Technology Scan

ASIA-PACIFIC

AUSTRALIA

Stem cell breakthrough

Queensland scientists have successfully turned synthetic material into an embryonic stem cell, in a research breakthrough that may one day quell the debate over stem cell therapies. The process, which derives embryonic stem cells from chemically-synthesized proteins, may eventually eliminate the controversial step of destroying human embryos for stem cell therapies, scientists from Queensland University of Technology (QUT) say.

"The achievement overcomes one of the major obstacles to the approved use of stem cell therapies," QUT Associate Professor David Leavesly said. "Traditional culture of human embryonic stem cells requires the presence of animal or human serum-derived products in the growth media for the embryonic stem cells to survive and grow."

Scientists hope embryonic, unspecialized cells will eventually be used to grow new tissue and replacement organs to cure a range of ailments from spinal cord injuries to Alzheimer's disease. "Health regulators have always held serious concerns about the possible transmission of infections to humans treated with stem cells grown in the presence of serum-derived (animal-derived) products," Professor Leavesly said. "But until now there have been no practical alternatives."

The new technique involves fusing synthetic proteins through polymer technology, whereby many small molecules, known as monomers, are synthesized into a cellular chain."(This) provides a completely new way of growing stem cells and has dramatic implications for being able to grow multiple stem cell types - blood stem cells, neuronal stem cells or human embryonic cells - are all possible," Associate Professor David Haylock from the Australian Stem Cell Centre said. "The idea is to provide a culture that mimics what these cells would see in a living tissue."

The combination of synthetic proteins has been patented by QUT and is being commercialized by Tissue Therapies Ltd, a subsidiary company of the university. Professor Leavesley said the artificial proteins are also cheaper and more efficient. "Now we can absolutely control the conditions that they grow in and with fewer components, they're cheaper to produce," he said.

http://www.brisbanetimes.com.au

Natural process to split water

An international team of researchers led by Monash University has used chemicals found in plants to replicate a key process in photosynthesis, paving the way to a new approach that uses sunlight to split water into hydrogen and oxygen. The breakthrough could revolutionize the renewable energy industry by making hydrogen - touted as the clean, green fuel of the future - cheaper and easier to produce on a commercial scale.

Professor Leone Spiccia, Mr Robin Brimblecombe and Dr Annette Koo from Monash University teamed with Dr Gerhard Swiegers at the CSIRO and Professor Charles Dismukes at Princeton University to develop a system comprising a coating that can be impregnated with a form of manganese, a chemical essential to sustaining photosynthesis in plant life.

"We have copied nature, taking the elements and mechanisms found in plant life that have evolved over 3 billion years and recreated one of those processes in the laboratory," Professor Spiccia said.

"A manganese cluster is central to a plant's ability to use water, carbon dioxide and sunlight to make carbohydrates and oxygen. Man-made mimics of this cluster were developed by Professor Charles Dismukes some time ago, and we've taken it a step further, harnessing the ability of these molecules to convert water into its component elements, oxygen and hydrogen," Professor Spiccia said.

"The breakthrough came when we coated a proton conductor, called Nafion, onto an anode to form a polymer membrane just a few micrometres thick, which acts as a host for the manganese clusters." "Normally insoluble in water, when we bound the catalyst within the pores of the Nafion membrane, it was stabilized against decomposition and, importantly, water could reach the catalyst where it was oxidized on exposure to light."

This process of "oxidizing" water generates protons and electrons, which can be converted into hydrogen gas instead of carbohydrates as in plants. "Whilst man has been able to split water into hydrogen and oxygen for years, we have been able to do the same thing for the first time using just sunlight, an electrical potential of 1.2 volts and the very chemical that nature has selected for this purpose," Professor Spiccia said

Testing revealed the catalyst assembly was still active after three days of continuous use, producing oxygen and hydrogen gas in the presence of water, an electrical potential and visible light. Professor Spiccia said the efficiency of the system needed to be improved, but this breakthrough had huge potential. "We need to continue to learn from nature so that we can better master this process."

