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# SPINOFF REPORT



confidential

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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



## ORII - THE VOICE POWERED RING THAT CAN MAKE CALLS OR SEND MESSAGES

Wearable devices have become a more common part of the tech world as companies have started to evolve more devices that are small enough to wear and that include sensor technologies that can collect and deliver information about their surroundings. Moreover, this type of devices is highly used in various fields such as medicine, tracking a patient's vital signs making the life more comfortable and safe. The Hong Kong spinoff Origami Labs developed a finger ring that can answer and make a call, send texts and even access the voice assistant instantly without a screen. All these functions the device provide without uncomfortable headphones. Developers mentioned that with ORII, it is possible to break the dependence on screen-based interactions and help to usher in the freedom that comes with voice interfaces.

[Origami Labs](#) has raised \$500,000 in crowdfunding and closed a hefty total funding of \$2.5 million. One of its founders is China-based [Alibaba Entrepreneurs Fund](#) for startups. Orii is produced in Taiwan, assembled in China. Its cost is \$ 160. Furthermore, the device, which was launched late last year, has sold 5,000 boxes (of 4 to 10 rings each) with another 5,000 expected to move by the end of August. Orders come primarily from Singapore, Hong Kong, Japan and Taiwan, as well as with Europe and the United States.



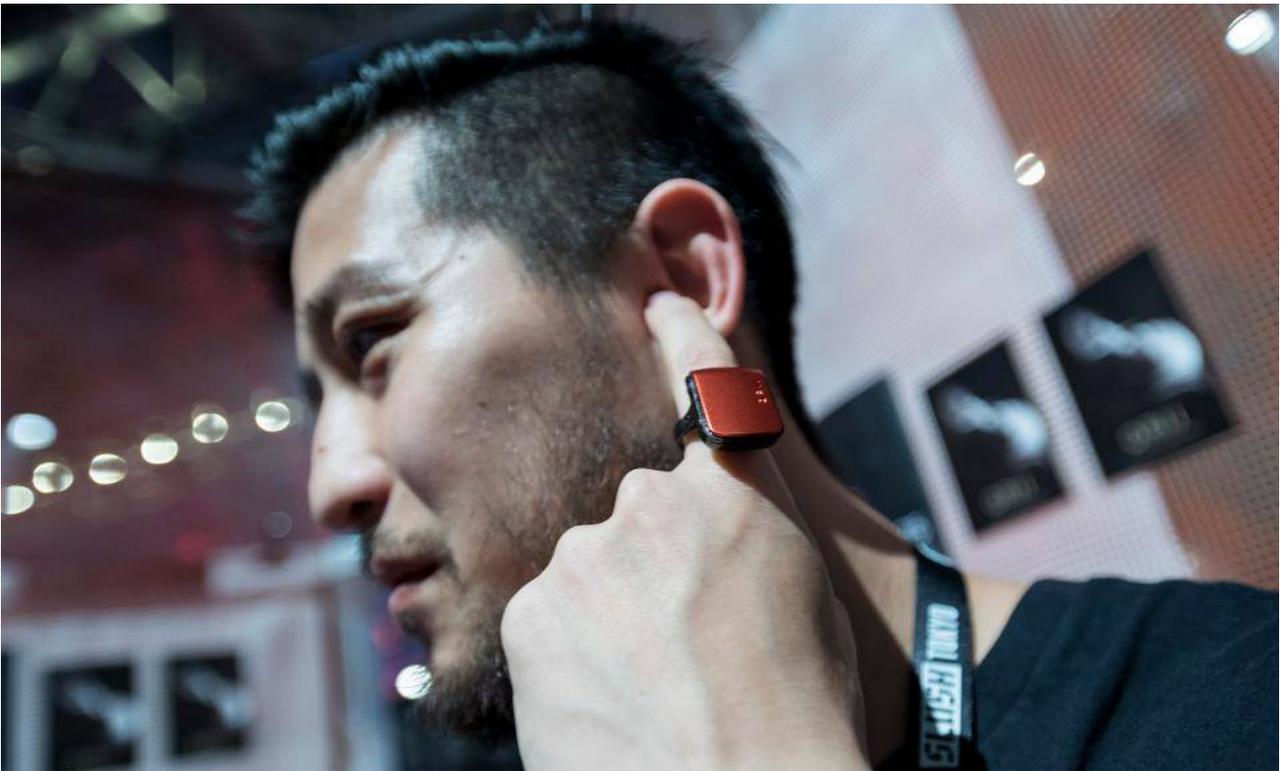
Origami Labs co-founders Emile Chan, Marcus Leung-Shea and Johan Wong wear their Orii rings. They got the idea as students at the Hong Kong University of Science and Technology  
source - forbes.com

Orii provides fast call or text, therefore, it built with walkers and texters in mind. The ring receives any kind of smartphone notification. The user just needs to touch the ear to send that short text message or take a quick call. It has the ability to provide clear audio, even in the case, it's noisy. ORIi makes phone's voice assistant more convenient than ever before by putting it at the fingertip. The voice assistant can make user's daily tasks easier and faster to handle. Just need a tap to wake up the voice assistant. The ring communicates with a phone via Bluetooth, with the user's finger bones conducting the sound. In addition, the LED light and vibration on the ring will notify the user about contacts, messages, and others. The battery provides 1.5 hours of continuous talk or 45 hours of standby time.



Wearing the ring and touching your ear gives you clear and crisp audio while listening to text messages through your finger. Send and hear a quick message without taking your phone out  
source - [producthunt.com](https://www.producthunt.com)

ORII is **waterproof**, therefore, the user can wash hands, get caught in the rain, and get sweat on the ring without any worries. But developers don't recommend showering or swimming with the ring on. Co-founder Johan Wong mentioned that this innovational device is ideal in a private setting, or if the user is outdoors or on the go. Orii operates something like wireless headphones, but it never needs to be taken off until the battery discharged in about 48 hours in standby mode. The ring's success could come down to fashion. The boxy Orii ring looms larger on the finger than the average wedding ring, and Origami Labs demos it by encouraging people to use the index rather than ring finger.



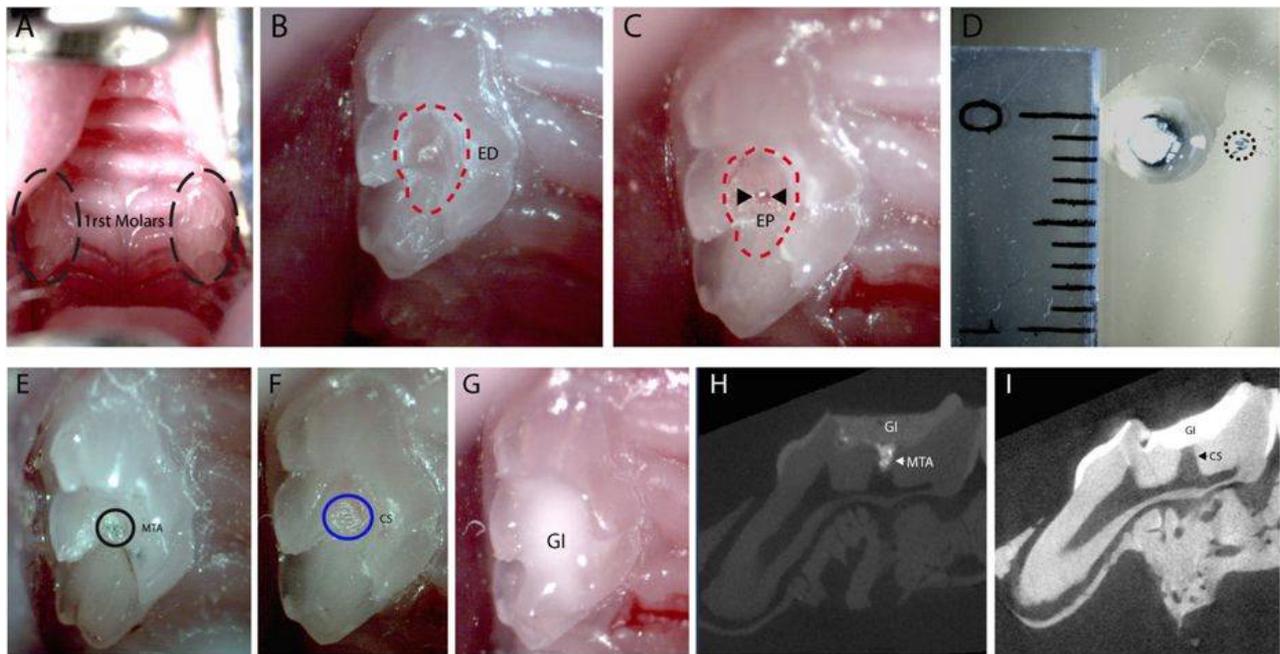
ORII's scratch-proof anodized aluminium finish is now available in four colours: sandblasted silver, metallic dark grey, matte black and the latest unlocked 100k stretch goal: armour red  
source - forbes.com

Company name: Origami Labs  
Contact person: -  
E-mail: hi@origami-labs.com  
Website: <https://www.orii.io/home>  
Phone: -  
Patent status: +  
On market since: -  
Regions: China  
Industries: Communications, Creative Industries, Elect...  
Source links: [Origami Labs](#)  
[Kickstarter](#)  
[Forbes](#)



## TIDEGLUSIB - THE DRUG THAT USED TO TREAT ALZHEIMER DISEASE CAN RECOVER TEETH

The restoration of dentine lost in deep caries lesions in teeth is a routine and common treatment that involves the use of inorganic types of cement, which is based on calcium or silicon-based mineral aggregates. Such types of cement remain in the tooth and fail to degrade and thus normal mineral volume is never completely restored. However, the scientific group, led by Professor Paul Sharpe, from King's College London has managed to find that the drug Tideglusib has the ability to encourage tooth regrowth and repair cavities. This biological method naturally stimulates the stem cells, which are contained in the pulp of teeth, hence, they generate new dentine that is the mineralised material under the enamel.

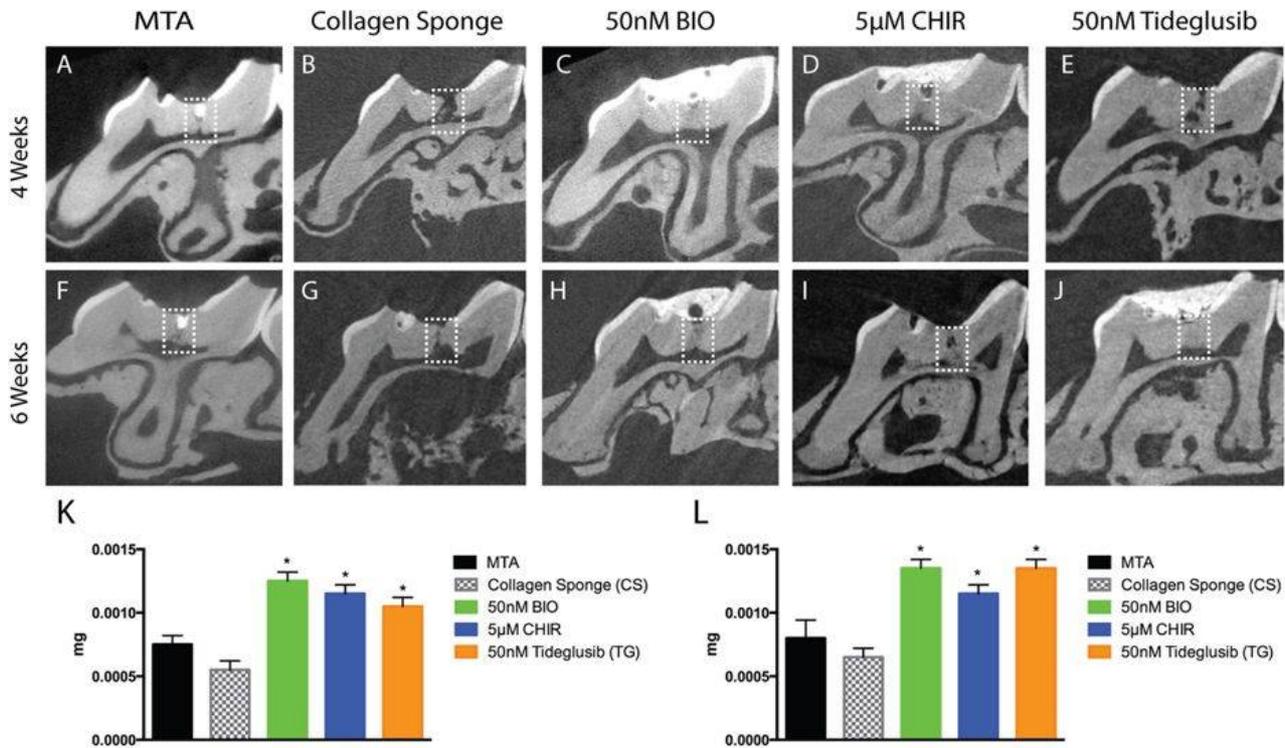


Using a needle the dental pulp is exposed, indicated by the arrowheads. The collagen sponge is soaked in drug and a small piece of it, indicated by the black dashed line, is removed for the direct capping  
 source - nature.com

The dentine is produced by highly specialised mesenchymal cells called odontoblasts. Teeth are able to regenerate dentine if the pulp inside the tooth becomes exposed through a trauma or infection (caries). Despite this, the layer of dentine will be very thin, and this is not enough to fill the deep cavities caused by tooth decay. Nevertheless, the developed drug Tideglusib can switch off an enzyme, the glycogen synthase kinase 3 (GSK-3), that suppress dentine formation. The activation of Wnt/ $\beta$ -cat signalling provides the cellular-based repair in all types of tissue. GSK-3 in the case of the absence of Wnt ligand/receptor binding phosphorylates  $\beta$ -catenin and Axin leads to ubiquitination and degradation. In other words, in the presence of Wnt ligands, GSK-3 activity is inhibited allowing  $\beta$ -catenin to enter the nucleus where it interacts with Lef/Tcf transcription factors to regulate expression of target genes, that include Axin2. Therefore, the addition of Wnt signalling agonists stimulate reparative dentine formation and thus restore lost dentine following caries removal with naturally-generated new dentine.

Scientists have demonstrated the method of using this drug: it is necessary to soak a small biodegradable sponge with the drug and insert it into the cavity, where it causes dentin growth and restores damage within 6 weeks. Since the carrier sponge is degraded over time, dentine replaces the degraded sponge leading to a complete, natural repair. Thus, this simple, rapid process of natural tooth repair potentially can provide an innovative and effective approach to the tooth restoration. As Tideglusib has already been demonstrated

to be safe in clinical trials of patients with Alzheimer's disease, therefore, scientists mentioned that this novel treatment can quickly put into practice.



MTA repair after 4 weeks notes the material (strong RO area at the injury site) at the injury site. Collagen sponge repair after 4 weeks, spaced dentine formation at the injury site  
 source - nature.com

**Company name:** King's College London  
**Contact person:** Professor Paul Sharpe  
**E-mail:** paul.sharpe@kcl.ac.uk  
**Website:** <https://www.kcl.ac.uk/index.aspx>  
**Phone:** +44 (0)20 7188 8308  
**Patent status:** -  
**On market since:** -  
**Regions:** United Kingdom  
**Industries:** Healthcare, Biotechnology  
**Source links:** [Scientific Reports](#)  
[The Telegraph](#)



## GREEN AND NUTRIENT-RICH COFFEE FROM BROCCOLI

Despite the latest developments in the field of nutrition, getting a daily dose of vegetables can be tricky. In particular, it concerns children or people who, due to various reasons, do not consume a sufficient dose of vegetables and accordingly do not get the required amount of nutrients and vitamins. Therefore, the researchers' group, led by Dr Mary Ann Augustin from the Commonwealth Scientific and Industrial Research Organisation (CSIRO) in collaboration with Hort Innovation has developed the nutritious broccoli powder that can be added during cooking such as cocktails, soups, pastries, or even make broccoli latte.



Australians don't eat enough vegetables and farmers across Australia will have access to an alternative market whilst improving farm yields and sustainability  
source - csiro.au

**Dr Augustin** mentioned that the broccoli has a high level of the protein and fibre, and health-promoting bioactive phytochemicals, making it the perfect candidate for powder development. There are also several studies determined that broccoli can help to fight cancer, for example, [genetically modifying a common type of gut bacteria and substance found in broccoli can help to treat bowel cancer](#). In addition, it can help to treat type 2 diabetes. Unfortunately, the processing of these vegetables causes the losing of the most of the nutrients before it reaches your dining table.

To get broccoli into more foods without losing its nutritional value, scientists have managed to produce **100% broccoli powder**. Furthermore, the combination of selected pre-treatment and drying processes **saves the natural flavour, colour, and nutrient composition of fresh broccoli**. 2 tablespoons of the powder equate to about one serve of broccoli. The product can be applied to make smoothies, soups, baked foods, or even just to hide this vegetable from fussy kids in meals. In addition, a Melbourne café became the first to experiment making a broccoli latte recently, having different reviews. Furthermore, broccoli powder has already been used for the production of extruded snacks with high vegetable content. Therefore, this innovational product is an option for farmers who want to produce value-added vegetable elements for different functional food markets. Previously, such snacks with **20 - 100 %** content of vegetables were

presented and have a big demand by adults and children. The broccoli powder and snacks are being developed as part of a larger research and production project, which will decrease vegetable waste by developing healthy food products from 'unfit' produce. Dr Augustin mentioned that researchers are going to provide product development and consumer sensory evaluation trials. In addition, they will **commercialize the powder and linked products.**



The CSIRO team and Hort Innovation are discussing potential commercial applications with produce growers and grower groups across Australia who are interested in getting the powder on the market  
source - adobe.com

**Company name:** Commonwealth Scientific and Industrial Re...  
**Contact person:** Dr Mary Ann Augustin  
**E-mail:** maryann.augustin@csiro.au  
**Website:** <https://www.csiro.au/>  
**Phone:** -  
**Patent status:** -  
**On market since:** -  
**Regions:** Australia  
**Industries:** Food and Drink  
**Source links:** [Commonwealth Scientific and Industrial Research Organisation](#)



## NEAHTID - WIRELESS ENERGY THAT IS AVAILABLE FOR EVERYONE

Exclusive interview for SPINOFF.COM with Rodrigo Augusto Coto, the CEO, and founder of Neahtid, that offers wireless charger solutions to businesses seeking to provide their customers and guests with easy, quick and efficient charging solutions for mobile devices. The company carefully design and build wireless charging solutions to keep your phone charged, at all times, regardless of where you are: in the office, at home or on the road, always taking into account these principles: safeguard and protect the environment; simplify the charging experience; ensure great charging speed. Neahtid' products are wireless energy chargers for smartphones, smartwatches, tablets and any low consumption device that uses electricity, covering enough radius to charge within a room or office. The added value of the company is fast charging that is innocuous, cover the larger range of charge, improve the user experience and provide an easy access to low consumption energy avoiding that the customer brings with himself a wired charger all the time.

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

Mr. Augusto: I have been in different fields of technology developing such as computer science, electronics, banking, for more than **15 years**. Currently, I am also working in this kind of industry.

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. Augusto: I have started working in this research field about 10 years ago. In 2017, we began collaborating with a very prestigious university, the [Federico Santa María Technical University](#), located here in Chile to test my theory. After that, using their advanced labs, we succeeded in adopting this theory. We applied some state funding to get some public funds and create a prototype of the product. Currently, **we are looking for an investment round of \$400,000**.



photo provided by Rodrigo Augusto Coto

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. Augusto: Currently, the project and the company are not in the commercialization phase because [we are working on the patent](#) and the papers for this kind of technology. Once the patent and documents are ready, we will be able to execute our commercial strategies and marketing strategies to reach the market. Even at this moment, we provide certain investigations to define, which market is the best one after Chile. We are working on these commercial strategies to execute it when the patent and the paper are ready.

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. Augusto: I am the founder of [Neahtid](#). It is my second company. The first one is the fintech company, which provide a solution for banks. It is still the important company in Chile' and Peru' markets in the fintech industry. I was the founder and CTO of [Finvox](#) and, currently, I am the CEO. I studied computer sciences and electronics. It is my background. Furthermore, I have got the diploma in financing and investing of the [University of Chile](#), which is the best one in these fields. The other part of the team is people who carry the patent. These people work in the patent industry more than 15 years creating engineering patents. We have a lawyer who also works with it in order to apply in the right way to get the international patent. In addition, there is a team of electronic engineers who create a product implementing the theory. There are a group of industrial designers who work with the plastic design. In addition, there is the administrative team.



Neahtid signed the collaboration agreement with one of the most prestigious universities in Chile and South America, the Federico Santa María Technical University  
photo provided by Rodrigo Augusto Coto

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. Augusto: To carry about **wireless charging**. To keep the gadgets on with wireless energies that people will never have to connect to annulet again.

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. Augusto: Currently, **there is no that kind of solution on the market**. However, there are some companies, which work in the same solutions but they don't have a ready technology on the market. Furthermore, concerning the patent, there are no similar things that we are doing.

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. Augusto: I am the owner of 80% of the company and 17% is open for stock options.

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. Augusto: As was previously mentioned, currently, there is no one on the market who provide the same solution for batteries and for energy, even, for example, power banks or wireless solution with the QA standard. That means no distance. There are several companies that work with similar solutions, but mostly with charging and power, but none with the same technology.



Rodrigo Augusto Coto (the third from the right) and representatives of the Federico Santa María Technical University

photo provided by Rodrigo Augusto Coto

SOC: We always need to paint a clear picture to the potential investors/partners 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 application and where do you think it could be

successfully applied in the future?

Mr. Augusto: A significant moment about our company is that we can reach a distance without many resources. We are currently working with public funds to use our solutions and enter the market. I think there will be even more companies in the future who are trying to solve the same problem and, therefore, we will continue to improve your system to provide the best option. We will always work on this solution. Currently, we can release a product that can be charged at a certain distance. Furthermore, in the future, we will continue releasing to the market product that works on the long distance providing the better experience for the user.

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. Augusto: Since we create the technology that simplifies the charging experience. People will realize that there is another way to do such known things. It will be not only wireless charging, it will be much more. We will make them love our products.

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. Augusto: Currently, our strategies are confidential. However, I have some experience in the B2B market in Chile, where it is really difficult to reach customers. The thing that I have learned makes the company apply to reach B2B market really quickly. The fact is that when the product and packaging are ready, customers will see our products in many places in few days.

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. Augusto: We do not have the set time. But, approximately, it will be at the end of this year or early next year.

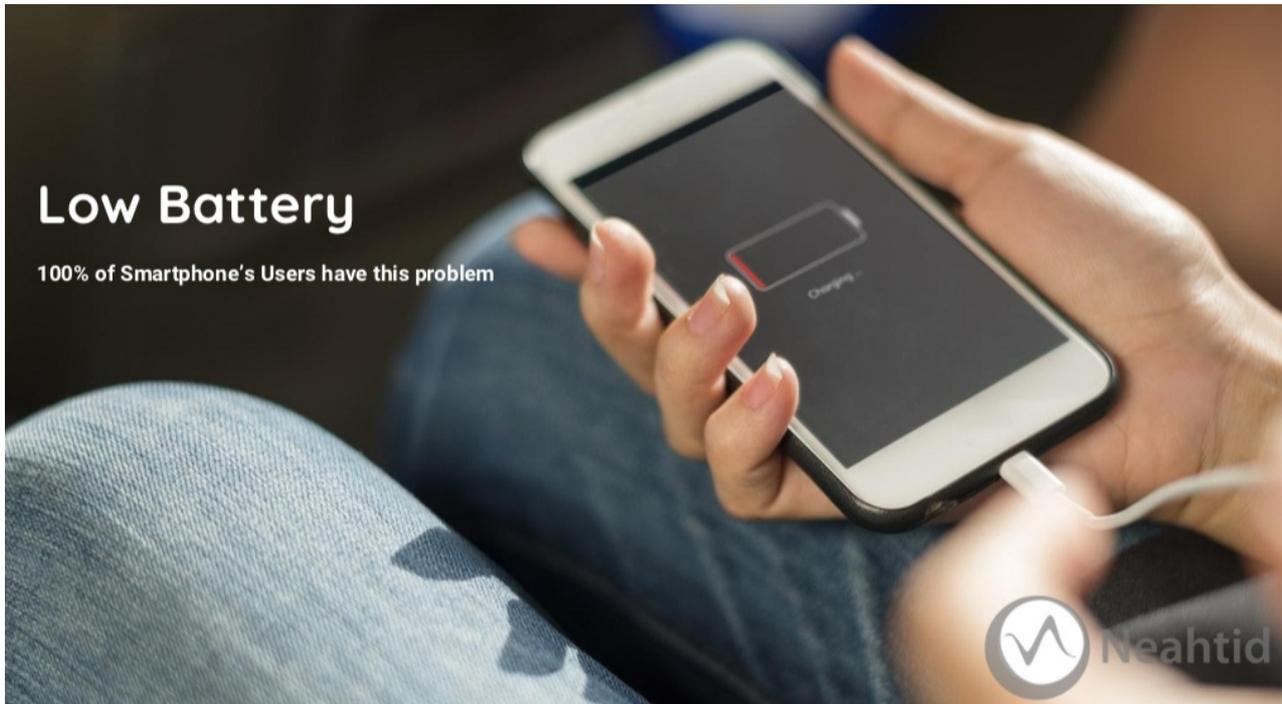


photo provided by Rodrigo Augusto Coto

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. Augusto: We would like to create a **very professional application for patent**. As we don't work with patent pending and provisional patents, we will do only one patent. It will be the very **professional application in order to make the difference with the current patents**. We work with the inspector who is creating the text to protect our technology.

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 prospects.

Mr. Augusto: Some kind of technologies is not obsolete for more than **10 years** such as the Internet or Wi-Fi. Our technology is the future of the chairing of electrical devices.

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. Augusto: This is the first round. After years of research, Neahtid reached a breakthrough in the field of wireless energy transfer. Neahtid is now **seeking partner channels and venture capital partners to further our development of wireless charging products and to bring those products to market** and finish the patent. Furthermore, we will provide investors having an interest in partnering with Neahtid with technical information and details about the development of our products and the technology on which they are based. Proformas, financial statements and details about investment options will also be provided to investors showing interest in becoming a venture capital partner. To make the request use this [link](#).

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

Mr. Augusto: The ideal investor is the investor who can provide experience and commercialization in different countries, for example, the US, European countries. The investor who can put us in such markets is perfect.



photo provided by Rodrigo Augusto Coto

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. Augusto: Both but I always prefer to have a conversation.

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 Neahtid to all potential investors.

**Company name:** Neahtid  
**Contact person:** Rodrigo Augusto Coto  
**E-mail:** coto@neahtid.com  
**Website:** <https://www.neahtid.com/>  
**Phone:** +56981983683  
**Patent status:** +  
**On market since:** -  
**Regions:** Chile  
**Industries:** Electronics, Energy



## WASHWOW - PORTABLE MINI WASHING DEVICE

Exclusive interview for SPINOFF.COM with Mr. ChuanKui Bao, the CEO, and founder of Guangzhou Man Xin Electronic Technology Co., Ltd., about an innovative portable washing machine WASHWOW 2.0 that is the environment-friendly, healthy and effective method to make clothes clean

WASHWOW 2.0 clothes washing & disinfect gadget opens a new era of doing laundry healthily and conveniently. WASHWOW 2.0 is only 265g or so, therefore carrying it does not feel a burden. It has adopted wireless charging technology, which is more convenient to easy and easier to take. Through its two-level variable-speed control, the user can control the washing rhythm at will. The reactive oxygen species produced by WASHWOW 2.0 can effectively decompose organic stains such as perspiration after sports and milk stains on baby clothes. It doesn't need any detergent, doesn't cause any pollution to water or remain any chemicals on clothes. The hypochlorous acid produced through electrolysis of water by the second generation of WASHWOW electrolysis washing devices has a stronger disinfection function. When washing fruits and vegetables, it can completely eliminate pesticide residues within 5 minutes. According to the tests conducted by an authoritative institution, the bacterium elimination rate of the second generation of WASHWOW electrolysis washing devices reaches 99.98%. It saves time, is prone to zero pollution and has no radiation. It is smaller and has stronger functions.

SOC: Dear Mr. Bao, we are so grateful for your generosity this day in spending time speaking with us and sharing your insights about [WASHWOW](#).

Mr. Bao: I'm very honored to have this interview for sharing my new technology innovation that is based on three concepts. Firstly, to develop new products that are useful to consumers. Secondly, to make new products to meet people's needs in their daily life. Thirdly, to make stylish and unique products in the market. Fourthly, to provide a new healthy and eco-friendly way of people's existence.

SOC: Our investors and we would like to learn more about a vast experience of your academic endeavors and your professional background.

Mr. Bao: When I studied at the university, my main specialization was the plastic molding. Therefore, I have got main technical skills in different mechanical fields such as mechanical principles, mechanical parts, polymer materials, plastic equipment, plastic processing technology and plastic molds. I have started my career in 1999 as a new product development technician. I have worked as a new product technical designer for many famous companies such as [HONDA Guangzhou](#), [Huawei](#), [P&G Guangzhou](#), [Siemens in Foshan](#), [Midea](#), [Wanjiale](#), [Wanhe](#) and so on.



photo provided by Ms. JoJo Jiang

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. Bao: Yes, I have some other projects. Some have already received patents, and some are applying for patents now. I would like to share a story about one of my projects that is called '[Singing Table](#)'. This project was developed in [2005](#). At that time, there was a chance for me to get the sonar material which is often used in the submarine. I was the product development engineer, so after about one year of thinking and researching, and based on the characteristics of the material, I eventually developed and designed an interesting device that could 'make a table sing'. The specific principle of this technology is that the sonar material is surrounded by a magnetic field. When an audio signal is applied to the magnetic field, the sonar material vibrates according to the audio signal. At this time, the sonar material is pressed against the table by gravity. Therefore, I can make the table to generate a sound, giving people the feeling that the table becomes a big speaker. People feel it very interesting. This product was officially launched in September 2006. The company that currently operates this product has already been successfully listed.

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

awards?

Mr. Bao: [WASHWOW 1.0](#) was launched on [Kickstarter](#) as a crowdfunding project in March 2017. By March 2018, about 30,000 units were sold. It has already started to make the profit. Currently, [WASHWOW 2.0](#) has launched a crowdfunding project on [Kickstarter](#). It just has been launched on the market and we already have built up a complete team from R&D to sales. There haven't been any ventures investment or awards so far.

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. Bao: Sure, I'm very happy to introduce our WASHWOW team members. Mr. Xiang is our product manager. He is specialized in electronic circuit development and software programming. Mr. Xue is a sale marketing director. He is specialized in marketing and has more than 15 years' experience in sale and marketing. In addition, he was the sales director of international digital cameras company. Ms. Jiang is the business manager. She is specialized in communication and negotiation with foreign customers. Currently, our team needs more marketing talents.

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. Bao: Our newest product WASHWOW is portable clothes washing and disinfecting device that **doesn't use any detergent**. WASHWOW 1.0 and 2.0 are the portable version of clothes washing devices. Currently, these two versions have already been developed and launched on market. By using electrolysis water, WASHWOW can clean and disinfect clothes without any detergent. **The sterilization rate of the device can reach 99.98%**. In the future, for the next generation of WASHWOW 3.0, I want to develop a new type of portable washing device that will have stronger cleaning ability and the drying function as traditional washing machines. For the upgraded version of WASHWOW, I want to develop

a washing device, which can wash clothes even without water. I already have the product concept on my mind now, and hope to bring it into reality in the near future.



photo provided by Ms. JoJo Jiang

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. Bao: Until now, my company has not yet received any investment capital. Personally, I still have a controlling stake in the spinoff.

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. Bao: Currently, we already have some distributors in HongKong, Taiwan, Turkey, and now we are negotiating with some companies from Japan, Korea, Italy, and France for distribution. Our competitor in the market is a portable ultrasonic washing gadget named [Dolfi](#). However, there is some main difference between [Dolfi](#) and [WASHWOW](#) in the working principle. [Dolfi](#) uses ultrasonic technology. In my personal opinion, ultrasonic technology can be used to wash items with hard surfaces, such as watches, glasses, jewelry, etc. but it can't wash textiles. [WASHWOW](#) can decompose organic dirt and

disinfect clothes without any detergent, as it uses electrolysis water technology. Therefore, I don't think there will be any barrier for us, because we have different targeted customers' group.

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. Bao: At present, we have some distributors overseas. As [WASHWOW 1.0](#) have completed crowdfunding and delivery last year. WASHWOW 1.0 has been successfully launched on the overseas market. Some customers have provided some helpful suggestions to us and hope we can provide an upgraded version, such as wireless charging, as well as connecting to the smartphone via a Bluetooth, with more intelligent functions. Therefore, we developed WASHWOW 2.0, and it has adopted the wireless charging function, which is more convenient to use and easy to take. Currently, [WASHWOW 2.0](#) is in the stage of crowdfunding on Kickstarter till 31st May 2018, and we plan to deliver them to customers around the late June. I'm looking forward to feedback from our customers.

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. Bao: I hope my partners have the ability or resources to open up the market, and, of course, hope to have enough funds to develop WASHWOW together.

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. Bao: My vision for the company is to make WASHWOW as a well-known, environment-friendly, healthy, and fashionable product brand.

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. Bao: I'm personally specialized in R&D and product development. I have no unique strategy in the marketing. Other members of the WASHWOW' team have an advantage in marketing planning.

SOC: How do you determine the market for your product 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?

Mr. Bao: In order to create WASHWOW 1.0 in 2015, I asked one of my friends who has rich experience in washing machine industry and found that the sales volume of washing machines in China market was more than 300 billion RMB yuan. It shows a great potential of the laundry market. Of course, WASHWOW is not a washing machine in the traditional sense, but with the development of society, people's consumption concept has also been changed. That's why I think WASHWOW may hit a big market. I think we can reach the peak in 2020 with the estimated market sales of 600,000,000 - 1,000,000,000 RMB Yuan.

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. Bao: Our company and I possess 10 patents in total. Among them, I personally have 9 patents. I have two trademarks: WASHWOW and Man Xi.

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 prospects.

Mr. Bao: In my point of view, I have a new technical developing ability. Therefore, I will constantly develop new products, which will be based on the core technologies. In

addition, we will develop new products based on market needs.

SOC: The investors/partners 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. Bao: We are seeking for the **\$2,000,000**. The proportion of the shareholders will be 20%. The time limit is before the end of 2018. I have some plans for new product development and our company will apply our patented technologies to several industries which are considered more marketable after we will get investment. For the usage of investment funding, about 20% of investment funds will be used for R&D and design of new products; 20% will be used for team building; 15% will be used for production; 35% will be used for market development and the remaining 10% will be used as a reserve fund.

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. Bao: At first, I would like to receive inquiries from potential investors by e-mail. If both of us will want to cooperate, then we can set up a call to discuss the details.



photo provided by Ms. JoJo Jiang

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 Ms. Jiang for providing all the necessary materials and we are pleased to forward the information on [WASHWOW](#) to all potential investors.

**Company name:** Guangzhou Man Xin Electronic Technology...

**Contact person:** ChuanKui Bao

**E-mail:** washwowteam@gmail.com

**Website:** <http://www.washwow.net/>

**Phone:** +86-13570554296

**Patent status:** +

**On market since:** -

**Regions:** China

**Industries:** Creative Industries, Electronics



## NOVEL SPECTACLE LENS CAN SLOW MYOPIA PROGRESSION

Nearsightedness, or myopia, is the most common refractive error of the eye, which includes diffuse, patchy macular atrophy with or without lacquer cracks, choroidal neovascularization, and Fuchs spot. The significant moment is that it can cause different complications such as visual impairment or even permanent blindness. Scientists developed the Defocus Incorporated Multiple Segments (DIMS) Spectacle Lens, which are able to slow down myopic progression in children up to 60% compared to typical single vision lenses. This novel invention has won a Gold Medal with the Congratulations of Jury at the 46th International Exhibition of Inventions of Geneva.



Principal Investigators of this project, Professor Carly Lam, and Professor To Chi-ho at the School of Optometry at the Hong Kong Polytechnic University  
source - polyu.edu.hk

The innovative lens was created by [Professor Carly Lam](#) and [Professor To Chi-ho](#) from the [Hong Kong Polytechnic University](#).

The prevalence of [myopia and high myopia](#) are increasing globally at an alarming rate, with significant increases in the risks for vision impairment from pathologic conditions associated with high myopia, including retinal damage, cataract, and glaucoma. The impact of myopia is difficult to determine because there are no standard definitions of myopia and high myopia, and recognition that myopia can lead to vision impairment is limited by the absence of a defined category of myopic retinal disease that causes permanent vision impairment. A further impediment to progress in this area is insufficient evidence of the efficacy of various methods for controlling myopia. According to the [WHO](#), in [2000](#), the prevalence of myopia did not exceed [50%](#) in any of the regions but, by [2050](#), the prevalence will be  $\geq 50\%$  in [57%](#) of the countries, if current trends continue.

The developed [DIMS Spectacle Lens](#) consists of the central optical zone for correcting the refractive error (i.e. myopia and astigmatism) and multi-segment of constant myopic defocus surrounding the central zone that spreading to mid-periphery of the glass. Therefore, this method provides clear vision and myopic defocus for vision correction

simultaneously for the wearer at all viewing distances. Such glasses based on the emmetropisation mechanism, whereby the eyeball adapts and forms in order to get focused images as normal vision operate. The study results demonstrated that using such glasses users can reduce the progression of the nearsightedness by 60%. The DIMS Spectacle Lens will be available in the market since **summer 2018**.



Halted the progression of myopia in some children. 21.5% of children in the treatment group had no myopic progression whereas only 7.4% of children in the control group had no myopic progression  
source - polyu.edu.hk

**Company name:** Hong Kong Polytechnic University  
**Contact person:** Professor Carly Lam  
**E-mail:** carly.lam@polyu.edu.hk  
**Website:** [www.polyu.edu.hk/](http://www.polyu.edu.hk/)  
**Phone:** -  
**Patent status:** -  
**On market since:** -  
**Regions:** China  
**Industries:** Healthcare  
**Source links:** [Hong Kong Polytechnic University](http://www.polyu.edu.hk/)



## A LIGHT BUOY THAT IS POWERED BY THE SEAWATER

Scientists from the Ulsan National Institute of Science and Technology managed to develop the light buoy that is powered by the seawater battery, which was created by the researchers' team from the Research Center for Resources Technique for Seawater, led by Professor Youngsik Kim. This type of battery is much more environment-friendly and cheaper compared to typical lithium batteries, thus providing the cost-effective way to harvest electricity. The novel invention was developed in cooperation with Woori Marine Company Limited and presented at the IALA AISM.



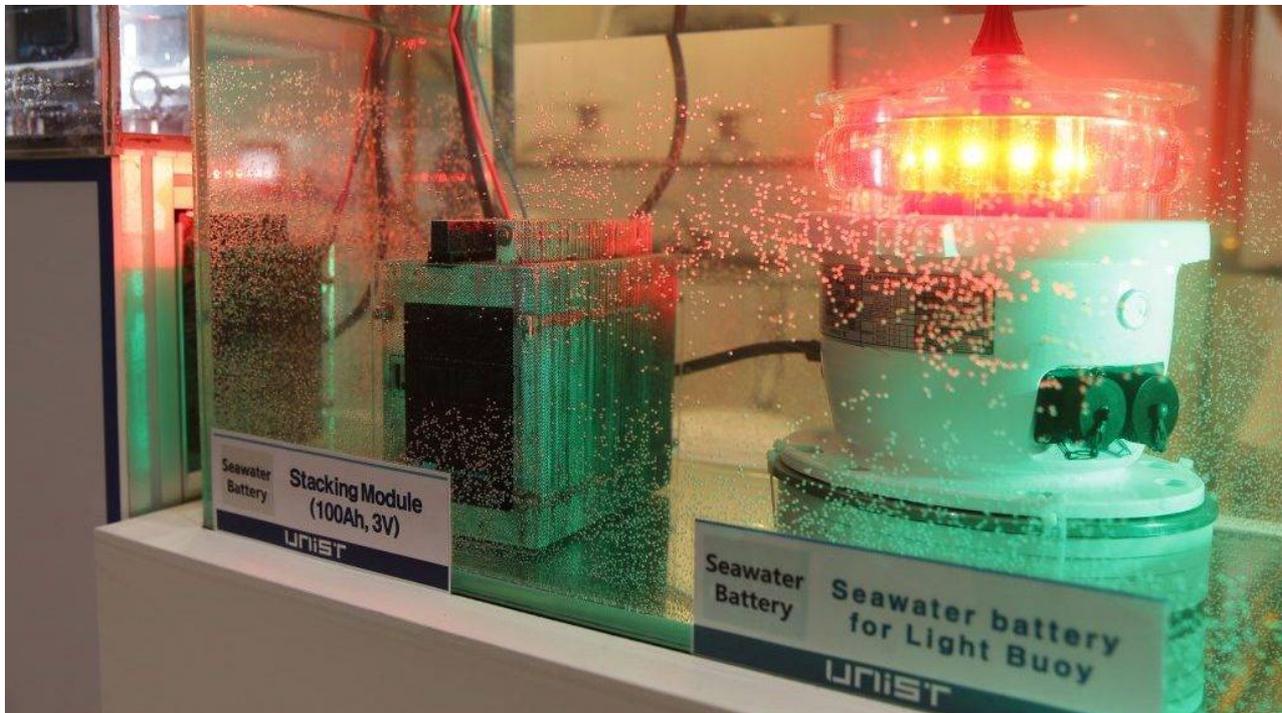
This product was originally developed as part of UNIST's efforts in nurturing research brands that well-represent the institution, thereby creating innovation-led growth engines for the nation  
source - unist.ac.kr

**Light buoys** are marine tools that have been fixed for sea areas and obstacle markings. Current buoys use LEDs that should be marked at night. However, the lead accumulators are very heavy thus it is difficult to center the buoys and, as the result, they can be inundated. Furthermore, the sulfuric acid and lead can leak out and cause the environmental pollution.

The scientific group used **sodium in seawater batteries in order to generate electricity**. It is a soft metal that tarnishes within seconds of being exposed to the air. It also reacts actively with water. Sodium is used as a heat exchanger in some nuclear reactors, and as a reagent in the chemicals industry. Therefore, such material makes the **novel type of batteries more eco-friendly than lithium providing the cost-effective method to large-scale energy harvesting**. Furthermore, it can significantly reduce the fire risk thanks to the seawater, as it has the ability to keep the thermal fluid in appropriate condition. It is reliably to flood and desalination of seawater during battery recharging process.

The primary market for the commercialization of the battery of seawater was determined as suitable for the field of marine environment, scientists provided the seawater battery research and further commercialization of such products. The novel seawater batteries have the ability to significantly improve current light buoy. Seawater cells cannot be

flooded but can be installed in the lower part of the buoy to facilitate centering. Scientists received 5 billion South Korean won from the [Korea Electric Power Corporation \(KEPCO\)](#) and [Korea East-West Power Co. \(KEPCO\)](#). Prof. Kim mentioned that seawater batteries can replace usual power supplies in the marine industry.



Adoption of buoy materials suitable for seawater battery applications, new designs of battery enclosures and light buoys, and reliability tests in marine environments are scheduled  
source - unist.ac.kr

**Company name:** Ulsan National Institute of Science and Tec...  
**Contact person:** Professor Youngsik Kim  
**E-mail:** ykim@unist.ac.kr  
**Website:** <http://www.unist.ac.kr/>  
**Phone:** +82-52-217-2921  
**Patent status:** -  
**On market since:** -  
**Regions:** Korea  
**Industries:** Aerospace, Defence and Marine, Energy, W..  
**Source links:** [Ulsan National Institute of Science and Technology](#)



## A NEW DEVICE FOR DIABETES MONITORING

The innovative portable diabetes test kit Glucosio was developed. Diabetes monitoring is a confusing and tiring process, which often causes physiological and mental discomfort especially in those patients who have recently been diagnosed. In order to alleviate such moments, inventor designed the special device Glucosio, which is the smartphone case integrated with a built-in glucose meter and lancet device.

The device was developed by **Mr. Dousan Miao** from Hong Kong who currently resides in London, U.K.

Patients with diabetes have certain physical and psychological discomfort because of the constant need to measure glucose levels and to make insulin injections. Permanent damage to the skin and unpleasant sensations can lead to the appearance of fear especially in those patients who have been recently diagnosed. It can lead to hard consequences because such patients sometimes neglect the necessary procedures. Moreover, patients, especially patients with type 1 diabetes and type 2 diabetes, may forget their test kits when they go outside, which also harms health. Some patients admit that they do not want to perform the necessary procedures in public places due to excessive attention and social pressure caused by the medical appearance of the products used. All these elements, and if they are repeated, can be extremely harmful to health.



Type 1 patients tend to use the meter to figure out how much insulin is needed, whereas type 2 patients use them to make better diet choices  
source - dousanmiao.com

Current manufacturers of glucometers are often mistaken for portability, resulting in an excessive miniaturized product with reduced usability (excessively multi-faceted and small buttons). In addition, the well-known fact that **80%** of people with diabetes are **50** years more, therefore, they can have some agility problems. It is obvious that this is not the right decision due to its unsuitability. [Glucosio](#) uses what almost everyone has in their pocket: a smartphone. In addition to the ability to use a much larger screen, the test set is

always present, meaning they have fewer tracking elements, thus decreasing the likelihood of forgetting to carry their test kits. **The more miniature and hidden shape of the device**, which is connected to the phone, significantly decreases the amount of attention that comes to the user in the public places. [Glucosio](#) is suitable for any patients needs. It has the ability to **provide different recommendations in the case of a hyper or hypo diabetes (high blood sugar/ low blood sugar)**. The main aim of this system is to educate patients how to properly deal with their disease. This device provides the perfect diabetic controlling system, which is portable.

Company name: -  
Contact person: Mr. Dousan Miao  
E-mail: dousanmiao02@hotmail.com  
Website: <https://www.dousanmiao.com/>  
Phone: -  
Patent status: -  
On market since: -  
Regions: China  
Industries: Electronics, Healthcare  
Source links: [Glucosio](#)  
[James Dyson Award](#)



## KHAPTO

Exclusive interview for SPINOFF.COM with Mr. Daniel Zuniga Aranguiz, the CEO & founder of Khapto, about a novel device that was designed for physiotherapy and allows to quickly and accurately evaluate physical activity. Khapto has the ability to visualize in real time the progress of the patient rehabilitation in the way of indexes such as forces, ranges, and speeds. The technology allows doing dynamometry, goniometry and accelerometry, all with the same tool and in the palm of your hand. Medical workers can measure the strength with which their patients are recovering. With Khapto, the user not only captures maximum power, but all the work was done during the evaluation, getting more useful recovery data.

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

Mr. Aranguiz: Thank you for your invitation. As for the beginning of my experience, I have been started when I was a teenager. I worked with my father in his clinical center helping him. Then I entered the university. I studied mechanical engineering because I wanted to be an inventor. It was my dream. Despite this fact, after **4 years** I started to feel the disenchantment due to the career and the educational system. It always focused on marks and not what you do. Therefore, in parallel, I started this incipient spinoff and left the university. That is a critical moment on my profile. Nevertheless, I don't have any regrets. If you have some skills and passion, you can work hard and learn by yourself getting experience. You can be successful.

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. Aranguiz: On my campus, I started a recycling project to establish the recycling system. I worked on this project during for **2 years**, contact with providers and companies, which can buy the recycling materials. Unfortunately, we don't have that recycling culture as other countries have. In Chile, about **1% or 2%** of the trash are recycled. Therefore, it was the important project for me.

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. Aranguiz: I worked with my father, who is the physical therapist, learning how they do their job, and mixed such experience with the carrier and my interests, engineering and on electronics. We discover the matching of these two different worlds, the engineering, and the health world. Consequently, we created a solution for all these professionals. Then we started prototyping and made more than **20 prototypes** in the entire story of the developing of this product. We know that we must to make a precise and comfortable

product. During the process of the technology creation, we noted that it hard to make the product with such characteristics. There are no companies that manufacture electronic devices in Chile. We had to import various requiring elements, such as sensors, from different countries like China, United States, and Europe. As the result, we created a product. Currently, **we are at the pre-sales stage**. Moreover, the product is almost ready for the commercialization, only solving a certain problem such as the packaging of the device.

We started applying to the competitions in various countries. We won one of the major entrepreneur competition in Chile, which is called '[Jump Chile](#)'. And with that, we traveled to the United States to compete in the [International Business Model Competition 'IBMC'](#) that is run by Steve Blank. It was a huge opportunity to learn more. More than 40 teams were competing there. We finished the final quarter. In Chile, we applied for public funding for **20 000 dollars**. Nevertheless, most of the work we have done with personnel sources. Another competition, which is called [Brain Chile](#), is focused on science and tech products or ideas. The major problem is to find spinoffs with products, which will give you money to accelerate you. The objective of the competition was to take you from one level to other. If you are on a prototype' level you can pass from TRL 4 to TRL 5. It was very helpful competition because it provided the ability to learn a lot. We passed to the investor round and received **12 000 dollars**.



Daniel Zuniga Aranguiz, the CEO & founder of Khapto  
photo provided by Mr. Aranguiz

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. Aranguiz: One of my business partners and member of the team is Francisco. He has a degree in physics and, furthermore, huge knowledge in electronics, programming, and design. Consequently, he is very involved with the company. We have been working together for several years as he is the very important piece for the company. In addition, we work with different professors from various universities. In the company, don't have our people who work in different spheres, but we consult with professionals from the health area, which make research and etc. Currently, we are working with students to make an investigation using Khapto. Moreover, we have the support of the Department of Physics of the [Catholic University](#), which is one of the best universities in Chile. In addition, Khapto has support for web design and some of the translations for the web or the applications.

For example, we have some potential customers in Brasil but we don't speak Portuguese. Consequently, we need to build the bridge. We have some consultants in the US that help us with the business model developing. Khapto is partnering with 30 years of experience company in Chile. They help us with hardware development process.

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. Aranguiz: The problem that we intend to solve by creating Khapto is **the lack of information on the recovery process and rehabilitation process**. It was a problem that faces not only my father. There are many tools that physical therapist can use. Despite, we have found that there was no technology for every physician or physical therapist to measure and track the progress of their patients. As a result, doctors didn't know how their patients recover. They just perceive it and that is subjective. As I had measurement classes and I found that this is terrible because the doctor can treat a person without knowing how it is on. I realized that the measurement process is very slow due to the tools are old. They are more than **50** years old. Doctors use some electrotherapy, thermal therapy and etc. Some of the tools can show only one metric. There is nothing digital in this field.

Consequently, it comes with a huge opportunity to create **this product providing the ability to physical therapies to measure the force and movement or motion of the patient and their progress. Khapto also provides the ability to measure the angles and the speed**. Doctors can compare the pain that patient feels during the recovering process with help of indexes and numbers. If the patient feels the same pain, which he or she felt on the beginning, doctors can use indexes to determine the progress. One of the principal issues was to create the tool that will be tiny, comfortable and wireless. Our device is the **reversible product**. Therefore, you can use it for both hands. The problem is the subjectivity of the measurement of the recovery process or their patients or of the rehabilitation. If we don't have any numbers and indexes how could we say that patient is recovering and which therapy is the best? Therefore we create this device to gather all this information. **Khapto is intended to put and analyze the data using AI in order to estimate the progress of the recovering and define the best therapy for every single**

patient.



photo provided by Mr. Aranguiz

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. Aranguiz: There are some products and some technologies, which are intended to solve the same problem but they are single-use. Such technologies can measure just one indicator. All these devices are digital, but not smart. We live in the time that such technologies should be smart. It must be connected to the cloud and be collaborative. It had to be like the crowdsourcing of the information. In this case, you can gather all the data to help patients, capturing his/her maximum force. For example, doctors can trace the strength of the patient by making his/her recovery relevant to these metrics. It is very crucial because the doctor can change the treatment at the time. You don't waste patient' and doctor' time. Some patients spend months, from 6 to 9 months, on rehabilitation. They just go like one or two times a week to the rehabilitation center. It is a problem of society

to spend months on the treating and not going to work. Of course, it depends on the medical injury but people can waste time and money of different institutions without appropriate process of the treatment.

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. Aranguiz: Yes, I still own 80% of the company.

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. Aranguiz: Only the US market of measurement devices for the physical rehabilitation is about 3.6 billion dollars. The Europe, Midwest or Asia market has a huge market that is more than 6 billion dollar industry. Furthermore, it grows at 6.5% each year due to the technology advancing. These devices are used for their therapies or the treatments. As a result, it is a growing market. Our company is focused on the physical rehabilitation niche. When we ask people to use Khapto, they usually are stunned. Some professionals don't even believe that such technology could be possible. It is hard to believe for them that all information can be processed and sent to the phone. Usually, we have to fight against that. When you have first adopters of your product then the next part just go easy. However, in the beginning, it is hard due to the necessity to educate first adopters. Here is a tiny market in Chile. There are just 25 000 physiotherapists. Brasil' market is an important market as they have 100 000 physiotherapists. Therefore, the rehabilitation market is significant as nobody is free for having an injured tomorrow.

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. Aranguiz: Currently, we are working with one of the biggest insurance company that provides the special insurance for the workers. This company is one of the major players on the market. They have over 40% of the market. Our product could help them to automate many processes. We can save more than 1hour of the time of their professional

workers every day because one of the major issues is that they have to register everything that they do. For example, they can have 3 patients per hour and had to make notes of the whole process. The patient can have 10 minutes of thermal therapy then stay 10 minutes on the cyclometer and etc. All these processes the worker must document. It is a big waste of time that taking more than 1 hour. Therefore, Khapto has the ability to recover all that hour and transform it into 3 or 4 more patients attend every single day. It is pure money and efficiency. Furthermore, we have a range of this information in order to show numbers and statistics. With the help of Khapto, you can know how your demand is going to be and you can make some predictions about how your health workers operate. Therefore, companies can note that this professionalism helps to recover more patient then others and this therapy is better than others methods of treatment. Furthermore, the process is fully automated. The user just works with the app that is connected to the device.

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. Aranguiz: We have received different offers from some investors but the problem was that they weren't working in this field. There was some negative point because they didn't really understand how this sphere operates. Therefore, we really need strategic partners. You need to know how this industry works and if you will have a partner or an investor. It will be better if they understand specifics of this industry. The distributor system is important but inaccurate making the health system expensive and ineffective. Consequently, we would like to offer it by yourself.



photo provided by Mr. Aranguiz

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. Aranguiz: The popularity of the artificial intelligence is huge and it is growing every single every day. We have to look forward to this. We are creating a data capture point. In the future, we will have all this information for granted. Medical workers will be able to capture data from different devices. The important moment is to use our real intelligence and most important in this field because you can many perishables. Consequently, Khapto can put all the information in one place in the way of numbers and indicators in order to give medical workers the ability to have the all required information about the patient and regulate the possible treatment. A person should not be injured to use the device, for example, sportsmen can use it to track the technique: movement, forces. The technology can be modified according to needs, for example, some worker needs to track the speed of the arm' moving. It is as a smart hand.

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. Aranguiz: We are going on the market with Khapto. In addition, we have a portfolio of some products that we want to produce. The technology is the same but it requires fundings. There are some clients waiting for them. The thing that is hard to know how big the market is. Therefore, to build the product you need to distribute them in order to make cash flow. Currently, we apply the preorder strategy. We are looking for different clients and asking them to order them face to face. We still don't have the capacity to produce **100 or 1000 units**. Nevertheless, we have been talking with Chinese producers in order to automate the electronic part of the process. After this, we will be able to produce **500 or 1000 units** in a couple months.

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. Aranguiz: We have made several pieces of research to see if there is something similar on the field. There are some technologies, therefore, we can have some troubles in the patent process because these patents are very generic. That it is a work that we still have to do.

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 prospects.

Mr. Aranguiz: The technological developing became very faster, as a result, the patent process follows it. The technologies can be changed in **3 or 4 years**. The speed and massification will grant us some portion of the future market. We need to move fast and capture clients to be in love with the product. If you are modifying the technology and have the information and the platform, which provide and create that value to your customers they won't leave you. There are other competitors, which are extremely good. Therefore, we need to develop constantly reacting accordingly to the needs. It's a constant process. If we want to keep going on the market we need to keep innovating.

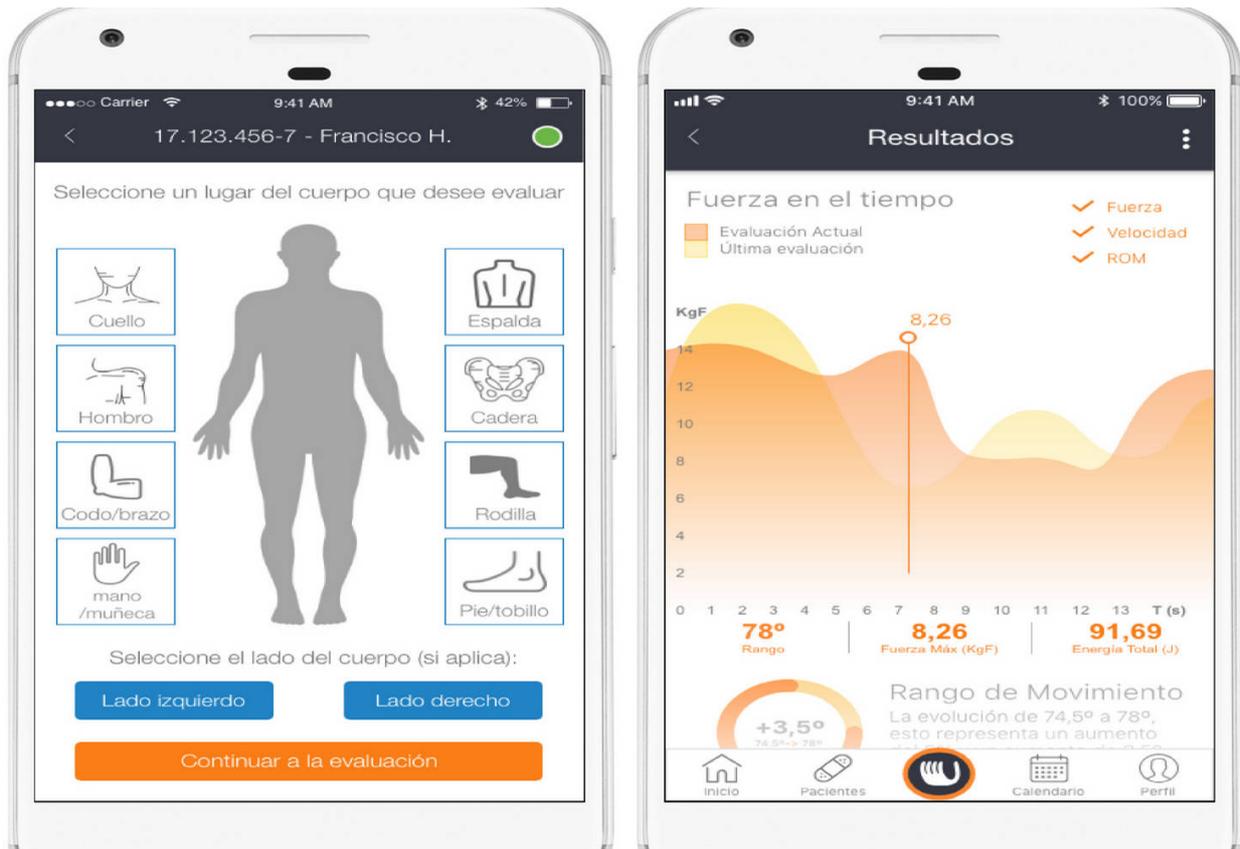


photo provided by Mr. Aranguiz

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. Aranguiz: We haven't had the investor round and we are fully having our shares. Khapto is waiting for the public funding to have the backup in order to provide the better negotiation with the investors. In Chile, the society is very conservative that leads to the ossified investors. They can invest funding in a product that is 40 years on the market. When you present them the innovation they don't even understand it. They don't want to run that risk. Despite, we have such opportunity in the US. They are very open to investing in tech companies and taking the risks offering 1 million or 2 million just for the start. In Chile, we can get 50 000 dollars that provide the ability to work just 1 year in the case if you will manage money very well. Therefore, we are seeking for the investor who has the vision for further 2-3 years. Currently, we are applying for 50 000 dollars for a public fund. If we will achieve it we can start in many regions of the country. Furthermore, it provides the ability to perfectly go to different countries. As the device is portable and required just

to be linked to the app, that was installed on the phone and connected the cloud.

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

Mr. Aranguiz: At least we are looking for the investor who will be as a partner and can help us to grow. As this problem that we trying to solve is a global issue, the investor could be as a promoter. In addition, we would like that potential investor will know the healthcare 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. Aranguiz: Both ways are convenient.

We would like to express gratitude for the time you have dedicated to this interview. [SPINOFF.COM](http://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 Khapto to all potential investors.

**Company name:** Khapto  
**Contact person:** Daniel Zuniga Aranguiz  
**E-mail:** contacto@khapto.com  
**Website:** <http://khapto.com/>  
**Phone:** +56 9 8420 9138  
**Patent status:** +  
**On market since:** -  
**Specialization:** -  
**Regions:** Chile  
**Industries:** Electronics, Healthcare



## DAEKI - SALIVA-BASED CHOLESTEROL MONITORING DEVICE

Exclusive interview for SPINOFF.COM with Ms Amanda Cespedes, CEO&Co-founder, and Mr Diego Alvarez, CFO&Co-founder of DAEKI Saliva Tech about an innovative screening device for diabetes that uses saliva to operate. The main purpose of the company is to diagnose and monitor the disease through saliva, avoiding painful invasive procedures, and provides with simple and fast methods to measure cholesterol level. Furthermore, the founders aim to do preventive screening and self-monitoring to avoid the complications of chronic diseases. It is the innovative non-invasive screening device for diabetes that only uses saliva through a test similar to a pregnancy test.



Amanda Cespedes, CEO, Diego Alvarez, CFO, Camilo Berrios, COO, Vicente Herrera, CTO  
photo provided by Ms. Cespedes  
photo provided by Ms. Cespedes

SOC: Dear Ms. Cespedes and Mr. Alvarez, 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 endeavours and your professional background.

Ms. Cespedes: We are an undergraduate in engineering from different facilitations.

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.

Ms. Cespedes: As a team, we have worked together on other projects. We had ideas but didn't consolidate them. We have been started working in DAEKI in 2015. It is one ongoing company that has had two projects. First of all, we started with a cholesterol project that is

also named DAEKI. It turned out to be a great product. Despite this, people always asked us if we are going to do the same for diabetes. Since our product was focused on the monitoring of cholesterol level with the use of saliva. As a result, based on that idea of the market requirements, we got a new product idea. We have been started working on the development of these new products in late **2016**. The technology of diabetes detection is based on the use of saliva. As we had the experience and data that the market, which demands such a product, we had the appropriate technology for its development.

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. Alvarez: We started with the **15 000 dollars grant from the Chili government**. Then DAEKI got the investment from [RebelBio](#) for **100 000 dollars** and **18 000 dollars** from another Chilean grant. We are still in the developing phase and not selling. Nevertheless, we are going to start selling by the end of this year. I was selected as a Chilean representative of one of the nine women integrant the year by the impact to form of IKO of this company.

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?

Ms. Cespedes: As for Diego Avarez, he has previous accounting experience. Diego had participated in innovation projects. Furthermore, he was a mentor in various groundbreaking projects. He studies innovation design engineering. Vicente Herrera, CTO, took part in university researching projects. He is an expert in molecular biology. Vicente studies biotechnology engineering. Camilo Berrios is the COO. He is a substep programmer. Currently, Camilo is pursuing that by being an engineer in computer sciences.

I am the CEO and biotechnology engineer. In additions, I am on the undergraduate way

from the inter piece long internship developing programs: 'One of the nine women of grant per year', 'One of the hundred leaders of tomorrow' and 'One of the one hundreds leaders of Chile'.

Mr. Alvarez: As a team, we have the opportunity to work together for many years. In fact, most of us knew each other from 4 years old. Therefore, we really know how to work with each other. It is incredible what we have managed to make and the traction that we have gotten in the past few years. Moreover, not only the government is ready to help us. It has already helped us with grants. In addition, private entities, which provide investment services. Currently, we are getting support from other companies that are willing to support us with trials and other products.



source - daekitech.com

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?

Ms. Cespedes: We solve the problem of undiagnosed diabetes. As **50% of diabetics** and **90% of free-diabetics are undiagnosed**, respectively. They can pass more than 10 years without proper treatment. Therefore, we are planning to reduce the number of such people, undiagnosed diabetics, and prevent the consequences of diabetes. This all started because of my father. He has been visiting a doctor for the past 5 or 7 years. I noticed this.

As a result, we started looking for the solution of this problem. We observed that he was not alone as there were a lot of undiagnosed people. Doctors determined that my father has high chances of having this disease. Despite, he wasn't able to visit doctor very often. Therefore, we tried to find a decision.

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?

Ms. Cespedes: **Our device is capable to detect diabetes. It does not require a reader and can be made anywhere. In addition, the device does not use blood, providing results within 5 minutes. Anyone can use it.** It works just like a pregnancy test. Results are provided due to a similar mechanism. There are other devices that are pursuing this problem. Most of them are for the disease monitoring. Therefore, they require the reader or use blood. Some of them can use saliva but the result will be inaccurate. As such devices measure a glucose level but glucose in saliva change every time when a person eat something.

Mr. Alvarez: In a fact, there were many companies, which make such products in the past few years. As Amanda said they are focusing on the disease monitoring using glucose. Unlike them, we are focusing on the early detection of the disease. We are not measuring glucose as glucose is not the accurate indicator to detect the presence of diabetes. For example, if a healthy person will eat a birthday cake, she or he will be diagnosed as a diabetic which she/he is not. That is why we are using glycated haemoglobin. With the help of saliva and our profiteering methods, we can detect with other particles because glycated haemoglobin is not present saliva. Consequently, our device is are capable to detect the disease in an early stage unlike the competitors, which are focused on the monitoring.

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. Alvarez: In general, the founders have the main part of the company. There are two parties, which are apart from the founders. One is the laboratory that is supporting us in Chile with 3.6% of the company. [RebelBio](#) has the research stock of 8.3%. We have an employee stock option plan for future employees to 10% of the company that is also reserved. Taking into account all that stock, this is not reserved and not effective. DAEKI has 10% that is for employees, the 8.3% that is for [SOSB](#), for 100,000 dollars investments. 3.6% for the laboratory in Chile that supports us and 78% for the founders alone. And this will change depending on the investments, which will be received in the future and how the investment will be implemented.

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. Alvarez: Currently, there is **1.2 billion dollar market for that detection of diabetes** that uses glycated haemoglobin. This is a specific market. What we are trying to do is to reach and expand into this market. As we can see the glycated haemoglobin is the growing market, and it is mainly focused on the monitoring of the disease. Therefore, we want to expand it to the disease detection. Currently, this market is focused on a small percentage, approximately, **30%** of diagnosed diabetics. That is at **1.2 billion dollars**. What we are aiming for is to use our product to expand the market to approximately 2.4 billion dollars. That is the potential market for the detection of diabetes using glycated haemoglobin. Regarding the competition, there are not many competitors in the field of glycated haemoglobin, because of the regulatory issues and because the technology was not there, which is why we started.



photo provided by Ms Cespedes

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. Alvarez: The main feature of our product is that it can be used in the detection of the early stage. Furthermore, it could be used to monitor as well as it measures A1C level (Hemoglobin A1c) that are used to do both. We can do a more specific test in the future to give a more exact result and use it to monitor. The main characteristic is to use it for the early detection of diabetes in the fast and simple way. It works as a pregnancy tested providing the ability to know if you have it or not. The use of this is for companies to acquire more customers. Consequently, companies can offer more treatment services to them.

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?

Ms. Cespedes: We have already had one represent that is brought **60 000 dollars** for the company. They are really waiting for us to get to the market, start the diagnosis product and treat people depends on the offer.

Mr. Alvarez: In additions, there is interest from other companies to apart this product in the order they can detect the disease to start treating patients at an early stage as they have services to prevent diabetes. As the result, we have different kinds of customers. We are on the one side retailers such as one that gave us a lot of interest. Furthermore, there are healthcare centres or healthcare providers or treatment providers, which want to use this product to get more customers. They are interested in DAEKI, but we can not reveal who they are.

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.

Ms. Cespedes: We have already had conversations with pharmaceutical companies that sell diabetes treatment drugs or devices in order to detect the disease and then managed with their products to prevent the consequences of diabetes. They could sell our device to pharmacies, hospitals, moreover, it can be done with doctors appointment or even giving for free for diagnostic exams.

SOC: It is very important to understand your particular vision about the 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. Alvarez: Currently, various companies are very interested in our product. Mainly, it is because our device can boost this company, therefore, they can provide treatment products or services. Our product will allow them to increase the number of customers, which they serve, drastically increasing their incomes by up to 20% annually.



photo provided by Ms Cespedes

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. Alvarez: We are following already proven strategies for the R&D, production, and distribution to minimize the risk because we know there are many risks involved in the development of new products. What we are innovating in is that target customers and the way they can use the product as in first aid. Our goal is not to provide a commercial product but a tool to increase our customer support. DAEKI will allow them to put their products to a market that is currently unserved.

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. Alvarez: We have estimated our market based on similar medical devices specifically for 1.2 billion dollars. Our potential share of this market is based on targeting the intended population that are undiagnosed diabetics and the ones that currently are afraid of needles, the ones that cannot get tested, the ones that are for many reasons not getting tested today. We aim to start by capturing **1% of this market and reach a peak of 20%**

by increasing the market.

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)?

Ms. Cespedes: We have already had the patent pending and, currently, we are working on PCT application for a patenting in a specific country, which we are interested in Europe, USA, and Asia.

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 prospects.

Mr. Alvarez: The company proved careful studies, therefore, it cannot be easily bypassed. Furthermore, we plan to develop our products using the same technology, the saliva-based technology, which will be patented as well. We know that R&D, the renewal of strategies currently form a crucial part of our business. We will renew and keep our status with this product and future products. DAEKI will not be out one product company.

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. Alvarez: We finished the pre-C round, which was funded by the [RebelBio](#). DAEKI has also received grant **195 000 dollars**. Currently, we are looking for 500 000 dollars for exploration to close the C round in the next 6 months. It will get us to more validation with patience and will take us to start the CE marking process.

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?

Ms. Cespedes: We prefer via email to schedule the phone call.

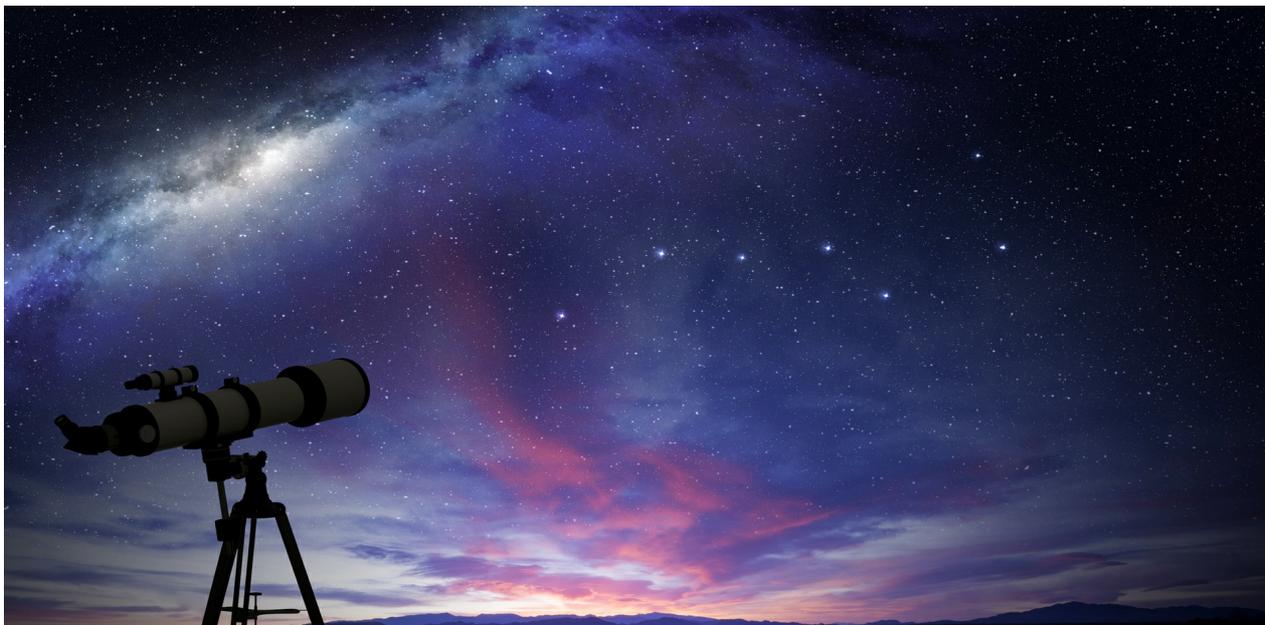


source - adobe.com

Company name: DAEKI  
Contact person: Amanda Cespedes  
E-mail: amanda@daekitech.com  
Website: <http://www.daekitech.com/>  
Phone: -  
Patent status: +  
On market since: 2015  
Specialization: -  
Regions: Chile  
Industries: Healthcare

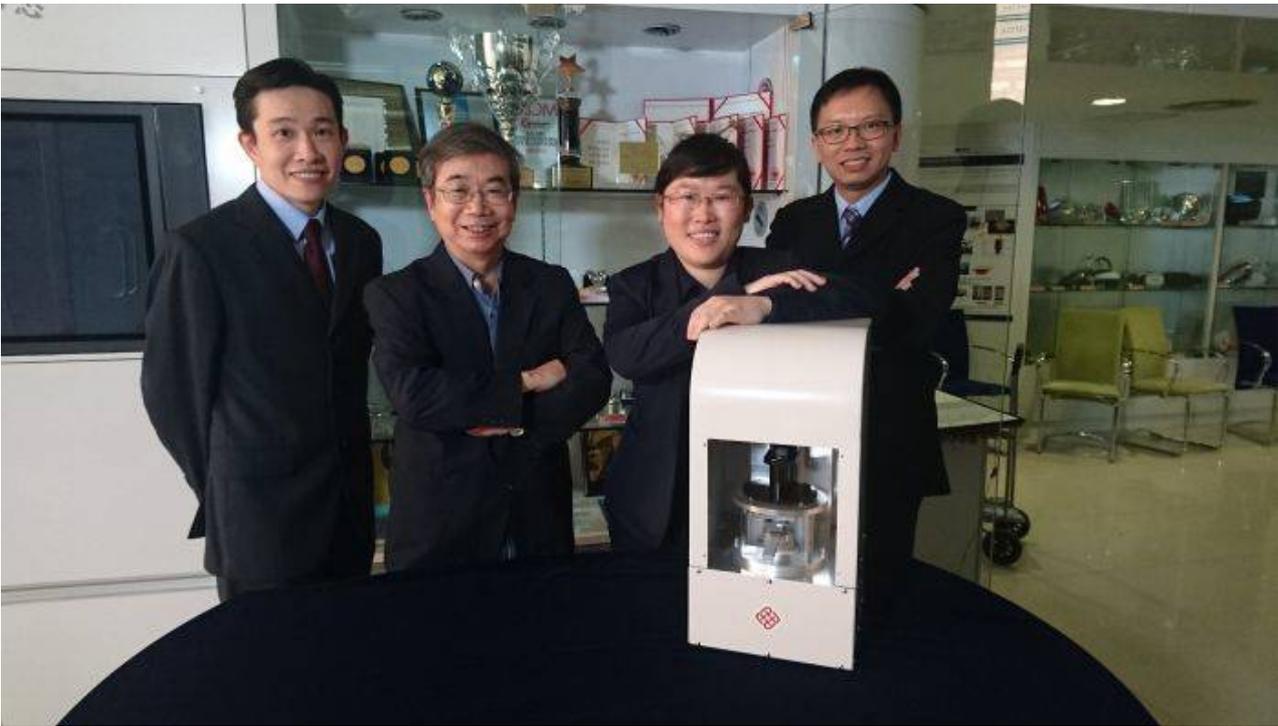


# TECHNOLOGY



## THE NEWEST MICRO-EMBOSSING EQUIPMENT FOR PRECISION OPTICAL MICROSTRUCTURES

The scientific group from the Hong Kong Polytechnic University (PolyU) has managed to create an innovative micro-embossing equipment in order to produce precision glass lenses with high image quality and resolution. Such lenses can be applied in state-of-the-art optical instruments and devices in different fields such as astronomy, national defense, medical scanning, consumer products developing, for example, cameras and mobile phones. The invention can emboss ultra-precise optical microstructures in glass in a much eco-friendly way than current technologies, saving electric power by 60 times and decreasing the production cost by two-thirds.



Prof. LEE Wing Bun and Dr. LI Lihua (second and third from left) with research team members Prototype of the micro-embossing equipment for the precision optical microlens and micro-lens array produced  
source - polyu.edu.hk

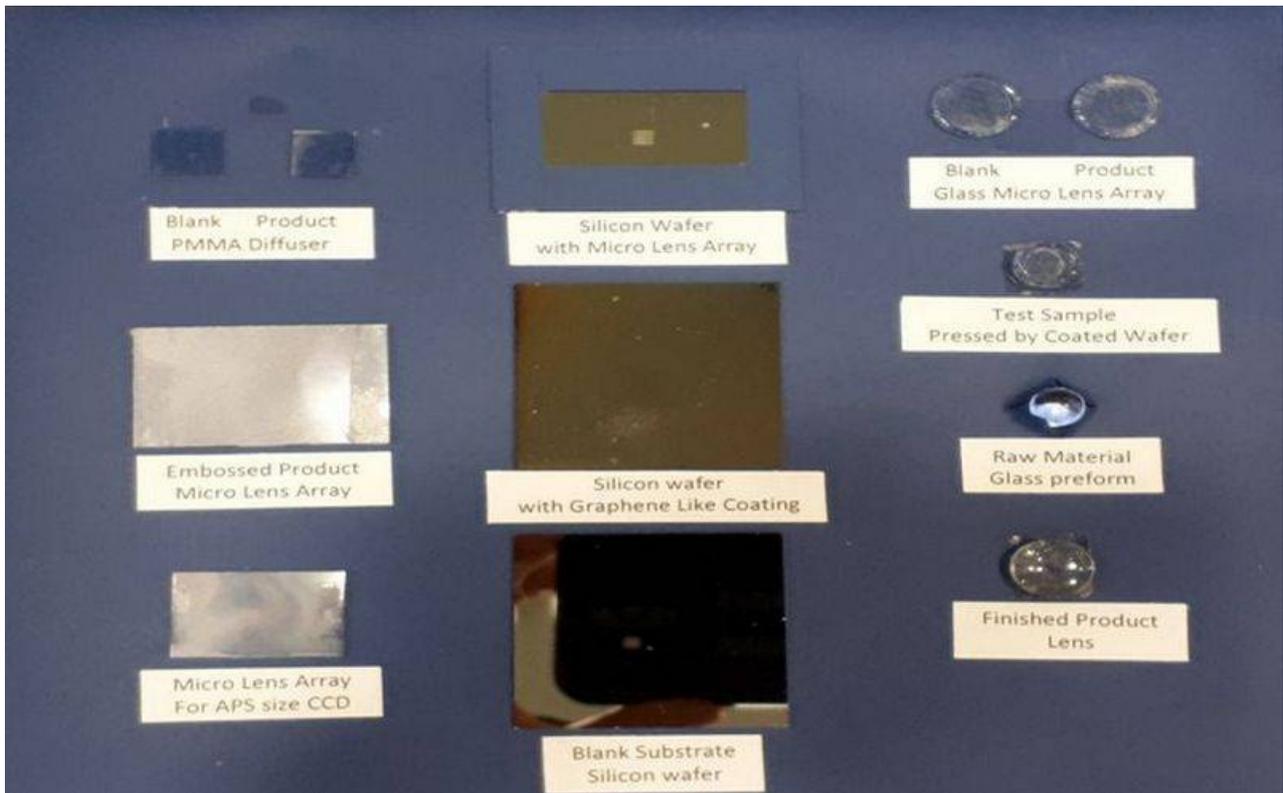
Glass optical components are difficult to manufacture due to the required high molding temperature and extremely hard-to-machine carbide materials to produce the mold, compared with plastic molding. It is also difficult to emboss micro-nano optical elements with micron-sized glass microstructures (1 micron = 1 of 1 million parts of a meter). Furthermore, there is a big surging demand for powerful lens of small size and high resolution in advanced optical systems and the demand for optical glass, which can replace optical polymers that has much lower transmittance.

The scientific group, led by Prof. Lee Wing Bun and Dr. Li Lihua from the [Department of Industrial and Systems Engineering](#) has managed to adopt a new design with graphene-like coating and self-developed heating technology to manufacturing the micro embossing equipment that is able to produce micron-level microstructural optical components in glass. Compared to a conventional bulky infrared heating device with large energy consumption, this innovative method is much **eco-friendly** and **cost-effective**. The applying of graphene-like coating provide the capacity to heat up the glass accurately and quickly with low energy consumption while decreasing thermal expansion and deformation of the mold.



The invention was awarded a Gold Medal at the 46th International Exhibition of Inventions of Geneva 2018  
source - polyu.edu.hk

With the help of specially developed software, users can **monitor and control the temperature in real-time**, as well as fine-tuning and adjustment of the process parameters. This reduces the cycle time and saves electric power by up to **60 times**, compared to conventional techniques. The novel embossing equipment can have wide applications in optoelectronics products, optical communication V Gutter substrate, a micro-lens array (MLA), Fresnel lens for collecting and tracking solar energy, and even for detection of low-altitude drones and security monitoring.



The research supported by the Innovation Technology Fund has also been granted with eight patents  
source - [polyu.edu.hk](http://polyu.edu.hk)

**Company name:** Hong Kong Polytechnic University  
**Contact person:** Dr. Li Lihua  
**E-mail:** lihua.li@polyu.edu.hk  
**Website:** <https://www.polyu.edu.hk/web/en/home/ind..>  
**Phone:** 3400 3876  
**Patent status:** -  
**On market since:** -  
**Regions:** China  
**Industries:** Manufacturing, Others  
**Source links:** [Hong Kong Polytechnic University](#)



# A COST-EFFECTIVE METHOD TO EXTRACT URANIUM FROM SEAWATER

The researchers' group from the Pacific Northwest National Laboratory (PNNL) in collaboration with LCW Supercritical Technologies has made a crucial breakthrough for the nuclear industry. Scientists managed to extract 5 grams of powdered uranium, called yellowcake, which is a powdered form of U used to produce fuel for nuclear power production, from the seawater. The new process uses cost-effective, reusable acrylic fibers and could one day make nuclear energy effectively unlimited. Furthermore, this innovative technology can also be applied to purify waterways contaminated by heavy metals.

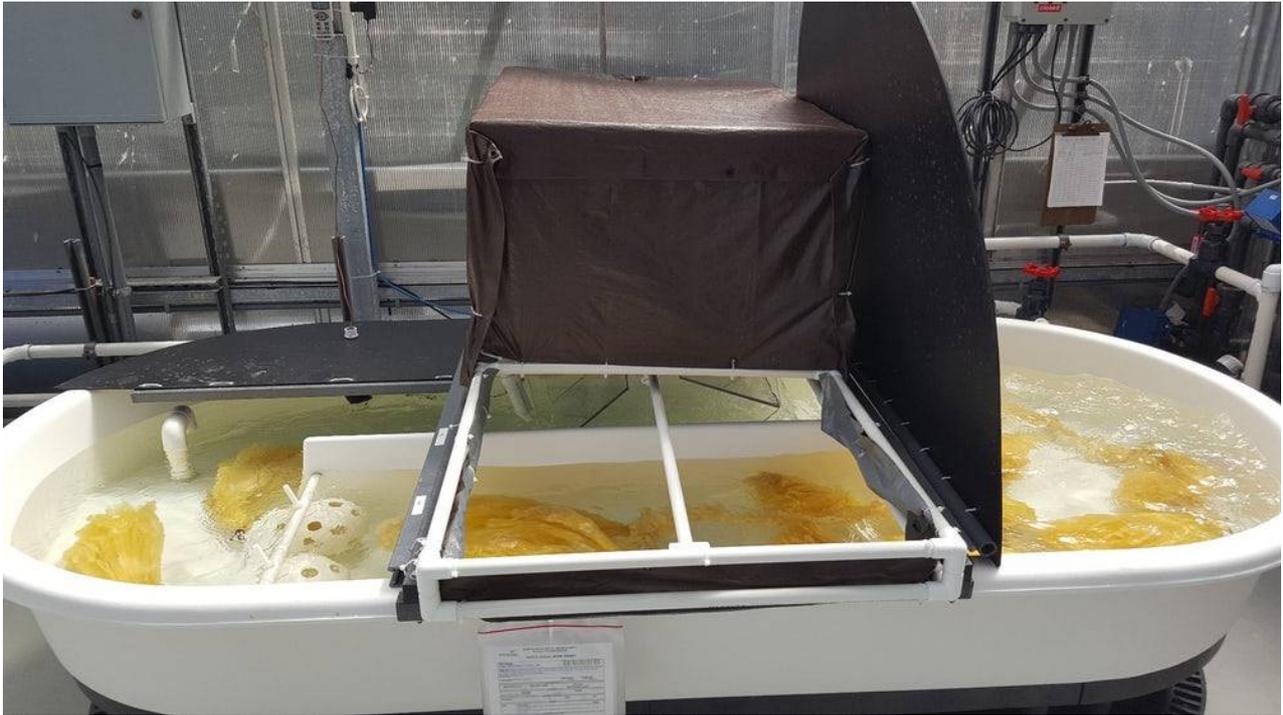
The seawater contains not only salt but also sulfates, magnesium, potassium, bromide, fluoride, gold, and even uranium. Its amount is not so big, about **3 micrograms per liter (0.00000045 ounces per gallon)**. If to imagine how big the ocean is, then you can calculate how much uranium can be produced. Expected, the amount of seawater' uranium will be about 500 times more than uranium produced on land, that's **4 billion tons**. This is enough to run a thousand 1-gigawatt fission reactors for 100,000 years. This is kind difficult to get the uranium out of the water. Previously, scientists from the [Japan Atomic Energy Research Institute](#) (currently, it is the [Japan Atomic Energy Agency](#)) developed the technology using polymer mats that would draw the uranium atoms out of solution. Despite its effectiveness, this method is very expensive. The cost-effective technique, which includes doping polymers with amidoxime and then irradiating them was created by researchers from the [Oak Ridge National Laboratory](#).



This first gram of yellowcake was produced from uranium captured from seawater with modified yarn source - newatlas.com

While this demonstrated more promise, scientists from [PNNL](#) and [LCW Supercritical Technologies](#) took it a step further by taking typical **acrylic yarn and transforming it into a uranium adsorbent**. The study results demonstrated that the yellowcake sample is effective, and the acrylic can be cleaned and reused. The biggest advantage of this technology is that it can even use waste fibers in order to save costs. Therefore, the seawater using can be competitive with land production at present prices. To test the

technique, researchers put the yarn in tanks and seawater circulated over it. As the water flowed, the yarn fibers extracted the uranium by chemically bonding it to a molecule. After processing, the result was **5 grams of uranium oxide or yellowcake**. Scientists mentioned that potentially **100 trillion tons** can be taken or enough to satisfy Earth's energy needs for the next billion years. Currently, [LCW](#) is seeking to license the technology and is finding funding for large-scale tests in the waters of the Gulf of Mexico.



For each test, scientists put about 2 lb (1 kg) of the fiber into the tank for about one month and pumped the seawater through quickly, to mimic conditions in the open ocean  
source - newatlas.com

**Company name:** LCW Supercritical Technologies  
**Contact person:** -  
**E-mail:** contactlcw@lcwsupercritical.com  
**Website:** <https://www.lcwsupertech.com/>  
**Phone:** 208-885-7785  
**Patent status:** -  
**On market since:** -  
**Regions:** United States, Russia  
**Industries:** Energy  
**Source links:** [Pacific Northwest National Laboratory](#)  
[New Atlas](#)



## FLEXIBLE BLUE VERTICAL MICRO LEDS WERE DEVELOPED

At the Global Stage for Innovation 2018, micro LED TV was presented as a strong candidate for replacing the active-matrix organic light-emitting diode (AMOLED) display. Micro LED is a sub-100 um light source for red, green and blue light, which has advantages of outstanding optical output, ultra-low power consumption, fast response speed, and perfect flexibility. Despite these facts, their production requires high costs. Therefore, the scientific group, led by Professor Keon Jae Lee, from the Korea Advanced Institute of Science and Technology, has managed to create an innovative and cost-effective technology to produce the thin-film blue flexible vertical micro LEDs (f-VLEDs). This newest method will significantly advance the commercialization of micro LEDs.



Conventional flexible lateral  $\mu$ LEDs have been investigated by several researchers, but still have significant issues of power consumption, thermal stability, lifetime, and light-extraction efficiency on plastics  
source - adobe.com

However, the current display industry has applied the individual chip transfer of millions of LED pixels, causing high production cost. It means, that the initial market of micro LED TV will be estimated up to **100 000 dollars** for the global premium market. In order to widely commercialize micro LEDs for mobile and TV displays, the transfer method of thin film micro LEDs needs a one-time transfer of one million LEDs. Furthermore, the highly efficient thin-film blue micro LED is crucial for a full-color display. Previously, scientists created a thin-film red f-VLED. They just have managed to realize thousands of thin-film blue vertical micro LEDs (thickness  $< 2 \mu\text{m}$ ) on plastics using a one-time transfer.

