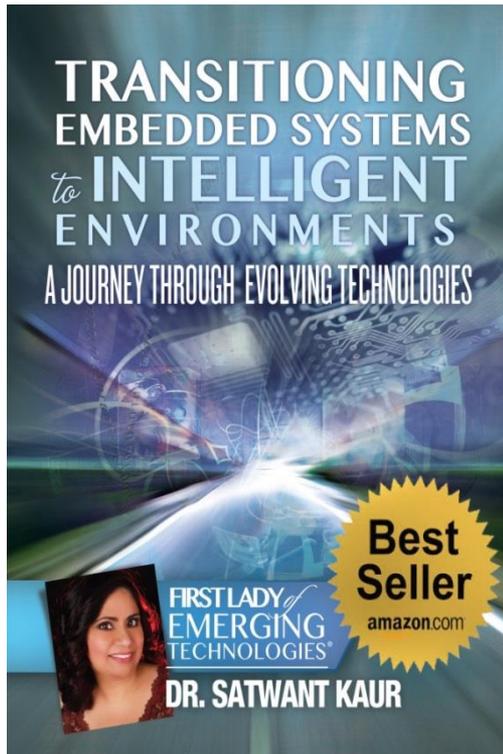


Emerging Embedded Medical Technologies

Satwant Kaur, PhD.

First Lady of Emerging Technologies

IEEE 2013 Embedded Systems Keynote



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Speaker's Bio

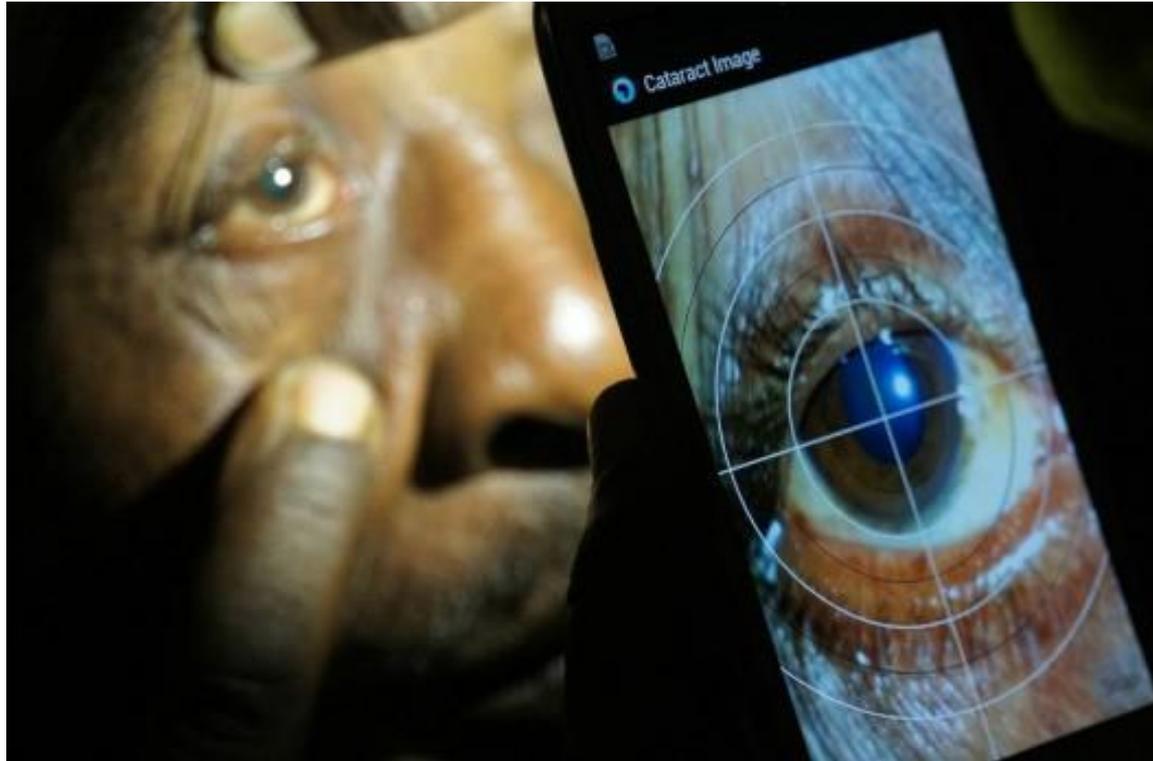
- **Current Position:**
 - HLS
Innovation Chief Technologist(CT)
Hewlett Packard Company(HP)
- **Previous Positions:**
 - Platform strategist, Intel
Architecture Group, Intel.
 - CTO, Emerging Technologies
Group, TIBCO Software.
 - Director of Development,
Symantec.
 - Faculty, EE, Idaho State
University
- **Author:**
 - Author, “Transitioning
Embedded Systems to Intelligent
Environments”
- **Education:**
 - B.Tech. in EE, IIT, Delhi.
 - M.S. in CS, Oakland University
 - Ph.D. in Mobile Internet
Protocols, Oakland University