"Hydrogen has long been considered the ideal clean green fuel, energy-rich and carbon-neutral. The production of hydrogen using nothing but water and sunlight offers the possibility of an abundant, renewable, green source of energy for the future for communities across the world."

http://www.innovations-report.de

CHINA

High purity carbon nanotubes

Thanks to the 7-year efforts, a high purity flexible carbon nanotube with an enhanced strength and associated manufacturing equipment, jointly developed by Zhejiang University and Hangzhou Xuanaikj Corp., were recently put into mass production. As a proprietary product, it has obtained 12 national invention grants.

The simple and unique technology is able to turn one gram of catalyst material into more than 40 grams of carbon nanotubes, a laudable efficiency four times that of the similar technologies developed overseas. Meanwhile, the technology produces a product with a purity as high as 95 per cent, and a length reaching the micron level. The inexpensive nature of the materials and technology has also brought down the price.

http://www.most.gov.cn

Improved functional nanomaterials

Nanostructured functional materials, a project assigned to Wu Xintao, an academician working for CAS Institute of Matter Structures, passed an approval check on July 6, 2008. Working on the synthesis, structures, and performance of nanomaterials, absorbing or hydrogen storing materials, novel lucid ceramic materials, and glass ceramic laser materials with fine semiconductor or florescent applications, the project has achieved the following innovative results:

- Researchers have rolled out nanostructured compounds of semiconductor applications, and nanostructured fluorescent materials able to change colour when heated, with an enhanced fluorescent illumination and reliability. They realized the self-assembly of nanostructured clusters in different dimensions, worked out an empirical formula to explain the relationship between coupled magnetism and the structure of 6-cored rare earth metal clusters, and improved their performance through regulating materials.
- Researchers studied the approach to synthesize microporous materials in moderate solutions (water), and the relationship between structures and effects, through synthesizing and characterizing porous absorbing materials. The study has made itself a world leader in the area.
- Researchers have made a systematic study of the preparation, structure, and physical and chemical properties of nanostructured lucid ceramics and glass ceramic laser materials with a compound structure, and established a link between structure and performance. They also produced novel nanomaterials with fine illumination performance and application perspectives in the area of photoelectrics. The findings have spurred up the R&D of preparing nanostructured functional materials, and associated structure regulation and structure-effect studies, allowing more applications in the area.

http://www.most.gov.cn

INDIA

Technology to produce bio-diesel

The Indian Institute of Chemical Technology (IICT), Hyderabad, which has developed technology for production of bio-diesel from karanja (Pongamia), is now ready to transfer the process if any industrial unit supplies the raw material.

IICT, which set up a plant five months ago on a pilot basis, is presently working towards drawing oil from seeds efficiently sans wastage, production of bio-diesel and using the cake to produce several by-products like bio-pesticides, detergents and high-value fertilizers. The Department of Science and Technology has given a grant of Rs 1.9 crore for IICT to develop these by-products. With this, IICT experts said the cost of oil might come down.

"India, which is deficient in edible oils, is already importing five million tonnes per year. Hence, non-edible oils are the choice for producing bio-diesel unlike in the West, where edible oils like soya bean, sunflower and palm oil are used for the production of the bio-fuel," head, Lipid Science & Technology Division, Dr. R.B.N. Prasad said during a press interaction session on the 'Open Day' organized by IICT.

IICT is also exploring to use minor seeds like rubber and tobacco to produce bio-fuel and a dedicated bio-diesel testing facility will also come up shortly. The Institute will also start 'Technology Business Incubator' facility by the end of the year at a cost of Rs 4.5 crore wherein prospective entrepreneurs, who do not have resources but ideas, can walk in, use the facilities and produce a product at a nominal cost.