Such high-performance flexible vertical GaN light-emitting diodes (LEDs) have been produced using silver nanowire networks and monolithic fabrication. The flexible vertical  $\mu$ LEDs (f-VLEDs) achieved **optical power density ( $30 \text{ mW mm}^{-2}$ ) at 3 times higher than lateral micro LEDs**, and a **device lifetime of 100,000 hours** (bending/unbending cycles) by decreasing heat generation. Blue f-VLEDs could be conformally attached to the curved skin and brains for wearable devices, and stably operated by wirelessly transferred electrical energy. Professor Keon Jae Lee mentioned that for future micro LEDs, the innovational technology of thin-film transfer, efficient devices, and interconnection is crucial. In addition, scientists plan to show a full-color micro-LED display in smartwatch sizes by the end of this year.

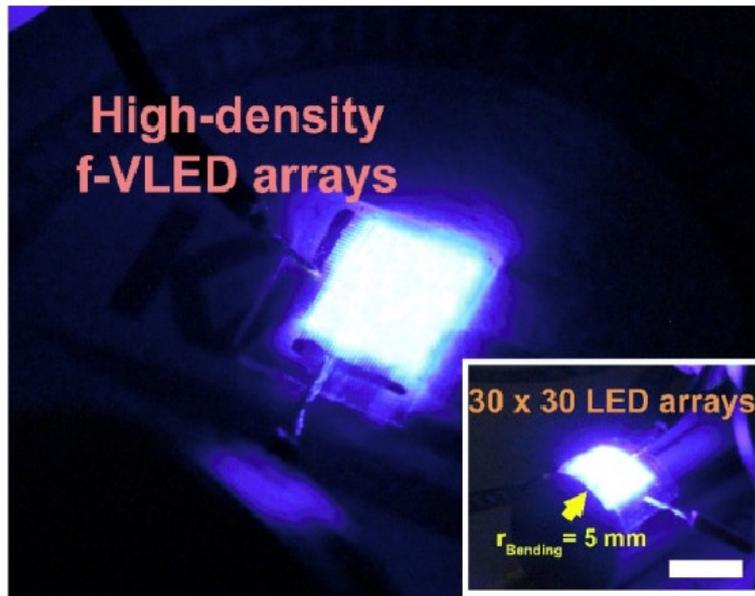


Photo of high-performance and high-density blue f-VLED arrays. Flexible inorganic-based micro-light-emitting diodes ( $\mu$ LEDs) are emerging as a significant technology for flexible displays  
source - kaist.edu

**Company name:** Korea Advanced Institute of Science and Te.  
**Contact person:** Professor Keon Jae Lee  
**E-mail:** keonlee@kaist.ac.kr  
**Website:** <http://www.kaist.edu/>  
**Phone:** -  
**Patent status:** -  
**On market since:** -  
**Regions:** Korea  
**Industries:** Electronics  
**Source links:** [Korea Advanced Institute of Science and Technology](#)  
[Advanced Materials](#)



## SUTE - A FIRE PREVENTION AND CONTROL SYSTEM

Uncontrolled wildfires caused by weather, wind, and dry underbrush, wildfires can burn acres of land and consume everything in their paths in few minutes. Except for the human factor, heat sources can cause the wildfire and bring fuel to temperatures hot enough to ignite. Lightning, burning campfires or cigarettes, hot winds, and even the sun can all provide sufficient heat to make a fire. Therefore, Beatriz Marco, Ainhoa Hualde, and Sonia Tena from the Jaume I University have developed an innovative fire prevention and control system Sute. The system can be activated automatically by a weather control sensor. When heat and drought levels are high, Sute turns on and freshens the vegetation.



As a fire extinguishing system, height was considered the most critical factor now that the radius of the water range depends on it

source - jamesdysonaward.org

Natural fires are generally started by lightning, with a very small percentage started by spontaneous combustion of dry fuel such as sawdust and leaves. This newest technology Sute arises from the need of controlling the vast vegetation areas, which are defenseless due to the high temperature and lack of cooling down, besides the absence of cleaning and care of the forest, which usually eases the propagation of fires. According to the [National Geographic](#), on average, more than **100,000 wildfires**, which is also called forest fires, destroy **4 million to 5 million acres** (or 1.6 million to 2 million hectares) of land in the U.S. every year. A wildfire moves at speeds of up to 23 kilometers an hour, consuming everything: trees, brush, homes, even humans - in its path.

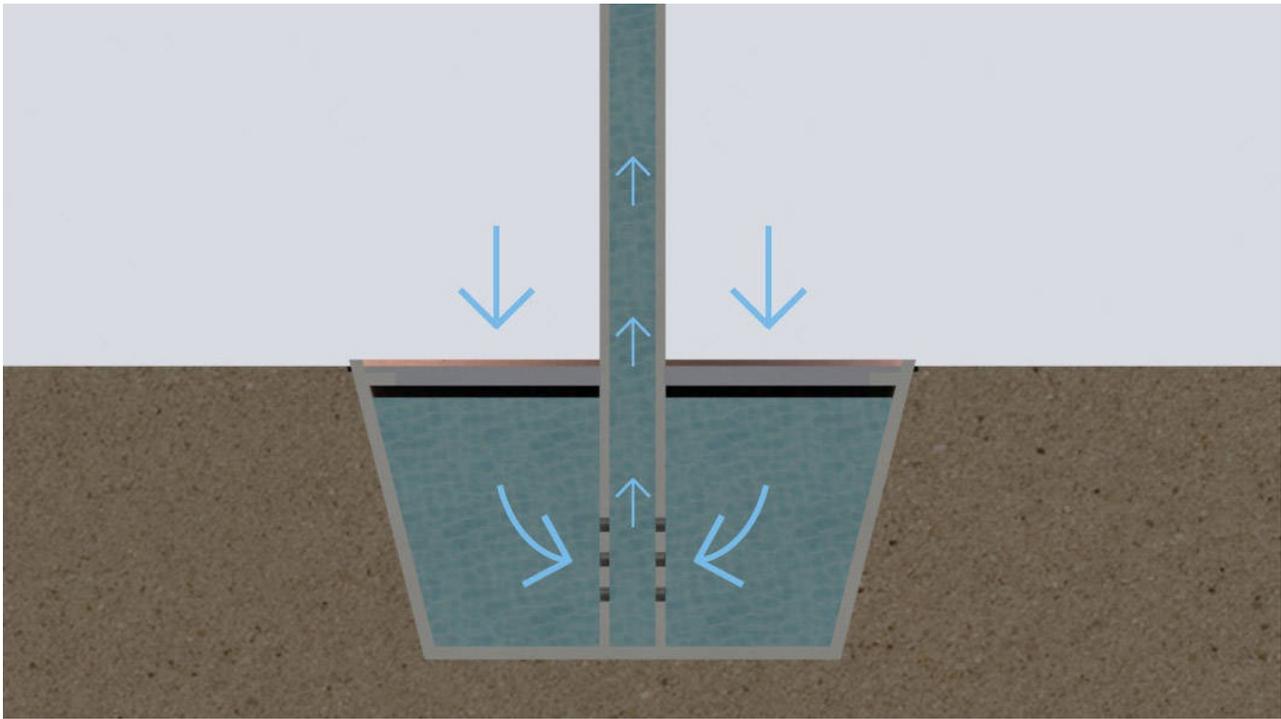
Therefore, developers created **Sute as the autonomous system whose activation depends on a sensor that controls the general parameters of the weather such as humidity, temperature**. When these indexes drop under previously established minimums, Sute turns on and freshens the environment. Furthermore, the **sensor also reacts to the smoke**, which is a direct sign of the fire, due to this, the system activates when this happens. Developers mentioned that in addition the automatic start, this novel invention doesn't require maintenance since water is stocked up in the underground tank, from where a pump lifts the water to the sprinkler located at the upper part of the device. The energy required for this action is provided by a photovoltaic plate, which is placed in

the highest point of the product. This means that Sute is not connected to the electricity distribution network and, therefore, it is self-sufficient. The sprinkler spins due to the force of water when it comes out, providing the specific mechanism for this function.

Furthermore, there are no similar systems on the market, as it is the only self-sufficient fire prevention device. Another advantage of this innovative system is that it prevents fires as well as extinguishes forest fires using the most eco-friendly methods.



This difficulty was solved by placing the tank where the natural resources can be collected, the device is located at the bottom part as it will allow storing more water and its transportation needs a pump  
source - [jamesdysonaward.org](http://jamesdysonaward.org)



In the future, Sute is expected to be installed in most of the forests with drought problem  
source - [jamesdysonaward.org](http://jamesdysonaward.org)

Company name: Jaume I University  
Contact person: -  
E-mail: info@uji.es  
Website: <https://www.uji.es/>  
Phone: +34 964 72 80 00  
Patent status: -  
On market since: -  
Regions: Spain  
Industries: Environment  
Source links: [James Dyson Award](#)



## EXOSUIT - THE FUTURE WORKFORCE

Despite the fact that the labor force is replaced by machines and robots on constructions, there are some types of work that still require human physical strength. The excessive strain on improper lifting is one of the most common injuries in the workplace, where heavy lifting is part of everyday tasks. The lower part of the back and knees are the two most common parts of the body that are usually damaged. Therefore, Erik Höglund from the Lund University has developed an innovative supporting suit Exosuit for heavy-lifting workers that provides with extra strength and minimizes overexertion. Exosuit is constructed with air-filled channels that, triggered by muscle sensors, expand and stabilize the user's back and give knees extra strength when lifting incorrectly.



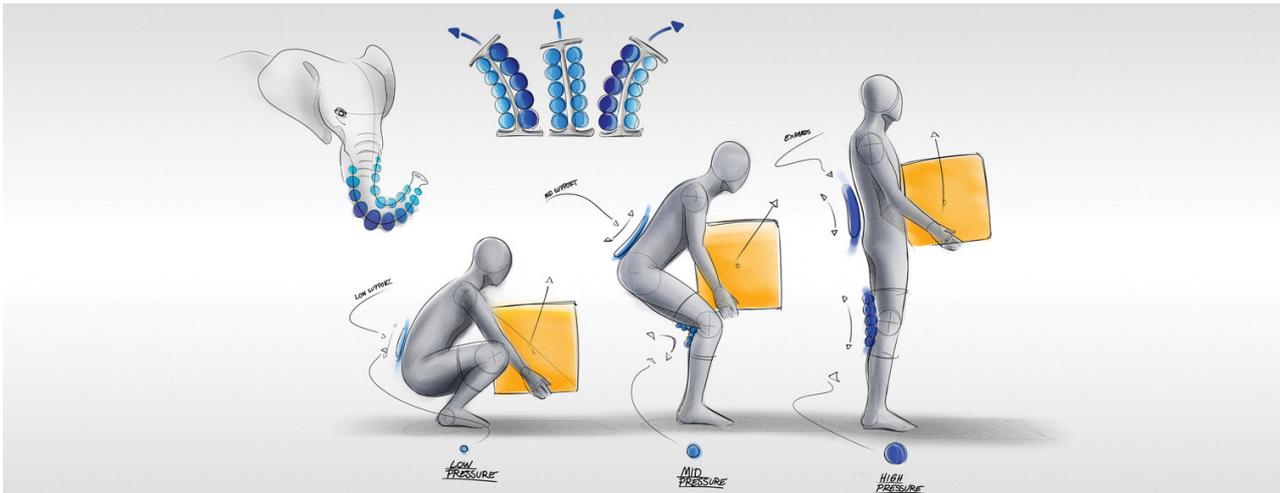
Models with air-filled tubes and sketched and sewed different prototypes to evaluate the progress  
source - jamesdysonaward.org

Despite the availability of advanced technology and high-performance robotic technology, the rate of injuries and deaths on construction sites is quite high all over the world.

According to the [Health and Safety Executive](#), each year around **80,000** construction workers in Great Britain suffer from an illness they believe was caused or made worse by their work. Around 40% of these cases were new conditions, which started during the year, while the remainders were long-standing conditions. **52,000** were cases of musculoskeletal disorders (MSD), of which just under a third were new conditions. Fatal injuries in the construction industry declined **38%** between 2006 and 2010 in the US. Nevertheless, the overexertion by incorrect lifting is one of the most common injuries at workplaces. More and more workers are suffering from this injury as a result of the high demand for production and workforce. **The lower back and knees are the two most common parts of the body that are injured which often results in a layoff or sick leave.**

The Exosuit is equipped with muscle sensors and air channels that are monitoring the important muscle groups for lifting heavy objects. The air-filled channel expands and creates a movement to support the muscles. The waistcoat has vertical air channels, which has the ability to shift from a flexible state to a stiffer support state in order to distribute the lift down to the knees. The air is compressed in special cartridges and located in the waistcoat. The air cartridges can supply the waistcoat with air for a long

time. Furthermore, it can be easily refilled with the help of the compressor. The main goal of this technology is to decrease numbers of injuries before they happen. Moreover, this technology can also be applied to post-care and rehabilitation periods in order to support and help training after the injury. Exosuit has a big potential since the current exoskeletons are very expensive and not as flexible as the rehabilitation process needs. The next step of this project will be to make full-scale models and evaluate the performance and the impact of this suit will have during the lifting.



The aesthetic features were made to enhance the look of flexibility and safety around the constructed air-filled channels

source - jamesdysonaward.org



Vest - rendering

source - jamesdysonaward.org

**Company name:** Lund University  
**Contact person:** Erik Höglund  
**E-mail:** erik.bele.hoglund@gmail.com  
**Website:** <https://www.lunduniversity.lu.se/>  
**Phone:** -  
**Patent status:** -  
**On market since:** -  
**Regions:** Sweden  
**Industries:** Construction, Creative Industries, Healthca...  
**Source links:** [James Dyson Award](#)



## A NOVEL INVENTION CAN HELP TO FIGHT THE ILLEGAL DRUG TRADE

The scientific group from the Australian National University in collaboration with the École polytechnique fédérale de Lausanne has invented an innovative system, the imaging-based nanophotonic method, which is able to detect chemicals in minuscule quantities and could be developed into a portable drug-testing kit to help authorities crack down on the illegal drug trade. The technology is based on the measuring infrared signatures of organic molecules and translating them into barcodes, which could be used to identify the specific type of drug. Furthermore, scientists mentioned, that this breakthrough system will be developed into a commercial drug-testing prototype within just a few years.



Professor Dragomir Neshev (the Nonlinear Physics Centre, the Physics Education Centre) is a co-author of the research source - [anu.edu.au](http://anu.edu.au)

Drug trafficking is a global illicit trade involving the cultivation, manufacture, distribution and sale of substances which are subject to drug prohibition laws. Despite drastic punishments for drug dealing, up to and including death in many countries, the worldwide illegal drug trade continues to flourish. Different drug testing kits use infrared spectroscopy. **Mid-infrared (mid-IR) spectroscopy** is the basis of molecular fingerprinting. Nevertheless, its sensitivity is diminished when looking at small volumes of sample. Scientists developed an imaging-based nanophotonic method for detecting mid-infrared molecular fingerprints and implemented it for the chemical identification and compositional analysis of surface-bound analytes.

This method has a two-dimensional pixelated dielectric metasurface with a range of ultrasharp resonances, each tuned to a discrete frequency. As the result, molecular absorption signatures can be read out at multiple spectral points, and the resulting information is then converted into a barcode-like spatial absorption map for imaging. **The signatures of biological, polymer, and pesticide molecules can be identified with high sensitivity, covering applications such as biosensing and environmental monitoring.** Professor Neshev mentioned that this innovative **system has the ability not only to detect but recognise drugs in extremely small quantities which are released when the body metabolises drugs.** The important moment is that it can be applied as a new device for

police to perform a mobile-drug test of automobilists or suspected drug traffickers in a simple, **fast** and **non-invasive way**. The device could replace the cumbersome and expensive mid-infrared spectrometers, which cost more than **\$100,000**. This device will be **portable** and **cheaper**.



These barcodes can be analysed and classified using advanced pattern recognition and machine learning such as artificial neural networks

source - adobe.com

**Company name:** Australian National University  
**Contact person:** Professor Dragomir Neshev  
**E-mail:** dragomir.neshev@anu.edu.au  
**Website:** <http://www.anu.edu.au/>  
**Phone:** -  
**Patent status:** -  
**On market since:** -  
**Regions:** Switzerland, Australia  
**Industries:** Chemicals, Others  
**Source links:** [Australian National University](#)  
[Science](#)

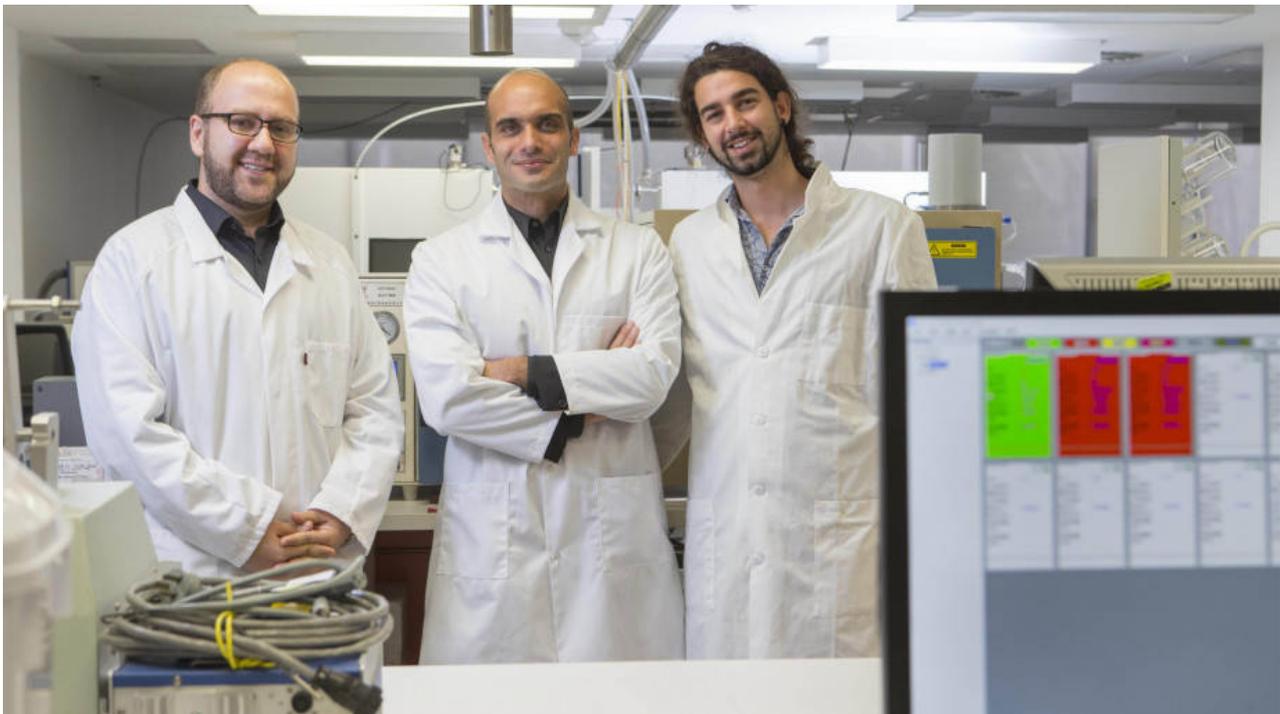


## NEWEST SENSORS OPEN DOOR TO WEARABLE MEDICAL DIAGNOSTIC DEVICE

The scientific group, led by Associate Professor Antonio Tricoli, from the Australian National University has managed to develop tiny optical sensors that will be able to create the wearable device, which will allow doctors to medically diagnose people in real time. These innovative sensors are at 50 times thinner than a human hair and will provide doctors with the capability to detect various hard diseases such as diabetes much earlier than is currently possible. In addition, it will enable the management of a whole range of chronic diseases, exceedingly improving not only diagnosis but also the standard of people living.

The development was made in collaboration with the [Queensland University of Technology](#) and the [Chalmers University of Technology](#) in Sweden.

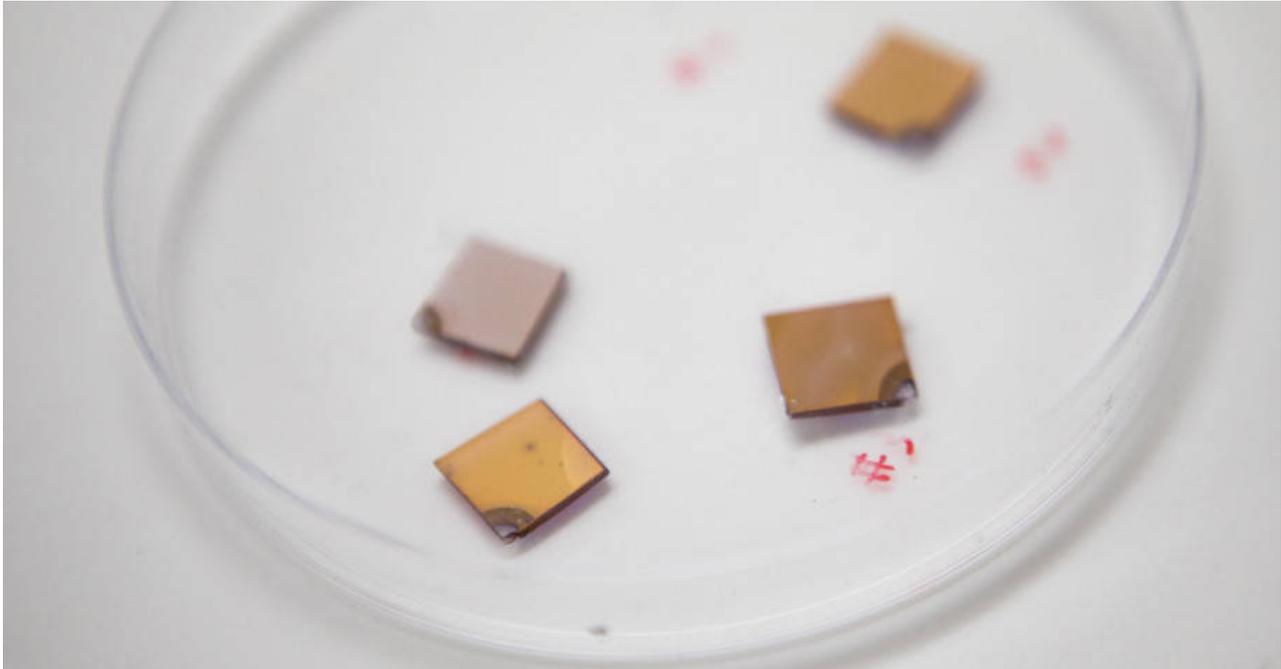
The plasmon resonance has found widespread use of optical transducers of refractive index changes in liquids. Despite this fact, it is hard to convert these achievements to the selective detection of gases, which typically adsorb non-specifically and induce refractive index changes below the detection limit. Therefore, scientists have managed to demonstrate that integration of tailored fractals of dielectric TiO<sub>2</sub> nanoparticles on a plasmonic metasurface strongly increases the interaction between the plasmonic field and volatile organic molecules and provides a tool for their selective detection. It allows creating dielectric–plasmonic materials with application extending from light harvesting and photocatalysts to contactless sensors for noninvasive medical diagnostics.



Dr Mohsen Rahmani, Associate Professor Antonio Tricoli (the leader of the Nanotechnology Research Laboratory at the ANU Research School of Engineering) and PhD scholar Zelio Fusco  
source - [anu.edu.au](http://anu.edu.au)

Assoc. Prof. Tricoli mentioned that **sensors can measure very small concentrations of gases coming through the skin and breath called metabolites, allowing doctors to keep track of the health in real time.** To track biomarkers of certain disease, the sensor use just the pulse of light. In other words, there is no need for batteries, wires or massive and expensive lab equipment. Furthermore, these **sensors can eliminate a requirement to perform blood tests and many other invasive procedures, making their use simple,**

painless, effective and fast. PhD scholar Zelio Fusco mentioned that this novel invention has advantages over other types as they could detect metabolites in much smaller concentrations and operate at room temperature. Moreover, they can be integrated not only into wearable medical sensors but in different farming and space exploration devices. For example, to detect whether a plant has a particular disease or the fruit is ripe.



Dr Mohsen Rahmani said the sensors combined very small gold nanostructures with semiconductors in a way that created unique properties to enable the detection of gas molecules at very low concentrations  
source - anu.edu.au

**Company name:** Australian National University  
**Contact person:** Associate Professor Antonio Tricoli  
**E-mail:** antonio.tricoli@anu.edu.au  
**Website:** <http://www.anu.edu.au/>  
**Phone:** -  
**Patent status:** -  
**On market since:** -  
**Regions:** Sweden, Australia  
**Industries:** Healthcare  
**Source links:** [Australian National University](#)  
[Advanced Materials](#)



## A NOVEL WATER PURIFICATION FILTER

Most of the water cleaning systems in order to detect organic elements and perform the purification use chemical elements whose effectiveness is limited. Scientists from Australia have managed to develop an innovative, world-first, graphene-based filter that is able to remove more than 99% of the ubiquitous natural organic matter left behind after the typical purification process of drinking water. This technology can be upgraded and installed in conventional water treatment systems highly improving the drinking water quality.



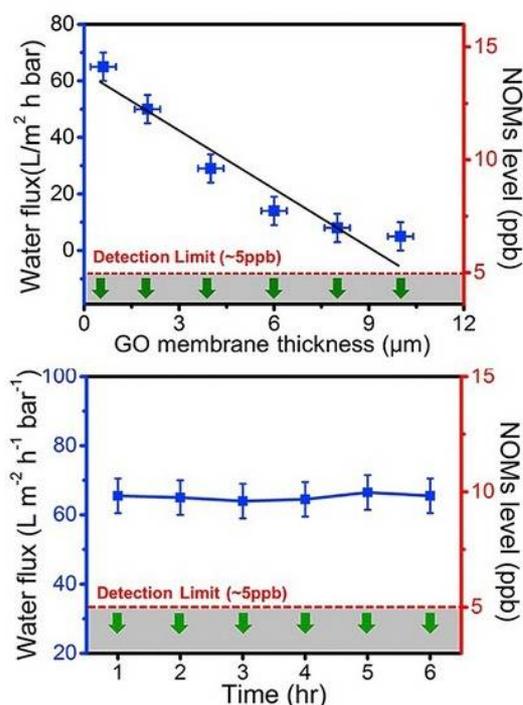
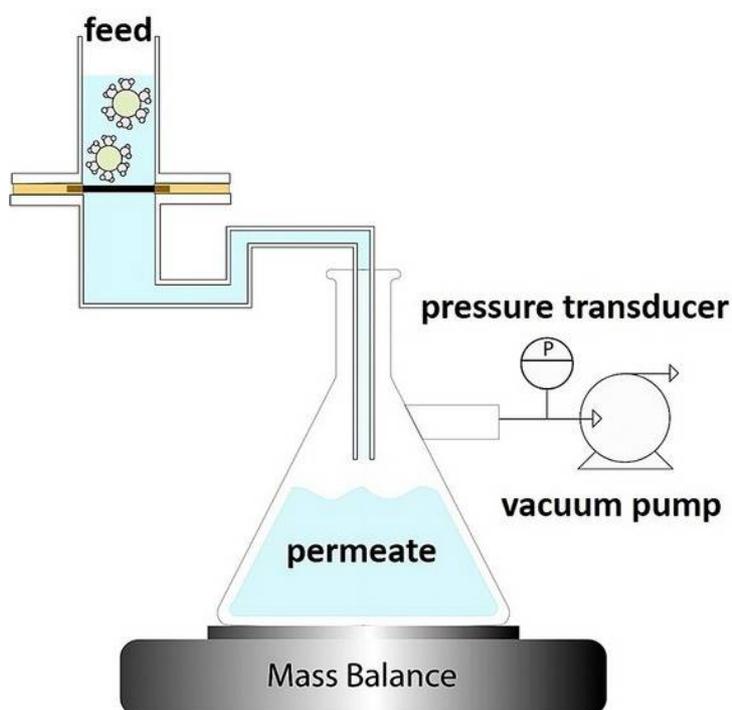
UNSW's Dr Rakesh Joshi (far left) and team members hand over water free of natural organic matter to Sydney Water's Dr Heriberto Bustamante (far right)  
source - [newsroom.unsw.edu.au](http://newsroom.unsw.edu.au)

The development was made by the scientific group, led by [Dr. Rakesh Joshi](#), from the [University of New South Wales](#) in collaboration with the [Sydney Water](#). The study results have demonstrated the success of this technology. The laboratory tests were provided on the [Nepean Water Filtration Plant](#), which is situated in western Sydney. Currently, scientists are working to scale up this innovative method.

Changes in the complexity of [natural organic matter \(NOM\)](#) have the influence on the effectiveness of direct filtration plants of water industries. As the result, it significantly decreased the cleaning capacity and can lead to increased disinfection by-products. Therefore, the need to detect new materials is crucial, as it can be used in developing of novel and more effective technologies to purify drinking water. Current methods in order to remove organic matter from water supplies use chemical coagulants. Nevertheless, their use is not very effective, particularly when the concentration of natural organic elements is enhancing.

Scientists used [graphene oxide membranes to remove NOMs from water](#) that had been

treated and still contained 5 mg/L of dissolved organic carbon. Dr. Joshi mentioned that no other filtration method has come close to removing 99% of NOMs from water at low pressure. These graphene-based membranes can be transformed into an alternative option, which will be modified and installed into current water treatment plants. The purifying system is produced by transforming naturally occurring graphite into graphene oxide membranes. It provides the high water flow at atmospheric pressure, simultaneously the removing of the organic matter occurs. Filters can reject about 100% of NOM while maintaining high water flux of 65 L at atmospheric pressure.



The UNSW team is upgrading the experimental rig to construct a small pilot plant that could be tested in the field source - [sciencedirect.com](https://www.sciencedirect.com)

Company name: University of New South Wales  
Contact person: Dr. Rakesh Joshi  
E-mail: r.joshi@unsw.edu.au  
Website: <https://www.unsw.edu.au/>  
Phone: -  
Patent status: -  
On market since: -  
Regions: Australia  
Industries: Water  
Source links: [University of New South Wales](#)  
[Carbon](#)



## NEW AND COST-EFFECTIVE ARTIFICIAL SKIN

Scientists from Japan developed a novel technology to produce an effective artificial skin in a cost-effective way. Current artificial skins technologies don't cause the real skin regrowth on the treated areas due to the insufficient blood flow. Recent methods are intended on the inserting of growth factors into the skin material in order to provide healing and cell growth. Despite this, such technologies cannot provide growth factors for a long time. Therefore, scientists improved the growth factor, a basic fibroblast growth factor (bFGF) in order to provide tissue regeneration. Furthermore, such artificial skin has been approved for use by the Japanese government.

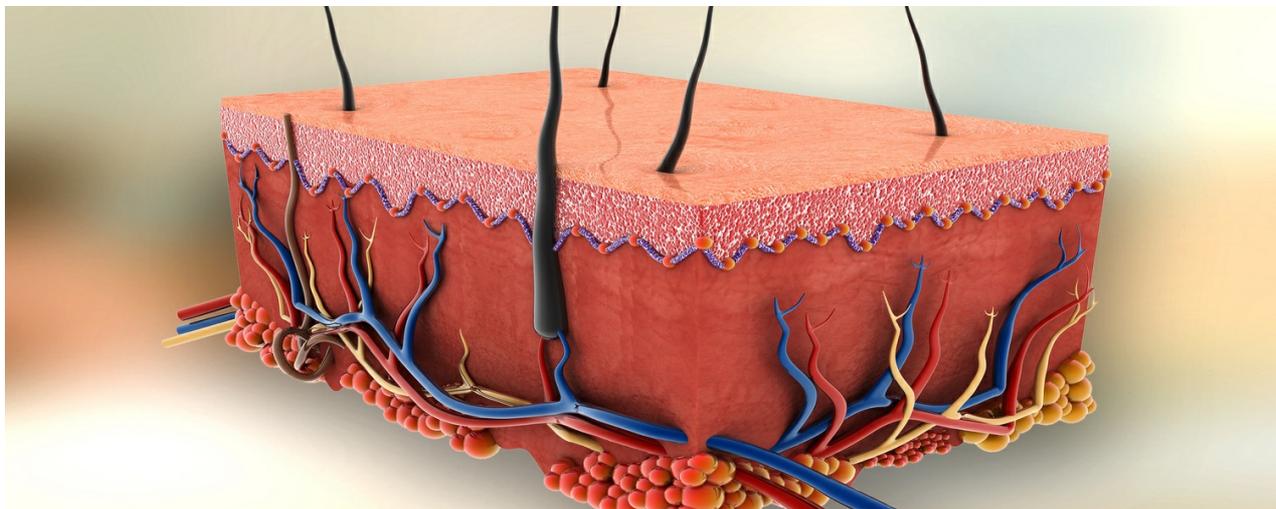


New artificial skin dramatically improves treatment prospects at a reduces cost  
source - kyoto-u.ac.jp

The innovative development was made by the scientific group, led by [Assistant Professor Naoki Morimoto](#) from the [Kyoto University's School of Medicine](#). This type of the artificial skin is intended for the treatment of chronic skin ulcers and other dermatological conditions. Skin, the largest organ of the human body, is organized into an elaborate layered structure consisting mainly of the outermost epidermis and the underlying dermis. Various multiple components of the skin ensure survival by carrying out critical functions such as protection, thermoregulation, excretion, absorption, metabolic functions, sensation, evaporation management, and aesthetics. Sometimes due to various reasons, such functions are disturbed. [Current artificial skin models are unable to provide real skin regrowth on the treated areas due to insufficient blood flow](#). Such technologies are based on the embedding of living cells or growth factors into the skin material to provide healing and cell growth. However, a sufficient amount of live cells for artificial derma requires a considerable amount of time and cost, and these materials cannot effectively provide growth factors for a long period of time.

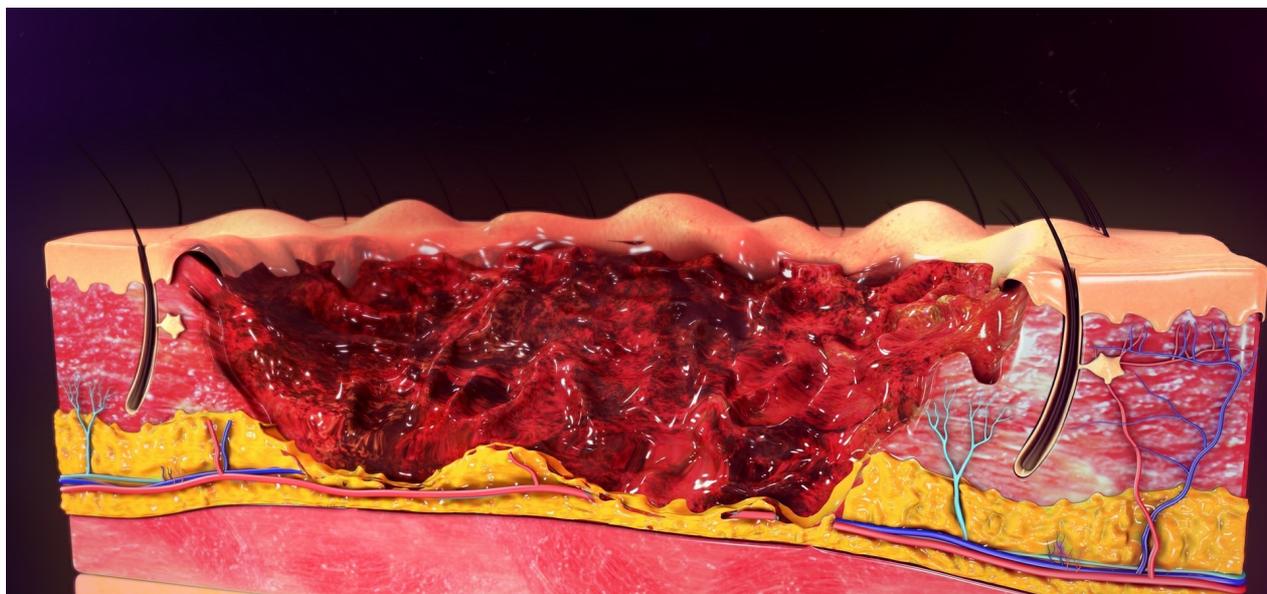
This innovative [artificial skin was developed to improve skin and blood regeneration by concentrating growth factors](#). Furthermore, scientists mentioned that since the material is not inserted into living cells, the production costs are tenth of currently available products. These skin models improve current designs with changes to sustain positively charged growth factors such as [basic fibroblast growth factor or bFGF in order to provide tissue regeneration](#). The artificial skin releases bFGF gradually for at least [10 days](#). Clinical trials were provided from May 2010 to June 2011 at Kyoto University Hospital and included [17](#)

patients. The study results demonstrated that 16 patients had improved wound beds and no serious side-effects. The skin has gained final approval as a medical device. [Gunze Limited](#) will start sales in summer, 2018.



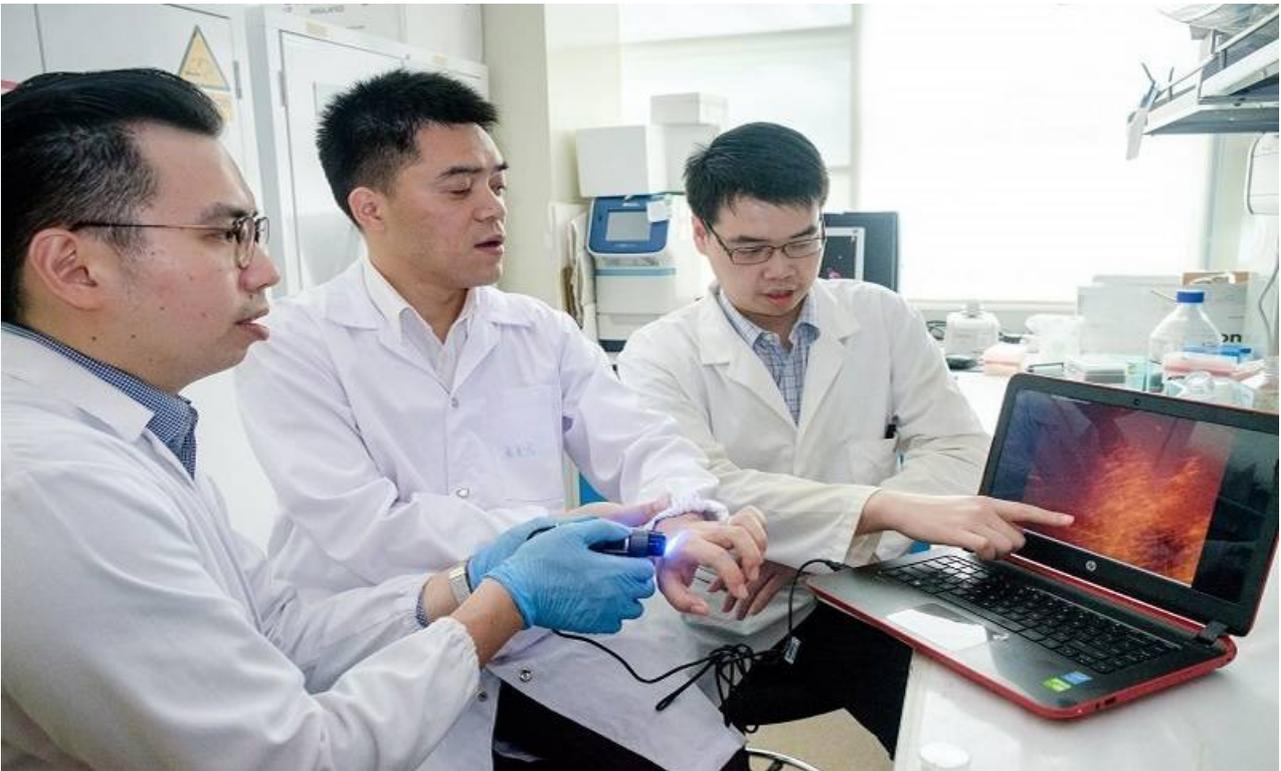
A new type of artificial skin, intended for the treatment of chronic skin ulcers and other dermatological conditions  
source - adobe.com

**Company name:** Kyoto University  
**Contact person:** Assistant Professor Naoki Morimoto  
**E-mail:** morimoto(at)anthro.zool.kyoto-u.ac.jp  
**Website:** <https://www.kyoto-u.ac.jp/en/>  
**Phone:** +81(0)75 753 4086  
**Patent status:** -  
**On market since:** -  
**Regions:** Japan  
**Industries:** Healthcare, Biotechnology  
**Source links:** [Kyoto University](#)



## NEW TECHNOLOGY TO DETECT ABNORMAL SCARRING OF WOUNDS

Currently, medicals hard predict how scars will develop following surgery or after a burn wound, without applying the invasive testing. Excessive or abnormal scarring can significantly affect a patient's quality of life, making it difficult. Scars can be painful when stretching significantly impeding motor activity of the person as well as causing psychological discomfort, making the everyday life more limited. Therefore, scientists developed a novel technology to identify heavy wound scars formation and providing doctors the ability to predict and intervene it. They used nanoparticles to accurately predict whether the wound could cause excessive scarring, as is the case with keloids and skin contractures.



The method was developed by a team led by Assistant Professor Xu Chenjie from NTU, Professor Chad A Mirkin from Northwestern University and Dr. Amy S Paller from the Northwestern University source - [ntu.edu.sg](http://ntu.edu.sg)

The innovative technique was developed by the scientific group, led by [Assistant Professor Xu Chenjie](#) from the [Nanyang Technological University](#) in collaboration with the [Northwestern University](#).

In developed countries alone, about **100 million** patients will have scars formation annually, arising from **80 million** elective and trauma surgery operations. Such **abnormal scarring highly limits people movements and motor activity in general, making it even painful in the case when scars stretch**. The precise diagnosis of scar type depends on the histopathology of biopsied tissue, which is invasive and time-consuming, causes some discomfort and may exacerbate scarring. Scientists developed the detection method uses thousands of nanoparticles called **NanoFlares**, which have DNA strands attached to their surfaces like a ball of spikes. Imaging nanoprobe for the live-cell detection of intracellular mRNA (NanoFlares) enable measurements of the expression of **connective tissue growth factor (CTGF)** as a visual indicator of hypertrophic scars and keloids.

Nanoparticles are applied to closed wounds using a cream. After nanoparticles penetrate the skin cells for **24 hours**, the handheld fluorescence microscope is applied to search for signals, which are generated by the interaction of nanoparticles with target biomarkers

inside the skin cells. If fluorescence signals are identified, they indicate abnormal scarring activity. Therefore, appropriate preventive action can be done in order to avoid heavier scarring. The important moment is that the technology is **painless**. The transepidermal penetration of the NanoFlares enabled the visual and spectroscopic quantification of underlying abnormal fibroblasts on the basis of CTGF mRNA expression. Furthermore, this novel method **to detect increases or decreases in gene expression can be a new tool for non-invasive biopsy for different types of skin disease and others clinical applications**. Scientists **have filed a patent application** and are going to commercialize the technology.



These NanoFlares are made by coating Northwestern's patented gold nanoparticles with tiny DNA strands targeting particular genes. It has shown negligible toxicity or side effects  
source - adobe.com

**Company name:** Nanyang Technological University  
**Contact person:** Assistant Professor Xu Chenjie  
**E-mail:** CJXU@NTU.EDU.SG  
**Website:** <http://www.ntu.edu.sg/Pages/home.aspx>  
**Phone:** (+65)6513 2893  
**Patent status:** -  
**On market since:** -  
**Regions:** United States, Singapore  
**Industries:** Healthcare  
**Source links:** [Nanyang Technological University](#)  
[Nature Biomedical Engineering](#)



## **SATELLITE IMAGING TECHNOLOGY WILL DEAL WITH VISION LOSS**

Scientists from University of New South Wales in collaboration with the Centre for Eye Health, have managed to adapt the pattern recognition technique that is applied to assess satellite images, in order to develop an innovative method to diagnose and determine blinding eye diseases, such as age-related macular degeneration (AMD). The device includes the results of multiple ocular imaging techniques and can successfully identify features of macular degeneration. The provisional patent for the new technique has also been filed.



This is a major concern, given age-related macular degeneration is a leading cause of blindness affecting one in seven Australians over the age of 50  
source - unsw.edu.au

**Prof. Michael Kalloniatis** mentioned that the idea of automated diagnosis was conceived 14 years ago but there were no data to further study its application. The hypothesis was tested only when imaging techniques became more advanced. One of the main challenges of the **AMD is to monitor patients, which can have the advanced stage, be diagnosed on the early stage in order to prevent the fast progress of this disease.**

Progression is usually monitored through inspection of ocular imaging, but the current technologies are tiring and inaccurate. Therefore, scientists demonstrated that such monitoring can be done via a pattern recognition approach in mo precise way.

The visual field (VF) test stimuli operating within complete spatial summation within the central VF reveal more functional loss in patients with ocular disease including AMD. Researchers investigated whether differences in functional changes detected with different size stimuli translate to structural changes on spectral-domain optical coherence tomography (SD-OCT). VF detected by stimuli within complete spatial summation translated to AMD-related abnormalities on OCT more frequently than with GIII. It suggests that **such stimuli can be more appropriate for the 10-2 paradigm in patients with**

intermediate AMD. This innovative technology can be widely used for ocular imaging centers or for custom software incorporated by ophthalmic imaging manufacturers. The study demonstrated that the technique has the ability to detect and classify a series of eyes with AMD 91% of the time. The commercialization of this technology has a big potential in screening and monitoring of this disease, providing the ability to detect AMD on the early stage. Therefore, doctors can provide the appropriate strategy of treatment that will lead to better outcomes for patients.



Dr. Angelica Ly noted that the amount of diagnostic imaging information routinely available to clinicians has increased substantially over the past decade and this has created a form of 'information overload'  
source - [unsw.edu.au](http://unsw.edu.au)



Professor Michael Kalloniatis mentioned that the study provides preliminary evidence that this monitoring can be done via a pattern recognition approach  
source - [unsw.edu.au](http://unsw.edu.au)

**Company name:** University of New South Wales  
**Contact person:** Prof. Michael Kalloniatis  
**E-mail:** m.kalloniatis@unsw.edu.au  
**Website:** <https://www.unsw.edu.au/>  
**Phone:** +61281150710  
**Patent status:** -  
**On market since:** -  
**Regions:** Australia  
**Industries:** Healthcare  
**Source links:** [Investigative Ophthalmology & Visual Science](#)  
[University of New South Wales](#)



## NOVEL DESICCANT KEEPS YOUR SHOES AND ELECTRONICS DRY

The scientific group, led by Dr. Rakesh Joshi, from the University of New South Wales, has managed to develop an innovative carbon-based material, which can significantly improve the moisture control system in various things such as electronics, packaging, air conditioning and even can keep shoes fresh. The innovative material was produced from the graphene oxide and significantly superior current driers and absorbing twice as much moisture.



As the moisture could be released back into the atmosphere using an ordinary household device like a warm oven, shoes could be recharged regularly to keep them constantly fresh  
source - adobe.com

The laminated structure of **graphene oxide (GO)** provides unique interactions with water molecules which can be utilized in a range of applications that require materials with tuneable hygroscopic properties. Therefore, scientists investigated the adsorption and desorption behavior of water in GO laminates as a function of relative pressure. Dr. Joshi mentioned that this material is newest and stable and demonstrates high adsorption ability over conventional desiccants. The study results determined that the material's extraordinary adsorption and desorption rates were due to the high capillary pressure in the laminates and tunnel-like wrinkles on their surfaces. Previously, this process was unclear.

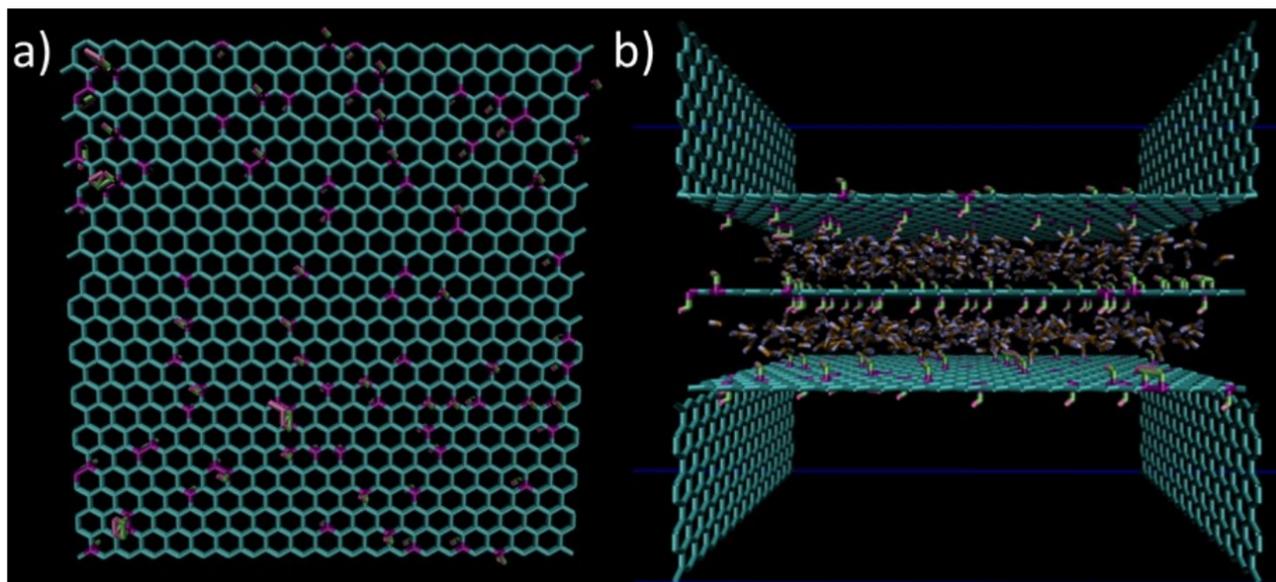
GO provides high water uptake capacity of up to **0.58 gram of water per gram of GO (g g<sup>-1</sup>)**. This is much higher than silica gel, which is used as the typical desiccant material. The adsorption and desorption kinetics of GO is at **5 times higher than silica gel**. Adsorption equilibrium experiments were performed at atmospheric pressure in an Environmental chamber. The relative pressure was controlled to **±3%** and the temperature could be controlled to an accuracy of **±1 K**. A microelectronic balance with an accuracy of **0.0001 g** was used to measure the sample weight. This invention can discharge moisture at energy-saving low temperatures, enabling it to be easily used over and over again. By contrast, the heating required to regenerate conventional desiccants is often considered extremely expensive. Prof. Sahajwalla mentioned that the biggest advantage of this technology is that **it combines the high adsorption capacity and a fast speed of absorption**.

All these factors lead to the ability to be applied to various desiccant systems improving electronics, packaging, air conditioning, and even shoes.



Likewise, the relatively low temperatures at which discharge can be achieved offers significant advantages by greatly reducing the energy intensity required for regeneration

source - adobe.com



MD simulation geometry with a) single GO flake at 10% oxidation level, the functional group facing both sides of the flake, b) 3 GO flake forming and the water molecule in the two GO laminates

source - rsc.org

**Company name:** University of New South Wales

**Contact person:** Dr. Rakesh Joshi

**E-mail:** r.joshi@unsw.edu.au

**Website:** <https://www.unsw.edu.au>

**Phone:** -

**Patent status:** -

**On market since:** -

**Regions:** Australia

**Industries:** Creative Industries, Others

**Source links:** [University of New South Wales](#)  
[Chemical Science](#)



# A NOVEL TECHNOLOGY CAN PREVENT POST-SURGERY BACTERIAL INFECTION

During after surgery period, bacterias can significantly slow down the process of healing and also cause infections, which significantly complicate the postoperative period and can lead to unwanted consequences. Therefore, scientists have managed to develop the capacitive coating, which has the ability to kill bacteria when it is charged with electricity. If to apply it to orthopedic implants such as artificial joints and dental implants, the innovative system will decrease the risk of infection after surgery and help patients recover faster. TiO<sub>2</sub> nanotubes, which are doped with carbon (TNT-C), continuously destroy molecules of bacteria over a period of time after charging with a small electric current.



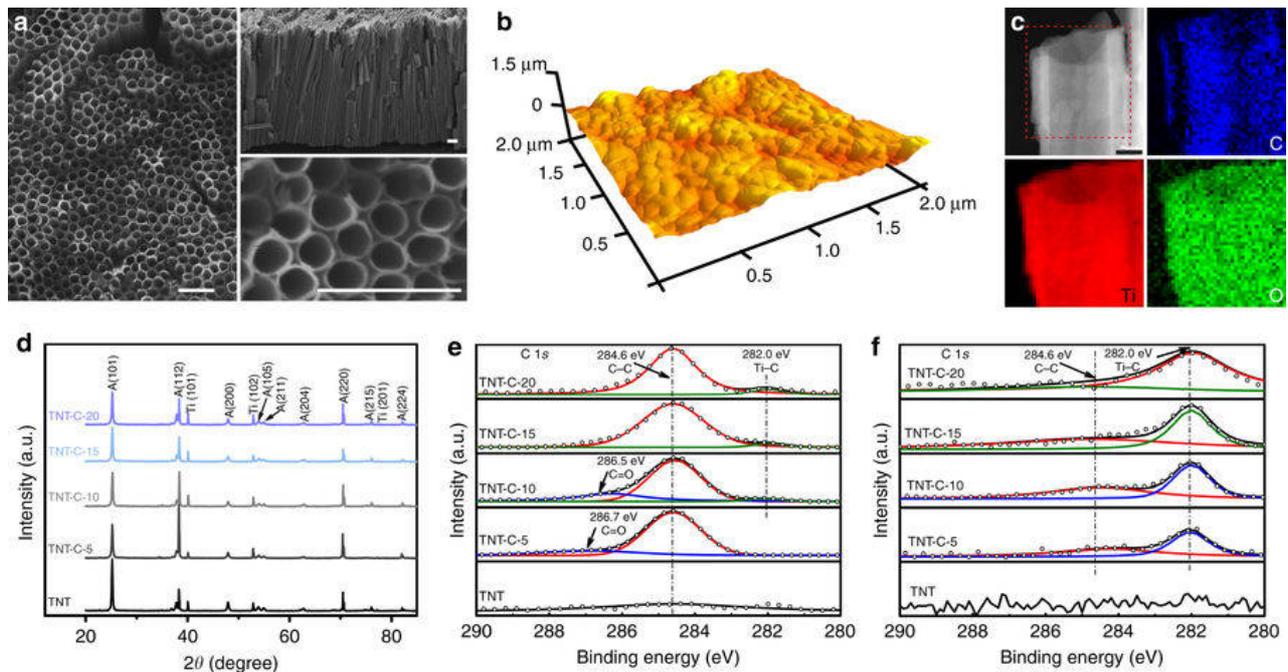
Professor Paul Chu Kim-ho (left) and Ph.D. student Wang Guomin from the Department of Materials Science and Engineering  
source - cityu.edu.hk

This antibacterial system was developed by the scientific group, led by [Professor Paul Chu Kim-ho](#), from the [City University of Hong Kong](#) in collaboration with the [University of Chinese Academy of Sciences](#) and the [Hong Kong Polytechnic University](#). The method is based on technology that was previously developed by Prof. Chu's scientific team and can kill bacteria in wounds using a high-voltage plasma jet.

Current biomedical materials such as titanium, titania, and different types of polymers do not have appropriate antibacterial properties. The antibacterial action can be achieved with help of surface charges. There were determined that positively charged carbon surface can reduce the viability of bacteria. Positive or negative surface charges have also been defined to promote the antibacterial efficiency of chitosan. Furthermore, the surface charges can disrupt the membrane of bacterial cells. Despite this fact, materials with positive charges can only disinfect bacteria in a very short term and they are not effective in antibacterial applications.

Scientists applied the external electrical current to [TNT-C](#) to evaluate the effects on bacteria killing and the underlying mechanism is investigated. Owing to the larger discharging capacity, the positive direct current (DC+) charging mode demonstrates better bacteria killing effects than alternating current (AC) charging. In other words, [NT-C](#)

destroys the cell membranes of the bacteria without affecting normal cells. This novel coating kills over 90% of different bacteria such as E. coli, S. aureus, P.aeruginosa, and S. epidermidis. Furthermore, the antibacterial effect continuous more than 5 hours after each charging cycle. The effectiveness of this type of treatment can be maintained for over several weeks if the coating is charged appropriately. This innovational technology can be applied to materials, which are usually implanted into the human body.



Representative sample characterization results. SEM image of TNT-C-15 with the insets showing the corresponding enlarged and cross-sectional images (Scale bar=500 nm)  
source - nature.com

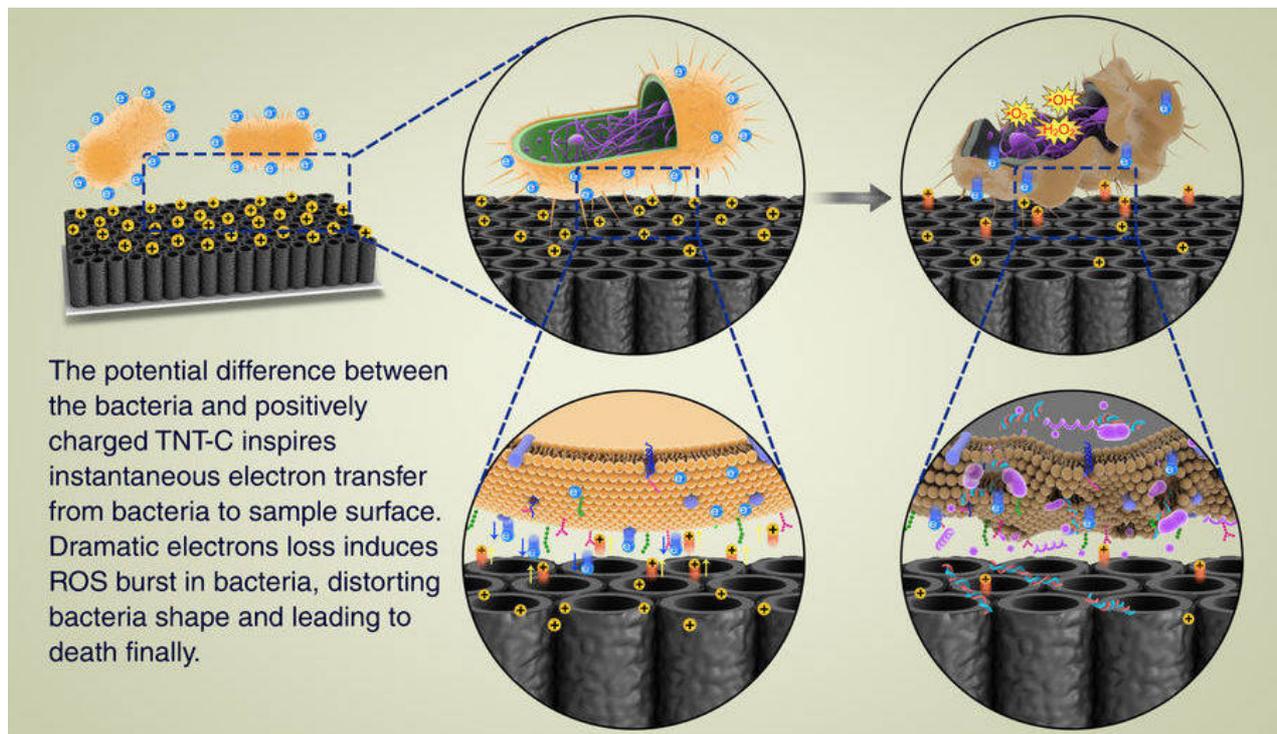


Diagram showing the antibacterial mechanism. Proposed antibacterial process on DC+ charged TNT-C based on the experimental results  
source - nature.com

**Company name:** City University of Hong Kong  
**Contact person:** Professor Paul Chu Kim-ho  
**E-mail:** paul.chu@cityu.edu.hk  
**Website:** <http://www.cityu.edu.hk/>  
**Phone:** +852 34427724  
**Patent status:** -  
**On market since:** -  
**Regions:** China  
**Industries:** Electronics, Healthcare  
**Source links:** [Nature Communications](#)  
[City University of Hong Kong](#)



## NOVEL FAST-CHARGING LITHIUM-OXYGEN BATTERIES

The limitation of driving distance per charge is one of the core challenges, which are connected with electric vehicles in supplanting fossil fuel-powered and environmentally unfriendly vehicles. Current battery technology supplies far lower gravimetric and volumetric energy densities compared to fossil fuels. Current lithium-oxygen (Li-O<sub>2</sub>) batteries usually demonstrate significantly lower efficiencies when the charge current rate was enhanced. Therefore, scientist developed fast-charging lithium-oxygen batteries. Such batteries show 80% round-trip efficiency even at high charging rates. This innovation is highly important for fields of electric vehicles or drones.



Professor Hye Ryung Byon from the Department of Chemistry at the Korea Advanced Institute of Science and Technology

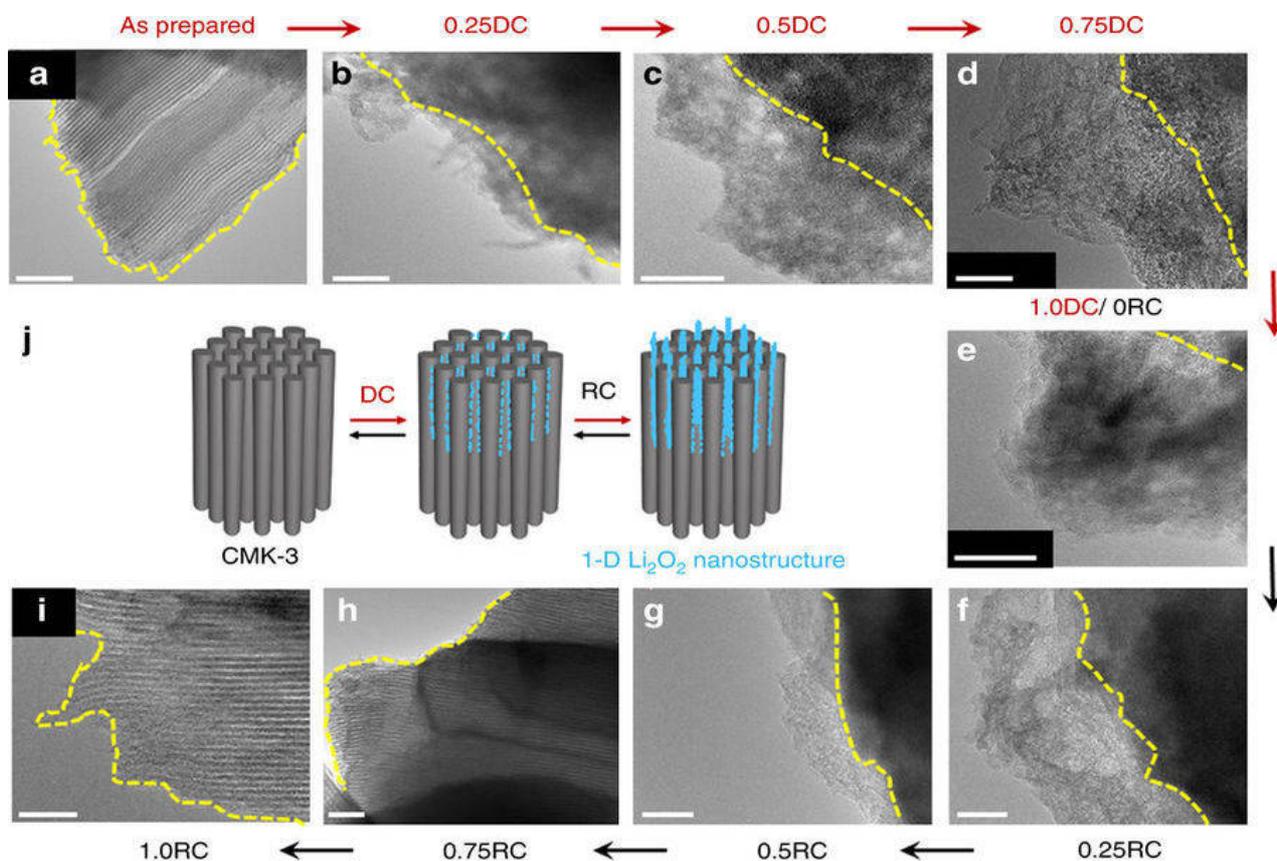
source - kaist.ac.kr

The development was made by the scientific group, led by [Professor Hye Ryung Byon](#) from the [Korea Advanced Institute of Science and Technology](#).

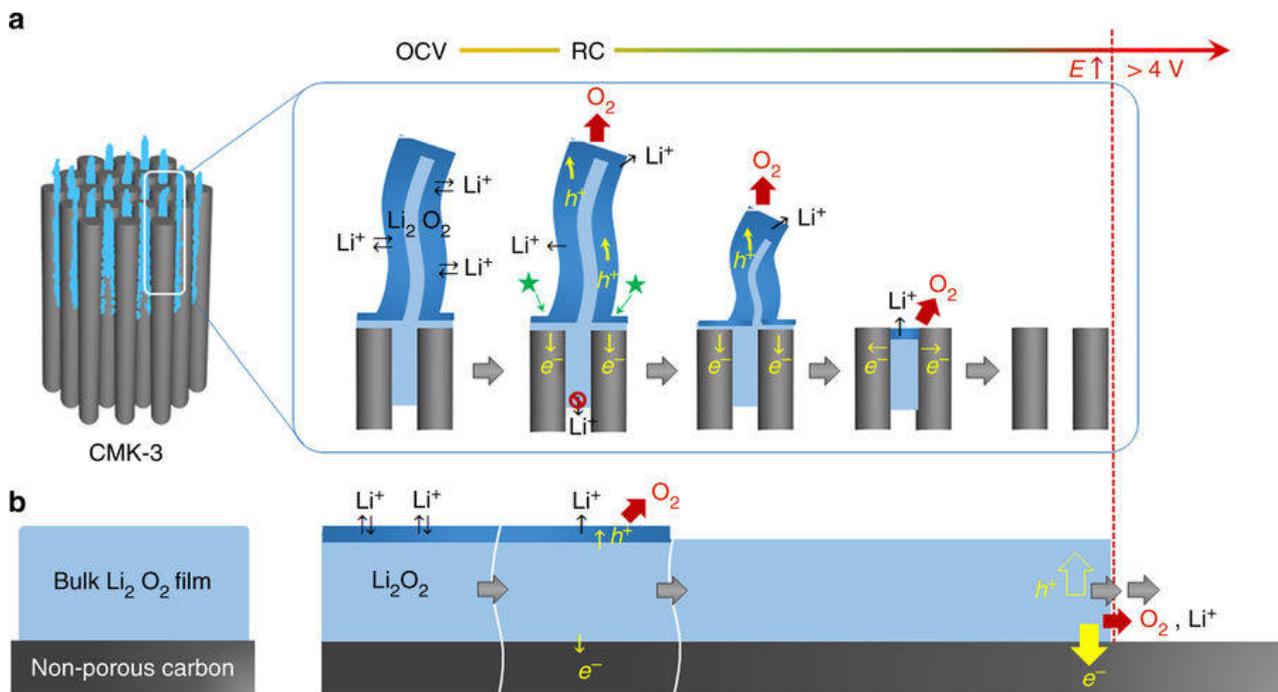
**Li–O<sub>2</sub> batteries** have the ability to accommodate from 3 to 5 times the energy density of lithium-ion batteries, which are currently used. They provide longer driving distance to electric vehicles or drones that operate in the condition of continued use of the electrical power. Therefore, the rechargeable lithium–oxygen (Li–O<sub>2</sub>) battery is one of the most suitable concepts with the essential precondition of high theoretical energy density. The low molecular weight of reactants, i.e., Li<sup>+</sup> and O<sub>2</sub> gas, and lightweight carbon electrode results in high specific capacities, which are typically over 1000 mAh g<sup>-1</sup>electrode. Despite these facts, during charge (DC), the lithium peroxide remains undecomposed at low overpotential. It leads to the lowering of the effectiveness of the battery. This is due to the poor ionic and electrical conductivity of lithium peroxide.

Scientists managed to **decrease the overpotential**, which is the difference between the thermodynamic reversible potential and the measured potential. **It improved the battery efficiency**. Of particular interest is the fact that these high-performance lithium-oxygen batteries can be realized without costly catalysts. They used the mesoporous carbon

electrode, which directs the growth of one-dimensional and amorphous lithium peroxide. The one-dimensional (1-D) nanostructures of amorphous  $\text{Li}_2\text{O}_2$  decrease the during recharge (DR) reaction and lead to the high round-trip efficiency of 80%. This innovational discovery can significantly improve the effectiveness of electric vehicles, drones and etc.

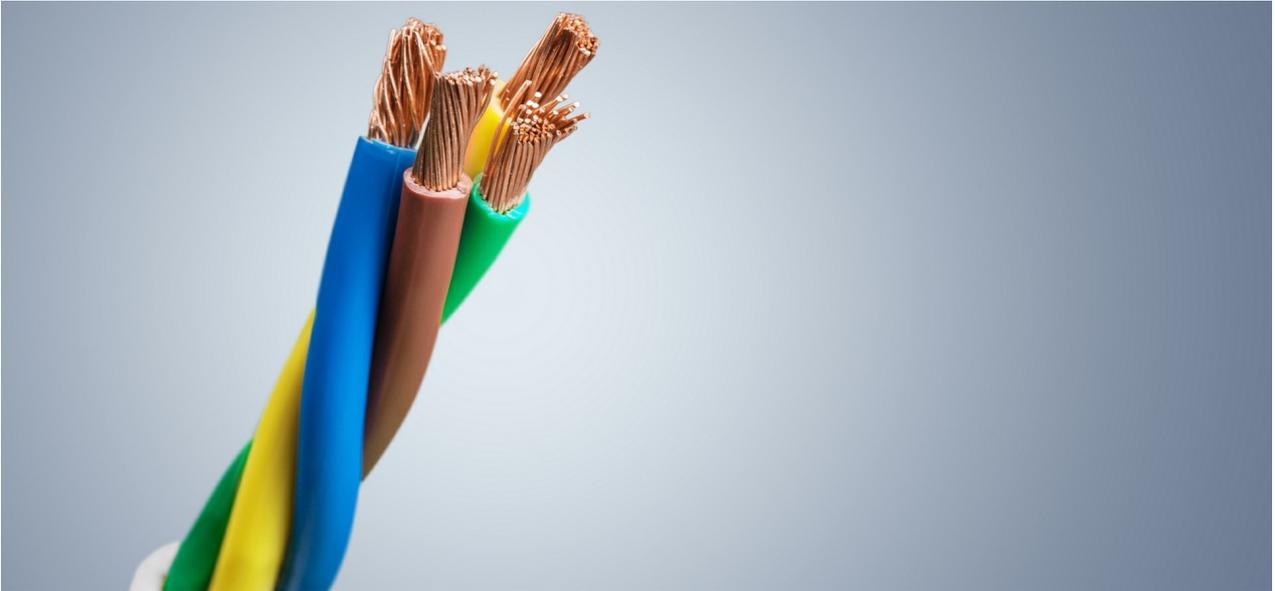


Transmission electron microscopy (TEM) images. a As-prepared, b–e discharging, and f–i recharging CMK-3 surfaces. The scale bars are 50 nm. The top label of the image denotes the depth of DC or RC source - nature.com



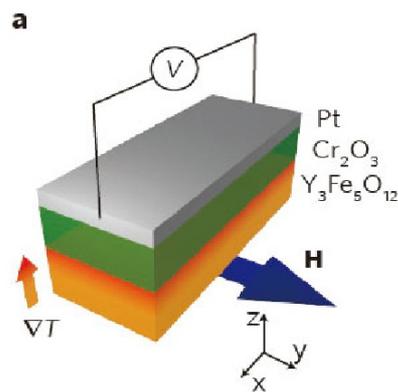
Schematic illustration for decomposition processes. The dark blue region that is distinguished from inside of  $\text{Li}_2\text{O}_2$  with the light blue color indicates activated  $\text{Li}_2\text{O}_2$  surface where free access of  $\text{Li}^+$  is allowed  
 source - nature.com

**Company name:** Korea Advanced Institute of Science and Te.  
**Contact person:** Professor Hye Ryung Byon  
**E-mail:** hrbyon@kaist.ac.kr  
**Website:** <http://www.kaist.edu/>  
**Phone:** -042-350-2822  
**Patent status:** -  
**On market since:** -  
**Regions:** Korea  
**Industries:** Electronics, Energy, Transport Systems and...  
**Source links:** [Nature Communications](#)  
[Korea Advanced Institute of Science and Technology](#)



## A SPIN CURRENT SWITCH

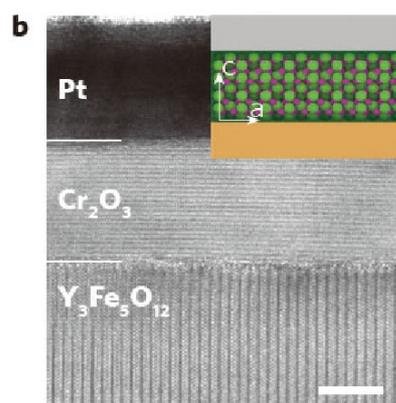
Scientists managed to discover the switch to control the spin current. This mechanism is highly required for information processing with full spin-based devices. As the technology that detects and generates the spin current has been previously achieved, the element that is needed for the spintronics is the 'spin current switch'. Such mechanism is equivalent to the transistor used in electronics to enable and disable the flow of electricity. This research was funded by ERATO spin quantum rectification project that is a Japanese government-funded academic research program.



Schematic illustration of the out-of-plane spin Seebeck setup for the YIG/Cr<sub>2</sub>O<sub>3</sub>/Pt trilayer device  
source - tohoku.ac.jp

The innovational discovery was made by the scientific group from the [Tohoku University](#) in collaboration with the [Mainz University](#).

**Spintronics** is an emerging field of nanoscale electronics including the detection and manipulation of electron spin. It has been applied in mass-storage components such as hard drives. The technology also holds promise for digital electronics in general as it doesn't require a specialized semiconductor material as the result the manufacturing is much more cost-effective. Therefore, it can be widely used on **various devices for processing information, memory, and storage** - in particular, ultra-high density hard disks and non-volatile memories.



A cross-sectional TEM image of the YIG/Cr<sub>2</sub>O<sub>3</sub> /Pt trilayer device used in this work. Scale bar, 5 nm. Each of layers makes pure crystal structure  
source - tohoku.ac.jp

Scientists created **the layered structure of materials perform as a spin current switch**. Using this mechanism, they are capable **to control the transmission of spin current at a 500% enhance at near room temperature**. Using a yttrium iron garnet YIG/Cr<sub>2</sub>O<sub>3</sub>/Pt trilayer, researchers injected a spin current from the YIG into the Cr<sub>2</sub>O<sub>3</sub> layer and collected, via the inverse spin Hall effect, the spin signal transmitted into the heavy metal Pt. They observed 2 orders of magnitude difference in the transmitted spin current within 14 K of the Néel temperature. By putting Cr<sub>2</sub>O<sub>3</sub> between the materials, the voltage signal at Pt reflects how much the Cr<sub>2</sub>O<sub>3</sub> layer can transmit the spin current. This mechanism, that was called **the spin colossal magnetoresistance (SCMR)**, can significantly simplify the design of spintronics components, for example, by enabling **the realization of spin-current switches or spin-current-based memories**. In addition, the transition between spin conducting and non-conducting states was modulated by a magnetic field in isothermal conditions. Prof. Eiji Saitoh mentioned that this novel development will put spintronics in a new direction.

Company name: Tohoku University  
Contact person: Eiji Saitoh  
E-mail: eizi@ap.t.u-tokyo.ac.jp  
Website: <http://www.tohoku.ac.jp/en/index.html>  
Phone: +81-22-217-6238  
Patent status: -  
On market since: -  
Regions: Germany, Japan  
Industries: Electronics  
Source links: [Tohoku University](#)  
[Natural Materials](#)

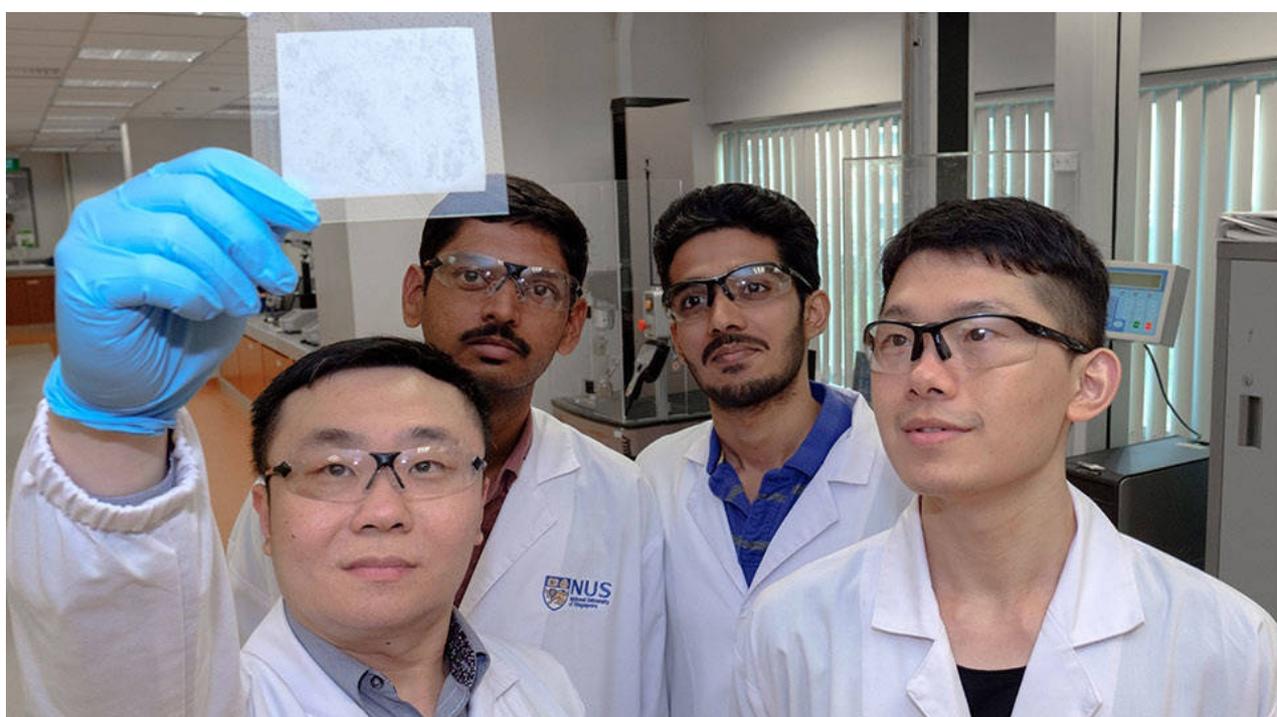


## THE NEWEST WATER-ABSORBING GEL HAS VARIOUS APPLICATION

Scientists developed a novel and unique water-absorbing gel, which harvests moisture from the air, and has different applications. It operates at 8 times better than current drying agents. Furthermore, the gel can perform as the privacy screen, conductive ink or battery that can power small devices. The gel has the ability to absorb around 230% of its weight with water from humid atmospheres. Therefore, the innovative development can be applied as the tool in order to prevent moldy walls at the building or make waiting at the bus stop during hot and raw weather more comfortable.

The innovational gel was developed by the scientific group, led by [Assistant Professor Tan Swee Ching](#), from the [National University of Singapore](#).

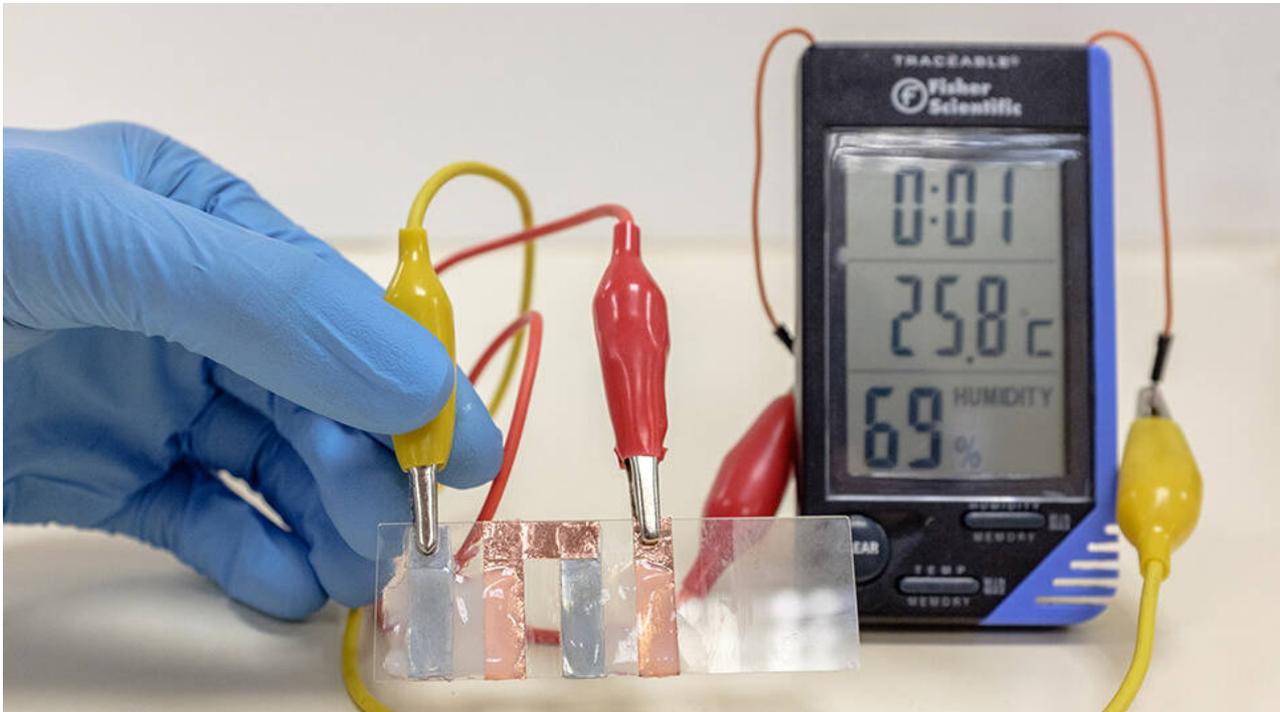
The moisture and its effects on people and the environment are everywhere. Too little moisture can be difficult, and ultimately fatal, to most living things whether large or microscopic. However, excessive moisture can also be problematic, and in extreme cases can cause decay, illness and even death. The moisture balance is necessary not only for humans, animals, and plants but for the preservation of many non-organic objects, like buildings.



Assistant Professor Tan Swee Ching (left) from the Department of Materials Science and Engineering and his team have invented a novel water-absorbing gel that harnesses humidity for various practical applications  
source - nus.edu.sg

Asst Prof Tan mentioned that despite the fact that moisture in the air a resource, there are only several methods to keep and use it. The novel [hydrogel decreases relative humidity of a confined space from 80% up to 60% in less than 7 minutes](#) providing the thermal comfort. It is cost-effective and easy to produce. The gel has humidity-triggered changes in optical, electrical and electrochemical properties that have been exploited for a wide range of applications such as the thermo-hygroscopic window, infrared radiation (IR) blocking windscreen and construction of an electrochemical cell for energy harvesting. The hydrogel does not require electricity to perform. Furthermore, it [can be easily coated onto walls, windows, and even decorative things in order to provide the dehumidifying](#)

function. The use of the gel as a conducting mechanism in flexible electronic substrates allows reusability of the printed circuit boards, mitigating the volume of solid electronic wastes and the energy needed for their disposal.



It generates about 1.8 volts of electricity that is sufficient to power a small digital clock. It can be easily washed, thus enabling the reuse of circuit boards and helping to cut down on the electronic waste source - nus.edu.sg

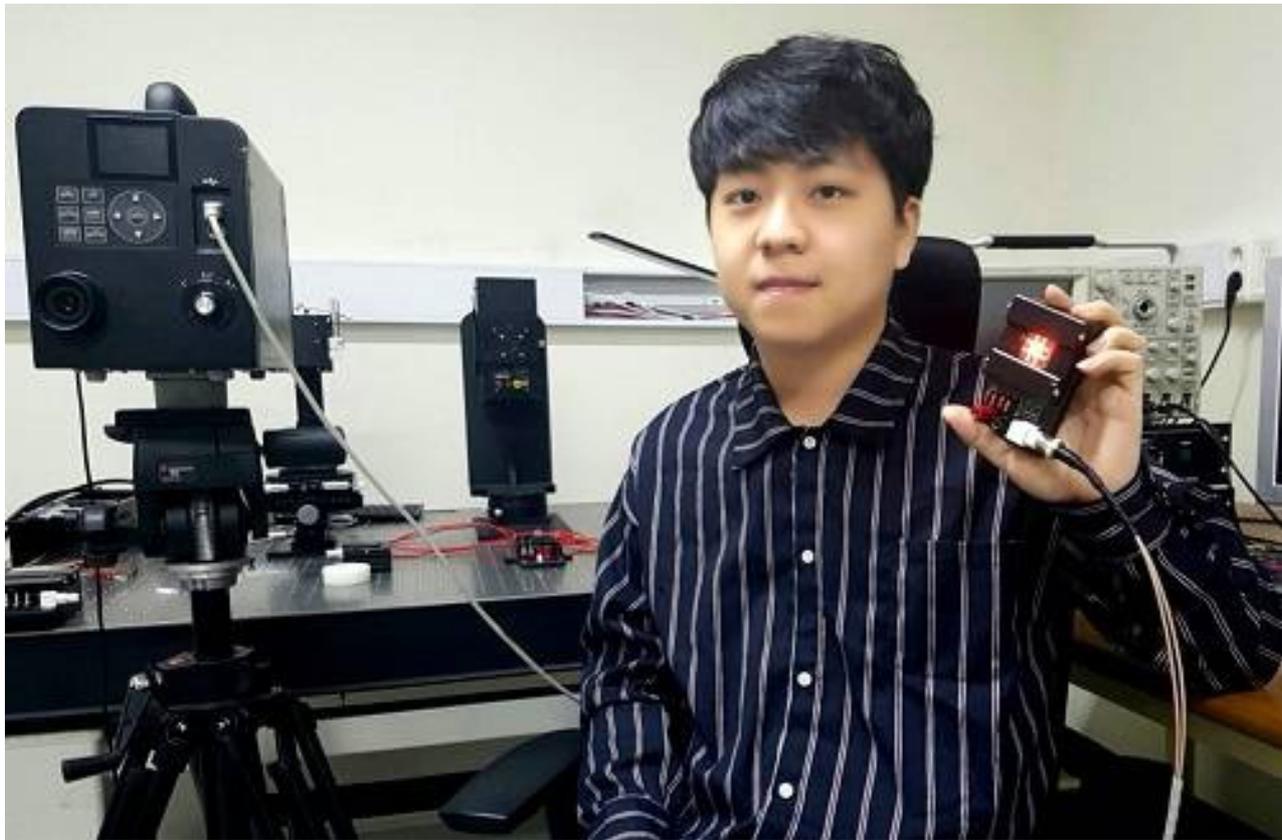
The scientific group **has filed a patent** for their invention, and the researchers will conduct more studies to further advance the application of the different properties of the novel hydrogel.

**Company name:** National University of Singapore  
**Contact person:** Assistant Professor Tan Swee Ching  
**E-mail:** msetansc@nus.edu.sg  
**Website:** <http://www.nus.edu.sg/>  
**Phone:** -  
**Patent status:** -  
**On market since:** -  
**Regions:** Singapore  
**Industries:** Chemicals, Electronics, Water, Others  
**Source links:** [Energy & Environmental Science](#)  
[National University of Singapore](#)



## A NOVEL PATCH WILL HEAL YOUR WOUNDS ANYWHERE AND ANYTIME

Scientists from Korea managed to create an innovative wearable patch, which is able to treat injuries regardless of location or time. The novel device is based on the photobiomodulation (PBM) technology that is a safe and noninvasive method, which can provide different clinical effects. This wearable patch contains a thin film, which consists of the flexible OLEDs and batteries and anti-superheating tools. Therefore, using this innovational technology, people will be able to be treated outside of hospitals.



