What does the future hold for medical technology?

Michael Dunn - July 21, 2016

I'm not a doctor, nor do I play one on TV. Nevertheless, it's fun to think how far medicine has come in EDN's first 60 years, and imagine what the coming 60 years might hold for medical technology.

We all know it's nigh impossible to predict medical breakthroughs six years ahead, let alone 60, so at least I'll restrict my prognostications to the electronics realm, leaving speculations about DNA, genomic medicine, gene drives, CRISPR, stem cells, and everything else that will come, to others. There's more than enough egg left for my face.

Here's a collection of medical advances we might see in coming decades, roughly ordered from most likely to most speculative. We'd love to hear your ideas too.

Non-invasive blood-glucose monitoring

EDN published a very popular article almost three years ago describing an optical blood-glucose monitor. Surely, commercial availability of a device like this is close, freeing those with diabetes from the daily grind of finger-pricking or invasive probes.

An even more remarkable sensor is Google’s Smart Lens. Will we be looking through these contacts by 2020?
The Google Smart Lens was featured in a DAC 2015 keynote. Click to enlarge.

Swallowable diagnostic tools

Already in use for some years, pillcams take photographs of a patient's innards after being swallowed. It's not hard to imagine extensions to this technology, such as adding multiple chemical sensors (perhaps printed ones). Going further, how about selective drug dispensing, and eventually, performing small surgeries from the inside?
Here’s the Pillcam Colon 2 just before EDN’s Patrick Mannion took his Dremel to it for a teardown.

**Health tracker**

Wearables will become truly useful as their sensing abilities improve. Combined with computing advances (see next item), anyone at high risk will have a personal cyber medical team constantly monitoring their condition. Eventually, these trackers will become so unobtrusive, they’ll be as ubiquitous as smartphones today.

The first prototype of the Health and Environmental Tracker (HET) chest patch will be shrunk prior to commercialization around 2020.

**Photo credit:** James Dieffenderfer (Source: NCSU)
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**Watson, dissolving sensors, and prosthetics**

**Cognitive computer systems play doctor**

IBM’s cognitive system, [Watson](#), astounded the world with its stunning win on the game show Jeopardy, but that was only the beginning. Expect Watson and similar cognitive systems to keep getting better at diagnosis and analysis. Visits to the doctor will be preceded by a “Watson” interview, which may prevent a needless visit, or expedite an urgently needed one.

Dr. Martin Kohn, Chief Medical Scientist, Care Delivery Systems, IBM Research, delivers a Watson healthcare talk.

**Dissolving sensors minimize surgery**

When sensors need to be surgically implanted, they later have to be surgically removed. Instead, what if they **just dissolved**? Entire sensing systems are being developed to do just that. [Here’s more](#) on this technology, and [dissolving electronics](#) generally.
Professor John Rogers from the U. of Illinois discussed dissolvable electronics at the final DAC 2015 keynote. Click to enlarge.

**Prosthetics**

Prosthetic limbs keep getting better and better. By 2076, I expect them to be virtually indistinguishable from the real thing, both for the user and others, with motors giving way to artificial muscles, and the human-machine interface in both control and sense directions approaching the real thing. What’s particularly exciting is that research is coming not just from big organizations like Johns Hopkins and The Center for Bionic Medicine, but also from scrappy startups, and even individual inventors.

Other EDN coverage includes:

- Rocket propels prosthetic arm
- DESIGN West keynoter envisions biomechatronic future
Vanderbilt professor Michael Goldfarb inspects a “rocket-powered” prosthetic arm.

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Tricorders, printed organs, and seizure control

Tricorder

You’ve heard about the Qualcomm Tricorder XPRIZE, which will name a winner in 2017. Entrants may not yet be up to Star Trek standards, but given 60 years, expect a handheld device that performs functions like NMR, X-ray, ultrasound, EEG, ECG, chemical sensing, blood pressure, stethoscopy, and more.
Tricorders in the future could monitor your health all the time.

**Source:** Qualcomm Tricorder XPRIZE

**Note:** Star Trek, Tricorder, and related marks and logos are trademarks of CBS Studios Inc. Used under license.

## Printed organs

3D printers have already been used to make [replacement body parts](#) of a structural nature, and there's even more excitement around the prospect of [3D-printing living organs](#).

Surgeon Anthony Atala demonstrates experiments toward a 3D-printed kidney.

## Seizure arrestor

Being plagued with epilepsy – never knowing when a seizure will hit – is a **very unpleasant way to live**. One day, implanted devices will detect the first hints of an oncoming seizure, then send out a jamming signal to stop it. A relatively primitive [probe device](#) was described at the recent DAC, but with biological and nanotech advances, I expect ultra-fine probe filaments will one day be able to root into the brain and other organs to exactly where they're needed.
Cortera described minimally-invasive neural probe arrays at DAC 2016. Click to enlarge.

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**Robot surgeons, nanobots, and conscious machines**

**AI & robot surgeons**

It may be a while before patients trust an AI to handle 100% of their treatment (preferring to get a human doctor's second opinion), but that day will come, and when surgery is called for - though that will become less frequent given other advances - the AI will be the surgeon. Before that, expect human assistants and remote manipulators to become commonplace.
The STAR is a semi-autonomous surgical robot. **Source:** Children’s National Health System

**Nanobots**

The field of nanotechnology encompasses many different sorts of tech, but as originally envisioned by people like Richard Feynman & Eric Drexler (not to mention **STTNG**), it refers to molecular-scale mechanical machines. In fact, it’s been posited that a molecular-mechanical nanocomputer would be far faster than anything possible with electronics. Will we see “Fantastic Voyage”-like nanosubs and nanobots travelling around inside us, perhaps as permanent residents like our microbiome, healing us or keeping us healthy?
A nanobot as imagined by WT VOX.

**Uploaded minds**

The ultimate bio-technological achievement will arguably be the transfer of consciousness to a machine (which may be more a bio-machine than anything electronic). Will it happen by 2076? I expect that at least simpler synthetic minds will be around long before that date – without the upload feature (you can have a generic hamster pet, but not an immortal Mr. Nosie).

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- Non-invasive blood glucose monitoring using near-infrared spectroscopy
- Robotic arm gives amputees increased range of motion, dexterity, and control options
- Could this take the $10 million Tricorder X Prize?
- Inside Given Technology's Pillcam Colon 2
- Biodesorbable electronics cap off DAC 2015
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