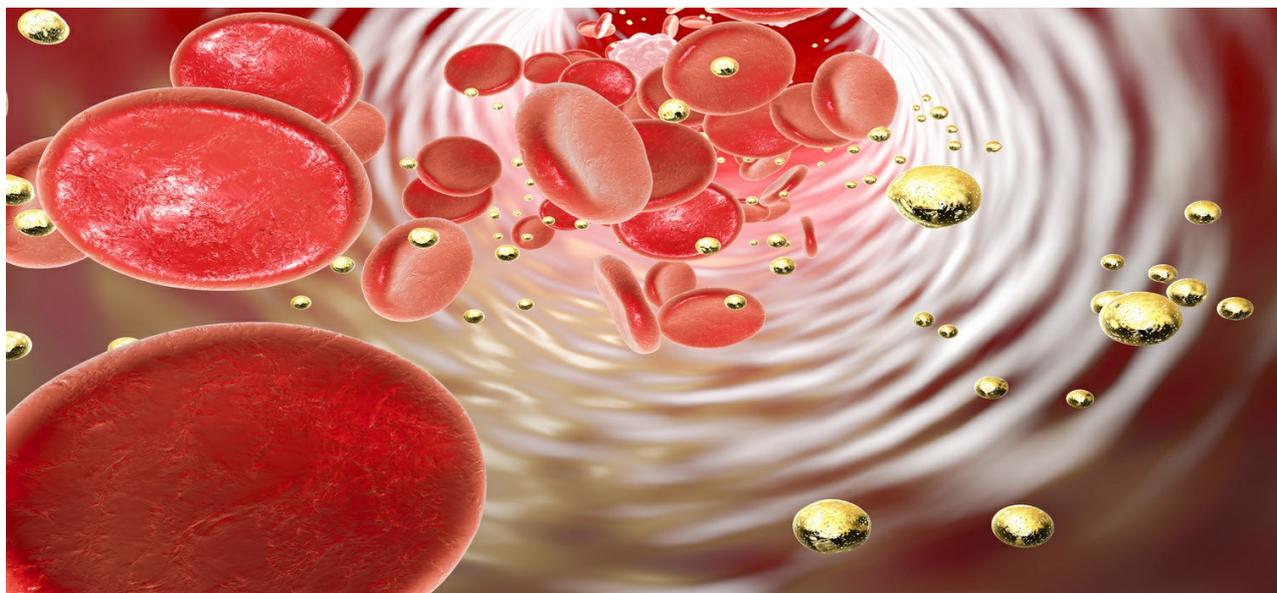
Scientists from India developed a novel targeting technology for cancer treatment that is based on the use of magnetic nanoparticles, which has the ability to precisely deliver the anticancer drug using a dual-purpose magnetic metal-organic framework of nanoparticles. They managed to include magnetite, which is easily broken down by human organism, into metal-organic frameworks in order to deliver medicines. Furthermore, the technology has been already approved for clinical practice by the U.S. Food and Drug Administration.



The magnetic moment of the composite increases with increase in the amount of Fe_3O_4
source - sciencedirect.com

The development was made by the scientific team, led by [Professor Sasidhar Gumma](#) and [Professor Mihir Kumar Purkait](#), from the [Indian Institute of Technology Guwahati](#).

Current anticancer medicines demonstrate insufficient effectiveness in targeted delivery. Moreover, required doses cause toxicity and various side effects. There were created different nanocarriers for the targeted acting of the chemotherapeutic drugs into cancer cells in order to act effectively avoiding the appearance of side effects. The crucial problems of current methods are their poor loading or premature release of the drug from the outer surface. To solve this problem, scientists applied porous metal-organic frameworks with higher tunability and the high surface area. Due to magnetic characteristics, nanoparticles have the ability to convert their electromagnetic energy into the heat that leads to the destruction of cancer cells. The current technologies are unable to regulate a large amount of drug and release the drug from the outside surface before they reach cancer cells.



The drug loading capacity of the composites is higher than that of the pure constituents
source - adobe.com

Characteristics of the metal-organic framework such as surface lead to the ability to control the speed and the location of drug delivery. The pore' diameter can be configured to release only a certain amount of medication to kill cancer cells. Furthermore, the most significant advantage of this method is that it reduces the risk of the killing of healthy cells avoiding the appearance of side effects. The metal-organic framework (MOF) MIL-100(Fe) and its composite with Iron oxide nanoparticles Fe₃O₄@MIL-100 were investigated as delivery agents for anticancer drug doxorubicin hydrochloride (DOX). Scientists synthesized series of composites by adding the various amount of Fe₃O₄ to the solvent mixture used for the synthesis of the MOF MIL-100 in order to define the effect of the nanoparticles in the MOF structure. They tested several composites by adding the aqueous solution of DOX with the porous carriers. The release profiles of the DOX-loaded carriers diffused in phosphate-buffered saline (PBS, pH 7.4, 37 °C) indicate that the kinetics slow down after incorporation of the Fe₃O₄ nanoparticles.

Scientists mentioned that the controlling ability of drug release is up to 20 days that allows patients visit the doctor not so often. Comparing to current methods, this technology is more effective and save.

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Patent status: -

On market since: -

Regions: India

Industries: Healthcare

Source links: [Microporous and Mesoporous Materials](#)
[Business Line](#)



'GOLD' TECHNOLOGY PROVIDES AN ACCURATE PROGNOSIS OF CANCER TREATMENT

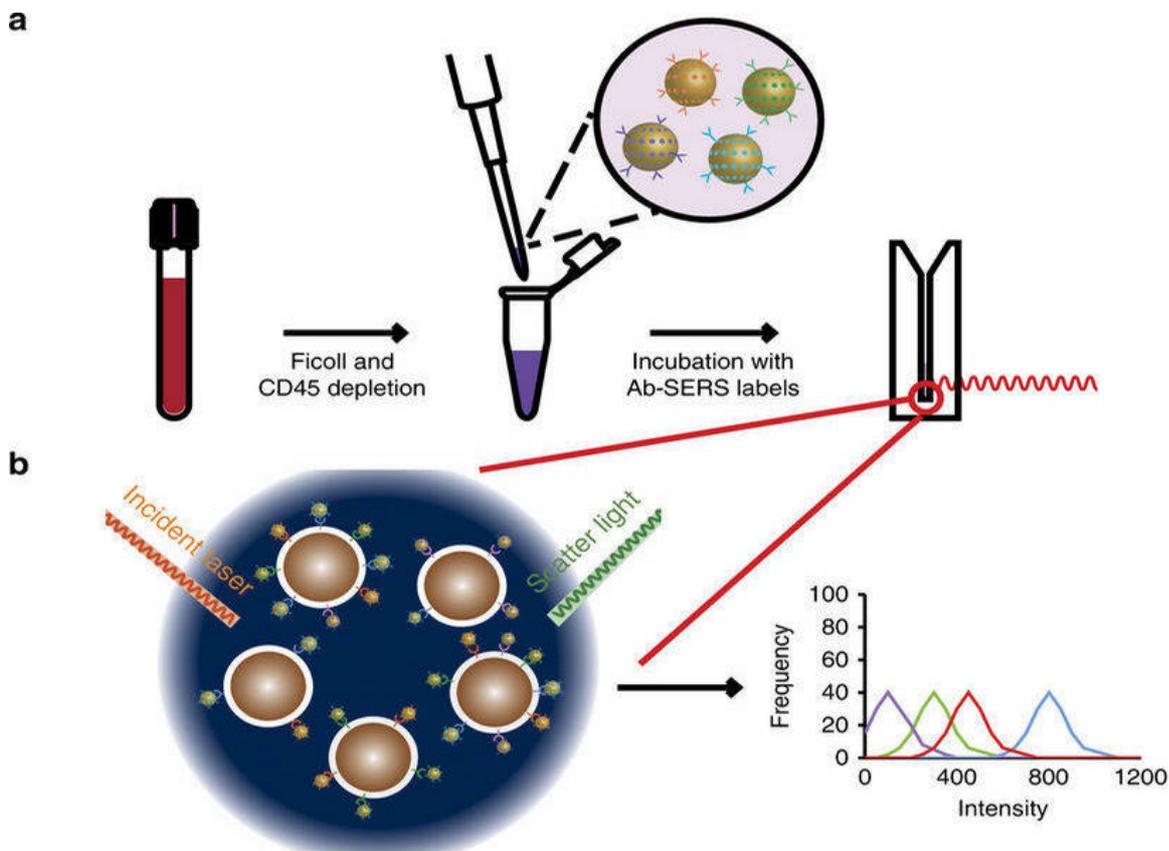
Australian scientists developed an innovational method of the real-time monitoring of cancer treatment, which has the ability to provide a precise and early prognosis of the therapy. The technology is based on the use of special type of gold nanoparticle, which is attached to various antibodies and can stick to different proteins on a wide variety of circulating tumor cells (CTCs) emitting a special signal. Furthermore, it can help to control the on-going therapy of patients making it much more effective.



Professor Matt Trau and Ph.D. student Jing Wang from the UQ's Australian Institute for Bioengineering and Nanotechnology
source - uq.edu.au

The development was made by the scientific team from the [University of Queensland](#) in cooperation with the [Olivia Newton John Cancer Research Institute](#).

The real-time monitoring of cancer cells during therapy can provide vital tumor data that will give the possibility to improve the process of the treatment. CTC analysis has been determined as a useful monitoring tool, but its use is limited by multiplexing capability or sensitivity. It is important to determine the treatment results in order to define the possible appearance of tumor cells, which are treatment resistant, including tumor cells able to avoid the immune system acting after immunotherapy. The therapeutic resistance can be as the result of selective and adaptive pressure that encourages the proliferation of the resistant cell population, which can be phenotypically different from their predecessors in form, shape, size, and surface marker expression. Furthermore, the types of proteins on the surfaces of CTCs could differ from one type of cancer to another, and even within in same cancer. It is much more complicate the finding. Therefore, the current CTC monitoring methods, which target predecessors cells can fail to detect cancer cells.

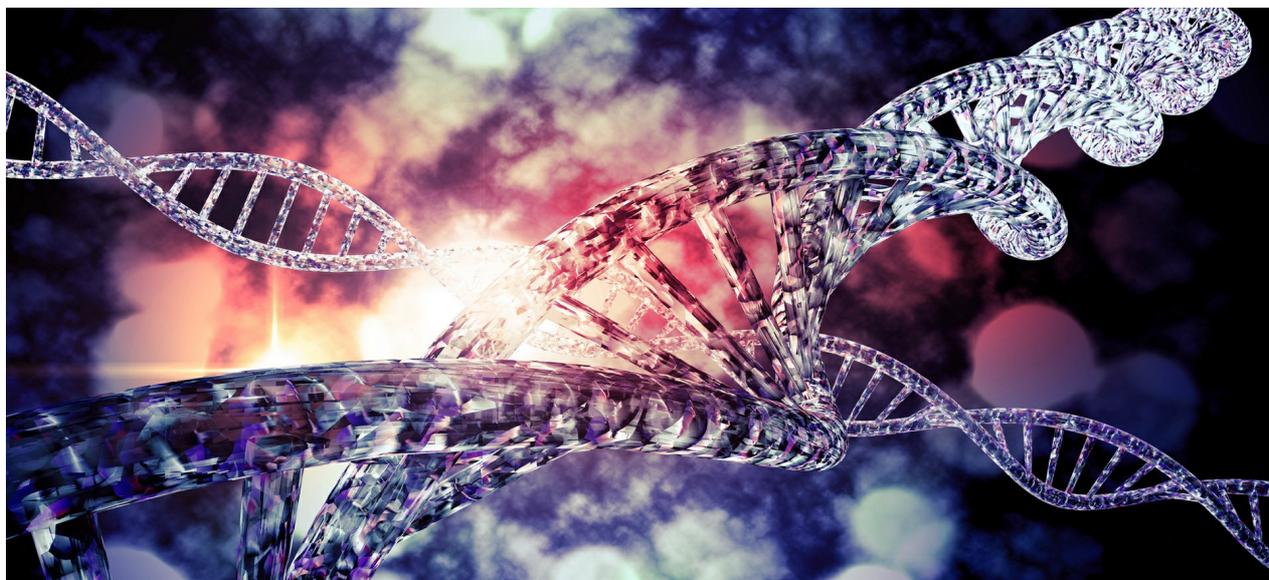


Schematics of experimental workflow: the blood sample taken from a patient is first depleted of RBC and PBMCs by processing over density gradient centrifugation (Ficoll) and subsequent CD45 depletion
 source - nature.com

As a result, scientists managed to develop the technology with the use of gold nanoparticle, which is pegged to various antibodies and has the ability to pester to various proteins of CTCs. This technique is targeted to observe CTC phenotypic changes by monitoring the expression levels of multiple surface markers simultaneously via surface-enhanced Raman spectroscopy (SERS). The specific antibodies for targeting each surface marker are conjugated to SERS labels (i.e., Raman reporter-coated gold nanoparticles (AuNPs)), and a unique Raman spectrum (fingerprint) for each SERS label is generated upon a common laser wavelength excitation. The group observed cell heterogeneity and phenotypic changes of melanoma cell lines during molecularly targeted treatment. Moreover, they follow the CTC signature changes of 10 stage-IV melanoma patients receiving immunological or molecular targeted therapies, noting significant changes during their treatment.

Professor Jonathan Cebon mentioned that this novel technology can help doctors to make informed decisions about the process of the therapy.

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Patent status: -
On market since: -
Regions: Australia
Industries: Healthcare
Source links: [Nature Communications](#)
[University of Queensland](#)



CATIONIC POLYMERS CAN KILL CANCER CELLS AND STOP THEIR SPREADING

The multidisciplinary scientific group from Singapore has created innovative synthetic macromolecules, which have the ability to kill multidrug-resistant cancer cells and cancer stem cells, impede metastasis formation, and prevent the development of drug resistance. Furthermore, scientists hope that these innovational macromolecules will provide the creation of the anti-cancer drug in order to treat patients with this disease and prevent cancer relapse.



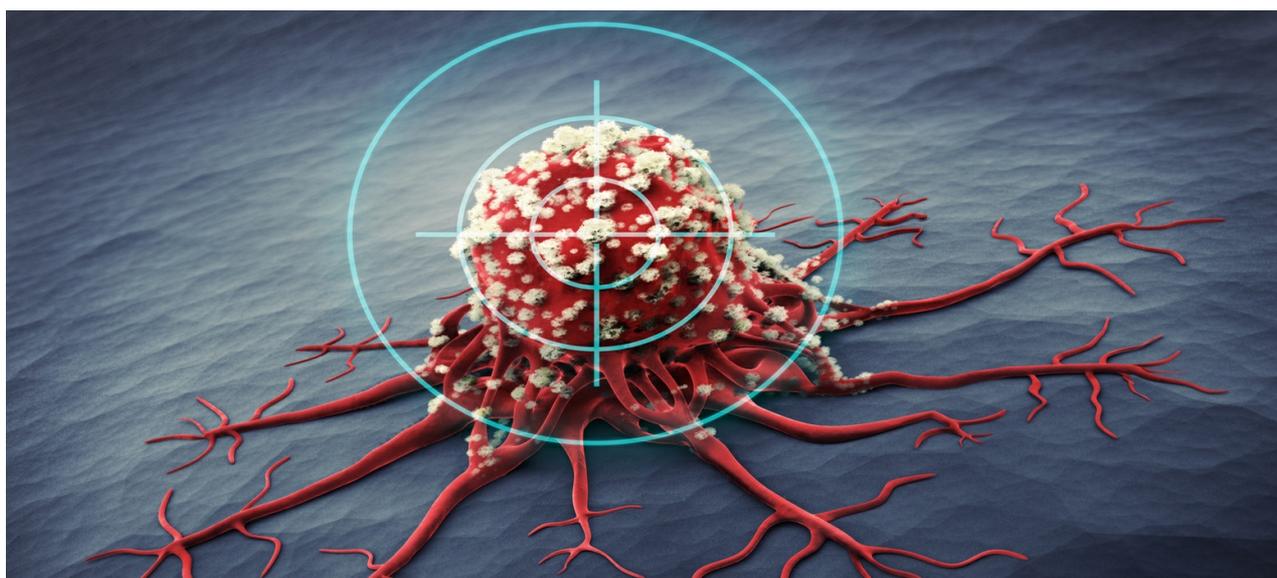
The new study was built on a May 2016 study about the discovery of a macromolecule to treat viruses and a more recent study published in March 2018
source - adobe.com

The development was made by the group of scientists from the [Agency for Science, Technology and Research \(A*STAR\)](#).

According to the [World Health Organization](#), cancer is the second leading cause of death globally and was responsible for **8.8 million deaths in 2015**. It affects people of different ages and nations. Globally, nearly **1 in 6 deaths** is due to cancer. About **70%** of deaths from cancer occur in low- and middle-income countries. Another crucial issue is that **multiple treatments with typical chemotherapeutic drugs cause the formation of the drug resistance**. Drug resistance to chemotherapeutics is a common problem that is peculiar to different cancer treatment techniques. Furthermore, it leads to metastasis and relapse happen in many patients. Consequently, there is a pressing demand to develop new methods of treatment, which will be able to kill multidrug-resistant cancer cells and do not cause the drug resistance creation. To tackle such a difficult problem, a multidisciplinary scientific group that involved scientists from diverse fields. To decide resistance problem, the group created **a new class of macromolecules as self-contained chemotherapeutic agents**.

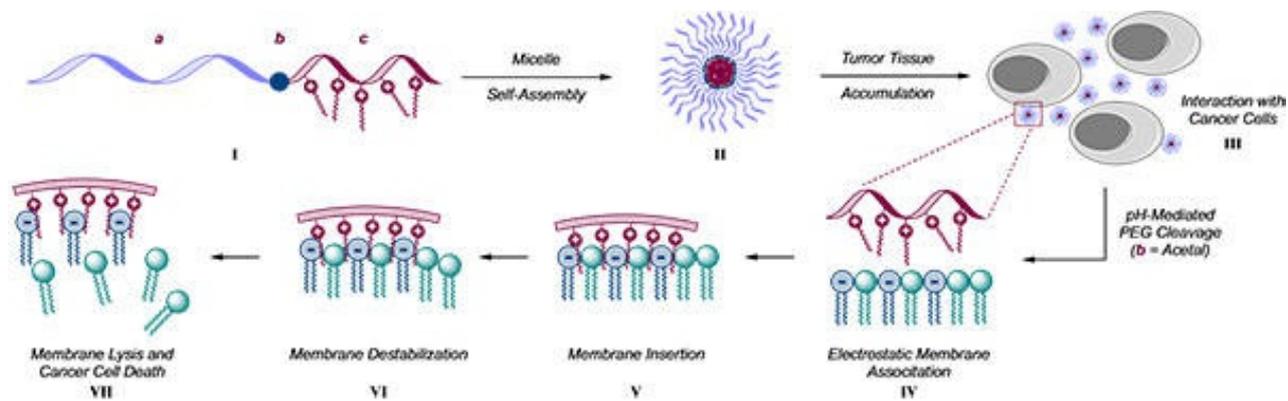
Macromolecules are large, complex molecules. They are usually the product of smaller

molecules, like proteins, lipids, and carbohydrates. The macromolecular chemotherapeutic agents easily self-assemble into well-determined nanoparticles and demonstrate prominent activity in vitro against multiple cancer cells. They **operate by selectively fastening and lysing cancer cell membranes**. These cationic polymers have the ability to **assimilate into the cell membrane, pierce holes in the cell of cancer and destroy it**. As a result, these type of macromolecules demonstrate **a huge potency against drug-resistant cancer cells and cancer stem cells, stop its spreading**. Furthermore, they do not cause resistance after multiple series of treatment. Simultaneous experiments with malemolecular chemotherapy, doxorubicin, demonstrate aggressive resistance observed in cancer cells, lack of efficacy against drug-resistant cell lines and inability to prevent cancer cell migration. In addition, polymers demonstrated antitumor efficacy in patients with hepatocellular carcinoma, which were obtained from the xenograft mouse model. In general, these results show a new and innovational approach to the **development of antitumor therapy using macromolecular compounds**.



The team collaborated with Dr. Paola Florez de Sessions from A*STAR's GIS to perform the transcriptomic analysis
source - adobe.com

This development is quite effective but is still under study. Scientists hope to find partners in the pharmaceutical industry in order to accelerate the availability of this treatment.



Macromolecule self-assembles into core/shell structured nanoparticle that accumulates in tumor tissue, cleaves the shell to expose the anti-cancer component that interacts with negative charges on the cell membrane, disrupts the membrane, killing the cell

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Regions: Singapore
Industries: Healthcare
Source links: [Journal of the American Chemical Society](#)
[A*STAR](#)



PLATFORM PREDICTS DRUG-DRUG AND DRUG-FOOD INTERACTIONS

A scientific group from Korea has developed a platform technology DeepDDI that is able to predict drug-drug and drug-food interactions. It is a computational framework, which can generate 86 types of drug-drug and drug-food interactions as outputs of human-readable sentences. The platform provides an important information about drug prescription and dietary suggestions, which can cause unexpected outputs or side effects while the patient takes the certain medicine. Scientists hope that this innovative development will be able to maximize healthcare results and maintain a healthy life avoiding undesirable consequences.



Distinguished Professor Sang Yup Lee from the Department of Chemical and Biomolecular Engineering at KAIST
source - kaist.ac.kr

DeepDDI, which precisely predicts 86 types of drug-drug interactions (DDIs) and drug-food constituent interactions (DFIs), was developed by the scientific team, that is consists of [Dr. Jae Yong Ryu](#), [Assistant Professor Hyun Uk Kim](#), and [Professor Sang Yup Lee](#), from the [Korea Advanced Institute of Science and Technology](#).

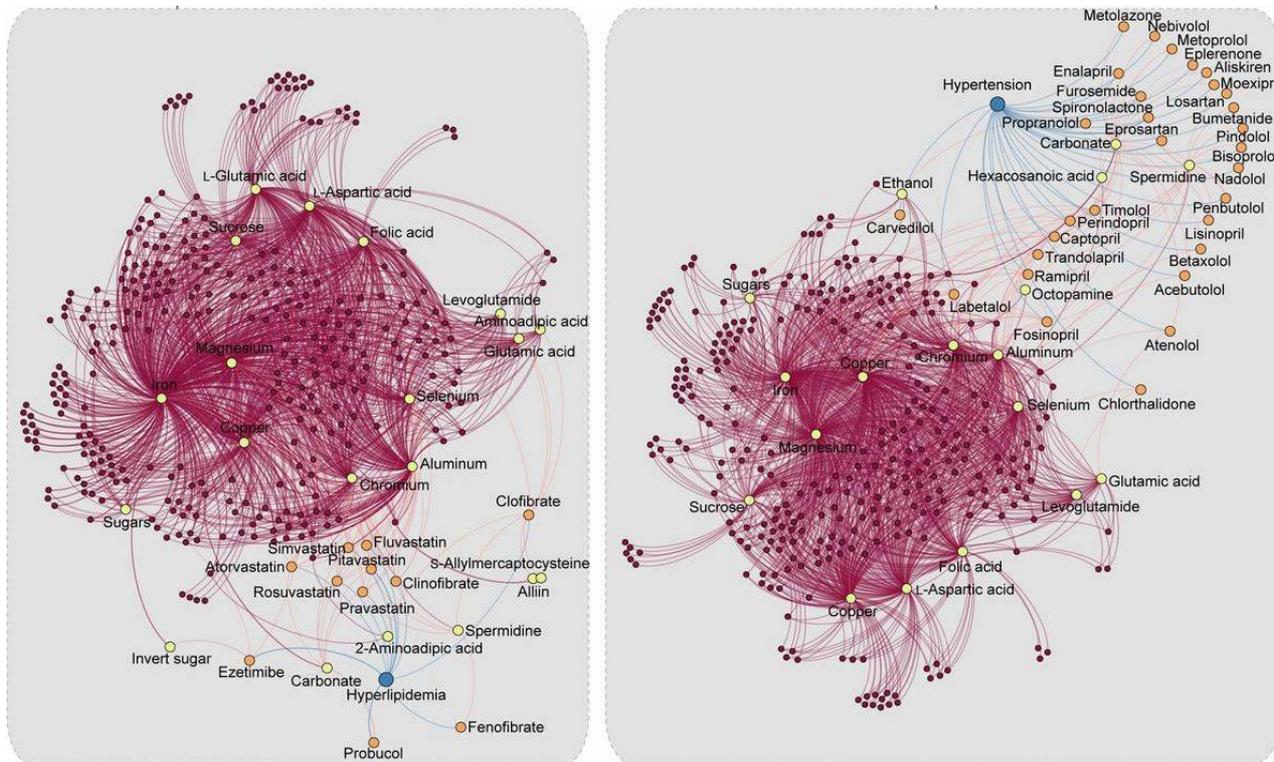
Drug interactions such as [DDIs and DFIs have the ability to cause unexpected and undesirable pharmacological results](#), including adverse drug events (ADEs). Usually, these mechanisms are unknown. Previously, there were created several computational methods in order to understand the process of action of DDI. Nevertheless, these techniques do not provide sufficient data or demand detailed information about certain medicine, which is usually inaccessible. Researchers created a computational framework DeepDDI that uses names of drug-drug or drug-food constituent pairs and their structural information as data to precisely [generate 86 important DDI types](#). The platform applies a deep neural network with its optimized prognosis operation and predicts [86 DDI types with the accuracy about 92.4%](#) using special dataset, which contains [192,284 DDIs](#) that include [191,878 drug pairs](#).



source - adobe.com

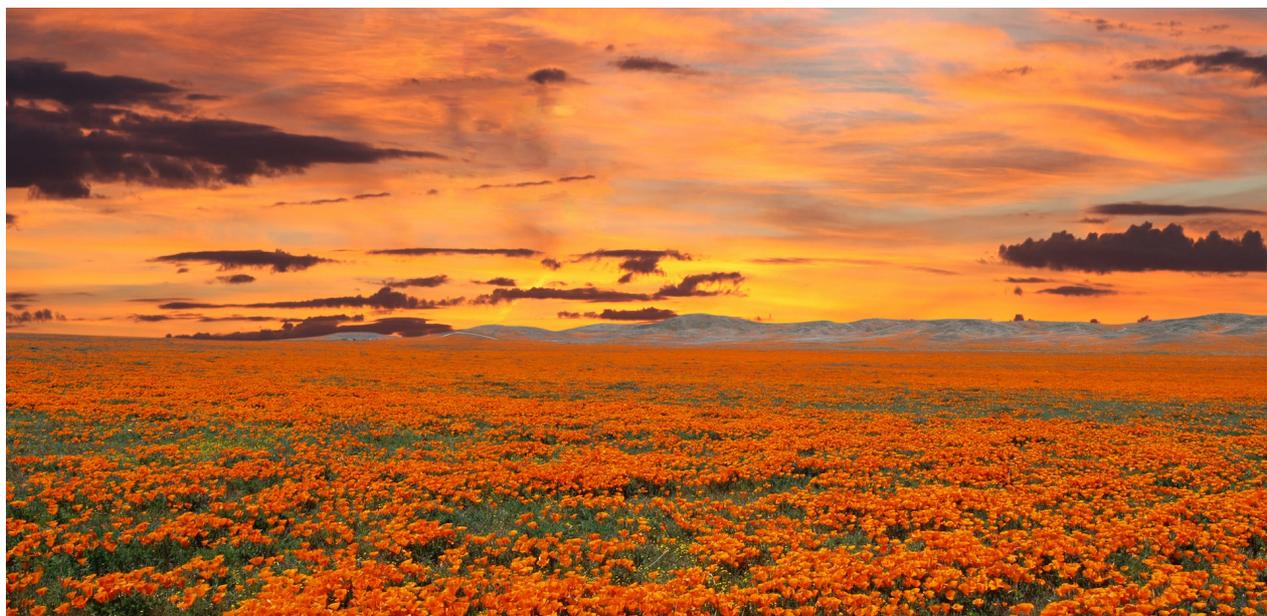
To implement DNN, structural information (SMILES) of each drug in the input drug pair was first used to produce a feature vector called structural similarity profile (SSP). It was made in order to note a unique structural characteristic of a certain drug and to link this characteristic with a set of the reported DDI types. To predict the DDI types for a certain drug pair, two SSPs were made for each drug pair, which was decreased and combined as a single vector. As the result, this combined SSP is a vector of a drug pair.

With the help of this technology, scientists managed to predict effects of **256 food constituents** on pharmacological effects of interacting drugs and bioactivities of **149 food constituents**. 149 food constituents could be assigned to at least one of the 30 types of bioactivities using 29,423 DeepDDI output sentences having such expression form. Consequently, such information can be useful for the patient who takes medications, for example, for chronic diseases such as hypertension or diabetes mellitus type. This novel study will provide the ability **to make treatment more effective and safe without undesirable consequences**.



A network showing relationships among 357 diseases, 430 approved drugs, 274 food constituents, and 356 food sources was created using the DeepDDI output sentences obtained from 358,995 drug-food constituent pairs source - pnas.org

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On market since: -
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Industries: Healthcare
Source links: [PNAS](#)
[Korea Advanced Institute of Science and Technology](#)



DRUG-MAKING GENES IN PLANTS

The scientific team from Japan, researching a California poppy has determined that this plant contains more enriched P450 genes involved in isoquinoline alkaloid synthesis, which are the basis of various analgesics such as morphine and codeine. The further genome mining of the genes encoding the enzymes involved in benzyloisoquinoline alkaloid (BIA) biosynthesis can be used for drugs developing. In other words, this innovational discovery will give the ability to create a new type of drugs.



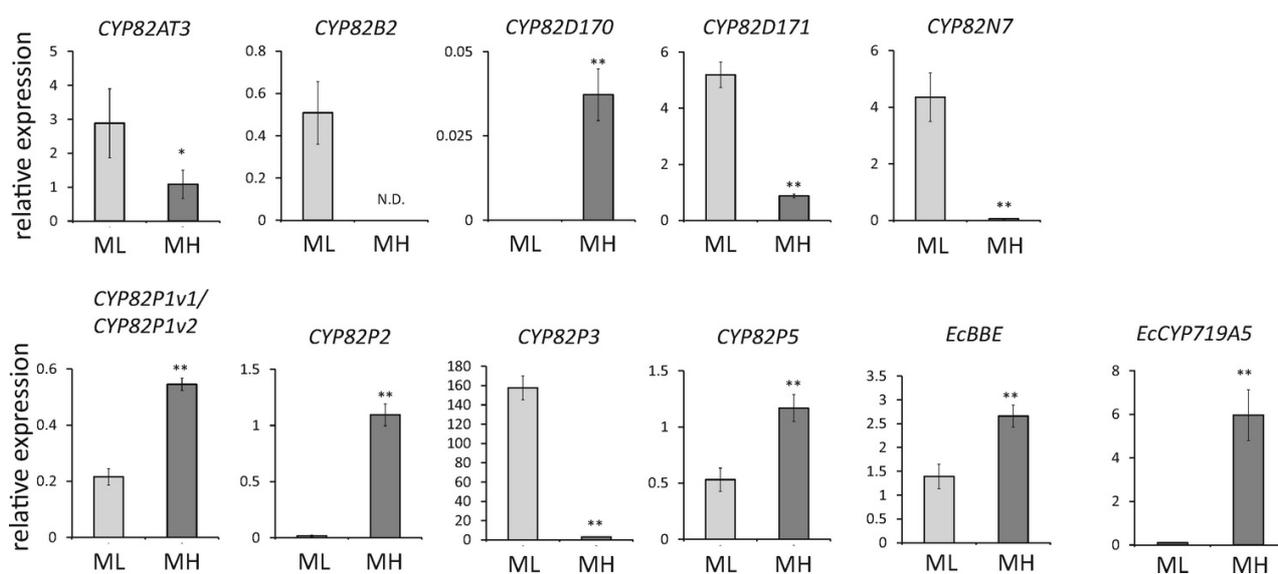
The research gives molecular-level insight into how plants produce a diverse range of metabolites that can be applied to drug synthesis
source - adobe.com

The innovative discovery was made by the researchers' team, led by [Professor Fumihiko Sato](#), from the [Kyoto University](#), in cooperation with [Japan's National Institute for Genetics](#) and the [Kazusa DNA Research Institute](#).

[Isoquinoline alkaloids](#) are the basis of different analgesics such as morphine and codeine. Various plants have the ability to produce specialized low molecular weight metabolites in order to adapt to different environmental irritants, such as infection, UV radiation, wounding and damage caused by animal feeding. As a result of irritants variations, plants can generate different chemicals, especially alkaloids, specific to plants, through specialized paths of biosynthesis. In BIA biosynthesis and many other specialized metabolite biosynthesis pathways, [P450s are important for determining chemical diversity in metabolism](#). Biosynthetic pathways involved in specialized metabolism have thus far been characterized using metabolite identification and tracer experiments. Many of these metabolites can be used for developing of novel drugs, causing scientific interest in the biosynthetic pathways, which lead to the metabolite generating.

Scientists researched [California poppy](#) that has the ability [to produce different types of benzyloquinoline alkaloids \(BIAs\)](#), i.e. aporphine-, pavine-, protoberberine-, protopine- and benzophenanthridine-type alkaloids. The major alkaloid biosynthesis pathways and biosynthetic enzymes of these BIAs have been characterized at the molecular level.

Macarpine biosynthesis causes a big interest due to its biosynthetic pathway from reticuline involves 6 different P450s. The team focused on the diversification of the P450 family in the draft genome sequence research. Scientists researching P450 genes managed to determine that the California poppy genome was enriched with genes belonging to the CYP80, CYP82 and CYP719 families. These genes are involved in BIA biosynthesis in this plant.



Expression analysis of novel P450 genes in cultured *E. californica* cells. Transcript expression was measured by quantitative real-time PCR using the cDNAs of macarpine ML/MH cultured cells
source - academic.oup.com

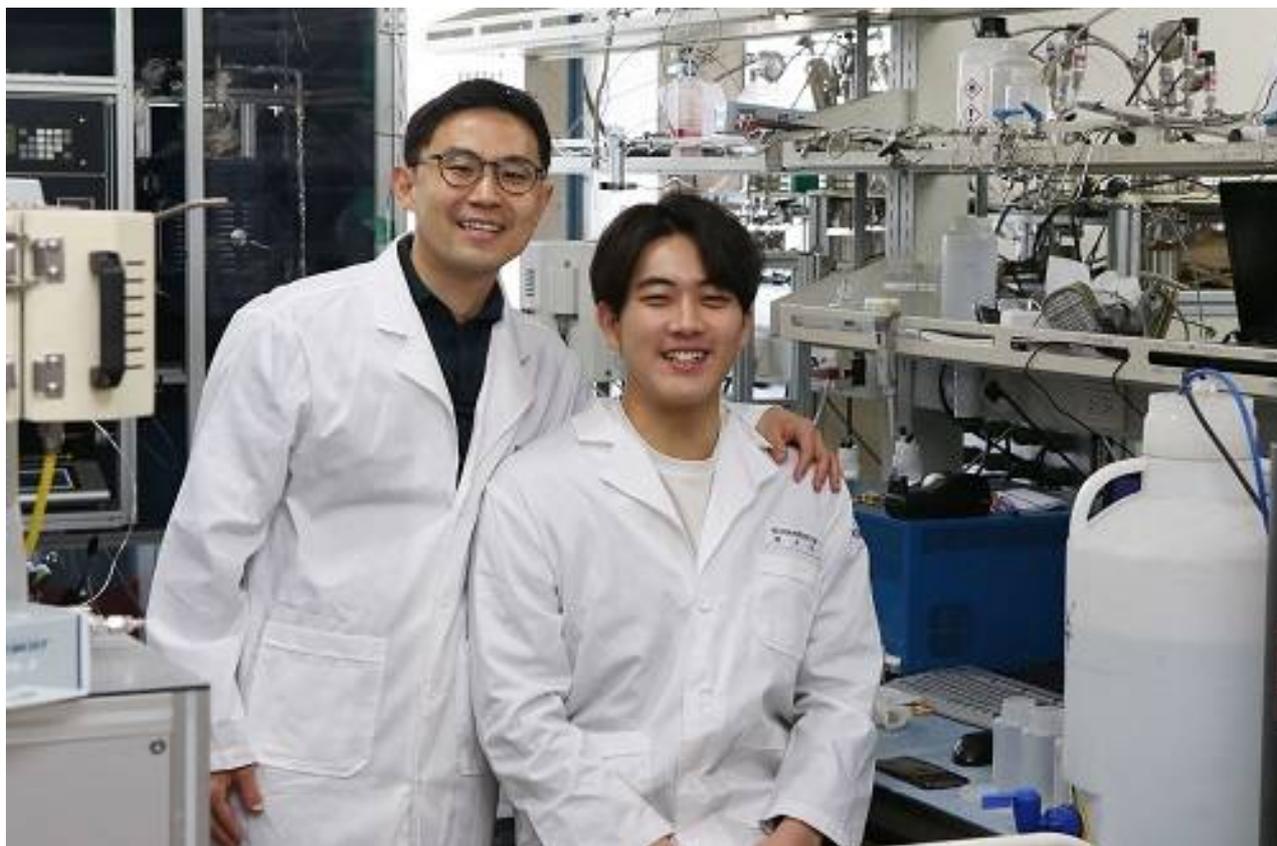
Professor Fumihiko Sato mentioned that the understanding of how plants make isoquinoline alkaloids is significant for medicine as it can bring a lot of benefits for humanity. The discovery will allow developing new painkillers and drugs.

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On market since: -
Regions: Japan
Industries: Healthcare
Source links: [Plant and Cell Physiology](#)
[Kyoto University](#)



AN INNOVATIVE ABSORBENT IS AT 50 TIMES MORE STABLE

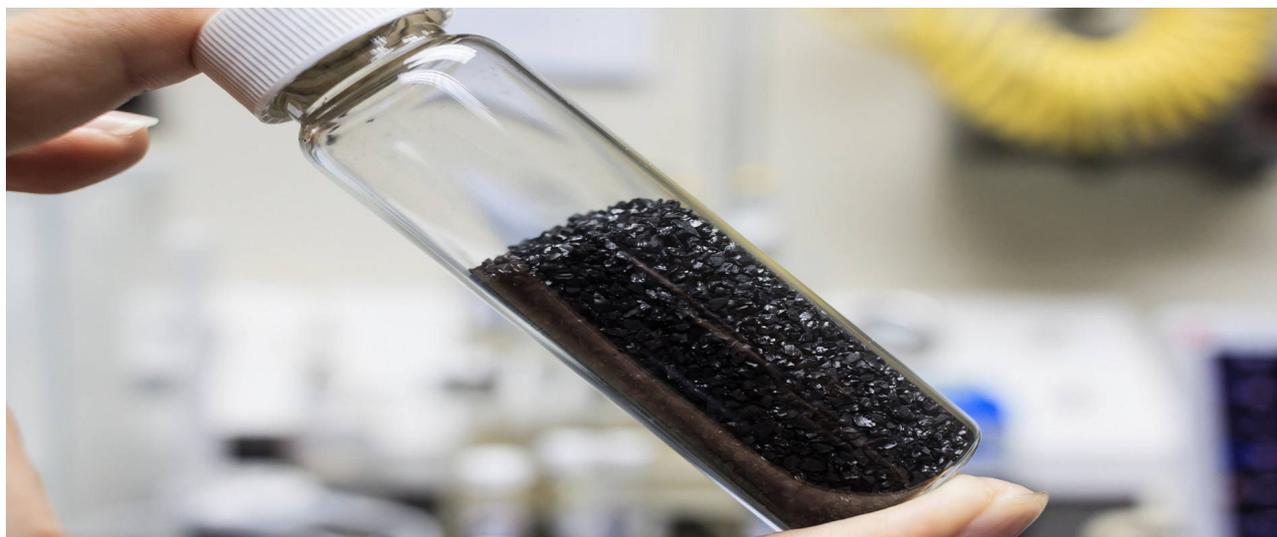
Korean researchers are going to commercialize a novel stable absorbent solving the problem of low oxidative stability of amines. This new technology is able to enhance the stability of amine-containing adsorbents at 50 times. Scientists used polyethyleneimine (PEI), which was functionalized with 1,2- epoxybutane (EB), and chelators as a catalyst poison. Therefore, this groundbreaking discovery will allow the wide practical use of amine-containing solids that capturing CO₂ and consuming less energy for the process of regeneration.



Professor Minkee Choi and Ph.D. candidate Woosung Choi
source - kaist.ac.kr

The technology was developed by the scientific team, led by [Professor Minkee Choi](#) and [Ph.D. candidate Woosung Choi](#), from the [Korea Advanced Institute of Science and Technology](#).

The delight of the greenhouse gas carbon dioxide is a significant investigative field due to its ability to decrease anthropogenic CO₂ emissions. Furthermore, amine-containing adsorbents can be not only [highly effective carbon capturing and storage \(CCS\) method](#) but [eco-friendly](#). Despite the fact, that there were thousands of attempts to optimize it the technique still has some limitations such as amine loss, reactor corrosion, and the high energy consumption to regenerate. In order to overcome these barriers, solid adsorbents can be a suitable alternative. The most important moment is that these adsorbents should be stable upon repeated CO₂ adsorption-desorption cycles over a long time. Typically, the low potential of adsorbent stability requires the incessant supplementation of fresh adsorbents but it highly enlarges the cost of the process of CO₂ capturing.



The resultant adsorbent showed a minor loss of CO₂ working capacity (8.5%) even after 30 days aging in O₂-containing flue gas at 110°C
source - adobe.com

The scientific group has discovered that the minimal amount of iron and copper, which are present in the amine expedite the oxidative dispensation of the amine-containing adsorbent. Consequently, they decided to use a chelator substance that has the capacity to restrain the activation of the impurities. The team synthesized a modified PEI/silica, which demonstrates high oxidative stability. The adsorbent was developed by combining 2 methods. PEI was functionalized with 1,2-EB that produces tethered 2-hydroxybutyl groups. Minimal amounts of chelators (<2wt%), which were pre-supported into a silica support before the impregnation of PEI. Scientists managed to discover that the polymeric that catalyze amine oxidation. As the result, the supplements of chelators as a catalyst poison have the ability to restrain the speed of amine oxidation.

Ph.D. candidate Woosung Choi mentioned that the technology makes absorbents suitable to commercial standards.

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On market since: -

Regions: Korea

Industries: Chemicals

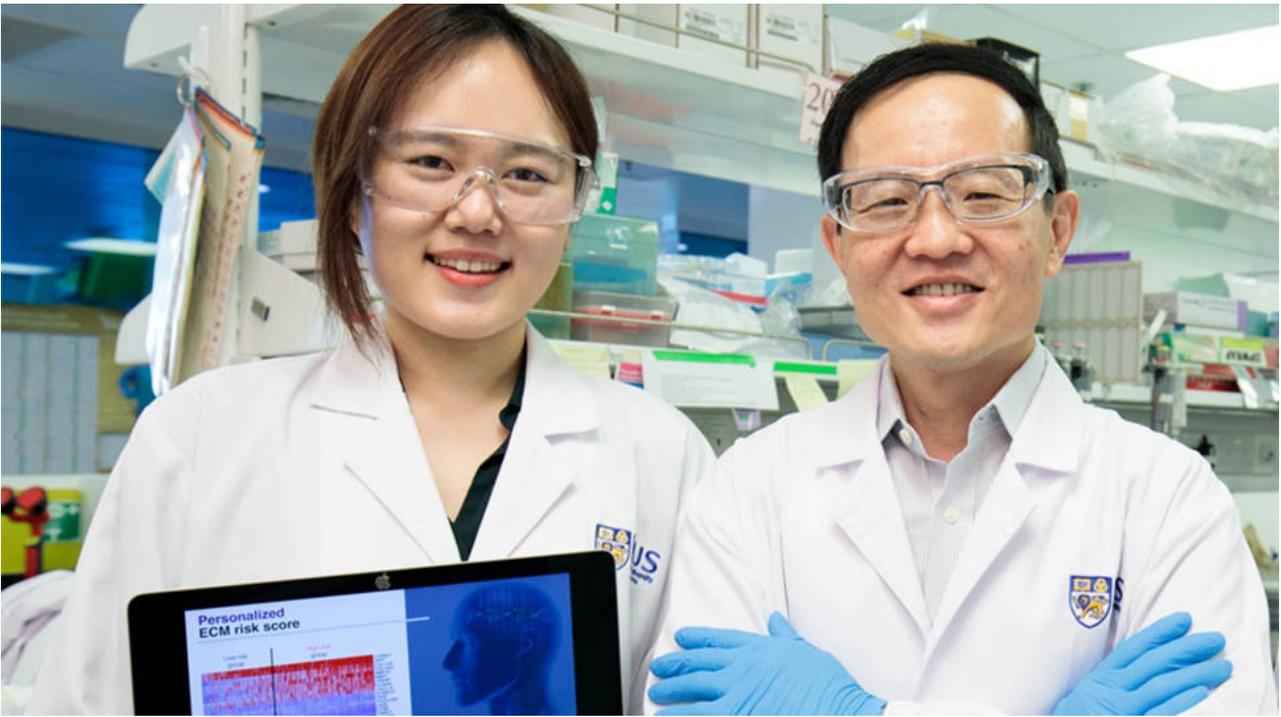
Source links: [Nature Communications](#)

[KAIST](#)



PREDICTING THE RESULTS OF TREATMENT FOR LUNG CANCER

Scientists developed a new clinical tool, using open source data to predict the survival rate of the patient and treatment outcomes for early-stage lung cancer. This innovative development is based on the panel of 29 unique extracellular matrix (ECM) genes that have been identified by the scientific group considering their abnormal expression in lung cancers compared to healthy lung cells. The biggest advantage of this technology is that it can provide the best benefits of adjuvant chemotherapy (ACT) and prevent unnecessary treatment or ACT-linked sickness.



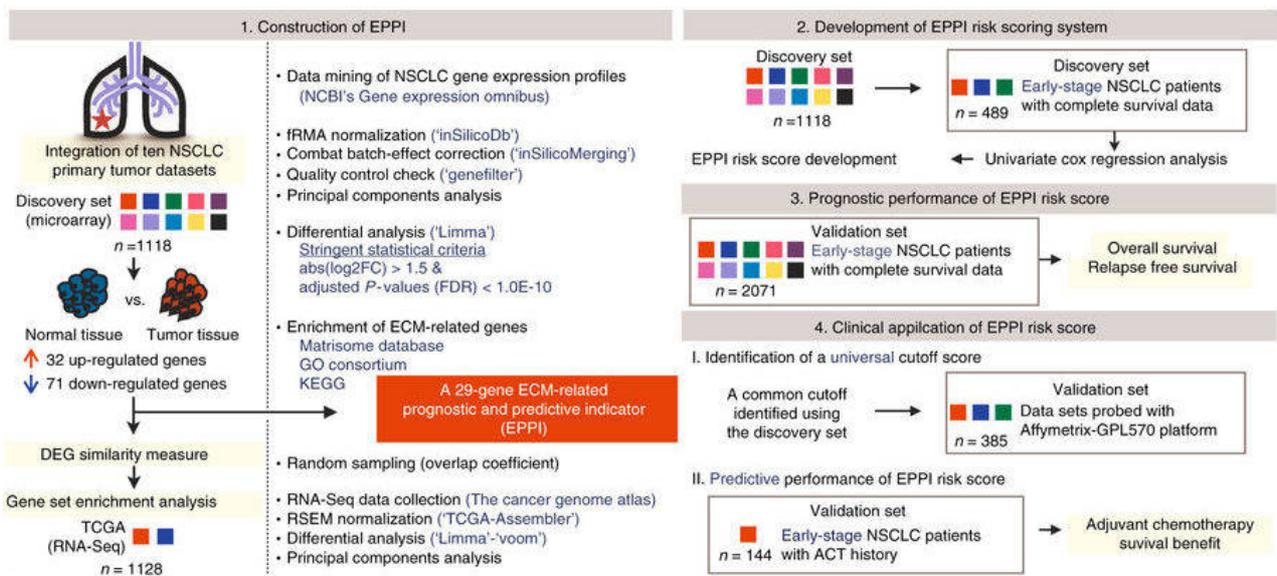
Professor Lim Chwee Teck (right) and Ph.D. student Ms. Lim Su Bin (left) from the Department of Biomedical Engineering at National University of Singapore
source - nus.edu.sg

The recent invention was made by researchers' group, led by [Professor Lim Chwee Teck](#) and [Ph.D. Candidate Lim Su Bin](#), from the [National University of Singapore](#).

Currently, the most established prognostic factor of the patient survival is the stage of the tumor. For many years, scientists have been trying to identify separate oncogenes or biomarkers. Two persons can have the same type of cancer but the disease progress and manifest are unique to each patient. Despite this fact, lung cancer is the leading cause of cancer death concerning men and women. There is a lack of accurate biomarkers or tools to effectively predict how the patient would respond to ACT before he or she will start the therapy. The advanced or metastatic non-small cell lung cancer (NSCLC) has typical testing for targets such as epidermal growth factor receptor (EGFR) mutations and anaplastic lymphoma kinase (ALK) rearrangements, there is still lack of validated genetic risk stratification score to select patients who may best benefit from ACT among early-stage resected NSCLC patients.

Scientists developed [bioinformatics pipeline for large-scale meta-analysis](#) revealed differential expressions and significant enrichment of ECM-associated components in [1,943 primary NSCLC tumors comparing to 303 normal lung tissues](#). In other words, ECM genes are the highly-important element in metastasis predicting. They have the ability to

predict risks of recrudescence and survival. The high efficiency of the gene panel in predicting survival and chemotherapy success rates has been confirmed in more than 2000 patients with the early stages of lung cancer. In addition, scientists identified a general cut off scale for stratification of patients. Consequently, this prediction technology will enable the development of a better treatment strategy for each patient by adjusting and anticipating possible consequences.



Schematic representation of the bioinformatics workflow. We constructed a 29-gene EPPI signature from 2,246 samples including primary NSCLC tumors and normal lung tissues using an integrative genomic approach source - nature.com

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Patent status: -

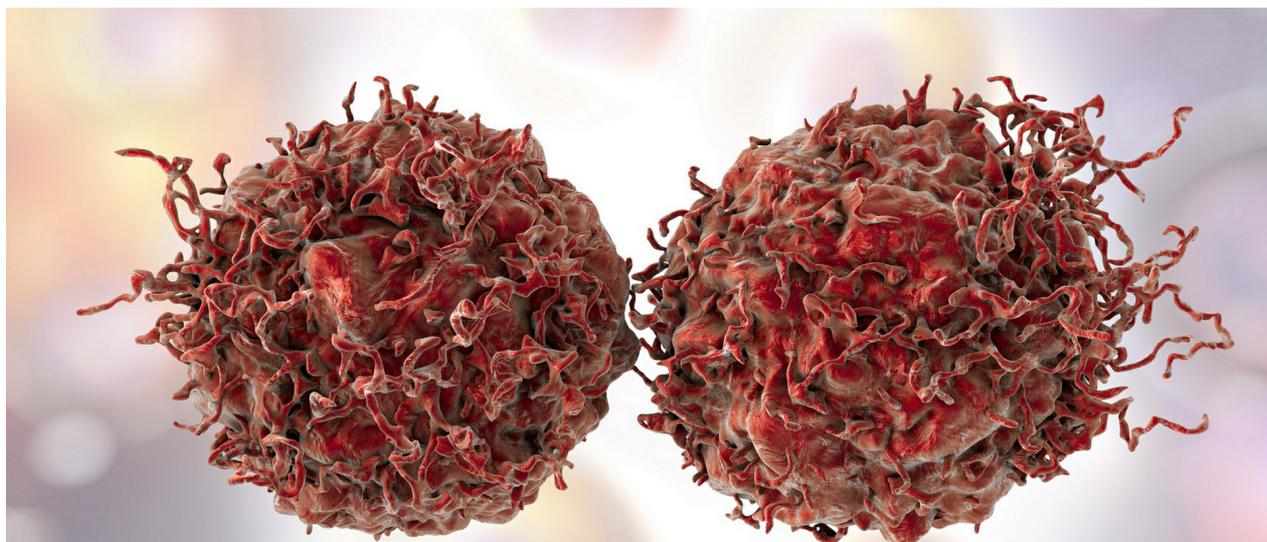
On market since: -

Regions: Singapore

Industries: Healthcare

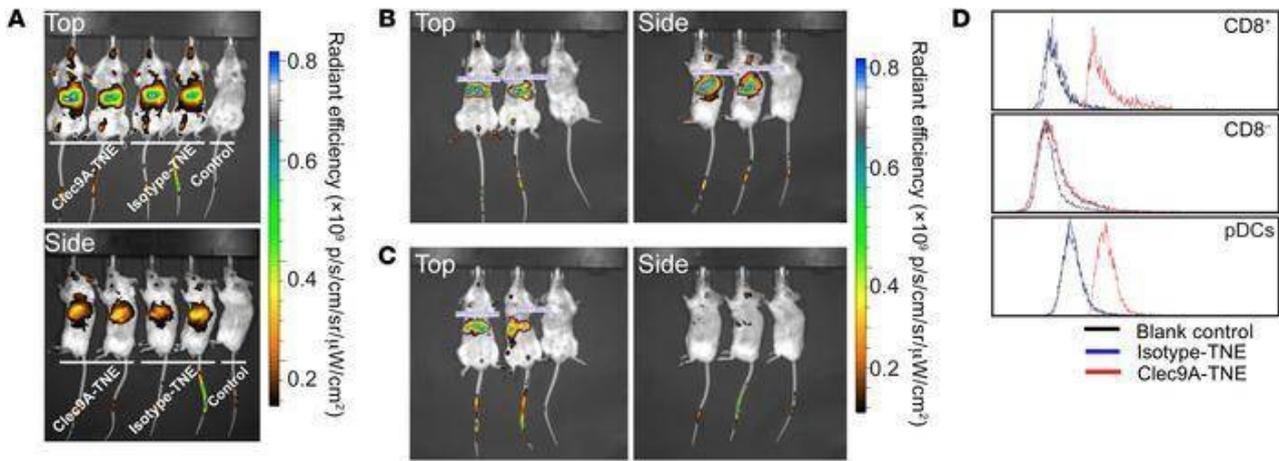
Source links: [National University of Singapore](#)

[Nature Communications](#)



A NOVEL CANCER VACCINE CAN PROVIDE TARGETING TREATMENT

Scientist developed a new vaccine delivery technology NanoEmulsion that has the ability to stimulate the immune system to attack cancer cells without having any effects on the healthy cells. It will provide the targeting treatment of various types of cancer without any side effects. Scientists have mentioned that the adaptability and efficiency of this technology will help to develop an individual immunotherapy that will facilitate the treatment process for thousands of patients.



