

The logo features a central dark blue circle containing the letters 'UIC' in a light blue, bold, sans-serif font. This circle is surrounded by two concentric rings, one yellow and one red. From the center, four thick lines radiate outwards: a yellow line pointing towards the top-right, a red line pointing towards the top-left, a yellow line pointing towards the bottom-left, and a red line pointing towards the bottom-right. The background is a solid, vibrant blue.

UIC

Alumni Exchange

THE UNIVERSITY OF ILLINOIS
COLLEGE OF MEDICINE
CHICAGO · PEDIATRIA · ROCKFORD · URBANA



Alumni
Exchange

The Future of Healthcare...

Cool stuff coming!

THE UNIVERSITY OF ILLINOIS
COLLEGE OF MEDICINE
CHICAGO PEORIA ROCKFORD URBANA

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Alumni
Exchange

AGENDA

- Introduction
- Telehealth
- Precision Medicine
- Internet of Things (IoT)
- Drones
- 3D Printing
- Nanobots
- Artificial/Augmented Intelligence (AI)

My Journey

Clinical, IT, Business

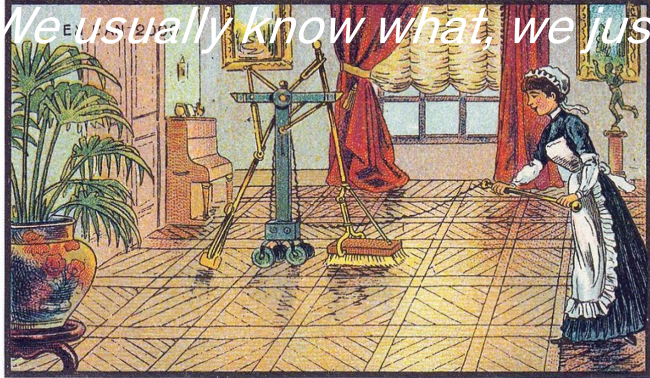


Advanced Health
Technologies

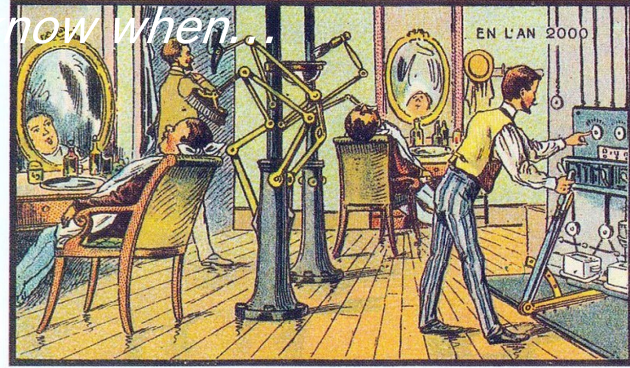


What Might The Future Look Like?

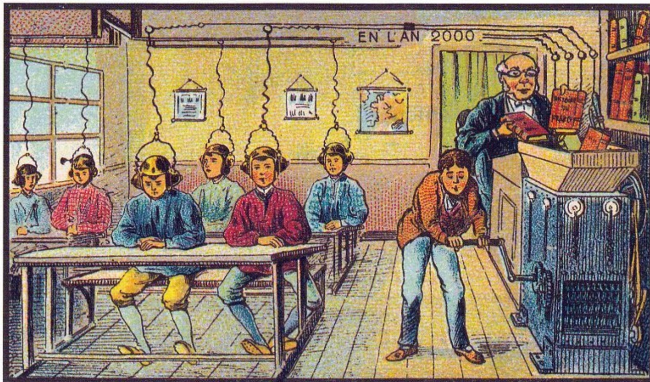
We usually know what, we just don't know when...