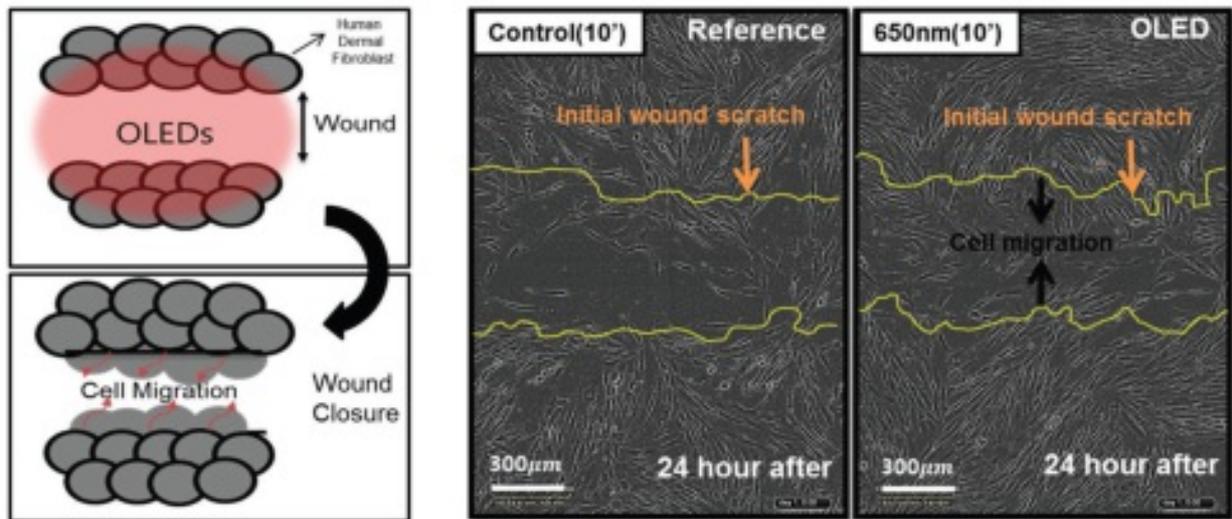
Ph.D. Candidate Yongmin Jeon at the School of Electrical Engineering. The device also meets the safety regulations of the International Organization for Standardization (ISO) at red wavelengths (600–700 nm) source - kaist.ac.kr

The organic light-emitting diode (OLED) technology does not require the backlight and filters that make it more high-performing, thin and simpler to produce. Therefore, it widely used in the production of electronic devices for different fields such as medicine.

Therefore, the scientific group, led by [Professor Kyung Cheol Choi](#), from the [Korea Advanced Institute of Science and Technology](#) in collaboration with the [Seoul National University Bundang Hospital](#) managed to create the non-invasive device that doesn't require high power.

Current [PBM devices](#) using point light sources, such as light-emitting diodes (LEDs) which have certain limitations such as low flexibility, heavyweight, and nonuniform effects that make difficult to irradiate light uniformly. Due to these characteristics, it is hard to increase the clinical effects of such LED devices. In addition, they are unable to stick to the body. Therefore, scientists developed wearable PBM patch using a flexible red-wavelength OLED surface light source that can be stuck to the body as a small PBM device. The tool can be very light, up to [0.82 g](#) and thin, about [676  \$\mu\text{m}\$](#) . Furthermore, the device has an accepted operation life ([>300 h](#)), flexibility ([20 mm bending radius](#)), and low-temperature

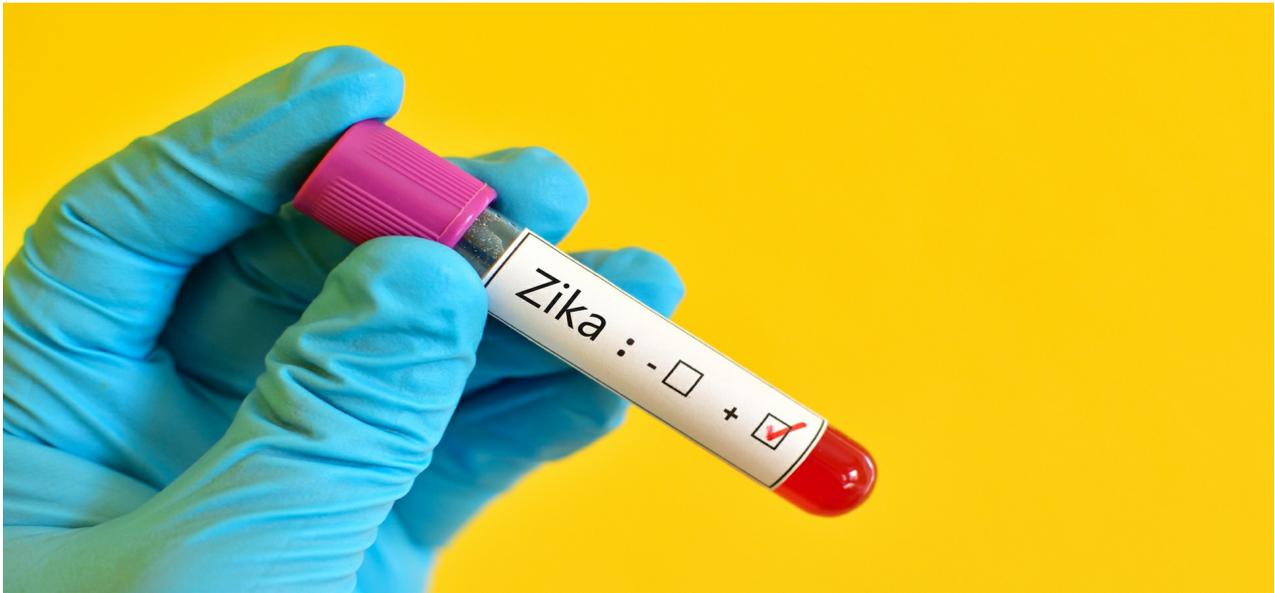
operation (<math><40\text{ }^\circ\text{C}</math>). Therefore, these characteristics ensure wide and safe application at any time and anywhere.



If researchers can adjust the power and wavelength of the OLEDs, its application can be extended to skin care, cancer treatment, Alzheimer's disease treatment, and mental healthcare  
source - kaist.ac.kr

PBM patches demonstrated the high-performing with *In vitro* wounds due to their ability to stimulate the fibroblast proliferation of the cell over 58% of control as well as fibroblast migration over 46% of control under different conditions. Ph.D. Candidate Jeon mentioned that the biggest advantage of this technology is that due to its simplicity and effectiveness people will be able to buy it in the pharmacy without having to go to the hospital.

**Company name:** Korea Advanced Institute of Science and Te.  
**Contact person:** Professor Kyung Cheol Choi  
**E-mail:** kyungcc@kaist.ac.kr  
**Website:** <http://www.kaist.edu/html/en/index.html>  
**Phone:** -  
**Patent status:** -  
**On market since:** -  
**Regions:** Korea  
**Industries:** Electronics, Healthcare  
**Source links:** [Advanced Materials Technologies](#)  
[Korea Advanced Institute of Science and Technology](#)



## NIRS - A DEVICE THAT CAN DETECT MOSQUITOES INFECTED WITH ZIKA VIRUS

Researchers from Australia in collaboration with researchers from Brazil and the USA have managed to develop a cost-effective and high-performing tool called Near Infrared Spectroscopy (NIRS), which can save thousands of lives by helping health authorities detect mosquitos, which are infected with Zika virus. The study results demonstrated that NIRS operates at 18 times faster and at 110 times cheaper than the current identifying RT-qPCR technology. The device involves shining a beam of light on the gnat in order to collect a diagnostic spectrum.

The novel development was made by the scientific group from the [University of Queensland](#), led by [Dr. Maggy Sikulu-Lord](#) and [Dr. Jill Fernandes](#), in collaboration with researchers from the [Oswaldo Cruz Foundation](#), the [Federal University of Rio de Janeiro](#) and the [University of Miami](#).

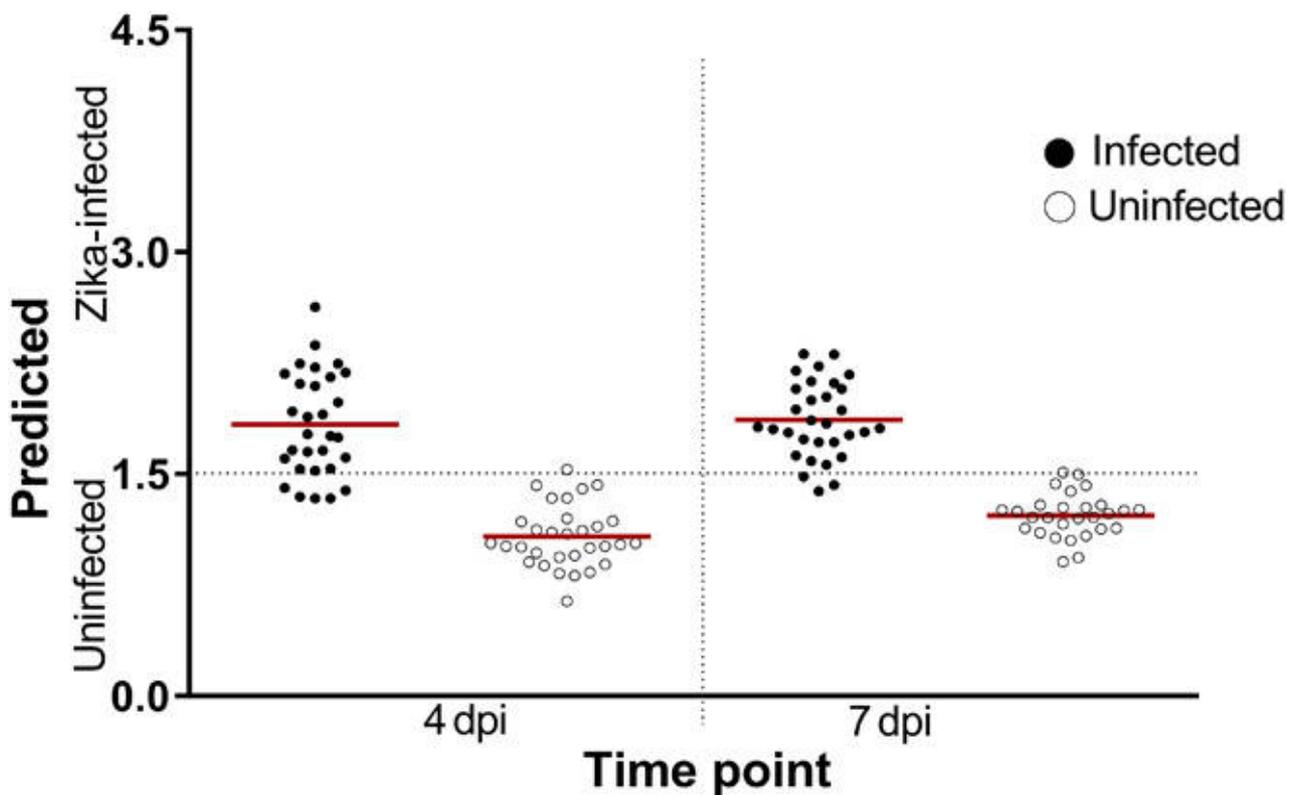
Zika virus (ZIKV) is a mosquito-borne virus of the family Flaviviridae transmitted to humans primarily by *Aedes* mosquitoes. It is of concern at the international level because of its rapid spread and its association with neurological disorders such as [Guillain-Barré syndrome in adults and microcephaly in babies](#). The timely detection of infected mosquitoes and their disposal can prevent people from infecting thousands of lives. Nevertheless, organized and appropriate monitoring of locations with the potential risk of infected mosquitoes is lacking in most countries. Dr. Sikulu-Lord mentioned that with the help of this innovative technology scientists will be able to detect mosquitoes that are infected with the virus very fast, therefore, health authorities can operate some areas before the disease will spread to humans. Currently, most of the available tests technologies that are intended on the detecting of the arbovirus in mosquitoes depend on the ability to capture the viral antigens through an enzyme-linked immunosorbent assay. NIRS is a light-based method of chemical analysis that is used in different fields such as medicine, pharmaceuticals and etc.



The research was supported by the Grand Challenges Canada Stars for Global Health and USAID  
source - adobe.com

Scientists approved NIRS as [the fast and cost-effective device that is able to noninvasively identify the virus](#). With the help of NIR, scientists collected spectra from infected mosquitos

and determined that analysis of NIR spectra by cross-validation and partial least squares (PLS) regression distinguished ZIKV-infected from uninfected mosquitoes with **92.5% accuracy** (n = 120). Given the technique's rapid, high-throughput, and reagent-free nature, hundreds of samples can be processed in a day by unskilled technicians, enabling rapid predictions of potential disease transmission, which in turn could facilitate a rapid action plan to stop major disease outbreaks. The biggest advantage of this method is that **it can stop disease outbreaks very fast**. In addition, the data can also be saved in a variety of formats that could be incorporated into decision support systems based on multicriteria system analysis, similar to the system proposed for Ebola control. Furthermore, the method was tested in small pilot studies for **detecting hepatitis C and human immunodeficiency viruses** in human serum and plasma and influenza virus in nasal fluids.



NIRS differentiation of ZIKV-infected and uninfected *A. aegypti* mosquitoes using leave-one-out cross-validation analysis

source - [advances.sciencemag.org](http://advances.sciencemag.org)

**Company name:** University of Queensland  
**Contact person:** Dr. Maggy Sikulu-Lord  
**E-mail:** maggy.lord@uq.edu.au; maggy.sikulu@gma..  
**Website:** <https://www.uq.edu.au/>  
**Phone:** -  
**Patent status:** -  
**On market since:** -  
**Regions:** United States, Brazil, Australia  
**Industries:** Healthcare  
**Source links:** [Science Advances](#)  
[University of Queensland](#)



## THE WAY OF COMPLETE TRANSMISSION OF LIGHT WAS IDENTIFIED

The scientific group, led by Professor Q-Han Park, from the Korea University has managed to determine the principle of the complete transmission of the light without any reflection into a medium.

Furthermore, researchers experimentally approved this technology using metamaterials. It will provide the ability to create a fully anti-reflective coating and stealth technology. This innovational development will significantly improve solar cells and optical devices, where energy efficiency is crucial, and, moreover, military technologies, for example, stealth technology.



From the left, Professor Park Q Han and co-authors Ji-Hun Kang and Ku Im at the Department of Physics  
source - korea.ac.kr

The reflection of light is a basic principle in optics, which allows people to see objects with the precision. Nevertheless, at the same time, reflection is inextricably linked to the light losses that are highly uncomfortable due to the lowering of the efficiency of optical devices such as lenses and solar cells. The light is reflected on the interface between heterogeneous environments due to the discrepancy of the impedance. If remove this discrepancy with the help of additional materials, the anti-reflection technique has several limitations such as specific frequencies and incidence angles. Currently, the complete transmission of light in the environment irrespective of the conditions of falling light, such as wavelength, polarization, and angle of incidence, was the main problem in optics and was determined impossible. Despite this fact, scientists developed **a theory of universal impedance matching and introduce a matching layer that will provide an ideal transmission of white light**. Therefore, the effective regulating of the reflection is determined as the main challenge in different fields such as optical technology, biomedicine, energy, military technology and other branches of science and technology.

Scientists developed **the technology of impedance matching and induce the appropriate film, which provides the ideal transmission of white light**. The capability of the film to support in omnidirectional and frequency-independent anti-reflection was approved analytically and numerically. The scientific group developed a simple metamaterial, which provides high localization, applying wave-structured plates as the suitable alternative to

materials, which usually were used before. They obtained the transmission speed about 99% for white light in the visible range with a double-layered dielectric metamaterial. This novel technology will highly improve the effectiveness of solar cells, optical devices, and certain military technologies.



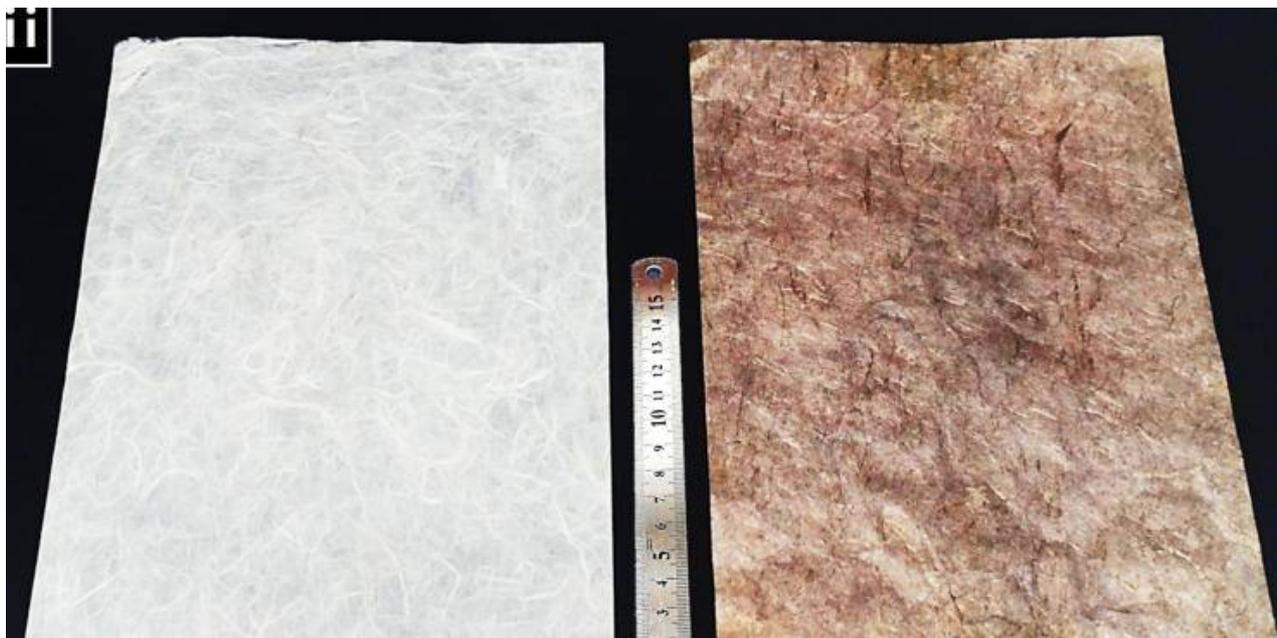
In previous work, the Park's research team uncovered some of the fundamental principles of wavelength-independent anti-reflection and developed an anti-reflection technique that used very thin film  
source - adobe.com

**Company name:** Korea University  
**Contact person:** Professor Q-Han Park  
**E-mail:** qpark@korea.ac.kr  
**Website:** <https://www.korea.edu/>  
**Phone:** -  
**Patent status:** -  
**On market since:** -  
**Regions:** Korea  
**Industries:** Energy, Others  
**Source links:** [Nature Photonics](#)  
[Korea University](#)



## MP-SC - A PAPER-BASED SUPERCAPACITOR

A supercapacitor is an energy harvesting device with an enhanced capacitance compared to typical capacitors. Flexible energy harvesting devices are a key providing factor for the spreading of wearable electronics in different field such as biomedicine, consumer electronics, and military applications. Scientists managed to develop an innovative and high-performance supercapacitor device using Hanji, Korean traditional paper. The device has the ability to instantaneously generate a high output. This invention will provide a creating of the high power, large capacity flexible wearable electronics.



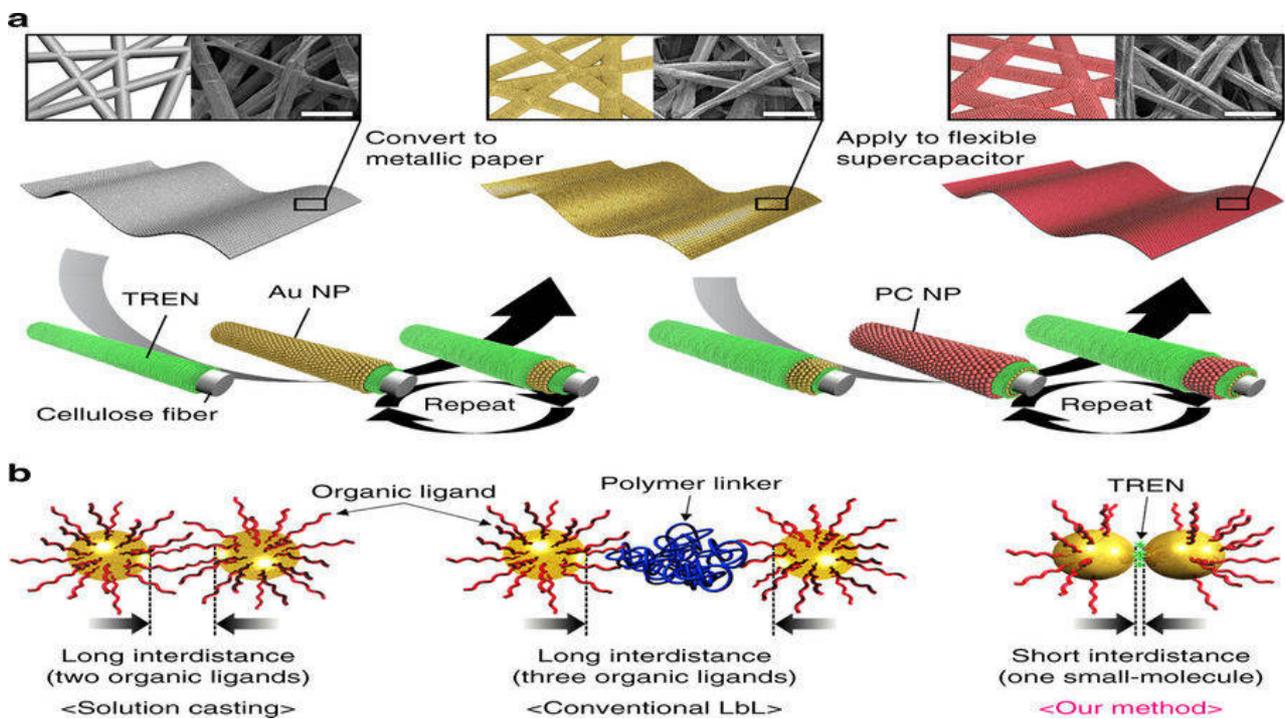
This approach can easily impart metal properties to various insulating substrates (i.e., polyester, nylon, poly(ethylene terephthalate), and cellulose papers  
source - gatech.edu

The newest development was made by the scientific group, led by [Professor Jinhan Cho](#), from the [Korea University](#) in collaboration with the [Georgia Institute of Technology](#).

Lithium-ion batteries (LIBs) and supercapacitors are 2 commercial power sources, which support consumer electronic devices. Supercapacitor' energy density is less than LIBs, but its power density is higher at 5 times ( $>10 \text{ kW kg}^{-1}$ ). Despite this fact, flexible electronic devices need the flexibility of energy storage devices in addition to typical performance considerations such as high energy and cycling stability. To provide such characteristics, energy harvesting tool requires the flexible and conductive material that will be applied as a current collector. The surface area of textile materials, for example, a paper that is very large, light and flexible. Furthermore, such prosperities make it easy to process. Therefore, the paper was determined an ideal substrate due to previously mentioned characteristics, low cost, and highly porous structures, that make them able to absorb active electrode elements. Despite this fact, their low conductance compared to metals and low energy density has continued are the barrier to use them in the production of energy storage devices.

Therefore, scientists developed [the high-performance and flexible metallic paper-based supercapacitor \(MP-SC\)](#) that is manufactured by an assembly approach, using the ligand-mediated LbL assembly, which is able to directly bridge all the interfaces of metal and

metal oxide NPs through small molecules. They managed to produce the flexible paper supercapacitor device, which uses metallic paper electrodes as current collectors. Furthermore, this fabricated paper electrode has no changes in its mechanical and structural characteristics, which are inherent to textile materials, and demonstrated the same level of conductivity as metal. The distance between the particles was minimized to greatly reduce the electrode's internal resistance, and in turn, a high output and capacitance value were achieved. Prof. Jinhan Cho mentioned that this innovational technology can be applied to different forms of devices. It will highly improve wearable electronics and flexible electronic devices markets. This research was supported by the [Ministry of Science & ICT](#) and the [National Research Foundation of Korea](#).



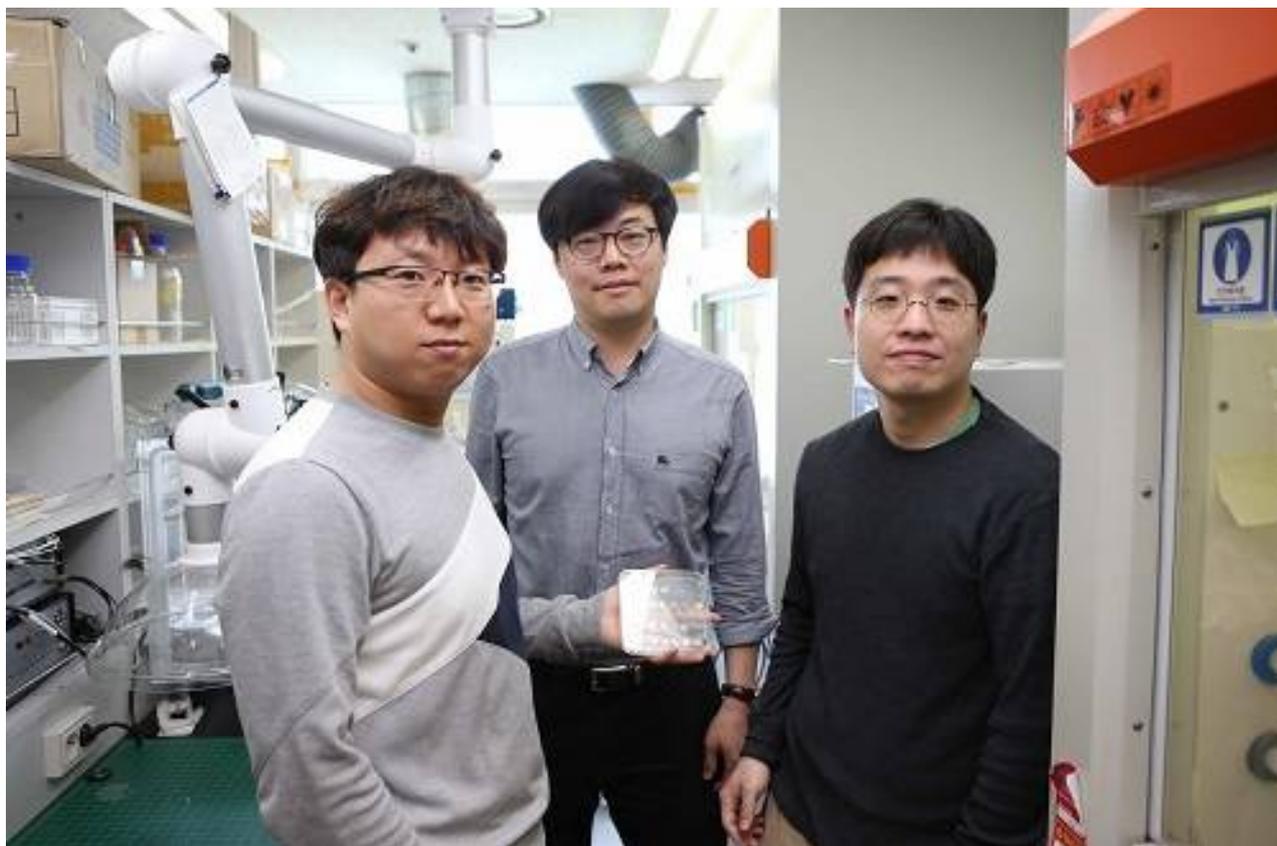
Schematic for the preparation of the MP-based supercapacitor electrodes using ligand-mediated layer-by-layer (LbL) assembly between hydrophobic metal (or metal oxide) nanoparticles (NPs) and TREN molecules  
source - nature.com

**Company name:** Korea University  
**Contact person:** Professor Jinhan Cho  
**E-mail:** jinhan71@korea.ac.kr  
**Website:** <https://www.korea.edu/>  
**Phone:** -  
**Patent status:** -  
**On market since:** -  
**Regions:** Korea  
**Industries:** Electronics  
**Source links:** [Nature Communications](#)  
[Korea University](#)



## A NOVEL SENSOR FOR CHEMICAL AND BIOLOGICAL DETECTION

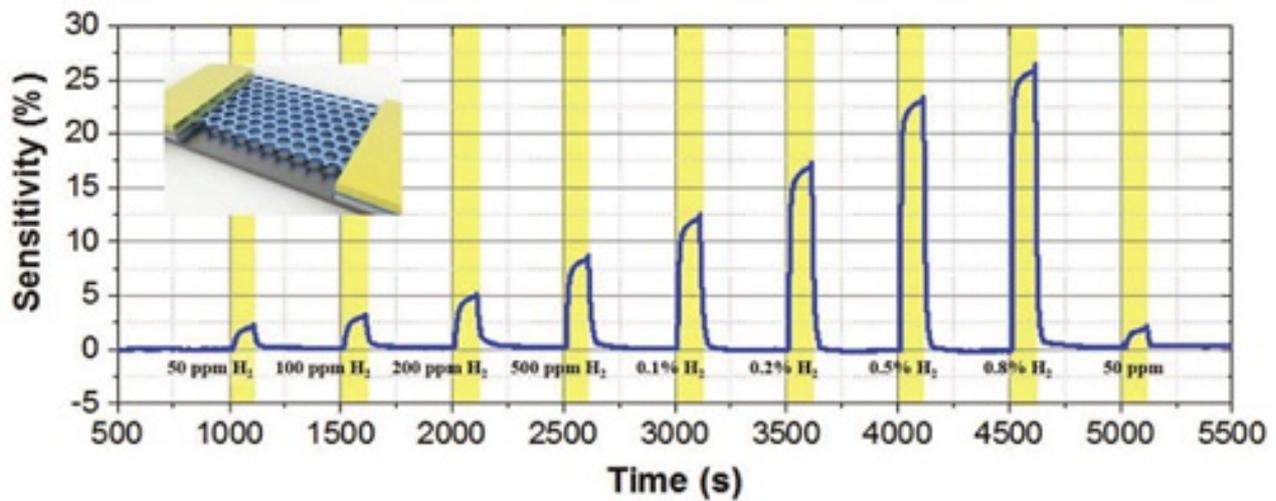
Scientists have managed to create an innovative, cost-effective and high efficient hydrogen sensor for chemical and biological detection. The technology can be used in the production of special wearable devices and can cooperate with mobile applications. The nanostructured hydrogen gas sensor, which is based on a silicon (Si) nanomesh structure decorated with palladium (Pd) nanoparticles and is fabricated with the use of polystyrene nanosphere lithography and top-down fabrication processes.



The research team of Professor Park (Department of Mechanical Engineering), Professor Jung (Department of Materials Science and Engineering), and research fellow Gao Min  
source - kaist.edu

The sensor was designed by the scientific group, led by [Professor Inkyu Park](#) and [Professor Yeon Sik Jung](#), from the [Korea Advanced Institute of Science and Technology](#).

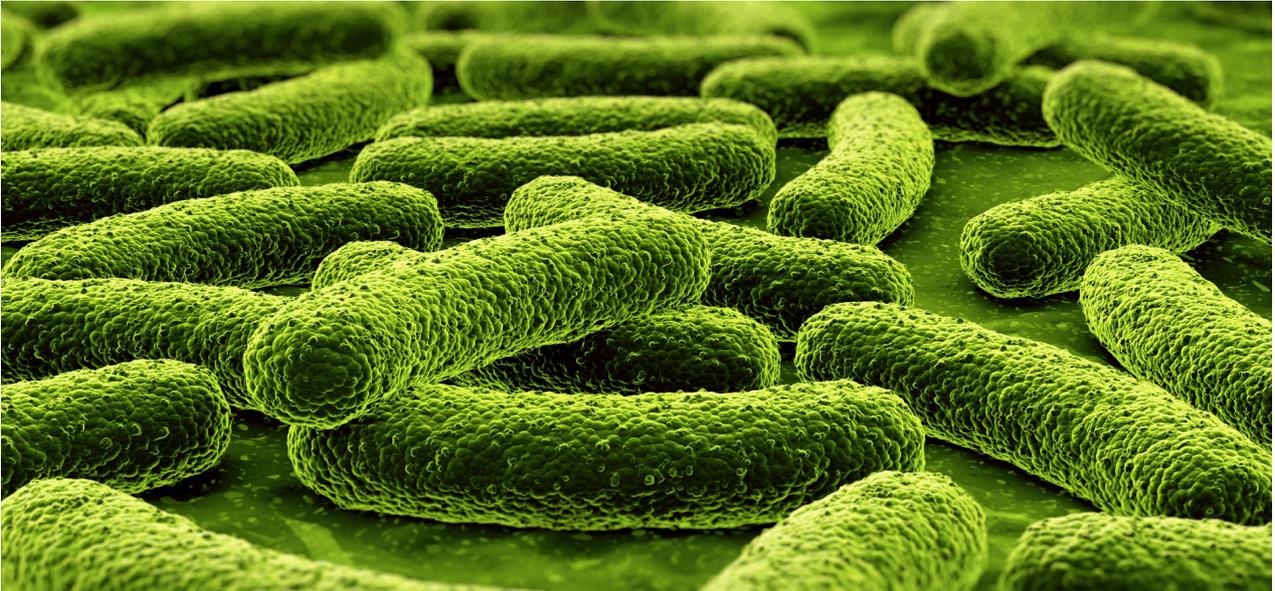
The nanosphere lithography technology uses self-assembly of nanoscale monolayers. This may be the alternative way for obtaining homogeneous and well-adjusted nanopatterns with a minimum size of up to **10 nanometers**. Scientists noted that small amounts of silicon enhance the effect of palladium, therefore, it significantly improves sensitivity. Considering that hydrogen gas (H<sub>2</sub>) is the next-generated clean fuel of the future as it produced from water and returns to water. Furthermore, it is can be used in different fields and industries, for example, it applied in ammonia production for agricultural fertilizer. It used in hydrogen-cooled systems, metallurgical processes and production of pharmaceutical products. Nevertheless, H<sub>2</sub> is very flammable, colorless and odorless. Therefore, it is hard to detect with human senses. Consequently, it is crucial for H<sub>2</sub> industry to create hydrogen gas sensors with good sensitivity and high stability.



Gas sensor responses upon the exposure to H<sub>2</sub> at various concentrations  
source - kaist.edu

The developed [gas sensor demonstrates significantly improved H<sub>2</sub> gas sensitivity compared with the Si thin film sensor](#). Moreover, a buffered oxide etchant (BOE) treatment of the Si nanomesh structure causes even more improvement of the effectiveness. The technology demonstrated [a very fast H<sub>2</sub> response and high selectivity to H<sub>2</sub> gas among other gases](#). Furthermore, it demonstrated the high stability without prominent operative degradation after 1 month. Therefore, Prof. Park mentioned that this technology can be used for manufacturing for [effective and cost-effective sensors, which can be applied in special wearable devices and can cooperate with mobile applications in order to provide the detection of chemical and biological elements](#).

**Company name:** Korea Advanced Institute of Science and Te.  
**Contact person:** Professor Inkyu Park  
**E-mail:** inkyu@kaist.ac.kr  
**Website:** <http://www.kaist.edu/>  
**Phone:** -  
**Patent status:** -  
**On market since:** -  
**Regions:** Korea  
**Industries:** Chemicals, Healthcare, Others  
**Source links:** [Small](#)  
[Korea Advanced Institute of Science and Technology](#)



## **SURFACE ACOUSTIC WAVES BASED DEVICE CAN DETECT BACTERIAL AND VIRAL INFECTIONS**

The scientific team, led by Professor Chae Seung Lim, from the Korea University developed an innovative and highly-efficient microfluidic technology, which is based on surface acoustic waves, and can to identify bacterial and viral infections in vitro. It uses 3-dimensional dual surface acoustic waves (3D-dSAWs) that are produced from 2 interdigitated transducers of the top and bottom piezoelectric substrates. This innovative device will provide the ability of early diagnosis of different diseases.



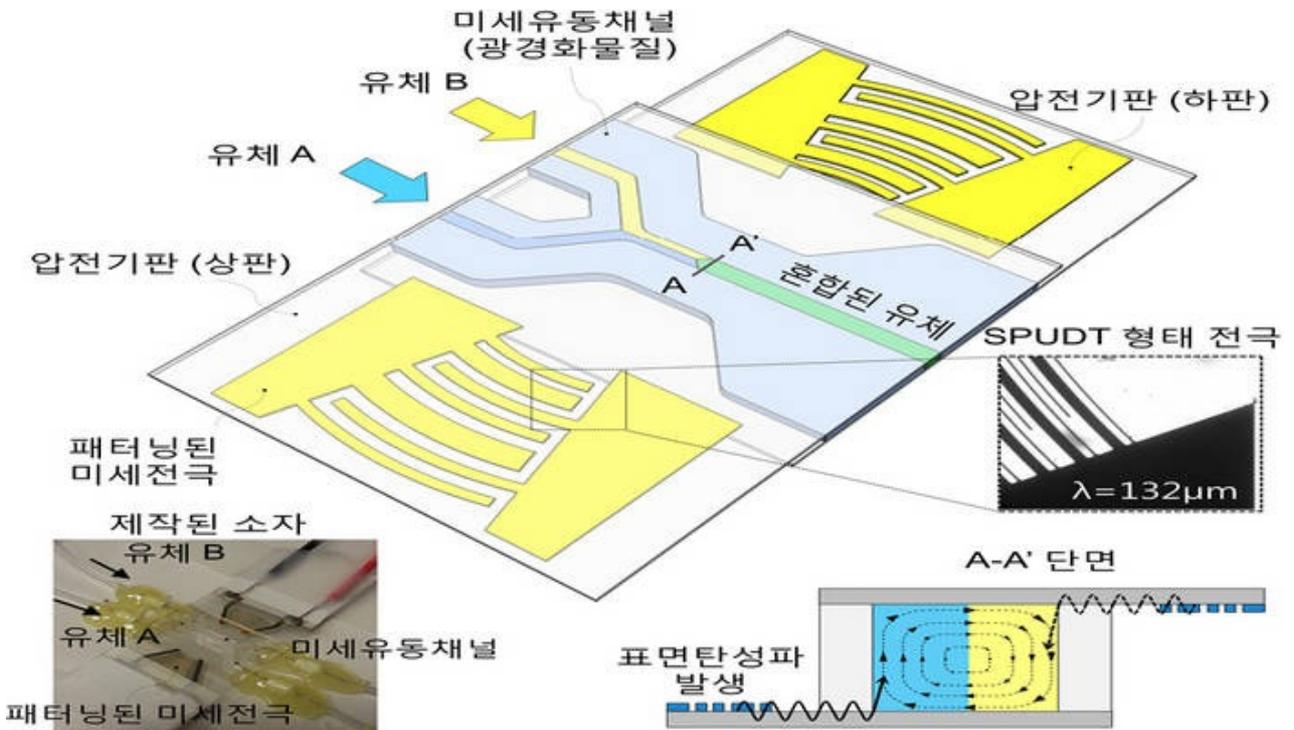
Dr. Jeonghun Nam (left, first author/co-corresponding author), Prof. Chae Seung Lim (right, co-corresponding author)

source - korea.ac.kr

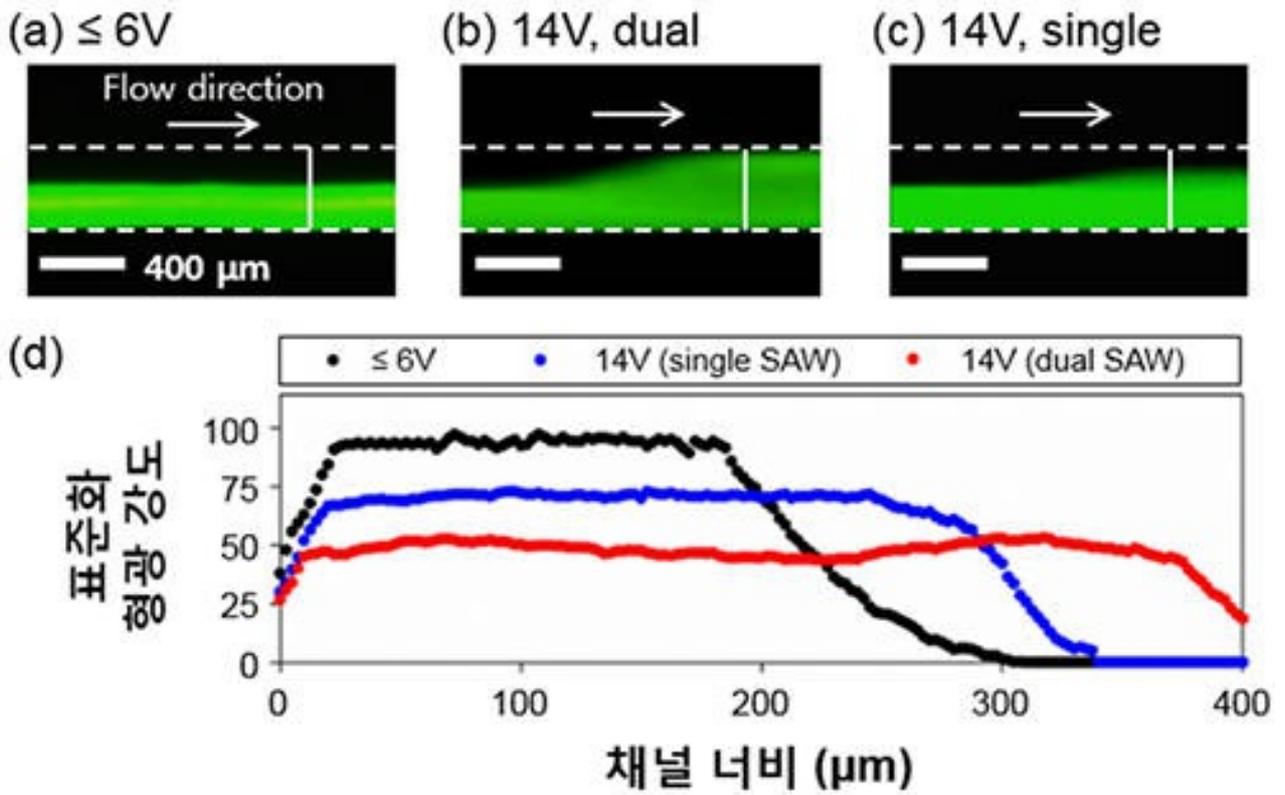
The microfluidic device technology is determined as the highly-effective next-generation biotechnology due to its capability to provide preliminary processing of samples, such as liquefaction, rapid mixing, selective segregation, and concentration. The acoustic-based mixing techniques have gained attention owing to their advantages, which include noninvasiveness and simplicity. Simple use of a bulk piezoelectric transducer can induce chaotic advection by utilizing an oscillating part, such as microbubbles trapped in the in the sidewall grooves or in the horseshoe structure and side-wall sharp edges. Such innovative technology plays a significant role in biochip systems in vitro performing as it stipulates its precision and sensitivity. Despite this fact, mixing technologies have some limitation due to bubble instability. Furthermore, such technology consumes less power and is more non-invasive than current methods.

Therefore, scientists developed **the device, which has the ability to generate hat surface acoustic waves from the top and bottom substrates in order to gain 3D control over 2 different fluids and microparticles**. By using the 3D-dSAW, internal swirling in a single direction is induced, which can facilitate more efficient mixing of a fluorescent particle suspension and deionized water. It means, by using the 3D-dSAW mixer, higher efficiency mixing operation can be done compared to the single SAW mixer at the same consumption

and voltage. Dr. Jeonghun Nam mentioned that [this novel device identifying in vitro bacterial infections and viruses will allow the early disease diagnosis.](#)

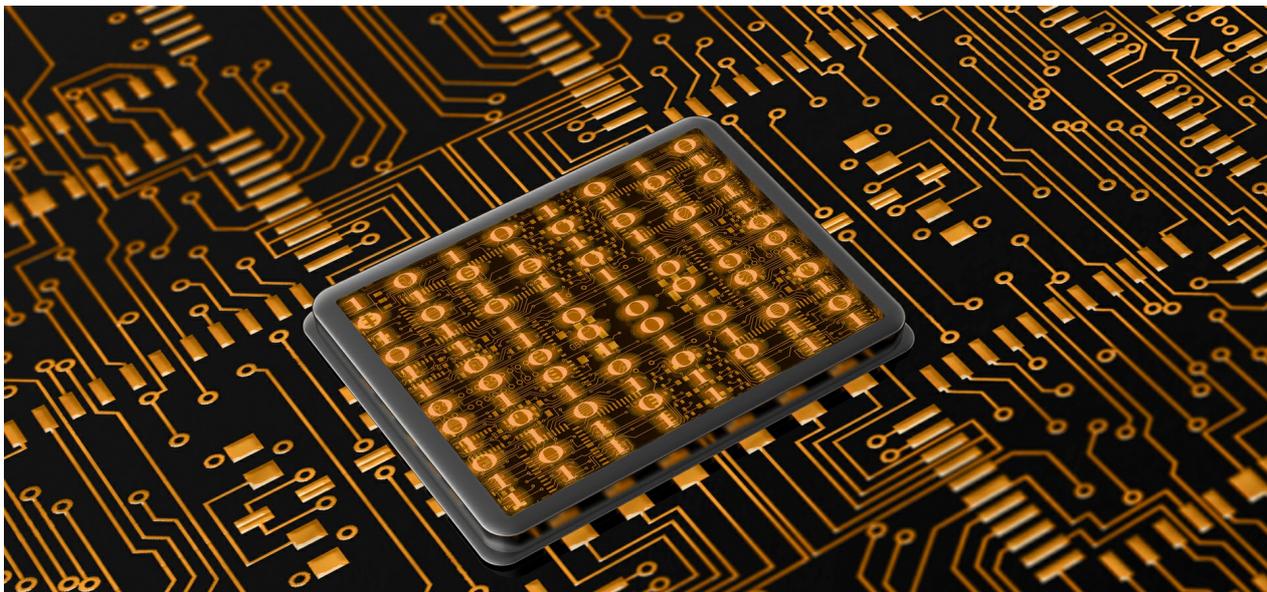


The mixer consists of a photocurable microchannel placed in the middle and interdigitated transducer electrodes patterned on piezoelectric substrates on the top and bottom  
source - korea.ac.kr



No mixing could be observed below 6V for the two fluids. The two fluids mixed fully at 14V, and showed a uniform distribution in the microchannel, as indicated by the white dotted line source - korea.ac.kr

**Company name:** Korea University  
**Contact person:** Professor Chae Seung Lim  
**E-mail:** malarim@korea.ac.kr  
**Website:** <https://www.korea.edu/>  
**Phone:** -  
**Patent status:** -  
**On market since:** -  
**Regions:** Korea  
**Industries:** Healthcare  
**Source links:** [Sensors and Actuators B: Chemical](#)  
[Korea University](#)



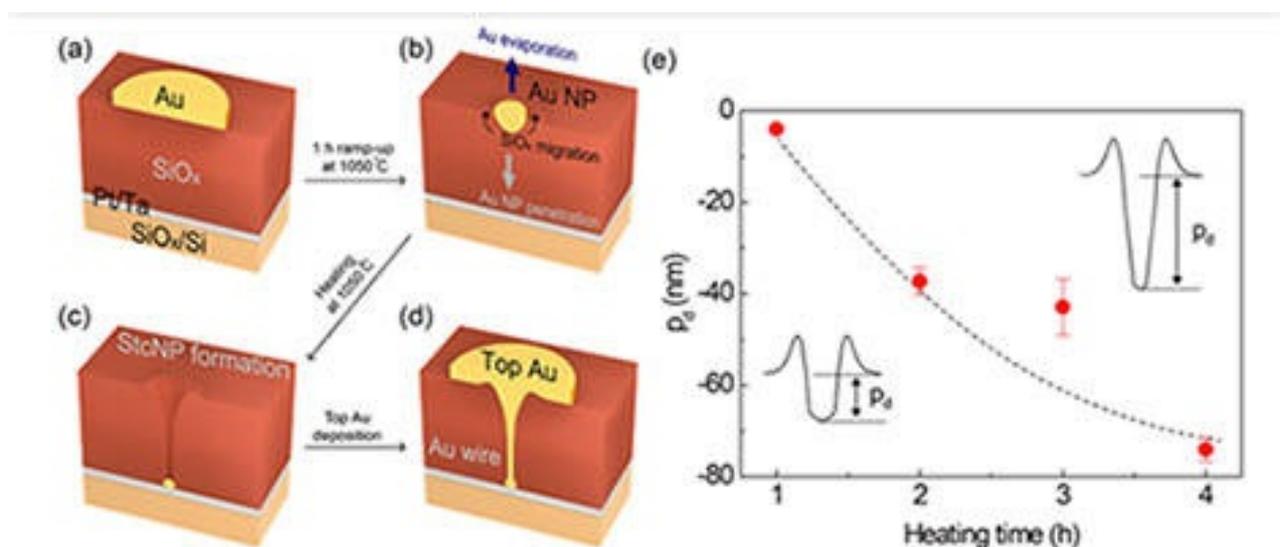
## NOVEL HIGH-SPEED SILICON OXIDE-BASED RESISTIVE MEMORY

The scientific group from the Korea University in collaboration with the Korea Institute of Science and Technology has developed a resistive memory technology, which has the ability to significantly reduce speed and stability by applying a sub-10 nanometer singular nanopore to control nanoscale filaments. Scientists have great expectations about the application of this innovative technology in the development of next-generation high-performance, high-density non-volatile memory.



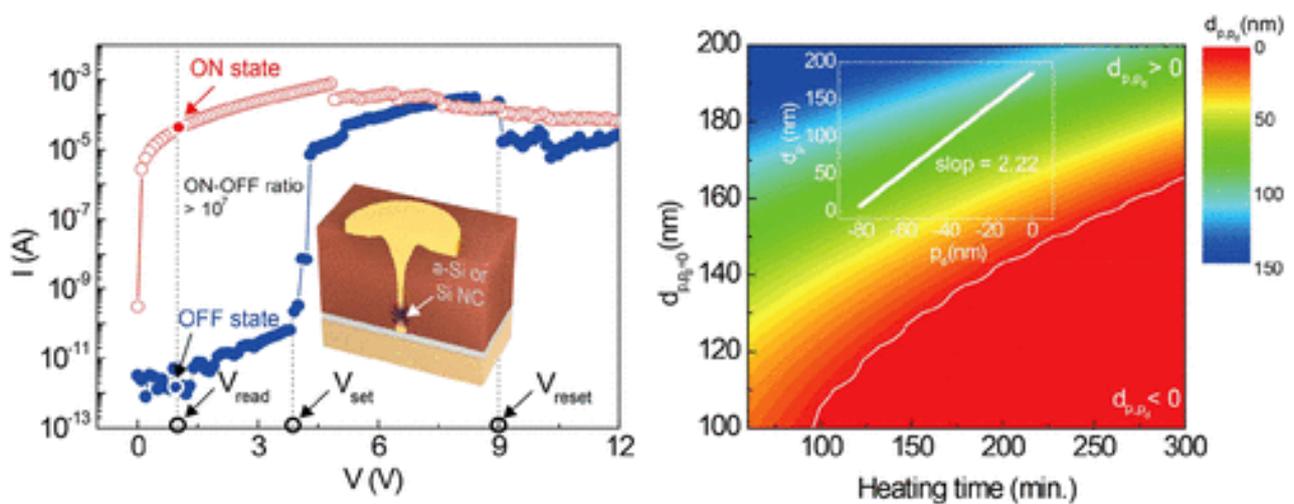
From the left, Gunuk Wang (Professor, Korea University), Soonbang Kwon (Researcher, Korea University), Tae-Wook Kim (Ph.D., Korea Institute of Science and Technology)  
source - korea.ac.kr

SRAM and DRAM are 2 types of the Random Access Memory. Both of them are different and have different characteristics due to the way they hold data. DRAM uses a single transistor and capacitor for each memory cell, whereas the SRAM uses an array of 6 transistors. Both of them have the high speed. Despite this fact, they have volatile characteristics when the power is turned off. Furthermore, the flash memory is stable but slow. Hard drives need the high power in order to perform. In additions, they are defenseless to impact.



Schematic diagram and heat treatment-based depth analysis of the nanopore oxide memory device. The heat treatment penetrates the oxide, and the formed nanopore is used to develop the memory device  
source - korea.ac.kr

The control of the switching of conducting threads is one of the main problems in the creation of reliable resistive metal-oxide memory as the random dynamic nature and the formation of threads provide the barrier to the necessary switching. Therefore, scientists developed an innovative and simple technology of controlling and forming of a single silicon nanocrystal (Si-NC) filament in order to use it in SiOx memory devices. The filament is created with a limited vertical nanoscale gap with the use of the designated single vertical truncated conical nanopore (StcNP) structure. As it uses silicon filament phase-change switching at low voltage it provides the ability to control the size and position of the thread due to the single pore structure. The developed SiOx memory junction with a StcNP of pore depth of 75 nm and a bottom diameter of 10 nm provides the speed of switching about 6 ns. It is much faster than current SiOx memory devices. Therefore, this innovative technology can be applied as next-generation high-speed, low-power memory, overcoming the constraints inherent in other types of this technology.



The developed SiOx memory junction with a StcNP of pore depth of  $\sim 75$  nm and a bottom diameter of  $\sim 10$  nm provides the speed of switching about 6 ns. It is much faster than current SiOx memory devices

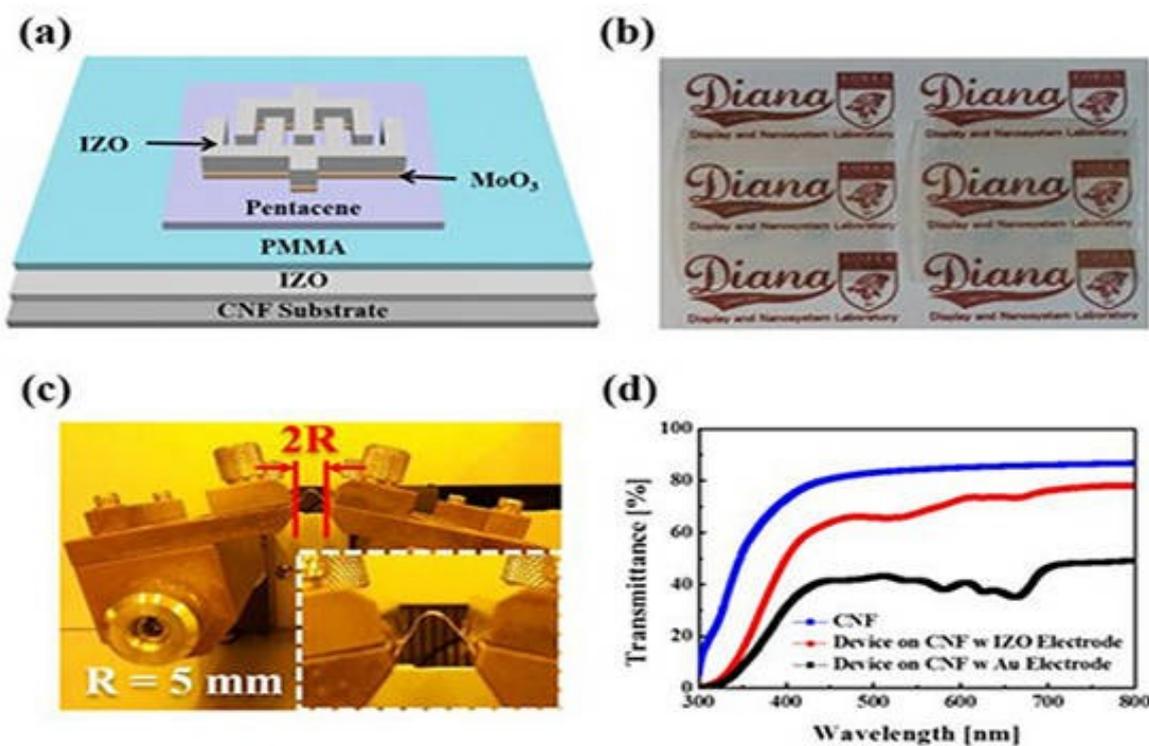
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**Company name:** Korea University  
**Contact person:** Professor Gunuk Wang  
**E-mail:** gunukwang@korea.ac.kr.  
**Website:** <https://www.korea.edu/>  
**Phone:** -  
**Patent status:** -  
**On market since:** -  
**Regions:** Korea  
**Industries:** Electronics, Information Technologies  
**Source links:** [Nano Letters](#)  
[Korea University](#)



## NEW ORGANIC PHOTOTRANSISTOR WILL IMPROVE WEARABLE DEVICES

The international group of scientists has developed an innovative, flexible and transparent biodegradable organic phototransistor that can be widely used in the production of wearable devices and biomedical material. It detects visible light with nontoxic organic active materials on biodegradable substrates. Therefore, apart from the advantages of a conventional flexible and organic phototransistor, this phototransistor is also eco-friendly. It can significantly reduce environmental pollution caused by electronic waste.



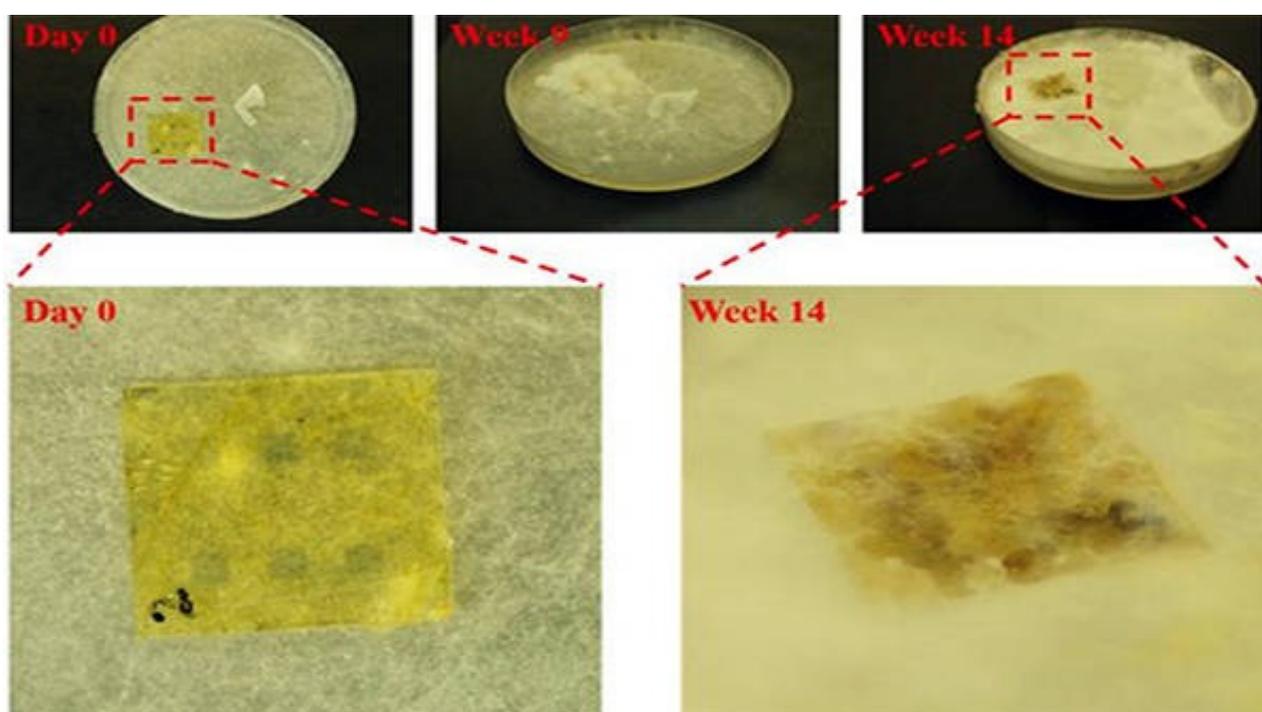
Structure diagram of an organic phototransistor device (b-c) A photograph showing that the fabricated device is visually transparent and flexible to mechanical bending (d) Transmittance in the visible light region  
source - korea.ac.kr

The novel development was made by the international scientific group, led by [Professor Ju Byeong Kwon](#), from the [Korea University](#) in collaboration with [KIST](#) and the [State University of New York](#).

Typical organic phototransistor has the ability to transform light into electrical signals by applying organic semiconducting materials. The usefulness of organic phototransistors is constantly enhanced due to its ability to be applied as an appropriate element in the production of the Internet of Things (IoT). Despite this fact, it has some limitation in order to be used in biomedical devices such as toxic materials or opaque electrodes. Furthermore, there is a significant problem of environmental pollution caused by e-waste. E-Waste broadly covers waste from all electronic and electrical appliances and comprises of items such as computers, mobile phones, digital music recorders/players, refrigerators, washing machines, televisions and many other household consumer items. Therefore, the development of biodegradable electronics is required.

The team created [the environmentally friendly, non-toxic, transparent biodegradable optical device](#), which is based on the use of cellulosic material that is the main component of wood and can be recycled by wood decay fungus. In other words, toxic substances,

which are usually used in the production of phototransistors, had been superseded by non-toxic organic semiconductors. The molybdenum trioxide (MoO<sub>3</sub>)-buffered indium zinc oxide as high-performance hole injector and transparent electrodes are applied for the first time to organic phototransistors on cellulose nanofibrillated fiber substrates to achieve more than 70% of transmittance in the visible range (400–750 nm) while demonstrating high conductivity under multiple bendings. Furthermore, the high stable performing during mechanical bending tests with radii ranging from 100 to 5 mm and cyclic bending tests of up to 2000 cycles at a radius of 5 mm was demonstrated by this novel device. Scientists mentioned that it can be very useful for reducing the toxicity of electronic waste being applied in developing wearable products such as biomedical material.



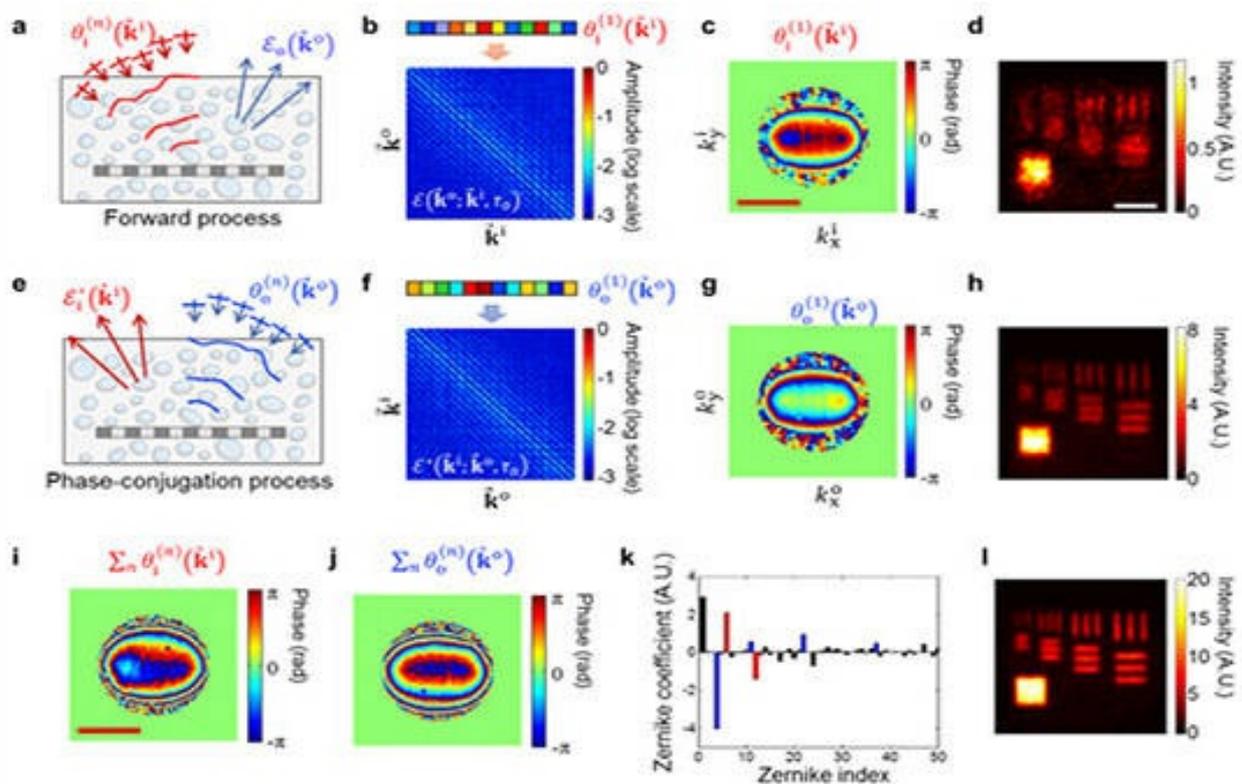
The device exposed to the brown rot fungus is completely covered by the fungus after 9 weeks and exhibits a process of biodegradation with a weight reduction rate of 47.22% after 14 weeks  
source - korea.ac.kr

**Company name:** Korea University  
**Contact person:** Professor Ju Byeong Kwon  
**E-mail:** bkju@korea.ac.kr  
**Website:** <https://www.korea.edu/>  
**Phone:** -  
**Patent status:** -  
**On market since:** -  
**Regions:** Korea  
**Industries:** Electronics  
**Source links:** [Advanced Optical Materials](#)  
[Korea University](#)



## A NOVEL OPTICAL COHERENCE IMAGING METHOD WILL PROVIDE THE EARLY DISEASE DIAGNOSIS

To provide the early disease diagnosis, medicals need a high-resolution adaptive optical imaging technology, which will be able to capture individual biological tissue. Nevertheless, light scattering and deformed images make some limitations such as a risk of abruptly lowering resolution of targeting cells, which are deep inside. Consequently, current techniques allow medicals to observe and research cells, which are only on the tissue surface. Therefore, scientists from Korea managed to develop the high-resolution adaptive optical image that has the ability to depose biological tissue-induced image deformation.



A Phase map was developed (c) for each angle that maximized the total intensity of a reconstructed image, and then the phase correction was applied to reconstruct the image (d)

source - korea.ac.kr

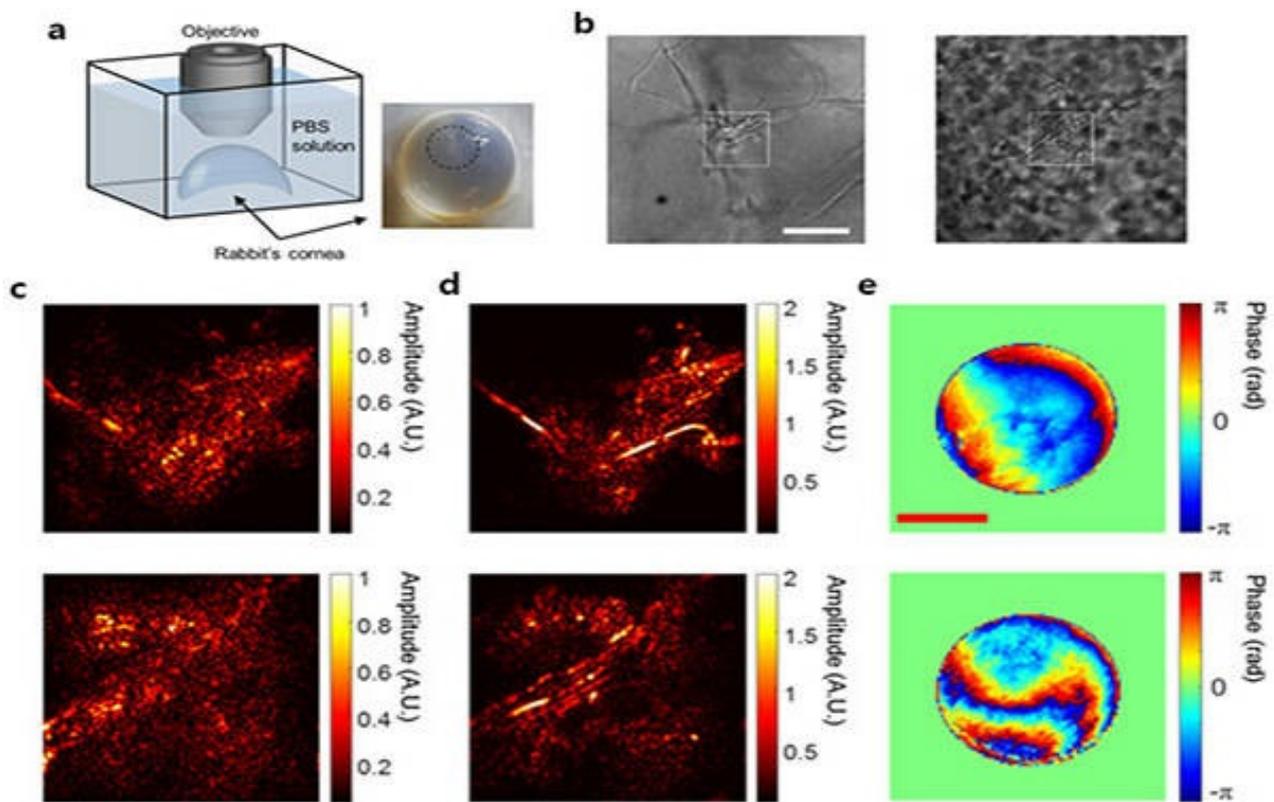
The development was made by the scientific group, led by [Professor Wonshik Choi](#), from the [Korea University](#) in collaboration with the [Asan Medical Center](#), the [Pohang University of Science and Technology](#) and the [Institute for Basic Science](#).

During the observation of the early stages of the disease, the sub-micron-scale biological reactions, which are happening inside living tissues, have been optically unapproachable, limiting the effectiveness of optical microscopy. The thick biological tissue causes not only the light scattering but the deviation of remaining signal waves. Therefore, scientists created the innovative technology that can correct light scattering and identify aberrations of waves, which are reflected from the samples separately, and eliminate them. The method that is used by the group is termed [the collective accumulation of single scattering \(CASS\) microscopy](#). It can identify the aberrations of single scattering, [causing the twice higher resolution compared to current CASS microscopes](#).

This technology records the time-gated complex-field maps of backscattered waves over various illumination channels and performs a closed-loop optimization of signal waves for both forward and phase-conjugation processes. Scientists have managed to achieve [the](#)

spatial resolution of the image up to 600 nm analyzing of a 700  $\mu\text{m}$ -thick tissue layer.

Using the closed-loop operations, they can independently identify the aberrations for the illumination and reflection paths without the need for a guide star. This novel development providing the capability to perform ultra-high spatial resolution imaging deep within scattering media will open new opportunities for studying important biological reactions in detail and significantly improve early disease diagnosis.



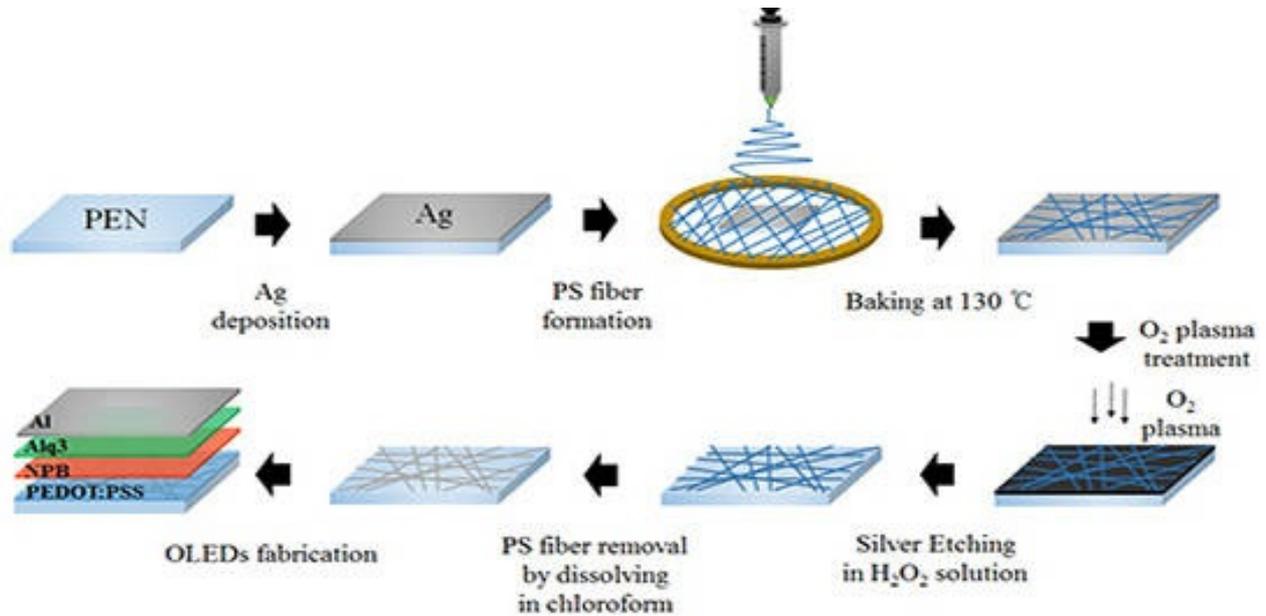
This is the image of a rabbit's cornea (a) infected by *A. fumigatus* using CLASS microscopy. The fungus has a thin and long structure (b), and it was not clearly imaged due to the aberrations of the cornea (c)  
source - korea.ac.kr

**Company name:** Korea University  
**Contact person:** Professor Wonshik Choi  
**E-mail:** wonshik@korea.ac.kr  
**Website:** <https://www.korea.edu/>  
**Phone:** -  
**Patent status:** -  
**On market since:** -  
**Regions:** Korea  
**Industries:** Healthcare  
**Source links:** [Nature Communications](#)  
[Korea University](#)



## A NOVEL TECHNOLOGY WILL IMPROVE OLED DEVICES

The organic light emitting diodes (OLEDs) is one of the types of display technology that is used in developing of digital displays for various devices such as TV screens, computer monitors, smartphones, digital cameras and etc. This technology has some limitations such as low electrical conductivity. Therefore, scientists from Korea developed innovative flexible transparent electrodes with Ag fibers, which are at 100 times longer than Ag nanowires. This invention significantly improves the electrical conductivity and transparency of OLED displays.



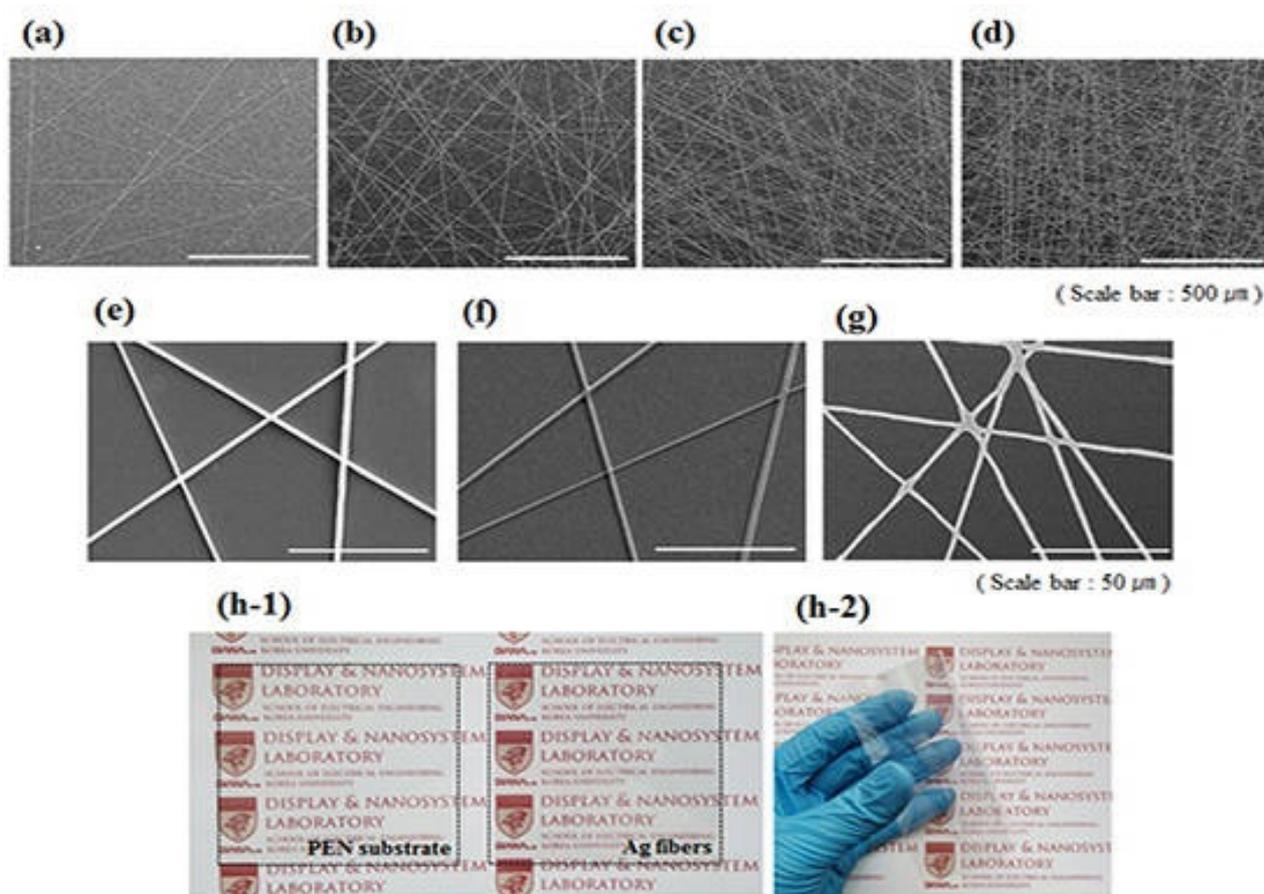
Ag is deposited on flexible substrates, and electrospun polymer fibers are used as an etch mask. Polymer fibers are removed after solution etching, long Ag fibers with adjusted surface roughness are produced  
source - korea.ac.kr

The novel technology was developed by the scientific group, led by [Professor Byeong-Kwon Ju](#), from the [Korea University](#) in collaboration with [Professor Young Wook Park](#) from the [Sun Moon University](#).

OLEDs have the unique properties of lightweight, flexible, transparent and color tuneability, which makes them an ideal modern light source. Interest in OLEDs is explained by the manifold benefits presented by this technology: operation in emissive mode (doesn't need backlighting), a wide viewing angle, a low operating voltage, light emission throughout the visible, flexible displays and cost-effective production. Ag nanowires consist of thin wires Ag, which diameter is 1 nanometer. Comparing to current transparent electrodes (ITO), Ag nanowires provide the high flexibility, electrical conductivity, and transparency. They are considered as an ideal material for display' transparent and lighting devices. Despite this fact, Ag nanowires are difficult to utilize in OLED displays production as that have several limitations such as the length (1 micrometer), this, in turn, creates a barrier to enhance conductivity and transparency. Furthermore, increasing the roughness of the surface due to threaded connections also leads to electrical instability.

Scientists used [the method of electrospinning](#), which applies polymer solutions for fibers production, [to make junction-free Ag fiber electrodes of a few centimeters in scale](#). This

process eases surface roughness control that is crucial for electrodes transparent and has the ability to prevent electrical instability of the OLEDs. In other words, **it highly improves transparency, stability, and conductivity of such displays**. The transmittance and resistance of Ag fiber electrodes can be independently regulated by controlling spinning time and Ag deposition thickness. They demonstrate the transmittance of **91.8%** at a sheet resistance of **22.3  $\Omega$ -1**. It causes the highest efficiency of OLED. Scientists mentioned that **this novel technology will significantly improve different displays, wearable electronics, and lightening equipment**.



The resulting Ag fibers, as shown in SEM images, are junction-free and continuous. The photographs of Ag fiber electrodes show that the fiber electrodes are highly transparent

source - korea.ac.kr

**Company name:** Korea University  
**Contact person:** Professor Byeong-Kwon Ju  
**E-mail:** bkju@korea.ac.kr  
**Website:** <https://www.korea.edu/>  
**Phone:** +82-2-3290-3237  
**Patent status:** -  
**On market since:** -  
**Regions:** Korea  
**Industries:** Electronics  
**Source links:** [Small](#)  
[Korea University](#)



## A FOOD WASTE RECYCLING SYSTEM GENERATES ELECTRICITY

Scientists from Singapore have managed to create a novel anaerobic digester system that recycles food waste to generate electricity and heat energy. This newest technology is self-sufficient since the produced electricity and heat fully power the system and its processes. Moreover, the present invention will help to combat food waste, as usually a small amount of them are recycled, without the need for energy expenditure.



The researchers calculate that a single tonne of food waste can produce about 200 kilowatt-hours to 400 kilowatt-hours of electricity, depending on the composition of the food waste source - nus.edu.sg

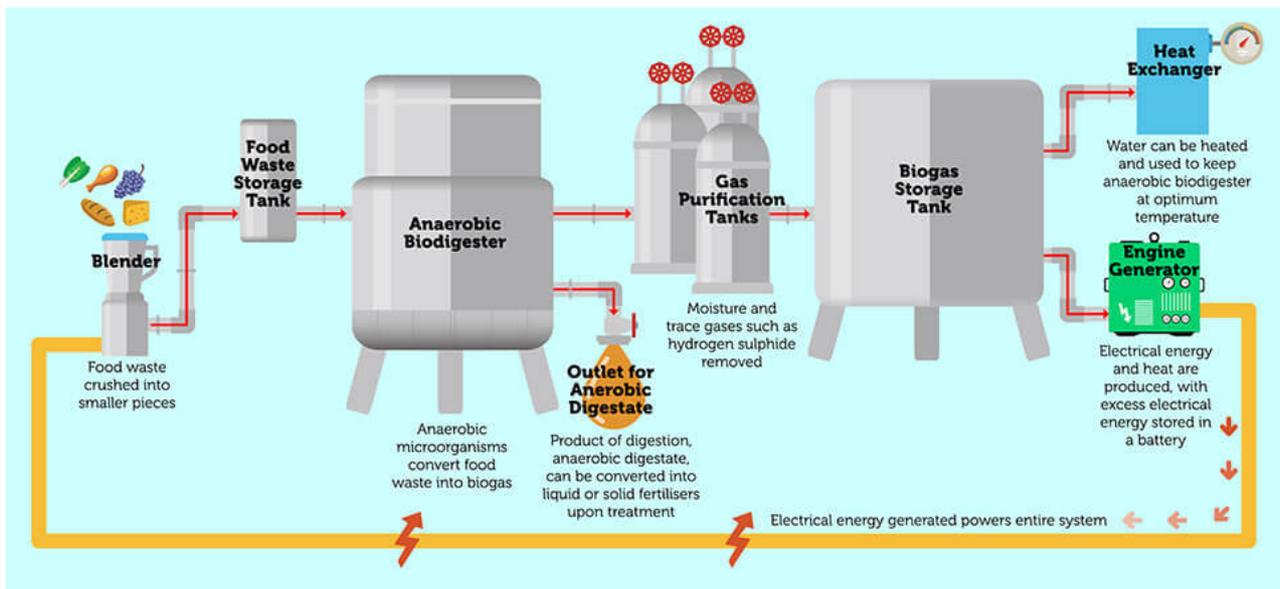
The innovative system was developed by the scientific group, led by [Associate Professor Tong Yen Wah](#), from the [National University of Singapore](#) in collaboration with the [Shanghai Jiao Tong University](#). The universities' cooperation was funded by the [National Research Foundation](#).

According to the [FAO](#), each year  $\frac{1}{3}$  of all food, which was produced, is wasted. This food refuses demonstrated a lost possibility to improve global food security, and, moreover, to decrease environmental impacts and resources use from food chains. All of these factors have an extremely negative impact on the environment. Wastage of cereals in Asia has a significant impact on carbon, blue water, and arable land. Wastage of meat generates the carbon footprint, especially in high-revenue areas and Latin America. Fruit wastage emerges as a blue water hotspot in Asia, Latin America, and Europe due to the food wastage volumes.

Therefore, scientists developed [the recycling system, which is easy to operate and has the ability to generate electricity, heat, and fertilizers from food waste](#) that usually are thrown away. Dr. Zhang Jingxin mentioned that the system operates like a biochemical belly that destroys organic substances in the environment without oxygen. [The special mix of anaerobic microorganisms is applied by the system in order to effectively destroys food](#)

waste in biogas that transforms into heat and electric energy. Furthermore, all these operations can be controlled to optimize its work and maximize the safety. Specially designed sensors provide all necessary information such as the end of the process and the state of security in real time. The data comes directly to the team through the mobile app.

## SELF-SUSTAINING ANAEROBIC DIGESTION SYSTEM FOR FOOD WASTE



Food with a higher concentration of carbohydrates, proteins, and fats will generate more biogas, yielding more electrical energy  
source - nus.edu.sg

The heat output power different process of the system such as hot water that keeps the optimal performing temperature of  $50^{\circ}\text{C}$  of the anaerobic biogas. The produced electricity powers the computer, lights, motors, ventilators, and pumps. Excess electricity is harvested in batteries that can be applied in order to charge phones and tablets. This electricity can be applied for other purposes, for example, the lighting of buildings. The system is already used in [Raffles Hall](#). The team is going to install such systems in local habitable areas and China. In additions, they are working on a larger, stationary system to cater to the needs of a canteen or food center. This system would be able to process up to 400 kilograms of waste food daily.



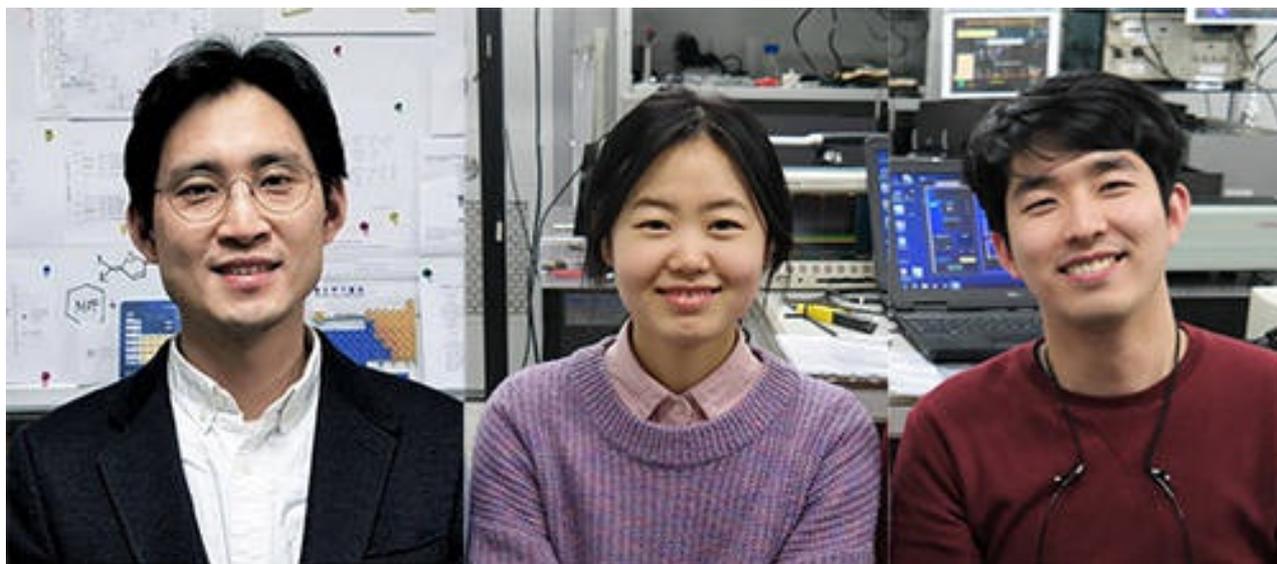
Year 4 NUS Chemical Engineering student Gu Danning, who worked on the system as part of her final year project, demonstrating the phone and tablet charging mechanism  
source - nus.edu.sg

**Company name:** National University of Singapore  
**Contact person:** Associate Professor Tong Yen Wah  
**E-mail:** chetyw@nus.edu.sg  
**Website:** <http://www.nus.edu.sg/>  
**Phone:** (65) 6516 8467  
**Patent status:** -  
**On market since:** -  
**Regions:** Singapore  
**Industries:** Energy, Environment, Food and Drink  
**Source links:** [National University of Singapore](#)



# A TECHNOLOGY OF CONVERTING CO<sub>2</sub> INTO FUELS

CO<sub>2</sub> is one of the most significant factors of climate changes that cause global warming. It hard to convert CO<sub>2</sub> into other materials due to its high stability. To overcome these issues, scientists from all over the world provide studies to develop such technology. Therefore, the scientific group, led by Professor Ho-Jin Son from the Korea University, has managed to create an innovative technology of converting CO<sub>2</sub> into synthetic fuel using the red light from solar energy.



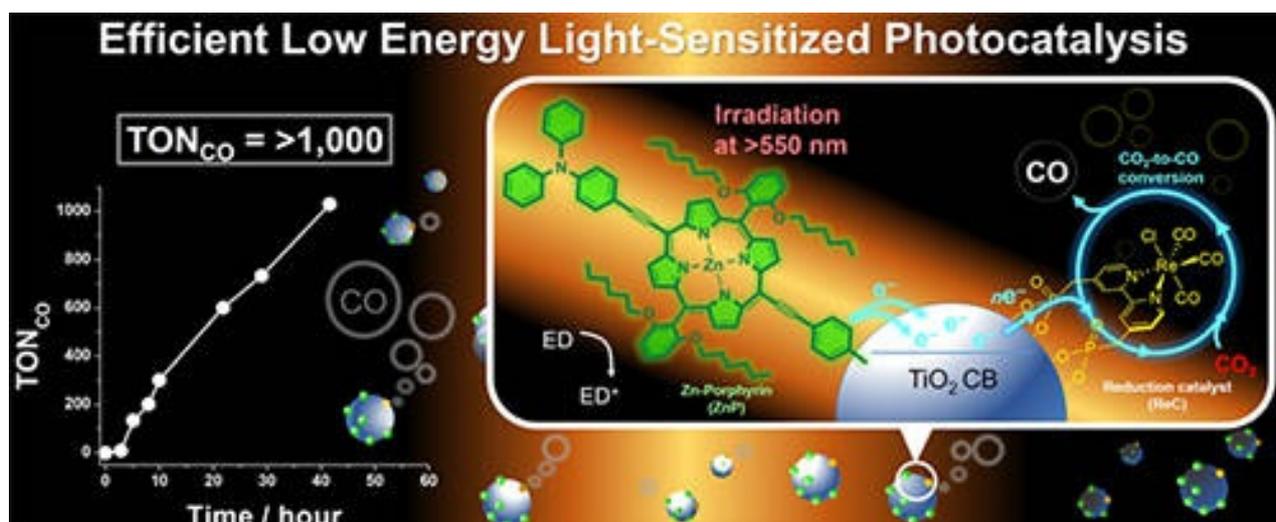
From the left: Professor Ho-Jin Son, Ha-Yeon Cheong (Researcher, Co-author) and Sunghan Choi (Researcher, Co-author) at the Department of Advanced Materials Chemistry  
source - korea.ac.kr

Current conversion technologies corrupt CO<sub>2</sub> using the electric and thermal energy. This method of CO<sub>2</sub> converting by artificial photosynthesis has several barriers such as poor catalytic efficiency and unstable reaction that makes this method not widespread.