Images of C57BL/6 mice 1 day after i.v. injection of DiR-labeled Clec9A-TNE, isotype-TNE, or free DiR solution as indicated

source - jci.org

The technology was developed by the group of scientists from the [University of Queensland](#).

Professor Ranjey Thomas noted that the technology of the flexible cancer vaccines is a highly-significant method of the treatment due to its ability to improve the accuracy of cancer immunotherapy. The success of the immunotherapy that is targeting immune checkpoint modulators has caused a big interest in cancer treatment. Despite checkpoint inhibitors provide clinical benefit to a small number of patients, the response is heterogeneous. Furthermore, it is commonly complicated by off-target effects. In other words, their operating is limited and often has inflammatory side-effects. Therefore, there is a crucial requirement to tailor **antitumor immune responses more accurately and usual individual antigens of tumors**.

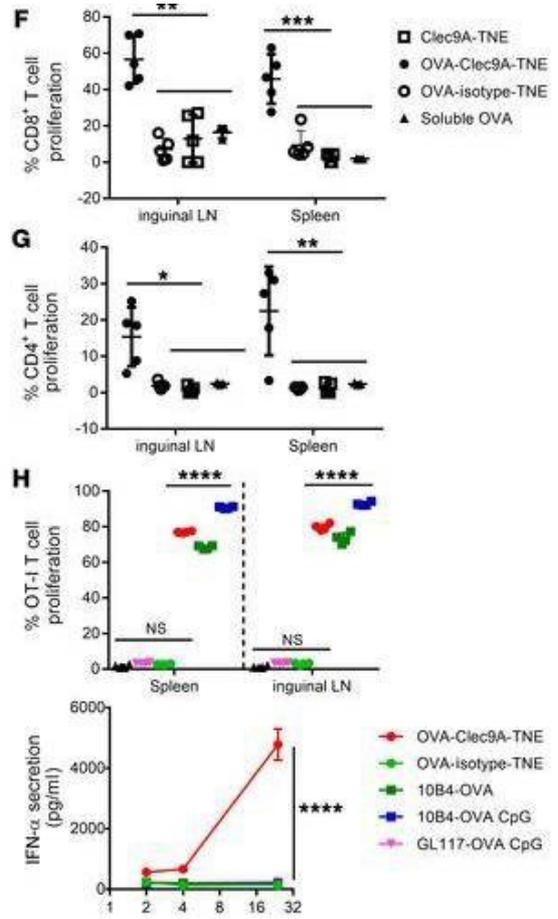
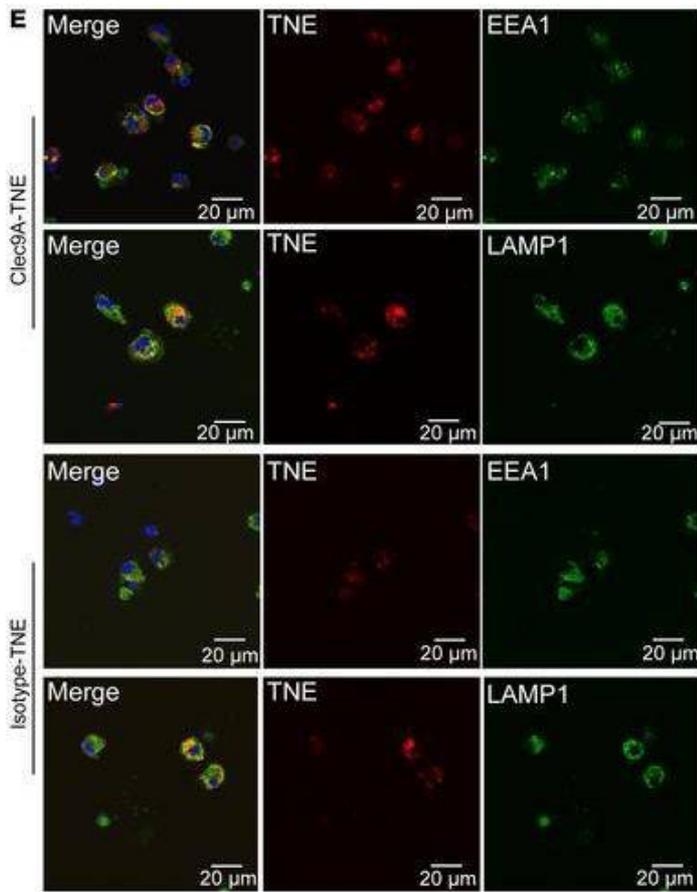
Cancer vaccines that are developed in order to generate **tumor-specific T lymphocytes** and therefore can complement the ability of checkpoint inhibitors to reinvigorate tumor-specific T cells. The deficiency of flexible systems targeting tumor antigens to **cross-presenting dendritic cells (DCs)** restricts medical development. Prof. Thomas noted that NanoEmulsions acts as small carrier packages, which encapsulate proteins that were generated only by cancer cells. Consequently, the development **stimulates protein that was produced to kill targeted cells**. Furthermore, Professor Riccardo Dolcetti mentioned that it accelerated the accurate attack on cells of cancer. Scientists decided to unite the idea of systemic nanoparticle delivery and the idea of targeting of antigen to cross-presenting DCs. They encapsulated antigen excipient in a Clec9A-targeting tailorable

nanoemulsion (Clec9A-TNE).



source - adobe.com

The universality and efficacy of novel vaccines that are based on NanoEmulsion are significantly important for adapting vaccines to individual patients that will help thousands of patients.



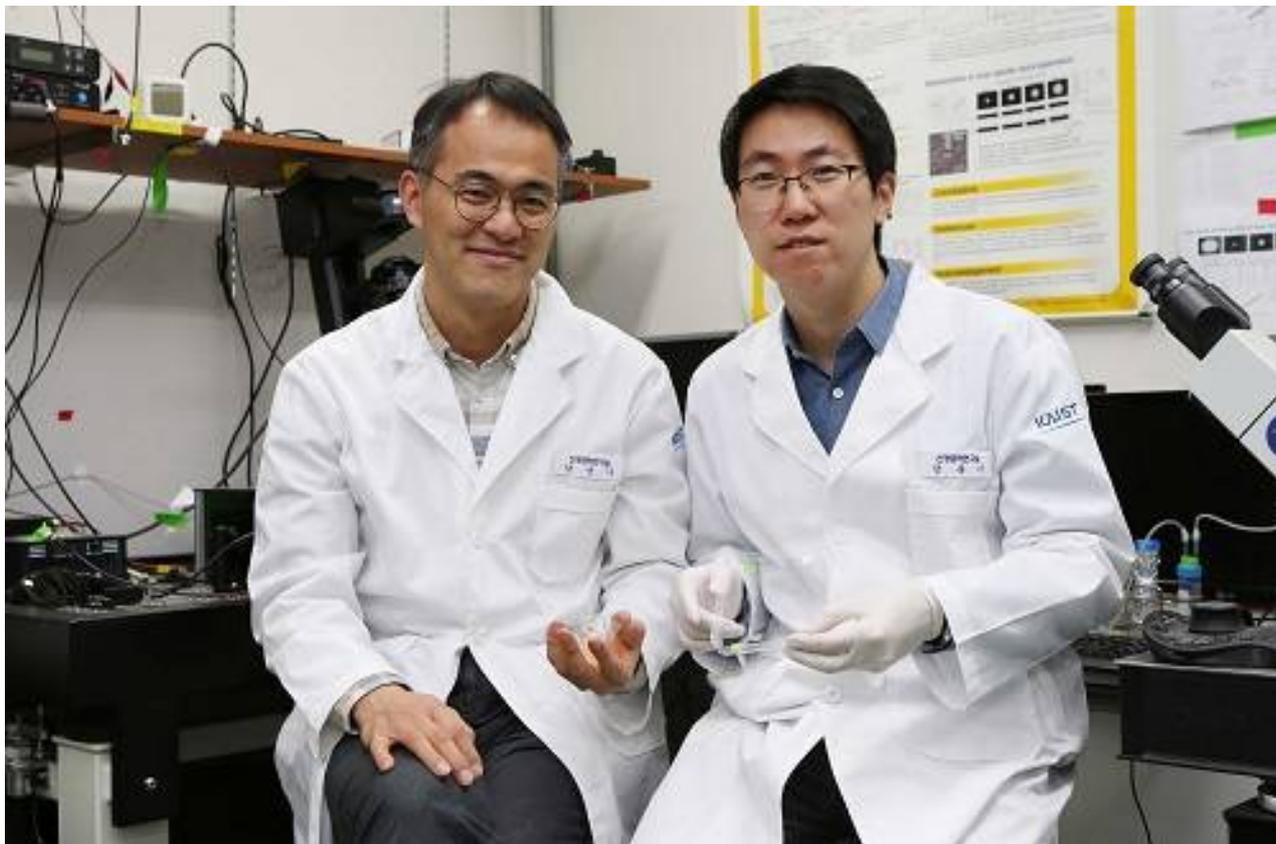
CD11c⁺ DCs sorted from naive C57BL/6 mice were incubated with Dil-labeled Clec9A-TNE or isotype-TNE (red) for 3 hours
 source - jci.org

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On market since: -
Regions: Austria
Industries: Healthcare
Source links: [The Journal of Clinical Investigation](#)
[University of Queensland](#)



A PRINTED THERMO-PLASMONIC HEAT PATTERNS FOR NEUROLOGICAL DISORDER TREATMENT

Scientists have managed to develop a highly customizable neural stimulation method. This innovational technology can print the heat pattern on a micron scale to enable the control of biological activities remotely. Furthermore, it can be a universal method for biofunctional thermo-plasmonic interfaces in different biomedical engineering applications.

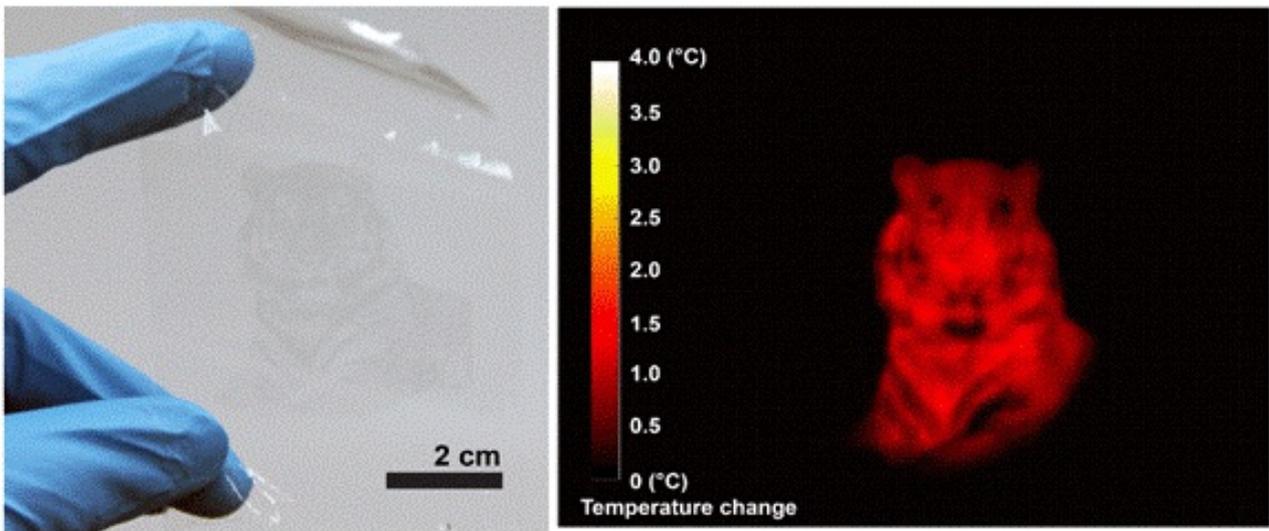


Professor Yoonkey Nam and Dr. Hongki Kang
source - kaist.ac.kr

The technology was developed by the scientific group, led by [Professor Yoonkey Nam](#) and [Dr. Hongki Kang](#), from the [Korea Advanced Institute of Science and Technology](#).

The localized heat producing by the thermo-plasmonic effect of metal nanoparticles provides a wide range of possibilities in the different biomedical engineering research. The accurate formation of the nanoparticles using inkjet printing has the ability to provide the application of the thermo-plasmonic effect in a well-controlled way. The shape and intensity will be operated. Despite this fact, the universally applicable inkjet printing method that can allow precise control of patterning and editing of nanoparticles with high biocompatibility is unavailable.

The scientists have managed [to integrate the accurate inkjet printing technology with bio-functional thermo-plasmonic nanoparticles](#) in order to achieve a "selective nano-photothermal neural stimulation method". In other words, it can modulate biological activities. The researchers' members mentioned that this innovative technology will serve as the personalized precision neuromodulation therapy for patients with neurological disorders.



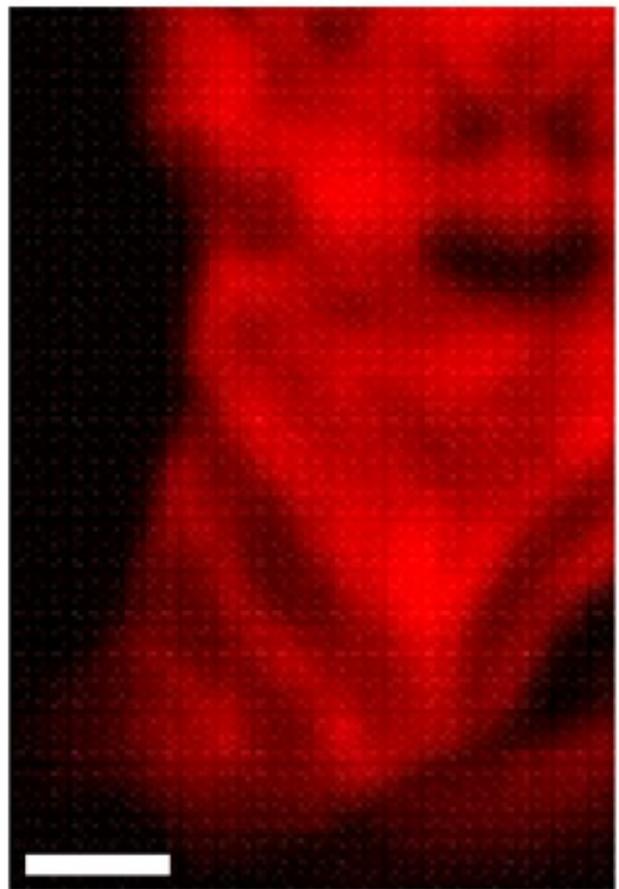
An example of an inkjet-printed thermo-plasmonic nanoparticle image on a flexible substrate in high spatial resolution over a large area (left), and remotely generated heat patterns from the printed image (right)
source - kaist.ac.kr

To overcome the barriers of the spatial selectivity and resolution of the beforehand developed nano-photothermal method, scientists adopted the inkjet printing technology to micropattern the plasmonic nanoparticles. They showed that the nano-photothermal stimulation can be used accordingly to the printed templates.

The scientific group has discovered that inkjet printing of plasmonic nanoparticles on a polyelectrolyte layer-by-layer substrate coating provides the high-quality, biocompatible thermo-plasmonic interfaces across different substrates. They applied the contact line pinning and electrostatically assisted nanoparticle assembly. Furthermore, it helped to stabilize the attached nanoparticles. Consequently, they approved that **the patterned thermo-plasmonic effect from the inkjet-printed gold nanorods has the ability to control neuronal network activities.**



Input image



Printed thermal image

source - kaist.ac.kr

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Patent status: -

On market since: -

Regions: Korea

Industries: Others

Source links: [ACS NANO](#)

[KAIST](#)



A NOVEL NON-TOXIC ANTIBIOTICS CAN KILL DRUG-RESISTANT BACTERIAS

Scientists have developed a new family of antibiotic compounds are able to kill both growing and persister cells of methicillin-resistant *Staphylococcus aureus* (MRSA) cells, which are the potentially lethal bacterium and cannot be destroyed by common types of antibiotics. These new retinoid compounds are non-toxic and their further research and development will bring significant changes in the treatment of certain severe and even fatal illness.

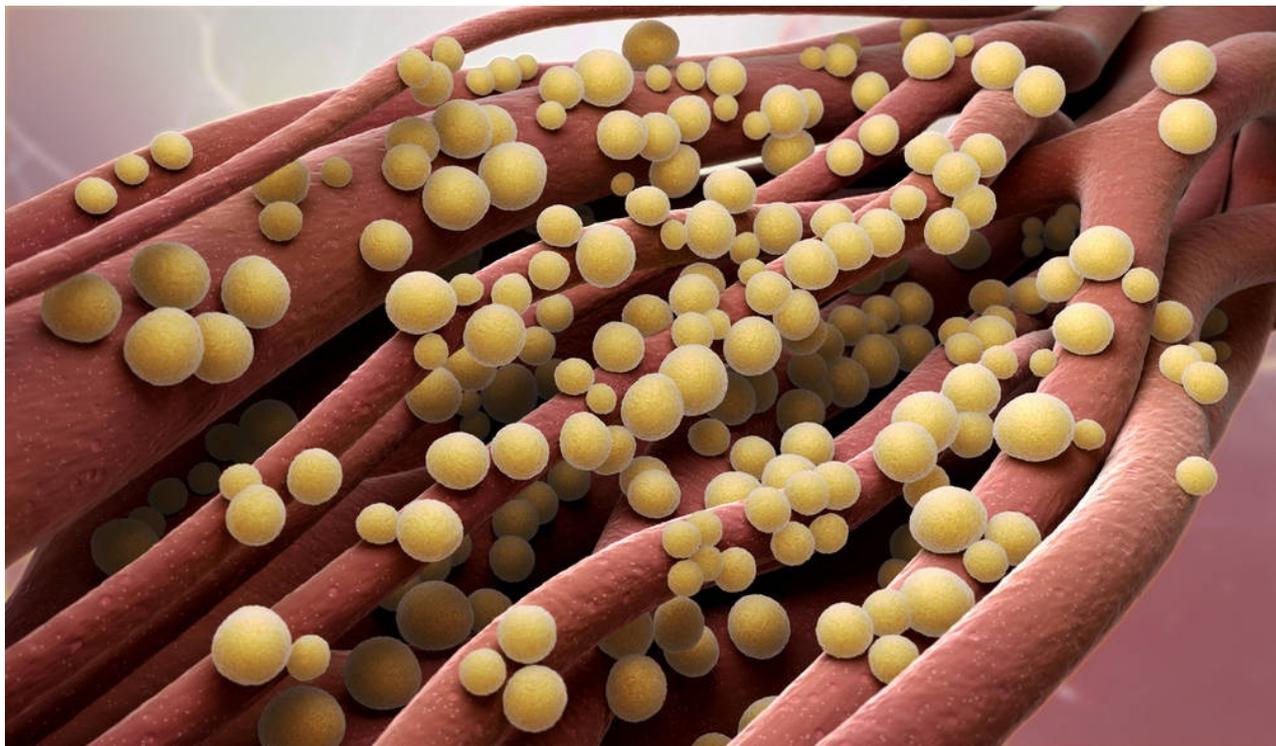


Eleftherios Mylonakis of the Warren Alpert Medical School of Brown University in the laboratory with Kiho Lee, a member of his research team. Lee is holding a petri dish containing tiny worms used to test potential antibiotics source - medicalxpress.co

The innovative discovery was made by the researchers' group, led by [Professor Eleftherios Mylonakis](#), from the [Brown University](#).

With antimicrobial resistance an increasingly considerably threat to global public health, the leading biomedical institutions try to invent a new effective type of antibiotic drugs. MRSA, which is a potentially lethal bacterium, causes difficult curable diseases in humans, such as sepsis, pneumonia. It was adapted to survival in the presence of methicillin, dicloxacillin, and oxacillin. MRSA is associated with nosocomial infections. Furthermore, it is resistant to a large group of antibiotics such as beta-lactams, including penicillins and cephalosporins.

MRSA forms subpopulations of metabolically inactive, antibiotic-tolerant 'persister' cells. The researchers' group has managed to identify 2 synthetic retinoids, [CD437 and CD1530](#), that have the ability to destroy growing and persister cells of this type of staphylococcus by disrupting lipid bilayers. CD437 and CD1530 demonstrate high killing capacity, synergism with gentamicin, and a low probability of resistance formation.



This study was supported by National Institutes of Health grant, National Science Foundation grant, and by National Institute of General Medical Sciences grant and National Science Foundation grant
source - scimex.org

These retinoids are capable to penetrate and embed in lipid bilayers, associating with their bactericidal capability. They determined that the analog of CD437 can retain anti-persister possibility and demonstrate an improved cytotoxicity profile. Dr. Heather Hendrickson from the Massey University mentioned that the scientific group started with a massive analyze of small synthetic molecules (over 82,000 of them) and used 185 candidates that allowed small worms to survive when they were in the presence of infectious MRSA bacteria.

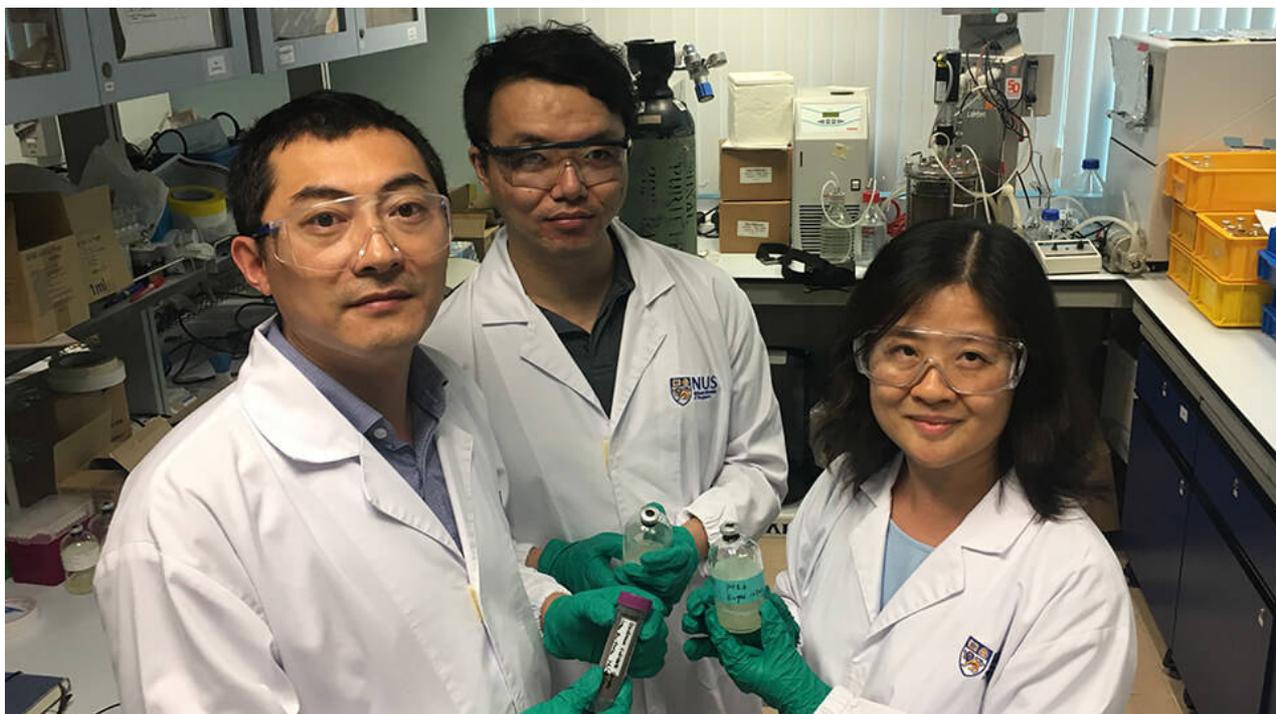
CD437 shows significant efficacy in a mouse model of chronic MRSA infection. These compounds have the big potential to become a new type of antimicrobials for the treatment of Gram-positive bacterial infections, which are hard to cure.

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On market since: -
Regions: United States
Industries: Healthcare
Source links: [Nature](#)
[Scimex](#)



MUSHROOMS THAT CAN PROVIDE A BIOFUEL

Scientists have managed to turn trash into treasure by transforming unwanted farming byproducts into fuel. The scientific team from Singapore found the way to isolate harness and naturally occurring bacterium from mushroom crop residue and transform it into biofuel. This bacterium has the ability to convert cellulose, which is a plant-based material, into a biobutanol that can replace petrol in the car engines.



Associate Professor He Jianzhong (far right) with members of her team
source - NUS

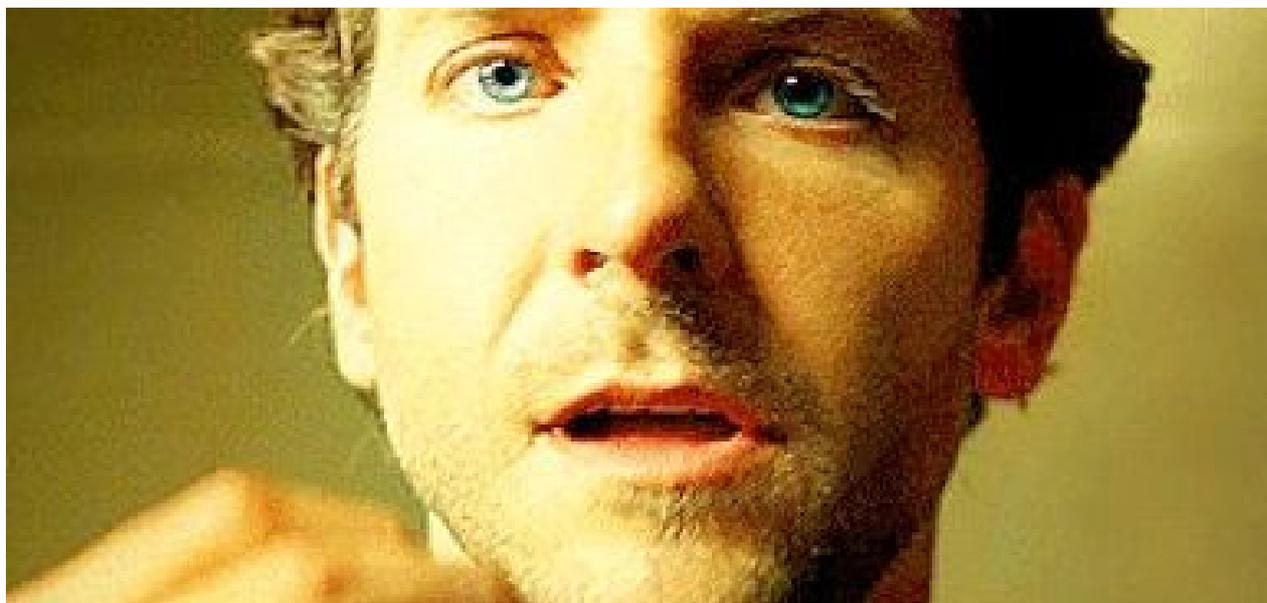
The development was made by the researchers' group, led by [Associate Professor He Jianzhong](#), from the [Civil and Environmental Engineering](#), the [National University of Singapore](#).

Researchers mentioned that microorganisms in the waste, which was generated after harvesting mushrooms, are left to evolve naturally during 2 years to receive the bacterium. When cellulose is added, the bacterium digests it to produce butanol. The bacterium, called [Thermoanaerobacterium thermosaccharolyticum TG57](#) was first found and cultured it in 2015 by the scientific group, led by Assist Prof He Jianzhong. [Scientists added to cellulose the bacteria, which convert cellulose into ethanol that can be a replacement for petrol.](#)

TG57 is capable of using microcrystalline cellulose directly to produce butanol (1.93 g/liter) as the only final product (without any acetone or ethanol produced), comparable to that of engineered microbes thus far.

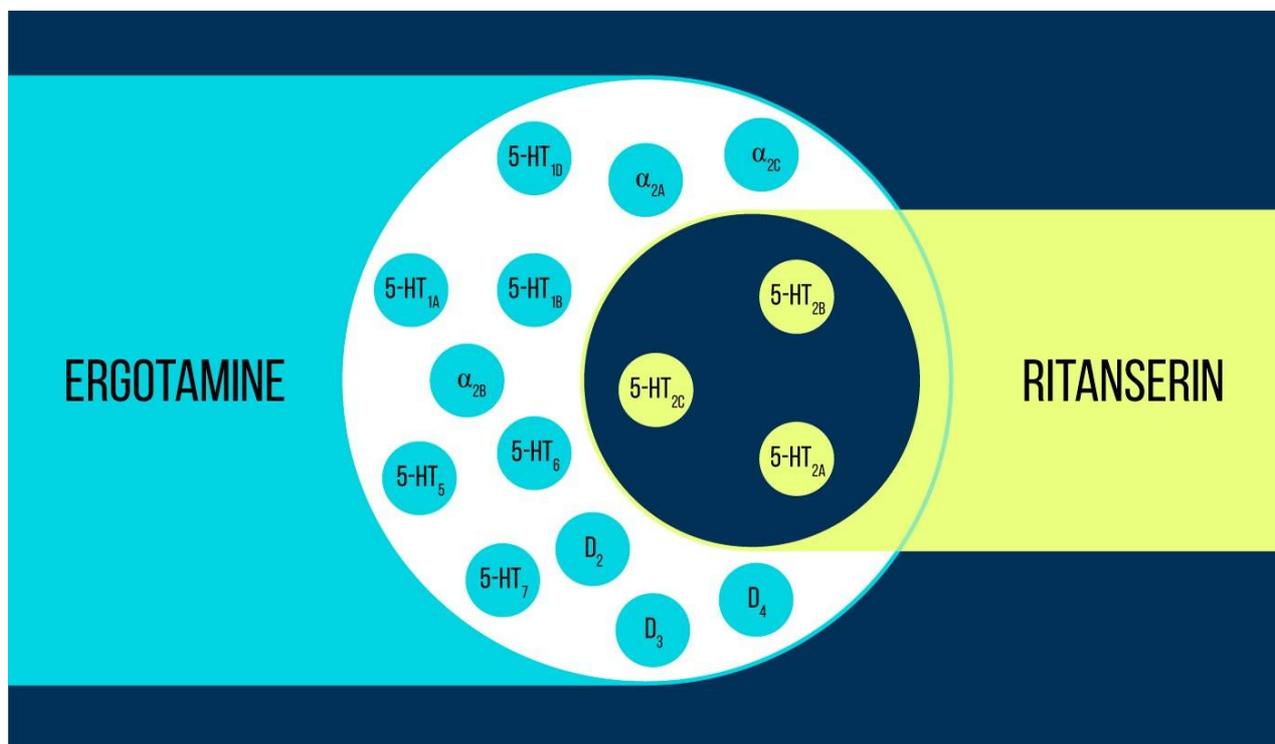
Typical biofuels, which are produced from food crops, are expensive and rival with food crops in the use of land, water, energy and other environmental and reused types of resources. Despite this fact, those generated from the unprocessed cellulosic materials, for

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On market since: -
Regions: Singapore
Industries: Chemicals, Environment
Source links: [Science Advance](#)
[National University of Singapore](#)



THE DISCOVERY WILL ALLOW REGULATING DRUGS ACTION

The international research will provide the opportunity to create various new medications with controlled action and fewer side effects. They managed to solve two structures of one of the most important nervous system proteins in complex with a number of drug molecules. This innovational research determines the structural basis of polypharmacology at typical G protein-coupled receptors (GPCRs) and demonstrates how understanding characteristic patterns of ligand-receptor interaction and activation can provide drug developing at multiple GPCRs.

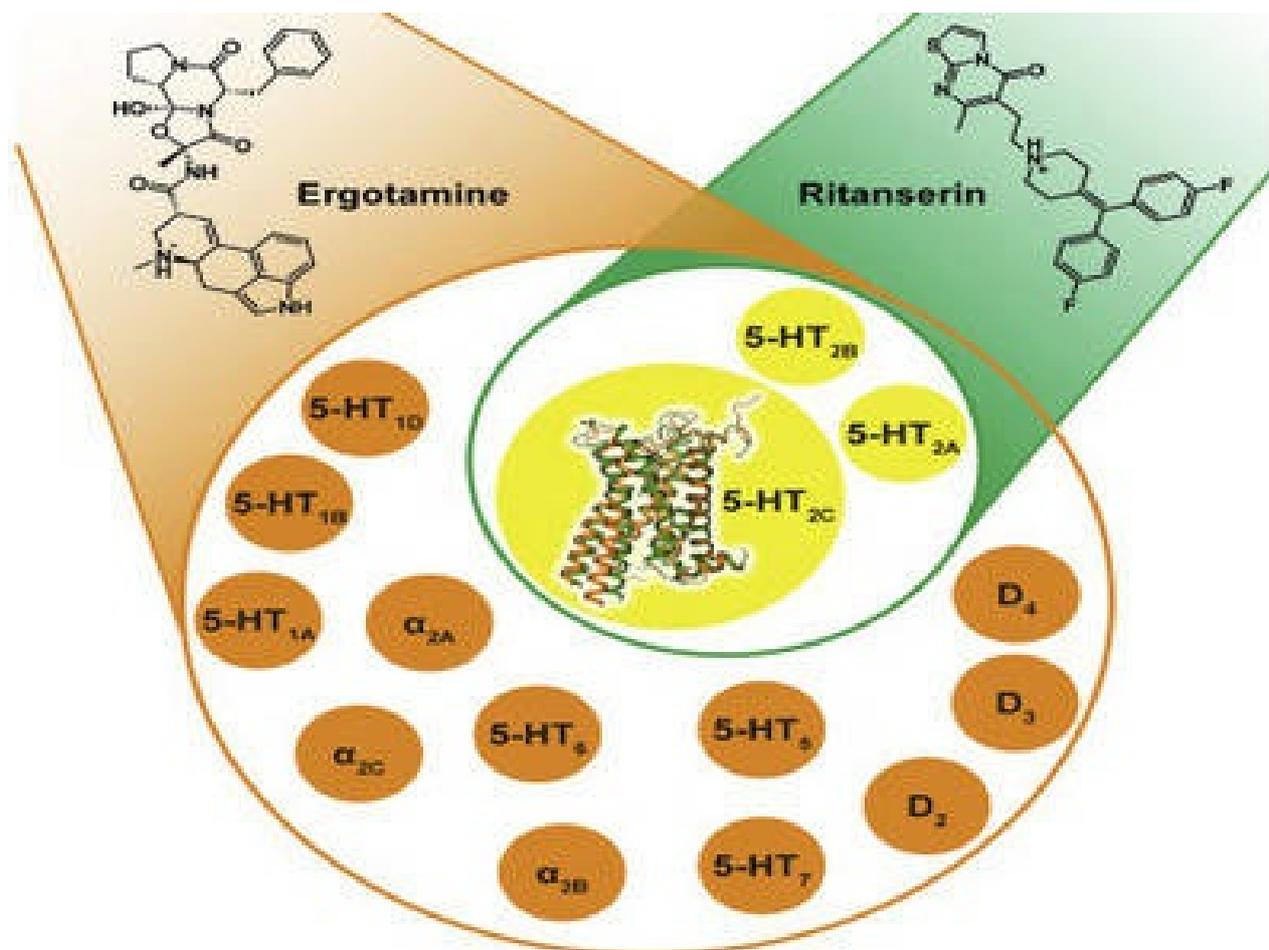


Comparison of ergotamine and ritanserin
source - labmanager.com

The investigation was made by the researchers' group from the [Moscow Institute of Physics and Technology \(MIPT\)](#) in collaboration with the [ShanghaiTech University](#), the [Kunming Medical University](#), the [University of North Carolina at Chapel Hill](#) and the [University of Southern California](#).

Many different current medications act targeting proteins due to they perform the most of the physical and chemical reactions in the cell. Molecules of the protein have the ability to provide the communication between cells by the way of transferring signals. When a person is ill, the process is interrupted. As the result, most of the medication operate to renovate proteins' capability, provisionally increasing or decreasing the activity of proteins. A lot of drugs provide similar functions and have almost selfsame characteristics. In other words, one and the same drug has the impact various types of protein. Often, medications require the interaction with multiple targets to provide their therapeutic operation. This process is called polypharmacology.

Previously, it was thought that the drug should act only on a specific protein. If the drug acts on several types of proteins, the effectiveness is less, causing side effects. However, with the development of biotechnologies and medicines, it has been proved that this is not entirely the case; **it is important to control their effects on proteins.**



Agonist ergotamine and inverse agonist ritanserin-bound 5-HT_{2C} structures solved. Conformational changes uncover key features of two distinct ligand-bound states
 source - cell.com

The main aim of this research was to identify the structural properties of proteins, which will be able to explain in which way some drugs act on protein selectively and others do not. The researchers' group solved 2 structures of the 5-HT_{2C} receptor together with the highly dissimilar agonist ergotamine and the 5-HT_{2A}-C receptor-selective inverse agonist ritanserin at resolutions of 3.0 Å and 2.7 Å, in accordance. They researched and analyzed their binding abilities to provide mechanistic insights into their receptor recognition and opposing pharmacological actions.

Consequently, scientists determined the structural basis of polypharmacology at canonical GPCRs and showed how the understanding of typical patterns of ligand-receptor interaction and activation can provide the drug creation at multiple GPCRs.

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Regions: United States, Russia, China
Industries: Healthcare, Biotechnology
Source links: [CELL](#)
[Lab Manager](#)



FERRIS BOX IS A KINETIC FURNITURE FOR WHEELCHAIRS USERS

Inventors from South Korea have created the kinetic furniture FERRIS BOX that can be easily adapted to all users for better accessibility of different heights of keeping units. The present invention is based on rail technology allowing the height of the shelves to be adjusted with the help of a special lever. This type of furniture is almost the same as ordinary furniture staying the usual place of storage of things, which can be used by all users. Moreover, this design is safe therefore it can be suitable for use by children.



FERRIS BOX

source - jamesdysonaward.org

FERRIS BOX was designed by Yoonjoong Kim and Jibaek Lee from the [International Design school for Advanced Studies, Hongik University](#).

The concept originated as a result of a simple situation, which was seen by one of the inventors. A child in a bookstore tried to reach one of the shelves, which, as usual for a child of her/his age, was impossible. A large number of shelves, such as wardrobes, racks, PAX systems, bookshelves are not adapted for use by children, wheelchair users or people with a very low height. Moreover, trying to get something from a regular cabinet can be not only uncomfortable but also dangerous.

As about the disadvantage of such furniture for wheelchair users, they usually divide the living space with employers according to which housing is filled with furniture. One of the advantages of ordinary furniture is that they are designed to maximize the use of space. Inventors, developing FERRIS BOX, based their concept on the benefits of conventional furniture, but also tried to make their invention comfortable for users of wheelchairs and children. In other words, they will have the ability to use receptacles of any height.



It was designed to the user who needs to not general furniture but kinetic furniture
source - jamesdysonaward.org

During this research process, mechanism of a Ferris wheel that provides a passenger's ride effortless by alighting cabins through rotation inspired this project. The concept based on the height changing mechanism applying. The keeping caskets are established on a rotary rail that **allows users control the height of each unit easily by using the lever**. The size of keeping units and the spaces between the rail were constructed to avoid the obstacles between the caskets and to prevent users from getting squeezed while the use. The furniture was structured with **the ideal height and angle for usage**, through defining the generally available distance for wheelchair users in accordance with human factors data. Furthermore, excess space was minimized for better area exploitation.



Its design was inspired by the mechanical principles of Ferris wheels
source - jamesdysonaward.org

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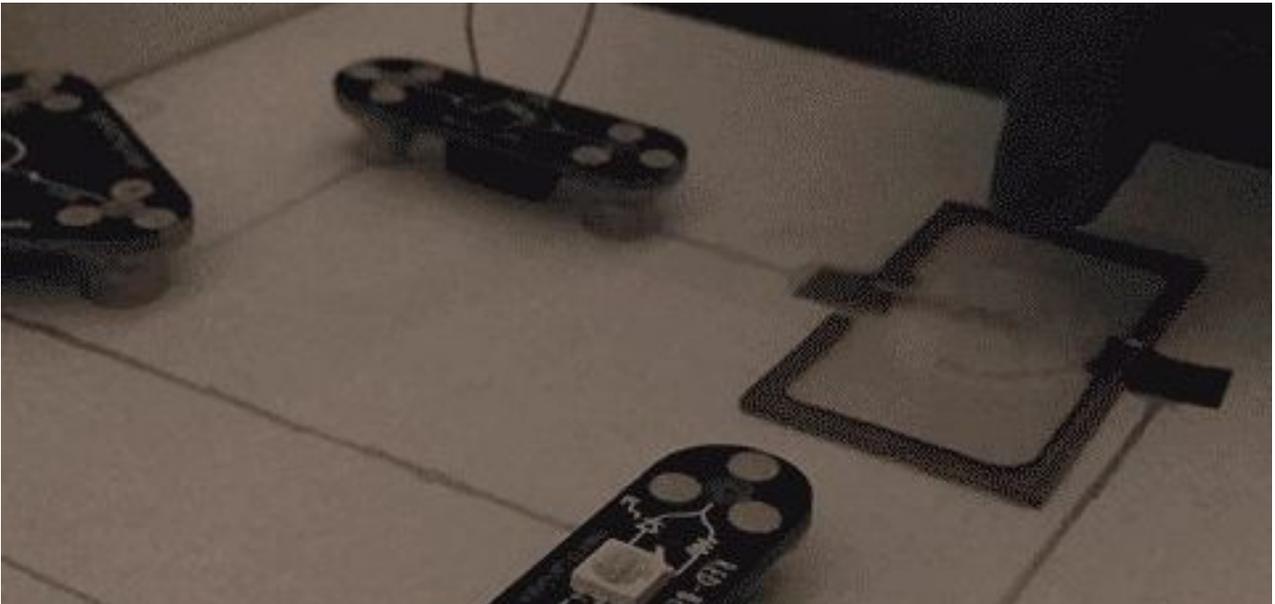
Patent status: -

On market since: -

Regions: Korea

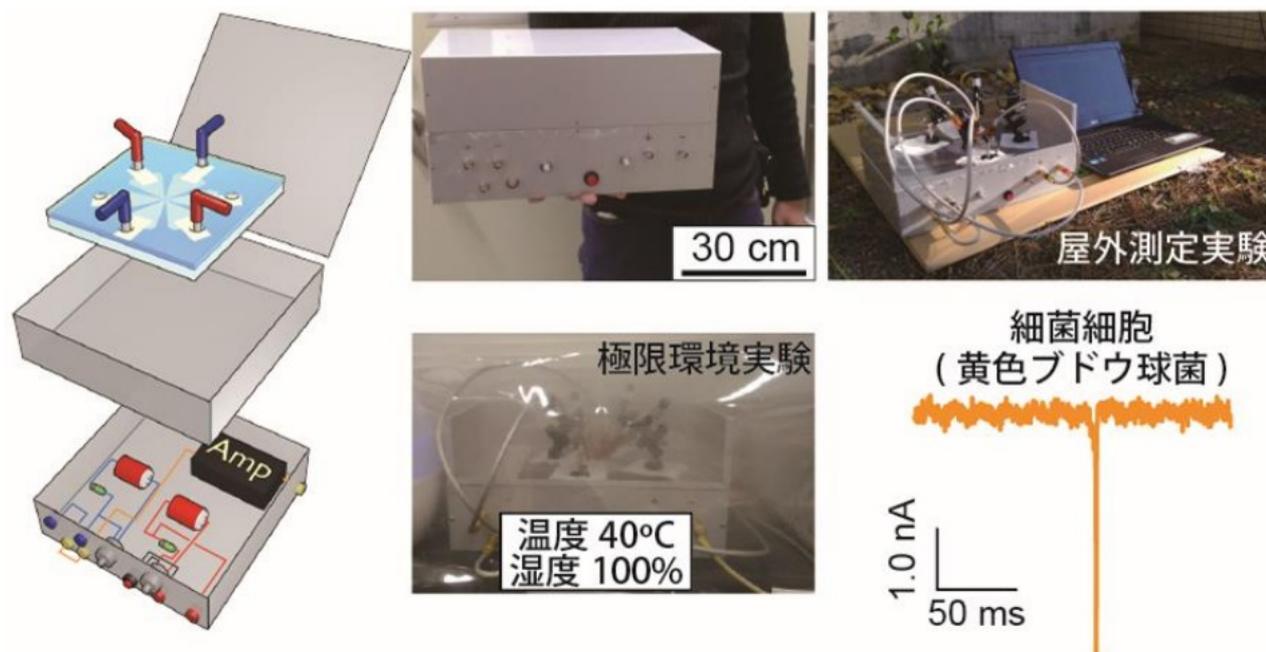
Industries: Creative Industries

Source links: [James Dyson Award](#)



AN IONIC CURRENT SENSOR THAT CAN DETECT BACTERIA

Scientists have developed a portable ionic current sensor (Robust-ICS) for detecting sub- to several-micron scale particles, such as bacteria. They used background current suppressing technology that allowed creating an innovative measurement technique that is high tolerance to the environment than other standard devices. Furthermore, this novel technology will ensure the creation of measuring devices as measures to protect against environmental pollution in food manufactures, pharmaceutical plants, hospitals, and vehicles, as well as safety measures aimed at preventing infection with poultry farms and airports.

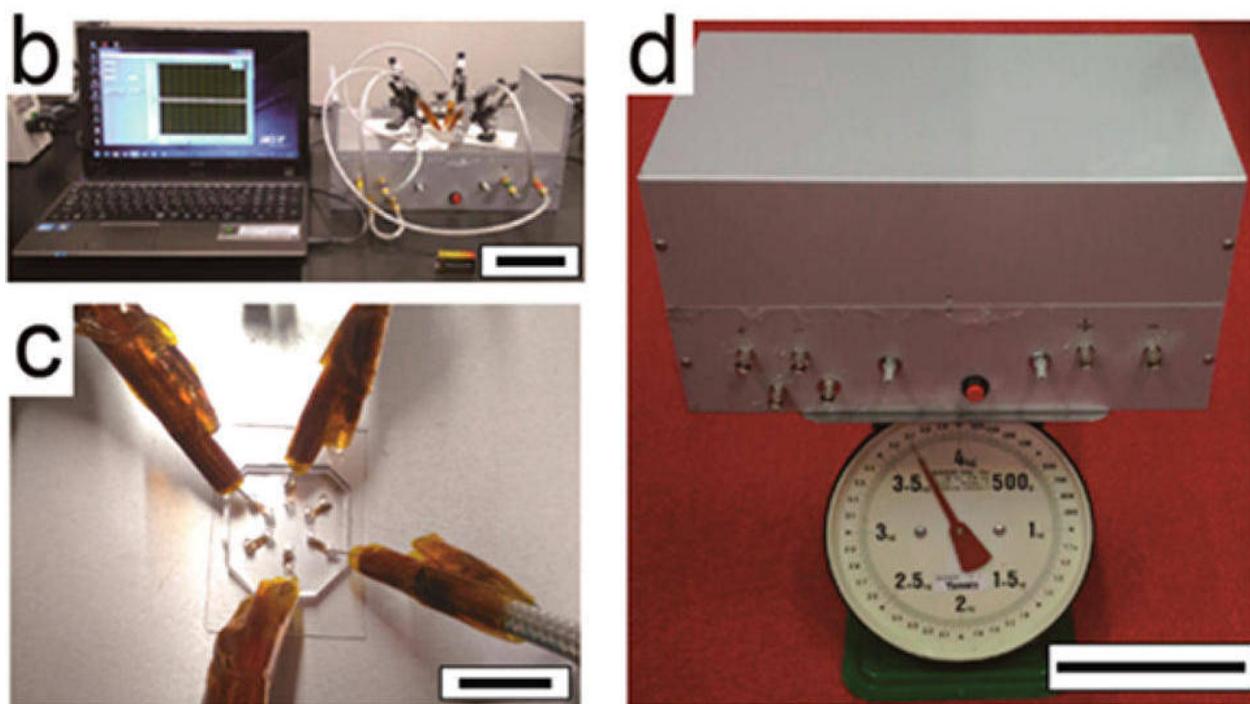


Conceptual illustration of the robust ionic current sensor (Robust-ICS)
source - resou.osaka-u.ac.jp

The novel device was made by the scientific group from the [Nagoya University](#) in collaboration with the [Kyushu University](#) and the [Osaka University](#).

The ionic current sensing devices are the useful technology for identification of small particles such as bacteria. Nevertheless, modern commercially available devices are not suitable for on-site measurement due to inherent restrictions in their reliability and portability. Scientists have used a bridge circuit, which provides a high signal-to-noise (S/N) ratio by restraining background current. Scientists have used a bridge circuit, which provides a high signal-to-noise (S/N) ratio by restraining background current. As this novel device has the capability to stand the increased noise in the sensing.

The well-known fact is that bacteria can cause food poisoning and infectious diseases. The incubation period of food poisoning by *Staphylococcus aureus* (*S. aureus*) has been reported to be 2–6 h. The ability to detect causative bacteria using on-site steep detection technique would help to prevent the spread of food poisoning and infectious diseases by rapid bacteria incubating. The researchers' team, using the **Robust-ICS**, has managed to detect the *S. aureus*. **The sensing results were highly accurate and equaled to the images that are made by the scanning electron microscope.**



Robust-ICS demonstrates its lightweight and compact size; scale bar, 15 cm
source - pubs.acs.org

In ionic current sensing, a voltage is applied to a micropore filled with conductive solution and the current flow change by the passing of a sample particle is monitored. This current change is defined as a signal. Bacteria species having various indigenous sizes can be discriminated based on the amplitude of the signals corresponding to cell volume. Despite, the standard ionic current sensing methods have only been reported for detections in a controlled environment such as a laboratory. Therefore, for general technologies, it is necessary to transport samples to a laboratory, and it remains difficult to detect the bacteria on-site.

To make this, scientists must lower the electromagnetic noise to detect a small-sized sample particle because of the inherently poor signal-to-noise (S/N) ratio of the conventional methods. In order to enable rapid bacteria detection in any place, the scientific group has created a Robust-ICS with a bridge circuit, which can suppress the background current, detecting small particles. To produce the device scientists applied an imposing of the detection unit, using a microfluidic chip, and an electric circuit unit, covered with an aluminum plate shield to lower the device weight. In addition, identification of bacteria based on cell shapes can be done by using a low-aspect-ratio micropore. The detection with the help of novel device will make it easier to determine bacteria on the surface of equipment or in such samples as foods and body fluids of

patients.

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Industries: Electronics
Source links: [ACS Sensors](#)
[Osaka University](#)



AN ECO-FRIENDLY FAUCET

The inventor from India developed an environment-friendly faucet that is based on the novel atomization technology and can reduce the amount of water use up to 95%. This device is based on the technology of the pounding of a continuous flow of water guiding it at different angles of inclination. As a result, a larger area is covered, while less water is consumed, making the present invention environment-friendly and efficient than typical faucets.



The DIY design was approved in the Manipal University. There are planning to install a few of these faucets in the university cafeteria

source - jamesdysonaward.org

The mankind consumes a huge amount of water. The growth of cities, the rapid development of industry, the intensification of agriculture, the expansion of the areas of irrigated land, and the improvement of cultural and living conditions increasingly complicate the problem of water supply.