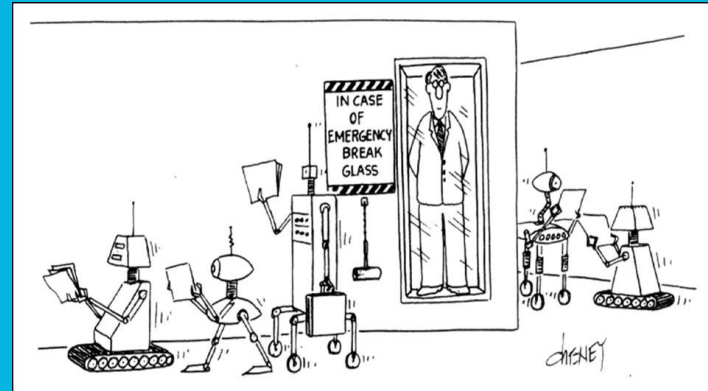
Electric Scrubbing



The New-Fangled Barber



At School

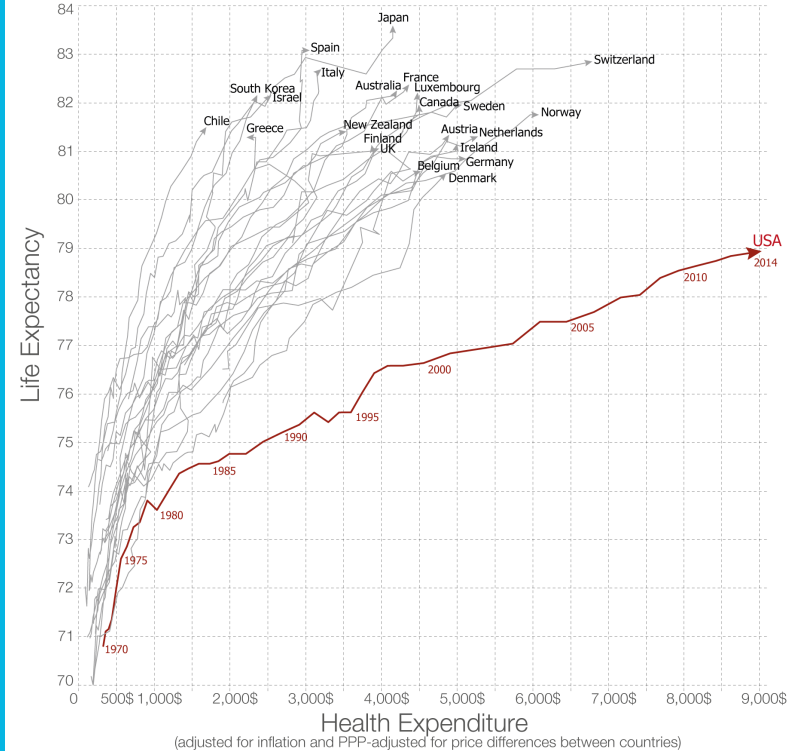


Introduction

Why we need Innovation In Healthcare

Life expectancy vs. health expenditure over time (1970-2014) Our World in Data

Health spending measures the consumption of health care goods and services, including personal health care (curative care, rehabilitative care, long-term care, ancillary services and medical goods) and collective services (prevention and public health services as well as health administration), but excluding spending on investments. Shown is total health expenditure (financed by public and private sources).



Data source: Health expenditure from the OECD; Life expectancy from the World Bank. Licensed under CC-BY-SA by the author Max Roser. The interactive data visualization is available at [OurWorldinData.org](https://ourworldindata.org). There you find the raw data and more visualizations on this topic.

Introduction

How to think about Innovation

“A car is not merely a faster horse. And email is not a faster fax. And online project management is not a bigger whiteboard. And Facebook is not an electronic rolodex. **Play a new game, not the older game but faster**” - Seth Godin



Introduction

*Doing new things
in Healthcare*

The glory of medicine is that it is constantly moving forward, that there is always more to learn. The ills of today do not cloud the horizon of tomorrow, but act as a spur to greater effort.

William James Mayo

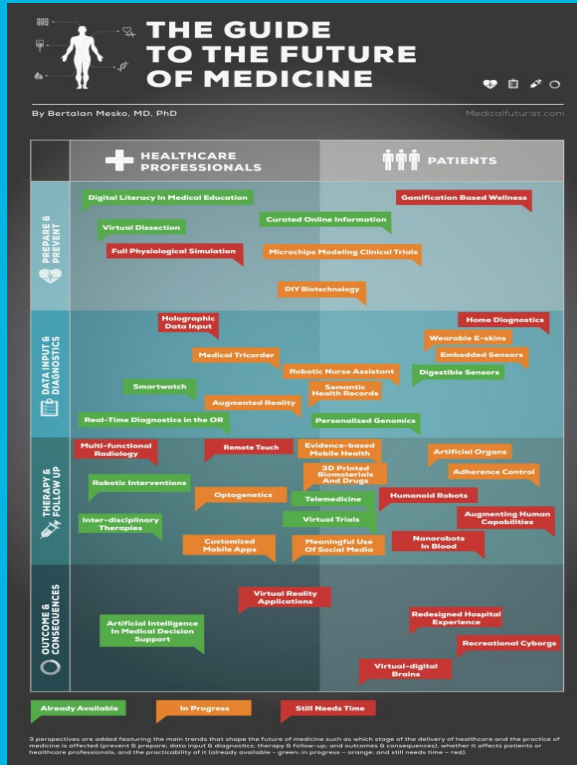
The aim of medicine is to prevent disease and prolong life, the ideal of medicine is to eliminate the need of a physician.

William James Mayo



Introduction

What the Future of Healthcare might look like...



IN THE NEXT 5 YEARS

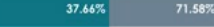
Portable medical devices for professionals

Portable diagnosis and treatment devices for medical professionals



Health sensors for consumers

Wearable devices, digital tattoos, smart clothes for monitoring health unobtrusively



IoT in healthcare

Internet of things in healthcare devices



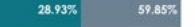
3D printing

3D printed tissues, skin, blood vessels, bones



Genomic analysis

Receiving treatment customised to our molecular makeup and genetic background



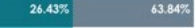
Robotics

Robotic nurse assistants to support the work of healthcare professionals with superhuman strength and precision



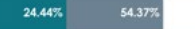
Virtual reality in healthcare

Usage of VR in medical training, relaxing chronic patients, speeding up recovery of patients



AI in medical decision support

The expanding role of artificial intelligence in monitoring and diagnosis



Augmented reality (AR)

Projecting digital data onto real-life imagery, used for diagnosis and health education



IN THE NEXT 25 YEARS

Tele-Medicine

Lack of doctor shortages will be solved via tele-medicine, via Libers of healthcare to bring the attention and expertise of doctors to the masses



Hospital redesign

Revolutionary changes in traditional "general hospitals": hospitals becoming smaller as more healthcare (diagnosis and treatment) will be done at home



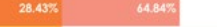
Precision medicine

Using big data and AI to identify medical approaches for patients based on genetic, environmental and lifestyle factors



Devices inside the body (nanotechnology)

Nanometer-sized robots in our body will cure and monitor health



Man-made organs

3D printing of organs



Ageing research

Ageing will become a treatable disease - people will cease to age



Designer babies

Manipulate DNAs to customise babies



Brain-Computer Interface (BCI technology)