Therefore, scientists developed **the innovational photocatalyst using solar capture technology**. Due to this and in the transformation of CO<sub>2</sub> into intermediate compounds of carbon monoxide, **useful synthetic fuel is generated**. Scientists applied **chlorophyll-like porphyrin dyes** that have the ability to capture light when plants provide photosynthesis. Natural photosynthesis carries serial chlorophyll units and arranges them in a coaxial manner to provide efficient energy transfer. Therefore, porphyrin molecule can be used for the artificial photosynthesis system (APS). Despite this fact, it has a limitation such as the photoinstability.

Furthermore, porphyrin dye can reduce energy photosensitization with modification of porphyrin dye. The efficiency of the converting enhanced by **10-20 times** compared to the photocatalyst composed only of porphyrin. The catalytic reaction extended more than **4 days**. A series of Zn-porphyrin dyes was prepared and anchored onto a TiO<sub>2</sub> surface to complete a dye-sensitized photocatalyst system, Zn-porphyrin-TiO<sub>2</sub>-Cat, and tested as lower energy photosensitizers for photocatalytic CO<sub>2</sub> reduction. Scientists determined that **including acetylene and linear hexyl groups into the Zn-porphyrin core made the energy sensitization lower**, moreover, the addition of the cyanophosphonic acid provides

the long-term dye stability on the TiO<sub>2</sub> surface. Therefore, Zn-porphyrin dye can be an ideal molecular platform to create lower energy light-sensitized photocatalysis with the addition of suitable organic groups to the dye, that leads to the required photocatalysis lifetime. Professor Son mentioned that this novel invention will provide the production of the large-capacity CO<sub>2</sub> converting system that will play an important role in energy industries in response to environmental change.



High-efficient, long-life CO<sub>2</sub> reduction through a chemically encapsulated Ternary System (Porphyrin-Titanium-Re-catalyzed) Hybrid Catalyst with Porphyrin Dyes

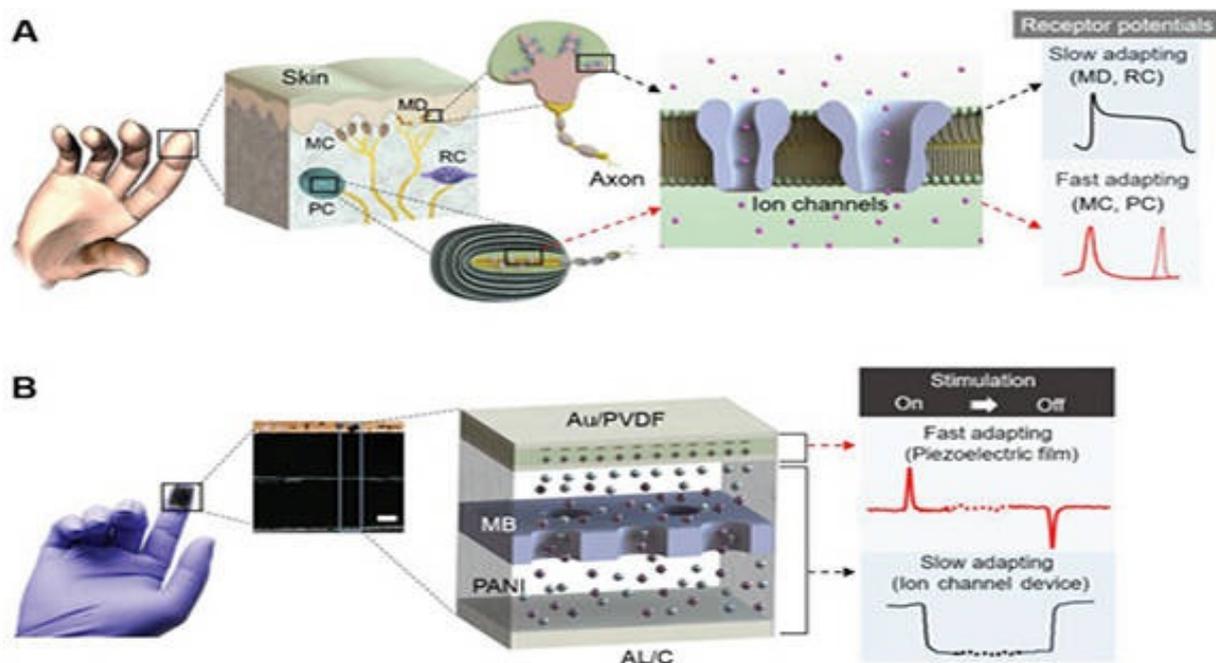
source - korea.ac.kr

**Company name:** Korea University  
**Contact person:** Professor Ho-Jin Son  
**E-mail:** hjson@korea.ac.kr  
**Website:** <https://www.korea.edu/>  
**Phone:** -  
**Patent status:** -  
**On market since:** -  
**Regions:** Korea  
**Industries:** Energy, Environment  
**Source links:** [ACS Catalysis](#)  
[Korea University](#)



## A NOVEL SKIN SENSOR WAS DEVELOPED

The scientific team led by Professor Chang-Soo Han from the Korea University has developed a self-powered and ultra-high accurate artificial skin sensor. In contradistinction to current silicon devices, this technology, which can simulate functions of the human skin, is based on the ion-channel system and the piezoelectric film. The novel device is able to measure pressure, vibration, and touch, which is produced from the external physical stimulus, in the real-time. Therefore, it can be wildly applied in the different areas such as medicine and industrial fields.



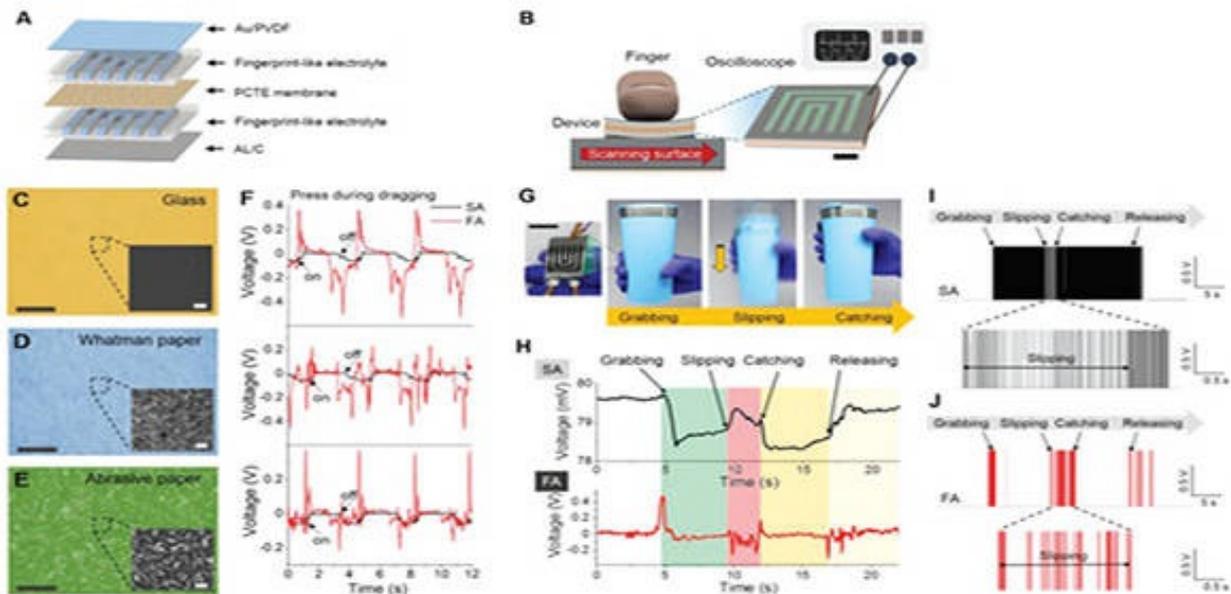
Cross-section and structure of the artificial cutaneous sensor. Slow-adaptation: Signal generated within ion channels. Fast-adaptation: Signal generated at the piezoelectric film source - korea.ac.kr

Sensors of high sensitivity are in high demand due to the wide use of pressure and touch sensors in different areas such as healthcare, cars, airplanes, household appliances, and the environment. Nevertheless, modern sensors have some limitations such as a low sensitivity and high power consumption. Furthermore, humans skin systems pass **fast adaptive (FA) and slow adaptive (SA) pulses** selectively or consolidative to the brain for a multitude of external stimulus. A comprehensive analysis of these signals defines how a person perceives external physical stimuli.

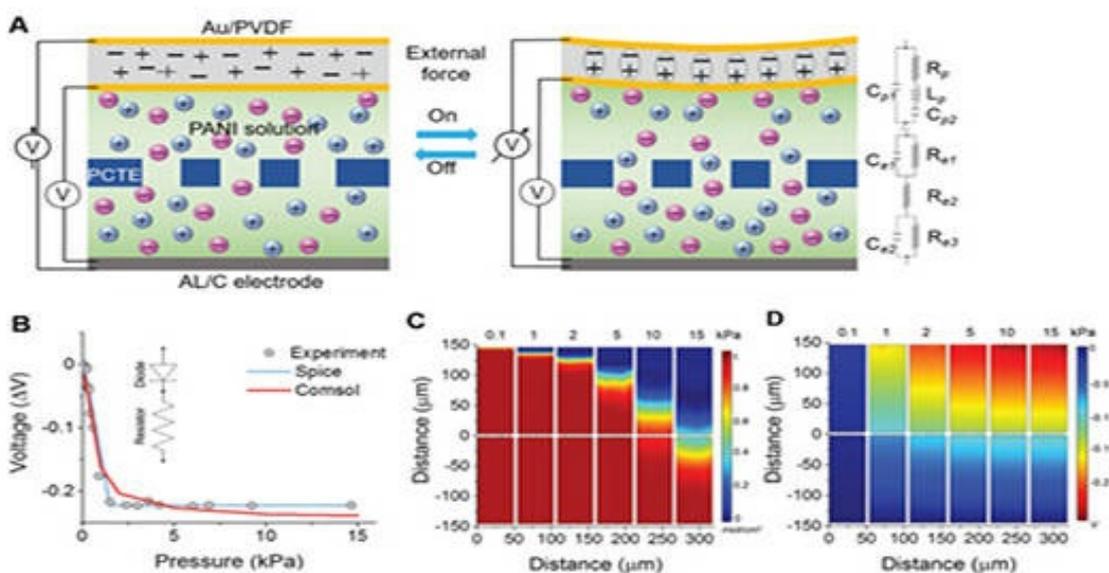
Recently developed self-powered mechanoreceptor sensor, which is based on **the artificial ion-channel system and the piezoelectric film**, has the ability to perform FA and SA pulses as the human skin at once time. This innovational technology identifies high-sensitivity and wide-band irritants without external power. By metering both **fast-adapting and slow-adapting signals**, the sensor provides the high accuracy in measuring vital signals, for example, **blood pressure, heart rate and ballistocardiogram**. Furthermore, surface peculiarities of the object such as **asperity, mechanical irritation, and as a braille can be separated, detected and characterized**.

Scientists mentioned that as the technology is characterized by the rapid and slow signals generating, it forms the new concept for artificial sensors. The technique will increase the

level of biosignal measurement and robot skin function. It can mimic the 5 senses of living creatures. Moreover, this invention will provide the ability to implement the idea of the somatic dermatic sensor of the real skin. The study was conducted under the Basic Science Research Program and the Global Frontier Project supported by the Ministry of Science and ICT.

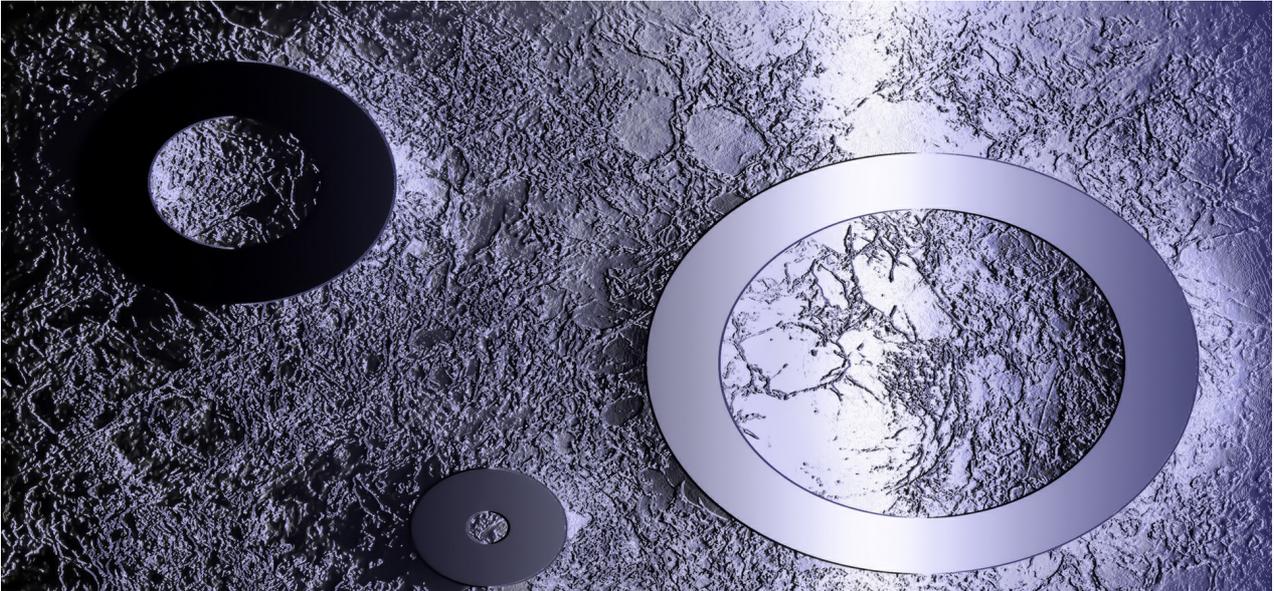


Photographs of a fingerprint-type sensor when a tumbler is dropped by the hand and then caught again. Fast-adaption and slow-adaption signals generated from the tumbler grabbing state to the release state source - korea.ac.kr



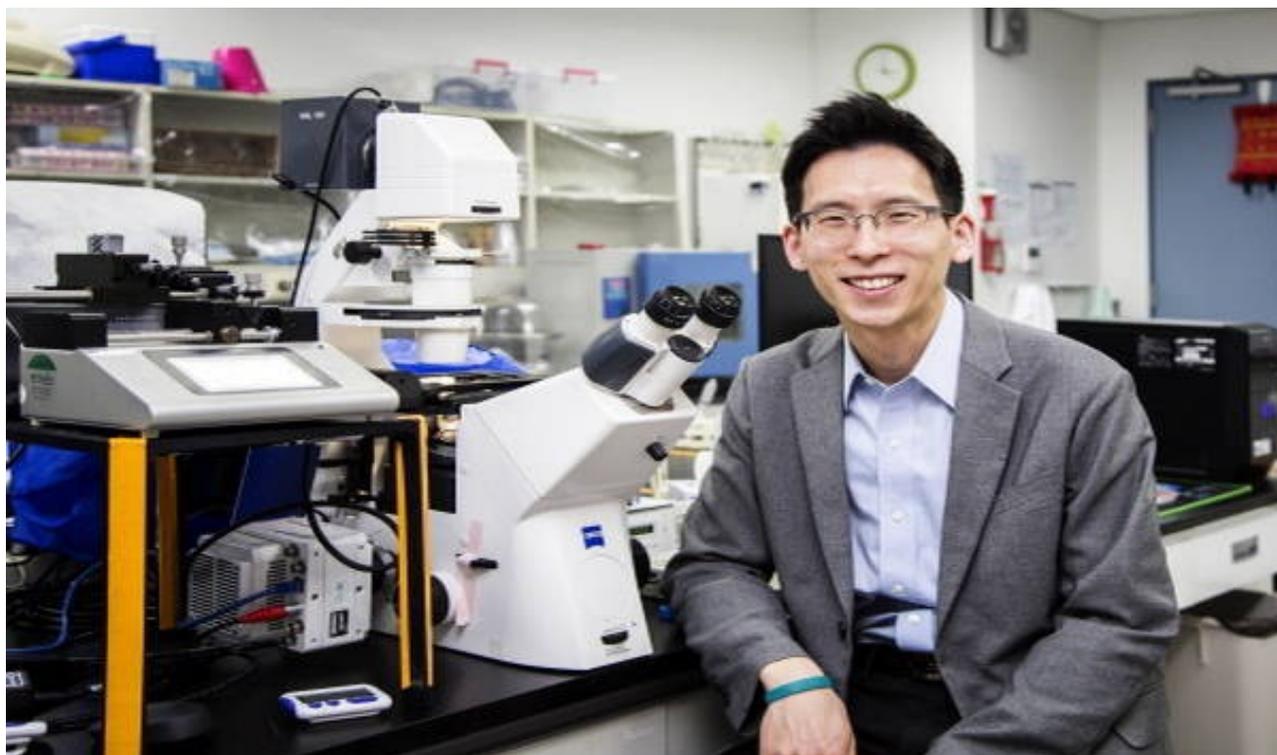
Schematic illustration of the sensing mechanism. Voltage generation in PVDF film and voltage measurement in the ion channels. Circuit diagram comprised of piezoelectric film, ion channels, and electrodes source - korea.ac.kr

**Company name:** Korea University  
**Contact person:** Professor Chang-Soo Han  
**E-mail:** cshan@korea.ac.kr  
**Website:** <https://www.korea.edu/>  
**Phone:** -  
**Patent status:** -  
**On market since:** -  
**Regions:** Korea  
**Industries:** Healthcare  
**Source links:** [Advanced Materials](#)  
[Korea University](#)



# AN INTRACELLULAR NANOMATERIALS DELIVERY PLATFORM

The innovative biochip for large-capacity, high-efficiency intracellular delivery of nanomaterials was developed by scientists from Korea. This inertial microfluidic platform has the ability to deliver a wide range of nanomaterials (CRISPR, nucleic acid, protein, plasmid, etc.) into more than 100000 cells per minute. The high efficiency of this novel development is about 90% that is much higher than current methods of nanomaterials delivering such as viruses, electroporation, etc. This will provide huge opportunities in various biomedical fields such as biomanufacturing, cell-based therapies, regenerative medicine, and disease diagnosis.



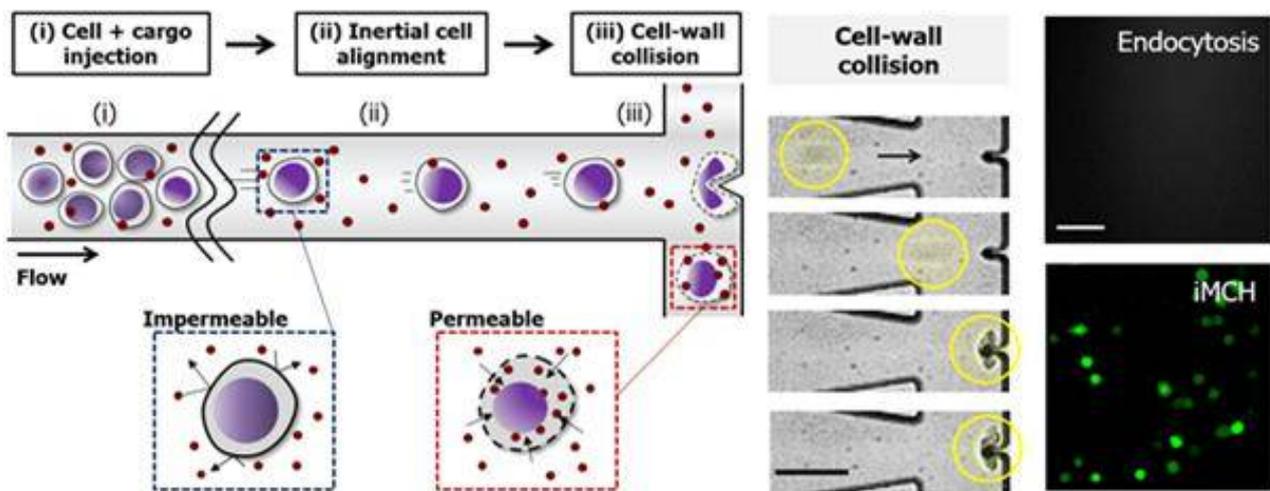
Professor Aram Chung at the School of Biomedical Engineering under the College of Health Science  
source - korea.ac.kr

The platform was developed by the scientific group, led by [Professor Aram Chung](#), from the [Korea University](#).

The intracellular delivery of materials is one of the most fundamental experiments in cell biology and cell engineering that provides the ability to treat numerous diseases taking into account fatal diseases, pathologies and gene mutations that lead to irreparable changes in the human body. Current methods of the delivering of foreign nanomaterials into living cells, typically endocytosis, viruses, microneedles, viral and lipid nanocarriers or electroporation are mainly used. Nevertheless, they have several limitations such as inconsistent delivery, low throughput, and low effectiveness. Furthermore, its premature release can cause toxic side effects. The whole process is time-consuming and labor-intensive.

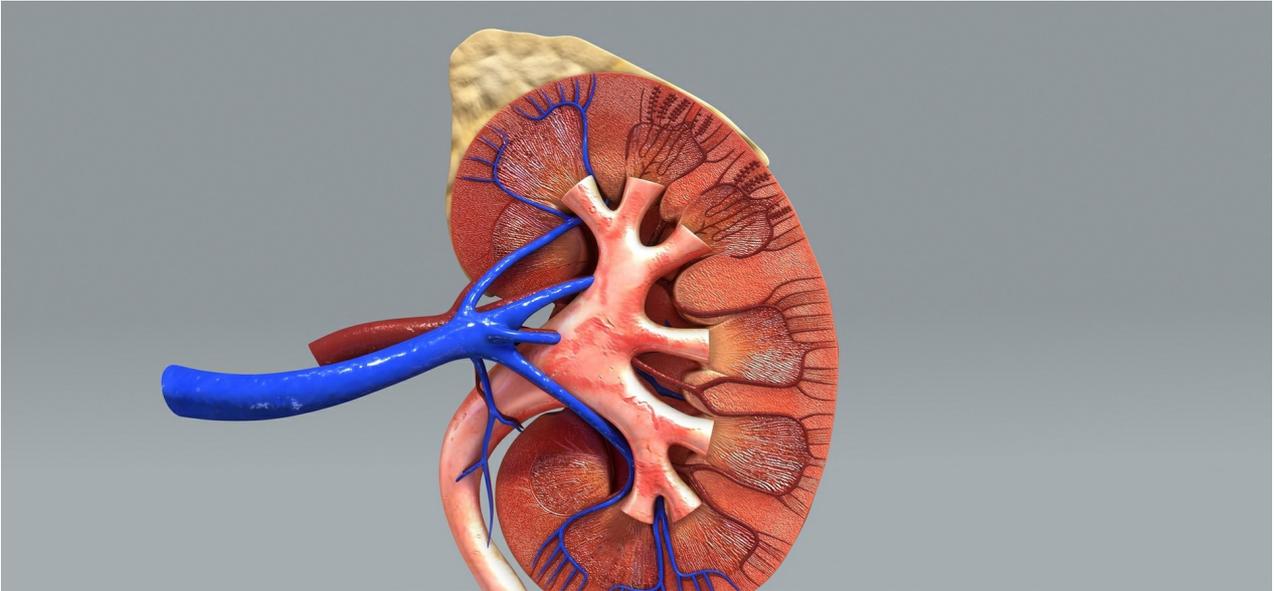
To overcome these issues, the group developed the [inertial microfluidic cell hydroperator \(iMCH\)](#) that is able to deliver the wide range of nanomaterials to various cell types in a single-step without the aid of carriers or external equipment. The device inertia puts cells in the center of the channel and sends the cells to collisions on the TT-junction. The compression and shear forces, which are controlled, produce transient membrane ruptures that facilitate passive diffusion of external nanomaterials in the cellular

cytoplasm, keeping high cell stamina. This innovational technology demonstrates highly delivery efficiency, high-throughput, and high regulating. The most significant advantage of this platform is that its efficiency, simplicity and low-cost performing provides a wide range of applications in different biomedical areas that will allow researchers to develop the effective treatments for different diseases.



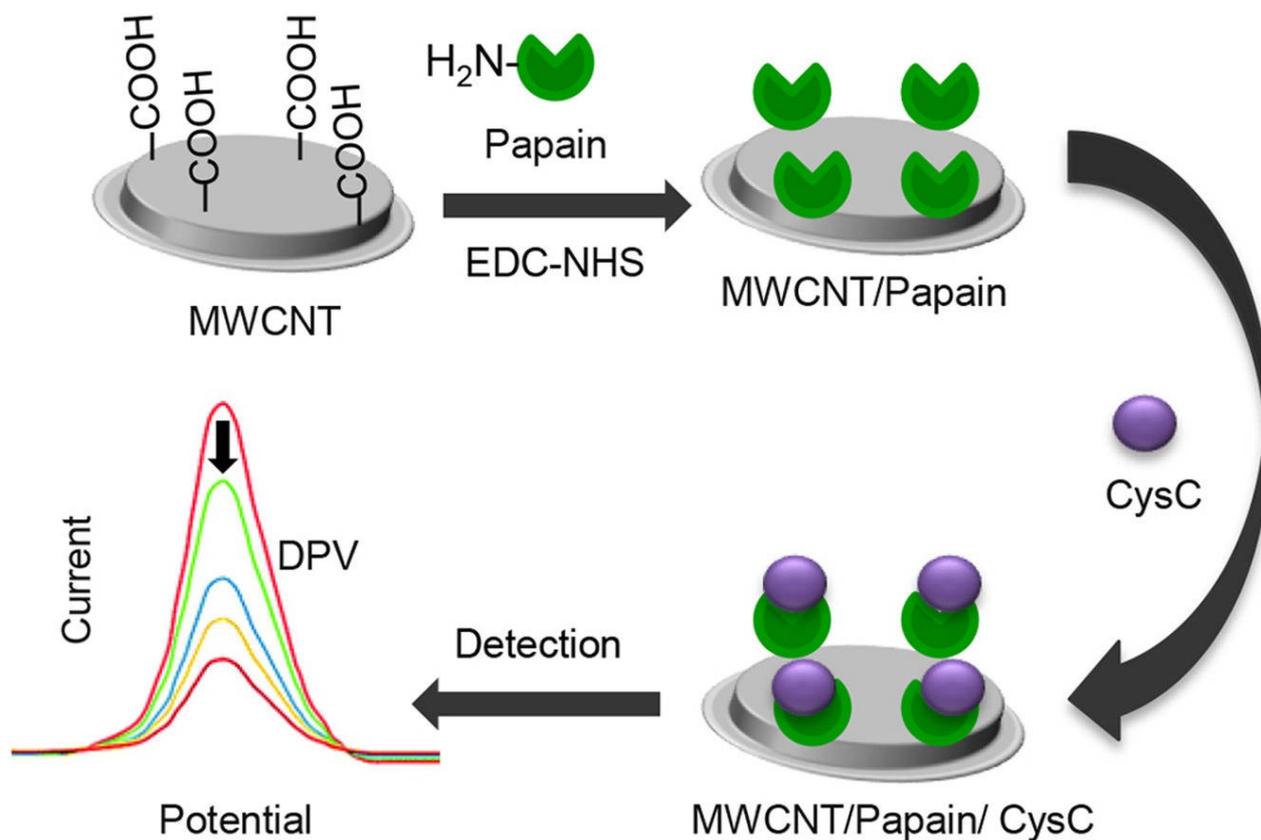
Inertial effects were used to create cell-wall collisions for delivery of various materials into cells. Nanopores were created in walls during cell-wall collisions were passively delivered due to the concentration gradient  
source - korea.ac.kr

**Company name:** Korea University  
**Contact person:** Professor Aram Chung  
**E-mail:** chung6@rpi.edu  
**Website:** <https://www.korea.edu/>  
**Phone:** -  
**Patent status:** -  
**On market since:** -  
**Regions:** Korea  
**Industries:** Healthcare, Biotechnology  
**Source links:** [Nano Letters](#)  
[Korea University](#)



## A NOVEL DEVICE CAN RAPIDLY DETECT CHRONIC KIDNEY DISEASE

Scientists created the newest and ultrasensitive technology that can be used for rapid detection of chronic kidney disease (CKD). An early intervention in patients with CKD has the potential to delay or even prevent the development of a terminal stage of renal failure and complications, which has a significant effect on life expectancy and quality of life. This ultrasensitive platform can detect different stages of CKD preventing the formation of the advanced stage of this disease.



The probe papain was immobilized onto cMWCNT and binding of CysC was detected electrochemically for confirmation of CKD in human source - sciencedirect.com

The innovative technology was created by scientists, led by [Dr. Manali Datta](#), from the [Council of Scientific and Industrial Research](#) in collaboration with the [Amity Institute of Biotechnology](#), [CSIR-Institute of Genomics and Integrative Biology](#), and the [Yobe State University](#).

According to the [National Kidney Foundation](#), about 10% of the population worldwide have the chronic kidney disease (CKD), and millions die each year because they do not have access to affordable treatment. About 70% of children with kidney disease will develop kidney failure by age 20 years. Children with kidney disease have a greater chance of dying than children in the general population. This disease is characterized by gradual loss of renal function due to the destruction of renal tubules. CKD has 5 stages, which are based on seriousness, and aggravation can happen over some periods of time. Therefore, scientists tried to create the technology that can to hinder the formation of the advanced stage of this disease.

The group managed to create [the novel diagnostic biosensor for use for on-site detection of samples](#). They modified a multi-walled carbon nanotube electrode with cysteine

protease using the covalent immobilization. The fastening of the probe to the electrode was approved by different microscopic and spectroscopic techniques. **Cystatin C** is freely filtered by the glomerulus but reabsorbed and catabolized by the kidney tubules. Trace detectable amount is eliminated in urine, giving this molecular marker an edge over serum creatinine's disadvantages. It is a marker of CKD that can unite with the capture molecule generating different variations in the electronic transitions. It performs through the surface of the changed electrode. The interaction between papain and CRD biomarker, Cystatin C was identified by cyclic voltammetry and differential pulse voltammetry within **10 min**. **The sensor is highly specific to Cystatin C and showed the negligible response to non-specific macromolecules present in urine.**



If CKD is detected at an early stage (Stage 1 or 2), mere modifications in diet and intake of ACE inhibitors may prevent the progression to end-stage renal disease  
source - adobe.com

The test's result demonstrated the **high accuracy**. The sensitivity of the device was  $1583.49 \mu\text{A cm}^{-2} \mu\text{g}^{-1}$  and lower limit of detection of Cystatin C was found  $0.58 \text{ ng L}^{-1}$  which presents as a promising platform for designing potable kidney disease detector.

**Company name:** Amity Institute of Biotechnology

**Contact person:** Dr. Manali Datta,

**E-mail:** manali.datta@gmail.com

**Website:** <http://www.amity.edu/aib/>

**Phone:** -

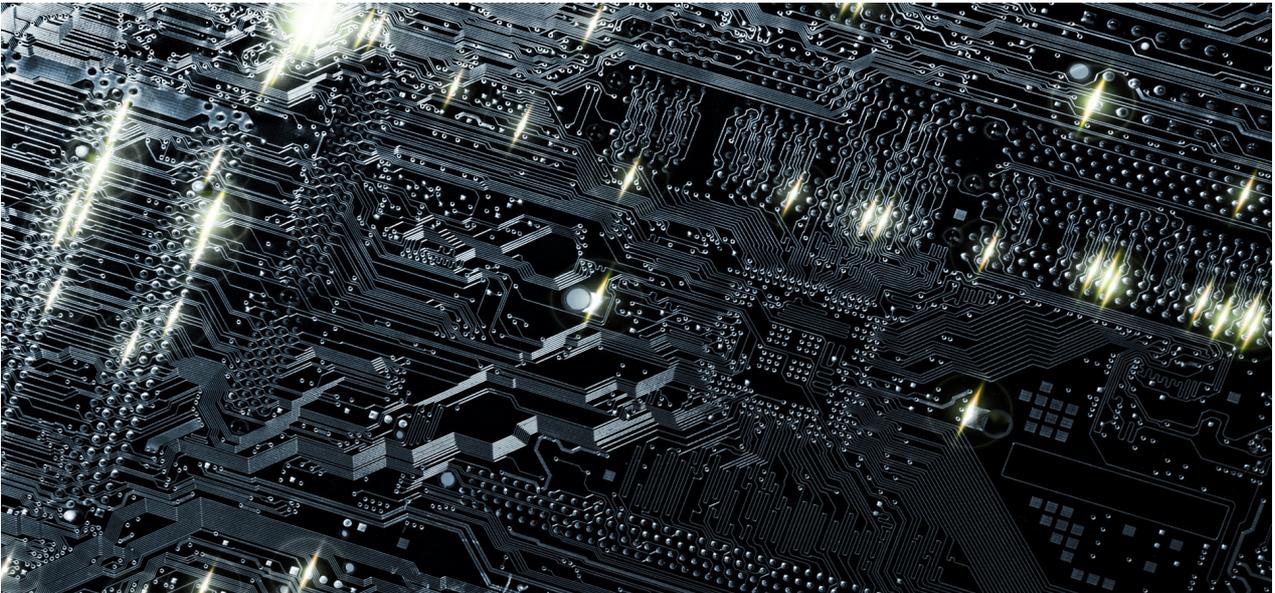
**Patent status:** -

**On market since:** -

**Regions:** India

**Industries:** Electronics, Healthcare

**Source links:** [Biosensors and Bioelectronics](#)  
[Research Stash](#)



## A NOVEL MICROCHIP CAN SELF-START AND OPERATE WHEN THE BATTERY IS DISCHARGED

Currently, IoT devices are much more battery-powered and at 3 times more expensive than the one chip, they supply. Nevertheless, standard IoT devices are unable to perform without a battery, and small batteries are fully discharged more often. Therefore, battery miniaturization leads to the high intermittent of IoT devices, as they stop operating whenever the battery is exhausted. Therefore, scientists managed to create an innovational microchip, which is called BATLESS, that can continue to perform in the case when the battery is fully discharged.



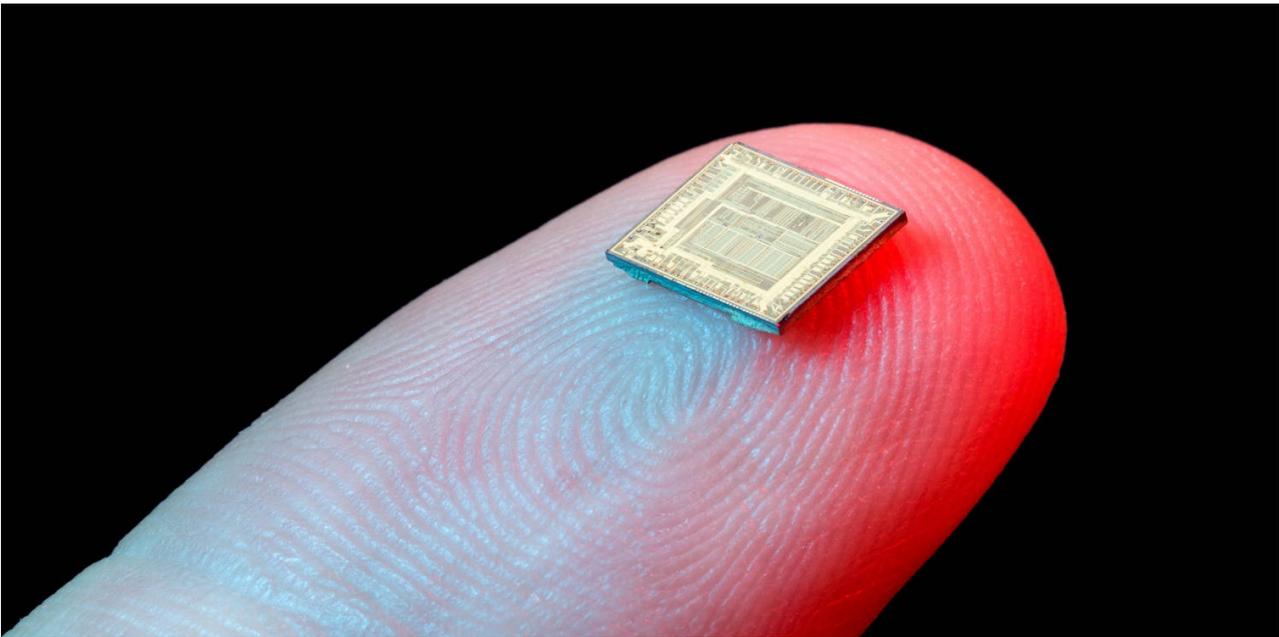
Associate Professor Massimo Alioto (centre) and his team have developed a smart microchip, BATLESS, which can self-start and continue to operate even when the battery runs out of energy source - NUS

The newest development was made by the group of scientists, led by [Associate Professor Massimo Alioto](#), from the [National University of Singapore](#).

[The Internet of Things \(IoT\)](#) has a huge impact on various industries and help to form our daily lives in significant ways. IoT has evolved from the convergence of wireless technologies, micro-electromechanical systems (MEMS), microservices, and the internet. It can be applied in various fields and it can be used by different people such as used by a person with a heart monitor implant or a car that has built-in sensors to alert the driver when tire pressure is low. One of the significant issues of IoT devices is the inability to long-continued perform under strictly limited energy sources, therefore, it requires high power efficiency. IoT devices usually applied in the massive scale and in places, which are distant and hard to service often. Battery-indifferent sensor nodes require continuous operation in spite of the intermittently available battery energy and hence require the low peak-power operation to fit the fluctuating power made available by the harvester when the battery is out of energy. Consequently, [the self-abundance is the crucial moment for IoT' appropriate operating](#).

[BATLESS is produced using newest power management technology that provides the capacity to self-start and pursue to perform under dull light without any battery support,](#)

using a tiny on-chip solar cell. Furthermore, this technology significantly decreases the size of the batteries needed to power the IoT sensor nodes, which makes them 10 times tiny and cheaper to manufacture. Assist. Prof. Alioto mentioned that batteries, which are used for IoT devices can be shrunk fundamentally, as they are not required for continuous supporting. Therefore, this innovational technology could enable smaller and cheaper Internet of Things (IoT) devices.



At the same time, our 16-bit microcontroller can also operate 100,000 times faster than others that have been recently designed for fixed minimum-power operation  
source - adobe.com

Company name: National University of Singapore

Contact person: -

E-mail: [registrariasst@gmail.com](mailto:registrariasst@gmail.com)

Website: <http://www.nus.edu.sg/>

Phone: -

Patent status: -

On market since: -

Regions: Singapore

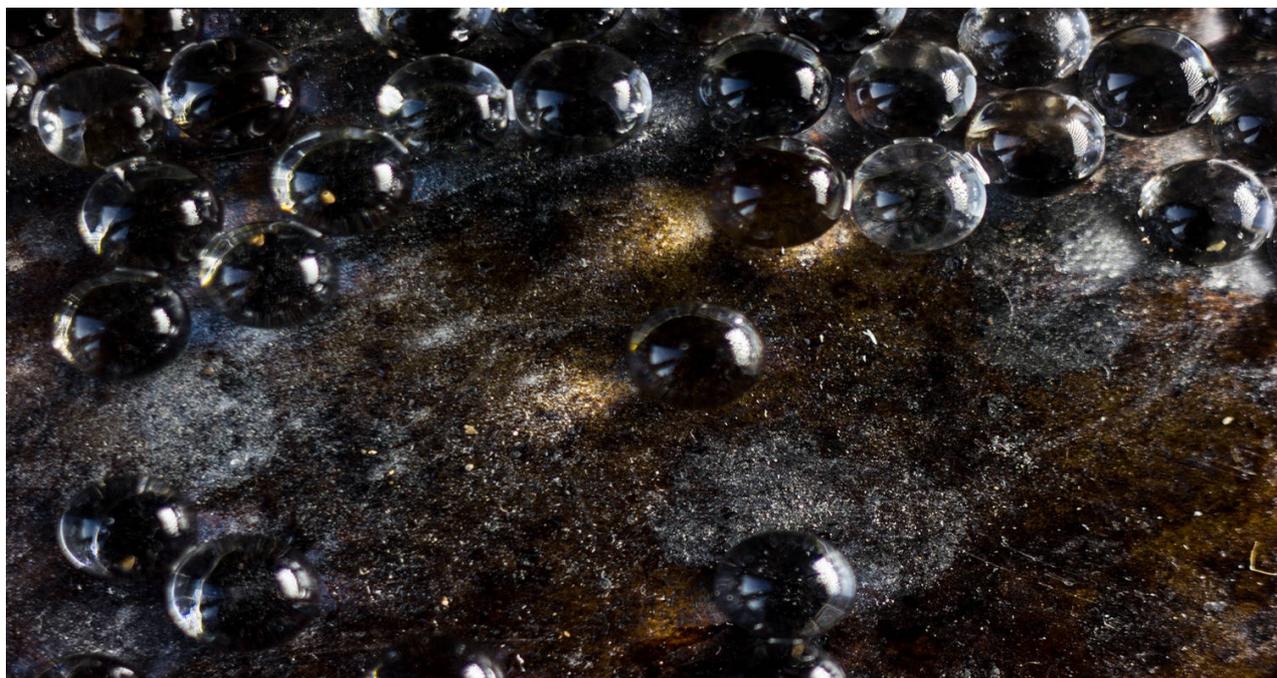
Industries: Electronics

Source links: [National University of Singapore](#)



## NOVEL GUAR GUM-BASED HYDROGEL CAN SAVE CROPS FROM DROUGHT

Scientists managed to create a hydrogel from the gum of guar or cluster bean, which can to enhance soil moisture and provide farmers the ability to save their crops during drought. In contradistinction to others types of a hydrogel, the guar gum-based hydrogel is environment-friendly due to its ability to decompose. Furthermore, it adds organic elements to the soil upon decomposition.



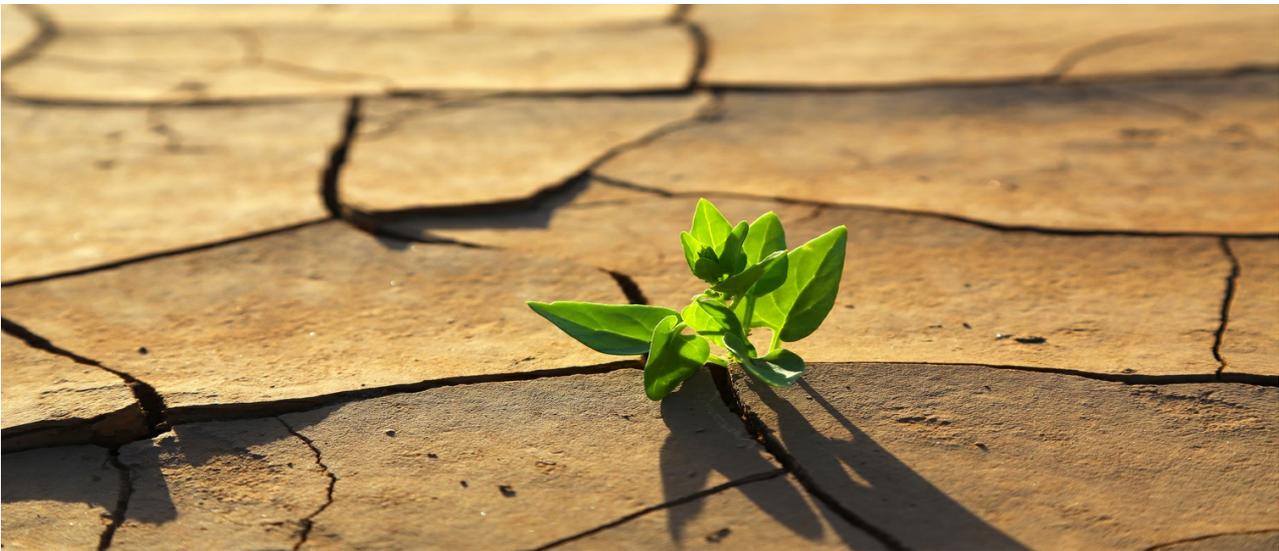
Synthesis of the novel, EGDMA cross-linked guar gum superabsorbent hydrogels. Characterization with FTIR, SEM, thermal and water absorption studies  
source - adobe.com

The innovative development was made by the scientific group from the [Indian Institute of Natural Resins and Gums](#) in collaboration with scientists from the [Birla Institute of Technology, Mesra](#), and [Central Coastal Agricultural Research Institute](#).

Drought leads not only to the critical shortage of water but to the massive failure of crops and etc. According to the [Faoland&water](#), since 1900 more than 11 million people have died as a consequence of drought and more than 2 billion have been affected by drought, more than any other physical hazard. Droughts are the primary cause of most ill health and death because they deny access to adequate water supplies and often trigger or exacerbate malnutrition and famine. While regional droughts have occurred in the past, the widespread spatial extent of current droughts is broadly consistent with expected changes in the hydrologic cycle under warming. The hydrogel is a network of polymers, which has the ability to store a large amount of water and is widely used in the production of different hygiene products. Nevertheless, the synthetic hydrogel is not easily biodegradable, and different products of their decomposition pollute the environment.

A new type of hydrogel was synthesized by grafting guar gum with acrylic acid and cross-linking with ethylene glycol di methacrylic acid (EGDMA). The synthesis of hydrogel was confirmed by characterization through the carbon-13 nuclear magnetic resonance, Fourier-

transform infrared spectroscopy, SEM micrography, thermo-gravimetric analysis and water absorption studies under different solutions. A microscopic analysis of the new type of hydrogel demonstrated spongy surface and both macro and micropores. These characteristics provide immediate permeation of the water enhancing the higher tuber ability. The hydrogel that has the ability to absorb up to 800 ml water per gram, after addition to soil, improved its porosity, moisture absorption, and harvesting capability respectively. The water holding capacity of water increased up to 54% of its original and porosity also increased up to 9% of its original. Consequently, this novel hydrogel demonstrates tremendous potential as soil conditioning material for agricultural applications.



The research team is going to continue to work on the hydrogen source - adobe.com

**Company name:** Indian Institute of Natural Resins and Gums

**Contact person:** NandkishoreThombare

**E-mail:** nandkishore.icar@gmail.com

**Website:** <http://ilri.ernet.in/~iinrg/>

**Phone:** -

**Patent status:** -

**On market since:** -

**Regions:** India

**Industries:** Food and Drink

**Source links:** [Carbohydrate Polymers](#)

[Biotech Times](#)



## FLY ASH CAN BE USED FOR MOSQUITO CONTROL

The researchers' team from India has successfully applied the fly ash as a bearer for the biopesticide that is called *Bacillus Thuringiensis* *Israelensis* (Bti) to kill mosquitos, which transmit malaria, dengue, yellow fever, and filariasis. The Bti formulation that includes the fly ash as the carrier and 1% of carboxymethyl cellulose as the additive is highly effective method against mosquito larvae and other insects. Bti has the ability to produce protein, which acts against pests of agriculture and medical importance. Furthermore, the use of this composite is safe for humans.



The Bti (VCRC B17) strain was revived from the lyophilized spores and was incubated at 30°C for 48 h and then stored at 4°C for further use  
source - adobe.com

The method was developed by the scientific group from the [Vector Control Research Centre \(VCRC\)](#) in collaboration with the [Pondicherry University](#).

Mosquitoes play a crucial role in the transmission of various dangerous diseases such as malaria, dengue fever, yellow fever and others. The effective monitoring and regulating of aquatic mosquito larvae have been achieved using Bti. The effectiveness of Bti is dependent on the bioavailability of the material in treated areas, which in turn depends on the design of the formulation. The coal and lignite are the most economical and available materials for power generation in India. Despite, it leads to hard environmental consequences such as the excessive production of fly ash (FA), which should be utilized in an appropriate manner.

As the result, scientists decided to use FA in order to solve several problems. For a successful use of the Bti, it requires the carrier. Currently, the Plaster of Paris and charcoal are used for this goal. The study results determined that **the applying of fly ash as bearer material can significantly increase its ingestion**. Furthermore, Bti has been used for **20 years**, no signs of the resistance have been detected. The Bti (VCRC B17) strain was revived from the lyophilized spores and streaked onto modified nutrient yeast salt medium (NYSM) agar slants. The slants were incubated at **30°C for 48 h** and then stored at **4°C** for further use. Moreover, **powder formulations are reputed for their long shelf life, miscibility in water** compared to technical grade materials, microgels, and aqueous suspensions.



An electron microscopic analysis did not find any toxic heavy metals  
source - adobe.com

Dr. Arulsamy Mary Manonmani mentioned that as various types of formulations have the different level of residual activity in addition to feasibility for use in specific types of habitats, their application will help in bringing about a drastic reduction in the mosquito population. In addition, FA will help not only in adding to its utilization as almost half of the formulated material contains FA but also in ensuring safety to the environment where it is applied as **it has proved to be safe to non-target organisms and mammalian systems.**

**Company name:** Vector Control Research Centre

**Contact person:** Dr. Arulsamy Mary Manonmani

**E-mail:** ammanonmani@yahoo.com

**Website:** <http://www.vcrc.res.in/>

**Phone:** -

**Patent status:** -

**On market since:** -

**Regions:** India

**Industries:** Healthcare

**Source links:** [Indian Journal of Medical Research](#)

[Biotech Times](#)



## THE AUXIN CAN HELP BOOST CROP YIELDS

Plants have the ability to change angle and length of their roots as well as hair-like extensions on roots for better absorbing nutrients from the soil, especially phosphate, which is a very important element for plant growth and development. The international team of scientists has discovered that the transportation of a hormone auxin in the zone of root hair provides the extension of root hair under low phosphate conditions, making the absorption ability higher that lead to the boosting of the crop yields.



Dr. Jitender Giri and Bipin K. Pandey from the National Institute of Plant Genome Research  
source - researchstash.com

The discovery was made by the scientific group from the [National Institute of Plant Genome Research](#) in collaboration with universities and research institutes from UK, Japan, China, Sweden, France, USA, and Australia.

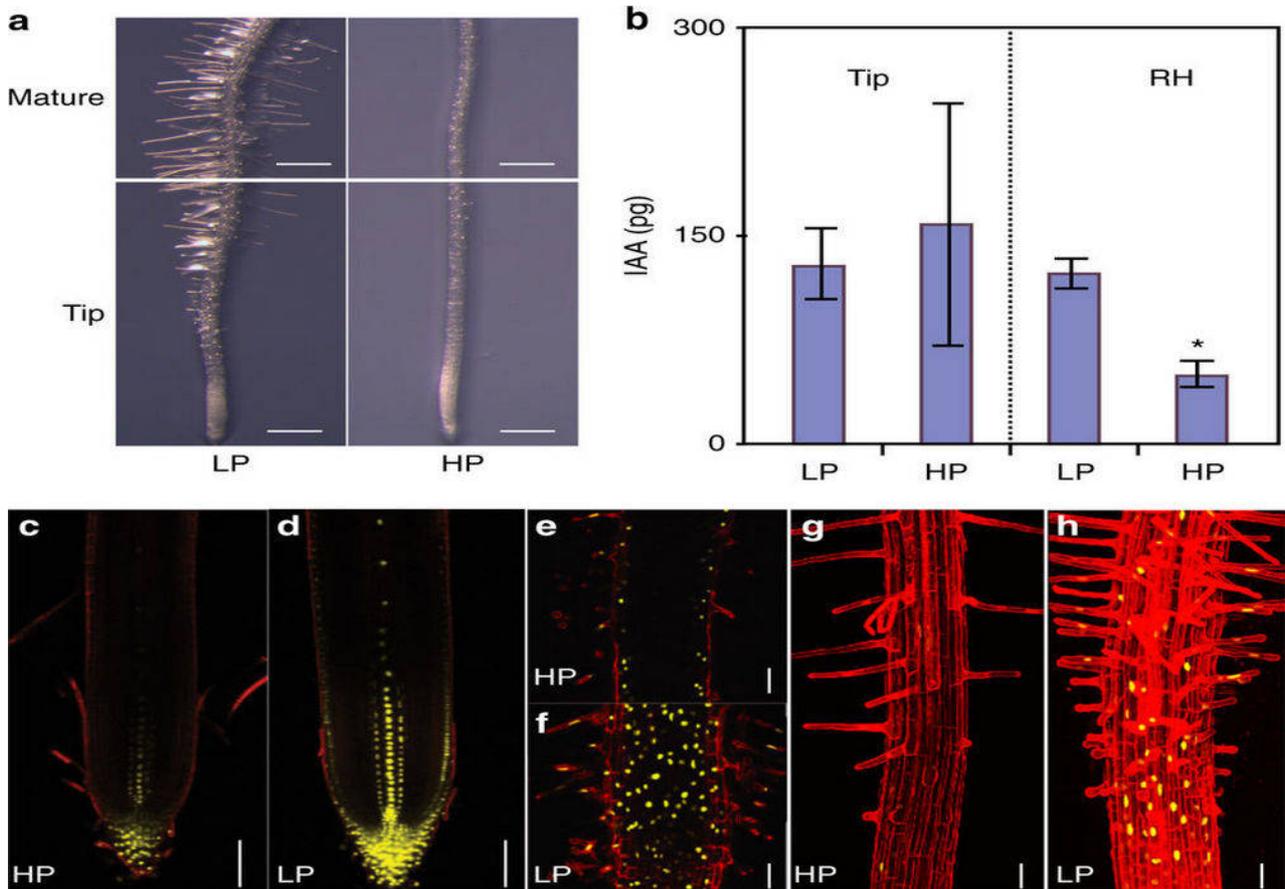
Plants have evolved a number of mechanisms to acquire soil phosphorus, transforming it into phosphate. Key adaptations under phosphorus-deficient conditions include exudation of organic acids and phosphatases to solubilize soil phosphorus, induction of high-affinity phosphate transporters and reprogramming of root system architecture (RSA). The root architecture has the ability to grow to change the root surface area and shallower root angle in order to increase the absorption of the phosphorus. There are several genes, which regulate root hair development. Trichoblasts cells provide the formation of root hairs.

Scientists have managed to promote the growth of Arabidopsis root hair using auxin. Under the low phosphorus level, auxin is regulated at the root tip. It is moved via AUX1 to the root hair differentiation zone. The auxin signals and provides the hair growth if the

level of phosphate in soil is low. The elevated level of auxin in trichoblasts trigger a gene expression cascade, which is intermediated by transcription factors ARF19, RSL2, and RSL4 that promotes hair growth. In previous research, scientists modified the root angle in rice by disrupting the **OsAUX1** auxin influx transporter gene in order to improve the rice phosphorus absorption efficiency. The auxin-dependent root hair response to low external phosphorus is highly conserved in the dicotyledonous model *Arabidopsis thaliana* and which relies on **AUX1** to promote hair elongation via intracellular auxin and calcium signaling. **Dr. Jitender Giri** mentioned that the green revolution managed to increase almost triple yields of common crops like rice and wheat. Despite this fact, it is highly dependent on chemical fertilizers. As the result, scientists wanted to provide the ability to improve plant roots for more efficient nutrient absorption.



The research work at NIPGR was funded by the Department of Biotechnology (DBT)  
source - adobe.com



Root hair elongation is a conserved response to low P in Arabidopsis and results in IAA accumulation in the root tip  
 source - nature.com

**Company name:** National Institute of Plant Genome Research

**Contact person:** -

**E-mail:** nipgr@nipgr.ac.in

**Website:** <http://www.nipgr.res.in/home/home.php>

**Phone:** 91-11-26735157

**Patent status:** -

**On market since:** -

**Regions:** United States, France, Sweden, United King.

**Industries:** Food and Drink

**Source links:** [Nature Communications](#)

[Biotech Times](#)



## NEW EYES SCREENING METHOD CAN TELL YOU IF YOU ARE DIABETIC

The researchers' group from India has applied machine learning technique for diagnosing diabetes. The precision of this technique is 89.63% and its specificity and sensitivity are 0.9687 and 0.988 respectively. Scientists are going to create the portable device applying artificial intelligence that will provide a non-invasive method of diabetes detection. Furthermore, it is cheap and easy to use making it appropriate for applying by a non-medical practitioner effectively.



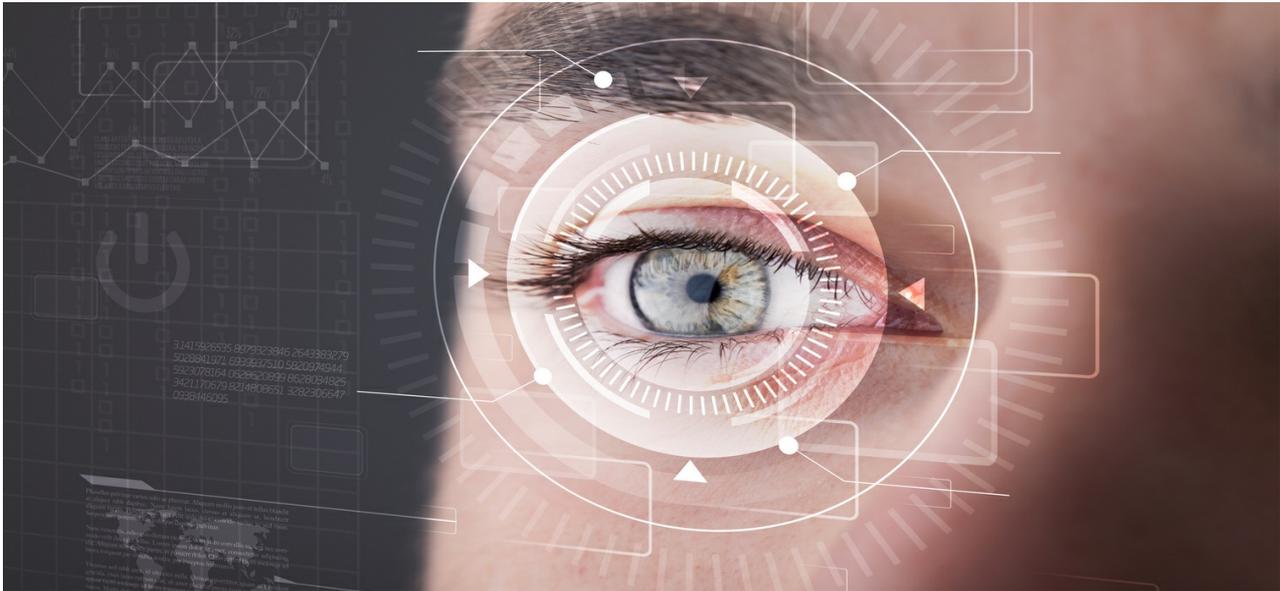
As per the estimates of International Diabetes Federation (IDF), 381.8 million people are affected by diabetes and about 591.9 million people will be affected by this disease by the year 2030  
source - adobe.com

The novel development was made by [Professor Ravinder Agarwal](#) and [Piyush Samant](#) from the [Thapar Institute of Engineering & Technology](#).

Additional and alternative medicine technologies have demonstrated a big potential for the detection and treatment of various chronic diseases like diabetes, arthritis etc. Doctors often examine human eyes for signs of jaundice, hyperthyroidism, anemia, and even can determine cholesterol levels. There is in the newly created field of medicine, which is called iridology, medical workers use the patterns of iris, colors, tissue weakness, breakage and other features in order to define early symptoms of various diseases. Nowadays scientists from all over the world use the artificial intelligence and iris images of people in order to found appropriate changes in patient' iris as the result of a particular health condition.

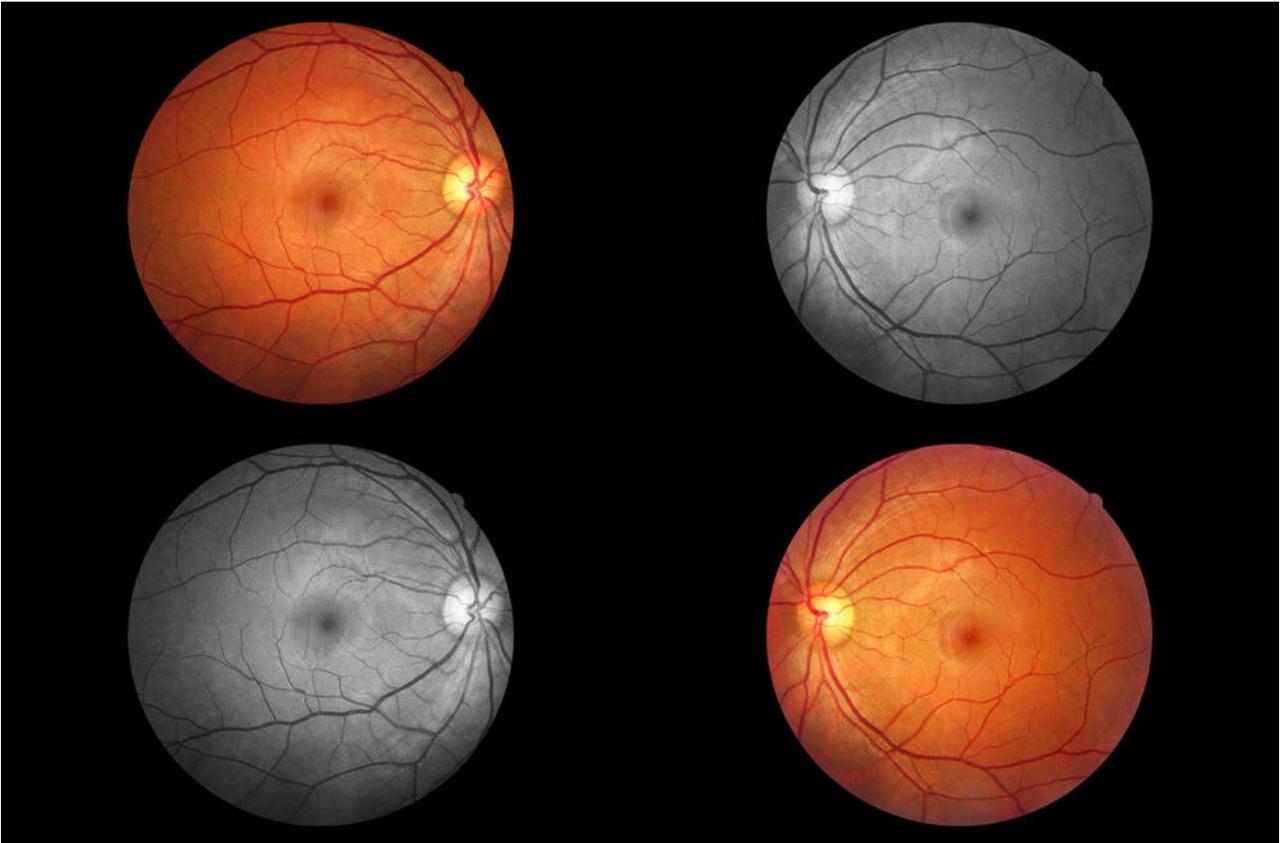
During the research, scientists explored over a close group of total **338** subjects from which **180** people were diabetic and **158** were non-diabetic. Infra-red images of both the eyes were taken simultaneously. The region of iris' exploration of the photo was cropped as part represents the position of pancreas organ according to the iridology chart. The discrete, statistical and texture wavelength conversion characteristics were taken from the research part. The study results demonstrate **the high precision at 89.63%** that was taken

from random forest classifier. The maximum of specificity and sensitivity were determined as 0.9687 and 0.988, respectively.



The proposed model is an attempt to evaluate diagnostic validity of an old complementary and alternative medicine technique, iridology for diagnosis of type-2 diabetes using soft computing methods  
source - adobe.com

Scientists mentioned that the most significant advantage of this development is that this technology has the ability to define early diabetes and pre-diabetes conditions. It will allow patients to prevent or even avoid serious complications. Professor Agarwal noted that they going to create a device, which will be based on this machine learning technique. It will provide non-invasive, cost-effective, precise and fast diabetes diagnostic that will be available even in rural areas.



Diabetes detection through computer machine vision technique using iris  
source - adobe.com

**Company name:** Thapar Institute of Engineering & Technolog.  
**Contact person:** Piyush Samant  
**E-mail:** piyush.samant@thapar.edu  
**Website:** <http://www.thapar.edu/>  
**Phone:** -  
**Patent status:** -  
**On market since:** -  
**Regions:** India  
**Industries:** Healthcare  
**Source links:** [Computer Methods and Programs in Biomedicine](#)



# SEAWEED CAN HELP TO CLEAN TOXIC WASTEWATER

The wastewater, which contains industrial dyes, textile waste, and toxic heavy metals is a major environmental problem since the existing cleaning methods are ineffective, costly and even polluting. The researchers' team from India has managed to develop a novel technology that is based on the use of nanomaterial, which is received from seaweed, for an effective purge of toxic wastewater. Furthermore, this technology is eco-friendly due to the using the seaweed as the basic material without applying any chemicals.



The research team included Ashesh Mahto, Anshu Kumar, Madhuri Bhatt, Jai Prakash Chaudhary, Atul Kumar Sharma, Parimal Paul, Sanna Kotrappanavar Nataraj, Ramavatar Meena  
source - thehindubusinessline.com

The innovative technology was developed by the scientific group, led by **Dr. Ramavatar Meena**, from the [Central Salt & Marine Chemicals Research Institute](#). The wastewater is the global problem in the modern world, and especially in developing countries due to the cheap labor and many factories of world-famous clothing brands, which are situated there. It leads not only to the poorly paid labor, moreover, it leads to the water polluting. The membrane-based filtration technology is used for water cleaning but it unable to purify heavy metal contaminants. To solve this issue, carbon can be applied in order to filter out dyes and heavy metals through adsorption. As a result, methods with the using of activated carbon, graphene or carbon nanotubes are being created. To make this technology fully eco-friendly, scientist managed **to synthesize graphene-iron sulfide nanocomposite from seaweed, which is called *Ulva fasciata*, using pyrolysis method.**

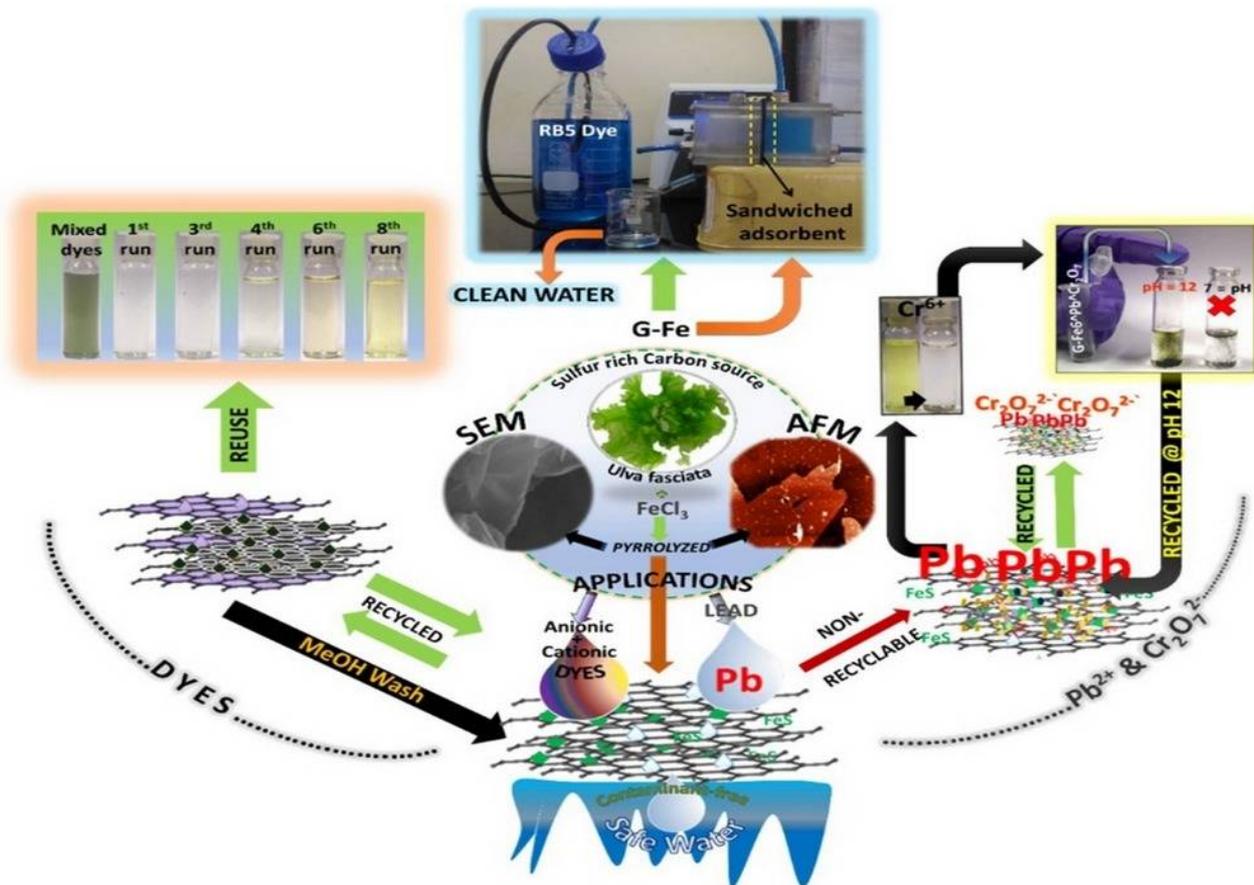
The team developed an easy and solvent-free synthetic method for the generating of **FeS/Fe(0) functionalized graphene nanocomposite (G-Fe) via a one-step pyrolysis of seaweed biomass**. Previously, this kind of the alga was used for adsorbing copper and zinc ions from water but its absorption abilities were relatively low. As the natural abundance of both inorganic and organic sulfur in the seaweed provides the decrease of exfoliated graphitic sheets at elevated temperatures. To solve the problem with low absorption capacity, **scientists derived thin carbon sheets from seaweed at very high temperature**. FeCl<sub>3</sub> was used as the iron precursor as well as the templating agent.

Graphene sheets were doped with the iron. Iron doping played a dual-faceted role of exfoliating as well as activating agent, producing composite with high adsorption capacity for  $Pb^{2+}$  ( $645 \pm 10$  mg/g), CR (970 mg/g), CV(909 mg/g), MO (664 mg/g), MB (402 mg/g) dyes and good recyclability (8 cycles).



source - adobe.com

As the result, the nanocomposite demonstrated high adsorption ability for different cationic and anionic dyes, lead, chromium and even mixed dyes. Furthermore, Dr. Meena mentioned that this novel technology can be combined with others membrane-based techniques for full purification of the wastewater.



This composite shows excellent removal ability of dyes with good recyclability (8 cycles). Suitable for membrane coatings and fabrication applications  
 source - sciencedirect.com

**Company name:** Central Salt & Marine Chemicals Research ...

**Contact person:** Dr. Ramavatar Meena

**E-mail:** rmeena@csmcri.res.in

**Website:** <http://www.csmcri.org/>

**Phone:** -

**Patent status:** -

**On market since:** -

**Regions:** India

**Industries:** Environment, Water

**Source links:** [Journal of Hazardous Materials](#)

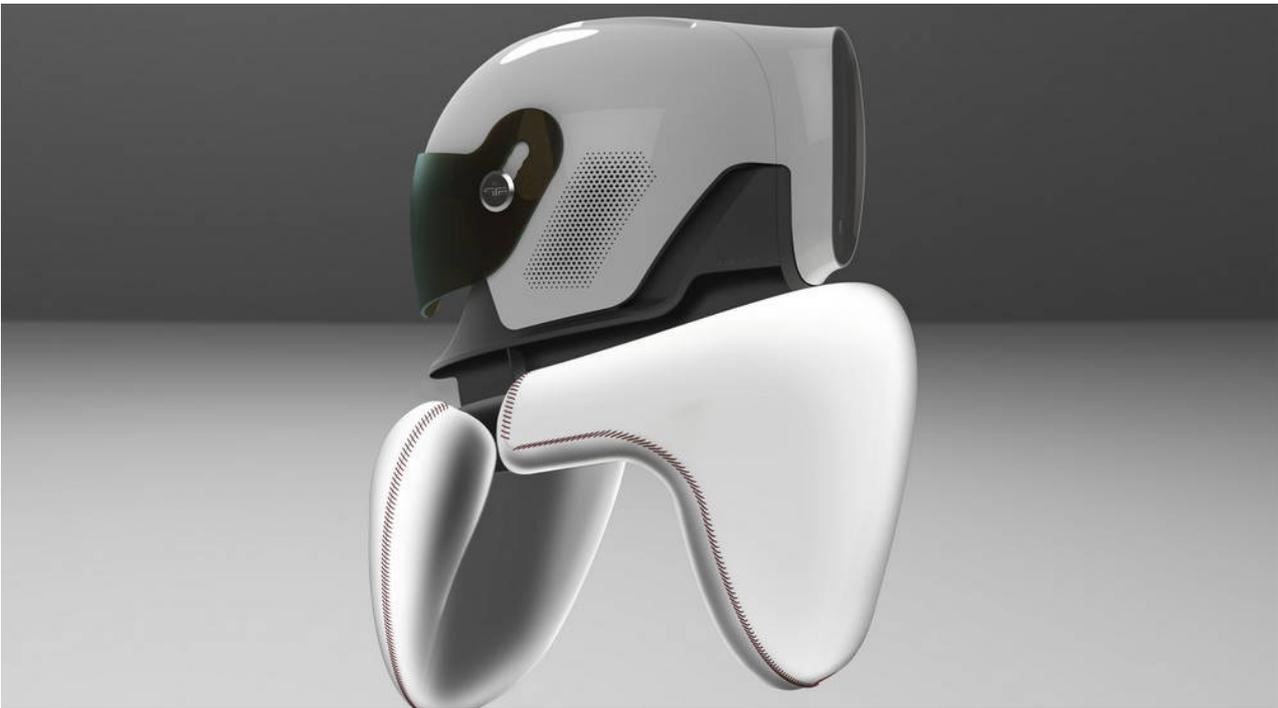


# PROTOTYPES



## POLARBAIR - THE SKI HELMET THAT PROVIDES HEAD AND NECK PROTECTION

Injury patterns in alpine skiing have changed over time as ski, boot, binding, and slope-grooming technologies have evolved. Despite advanced protection mechanisms, the level of ski injuries is high respectively. There are only a few airbags systems except cars, which protect users from various traumas. Therefore, Tim Fassbinder from the University of Wuppertal developing his innovative POLARBAIR, became the first one in this field applied the airbag protection system. The airbag includes a CO<sub>2</sub> cartridge and is activated with the help of the G-sensor, protecting the neck while the helmet' part protects the head.



Activated airbag

source - jamesdysonaward.org

Injury characteristics of extreme sports vary extensively due to their high-energy, high-risk nature. Specifically, head and neck injuries (HNIs) are of growing concern because of increased awareness of short- and long-term consequences. HNIs include concussions, fractures, and traumatic brain injuries (TBIs), which can result in outcomes such as chronic depression, headaches, paralysis, and, even, death. A lot of research described injuries associated with extreme sports; however, they have primarily focused on mainstream activities such as snowboarding, snow skiing, and skateboarding. Therefore, the inventor recognized that an important niche has a big potential for optimization.

Current ski helmet protects the skull area, but not the neck. However, wearing different neck protection often considerably limits the movement ability. To avoid this, but still protect the neck, Tim Fassbinder made **the airbag integrated into the ski helmet inconspicuously**. It is an additional protection that you can see only when you need it. **The airbag includes a CO<sub>2</sub> cartridge and is activated with the help of the G-sensor, being installed in the chin area of the ski helmet around.** The cartridge, arranged at the back for aerodynamic reasons, fills the airbag with air in a fraction of a second. Plastic flaps must be soft, but they can then be closed again when the airbag is rolled back in. In principle, the airbag works just like with airbag-motorcycle vests, with the only difference that it is not triggered by a ripcord but by a G-sensor. As ripcord could be

often activated due to the sudden deceleration or a hard shock, making the device dangerous. The CO2 cartridge, as well as the G-sensor, can be easily exchanged via an openable flap at the rear part. The inventor would like to optimize the invention with potential professional partners.



It does not require any transition compared to conventional neck protection and does not stimulate much to the lawn as a classic neck protector would do because you feel (too) safe  
source - jamesdysonaward.org



Materials and components. The rough textile cover of the neck area contrasts with the shiny surface of the helmet shell  
source - jamesdysonaward.org

**Company name:** University of Wuppertal  
**Contact person:** Tim Fassbinder  
**E-mail:** t-fassbinder@gmx.de  
**Website:** <https://uni-wuppertal.de/en/study-internatio..>  
**Phone:** -  
**Patent status:** -  
**On market since:** -  
**Regions:** Germany  
**Industries:** Sports and Recreation  
**Source links:** [James Dyson Award](#)



## STAR TREK-STYLE DEVICE CAN DIAGNOSE SKIN CANCER AND STROKE FAST AND PAINLESS

The group of scientists from the Aston University managed to develop a working prototype of a device that is able to take readings from blood and human tissue using laser beams. It doesn't use needles providing the non-invasive and painless method for easy diagnoses. The desktop machine uses three separate lasers to monitor health signs. It measures blood flow, blood-oxygen levels and looks at cell metabolism.

Furthermore, this innovational device has already been successfully trialled at a hospital in Dundee where it was used in order to diagnose skin cancers and strokes. Scientists mentioned that the device is a huge step forward in terms of improving the speed of diagnostic performing and also in terms of reducing invasive tests.

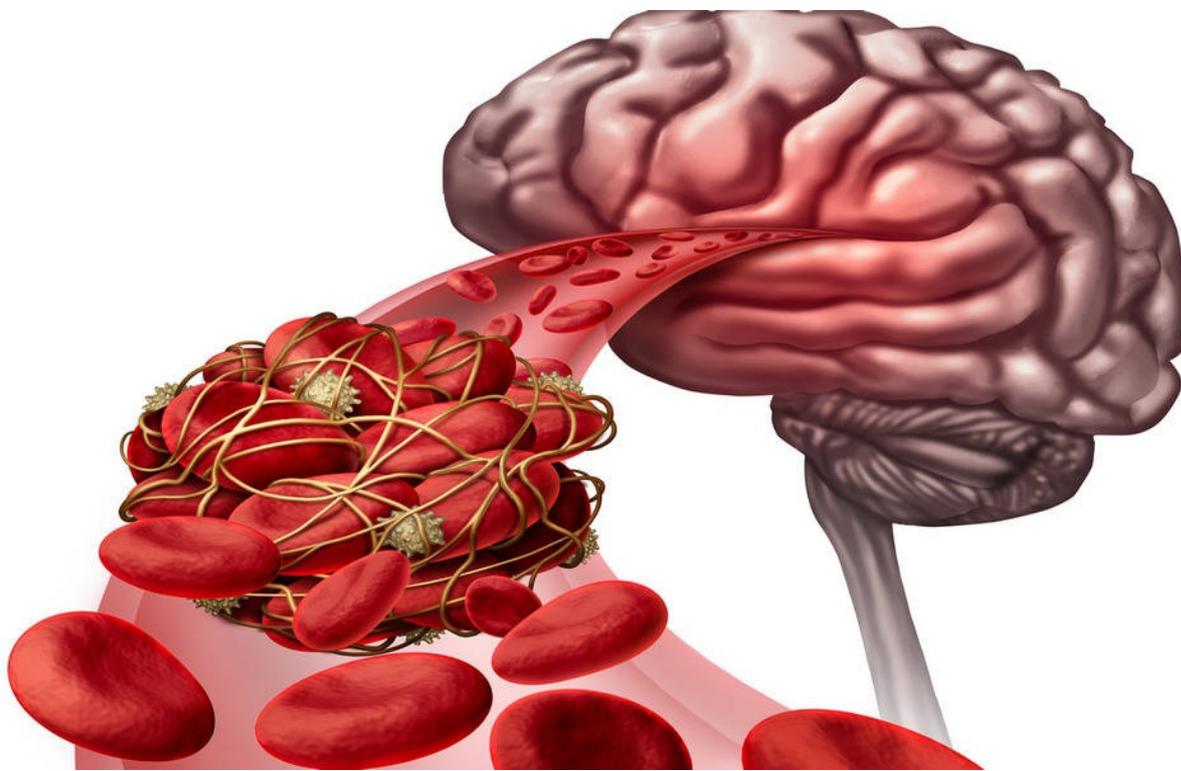


The innovation means the once fanciful idea of doctors using handheld gadgets to effortlessly diagnose a variety of ailments, first depicted in sci-fi television series Star Trek, may soon become reality  
source - [dailymail.co.uk](http://dailymail.co.uk)

The medical tricorder, that diagnoses various health problems at the push of a button in the science fiction television series Star Trek, is now a step closer to reality. Currently, the machine is based on a desktop computer but scientists already created a portable prototype that uses laser beams. It applies 3 separate lasers to monitor how effectively blood is delivered to tissue, measure blood-oxygen level and look at cell metabolism. The biggest advantage is that the device operates by shining the laser beam on the patient's skin, while the patient feels nothing. The data is instantly processed by a computer and represented as a graph.

The device constantly monitors blood delivery above the eyebrows, providing doctors with the ability to prevent or mitigate the risk of stroke in patients with hypertension. Furthermore, it can identify the margins of head and neck skin cancers highly accurate way, that can reduce the risk of cancer recurrence. Professor Edik Rafailov mentioned that this novel technique allows performing a range of tests very quickly, painlessly and without any reason for patients to feel psychological discomfort as it doesn't apply any needles. The technology is almost ready to go into production, and the university launched [Aston Medical Technology Limited](#) in order to commercialise inventions. Also, the wearable

monitor prototype was created that athletes can wear on their wrists. Consequently, scientists have managed to combine several methods in one compact device, which provides a quick, safe, non-invasive diagnosis of patients.



Scientists have managed to bring together multiple technologies in a machine that is compact, simple to use. Results are instantaneous, which is better for patients and more efficient for healthcare providers  
source - adobe.com

**Company name:** Aston University  
**Contact person:** Professor Edik Rafailov  
**E-mail:** e.rafailov@aston.ac.uk  
**Website:** <http://www.aston.ac.uk/>  
**Phone:** 0121 204 3718  
**Patent status:** -  
**On market since:** -  
**Regions:** United Kingdom  
**Industries:** Electronics, Healthcare  
**Source links:** [Daily Mail](#)



## ARCAORANGE IS A HOLISTIC CONCEPT FOR WASTE DISPOSAL

Tobias Leonhardt and Angelo Schulz from the University of Design Schwaebisch Gmuend developed an innovative waste disposal system, which is called ArcaOrange and has the ability to compress and squeeze voluminous packaging and to vacuum-seal trash-bags. The system can liquidate unpleasant odors and overflow. Moreover, it has a vacuum-hoover for sweepings and 3 compartments for waste. The minimalistic design of ArcaOrange is the perfect alternative for every kitchen and operates with low-power a powerful product. It is the all-in-one product that can provide the comfortable recycling system.



Recycling and political aspects became bigger issues in the project. Simultaneously developers created first models for our ideas out of cardboard with simple mechanisms to better estimate sizes and possibilities  
source - jamesdysonaward.org

The home recycling requires a trivial amount of time, however, it provides substantial benefit to the homeowner as well as the environment. In 2016, world plastics production totaled around **335 million metric tons**. There are **5.25 trillion** pieces of plastic debris in the ocean. Of that mass, **269,000 tons** float on the surface. Shoppers worldwide are using approximately **500 billion** single-use plastic bags per year. Despite these facts, with some things, people can manage to set up a system of reuse just at home. For example, recycling just 1 aluminum can save enough energy to run a TV for 3 hours. Furthermore, it may return to the grocery store 60 days after collection. Most recycled aluminum is used to make new cans. There is no limit to the amount of aluminum reuse.

Therefore, developers were intended to create a useful product for micro apartments and provide the solution for the domestic waste. Furthermore, they decided to combine ideas in order to generate a holistic concept with advantages for all parties - the consumer, the communities and the recycling companies. The system has 2 pneumatic springs, which allow the compression. The suction tube can be unfolded from the back cover. The vacuum motor is activated when pulling it down and the electric valve closes the hole at the suction bar. The garbage collection for organic waste is removable, the filter with activated carbon prevents the seepage of bad odors from this device. Below is a section for household waste, where the vacuum unit is also combined from the vacuum cap. **The ArcaOrange design is minimalistic in order to provide the best experience of disposing**

and eliminating unpleasant smells. The vacuum turbine, 2 pneumatic springs, and several molded parts make ArcaOrange very easy to repair and can be manufactured with the little number of materials, which makes it cost-effective and fully recyclable. The developers are going to optimize the design in terms of production and use the compression unit also for other kinds of waste. After this, they are planning to commercialize the product.



The concept itself does not just focus on just one stakeholder but bothers about everyone advantage  
source - jamesdysonaward.org



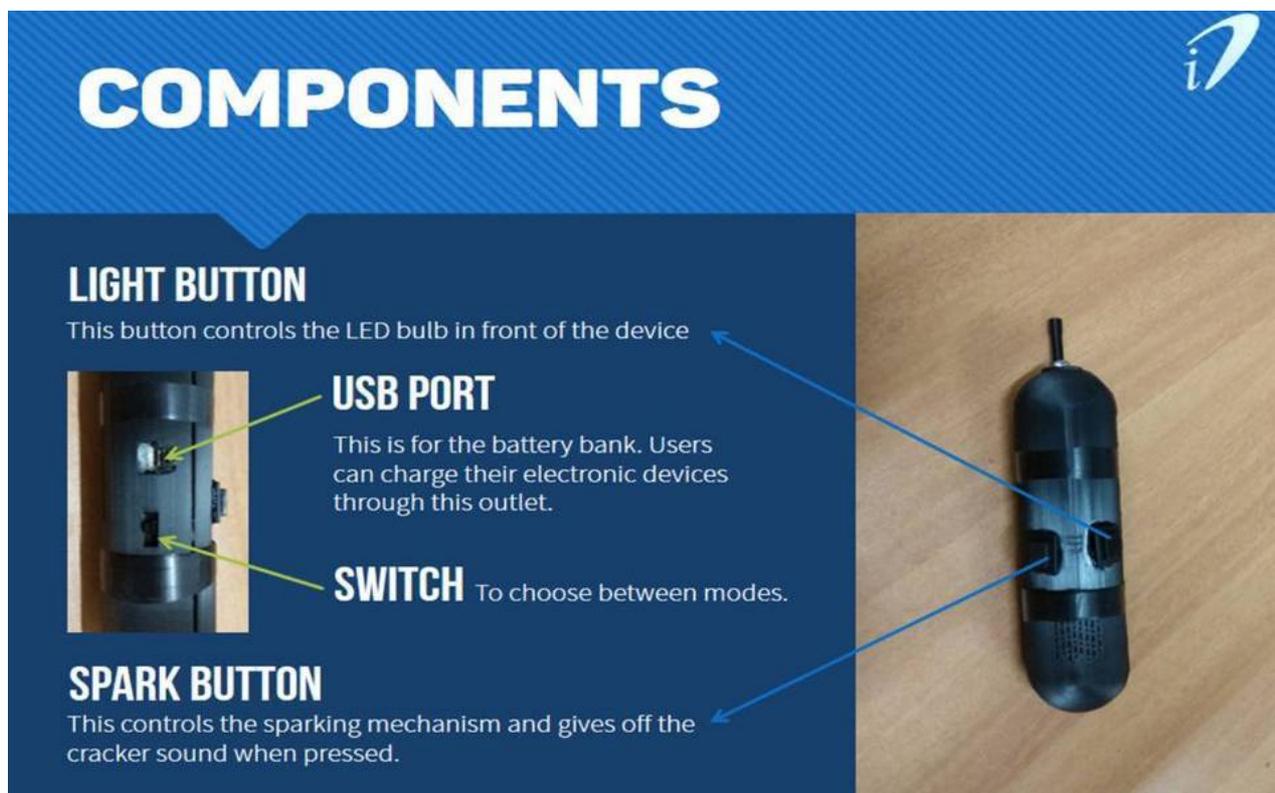
ArcaOrange is an all-in-one product, which is not just for micro-apartments, but for every household and provides a comfortable experience connected with recycling  
source - [jamesdysonaward.org](http://jamesdysonaward.org)

Company name: ArcaOrange  
Contact person: Tobias Leonhardt  
E-mail: -  
Website: <http://leonhardttoobias.de/arcaorange>  
Phone: -  
Patent status: -  
On market since: -  
Regions: Germany  
Industries: Environment  
Source links: [ArcaOrange](#)  
[James Dyson Award](#)



## UCOM CAN PREVENT STRAY DOG ATTACKS

Shyam Pradeep from the Calicut University developed a special tool UCOM or Your Companion Stick that provides the protection against stray dog attacks. It is the extendable strong pipe-like stick with different functionalities used to fight against the increasing dog menace. The stick provides a variety of functionalities which scares the dog away and does not involve killing or harming the stray dogs, thus preventing unnecessary controversies. It can be carried around in handbags, thus making it comfortable and easy to use.