The universal ideal of total cost recovery for potable water production and distribution is not a reality on the ground; water consumption remains subsidized in many countries and cities. According to the [International Statistics for Water Services 2016](#), the consumption of potable water is widely variable, with a large gap between cities. The water system of current buildings consumes about 200-500 liters per day. Household consumption per capita varies from 28 to 631 liters per day, a factor of 20.

Furthermore, during water flow from the typical current faucet, most of the water never touches the surface of the cleaning subject just flowing down the drain. Consequently, [Sandesh Manik](#) from the [Manipal Academy of Higher Education \(Manipal University\)](#) decided to create the [eco-friendly faucet](#). The inventor made a research about the implementation of water atomization system in houses and found that in the past there are

various prototypes, but most of them have some drawbacks and limitations, which prevents their everyday life realization.



Mr. Sandesh Manik plans to develop souls using this technology
source - jamesdysonaward.org

His technology is based on **the water atomization**, which provides the pounding of water flow into small droplets, moving with a big speed. This process is suitable for cleaning, as the droplets have an increased touching area of the subject surface and velocity. The device has atomizers water spraying cleaning the subject with the different strike of angles. It is much more efficient in removing dirt without taking a lot of time and without wasting of added water.

Mr. Sandesh Manik mentioned that device can be manufacturing with the help of 3D printing using simple materials.

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On market since: -

Regions: India

Industries: Creative Industries, Environment

Source links: [ECO-FRIENDLY FAUCET](#)

[James Dyson Award](#)



THE BRAILLE KEYGLOVE

Inventors from Singapore have designed a cost-effective device that is able to type in Brille using just one hand. This is a great alternative to outdated braille keyboard technology, which has a huge size and high price. Moreover, the inventors mentioned that this novel technology can be used for patients with the stroke, visual impairment, rehabilitated patients or just for people with limited finger mobility.



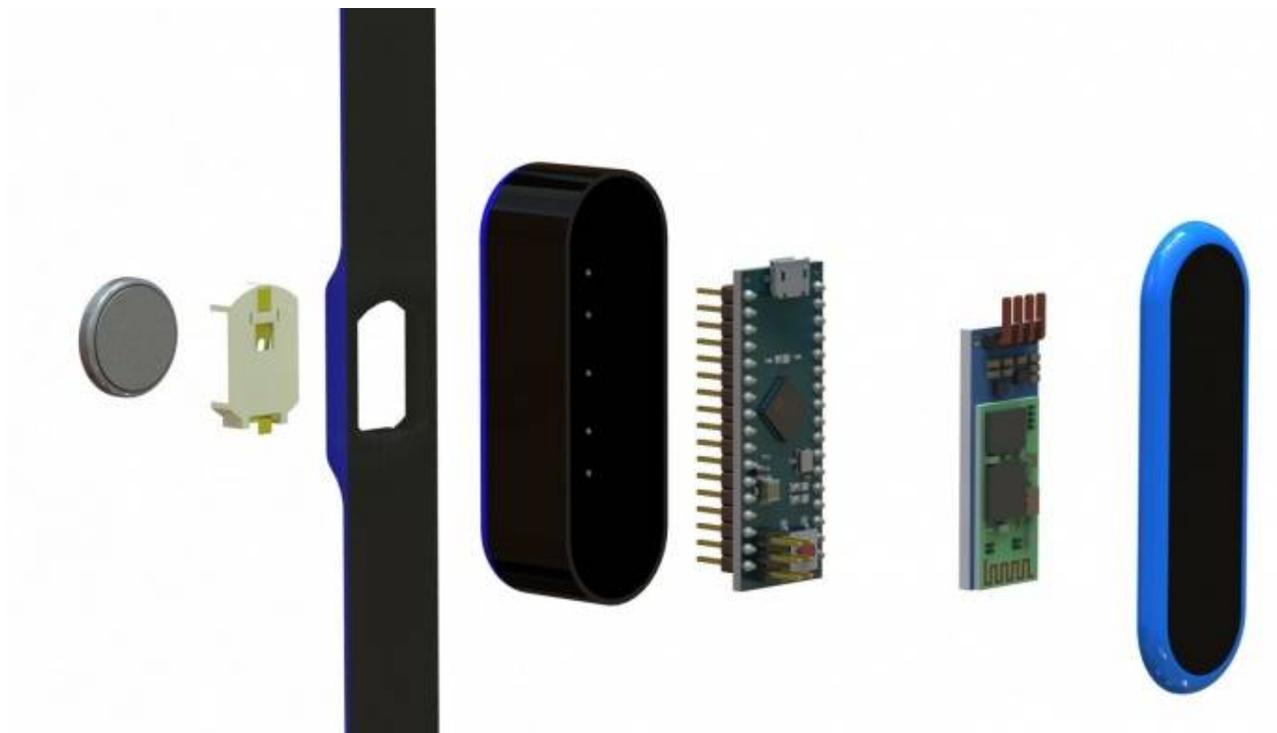
CAD Rendering of Braille KeyGlove
source - jamesdysonaward.org

For blind and visually impaired people, the ability to read and write Braille is the key to literacy, successful employment and independence. The Braille is a relief-dotted font for writing and reading by the blind, which is based on a combination of six points. The sign that is represented by a combination of relief points 0.6 mm high, 1.4 mm in diameter, recorded in a 4.2 mm x 7 mm cell. Having certain skills, people can decode the text by the touch. The ease of reading signs and their compactness allow blind people quickly read the text.

Current Braille keyboards are too big and its technology is old. Furthermore, they are expensive and unsuitable for use in everyday life. Consequently, the group of inventors, led by [Yang Ang](#), from the [Nanyang Technological University](#) has designed [the single-handed Braille KeyGlove](#), which is cost-effective and simple to use the device that requires just one hand.

They combined the keyboard and a glove making the single hand-device that provides [fast and comfortable inputting](#). Each finger accords to an individual command. Users can choose dots of a Braille grid column by column. Each finger is supplied with a Force Sensitive Resistor (FSR) that is connected to the Arduino. The FSR has the ability to note a

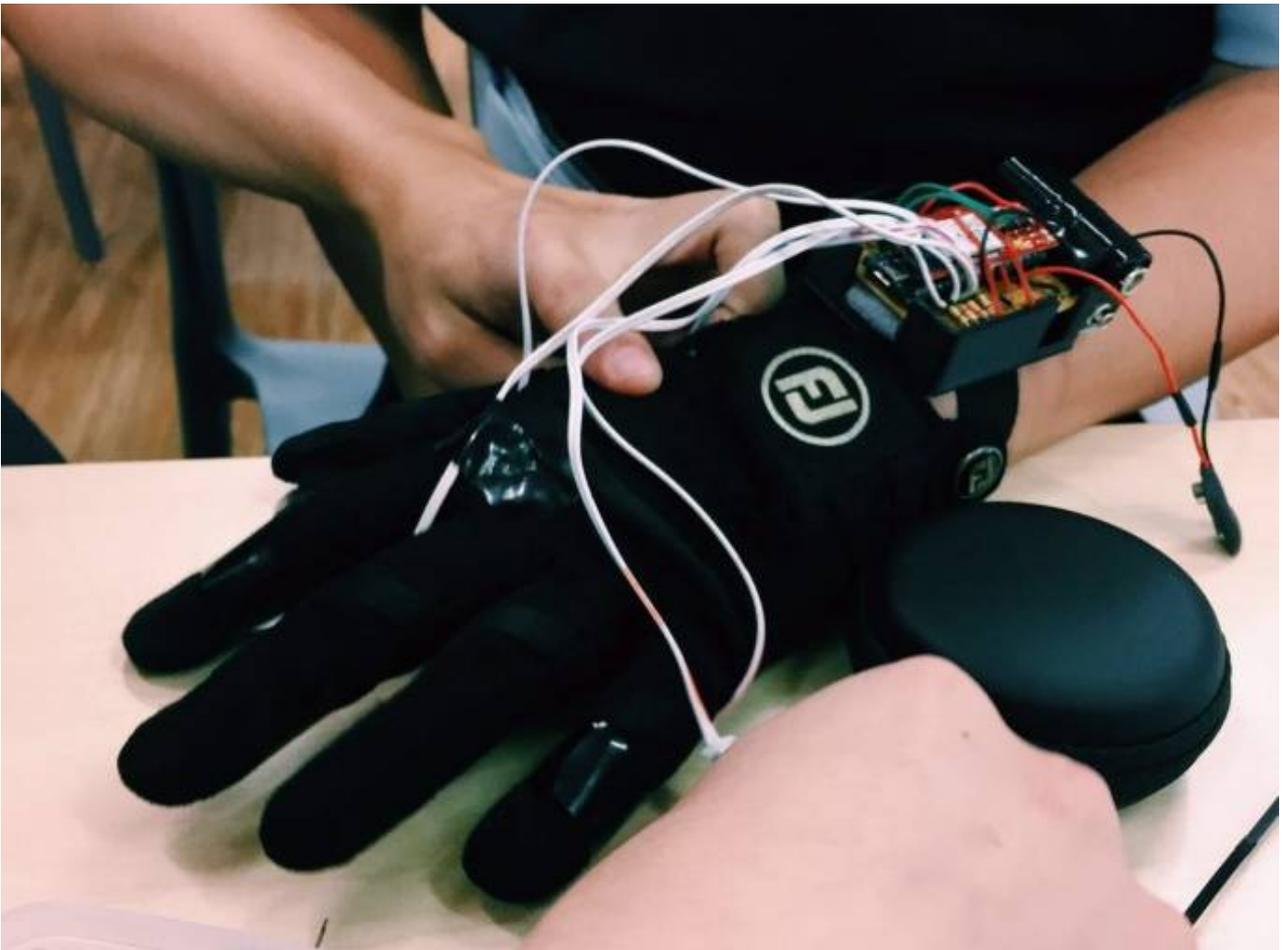
finger press while the Arduino converts the presses accordingly with a library that was written by the team. Translated into ASCII code data are sent to the Bluetooth HID Chip that is connected to the certain device, such as phones, computers etc.



The chip converts our ASCII codes to raw HID Keyboard reports which then enable us to send the ASCII codes via Bluetooth to a connected device

source - jamesdysonaward.org

Furthermore, inventors cooperated with specialists in the relevant fields and concluded that the device could be **used for stroke patients with limited mobility** since it does not require a high speed or special skills. They mentioned that the development can be applied by physiotherapists **for patients rehabilitation**. They mentioned that the development can be applied by physiotherapists for patients rehabilitation. The glove could provide an additional stimulus during rehabilitation sessions.



The team consists of Yang Ang, Ng Ting Hao, Glenn Tan, Sim Zhi Heng, Beverly Low
source - jamesdysonaward.org

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Industries: Creative Industries, Electronics
Source links: [James Dyson Award](#)



POLYMERS THAT MIMIC CHAMELEON SKIN

A biocompatible synthetic material that replicates tissue mechanics and alters color when it changes shape, like chameleon skin, has been developed by the researchers at CNRS in cooperation with the researchers at University of North Carolina at Chapel Hill and University of Akron. They promise new materials for biomedical devices. Biological tissues have complex mechanical properties - soft-yet-strong, tough-yet-flexible - that are difficult to reproduce using synthetic materials.

To produce a **medical implant**, the team of researchers needs to select materials with similar mechanical properties to those in biological tissues, so as to mitigate inflammation or necrosis. A number of tissues including the skin, the intestinal wall, and the heart muscle, have the particularity of being soft yet stiffening when they are stretched. Until now, it has been impossible to reproduce this behavior with synthetic materials.

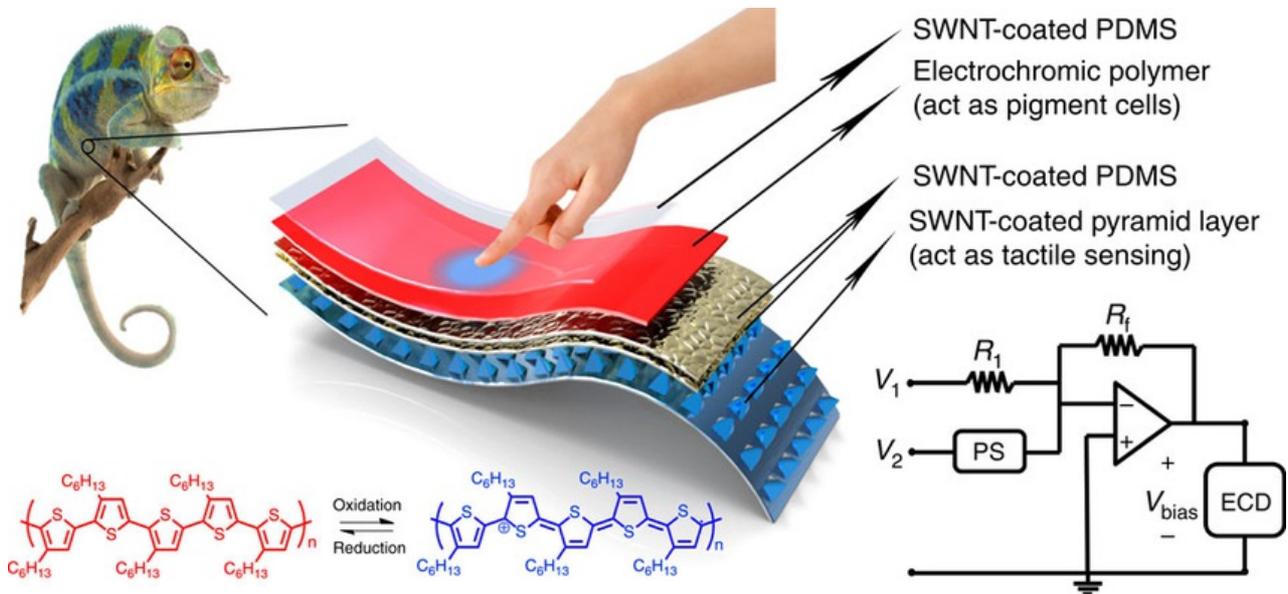


Polymers that mimic chameleon skin
source - shutterstock.com

The researchers have attempted to achieve this with a **unique triblock copolymer**. They have synthesized a physically cross-linked elastomer composed of a central block onto which side chains are grafted (like a bottle brush) and with linear terminal blocks at each end. The team of researchers has found that by carefully selecting the polymer's structural parameters, the material followed the same strain curve as a biological tissue, in this case pigskin. It is also **biocompatible**, since it does not require additives, e.g. solvent, and remains stable in the presence of biological fluids.

Another property of the material appeared during the experiments: its color change upon deformation like chameleon skin. A chameleon changes its color to adjust its body temperature to that of the outside temperature. A cold chameleon will turn dark to absorb more heat, while a hot chameleon will turn lighter in shade in order to reflect. As the scientists have demonstrated, this is a purely physical phenomenon, which is caused by light scattering from the polymer structure. Atomic force microscopy and X-ray diffraction

experiments have shown that the terminal blocks of these polymers assemble in nanometer spheres, distributed in a brush-polymer matrix. Light interferes with this microphase-separated structure to produce color according to the distance between the spheres. So when the material is stretched **it changes color**. It is the same mechanism that explains - in large part - how chameleons change color.



A new material that replicates tissue mechanics and alters color when it changes shape, like chameleon skin
source - shutterstock.com

The researchers have therefore succeeded in encoding in a unique synthetic polymer both mechanical properties (flexibility, strain profile) and optical properties, which had never previously been achieved. By adjusting the length or density of the 'brush's' various side chains, these properties can be modulated. This discovery could lead to **medical implants or more personalized prostheses** (vascular implants, intraocular implants, replacement of intervertebral discs), and also to materials with completely new strain profiles, and applications that have not yet been imagined.

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Industries: Biotechnology
Source links: [CNRS](#)



A HIGH-FIBER DIET CAN HELP PATIENTS WITH TYPE 2 DIABETES

The scientific group from China has discovered that diverse and abundant dietary fibers, which have the ability to provide the gut ecosystem with the specific group of bacteria that alleviates type 2 diabetes (T2DM) clinical phenotypes. In other words, it can help relieve the symptoms in patients with type 2 diabetes.



The gut microbiota benefits humans via short-chain fatty acid (SCFA) production from carbohydrate fermentation, and deficiency in SCFA production is associated with type 2 diabetes mellitus (T2DM)
source - asianscientist.com

The novel development was made by the group of scientists from the [Shanghai Jiao Tong University](#) in cooperation with the [Rutgers University](#) and the [Army Medical University](#).

To improve the efficiency of dietary therapy, it is important to comprehend in which way the gut microbiome responds to dietary changes. The microflora of the intestine is very important for the correct operating of this organ and for the health in general. These are microorganisms that live in the gastrointestinal tract in symbiosis with the carrier. For example, **short-chain fatty acids (SCFAs)** are generated by different human gut microbes. SCFAs act as an energy source to the colonic epithelium. Furthermore, the deficiency of SCFAs is linked to the type 2 diabetes.

Recovering or improvement of the lost or deficient function by the restoring of the functionally efficient ecological group of bacterias as **ecosystem service providers (ESPs)** is the key to a healthy microbiota. Scientists have used a novel method in studying the connection between gut microbes and chronic metabolic disease. They have identified and characterized **a select group of SCFA-producing microbes, which have the ability to provide the positive impact of high-fiber diets on patients with T2DM.**



The promoting this exclusive microbial group via personalized nutrition may serve as a novel approach for maintaining the beneficial relationship between the body and its microbiome during T2DM
source - theholisticingredient.com

Dr. Liping Zhao and the scientific team have discovered that the high-fiber diet causes the growth of SCFA-generating organisms in diabetic patients. Furthermore, the high-fiber diet provides changes in the gut microbe group and controls the levels of glucagon-like peptide-1, decrease in acetylated hemoglobin levels, and refine blood-glucose regulation.

The results of the clinical study of specifically designed isoenergetic diets, together with fecal shotgun metagenomics, to demonstrate that a select group of SCFA-producing strains was provided by dietary fibers and that most other potential producers were either diminished or unchanged in patients with T2DM. Researchers have found 15 SCFA-producing strains that were provided by dietary fibers. Moreover, these 15 bacteria strains operated in concert to cause SCFA production. The patients with enough level of SCFA producers had **better improvement in hemoglobin A1c levels**, due to elevated glucagon-like peptide-1 generation. As a result, **it diminished the formation of metabolically detrimental compounds such as indole and hydrogen sulfide.**

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On market since: -

Regions: China

Industries: Food and Drink, Healthcare

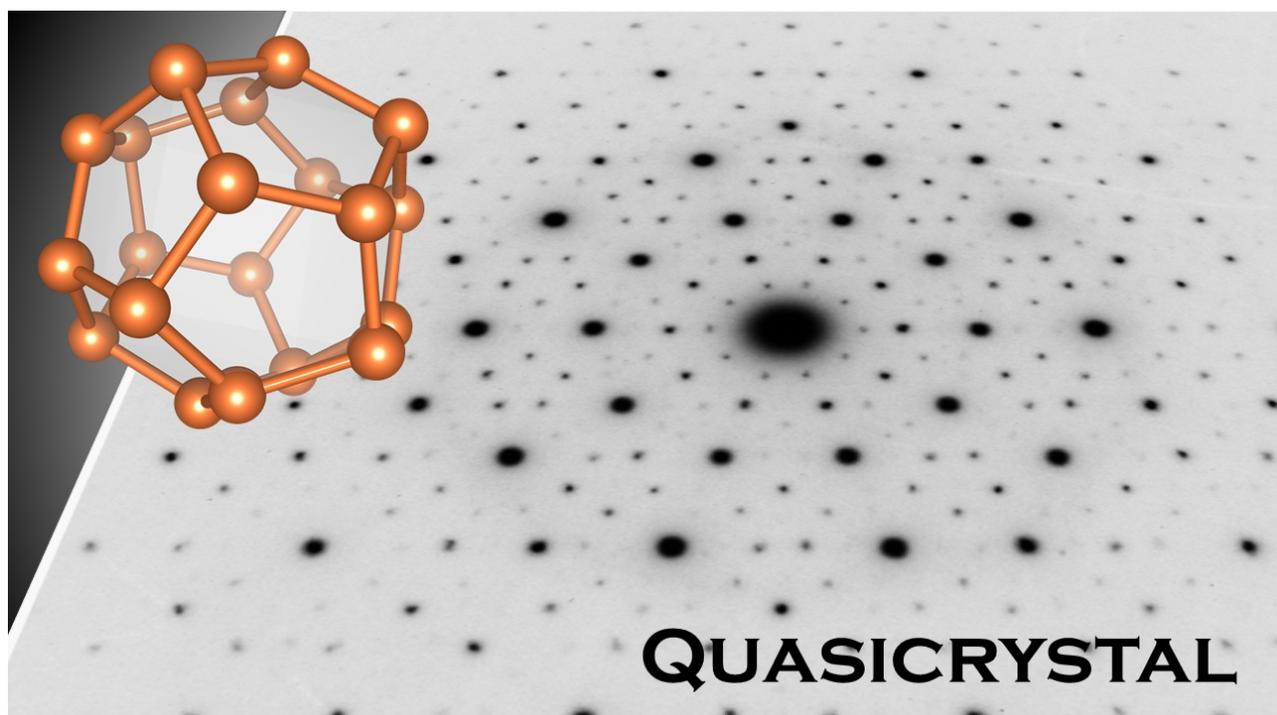
Source links: [Science](#)

[Asian Scientist](#)



A SUPERCONDUCTING QUASICRYSTAL

The researcher's team from Japan has managed to develop a superconductivity in a quasicrystal structure for the first time. This innovational discovery demonstrates that characteristics of Al–Zn–Mg quasicrystal approve the possibility of the emersion of bulk superconductivity at a very low transition temperature of 0.05 K. Furthermore, it provides the ability to create a new type of superconductivity, fractal superconductivity.



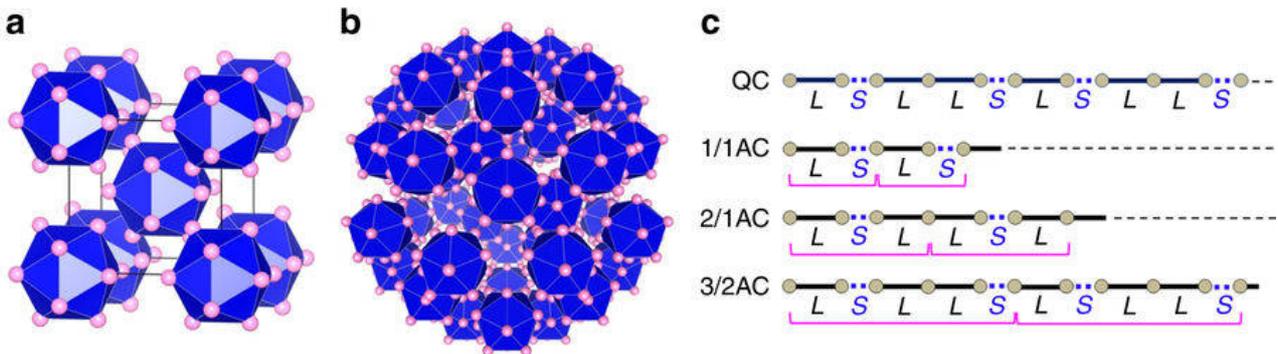
Since the 1980s an alternative form of solid, the quasicrystal (QC), has become the prominent source - Nagoya University

The superconductivity in the **quasicrystal (QC)** was found for the first time by the scientific team from the [Nagoya University](#) in cooperation with [Tohoku University](#) and [Toyota Technological Institute](#). It is the property of many conductors, which is based on the ability of their electric resistance fall to 0 when cooled below a certain critical temperature which is characterized by this material. This quantum phenomenon of the flow of electric current can occur in a solid body without loss, that is, with **a strictly 0 electric resistance of the body**.

In traditional scientific knowledge, the crystal was determined as a periodic disposition of atoms with translational periodicity, which cause an infinitely prolonged crystal formation by aligning building parts that are called unit cells. Most superconductors are crystalline. It means that their atomic structures are constructed from periodically repeating cells. Despite this fact, this definition was modified due to the discovery of QC. Notwithstanding quasicrystals have symmetry, like crystals, they have no repeat parts. This lack of periodicity causes extraordinary electronic structures.

Scientists studied an alloy of aluminum, magnesium, and zinc. They decided to research this **Al-Zn-Mg system** as a test material due to 2 reasons. The first one is that it contains both QC and AC phases. The second one is that the AC phase demonstrates

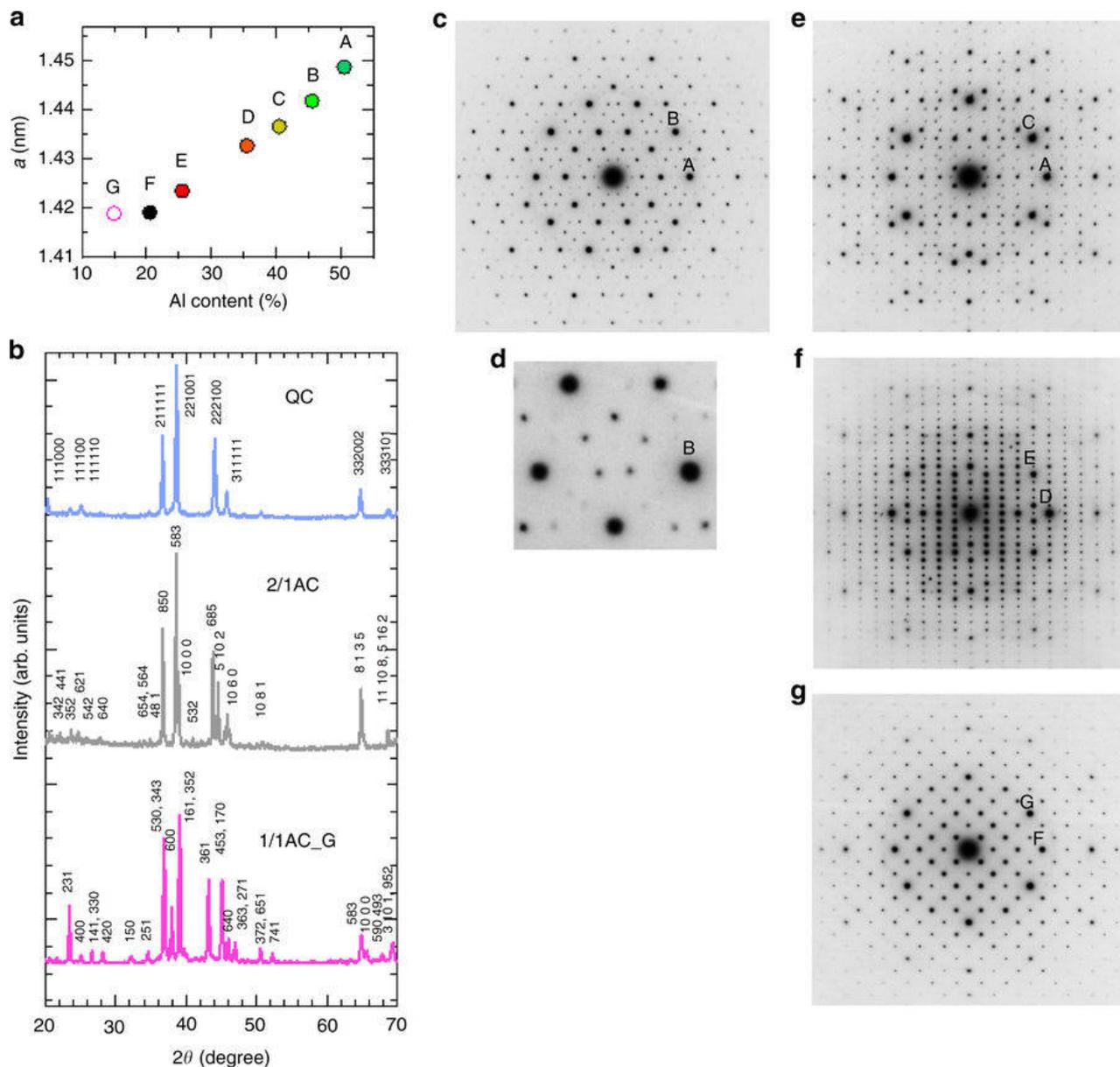
superconductivity. The bulk superconductivity appears at **0.05 K** in the Al-Zn-Mg QC. It means that it is not only the first superconducting QC, furthermore, it is the first QC, which demonstrates **the electronic long-range order**. The QC has managed to demonstrate showed 2 archetypal opportunities of superconductors: a heat capacity jump, and the almost total dismemberment of magnetic flux from the interior. The negatively charged electrons have the ability to overcome their mutual reverberation and allure each other at low temperature, forming pairs.



The periodic and quasiperiodic arrangement of atoms. An example of the cubic unit cell in which the icosahedron occupies the corner and body-centered positions
source - nature.com

The Cooper pairs in the Penrose lattice are unconventional due to the lack of the translational symmetry, which does not provide the ability of the conventional Cooper pairing formed at the opposite Fermi momenta, k and $-k$. Scientists used inductively coupled plasma (ICP) spectroscopy and scanning electron microscope (SEM) to analyze the received samples.

The scientific group found no difference between the Al-Zn-Mg QC and other weak-coupling superconductors. They hope that this innovational research propels a further study to create **the completely novel type of superconductivity, such as fractal superconductivity**.



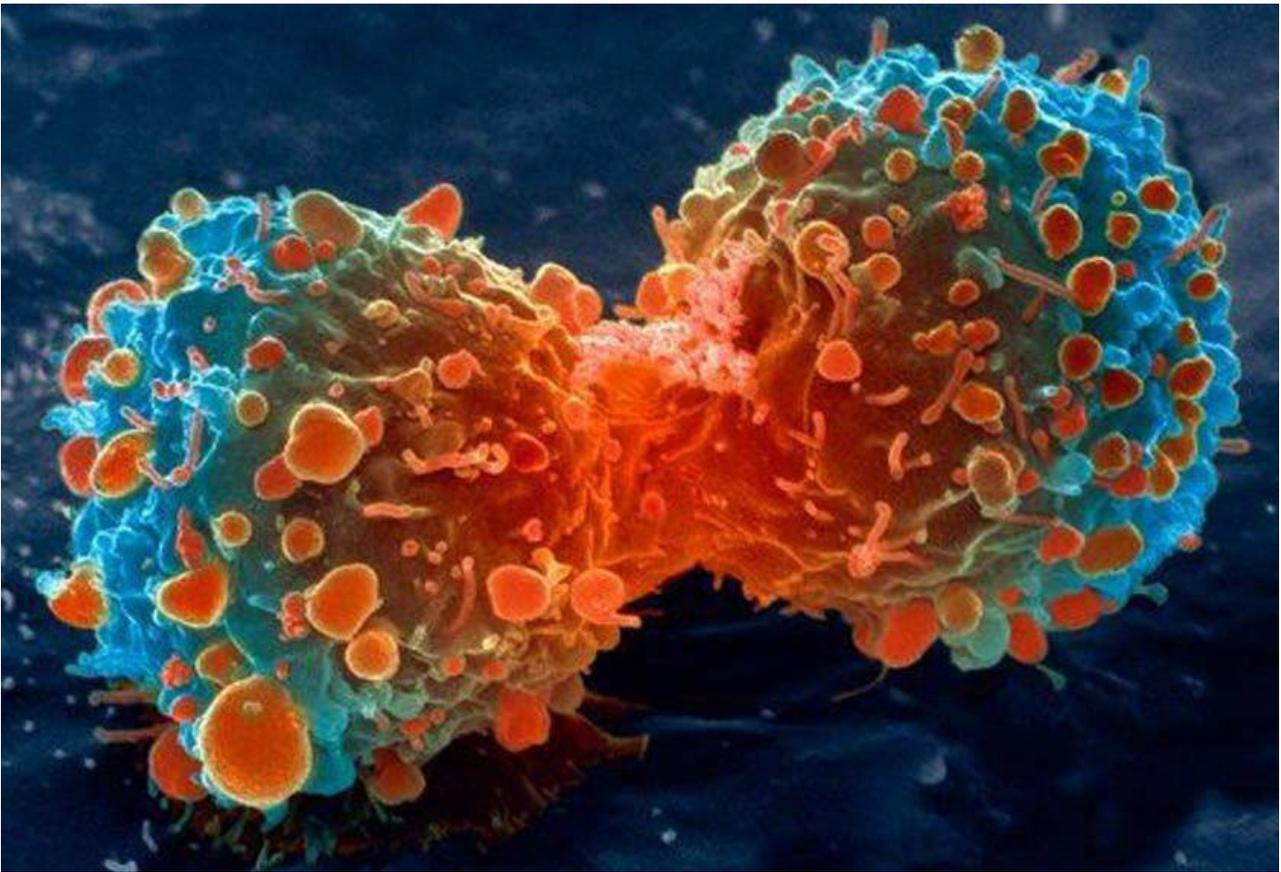
Diffraction patterns. a Lattice parameter a of 1/1AC samples determined from X-ray diffraction method as a function of Al content. Note that a decreases almost linearly with Al content
 source - nature.com

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On market since: -
Regions: Japan
Industries: Chemicals, Electronics, Others
Source links: [Nature Communications](#)
[Nagoya University](#)



A NEW WAY TO PREVENT CANCER SPREADING IN THE LIVER

Scientists have found an innovational method to stop cancer dissemination, which is based on the disruption of the biological pathway by modified fucose sugar, which has the ability to block hepatoma (cancer cells in the liver) to penetrate healthy liver cells. The development was made by the group of scientists from the [RIKEN](#).



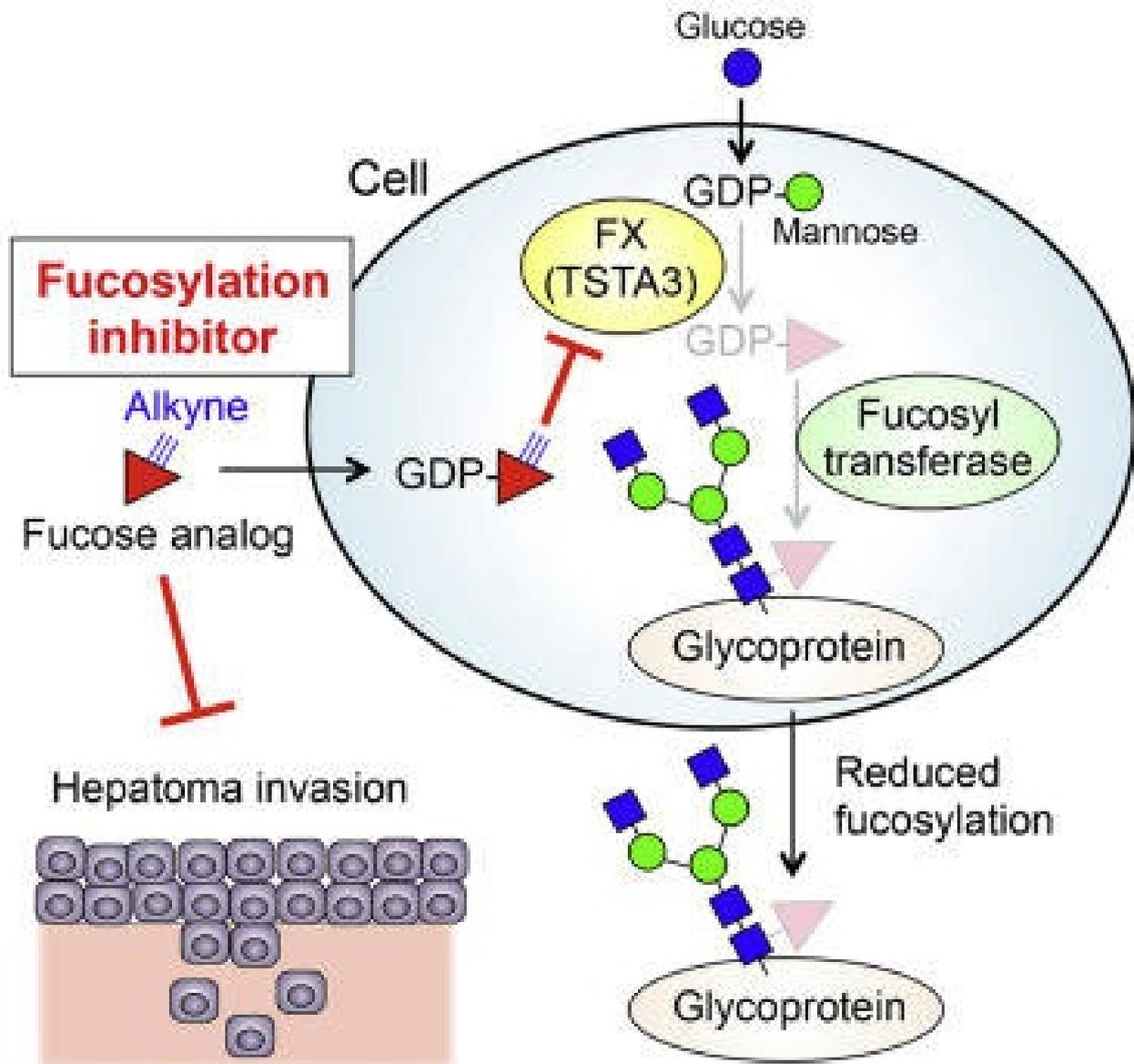
A hepatoma is cancer cells in the liver
source - theday.co.uk

Glycosylation is a post-translational modification (PTM), which provides the process of the attachment of sugar moieties to proteins. It is highly important for a wide range of biological processes, including cell attachment to the extracellular matrix and protein-ligand interactions in the cell. When the **sugar fucose (Fuc)** is connected with a chain of sugars, which is called glycans, they are transformed into fucosylated glycans. Fucosylation is a glycan modification that is significantly involved in cancer and inflammation.

Furthermore, Associate Professor Yasuhiko Kizuka mentioned that they are involved in various mechanisms, which also have an impact on the development and immunity formation. Despite this fact, the defective fucosylation can cause various diseases such as liver cancer, which is characterized by **the excess of fucosylated glycans in cancer cells**. Scientists have managed to establish that treatment, which is targeting on the fucosylation in these cells, will be highly effective for cancer therapy.

Biological paths are chains of mechanisms in which a number of molecules cooperate sequentially, usually with the help of enzymes. Some mechanisms convert glucose into a

compound, which is called **GDP-fucose**. An enzyme then disconnects fucose from GDP and unites it into glycans. The method of blocking this type of process is to inject molecular analogues-molecules, which are similar to those required in the chain of interactions.



6-Alkynyl-fucose, a widely used fucosylation probe, strongly inhibits fucosylation. 6-Alkynyl-fucose competitively inhibits GDP-fucose synthetase FX
source - cell.com

The researcher's team using this method compared the impact of 2 fucose analogues on fucosylation. They focused on a fucose analogue with an alkyne group, **6-alkynyl-fucose (6-Alk-Fuc)**, which is used widely as a detection probe for fucosylated glycans but is also suitable for use as a fucosylation inhibitor. Scientists, applying few cell lines of the

hematoma, which had exorbitant levels of FG, managed to find that the analogue has the capacity to prevent the intrusion of hepatoma into healthy cells. Furthermore, it can restrain the migration of hepatoma cell lines.

Scientists made a glycan analysis using lectin and mass spectrometry, which showed that 6-Alk-Fuc is a potent and general inhibitor of cellular fucosylation, with greater potential than the existing inhibitor, 2-fluoro-fucose (2-F-Fuc). Consequently, 6-Alkynyl-fucose is a powerful tool for modulating cellular fucosylation and has the ability to halt hepatoma invasion.

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Regions: Japan
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Source links: [RIKEN](#)
[Cell Chemical Biology](#)



THE VINEGAR CAN HELP PLANTS TO FIGHT DROUGHT

Researchers have found a novel, simple and cost-effective method to make various plants more tolerance to drought. They managed to activate the biological mechanism of resistance and cause a high stability to hard drought environment simply by growing plants in vinegar. This technology forms the function of adaptations to the hard conditions in plants. Scientists have managed to considerably increase the drought tolerance of different plants such as rice, wheat and many others.



The effect of several organic acids on plant drought tolerance after 14 days. From left to right, water, HCl, formic acid, acetic acid, butyric acid, lactic acid, citric acid. Note, only plants treated with acetic acid survived
source - riken.jp

The innovational discovery was made by the scientific group from the [RIKEN](https://www.riken.jp/).

The water shortages caused by global climatic changes seriously threaten the survival of organisms and yields and increasing environmental degradation. Plants' resistance to drought includes the reprogramming of transcription, cellular metabolism, hormone signalling and chromatin modification. Nevertheless, mechanisms of its action are largely unknown.

Scientists managed to identify Arabidopsis plants, which have a high drought resistance, also have some mutation of the **HDA6 enzyme (histone deacetylase6)**. HDA6 is a homologue of human HDAC1 and yeast RPD3, and has wide-ranging functions, for example, gene silencing. The hda6 mutants demonstrated enhanced drought tolerance, consequently, it has a fundamental role in regulating a unique drought response pathway.

To identify drought tolerance genes that are regulated by HDA6, the researcher's team profiled the genome-wide expression patterns of hda6 during drought stress. The analysis showed that the **acetate biosynthesis pathway was upregulated in wild-type plants under drought-stress** and that this upregulation was greatly enhanced in the hda6 mutant. In

Arabidopsis, the response mechanism is directly dependent on histone deacetylase HDA6. In addition, exogenous acetic acid promotes de novo JA synthesis and enrichment of histone H4 acetylation, which influences the priming of the JA signalling pathway for plant drought tolerance. The acetate, a basic and simple biochemical compound, has a significant role as an initial factor that orchestrates plants' survival capability, which connects fundamental metabolism, epigenetic regulation and hormone signalling, ultimately conferring plant drought tolerance.

Consequently, this mechanism forms the function of adaptations to the hard conditions in plants increased the resistance in Arabidopsis. The amount of acetate produced by plants during drought directly related to the possibility to survive. Scientists mentioned that they managed to increase the resistance different plants such as rice, wheat, rapeseed and maize.

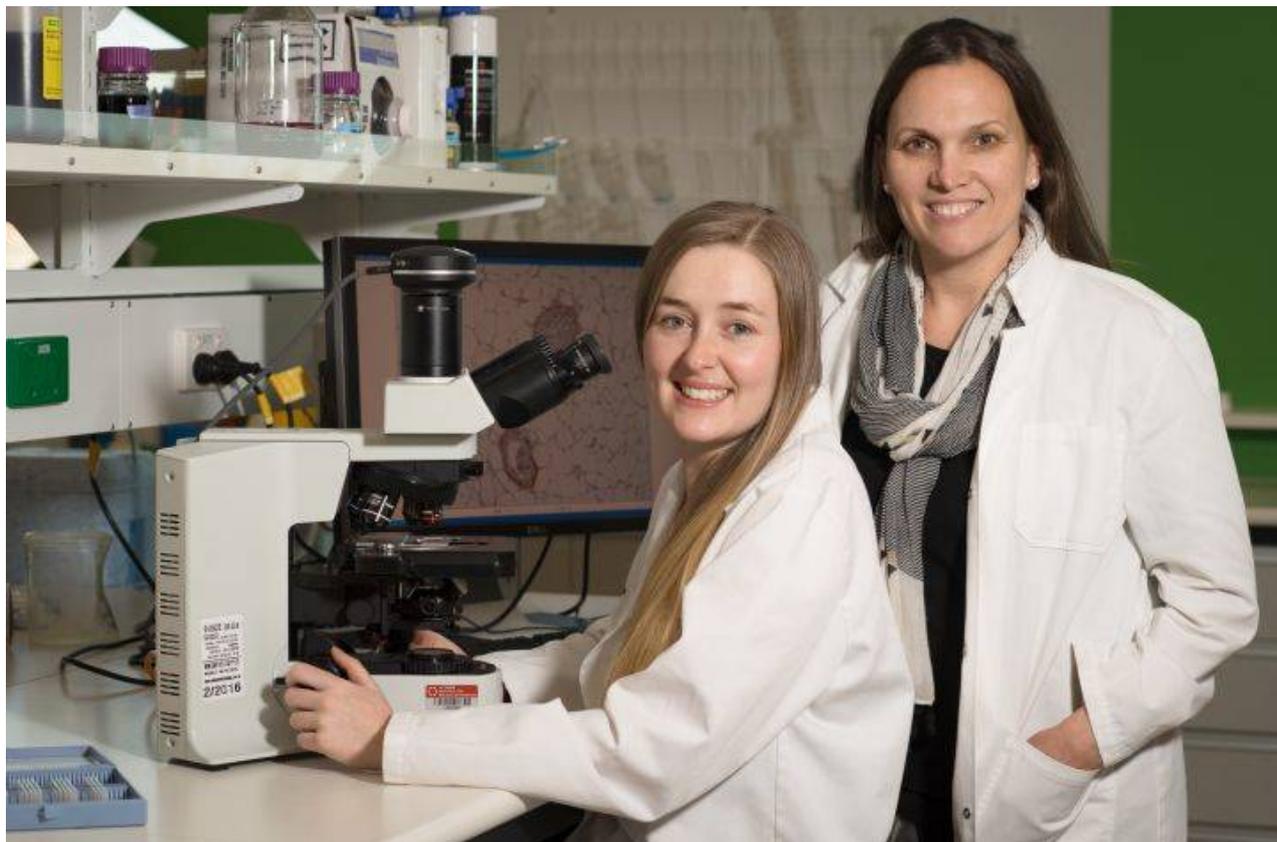
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Source links: [Nature Plants](#)
[RIKEN](#)



A KEY PROTEIN STOPS SPREADING OF THE BREAST CANCER

Scientists have identified the mechanism of action of the stefin A protein, which provides the ability to stop the spreading of the breast cancer. The cancer suppressor protein, stefin A, that increase the capacity of the myoepithelial cells to act as a barrier, basically catching the cancer cells in the breast duct and stopping the dissemination. This innovational discovery will help to develop more suitable and effective methods of treatment.

The innovational discovery was made by the scientific group from the [La Trobe University](#) in cooperation with the [Garvan Institute of Medical Research](#).



Dr Hendrika Duivenvoorden (front) and Dr Belinda Parker (back) from the La Trobe Institute for Molecular Science source - latrobe.edu.au

The well-known fact is that without timely treatment, the breast cancer has the ability to diffusion through the body. Mechanisms for the spread of metastases are only 2: by blood or by lymph. Most often, cancer of this type is formed in the breast ducts. This is called the **ductal carcinoma in situ (DCIS)**. This type of cancer is enclosed by myoepithelial cells, which act as a barrier. Despite this fact, about **7%** of DCIS cancer usually break through the limit from myoepithelial cells and continue the dissemination.

The technology of the screening mammography has enhanced the possibility of the early-stage breast cancer detection. It increases the urgency of identifying molecular regulators of invasion as prognostic markers to predict local relapse.

The group of researchers has found that cysteine cathepsins play the key role in early-stage tumorigenesis. To characterize the cell-specific roles of cathepsins in the early invasion, the scientific team created a DCIS-like model, including an immortalized

myoepithelial cell line (N1ME) that has the ability to suppress tumour cell invasion in 3D culture.

Using this model, researcher's group has found that **the stefin A can stop cancer dissemination increasing the capacity of the myoepithelial cells to obstruct it**. It suppresses invasion, whereby targeted stefin A loss in N1ME cells blocked myoepithelial-induced suppression of breast cancer cell invasion.



The research was funded by the National Health and Medical Research Council, Cancer Council Victoria, the National Breast Cancer Foundation and the Sydney Breast Cancer Foundation
source - indianexpress.com

Previous studies on the involvement of stefin A in tumorigenesis are contradictory, with reports that it is a tumour suppressor in some cancers yet a malignant marker in others. Nevertheless, investigations into the cell-specific expression and function of stefin A in early tumorigenesis are limited.

Scientists managed to confirm that stefin A was indeed abundant in myoepithelial cells in breast tissue. Use of a **138-patient cohort** confirmed that myoepithelial stefin A (cystatin A) is abundant in normal breast ducts and low-grade DCIS but reduced in high-grade DCIS, supporting myoepithelial stefin A as a candidate marker of lower risk of invasive relapse. Consequently, they have found that this type of protein as a suppressor of early tumour invasion and a candidate marker to distinguish patients who have some risk of metastasis.

Dr Belinda Parker mentioned that this important discovery will provide the ability to predict which DCIS patients can have the metastasis developing. It will allow doctors to provide individualised therapy.

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TRANSFORMING PLANTS INTO PHARMACEUTICAL FACTORIES

Scientists made a big step forward in the cost-effective method to produce medicines in edible plants on a large scale. They managed to generate cyclotide proteins (cyclic peptides), which are suitable for developing drugs in plants such as lettuce and canola. This type of protein is proper for use in oral drugs developing, for example, painkillers or cancer medicines. Scientists hope that this method of medicine production will be particularly suitable for developing countries due to certain limits with the availability of drugs.

The innovational development was made by the scientific group, led by Prof. Marilyn Anderson from the [La Trobe University](https://www.latrobe.edu.au/) in cooperation with the [University of Queensland](https://www.uq.edu.au/).



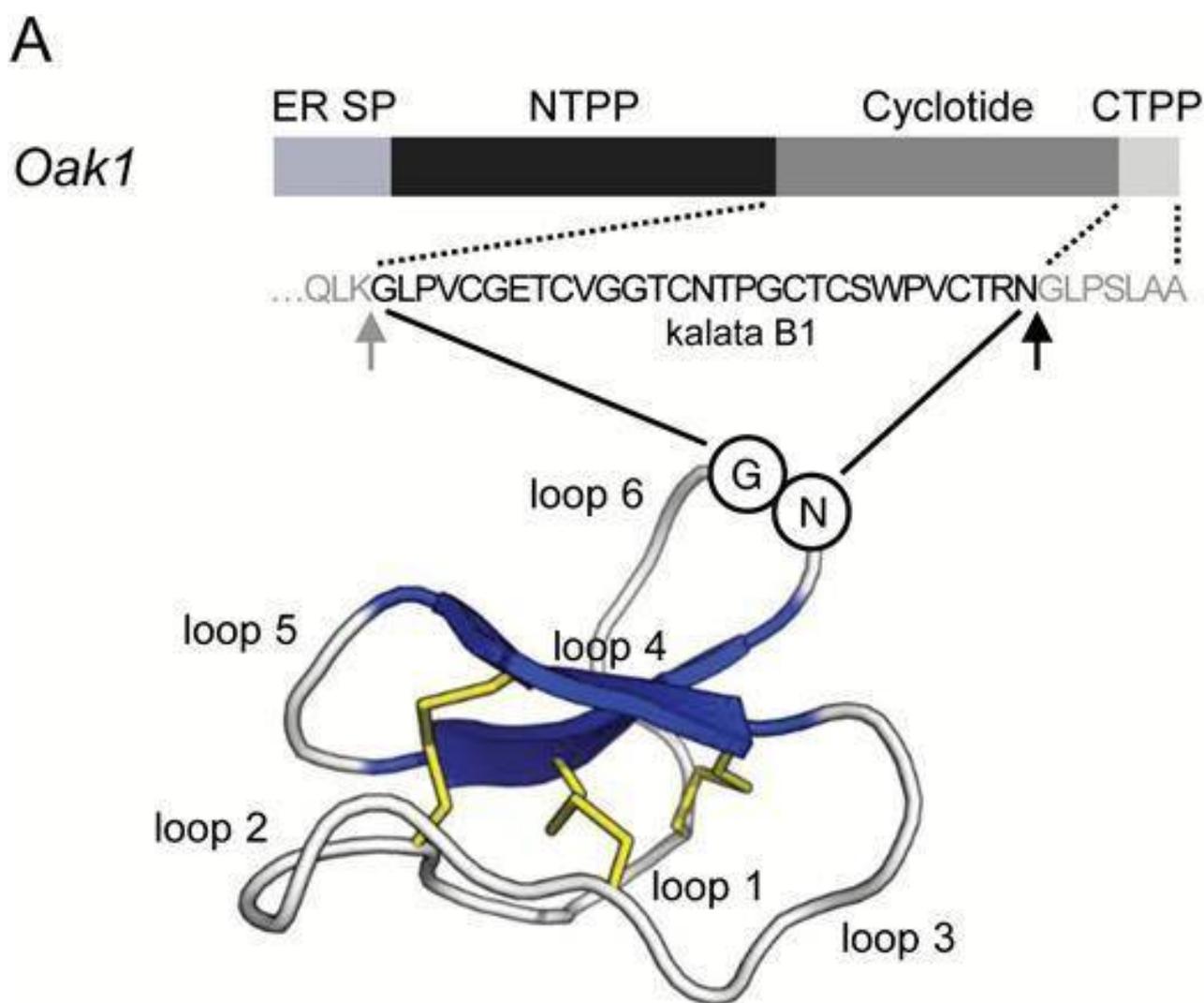
Professor David Craik and Professor Marilyn Anderson
source - imb.uq.edu.au

Cyclotides are highly stable peptides that protect plants. They have a big interest as candidates for application within the pharmaceutical and agricultural industries, by harnessing their intrinsic bioactivities, and indirectly by presenting foreign bioactive peptides within their stable structure. Cyclotides have the capacity to stabilize other bioactive peptides within their structure. Despite the fact, that their structure is complicated, cyclotides can be produced synthetically.