Our brains will be directly connected to AI



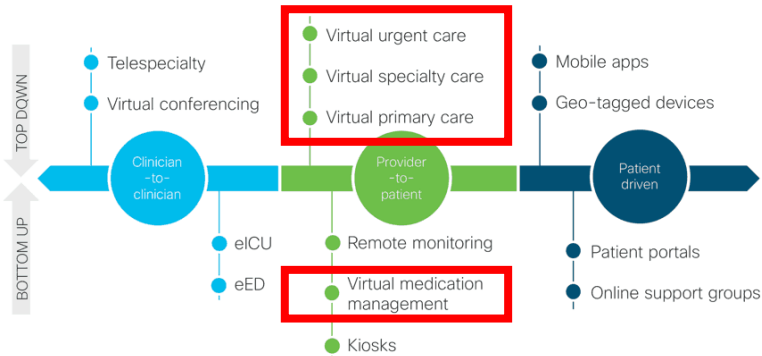
Telehealth



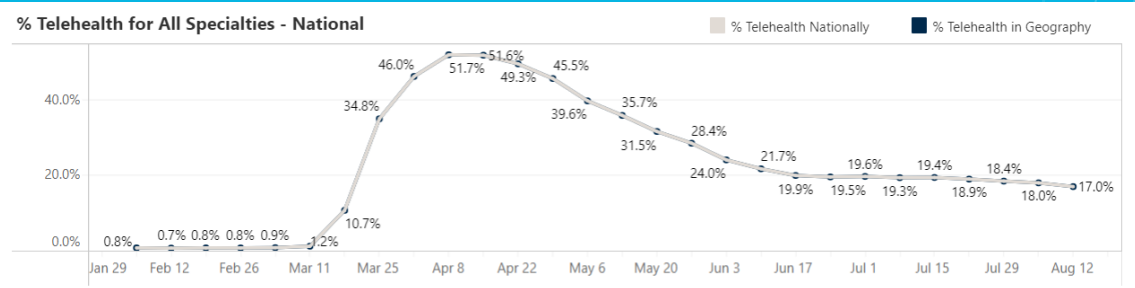
Telehealth

Tech + Services across multiple use cases

Telehealth continuum



% Telehealth for All Specialties - National




Telehealth Examples

Urgent, Chronic, Preventive Care

dr. on demand

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Just like an in-person visit, the doctor takes your history and symptoms, performs an exam and may recommend treatment - including prescriptions and lab work.

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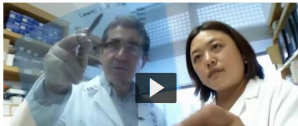
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M-F 9AM-5PM PACIFIC TIME

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Get a doctor's prescription for \$25.

Birth Control Pills →	Urinary Tract Infection (UTI) →	Sinus Infection →	STD Testing →
A1C Blood Sugar Test →	Erectile Dysfunction →	Cholesterol →	Hair Loss →
Acne →	Flu →	Acid Reflux →	

Available in Arizona, California, Connecticut, Florida, Georgia, Illinois, Maryland, Michigan, Missouri, New York, Ohio, Oregon, Pennsylvania, Rhode Island, South Carolina, Virginia, and Washington. Other states and services coming soon.



1 check left today

160 / 200

Last 14 Days

Blood Glucose Stats (mg/dL)

Blood Glucose Trends (mg/dL)

Lowest 50 Average 120 Highest 230

Total Number of Checks: 55

Below 1% In Range 60% Above 31%

Our team of certified diabetes educators are ready to answer your questions.

Tap the Livongo to learn more about the coaching team.

Livongo Comment: Welcome to Livongo Btl. Ask anything about your diabetes. Just tap the text box below.

Tap a message...

CHECK BG MY LOGS

SHARE & SUPPORT MESSAGES

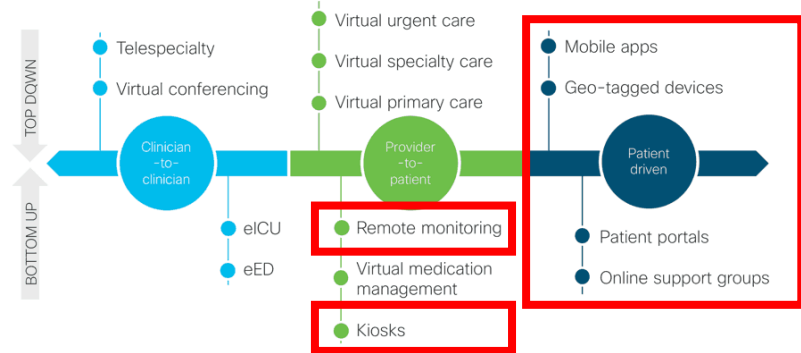
SETTINGS

Livongo

Telehealth

Virtual Care = TeleHealth (TH) + Autonomous Health

Telehealth continuum



COVID-19
Coronavirus Virtual Assistant

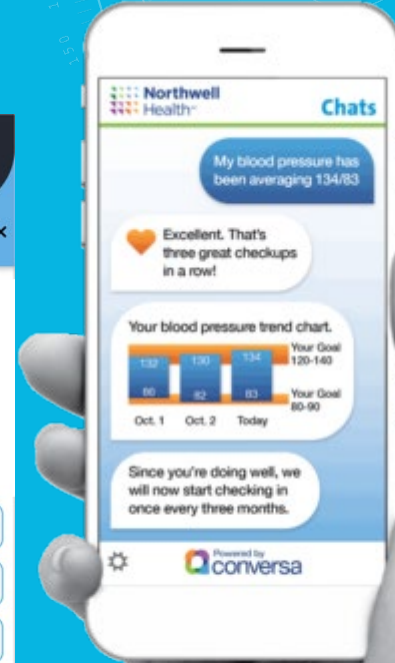
Click here if you think you have been exposed to COVID-19

I am here to help answer your questions and provide resources to assist with your concerns on the COVID-19 strain of the Coronavirus.

How can I help?

- Ask a Question about COVID-19
- Take a COVID-19 Screening Test
- What To Do if You Are Sick