Emerging Medical Technologies

- **Imaging and Diagnostics**
 - More portable, higher quality
- **Monitoring**
 - For the heart, blood
- **Remote Care**
 - Cheaper and available to everyone
- **In the body**
 - Embedded systems on and inside our bodies
- **Assisting Doctors**
 - Improving human accuracy
- **Advanced Research**
 - Emulating human organs in lab

Imaging and Diagnostics

Smartphone Portable Ophthalmic Exam



Portable Eye Exam Kit (Peek) by team of experts

- Consists of smartphone, mobile app and clip-on hardware
- Mobile app allows users to do eye exams with their smartphones using bright light to scan eye
- Checks glasses prescription , visual acuity, visual field, color vision and contrast sensitivity
- Diagnoses cataracts
- Examine the back of eye

Smartphone portable Ultrasound Imaging



MobiSante MobiUS SP1

Can carry out ultrasound exam using smartphone and endocavity probe.

Can save and review images or video.

Ultrasound exams are useful in case of:

- Trauma to hasten diagnosis and treatment of hemorrhage
- Routine screening for bladder measurements
- Ob/Gyn monitoring of uterus and ovaries during infertility treatment.

Portable color Doppler system for Sonography

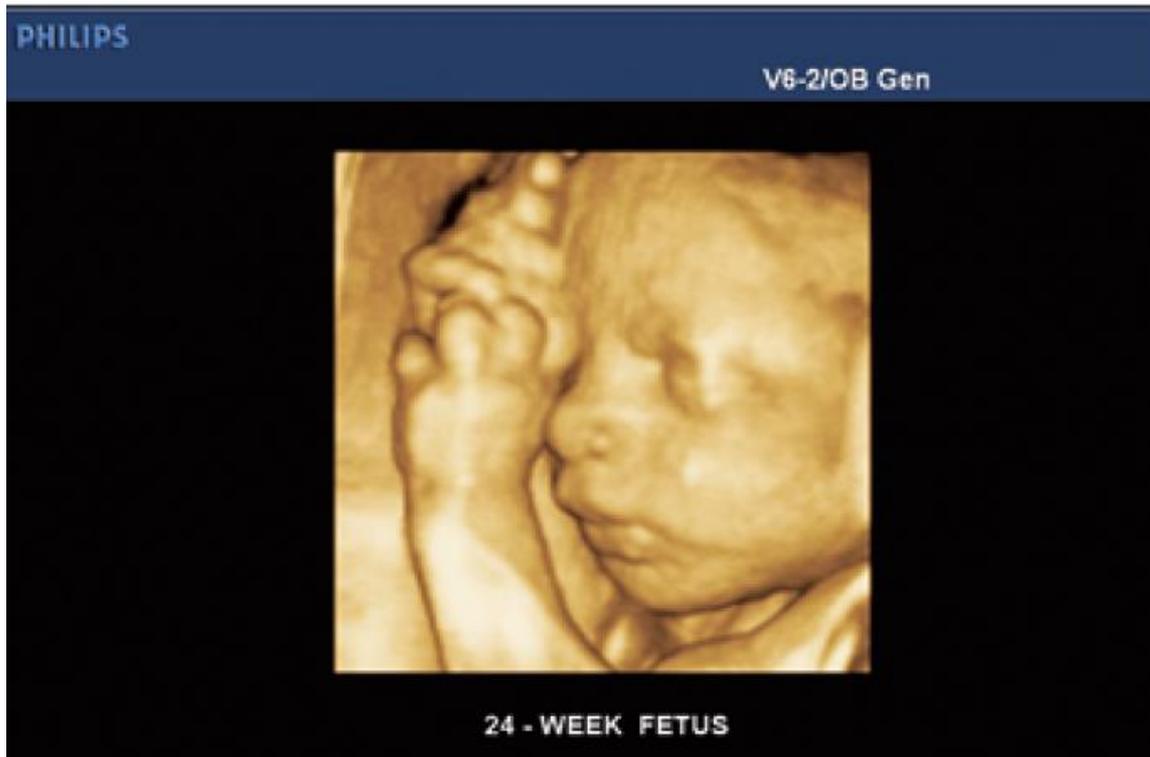


S2, Portable ultrasound imaging by Sonoscape

S2 allows us to do ultrasound exam for:

- Liver dimensions and blood flow
- The gall bladder and bile passages to detect presence of concrements
- Pancreatic gland for homogeneity
- Thyroid gland to detect the presence of ganglions
- Cardiology
Echocardiography to detect heart diseases.