Prof. David Craik mentioned that cyclotides have a round structure that makes them less suitable to be split by the digestive system. Consequently, they **can be used in production of oral medication such as different painkillers and even cancer medications.**

Nevertheless, the barrier to their widespread application is the lack of cost-effective methods of production. Prof. Marilyn Anderson noted the process of synthetic cyclotides production is expensive and low-effective.

The scientific group determined that **using the appropriate enzyme in plants can improve the process of cyclic peptides generation from the linear peptides**. They can be efficiently produced in *Nicotiana benthamiana*, one of the leading plant-based protein production platforms, by co-expressing cyclotide precursors with asparaginyl endopeptidases that catalyse peptide backbone cyclization.



Cyclotide structure and production in *N. benthamiana*. (A) The prototypic cyclotide, kalata B1, is encoded by *Oak1*
source - academic.oup.com

The maturation of cyclotide precursors involves successive enzymatic removal of the ER signal sequence and N-terminal propeptide (NTPP) followed by a transpeptidation reaction in which a C-terminal propeptide (CTPP) is released and the N- and C-termini of the

cyclotide domain are joined. Co-expression of a cyclizing asparaginyl endopeptidase with a cyclotide gene significantly **improves cyclization efficiency in non-cyclotide producing plants**, resulting in a much higher proportion of cyclic product than with the cyclotide gene alone. The high efficiency of cyclotide maturation was independent of whether the substrate and cyclizing asparaginyl endopeptidase (AEP) were in separate constructs that were co-infiltrated, or in a single, double-stack construct.

This approach was successful in a range of food and non-food plants, and is applicable to both native and engineered cyclotides as well as the trypsin inhibitor class of cyclic peptides. The establishment of agroinfiltration for heterologous protein production in *N. benthamiana* on an industrial scale means that large-scale, affordable production of cyclic peptides may be possible. Consequently, **plants can be used for the production of natural cyclotides for therapeutic use**.

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Source links: [Journal of Experimental Botany](#)
[University of Queensland](#)



A CITRUS SKIN CAN HELP TO TREAT GLAUCOMA

A group of scientists from Japan has discovered that hesperidin, a polyphenol that is contained in citrus skins, has a neuroprotective effect on the damaged cell of eyes' retina. This discovery can help to treat diabetic retinopathy (DR) and glaucoma that leads to irreversible loss of vision. The potential treatment is targeting oxidative stress that is a risk factor for age-related macular degeneration, DR and glaucoma.



A hesperidin, a plant-derived bioflavonoid, contains in citrus skins
source - Tohoku University

The innovational development was made by the scientific group, led by Professor Toru Nakazawa from the [Tohoku University](#).

Glaucoma is an ophthalmic disease that is characterized by an affection of the optic nerve and retinal eye with a significant or even complete loss of vision, usually associated with increased intraocular pressure. Loss of vision caused by glaucoma is irreversible because the optic nerve dies.

The **oxidative stress** is the main reason for various neurodegenerative diseases such as Alzheimer's disease, Parkinson's disease, and amyotrophic lateral sclerosis. The oxidative stress in the eyes' retina can cause glaucoma, DR and etc. [The Age-Related Eye Disease Study \(AREDS\) results](#) have demonstrated that antioxidant supplements had a helpful effect in these diseases and can slow their development and aggravation. The results of various researchers have determined that the level of advanced glycation end products (AGEs) in the skin is connected with the severity of DR and can be used by researchers as a biomarker of oxidative stress. Therefore, scientists developing possible methods of treatment of retinal diseases were targeting oxidative stress.

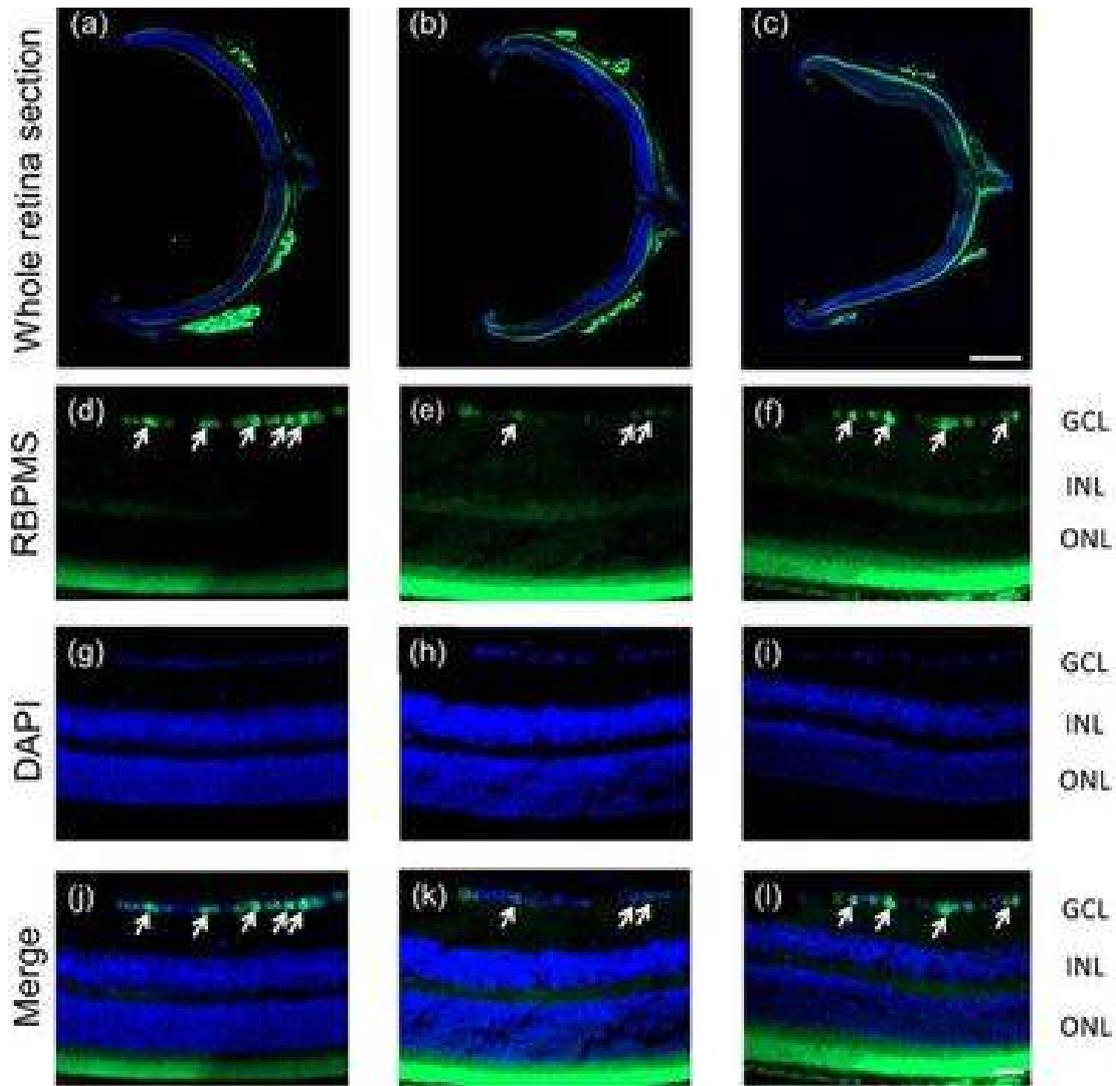
Moreover, since most of the methods of treatment for glaucoma are aimed at reducing pressure by surgical intervention. Despite this fact, some patients have the intraocular pressure within the normal range, consequently, this method is not effective. It confirms

the importance of developing an alternative treatment method such as treatment aimed at oxidative stress.



A citrus polyphenol may be a good supplement for glaucoma
source - Tohoku University

The hesperidin, a plant-derived bioflavonoid that is contained in the citrus skin, can be the **highly-effective mechanism for neuroprotective treatment of the retina**. Scientists screened **41** materials for anti-oxidative characteristics in a primary retinal cell culture under oxidative stress. They found that **the hesperidin prevents the reduction of retinal cell death**. It is commercially available as a food supplement, therefore, the scientific group used it as the antioxidant compounds in food that could most effectively protect neurons, especially the retinal ganglion cells (RGC).



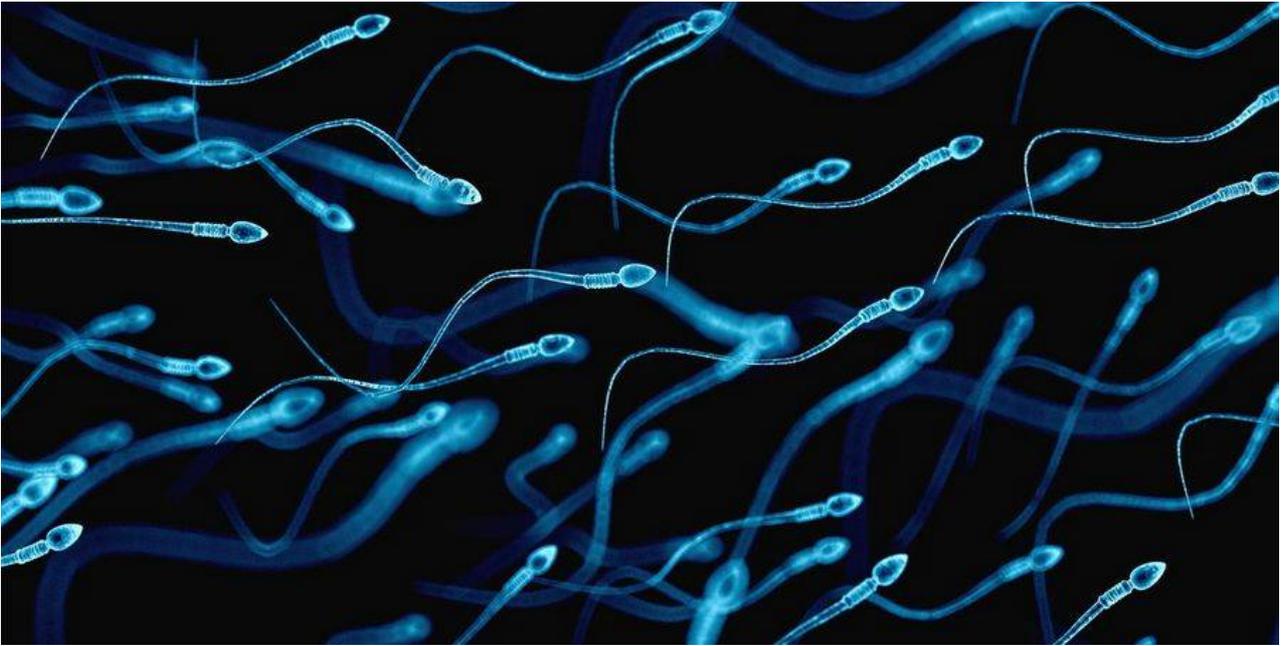
Hesperidin treatment preserved RGC marker-positive cells after NMDA injury. Representative photographs at lower (a–c) and higher (d–l) magnification with nuclear staining (DAPI)
 source - nature.com

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Source links: [Scientific Reports](#)
[Tohoku University](#)



THE HORMONE-FREE MALE CONTRACEPTIVE PILL WITHOUT SIDE-EFFECTS

Scientists managed to develop the hormone-free combination of oral contraceptive drugs that have the ability to block the transport of sperm during ejaculation but not interrupt sperm development or maturation. This innovational technology does not cause any side-effects for fertile ability and when a person does not use pills the fertility function operates. This development is effective and safe birth control method, which does not affect libido or sexual function.



New funding from the Male Contraceptive Initiative has allowed researchers to move into this next phase of drug development but the team is still relying on further funding to fast-track the process
source - theverge.com

The group of scientists, led by Dr Sab Ventura, from the [Monash University](#) has developed this novel birth control option.

For centuries, all men have had in the form of reversible contraception has been the condom. Nevertheless, it does have some drawbacks: it interrupts intercourse, reduces sensation for both men and women. Furthermore, it has a real-world pregnancy rate of 18% over one year among couples that use condoms as their primary method.

Formerly, the scientific group demonstrated that male infertility can be achieved using the genetic method, which is based on the concurrently **removing 2 proteins α 1A-adrenoceptor and P2X1-purinoceptor that provide the transportation of sperm**. This alpha-adrenergic receptor mediates its action by association with G proteins that activate a phosphatidylinositol-calcium second messenger system. Its effect is mediated by G(q) and G(11) proteins. P2X purinoceptors are cell membrane ion channels, gated by adenosine 5'-triphosphate (ATP) and other nucleotides; they have been found to be widely expressed on mammalian cells, and, by means of their functional properties, can be differentiated into three sub-groups.

This technology **doesn't affect the durable sperm viability or sexual condition of the health**. The sperm is available but the muscle is not got the chemical message to transfer

it.



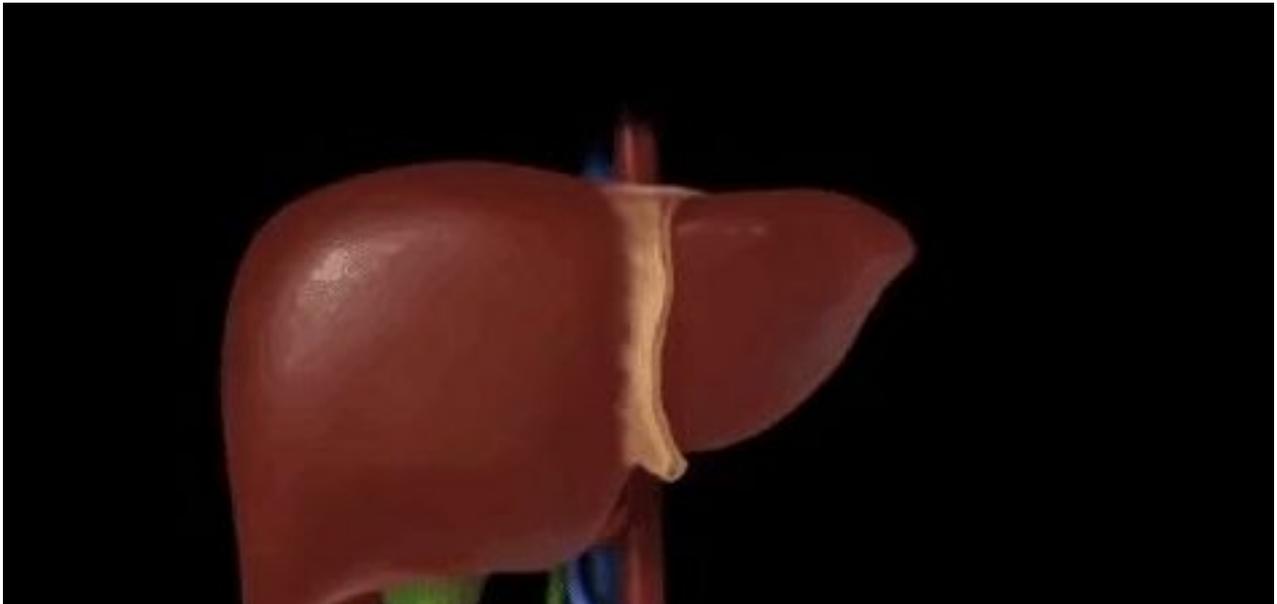
This research involved in the project Dr Sab Ventura, Professors Jonathan Baell, Sue Charman and Patrick Sexton
source - monash.edu

There is already an available medication, which was approved for durable use, successfully targeting to block one of two proteins. Despite this fact, scientists tried to develop the oral contraceptive for obstructing the second protein. The hormone-free tablet will have the unique capability to avoid the side-effects that have current technologies of a male contraceptive. These negative consequences are often caused by impeding functions of male hormones. It leads to invariable effects on fertility, libido and cause birth blemishes of the future generation.

Dr Sab Ventura mentioned that this non-hormonal oral male contraceptive will be safe and effective due its ability to simply cancel their action by stopping the use of the remedy. It will be possible by using the method of creating the combination of two drugs that block sperm transport together but not damage the function of sperm formation.

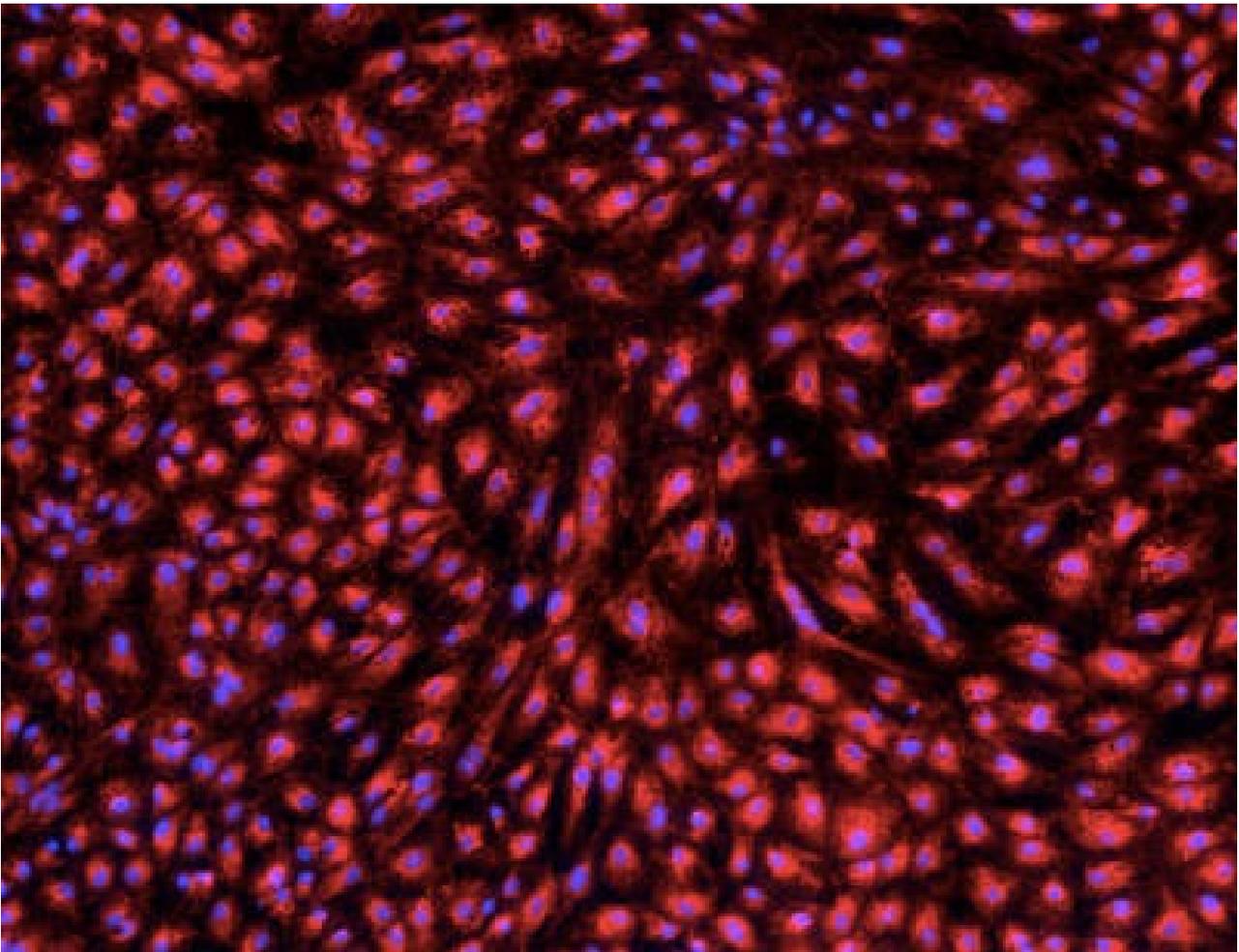
The study results showed that the sperm retains its fertile function after the completion of taking the medicines because the technology stopped only the transport of sperm without affecting them directly. In additions, libido and sexual activity will remain normal.

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Source links: [Monash University](#)
[Male Contraceptive Initiative](#)



AN INNOVATIONAL METHOD OF TREATING LIVER FAILURE USING HUMAN STEM CELL

The international group of scientists managed to generate pure liver cells from human stem cells. This novel technology will help to develop more effective methods to treat liver failure. Moreover, it can help patients, which await a liver transplantation. The testing results on mouse models were successful.



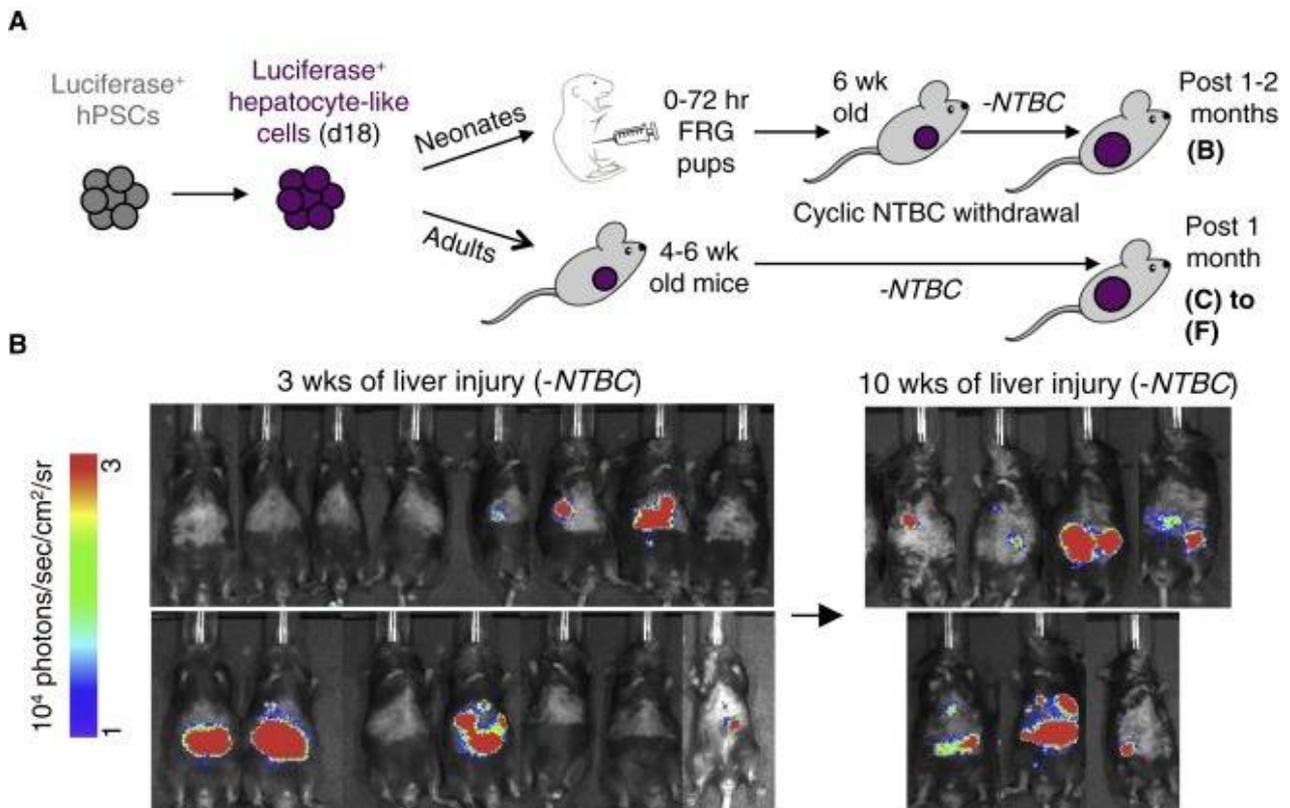
Stem cell-derived liver cells
source - A*STAR

The development was made by the group of scientists from the [Agency for Science, Technology and Research \(A*STAR\)](#) in cooperation with the [Institute of Molecular and Cellular Biology](#) and the [Stanford University School of Medicine](#).

Liver failure is a condition in which the liver cannot perform its metabolic functions that cause necrotic, fibrous or dystrophic changes in its parenchyma. The disease is accompanied by an advanced and terminal stage of general intoxication of the body and can cause neurological and psychiatric disorders. The treating of liver disease can be occurred using several methods but in the case of the advanced-stage, it can only be treated just by liver transplants. More than **1 million** patients worldwide die every year while waiting for transplants. Scientists artificially produce a big amount of liver cells from human embryonic stem cells to decide this problem.

Dr Ang Lay Teng mentioned that the main barrier of using stem cell is its capacity to transform into liver cells, notwithstanding, stem cells can turn into various types of human

cells. Scientists managed to **control early liver development through a sequence of 6 consecutive lineage choices** and detail the signals at each juncture that specify each cell type (either liver or non-liver lineages).



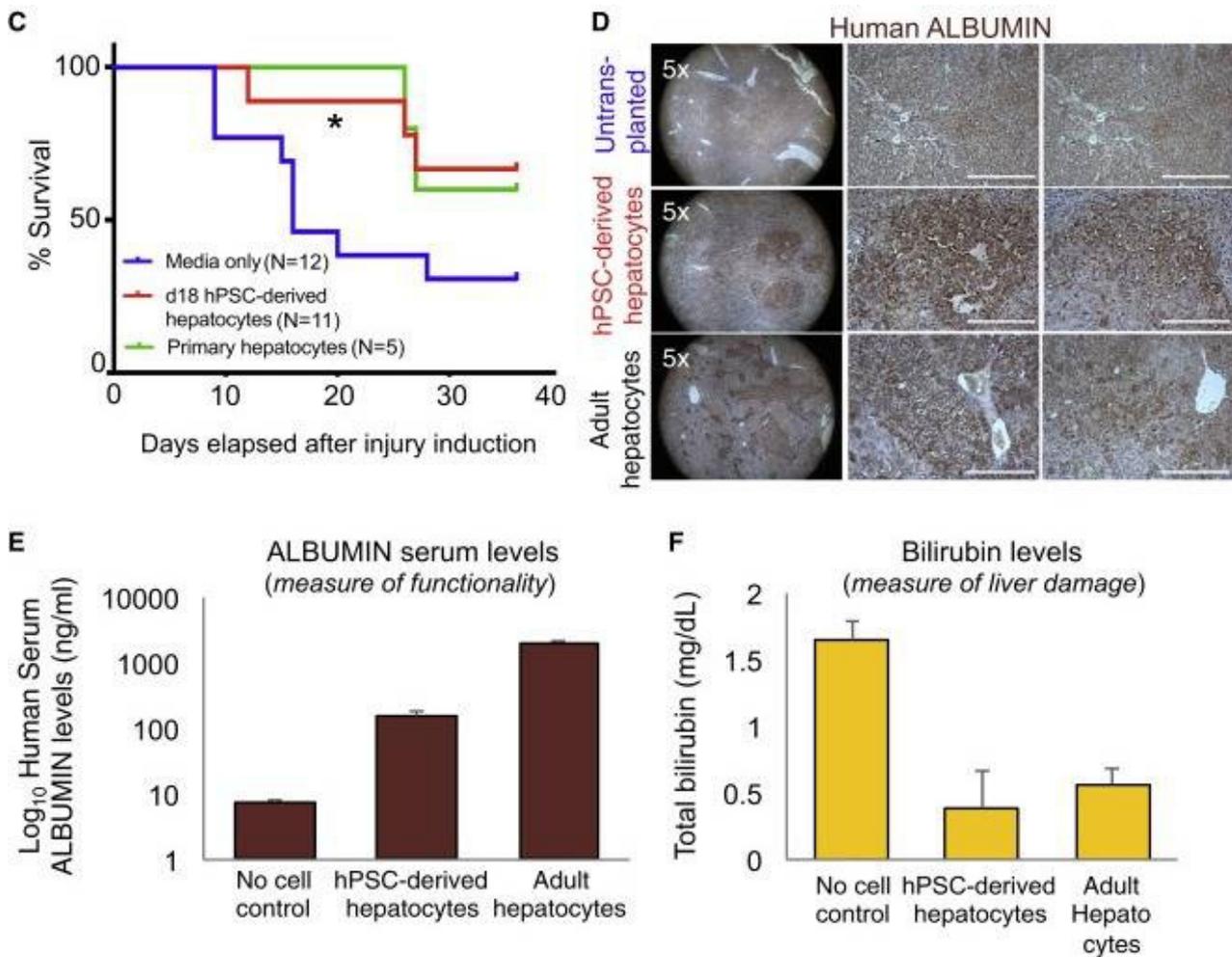
Strategy to inject hPSC-derived hepatocytes into the livers of neonatal FRG mice or adult mice (4–6 weeks old) and to subsequently induce liver injury
source - cell.com

Professor Kyle Loh noted that the main goal of researchers process to identify the 6 requisite stops and map the path needed for a stem cell to develop into a liver cell. They managed to precisely control differentiation by mapping the generation of closely related endodermal lineages (liver, pancreatic, and midgut/hindgut progenitors). The strategy can specify liver progenitors while suppressing formation of unwanted lineages such as pancreas.

Human liver fate was encoded by combinations of inductive and repressive extracellular signals at different doses. Nevertheless, these signalling combinations were temporally re-interpreted: cellular competence to respond to retinoid, WNT, TGF- β , and other signals sharply changed within **24 hr**. The temporally dynamic manipulation of extracellular signals was imperative to suppress the production of unwanted cell fates across six

consecutive developmental junctures.

Dr Ng Huck Hui mentioned that this novel method will provide the capability to generate a big amount of liver cells to improve current method of treatment. Moreover, it can help patients with neediness of liver transplantations.



Adult FRG mice were injected with Luciferase+ day-18 hPSC-derived hepatocytes. Primary adult human hepatocytes (red line; n = 5), or media-only control (blue line; n = 12) source - cell.com

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Regions: United States, Singapore

Industries: Healthcare, Biotechnology

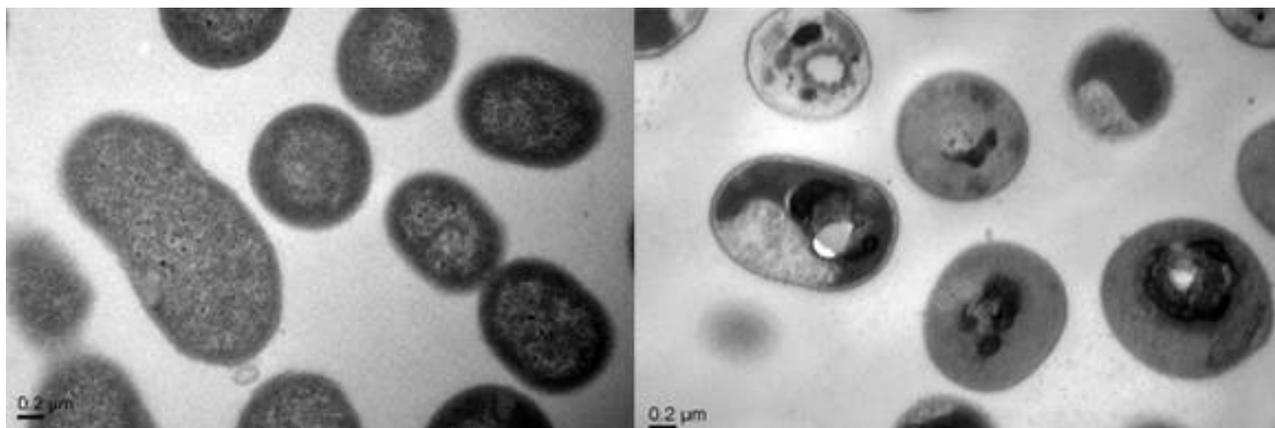
Source links: [Cell Reports](#)

[A*STAR](#)



A SUPERMOLECULE IS AN EFFECTIVE ALTERNATIVE TO ANTIBIOTICS

The international group of scientists has created a synthetic molecule, which has the ability to kill 5 deadly types of multidrug-resistant bacteria hasn't any toxic effects on human cells. This type of molecule was developed as an alternative to antibiotics since many bacteria were modified and become resilient to antibiotic exposure. This development is significant in the field of molecular therapy and will allow scientists creating completely new types of treatment.



Normal cells of the *Acinetobacter baumannii* bacteria before (left) and after (right) the cytoplasmic substances within the bacterial cell membrane have precipitated, killing the bacteria

source - A*STAR

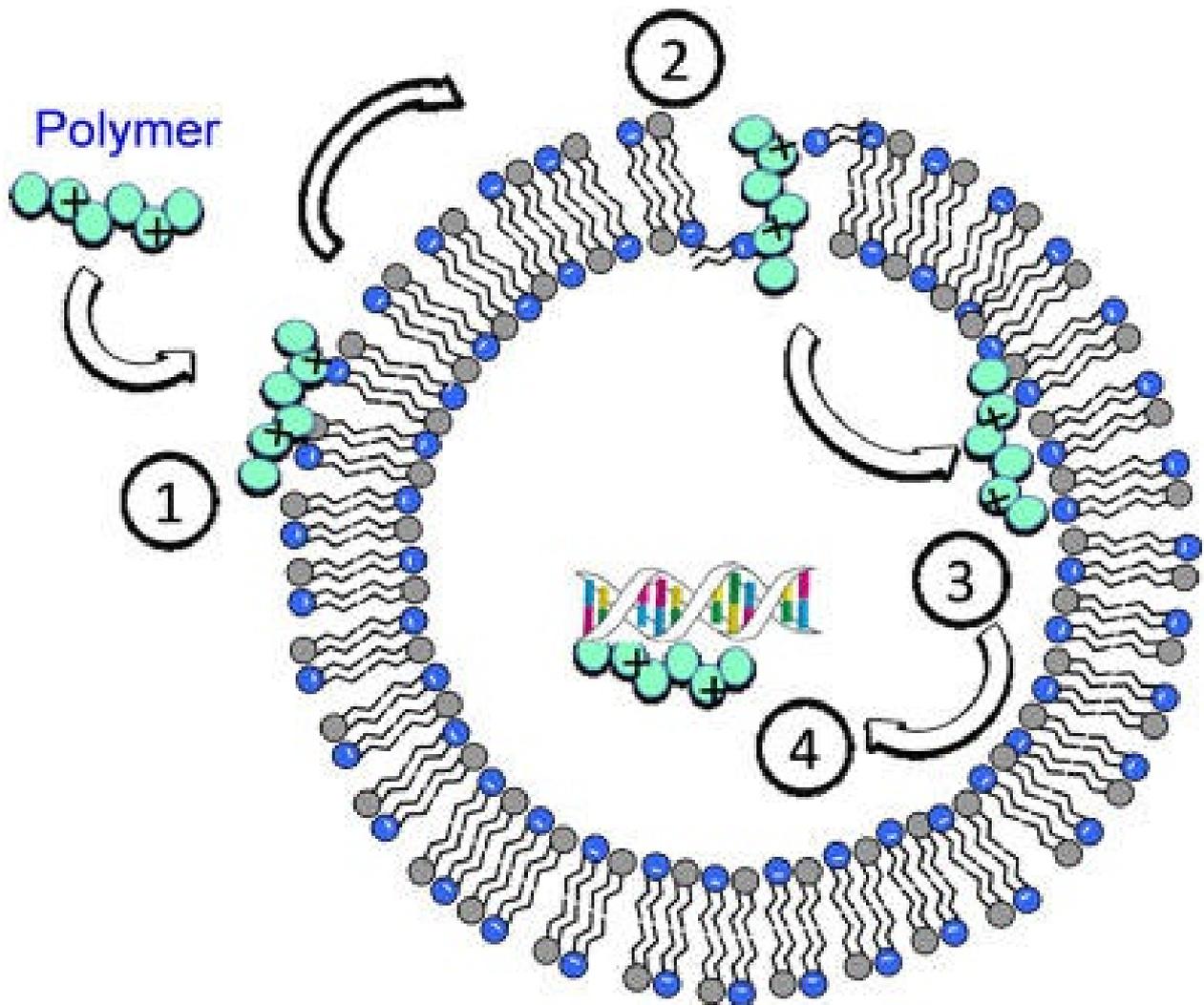
The innovational development was made by the group of scientists from the [Agency for Science, Technology and Research \(A*STAR\)](#) in cooperation with the [First Affiliated Hospital of Zhejiang University's College of Medicine](#) and the [University of North Dakota](#).

The innovational type of synthetic molecules is highly-important for treating patients with antibiotic-resistant infections. Professor Jackie Y. Ying mentioned that some bacterias began to develop firmness to the newest antibiotics, which are taken by patients, which are infected with stable bacterias. Polymyxins are the last possible treatment for **multidrug-resistant (MDR) infections**. Despite this fact, the polymyxins resistance forms. Therefore, the need to develop an effective antimicrobial agent, which will be able mitigating MDR, exists.

The scientific community during the development process uses synthetic polymers. Nevertheless, the current antimicrobial polymers cause either toxic side effects or not dissolved or act only on one type of superbugs. Consequently, scientists have created a novel category of biodegradable antimicrobial polymers, which are called **guanidinium-functionalized polycarbonates** with a distinctive mechanism that **does not induce drug resistance**.

Polycarbonates are functionalized with guanidinium groups to provide biodegradable broad-spectrum polyguanidiniums. The antibacterial function of the polymer is mainly based on membrane translocation followed by precipitation of bacterial cytoplasmic contents (such as proteins and genes). These polymers can be effective in treating multidrug-resistant (MDR) infections such as opportunistic infections, infections of the

genitourinary system, hospital-acquired infections and, furthermore, which can cause severe food poisoning, sepsis, pneumonia.



A diagram of the four-step killing mechanism of the polymer against drug-resistant superbugs
source - A*STAR

The important advantage of synthetic molecules is that polymer treatment at the effective doses **does not cause acute systemic toxicity in vivo**. These polymers have a big potential as antimicrobial agents in the preclusion and treatment of MDR. Scientists mentioned that this innovational development is significant in the **field of molecular therapy and will allow scientists creating completely new types of treatment**.

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Regions: United States, China, Singapore

Industries: Healthcare, Biotechnology

Source links: [Nature Communications](#)

[A*STAR](#)



GREEN TEA-BASED DRUG TREATS CANCER

Scientists have developed new green tea-based nanocarrier that can deliver drugs and kill cancer cells. This technology is much more effective comparing to other similar technologies due to its ability to transport a big amount of the drug and to provide thermodynamic and kinetic stability. Therefore, such nanocarriers allow killing more cancer cells decreasing toxic side-effects of the therapy.

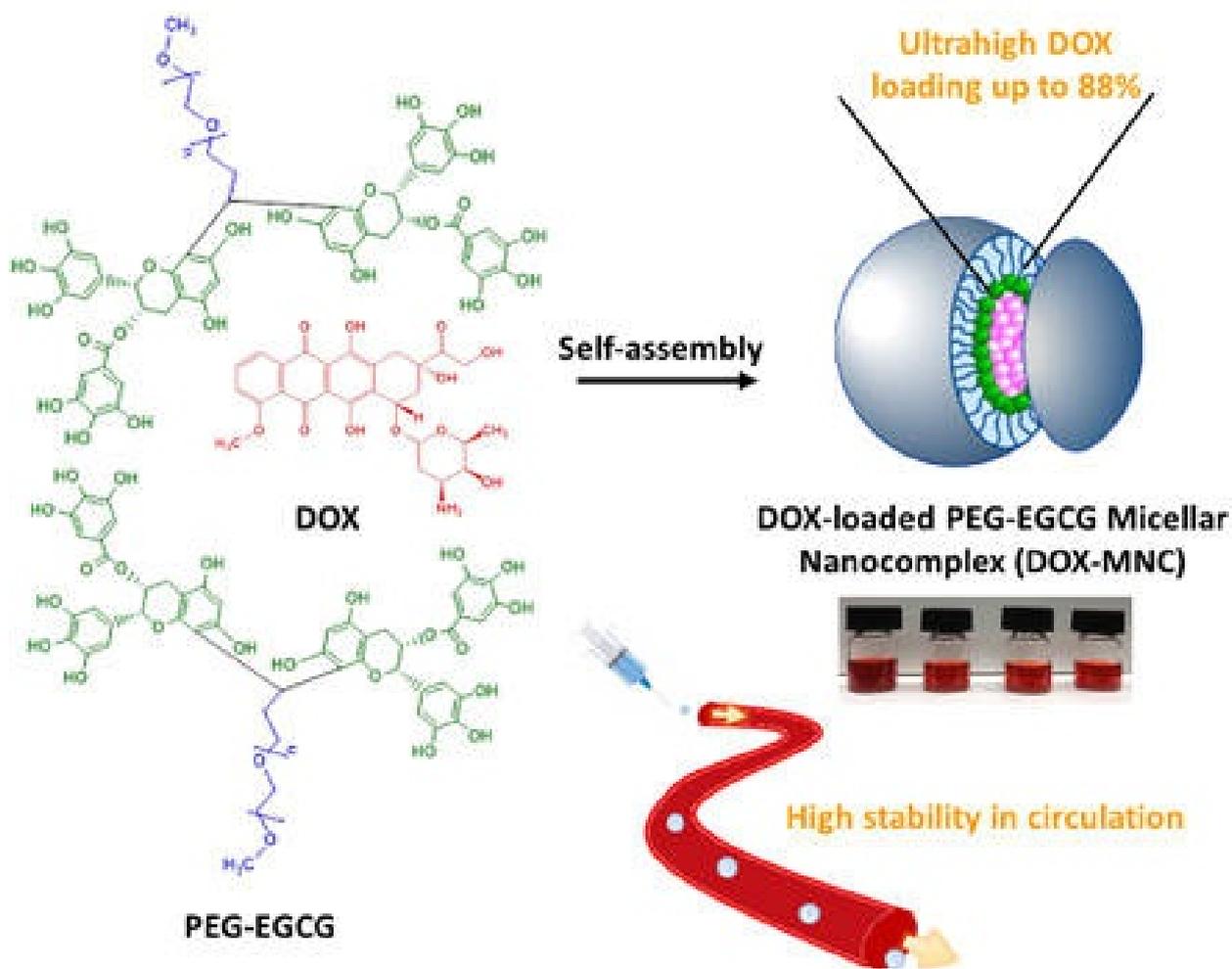
The innovational development was made by the group of scientists, led by Dr Motoichi Kurisawa, from the [Agency for Science, Technology and Research \(A*STAR\)](#).



The research team at IBN that developed the green tea nanocarriers. Clockwise from right: Dr Kun Liang, Dr Motoichi Kurisawa, Dr Joo Eun Chung, Dr Shu Jun Gao and Dr Nunnarpas Yongvongsoontorn source - A*STAR

When creating drug carriers, the ratio between these elements is extremely important, otherwise, the use of high numbers of carriers can cause the toxicity as a result of lower metabolism. There are 2 main barriers to improvement various cancer treatment technologies. The first one is a low drug loading of nanocarriers. These elements have the ability to bring only about **10% of their general weight** in medicament that lead to the negligible therapeutic efficacy and toxic side effects associated with untimely drug action. It is connected to the second barrier of the unstable blood circulation. Standart carrier systems are unstable. They can be easily attenuated in the bloodstream or damaged by proteins. Consequently, it leads to the outflow of the medicament before the nanocarrier reaches the destination, therefore harming healthy cells on the way to a cancer tumour.

In 2014, the scientific group led by Dr Motoichi Kurisaw created **self-gathering nanocarriers from epigallocatechin-3-O-gallate (EGCG)**, which is known antioxidant that was found in **green tea**. Those nanocarriers can load and transfer more medicament to the cancer cells, consequently, killing them more effectively.



Structure of IBN's green tea-drug nanocarrier, which can carry more drugs and are more stable than current drug delivery systems
source - A*STAR

During this investigation, scientists have applied the same technology. They developed a highly stable and ultrahigh drug loading micellar nanocomplexes (MNCs) based on the self-assembly of the anticancer drug doxorubicin (DOX) and a poly(ethylene glycol)–epigallocatechin-3-O-gallate (EGCG) conjugate. The formation of these MNCs is facilitated by strong favorable intermolecular interactions between the structurally similar aromatic EGCG and DOX molecules, which impart exceptionally high drug-loading capability of up to **88%**.

Professor Jackie Ying mentioned that study results showed the versatility and innovation of this green tea-based carrier system. It can be universal deliver mechanism of other therapeutics agents to treat various cancer type. Comparing to 2 clinical formulations of DOX—free DOX and liposomal DOX, which are not effective up to their lethal dosages, these DOX-loaded MNCs show significant tumor growth containment with minimal unwanted toxicity. Consequently, these MNCs can be **a safe and effective method to deliver DOX for cancer therapy**. In other words, this technology is not only effective and safe it is universal due to its possible application.

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Regions: Singapore

Industries: Healthcare, Biotechnology

Source links: [Advanced Materials](#)

[A*STAR](#)



A GENE-EDITING TECHNOLOGY WILL HELP TO STUDY DISEASE-RELATED MUTATIONS

The group of scientists has developed an innovational method to modify a single DNA base in the human genome with absolute precision. The most significant advantage of this technology is that it has the ability to control repair mechanisms of the cell, providing pairs of genetically matched cells for investigating mutations connected with various disease.



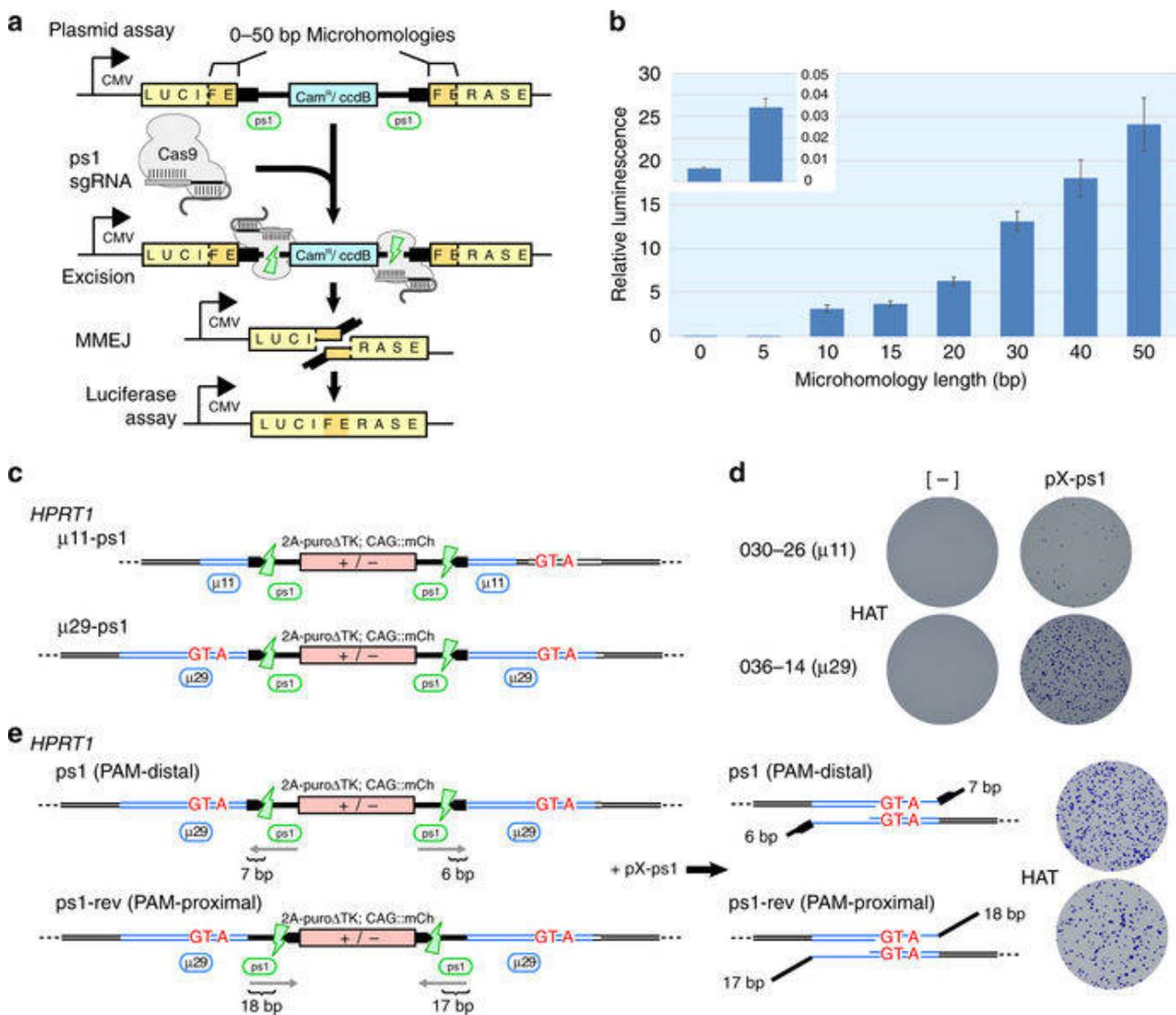
Microhomology-assisted scarless genome editing in human iPSCs
source - clinicalleader.com

The unique development was made by scientists, led by Dr Knut Woltjen, from the [Kyoto University](#).

The single mutation in DNA, which is known as **single nucleotide polymorphisms (SNPs)** is the most frequent kind of variation in the human genome. Scientists identified about **10 million SNPs** and a lot of them are linked to various diseases such as heart disease, Alzheimer's and diabetes. To understand the role of SNPs in genetic diseases development, researchers create induced pluripotent stem cells from patient donors.

Gene-edited induced pluripotent stem cells (iPSCs) supports relevant isogenic human disease models in mutated-genetic or healthy genetic backgrounds. They have the ability to maintain the genetic structure of the donor and can be transformed into any type of cells in the organism. It means that tissue cells from different part of the body can be created, watched and studied in the laboratory, providing safe conditions for testing new treatments for various disease before starting clinical trials. To approve that certain SPN causes some diseases researchers need to compare it with iPS cells, which were genetically matched. Proving that a SNP causes disease requires very strict comparisons

to genetically matched, or isogenic, iPS cells. As the result, scientists developed the method to create isogenic "twins", which are cells whose genomes differ only by one SNP.



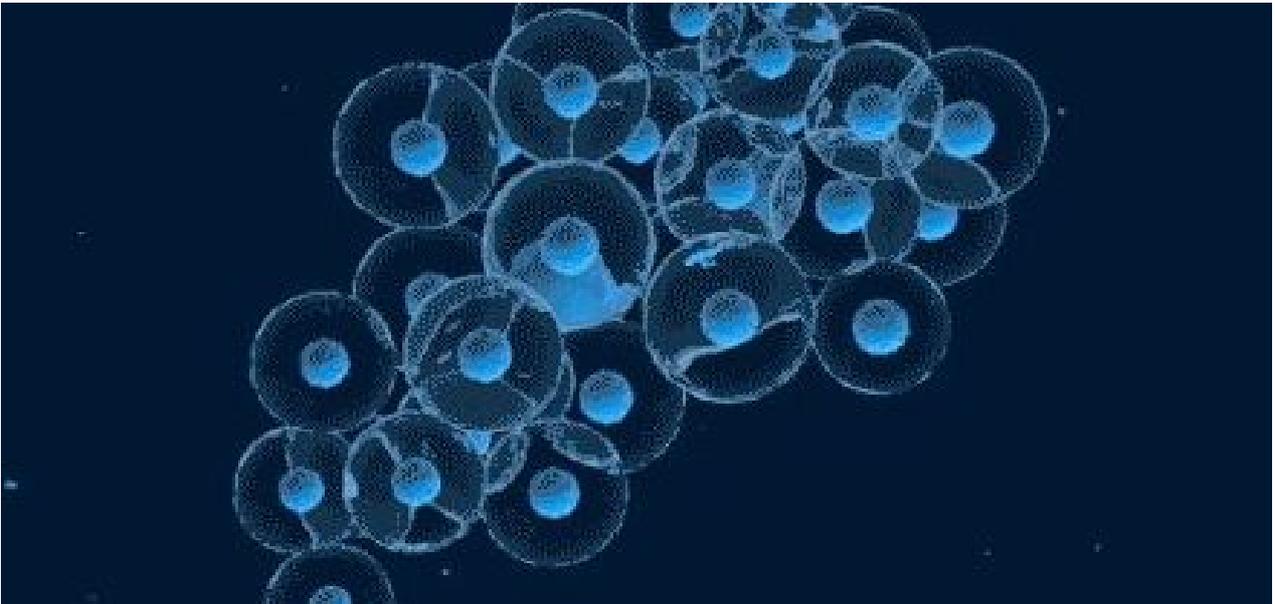
Parameters affecting cassette excision by MMEJ
source - nature.com

This technology scarless selection marker excision using engineered microhomology-mediated end joining (MMEJ). Combining the homology arms of standard donor vectors, short tandem microhomologies are generated flanking the selection marker. To create isogenic twins, they embed the SNP modification along with a fluorescent reporter gene that can identify modified cells. Using standard donor vector design where a point mutation is juxtaposed with a positive selection marker, the team go on to engineer μH that flank the marker through a PCR-generated overlap in the left and right homology arms. After positive selection for gene targeting, they introduce DSBs using validated and standardized CRISPR-Cas9 protospacers nested between the selection marker and μH, stimulating the cell to employ MMEJ for scarless excision, leaving behind only the designer

point mutation at the locus.