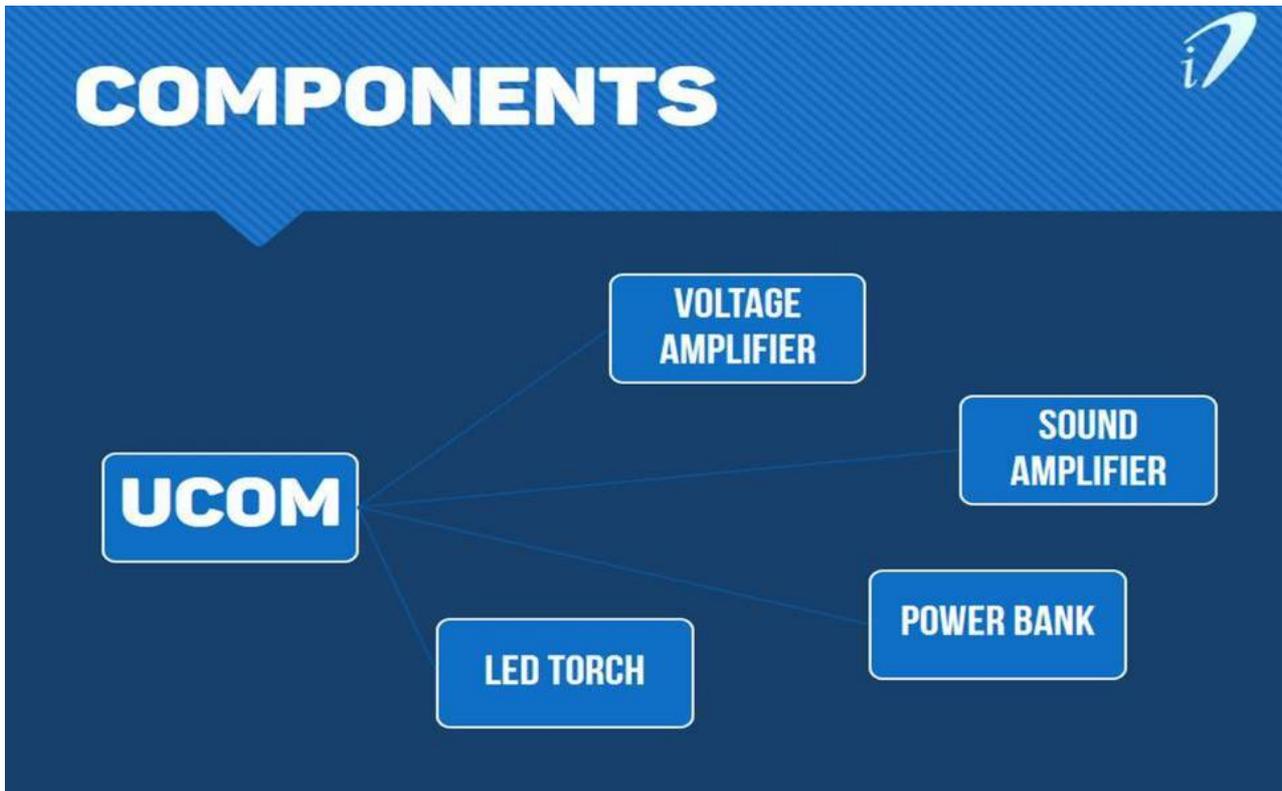


The first prototype of UCom was developed only with spark & shocking system and a torch. It was built from a small piece of stainless steel pipe and circuit board of a mosquito swatter  
source - jamesdysonaward.org

According to the [World Health Organization](#), there are no global estimates of dog bite incidence, however, studies suggest that dog bites account for tens of millions of injuries annually. In the United States of America for example, approximately **4.5 million** people are bitten by dogs every year. **30 000** people have reconstructive procedures. Furthermore, **3–18%** develops infections and between 10 and 20 fatalities occur. However, such a problem is extremely important for developing countries and low-income countries, because people are biting not just single dogs, but often people are attacked by the stray dogs. Study results demonstrate that dogs account for **76–94%** of animal bite injuries.

Dogs are afraid of loud noises. Therefore, the principle of this technology' action is very simple. The inventor and his team developed a **similar mini-mechanism that scares dogs in a completely harmless way**. The **flashing mechanism** is built into the front of the stick shocking the dog (the moment continuous some period of time) and providing the ability to react appropriately. This sparkle is absolutely harmless for both people and animals. The only purpose of this function is to scare dogs. The brightest torch is also attached to the very end of the spark. The stick can be put in the bag due to its **small size and lightweight**, making it useful for women who work or travel alone or at night. The power bank is also

integrated into UCOM makes it the most powerful companion. The pill-shaped carcass was designed and 3D printed. The custom circuit board capable of generating a high voltage of about 2000 V with a negligible current of 200 micrometers was also designed. The main idea behind the concept underlying this device is that it is safe to the user, protecting him from possible attacks due to a specially developed systems of light and sound flashes, and does not harm the animals.



A music player and a power bank were also integrated into the second prototype to make it more useful than a mere stray dog repellent stick  
source - jamesdysonaward.org

**Company name:** Infusory Designs  
**Contact person:** Shyam Pradeep  
**E-mail:** shyam@infusorydesigns.com  
**Website:** <https://infusorydesigns.com/>  
**Phone:** -  
**Patent status:** -  
**On market since:** -  
**Regions:** India  
**Industries:** Creative Industries, Electronics  
**Source links:** [James Dyson Award](#)



## A NOVEL DEVICE CAN CONTROL HERBICIDES USE

The international group of scientists has developed an innovative device that controls the use of herbicide significantly decreasing the crop damage and contamination of the soil. The device applies the herbicide by contact with weeds comparing to conventional devices that with conventional devices that spray continually. Furthermore, this method overcomes losses due to chemical drainage and percolation of the soil that decreases the environmental pollution.



The field experiments showed that groundnut plant damage with the device was 3.6 times less than constant spray application (CSA) and 1.37 times less than constant contact application  
source -researchstash.com

Weeds hamper a major part of crop production. The manual removal of weeds is a labor-intensive activity, which requires a huge and constant labor force, economic costs and time. The use of chemicals to delete them is dangerous to the environment since such a method not only damages crops but also pollutes the soil by making it unsuitable for plants and significantly reducing future harvests.

Scientists from the [Indian Institute of Technology, Kharagpur](#) in collaboration with the [Central Potato Research Institute, Shimla](#), the [Central Institute of Agricultural Engineering, Bhopal](#), and the [Washington State University](#) developed the **robust contact-type weed eradicator** that is based on position sensing, digital image processing and the microcontroller for weed control in common crops.

The contact methodology efficiently interacts with weeds and minimizes the chemical drift. A roller-wiper absorbing pad-type contact weed eradicator was therefore developed and tested with crawler tractor at various speeds for woody plant control. The roller-wiper contact applicator was further tested for leafy spurge control. **The device releases the precise amount of herbicide due to the sensing weed density between the crops using the image analyzer**, which was developed in [Visual Studio Open](#) computer vision platform for use under varying illumination levels. The graphic user interface was developed for

parametric adjustments of the image analyzer. The image analyzer conducts image analysis after image acquisition and the data is sent via computer serial to the microcontroller for pulse width modulation controlled chemical release. Solenoid valves are used for liquid release on sponge rollers. The machine locomotion sensing is done through an inductive type proximity switch. Comparing to standard systems, the amount of herbicide varies for every 5% change in weed infestation during the use of this technology.



Field experiments on dry land with groundnut and maize crops have shown that the use of the device increased production, reduced crop damage and also saved around 80% of the herbicide  
source - adobe.com

Furthermore, scientists are going to create the portable variant making it suitable for all farmers because some cannot afford to have tractors.

**Company name:** Indian Institute of Technology, Kharagpur

**Contact person:** -

**E-mail:** nm@agfe.iitkgp.ernet.in

**Website:** <http://www.iitkgp.ac.in/>

**Phone:** +91-3222-283166

**Patent status:** +

**On market since:** +

**Regions:** United States, India

**Industries:** Food and Drink

**Source links:** [Current Science](#)  
[Research Stash](#)

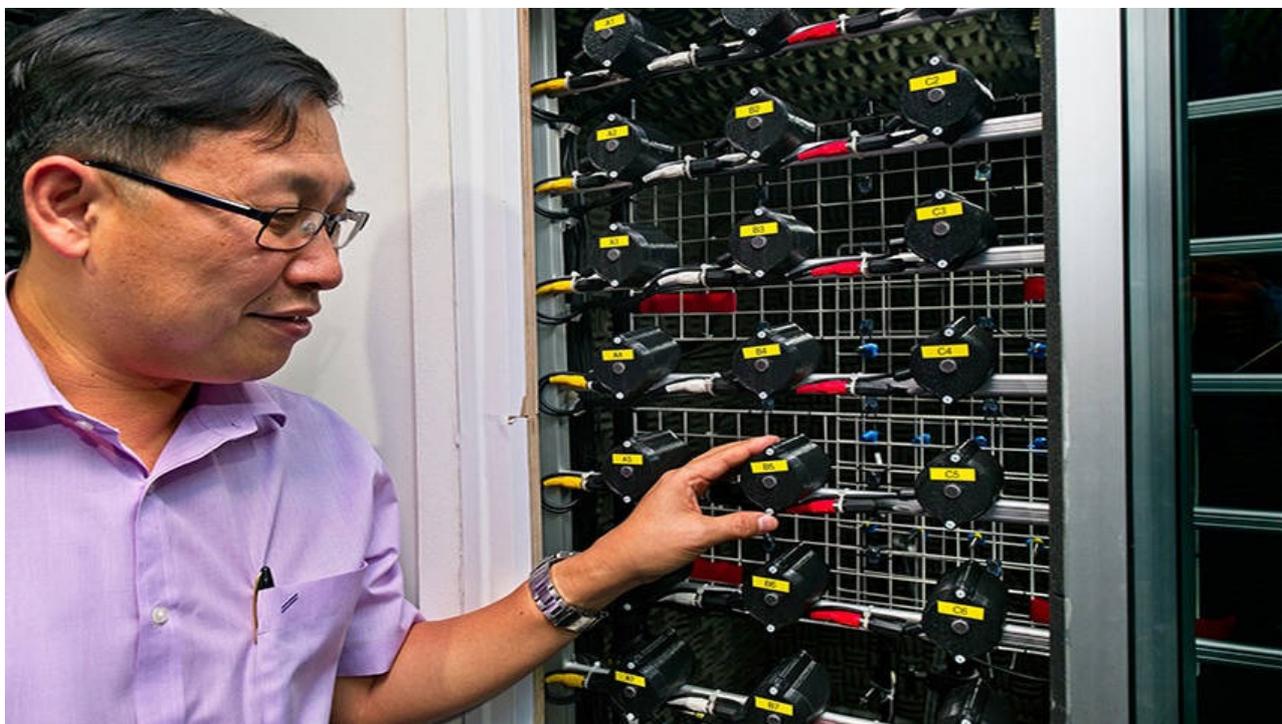


## THE NOVEL DEVICE CAN REDUCE THE NOISE POLLUTION UP TO 50%

The international group of scientists developed an innovational technology that has the ability to decrease the noise pollution, which enters the buildings, even in the case when windows are open. The device should be installed into window grilles, reducing the noise up to 50% from nearby environments such as highways, railways, construction work and just background noise. The development is based on the use of the Active Noise Control (ANC) technology, which is also applied in many high-end headphones that suppress external noise.

The device was created by the scientific group, led by Professor Gan Woon Seng, from the [Nanyang Technological University](#), in collaboration with the [Tottori University](#), Japan and the [University of Southampton](#), UK.

The well-known fact is that environmental noise such background music, city sounds, sounds of cars and trains, construction noise leads to the decrease of performance for most people. The most crucial moment is that not all sounds are easy to tune out. Furthermore, the study results demonstrated various city' sounds, for example, the noise of road traffic, significantly enlarge the risk of high blood pressure, especially noise exposure at night. The aircraft noise is linked to the raised risk of hospital admission and death for stroke, coronary heart disease, and cardiovascular disease in people who are situated in the nearby region. Scientists developed the device, which decreases surrounding sounds from opened window, using **ANC technology** that was adjusted to work in the big open area. ANC is a novel and very effective technology that in various applications is a perfect alternative to traditional solutions to industrial noise. The technology is based on the concept that sound vibrations can cancel themselves out. In other words, fighting with sound using sound.



This noise cancellation technology is an example of research innovations that NTU is encouraging under its Smart Campus initiative, which aims to improve quality of life for society  
source - [media.ntu.edu.sg](http://media.ntu.edu.sg)

The most significant advantage of this invention is that **windows can be open to getting more fresh air without disturbance from outside sounds and decreasing the demand for air-conditioning to keep the buildings cool**. Professor Seng mentioned that unlike headphones, which prevent noise around the ear, scientists managed to control noise in the big open area. The device uses **8 watts of power**. Few single units are inserted together in order to create a grid-like system on a window grille. The technology applies the sound emitting technique that operates as a speaker and is connected to a processing unit. Moreover, the device is appointed with a microphone providing the ability to detect the noise before it reaches the window. It calculates the inbound noise indexes in real time. The technology uses **countering sound or 'anti-noise'**, which has the same waveform features but it is inverted. Consequently, **when both sound and anti-sound meet, they stop each other**.

Scientists mentioned that they are going to re-make this technology into the more economical variant and also integrate it into the window' grid in order to decrease the harmful impact of the city.



It is supported by Singapore's Ministry of National Development and the National Research Foundation in the Prime Minister's Office, under the L2 NIC Research Programme  
source - NTU

**Company name:** Nanyang Technological University  
**Contact person:** Nur Amin Shah  
**E-mail:** aminshah@ntu.edu.sg  
**Website:** <http://www.ntu.edu.sg/Pages/home.aspx>  
**Phone:** -  
**Patent status:** -  
**On market since:** -  
**Regions:** United Kingdom, Japan, Singapore  
**Industries:** Creative Industries, Others  
**Source links:** [NTU](#)

# RESEARCH



## CONNECTIVE TISSUE PROBLEM CAUSES ACNE SCARRING

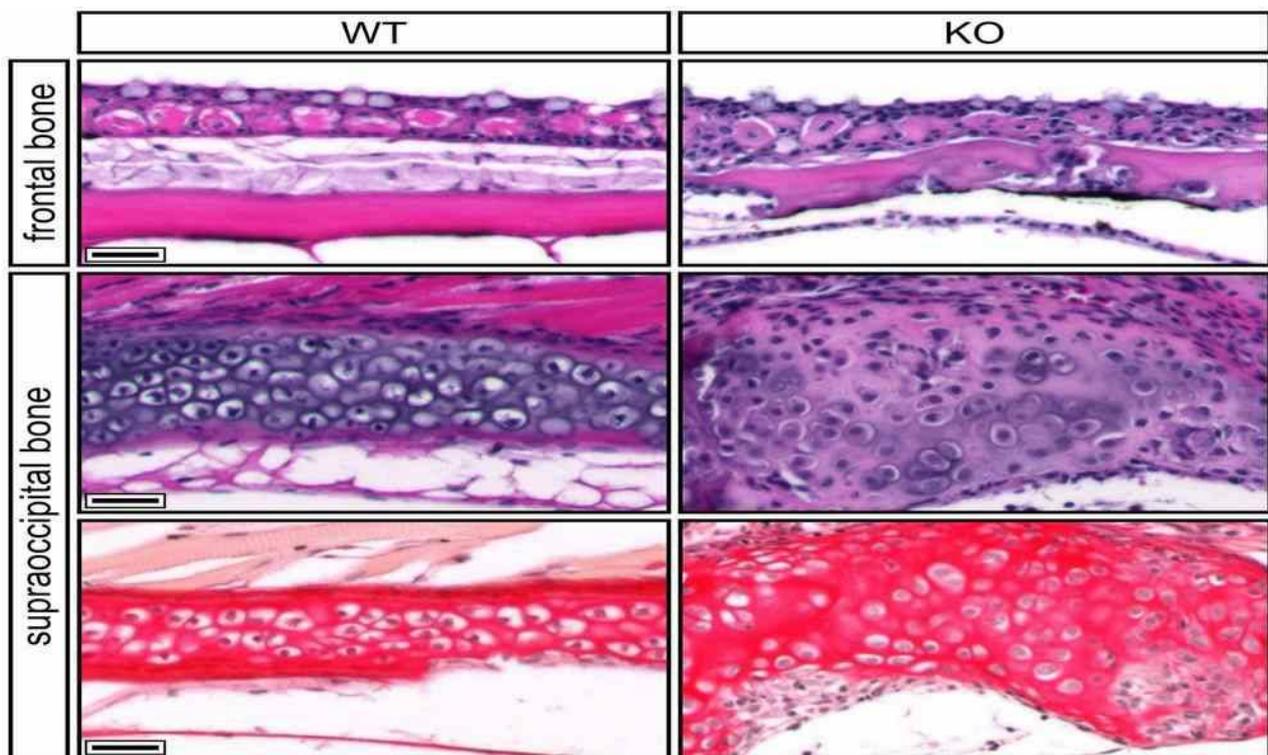
Acne vulgaris or acne is the most common skin disease in the world. The biggest problem is that acne can persist into adulthood and leave disfiguring scars, estimated to affect up to 95% of patients. The resulting disfigurement can lead to anxiety, reduced self-esteem and, in extreme cases, depression or even thoughts of suicide. The international group of researchers has managed to discover that acne, as well as the resulting scarring, is caused by connective tissue problems. Scientists determined that Winchester syndrome (WS), the disease that causes osteoporosis, leads to the cells' inability to digest the collagen that is around them. In addition, researchers developed a zebrafish model of WS in order to test new acne and osteoporosis treatment.



The starting point was to study a WS, which causes severe acne, bad scarring, and osteoporosis. Understanding the role of genes in rare diseases can help boost understanding of common diseases  
source - adobe.com

Acne vulgaris is the most common skin condition affecting late adolescents across the globe. According to the [Global Burden of Disease](#), acne affects about 85% of young adults aged 12–25 years. Acne consistently represents the top three most prevalent skin conditions in the general population, as found in large studies within the UK, France, and the USA. Recent studies have evaluated epidemiologic patterns of acne vulgaris in various ethnicities and regions, an adequate understanding of the worldwide burden of the disease associated with patients in their late adolescence remains lacking.

Therefore, researchers' team from the [A\\*STAR](#) in collaboration with the [Nanyang Technological University](#), the [University of Melbourne](#), the [National University of Singapore](#), the [Maastricht University Medical Center+](#), and the [University of Dundee](#) studying WS, determined a novel hypomorphic MMP14 p.Arg111His (R111H) allele, associated with a mitigated form of WS. This mutation impairs **MMP14's** proteolytic activity. Scientists, led by Professor Maurice Van Steensel from [A\\*STAR](#) discovered that the **symptoms arising from WS are all due to issues with an inability of cells to digest the collagen that is around them.** Collagen is the protein that makes up most of the connective tissue in the skin and is also essential for bones.



Left column: Bone in a normal zebrafish, collagen is red in the lower panel. Right column: Bone in a zebrafish with Winchester syndrome, showing the abnormal shape and collagen organization  
source - biotechn.asia

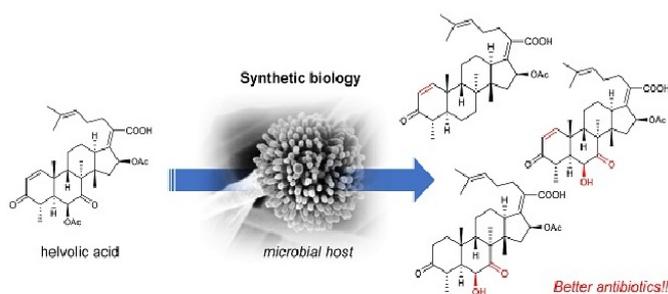
MMP14's catalytic activity is the prime determinant of disease severity. Given the limitations of the in vitro assays in addressing the consequences of MMP14 dysfunction, researchers generated a novel *mmp14a/b* knockout zebrafish model. The fish accurately reflected key aspects of the WS phenotype including craniofacial malformations, kyphosis, short-stature and reduced bone density due to defective collagen remodeling. This will provide the ability to develop and test innovative methods of therapies in order to treat acne, scarring, and osteoporosis.

Company name: A\*STAR  
Contact person: Prof Maurice Van Steensel  
E-mail: maurice.vansteensel@imb.a-star.edu.sg  
Website: <https://www.a-star.edu.sg/>  
Phone: -  
Patent status: -  
On market since: -  
Regions: Netherlands, United Kingdom, Australia, Sin.  
Industries: Healthcare  
Source links: [Human Molecular Genetics](#)  
[Biotechnin Asia](#)



## A SPECIAL TYPE OF MOLD HELPS TO SYNTHESIZE SUPERIOR STEROID ANTIBIOTICS

The scientific group, led by Ph.D. Dan Hu and Professor Ikuro Abe, from the University of Tokyo in collaboration with the Jinan University, has managed to obtain supernatural analogs of steroid antibiotics from a system they constructed for the microbial production of the antibiotics. They constructed a helvolic acid-producing system by expressing acids in a special type of mold called *Aspergillus oryzae*, which is typically used for fermentation in food production. Such analogs have better antibiotic activity than compounds synthesized through conventional natural methods. Furthermore, this novel discovery will provide the ability to apply the synthetic biology methods in drug development by offering a scaffold for pharmaceutically important molecules.



Artificial biosynthesis of steroid antibiotics. A synthetic biology method enables us to create novel antibiotics in an efficient and easy way  
source - u-tokyo.ac.jp

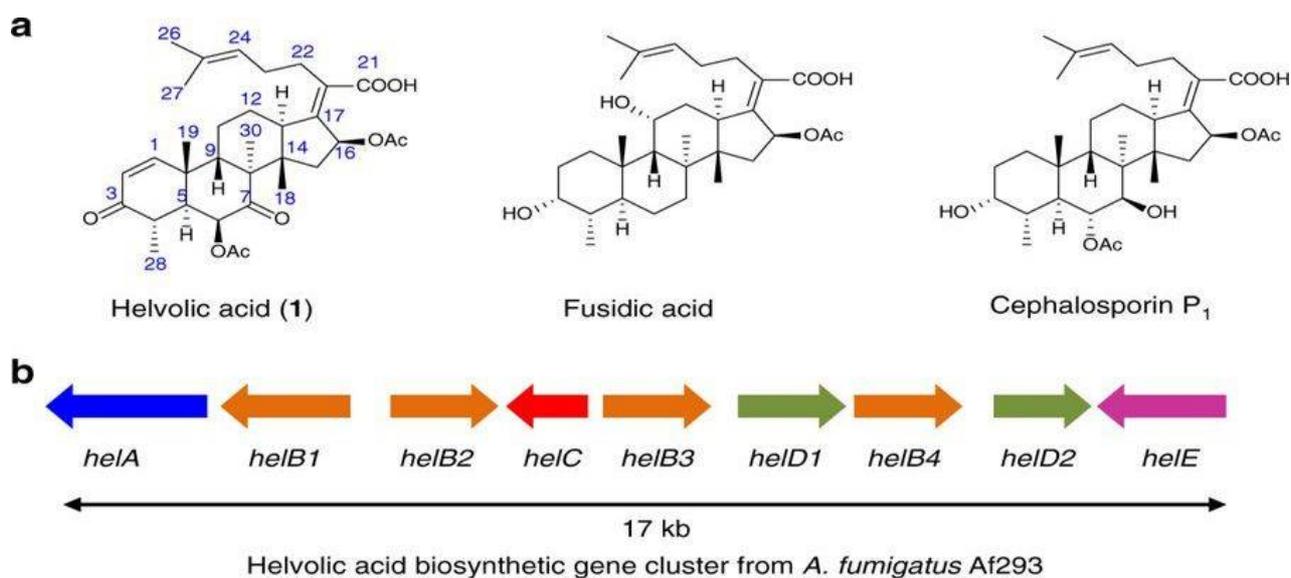
Natural products have aroused a great interest among scientists due to their enormous structural diversity and proved to be a valuable source for the discovery of drugs. Among these products, a group of steroid antibiotics, represented by fusidic acid and helvolic acid, exhibits great antimicrobial activity, suppressing the translation system. However, the lack of biosynthetic data about steroidal natural products prevented their production with the help of biosynthetic enzymes. Therefore, scientists received the newest helvolic acid analogs by isolating the biosynthetic intermediates from the system.



This development will allow researchers to biosynthesize fusidane-type antibiotics and demonstrate the applicability of synthetic biology to generate analogs of helvolic acid  
source - adobe.com

By performing a stepwise introduction of the nine genes from the proposed gene cluster for helvolic acid into *Aspergillus oryzae*, they were able to isolate helvolic acid and its **21 derivatives**. The important moment is that some of the analogs provided better activity than helvolic acid, thereby approving the advantages of this production system. By comparing the structures, scientists managed to find out that the structural difference

between the A and B rings of the compounds are critical for antibiotic activity. They clarified the C-4 demethylation pathway, which involves a P-450 oxidase and a reductase. In addition, Anti-Staphylococcus aureus testing demonstrates that the antibacterial activity of 3 intermediates is even stronger than that of helvolic acid. Prof. Abe emphasized that scientists were managed to develop an innovative production system for steroid antibiotics.



Representative fusidane-type antibiotics and biosynthetic gene cluster of helvolic acid a Structures of helvolic acid, fusidic acid and cephalosporin P<sub>1</sub>; b Gene map of the helvolic acid gene cluster from source - nature.com

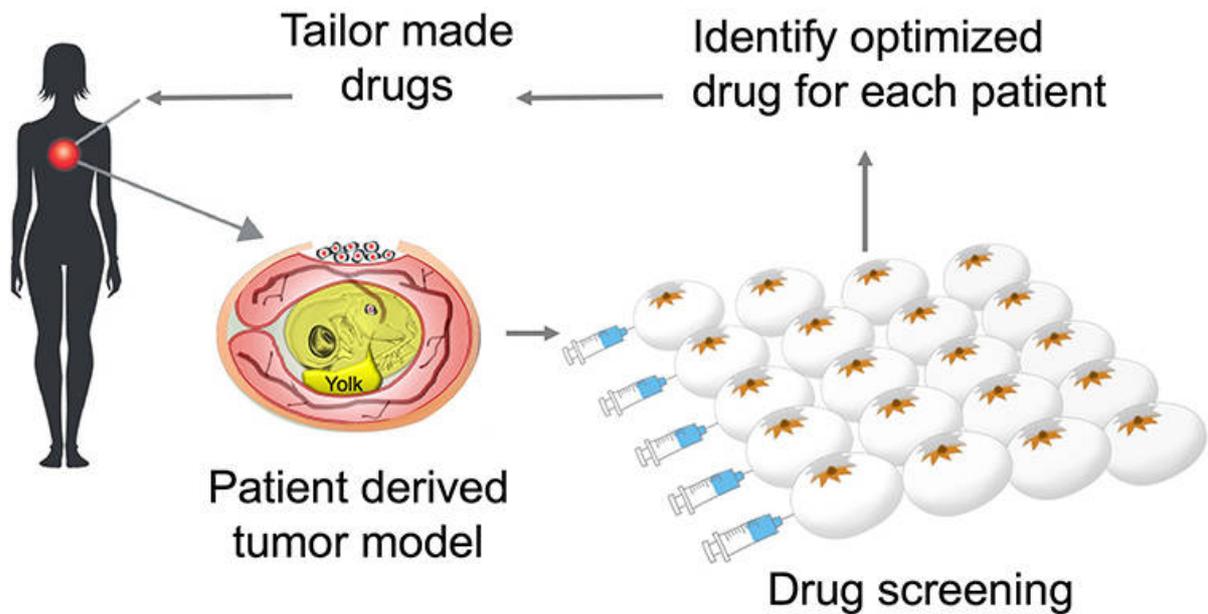
The research was supported by [Grants-in-Aid for Scientific Research on Innovative Areas 'Creation of Complex Functional Molecules by Rational Redesign of Biosynthetic Machineries'](#) and a [JST/NSFC Strategic International Collaborative Research Program Japan-China 'Exploitation of the cryptic secondary metabolites from plant microbiome through biological interaction'](#).

**Company name:** University of Tokyo  
**Contact person:** Professor Ikuro Abe  
**E-mail:** abei@mol.f.u-tokyo.ac.jp  
**Website:** <https://www.u-tokyo.ac.jp/en/>  
**Phone:** +81-3-5841-4740  
**Patent status:** -  
**On market since:** -  
**Regions:** China, Japan  
**Industries:** Healthcare, Biotechnology  
**Source links:** [University of Tokyo](#)  
[Nature Communications](#)



## A CHICKEN EGG CAN PROVIDE AN INDIVIDUALIZED CANCER THERAPY

The international team of researches has developed an innovative method of testing new therapies for ovarian cancer. They used the chicken egg to evaluate the efficacy of anticancer drug delivery using recently developed biodegradable PMO (periodic mesoporous organosilica) nanoparticles. Human ovarian cancer cells were transplanted onto the CAM membrane of fertilized eggs, resulting in rapid tumor formation. The successful replication of ovarian tumors inside chicken eggs presents a new era for the individualized cancer treatment. This innovative testing technology has many advantages comparing to current testing methods such as mouse models.

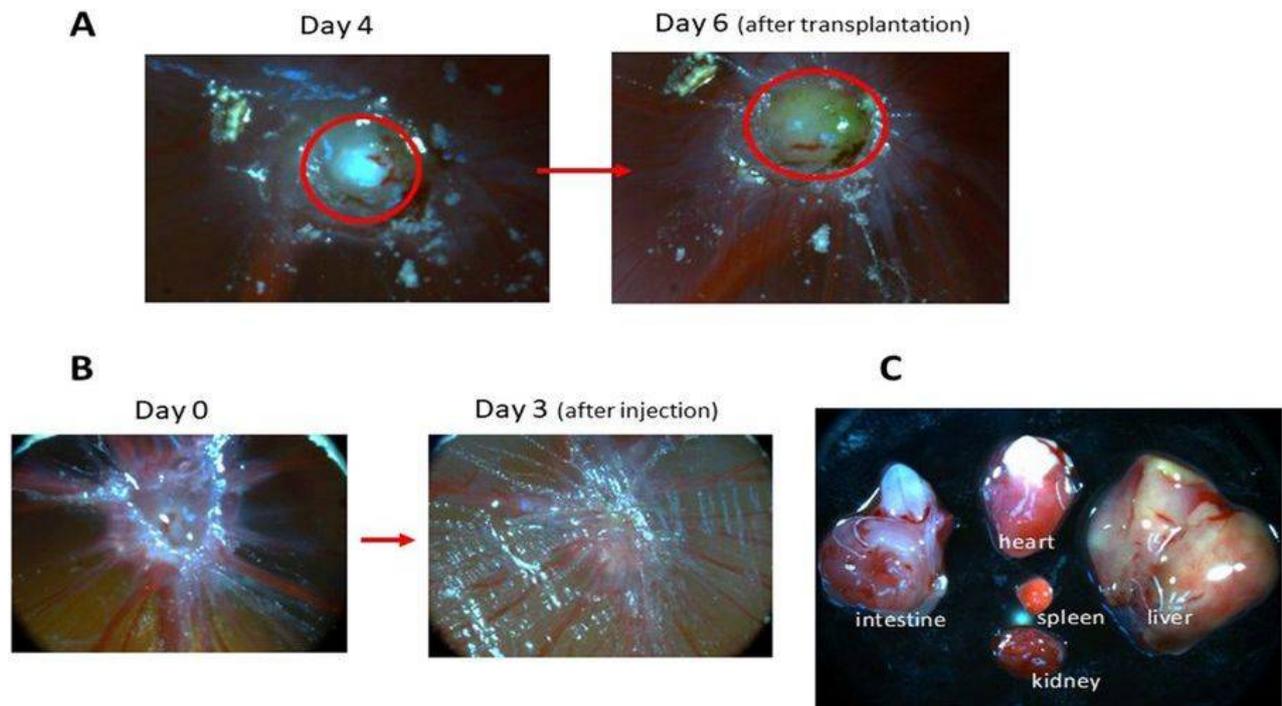


The tumors form much more rapidly on the chicken embryonic membranes than in mice due to the rich nutrient environment and the incomplete immune system at this stage of embryonic development  
 source - kyoto-u.ac.jp

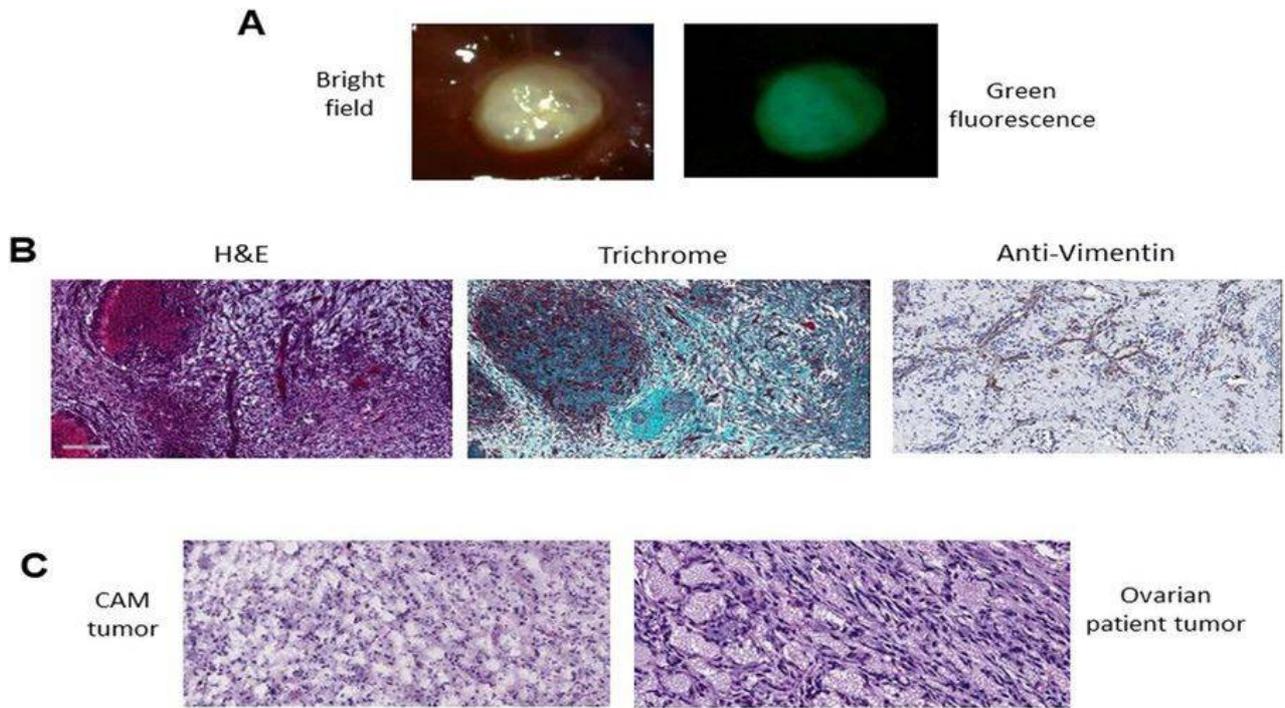
Ovarian cancer accounts for an estimated 239,000 new cases and 152,000 deaths worldwide annually. This disease has both the highest morbidity and mortality rate among cancers of the reproductive system. To initiate development of a novel therapy, it is necessary to employ a tumor model to evaluate its efficacy. Therefore, researchers from the [Kyoto University](#) in collaboration with the [City of Hope-Beckman Research Institute](#), the [Institut Charles Gerhardt Montpellier](#), the [King Abdullah University of Science and Technology](#), the [University of California](#), the [Vietnam National University-Ho Chi Minh City](#), and the [University of New Mexico](#) decided to apply the chicken egg as the tumor model, which possesses various advantageous features.

They transplanted cultured ovarian cancer cells into a top of the membrane that surrounds a 10-day-old chicken embryo. An ovarian tumor forms on top of the membrane within 3 days of transplantation. The tumor closely resembles cancer patient tumor and contains extracellular matrix as well as stromal cells and extensive vasculature. Scientists received similar results when they used ovarian tumor samples taken directly from patients, demonstrating that the chicken egg model provides a convenient system for replicating human cancer. Furthermore, this method is much faster as it takes weeks to do the same with mice. The scientific group, led by Dr. Fuyuhiko Tamanoi in cooperation with colleagues in France and Saudi Arabia, also developed a new type of biodegradable

silica nanoparticle that is only 200 nanometers in size. PMO nanoparticles loaded with doxorubicin were injected intravenously into the chicken egg resulting in the elimination of the tumor. Moreover, the biodegradable PMO with the doxorubicin quickly eliminated the human ovarian tumors **without affecting other organs in the chicken embryo**. Consequently, this novel technique provides the individualized cancer treatment.



The tumor is eliminated after intravenous injection of PMO-1 containing doxorubicin. Chick embryo major organs look normal three days after injection  
source - nature.com



Characterization of ovarian tumor established on the CAM membrane. The tumor formed on the CAM membrane by transplanting Ov8GFP cells  
source - nature.com

**Company name:** Kyoto University  
**Contact person:** Dr. Fuyuhiko Tamanoi  
**E-mail:** fuyut@microbio.ucla.edu  
**Website:** <https://www.kyoto-u.ac.jp/en/>  
**Phone:** 310-206-7318  
**Patent status:** -  
**On market since:** -  
**Regions:** United States, France, Japan, Saudi Arabia...  
**Industries:** Healthcare, Biotechnology  
**Source links:** [Kyoto University](#)  
[Scientific Reports](#)



## THE NEWEST TEST CAN PREDICT THE RISK OF HEART ATTACK

The researchers' team, led by Professor Louise Burrell, from the University of Melbourne in collaboration with the Austin Health has developed a world-first blood test that is able to significantly improve the prediction of the long-term risk of heart attack in people with severe coronary artery disease (CAD). Using this blood test, doctors will be able to identify patients with a high risk of suffering a life-threatening cardiac event. Scientists managed to find that the higher the level of circulating ACE2, the greater the risk to have a heart attack. The high level of ACE2 more than doubled the chances of heart attack, heart failure, and death over 10 years among patients with CAD.



It is emerging as an increasingly promising avenue for researchers looking to understand who is at the greatest risk of dying from CAD

source - [pursuit.unimelb.edu.au](http://pursuit.unimelb.edu.au)

CAD is the most common type of the heart disease when arteries become clogged with fatty plaque. Globally, CAD is the leading cause of death and is predicted to remain so for the next 20 years. According to [WHO](http://www.who.int), each year, approximately **3.8 million men and 3.4 million women** die from CAD. In 2020, it is estimated that this disease will be responsible for a total of 11.1 million deaths globally. This novel research provides medicals with a new biomarker for identifying those patients who are at high risk and may need their medications increased or other measures to prevent future heart attack or heart failure. The **angiotensin converting enzyme 2 (ACE2)** is an endogenous regulator of the renin-angiotensin system. Increased circulating ACE2 predicts adverse outcomes in patients with heart failure (HF). Furthermore, scientists determined that the plasma ACE2 activity independently increased the hazard of adverse long-term cardiovascular outcomes in patients with obstructive CAD.

The researchers followed **79 patients with CAD over 10 years** and found that 46% of them experienced heart attacks, heart failure or death in that time. Moreover, in those with **the highest levels of ACE2, the risk was increased by 2.5 fold compared to patients with lower levels of ACE2**. ACE2 plays a big role in breaking down a peptide, which is called angiotensin II, that causes inflammation and constriction in the blood vessels, contributing to the development of cardiovascular disease. Therefore, rising of the

ACE2 level is the protection mechanism of the body. The level of the enzyme begins to increase with the onset of cardiovascular risk factors, such as hypertension and high lipids. A further increase is observed in heart failure and abnormal heart rhythms. Consequently, this ACE2 targeted blood test is able to identify patients with a high risk of CAD or heart attack.



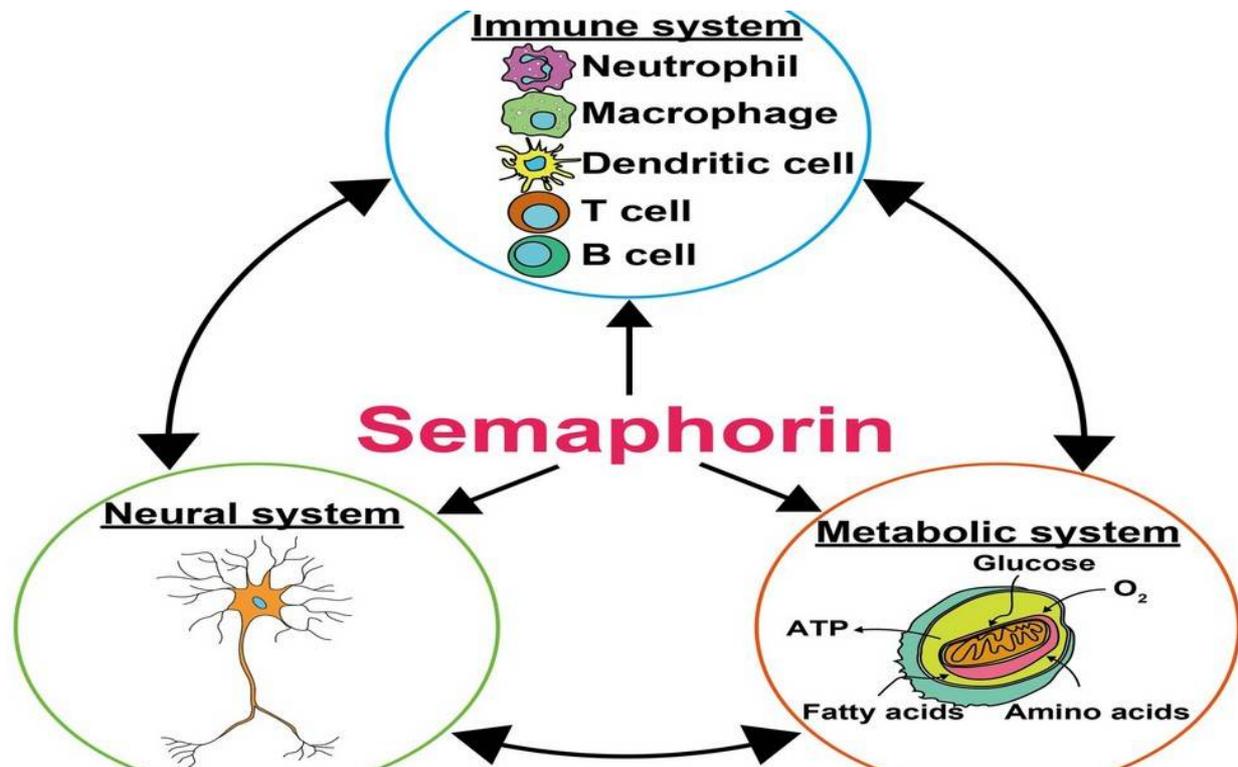
Clinical guidelines could be updated to include high ACE2 levels to a range of biomarkers already used in treating patients with coronary artery disease  
source - [pursuit.unimelb.edu.au](http://pursuit.unimelb.edu.au)

**Company name:** University of Melbourne  
**Contact person:** Professor Louise Burrell  
**E-mail:** l.burrell@unimelb.edu.au  
**Website:** <https://www.unimelb.edu.au/>  
**Phone:** -  
**Patent status:** -  
**On market since:** -  
**Regions:** Australia  
**Industries:** Healthcare  
**Source links:** [University of Melbourne](#)  
[PLOS ONE](#)



## A PROTEIN THAT CAN FIGHT INFLAMMATORY DISORDERS WAS FOUND

The scientific group, led by Sujin Kang, from the Osaka University has identified a Sema6D protein that has the ability to maintain energy supplies in immune cells that protect against inflammatory disorders. Macrophages are white blood cells, which are involved in different biological processes such as destroying infectious pathogens or repairing damaged tissue. To provide these functions, they must be activated and transformed into different subtypes. However, their activation is not fully clear. Despite this fact, scientists managed to define that Sema6D activates macrophages and allows them to take on a protective role against inflammatory disorders such as sepsis and inflammatory bowel disease (IBD).

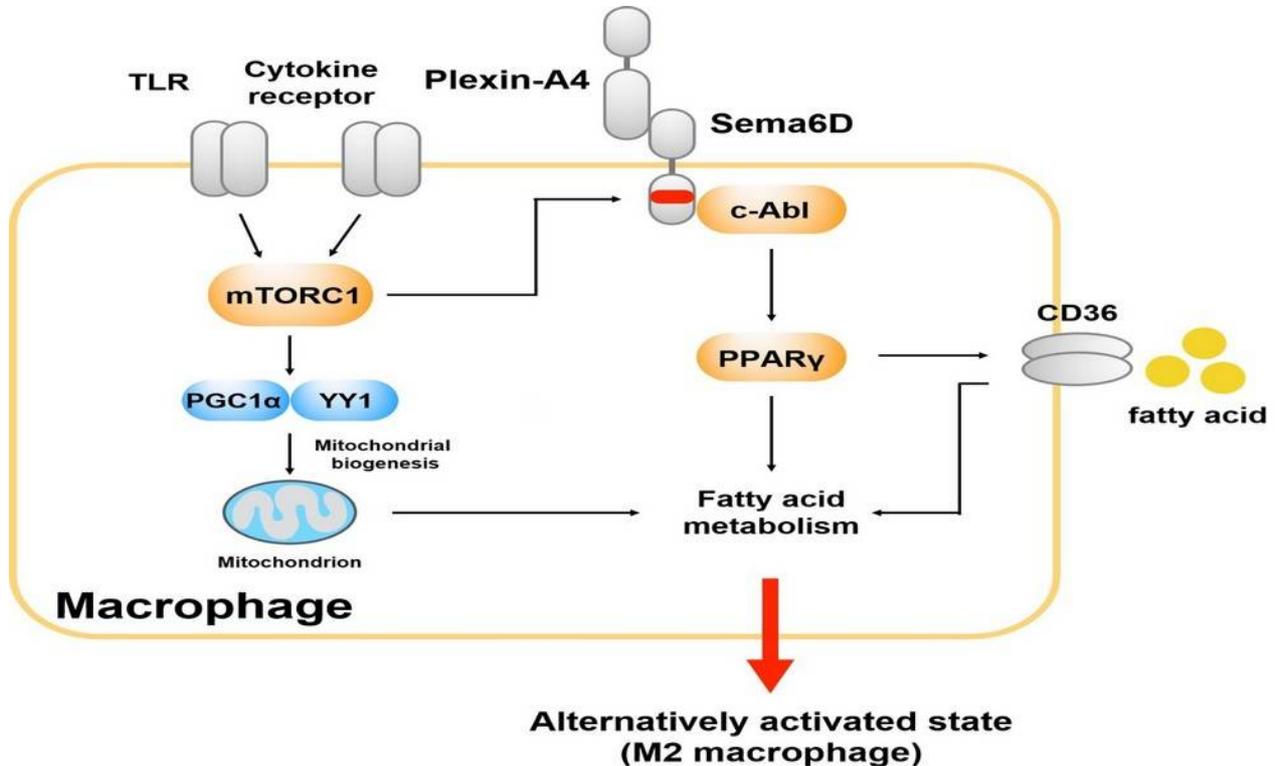


To gain insight into how M2 macrophages meet their energy demands, the researchers focused on a signaling pathway called mTOR, which is involved in cell metabolism and known to drive macrophages to the M2 type source - med.osaka-u.ac.jp

Macrophages are classified into 2 types, inflammatory (M1) or anti-inflammatory (M2). The M1 type plays a crucial role in the inflammatory response that kills invading organisms. M2 have anti-inflammatory abilities to protect against inflammatory disorders such as sepsis and Inflammatory bowel disease (IBD). The polarization of macrophages has distinct metabolic requirements, with the mechanistic target of rapamycin (mTOR) kinase signaling is highly important. The process in which mTOR regulates metabolic status in order to promote polarization of these cells is unknown. In other words, **mTOP transform macrophages into the M2 type.**

Inhibition of mTOR or loss of Sema6D blocked anti-inflammatory macrophage polarization, concomitant with severe impairments in PPAR $\gamma$  expression, uptake of fatty acids, and lipid metabolic reprogramming. Macrophage expression of the receptor Plexin-A4 is responsible for Sema6D-mediated anti-inflammatory polarization. When scientists genetically removed Sema6D from macrophages, the cells could no longer efficiently take up fatty acids from their environment, which is a crucial element if the energy source for M2 macrophages. Without this fatty energy, the macrophages were unable to perform their conversion into the M2 type. The study results demonstrated that mimics colitis models with the deficit of Sema6D have a shorter colon, severe infiltration of inflammatory cells,

and extensive damage to the cells lining the colon. Mr. Kang mentioned that this innovational discovery has crucial clinical implications, as will provide a new therapeutic target for the treatment of inflammatory diseases such as IBD and sepsis.



The scientific team used a chemical inhibitor to shut down the activity of the mTOR protein, allowing them to see how other players in the pathway were affected  
 source - med.osaka-u.ac.jp

**Company name:** Osaka University  
**Contact person:** Professor Atsushi Kumanogoh  
**E-mail:** kumanogo@imed3.med.osaka-u.ac.jp  
**Website:** <http://www.osaka-u.ac.jp/en>  
**Phone:** +81-6-6879-3833  
**Patent status:** -  
**On market since:** -  
**Regions:** Japan  
**Industries:** Healthcare, Biotechnology  
**Source links:** [Osaka University](#)  
[Nature Immunology](#)



## THE WAY IN WHICH P53 GEN PREVENTS CANCER DEVELOPMENT WAS DETERMINED

The well-known fact that gen p53, which is also called super tumour suppressor gene, causes at least half of all cancers. This gene regulates in which way the cell reacts to various irritant and stresses and can make a rogue cell to die or stop multiplying. Scientists from Australia have managed to discover how the most important cancer-preventing gene stops the development of lymphoma and potentially other types of cancer. Researchers found that the DNA repair gene MLH1 and as well as other related genes are decisive to p53's capacity to suppress the development of B-cell lymphomas. This innovational discovery will provide doctors with the ability to better identify patients with an increased risk of certain cancers. Furthermore, it will also allow creating safer and more effective therapies.



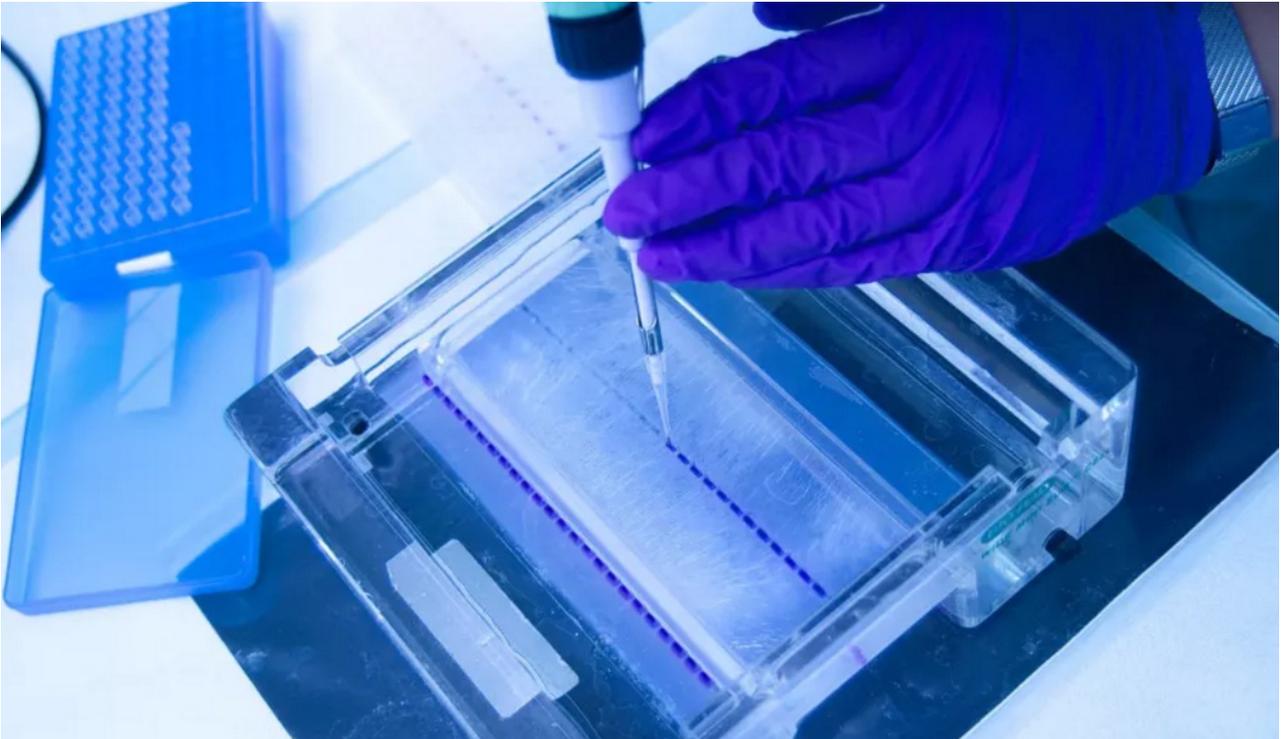
It has long been assumed that p53 suppresses tumor development through induction of apoptosis, possibly with contributions by cell cycle arrest and cell senescence  
source - [pursuit.unimelb.edu.au](http://pursuit.unimelb.edu.au)

This groundbreaking find was made by the scientific group, led by **Dr Ana Janic**, **Associate Professor Marco Herold** and **Professor Andreas Strasser** from the [University of Melbourne](http://www.unimelb.edu.au).

There some additional mechanisms that are critical mediators of p53-dependent tumour suppression function. To determine such mechanisms, scientists performed in vivo shRNA screens targeting p53-regulated genes in sensitized genetic backgrounds. Therefore, they managed to find that the loss of the DNA repair gene **Mlh1** caused lymphoma/leukaemia, and its forced expression has the ability to suppress the tumour development driven by the loss of p53.

Dr Janic mentioned that while the results will take few years to put it into a practice, the discovery is ground-breaking, making the treatment more effective and appropriate for each patient accordingly to the type of cancer. For example, if a patient has lymphoma with a mutation that disables the DNA repair mechanism, doctors will know to avoid certain DNA-damaging treatments, like chemotherapy, that can make cancer more aggressive. The study results demonstrated that extensive functional overlap of several p53-regulated processes safeguards against cancer and that coordination of DNA

repair appears to be a decisive process by which p53 suppresses tumour development. This discovery will provide the ability to investigate whether the DNA repair process is as significant in others type of cancers. Furthermore, if scientists will determine that the mutation in this gene causes about 50% of all cancers, it will pave the way to newest discoveries and effective treatments.



In DNA repair showed that knockdown of Mlh1, Msh2, Rnf144b, Cav1 and Ddit4 accelerated MYC-driven lymphoma development to a similar extent as knockdown of p53

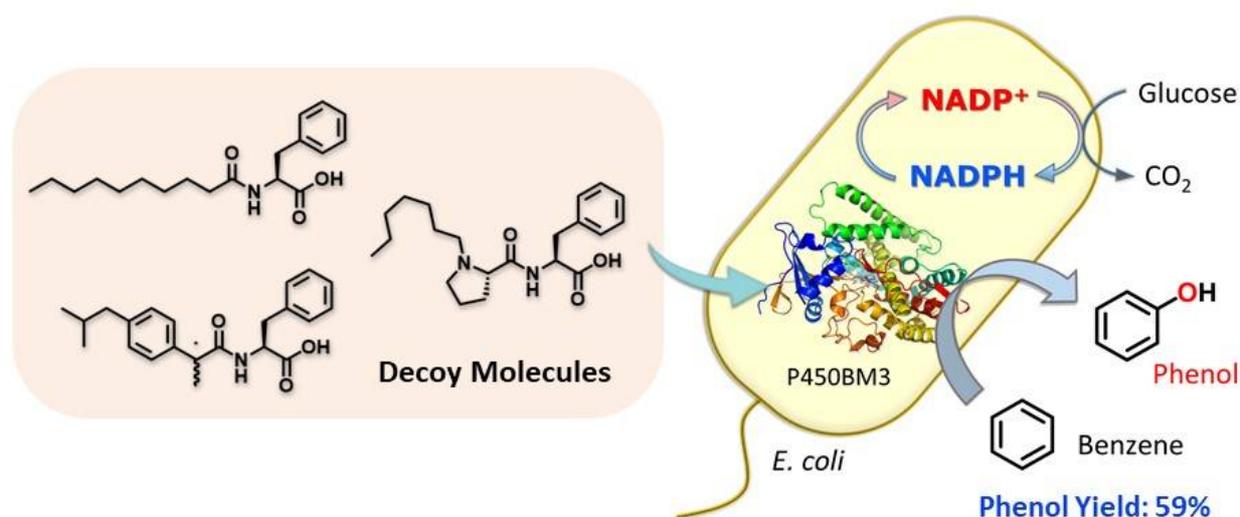
source - [pursuit.unimelb.edu.au](http://pursuit.unimelb.edu.au)

**Company name:** University of Melbourne  
**Contact person:** Professor Andreas Strasser  
**E-mail:** strasser@wehi.edu.au  
**Website:** <https://www.unimelb.edu.au/>  
**Phone:** -  
**Patent status:** -  
**On market since:** -  
**Regions:** Australia  
**Industries:** Healthcare  
**Source links:** [Nature Medicine](#)  
[University of Melbourne](#)



## E.COLI CAN CONVERT BENZENE INTO PHENOL

Phenol is one of the most important basic chemicals, widely used in different fields such as medicine or as a source of resin, fibres, and various organic materials. Complex processes and resources, in particular enzymes, are necessary for its production. For example, getting enzymes to perform novel reactions often demand a genetic modification of the enzymes themselves. Therefore, the scientific group from the Nagoya University used E.coli in order to transform benzene into phenol, simplifying a chemical reaction that is difficult by conventional methods. Moreover, scientists have determined that this method can be used for the modification of other bacteria.

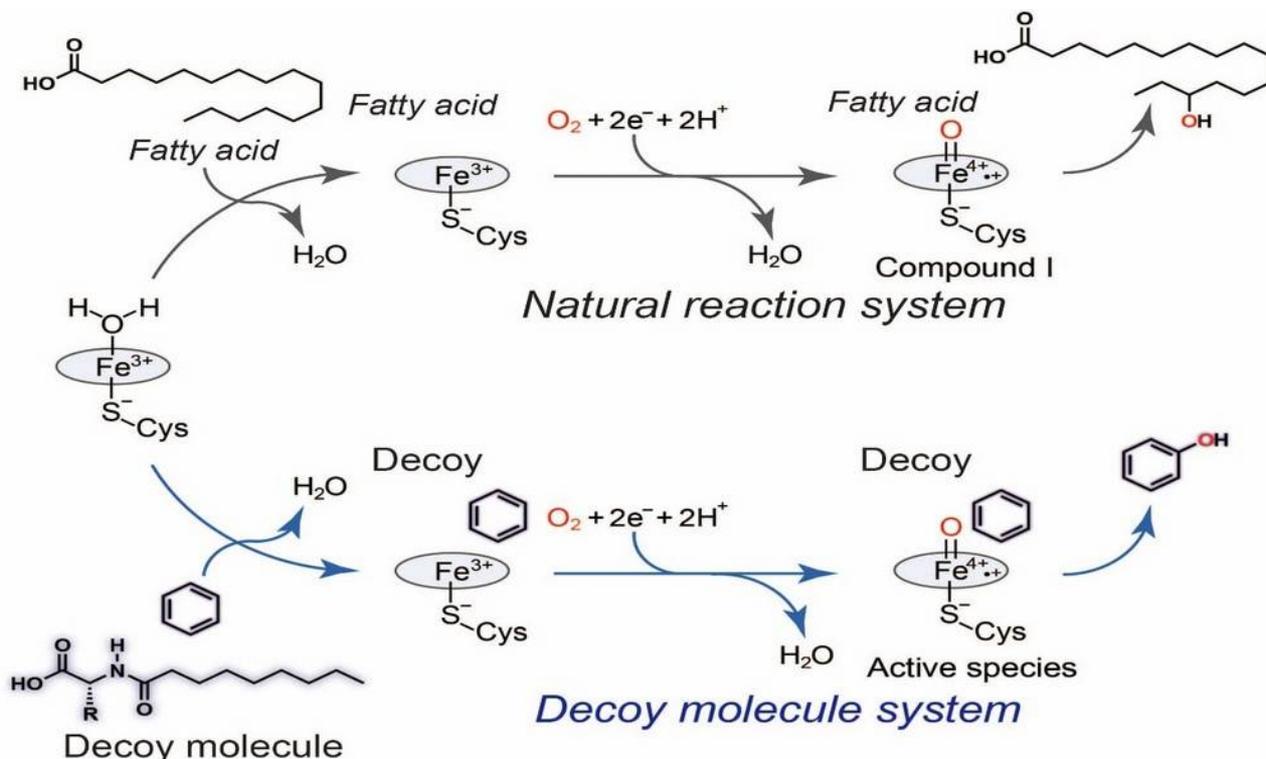


Whole-cell biocatalyst utilizing *E. coli* for benzene hydroxylation activated by decoy molecules. The advantage of our system is that C7-Pro-Phe can be taken up by the bacteria, where it activates P450BM3 in the cell  
 source - nagoya-u.ac.jp

Currently, breaking carbon-hydrogen bonds is difficult in the lab, yet nature does it simply. Researchers have used *E. coli* bacteria to oxidize the C-H bonds in benzene to produce phenol, with a genetically inserted enzyme (cytochrome P450BM3), that originally made to target other molecules, long-chain fatty acids. However, to get enzymes in order to perform novel reactions the genetic modification of the enzymes themselves is often necessary. Therefore, the scientific group had been working on this by using 'decoy' molecules, which have the ability to simulate the native targets (substrates) of naturally occurring enzymes, to activate the essential reaction. An *E. coli* whole-cell biocatalyst for the direct hydroxylation of benzene to phenol has been generated.

Scientists produced a compound, N-heptyl-L-prolyl-L-phenylalanine (C7-Pro-Phe), that is based on amino acids. This decoy molecule mimics the fatty acids that *E. coli* metabolizes. By adding them as decoy molecules to the culture medium, wild-type cytochrome P450BM3 (P450BM3) expressed in *E. coli* can be activated and non-native substrates hydroxylated. Insert a bait into the *E. coli* cell, and it will be incorrectly recognized as the fatty acid, which causes activation of the introduced P450 enzyme. As the result, bacteria oxidize C<sub>6</sub>H<sub>6</sub> into phenol C<sub>6</sub>H<sub>6</sub>O. The yield of phenol reached 44% when C7-Pro-Phe was used as the decoy molecule. Since the natural variant of the enzyme, and not genetically modified, is expressed by *E. coli*, it is likely that other bacteria can also be generated with the same gene to provide this reaction. In addition, various decoys can be appropriate for different substrates or bacteria. Associate Professor Osami Shoji mentioned that these

methods can provide the ability to create a versatile toolkit for whole-cell reactions using bacteria.



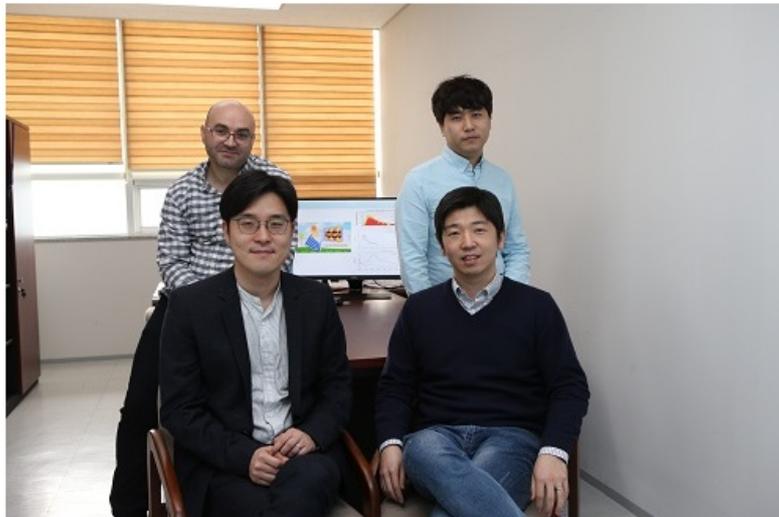
The general catalytic cycle of P450BM3 (black) and a plausible catalytic cycle (blue) for benzene hydroxylation catalyzed by P450BM3 with the assistance of the decoy molecule  
 source - nagoya-u.ac.jp

**Company name:** Nagoya University  
**Contact person:** Associate Professor Osami Shoji  
**E-mail:** shoji.osami@a.mbox.nagoya-u.ac.jp  
**Website:** <http://en.nagoya-u.ac.jp/>  
**Phone:** +81-52-789-3557  
**Patent status:** -  
**On market since:** -  
**Regions:** Japan  
**Industries:** Chemicals  
**Source links:** [Nagoya University](#)  
[Angewandte Chemie International Edition](#)



# NOVEL LEAD-FREE PEROVSKITE FOR PHOTOVOLTAIC CELLS

Current organic-inorganic hybrid perovskite materials have low stability, demonstrates bad performance, making them unfit for continued use. Furthermore, the use of lead (Pb) has undermined their environmental friendliness. Therefore, the scientific group, led by Postdoctoral Researcher Lamjed Debbichi and Master candidate Songju Lee from the Korea Advanced Institute of Science and Technology, has used perovskite  $\text{Cs}_2\text{Au}_2\text{I}_6$  as a perfect material for highly efficient lead-free thin-film photovoltaic devices. The biggest advantage of such material is that it has the ability to overcome typical limitations of perovskite such as low stability and toxicity issues.

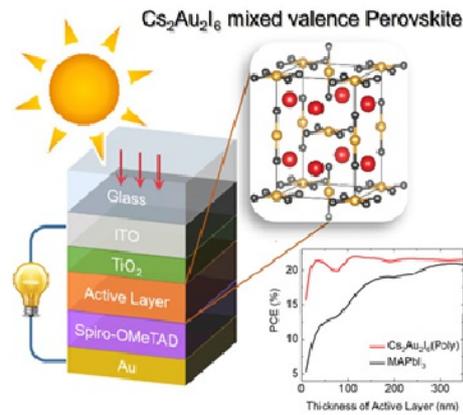


This research, led by Postdoctoral Researcher Lamjed Debbichi and Master candidate Songju Lee, Professor Min Seok Jang and Professor Hyungjun Kim  
source - kaist.edu

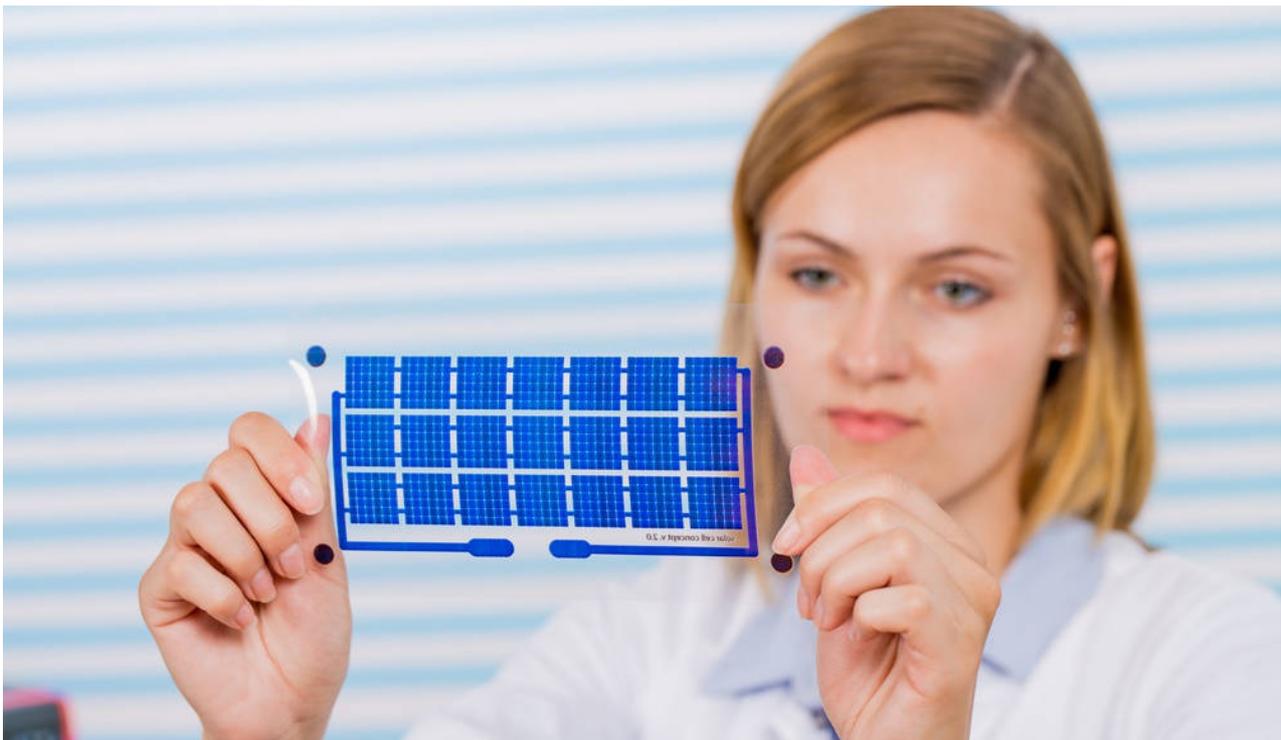
Perovskite photovoltaic cells have a big attention as the next-generation high-efficiency candidate to produce photovoltaic cells. It has a maximum photoconversion efficiency of **22%**, comparable to high-performance crystalline silicon photovoltaic cells. Furthermore, perovskite-based cells can be manufactured at low temperatures, thereby bringing about significant cost reductions. Therefore, scientists used **Cs<sub>2</sub>Au<sub>2</sub>I<sub>6</sub> to produce high-efficiency thin-film Pb-free photovoltaic cells**. Cs<sub>2</sub>Au<sub>2</sub>I<sub>6</sub> has an optimal band gap that is close to the Shockley–Queisser value. The band gap size is governed by intermediate band formation. Charge disproportionation on Au makes this perovskite a double-perovskite material, although it is stoichiometrically a single perovskite.

The study results demonstrated that this novel perovskite material is not only highly effective but also **more stable and eco-friendly compared to the current perovskite materials**. In order to provide analysis, researchers created multiscale multiphysics simulation frameworks. As in contrast to current double perovskites, it has a direct-band-gap feature. Atomic-scale first-principle quantum calculations were calculated to provide the study of optical characteristics of the proposed material. The optical simulation demonstrated that a very thin layer of active material has the ability to achieve a high photoconversion efficiency using a polycrystalline film layer. In other words, the device-scale electromagnetic simulations were approved that this material can be applied as a promising photovoltaic element at the device level. Consequently, **Cs<sub>2</sub>Au<sub>2</sub>I<sub>6</sub> is highly efficient, nontoxic material to produce thin-film perovskite solar cells in the very near**

future.



Schematic of full solar cell device structure. Perovskite materials are highly efficient, but in order to completely replace the conventional solar cells, their stability and toxicity issues must first be resolved  
source - kaist.edu



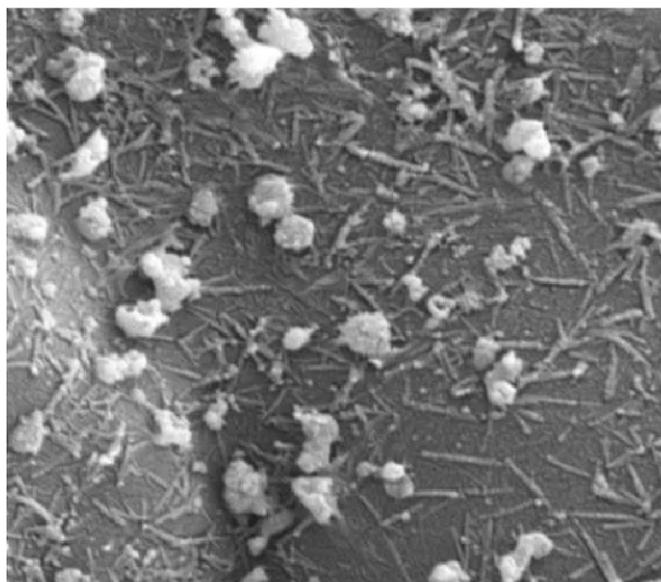
The already confirmed synthesizability of this material, coupled with the state-of-the-art multiscale simulations connecting from the material to the device  
source - adobe.com

Company name: KAIST  
Contact person: Professor Min Seok Jang  
E-mail: jang.minseok@kaist.ac.kr  
Website: <http://www.kaist.edu/>  
Phone: -  
Patent status: -  
On market since: -  
Regions: Korea  
Industries: Energy  
Source links: [KAIST](#)  
[Advanced Materials](#)



## NANOPARTICLES THAT CAN FIGHT DRUG-RESISTANT BACTERIA

Drug resistance is a growing threat to the global public health, requiring action in all government and public sectors. As antibiotics become less effective, researchers are looking for new methods to fight drug-resistant bacteria such as *S. aureus*, *E. coli* and Methicillin-Resistant *S. aureus*. Furthermore, another problem is that without appropriate antibiotics, the success of surgery and cancer chemotherapy would be compromised. Therefore, the scientific group, led by Associate Professor Andrea O'Connor, from the University of Melbourne has managed to develop nanoparticles that are able to fight some of the most dangerous antibiotic-resistant bacteria. This development is extremely important for the control of resistant bacteria.



Needle-shaped nanoparticles with S.aureus (Golden Staph) that is rough, showing damage caused to the bacterial cell membrane by the nanoparticles  
source - pursuit.unimelb.edu.au

According to [WHO](#), the antimicrobial resistance (AMR) menaces the effective prevention and treatment of different infections caused by bacteria, parasites, viruses and fungi. The most significant problem is that it can compromise different types of therapies, surgery and even chemotherapy as all these treatments can be accompanied by the taking of antibiotics. For example, there were **490 000** people with multi-drug resistant TB globally in **2016**. Moreover, the drug resistance is starting to complicate the fight against HIV and malaria.

Assoc. Prof. O'Connor, who works with biomaterials, implants and tissue engineering, and the researchers' group identified that **selenium (Se) and silver (Ag) in the form of nanoparticles have the ability to suppress the growth of bacteria such as 'Golden Staph' (S. aureus). Nanoparticles kill bacteria by destroying their membrane.** As Se and Ag are known for their antimicrobial properties, they investigated the separate loading of these materials into porous chitosan/PVA (CS) scaffolds through a simple in situ deposition method to create two distinct wound dressing materials (CS-Se and CS-Ag). Researchers incorporated the nanoparticles as a coating on the surface of a medical implant, or as part of a tissue-engineering scaffold. The antimicrobial components are then gradually released into their surrounding environment and **prevent the development of infections.** Se-loaded scaffolds demonstrated the ability to damage bacterial cell membrane and non-toxicity to fibroblast. Generally, the selenium nanoparticles have the big potential in different medical applications. The big advantage of this discovery is that **it can help fight**

with chronic wounds, for example, it will be very helpful for patients with diabetes.



Overall, in this study scientists have demonstrated simple, in situ immobilization porous CS scaffolds with either Se or Ag nanostructures which could be used to suit different wound healing applications  
 source - sciencedirect.com

**Company name:** The University of Melbourne  
**Contact person:** Associate Professor Andrea O'Connor  
**E-mail:** a.oconnor@unimelb.edu.au  
**Website:** <https://www.unimelb.edu.au/>  
**Phone:** +61 3 83448962  
**Patent status:** -  
**On market since:** -  
**Regions:** Australia  
**Industries:** Healthcare  
**Source links:** [The University of Melbourne](#)  
[Journal of Colloid and Interface Science](#)



## AN UNEXPECTED DISCOVERY WILL HELP TO TREAT NON-ALCOHOLIC FATTY LIVER DISEASE

Non-alcoholic fatty liver disease (NAFLD) is the condition caused by the extra fat accumulation in the liver. Usually, this disease forms in patients with obesity, diabetes type 2 or pre-diabetes (insulin resistance) and can cause hard consequences such as the cirrhosis or liver cancer.

However, fat cells, insulin and iron are the main causes of the disease development, but mechanisms of their effects remain unknown.

Therefore, PhD student Laurence Britton from the University of Queensland has discovered the key process by which iron is able to make the liver more vulnerable to the injury and metabolic dysfunction that precedes the disease. This discovery will help to create the treatment to prevent the NAFLD development.



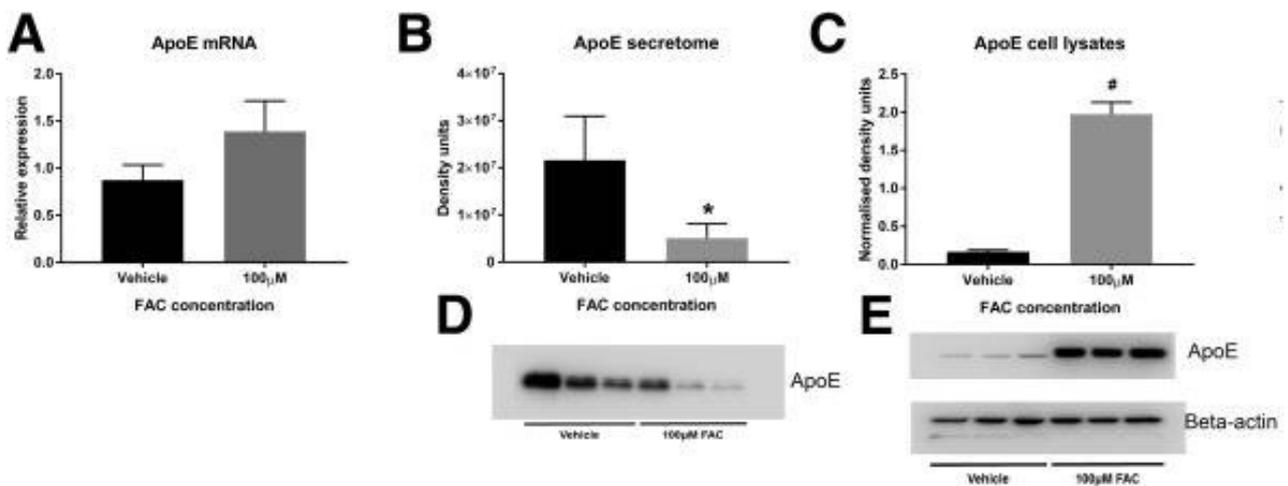
PhD student Laurence Britton. The University of Queensland, Herston, Queensland, Australia. Department of Gastroenterology, Princess Alexandra Hospital, Queensland, Australia  
source - uq.edu.au

**Nonalcoholic steatohepatitis (NASH)**, which is the most extreme form of NAFLD, also characterized by adipose tissue dysfunction with insulin resistance and the dysregulation of adipokines. The recent study results demonstrate that there is the repartitioning of iron from the liver to adipocytes in obesity and a role for iron in the formation of adipose tissue dysfunction. Despite these facts, mechanisms have not been determined. Dr Britton has managed to find that **iron decreases the availability of the protective hormone, ApoE, that is involved in fat regulation and insulin resistance process**. The important moment is that this discovery provides an evidence why obesity and type 2 diabetes are crucial risk factors for NAFLD and provide scientists with the ability to develop newest therapies and treatments.

Scientists used the quantitative proteomics analysis of the human **Simpson-Golabi-Behmel Syndrome (SGBS)** adipocyte secretome after 48 hours of treatment with ferric ammonium citrate (FAC) in order to test this hypothesis. Currently, there are no standard therapies or treatment strategies. Usually, curing diseases are developed as a consequence and require more serious treatment. Understanding the regulating role of iron provides researchers with the ability to reflect the development of fatty liver dysfunction. Each element of dysfunction allows **creating the newest treatment to block the process and prevent disease progression**.



Dr Britton's PhD scholarship was funded by the Gallipoli Medical Research Foundation, with support from the Gastroenterological Society of Australia  
 source - uq.edu.au



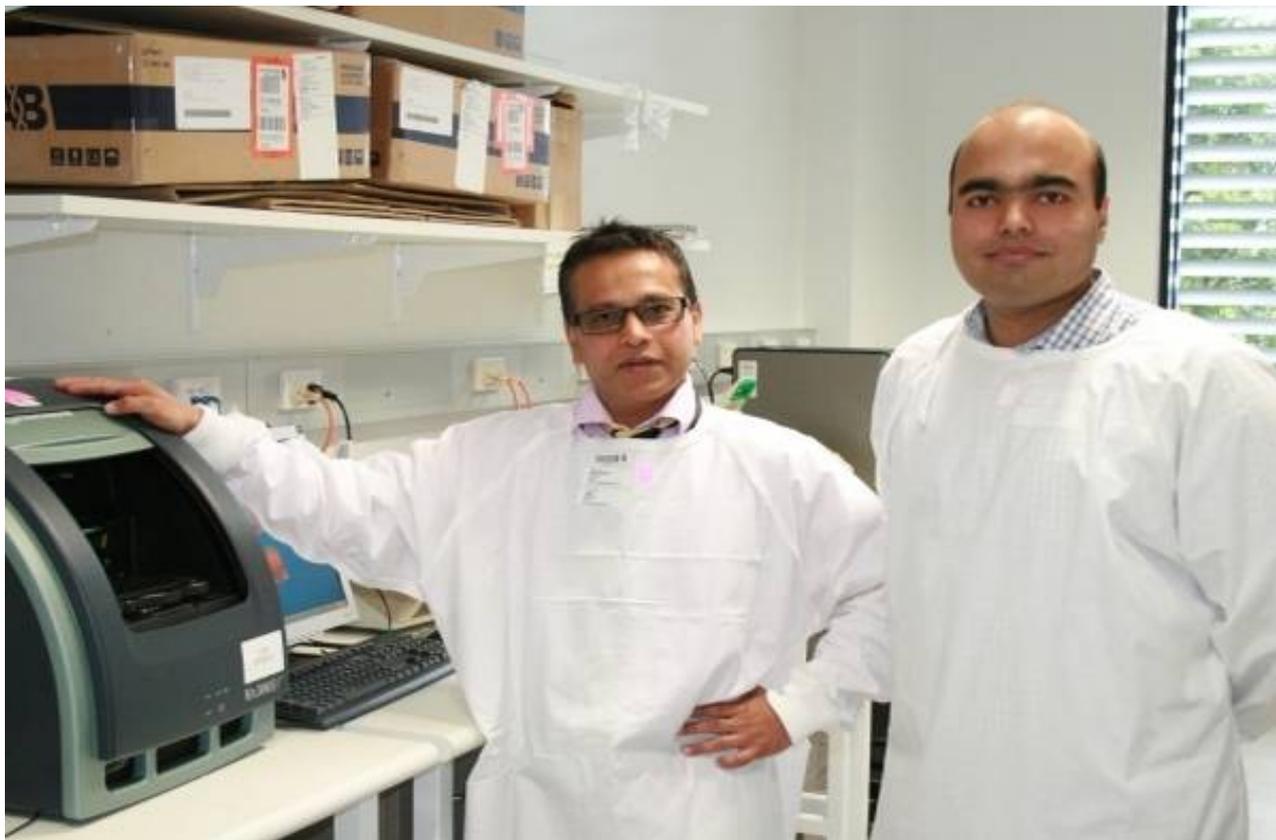
Iron treatment increased intracellular ApoE levels by more than 11-fold, without causing a significant change in mRNA levels. Iron inhibits the secretion of ApoE from adipocytes, causing ApoE to become sequestered  
 source - cmghjournal.org

**Company name:** University of Queensland  
**Contact person:** PhD student Laurence Britton  
**E-mail:** l.britton@uq.edu.au  
**Website:** <https://www.uq.edu.au/>  
**Phone:** -  
**Patent status:** -  
**On market since:** -  
**Regions:** Australia  
**Industries:** Healthcare  
**Source links:** [University of Queensland](#)  
[Cellular and Molecular Gastroenterology and Hepatology](#)



## AZA-MS - A TEST PREDICTS WHETHER PATIENTS WITH BLOOD CANCER RESPOND TO THERAPY

Myelodysplastic syndromes (MDS) are a group of hematologic malignancies of the pluripotent hematopoietic stem cells. To treat MDS the bone marrow transplantation is needed. Since this procedure is not suitable for everyone, patients are forced to take the drug azacitidine (AZA). However, half the patients do not respond to AZA. The group of scientists, led by Dr. Unnikrishnan and Professor John Pimanda, from the University of New South Wales, has managed to develop a new method AZA-MS to predict whether patients with the blood condition myelodysplastic syndrome will respond to treatment. This test is a big step towards personal therapy and can improve the treatment for a thousand patients.



UNSW Medicine researchers led by Dr. Unnikrishnan and Professor John Pimanda set out to develop a new quantitative method to measure AZA in patients receiving the treatment  
source - [newsroom.unsw.edu.au](http://newsroom.unsw.edu.au)

MDS is characterized by ineffective hematopoiesis, including abnormalities in proliferation, differentiation, and apoptosis. The incidence of MDS approximates **3 to 4 cases per 100,000 population per year**, with 30 cases per 100,000 population per year in patients more 70 years old. According to [ACS](#), there are approximately 10,000 to 15,000 new cases are diagnosed annually in the United States. To treat MDS the bone marrow transplantation is needed. Despite, this procedure is often not tolerated by older people, which are the majority of patients with MDS. Such patients must take AZA in order to improve blood production and reduce the risk of MDS progressing into leukemia. Nevertheless, about half of patients are not responding to AZA treatment. **Dr. Unnikrishnan** mentioned that doctors need about 4 - 6 months to tell if the patient is responding to this type treatment.

Therefore, scientists developed the newest **quantitative method to measure AZA, which is called AZA-MS**, in patients receiving the treatment in order to predict their response. This technology is based on researcher's recent discovery that **increased cell cycle quiescence of blood cells is linked to the failure to respond to AZA treatment**. AZA-MS uses the mass

spectrometry to measure the different forms of AZA inside blood cells such as the AZA molecules, which are consolidated into the DNA or RNA. In other words, the enhanced cell cycle quiescence of blood cells is a key element of resistance to AZA treatment. The most advantage of this method is that can be a step towards personal therapy and can improve the treatment for a thousand patients. Furthermore, it can determine if people respond to AZA tablets, compared to the currently used injectable way.