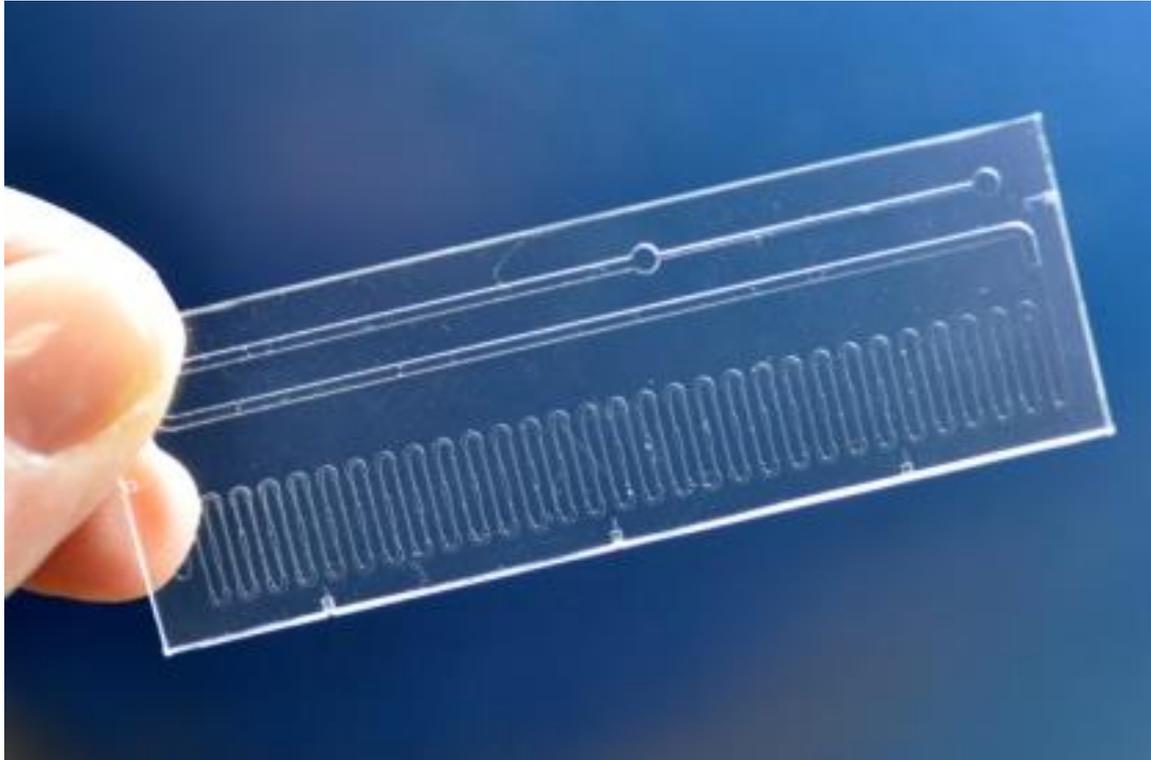
4D Imaging for fetus and mammogram



3D ultrasound image of a 24-week old fetus by Philips' iU22 Ultrasound System

- Creates 4D images (3D over time) from a spattering of 3D images using fusion process.
- Aligns two or more images captured by different devices (MRI and CT), or the same device on different dates.
- Eliminates false positives or false negatives frequent in Traditional mammograms

Diagnose Flu with Microfluidic chip



Microfluidic chip for influenza detection at point of care by Boston University

- Is the size of a standard microscope slide
- A top column that extracts RNA from signature proteins in the sample
- A middle chamber to convert the RNA into DNA
- A lower channel to replicate the DNA in sufficient quantities so it can be detected by external reader.

Monitoring

Needle less Glucose testing by clipping earlobe



Glucotrak non invasive glucose testing with earlobe clip by Integrity applications

- Helps diabetics test blood glucose level without the pain caused by needles that draw blood.
- User clips the device's Personal Ear Clip to his earlobe, and then result is displayed on the device's Main Unit. This result is also spoken out
- No longer needs needles

Non invasive Glucose Continuous Monitoring



Echo Therapeutic Symphony

- Non-invasive, needle-free, wireless, continuous glucose monitoring (CGM)
- Contains skin permeation device, a transdermal sensor, wireless transceiver
- wirelessly provides the patient's glucose level every minute to a remote monitor.