Type your response

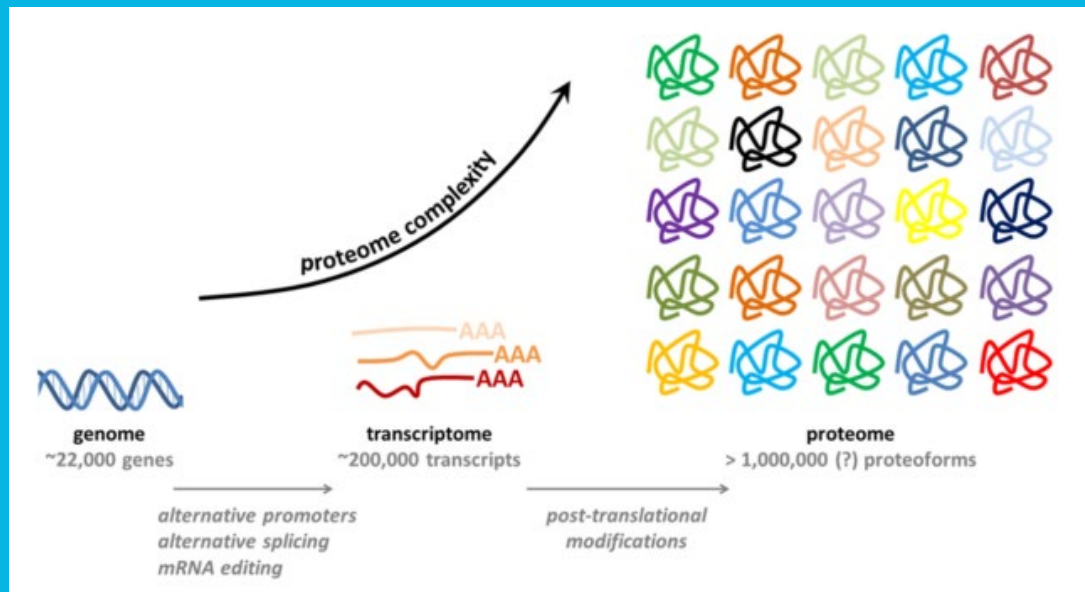
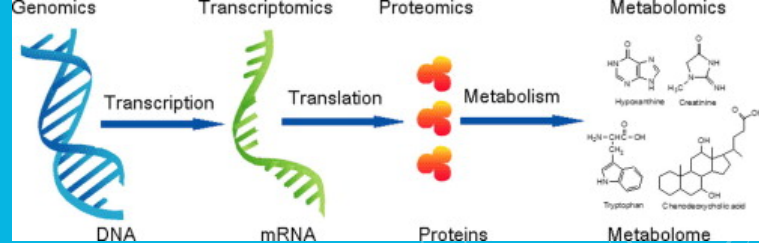


Precision Medicine


























Precision Medicine

Diagnosis and Treatment across a Spectrum



Precision Medicine

Genomics for Risk Evaluation and Treatment Choices

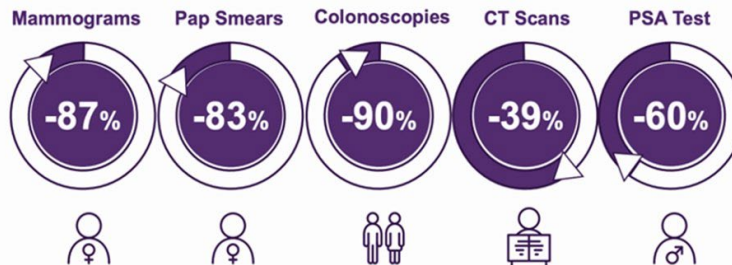
Provider	Entertainment Genetics		Medical Genetics			Cancer Genetics
	Ancestry 	Traits 	Pharmacogenomics 	Risk Factors 	Carrier Status 	Tumor 
		 Limited	 Reviewed comprehensive screening	 Reviewed comprehensive screening	 Reviewed comprehensive screening	
 23andMe Service			 Reviewed screening	 Reviewed screening	 Reviewed screening	
						
				 Limited non-professional without review	 Limited non-professional without review	

Precision Medicine

Genomics for Cancer Detection



Shelter-In-Place Impact on Cancer Screenings



Source: IQVIA Real World Claims, April 17, 2020

#DetectCancerEarly

GRAIL

Precision Medicine

Proteomics for Biometrics and Risk Detection



SAME GENOTYPE. DIFFERENT PHENOTYPE.

PROTEIN ASSAYS COMPLEMENT GENOMICS TO IDENTIFY:

- Patient subpopulations
- Novel therapeutic targets
- New disease applications for approved drugs
- Possible safety concerns
- Mechanisms of action



Primary Cardiovascular Risk

What is my risk of having a heart attack, stroke or heart failure within the next 4 years?



Secondary Cardiovascular Risk

What is my risk of having a new issue with my heart such as a heart attack, stroke or heart failure within the next 4 years?



Liver Fat

Do I have excess fat in my liver?



Cardiorespiratory Fitness - VO_2 Max

What is my aerobic fitness level?



Percent Body Fat

What is my body fat percentage?



Lean Body Mass

What is my lean body mass?



Alcohol Impact

Is my body showing the effects of my weekly alcohol consumption?



Glucose Tolerance

If I have simple sugars, does my blood glucose spike to unhealthy levels?



Visceral Fat

How much fat is around my organs?



Resting Energy Rate

How many calories does my body burn at rest when I am not doing physical activity?

Precision Medicine

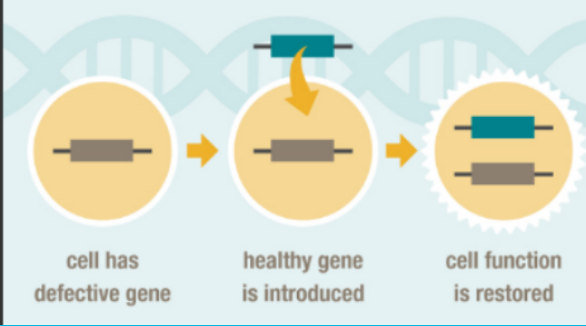
Gene Therapy



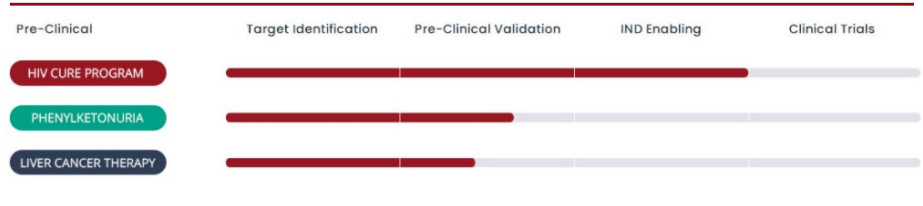
What is Gene Therapy?



Gene Therapy is when a "normal" healthy gene substitutes in for a harmful gene in cell by using a vector.



Pipeline



The New York Times

A 'Cure for Heart Disease'? A Single Shot Succeeds in Monkeys

A novel gene-editing experiment seems to have permanently reduced LDL and triglyceride levels in monkeys.

