

Growing spares

We may soon be able to generate our own body parts for transplant, says s ananthanarayanan

PEOPLE in need of organ transplants face two challenges: the first is to find a donor and the next is that the body should accept the organ that has come from a different person. Generating organs from our own body cells would eliminate both these challenges at one go. Professor Doris Taylor, director of the Center for Cardiovascular Repair at the University of Minnesota, has spearheaded work that uses an animal's stem cells to build organs, in just weeks — organs that the animal would not reject because it is made of the animal's own body cells.

When cells that do not belong in the body are introduced, the body calls out agencies that throw the intruder out — a built-in defence mechanism to protect the body against infection and invading pathogens. What these policing agencies in the body use to recognise outsiders are specific proteins found on the surface of cells. If the patterns do not belong in the body, *flash*, antibody production starts — production of specific antibodies that have the patterns actually found on the predator cells so that they can swiftly identify and destroy them. It is this system of surveillance that keeps the body safe from billions of foreign organisms that invade the body every minute!

But the same system would also throw out a massive foreign body like a whole organ that has come from another person's body. In organ transplant, the doctors carefully select the donor — apart from the same blood group, the more genetically similar the donor, the less eventful the transplant. And then, powerful drugs that weaken the body's immune response are used to hold back the body's defences against the "friendly" outsider. Apart from the side effects of these drugs, weakening body defences, with their help, allow other pathogens a field day and the patient needs to be carefully quarantined. And still, in most cases, the immune system does revive and not many transplants succeed for a long time.

Using native cells

While the effort in organ transplant is to get "as near as possible" to the recipient's cell

genetics, the best solution would be if the organ was not donated by an outsider but built from the recipient's own cells. Biologists do have experience in growing living cells in the correct media. But cells grown in this way just grow as a lump and can scarcely form an organ. A first start to building body parts was to grow cells on a suitable mould so that the cells assumed the desired shape. Special materials, called *biorubber*, were developed and once the cells began to grow they were allowed to develop on the body of a living thing, like a mouse, so that they received nutrients and oxygen. Artificial ear cartilage and blood vessels, skin, even bladders, have been grown in this way for some years now.

But this method cannot work for a more complex organ, which has internal parts and a network of blood vessels that branch, ending as capillaries that connect with each individual cell.

What is needed for building cells in such a complex way is a scaffold or the framework, on which the cells need to grow, to end up in the right shape, and as the right kind of cell, down to the last detail! To do this, Professor Doris Taylor and her associates have used an ingenious method



Doris Taylor.



Paulo Macchiarini.

that actually amounts to going backwards in building an organ. They start with a real organ, say a heart, where the cells have died.

Well, the cells in a dead organ are no good, but the good thing is that when the organ was originally formed, these cells grew on a framework of protein, called *collagen*, and this framework, which was there in the dead organ, follows the exact shape of the organ when it was well. In the case of the heart, this means the shape of the chambers, the valves, the blood vessels, down to the capillaries, are preserved in the collagen scaffold under the dead cells.

Exposing the skeleton

The method of extracting this scaffold from a real heart to build a new one was discovered by Doris Taylor's colleague, Harald Ott, now in Massachusetts General Hospital. Getting at the scaffold underlying an organ means stripping the organ of its cells, and nothing else, so that the scaffold remains intact. Ott thought one way could be to use the organ's blood vessels to deliver a chemical to each cell so that the cell got washed away but left everything else unchanged.

He experimented with a host of candidate reagents and finally zeroed in on one, ironically a common soap used in cosmetics. This chemical, as it dripped through the blood vessels of the dead heart of a rat, slowly stripped away every cell, leaving only a translucent jelly that was the exact protein framework on which every cell of the heart had been placed. Injecting a dye into the blood vessel showed graphically that the network was complete and undamaged.

Ott then went on to build a new heart by allowing stem cells to build on the scaffold, or the mould, now available for the complex organ.