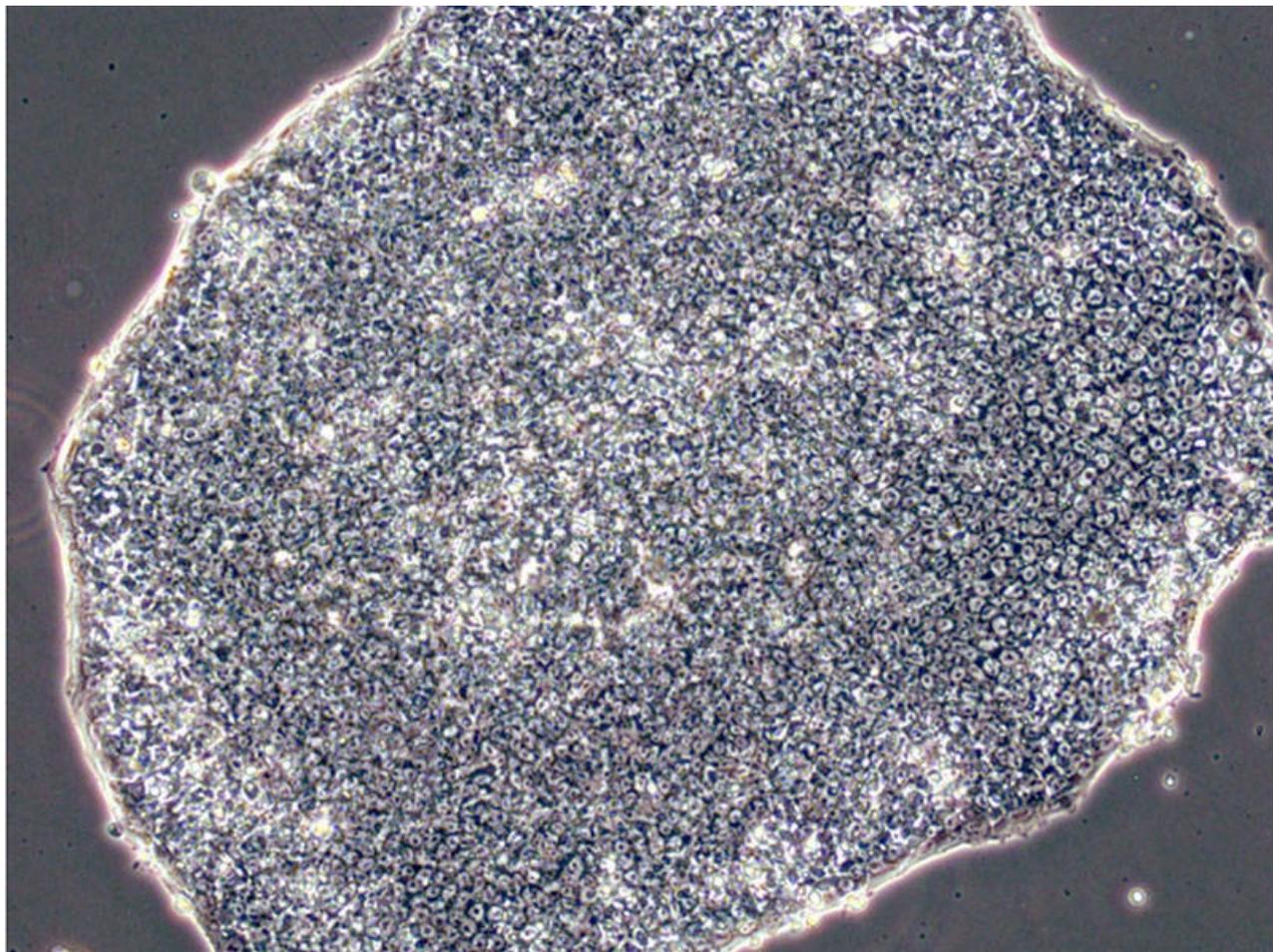
[Woltjen laboratory](#) has already begun [applying this technology to the creation and editing of SNPs in genes connected with diseases](#). Cooperating with researchers from Japan and Canada, they are studying the genetic reason for severe diabetes in young patients.

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Patent status: -
On market since: -
Regions: Japan
Industries: Healthcare
Source links: [Nature Communications](#)
[Kyoto University](#)



A COST-EFFECTIVE TECHNOLOGY OF STEM CELLS GROWING

Scientists have managed to grow human pluripotent stem cells (hPSCs) in the special culture medium, which was made using 3 chemical components. The culture medium has the ability to provide the generation and long-term propagation of hPSCs. Scientists note that this novel technology can promote the large-scale, high-quality and cheap applying of hPSC for medical purposes.



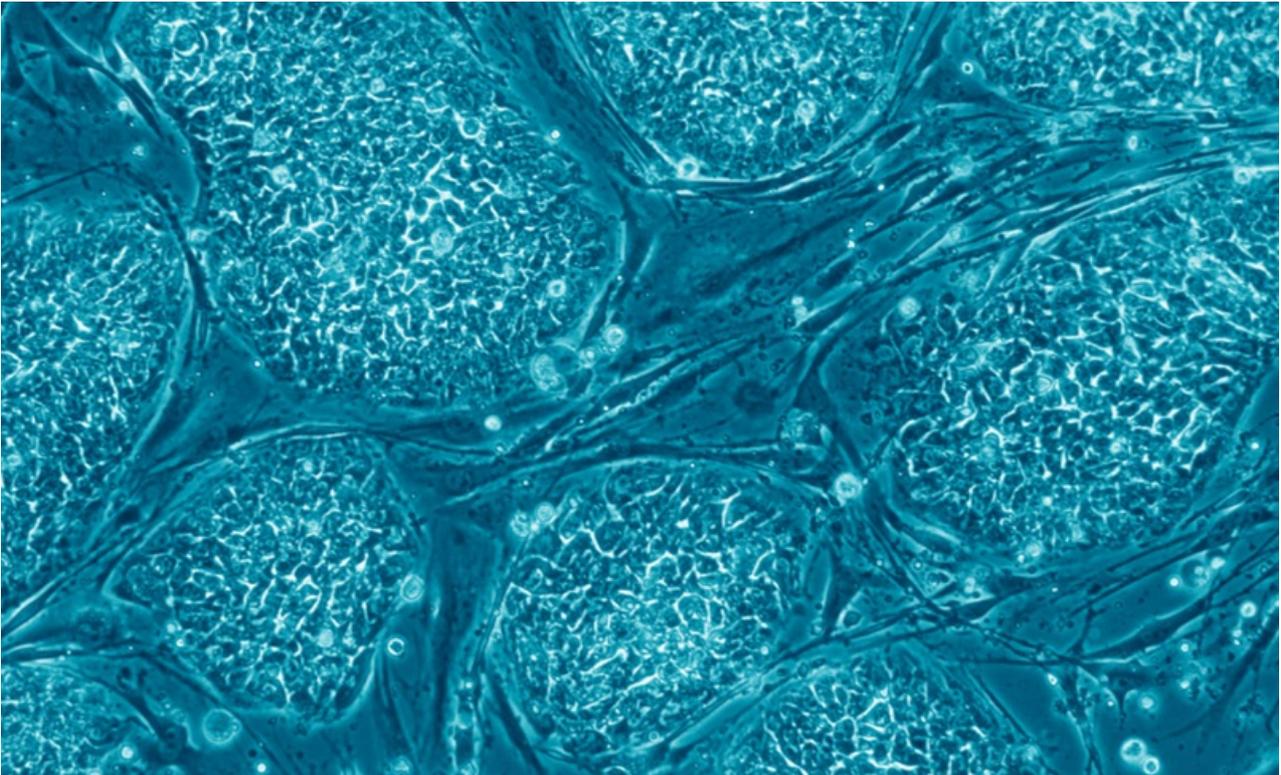
A human embryonic stem cell colony cultured in the newly developed medium
source - kyoto-u.ac.jp

Researchers from [Kyoto University](https://www.kyoto-u.ac.jp/) cooperating with colleagues from Iran and India had developed the culture medium to grow human pluripotent stem cells.

The most significant advance of this type of stem cells is that hPSCs, which involve human embryonic stem cells (hESCs) and human induced pluripotent stem cells (hiPSCs), have **the capacity to self-recover in culture while keeping the ability to become almost any kind of cell in the organism**. It makes them important for organ regeneration and replacement. Despite this fact, growing them in large amounts for clinical and medical purposes can be very expensive. The extensive and practical generation of hPSCs for use in the cell therapy and drug development needs a chemically determined xenobiotic-free culture system. To create such a system, scientists need to reduce costs, which are connected with recombinant proteins using as supplements in basal culture media.

Modern technologies of culture medium development require to include components that can support hPSC self-renovation while preventing them from modifying into other types of

cells. The growth factors, which are received from this components, can be obtained in bacteria or animal cells. This process is expensive. Consequently, scientists developed a growth-factor-free culture medium, which uses **3 chemical compounds** and a lower amount of recombinant proteins that are used in commercially available technologies of the medium cultivating. **The new culture medium is capable to establish the long-term regeneration of hPSCs without the use of expensive growth factors.**



The title of the study is 'Chemically defined and growth-factor-free culture system for the expansion and derivation of human pluripotent stem cells'
source - brownpoliticalreview.org

Dr Kouichi Hasegawa and the scientific team has developed the 'AKIT' culture using 3 chemical compounds: **1-azakenpauillone (AK)**, **ID-8 (I)**, and **tacrolimus (T)**. The first one has the ability to maintain hPSC self-renovation but it can be differentiated into other cells. To counter this process, researchers added ID-8. Despite this fact, this compound can cause the partial cell growth suppression. To avoid it, they add tacrolimus.

hPSCs, which were developing in this medium, were less dependent on glycolytic pathways than cells grown in the environment including growth factors. Furthermore, the medium causes the generation of induced PSCs, which were received from human dermal fibroblasts or peripheral blood mononuclear cells.

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On market since: -
Regions: Japan, India, Others
Industries: Healthcare, Biotechnology
Source links: [Nature Biomedical Engineering](#)
[Kyoto University](#)



FISH SCALES CAN HELP TO HEAL WOUNDS

The group of scientists have discovered that collagen obtained from scales of fish has the ability to effectively heal wounds. They modified this collagen and now it can provide the formation of blood and lymphatic vessels, due to which the regeneration of tissue occurs. Moreover, such collagen can not only restore tissues but also deliver medications that intensify healing. It considerably expands the use of this development in the field of medicines.

The innovative development was made by the scientific group from the [Nanyang Technological University](#).

Collagen is the main component of connective tissue, which plays a key role in providing structural protection of cells, tissues, organs. Collagen is the most common protein in mammals. Asst. Prof. Cleo Choong, Asst. Prof. Andrew Tan in cooperation with Asst. Prof. Véronique Angeli from the [NUS](#) have determined that **collagen from the fish scales, which was changed, causes the blood and lymphatic vessel development, thus leading tissue regeneration.**

Furthermore, it has excellent biocompatibility, low antigenicity and is able to biodegrade into physiologically non-toxic products. Thus, this type of protein can be widely used in tissue engineering either on its own, or in combination with other biomaterials as hybrid materials for the fabrication of porous scaffolds for bone graft, skin substitute, drug delivery, wound dressings and artificial blood vessels.

The team has developed the water-soluble collagen from the fish scales, that provides the possible use of this collagen combining with drugs. However, **collagen can deliver medications that exacerbate wound healing.** Despite this factor, the primitive collagen can dissolve in the acidic environment that damages the drug. Therefore, they decided to modify it, which would provide an opportunity to manufacture wound dressings with higher healing potential.

The number of lymphatic vessels was found to be more abundant around collagen patches with methylation modification and BDE crosslinking. The team showed the possible applying of fish scale-derived collagen as a promising scaffolding material for various biomedical purposes.

The source of natural collagen can be large mammals such as cows, horses. Comparing to other sources, the source of collagen, which was not taken from mammals, led to endothelialised surfaces with higher expression levels of Type IV collagen by HUVECs and comparable anti-thrombogenic properties, thus making them more suitable candidates for blood contacting applications. In addition, the low expression levels of ICAM-1 and VCAM-1, which are leukocyte adhesion marker, indicated that these **non-mammalian sources of collagen did not elicit pro-inflammatory phenotypes in the cells.**



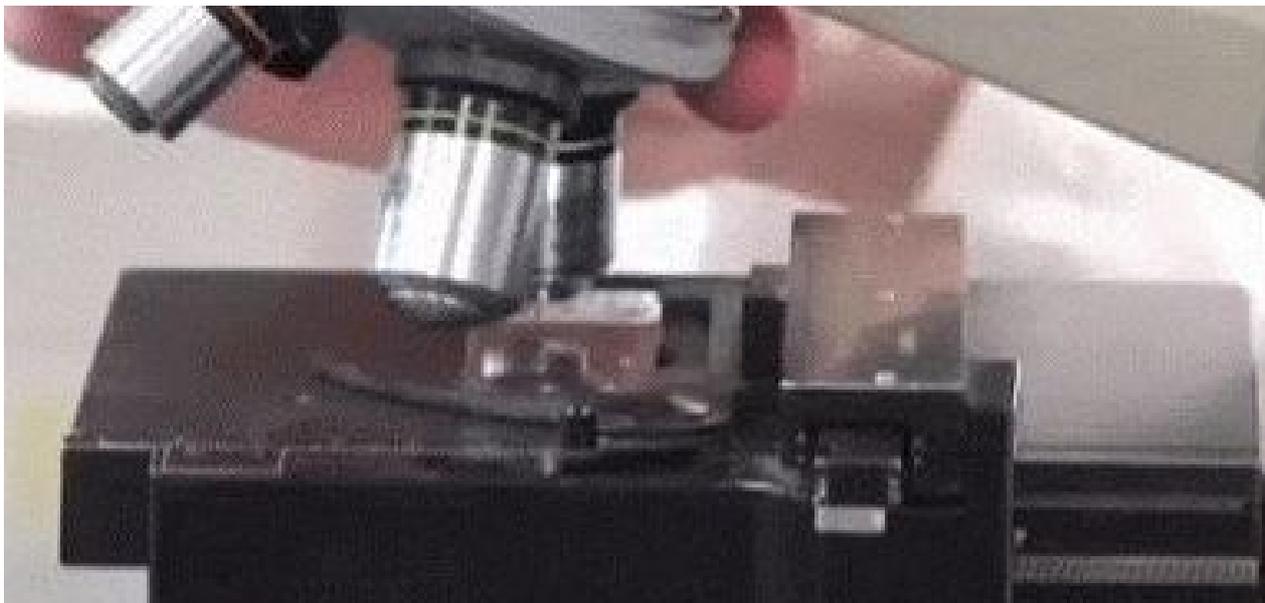
From left: Associate Professor Andrew Tan, research fellow Dr Wang Jun Kit and Assistant Professor Cleo Choong
source - ntu.edu

However, the use of mammals has a number of ethical, cultural and religious barriers, which leads to restrictions of commercialization processes. Fish scales are usually thrown away, making this material more accessible than cows used in agriculture. Furthermore, **200 milligrams (mg) of collagen can be received from 10 grams of scales** that can be received from **1 or 2 fish**. It makes this technology ideal for medical purposes, due to its affordability and efficiency.



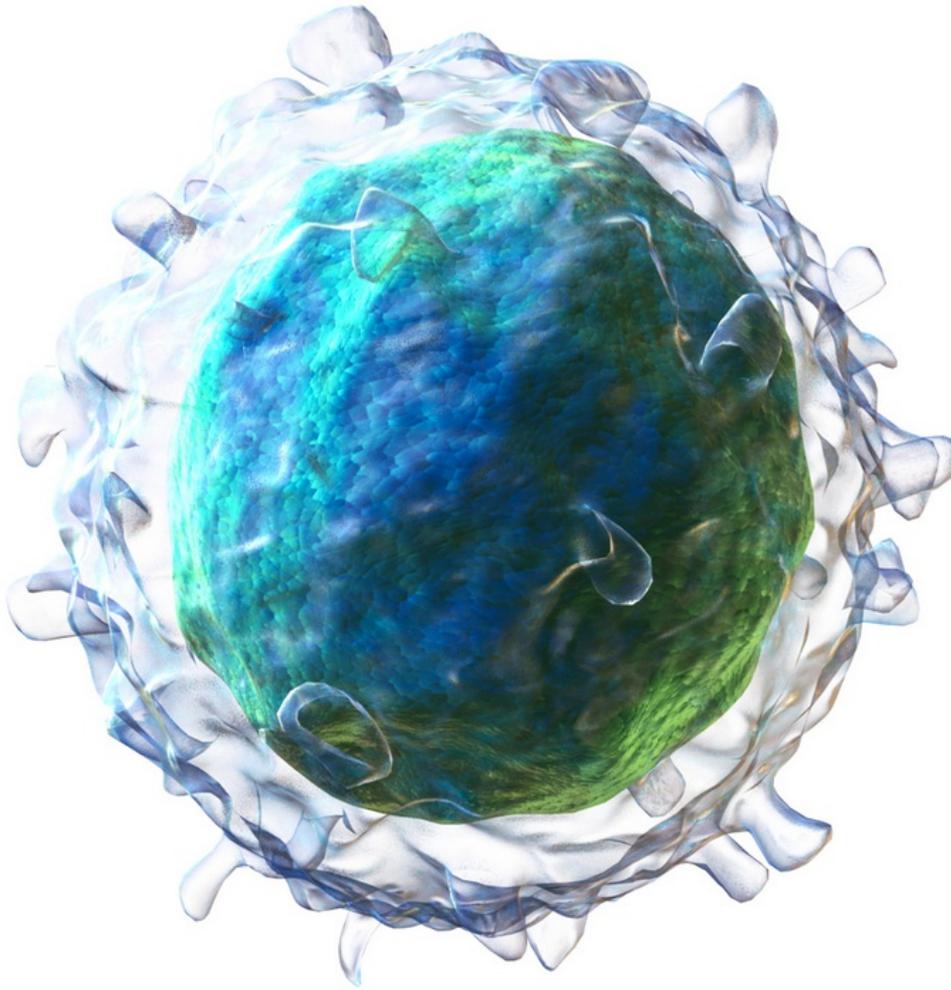
NTU Singapore scientists found that collagen (in right petri dish) processed from snakehead fish scales has potential for biomedical applications
source - biotechn.asia

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On market since: -
Regions: Singapore
Industries: Healthcare, Biotechnology
Source links: [PubMed](#)
[Nanyang Technological University](#)
[Journal of Materials Science: Materials in Medicine](#)



B IMMUNE CELLS CAN HELP TO TREAT NEUROLOGICAL DISORDERS

Different neurological disorders are connected with the inability of myelin to properly surround axons during development. Scientists have discovered that B immune cells (B-1a cells) provide the oligodendrocyte proliferation and neuron myelination. Therefore, this innovational discovery can be used for developing treatments for diseases driven by early defects in neuronal growth.



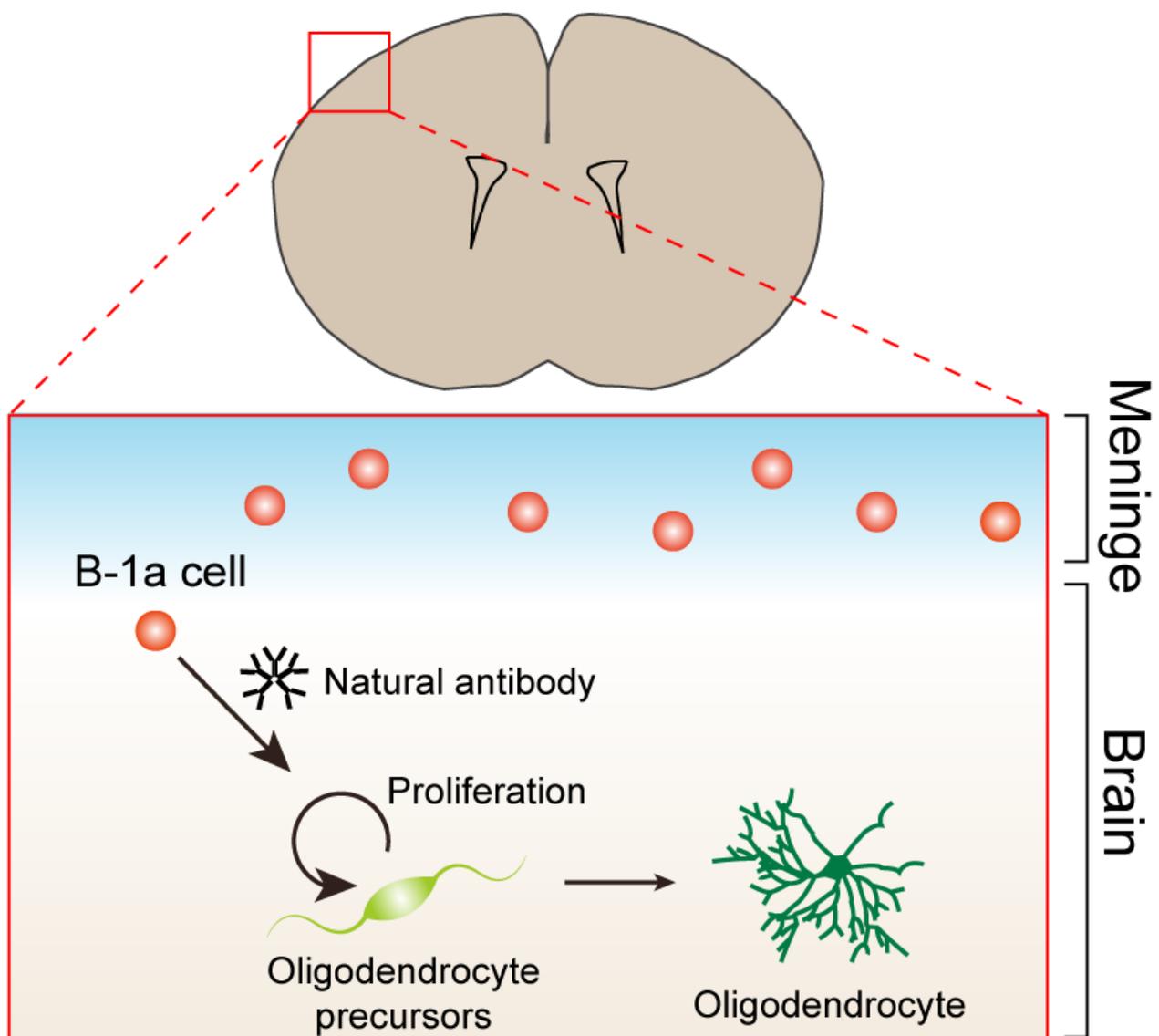
B-1a lymphocytes promote oligodendrogenesis during brain development
source - Wikipedia

The main characteristic of neurons is the capacity to be activated under the influence of an electrical signal. The information is transmitted using the axon, which is appropriate for conducting nerve electrical signals. The capacity to conduct these signals requires myelin, an adipose substance that encompasses axons as the plastic cover envelops an electrical wire.

Various neurological disorders such as autism and schizophrenia are connected with the inability of myelin to encompass axons during their development. The group of scientists from the [Osaka University](#) have managed to approve that immune cells play an essential role in providing myelin to form around neurons.

During brain development, the immune system interposes neurogenesis, gliogenesis and synapse formation. Scientists managed to detect the subtypes of lymphocytes in the neonatal mouse brains. T and B cells are the important elements of the functioning of the

immune system. They act on the humoral immunity component of the adaptive immune system by using the method of secreting antibodies. In other words, it circulates through the body, detects infectious agents, and activates the protective response.

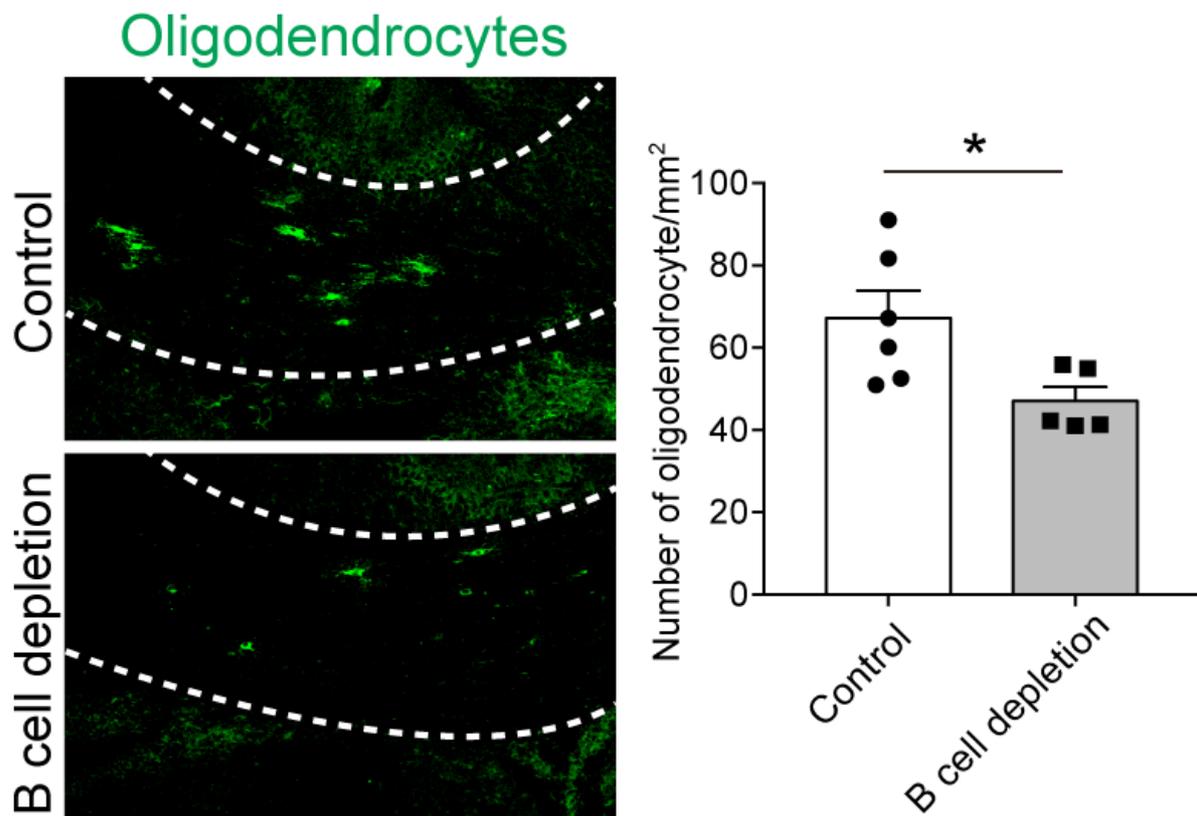


B-1a cells in meningeal space secrete natural antibodies, which promote the proliferation of oligodendrocyte precursors

source - osaka-u.ac.jp

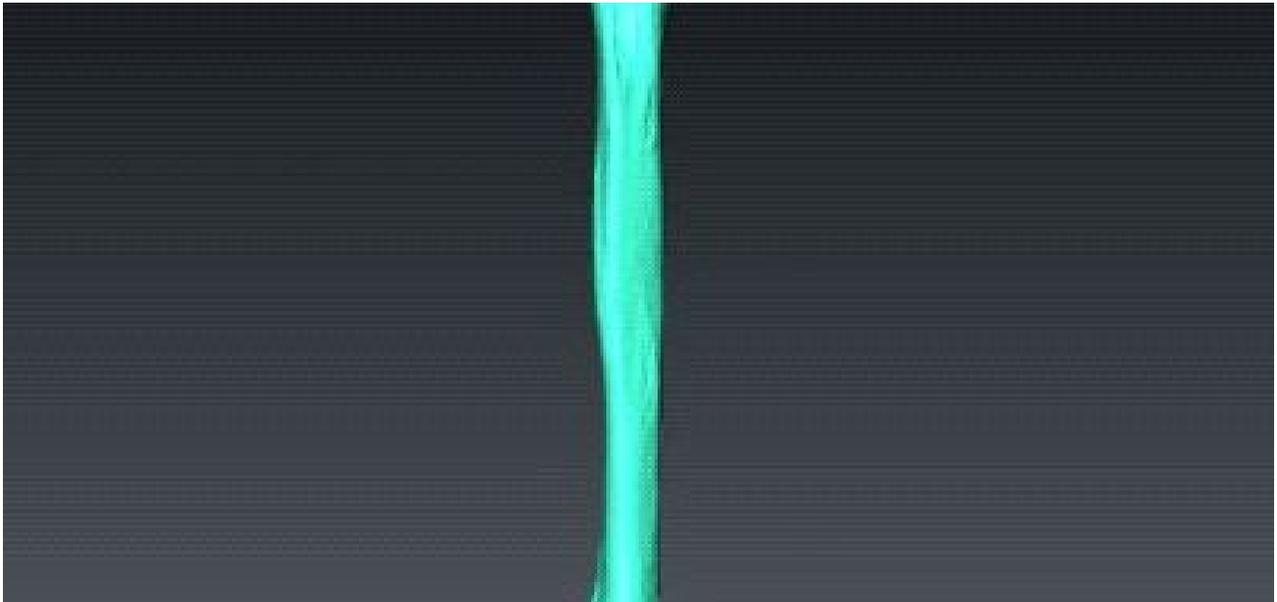
The researcher's team have discovered a big amount of **B-1a cells** in the neonatal mouse brain and infiltrated into the brain in a **CXCL13–CXCR5-dependent manner**. Assistant Professor Shogo Tanabe mentioned that usually believed that the barrier, which protects the central nervous system from pathogens, eliminates immune cells from the brain. Despite this fact, the group has found a big amount of the particular type of B cell in the ventricles, meninges, and choroid plexus in the brains of young mice. Furthermore, these cells have the capacity stimulate axon myelination in the surrounding neurons.

Neurons can generate own myelin. Moreover, oligodendrocytes cells provide the myelin sheath forming, which are wrapped around axons. B-1a cells ensure the appropriate quantity of oligodendrocytes in the developing brain to generate myelination. Professor Toshihide Yamashita mentioned that B cell dysfunction in early brain development can lead to later mental disorders. This novel discovery can be used for treatment creating for diseases driven by early defects in neuronal growth.



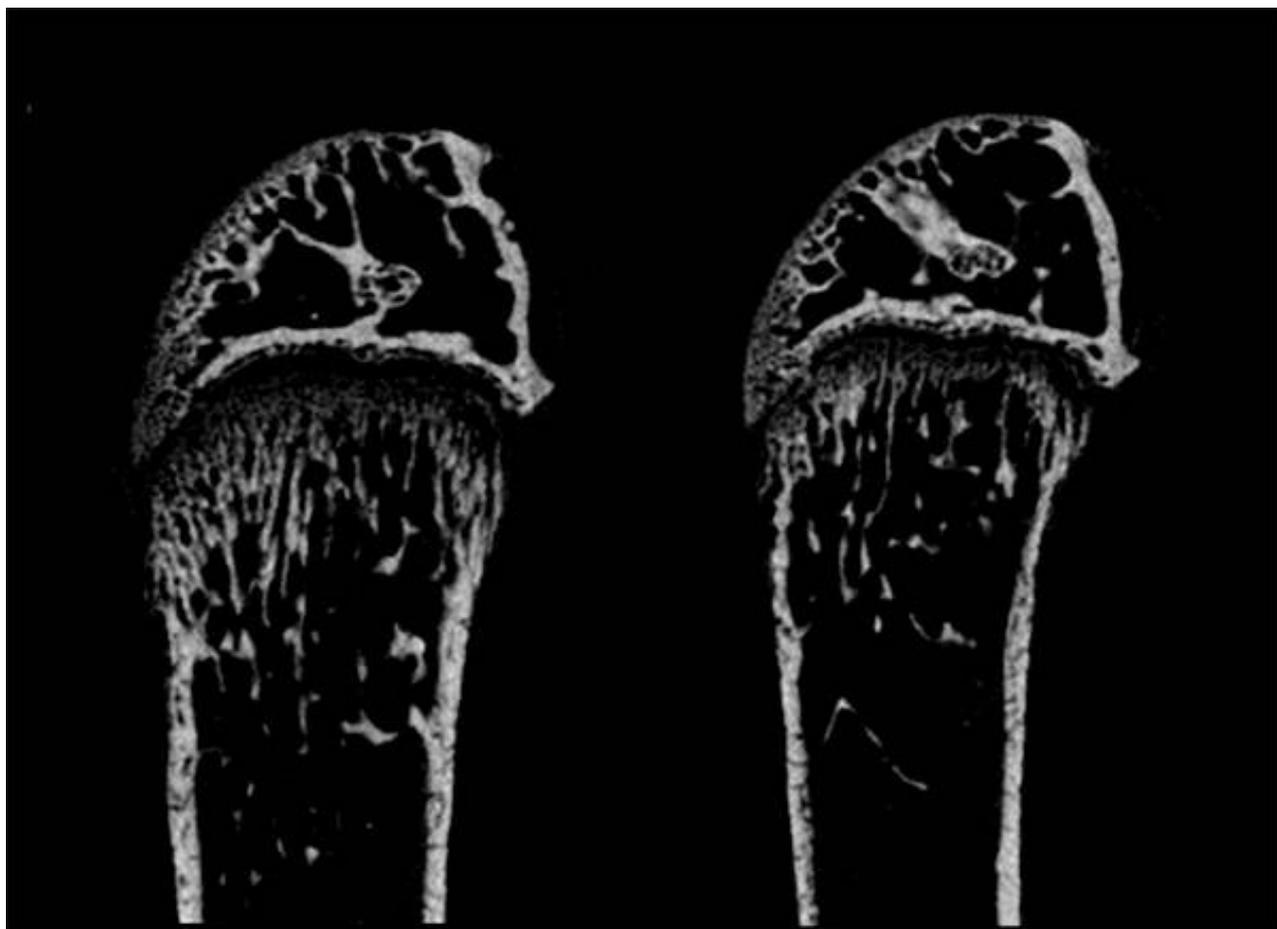
The group depleted B cells from developing brain and counted the number of oligodendrocyte source - osaka-u.ac.jp

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On market since: -
Regions: Japan
Industries: Biotechnology
Source links: [Nature Neuroscience](#)
[Osaka University](#)



A NEW METHOD TO TREAT ARTHRODENTOOSTEODYSPLASIA

The scientific group managed to develop a treatment for a rare bone loss disorder that also can help to create a therapy for ageing brittle bones. They defined that the inability of FBW7 protein to bind to NOTCH2 proteins leads to the development such a disease as Hajdu–Cheney syndrome or arthrodentoosteodysplasia.

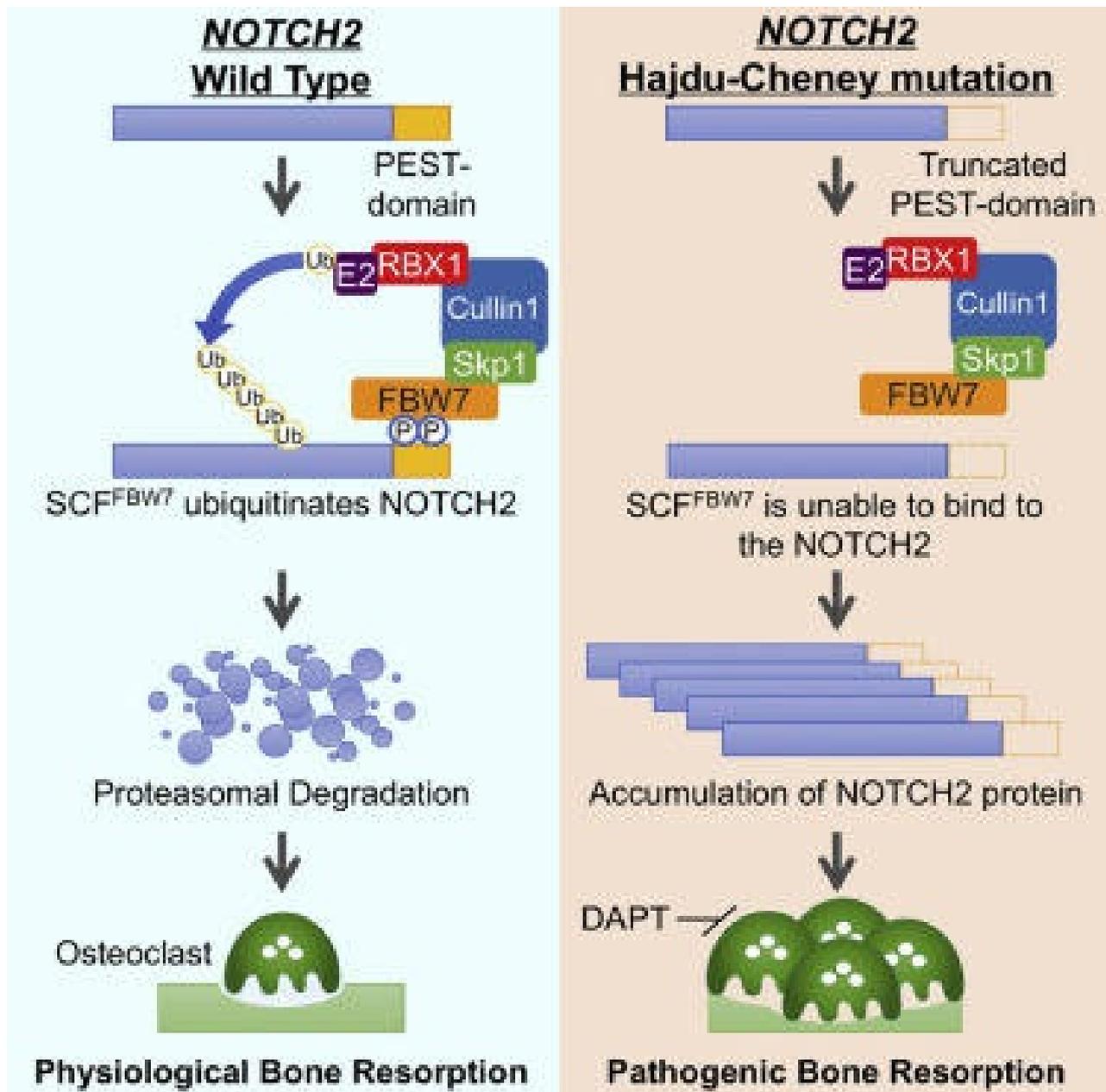


A computed tomography image shows more bone breakdown of a mouse with Fbw7 gene knocked out similar to people with Hajdu-Cheney syndrome (right) compared to control mice (left)
source - tohoku.ac.jp

The innovational discovery was made by the researcher's group, led by Associate Professor Hiroyuki Inuzuka, from the [Tohoku University](https://www.tohoku.ac.jp/).

Hajdu-Cheney syndrome (HCS) is a rare autosomal dominant skeletal disorder. It causes the hard osteoporosis and various defects such as the reabsorption of bones in the hands and legs, arching of long bones and spinal anomalies. Patients have focal bone fractures, including acroosteolysis and osteoporosis. Molecular-genetic cause of the disease is the mutation of the **gene NOTCH2 that codes proteins, which are involved in bone generation**. It has the ability to encode a contact transmembrane protein that belongs to NOTCH proteins. The activation of the signalling pathway occurs through intercellular interaction. The NOTCH2 proteins regulate destruction and construction necessary for bone maintenance and repair. The binding of the ligands causes the splitting of the NOTCH and its further translocation from the intracellular domain into the nucleus where it regulates the function of the gene and transcriptional co-factors.

The aberrant NOTCH2 signalling and consequent osteoclast hyperactivity are connected to the bone-related disorder pathogenesis. Despite this fact, the molecular mechanisms are unclear. Scientists showed that continued osteoclast activity mostly depends on the accumulation of NOTCH2 carrying a truncated C terminus that escapes FBW7-mediated ubiquitination and degradation.



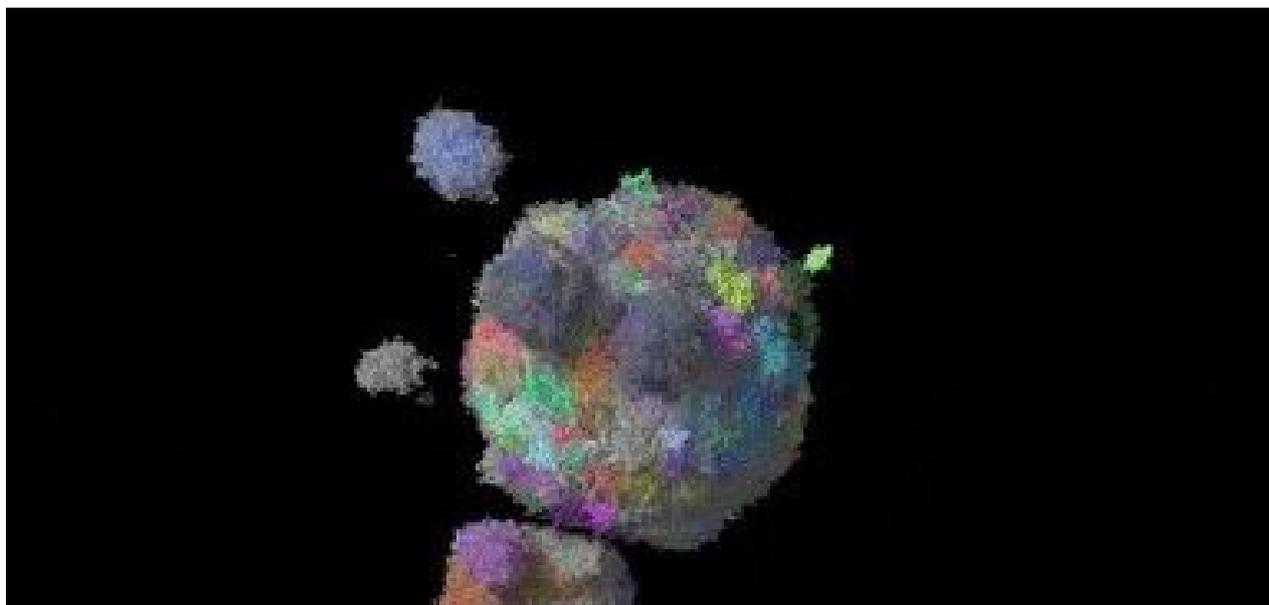
NOTCH2 Hajdu-Cheney mutants escape FBW7-mediated ubiquitination and proteolysis. Elevated NOTCH2 and osteoclast activities in the peripheral blood of HCS patients
source - cell.com

The team determined that the NOTCH2 mutation does not have the standard NOTCH2 protein amount. **The FBW7 protein binds to NOTCH2 proteins.** Scientists exempt the gene from the bones of mice and determined that **FBW7 regulates bones generating and**

repairing system. The mice without this protein had severe osteoporosis as patients with HCS. Furthermore, they found that in humans with arthroosteodysplasia, the FBW7 protein was incapable to bind to NOTCH2 proteins due to the absence of the binding spot in osteoclasts. In other words, this phenomenon provides the over-operate of osteoclasts that leads to the splitting up of the bone tissue.

Mice with osteoclast-specific Fbw7 ablation revealed osteoporotic phenotypes reminiscent of HCS, due to elevated Notch2 signaling. The administration of Notch inhibitors in Fbw7 conditional knockout mice alleviated progressive bone resorption. Scientists made various treatments such a chemical drug, which is called DAPT that was especially effective. It means that researchers managed to define potential therapeutic targets for patients with this disease.

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Regions: Japan
Industries: Healthcare, Biotechnology
Source links: [Molecular Cell](#)
[Tohoku University](#)



THE INNOVATIONAL DRUG FOR BLOOD CANCER PATIENTS WAS APPROVED

A novel medicine, which has the ability to increase the length of time myeloma patients, can act without worsening their condition. Carfilzomib drug increases the length of time during the process of treatment of myeloma patients from 9 months to 18.7 months. Scientists noted that this drug has a big potential compared to the standard treatment due to the body's resistance.



Professor Chng Wee Joo with Madam Oh Hwee Hong, 64, a retired library officer, who was diagnosed with myeloma in 2015. The NUCI has seen a spike in new myeloma cases here, with 39 patients diagnosed source - straittimes.com

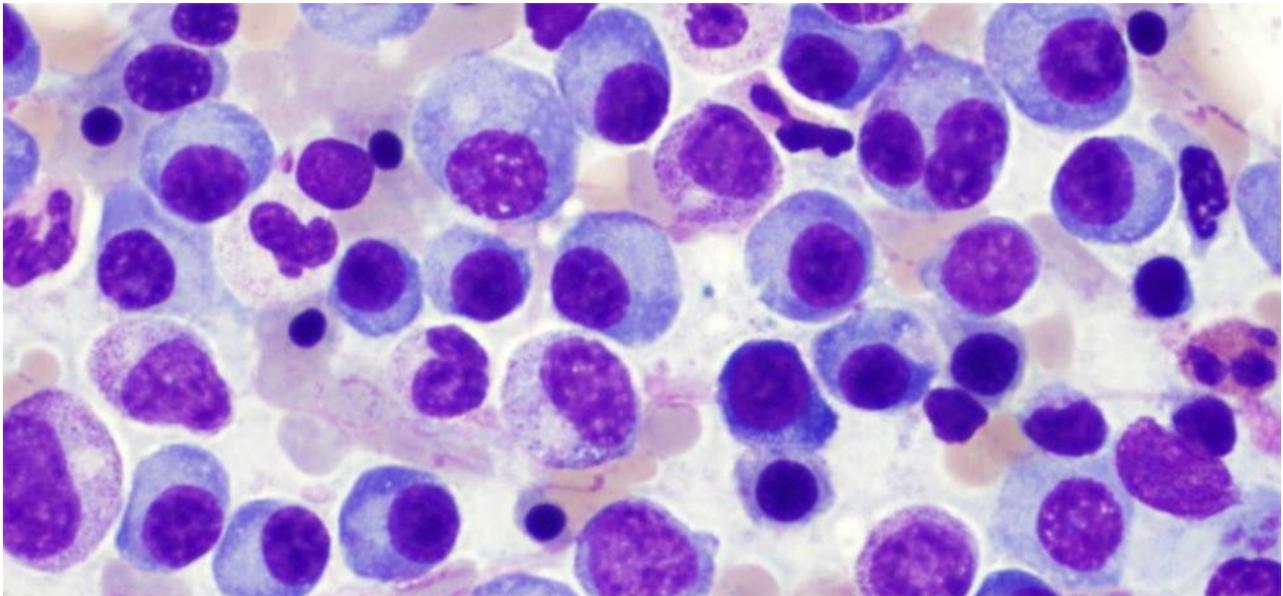
This innovative development was made by the group of scientists from the [National University Cancer Institute](#),

Multiple myeloma (MM) is a debilitating malignancy that is part of a spectrum of diseases ranging from monoclonal gammopathy of unknown significance (MGUS) to plasma cell leukaemia. The disease of the blood system, which is related to paraproteinemic leukaemia, is called due to its primary localization of the process in the bone marrow. It is an almost incurable type of cancer. Usually, patients with this type of cancer live from **8 up to 10 years** upon diagnosis.

Carfilzomib drug provides stable treatment, increase the life expectancy at which there is no progression of the disease.

Professor Chng Wee Joo mentioned that the approving of the Carfilzomib is a forehanded, as there were increasing the number of cases of myeloma diagnosis according to the [National University Cancer Institute, Singapore \(NCIS\)](#). Accordingly, there were diagnosed

39 patients in 2017 in Singapore. It means that amount of patients increased up to 80% comparing to 2012. Professor also mentioned that about 10% of all myeloma patients can be cured. But they are exceptions.



Symptoms include bone pain, kidney failure and anaemia
source - Science News Journal

Carfilzomib drug has the capacity to increase the length of time from 9 months up to 18,7 months. The important advantage is that this innovational drug is effective compared to the modern methods of treatment. Human organisms get used to most therapies and stop responding effectively.

Moreover, 4 out of 10 patients with this disease have a recession due to the habituation of the body to the treatment, which leads to the fact that people spend a lot of money on treatment, up to \$2,000 a week. Each vial of carfilzomib will cost about \$1,100 for subsidised patients and \$2,200 for private patients at different hospitals. The price will depend on the patient's height and weight. Moreover, NCIS's scientists conduct a trial with carfilzomib and 2 other medicines in order to create a more affordable alternative to the current methods of myeloma therapies.



It is a national specialist centre under the National University Health System (NUHS). It is the only public cancer centre in Singapore treating both paediatric and adult cancers in one facility
source - yelp.com.sg

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Patent status: -

On market since: -

Regions: Singapore

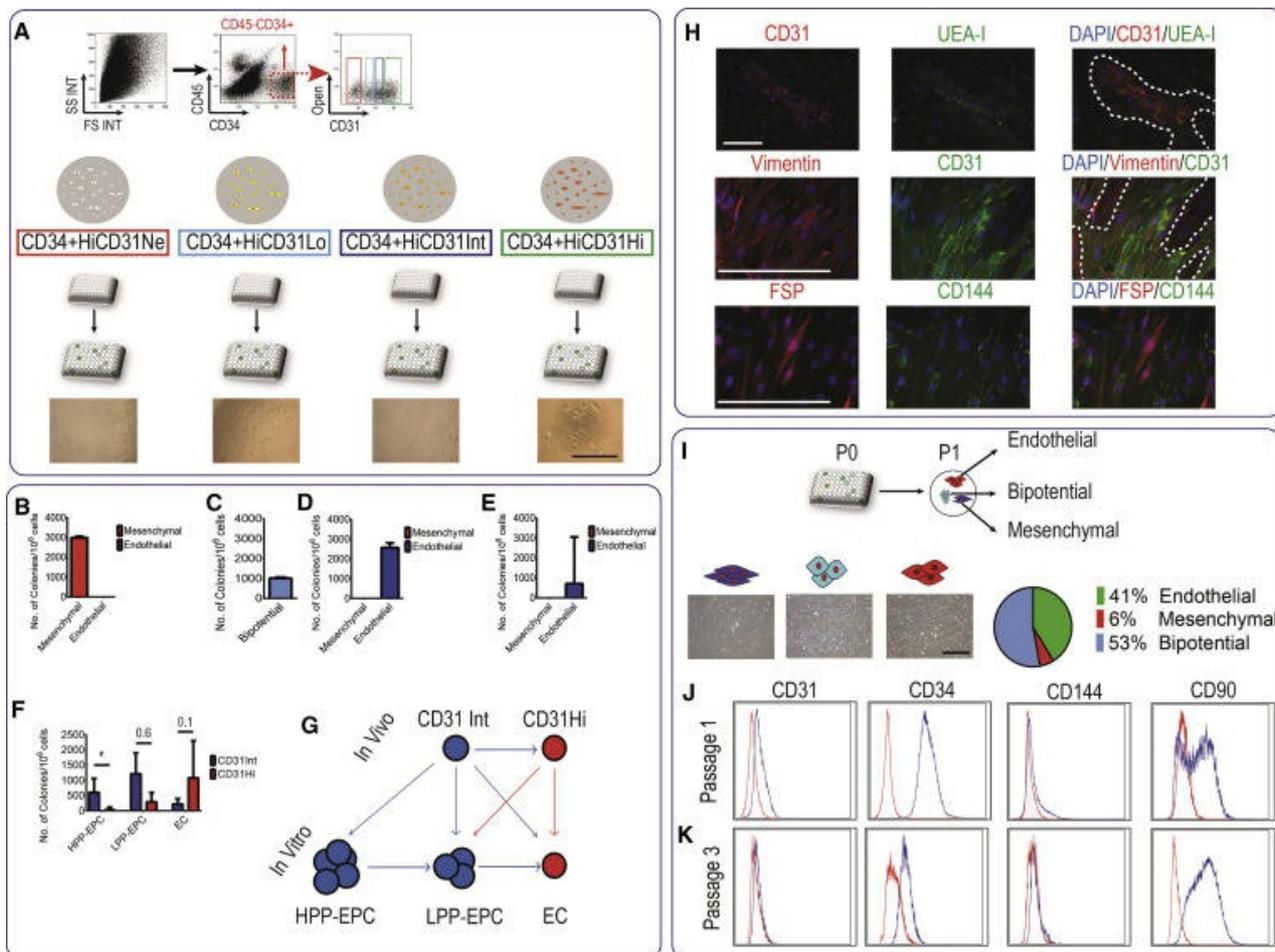
Industries: Healthcare, Biotechnology

Source links: [The Straits Times](#)



RECENTLY IDENTIFIED STEM CELLS CAN PERFORM A DUAL FUNCTION

A new type of stem cell, which has the capacity to perform two functions at the same time, was discovered by scientists from Australia. These stem cells in the placenta can produce tissues with blood vessels. Furthermore, this discovery will provide the development of effective treatment and cure for many diseases such as pulmonary fibrosis and heart disease.