Alzheimer's In a trial done on mice, less plaque developed in the brain of the mouse that received gene therapy, resulting in less damage to the part of the brain containing memory.

A gene therapy trial to treat leukemia (a cancer affecting the blood) 26 out of 59 patients "experienced complete remission" Cancer

Immune deficiencies Stem cells are removed from the patient. A working copy of the gene is inserted into a virus. The stem cells, now with the working gene, are returned to the patient. The virus delivers the working gene to the patient's extracted stem cells.

Heredity Blindness Patients with LCA after trials with gene therapy, 6 out of 9 experienced better vision Vision regions located in the back of brain.

Internet of Things (IoT)



IoT

Sensors in Healthcare



THE INTERNET OF THINGS

Being Connected

A more connected world gives us the power to monitor anything, from the environment to our health.



Actuators

Rapidly falling prices of microelectromechanical systems (MEMS) will allow us to put sensors on virtually anything—even people.



Sensors

RFID tags can attach to almost any object, connecting the physical world with its virtual counterpart.



Data Communication Technology

Closed-loop setups will automatically trigger actions based on sensory data.



5x

Within this decade, the number of devices will quintuple, from **50 billion** to **250 billion**.



Content: "Disruptive Technologies: Advances that will transform life, business and the global economy". McKinsey Global Institute, May 2013.

Infographics: <http://enterprise.microsoft.com/en-us/roles/it-leader/infographic-5-technologies-disrupting-your-business/>

IoT Wearables



Wearable Electronic Sweat Sensor Detects Health Biomarkers

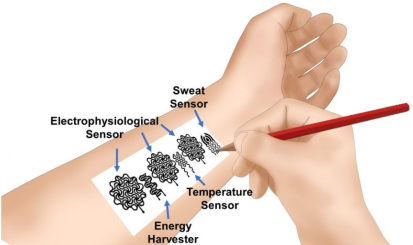
NEWS | Jul 28, 2020



The new tattoo: Drawing electronics on skin

One day, people could monitor their own health conditions by simply picking up a pencil and drawing a bioelectronic device on their skin. In a new study, University of Missouri engineers demonstrated that the simple combination of pencils and paper could be used to create devices that might be used to monitor personal health.

July 13, 2020
Contact: Eric Stamm, 573-882-3346, StammE@missouri.edu



Reference: <https://www.pnas.org/content/early/2020/07/09/2008422117>

IoT

Ingestibles for biometrics and imaging

Traditional



Apogee system



Portable



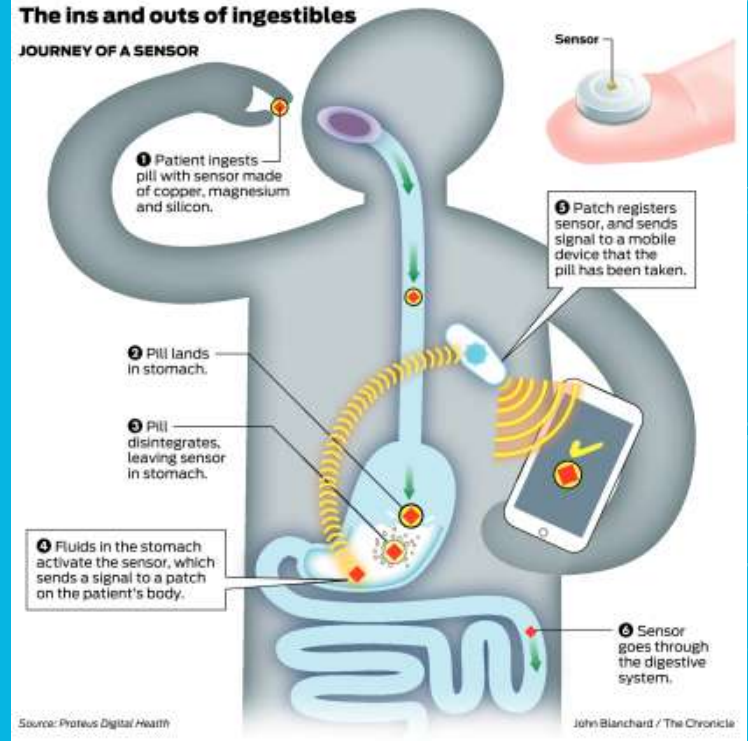
Philips Lumify



Ingestible

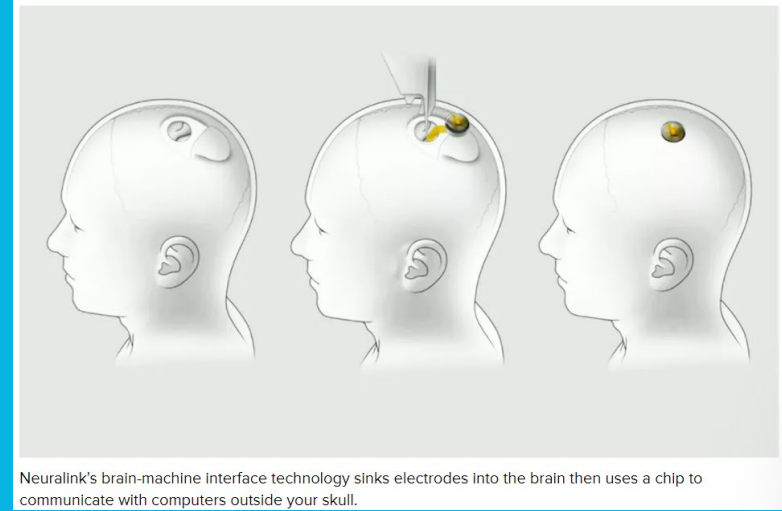
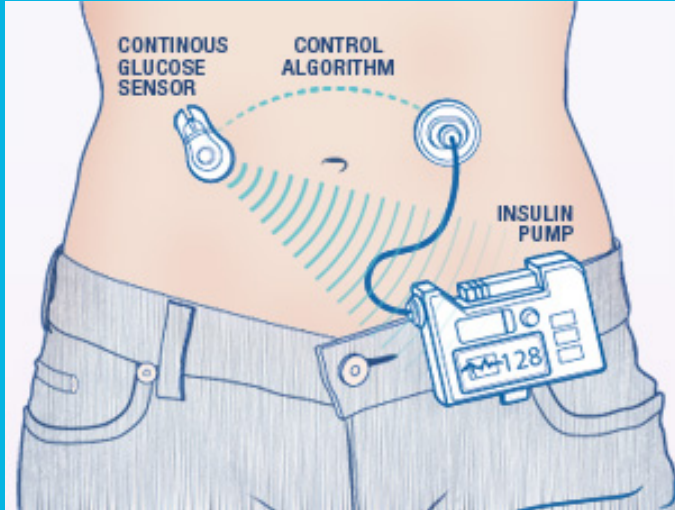