This study was funded by the National Health and Medical Research Council, Leukaemia Foundation, and Anthony Rothe Memorial Trust  
source - [newsroom.unsw.edu.au](http://newsroom.unsw.edu.au)

**Company name:** University of New South Wales  
**Contact person:** Dr. Unnikrishnan  
**E-mail:** ashwin.unnikrishnan@unsw.edu.au  
**Website:** <https://www.unsw.edu.au/>  
**Phone:** +61 2 93852527  
**Patent status:** -  
**On market since:** -  
**Regions:** Australia  
**Industries:** Healthcare  
**Source links:** [University of New South Wales](#)



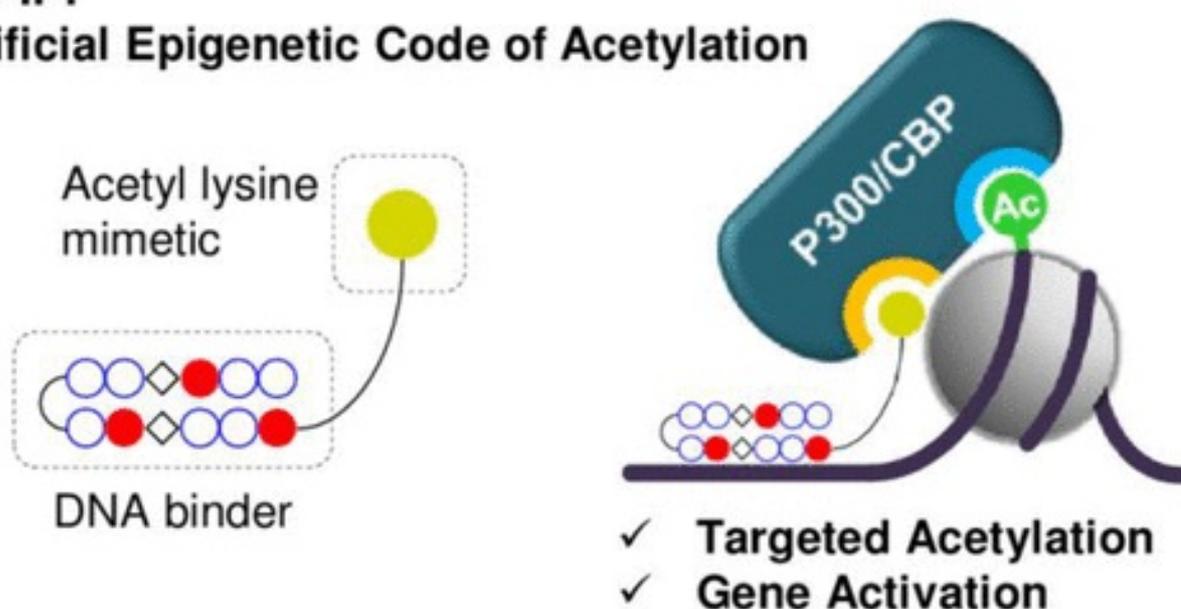
## 'TURN ON' GENES TO TREAT THE DISEASE

The group of scientists from the Kyoto University has managed to develop a biomimetic epigenetic code that has the ability to activate genes on demand to treat various diseases. This synthetic molecular code that provides gene activation leads to future gene-based therapies for a wide array of diseases. In particular, this code can help fight epigenetic mutations that change the way in which genes express themselves and can play a crucial role in neurodegenerative disorders such as Parkinson's disease, Alzheimer's disease, and multiple sclerosis.



consists of 2 components: a P300/CBP-selective bromodomain inhibitor (Bi), which recruits a specific type of histone acetyltransferase enzyme; and the synthetic hairpin-shaped molecule that distinguishes the specific DNA sequence. The study results demonstrated that Bi-PIP acts as the synthetic programmable histone code of acetylation that emulates the bromodomain-mediated natural propagation system of histone acetylation to activate gene expression in a sequence-selective manner. In other words, **the code activates the specific gene, which is associated with the central nervous system inside living cells.** This development will help **to treat different neurodegenerative disorders.**

## Bi-PIP: Artificial Epigenetic Code of Acetylation



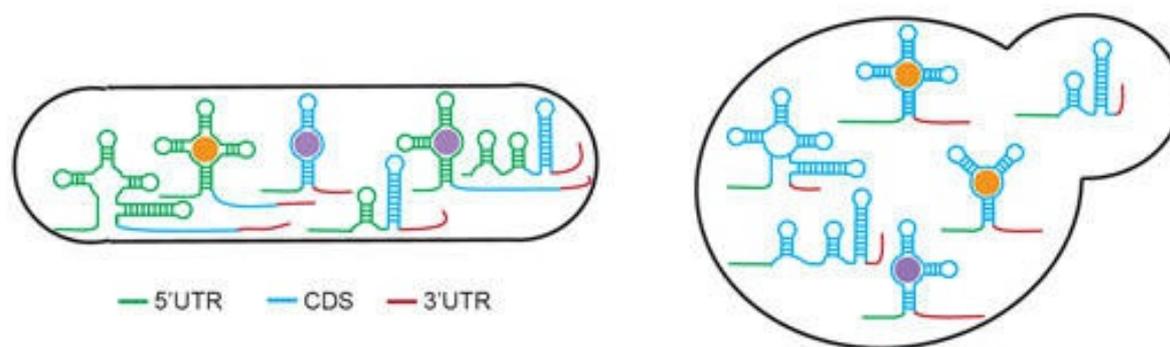
Bi-PIP has a P300/CBP-selective bromodomain inhibitor (Bi) as a P300/CBP recruiter and a pyrrole-imidazole polyamide (PIP) as a sequence-selective DNA binder  
source - [pubs.acs.org](https://pubs.acs.org)

**Company name:** Kyoto University  
**Contact person:** Assistant Professor Ganesh Pandian Namas..  
**E-mail:** ganesh@kuchem.kyoto-u.ac.jp  
**Website:** <https://www.kyoto-u.ac.jp/en/>  
**Phone:** -  
**Patent status:** -  
**On market since:** -  
**Regions:** Japan  
**Industries:** Healthcare  
**Source links:** [Kyoto University](#)  
[Journal of the American Chemical Society](#)



## SENSOR FOR VITAMINS AND ESSENTIAL MOLECULES SCREENING AND DETECTION

Scientists from the Agency for Science, Technology and Research A\*STAR, led by Dr. Wan Yue and Professor Niranjan Nagarajan have managed to develop the first rapid, large-scale structure-probing screening method for biological sensors known as riboswitches or RNA sensors. Furthermore, this innovational high-throughput method for screening RNA sensors will provide the ability to better understand of how the human body detects and responds to environmental changes, and aid the monitoring of the health more closely and effectively.



Known and new RNA sensors are found in bacteria and fungi, expanding our understanding of RNA-based gene regulation

source - a-star.edu.sg

If the body lacks food, RNA sensors will inform person causing the feeling of hunger. The ability to comprehensively identify these RNA sensors could expand methods for synthetic biology, which combines science and engineering in order to design and build new biological parts, devices or systems.

Therefore, scientists developed a novel **genome-wide strategy, which is called Parallel Analysis of RNA Conformations Exposed to Ligand binding or PARCEL, that can identify RNA aptamers in vitro**. It detects ligand-induced RNA structural changes using high-throughput sequencing. Current methods use computational strategies to focus on only one particular output of riboswitches, such as transcription termination. Scientists used both experimental and computational methods and detect many new riboswitches in the process. The technique revealed the breadth of RNA-ligand interactions in prokaryotic and eukaryotic transcriptomes, detecting many new natural RNA aptamers in the process.

The newly identified RNA aptamers exhibit significant sequence conservation, are highly structured and demonstrate the prevalence in coding regions. Prof. Nagarajan mentioned that they managed to **discover 2 new RNA sensors that sense Vitamin B2** and demonstrated that genes undergo changes in protein levels in the presence of Vitamin B2. Previously, it was believed that there are mainly riboswitches exists in bacteria, and the only one class of eukaryotes (complex organisms, such as mammals) is switched to Vitamin B1. The discovery of a Vitamin B2 riboswitch in *Candida albicans* opened the door to potentially new classes of riboswitches controlling gene expression in other organisms. In other words, **RNA sensors play a significant role in controlling gene expression than previously thought**. Furthermore, the newest technique also provided **a platform to rapidly**

screen new RNA sensors in complex organisms.



A prokaryotic precursor tmRNA that binds vitamin B2 (FMN) to facilitate its maturation, as well as eukaryotic mRNAs that bind and respond to FMN  
source - adobe.com

Scientists mentioned that this novel invention will provide the ability to screen and detect new RNA sensors, analyzing environmental changes, monitor patient' health, and design interventions where needed.

**Company name:** Agency for Science, Technology and Resea..

**Contact person:** Dr. Wan Yue

**E-mail:** wany@gis.a-star.edu.sg

**Website:** <https://www.a-star.edu.sg/>

**Phone:** -

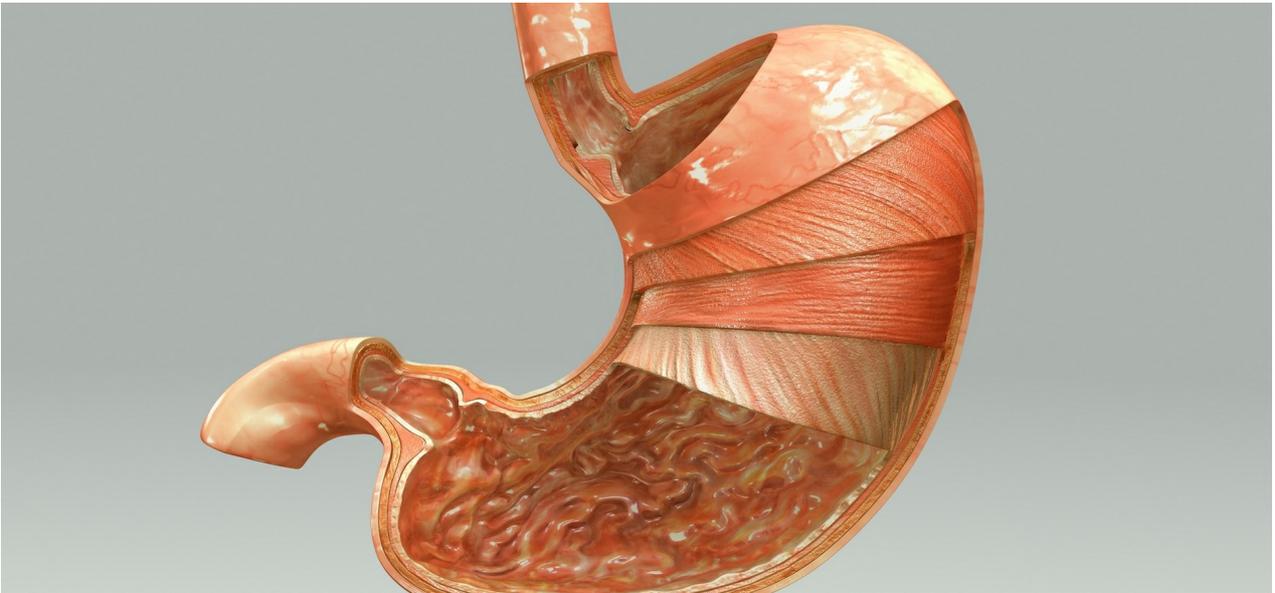
**Patent status:** -

**On market since:** -

**Regions:** Singapore

**Industries:** Healthcare

**Source links:** [Nature Communications](#)  
[Agency for Science, Technology and Research A\\*STAR](#)



## AN UNEXPECTED DISCOVERY WILL FIGHT AGAINST STOMACH CANCER

Scientists managed to discover that the absence of the gene NF-KB1 causes the direct development of malignant stomach cancer, driven by chronic inflammation. This inflammation is accompanied by high levels of proteins cytokines, which are called STATS and make cells to grow and divide very fast making the DNA damage and mutations and causing cancer. Therefore, this unexpected discovery allows scientists to create a new treatment that will be targeting the STATS protein in order to prevent or fight gastric cancer.

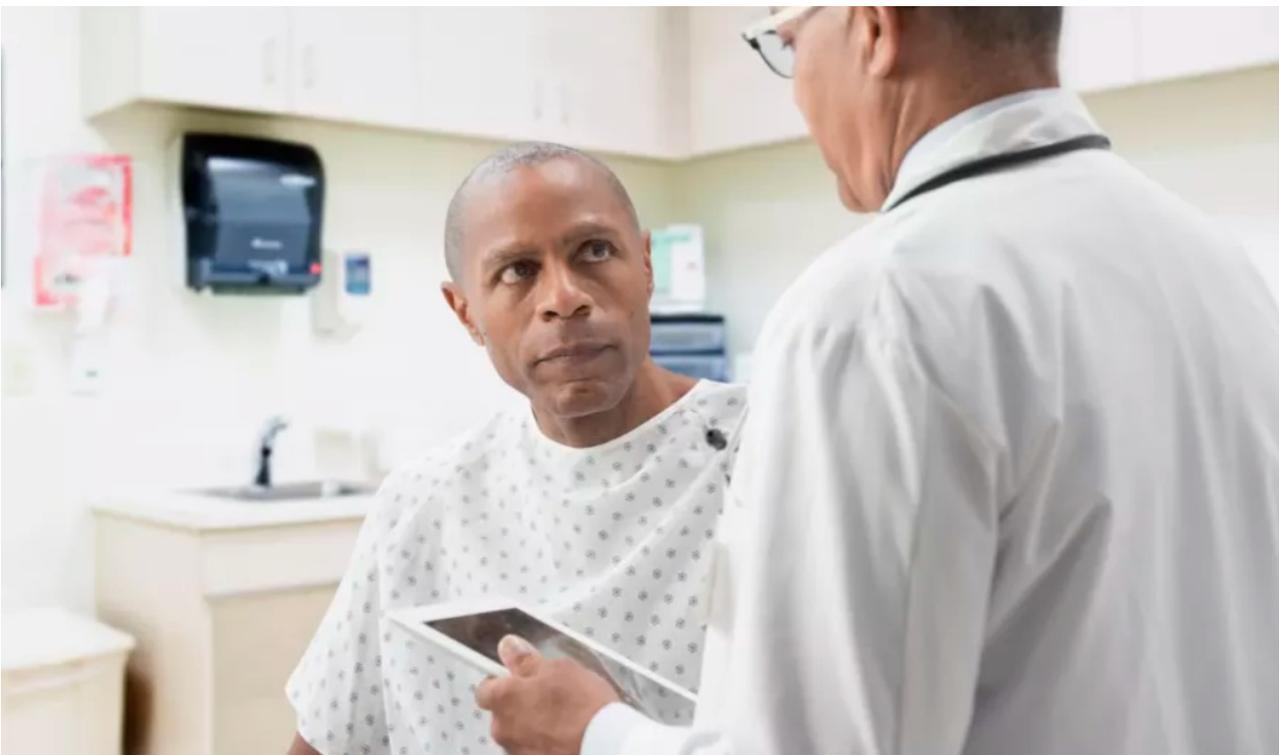


Dr. Tracy Putoczki (left) and Dr. Lorraine O'Reilly (right) discovered removing the NF- $\kappa$ B1 gene led to the spontaneous development of malignant stomach cancer, driven by chronic inflammation  
source - unimelb.edu.au

The discovery was made by the scientific group, led by [Dr. Lorraine O'Reilly](#), from the [University of Melbourne](#) in collaboration with the [Walter and Eliza Hall Institute of Medical Research](#), the [Olivia Newton-John Cancer Research Institute](#) and [La Trobe University School of Cancer Medicine](#) and the [Monash University](#). Stomach cancer is the fifth most common cancer in the world. It is divided into cardia and non-cardia cancers, depending on where they first appear. Stomach cancer is more common in older adults and is about twice as common in men than women. The bacterium [Helicobacter pylori](#) is an important cause of stomach cancer, particularly non-cardia cancer. Epstein-Barr virus, which is carcinogenic to humans, has also been linked to stomach cancer in some studies.

NF- $\kappa$ B1 deficiency resulted in spontaneous invasive gastric cancer (GC) in mice that mirrored the histopathological progression of human intestinal-type gastric adenocarcinoma. Scientists removed the gene NF- $\kappa$ B1 and identified that it causes the direct development of malignant stomach cancer, driven by chronic inflammation. [The inflammation provides the high levels of proteins STATs](#) (Signal Transducer and Activators of Transcription), which make cells to grow fast causing the DNA damage and mutations

and **causing cancer**. The study results demonstrated that NF- $\kappa$ B1 deficiency resulted in aberrant JAK-STAT signaling, which dysregulated expression of effectors of inflammation, antigen presentation, and immune checkpoints. Concomitant loss of STAT1 prevented these immune abnormalities and GC development. Scientists determined that **loss of STAT1 is very promising in preventing inflammation link to the GC development**. However, there are effective STAT1 inhibitors for human therapy. Nevertheless, **they research inhibiting different STATs as a method to stop inflammation and, therefore, to prevent tumors developing**. In addition, this discovery will provide the ability to create highly effective drugs and therapies to fight this type of cancer.



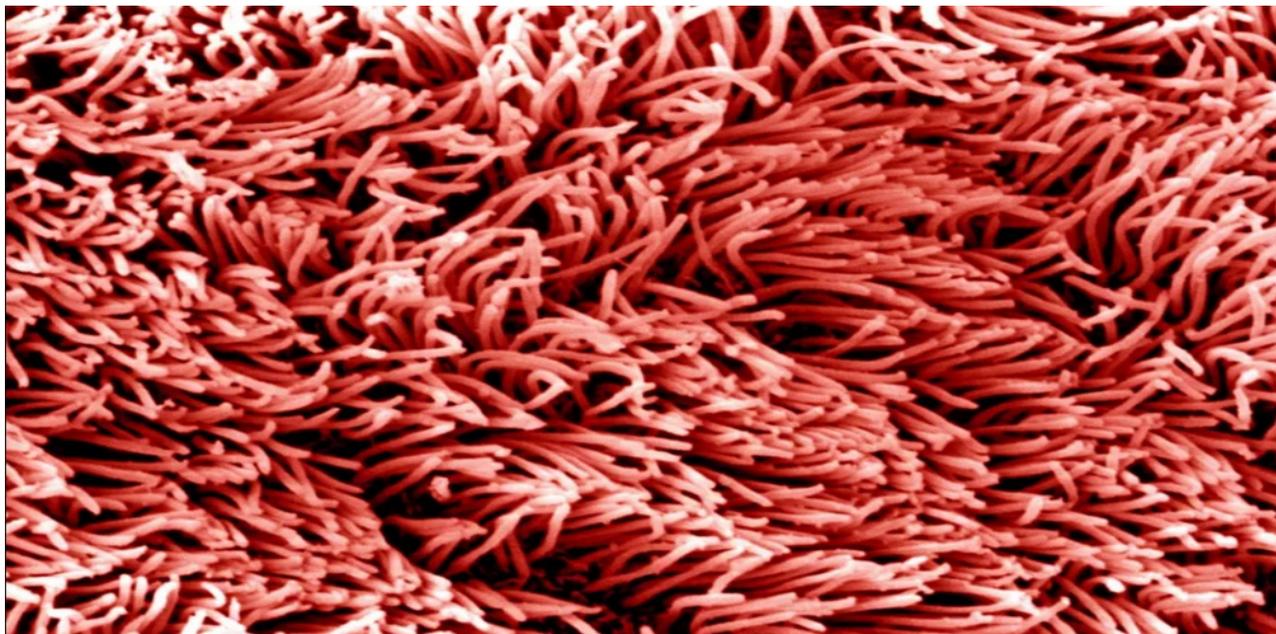
Usually, the symptoms are hard to pick up until it's too late, making what is a relatively common cancer also an often fatal one. It's the fifth most common cancer worldwide, and the third most deadly source - [unimelb.edu.au](http://unimelb.edu.au)

Company name: University of Melbourne  
Contact person: Dr. Lorraine O'Reilly  
E-mail: oreilly@wehi.edu.au  
Website: <https://www.unimelb.edu.au/>  
Phone: -  
Patent status: -  
On market since: -  
Regions: Australia  
Industries: Healthcare  
Source links: [University of Melbourne](#)  
[Immunity](#)



## A NEW WAY TO TREAT PATIENTS WITH COPD

Chronic obstructive pulmonary disease (COPD) is a chronic inflammatory lung disease that causes obstructed airflow from the lungs. Symptoms include breathing difficulty, cough, mucus (sputum) production and wheezing. It caused more than 3 million people deaths each year. The most significant moment is that there is no effective treatment inasmuch as the disease runs the process when human's white blood cells attack lungs fibers. Therefore, scientists managed to determine the method of blocking a critical protein G-CSF that stimulates the production of white blood cells. This discovery will give the ability to prevent the progression of the COPD.



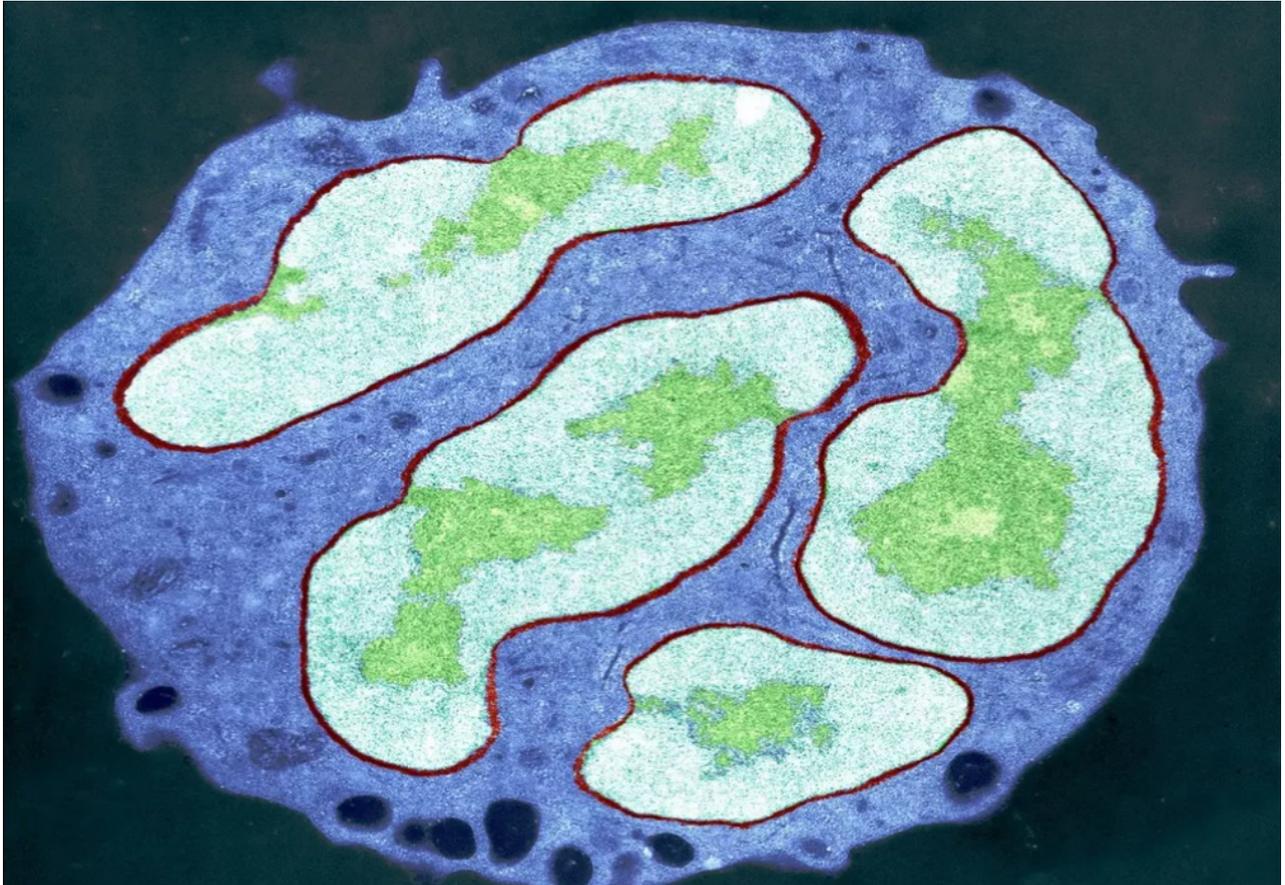
A scanning electron micrograph of the lining of a bronchus, or airway passage, inside a healthy lung  
source - [pursuit.unimelb.edu.au](http://pursuit.unimelb.edu.au)

The novel discovery was made by the scientific group from the [University of Melbourne](#) in collaboration with the [Monash University](#).

According to [WHO](#), there are about **65 million** people with the COPD worldwide. In **2005**, the disease caused more than **3 million deaths**. Researchers mentioned that total deaths from COPD are projected to increase by more than **30% in the next 10 years**. Furthermore, in **2030** the disease will be the third leading cause of death worldwide. The COPD patient's lung tissues are destroyed by chronic inflammation, and the major culprits are white blood cells, neutrophils, and macrophages. **These cells attack the elastic fibers of the lungs causing the hard breath and risk of chest infections**. Therefore, there is no effective cure to treat this disease. These cells are critically dependent on **CSFs** for their development and activation, thereby linking bone marrow myelopoiesis with tissue-damaging inflammation, and hence host defense. Despite the fact that G-CSF plays an important role in the immune system, they also have **pathogenic roles in inflammatory autoimmune diseases** such as inflammatory arthritis, experimental allergic encephalomyelitis, and uveoretinitis. Furthermore, G-CSF is induced in airway inflammation and in response to cigarette smoke.

Scientists discovered **the mechanism that has the ability to block G-CSF preventing the development of the COPD**. Furthermore, this discovery will provide the ability to create **the first treatment, which will prevent the progression of the disease and provide the**

newest biomarker in order to identify the COPD on early stage. Assoc. Prof. Margaret Hibbs mentioned that scientists managed to determine that the reducing of the level of G-CSF in mice models lungs leads to the reducing of the numbers of white blood cells in lungs. As the result, mice weren't sick. Prof. Anderson noted that they will provide human clinical trials to test several methods to decrease G-CSF in the body.



A color-enhanced electron microscope image of a polymorphonuclear leucocyte or neutrophil, a type of white blood cell

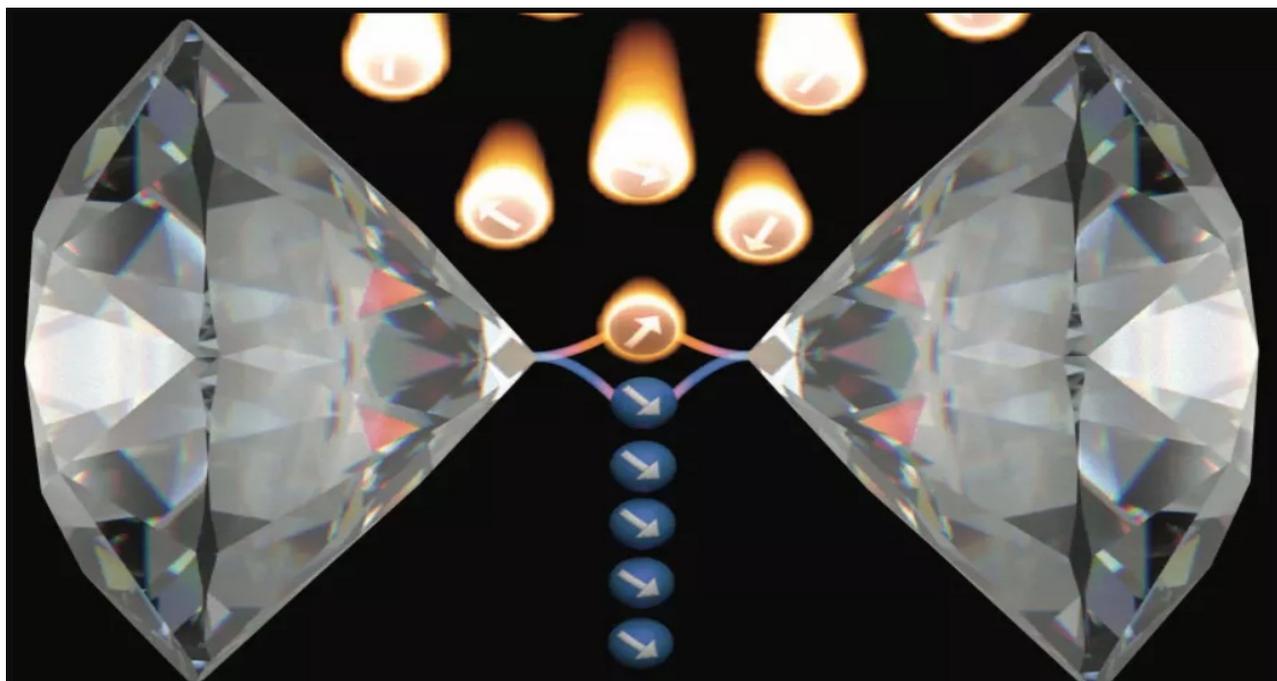
source - [pursuit.unimelb.edu.au](http://pursuit.unimelb.edu.au)

Company name: Monash University  
Contact person: Assoc. Prof. Margaret Hibbs  
E-mail: Margaret.Hibbs@monash.edu.  
Website: <https://www.monash.edu/>  
Phone: -  
Patent status: -  
On market since: -  
Regions: Australia  
Industries: Healthcare  
Source links: [The Journal of Clinical Investigation](#)  
[University of Melbourne](#)



## NEW INVENTION MAKES MRI LESS HARMFUL AND HUNDREDS OF TIMES MORE POWERFUL

Scientists developed an innovational method to 'light up' our molecules inside the body in order to provide for more powerful MRIs. Such molecules can be scanned at a detail hundreds of times those current MRIs. They used light shone through incredibly thin layers of synthetic diamond crystals containing quantum probes. The most important moment is that this technology will provide much faster, cost-effective and precise diagnosis of cancer tumors. In other words, scientists will be able to produce newest and improved molecular contrast agents, which will be targeted certain parts of the human body, in order to 'light up' magnetically, significantly enhancing the amount of detail that can be detected by the Magnetic Resonance Imaging scan.



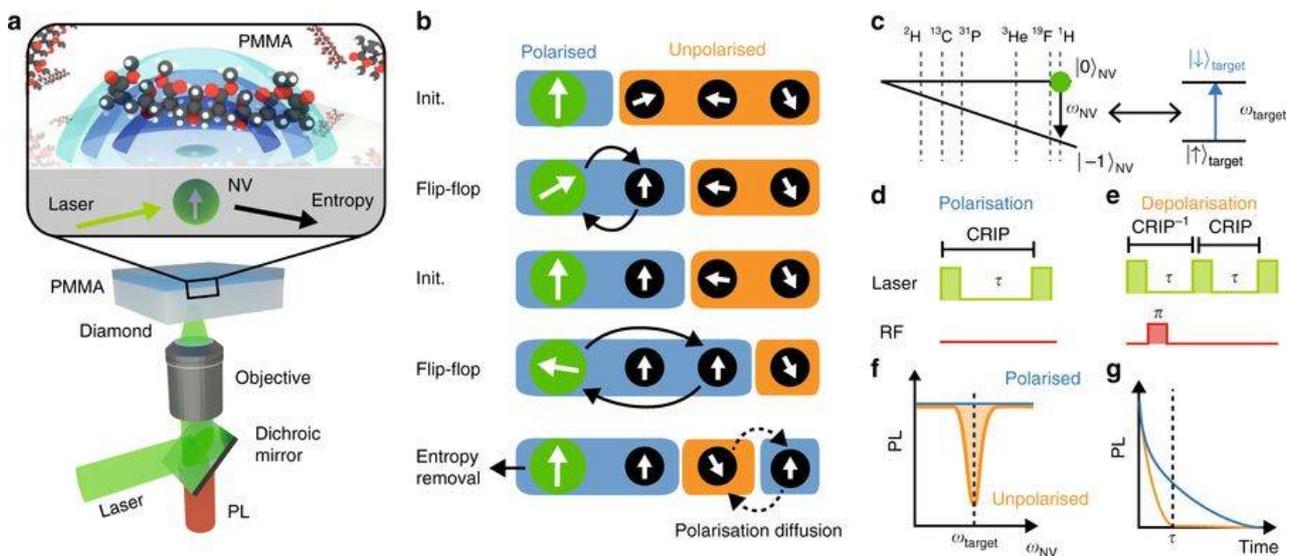
Nuclear spins with random magnetic orientation (“hot”) are subjected to a controlled interaction with atomic defects in diamond which aligns (hyperpolarises) their spins (“cold”) and amplifies their magnetic source - [signalunimelb.edu.au](http://signalunimelb.edu.au)

The novel development was made by the scientific group, led by [Professor Lloyd Hollenberg](#), from the [University of Melbourne](#). They applied the light shone through a [diamond layer 100 microns thick](#) to change the magnetic spin of nuclei within molecules on the diamond surface so that they can hyperpolarise or 'line up' in the same way. Therefore, the different nuclei generate the stronger magnetic field among themselves.

The hyperpolarization of nuclear spins is important in overcoming sensitivity and resolution limitations of magnetic resonance imaging and nuclear magnetic resonance (NMR) spectroscopy. Furthermore, it is an important challenge in MRI. In general, the hyperpolarisation can [highly improve signal and spatial resolution that can lead to the development of molecular MRI and NMR](#), with the prospect of revolutionizing many fields of research and [clinical applications](#).

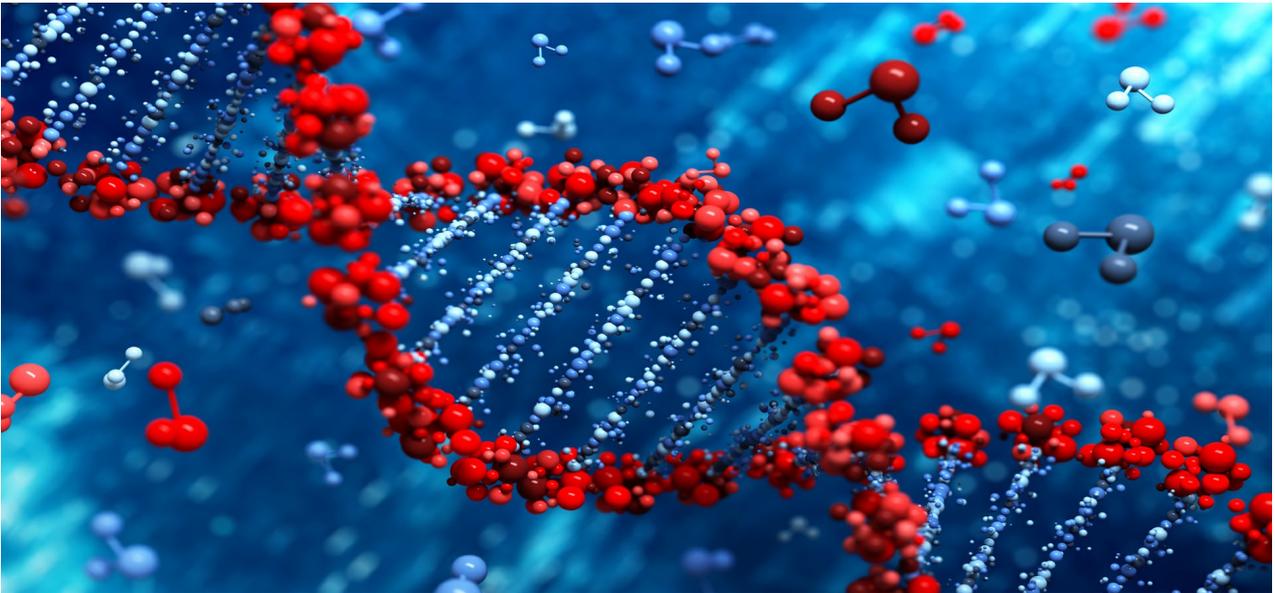
Scientists applied a microwave-free cross-relaxation induced polarisation protocol to a nitrogen vacancy qubit. As the result, quantum probe hyperpolarisation of external molecular nuclear spins achieved up to 50% under ambient conditions, demonstrating a single qubit increasing the polarisation of 106 nuclear spins by 6 orders of magnitude over the thermal background. In other words, researchers managed [to achieve the level of polarisation of around 50% for polymer molecules on the diamond surface](#). This is the first

time it has been achieved using the diamond-based quantum technology. Hyperpolarised bio-molecules can be injected into patients and travel to tumor sites where they can be monitored in real-time using MRI, or hyperpolarised gases could be inhaled for MRI imaging of the lungs and their function. As scientists don't modify contrast agents beyond the polarisation of their nuclear spins, this process doesn't have any harmful influence on human body, making this method much safe and accurate in tumors detecting.



Schematic of the system showing a near-surface nitrogen-vacancy (NV) spin probe in diamond and a hydrogen nuclear spin target ensemble in molecular Poly(methyl methacrylate) (PMMA) on the surface source - nature.com

**Company name:** University of Melbourne  
**Contact person:** Professor Lloyd Hollenberg  
**E-mail:** l.hollenberg@physics.unimelb.edu.au  
**Website:** <https://www.unimelb.edu.au/>  
**Phone:** -  
**Patent status:** -  
**On market since:** -  
**Regions:** Australia  
**Industries:** Healthcare, Others  
**Source links:** [University of Melbourne](#)  
[Nature Communications](#)



## A NOVEL METHOD TO IDENTIFY DISEASE GENES

Scientists have managed to develop an innovative statistical algorithm that has the ability to detect potential disease genes. The method is highly precise and cost-effective. Furthermore, it has also been considered as a new promising approach for the identification of candidate disease genes, as it works effectively with less genomic data and takes only 1 or 2 minutes to provide with the results. The method is also able to visualize protein interaction networks within and across the significant pathways so that the user can prioritize the core subnetworks for further studies. The research was supported by the National Research Foundation of Korea.



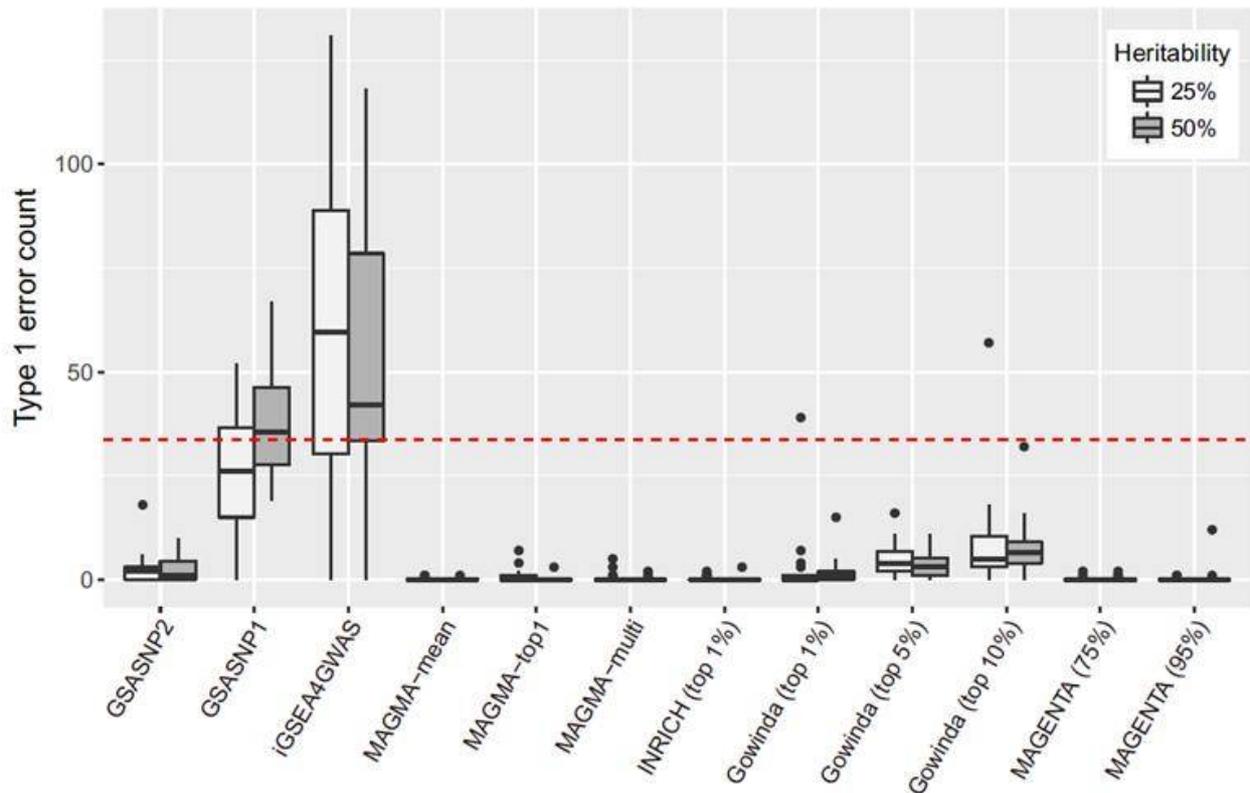
Each individual's genome is a unique combination of DNA sequences that play major roles in determining who we are. This accounts for all individual differences, including susceptibility to disease and diverse phenotypes  
source - unist.ac.kr

The development was made by the scientific group, led by [Professor Dougu Nam](#), from the [Ulsan National Institute of Science and Technology](#).

The pathway-based analysis in [genome-wide association study \(GWAS\)](#) is being widely applied to identify novel multi-genic functional associations. Different pathway-based methods have been used in order to test the enrichment of the associated genes in the pathways, but exhibited low powers and were highly affected by free parameters. Therefore, scientists developed the newest method and software [GSA-SNP2](#) for pathway enrichment analysis of GWAS P-value data. It has the ability to provide the high power, decent type I error control and fast computation by incorporating the random set model and SNP-count adjusted gene score.

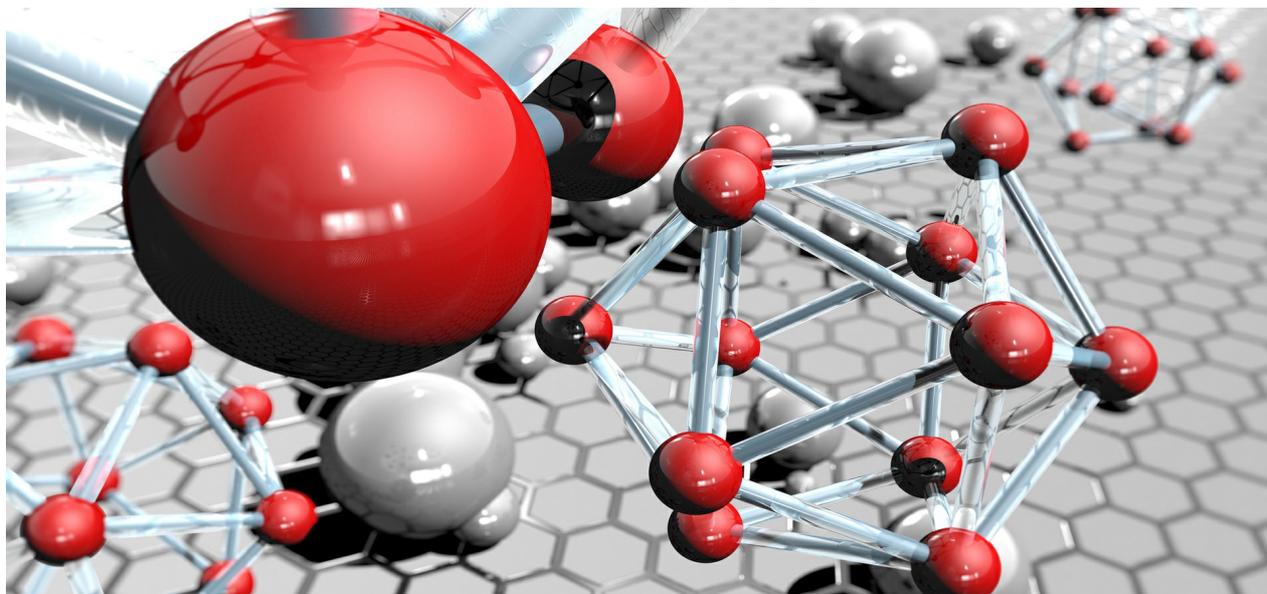
Prof. Nam mentioned that using this method, [scientists will be capable to easily detect new drug targets](#), thereby extending the understanding of diseases and, as the result, creating new treatments and therapeutic strategies. In order to improve the statistical predictability while maintaining precise control of false positives, scientists applied the monotone Cubic Spline trend curve to the gene score via the competitive pathway analysis for gene expression data. [GSA-SNP2](#) provides [a greatly improved type I error](#)

control by using the SNP-count adjusted gene scores, while nevertheless preserving high statistical power. Furthermore, it provides both local and global protein interaction networks in the associated pathways, and may facilitate integrated pathway and network analysis of GWAS data. The most significant advantage of this innovative development is that it can identify not only disease genes but also help to create new treatments for various diseases.



The difference between pathway analysis approaches was investigated and the effects of the gene correlation structures on the pathway enrichment analysis were also discussed  
 source - unist.ac.kr

**Company name:** Ulsan National Institute of Science and Tec...  
**Contact person:** Professor Dougu Nam  
**E-mail:** dougnam@unist.ac.kr  
**Website:** <http://www.unist.ac.kr/>  
**Phone:** +82-52-217-2525  
**Patent status:** -  
**On market since:** -  
**Regions:** Korea  
**Industries:** Healthcare  
**Source links:** [Nucleic Acids Research](#)  
[Ulsan National Institute of Science and Technology](#)



## 'NEW' MOLECULES CAN MAKE A BREAKTHROUGH IN MEDICINE AND ELECTRONICS

Scientists have managed to find an absolutely new way to join groups of atoms together into molecules, which are able to change the shape. This innovational discovery will provide the ability to create a new range of drugs, microelectronics, and materials, which have newest features. A novel form of conformational isomerism was achieved through 4 resolved stereoisomers of a transoid (BF)O(BF)- quinoxalinoporphyrin . In addition, it allows creating not only new medicines but a new branch of chemistry.



Based on an extended polytope formalism of molecular structure and stereoisomerization, BAI-driven akamptisomerization is shown to be the final fundamental type of conformational isomerization  
source - adobe.com

The innovational development was made by the scientific group, led by [Ph.D. candidate Peter Canfield](#) from the [University of Sydney](#) in collaboration with the [University of Technology Sydney](#), and the [Shanghai University](#).

**Isomerism** is a fundamental concept in the chemistry. It presupposes the existence of molecules, which have the same numbers of the same types of atoms, therefore, the same formula, but differ in chemical and physical characteristics. This concept represents the fact that the disposition of atoms in a molecular being has the main influence on its chemical and physical properties. The discovery of another form of isomerism opens **a new type of materials, which can be produced, either with the same functions as existing one or with characteristics, which are currently unattainable**. In addition to **new types of drugs**, other potential real applications could be **newest materials**, which can be manipulated to 'turn on or off', polymers with special operating features, and even innovative molecular information storage devices.

The novel method includes **2 pairs of enantiomers**, which demonstrate structural bonds that cannot be determined within existing [International Union of Pure and Applied Chemistry](#) nomenclature and terminology. They undergo thermal diastereomeric interconversion over a barrier of  $104 \pm 2$  kJ mol<sup>-1</sup>, which was named '**akamptisomerization**' by scientists. Ph.D. candidate Canfield mentioned that according to study results the scientific group will be engaged in commercial applications. The prototype demonstration

will be performed through two and a half years. Scientists applied the nanoscale porphyrin scaffolds, which was created by Prof. Crossley, to 'host' boron 'guest' molecules. As the result, molecules are stable in a bottle at room temperature. The [National Computational Infrastructure](#) and the [Australian National University](#) approved that such way of molecules synthesis was performed for the first time.

**Company name:** University of Sydney  
**Contact person:** Ph.D. candidate Peter Canfield  
**E-mail:** canfield@chem.usyd.edu.au  
**Website:** <https://sydney.edu.au/>  
**Phone:** -  
**Patent status:** -  
**On market since:** -  
**Regions:** Australia, China  
**Industries:** Chemicals, Others  
**Source links:** [Nature Chemistry](#)  
[University of Technology Sydney](#)



## AN OLFACTORY RECEPTOR 544 CAN HELP TO DEAL WITH THE OBESITY

The scientific group, led by Professor Sung-Joon Lee, from the Korea University has managed to identify a new obesity control mechanism of the human body. They found that olfactory receptor 544 (Olf544) is highly expressed in the liver and adipose tissue and has the ability to control cellular energy metabolism and obesity. The azelaic acid acts as a ligand on the Olf544 that activates the protein kinase cAMP-dependent (PKA) signaling transfer in the adipose tissue and liver tissue causing the antiobesity effect.

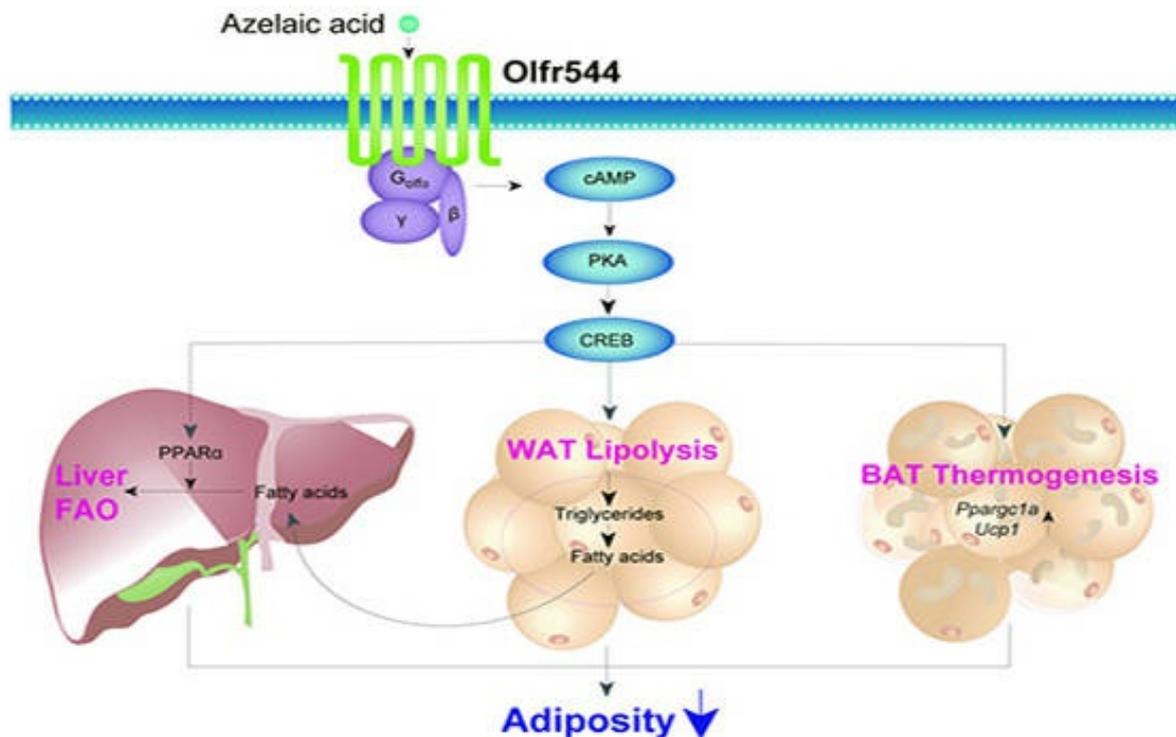


Primary author Chunyan Wu, Ph. D. (Left), Corresponding author Professor Sung-Joon Lee (Right)  
source - korea.ac.kr

Usually, food includes and different aroma components, which are intended to increase the flavor of food and boost the appetite. Moreover, when they are led into the human body, they can operate as functional materials causing different biological processes. Despite this fact, it is hard to identify which process in the cell is caused by the component. **Olfactory receptors (ORs)** are present in tissues outside the olfactory system. Nevertheless, their function is still relatively unknown. Through the signaling transmission of ORs, which are expressed in olfactory epithelium cells, aroma elements of the food send olfactory data into the cerebrum. Furthermore, ORs demonstrate the ectopic expression in different types of the tissues such as the kidney tissue, liver tissue, muscles, and immunocytes.

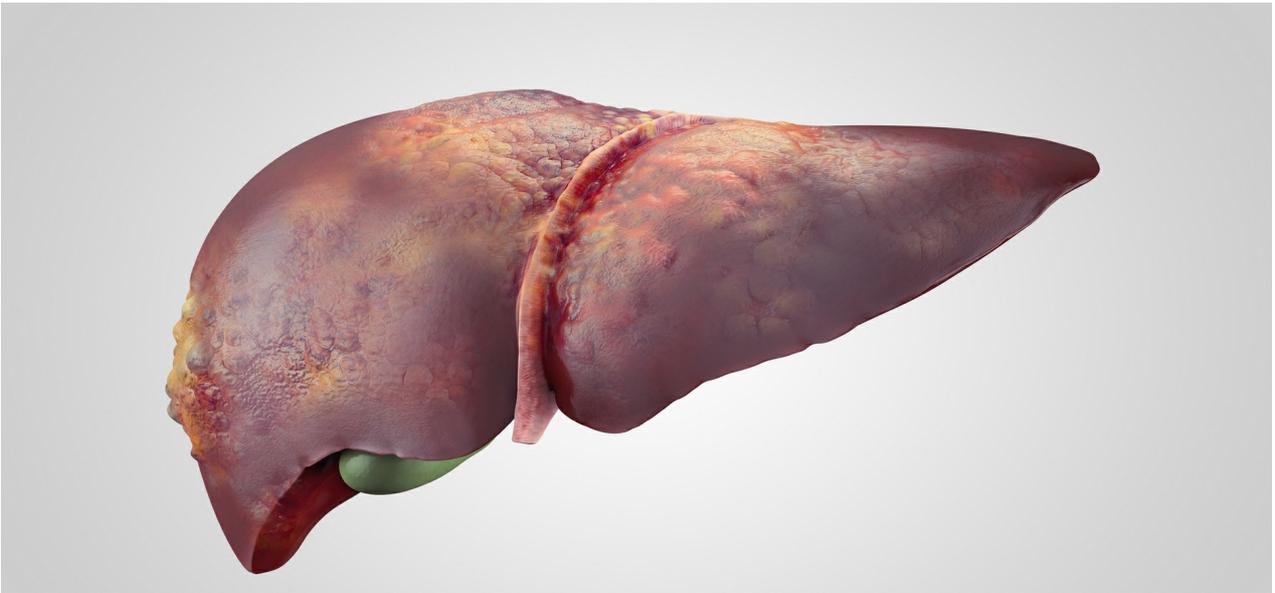
Scientists made the concept that the OR in the adipose tissue has the ability to act as the food aroma elements' target protein and intermediate effects of the food aroma elements on the health. They managed to defined that **highly expressed Olfr544 can regulate cellular energy metabolism and obesity**. Azelaic acid (AzA) induced in adipocytes and promoted fatty acid oxidation (FAO) and ketogenesis in the liver, therefore putting the fuel preference to fats. The study results demonstrated **those mouse models, which had a high-fat diet (HFD), also had adiposity decreasing**. The azelaic acid operates as a ligand and

influences on the Olfr544, causing PKA signaling transfer in the adipose and liver tissue. Therefore, it leads to the antiobesity operation. Scientists were the first who present results that demonstrated that olfactory receptors, which make up from 3% to 5% of mammal genomes, can also be expressed in metabolic tissues and can influence energy metabolism and body fat control. This is significant, in that it explains various additional functionalities of the olfactory receptors and presents a new body fat control mechanism, which will allow creating newest treatment strategies.



Olfr544 is expressed in the liver, white adipose tissue, and brown adipose tissue, and it activates the PKA signaling pathway process with azelaic acid acting as a ligand compound  
 source - korea.ac.kr

**Company name:** Korea University  
**Contact person:** Professor Sung-Joon Lee  
**E-mail:** junelee@korea.ac.kr  
**Website:** <https://www.korea.edu/>  
**Phone:** -  
**Patent status:** -  
**On market since:** -  
**Regions:** Korea  
**Industries:** Healthcare  
**Source links:** [Journal of Clinical Investigation](#)  
[Korea University](#)



## A NOVEL TREATMENT FOR NAFLD DISEASES

Non-alcoholic fatty liver disease (NAFLD) is the condition when extra fat accumulates in the liver. Usually, this disease forms in patients with obesity, diabetes type 2 or pre-diabetes (insulin resistance) and can cause hard diseases and even the necessity of liver transplantation. Scientists from Singapore identified that thyroid hormone (TH) was important for metabolism of fatty acids in the liver. Furthermore, the clinical study demonstrated that low dose thyroid hormone supplementation has the ability to reduce the level of fatty liver in diabetic patients with NAFLD.



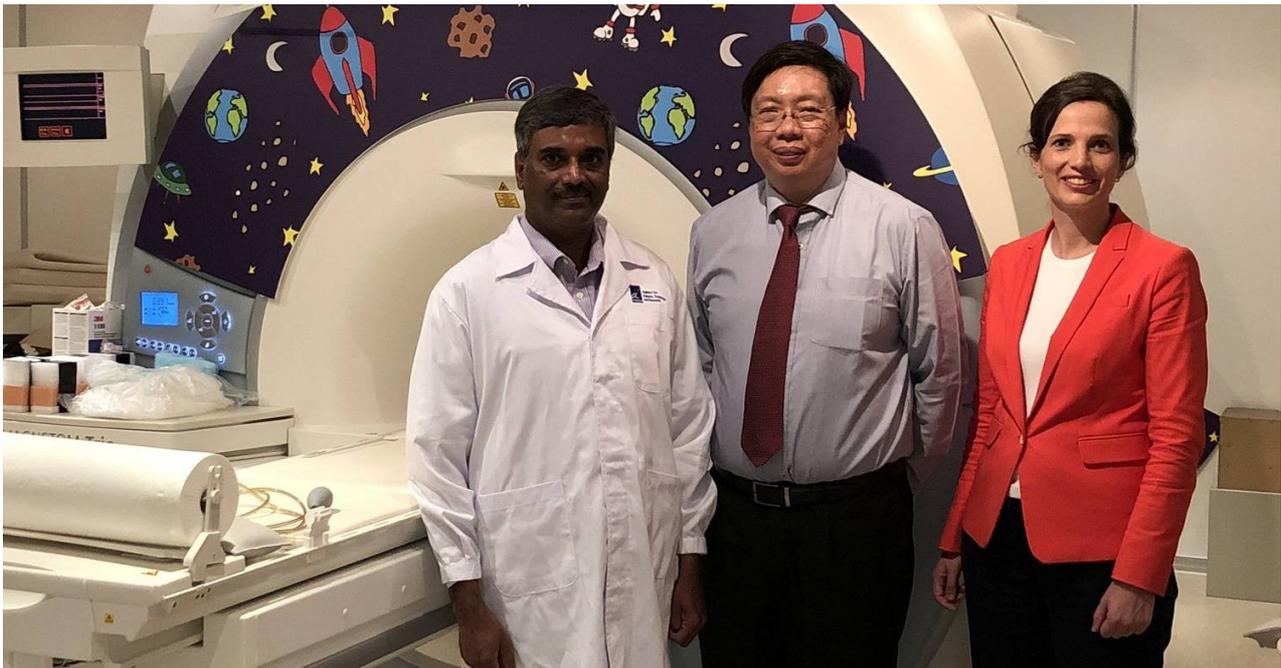
Assoc. Prof. Teoh Yee Leong, CEO of Singapore Clinical Research Institute; Dr. S. Sendhil Velan, Head of Metabolic Imaging Group, A\*STAR's SBIC; and Dr. Eveline Bruinstroop, Duke-NUS Medical School  
source - a-star.edu.sg

The novel development was made by the scientific group from the Duke-NUS Medical School in cooperation with the SCRI and [A\\*STAR](#).

Considered, that NAFLD is not only very common diseases in adults but the most widespread type of liver disease in kids. Such patients also have increased blood lipids such as cholesterol and triglycerides. Typically, some people have the easy type of NAFLD that is called fatty liver when the fat build-ups in cells. Other patients have the hard type of NAFLD that is called NA steatohepatitis (NASH) when the liver cell inflammation develops. It can cause fibrosis or even cirrhosis. Furthermore, some patients with cirrhosis may require a liver transplant as their liver can't perform its function that can lead to the lethal results. Previously, the scientific team, led by Prof. Yen, determined the importance of thyroid hormone in the metabolism of fatty acids in the liver. It means, that this hormone can be applied in the treatment of patients with NAFLD. During clinical studies, scientists treated **20 NAFLD patients with type 2 diabetes applying thyroxine hormone therapy for 4 months.**

The clinical tests, such as magnetic resonance imaging, blood glucose levels, and others demonstrated that **the low dose thyroid hormone significantly reduces the liver fat in male type 2 diabetic patients with NAFLD in a safe way.** Scientists implemented non-invasive

magnetic resonance imaging and spectroscopic techniques to quantitatively assess visceral fat, subcutaneous fat and liver fat before and after TH treatment in NAFLD patients. They plan to provide more research in order to estimate the changes in fat composition within liver fat in response to an intervention. Furthermore, the reduced level of intrahepatic lipid demonstrated improvements of diabetes. Scientists mentioned that the successful clinical study affirms MRI and spectroscopic approaches as gold standards for measuring metabolic activity, and these will support future clinical studies in NA fatty liver disease, and the development of medical treatments that improve health outcomes.



The study was funded by Tanoto Initiative for Diabetes Research and the trial and was conducted through the Metabolic Research Network (MRN) of SCRI, and involved six clinical centers across Singapore  
source - a-star.edu.sg

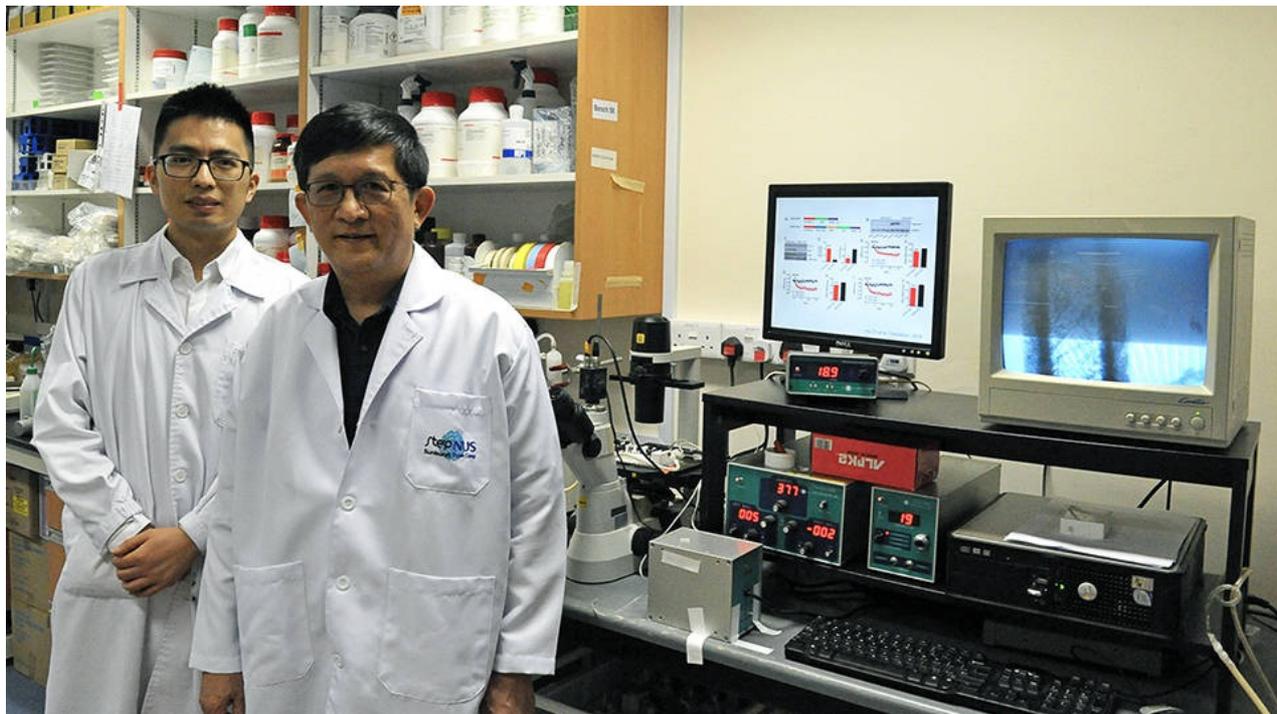
The study was funded by [Tanoto Initiative for Diabetes Research](#) and the trial and was conducted through the [Metabolic Research Network \(MRN\)](#).

Company name: A\*STAR  
Contact person: Associate Professor Teoh Yee Leong  
E-mail: yeeleong.teoh@scri.edu.sg  
Website: <https://www.a-star.edu.sg/>  
Phone: -  
Patent status: -  
On market since: -  
Regions: Singapore  
Industries: Healthcare  
Source links: [A\\*STAR](#)



## A NEW METHOD TO CONTROL BLOOD PRESSURE

Scientists managed to identify the process of human's body that regulates blood pressure. This novel discovery will help to develop newest treatment strategies to fight hypertension and other related health diseases such as diabetes, stroke, and different cardiovascular diseases. They found that Galectin-1 protein has the ability to affect the function of another protein that is called L-type (Cav1.2) calcium channel, which was found on the arteries that normally acts to contract the blood vessels. By decreasing the activity of these CaV1.2 channels, Galectin-1 reduces the blood pressure.



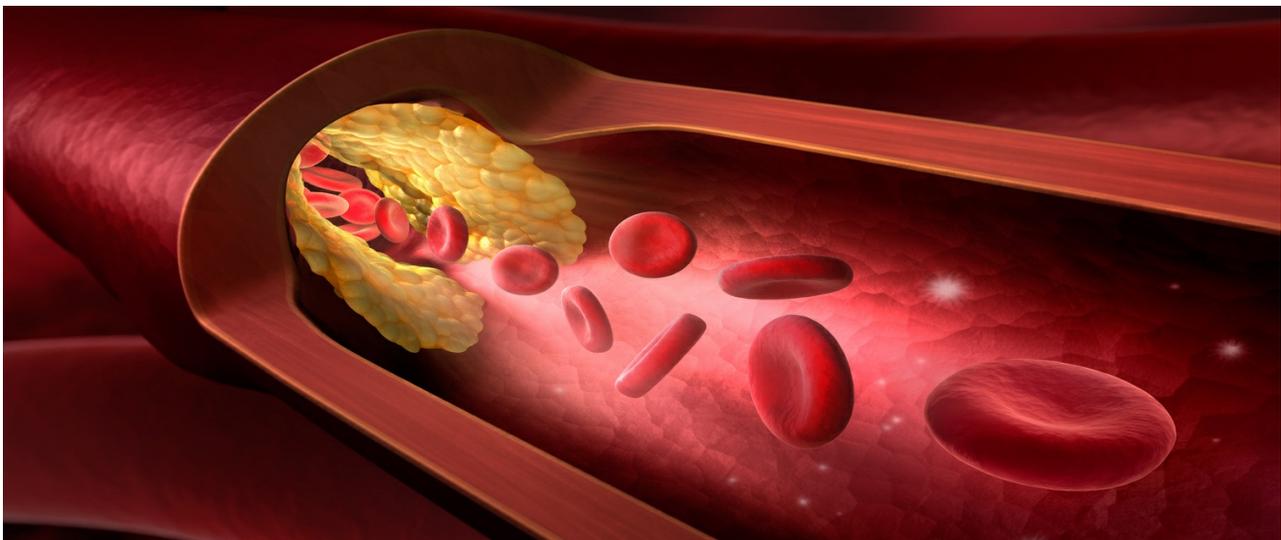
This project was led by Professor Soong Tuck Wah from the Department of Physiology together with Dr Hu Zhenyu, the lead author of the study  
source - nus.edu.sg

The newest discovery was made by the international scientific group, led by [Professor Soong Tuck Wah](#) and [Dr. Hu Zhenyu](#) from the [National University of Singapore](#), in collaboration with the [Southwest Medical University](#), the [Columbia University](#), the [National University Health System](#), the [National Heart Centre Singapore](#), and the [National Neuroscience Institute](#).

The raised blood pressure is the main risk factor for cardiovascular diseases such as ischemic and hemorrhagic stroke. According to the [WHO](#), raised blood pressure leads to 7.5 million deaths worldwide. It is about 12.8% of the total of all deaths. Usually, calcium channel blockers (CCB) are applied in the clinic' condition in order to reduce blood pressure. Despite its effectiveness, they can cause heart failure in hypertensive patients due to their side effects. However, the creation of methods of treatment, which will have the ability to [regulate the operation of CaV1.2 channel, rather than block its normal function](#), is crucial. Gal-1 was determined to bind to the I-II loop of CaV1.2 channels to decrease their current density.

The study results demonstrated that [Gal-1 is the main regulator for proteasomal degradation of CaV1.2 channels](#). To control blood pressure by targeting the CaV1.2-Gal-1 interaction, scientists applied Tat-e9c, which is a peptide that rivaled for binding of Gal-1,

by a mini-osmotic pump and this specific disruption of CaV1.2-Gal-1 coupling elevated smooth muscle CaV1.2 currents, generated larger arterial contraction and caused hypertension in models of rats. This competitive disruption of CaV $\beta$  binding led to CaV1.2 degradation by exposing the channels to poly-ubiquitination. **The enhanced expression of Gal-1 in smooth muscle by a single bolus of AAV5-Gal-1 significantly decreased blood pressure in previously hypertensive rats models.** In vivo experiments involving delivery of Tat-e9c peptide and AAV5-Gal-1 into rats were performed to investigate the effect of targeting CaV1.2-Gal-1 interaction on blood pressure monitored by tail-cuff or telemetry methods. This mechanistic understanding provided the basis for targeting CaV1.2-Gal-1 interaction to demonstrate clearly the modulatory role Gal-1 plays in regulating blood pressure and offering a potential approach for therapeutic management of hypertension.



Patients with Stage 2 hypertension or above have to take anti-hypertensive medicines to control blood pressure  
source - adobe.com

This targeting treatment will provide the ability not only **treat high blood pressure but prevent the development of different cardiovascular diseases.** Furthermore, it also can help to treat the pulmonary arterial hypertension, the therapy of which is costly.

**Company name:** National University of Singapore

**Contact person:** Professor Soong Tuck Wah

**E-mail:** phsstw@nus.edu.sg

**Website:** <http://www.nus.edu.sg/>

**Phone:** -

**Patent status:** -

**On market since:** -

**Regions:** United States, China, Singapore

**Industries:** Healthcare

**Source links:** [Circulation](#)

[National University of Singapore](#)



## 5-ALA COMPOUND CAN HELP TO TREAT ATR-X SYNDROME

Scientists from Japan developed a novel therapy of the Alpha-thalassemia mental retardation syndrome or ATR-X using previously established compound. They managed to find that 5-aminolevulinic acid or 5-ALA can be applied as an effective therapeutic agent to treat this disability. Furthermore, 5-ALA has already been used in medicine demonstrating minimal risk and confirmed as the effective photosensitizer in photodynamic diagnostics in neurosurgery. In addition, it shows that the clinical approval will be much shorter and cheaper.



ATR<sub>X</sub> normally binds to G-quadruplexes in the Xlr3b gene, and regulates its expression by recruiting DNA methyltransferases (above)

source - adobe.com

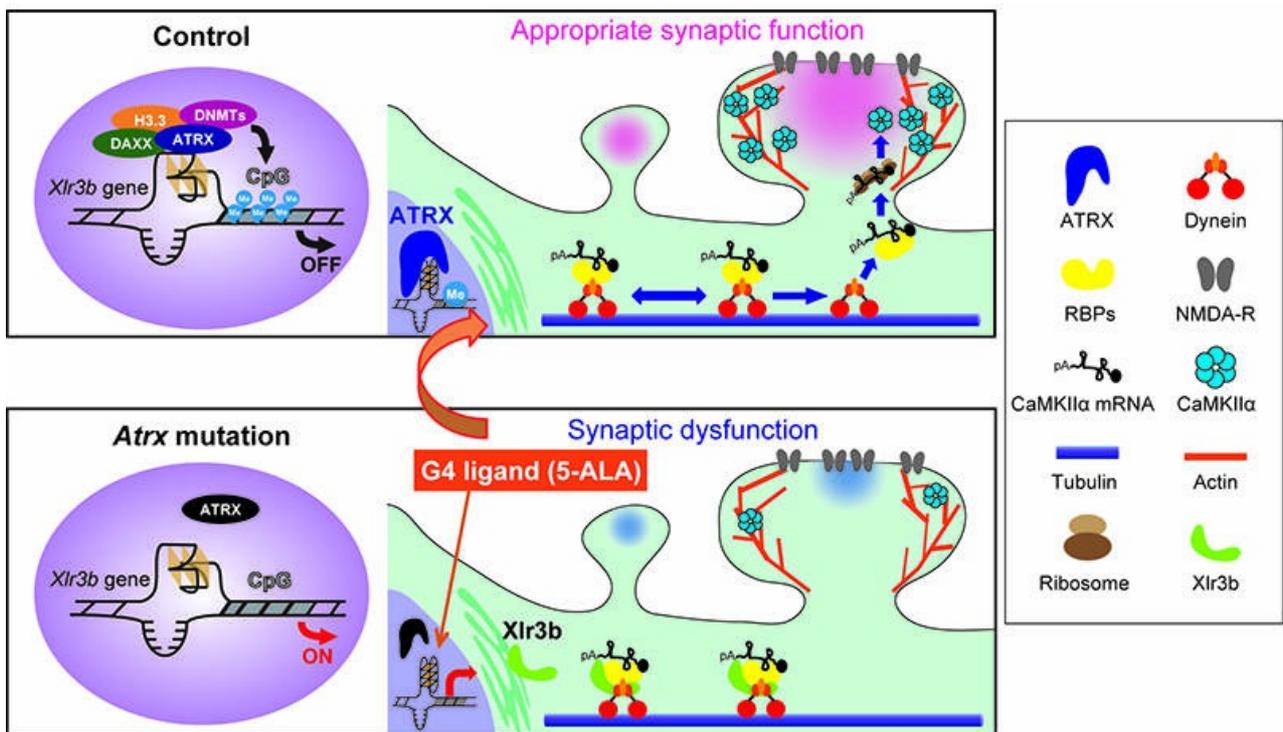
The innovative discovery was made by the scientific group from the [Kyoto University](#) in collaboration with the [Gifu Pharmaceutical University](#) and the [Tohoku University](#).

Prof. Fukunaga noted that different neurodevelopmental disorders are rare and there is a lack of methods of therapy in order to treat such syndromes. **ATR-X syndrome is caused by the mutation of ATRX gene.** This type of the gene is highly important as it codifies a chromatin-remodeling protein providing the hemoglobin production by binding to a special DNA structure, which is called **G-quadruplexes**. Scientists managed to demonstrate that ATR<sub>X</sub> mutation promotes aberrant upregulation of Xlr3b expression in the brain of mice. The results are linked to neuronal pathogenesis demonstrated by ATR-X model mice. The group researched different compounds in order to find out which one has the ability to bind to G-quadruplexes in a similar way as ATR<sub>X</sub> gen. They determined that 5-ALA can be transformed into G-quadruplex binding metabolites in the body. As the compound was previously approved, the clinical trial will take less time and costs.

Moreover, the G-quadruplexes are linked to the processes of formation of other diseases and this finding can be applied in the development of new medicines and therapies.

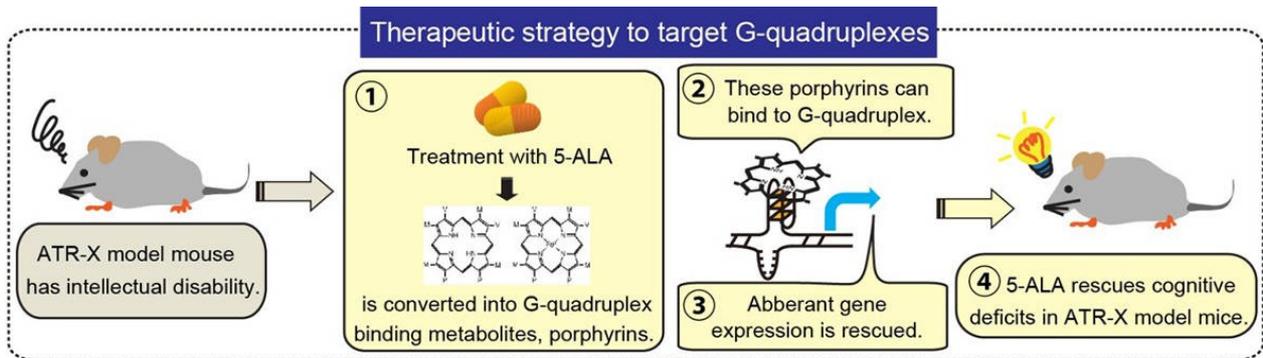
Usually, it binds in CpG islands of the Xlr3b gene, controlling its expression by recruiting DNA methyltransferases. Xlr3b connects with mRNAs, and prevents dendritic transport of

the mRNA encoding CaMKII- $\alpha$ , causing synaptic dysfunction. Scientists tested this type of treatment using mouse models during 2 months. Consequently, mice demonstrated enhanced synaptic plasticity and cognitive capabilities. The treatment with 5-ALA reduces RNA polymerase II recruitment and suppress Xlr3b transcription in ATR-X. Professor Fukunaga mentioned 5-aminolevulinic acid is already proven as safe and is already applied in supplements in Japan. Therefore, the risk of failure of this type of treatment is decreased as data relevant to 5-ALA safety and pharmacology is available. There is also evidence that it can improve autism spectrum disorders which is one of the most common developmental disorder. About 1 in 59 children has been identified with ASD.



Xlr3b binds to dendritic mRNAs. In ATRX mutations, Xlr3b is over-expressed and inhibits dendritic transport of the mRNA and causes synaptic dysfunction (below)

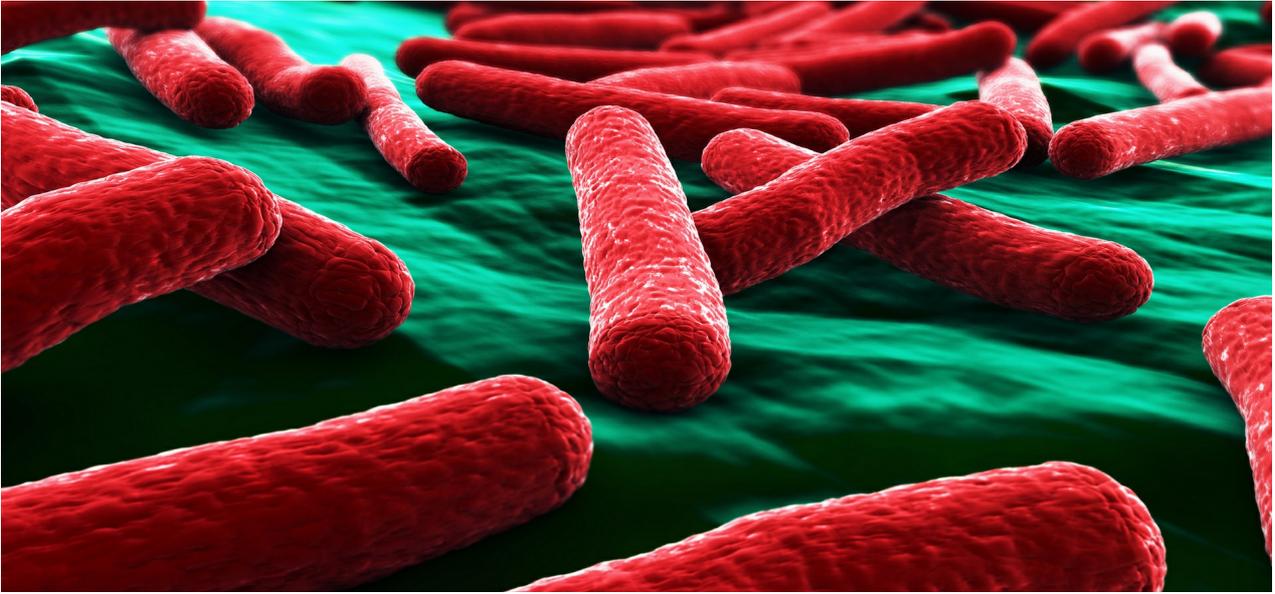
source - kyoto-u.ac.jp



Novel therapeutic strategy for intellectual disability

source - tohoku.ac.jp

**Company name:** Kyoto University  
**Contact person:** Associate Professor Takahito Wada  
**E-mail:** wadataka@kuhp.kyoto-u.ac.jp  
**Website:** <https://www.kyoto-u.ac.jp/en/>  
**Phone:** -  
**Patent status:** -  
**On market since:** -  
**Regions:** Japan  
**Industries:** Healthcare  
**Source links:** [Nature Medicine](#)  
[Kyoto University](#)  
[Tohoku University](#)



## RECOMBINANT E. COLI AS A SOURCE OF VARIOUS NANOMATERIALS

Nanomaterials (NMs) including metals, metal oxides, and quantum dots are growingly applied in developing different materials in various industrial fields. Scientists from Korea have managed to develop the recombinant E. coli strain that has the ability to biosynthesize 60 different nanomaterials covering 35 elements on the periodic table. Furthermore, with its help scientists can biosynthesize 33 novel nanomaterials for the first time. The technology will be profitable for producing under mild conditions various single- and multi-element NMs for industrial application.



Ph.D. candidate Yoojin Choi and Professor Sang Yup Lee at the Department of Chemical and Biomolecular Engineering

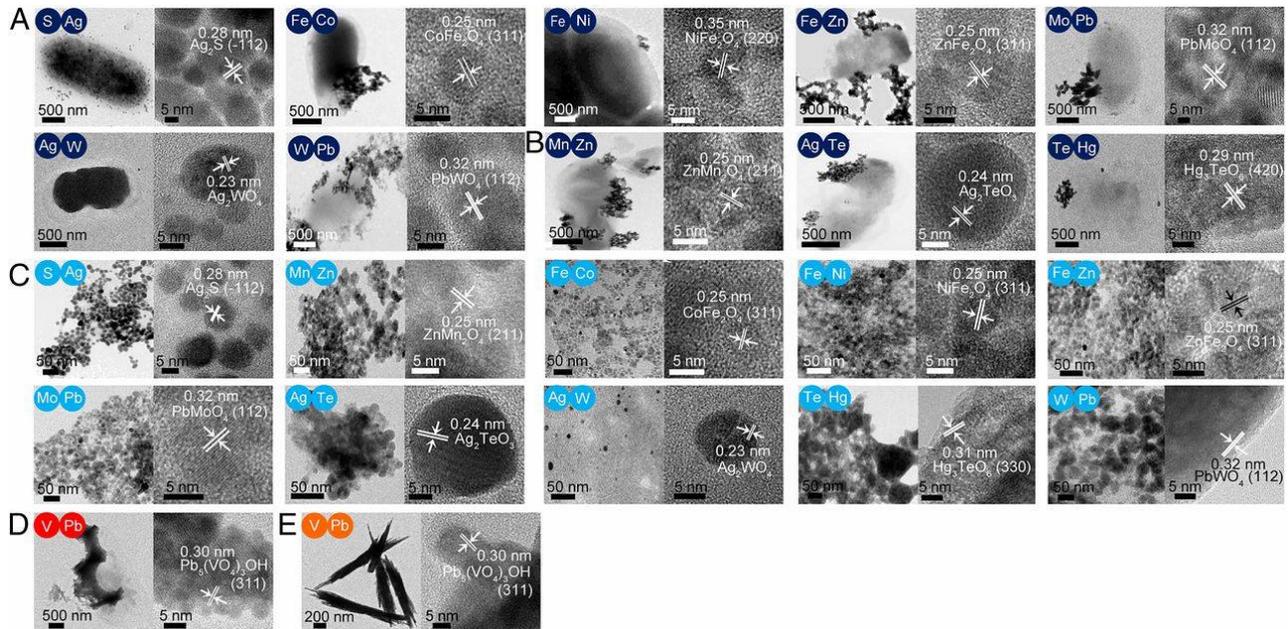
source - kaist.ac.kr

The innovative development was made by the scientific group from the [Korea Advanced Institute of Science and Technology](#) in collaboration with the [Chung-Ang University](#).

The well-known fact is that NMs, for example, metal nanoparticles, graphene, metal nanorods due to its unique characteristics are gradually used in different industries such as biomedicine, flexible electronics, chemicals, and etc. Despite, NMs are usually synthesized using energy-intensive chemical and physical consuming technologies that often require hazardous toxic capping agents in order to disperse and clean NMs after the process of synthesis. Therefore, the clean technology of biosynthesis and purification of NMs under mild conditions without toxic solvents and complicated process is required. In addition, scientists pay a big attention to the bacteria as it grows much faster than fungi and yeast. **The bioreduction of the exposed precursor ions by bacteria causes the precipitation of insoluble complexes and creates NMs.**

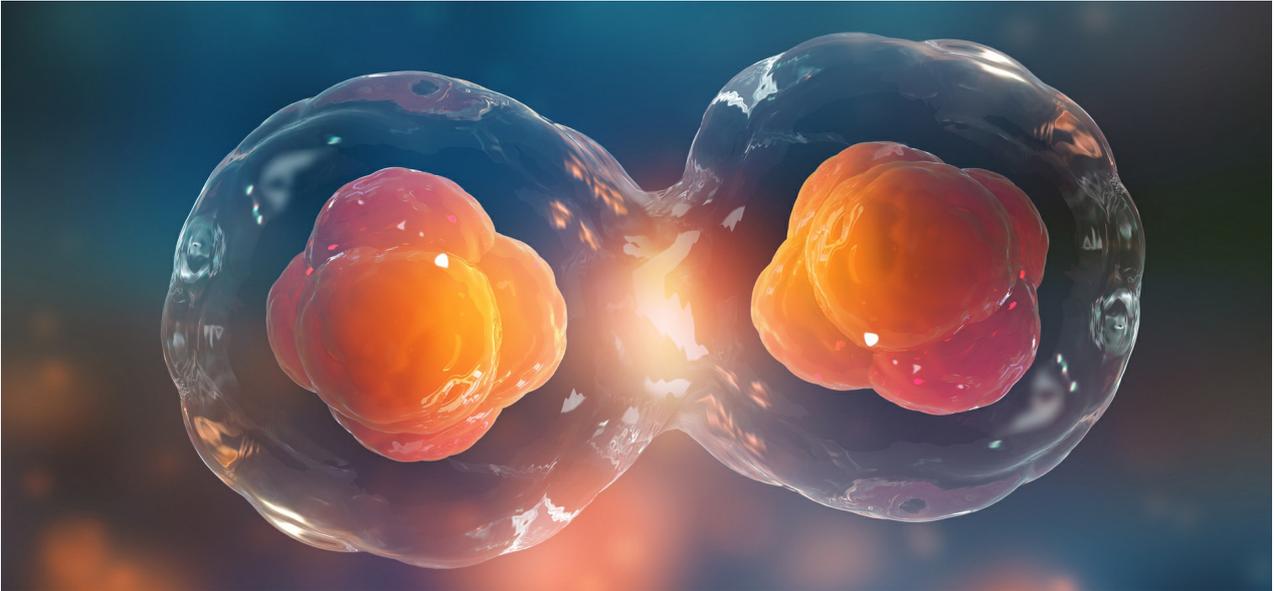
Therefore, scientists developed **the recombinant E. coli strain** that can synthesize NMs of the noble metal such as Argentum and Aurum and the transition metal such as Cuprum, Selenium, and Cadmium elements. Furthermore, it co-expresses metallothionein, which is a metal binding protein, and phytochelatin that provides the biosynthesis of different

nanomaterials. The biosynthesis of different NMs was performed through the extensive screening of single elements and bi-elemental combinations through in vivo and in vitro biosynthesis using recombinant *E. coli* and the cell extract. Prof. Lee mentioned that **this environmentally-friendly method of biological synthesis will be very useful in creating of nanomaterials and developing new ones.** It will significantly simplify the processing.



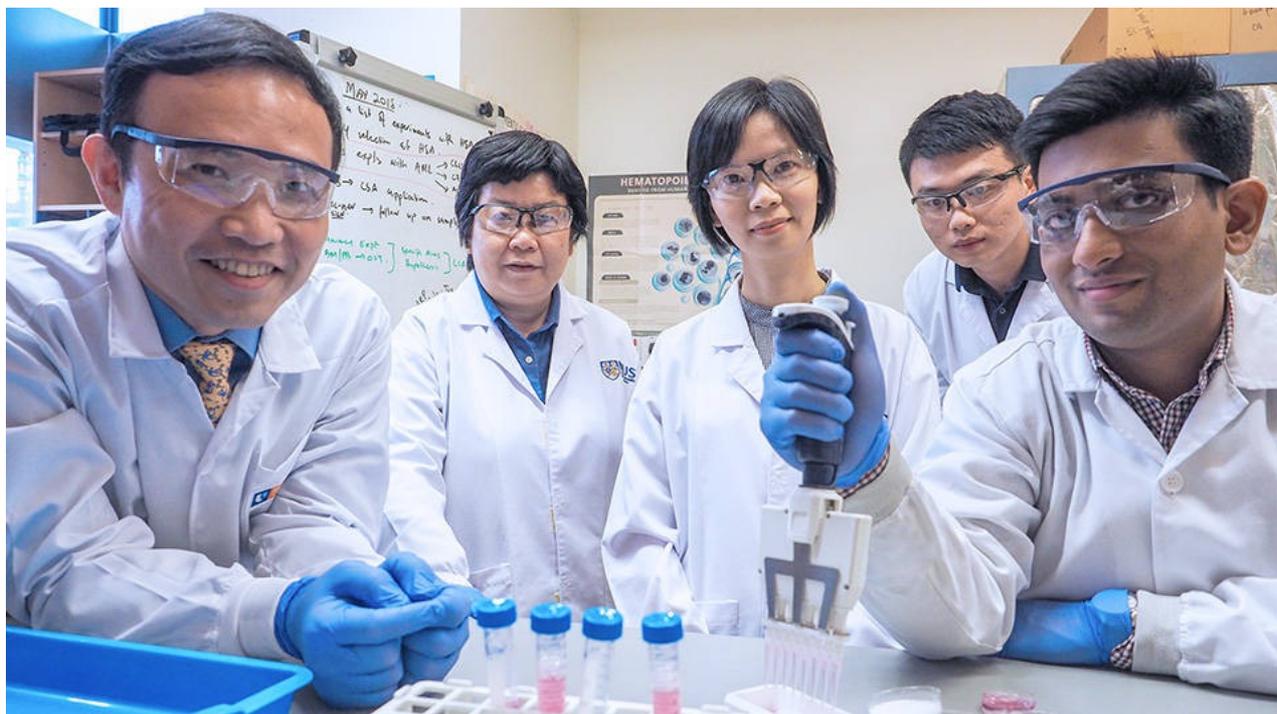
In vivo and in vitro biosynthesis of multi-element crystalline NMs. For each result with indicated bi-elements: (Left) the TEM image and (Right) the HR-TEM image  
source - pnas.org

**Company name:** Korea Advanced Institute of Science and Te.  
**Contact person:** Professor Sang Yup Lee  
**E-mail:** leesy@kaist.ac.kr  
**Website:** <http://www.kaist.edu/>  
**Phone:** +82-42-350-3930  
**Patent status:** -  
**On market since:** -  
**Regions:** Korea  
**Industries:** Chemicals, Healthcare, Biotechnology  
**Source links:** [PNAS](#)  
[Korea Advanced Institute of Science and Technology](#)



## A NEW METHOD TO GROW STEM CELLS WILL HELP TO TREAT CANCER

The well-known fact that stem cells attract much attention of scientists due to their properties and can be used in cell-based therapies and drug discovery. Scientists from Singapore have developed an efficient, rapid and cost-effective technology to spread the amount of haematopoietic stem (HSPC) and progenitor cells in umbilical cord blood that can be saved and collected in order to treat more than 80 diseases such as blood cancers, various metabolic and immune disorders. The scientific group intends to begin clinical trials by mid-2019.



The research team includes (from left) Assoc. Prof. Hwang, Prof. Chai, Assoc. Prof. Chiu, Dr. Zhong, and Dr. Bari source - nus.edu.sg

The innovative technique was made by the scientific group from the [Department of Pharmacy, Faculty of Science at the National University of Singapore](#) in collaboration with the [Duke-NUS Medical School](#), the [National Cancer Centre Singapore](#), and the [Singapore General Hospital](#).