Earlier, school children from over 25 schools observed experiments and projects exhibited by different divisions of IICT to mark 'Open Day'. Experiments like preparation of bio-diesel from karanja seeds, purification of water, bio-hydrogen units and fuel cell technology attracted many students.

http://timesofindia.indiatimes.com

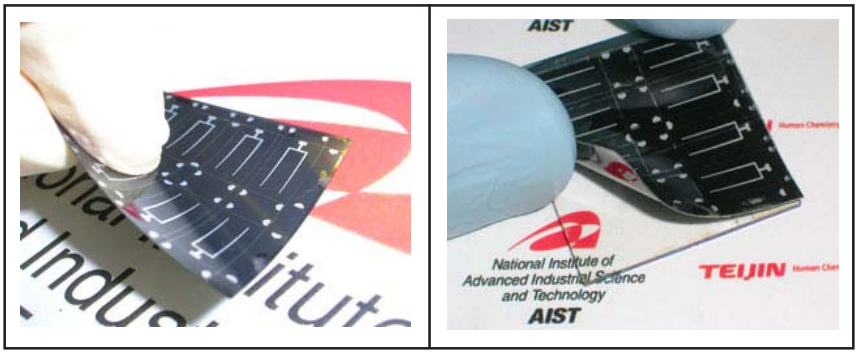
Technology for safe disposal of arsenic

Industries that use or generate arsenic in any product manufacture and face problems of disposal due to its high toxicity can now look forward to the Nagpur-based National Environmental Engineering Research Institute (Neeri) for a safe and cheap solution. Neeri has developed an unconventional, safe and effective technology for safe disposal for which its parent body, the Council of Scientific and Industrial Research (CSIR), has been granted a US patent recently.

Tapan Chakrabarti, acting director, Neeri said, "The institute had invented the technology while trying to solve the problem of about 450 cubic meters of arsenic solution stored in a pit for over 30 years due to non availability of any technology for its safe disposal.

The Zuari Industries Private Ltd in Goa used arsenic in manufacturing urea, an old technology dating back to the 1970s. The industry approached Neeri when the Supreme Court Committee on hazardous waste disposal raised an objection to such storage and directed the industry for immediate disposal of arsenic in 2004."

Mahendra Patil, who developed the technology under the guidance of Chakrabarti, Sukumar Devotta, former Neeri director and two other scientists Ashok Deskar and S. Deshpande, told the TOI



Flexible CIGS solar cells fabricated using a ceramics sheet substrate (left) and a polymer film substrate (right)

that although the technology was developed specifically to solve the issue for a particular industry, it can be used for other industries like the veterinary medicine industry, pharmaceutical industry and the fertilizer industry for arsenic removal, stabilization and safe disposal. The technology for which the institute applied for the US patent in 2006, and obtained it now, basically consists of two simple tried and tested steps.

http://timesofindia.indiatimes.com

JAPAN

Flexible CIGS photovoltaic cell

Shigeru Niki (Leader, also Deputy Director of RCPV) and Shogo Ishizuka (Research Scientist), the Thin Film Compound Semiconductor Team, the Research Center for Photovoltaics (RCPV) of the National Institute of Advanced Industrial Science and Technology (AIST) with cooperation of Teijin Limited (Teijin), have developed a technique for dramatically improving the energy conversion efficiency of flexible photovoltaic cells that use CIGS, a non-silicon material. Using this technique, high-performance photovoltaic cells with a variety of flexible substrates such as ceramics, metal foils, and polymers are fabricated.

The thickness of the photoelectric conversion layer in solar cells that use CIGS, a semiconducting material made of copper (Cu), indium (In), gallium (Ga), and selenium (Se), can be reduced to the order of several micrometers. Owing to this feature, lightweight and flexible photovoltaic cells that can be installed on a curved surface and portable photovoltaic cells are expected to be realized. It has been difficult to develop high-performance flexible CIGS photovoltaic cells, so far. By the development of a new controlled alkaline addition technique and a new polymer substrate handling technology, the energy conversion efficiency of the flexible CIGS photovoltaic cells is dramatically improved.

http://www.aist.go.jp

REPUBLIC OF KOREA

Thin-film transistor technology

A transparent thin-film transistor technology, developed jointly by a Republic of Korean university and corporate researchers, is expected to help realize a dream-like reality. When installed as a transparent display on car windows, the new technology offers innovative touch-screen navigation.

Professor Park Jae-woo and Yoo Seung-hyup of the Korea Advanced Institute of Science and Technology said that the team is the world's first developer of original technology for titanium dioxide (TiO_2)-based TTFT in cooperation with Samsung Electronics LCD Business Division and Techno Semichem.