**Capsule
Ultrasound
Device (CUS)**



IoT

Implantables

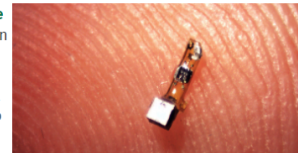


Dust-sized implantable sensor could enable brain-controlled prosthetics, continuous organ monitoring

By [Jonah Comstock](#) | August 08, 2016

SHARE 26

Researchers at the University of California Berkeley **have created a tiny sensor**, the size of a grain of sand, that can sit on a nerve, muscle, or organ and monitor the electrical signals passing through it. The sensor, dubbed "neuro dust", was designed as a next-generation control interface for prostheses but could eventually turn out to have a wide range of healthcare applications.



Drones

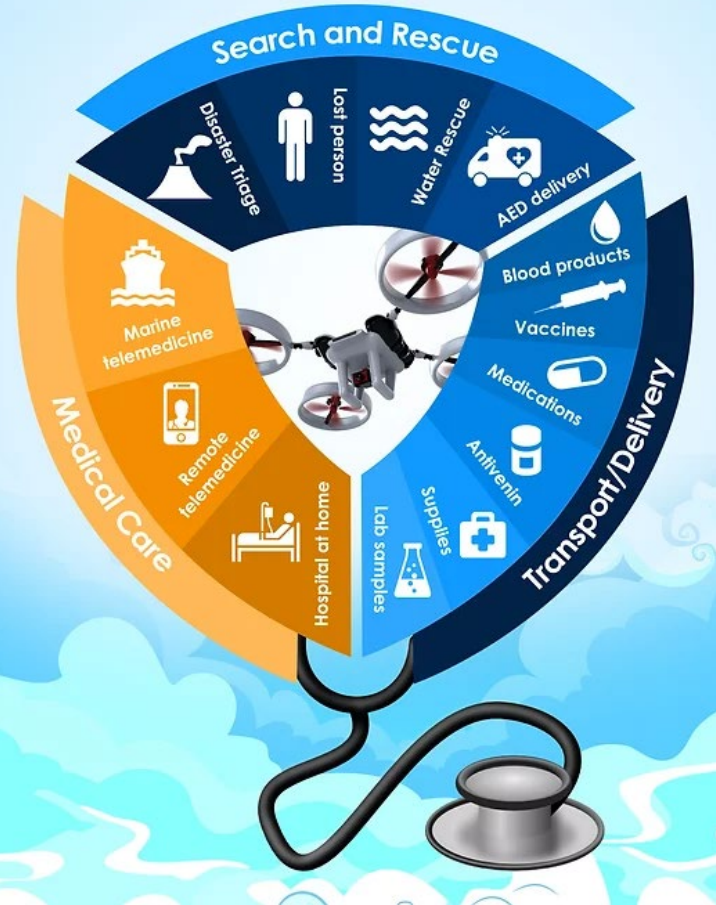


Drones

Search, Delivery, Care



MEDICAL USES FOR DRONES

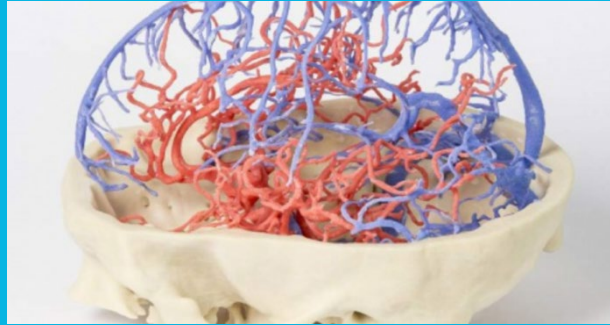
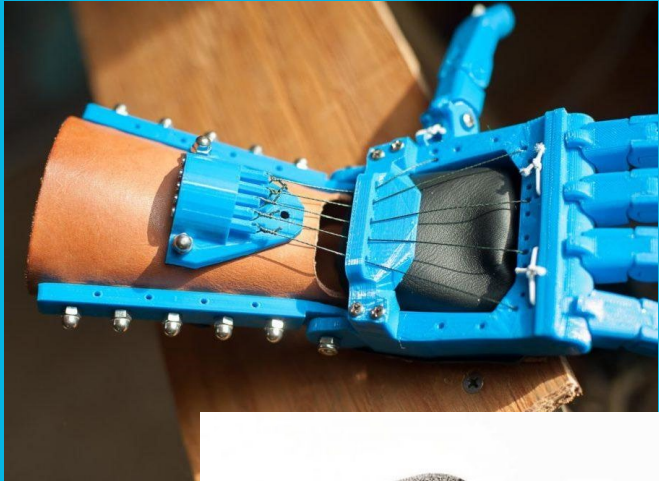


3D Printing



3D Printing

Prosthetics, Devices, Personalized Surgery, Tissue/Organs



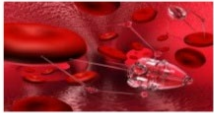
Nanobots



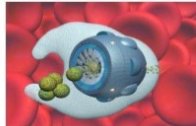
Nanobots

Diagnosis, Surgery, Treatments

Nanobot in action



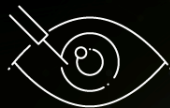
A nanobot machine roaming through the bloodstream, injecting or taking samples for identification and determining the concentrations of different compounds.