The cells could grow in the exact shape of the organ, developing, in the case of the heart, the chambers, the valves and the blood supply system of vessels. Along with not only creating the cells body, there was the challenge of providing blood supply, with oxygen for the cells and the blood pressure for the heart, and the electrical signals to get the heart muscles contracting. In short, creating an artificial body to try out the new grown heart. But in a space of eight days of handling the complexity, the team was thrilled to see the heart they had built from scratch burst into life and start beating!

After this first success, Ott has used the same method to build a living lung, which was transplanted into a rat. Soon after, the method has been used in Barcelona, Spain, to build a new windpipe for a patient who had lost her own through tuberculosis. Surgeon Paulo Macchiarini, of the Instituto Universitario Dexeus, took a windpipe from a cadaver, cleaned it of cells and used living cells from his patient to

arm. The word, "aphaeresis" means "taking away" in Greek and the machine is basically a centrifuge that which spins the blood round so that heavier components collect on the outside and lighter components on the inside. It is not unlike separating butter from milk by "churning".

Peripheral blood harvests produce better results and are also less stressful. But sometimes, if the yield of stem cells is not adequate, the traditional bone marrow harvest is the fall back.

Harald Ott and a rat's lung (left) at his laboratory.



S.A.

Harvesting stem cells

THE living cells that are used to build organs are stem cells or pluripotent cells that have the capacity to become a particular type of cell — for example, a liver cell or a kidney cell. Apart from following the shape that the protein collagen framework defines, stem cells also discover what kind of cells to become from the proteins in the framework.

Stem cells are created in bone marrow and are present, although in smaller numbers, in the bloodstream. One method of collecting stem cells is to put the donor under general anaesthesia and tap the bone marrow, generally in the pelvic region, with needles. A safer procedure, called the peripheral blood stem cell harvest, which is usually followed now, is to collect stem cells from the bloodstream. The method is to tap the blood flow, intravenously from one arm, separate stem cells in an *aphaeresis* machine and send the blood back, intravenously, through the other

Under the skin

A stick-on circuit can monitor heart rate as well as conventional devices but is weightless, wireless and inconspicuous, writes steve connor

IT may soon be possible to wear your computer or mobile phone under your sleeve with the invention of an ultra-thin and flexible electronic circuit that can be stuck to the skin like a temporary tattoo. The devices, which are almost invisible, can perform just as well as more conventional electronic machines but without the need for wires or bulky power supplies, scientists said.

The development could mark a new era in consumer electronics. The technology could be used for applications ranging from medical diagnosis to covert military operations.

The "epidermal electronic system" relies on a highly flexible electrical circuit composed of snake-like conducting channels that can bend and stretch without affecting performance. The circuit is about the size of a postage stamp, thinner than a human hair and sticks to the skin by natural electrostatic forces rather than glue.

"We think this could be an important conceptual advance in wearable electronics, to achieve something that is almost unnoticeable to the wearer. The technology can

research team.

A simple stick-on circuit can monitor a person's heart rate and muscle movements as well as conventional medical monitors, but with the benefit of being weightless and almost completely undetectable. Scientists said it may also be possible to build a circuit for detecting throat movements around the larynx in order to transmit the information wirelessly as a way of recording a person's speech, even if he/she were not



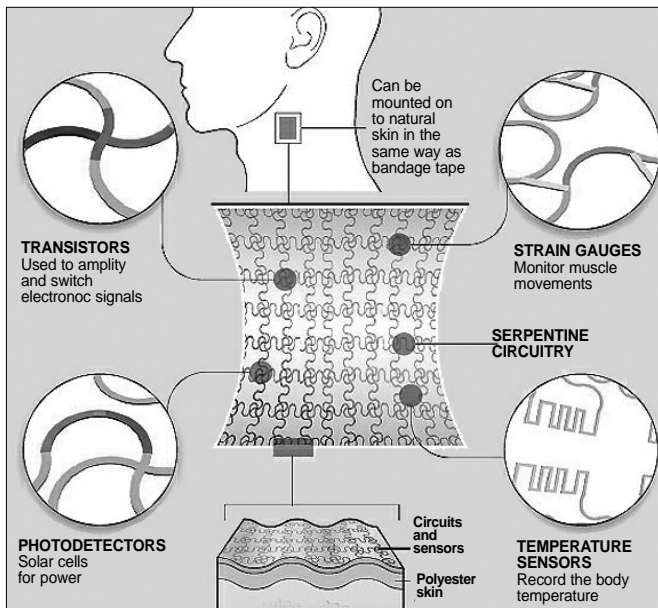
The patch of electronic skin consists of an array of electrical devices for monitoring the vital signs of the body.