- Can identify prolonged excursions into the hyperglycemic or hypoglycemic zone

Cuff-less Blood Pressure Monitoring



CNIBP - Continuous non invasive monitoring of blood pressure by Sotera wireless

- CNIBP is a wrist worn monitor that is cuff-less
- Continuously monitors all patient vital signs
- Today's catheters are continuous but is invasive and can cause discomfort and infection
- Today's cuff BP monitor is not continuous
- Send alarm notification to clinicians if unfavorable changes in a patient's condition

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Remote Care

Complete Remote Real Time Patient Monitoring



Embedded medical technology systems by Habey

- Monitors patients at Point-of-Care
- Is portable and cost effective
- Runs diagnostics on patient
- Allows Doctors to remotely monitor patient
- Allows medical staff to react in real-time in case something looks wrong
- It has a fanless design for low power and prevention of spreading of airborne bacteria

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In the Body

Micro-Stent eye Implant to treat Glaucoma



Ivantis Hydrus micro-stent:

- Micro-stent is a device to be implanted in eye
- It is shaped and sized like an eyelash
- Glaucoma is caused by increased eye pressure.
- Eye pressure increases when eye's fluid channels become blocked.
- Upon insertion of micro stent in the primary fluid canal of the eye, the channel is opened and fluid starts flowing freely.
- Thus eye pressure is fixed