Allowing visible rays to pass through it, TTFT is a core component for the manufacturing of next-generation displays like transparent, flexible, and active matrix organic light emitting diode displays. Korean companies had difficulty developing displays because the U.S. and Japan own over 3,000 patents for zinc oxide (ZnO)-based TTFT technologies.

The developers have already applied for patents for the new technology in the U.S., Europe and Japan, as well as Korea. The research was published in the July issue of the IEEE Electron Device Letters.

"We will spend another two or three years developing additional technologies and testing them to find mass-production technology," Prof. Park said. "And as soon as we succeed, we will transfer the technology to Korean companies."

http://english.chosun.com

Clean energy breakthrough

A Republic of Korean research team has made a potential breakthrough in the clean energy debate by discovering that icy organic hydrates can create and trap hydrogen atoms. The research team, led jointly by Lee Huen of the Korea Advanced Institute of Science and Technology and Kang Young-soo of Sogang University, said that freezing water with a small amount of organic matter creates a nanometer (one billionth of a meter) of vacant space where hydrogen atoms can be stored safely. In contrast, pure water does not create this empty space when frozen alone.

Generating electricity when combined with oxygen to leave water as its by-product, hydrogen is widely touted as a clean energy source. But it is difficult to commercialize, because it must be stored at an ultra-low temperature or under ultra-high pressure. Prof. Lee said, "It is an economical, eco-friendly way of storing hydrogen, since water is used as a medium."

http://english.chosun.com

PAKISTAN

Patent for anti-convulsant drug

A new anticonvulsant drug and its use in the treatment of a variety of disorders has been patented in the USA. The team of

researchers includes Dr. Iqbal Choudhry, Dr. Farzana Shaheen, Dr. Arun Ganesan, Dr. Shabana Usman Simjee and Dr. A. Mohsin Raza from the International Centre of Chemical and Biological Sciences at the University of Karachi, and Dr. Atta-ur-Rahman, Chairman Higher Education Commission. The invention is based on investigations on a plant, Delphinium, which has been traditionally used as anticonvulsant, but without recognizing the source of its activity or structure of the active principle.

The compound possesses potent anticonvulsant activity and is therefore potentially useful in the treatment or prevention of anxiety, mania, depression, panic disorders, epilepsy, Parkinson's disease, migraine, sleep disorders, neuralgia, etc.

In an effort to encourage scientists to patent their findings, the Higher Education Commission has developed a programme to encourage innovation. Under this programme, researchers can submit research ideas, published papers, and thesis synopsis for evaluation for patentability.

The submission remains completely confidential. The purpose of this evaluation is to determine patentability. In case an invention is determined to be patentable the inventor is encouraged to file for an international patent.

http://www.app.com.pk

RUSSIAN FEDERATION

Bamboo rechargeable battery

Specialists of the Institute of Chemistry of the V.V. Kuibyshev Far-Eastern State Polytechnic University (Far-Eastern Branch, Russian Academy of Sciences) have designed an experimental facility for producing anodic matrices for rechargeable lithium-ion cells. The rechargeable cells are made of renewable vegetable stuff - bamboo sprouts and cane-sugar.

Dynamic evolution of portable electronics is impossible without rechargeable lithium-ion cells. They take a leading place in the area of self-contained power supply. Irrespective of the rechargeable cells shape and dimensions, anode, cathode and electrolyte make part of the cells. To produce them, researchers are trying to select the less-expensive and nonpolluting materials, keeping in mind, however, the quality of the article. The Far-Eastern researchers suggest that the cells should be produced from bamboo sprouts and cane-sugar of Chinese manufacturing. To produce anodic material, the raw stuff is cleaned and then heated up several times at high temperatures (from 800°Ñ to 1100°Ñ), cooled off and reduced to fine particles. In the course of manufacturing, the material is processed by soda, calcium, sodium and potassium chlorides, and sodium hydroxide. As a result, carbon dust is obtained, its particle size making about 14 microns.

The obtained anodic materials is fit for both lithium-ion and lithium-polymer rechargeable cells. As the investigations have proved, the obtained carbonic modifications contain oval-shaped particles of a layer structure resembling a graphite layer structure. The obtained carbonic structures are practically similar to the structure of commercial anodic materials (graphite modifications), i.e., they have a crystal structure. They possess very good operating qualities and even exceed some commercial materials. Nevertheless, to enable carbon modifications (obtained from cane-sugar and bamboo sprouts) serve as the anode material for lithium-ion (polymer) rechargeable cells, their processing characteristics should be refined.