making any discernible sounds. Tests have already shown

that such a system can be used to control a voice-activated computer game, and one suggestion is that a stick-on voicebox circuit could be used in covert police operations where it might be too dangerous to speak into a radio transmitter. "The blurring of electronics and biology is really the key point here," said Yonggang Huang, professor of engineering at Northwestern University in Evanston, Illinois. "All established forms of electronics are hard, rigid. Biology is soft, elastic. It's two different worlds. This is a way to truly integrate them."

Engineers have built test circuits mounted on a thin, rubbery substrate that adheres to the skin. The circuits have included sensors, light-emitting diodes, transistors, radio frequency capacitors, wireless antennas, conductive coils and solar cells.

"We threw everything in our bag of tricks on to that platform, and then added a few other new ideas on top of those, to show that we could



Sources: ScienceMag.org, Department of Electrical and Computer Engineering, University of Wisconsin

make it work," said John Rogers, professor of engineering at the University of Illinois at Urbana-Champaign, a lead author of the study, published in the journal *Science*.

The Independent, London

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D.G. (W.S.) invites separate sealed item wise tender in duplicate from bonafide, resourceful and experienced contractors super-scribing the name of the work on the envelope as "TENDER FOR as below" enclosing up-to-date PAN, VAT & T.L. along with tender for the following works upto 1.00 p.m. on 26.08.11 & will be opened on the same day at 2.00 p.m. Details & permission may be had from D.G.(W.S.)/Dy.C.E.(E)/H/EE.(W.S.)-S.S.U. on production of satisfactory evidence of past experience and financial capabilities along with PAN, VAT and requisite certificates upto 2.00 p.m. on 24.08.11 on any working day. KMC reserves the right to accept/reject any/all tender without assigning any reason. **Sl.No; Name of works; Estd. Cost; Earnest Money; Price of Tender Form & Time of completion** are as follows : (1) Laying of 300 mm dia reserve main through Majlish Ara Road from R.R.M. Roy Road to P.B. Road in Ward No. 121, Br.-XIV; Rs. 5,92,521.00; Rs. 12,210.00; Rs. 100.00; 75 days. (2) Laying of 600 mm dia M.S. pipe line at B.L. Saha Road in the junction of Roy Bahadur Road with necessary interconnection with 300 mm, 450 mm, 150 mm diameter reserve mains with other allied works; Rs. 8,20,728.00; Rs. 17,000.00; One month. (3) Laying of 450 mm dia D.I. Reserve main along James Long Sarani from Basket Ball Ground, V.S. Sarani to Santosh Roy Road, J.L. Sarani in Ward No. 123, Br.-XIII; Rs. 6,69,083.00; Rs. 13,800.00; Rs. 100.00; 35 days. 11/11-12

build a new windpipe. The new organ was put in place in just four days and the patient, Claudia Castillo, has been doing fine, without any immuno-suppressant, and was home just four days after surgery.

"I think we're years away and not decades away. It is not unreasonable to imagine within the next four or five years we'll have some organs we can transplant", says Professor Doris Taylor.