Continuous ECG monitoring with Necklace



IMEC ECG Necklace

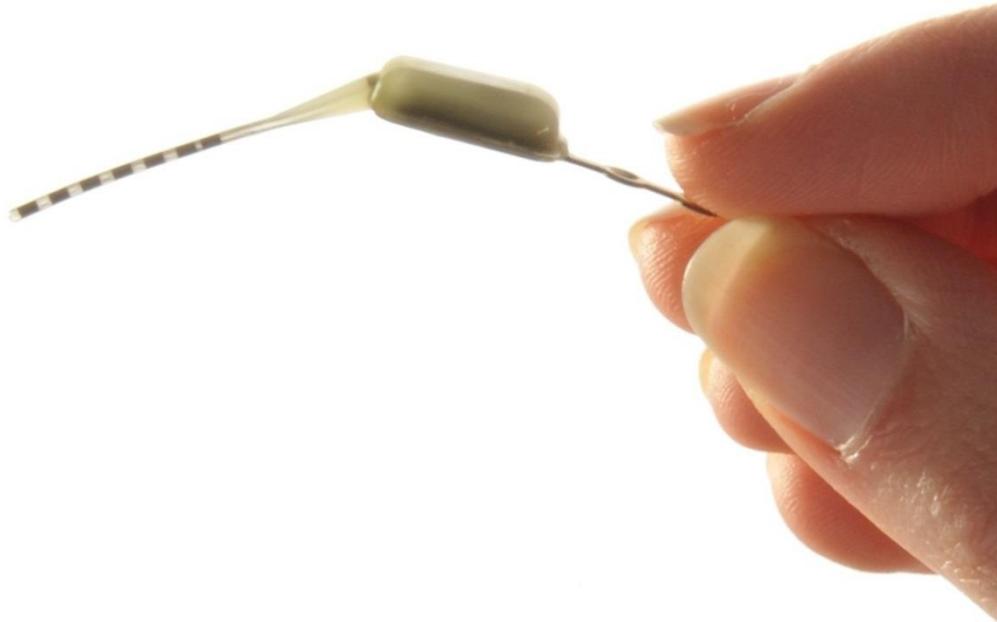
- Imed ECG (Electrocardiography) necklace monitors cardiac activity during every-day life situations.
- It measures a bipolar ECG signal between two electrodes attached to the body, and connected to the necklace.
- Helps in arrhythmia detection, stress monitoring and epilepsy monitoring.

Neuro-stimulator Implant to treat headache

Autonomic Technologies, Inc. (ATI) Neuro-stimulation System

Provides low-level electrical stimulation to relieve acute headache.

- Miniaturized Neuro-stimulator is implanted through a small incision in the upper gum at the sphenopalatine ganglion (SPG) nerve bundle.
- Patient controls his stimulation treatment as needed by turning on the Remote Controller fater placing it on cheek



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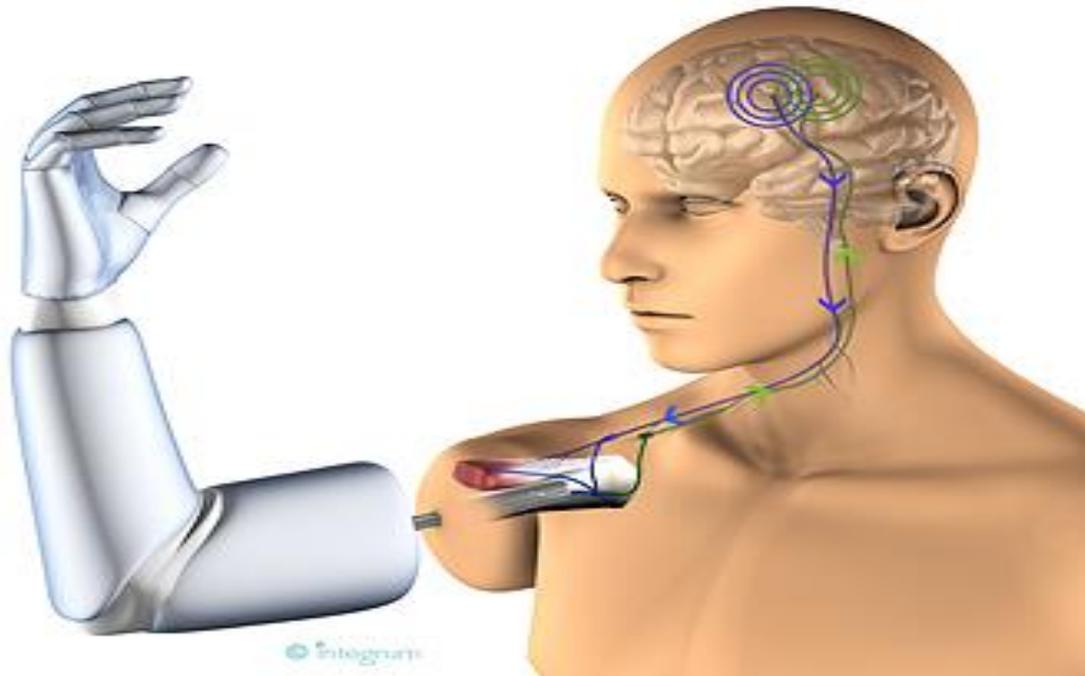
Pacemaker without leads inside the heart



Pacemaker from Nanostim doesn't use leads that are used in conventional pacemakers.