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http://www.informnauka.ru

VIET NAM

Flood forecast technology

Scientists at the University of Natural Sciences in Ha Noi have developed a technology to forecast floods three days in advance, but the government has mothballed, though floods continue to batter the country every year. Prof Dr. Tran Tan Tien, the director of the research programme, shared his thoughts on this matter. He said he and his colleagues built upon KC.09.04, his own national-level research on "Building a model of hydrometeorology forecasting in the Eastern Sea." They tried to develop a digital model to forecast floods in the central region three days before they occurred.

This region has a steeply sloping terrain, making the work of forecasting floods especially difficult: Heavy rains almost always immediately cause floods. Current technology only makes it possible to issue a 12-hour warning. One essential requirement to predict floods is a precise forecast of rains - how much and exactly where. Thus, the earlier the forecast the harder it is to get it right, Tien said. His team applied the modern RAMS model (created by American scientists) with certain modifications done to suit local conditions to accurately forecast the quantity and exact place of rain three days in advance. It achieved very high accuracy, with an error factor of just three per cent, he said.

The technology can be used everywhere in Viet Nam since it has been successful in the centre, the most unpredictable region. But it is yet to be used practically, Tien said, mentioning certain reasons. He said funds were a problem in installing the system while scientists and officials have yet to accept its efficacy despite the proof available.

Tien said the requisite machines, equipment, and human resources would cost around VND 300 million (US$ 18,200). But he rejects the monetary argument - when the government can spend billions of dong to fund research, it can spend a little more to apply them, he said.

http://english.vietnamnet.vn

EUROPE

GERMANY

New record efficiency for solar cells

At 39.7 per cent efficiency for a multi-junction solar cell, researchers at the Fraun-

hofer Institute for Solar Energy Systems ISE in Freiburg have exceeded their own European record of 37.6 per cent which they achieved just a short time ago. III-V semiconductor multi-junction solar cells are used in photovoltaic concentrator technology for solar power stations.

"We have improved the contact structures of our solar cells," says Frank Dimroth, Head of the III-V – Epitaxy and Solar Cells Group at Fraunhofer ISE. "As a result, using the same semiconductor structures, we now achieve higher efficiency when converting sunlight into electricity."

For the utilization in photovoltaic concentrator systems, the optimal efficiency of multi-junction solar cells must often be achieved between 300-600 suns, that is, at a sunlight concentration factor of 300-600. The metallization of the front side makes the main difference for different concentration factors. In the front grid the current is conducted through a network of thin wires from the middle of the solar cell to the edge, where it is then picked up by a 50 µm gold wire. Particularly under concentrated sunlight, the structure of this metal network is decisive.

For one, the metal wires must be big enough to transport, with low resistance, the large currents which are generated under concentrated sunlight. On the other hand, the wires must be as small as possible since the sunlight cannot penetrate through metal and thus the cell area covered by metal cannot be used for the electrical conversion.

For the past two years at Fraunhofer ISE, work is being performed on a new programme for the theoretical calculation of optimal contact structures. Based on this work sponsored by the EU Project Fullspectrum (SES6-CT-2003-502620), solar cells holding the newest record efficiencies were developed. These cells are especially suitable for situations of inhomogeneous radiation, as occurs in the case of concentrated sunlight. These solar cells are installed in the concentrator modules of the type FLATCON® at Fraunhofer ISE and at the spin-off company Concentrix Solar GmbH, among others.

"We are very pleased to have advanced a further decisive step in such a short amount of time," says Dr. Andreas Bett, Department Head at Fraunhofer ISE. "Highest conversion efficiencies help the young technology to become market competitive and to further sink the costs of generating electricity from the sun for the future."

For more than ten years, researchers at Fraunhofer ISE have been developing multi-junction solar cells with highest efficiencies. One emphasis here is on the so-called metamorphic (lattice mismatched) triple-junction solar cells made out of Ga0.35In0.65P, Ga0.83In0.17As and Ge, which have an especially high theoretical efficiency potential. The solar cell structures consist of more than 30 single layers, which are deposited on a germanium substrate by means of metal-organic vapour-phase epitaxy (MOVPE).