NANO
BOTS

Magnetic Micro Surgery

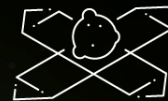
Around the world, researchers are developing specialized nanobots to perform a wide variety of surgeries using external magnetic fields to direct the bots



Performing Eye Surgeries



Clearing Blocked Arteries

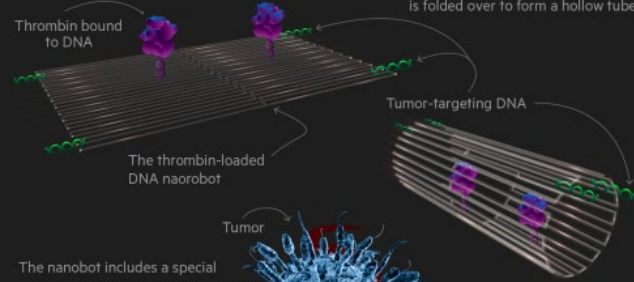


Collecting Biopsies

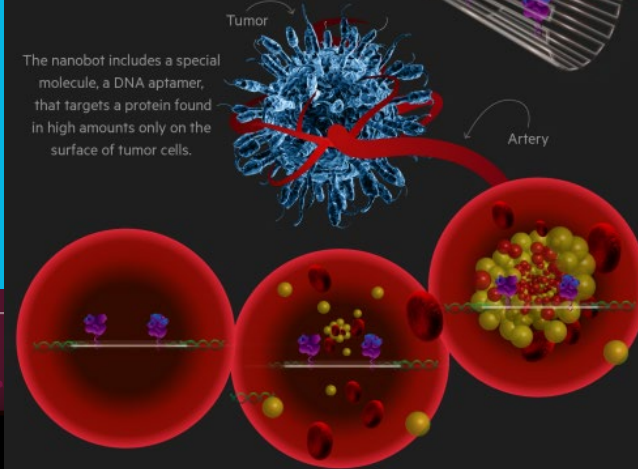
Nanobots fighting cancer

The nanobots are made from flat, rectangular DNA sheets

A key blood-clotting enzyme, called thrombin, is attached to the surface, and the DNA sheet is folded over to form a hollow tube



The nanobot includes a special molecule, a DNA aptamer, that targets a protein found in high amounts only on the surface of tumor cells.



This directs the nanobot to the tumor cells, where the blood-clotting enzyme is released, stopping the blood flow to the tumor.

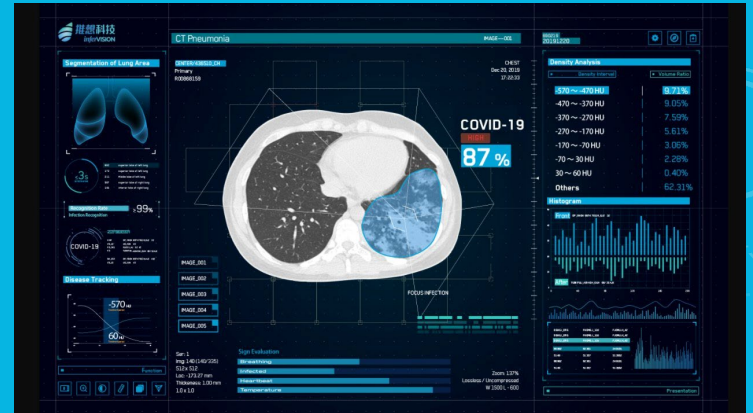
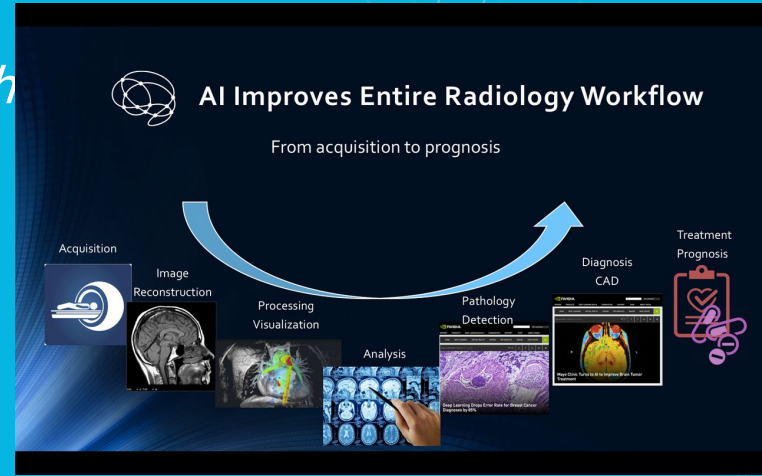
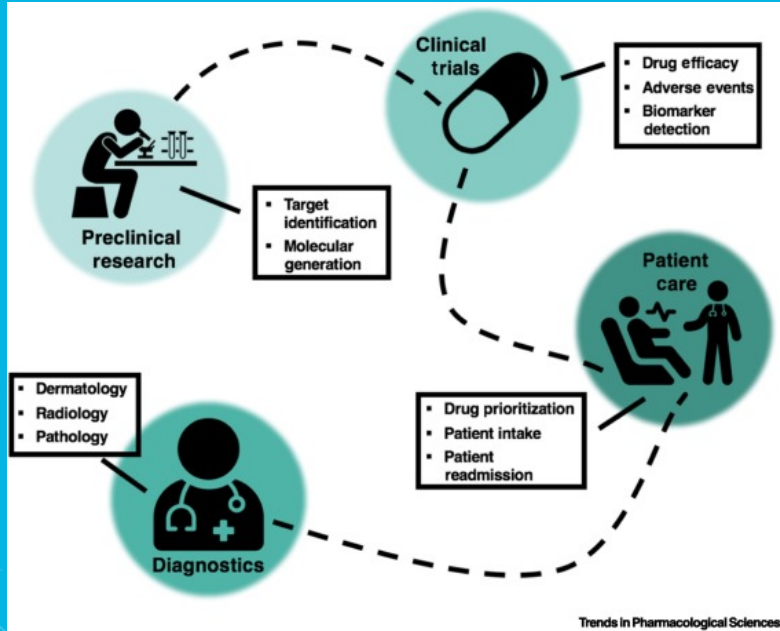
Sources: Arizona State University; The Biodesign Institute; Dreamstime
© FT