- Leads can fracture, become dislodged, and cause other problems like infections.
- Nanostim Pacemaker is small enough to fit completely within the heart.
- Pacemaker no longer needs leads

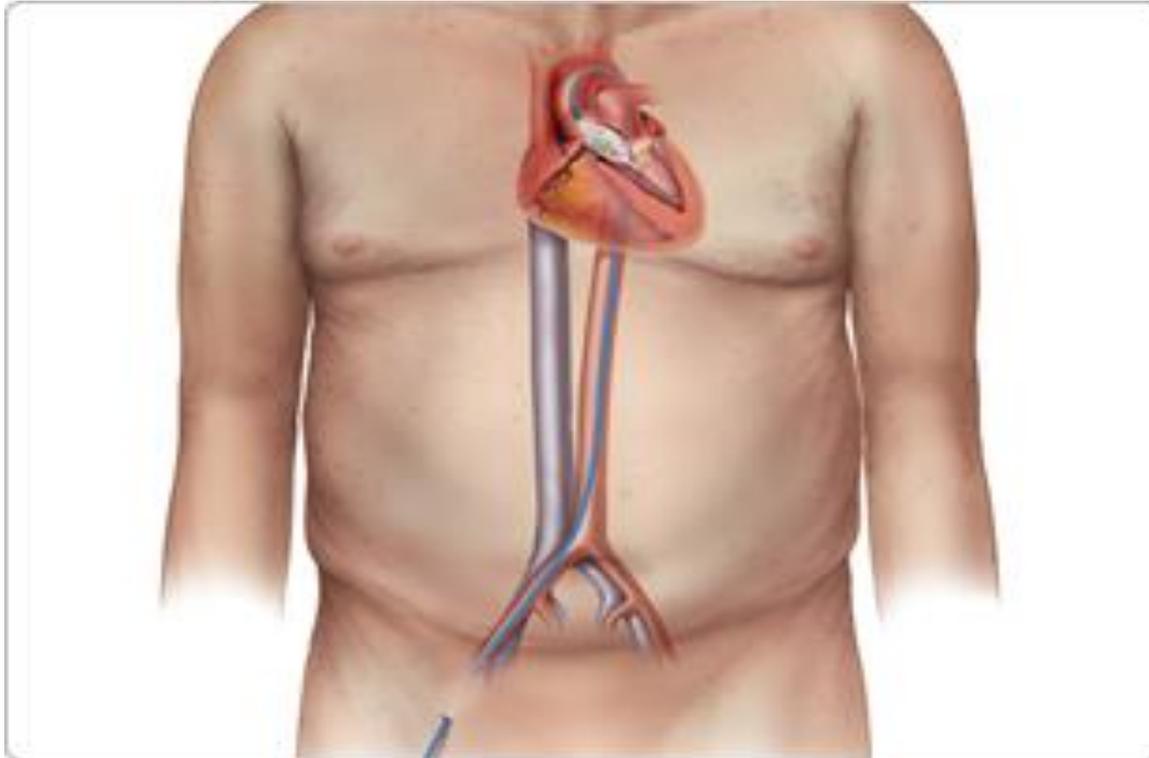
Controlling implanted prosthetics by thought



Implantable robotic arm controlled by thoughts by Chalmers researcher

- Prosthesis for amputee patients that are controlled with their own brain signals.
- The brain signals are transferred via the nerves through the arm stump and captured by electrodes.
- These will then transmit the signals through a titanium implant to be decoded by the prosthetic arm.