Today, such multi-junction III-V semiconductor solar cells achieve the highest conversion efficiency worldwide by far. Due to the large material and manufacturing costs, however, they are only used in concentrating PV systems and in space.

http://www.sciencedaily.com

THE NETHERLANDS

Ultra low-cost plastic memory

Researchers at the Zernike Institute of Advanced Materials at the University of Groningen have developed a technology for a plastic ferro-electric diode which they believe will achieve a breakthrough in the development of ultra low-cost plastic memory material.

The newly developed technology is similar to that used in Flash memory chips. In both cases, the memory retains data without being connected to a power source. Flash memory chips are used in memory sticks, MP3 players, cellular phones and in the memory cards of digital cameras. The researchers at the Zernike Institute of Advanced Materials expect the new technology to lead to the development of comparable products possibly even more significant. One product they have in mind is an electronic price tag which could be read radiographically at the cash desk of retail stores, replacing the bar codes currently in use. Another possible application is for the material to be used in packaging material which could warn consumers when a product is nearing its expiration date.

In 2005, a joint team of researchers from the University of Groningen and Philips already successfully integrated a ferroelectric polymer into a plastic transistor. Because the ferro-electric material can be switched between two different stable states through the use of a voltage pulse, it operates as a 'non-volatile' memory (meaning that the material retains data without being connected to a power source). The disadvantage of such a transistor is that three connections are needed for programming and reading out the memory, and complicating the fabrication. The challenge was therefore to realize comparable functionality within a memory component carrying only two connections: a diode.

The breakthrough was accomplished during the research project of PhD student Kamal Asadi, which was financed by the University of Groningen. It is based on a radically new concept: instead of stacking a layer of semiconducting material on a layer of ferro-electric material, a mixture of these two materials is used. The ferro-electric characteristic of the mixture is then used to direct current through the semiconducting part of the mixture.

The new memory diode can be programmed quickly, retains data for a long time and operates at room temperature. The voltages needed for programming are low enough for the diode to be used in commercial applications and the material can be manufactured at low cost, using large-scale industrial production techniques. The University of Groningen has obtained a patent on the new material.

http://www.innovations-report.com

NORTH AMERICA

USA

Novel method to grow stem cells

The majority of researchers working with human embryonic stem cells (hESCs) -

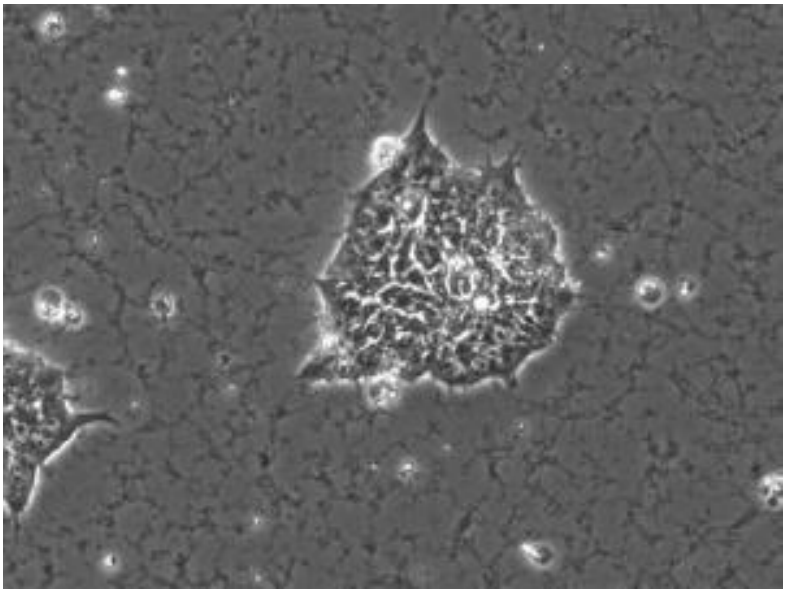
cells which produce any type of specialized adult cells in the human body - use animal-based materials for culturing the cells. But because these materials are animal-based, they could transmit viruses and other pathogens to the hESCs, making the cells unsuitable for medical use.