Artificial/ Augmented Intelligence (AI)



AI

Diagnosis, Prognosis, Treatment, Research



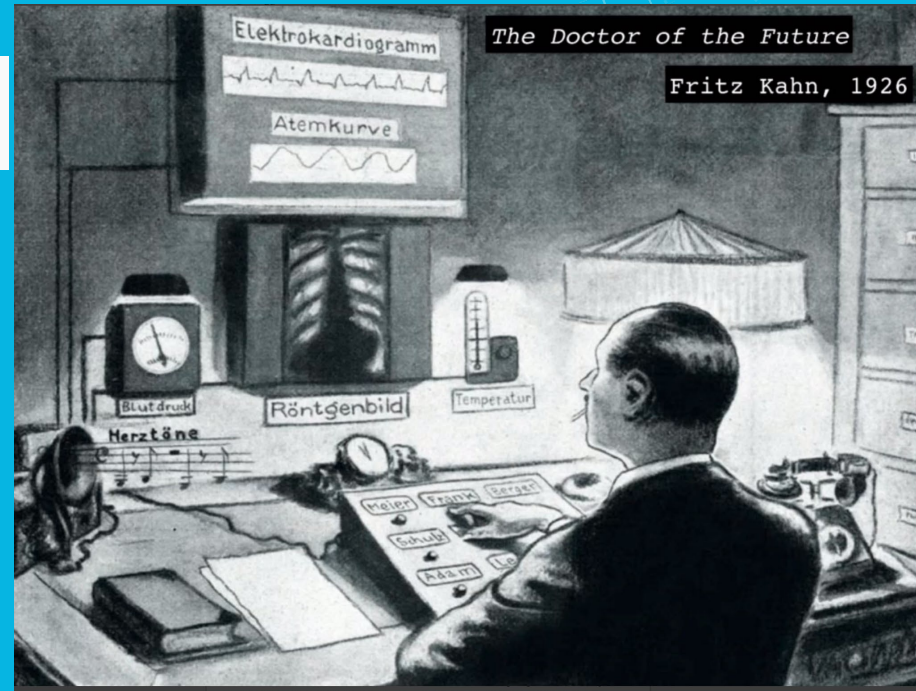
AI

How far will we go?

The Reinvention Of Medicine: Dr. Algorithm Vo-7 And Beyond

Posted Sep 22, 2014 by [Vinod Khosla \(@vkhosla\)](#)

NYT: Can Computers Replace Doctors?



Conclusion



The Future of Healthcare

What to expect...

- **The “Tricorder”**

- *Biometrics + Labs + Imaging = Detect faster, better, cheaper*
- *Ambulatory: Predict and Prevent*
- *Hospital: Track objects and people*

- **Robo-Doc**

- *Replacing Doctors: Automation of routine, repeatable care*
- *Augmenting Doctors: Finding edge cases, New Treatments...*

- **Bio-hacking**

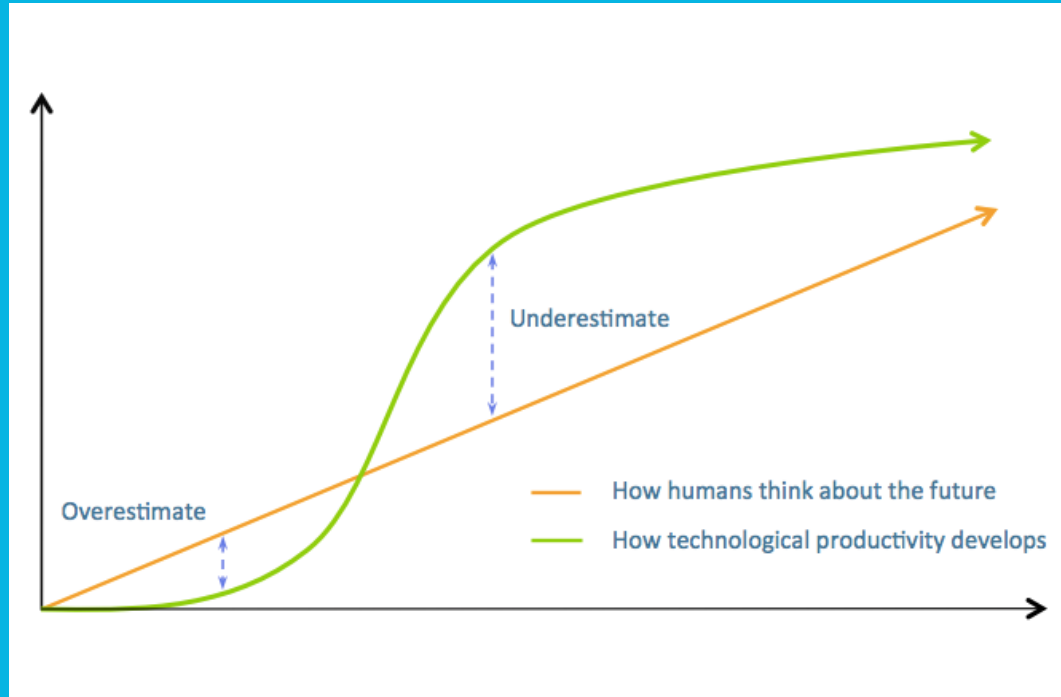
- *Cyborg (man-computer interface)*
- *CRISPR for gene editing*
- *Nanotechnology for diagnosis and treatment*
- *Regenerative medicine (eg stem cells) for arthritis and other repairs*



- **What if computers could manage 80% of health care?**
- **What if we cured heart disease or cancer?**
- **What if most people lived to 120?**

AMARA'S LAW

We tend to overestimate the effect of a technology in the short run and underestimate the effect in the long run





THANK YOU

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