Minimally invasive Trans-catheter Heart Valve



Sapien Valve by Edwards

- Human heart valves open and close for blood flow
- Narrowing of aortic valve affects blood flow
- Open Heart Surgery is needed to replace it
- Transcatheter aortic valve replacement (TAVR) is a less invasive procedure
- Allows a new valve to be inserted within the diseased aortic valve through an incision in the leg or in chest between ribs

Assisting Doctors

Doctor assisted by Google Glass



Google glass helps in medical field in following ways:

- Doctors can access data in real time with the help of Google Glass.
- Doctors can communicate with other doctors from remote using Google Glass and get their instant expert opinion
- Performing surgery, surgeons can see data of the patient in real time.
- Google Glass is great as a teaching tool

Surgeon assisted by a Robotic Surgeon



Da Vinci Surgical System by Intuitive Surgical

enables surgeons to do surgery with few tiny incisions

- Increases vision, precision, dexterity and control
- Has a console where the surgeon sits
- Has a patient-side cart where the patient lies
- Has four interactive robotic arms, a high-definition 3D vision system, and EndoWrist® instruments.

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Remote Presence Robot

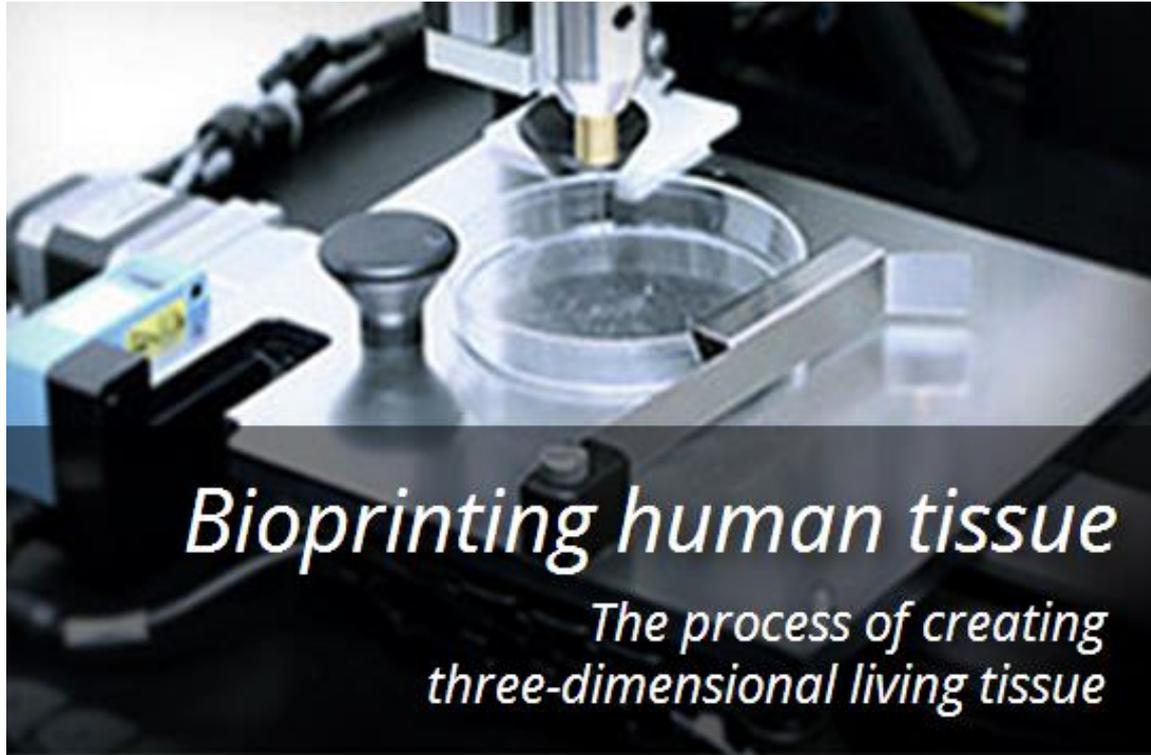


RP-VITA remote presence robot by Intouch and iRobot

- expands the use of remote doctor consults
- eliminates the need for telemedicine specific staffing and support
- AutoDRIVE capabilities allow RP-VITA to safely navigate and travel to selected destinations
- ControlStation App for iPad® enables fast and easy access and control from anywhere