The writer can be contacted at simplescience@gmail.com

TENDER
ANDREW YULE & COMPANY LIMITED
(A Government of India enterprise)
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P-25, Transport Depot Road, Kolkata-700 088.
Tender Notice No. ED/BU/PU/COPPER/07/11-12
Date of Last Sale: 30.08.2011 up to 4 PM, Due Date & Time: 01/09/2011 up to 4 PM, Cost of Tender Document: Rs.200/- (Non-refundable), EMD: Rs.50,000/- (both in the form of DD/PO in favour of Andrew Yule & Co Ltd. payable at Kolkata), Date & Time of Opening: 02/09/2011 at 11 AM.
Inviting offers from manufacturer of Paper/Nomex covered EC grade Copper Conductor on rate contract basis. Interested vendors may visit our website: www.andrewyule.com for detail of the Tender. It may also be collected from above address against submission of said DD of Rs.200/- For downloading Tender from website, fees of Rs.200/- to be submitted along with offer.
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NOTICE INVITING TENDER
No. TE/F-509/11/1271 Date : 11.08.2011
Sealed percentage rate tenders, in two parts, are invited from experienced and eligible contractors for the following work to be executed at CMPDI (HQ), Ranchi : **Tender Notice No. : 13 of 2011-2012 Date : 11.08.2011. Name of work :** Development of Logistic support in CMP Division including renovation of CP Lab and renovation of Opencast Division for creation of Simulation Lab at CMPDI (HQ), Ranchi. **Estimated Cost :** Rs. 51.28 Lakhs. **Earnest Money :** Rs. 51,280/- **Cost of Tender Document :** Rs. 2,000/- **Completion Period :** 06 (Six) Months. **Period of Sale :** From 17.08.2011, 10.00 A.M. to 15.09.2011, 12.00 Noon from the office of GM (TE & CM), CMPDI (HQ), Kanke Road, Ranchi. **Receipt of Tenders :** Upto 3.00 P.M. on 16.09.2011. **Opening of Tenders :** At 3.30 P.M. on 16.09.2011. For details of tenders, please log on to our website : <http://www.cmpdi.co.in> OR the same can be had in detailed tender document available with the Office of GM (TE&CM).
Chief Manager (Civil)/TE&CM

GUJARAT STATE ROAD DEVELOPMENT CORPORATION LTD.
(Government of Gujarat Undertaking)
Expression of Interest (EOI) for Providing Services as Statutory Auditor (SA)
Expression of Interest is being invited from eligible Chartered Accountancy Firms for discharging of duties as Statutory Auditor for construction of additional two-lane road (making it 4-lane road) for following projects.
1) Details of Project:

Sl. No.	Project	Configuration of Project	Project Cost (Rs. in crore)
1.	Chirai-Anjar Section of SH-45 & 50 and Spur Road	4-lane	237.75
2.	Surat-Bardoli Section of old NH-8	4-lane	119
3.	Dakor-Sevaliya Section of SH-12	4-lane	155.05
4.	Vadodara-Dabhoi Section of SH-11	4-lane	147.70
5.	Surat-Olpad-Kim Section of SH-6 & SH-65	4-lane	228.20

The selected road is being developed on PPP (Public Private Partnership) model. The interested bidders can obtain details from GSRDC's Website, however, EOI documents needs to be compulsorily purchased from GSRDC's office from the below mentioned address as per stipulated time and date. The EOI document must be submitted only through RPAD or Speed Post or Courier. The bidders have to purchase and submit single EOI document for all projects or part thereof. However, in the second stage (i.e. Request for Proposal Stage), the bidder has to purchase and submit the bids separately for each project and projects shall be considered separately as stand-alone project.
2) Schedule for Qualification:

i) Sale of EOI documents	From 16-08-2011 to 31-08-2011 up to 17-00 hrs. on working days.
ii) Cost of EOI document (additional Rs. 500 (Rs. five hundred) shall be paid separately in the form of DD if EOI document required through courier)	Rs. 10,000 (non-refundable & non-transferable) in the form of DD in favour of Gujarat State Road Development Corporation Limited, payable at Gandhinagar.
iii) Last date for submission of proposal	08-09-2011 up to 16-00 hrs.
iv) EOI opening at GSRDC Office	08-09-2011 at 17-00 hrs.
v) Pre-Application Meeting at GSRDC Office	24-08-2011 at 15-00 hrs.

3) For more details log on to www.gsrdc.com
Company Secretary
Gujarat State Road Development Corporation Ltd., Gr. Floor, Nirman Bhavan, Sec. 10-A, Gandhinagar-382010, Gujarat, Phone: 079-23252912, 23252915. Fax No.: 079-23252090.
INF/998/11-12