Now, a stem-cell scientist at UC Riverside has devised a method of growing hESCs in the lab that uses no animal-derived materials - an important advance in the use of hESCs for future medical purposes. Because of their tremendous potential, hESCs are considered promising sources for future cell therapy to treat diseases such as Parkinson's disease and diabetes mellitus.

Noboru Sato, an assistant professor of biochemistry, developed the new method, which is not only cleaner and easier to use than conventional methods of culturing hESCs but also results in hESCs whose pluripotency - the potential to differentiate into any of the specialized cells of the body such as neurons, cardiac muscles, and insulin-producing cells - is uncompromised.

Currently in labs worldwide, many researchers grow hESCs on Matrigel-coated culture plates, Matrigel being the trade name for a gelatinous extract, taken from mouse tumor cells, that contains extracellular matrices (ECMs), made up of special proteins. The Matrigel coating provides the scaffolding to which the hESCs first attach and then grow in undifferentiated colonies before differentiating into specialized cells.

"The development of animal-free coating methods for hESCs still remains a major challenge due to the complexity of ECMs and insufficient knowledge about how hESCs control cell-cell and cell-ECM interactions," explained Sato, who led the research project. His lab identified a specific signaling pathway, called Rho-Rock, which the hESCs use during colony formation and which plays an important role in physical interactions between hESCs. When the researchers blocked the pathway, they found, as expected, that the normal colony formation of hESCs was considerably impaired. They also found that the hESCs maintained their pluripotency. "Until now, it was generally assumed that the hESC colony formation was pivotal for maintaining pluripotency," Sato said. "But we show that pluripotency can be retained independent of close cell-cell contact."



hESCs grown on Matrigel in defined culture media. The mesh-like structure in the background is Matrigel. (Credit: Sato lab, UC Riverside)

Prue Talbot, the director of the UCR's Stem Cell Center of which Sato is a member, noted that Sato's discovery could affect the way embryonic stem cells are grown in the future. "His work is certainly an important step forward in both understanding signal transduction pathways in stem cells and in the development of an improved methodology for culturing stem cells," she said.

In the study, Sato's group extensively screened various types of scaffold materials in combination with Y27632, a chemical compound that blocks the Rho-Rock pathway, and found that the Matrigel coating could be replaced with "poly-D-lysine," a chemically synthesized ECM.

The major advantages of poly-D-lysine over Matrigel are that poly-D-lysine is completely animal-free, easy to handle, and of consistent quality. "We found that the growth of the hESCs under this novel culture condition was almost identical to the growth of hESCs on Matrigel-coated culture plates, with no compromise in pluripotency," Sato said.

Having started his career as a physician in Japan, Sato began researching stem cell biology as a research fellow at The Rockefeller University, NY, one of the foremost research centres in the world. He accepted a faculty position in the Department of Biochemistry at UCR in 2006. He was joined in the research project by Nicole Harb of UCR and Trevor K. Archer of the National Institute of Environmental Health Sciences (NIEHS), North Carolina.

The research was a collaboration between UCR and NIEHS, and funded by UCR start-up funds to Sato and a grant to Archer from the National Institutes of Health.

"Our research goal is to understand the basic mechanisms underlying unique biological functions of pluripotent stem cells, and to translate the obtained knowledge into future medical applications," Sato said.

His group is now focusing on applying his technique to the latest stem cell technology, "induced pluripotent stem (iPS) cells," which are pluripotent stem cells artificially derived from adult cells with-

out using embryos. “Our next step is to produce new animal-free iPS cell lines,” Sato said.

UCR’s Office of Technology Commercialization has applied for a patent on Sato’s discovery and is looking for industrial partners interested in further developing it.

Sato’s lab used available hESC lines to develop the novel culture method. The researchers used a commercially available defined medium and supplemented it with Y27632, a chemical compound. They found the hESC could self-renew (i.e., grow with pluripotency) on poly-D-lysine (PDL)-coated plates in the defined medium. The new method - a combination of PDL coating, Y27632, and available defined medium - can avoid any animal-derived materials from hESC cultures.