The key **hematopoietic stem cell (HSCs)** characteristic is the ability for self-renewal. Blood cells are produced by the proliferation and differentiation of a very small population of HSCs. Typically, the number of HSPC that can be collected from the umbilical cord. Despite, it is deficient for adults, which are the majority of patients who require them. Therefore, this type of stem cells should be expanded for clinical use. The significant role in the developing of this technology plays the **C7 molecule**, which was designed by **Prof. Christina Chai**. Scientists determined that this recently synthesized molecule can spread umbilical cord blood stem cells. **The use of C7 provides more HSPC within a shorter period of time and requires less biological agents and less processing.**

Assoc. Prof. Hwang mentioned that for some patients the umbilical cord blood is the only way of transplantation as they cant find a fully appropriate bone marrow or peripheral blood stem cells. Despite this fact, happens that patients, which found an umbilical cord blood, the transplantation can be performed because of the small number of cells.

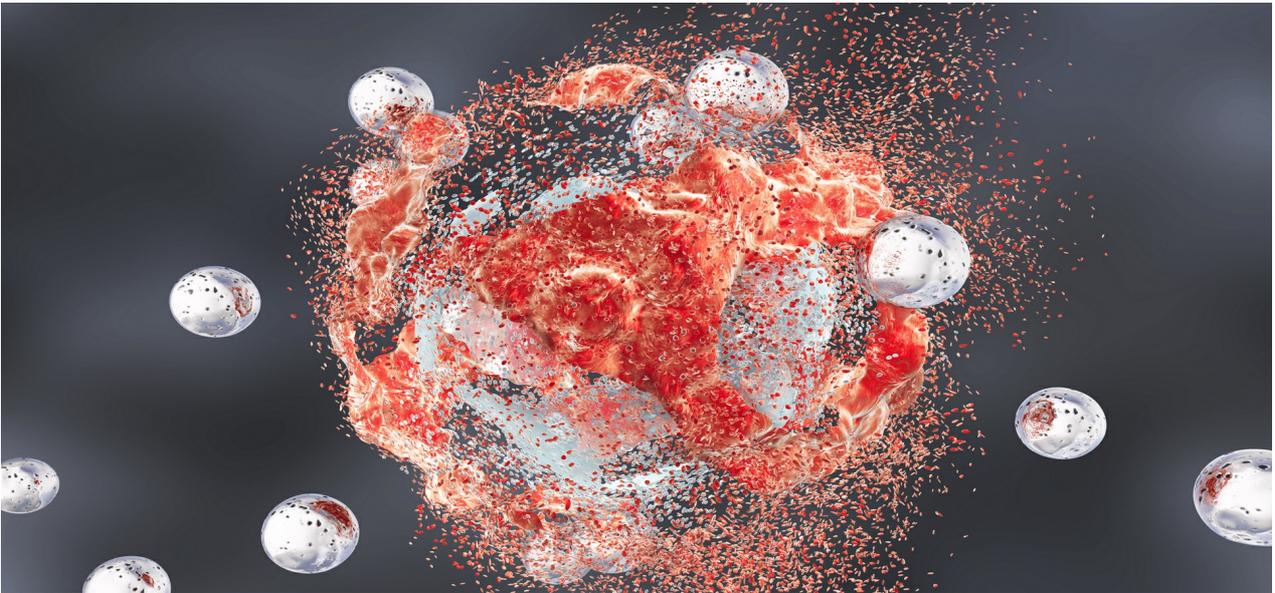
Consequently, this innovative technology, providing the ability of transplantation, can treat different diseases and therefore, save a million lives.



The laboratory-synthesized compound C7 has the ability to expand the amount of umbilical cord blood stem cells source - nus.edu.sg

The technology was patented. Furthermore, scientists got two grants, an Innovation and an Ignition grant of \$244,000 from the [Singapore-MIT Alliance for Research and Technology](#), and a \$250,000 grant from the [National Health Innovation Centre](#).

**Company name:** National University of Singapore  
**Contact person:** Professor Christina Chai  
**E-mail:** phacllc@nus.edu.sg  
**Website:** <http://www.nus.edu.sg/>  
**Phone:** +65 6601 1061  
**Patent status:** -  
**On market since:** -  
**Regions:** Singapore  
**Industries:** Healthcare  
**Source links:** [National University of Singapore](#)



# A NOVEL REAL-TIME SCANNING TECHNOLOGY FOR CANCER PHOTOTHERMAL THERAPY

Photothermal therapy (PTT) is considered to be an alternative type of cancer therapies as it doesn't cause certain side effects such as hair loss or vomiting. It inserts nanoparticles into cancer tumors and uses heat produced by near-infrared (NIR) laser irradiation in order to destroy cancer cells. Scientists created an innovative technology using fluorescence detected in the cellular system and the photothermal effects of  $\text{Fe}_3\text{O}_4$  nanoparticles (NPs). Furthermore, the technology can provide the ability to monitor whether the PTT is properly performed. Therefore, it will significantly improve the cancer treatment.



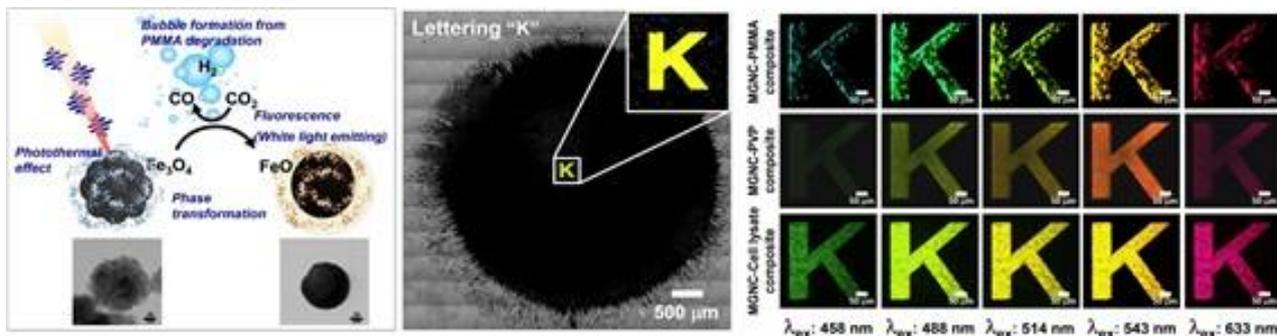
Prof. Young Keun Kim's research team (from left, Prof. Young Keun Kim, Yu Jin Kim, and Bum Chul Park)  
source - korea.ac.kr

The technology was developed by the scientific group led by [Professor Young Keun Kim](#) from the [Korea University](#). The research was funded by the [Basic Science Research Program of the National Research Foundation of Korea \(NRF\)](#), which aims to nurture excellent researchers by encouraging the motivation for creative research and maximizing research capacity among researchers.

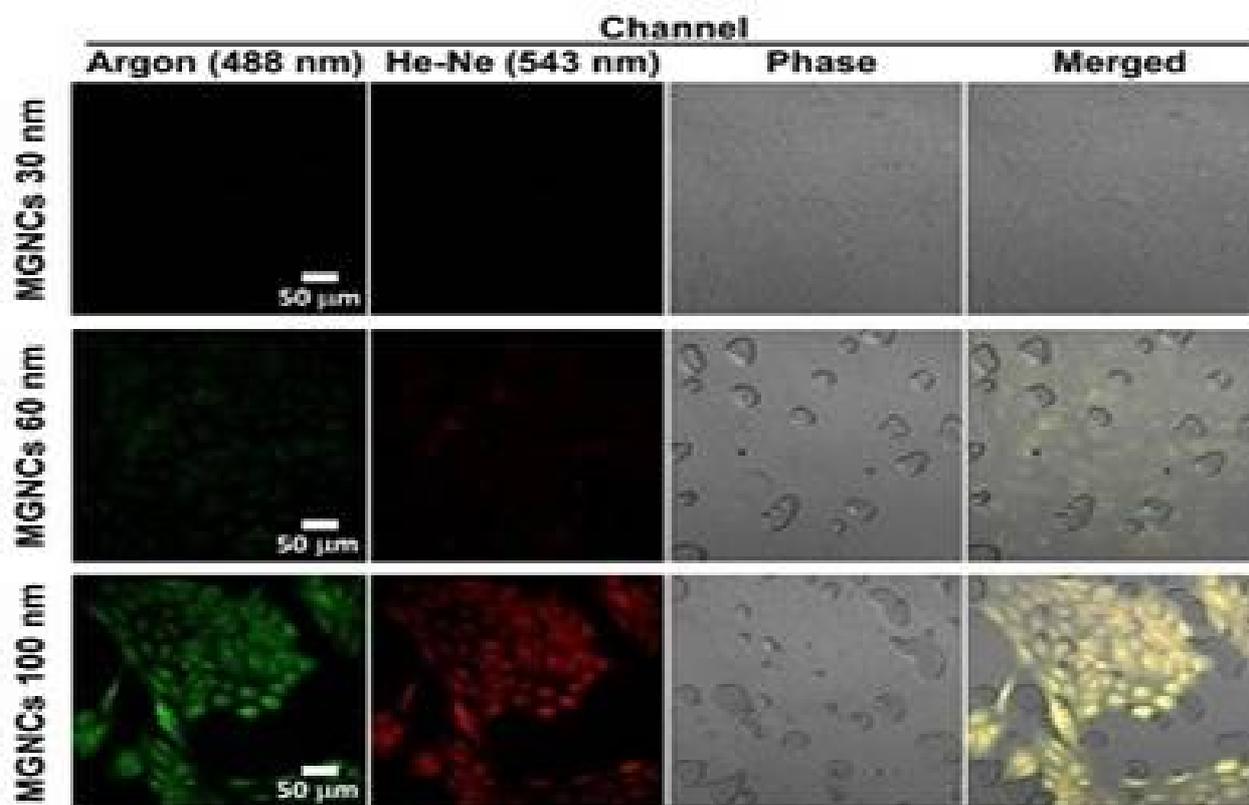
The [polymer-coated magnetite \(Fe<sub>3</sub>O<sub>4</sub>\) nanoparticles \(NPs\)](#) are studied in order to apply them in therapeutics or diagnostics through the PTT as they have the ability to generate heat by absorbing visible and NIR light. The irradiation has an impact on Au NPs reducing their effectiveness and structural stability. Therefore, scientists analyzed the photonic reactions of Fe<sub>3</sub>O<sub>4</sub> NPs and polymer composites using the 780 nm multiphoton laser. Fe<sub>3</sub>O<sub>4</sub> NPs can be alternative to Au NPs. The photonic reactions provide suitable outcomes such as fluorescence from conformationally changed polymer and low-temperature phase transformation of Fe<sub>3</sub>O<sub>4</sub> NPs. The fluorescence is found in the cellular system by photonic reactions between Fe<sub>3</sub>O<sub>4</sub> NPs and biomolecules. The heat, which was produced during the process, makes  $\pi$ -conjugated chains, inducing fluorescence.

Furthermore, after multiphoton laser irradiation, the fluorescence emission varied with the vehemence of the laser and the size of nanoparticles of polymer-coated magnetite with a higher intensity that is noted in large nanoparticles. Scientists mentioned that [if apply Fe<sub>3</sub>O<sub>4</sub> NPs to photothermal therapy, medicals will be able to control the correctness of performing the photothermal cancer therapy](#). Therefore, [it highly improves the](#)

effectiveness of its type of cancer treatment makes it the appropriate alternative without toxic side effects.



The photonic reactions of Fe<sub>3</sub>O<sub>4</sub> NPs and polymer composites leading to π-conjugated chains and fluorescence source - korea.ac.kr



Fluorescence emission from the cells by the photonic reaction of Fe<sub>3</sub>O<sub>4</sub> NPs by size. π-conjugated system: An electron structure with alternating π-bonds of molecular orbits source - korea.ac.kr

**Company name:** Korea University  
**Contact person:** Professor Young Keun Kim  
**E-mail:** ykim97@korea.ac.kr  
**Website:** <https://www.korea.edu/>  
**Phone:** -  
**Patent status:** -  
**On market since:** -  
**Regions:** Korea  
**Industries:** Healthcare, Others  
**Source links:** [Small](#)  
[Korea University](#)



## A NOVEL THERAPY TO PREVENT A MYOCARDIAL INFARCTION

Scientists from Korea developed an innovative target therapy that selectively treats high-risk atherosclerotic plaque that causes myocardial infarction and heart failure. This novel therapy has the ability to maximize therapeutic effects simultaneously minimize side effects. It can activate the pathway of PPAR $\gamma$  agonist in order to highly reduce the plaque burden and inflammation causing any toxic effects. In addition, scientists mentioned that this novel development can be an effective alternative to cardiovascular disease treatment.



Jah Yeon Choi, Ph.D. student, Korea University Medical School (left, first author) and Prof. Jin Won Kim, Cardiovascular Center, Korea University Guro Hospital (right)

The therapy was developed by the scientific group, led by [Professor Jin Won Kim](#) from the [Korea University Guro Hospital](#).

Atherosclerosis is the progressive process that is responsible for most heart disease such as the myocardial infarction, stroke, abdominal aneurysms and lower limb ischemia that cause mortality. Despite this wide range of clinical conditions, most of the acute manifestations of atherosclerosis have a common pathogenetic feature: the atherosclerotic plaque. It is a chronic inflammatory disorder involving lipid accumulation within arterial walls. Therefore, scientists developed the method that has the ability [to activate the pathway of PPAR \$\gamma\$  agonist in order to reduce the plaque burden and inflammation.](#)

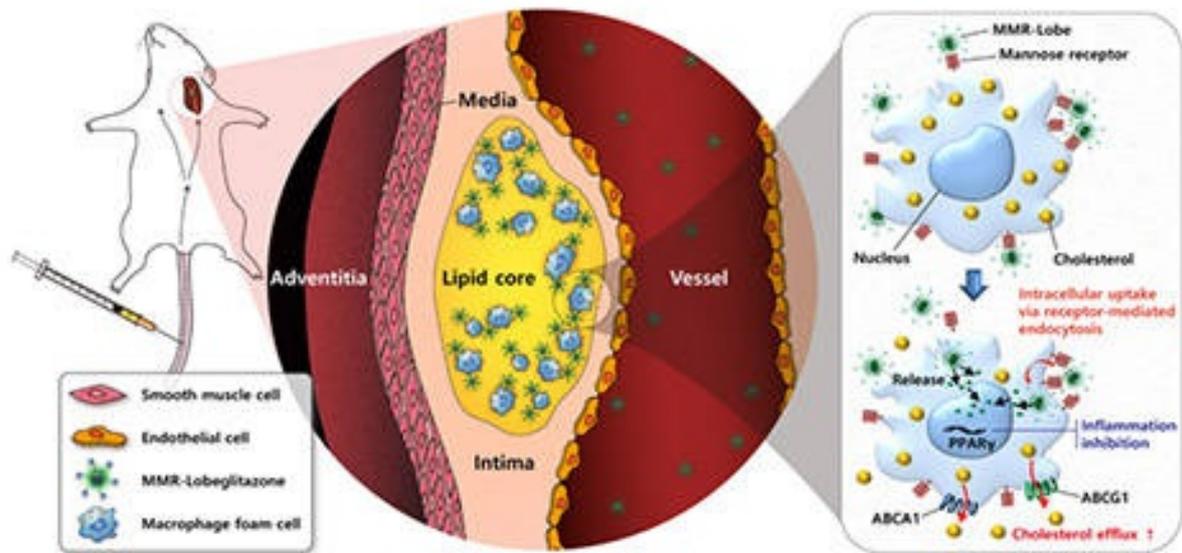
They managed to create [the macrophage mannose receptor \(MMR\)-targeted biocompatible nanocarrier loaded with lobeglitazone \(MMR-Lobe\)](#), which has a high affinity to macrophage foam cells, and the ability [to effectively provide the cholesterol efflux via LXR \$\alpha\$ -, ABCA1, and ABCG1 dependent pathways, and inhibit plaque protease expression.](#) The results of serial in vivo optical imaging demonstrated that the treatment of injectable MMR-Lobe highly decreased plaque burden and inflammation in atherogenic mice without toxic side effects. Scientists loaded a new PPAR $\gamma$  agonist, lobeglitazone, into the MMR-targeted GC carrier (MMR-Lobe) to specifically activate PPAR $\gamma$  pathways in high-

risk plaques. Hydrophobically-modified glycol chitosan (GC) was used as a carrier vehicle due to its biocompatible, biodegradable, and rarely immunogenic and its general properties and in vivo biodistribution. The intravenous administration of MMR-Lobe can quickly suppress plaque inflammation using the method of modulating the macrophage inflammatory cascade in patients with the acute coronary syndrome, in addition to standard therapy. Moreover, Prof. Kim noted that this innovative therapy can be **the effective alternative to cardiovascular disease treatment**. The research was supported by the [National Research Foundation of Korea](#) and the [Korean Ministry of Science and ICT](#).



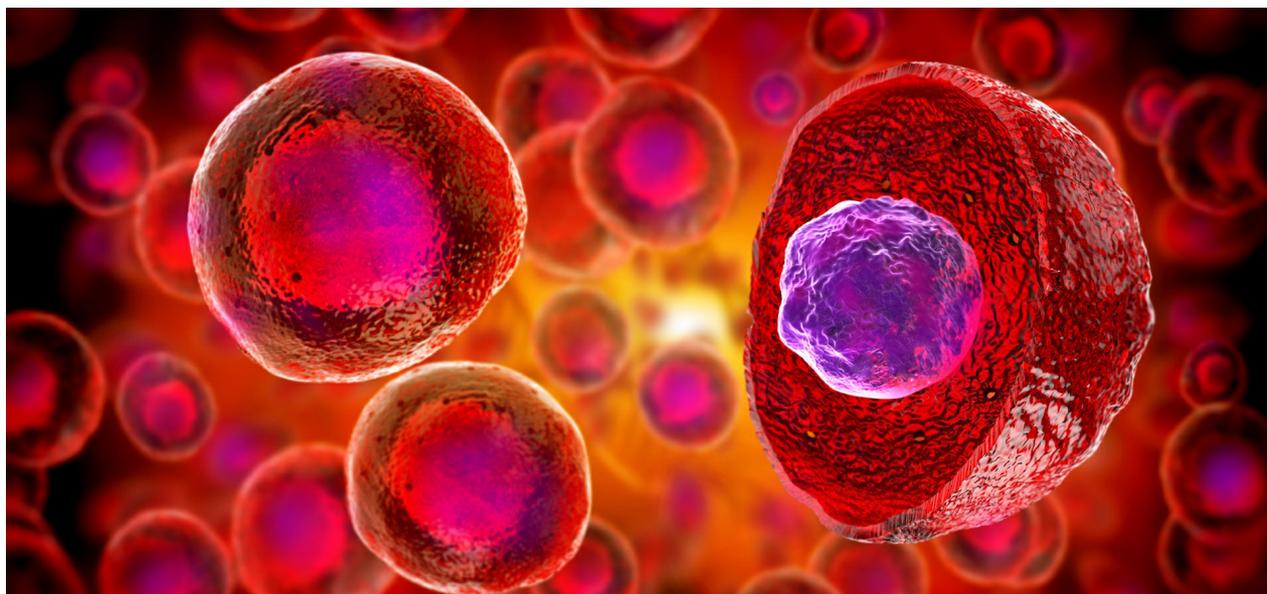
Schematic illustration of MMR-Lobe and in-vivo microscopy image system of small animals, resulting in reduction of atherosclerotic plaques and inflammation activity after the targeted therapy

source - korea.ac.kr



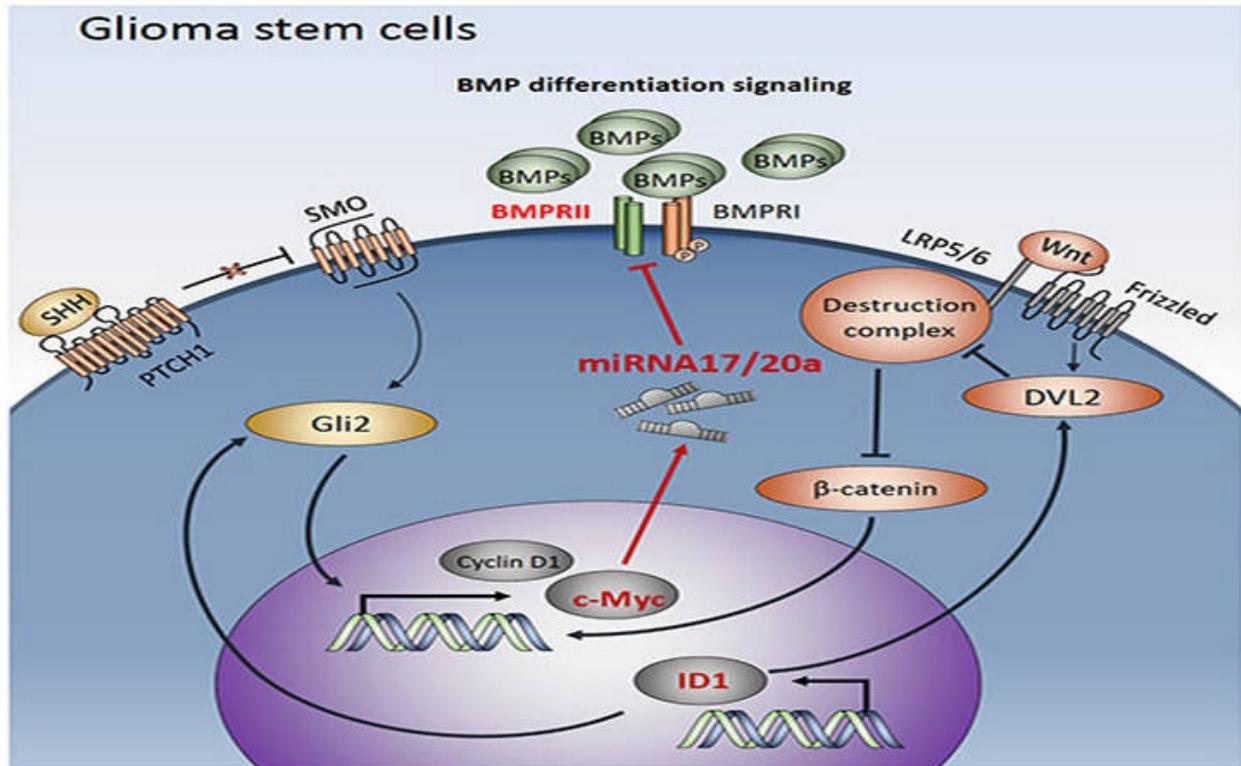
Schematic illustration of targeted MMR-Lobe effects. Circulating MMR-Lobe specifically binds to high-risk plaque macrophages in atherosclerotic plaques and releases lobeglitazone  
source - korea.ac.kr

**Company name:** Korea University Guro Hospital  
**Contact person:** Professor Jin Won Kim  
**E-mail:** rk.ca.aerok@mmwjk  
**Website:** <http://guro.kumc.or.kr/language/ENG/main/...>  
**Phone:** -  
**Patent status:** -  
**On market since:** -  
**Regions:** Korea  
**Industries:** Healthcare  
**Source links:** [Theranostics](#)  
[Korea University](#)



## A NOVEL CANCER THERAPY

Cancer stem cells (CSCs) cause initiation and differentiation of cancer. Furthermore, such cancers stem cells are resistant to various types of therapy causing re-formation of tumors. Despite the fact that a tumor therapy targeted to the cancerous stem cells has recently been studied, the self-renew ability of these cells causes the limitation of therapeutic effects or even the recurrence of cancer. Therefore, scientists from Korea developed an innovative tumor therapy using differentiation of cancer stem cells.



The experiment confirmed that suppressing stem cell control signaling while activating differentiation induction signaling inhibits cancer stem cells as well as tumors  
 source - korea.ac.kr

The novel development was made by the scientific group, led by [Professor Hyunggee Kim](#), from the [Korea University](#) in collaboration with the [National Cancer Center](#), the [First Affiliated Hospital of Wenzhou Medical University](#) and the [Lerner Research Institute, Cleveland Clinic](#).

As there was mentioned before, cancer stem cells have the ability to self-renew causing recurrent cancer. Healthy stem cells control self-renewal and differentiation during the process of their formation. In contradistinction to them, **CSCs provides formation via aberrant activation of stemness and prevarication of differentiation**. A brain tumor, glioblastoma (GBM) is a lethal type of cancer that is characterized by low survival. Glioblastoma stem cells (GSCs) are determined by self-renewal and tumor spreading. It means that GSCs are significant targets for therapy.

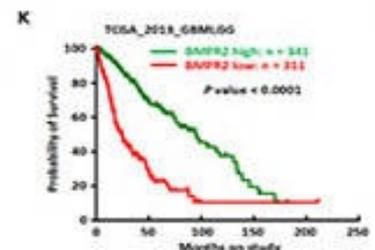
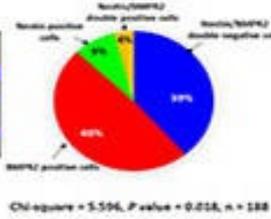
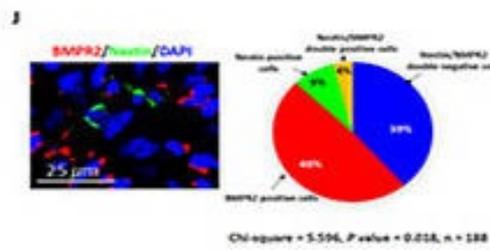
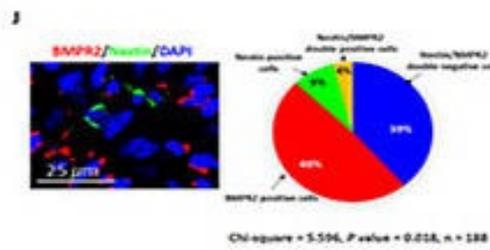
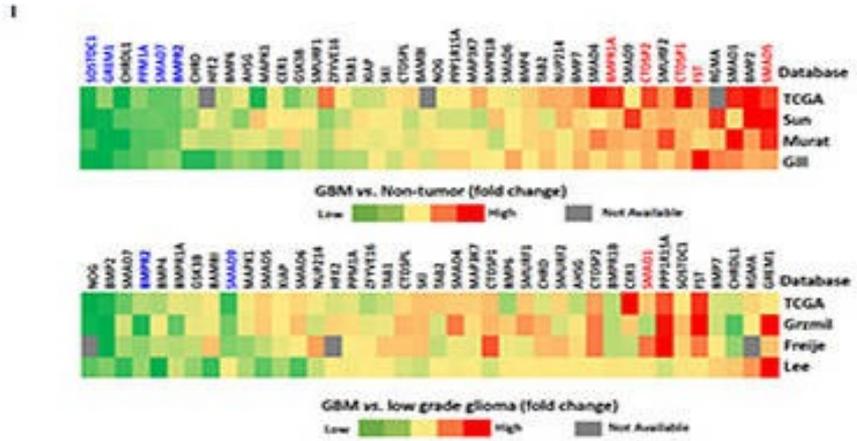
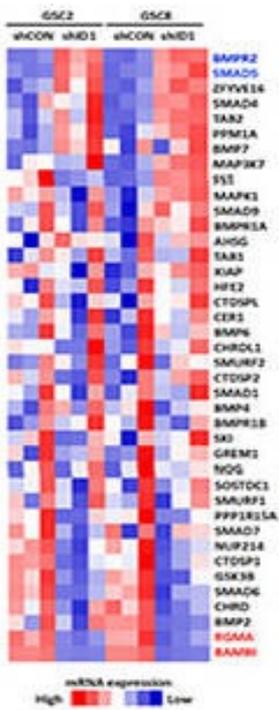
The scientific group showed the special method, which is named 'carrot and sticks', that controls stemness and promotes differentiation. Scientists made in silico screening and in vitro validation studies through Western blotting, qRT-PCR for treatment of WNT and SHH signaling inhibitors, and bone morphogenetic protein (BMP) signaling inducer with control

and ID1-overexpressing cells. The inhibitor of differentiation (ID) proteins is basic helix-loop-helix (bHLH) transcriptional factors lacking a DNA-binding domain that perform main functions in normal neurogenesis and GBM tumorigenesis. ID proteins maintain stemness traits by interacting with the differentiation-related bHLH transcription factors, such as Mash1 and MyoD, consequently inhibiting differentiation-related genes.



The survival rate of brain tumor-bearing mice was increased by regulating WNT and SHH signaling and activating BMP signaling in brain tumor stem cells  
source - adobe.com

The study results demonstrated that **ID1 canceled differentiation signals from BMPR signaling in GSCs to provide self-renewal**. ID1 inhibited BMPR2 expression through miRNAs, miR-17 and miR-20a, which are transcriptional targets of MYC. With the help of the innovative GSC-specific intrinsic signaling program, scientists demonstrated **a strong mechanism that helps in maintaining hierarchy in GBM tumors**. Furthermore, Professor Kim mentioned that this significant development will improve **the creation of various anticancer medicine, which is targeting different types of cancer**. In addition, they support the same combinatorial treatment approach using pharmacologic inhibitors of intrinsic signaling cascades along with a differentiation inducer for effective targeting of CSCs and eradication of malignant tumors.



BMPR2 mRNA expression was consistently downregulated in glioblastoma (GBM) specimens compared with nontumorigenic brain or low-grade GS in multiple available gene expression patient datasets source - adobe.com

**Company name:** Korea University  
**Contact person:** Professor Hyunggee Kim  
**E-mail:** hg-kim@korea.ac.kr  
**Website:** <https://www.korea.edu/>  
**Phone:** -  
**Patent status:** -  
**On market since:** -  
**Regions:** United States, China, Korea  
**Industries:** Healthcare  
**Source links:** [Clinical Cancer Research](#)  
[Korea University](#)



## NEW PLATINUM CATALYST WILL IMPROVE ELECTRIC VEHICLES

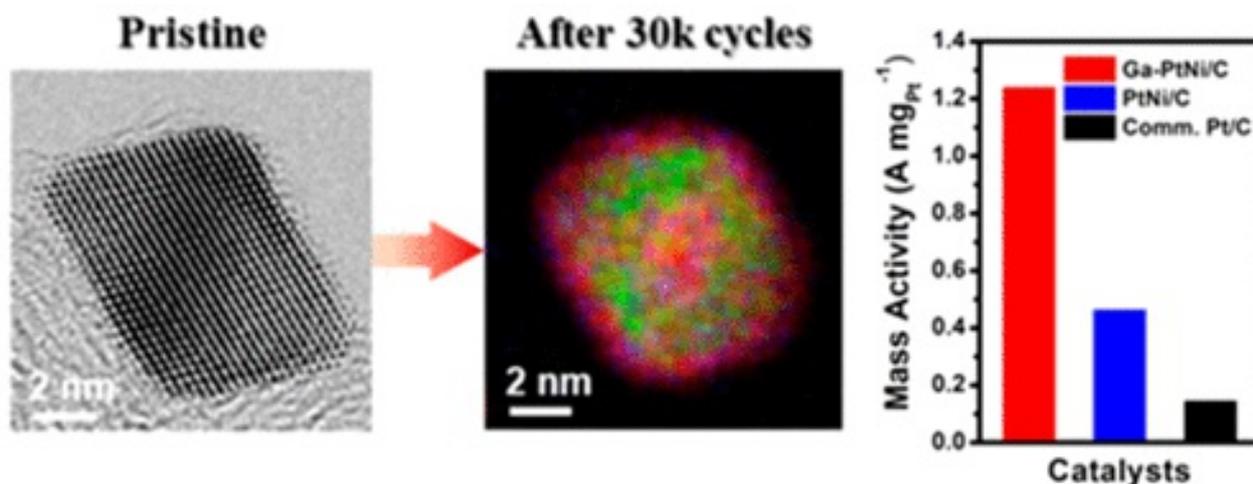
Electric vehicles, which are based on the fuel cell, can significantly mitigate climate changes and especially air pollution in large cities, which is predominantly caused by motor vehicles. Despite this, their rapid commercialization faces some limitations such as the price of platinum that is used as the electrode catalyst. Therefore, scientists developed the fuel cell catalyst, which demonstrates 12 times higher performance and twice the durability than the current platinum catalyst. In addition, it is cost-effective.



Professor EunAe Cho at the Department of Materials Science and Engineering  
source - kaist.edu

The novel development was made by the scientific group, led by [Professor EunAe Cho](#), from the [Korea Advanced Institute of Science and Technology](#) in collaboration with the [Pohang University of Science and Technology](#) and the [California Institute of Technology](#).

The fuel cell is an environment-friendly power generator that is considered to purify the air. The hydrogen vehicle, which performing is based on the fuel cells, has the ability to ostensibly clean more than **98%** of the particulate matter and ultrafine particles from the air that about **70** people inhale. **Polymer electrolyte membrane fuel cells (PEMFCs)** are an appropriate power source for zero-emission vehicles due to their eco-friendliness, high energy efficiency, and high power density. Despite these advantages, it has some limitations such as the high price of platinum that is applied in as the electrode catalyst in order to overcome the sluggish kinetics of the **oxygen reduction reaction (ORR)** in the cathode. This significantly slows down commercialization and their widespread use in everyday life. The bimetallic PtNi nanoparticles can be used as the electrocatalyst for ORR in PEMFCs due to their high catalytic activity. However, under normal fuel cell performing, Ni atoms are readily soluble in an electrolyte. It causes the degradation of the catalyst and the membrane-electrode assembly (MEA).



The majority of the Ga–PtNi nanoparticles well maintain the octahedral shape without agglomeration after the single cell durability test (30,000 cycles)

source - pubs.acs.org

Therefore, scientists used gallium-doped PtNi octahedral nanoparticles on a carbon support (Ga–PtNi/C). They managed to find that gallium has the ability to modulate the oxygen intermediate binding energy, leading to the increase of the catalytic activity toward ORR. Ga–PtNi/C demonstrates high ORR activity, marking an 11.7-fold improvement in the mass activity ( $1.24\ A\ mg_{Pt}^{-1}$ ) and a 17.3-fold improvement in the specific activity ( $2.53\ mA\ cm^{-2}$ ) compared to the commercial Pt/C. Furthermore, the single cell using Ga–PtNi/C also demonstrates higher initial performance and durability. In other words, Ga–PtNi/C can be instantly utilized as a cathode catalyst for PEMFCs. Scientists mentioned that it can allow the mass manufacturing of the catalysts that will lead to the fast commercialization of electric vehicles.

**Company name:** Korea Advanced Institute of Science and Te.  
**Contact person:** Professor EunAe Cho  
**E-mail:** eacho@kaist.ac.kr  
**Website:** <http://www.kaist.edu/>  
**Phone:** -  
**Patent status:** -  
**On market since:** -  
**Regions:** United States, Korea  
**Industries:** Energy, Environment, Transport Systems an..  
**Source links:** [Nano Letters](#)  
[Korea Advanced Institute of Science and Technology](#)



# A NOVEL TECHNOLOGY OF THE CIRCULATING TUMOR DNA DETECTION

The scientific group, led by Professor Na Sung Soo and Chanho Park from the Korea University, in collaboration with the Hoseo University and the Stevens Institute of Technology, have invented an innovative and ultra-sensitive technology for the detection of circulating tumor DNA (ctDNA). Currently, scientists from all over the world are trying to apply ctDNA as a biomarker for detecting the presence of tumors in different types of cancer. The early diagnosis of cancer requires extremely accurate testing that can be operated at extremely low concentrations of mutant DNA. This technology, due to its sensitivity, will ensure the early diagnosis of cancer, providing the opportunity for a more appropriate treatment strategy.

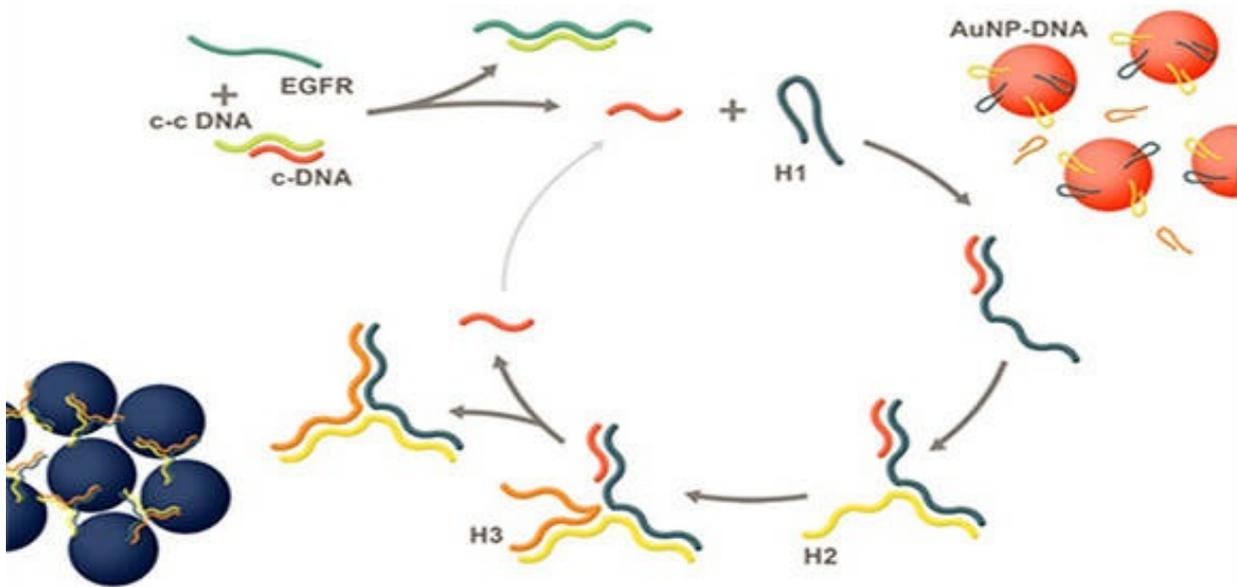


Professor Na Sung Soo (left) and Chanho Park (right) at KU's College of Engineering, Department of Mechanical Engineering  
source - korea.ac.kr

To diagnose cancer on the early stage, it is crucial to detect the **circulating tumor DNAs (ctDNAs)**. ctDNA is a mutant form of DNA that is present in the blood of the cancer patient. It can operate as a noninvasive type of biomarker, providing the alternative technique comparing to the invasive method of biopsy. In other words, such technique can be highly important for the method of early liquid biopsy diagnosis. Despite this fact, it is difficult to detect low levels of ctDNA in the bloodstream as its nucleotide sequence is very similar to the normal DNA circulating of the healthy people. Therefore, such detection requires highly sensitive and high precision test. Furthermore, in the future ctDNA could potentially be used as the noninvasive tool for **real-time monitoring of the treatment response and determining candidates for therapy**.

To perform this, scientists studied the suitability of a 2-ways CHA method and determined that there were some limitations such as sensitivity and selectivity. To solve these problems, they revised their method to **3-ways target switching catalytic hairpin assembly (TSCHA)**. This innovational technology targets on the **epidermal growth factor receptor (EGFR) mutation DNA**. EGFR mutation DNA is a very long DNA about **84 mer**. Consequently, due to its length, it is difficult to identify such a long DNA. Nevertheless, using the TSCHA technique, scientists are able to generate the short catalyst DNA (c-DNA)

applying the long target DNA. Performing the catalytic reaction of the DNA, scientists managed to improve the detection signal. Furthermore, it helped to achieve the high selectivity. Consequently, they were able to detect such type of mutated DNA at a very low concentration of 7.7 fM. Therefore, this innovative and precise technology provides early diagnosis of cancer.



EGFR mutant is detected in the presence of wild-type DNA, as little as 1%. TSCHA method can be utilized as a platform to detect mutant DNA in the blood of cancer patients  
source - korea.ac.kr



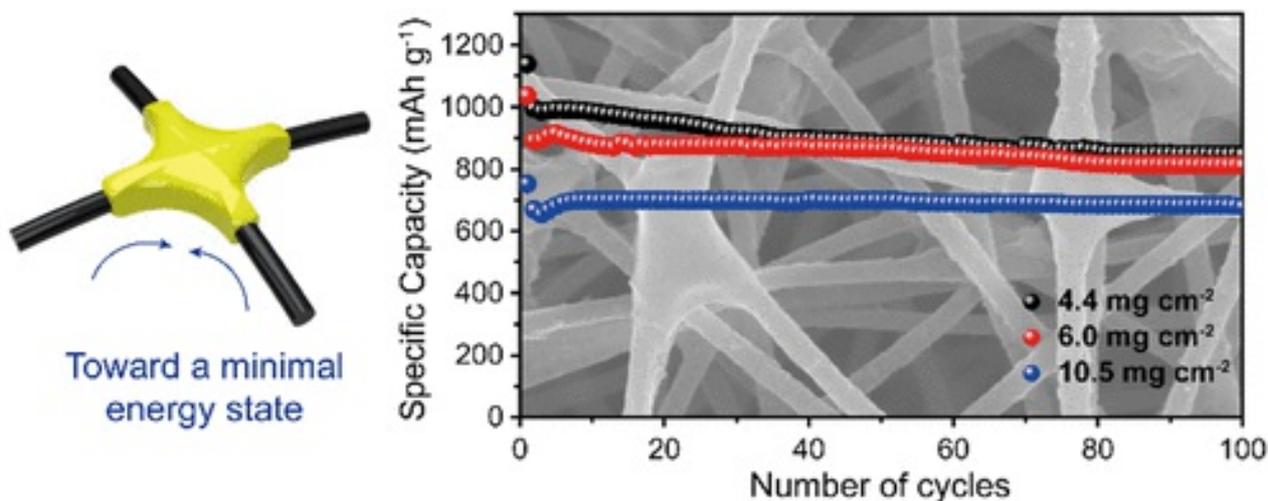
The study was supported by the ERC ' Nano-Biofluignostic Research Center', Korea Research Foundation Leading Research Center  
source - korea.ac.kr

**Company name:** Korea University  
**Contact person:** Professor Na Sung Soo  
**E-mail:** nass@korea.ac.kr  
**Website:** <https://www.korea.edu/>  
**Phone:** -  
**Patent status:** -  
**On market since:** -  
**Regions:** United States, Korea  
**Industries:** Healthcare  
**Source links:** [Sensors and Actuators B: Chemical](#)  
[Korea University](#)



## NEW HIGHLY EFFICIENT LITHIUM-SULFUR BATTERIES

The scientific group from Korea developed high-area-capacity lithium-sulfur batteries (Li-S batteries) using the method of capturing polysulfide with carbon nanofibers. This novel technology will open a new of creation of high-area-capacity Li-S batteries, which will replace current lithium rechargeable batteries, accelerating the commercialization of related technologies and be widely used in electric vehicles, unmanned aerial vehicles (UAVs), and drones.



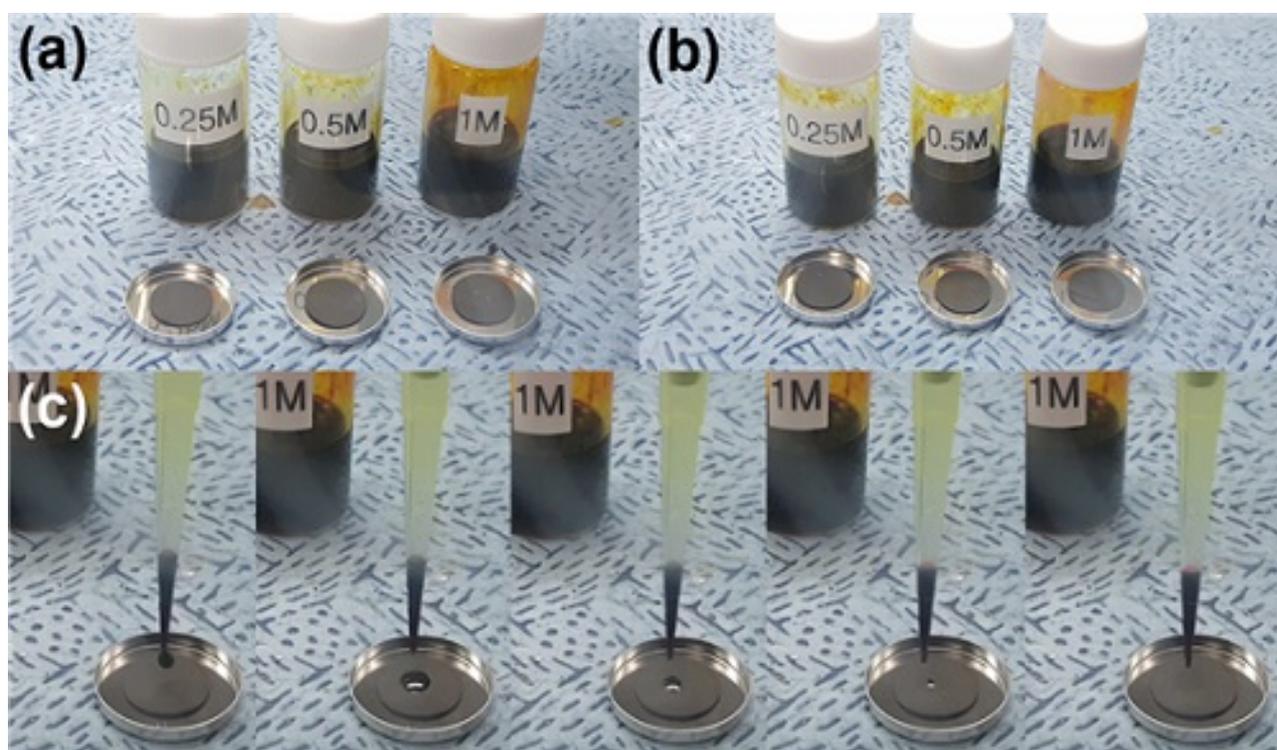
Electrochemical reaction leading to the containment of the sulfur within the carbon nanofiber and the corresponding specific capacity of the battery over a number of charge-discharge cycles  
source - kaist.edu

The innovational development was made by the scientific group, led by [Professor Do Kyung Kim](#), from the [Korea Advanced Institute of Science and Technology](#) in collaboration with the [Ulsan National Institute of Science and Technology](#).

Nanostructural design performed few breakthroughs in order to provide high-performance materials and devices including energy-storage systems. Different types of electric vehicles and big data centers require the creation of batteries with high energy density and cost-effectiveness. [Li-S batteries](#) have a great potential to achieve these goals. Furthermore, this type of battery has the ability to provide a cheaper energy-storage alternative for microgrids and the conventional electric grid. Despite this fact, to achieve these goals in using of Li-S batteries, it is crucial to attaining a high areal capacity with stable cycling. To widely use and commercialize this type of batteries scientists faced with several problems such as a low electrical conductivity of sulfur, a volumetric enlargement and curtailment of the battery during processes of charging and discharging, and regular electrode damaging, which is entailed by the dilution of the lithium polysulfide into the electrolyte.

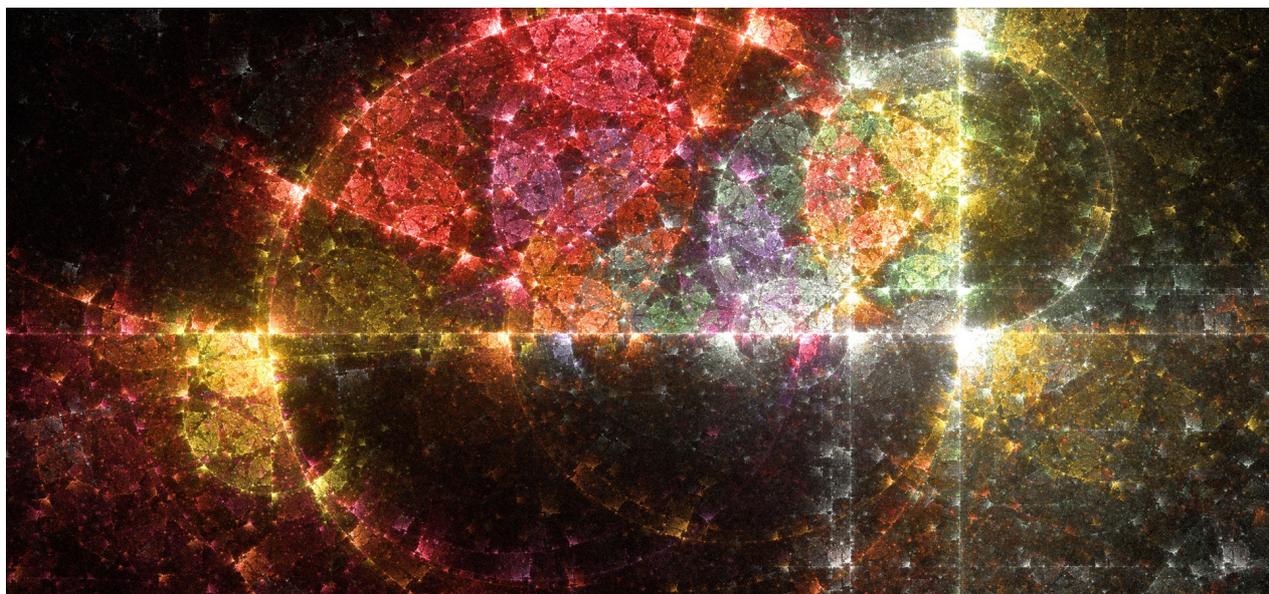
There were used different methods to solve these issues such as the physical encapsulation of sulfur. Despite, this caused other limitations, for example, the difficult synthetic processing and the limited mass loading of sulfur. [The physical encapsulation via nanostructural design has the ability to solve the problem of lithium polysulfide dilution during but provides significant contact resistance and reduce the kinetic at a high sulfur](#)

loading. Therefore, scientists decided to use **one-dimensional (1D) carbon materials** instead. In contradistinction to the 0D carbon, 1D carbon material provides a big surface area and a long-range conduction way for electrons and lithium ions. Furthermore, its using solves the high-contact resistance issue. As the result, the group showed the electrospun **carbon nanofiber (CNF) matrix** for a sulfur cathode. It provides the high mass loading of **10.5 mg cm<sup>-2</sup>** with the high capacity and the stable cycling. The CNF provides a high areal capacity of greater than **7 mAh cm<sup>-2</sup>**, that is connected to the great electrical conductivity of 1D. Scientists mentioned that this novel invention made them step closer to the commercialization of the high-capacity Li-S batteries, which can be used for developing of different products such as **electric cars, unmanned aerial vehicles (UAVs) and unmanned aerial vehicles.**



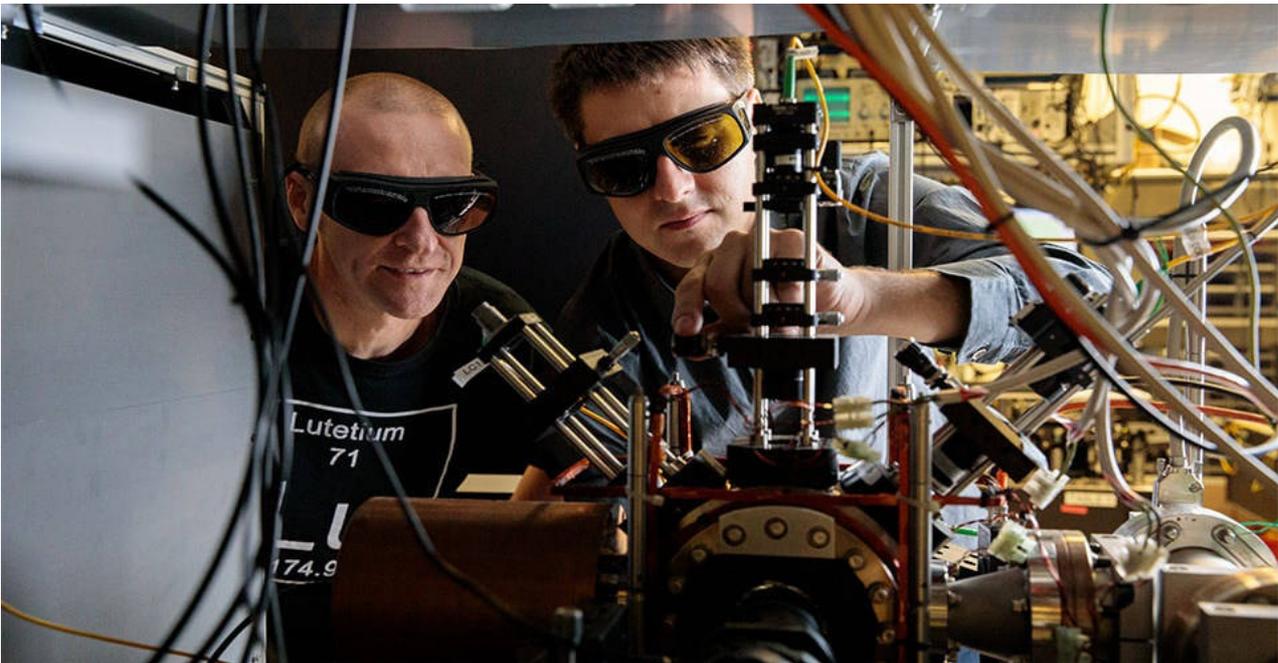
Carbon nanofiber effectively absorbing liquid based lithium polysulfide  
source - kaist.edu

**Company name:** Korea Advanced Institute of Science and Te.  
**Contact person:** Professor Do Kyung Kim  
**E-mail:** dkkim@kaist.ac.kr  
**Website:** <http://www.kaist.edu/>  
**Phone:** -  
**Patent status:** -  
**On market since:** -  
**Regions:** Korea  
**Industries:** Chemicals, Energy  
**Source links:** [Nano Letters](#)  
[Korea Advanced Institute of Science and Technology](#)



## HIGHLY ACCURATE ATOMIC CLOCKS WILL BE AVAILABLE

Atomic clocks have a wide spectrum of use such as navigation, determination of the location of satellites, planes, submarines and the application on the Internet. Recently, the group of scientists from Singapore has found that lutetium, which is a previously ignored element, has characteristics that make it ideal for high-performance atomic clocks production. This novel discovery opens the way for the creation of next-generation atomic clocks, which will be more precise and stable over time.



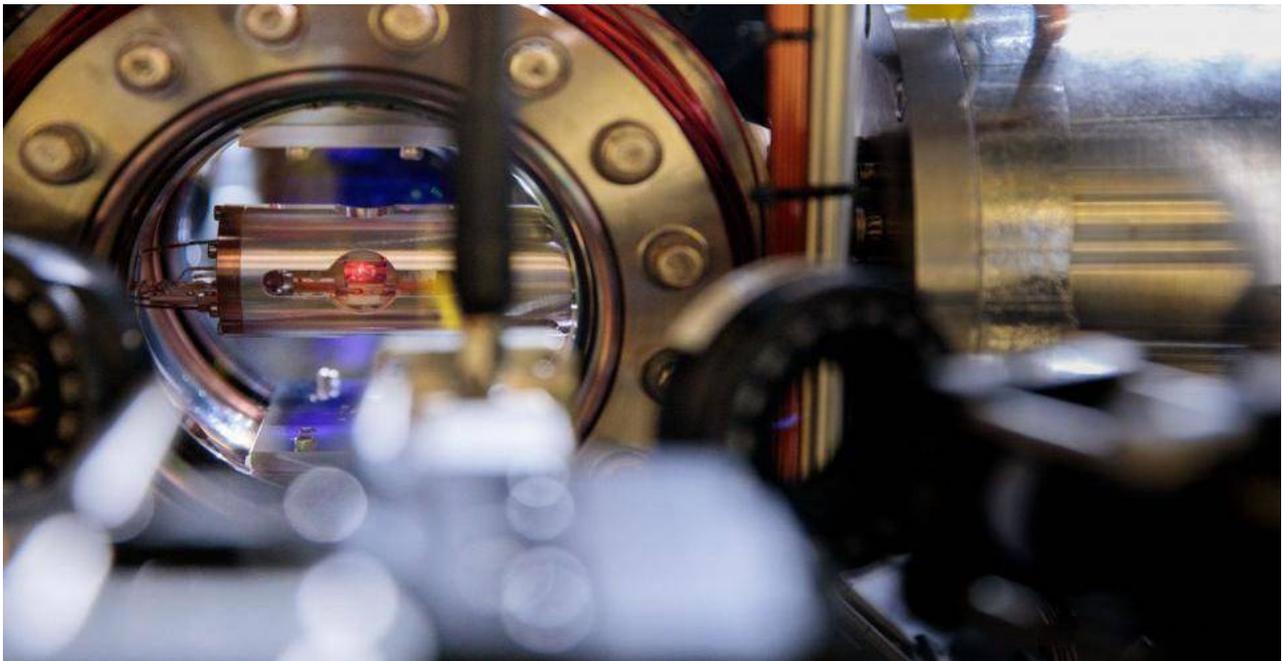
Assoc Prof Barrett (left) and Research Fellow Dr. Kyle Arnold from CQT realized the potential of adopting lutetium in building high-performance atomic clocks  
source - nus.edu.sg

The novel discovery was made by the scientific group, led by [Associate Professor Murray Barrett](#), from the [Centre for Quantum Technologies \(CQT\)](#) at the [National University of Singapore](#).

The atomic clock is a device for measuring time, in which, as a periodic process, natural oscillations associated with processes occurring at the level of atoms or molecules are used. It is highly important in navigation. The determination of the position of spacecraft, satellites, ballistic missiles, aircraft, submarines, as well as the movement of cars in automatic mode via satellite communication ([GPS](#), [Galileo](#)) are inconceivable without atomic clocks. The accuracy of current atomic clocks is led out from the insensitivity of narrow optical atomic resonances to environmental perturbations. Scientists managed to identify 2 such resonances in singly ionized lutetium, which has low sensitivity.

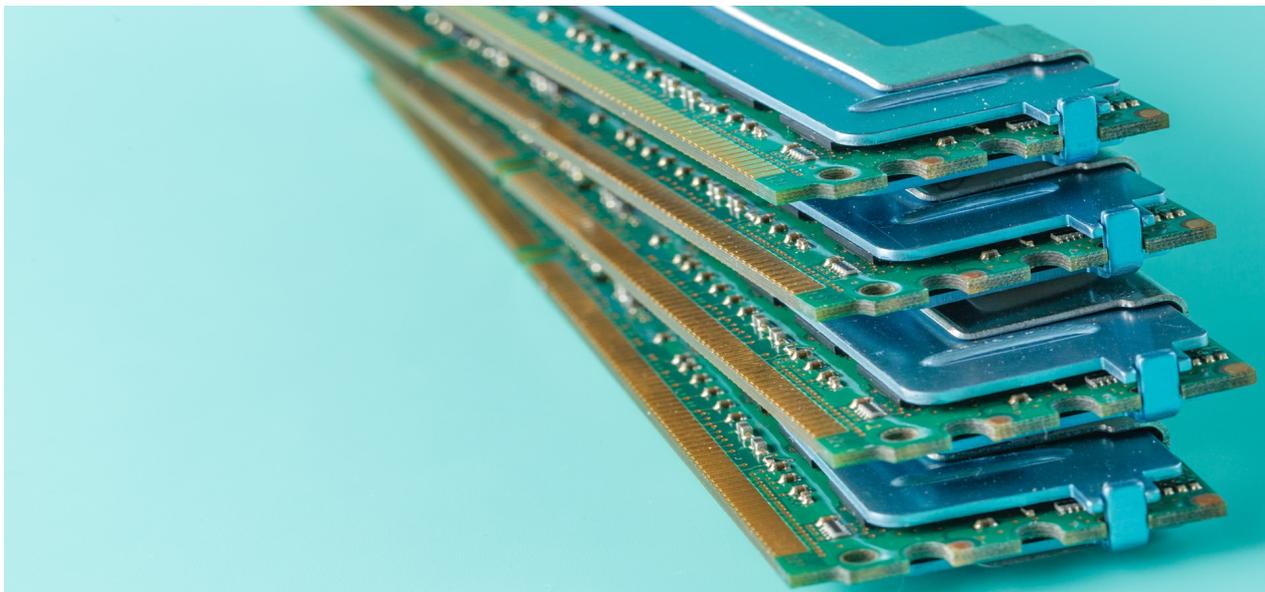
The cesium is used in current atomic clocks. Nevertheless, there is worldwide competition to applying other elements in order to improve the precision and stability of atomic clocks, for example, ytterbium, strontium, and aluminum. [The performance of the clock depends on the properties of the atom such as the intensity of the atom to its environment](#). The atoms of the lutetium are perfect to achieve this goal. The atomic properties of lutetium required to estimate clock systematic are known with sufficient accuracy to assess its future potential. The lutetium clock holds [10 000 times](#) faster than the cesium clock, which

allows it to accurately measure the time. The elimination of tensor shifts was performed by hyperfine averaging. Achievable uncertainties in these systematic shifts are considered in reference to state-of-the-art experimental techniques. The  $1S_0 \leftrightarrow 3D_1$  transition is uniquely insensitive to the blackbody radiation shift, leaving the residual micromotion-induced time dilation shift and ac-Stark shifts from the clock laser as leading systematics. Therefore, it is the least sensitive to the temperature among all current atomic clocks, which makes it very stable. The unique combination of atomic properties of lutetium makes it a favored candidate for multi-ion approaches to advance the stability of ion-based atomic clocks.



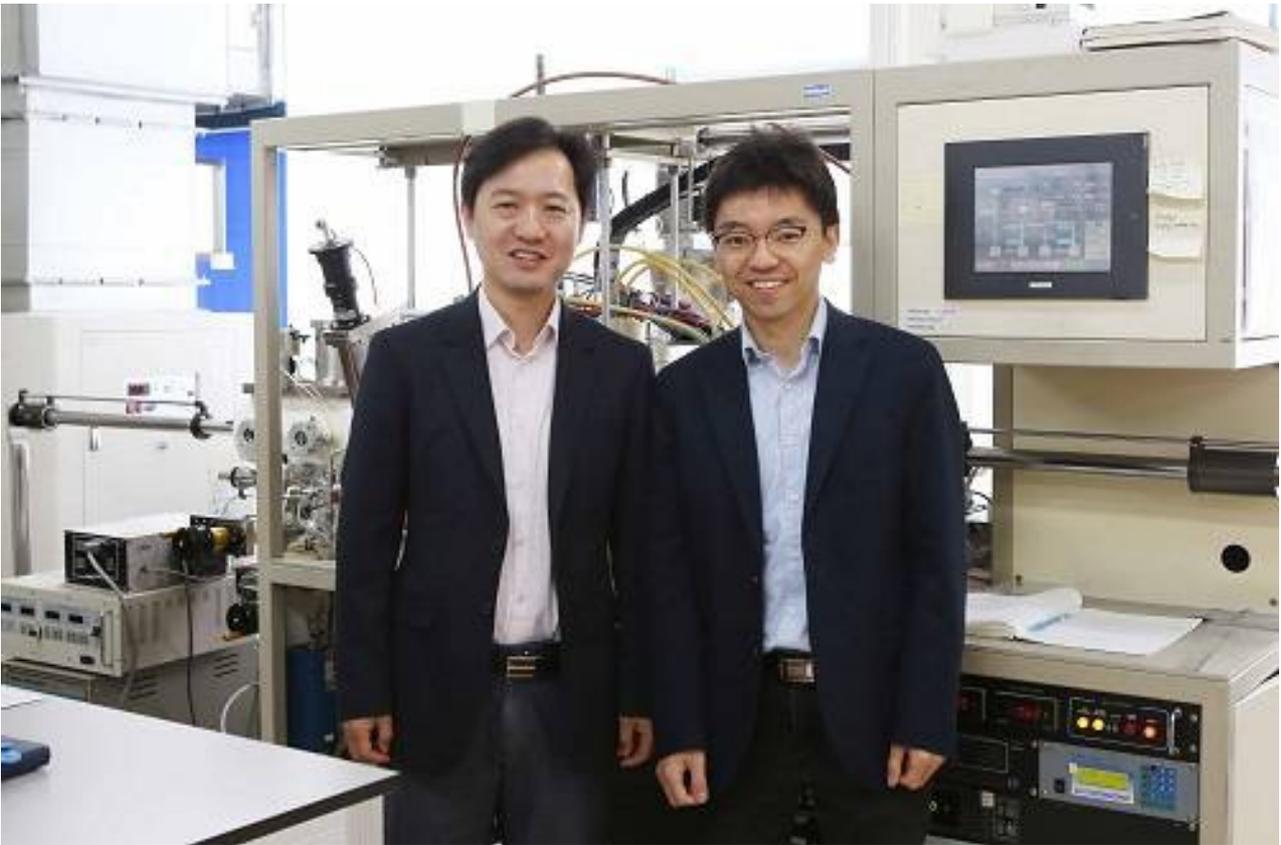
A novel 'hyperfine averaging technique' invented by Assoc Prof Barrett and his collaborators that cancels out certain sources of inaccuracy enabled the team to realize the potential of adopting lutetium in atomic clocks  
source - nus.edu.sg

**Company name:** Centre for Quantum Technologies  
**Contact person:** Associate Professor Murray Barrett  
**E-mail:** phybmd@nus.edu.sg  
**Website:** <https://www.quantumlah.org/>  
**Phone:** (65) 6516 2983  
**Patent status:** -  
**On market since:** -  
**Regions:** Singapore  
**Industries:** Aerospace, Defence and Marine, Others  
**Source links:** [Nature Communications](#)  
[NUS](#)



## A NOVEL MATERIAL TO GENERATE SPIN CURRENTS

The recent development of Korean scientists has opened the way for a production of a new generation memory. They managed to develop the newest material that has the ability to generate the energy-efficient spin current, which is the main part of the magnetic random access memory (MRAM) performing. This innovative material consists of ferromagnet-transition metal bilayers. It is able to arbitrarily control the direction of the produced spin current, in contradistinction to the current materials. In addition, MRAM can significantly improve smartphones, wearable electronics, and IoT devices.



Professor Byong-Guk Park from the Department of Materials Science and Engineering and Professor Kab-Jin Kim from the Department of Physics at KAIST

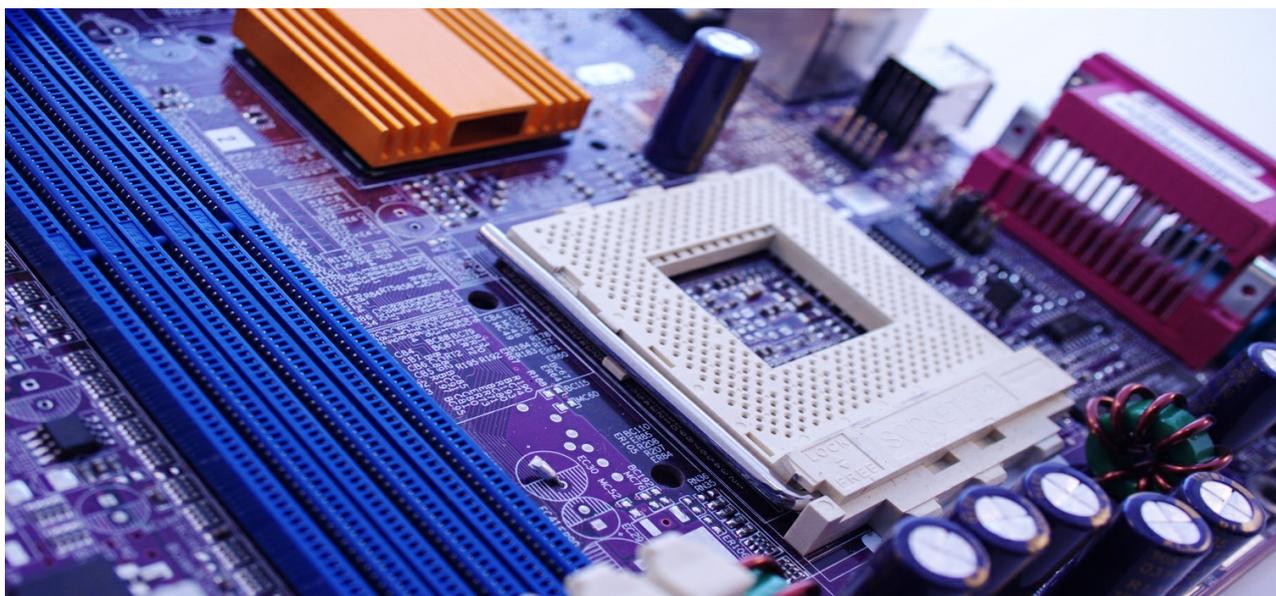
source - kaist.edu

The novel development was made by the scientific group, led by [Professor Byong-Guk Park](#) and [Professor Kab-Jin Kim](#), from the [Korea Advanced Institute of Science and Technology](#) in collaboration with the [Korea University](#) and the [National Institute of Standards and Technology](#).

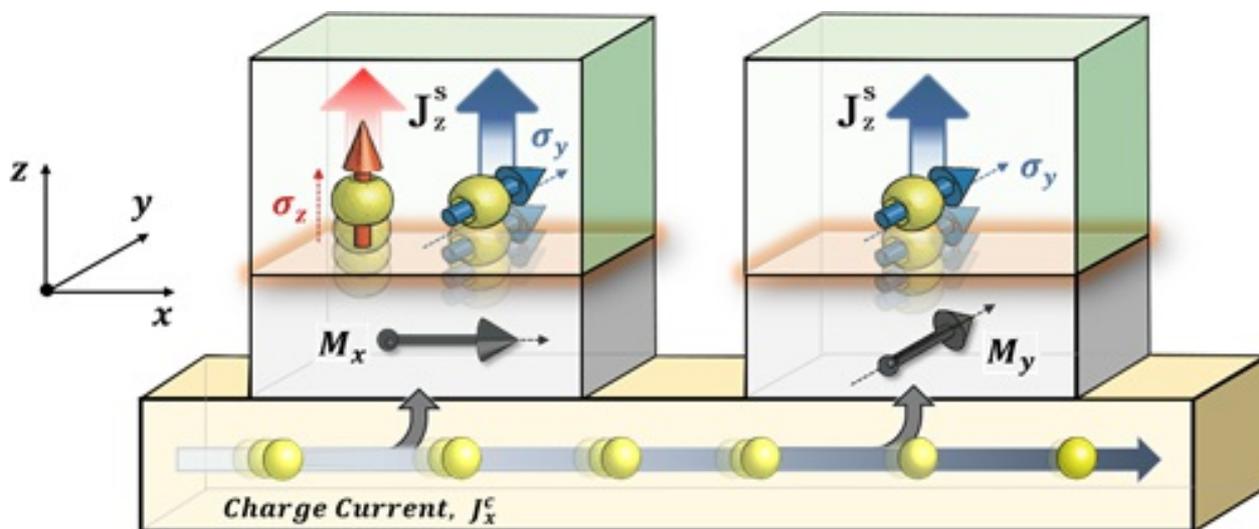
MRAM is the next-generation type of memory that provides the ability to keep data without the external power supply. Its unique and effective combination of high density and high-speed performing is the driving force of world-class semiconductor manufacturers in order to continuously create new versions. The biggest advantage of this type of memory is that it can significantly improve electronic devices by keeping greater amounts of information, allowing the quick access but consuming less battery power than current electronic memory.

The spin current generates at the interface between the bottom ferromagnetic layer and the non-magnetic spacer layer. It provides the rotational moments on the upper magnetic layer, which is consistent with the measured dependence of the magnetization. If to apply

this to spin-orbit torque magnetic memory, it will demonstrate the enhanced efficiency of spin torque and production of the spin current without the outside magnetic field. The high-speed performing, which is the expressive peculiarity of spin-orbit torque-based MRAM that provides stability, has the capacity to significantly decrease the standby power better than the static random-access memory. Scientists hope that this innovational material will speed up the commercialization of MRAM. Furthermore, they mentioned that MRAM can be applied in the production of smartphones, wearable electronics, and IoT devices.



MRAM does not lose its memory when power is removed causing a big demand. The research was funded by the Creative Materials Discovery Program of the Ministry of Science and ICT  
 source - adobe.com



Ferromagnet-transition metal bilayers which can randomly control the direction of the generated spin current  
 source - kaist.edu

**Company name:** Korea Advanced Institute of Science and Te.

**Contact person:** Professor Byong-Guk Park

**E-mail:** bgpark@kaist.ac.kr

**Website:** <http://www.kaist.edu/>

**Phone:** +82-42-350-3330

**Patent status:** -

**On market since:** -

**Regions:** United States, Korea

**Industries:** Electronics

**Source links:** [KAIST](#)



## **BRAZILIAN GREEN PROPOLIS CAN HELP TO TREAT ALZHEIMERS DISEASE**

Previously, a link between chronic systemic inflammation and the rate of cognitive decline in Alzheimer's disease was determined by various clinical studies. The reduction of systemic inflammation is crucial for the prevention of Alzheimer's disease. The researchers' group, led by Assoc. Prof. Zhou Wu and Assist. Prof. Junjun Ni, from the Kyushu University in collaboration with Institution of Geriatric Qinghai Provincial Hospital and the People's Hospital, found that Brazilian green propolis has the ability to prevent cognitive decline by reducing systemic inflammatory levels.



The cognitive function of elderly people living at high altitude declined to MCI after an increase in the SIL, propolis improves the cognitive function by reducing the SIL  
source - adobe.com

Alzheimer's disease (AD) is the most common cause of dementia. The **mild cognitive impairment (MCI)** that is a condition between normal aging and AD and is connected with a relative risk of the AD. There are no effective methods of treatment of this disease, therefore, scientists paid the attention to alternative interventions in MCI that can reduce the risk of the AD. As the result, the team has found that intake of Brazilian green propolis for 24 months prevents the cognitive decline with reducing systemic inflammation in the elderly people living at Tibetan Plateau, for the first time. The well-known fact that Brazilian green propolis provides the natural defense against viruses and bacteria without any toxic effects on human body. Moreover, it performs as an anti-oxidant to protect delicate nerve cells and helps prevent brain injury.

**Neuroinflammation has been implicated as the key contributor to the cognitive decline in the AD** and mild cognitive impairment because microglial-triggered neuroinflammation promotes neuronal damage as well as the deposition of A $\beta$ . The epidemiological research has suggested that antiinflammatory agents protect against the development of AD by restraining neuroinflammation. Propolis, a resinous substance produced by honey bees as

a defense against intruders has anti-oxidative and anti-inflammatory effects. Brazilian green propolis contains mainly prenylated derivatives of cinnamic acid, among which artepillin C is known to be the main element. Scientists managed to discover that propolis reduces the monocyte/macrophage-related systemic inflammation and microglial-mediated neuroinflammation, and propolis has been shown to have neuroprotective effects. They confirmed the positive linking of chronic systemic inflammation and the rate of the cognitive decline in the elderly people living at high altitude. Therefore, this novel discovery will provide the ability to treat Alzheimer's disease by the method of decreasing of systemic inflammation in order to prevent the cognitive decline in elderly people.



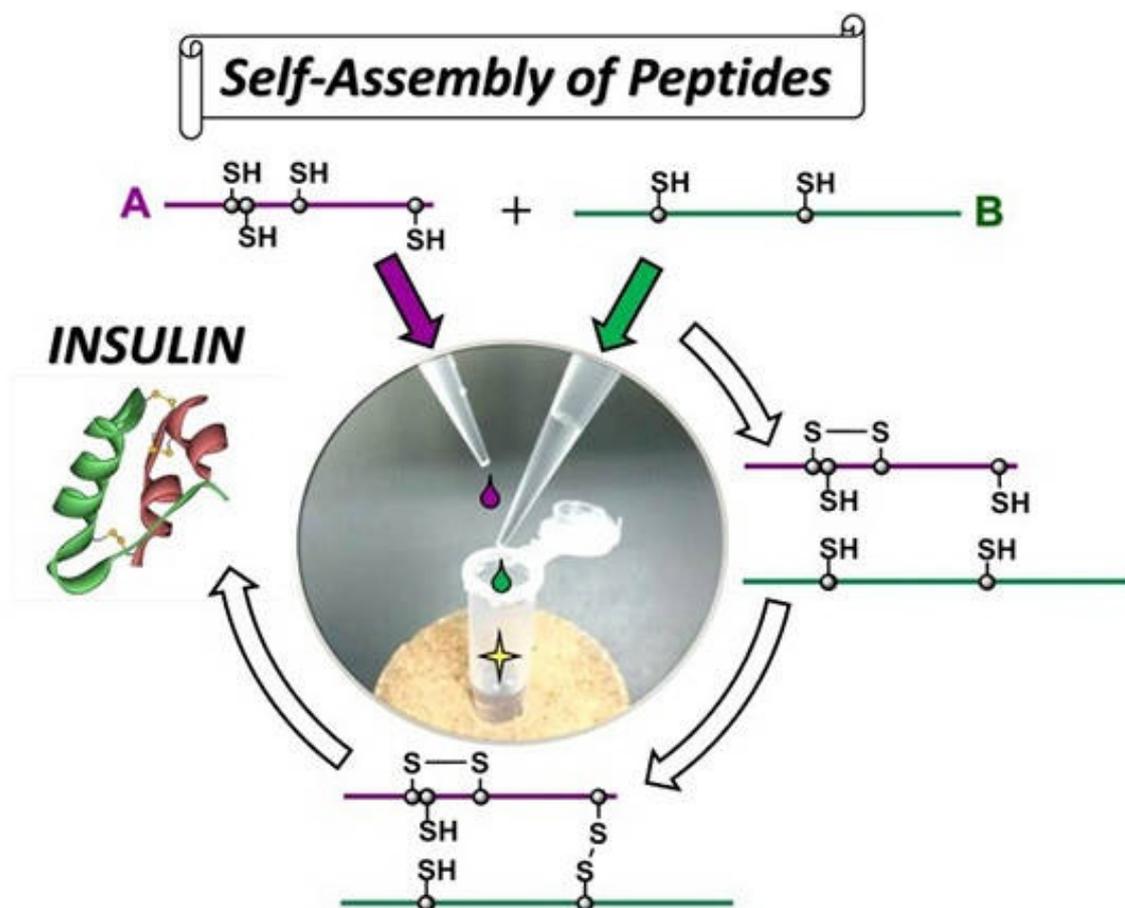
The research was supported by JSPS KAKENHI Grant Numbers JP16H05848, JP17K17093, Yamada Research Grant, and Ministry of Human Resources and Social Security P.R. China  
source - adobe.com

**Company name:** Kyushu University  
**Contact person:** Assoc. Prof. Zhou Wu  
**E-mail:** zhouw@dent.kyushuu.ac.jp  
**Website:** <https://www.kyushu-u.ac.jp/en/>  
**Phone:** -  
**Patent status:** -  
**On market since:** -  
**Regions:** Japan  
**Industries:** Healthcare  
**Source links:** [Journal of Alzheimer's Disease](#)  
[Kyushu University](#)



## NOVEL AND EFFECTIVE WAY TO SYNTHESIZE INSULIN

Scientists managed to synthesize insulin, which is based on the self-assembly of polypeptide chains at about 40% efficiency, applying biomimetic monocomponent proinsulin approaches. They hope that this novel method provides the flexibility of the synthesis of sequential insulin compounds that cannot be obtained using standard biological technologies based on genetic engineering. Furthermore, this innovational technique can be used to create different types of insulin preparations such as long-lasting and super quick-acting types.



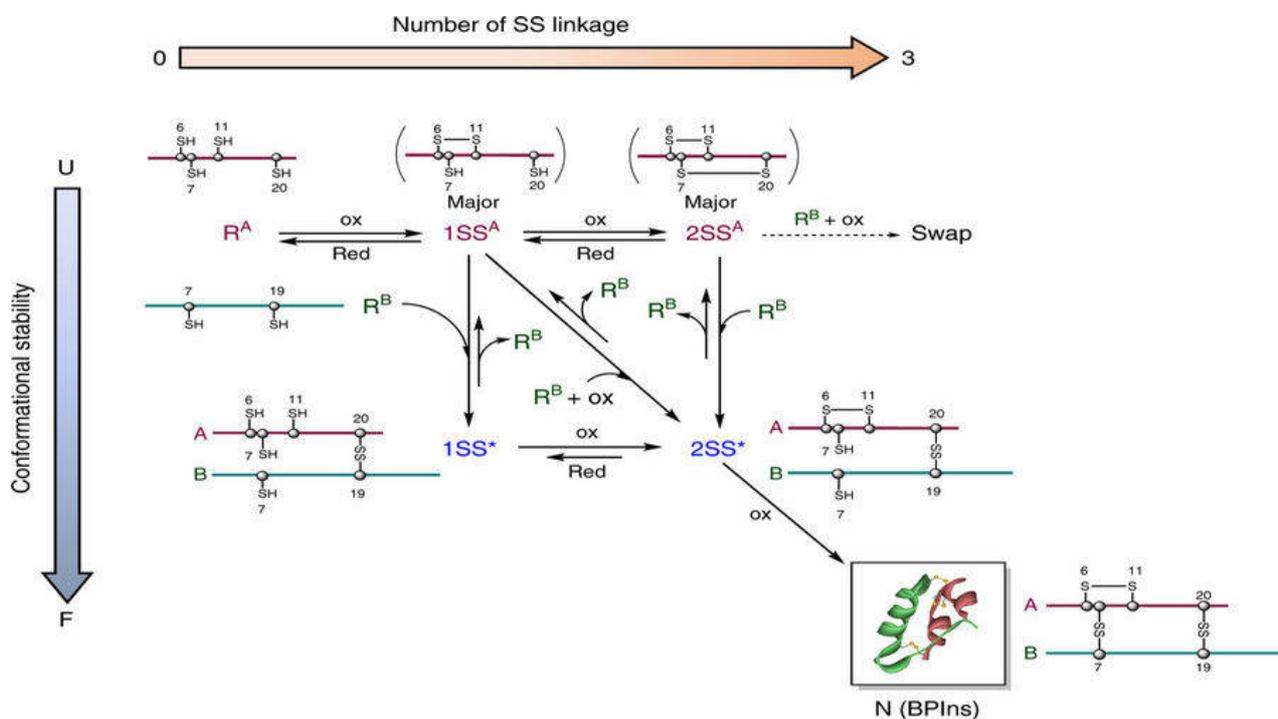
A simple protocol developed for insulin preparation  
source - [tohoku.ac.jp](http://tohoku.ac.jp)

The novel development was made by the scientific group from the [Tokai University](#), [Osaka University](#), [Tohoku University](#) and [Fukuoka University](#).

Insulin is a hormone that regulates the amount of glucose in the blood and is used as a therapeutic agent for diabetes. Naturally, it is generated by cells in the pancreas, which is called the islets of Langerhans. Insulin consists of 2 peptide chains, the A-chain (Ins-A, 21 amino acid residues) with its intramolecular disulfide bridge (CysA6–CysA11) and the B-chain (Ins-B, 30 amino acid residues), which are crosslinked by two interchain disulfide (SS) bridges (i.e., CysA7–CysB7 and CysA20–CysB19). Due to its characteristics, the chemical synthesis is difficult to perform. Currently, insulin is produced with the use of a genetic engineering method.

Previously, scientists managed to synthesize the seleno-insulin and the natural insulin (bovine insulin). It was generated with a higher yield, about 40%, that is more effective than seleno-insulin. The selenocysteine has been superseded by insulin containing cysteine to replace SS bonds between peptide chains with diselenide transverse bonds.

With the help of this technology, researchers successfully performed the chemical synthesis of the human insulin and human type-II relaxin (HRlx-2).



Major NCA folding pathways of BPIs at pH 10.0. Ox is either of oxygen, 1SSA, 2SSA, 1SSB, or DHSox. Red is either of RA, 1SSA, or RB. 1SS\* and 2SS\* correspond to TS or TS'

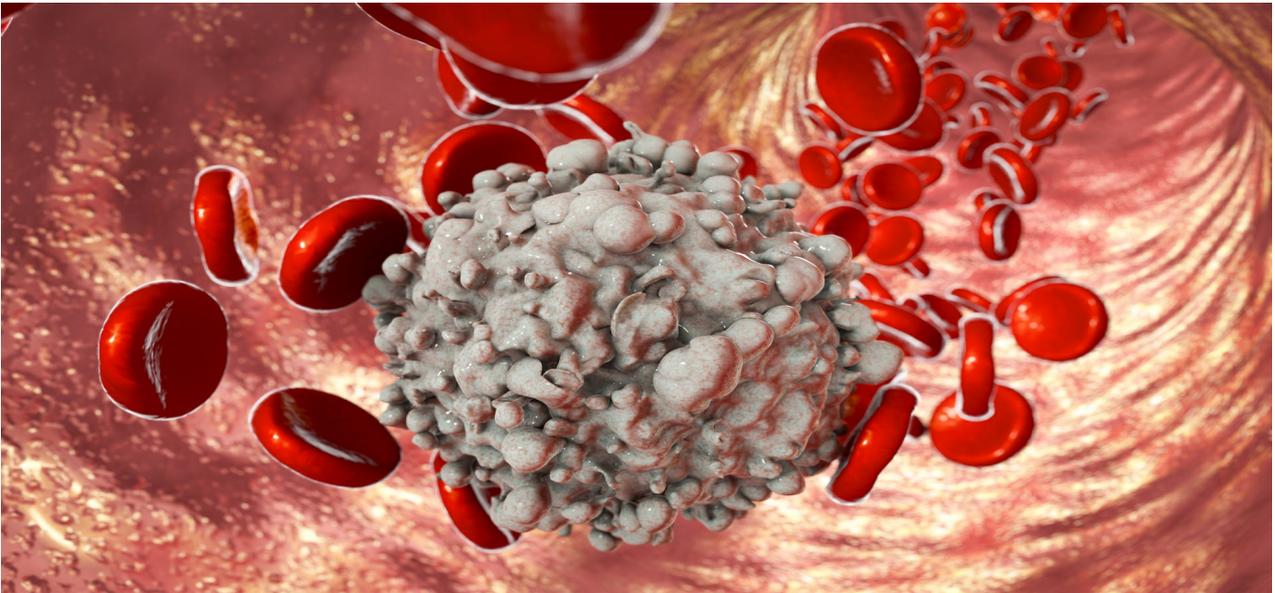
source - nature.com

Scientists optimized native chain assembly conditions for the synthesis of wild-type BPIs from A- and B-chains without applying modifications or protections on the peptide chains. They obtained bovine insulin at the high yield of about 40%. To access this goal, the two-chain oxidative folding pathways of BPIs are first determined and then optimized. Based on the obtained native chain assembly conditions, human insulin (HIns) and human type-II relaxin (HRlx-2) are both produced in a yield of nearly 50%. The biggest advantage of this novel synthesis technology is that it does not demand any big manufacturing equipment as it does not use any genetic engineering methods. Therefore, insulin can be generated by the technology of mixing A chain and B chain. When the reduced A-chain (RA) and B-chain (RB) were mixed in a buffer solution, the native CysA6–CysA11 SS bond formed most abundantly in A-chain, and then A- and B-chains would couple together to form metastable heterodimeric intermediates, 1SS\* and 2SS\* both containing the native disulfide bridge CysA20–CysB19. Furthermore, they can be produced by a solid phase peptide synthesis technique using a resin.

In additions, this method provides the access to foldable insulin analogs, which cannot be

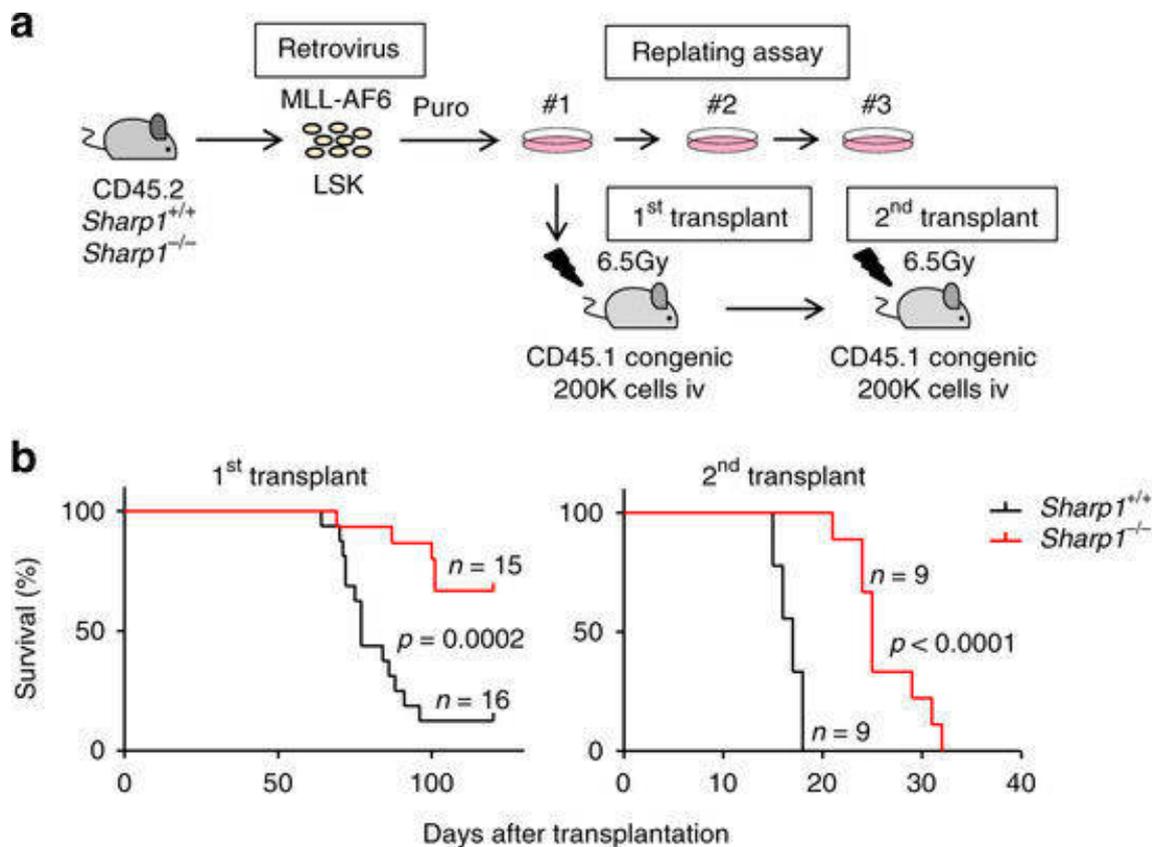
obtained by the rDNA technology, because all the processes, including solid-phase peptide synthesis and native chain assembly, are based on chemical reactions, which would enable insertion of unnatural amino acids into the primary sequence.