Bipotential Capacity of CD45–CD34+ CD31Lo Cells in Limiting Dilution Assay. Meso-endothelial progenitor gives rise to both endothelial and mesenchymal cells
 source - cell.com

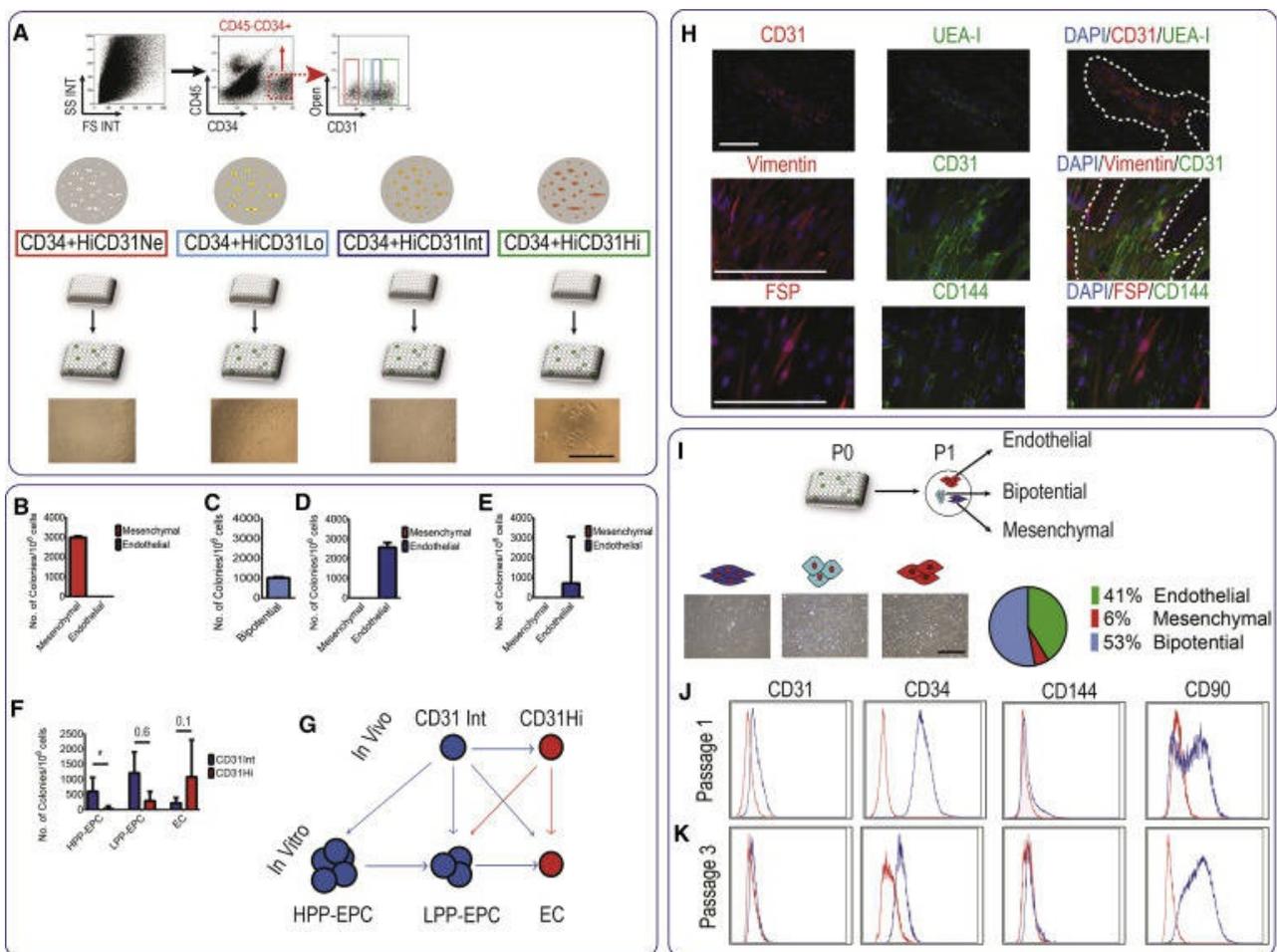
Meso-Endothelial stem cells were discovered by the researcher's team from the [University of Queensland](#). These cells have the capability to generate 2 kinds of cell and, consequently, one cell can perform 2 functions.

Scientists made a hypothesis that bipotential precursors for both mesenchymal and endothelial stem/progenitor cells are present in the human term placenta.

They showed that human **endothelial colony-forming cells (ECFCs)** can be isolated from the term placenta. The vascularization of the human placenta from mesodermal precursors gives a unique opportunity to characterize the human mesoangioblast phenotype. The meso-endothelial bipotent progenitors EC capable to giving rise to both endothelial and mesenchymal progeny. Characterization of this progenitor distinguishes it from both mesenchymal (MSCs) and endothelial progenitors (ECFCs) at the functional and molecular level.

In other words, it shows a bipotent progenitor phenotype in the human placenta at the cellular and molecular levels, giving rise of endothelial and mesenchymal cells ex vivo. Dr. Abbas Shafiee mentioned that the capacity to generate 2 duties in one cell. It means that they can be used to reconstruct and regenerate human's cell and damaged tissue.

These stem cells are linked to endothelial cells that are usually used for blood vessels creation. The most significant advantage of this development is that it can provide the inventions of various therapeutic procedures to treat the disorder of Musculoskeletal System and neurodegenerative diseases.



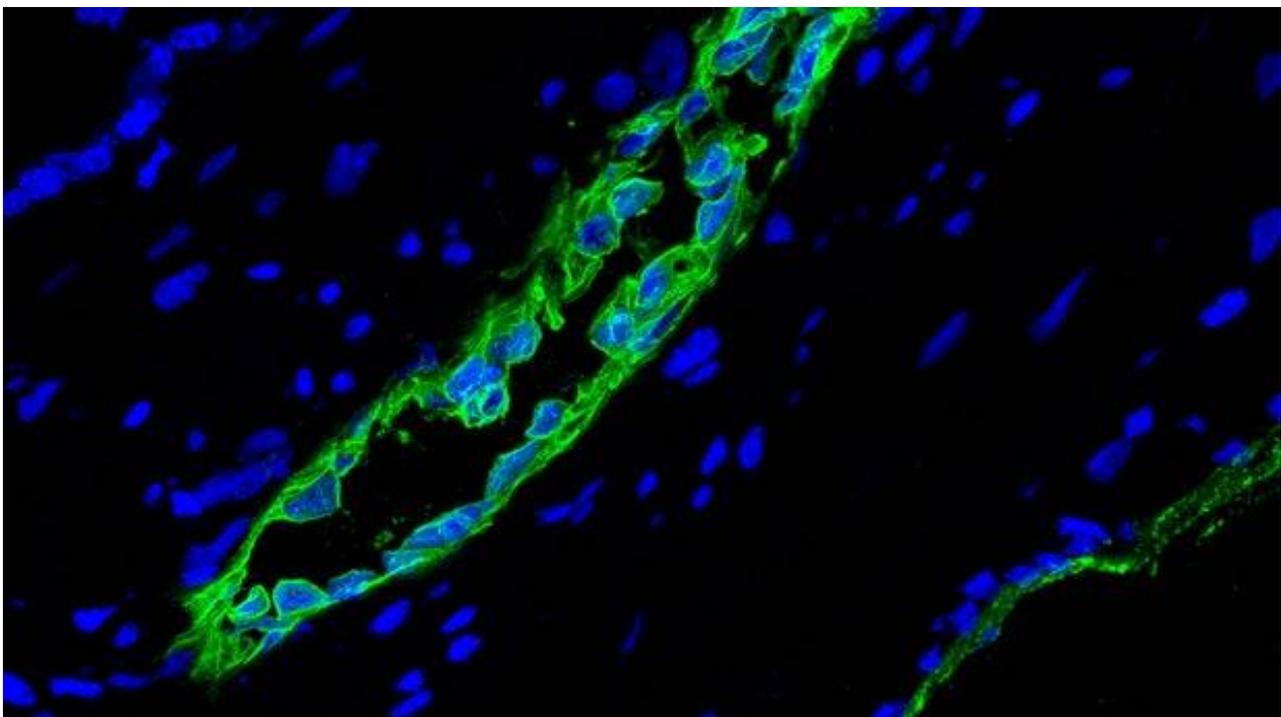
Bipotent Capacity of CD45–CD34+ CD31Lo Cells in Limiting Dilution Assay. Meso-endothelial progenitor gives rise to both endothelial and mesenchymal cells
 source - cell.com

To enrich for EPCs or bipotent cells with endothelial potential, researchers next characterized term placental cells according to well-established endothelial (CD31 and CD34) and hematopoietic (CD45) surface markers. Unsorted placental cells consisted mostly of hematopoietic (CD45+) cells and comprised a small CD34+ fraction. Endothelial

cells, which were isolated, had significant heterogeneity in their capacity to generate colonies. This can suggest a hierarchy in self-renewal among endothelial cells within the CD45-CD34+ cells. Accordingly, the CD31^{int} population that could form HPP-ECFC may be considered as the progenitor of CD31^{hi} cells in vivo that only formed non-proliferating endothelial clusters. This demonstrates a hierarchy among endothelial cells in vivo, recapitulating similar findings in mice.

Dr Shafiee said this regenerative process was the key to taking the next step in stem cell treatment, but more research was needed to better understand the biology of placental stem cells. Furthermore, these meso-endothelial bipotent progenitors were closely associated with the vasculature. This cells phenotypes **can be applied in regenerative medicine for vessel creating**.

Assoc. Prof. Kiarash Khosrotehrani mentioned that this innovational discovery will give the capacity to develop a productive treatment for numerous diseases. This tremendous research has been supported by [National Health and Medical Research Council](#) funding.



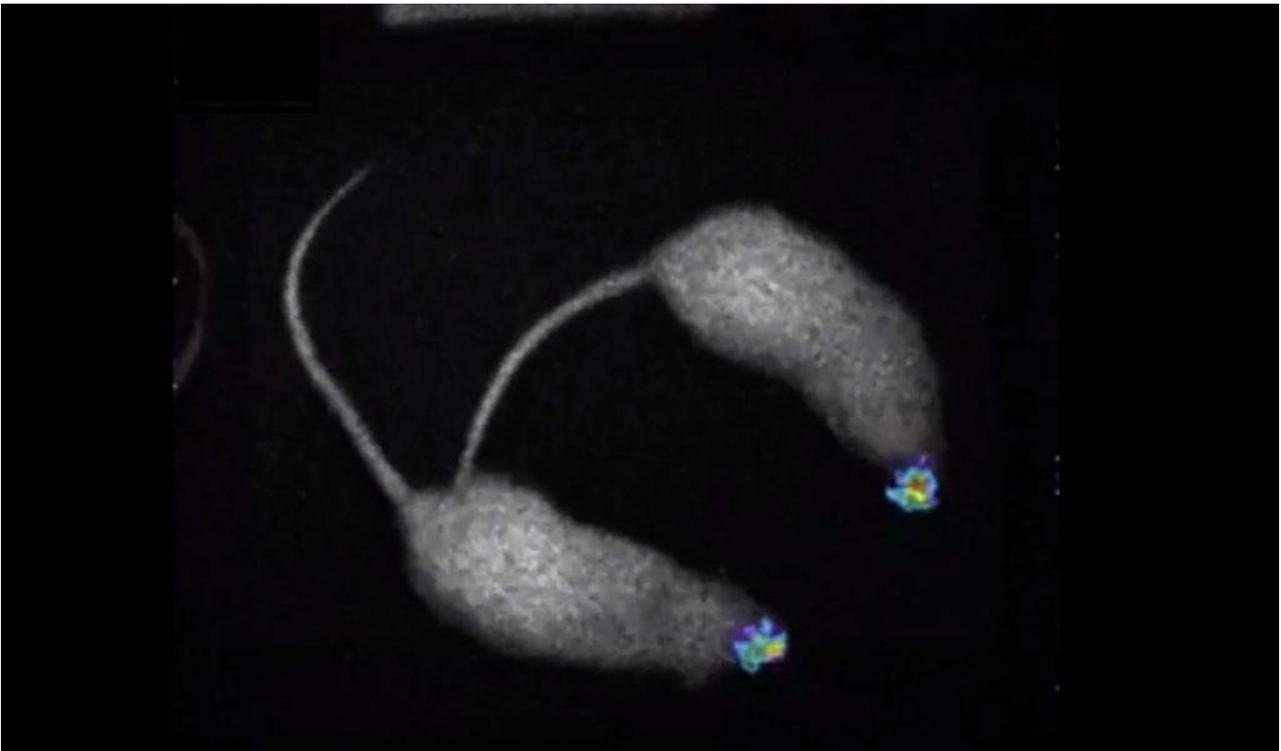
The dual cells meant arteries and veins could be created in engineered tissue to provide more effective treatments for pulmonary fibrosis and heart disease
source - uq.edu.au

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On market since: -
Regions: Australia
Industries: Healthcare, Biotechnology
Source links: [Stem Cell Reports](#)
[University of Queensland](#)



THE SYSTEM TO OBSERVE LIVE CELLS FROM OUTSIDE THE BODY

The bioluminescent molecules for visualizing various biological processes in the living organism was developed by Japanese scientists. Bioluminescence imaging plays a significant role in various medical studies due to its ability to provide a technology to control living cells in a non-invasive way. Scientists hope that this novel technology will provide the stable and long-lasting monitoring for understanding neural circuitry during natural behaviours.



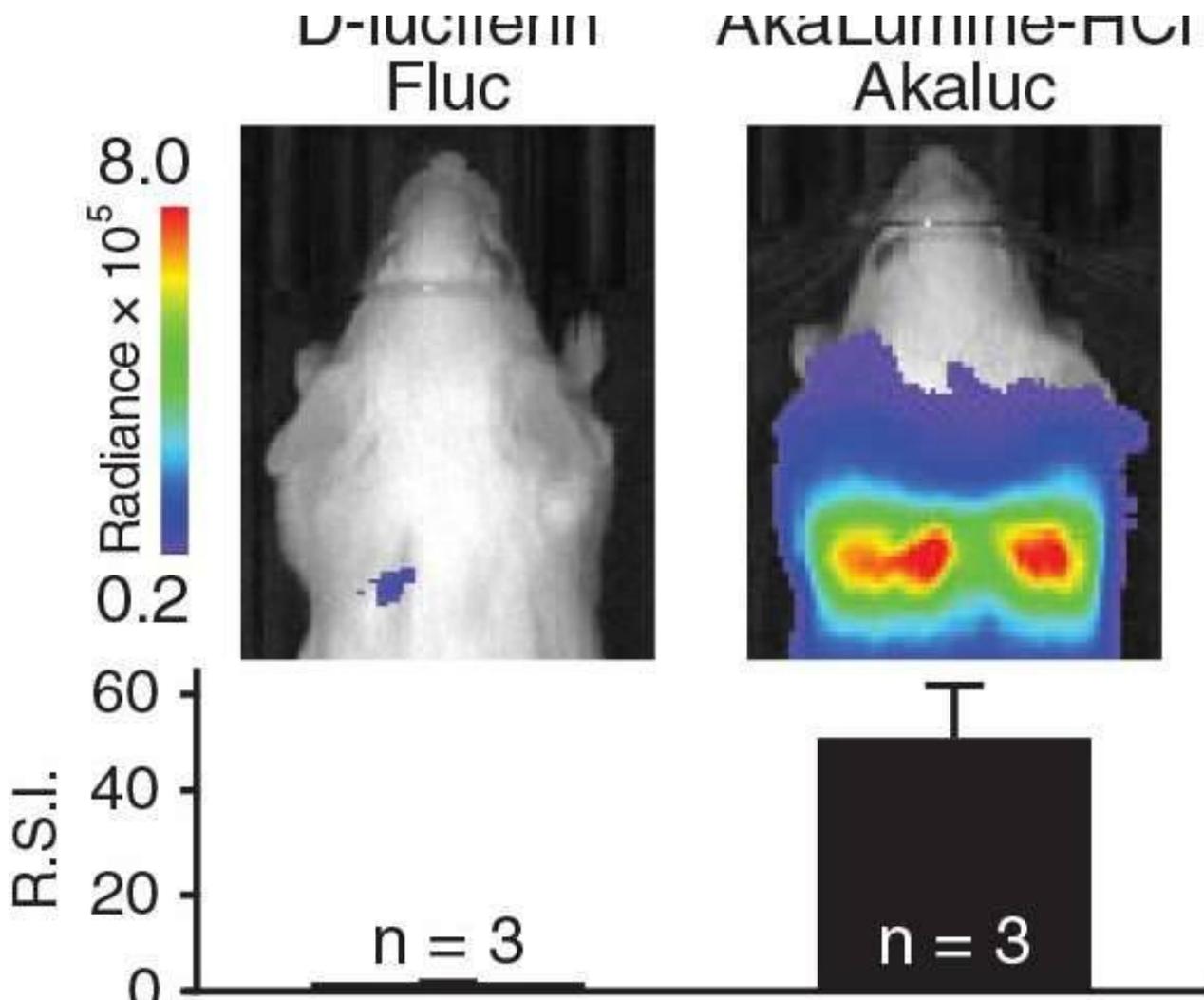
The AkaLumine-HCl/Akaluc signals were statistically compared to D luciferin/Fluc signals. Data are presented as mean \pm SEM of $n = 3$ mice
source - eurekaalert.org

The innovational development was made by the researcher's group, led by Dr. Atsushi Miyawaki from the [RIKEN](#) in cooperation with the [University of Electro-Communications](#), [Tokyo Institute of Technology](#) and [Kyoto University](#).

Bioluminescence is a natural light source, which is based on luciferase catalysis of its substrate luciferin. Furthermore, with its help scientists can monitor cells in their natural environments. Using imaging methods scientists can measure tumour growth, visualize developmental processes, and track cell-cell interactions. Despite this fact, the technical limitation exists, and it is difficult to analyze tissues or detect a tumour in vivo. Scientists have developed a bioluminescence imaging system that provides brighter emission by up to a factor of 1000 compared with conventional technology.

The synthetic luciferin called **AkaLumine-HCl** is capable to **enter into the blood-brain barrier and provide a reddish light, which is more easily seen in body tissues.**

Nevertheless, the synthetic luciferin was not very cooperative with the natural luciferase, consequently, scientists decided to change luciferase improving the enzyme's pairing with AkaLumine-HCl.



Bioluminescence images of mice intravenously injected with 10³ HeLa cells expressing Fluc or Akaluc. Substrate administration was performed intraperitoneally. Images were acquired using a cooled CCD camera source - phys.org

They made the evolution of firefly luciferase using a red-shifted and highly deliverable luciferin analogue to create AkaBLI, an all-engineered bioluminescence in vivo imaging system. AkaBLI generated emissions in vivo that were brighter by a factor of 100 to 1000 than conventional systems, allowing non-invasive visualization of single cells deep inside freely moving animals. For example, scientists manage to detect and visualized tumour cells in the lungs of mice. The small amount of striatal neurons were identified in the brains of naturally behaving marmosets too.

Dr. Atsushi Miyawaki mentioned that this fundamental development can provide various physiological studies in vivo. In additions, AkaBLI is a bioengineered light source to induce unprecedented scientific, medical, and industrial applications.

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Industries: Healthcare, Biotechnology
Source links: [Science](#)
[Asian Scientist](#)



A METHOD TO PREVENT TISSUE DAMAGE FROM HEPATITIS A VIRUS

The process of tissue damage caused by bystander-activated CD8⁺ T cells in acute viral infections such as hepatitis A, hepatitis B virus and hepatitis C virus was identified by the group of scientists. They hope that this novel discovery will indicate the possible direction for the development of treatment of immune diseases and help to create medicines.



Professor Eui-Cheol Shin and Professor Su-Hyung Park from the Graduate School of Medical Science and Engineering analyzed patients with acute hepatitis A
source - kaist.edu

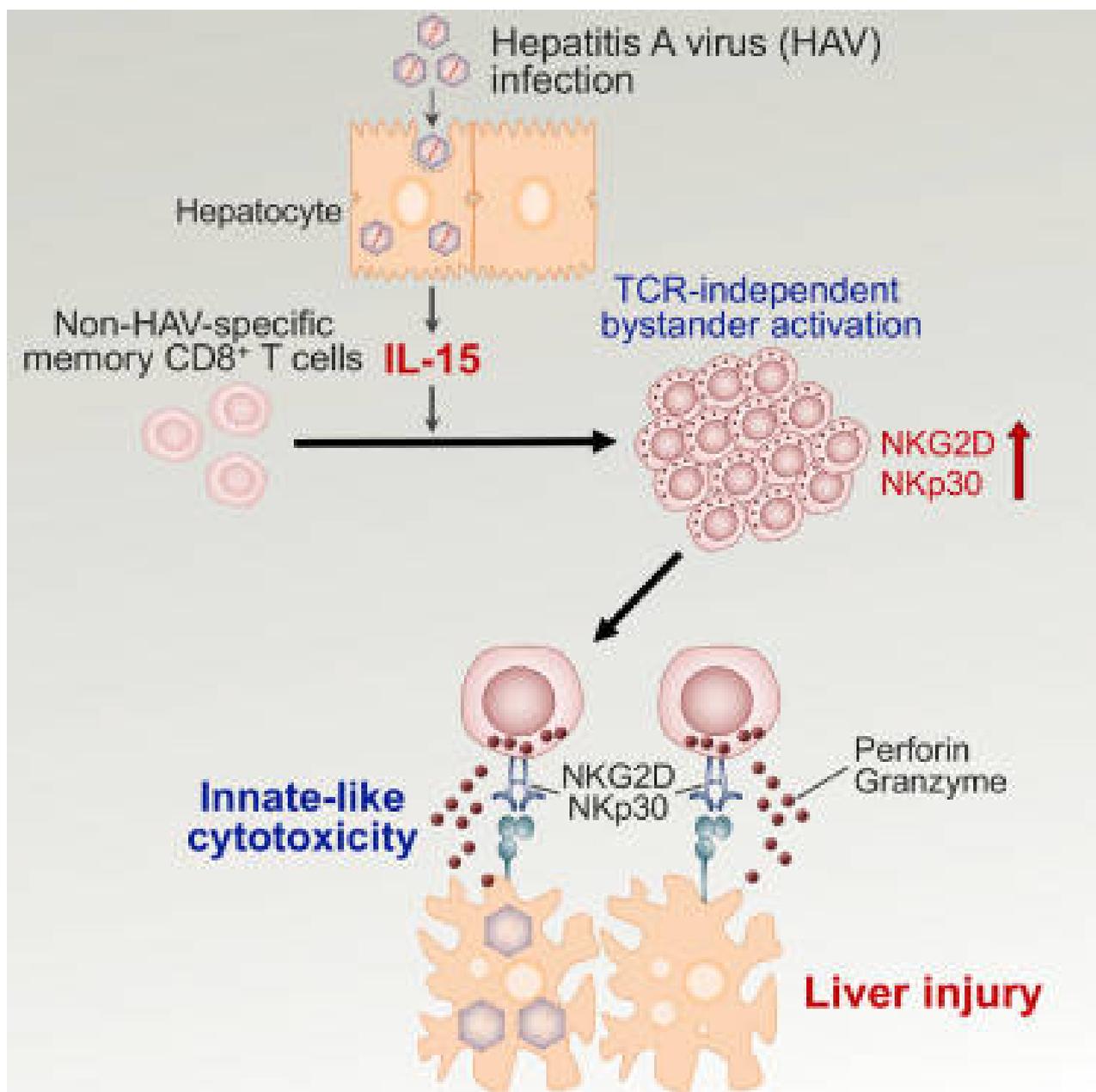
The innovational development was made by the researcher's group from the [Korea Advanced Institute of Science and Technology](#) in cooperation with [Chung-Ang University Hospital](#).

After the patient was infected with a viral infection, viral replication usually destroys human cells, however, viral replication is not the direct reason for the tissue damage. Despite this fact, the destruction of infected cells is the main reason for damaging of the tissue during non-cytopathic viral infections such as acute hepatitis A virus, acute hepatitis B virus and acute hepatitis C virus. Nevertheless, main pathological mechanisms, which are associated with the tissue damage have not been fully explained. The infection connected with a certain virus has the ability to activate immune cells targeting the virus, while other immune cells targeting to other viruses remain inactive.

The immune cell, which is not targeted to the infected virus is called a **bystander immune cell**. The process of activation of irrelevant immune cells not targeting to infecting virus is called the activation of bystander immune cells. This process was not well studied.

Acute hepatitis A (AHA) involves severe **CD8+ T cell-mediated liver injury**. The study results demonstrate that during AHA, CD8+ T cells specific to unrelated viruses became activated. Hepatitis A virus (HAV)-infected cells produced IL-15 that induced T cell receptor (TCR)-independent activation of memory CD8+ T cells. In other words, that not only immune cells targeting the hepatitis A virus were activated, however, **bystander immune cells were activated and connected with the damaging of liver tissues through**

acute hepatitis A.



During acute hepatitis A (AHA), non-HAV-specific memory CD8⁺ T cells are activated. Non-HAV-specific CD8⁺ T cells are activated by IL-15 produced by HAV-infected cells
source - kaist.edu

The severity of liver injury in AHA patients is correlated with the activation of HAV-unrelated virus-specific CD8⁺ T cells and the innate-like cytolytic activity of CD8⁺ T cells, but not the activation of HAV-specific T cells. Consequently, host injury in AHA is associated with innate-like cytotoxicity of bystander-activated CD8⁺ T cells, a result with implications for acute viral diseases.

Professor Eui-Cheol Shin mentioned that this innovational discovery will provide the ability

to develop treatments which can prevent tissue damage and create possible medicines.

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On market since: -

Regions: Korea

Industries: Healthcare, Biotechnology

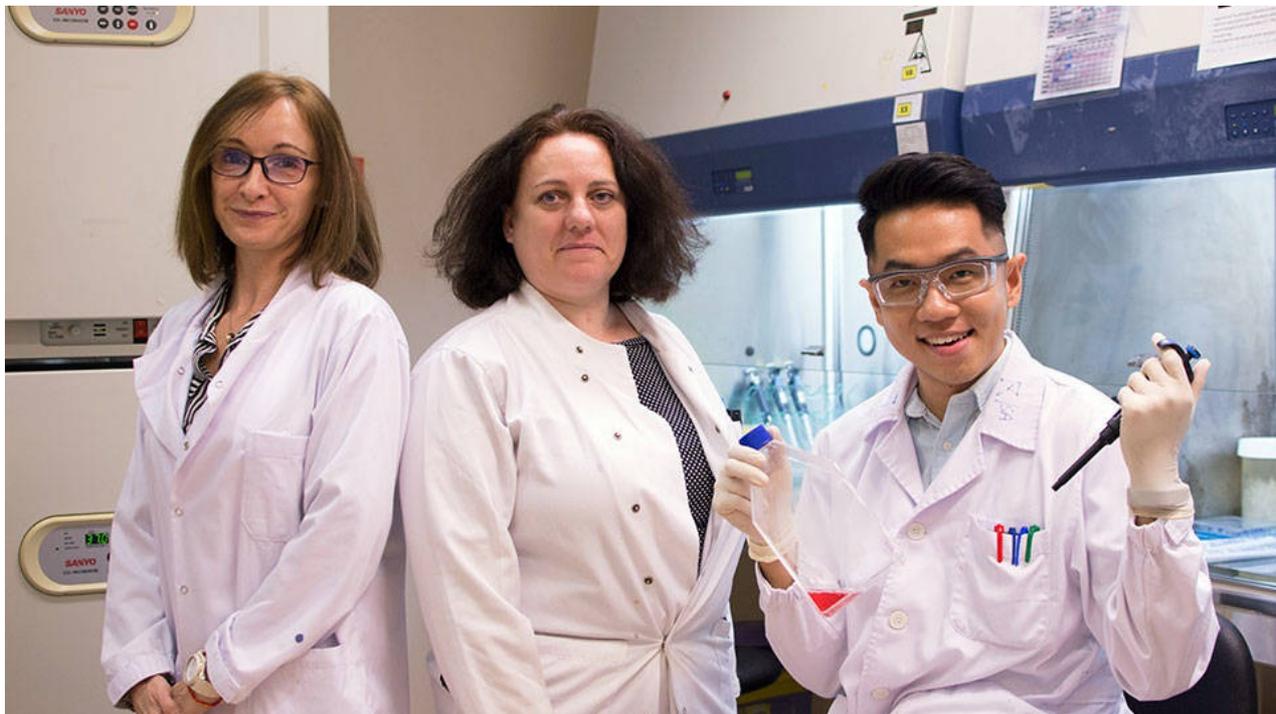
Source links: [Immunity](#)

[KAIST](#)



PHB CAN HELP TO CREATE TREATMENTS TO PREVENT NEUROLOGICAL COMPLICATIONS

The group of scientists managed to identify a host protein, prohibitin (PHB), which is used by EV71 to infect the brain. The virus has the ability to attack the brain and cause hard consequences such as pulmonary edema and the inflammation of the brain. Furthermore, the patients can have longer-term side effects, including cognitive impairment and psychiatric disorders.



From the left: Associate Professor Sylvie Alonso, Dr Isabell Bonne and PhD student Mr Issac Too
source - nusmedicine.nus.edu.sg

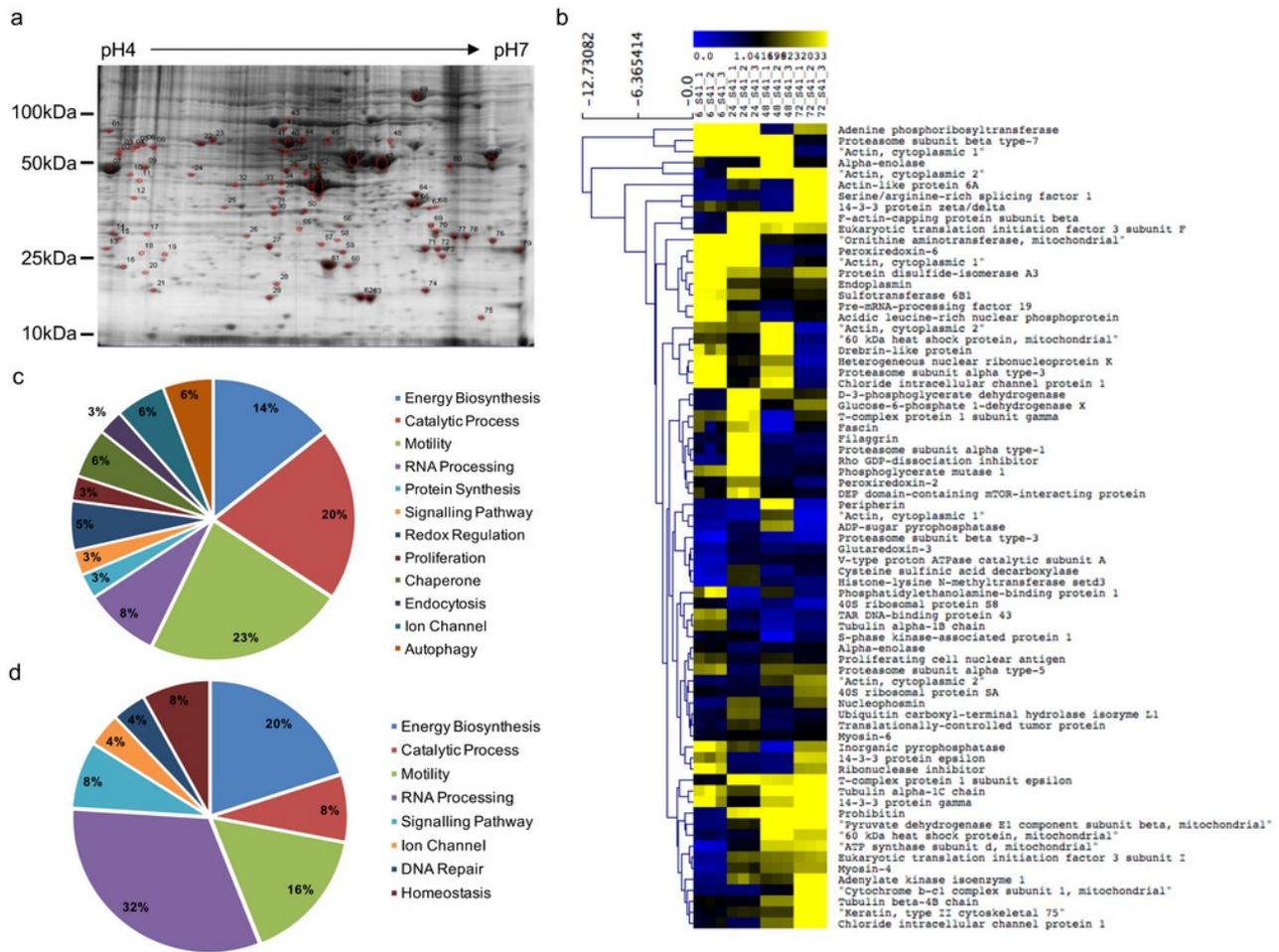
The innovational development was made by the researcher's group, led by Associate Professor Sylvie Alonso from the [National University of Singapore](https://www.nus.edu.sg).

Enterovirus 71 (EV71) is a non-enveloped, positive-sense, single-stranded RNA virus, and causes hand, foot and mouth disease (HFMD) in humans. Being a close relative of poliovirus, EV71 is deemed as an important neurotropic virus worldwide. Despite the clinical manifestations are generally mild and self-limiting, including HFMD and herpangina, severe neurological complications have been consistently reported with EV71-associated infections, causing brainstem encephalitis, acute flaccid paralysis, pulmonary oedema and cardiopulmonary failure. Furthermore, it can cause the developing of neurologic and psychiatric disorders.

Scientists were focused on **prohibitin (PHB)**, which were identified as that, which plays the main role during the process of EV71 infection of neuronal cells. The study results showed that PHB is used by the virus not only to attach the neuronal cells, furthermore, to multiply inside them.

The researches aiming at studying EV71 neurovirulence have employed **neuroblastoma cell lines** that may not reflect accurately infection in motor neurons. To address this gap,

scientists made a novel in vitro model of EV71 infection in the murine motor neuron cell line NSC-34.



Three independent experiments were performed. UI, uninfected. Heat map was generated using MultiExperiment Viewer. Distance was represented by Euclidean average linkage clustering
source - journals.plos.org

In additions, the group demonstrated that an anti-cancer drug Rocaglamide, which inhibits PHB, can be applied to control EV71 infection in neuronal cells, and, therefore, protect the brain. Associate Professor Sylvie Alonso mentioned that this innovative discovery can provide the creation of particular treatments for serious neurological complications resulting from Hand, Foot and Mouth Disease.

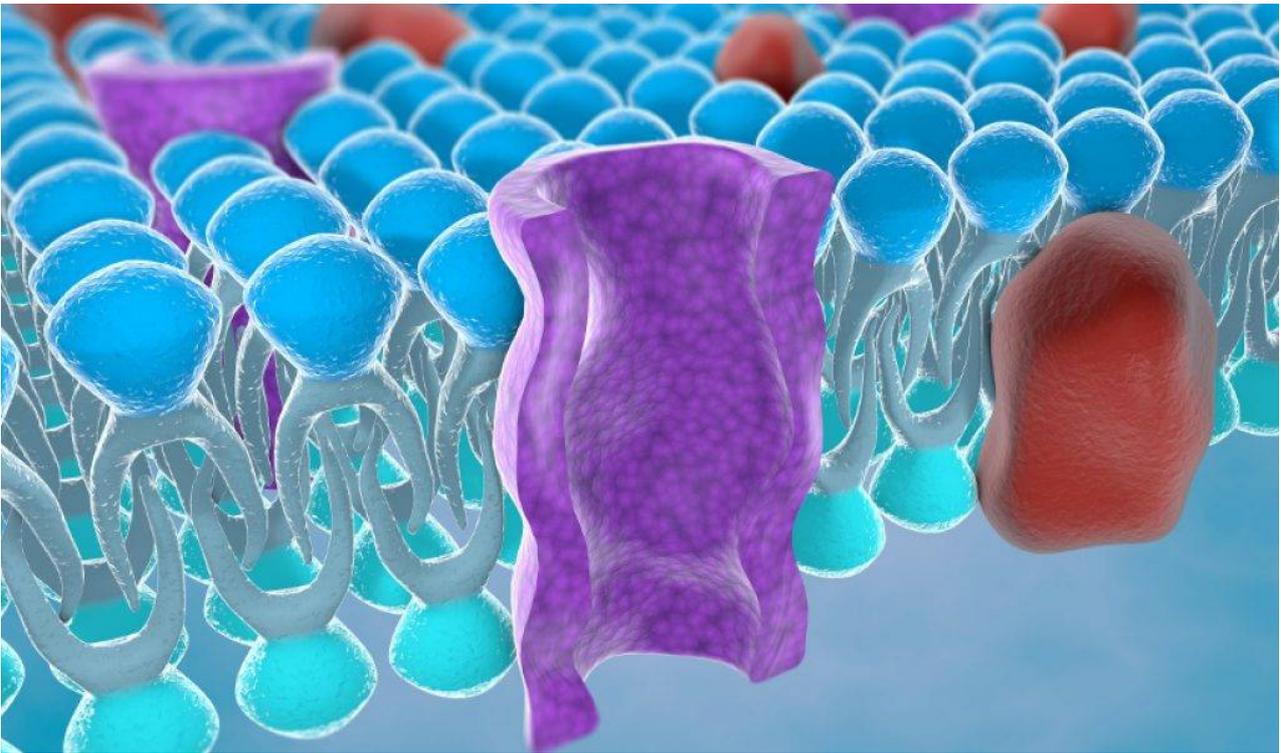
Associate Professor Lee Yung Seng said that scientists have managed to find the protein which allows the virus to get to the brain and cause complications. The protein will be the target for the future treatments, which are aimed at preventing this.

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On market since: -
Regions: Singapore
Industries: Healthcare, Biotechnology
Source links: [PLOS Pathogens](#)
[NUS Yong Loo Lin School of Medicine](#)



A NOVEL CHIP CAN TEST POTENTIAL SIDE EFFECTS OF THE DRUG

The group of scientists managed to develop an innovational device to screen drugs for heart-related side effects. This unique development could be a new screening platform for estimating the potential risks of drug side effects, which act on human ether-a-go-go-related gene (hERG) potassium channels of the patient.



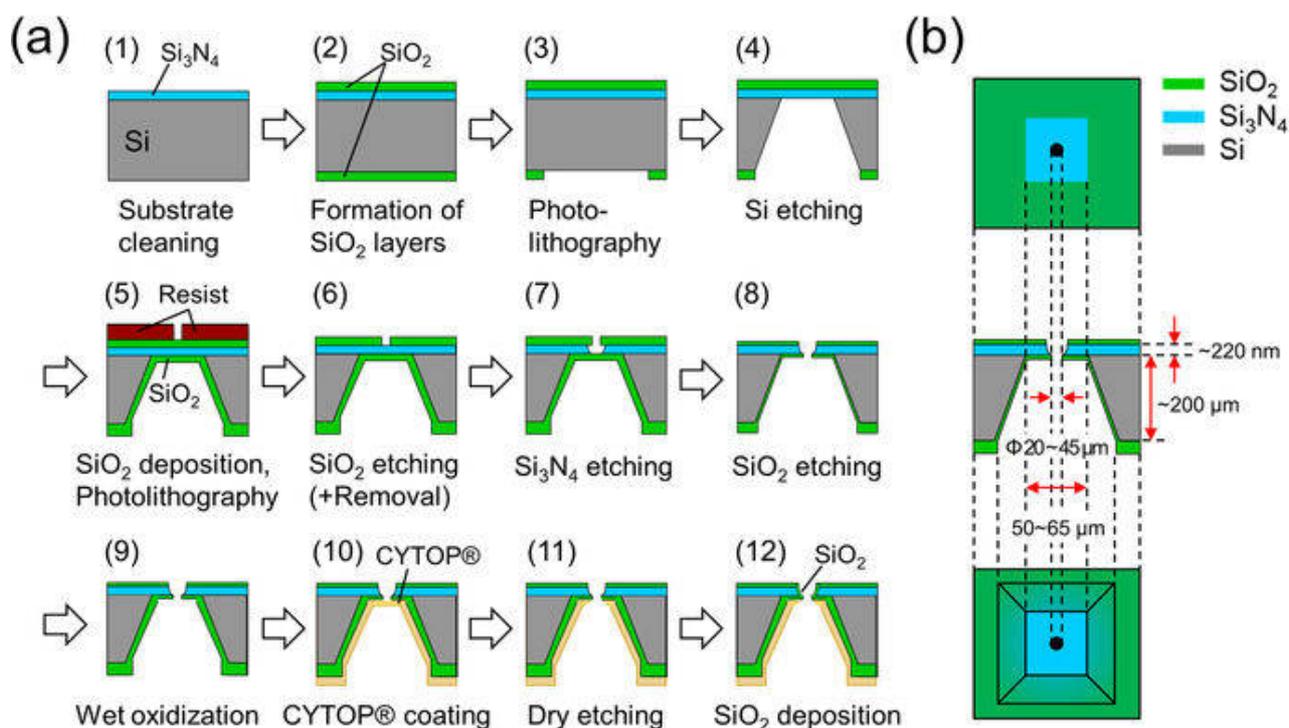
The self-assembled bilayer lipid membrane (BLM) is the basic component of the cell membrane
source - asianscientist.com

The innovational development was made by the researcher's group, led by Professor Ayumi Hirano-Iwata from the [Tohoku University](http://www.tohoku.ac.jp).

The cell membrane consists of a **bilayer lipid membrane (BLM)**, which is a self-gathered structure of phospholipid molecules, and inserted membrane proteins. The reproduction of ion channel proteins in BLMs demonstrates the well-determined system for the functional testing of ion channels and testing the effects of medicines that have the ability to act on them. Ion channels can open and close to pass ions through, generating an electrical signal. Nevertheless, erraticness of BLMs limits the throughput capacity. Despite this fact, ion channels have a big attention as major targets for drug-induced side effects. Monitoring of the ion-channel currents is an efficient way for studying the functions of ion channels and testing the drug effects acting on them.

Scientists managed to create **the mechanically stable solvent-free BLMs in microfabricated apertures with defined nano- and micro-tapered edge structures.**

As the result, they made 3 silicon chips, which have differently-shaped holes and tested their capacity to receive ion-channel that include lipid membranes. The chip was produced a thick layer of silicon that was covered by a thin layer of silicon oxide (Si₃N₄).

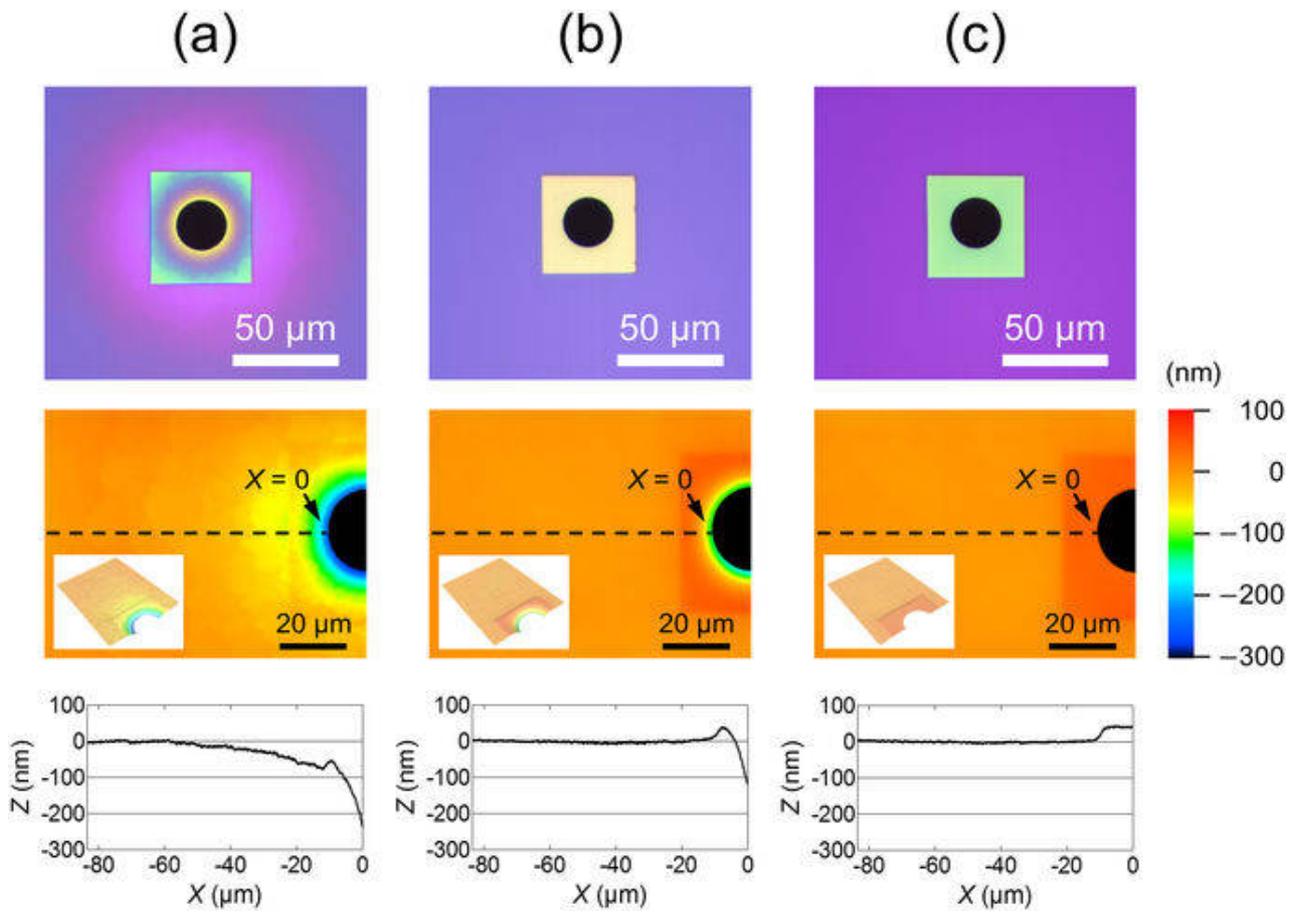


Fabrication of microapertures in Si chips. Procedure for fabricating Si chips with microapertures, and schematics of fabricated Si chips
source - nature.com

Scientists established a reproducible process for fabrication of microapertures with defined nano- and micro-edge structures in nanometer-thick $\text{Si}_3\text{N}_4/\text{SiO}_2$ septa. Through the comparison of static and mechanical stability of BLMs formed in the apertures, it was found that both nano-tapered and micro-tapered edge structures were important in forming stable solvent-free BLMs, however, a micro-tapered edge structure was more crucial for the mechanical stability of a BLM.

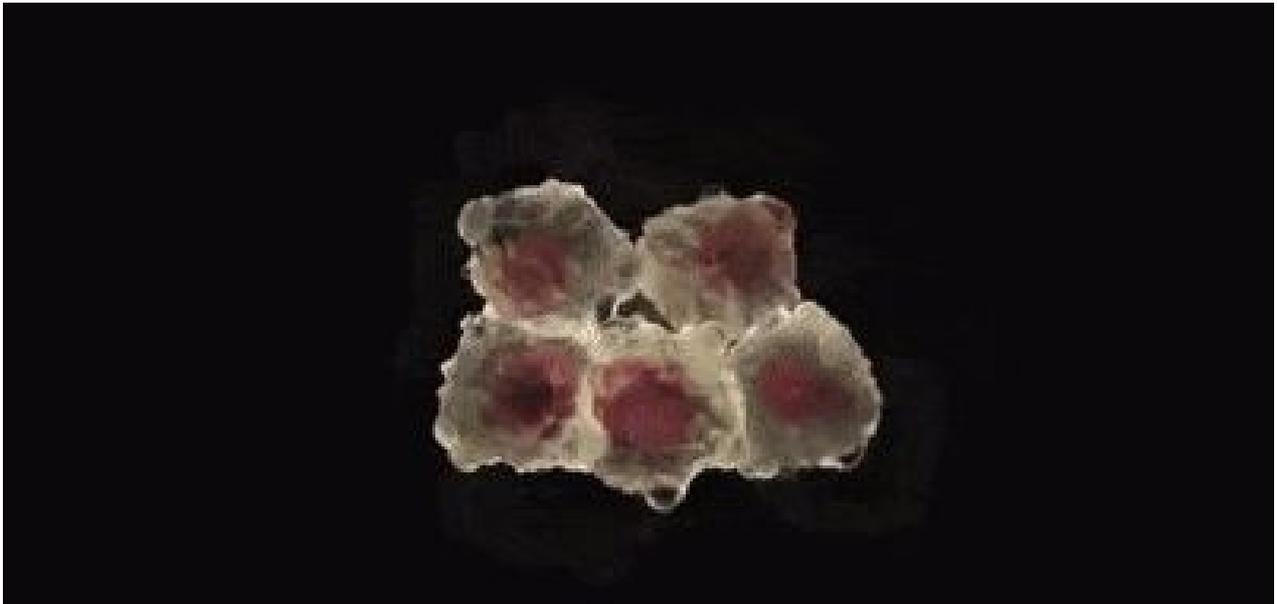
The group used a cell-free synthesized cardiac muscle ion channel, which is called hERG, to the membranes by centrifugation. They found electrical currents from the channels and blocked them by applying the astemizole that has a high adverse effect on hERG channels in the heart.

The advantage of BLMs combined with cell-free expression system is its broad applicability to various ion channel genotypes including disease-causing genetic variants. Considering that a relationship has been implied between the hERG channel genotypes and drug-induced arrhythmia, extending the present approach to various hERG genotypes has the ability to provide the absolutely novel testing platform for estimating the possible risks of medication side effects, which act on hERG channels of patients.



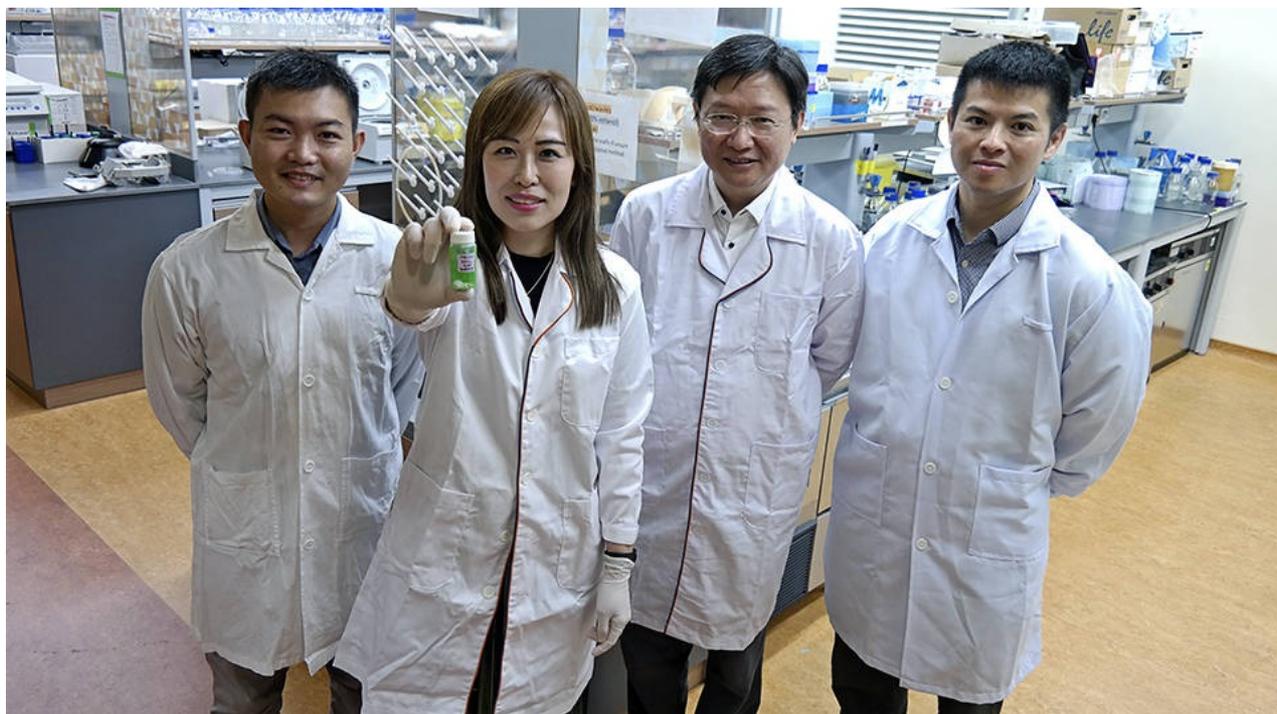
Micrometer-range structure around the aperture edges. Photomicrographs of the apertures from the top. Laser scanning confocal microscopic images around the edge of the apertures
source - nature.com

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Industries: Healthcare, Biotechnology
Source links: [Scientific Reports](#)
[Asian Scientist](#)



AN INNOVATIONAL METHOD OF CUSTOMISING LIVER CANCER TREATMENT

The group of scientists managed to create an innovational technology to grow liver cancer cells in the laboratory. This method will provide the capacity to test drug efficacy. The patient-derived xenografts (PDX) models ensure an accurate picture of potential effects of the cancer drug when it is used in humans. This technology will allow the cost-effective method of controlling the selection of treatment.