Stem cells, which can transform themselves into many other tissue types, give rise to all the cells in the human body and hold the key to finding cures for many diseases, such as Parkinson’s, Alzheimer’s, heart disease and diabetes. These master cells are found in the body at any age, acting as the root of all the cells that make up the body’s tissues.

When a stem cell divides, each new cell has the potential to either remain a stem cell or become a specialized cell, such as a muscle cell, a red blood cell, or a brain cell. Stem cells can theoretically divide without limit to replenish other cells as long as the person or animal is still alive. Scientists believe, therefore, that it should be possible to turn stem cells into a “repair kit” for the body.

Human fetal tissue provides the best source of stem cells (embryonic stem cells). Stem cells also are found within adult organs (adult stem cells), but currently their potential to become other types of cells is limited. The latest exciting discovery is that normal adult cells such as skin fibroblasts can be turned to pluripotent embryonic stem-like cells by introducing key genes involved in pluripotency. The pluripotent stem cells generated by this technique are called induced pluripotent stem (iPS) cells. Study results appear online in the August 20, 2008 issue of the Public Library of Science (PLoS) One.

http://www.sciencedaily.com

Turning waste heat from exhaust into electricity

Researchers have invented a new material that will make cars even more efficient, by converting heat wasted through engine exhaust into electricity. The same technology could work in power generators and heat pumps, said project leader Joseph Heremans, Ohio Eminent Scholar in Nanotechnology at Ohio State University. Scientists refer to such materials as thermoelectric, and they rate the materials’ efficiency based on how much heat they can convert into electricity at a given temperature. The paper was published in *Science*.

Previously, the most efficient material used commercially in thermoelectric power generators was an alloy called sodium-doped lead telluride, which had a rating of 0.71. The new material, thallium-doped lead telluride, has a rating of 1.5. What’s more important, according to a Press release by the Ohio State University, is that the new material is most effective between 450-950°F - a typical temperature range for power systems such as automobile engines.

Some experts argue that only about 25 per cent of the energy produced by a typical gasoline engine is used to move a car or power its accessories, and nearly 60 per cent is lost through waste heat - much of which escapes in engine exhaust.

A thermoelectric (TE) device can capture some of that waste heat, Heremans said. “The material does all the work. “It produces electrical power just like conventional heat engines - steam engines, gas or diesel engines - that are coupled to electrical generators. But it uses electrons as the working fluids instead of water or gases, and makes electricity directly.”

http://www.hindu.com

Stem cell technology

Blood donations could one day become unnecessary, after the discovery of a way to grow potentially unlimited supplies of blood in the lab. An American team has found a way to turn the parent cells of other types, human embryonic stem cells, into functional oxygen-carrying red blood cells.

The research, which appears in the journal *Blood*, was carried out by Advanced Cell Technology, Worcester Massachusetts, and its collaborators at the Mayo Clinic and the University of Illinois, shows for the first time that the oxygen-carrying capacity of these blood cells is comparable to that of normal blood transfusions. And it should be easier to ensure that blood created this way is free of contamination by disease agents.

“Limitations in the supply of blood can have potentially life-threatening consequences for patients with massive blood loss,” said Dr Robert Lanza, Chief Scientific Officer at ACT, and senior author. “Embryonic stem cells represent a new source of cells that can be propagated and expanded indefinitely, providing a potentially inexhaustible source of red blood cells for human therapy. We can currently generate 10 to 100 billion red blood cells from a single six-well plate of stem cells.”

The breakthrough by a team that includes Dr Shi-Jiang Lu raises the prospect of mass-producing supplies of the “universal donor” blood type O-negative, which can be safely transfused into any patient, whatever their blood group, he said. The team is also working on the new embryo-free method to make stem cells from patients themselves, so called iPS cells, as well as conducting further tests in animals.

“Although more work is required before it can move into the clinic, it is clear from the rapid progress that stem cells could serve as an unlimited source of blood for transfusion in the future,” said Dr Lanza. A spokeswoman from the American Red Cross told New Scientist the work is “an important step towards the possibility of growing transfusible red blood cells in the laboratory”.

http://www.telegraph.co.uk