**Company name:** Tohoku University  
**Contact person:** Kenji Inaba  
**E-mail:** kinaba@tagen.tohoku.ac.jp  
**Website:** <http://www.tohoku.ac.jp/en/>  
**Phone:** -  
**Patent status:** -  
**On market since:** -  
**Regions:** Japan  
**Industries:** Chemicals, Healthcare  
**Source links:** [Communications Chemistry](#)  
[Tohoku University](#)



## RECENT DISCOVERY WILL HELP TO TREAT LEUKEMIA

The international group of scientists has discovered a newest molecular pathway by which a circadian clock gene, SHARP1, causes the development of blood cancer and bone marrow cancer, an acute myeloid leukemia (AML). The 5-year survival rate for patients with this disease is less than 20%. This novel discovery will provide the ability to create new and effective therapeutic strategies that will prevent the development of AML.

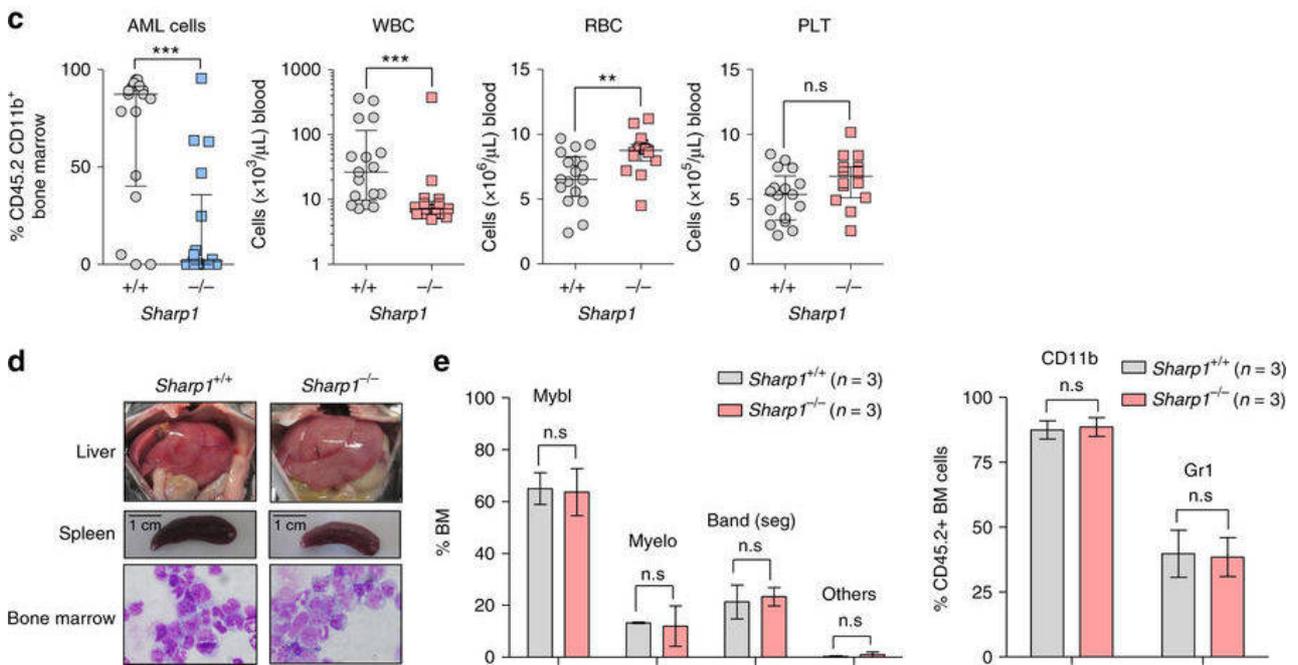


Experimental strategy for replating and in vivo leukemia assays in Sharp1<sup>+/+</sup> or Sharp1<sup>-/-</sup> hematopoietic stem/progenitor cells following retroviral transduction of MLL-AF6  
source - nature.com

AML is the most common type of aggressive leukemia in adults. Approximately 20,000 people in the United States and 18,000 in Europe are diagnosed with AML each year. According to the [American Cancer Society](#), about 60,300 new cases of leukemia and 24,370 deaths from leukemia are processed in 2018 in the US. Dr. Ng Chin Hin from the [National University Cancer Institute of Singapore](#) mentioned that the median survival without treatment is around 3 months, but with appropriate treatment, doctors can cure about 30-40% of patients, which have the intensive chemotherapy. AML is a highly deadly disease. The newest discovery was made by the international scientific group from the [National University of Singapore](#), [Cancer Science Institute of Singapore](#), [Yale University](#), the [University of Alabama at Birmingham](#), the [University of Oxford](#), [Sanford Burnham Medical Discovery Institute](#), [Erasmus University Medical Center](#), and the [Harvard Stem Cell Institute](#).

Scientists focused on the oncogenic role of SHARP1, in the subset of AML cells which contain alterations to the Mixed-Lineage Leukemia (MLL) gene. SHARP1 is a protein that is the important element in the regulation of the circadian rhythm in humans. The alteration

to the MLL gene is the most common reason for the formation of AML. The alteration leads to the linking of the MLL gene with other genes, therefore, having the impact on its function. AML with MLL gene rearrangements show unique gene expression profiles driven by MLL-fusion proteins. The enhance of SHARP1 levels leads to the initiating of the leukemia formation and maintaining the growth of leukemic cells. Furthermore, SHARP1 could act upon other target genes of MLL-AF6 to enlarge the progression of AML. Scientists discovered that the circadian clock transcription factor SHARP1 is a newest oncogenic target in MLL-AF6 AML, which has the worst prognosis among all subtypes of MLL-rearranged AMLs. **If to decrease the level of SHARP1, the formation of leukemic cells can be prevented.** This nearly identified process will provide the ability **to create new therapeutic strategies that will prevent the development of AML.**



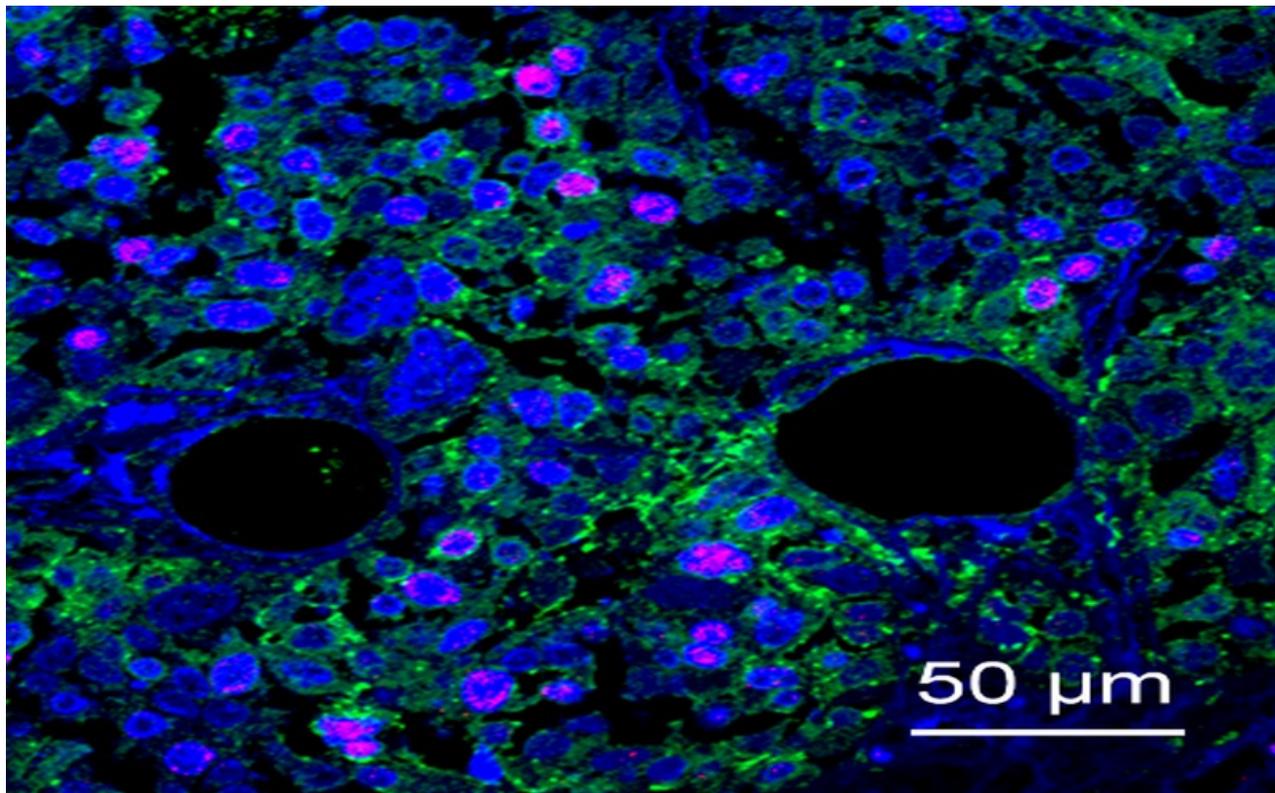
Representative pictures of liver and spleen and Wright Giemsa staining of bone marrow (BM) cells from moribund leukemic mice  
source - nature.com

**Company name:** National University of Singapore  
**Contact person:** Reshma Taneja  
**E-mail:** phsrt@nus.edu.sg  
**Website:** <http://www.nus.edu.sg/>  
**Phone:** +65-6516 3236  
**Patent status:** -  
**On market since:** -  
**Regions:** United States, Netherlands, United Kingdom  
**Industries:** Healthcare  
**Source links:** [Nature Communications](#)  
[Biotechnin Asia](#)



## VITAMIN A CAN HELP TO KILL LIVER CANCER STEM CELLS AND PREVENT THEIR SPREADING

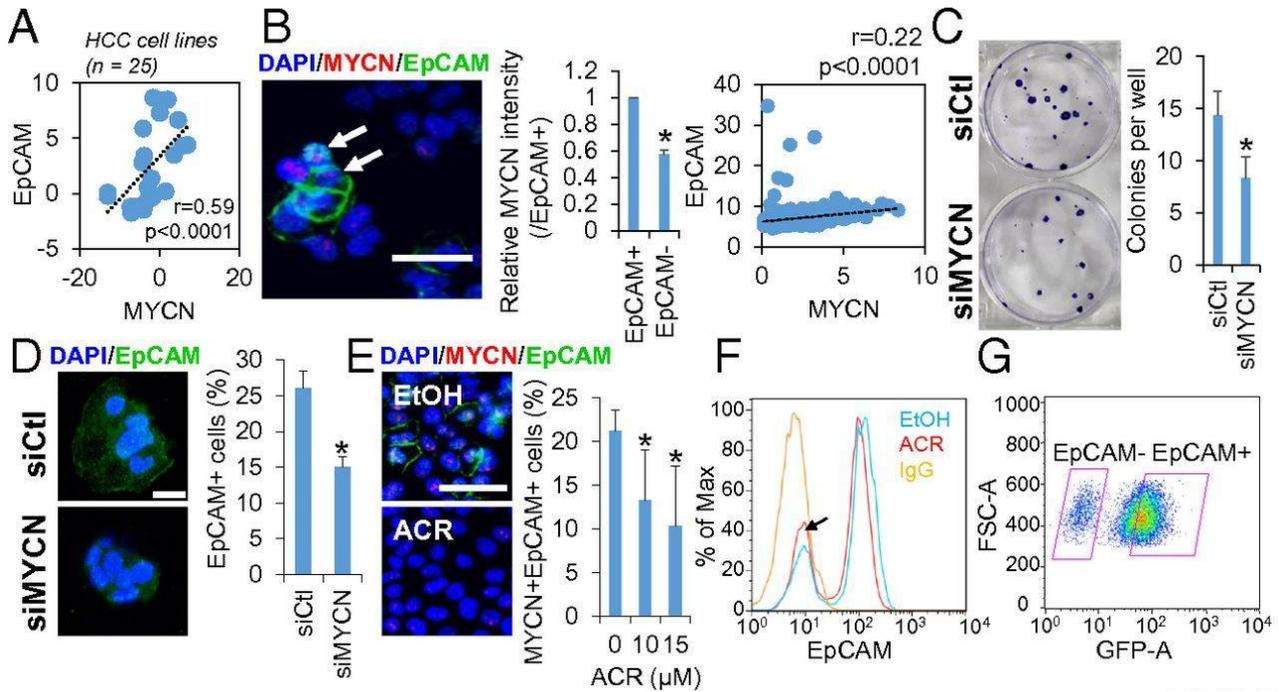
Scientists from Japan determined that the acyclic retinoid, which is an artificial compound derived from vitamin A, has the ability to prevent the recurrence of hepatocellular carcinoma (HCC) that is the most common type of liver cancer. This compound targets one form of cancer stem cell, preventing them from causing new tumors. With the help of novel development, doctors will be able to regulate the treatment and reduce cancer recurrence. The research is still on the stage of clinical trials, which are currently being performed in Korea, Taiwan, and Singapore.



Immunofluorescence staining of HCC cells expressing MYCN  
source - riken.jp

HCC is very malignant and causes nearly 600,000 deaths annually. Chronic infection with the hepatitis B or C viruses provides up to 60% of cirrhosis cases and 80% of all HCC cases globally. Furthermore, there were determined that alcohol consumption or a high-fat diet substantially enhances the risk of HCC. In additions, the reason for the high mortality in most is that it has a high rate of relapse. Consequently, the scientific group, led by Ph.D. Soichi Kojima, from [RIKEN](#) managed to determine that ACR selectively suppressed the expression of MYCN in HCC cells.

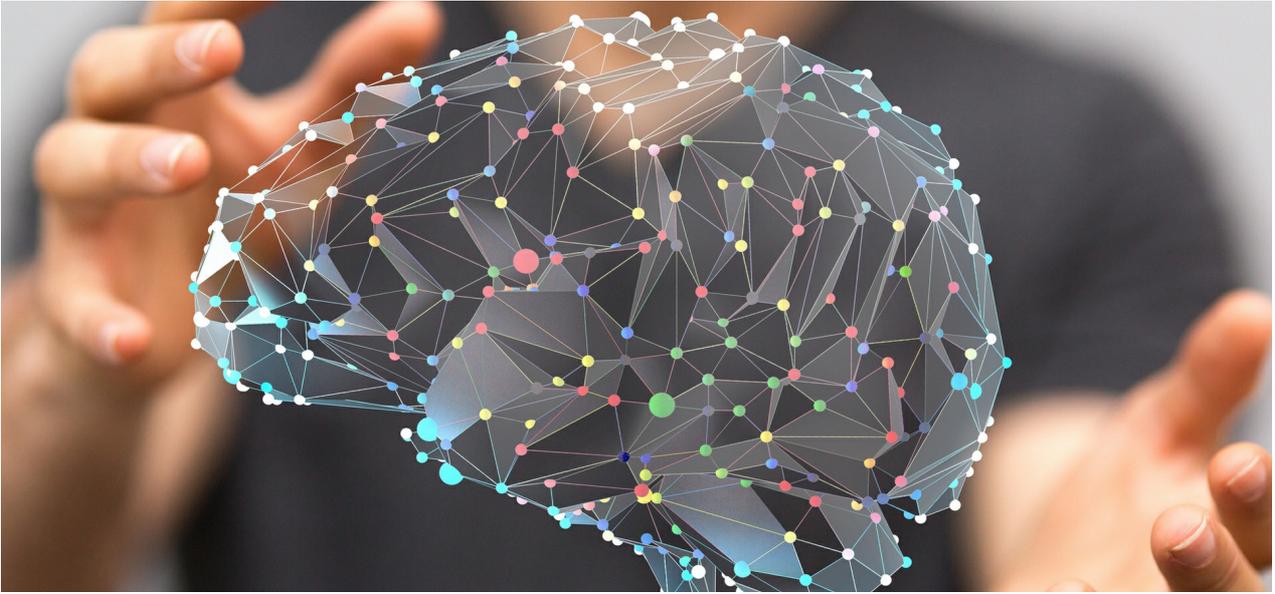
MYCN is a member of the MYC family of basic helix–loop–helix–zipper transcription factors, and central regulators of growth-promoting signal transduction that maintain stem cell mutation. MYCN was determined as the oncogene in neuroblastoma. Its increasing is identified in 20–25% of all neuroblastoma cases and is strongly linked with rapid tumor formation. Scientists used the method of genome-wide screening and determined MYCN as an HCC-selective target of acyclic retinoid (ACR) and a biomarker of liver cancer. The immunofluorescence double staining demonstrated a strong correlation between MYCN and another liver CSC marker, CD133.



The MYCN-positive CSC subpopulation of JHH7 cells is selectively targeted by ACR. Correlation between gene expression of MYCN and EpCAM in a total of 25 HCC cell lines in the CCLE database  
source - pnas.org

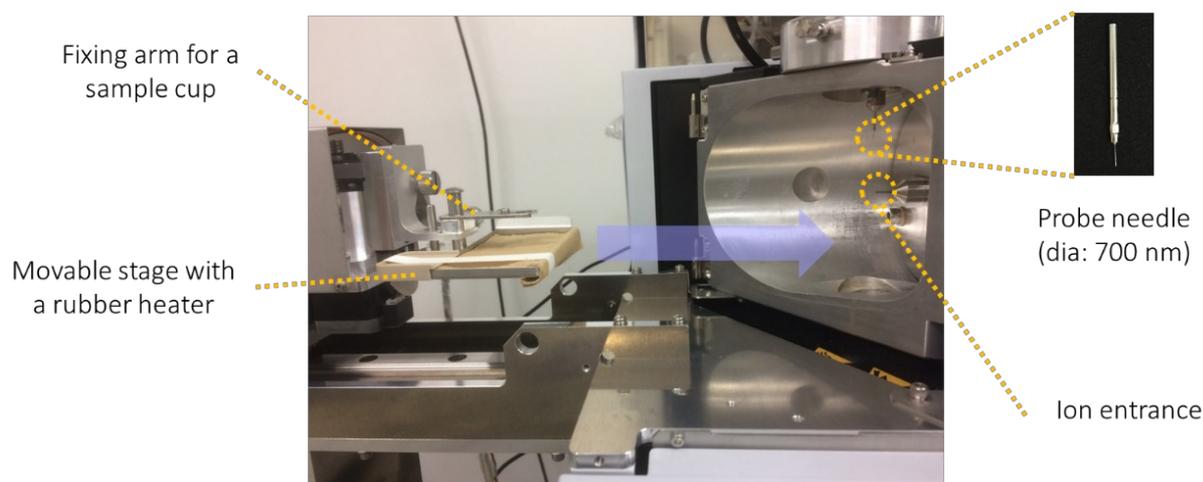
Dr. Kojima mentioned that EpCAM-positive cancer stem cells contain the increased level of MYCN. It means that acyclic retinoid can target on the hepatic cancer stem cells. As the result, researchers performed the series of experiments, which showed the reduced level of MYCN expression in patients that had received acyclic retinoid. It approved the concept that MYCN performs as a molecular target for ACR during HCC cell killing and in neuroblastoma cells. The clinical microarray data analysis showed a correlation between MYCN and Wnt/ $\beta$ -catenin signaling markers in human HCC, MYCN might be a pan marker of liver CSC/TIC-like cells with tumorigenic capacity. The novel discovery will provide the ability to regulate the treatment and reduce cancer recurrence.

Company name: RIKEN  
Contact person: Ph.D. Soichi Kojima  
E-mail: [skojima@riken.jp](mailto:skojima@riken.jp)  
Website: <http://www.riken.jp/en/>  
Phone: -  
Patent status: -  
On market since: -  
Regions: Japan  
Industries: Healthcare  
Source links: [PNAS](#)  
[RIKEN](#)



## A NOVEL SYSTEM FOR REAL-TIME MONITORING OF THE BRAIN

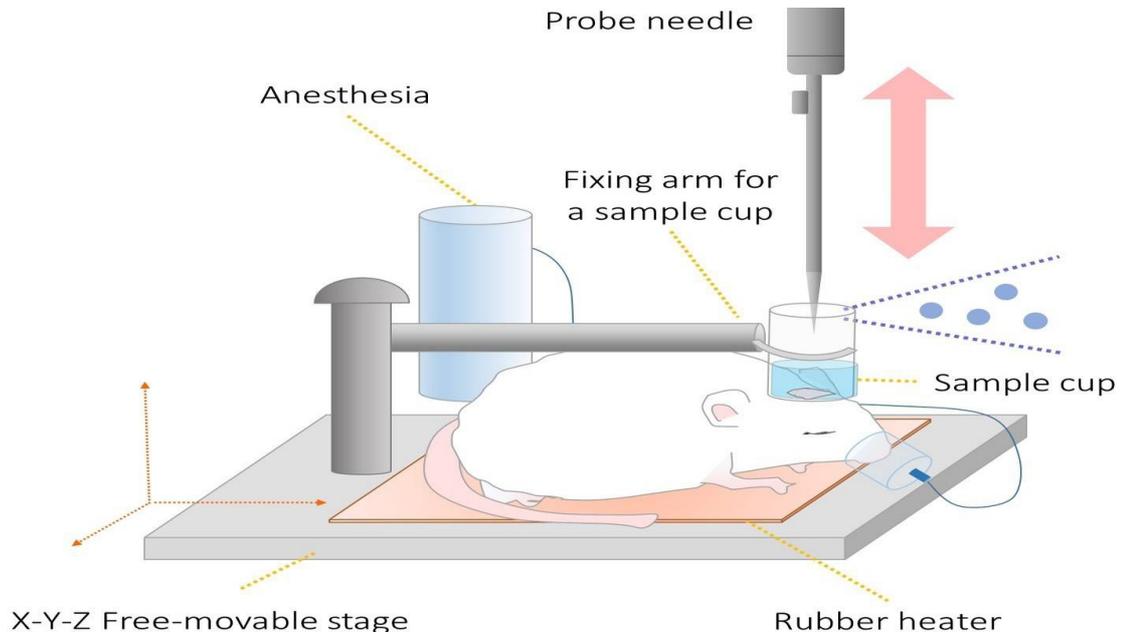
Scientists managed to develop the newest system for in vivo real-time monitoring of metabolites in the brain. The real-time monitoring of the dynamics of endogenous molecules in organisms is the crucial moment in the observation of various diseases. Nonetheless, this process is difficult due to the persistence of different limitations such as sensitivity, resolution, and invasiveness. This innovational technology can be successfully used for the analysis and studying of neurodegenerative diseases, such as Alzheimer's disease giving researchers the ability to create effective treatments.



The newly developed system combines a free-movable stage and PESI-tandem mass spectrometer. The stage is set in front of the mass spectrometer source - nagoya-u.ac.jp

The scientific group from the [Nagoya University](https://www.nagoya-u.ac.jp/) used a **probe electrospray ionization/tandem mass spectrometry (PESI/MS/MS)** and a movable stage that is able to fix a mouse and control the sampling point. This method provides the precision characterization of endogenous metabolites especially in the case when the metabolites cannot be defined by single MS. Furthermore, scientists managed **to achieve real-time monitoring of metabolites in a living mouse brain for 3 hours, contributing the analytical improvement in the real-time metabolomics field**. PESI uses a very thin solid needle with the diameter of **700 nm** in order to simultaneously sampling and ionizing, though there is a need to control the sampling point and to fix a mouse in place for in vivo real-time monitoring. The system was constructed with an x-y-z axial free-movable stage (manual control for x- and y-axes, electric control for z-axis, each spatial resolution: **3 μm**), that can be manually moved to the front of the ion source, and a control device.

The device is able to monitor **8 cerebrum metabolites** that are connected with the central energy metabolism in an isoflurane-anesthetized mouse in real time with a **20-second interval**. To prevent hypothermia of the anesthetized mouse, scientists installed a rubber heater on the stage surface. The glycolysis was enhanced, while TCA-cycle intermediates have fluctuated. These phenomena were not observed in a control mouse, **showing the practicality of the system**. In addition, neither remarkable traumatic injury nor edema were observed on the brain surface, especially around the probe-insertion position. In vivo real-time monitoring was executed for a living mouse brain using the system, succeeding in **8 metabolites** such as glucose and citric acid for **3 hours**.

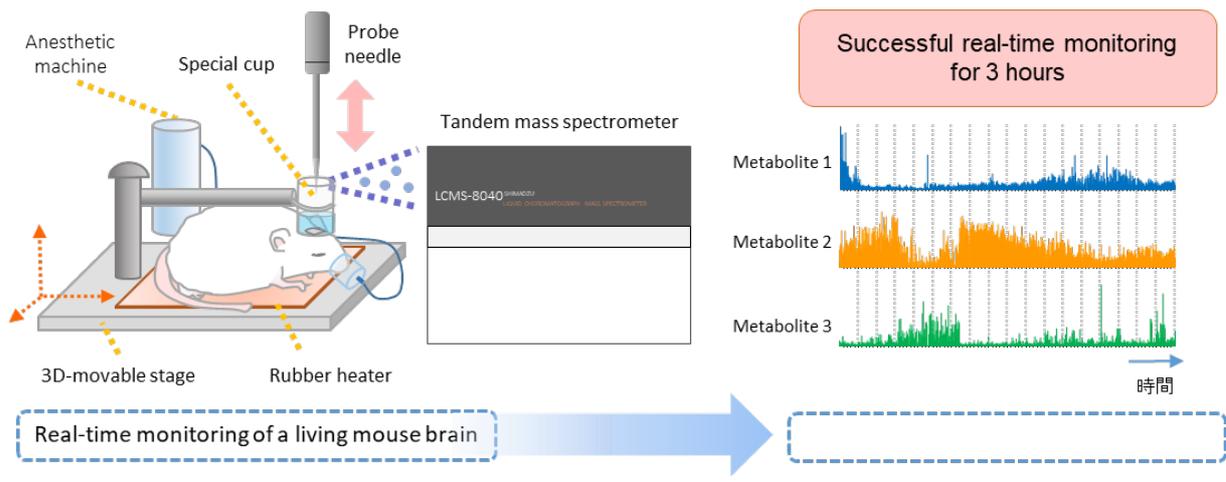


The newly developed stage is composed of an x-y-z free movable stage, rubber heater, and fixing arm unit. The stage enables control of the sampling point with a  $\mu\text{m}$ -order spatial resolution

source - nagoya-u.ac.jp

Researchers managed to capture the synchronized alteration of energy-metabolism related metabolites in an energy-disruption model mouse, proving the practicality of this novel method. Consequently, the technology will provide **the ability to perform pathophysiological analysis for various neurological diseases such as Alzheimer's disease or cognitive impairment**. Furthermore, the team is going to apply the technology to estimate the quality of homeostasis.

**(b) The newly-developed in vivo real-time monitoring system**



- Real-time monitoring of metabolic dynamics in a living mouse brain
- True profile is obtained because there is no effect of death on metabolic fluctuation.
- The system will be a novel visualization technique of homeostasis, which can potentially be applied to healthcare risk management.

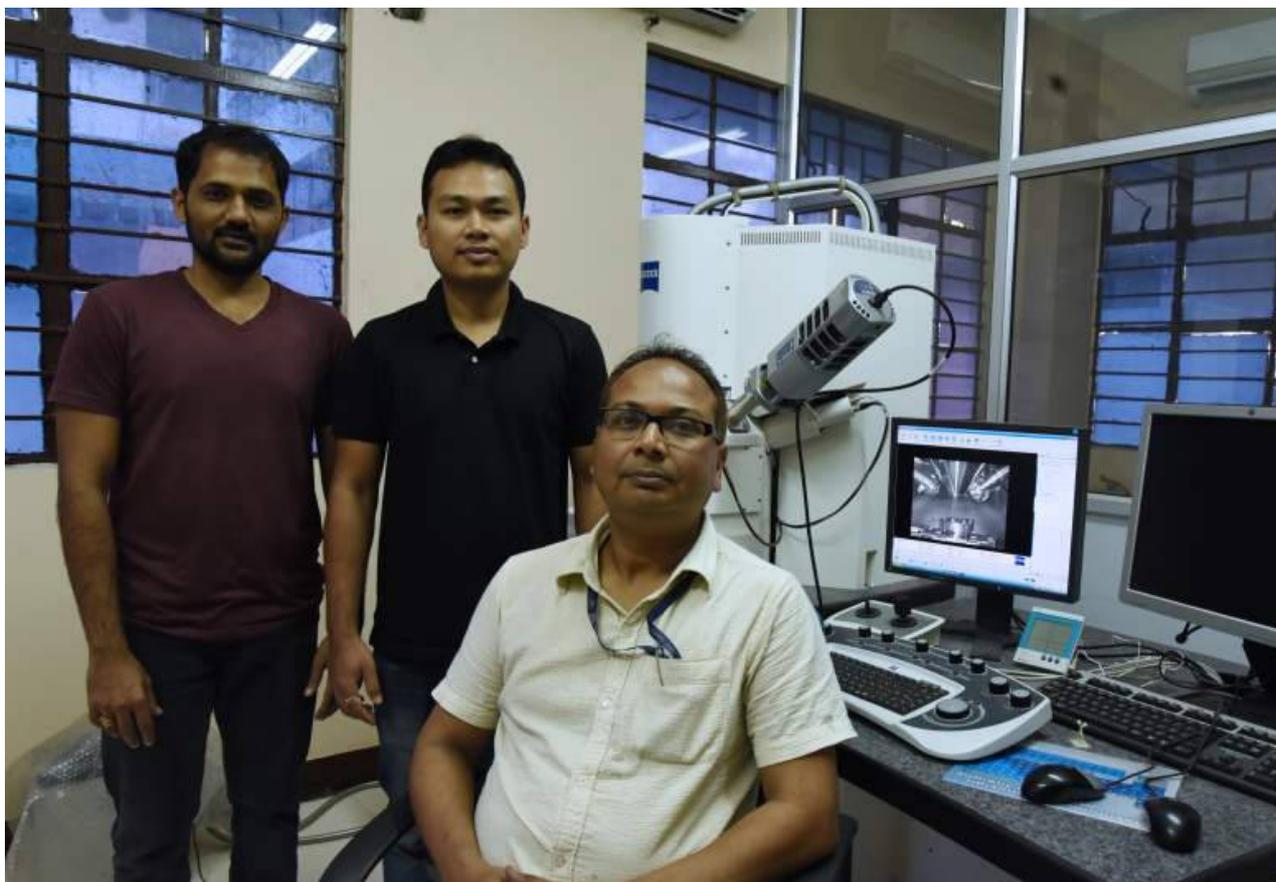
Differences between conventional metabolome analysis for dissected brain samples and the newly developed in vivo real-time monitoring system  
 source - nagoya-u.ac.jp

Company name: Nagoya University  
Contact person: Kei Zaitso  
E-mail: kzaitso@med.nagoya-u.ac.jp  
Website: <http://en.nagoya-u.ac.jp/>  
Phone: +81-52-744-2118  
Patent status: -  
On market since: -  
Regions: Japan  
Industries: Healthcare  
Source links: [Analytical Chemistry](#)  
[Nagoya University](#)



## NOVEL PATCH FOR WOUND HEALING

Scientists created a smart bandage that can be loaded with antimicrobials and used for healing wounds in a faster and effective way. The newest development includes the cotton patch, which is coated with the chitosan-based hydrogel that is loaded with the curcumin and graphene oxide. The scientists applied the curcumin as a medicine and it can be replaced with other antimicrobials drugs. The study results demonstrated the full incarnation and the hair growth in the injured area in rat models until the end of the third week.



The antimicrobial property of four cotton patches was tested in vitro using *Staphylococcus aureus* and *E. coli* bacteria

source - [journosdiary.com](http://journosdiary.com)

The novel development was made by the scientific group from the [Institute of Advanced Study in Science and Technology \(IASST\), Guwahati](#).

This is an absolutely **new method of production of the highly absorbent, stable, flexible, and compact biopolymeric hydrogel bound cotton patch that has the perfect antimicrobial characteristic**. Usually, cotton adheres to wounds, and due to its fibrous structure, it is hard to remove it. Covering the cotton with chitosan and squeeze a bandage, scientists managed to get a material with similar characteristics as the cotton. It means that this patch is poriferous and able to absorb water as cotton, but despite the fact, it does not adhere to the wound. This new method not only exempts the spinning of cotton yarn and use of loom or other types of weaving machines but also makes it possible to get a soft but mechanically strong textile material.

The most significant advantage of this patch is that **its absorption ability can be used for lading nanomaterials and antimicrobials drugs to improve wound-healing characteristics**. Scientists decided to apply graphene oxide nanomaterial since its disinfectant features

and biocompatibility are successfully approved. The nanosize of graphene oxide provides the ability to put a large amount of medicine into the patch. Furthermore, graphene oxide significantly enhances the robustness of the patch especially when it gets wet. The mechanical robustness and softness, as well as the flexibility of such material, can be adjusted simply by changing the concentration of the biopolymer. In other words, the inclusion of graphene oxide in this technology not only improved mechanical robustness of this patch but also provided the antimicrobial capacity. Moreover, these innovational patches are stable in the case of aqueous conditions.



The high absorption capacity of the patch takes care of the pus and porous nature provides good oxygen supply for faster healing

source - pubs.acs.org

Another advantage of this development is that various medicines can be loaded into the patch according to the nature of the wound. With this hydrogel coated cotton patch scientists developed a bandage material, that is a complete package with a minimal number of ingredients, viz., graphene oxide and curcumin, specially designed to work on infected wounds. The study results showed the high incantation and the hair growth in the injured area in rat models until the end of the third week.

**Company name:** Institute of Advanced Study in Science and...

**Contact person:** Devasish Chowdhury

**E-mail:** devasish@iasst.gov.in

**Website:** <http://iasst.gov.in/>

**Phone:** +91 361 2912073

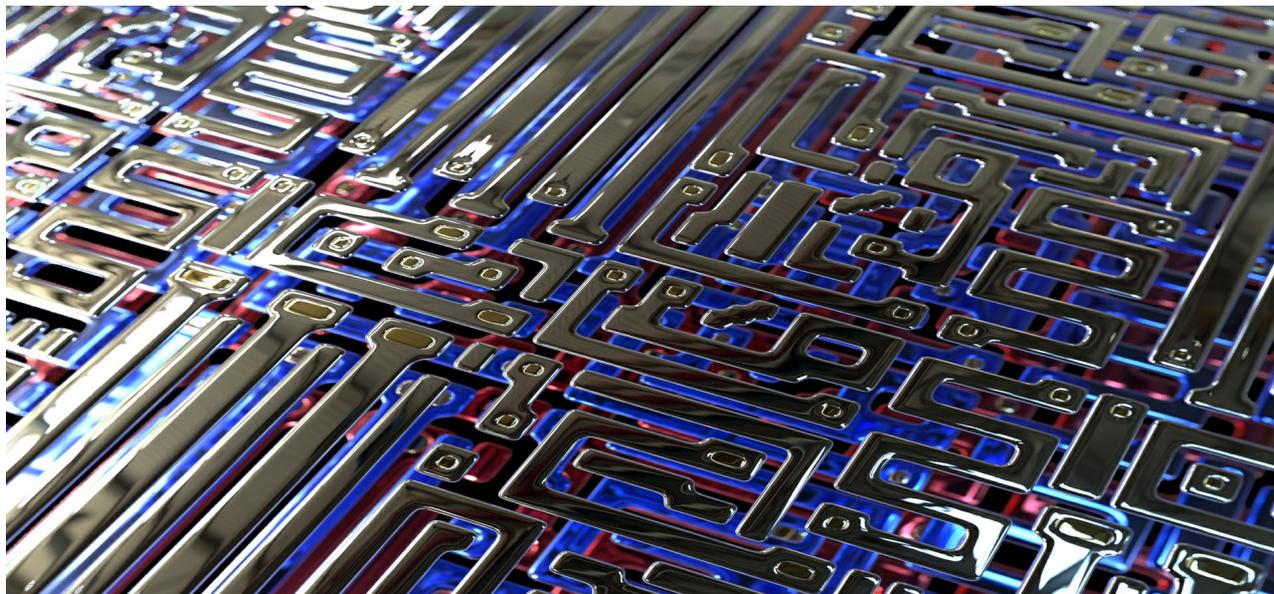
**Patent status:** -

**On market since:** -

**Regions:** India

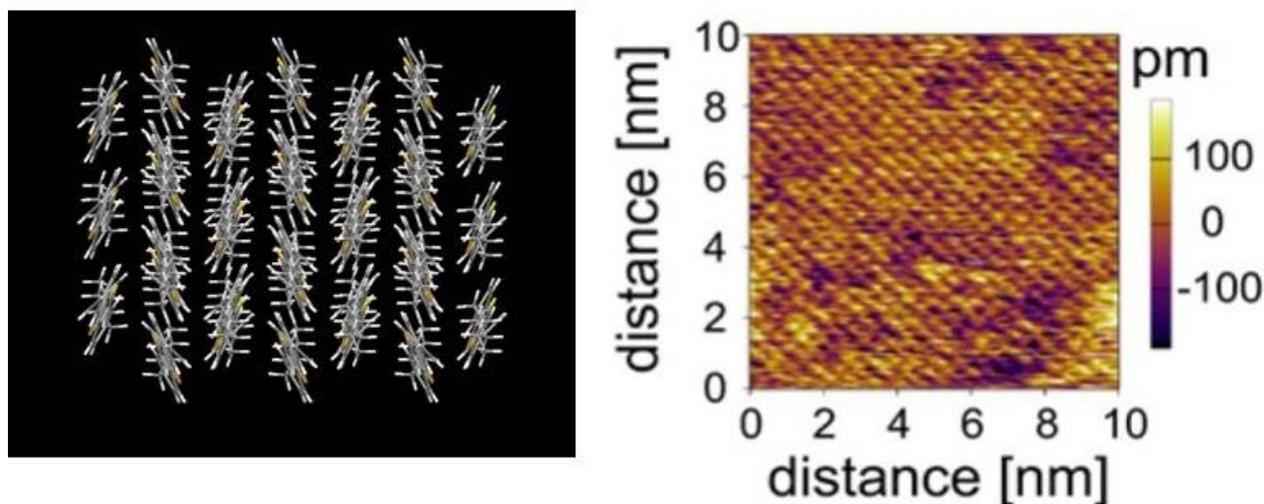
**Industries:** Healthcare

**Source links:** [ACS Sustainable Chemistry & Engineering](#)  
[Science Chronicle](#)



## THE NEWEST ULTRATHIN ELECTRONIC FILM WAS INSPIRED BY THE CELL MEMBRANE

The group of scientists from Japan has developed a novel method to create a film, which operates as a transistor, that is just 2 molecules thick and a total of 4.4 nanometers tall. This area of semiconductive material can be successfully used in the flexible electronics and chemical detectors manufacturing. These newest film transistors are the first example of semiconductive single molecular bilayers produced through using of liquid solution processing, which significantly minimizes costs.



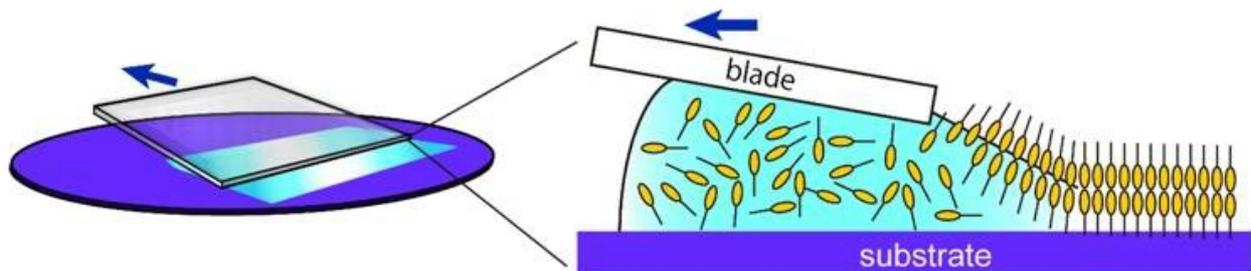
Top surface view of the 3D computer model (left) and Atomic Force Microscopy image (right) of the new film made by University of Tokyo scientists  
source - u-tokyo.ac.jp

The innovational development was made by the scientific group, led by [Professor Tatsuo Hasegawa](#), from the [University of Tokyo](#).

The group developed the absolutely novel technology of producing of [self-assembled ultrathin organic-semiconductor layers with ultra-uniform single-molecular-bilayer thickness over an area as large as wafer scale](#). Assist. Prof. Shunto Arai mentioned that they wanted to provide devices with the characteristics of the cell membrane such as sensitivity, flexibility, force and tiny scale. A novel method is based on the idea of geometrical frustration that has the ability to effectively repress the interlayer stacking (or multilayer crystallization) while maintaining the assembly of the intralayer, which originates from the strong intermolecular interactions between  $\pi$ -conjugated molecules. It allows scientists to produce large surface areas, up to 100 square centimeters (39 square inches). Furthermore, these areas can operate as high-performance thin film transistors and could have various applications in the future.

Such films are [transparent, but the forces of gravity and reflection between the molecules generate an organized, repetitive herringbone pattern](#) when the film is watched through the microscope. The mixed solution of extended  $\pi$ -conjugated frameworks substituted asymmetrically by alkyl chains of variable lengths (i.e.,  $(\pi\text{Core})\text{-C}_n$  's) is utilized for the solution process. The molecular structure of the development is very stable. The simple blade-coating with a material, which contains 2  $(\pi\text{Core})\text{-C}_n$  's with different alkyl chain lengths is effective to generate single molecular bilayers (SMBs) composed of a pair of

polar monomolecular layers, which is analogical to the cell membranes of living organisms. These SMBs are stable. Scientists mentioned that this development will provide the ability to create the same structure out of different molecules with different functionalities.



Artist's representation of the blade coating solution process to produce single molecular bilayer thin film transistors  
source - u-tokyo.ac.jp

Company name: University of Tokyo  
Contact person: Professor Tatsuo Hasegawa  
E-mail: t-hasegawa@ap.t.u-tokyo.ac.jp  
Website: <https://www.u-tokyo.ac.jp/en/>  
Phone: -  
Patent status: -  
On market since: -  
Regions: Japan  
Industries: Electronics  
Source links: [Advanced Materials](#)  
[The University of Tokyo](#)



## SUGAR CAN HELP TO DETECT A LEAD IN WATER

A lead is most common heavy metal ion pollutant in water. It acts on the hematopoiesis and nervous system, causes serious consequences for human health. This element causes anemia because it is included in the chain of biosynthesis of the heme and reduces the life of erythrocyte. Furthermore, the lead can cause encephalopathy, hyperkinetic or aggressive conditions, gastrointestinal disorders, dyspepsia, colic, nephropathy and decrease mental properties. Therefore, scientists from India have developed a method to get nanoparticles from sugar, which can detect the lead in water.



The CDots perform as an excellent visual sensor for Pb (II). The Limit of Detection (LOD) value was as low as 14 ppb

source - researchstash.com

The development was made by the scientific group, led by [Dr. Renuka N. K](#), from the [University of Calicut](#).

Nanotechnology uses particles, which are several thousand times smaller than a human hair. One nanometer is **10<sup>-9</sup> meters** or about **3 atoms long**. For comparison, a human hair is about **60-80,000 nanometers wide**. The most significant application of nanoparticles (NPs) is the drug delivering and diagnostic tests. It can be used for targeting treatment delivering medication just in one place in order to make the treatment more effective and prevent the appearance of toxic side effects. Such technologies are highly used for cancer therapy. Latterly, researchers have been looking for eco-friendly sources for nanoparticles. Super tiny nanoparticles, which are known as carbon points, usually are received from graphite or carbon nanotubes using physical techniques. Therefore, scientists have managed to create a simple and fast technique for receiving nanoparticles from table sugar and have demonstrated that these particles can be used as an actuator for identifying lead in water. The generating of carbon dots through **an easy and cost-effective synthetic technology use table sugar as the precursor**. The synthesis method completely **avoids chemical modifications or post-chemical procedures**.

Researchers melted the sugar at high temperature that is **150 degrees Celsius** and attenuated with ammonia liquid. After this, the solution was put in microwave for few minutes, filtered and freeze-dried in order to receive yield quantum dots, which include carbon. Visible aggregation of table sugar derived carbon dots in presence of Pb (II) ions leads to a novel method of identification of these toxic ions. A simple turbidimeter could quantify the amount of Pb (II) in parts per billion (ppb) levels with extraordinary selectivity. As a result, scientists managed to find that **dots precipitate only in the case of the presence of lead ions**.



Carbon dot (CD) system achieved from Table Sugar through green strategy  
source - adobe.com

**Company name:** University of Calicut  
**Contact person:** Dr. Renuka N. K  
**E-mail:** nkrenu@gmail.com  
**Website:** <http://www.universityofcalicut.info/>  
**Phone:** -  
**Patent status:** -  
**On market since:** -  
**Regions:** India  
**Industries:** Chemicals, Environment, Healthcare  
**Source links:** [Sensors and Actuators B: Chemical](#)



# EARTHWORM WILL HELP TO DEVELOP A NEW WAY OF RECYCLING OF ORGANIC WASTE

The well-known fact is that earthworm is helpful in the decomposition of waste, producing biofertilizers. Researchers from India have managed to determine that the bowel of earthworms provides an ideal environment for nurturing different bacterias, which are able to recycle of cellulose due to which they can transform organic waste from plant sources into fertilizer or compost. This newest discovery provides the ability to create absolutely new methods for the processing of organic waste. It can also be highly useful for rice fields by recycling the remnants of cellulose in a very fast period of time, thus giving the possibility of transplanting winter rice.



Further analysis revealed that the growth rate of cellulose-degrading bacteria in semi-aquatic freshwater earthworms was faster making them an effective decomposers  
source - adobe.com

Earthworms are often called 'ecosystem engineers'. Various types of earthworms can make both horizontal and vertical burrows providing the ability to enter of oxygen and water and leaving of carbon dioxide. Furthermore, due to the persistence of some bacterias in earthworm' bowel, they decompose releases nutrients making them available for use by living plants. In addition, earthworms breaking organic matter into smaller pieces allow bacteria and fungi to feed on it and release the nutrients.

The group of scientists from the [Institute of Advanced Study in Science and Technology, Guwahati](#) in collaboration with the [Central Agricultural University, Imphal](#) and the [University of Hawaii](#) established the link between the cultural community of cellulose degrading bacteria (CDB) and the bowel walls of 2 habitat-specific earthworm species, epigeic earthworm, which is called *Perionyx excavatus* (PE) and an endogeic *Glyphidrilus spelaeotes* (GS), and their importance for the nutritional property of the soil. The 16Sr RNA analysis for the isolated CDB from 2 biologically distinct earthworms demonstrated the presence of separated communities of CDB in their bowel.

The speed of the cellulose breaking with the help of the enzyme, that was determined in these bacterias, was significantly higher than that, which was discovered in *Cellulomonas cellulans*, a bacteria whose distinguishing characteristic is fragmentation of cellulose and was used as an etalon for this research. The enzymatic assay of cellulase for the isolated CDB demonstrated significantly higher cellulase activity. [This high cellulase recycling](#)

showed the increase of decay of rice straw and fresh vegetation biomass in the presence of native microbiota community. The growth rate of CDB of epigeic PE was approximately twice slower than that of CDBs of endogeic GS. The CDB of PE exhibited 12 polymorphs of esterase isozyme as against 4 polymorphs for CDB of GS. Consequently, this discovery provides the ability to develop newest methods for the decomposing of organic waste.



In rice-growing tropical and sub-tropical regions, cellulose-containing rice straw remains in the field after harvesting and needs to be decomposed quickly for efficient release of nutrients  
source - adobe.com

**Company name:** Institute of Advanced Study in Science and...

**Contact person:** -

**E-mail:** registrariasst@gmail.com

**Website:** <http://iasst.gov.in/>

**Phone:** +91-361-2270084

**Patent status:** -

**On market since:** -

**Regions:** United States, India

**Industries:** Environment, Food and Drink

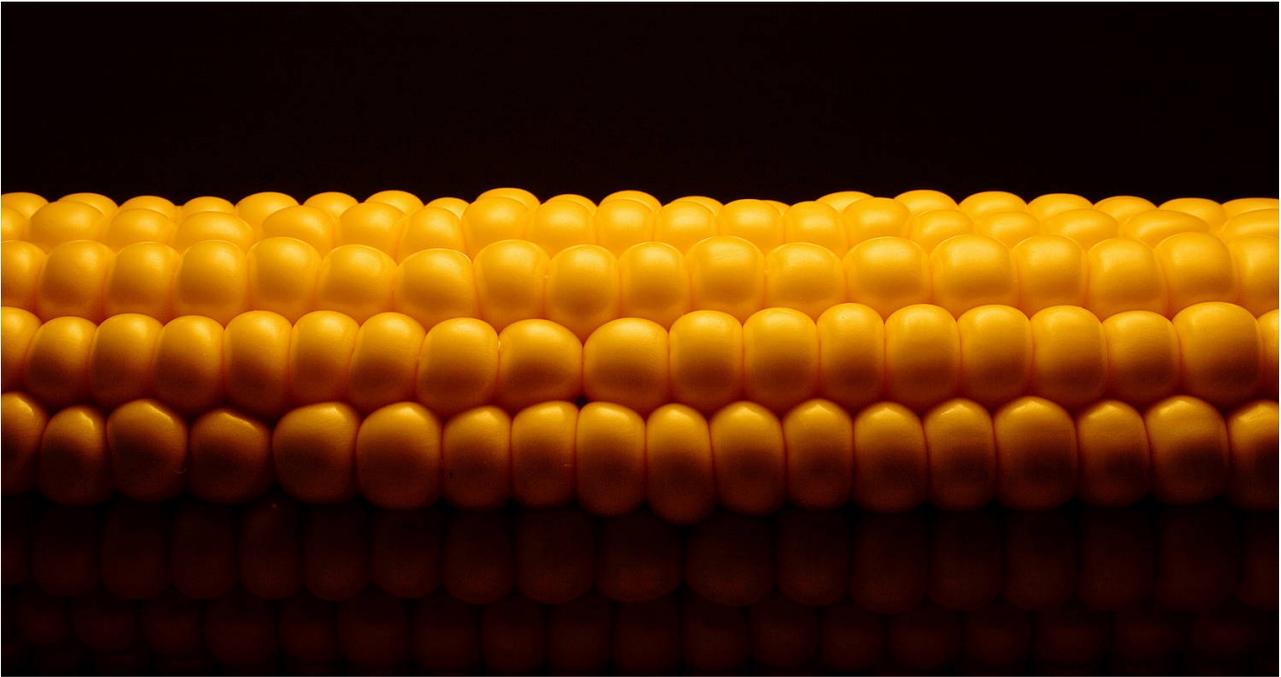
**Source links:** [Current Science](#)

[Research Stash](#)



## NEW BIO-FORTIFIED MAIZE WAS DEVELOPED

Hidden hunger, or micronutrient deficiency, is a major public health problem in developing countries caused by a lack of essential vitamins and minerals such as vitamin A, zinc, iron, iodine. Furthermore, signs of this form of the undernourishment can be hidden due to its people can look good, but suffer from very negative health impact. The researchers' team has managed to create a type of Indian corn that is rich in both Vitamin A and important amino acids through the process of plant breeding.



Maize occupies an important position in the world economy. It along with rice and wheat provides at least 30% of the food calories to more than 4.5 billion people in 94 developing countries

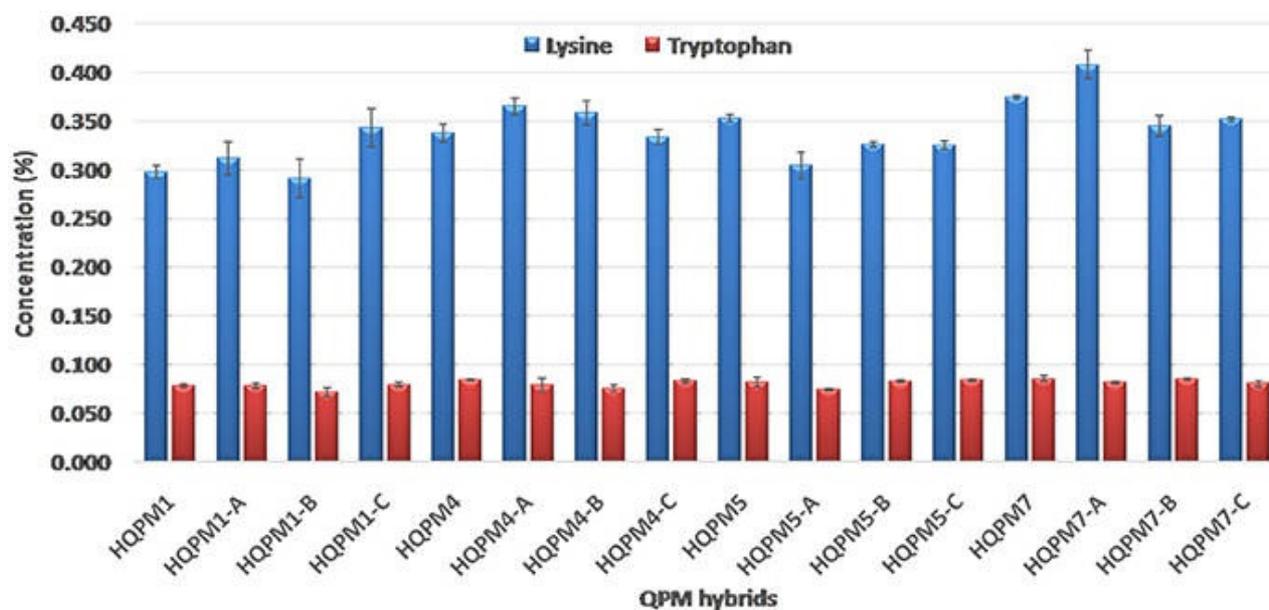
source - adobe.com

The newest development was made by the scientific group from the [Indian Agricultural Research Institute](#).

1 out of 3 people in developing countries suffers from hidden hunger, which increases their vulnerability to infection, birth defects, and impaired development. Hidden hunger cause hard health consequences such as illness, blindness, premature death, reduced productivity, and impaired mental development. This is especially striking for children and women in developing countries. For example, children can be stunted, have poor night vision or suffer frequently from illness. Adults are more often ill and suffer from chronic exhaustion. The unbalanced protein in the diet leads to **protein-energy malnutrition (PEM)** that affects more than a billion people across the world. The **quality protein maize (QPM)** contains balanced protein due to higher lysine and tryptophan. Cereals are the rich source of energy, but lacking the required content of micronutrients. Maize is mostly known as Indian corn and is used to make food items such as chips, flakes, popcorns etc. It serves as a major component of animal feed.

Scientists developed a **new hybrid type of Indian corn using the method by crossing**. It includes natural variations of **3 genes – beta-Carotene Hydroxylase, Lycopene-eta-Cyclase, and Opaque2 – needed for the generation of the high level of vitamin A and 2**

**important amino acids.** The range of provitamin A concentration was observed among both MABB-derived inbreds and hybrids, despite having the same allele of *crtRB1* and *lcyE*. This suggests that other genetic loci or QTLs apart from favorable alleles of the *crtRB1* and *lcyE* genes, contribute to the accumulation of provitamin A. The current study has achieved **70%** of target level 15  $\mu\text{g/g}$  provitamin A in reconstituted hybrids (mean: 10.58  $\mu\text{g/g}$ ).



Lysine and tryptophan concentration in original- and reconstituted- hybrids  
source - frontiersin.org

Consequently, this newest type of corn has **4.5 folds** more vitamin A content and similar amounts of lysine and tryptophan as others.

**Company name:** Indian Agricultural Research Institute

**Contact person:** Rajkumar U. Zunjare

**E-mail:** fh\_gpb@yahoo.com

**Website:** <http://www.icar.org.in/>

**Phone:** -

**Patent status:** -

**On market since:** -

**Regions:** India

**Industries:** Food and Drink

**Source links:** [Frontiers in Plant Science](#)

[The hindu business line](#)



## A NATURAL ANTIBACTERIAL MECHANISM CAN HELP TO CREATE NEW ANTIBIOTICS

Scientists have managed to discover the mechanism, which is the basis of the antibacterial feature of a natural compound, which is called Chlorogenic Acid. This compound has the ability to trigger a special process in the bacteria that suppress its growth and kill. Chlorogenic acid is peculiar to different plants such as coffee, seeds of sunflower, leaves of blueberries, white poplars, chicory' roots. Furthermore, this innovative discovery will provide the ability to create a new type of antibiotics.



Members of the research team at the Indian Institute of Technology, Roorkee  
source - researchstash.com

The discovery was made by the scientific team from the [Indian Institute of Technology, Roorkee](#).

**Chorismic acid** is crucial for the survival of bacteria and is synthesized through the shikimate pathway. The shikimate pathway is peculiar to different microorganisms, and plants. Such characteristics make enzymes of this pathway suitable for the creation of antibiotics, herbicides, and pesticides. The first step of the pathway provides due to the **DAHPS** synthase enzyme. DAHPS is functionally homologous to the downstream AroH class chorismate mutase. This is the first structure of chorismate mutase, AroQ (BsCM\_2) enzyme from *Bacillus subtilis* in complex with citrate and chlorogenic acid. **Chlorogenic acid has the ability to link to the chorismate mutase in bacteria, thereby, restraining its growth and causing its death.**

Scientists said that molecular mechanism of antibacterial properties of chlorogenic acid has been decoded **for the first time**. This research is the first note of the AroQ class of BsCM\_2 structures and provides information about active site architecture and its regulatory role. In BsCM\_2–CGA, the monomeric structure contains a Chorismate Mutase,

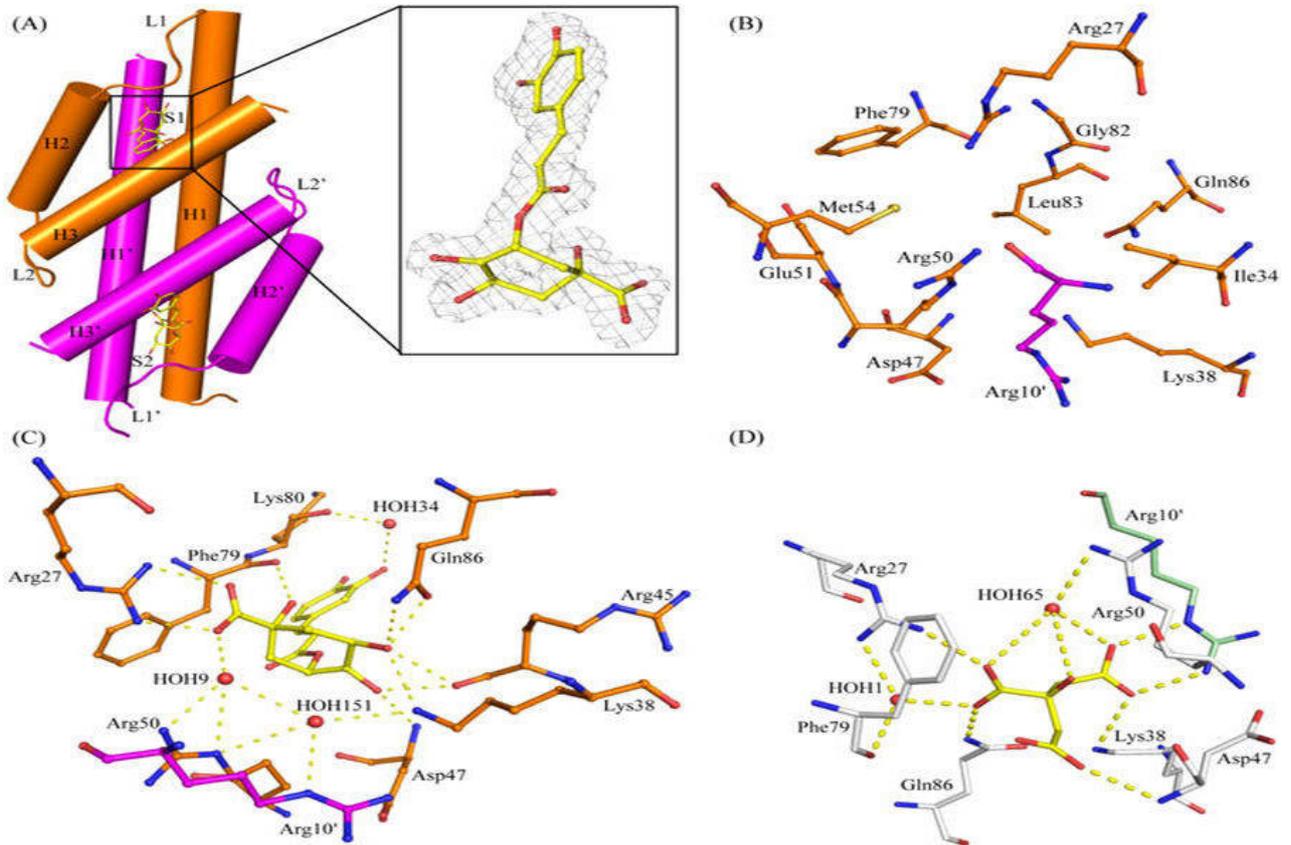
type II fold, that is a 3-helix bundle connected through the loops. They performed the molecular dynamics simulations in order to trace active site loop flexibility. With the help of structural analysis, they made the explanation of the minimal catalytic activity of BsCM\_2 and other previously reported observations regarding its role in DAHPS activity regulation. Furthermore, scientists have managed to determine the kinetic parameters of inhibitory activity of chlorogenic acid and its minimum inhibitory concentration against *B. subtilis*.



Different organisms have evolved to regulate DAHP synthase activity through different allosteric mechanisms and associated allosteric machinery

source - adobe.com

Dr. Pravindra Kumar mentioned that this discovery will provide scientists the ability to create the new and more efficient type of antibiotics.



The overall structure, active site, and ligand interactions. Panel (A) shows the overall structure of BsCM\_2 complexed with chlorogenic acid

source - nature.com

**Company name:** Indian Institute of Technology, Roorkee

**Contact person:** Dr. Pravindra Kumar

**E-mail:** kumarfbs[at]iitr.ac.in

**Website:** <https://www.iitr.ac.in/>

**Phone:** 91-1332-285072

**Patent status:** -

**On market since:** -

**Regions:** India

**Industries:** Chemicals, Healthcare

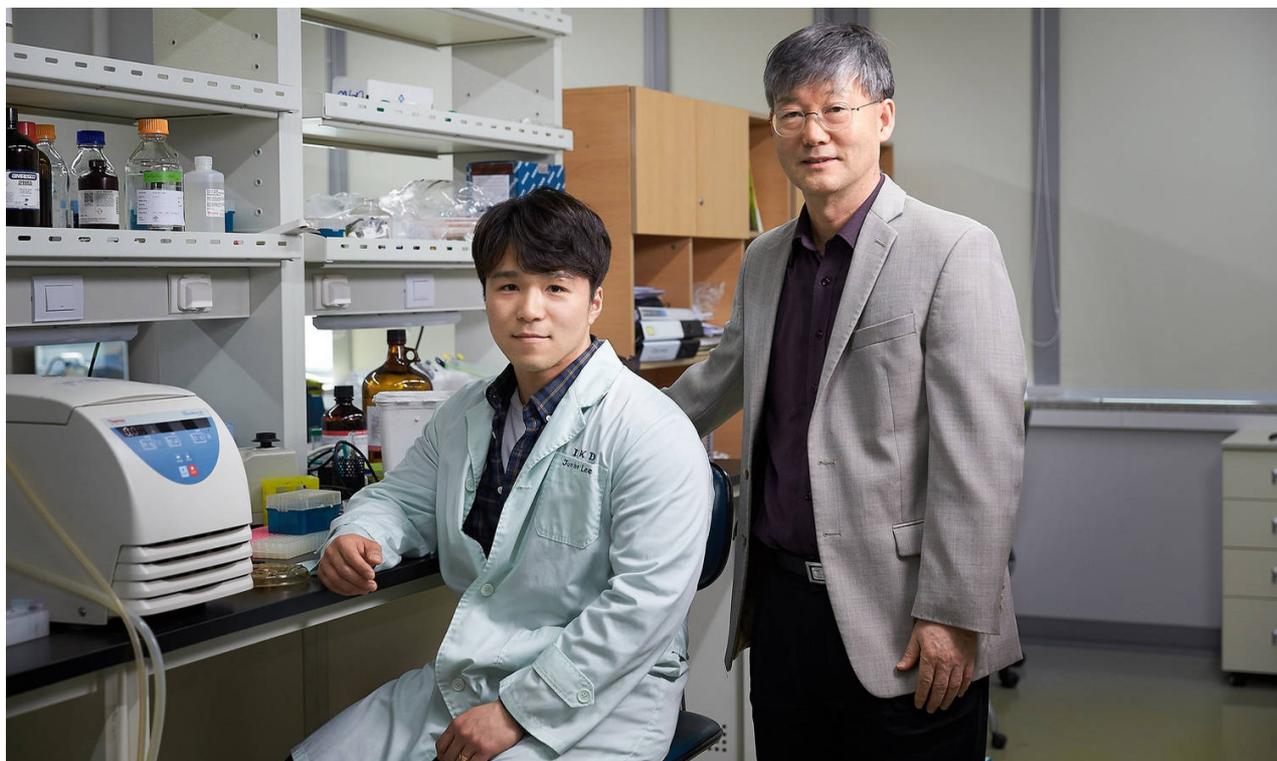
**Source links:** [Scientific Reports](#)

[Research Stash](#)



## THE GENE THAT PROMOTES THE DEVELOPMENT OF THE LIVER CANCER

A liver cancer has the ability to resist most types of chemotherapy drugs. Even in the case when cancer cells are completely destroyed, the incidence of relapses in patients who underwent complete surgical resection is 70%. Despite the advances in medical progress, it is still particularly difficult to treat liver cancer. Recently, scientists from Korea, have managed to identify that a gene, which is called Tonicity-responsive enhancer binding protein (TonEBP) promotes the formation and recurrence of liver cancer. This innovational discovery can significantly improve methods of the diagnostic, prognostic, and even treatment.



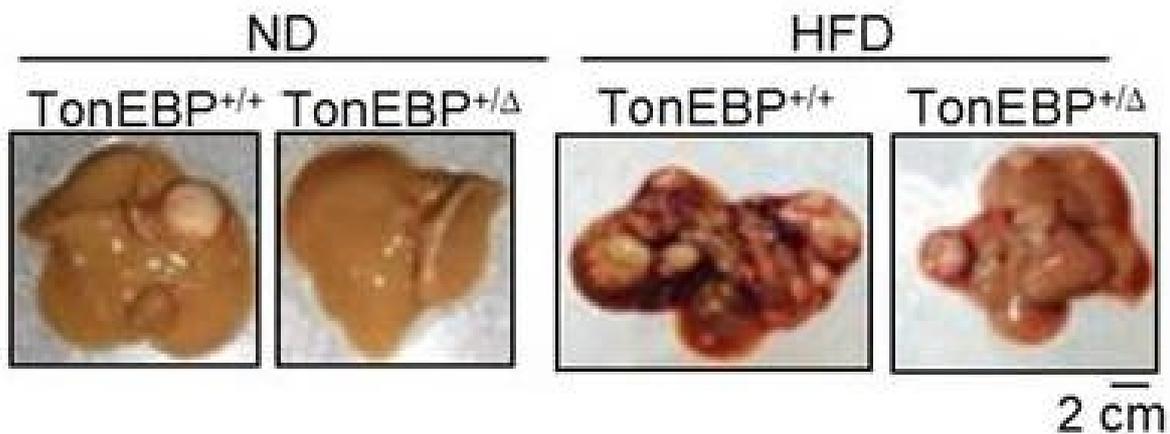
Professor Hyug Moo Kwon at the School of Life Sciences at UNIST (right)  
source - [news.unist.ac.kr](http://news.unist.ac.kr)

This breakthrough was made by the scientific group, led by [Professor Hyug Moo Kwon](#), from the [UNIST](#) in collaboration with researchers, led by [Professor Neung Hwa Park](#) from the [Ulsan University Hospital](#).

The [hepatocellular carcinoma \(HCC\)](#) is the common type of cancer with the high rate of recurrence and mortality. Various etiologic agents and wide heterogeneity in individual tumors prevent effective and personalized treatment. Despite the fact that inflammation is closely linked with the pathogenesis of HCC, the role of TonEBP is unknown. Scientists wanted to determine the role of TonEBP in HCC. This gene [TonEBP](#) was discovered by Professor Kwon in [1999](#). He defined that it provides the regulation of urine and promotes inflammations that fight infections, which were caused by virus or bacteria. Scientists managed to determine that [TonEBP expression was higher in tumors than in adjacent non-tumor tissues in 92.6% of patients with HCC regardless of etiology associated](#). Liver cancer can be hard to diagnose due to various symptoms, which appear during the advanced stage.

TonEBP drives the expression of [cyclo-oxygenase-2 \(COX-2\)](#) by stimulating the promoter. In the mouse model of DEN-induced HCC, expression of TonEBP mRNA was

higher in non-tumor regions surrounding tumors compared to normal hepatic tissues indicating that HCC was associated with hepatic inflammation as expected. Within the hepatic tissues from animals with HCC, expression of TonEBP and its mRNA was higher in tumors compared to their surrounding non-tumor regions. Scientists analyzed the inflammatory stimuli-responsive inflammation. The effect of TonEBP deficiency on suppressing inflammation was confirmed in the non-cancerous hepatocyte cell line AML-12. Taken together, these data demonstrate that TonEBP is a general mediator of hepatocyte inflammation. This is consistent with the elevation of TonEBP expression regardless the cause of HCC – HBV, HCV, and alcohol abuse. **In the patients with HCC, TonEBP expression in tumor and non-tumor region correlated positively with COX-2 expression.**



source - news.unist.ac.kr

The study results demonstrated that as a smaller quantity of TonEBP, the smaller quantity of cancer cells and its size. Therefore, **TonEBP provides the development of liver cancer.** This novel discovery can significantly improve diagnosis and treatment of this type of cancer.



The team anticipates that their work will have a profound impact on people living with liver cancer  
source - [news.unist.ac.kr](http://news.unist.ac.kr)

**Company name:** Ulsan National Institute of Science and Tec...

**Contact person:** Professor Hyug Moo Kwon

**E-mail:** hmkwon@unist.ac.kr

**Website:** <http://www.unist.ac.kr/>

**Phone:** +82-52-217-2535

**Patent status:** -

**On market since:** -

**Regions:** Korea

**Industries:** Healthcare

**Source links:** [BMJ Gut](#)

[UNIST](#)



## A GOLDEN APPLE CAN NEUTRALIZE COBRA VENOM

There are thousands of people die every year due to the snakebites. The problems of decentralization of the antidotes' manufacturing, side effects, the lack of antidote in some regions, lead to fatal cases. In traditional medicine, various plants are often used as the antidote to snake bites, but the effectiveness of these plants either has not been confirmed, or such studies have not even been made. Therefore, researchers from India have successfully managed to extract the substance from bael tree or Aegle Marmelos, which has the ability to neutralize toxic effects of cobra venom.



Besides Dr. Sreekumar, the research team included N. C. Nisha, D. A. Evans and C. K. Biju  
source - adobe.com

The novel development was made by the scientific team at the [Jawaharlal Nehru Tropical Botanical Garden and Research Institute \(JNTBGRI\)](#) in collaboration with the [University College Thiruvananthapuram](#).

According to the [World Health Organization](#), about 421,000 envenomings and 20,000 deaths occur each year due to snake bites worldwide. The highest numbers of such cases occur in South Asia, Southeast Asia, and sub-Saharan Africa. Currently, the anti-venom serum is the only method to treat snake bites, despite this fact, it can lead to different complications such as anaphylactic shock, pyrogen reaction, and serum sickness. The serosity is produced by injecting horses with safe levels of poison. The antibodies, which were generated, are extracted from their blood and produced into the serum.

The anti-venom production at one location loses its effectiveness when used at another site. Dr. Bavaskar mentioned that scientists wanted to decentralize anti-venom manufacturing to overcome geographical variation in snake venom. Consequently, they generated the extract from the bael tree. It is a common medicinal tree distributed throughout India with its root, stem bark and leaves being used against snake envenomation. Nevertheless, there is a controversy on its anti-snake venom activity. In these backdrops, this research was aimed to evaluate the anti-cobra venom activity of bael through in vitro method, and identify lead molecules against each cobra venom toxic protein through in silico method. The docked results between 81 phytochemicals from

baels and each of the 14 venom proteins revealed that the plant contains potential molecules for detoxification of all cobra venom proteins. The extracts inhibited destruction of red blood cells and action of acetylcholinesterase blockers induced by the venom.

Acetylcholinesterase blockers have the ability to prevent muscle contraction of ribs and chest, which is the main reason for death due to the making breathing difficult.

Furthermore, the substance decreased the abnormal breakdown of proteins by the venom. This development has demonstrated a high efficiency but requires further clinical trials.



In order to make the research leaves, stem and root bark of *Aegle marmelos* collected from 5 to 10-year-old field grown plants were shade dried and powdered separately  
source - adobe.com

Company name: Jawaharlal Nehru Tropical Botanical Garde..

Contact person: -

E-mail: director@jntbgri.res.in

Website: <http://jntbgri.res.in/>

Phone: +91(0)472 2869246

Patent status: -

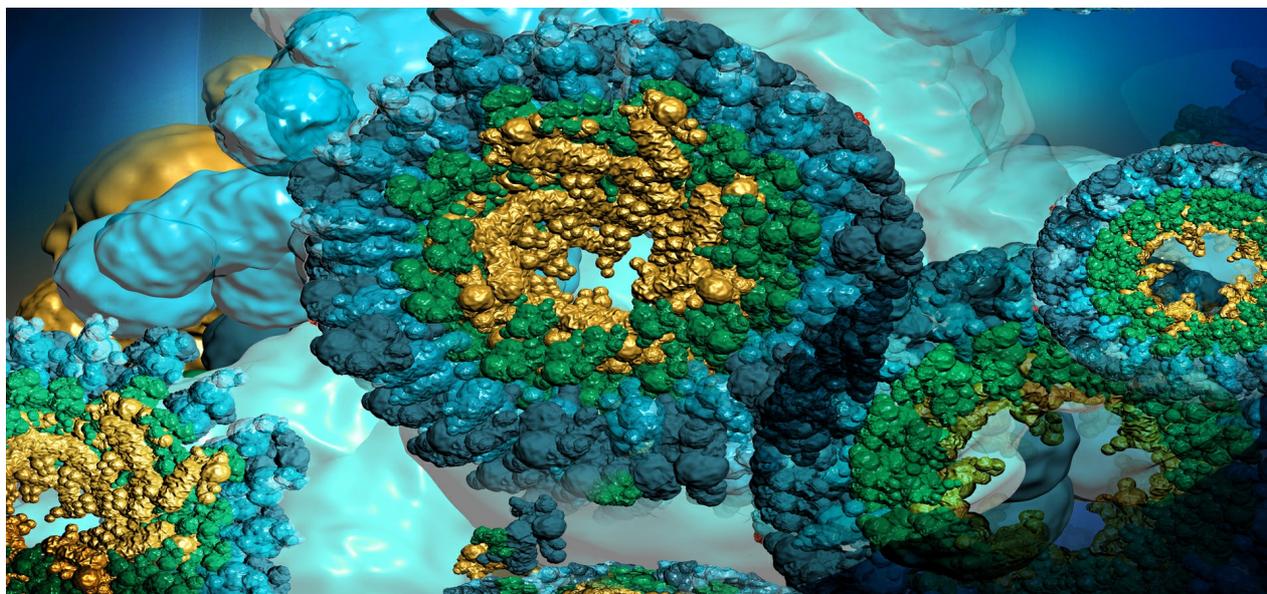
On market since: -

Regions: India

Industries: Healthcare

Source links: [Current Science](#)

[Research Stash](#)



## NOVEL PROTEIN CAN BOOST THE NUTRITIONAL VALUE OF CEREALS

Scientists managed to identify a new protein tyrosine phosphatase-like phytase (PTPLP), which was determined as PhyLf, from yak cheese. This enzyme was received from probiotic bacterium *Lactobacillus fermentum* NKN51 and has the ability to increase the nutritional value of cereals by improving the bioavailability of vital minerals. Furthermore, scientists mentioned that this discovery can be potentially used in increasing the micronutrient availability to babies, pregnant women and the aged.



Members of the research team at IIT Roorkeer  
source - researchstash.com

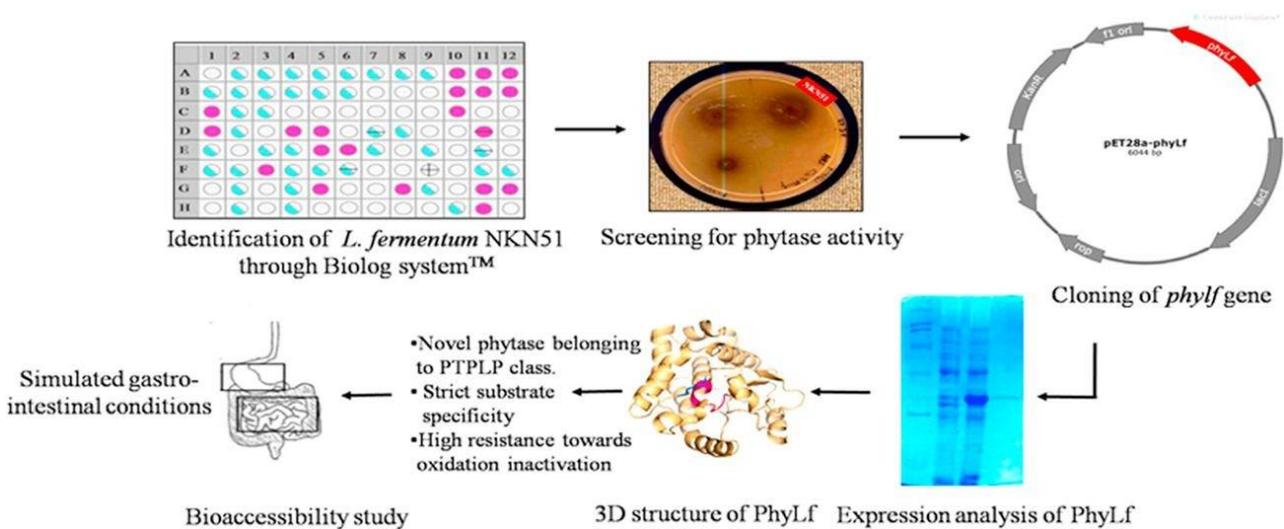
One of the main healthcare challenges is to solve the deficiency of micronutrients such as phosphorous, iron, calcium and zinc. This issue is highly important for infants, elderly and vegetarians. In plants, phosphorus is harvested mainly as organic phosphorous, which is called **phytate**. It is an anti-nutritional factor (ANF). Individuals who for various reasons can only receive phosphorus from plants have the problem of the lack of phytase. This substance is necessary for the assimilation of phytate by the human body. Typically, phytase enzymes are received from fungi. It is considered fit for the application in order to increase nutritive values of poultry and other livestock feeds.

The scientific group, led by **Dr. Naveen Kumar Navani**, from the [Indian Institute of Technology Roorkee](#) in collaboration with the [Indian Institute of Science Education and Research, Kolkata](#), was trying to find the source to enhance food that will be suitable for the consuming by humans. They managed to identify the **enzyme PhyLf**, which was generated from the probiotic bacterium *Lactobacillus fermentum* NKN51, and has the ability to solve this problem. The bacterium was isolated from cheese that was produced from the milk of Himalayan Yak.



The research was funded by the National Agricultural Science Fund of Indian Council of Agriculture Research (ICAR) and Uttarakhand Council of Science and Technology  
 source - adobe.com

PhyLf demonstrated specific activity of 174.5 U/mg. It provides strict specificity towards phytate and optimum temperature at 60 °C, pH 5.0 and ionic strength of 100 mM. Km and Kcat of PhyLf for phytate were 0.773 mM and 84.31 s<sup>-1</sup>, respectively. In addition, this protein exhibited high resistance to oxidative inactivation. The study results showed that the dephytinization of durum wheat and finger millet under in vitro gastrointestinal conditions with the help of PhyLf increased the bioaccessibility of mineral ions. It could be highly useful for ameliorating nutritional value of cereals due to its characteristics such as releasing of micronutrients, probiotic origin, and resistance to oxidative environment.



Novel PTP like phytase (phyLf) was cloned and expressed from *L. fermentum* NKN51. PhyLf exhibited high substrate specificity and resistance against oxidation by ROS  
 source - sciencedirect.com

**Company name:** Indian Institute of Technology Roorkee

**Contact person:** Dr. Naveen Kumar Navani

**E-mail:** [navnifbs@iitr.ac.in](mailto:navnifbs@iitr.ac.in)

**Website:** <https://www.iitr.ac.in/>

**Phone:** -

**Patent status:** -

**On market since:** -

**Regions:** India

**Industries:** Food and Drink

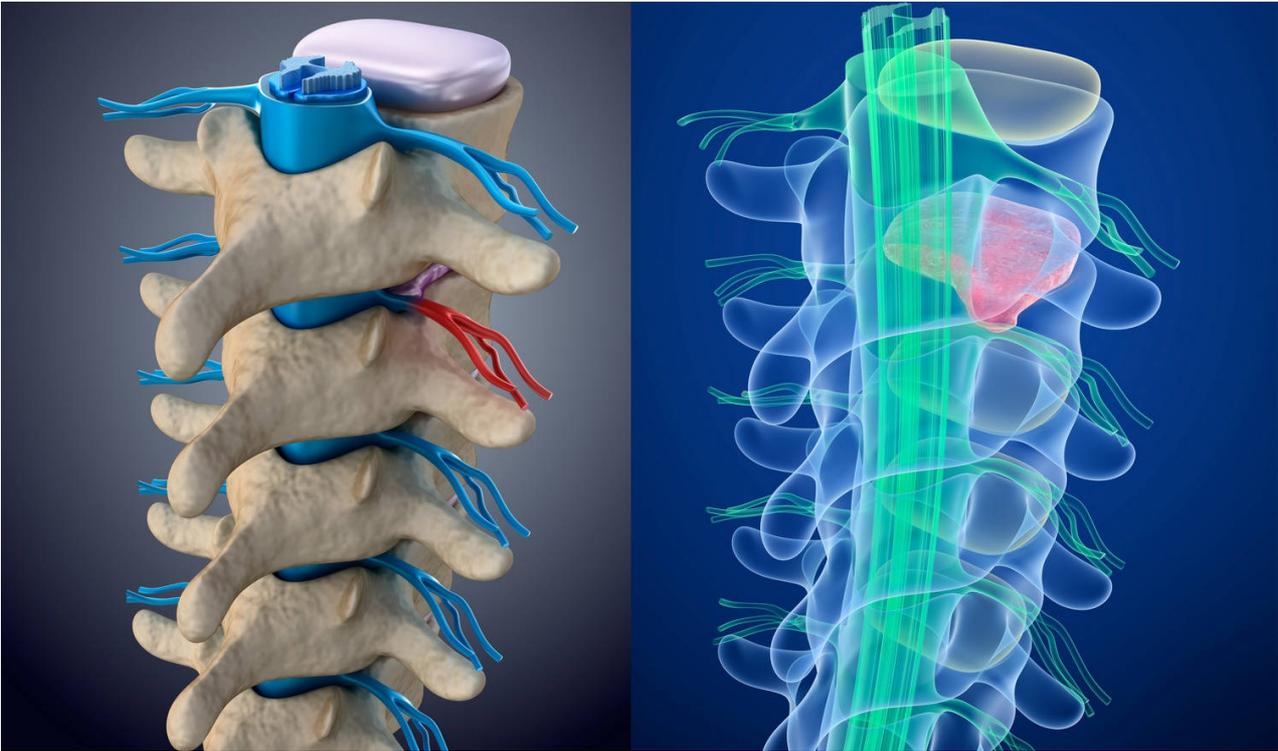
**Source links:** [Bioresource Technology](#)

[Research Stash](#)



## NEW TREATMENT RECOVERIES THE MOTION ABILITY OF PATIENTS WITH A PARALYSIS

Spinal cord injury (SCI) is characterized by the damaging of the motor ability of the person and often causes the paralysis. The main reason is that the body cannot regenerate the lost neural bonds making the patient paralyzed. Scientists from Japan developed a novel treatment that is based on the use of an antibody for repulsive guidance molecule-a (RGMa). This method has the ability to recover motor function in rhesus monkeys, which had SCI. Furthermore, researchers mentioned that this newest treatment can be potentially used for humans.



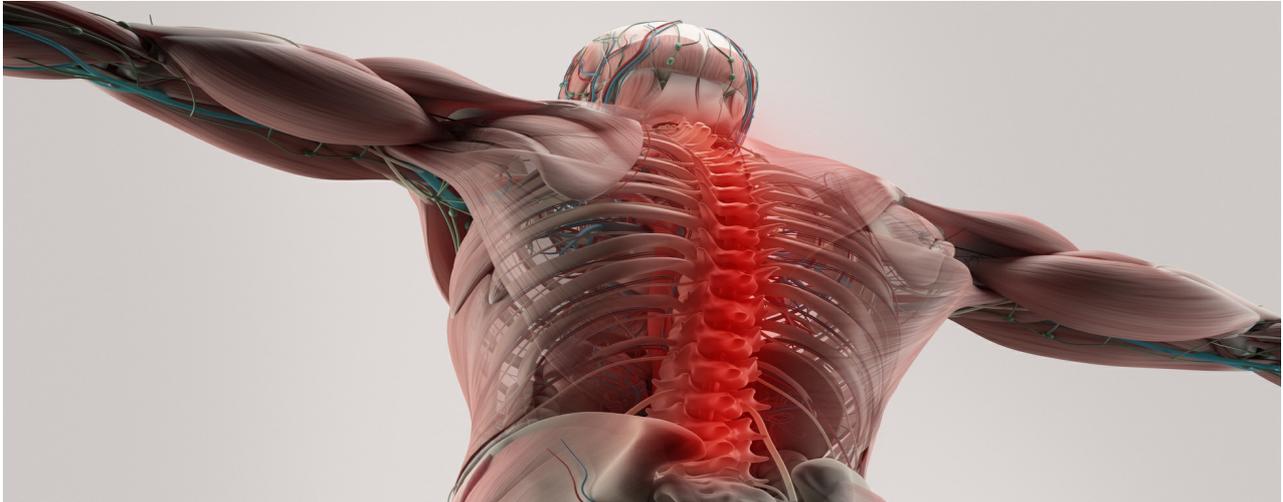
The pharmacological inactivation following intracortical microstimulation revealed that the contralesional, but not the ipsilesional, primary motor cortex was crucially involved in functional recovery at a late stage in the SCI model source - adobe.com

The discovery was made by the scientific group from the [Kyoto University](#).

The central nervous system of mammals has a limited ability to grow or recover from injury due to the inhibitory factors. RGMA is generated by immune and inflammatory cells, which are situated in the certain region of the spinal cord that was traumatized. To provide recovery after SCI, it is significant that corticospinal tract (CST) fibers conjoin correctly with target spinal neurons with the help of increased axonal growth/regeneration. RGMA demonstrates the ability to effectively promote the axonal growth.

Scientists used **antibody treatment against RGMA** in monkeys with SCI. They continuously supplied the RGMA antibody to one group of monkeys during **4 weeks**. After these, animals performed some dexterity tasks such as taking food from vertical or horizontal slots. Those animals, which were received this novel treatment, demonstrated almost full recovery during the task, especially, comparing to untreated monkeys. The results of **the further neuroanatomical study determined that the antibody treatment provides axon growth in damaged regions**. The oppression of upregulated RGMA around this region in the cervical cord lead to **the recovery from impaired manual dexterity by accentuated penetration of CST fibers into laminae VII and IX, where spinal interneurons and motoneurons are**

located, respectively. The present data indicate that this type of the treatment with the neutralizing antibody against RGMA after SCI is a potential target for achieving restored manual dexterity in primates. Consequently, this therapy can be potentially used for humans but it still requires further research.



Considering that the antibody was delivered directly into the brain for 4r weeks, the recovery mechanism is still unclear  
source - adobe.com



One test to determine recovered dexterity after SCI. Subjects pick out food from thin slots and their time is recorded  
source - kyoto-u.ac.jp

Company name: Kyoto University  
Contact person: Hiroshi Nakagawa  
E-mail: h.nakagawa@ucl.ac.uk  
Website: <https://www.kyoto-u.ac.jp/en/>  
Phone: -  
Patent status: -  
On market since: -  
Regions: Japan  
Industries: Healthcare  
Source links: [Cerebral Cortex](#)  
[Kyoto University](#)



**OTHERS**