From the left: Dr Toh Tan Boon, Dr Eliza Fong, Professor Henry Yu, and Dr Edward Chow with the scaffold of the HCC organoids

source - nusmedicine.nus.edu.sg

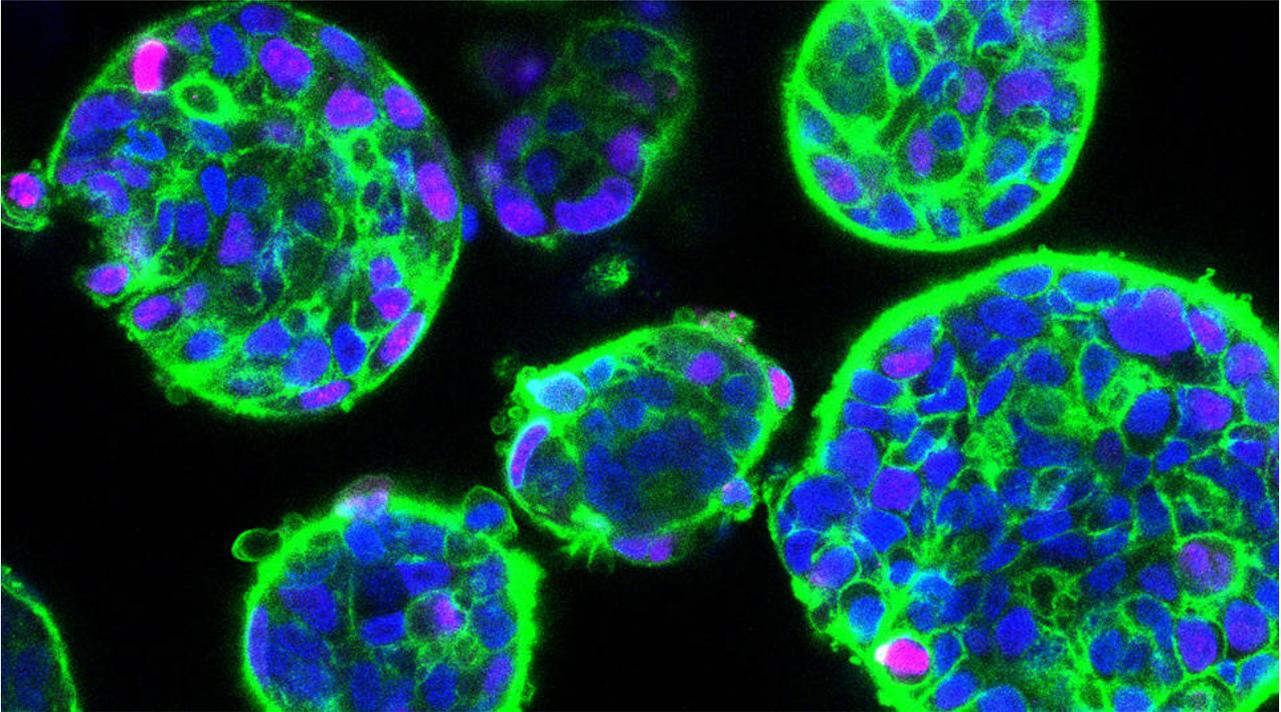
The innovational development was made by the researcher's group led by Dr Eliza Fong and Dr Toh Tan Boon from the [National University of Singapore](#) in cooperation with the [Cancer Science Institute of Singapore](#), the [Institute of Bioengineering and Nanotechnology, A*STAR](#) and the [National Cancer Centre Singapore](#).

Liver cancer or Hepatocellular carcinoma (HCC) is the 4th leading cause of cancer death worldwide. Unfortunately, it is often detected at the advanced stage. The main issue in medicines developing is the inability to correctly iterate the cancer characteristics and its environment in the human body in which a tumour is placed. Furthermore, it led to numerous potential medicines to fail in the clinical trial.

Scientists try to find the **method to accurately simulate the cancer environment in order to grow cancer cells, test drugs and create the appropriate treatment.**

The team have managed to develop models of cancerous growths, which was called **patient-derived xenografts (PDX)**. The main feature of these models is the ability to demonstrate the realistic picture of how effective potential medicines can be when they will be used for human treatment. Despite this fact, the method is expensive and require a lot of time to be produced. Growing PDX cancer cells in the laboratory will provide the

capacity to test medicines efficacy in cost-effective and faster way. Nevertheless, tries to grow these cells have been unsuccessful.



Hepatocellular carcinoma organoids in culture
source - nus.edu.sg

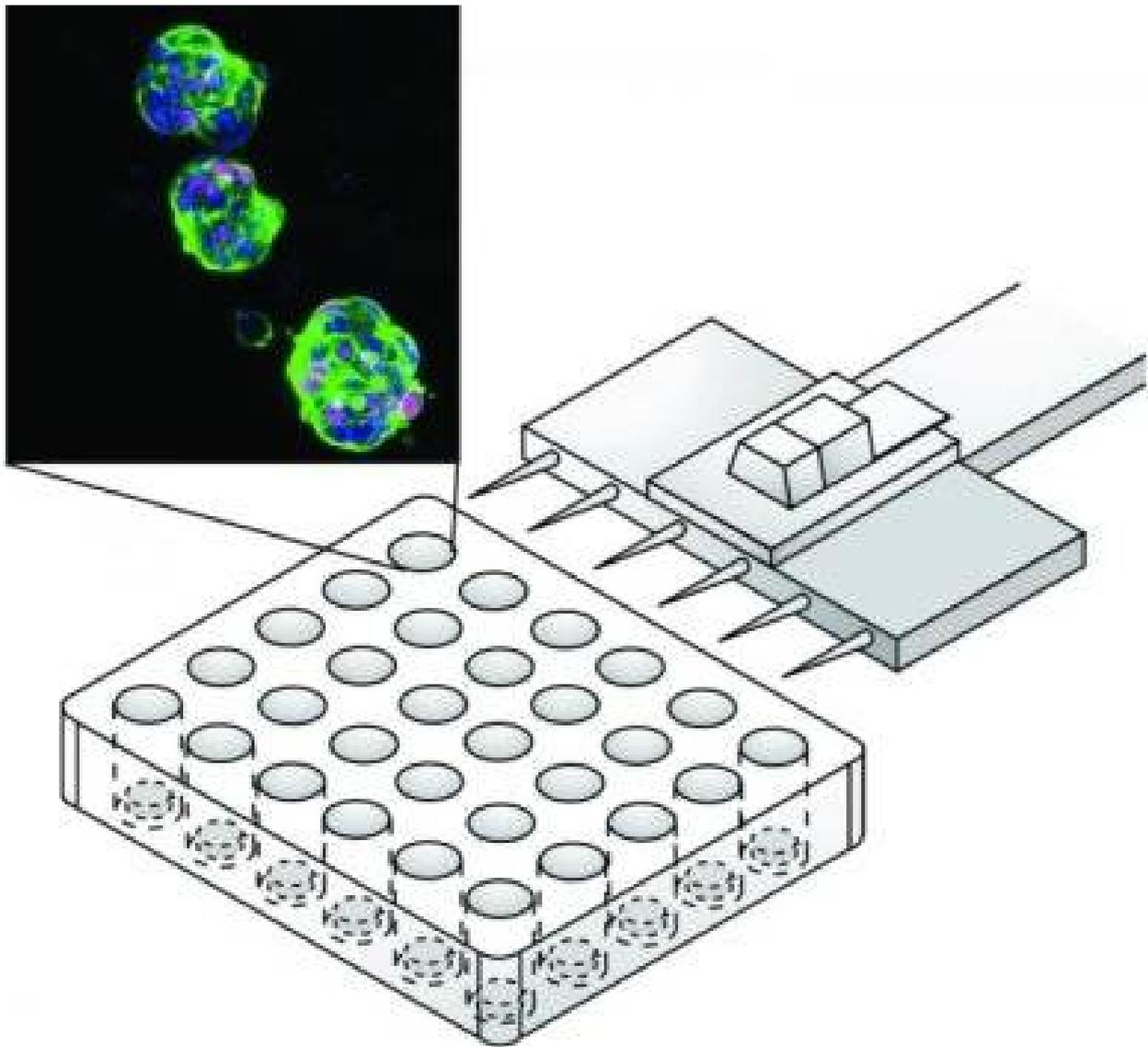
The scientific group managed to grow cancer cells from 14 liver cancer PDXs. Each line, which was received from the patient with liver cancer, was grown on the special three-dimensional (3D) scaffold that was made from a plant-based porous hydrogel. This gel stimulates the environment of the liver.

Porous scaffolds, which are 6mm in diameter, provide the location for cancer cells. They were produced to optimise biochemical and mechanical characteristics, which promote the growth of liver cells. Furthermore, these features allow cells to reach their form and functions and grow as organoids. Using one PDX, scientists will be able to generate up to hundreds of scaffolds, which have organoids, to test drug and develop the most suitable treatment for the patient.

To validate the *in vitro* HCC-PDX models, both *in vivo* and *in vitro* HCC-PDX models were subjected to whole exome sequencing and RNA-sequencing. Correlative studies indicate strong concordance in genomic and transcriptomic profiles as well as intra-tumoral heterogeneity between each matched *in vitro*-*in vivo* HCC-PDX pairs. Moreover, scientists

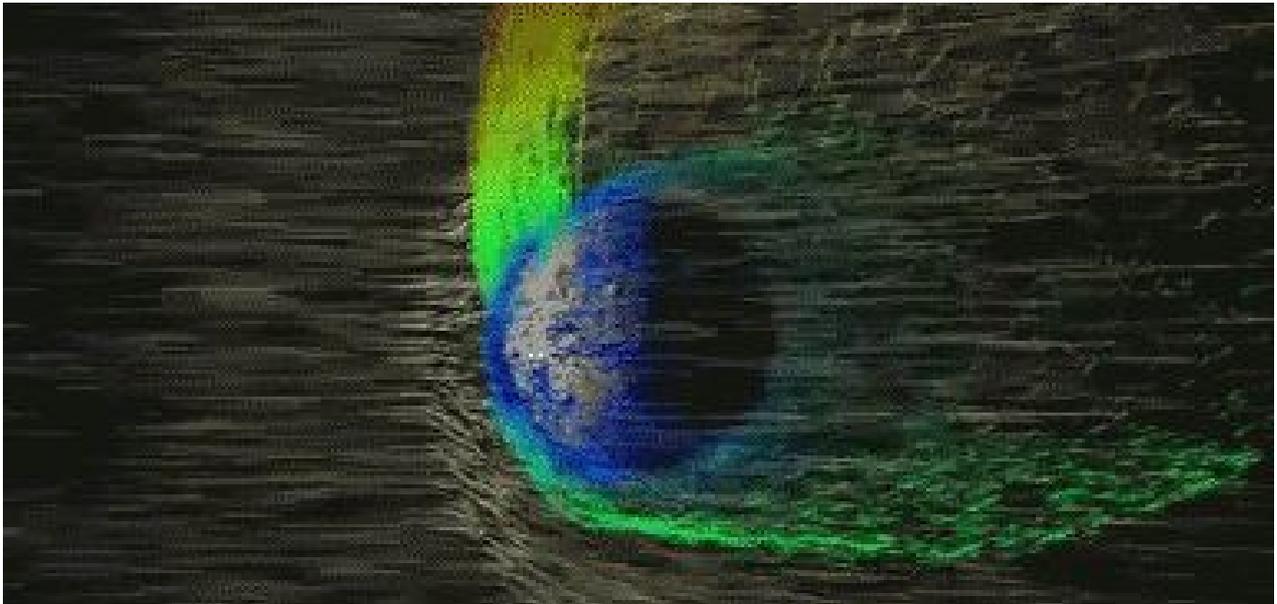
show the feasibility of using these in vitro HCC-PDX models for medicines testing, paving the way for more efficient pre clinical researches in HCC drug production.

Professor Henry Yu mentioned that this innovational technology will give people the possibility to **choose the most appropriate method of cure, which is based on results of the medicines trial of their own cancer cells.**



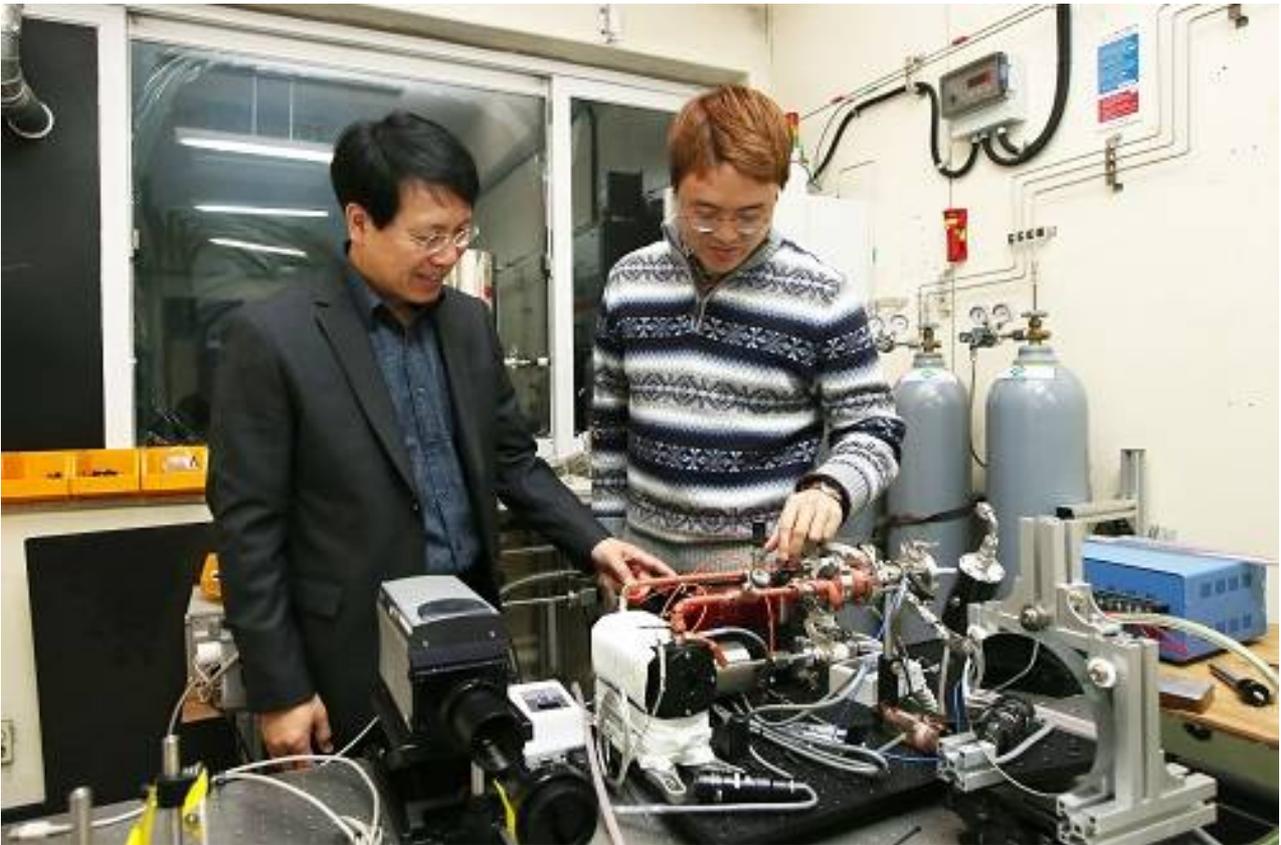
These are liver cancer organoids amenable for personalized drug testing
source - sciencedaily.com

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Regions: Singapore
Industries: Healthcare, Biotechnology
Source links: [Biomaterials](#)
[National University of Singapore](#)



THE ELECTRIC WIND GENERATION

Scientists managed to identify the basic principle of electric wind in plasma. The method of creating air movement without mechanical movements can be the next-generation technology. This innovational development will cause the creating different technologies with plasma using such as fluid control technology.

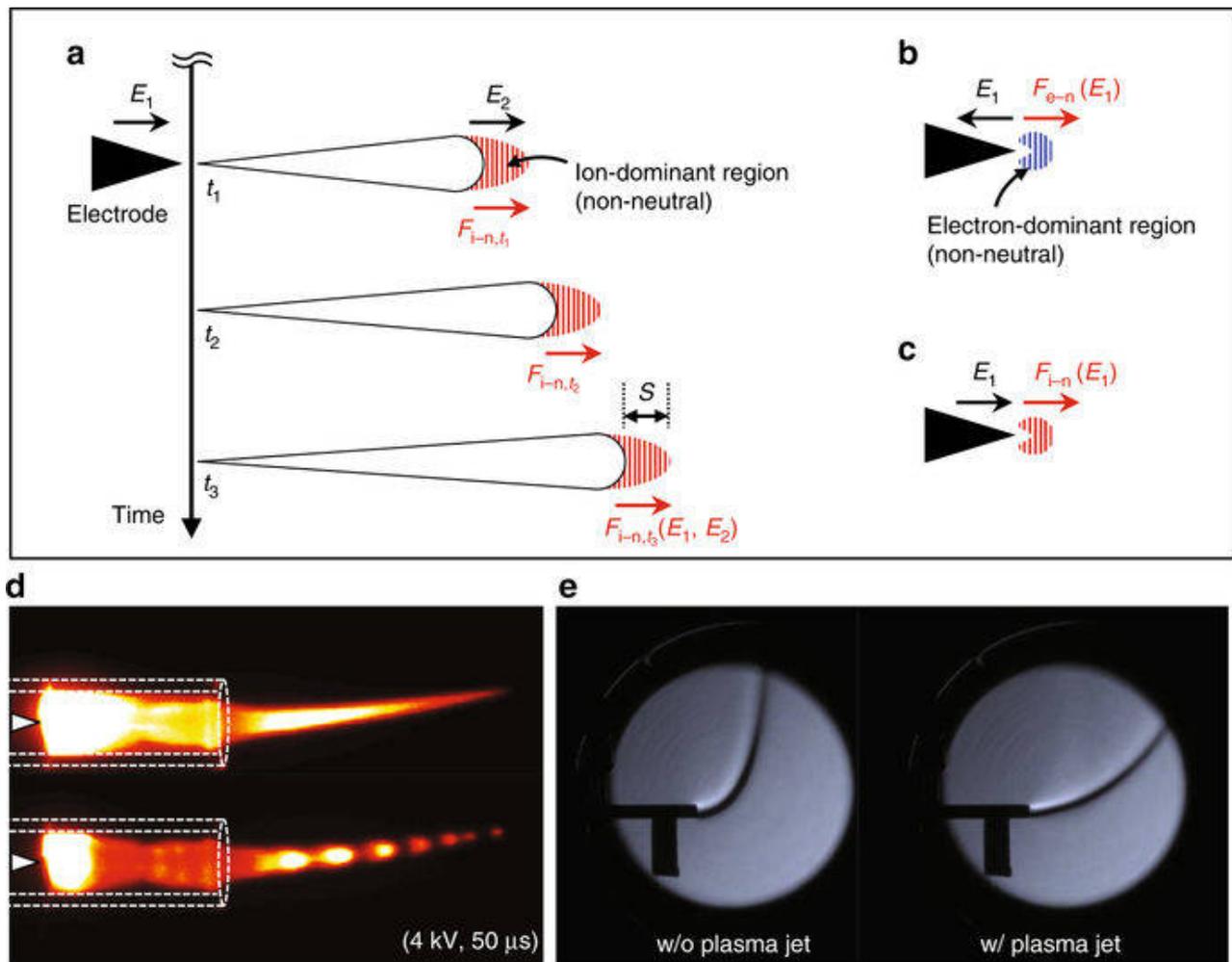


Professor Wonho Choe and PhD Sanghoo Park
source - KAIST

The innovational discovery was made by the group of scientists, led by Professor Wonho Choe and PhD Sanghoo Park from the [Korea Advanced Institute of Science and Technology](#).

They found the main principle of neutral gas flow in plasma, that is known as 'electric wind' (EW). The EW, which presumably caused by the charged particle–neutral connecting in systems of dimly ionized gases. The process is caused by the clash between charged particles (electrons or ions) and neutral particles.

Scientists made the experiment with using of atmospheric pressure plasma as a source of weakly ionized gases generated in the helium gas at atmospheric pressure using Schlieren photography. The electric wind becomes more significant as the pulse width increases (to some extent) at a given pulse voltage and as the pulse height (that is, electrode voltage) increases. This process is directly connected with charged species, which has the ability to move and cooperate with neutrals forming a plasma head.



A simple illustration of EHD force generation via different mechanisms. The schematic of EHD force generation source - nature.com

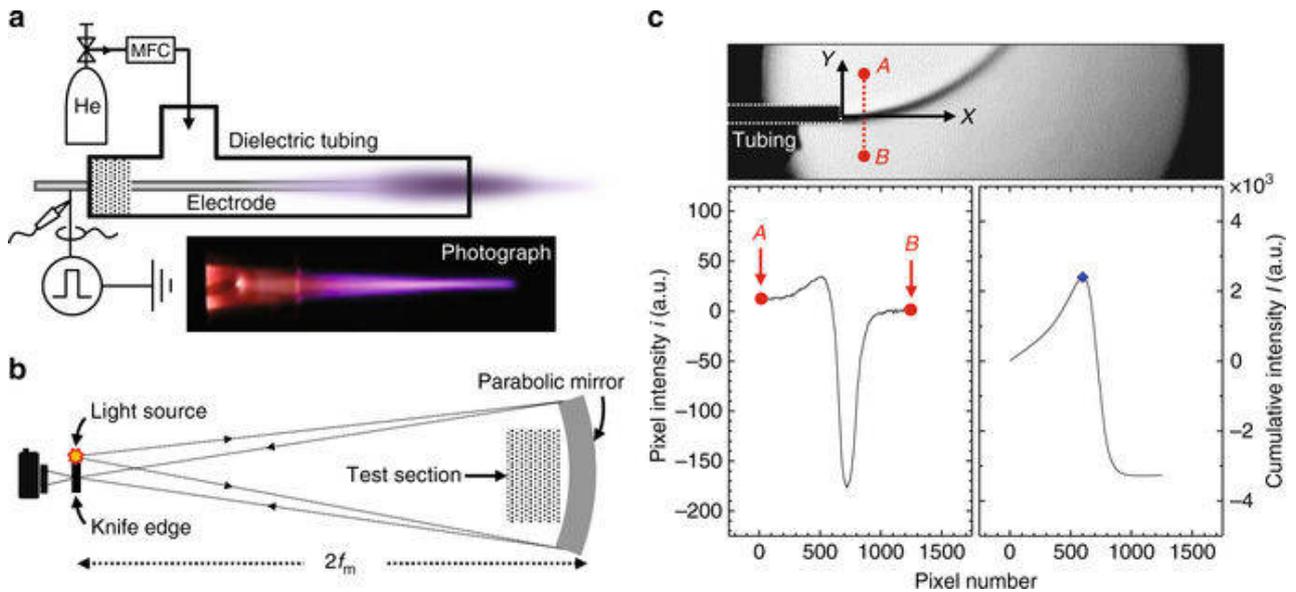
Furthermore, this process provides the determination of **the role of electrons and (positive) ions in wind generation**.

Consequently, **electrons were the most important elements of electric wind production in the plasma**. The EW can cause other effects, such as modifications of the streamer generation and propagation, thus altering the neutral gas density and/or the efficient transport of long-lived chemical species with lifetimes ranging from milliseconds to minutes due to the enhancement of the gas flow. Scientists have used a helium flow and a μ s-pulsed plasma jet to monitor charged particle–neutrals couplings.

Moreover, the group managed to create the EW with the speed of **4 m/s** in a helium jet plasma that is one fourth the speed of a typhoon. Moreover, this research provides fundamental knowledge about the electric wind generated by the EHD force and can serve as a basic reference for understanding the coupling between charged particles and

neutrals in any plasma, ranging from plasma processing, fusion, and astrophysics to space propulsion. In other words, this innovational technology provides **basic principles to effectively control the speed of the EW.**

Professor Choe mentioned that this discovery made a significant contribution not only to the scientific sphere but also made it possible to expand the sphere of the use of the method of **liquid control since such technology is economically profitable.**



Experimental apparatus for atmospheric-pressure plasma jet and Schlieren photography. Schematic of a plasma jet actuator and relevant setup source - nature.com

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Regions: Korea

Industries: Energy

Source links: [Nature Communications](#)

[KAIST](#)



SCIENTISTS WERE INSPIRED BY MUSSEL TO CREATE SKIN REGENERATION GLUE

The developing of the innovational decorin glue was caused by series of experiments of mussel-derived bioadhesives. Scientists decided to combine a small amount of decorin with mussel 'gloop' and molecules, which has the ability to binding collagen. This invention has shown tremendous results since the wound heals on day 28 of the use of this remedy.



Scars are caused by a change to skin tissues, which is a part of the healing phase
source - dermeffacefx7.com

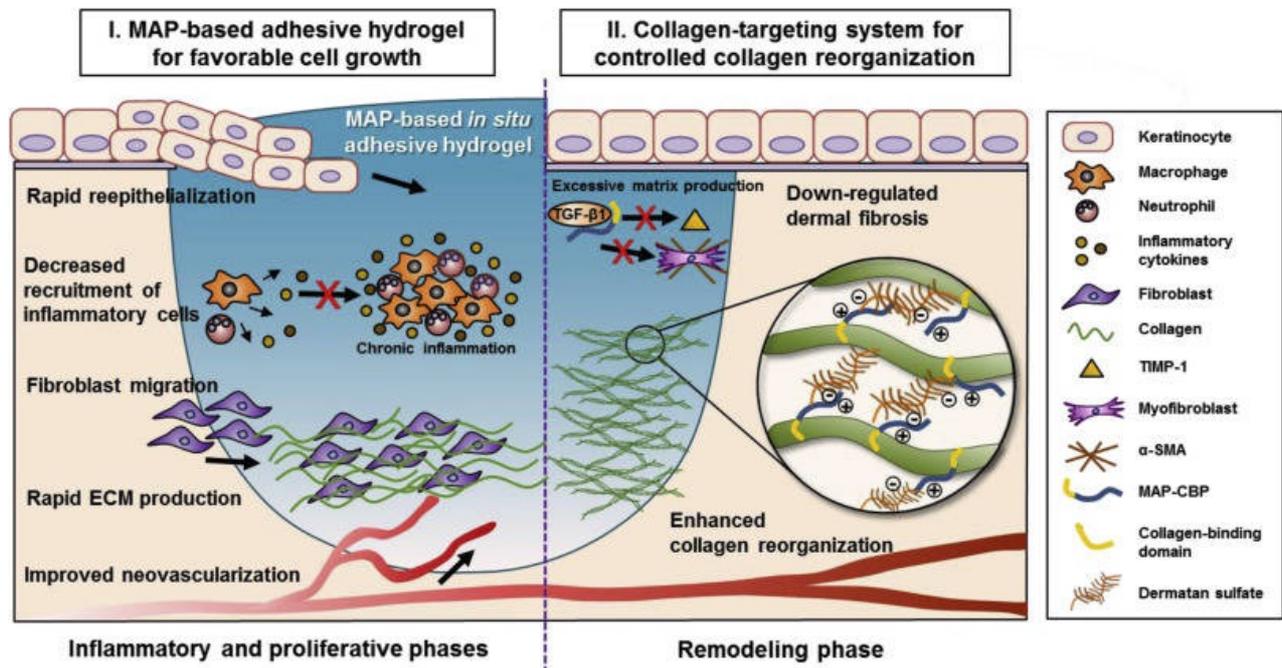
The innovational development was made by the group of scientists, led by Professor Hyung Joon Cha from the [Pohang University of Science and Technology](#).

The formation of scars is not only a cosmetic problem, although, most of the removing methods are painful. Despite, scars are often a reminder of certain unpleasant events or even accidents. It can cause a psychological discomfort in the person who has a scar. Collagen, the most **abundant ECM structural protein**, holds a vital clue for normal tissue development, maintenance, and regeneration as a substrate for cell attachment and a repository for various bioactive molecules. Scars are formed due to abnormal collagen production, in the process of wound healing. This happens when the skin can not recover itself as a cross-linked structure. Consequently, collagen fibres grow in the form of parallel groups forming scars.

The decorin can help to **reduce scarring by facilitating collagen arrangement**. However, decorin is hard to synthesize in a big amount.

The scar-preventive collagen-targeting glue consisting of a newly designed **collagen-binding mussel adhesive protein and a specific glycosaminoglycan**. The collagen-targeting glue specifically bound to type I collagen in a dose-dependent manner and regulated the rate and the degree of fibrillogenesis. In a rat skin excisional model, the collagen-targeting

glue successfully accelerated initial wound regeneration as defined by effective reepithelialization, neovascularization, and rapid collagen synthesis.

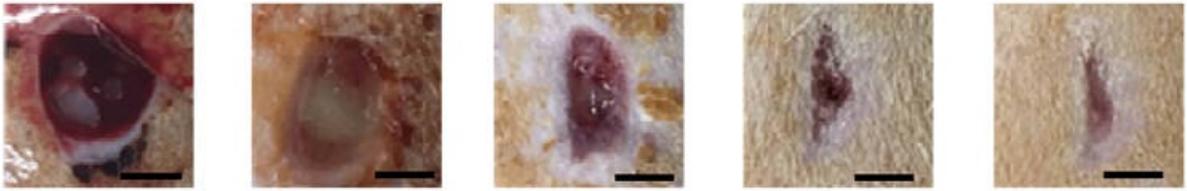


Schematic representation of proposed mechanisms for enhanced in vivo scarless skin regeneration where a natural healing-inspired MAP-based collagen-targeting surgical glue was used
source - sciencedirect.com

Scientists conducted a series of experiments on rats, which showed tremendous results. Scars became barely noticeable on the **28th day** of using this invention. Moreover, the analysis of such scars demonstrated that under the action of the substance **there were developed hair follicles, sweat glands and blood vessels**. They usually do not occur in damaged areas.

The present invention is innovative and can help heal scars not only for aesthetic reasons but can help many people get rid of psychological discomfort as a result of removing scars that are a reminder of the unpleasant events. Scientists plan to test a gel on a skin of a pig, which is similar to a human's skin.

No treatment



Treatment with glue



The wounds that received the new treatment (bottom) showed less scarring than those that didn't (top)
source - sciencedirect.com

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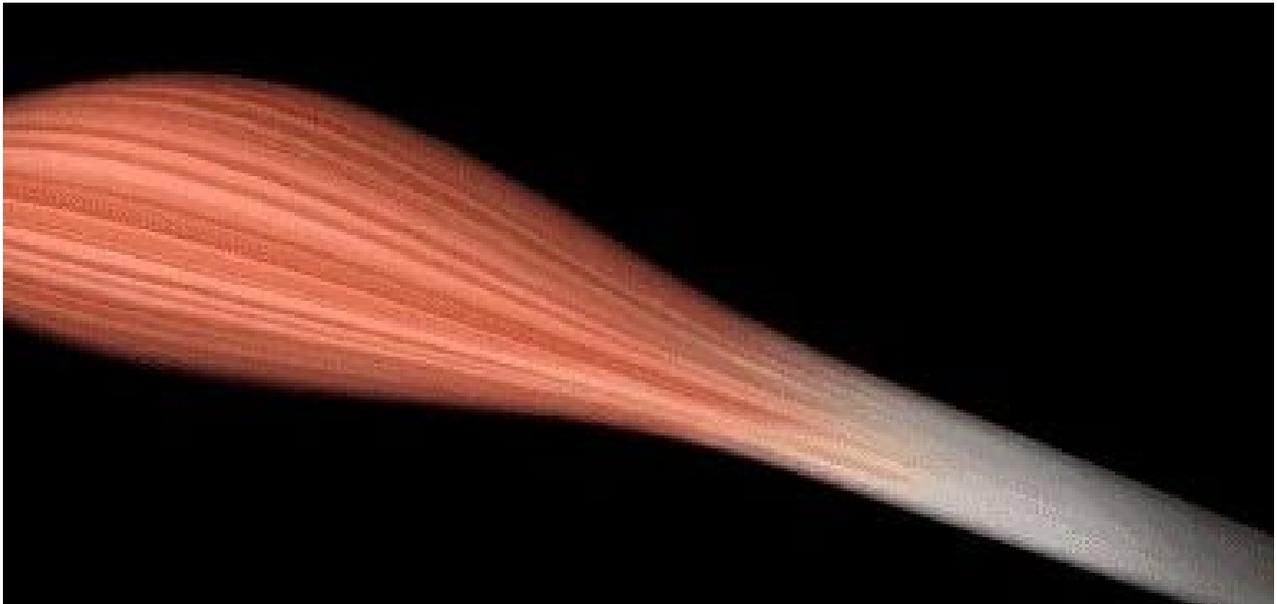
Patent status: -

On market since: -

Regions: Korea

Industries: Healthcare, Biotechnology

Source links: [Biomaterials](#)



THE METHOD OF MUSCLE GROWTH CAN HELP TO TREAT CANCER

Australian scientists have developed an innovational therapeutic method that allows muscle mass to grow very fast. This approach has the ability to prevent muscle wasting diseases such as muscular dystrophy and even cancer. Scientists decided to combine molecules, which inhibit three proteins that in turn repress muscle growth.



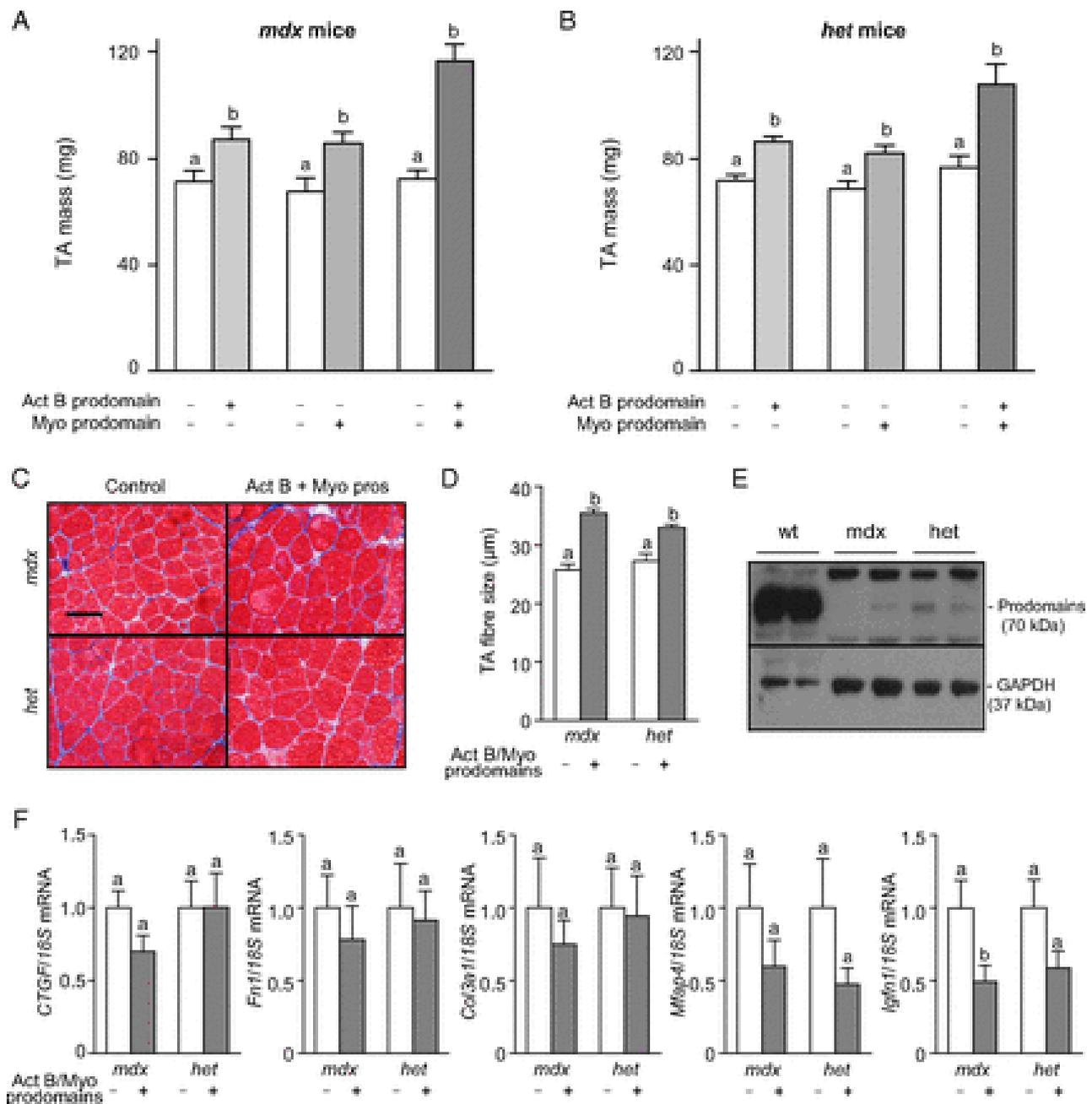
Dr Craig Harrison and Dr Kelly Walton from the Monash Biomedicine Discovery Institute
source - monash.edu

The innovational development was made by the scientific group from the [Biomedicine Discovery Institute](#), [Monash University](#), in cooperation with Baker Heart and Diabetes Institute.

Myostatin is the body's main negative factor of controlling the skeletal muscle mass using the method of activation of the **Smad2/3** pathway. Researchers found that **inhibiting activin A, activin B and myostatin leads to the skeletal muscle mass increase up to 150%** in preclinical models. Scientists showed that blocking activin and myostatin signalling leads to the massive hypertrophy that depends on the complete inhibition of the Smad2/3 pathway and activation of the parallel bone morphogenetic protein (**BMP**)/**Smad1/5** axis.

Despite this fact, it helps to sustain muscle homeostasis in the organism. The novelty of this technology is based on the **combining molecules to target all 3 related proteins together**.

Dr Craig Harrison mentioned that scientists have the ability to **regulate increasing of the muscle mass in the case of the disease**. Furthermore, he noted that this research was aimed at the creation of the method of preventing muscle loss in the wasting condition cachexia, in cancer.

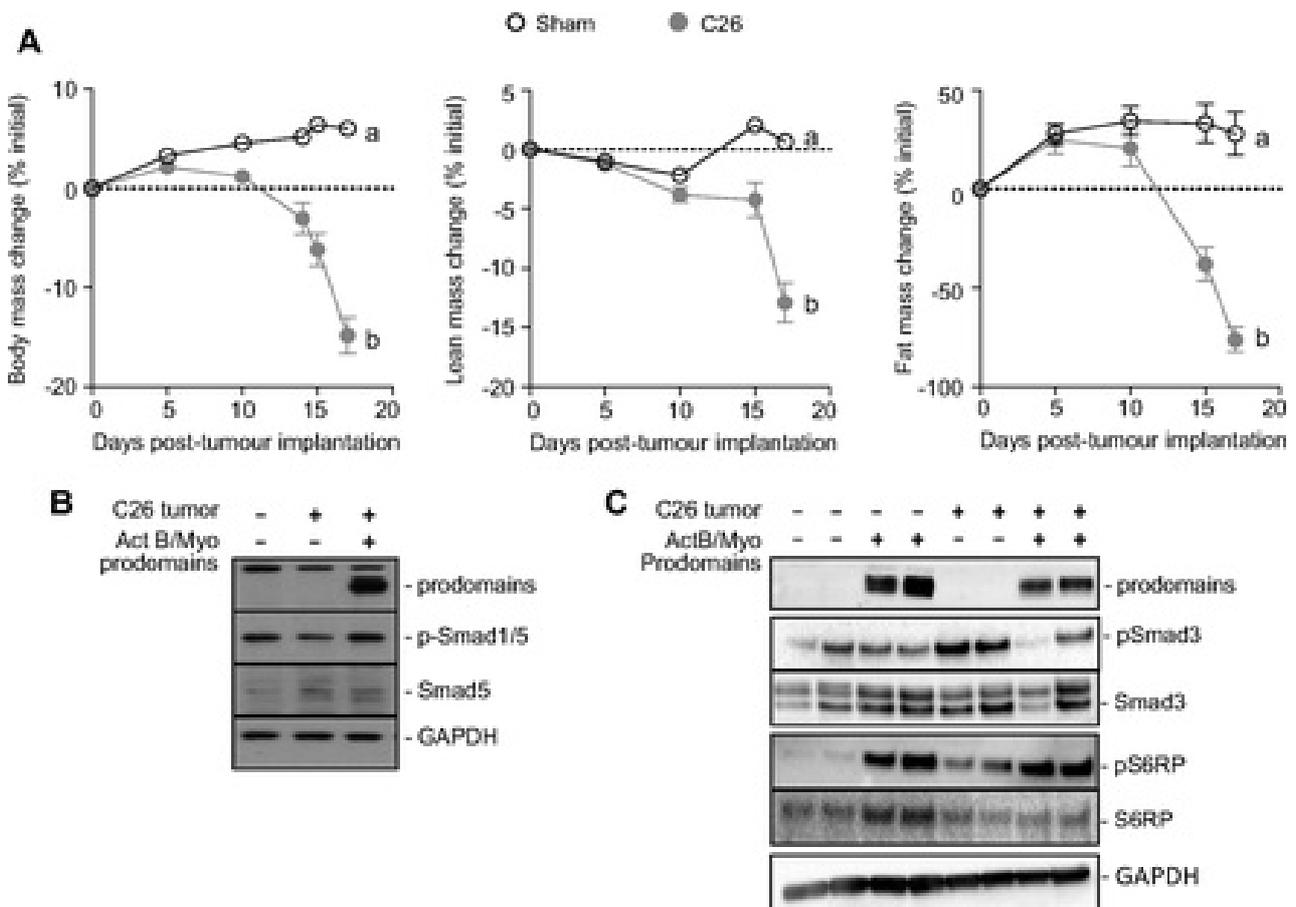


The effects of inhibiting Smad2/3-activating ligands in dystrophic mice. The right tibialis anterior (TA) muscles of 4- to 6-wk-old male and female C57BL/6 dystrophin^{-/-} mice (*mdx*) and dystrophin^{-/-}/utrophin^{+/-} mice source - pnas.org

The cachexia, observed in the latest stages of cancer, leads to the death or directly cause 20% - 30% of all cancer-related deaths. Currently, the palliative care is the only way of the treatment of cancer cachexia. In addition, this disease accompanies diabetes, AIDS, and in heart and kidney failure. To define the relative contribution of endogenous TGF-β proteins to the negative regulation of muscle mass via their activation of the Smad2/3 signaling axis, scientists have used a local injection of adeno-associated viral vectors (AAVs) encoding ligand-specific antagonists into the tibialis anterior (TA) muscles of mice.

To determine the relative contribution of endogenous TGF- β ligands to the negative regulation of muscle mass, scientists have used local injection of AAV vectors encoding either the myostatin prodomain (inhibits myostatin and the closely related ligand, GDF11), a modified activin A prodomain (specifically inhibits activin A), or a modified activin B prodomain (inhibits activin A and activin B) into the tibialis anterior (TA) muscles of mice.

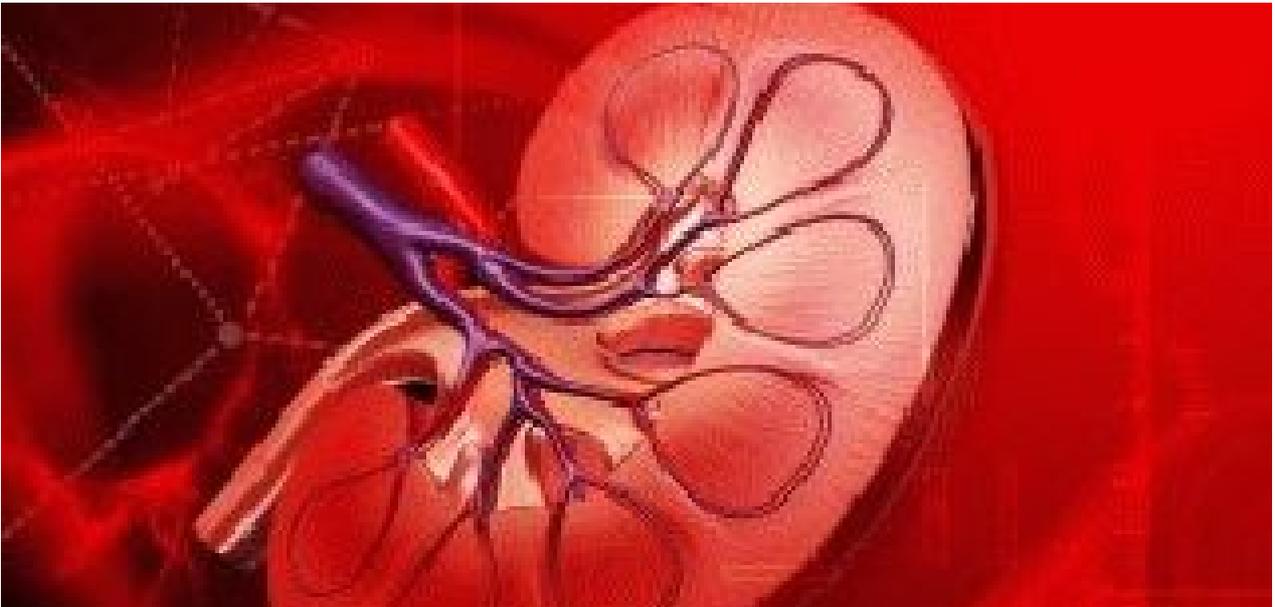
In additions, this method can be used in treatment developing for elderly people who gradually lose their muscle function.



Catabolic effects of C26 tumors in mice. C26 tumor fragments were implanted s.c. into 8- to 10-wk-old male BALB/c mice

source - pnas.org

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Industries: Healthcare, Biotechnology
Source links: [Proceedings of the National Academy of Sciences](#)



TONEBP CAN HELP TO TREAT THE DIABETIC KIDNEY DISEASE

The group of scientists found that the genetic variability of tonicity-responsive enhancer-binding protein (TonEBP) is connected with inflammatory responses, vascular injury, and CKD, in response to stressors such as hyperglycemia. The study results can help to minimize diabetes- and stress-induced inflammation and renovascular injury.

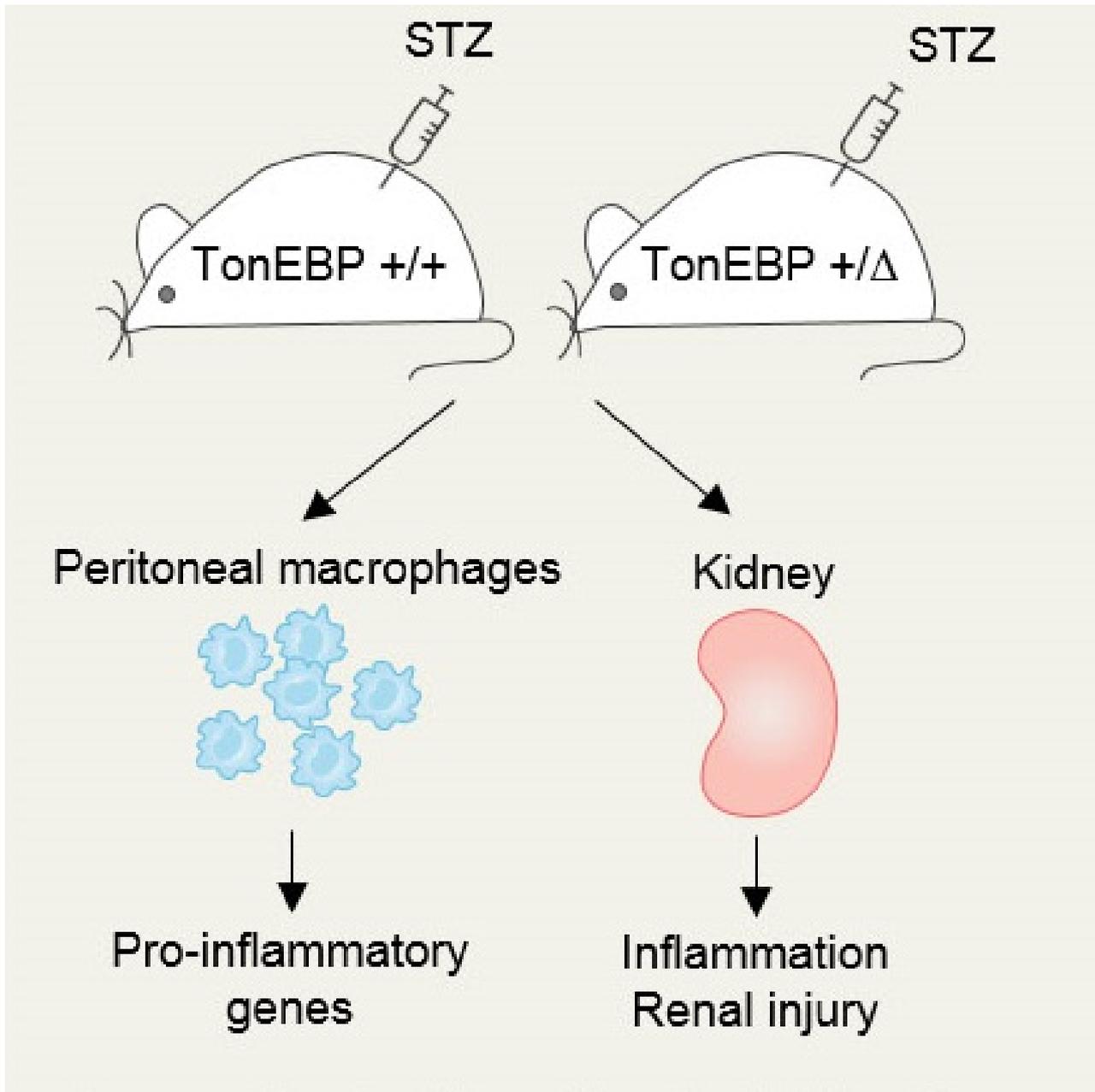


Diabetic nephropathy (DN) has become the single leading cause of ESRD in developed nations. Bearing in mind the paucity of effective treatment for DN and progressive CKD, novel targets for treatment are sorely needed source - unist.ac.kr

This significant discovery was made by the scientific group, led by Professor Hyug Moo Kwon from the [Ulsan National Institute of Science and Technology](http://unist.ac.kr).

A well-known fact is that diabetes can lead to dangerous consequences, such as cardiovascular disease, neuropathy, lower-extremity amputation and kidney disease. **Diabetic Nephropathy (DN) or diabetic kidney** disease is a specific kidney disease characterized by a lesion of the glomeruli, leading to the development of chronic renal failure. In the most difficult situations, the poisoning of the internal environment of an organism, unable to independently get rid of excess and harmful substances. In these cases, in order to support the life of the patient, hemodialysis therapy has to be used.