Advanced Research

Bio Printing of 3-D Human Liver Tissue

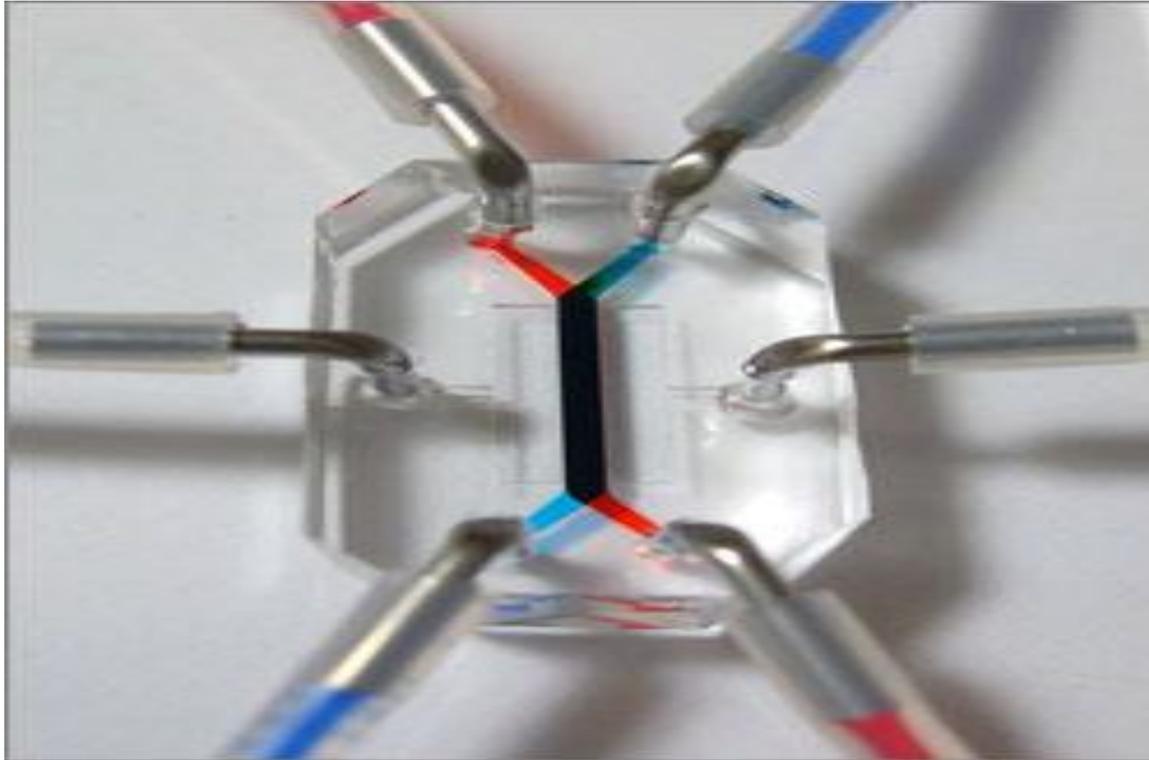


Organovo's NovoGen Bioprinting™ platform can generate bioprinted liver tissue prototypes

- Liver tissue used to grow in bodies only
- Now it can be fabricated outside the body
- Bio printing reproduces compositional and architectural features of native liver tissue
- Bio printing enables comparative testing of multiple compositions geometries to identify winning combinations.

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“Gut on a Chip” emulate human intestine



"gut-on-a-chip" by Harvard

- It is a silicon polymer device whose central chamber is lined by human intestinal epithelial cells
- The device mimics the movement of food along the digestive tract
- Intestinal microbes can be grown on the surfaces of the intestinal cells, mimicking various physiological features.
- This helps understanding Crohn's and other diseases

Thank You