Previously, the scientific group had studied the activity of **TonEBP** in monocytes and how they are connected with early DN and progressive chronic kidney disease (CKD). To prove this hypothesis, scientists have found that the **genetic variability of TonEBP is connected with phenotypes, which are linked to the inflammatory, nephritis, and vascular function.**

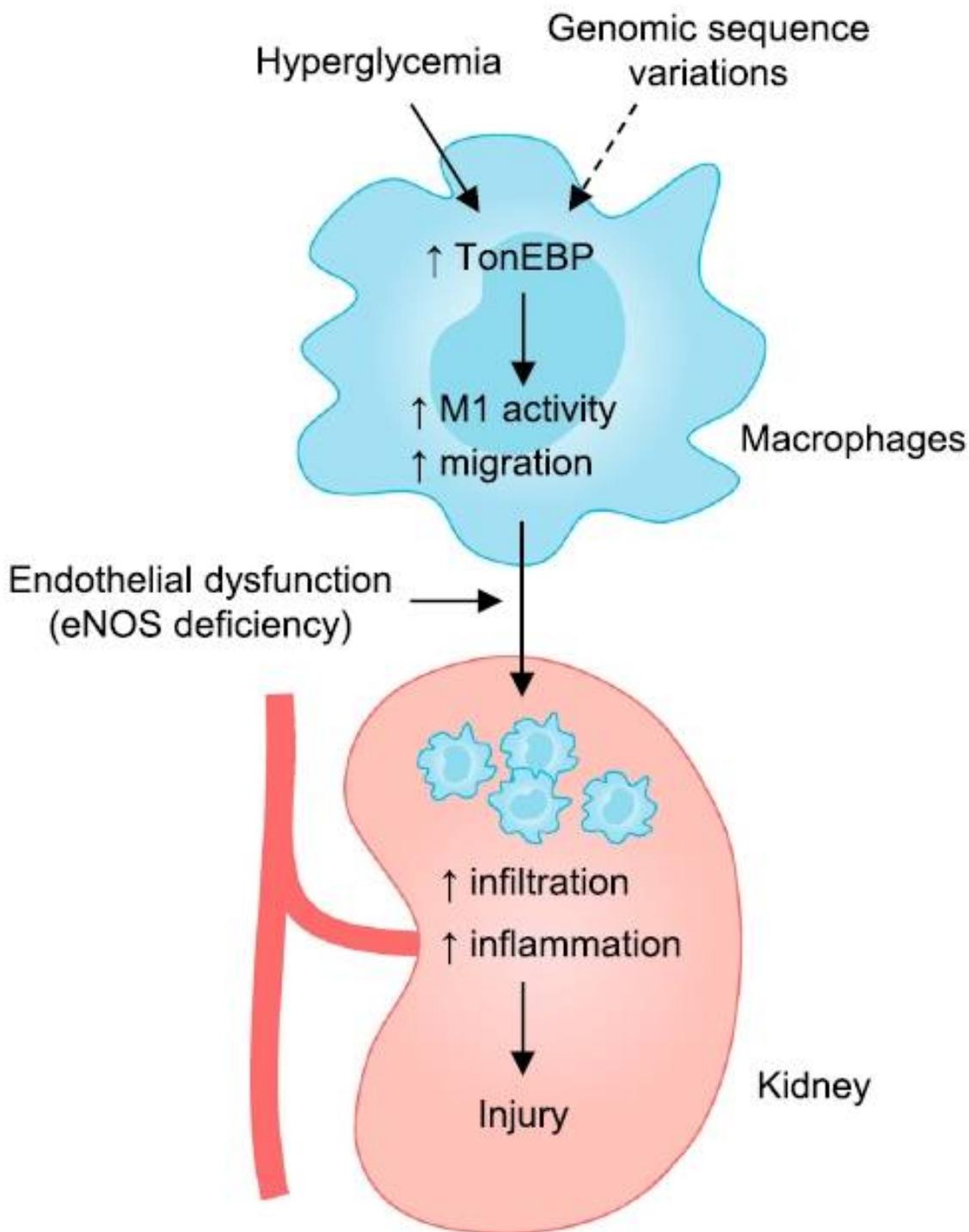


Scientists have found a major risk factor for diabetic nephropathy
source - unist.ac.kr

Professor Hyug Moo Kwon mentioned despite the fact, that patients with ESRD have dialysis treatment, they are associated with increased level of the mortality. The main problem is that there are no methods for DN treatment, that is the most common reason for ESRD appearance. The important moment is that it has been impossible to predict disease on early stages of diabetes.

The scientific group studied early symptoms of kidney disease in patients with diabetes. They defined the activation of inflammatory and kidney injury in mice with the TonEBP haplodeficient diabetic nephropathy.

Scientists discovered that in the mouse model, **TonEBP haplo deficiency is connected with the decreased process of macrophages activations by hyperglycemia**, less macrophages in the organ, lower nephritic generation of proinflammatory genes, and attenuated DN. Moreover, in healthy people, genetic variants of TonEBP connected to the renal function, systemic inflammation. The results of this research proved that **TonEBP has the ability to minimize diabetes- and stress-induced inflammation and renovascular injury**.



TonEBP mediates hyperglycemia-induced DN
source - unist.ac.kr

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On market since: -

Regions: Korea

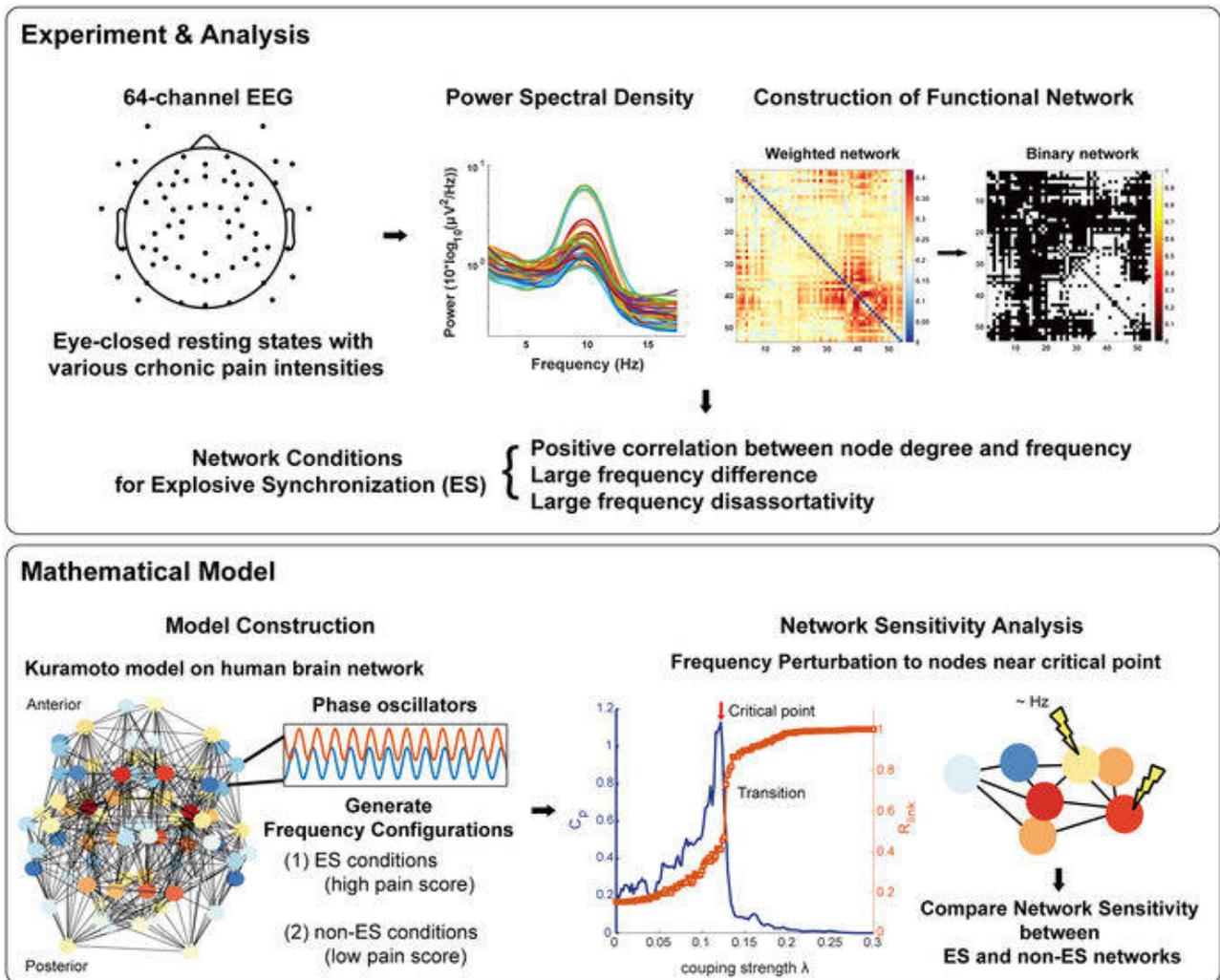
Industries: Healthcare, Biotechnology

Source links: [American Society of Nephrology](#)
[Ulsan National Institute of Science and Technology](#)



A NEW DISCOVERY WILL HELP TO TREAT FIBROMYALGIA IN THE FUTURE

The latest research showed that hyperreactive brain network can cause the hypersensitivity of the brain that is inherent to the fibromyalgia. Scientists can model the brain activity and test regions of the brain to transform a hypersensitive network into a more stable one. These regions can be targeted in living humans using noninvasive methods of therapies.



Schematic diagram of study design. The study was composed of two parts, an experimental analysis section and a mathematical modeling section

source - nature.com

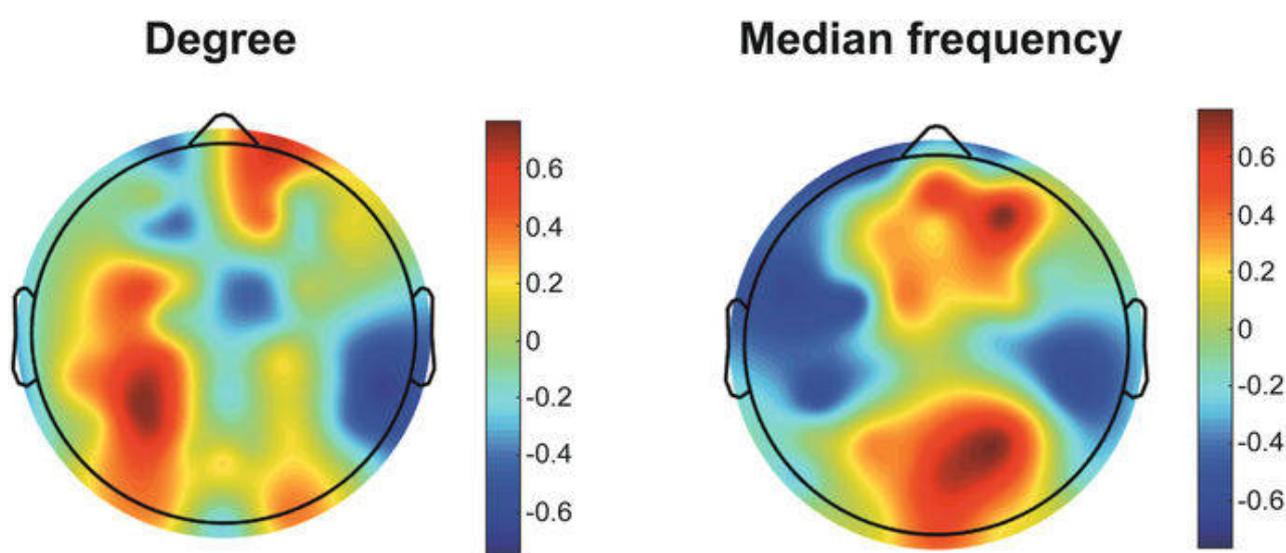
This innovational method was developed by the international group from the [Pohang University of Science and Technology](#) and the University of Michigan.

Fibromyalgia (FM) is a chronic diffuse symmetrical musculoskeletal pain, which is characterized by memory issues, sleep, fast fatigability, swelling, tension headaches and sensation of numbness and tingling in various parts of the body. It is considered that fibromyalgia increases painful feelings by affecting the way your brain processes pain signals. The results of the new study demonstrate that hyper-reactive brain networks can play a significant part in the abnormal sensitivity of fibromyalgia.

The researcher's group made a hypothesis that **Explosive Synchronization mechanism can be connected with the FM**. The Explosive Synchronization or ES is the abnormal hyper-sensitivity of brain systems. Associate Professor Richard Harris mentioned that the study

results demonstrate that the chronic pain of patients with FM is caused by unusual sensitivity of brain networks.

To prove this supposition, scientists analyzed results of the electroencephalogram (EEG) of 10 FM patients. The team tested ES conditions within functional brain networks using EEG. They tested whether the model of brain system with ES is sensitive to an external perturbation. Furthermore, scientists show that characteristics of ES are significantly correlated with chronic pain intensity. The results of this modelling research prove that connections of ES are more sensitive to perturbation compared to the non-ES network of the brain. In other words, the ES leads to the FM unusual sensitivity.

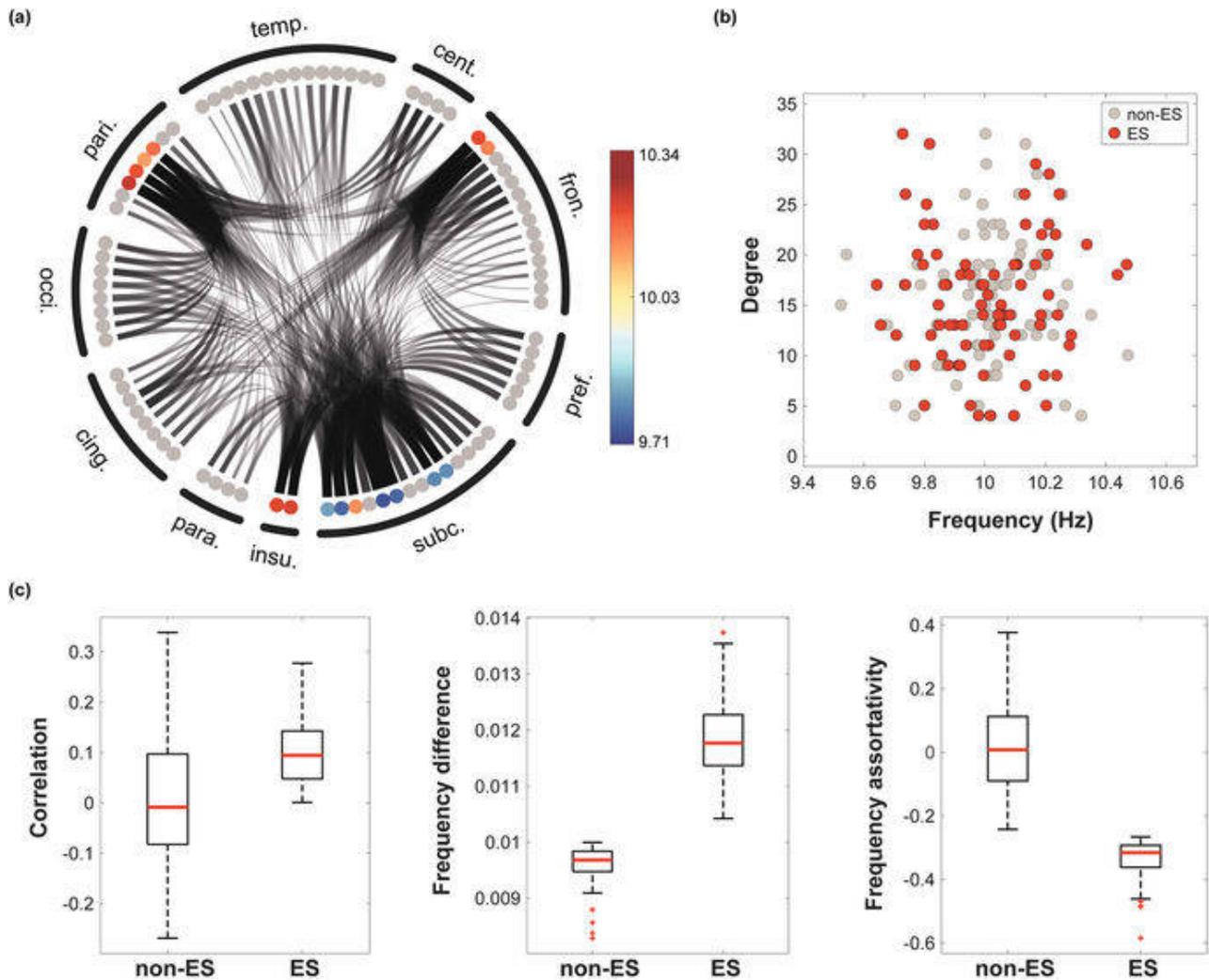


The relationships of regional node degree (Left) and median frequency (Right) with pain intensity
source - nature.com

Considering the characteristic hierarchical hub structure of the human brain connections, it may be possible to convert an ES connection to a non-ES network just by modulating one or two hub nodes. The transcranial magnetic stimulation and transcranial direct current incitement can be improved by 'targeting' these sensitive hub nodes. The application of deep brain stimulation to critical nodes that could modify the state of explosive synchronization is another therapeutic possibility.

Consequently, the results of the discovery showed that pain in FM patients correlates with the strength of ES states in functional brain connections reconstructed from high-density EEG. Moreover, the human brain network model supported the supposition that connection of ES may give rise to hypersensitivity from a perturbation. The results suggest that ES can

be a mechanism of the unusual sensitivity of the brain connection in FM. The most important moment is that this discovery can be a fundamental basis for modulating chronic pain through the conversion of an ES brain connection to a non-ES network using brain stimulation methods.



Network configurations of ES and non-ES conditions
 source - nature.com

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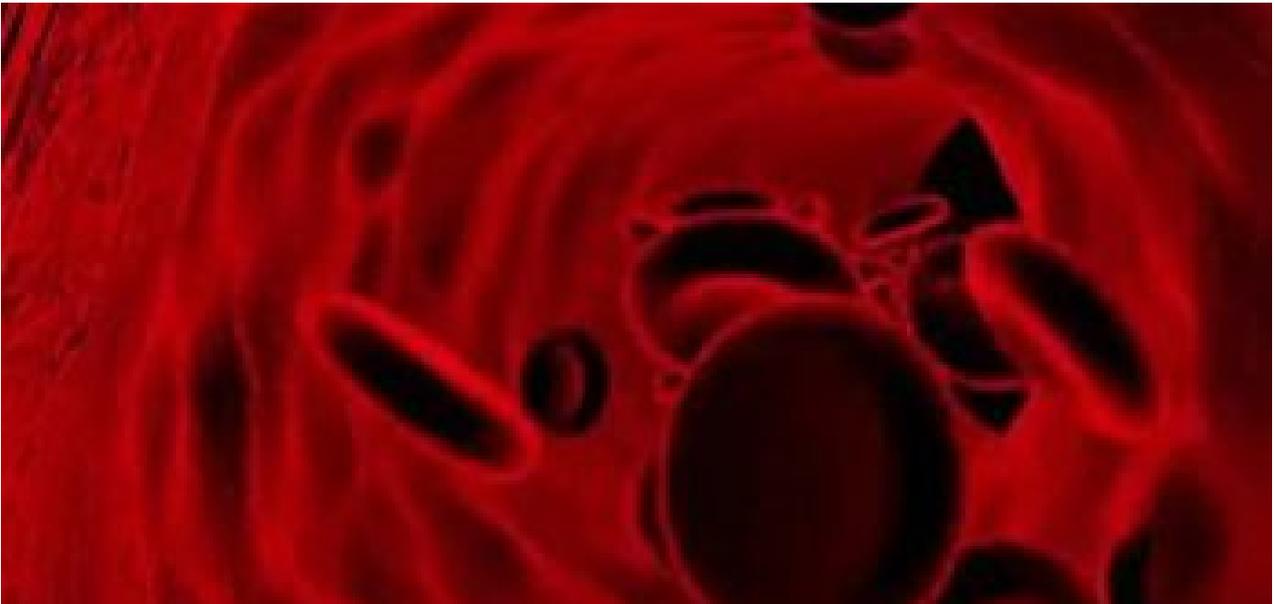
Patent status: -

On market since: -

Regions: United States, Korea

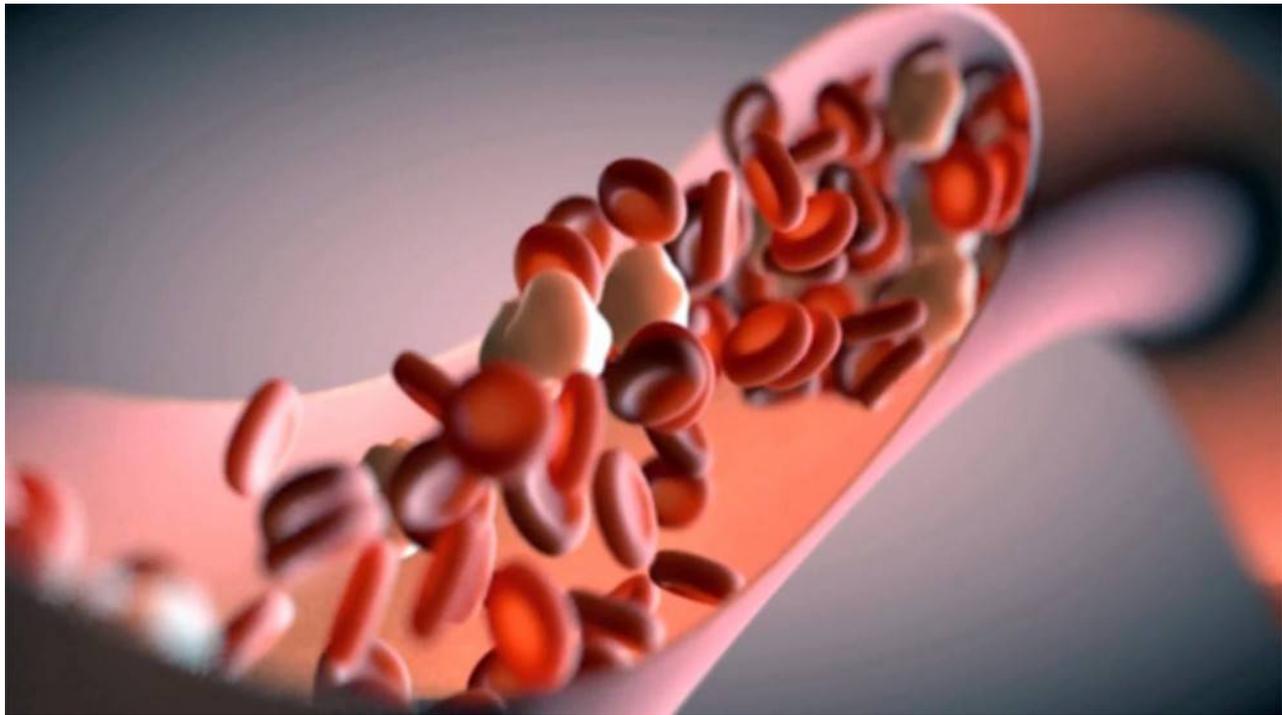
Industries: Biotechnology

Source links: [Scientific Reports](#)
[Pohang University of Science and Technology](#)



3D-PRINTED BIO-BLOOD-VESSELS TREAT ISCHEMIC DISEASE

Korean scientists have developed an innovative 3D printed bio-blood-vessels that have many advantages compared to the current collagen-based bionik method. This unusual technology doesn't have various limitations such as blood clotting, which arises during the transplantation process. Scientists have used a novel hybrid bioink, proangiogenic drugs and versatile 3D coaxial cell printing method.

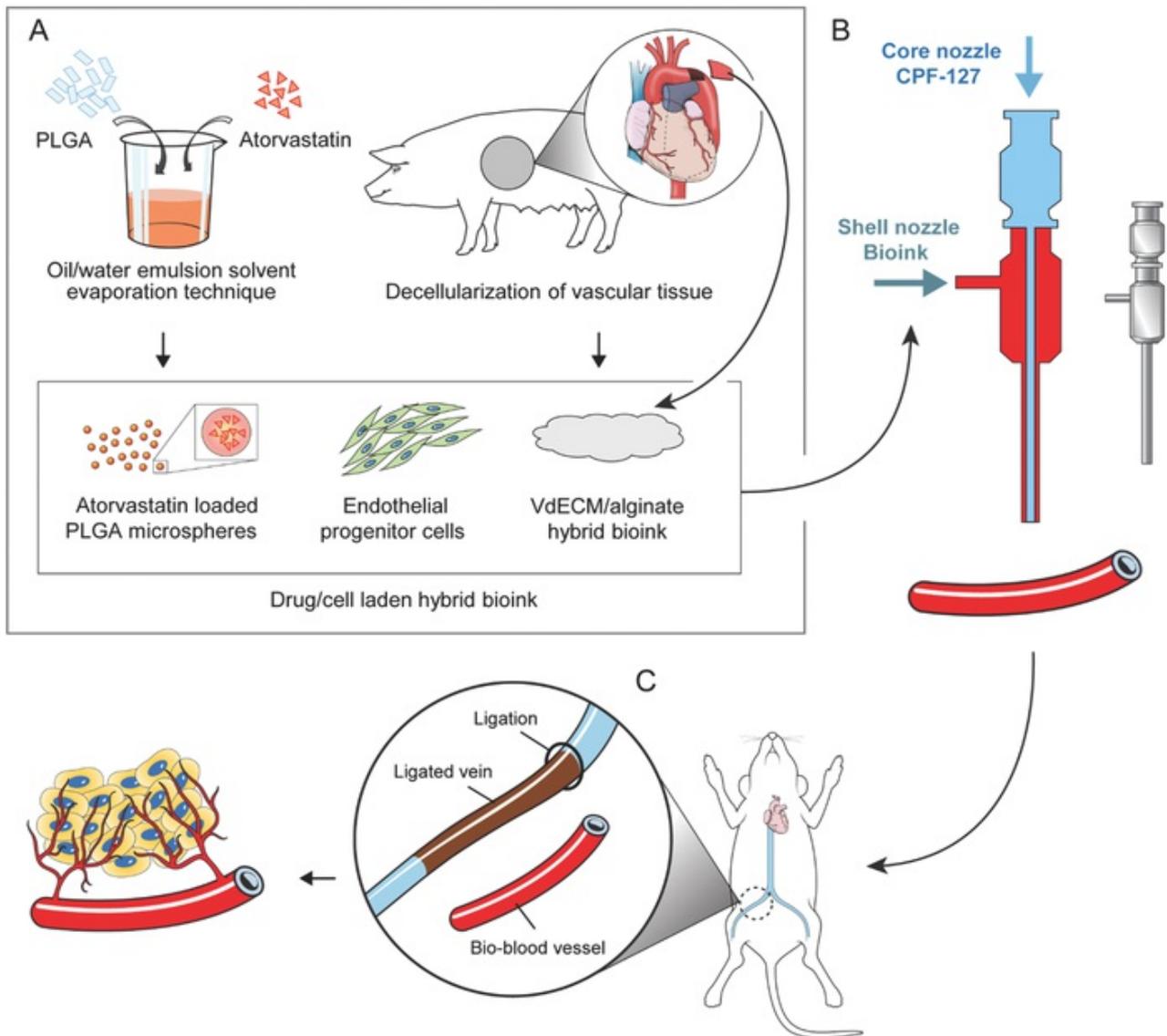


The main advantage of the developed bioink is its capability of providing a stem cell niche environment in tissue engineered BBVs that have a hollow tube shape
source - sciencenewsjournal.com

This innovational method was developed by the group of scientists led by Professor Dong-Woo Cho from the [Pohang University of Science and Technology](#).

The ischemia is the lessening of blood flow in the body, usually caused by plaques creation inside blood vessels. Typically, the disease leads to dangerous complications such as blood vessels damages. The treatment of this disease requires transplantations of blood vessels. 3D printing of bio-tissue, which can be implanted in the body, is a universal method of treating many diseases such as the ischemia. However, these methods can cause dangerous complications, for example, the blood coagulation during transplantation.

Typically, **endothelial progenitor cells (EPCs)** are considered as the source of cells for the ischemia treatment due to its potentials in neovascularization. Nevertheless, the therapy, which is based on its use, has a low therapeutic efficiency. As the result, the group of scientists have created a method based on the **bio-blood-vessel (BBV)**. To create BBV the group used a **compound of the vascular-tissue-derived decellularized extracellular matrix (VdECM)** and **alginate**. In addition, to deliver atorvastatin and BBV scientists used 3D printing technology.

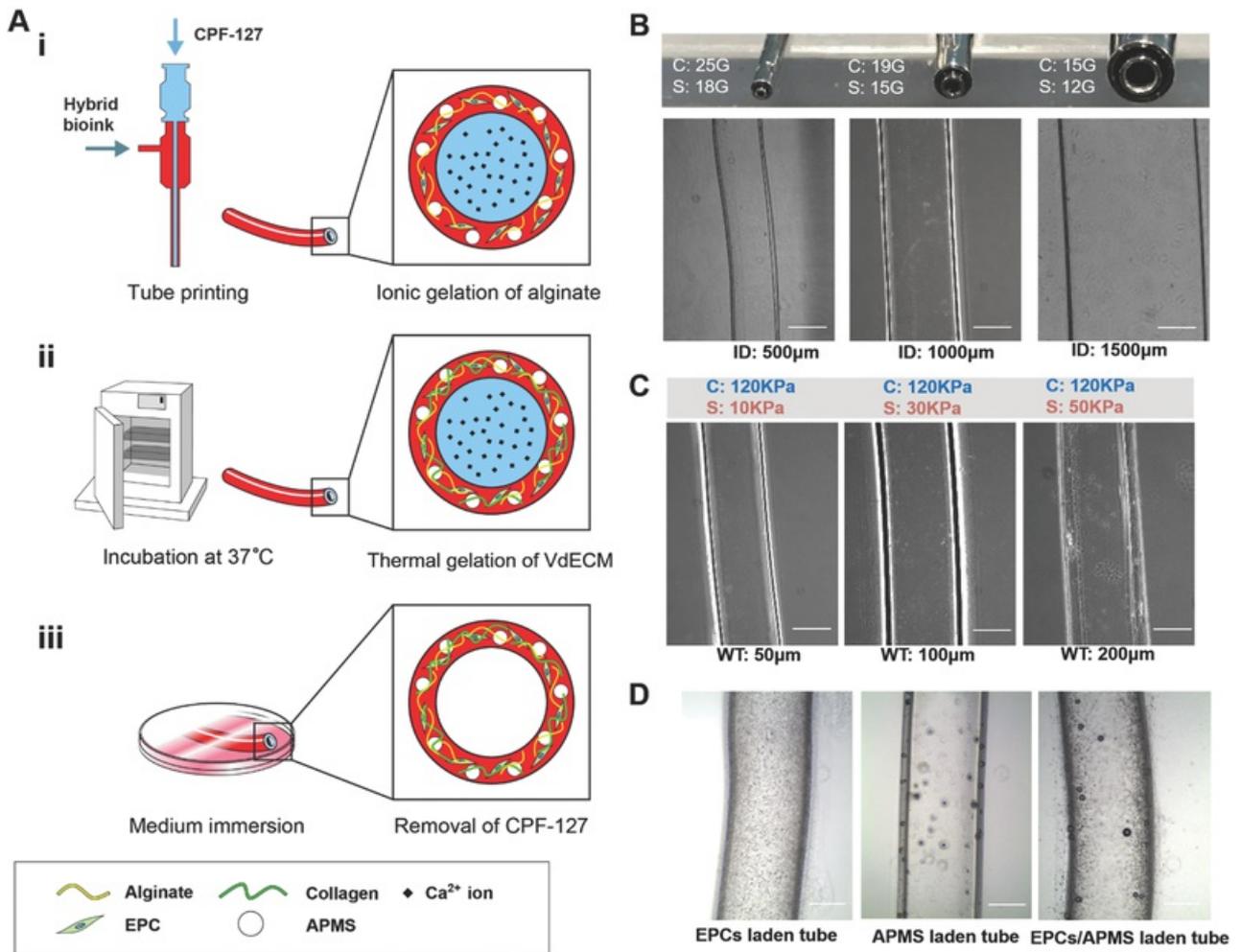


The fabricated BBV was evaluated in a mouse model by transplanting the structure to the vicinity of the ligated limb vein to treat ischemic disease
source - onlinelibrary.wiley.com

The researcher's results demonstrated that BBVs, which were transplanted into mice, works efficiently and without **any complications**. Compared to the standard collagen-based bioink, the innovative hybrid bioink contains stem cells and drugs, which has the ability to treat ischemia. The 3D printed BBVs cause the brief incubation to **promote the thermal gelation of their extracellular matrix**. The hybrid bioink has the ability to provide direct production of tubular BBV. Scientists mentioned that **by controlling the printing parameters, can construct BBVs in requested dimensions**.

The group have provided a series of experiments that demonstrated the reducing risks of necrosis at **7 times**. Accordingly, BBVs were also laden with drugs that would be released into its surroundings, the remarkable likelihood of a successful recovery of the injured

tissue would be increased. Professor Jinah Jang noted that the capabilities of generating desired blood vessels using 3D printing method will lead to the creation of various types of implants, for example, the production of arteries.



The ionic gelation of alginate in 3V2A realized BBV printing (i), the thermal crosslinking of collagen fibers was induced by incubation at 37 °C (ii)

source - onlinelibrary.wiley.com

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On market since: -

Regions: Korea

Industries: Healthcare, Biotechnology

Source links: [Advanced Functional Materials](#)
[Pohang University of Science and Technology](#)

thy Knee



AN INNOVATIVE HYDROGEL CAN TREAT A RHEUMATOID ARTHRITIS

Korean scientists have developed a therapeutic-das-responsive hydrogel that has the ability to treat rheumatoid arthritis by absorbing the synovial liquid. The gel changing its structure can deliver the drug and absorb the liquid due to the reaction to the nitric oxide (NO) contained in the immune cells near the inflammatory joints.



The hydrogel consists of polyacrylamide and a cross-linking agent (NOCCL)
source - reliawire.com

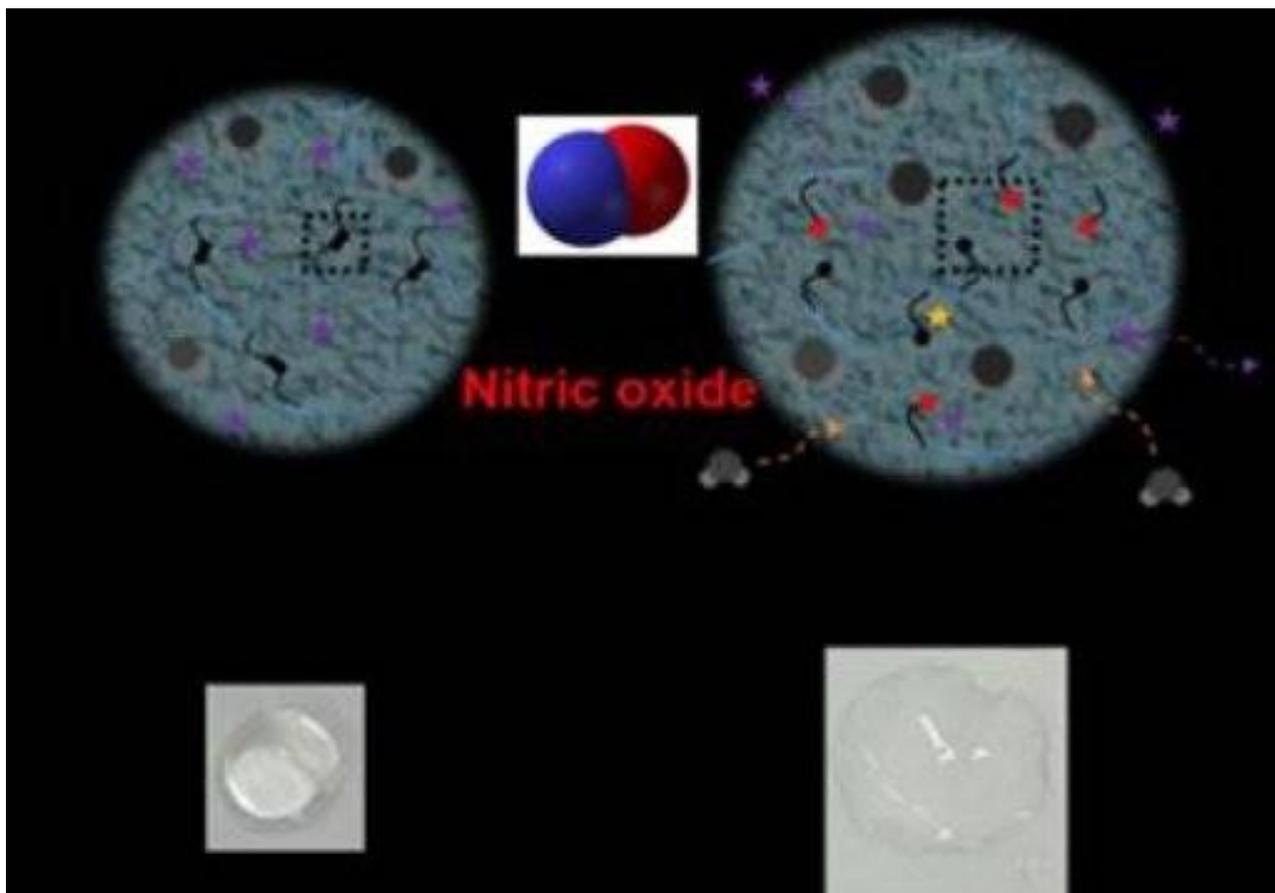
This innovational discovery was made by the group of scientists led by [Professor Won Jong Kim](#) and [PhD candidate Junghong Park](#) from the [Pohang University of Science and Technology](#).

Rheumatoid arthritis or is the disease of connective tissue with a predominant lesion of small joints as an erosive-destructive polyarthritis of an unclear aetiology that has a complex autoimmune pathogenesis.

According to the Professor Won Jong Kim, immune cells from the sore articulation are the main source of NO, which is the gas that has different functions and characteristics. Usually, it created as a result of inflammation and can protect our organism by preventing pathogens performing. Nevertheless, when there is a lot of nitric oxides, it can toxically act on the body and cause RA, as well as other diseases, in some cases even cancer. The most methods of treatment of RA are based on anti-inflammatory medications, which have the ability to reduce pain and inflammation. However, scientists have tried to create a method that can give out NO.

The innovational hydrogel contains the [polyacrylamide](#) and [a cross-linking agent \(NOCCL\)](#) that generates the connection between molecules of the acrylamide. When molecules of hydrogen and nitric oxide meet, clearances in the polyacrylamide open up and release

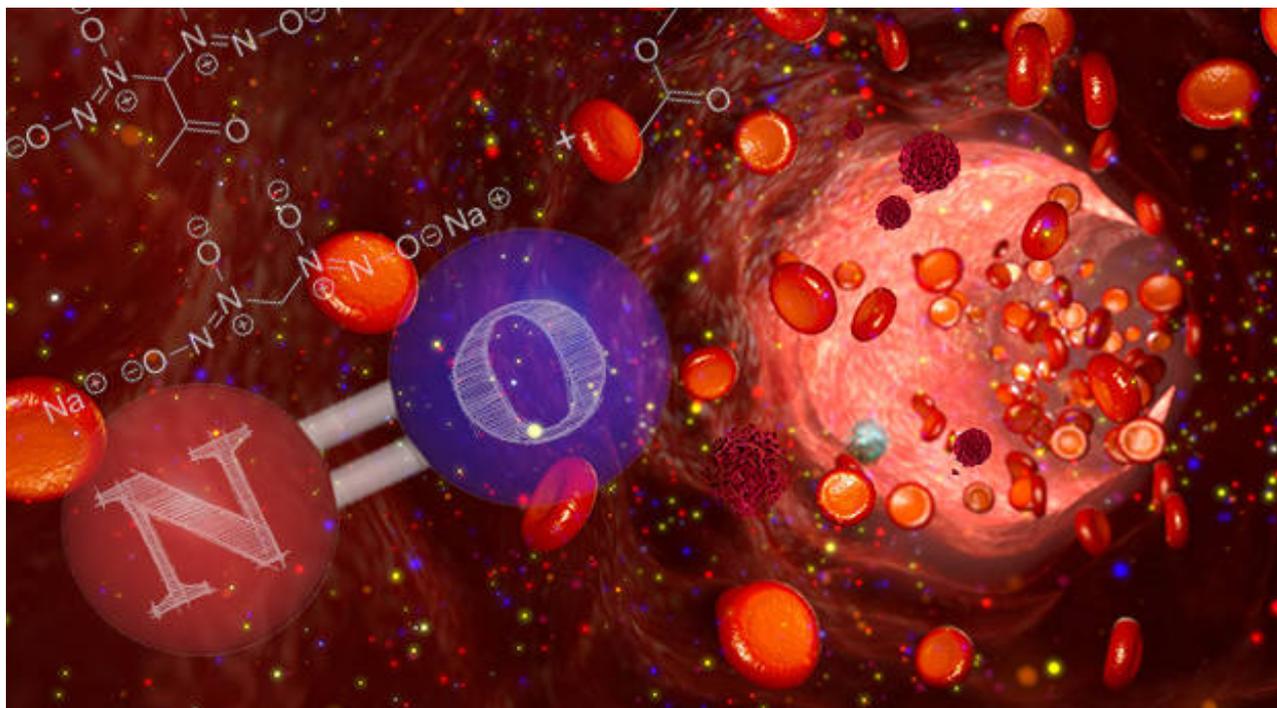
water, increasing the mass of the gel more than 3 times.



IBS scientists developed a hydrogel made of polymeric acrylamide (blue spaghetti) linked with crosslinkers (black), which can accommodate drug molecules (purple stars) within its mesh (grey)
source - sciencedaily.com

Scientists mentioned that this technology is unique because of its possibility. This method can be used to allow the hydrogel to deliver and let out drug molecules while absorbing fluids. When the synovial liquid permeates the gel, it can expel medicines to maximize the therapeutic effect. Furthermore, the other crucial moment is that the gel can be used not only as the support for a drug-delivery method but as a potential tissue frame as well.

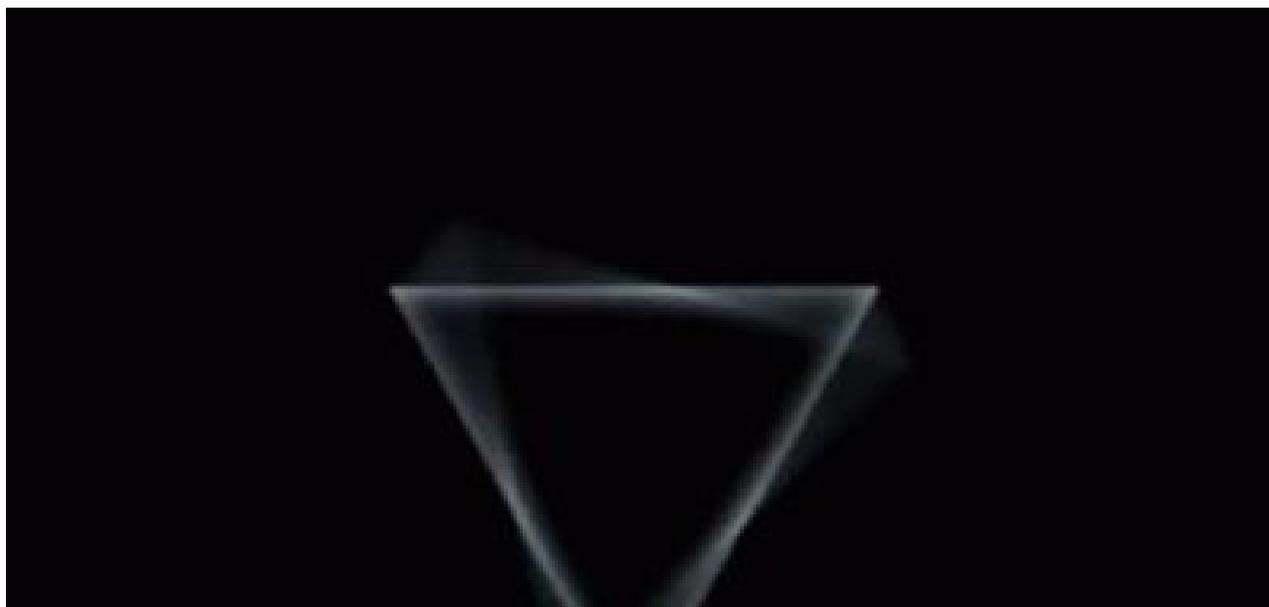
This discovery is extremely important, because it not only efficiently let out protein drug, but also acts on inflammation of the site, it can also serve as a tissue structure. In addition, it enhances the action of drugs.



Nitric oxide (NO) is a crucial signaling molecule with various functions in physiological systems. The preparation of responsive biomaterials upon NO having temporally transient properties is a challenging task
source - thetruthaboutcancer.com

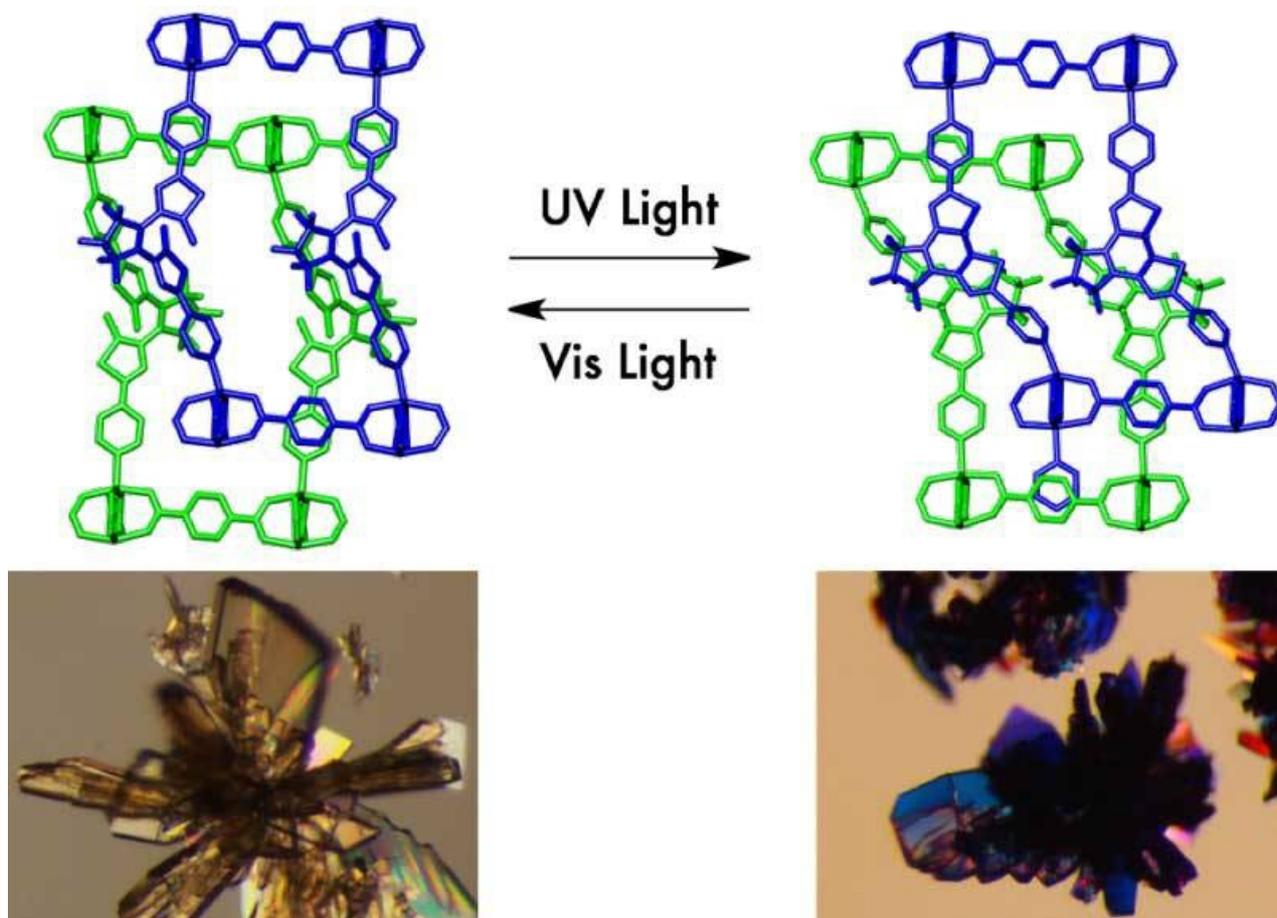
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Patent status: -
On market since: -
Regions: Korea
Industries: Chemicals, Healthcare, Biotechnology
Source links: [Pohang University of Science and Technology](#)
[Advanced Materials](#)

OTHERS



A NEW FLEXIBLE AND LIGHT-RESPONSIVE MATERIAL

Scientists have developed a light-responsive crystalline material, which has the ability to change its porous nature. This porous framework with the structural flexibility of that provides a highly efficient photochemical electrocyclization in a single-crystal-to-single-crystal manner.



Entangled porous coordination polymers like 'wire-and string puzzles' enable reversible and repeatable photomodulation of CO₂ sorption
source - Kyoto University

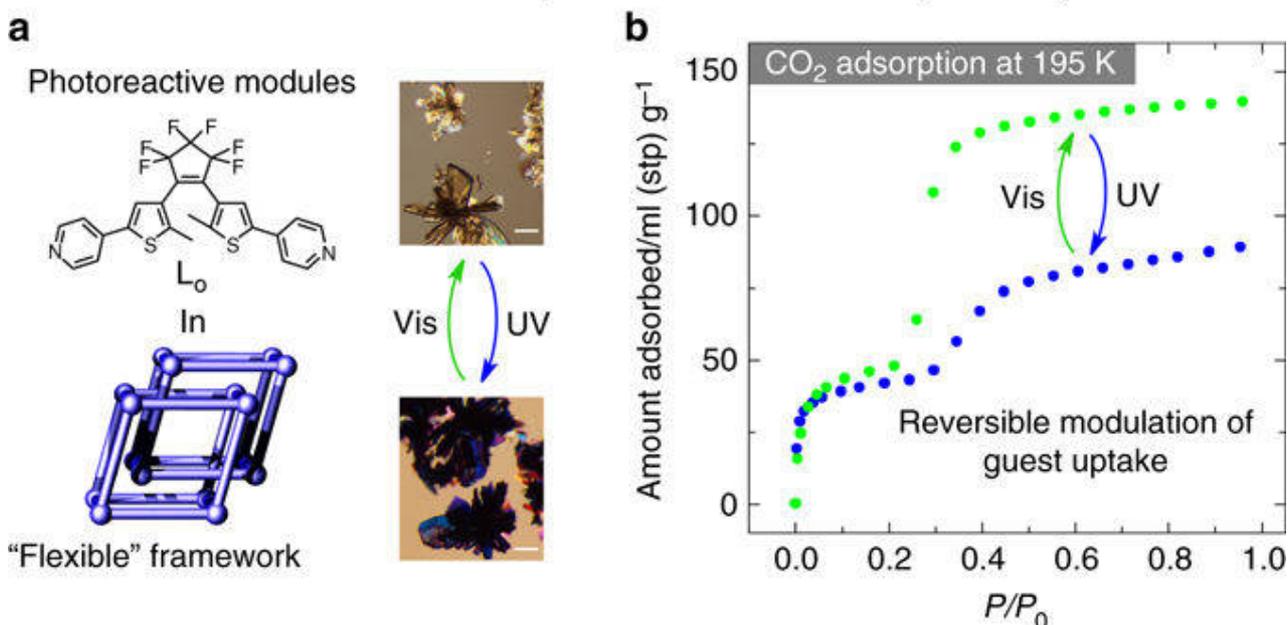
The innovational development was made by the scientific group from the [Kyoto University](#) in collaboration with the [University of Tokyo](#).

Photochromic molecules are substances, which display colour changes upon photoirradiation. They are characterized by changes of geometric structures, electronic states, and chemical and physical properties. These molecules are an important element in creating of different photoresponsive materials such as polymers, gels and liquid crystals. Photochromic molecules are highly-useful as they can be applied in medicine. For example, it can help to control drug release in the complicate medicine delivered mechanism or to generate dynamic scaffolds for tissue engineering. Furthermore, **porous coordination polymers (PCPs)** or **metal-organic frameworks (MOFs)** represent a highly-demand new class of porous materials with crystalline frameworks.

Consequently, scientists managed to develop a **framework with the flexibility, which provides a sufficient room for structural changes of the dithienylethene (DTE) moieties for**

quantitative conversion during photoisomerization. The crystal also contains zinc ions (Zn^{2+}) and 1,4-benzenedicarboxylate.

Quantitative and reversible photochemical reaction in porous crystals



Quantitative and reversible photoisomerization in a flexible porous crystal for modulating CO₂ sorption. The highly effective photochemical reaction in the porous crystal realizes a reversible modulation of CO₂ sorption source - nature.com

The team created a PCP, which demonstrates a highly effective isomerization and cooperative structural transformations by combining flexible frameworks with DTE derivatives. The synthesis and characterization of a photoresponsive PCP with a twofold interpenetrated framework composed of a DTE-based ligand. Taking advantage of the flexible nature of the entangled framework, the porous crystal shows a quantitative and reversible isomerization upon UV and visible light irradiation, which is applicable to reversible photomodulation of its gas sorption properties. The material is able to absorb CO₂, nitrogen at various temperatures, under the influence of visible and ultraviolet light.

Due to the flexibility of the structure, channels have changed under the influence of light. The distance between the 2 layers decreased with ultraviolet irradiation, then expanded with the light of visible light.

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Patent status: -
On market since: -
Regions: Japan
Industries: Chemicals, Others
Source links: [Nature Communications](#)
[Kyoto University](#)