I found this list of medical marvels through scientific research in 2012 on TIME’s Health & Family website. All of these discoveries and innovations would not have been possible without electronics. The advances in Medical electronics make research not only possible, but enable researchers to discover these things faster than ever. Along-side each of the following 10 items, I have provided some of the key electronics involved in these helping these medical research areas reach new heights.

1. Junk No More

After being ignored as useless genetic garbage, the vast 98% of the human genome that does not code for genes finally has a purpose. It turns out that these previously insignificant portions of DNA are the true genetic masterminds, or metabolic switches that regulate how and when genes function as well as how prolifically genes churn out their respective proteins. Without them, scientists say, genes would be like a jumbled mess of words that have no meaning. Scientists are already exploiting the newly discovered trove of biological information and pursuing new ways of controlling, and possibly even curing, diseases with the flick of a genetic switch.
Electronics role: 454 Life Sciences, Illumina, Beckman Coulter, Pacific Biosciences just to name a few of the companies who have developed modern DNA sequencers.

What Are Bugs For?
2. What Are Bugs For?

What’s the most populace component of the human body? Cells? No. Genes? Not even close. It’s bugs. The microbes, including bacteria, that live in, on and around us outnumber our human cells 10 to 1. And researchers have just completed the first phase of the Human Microbiome Project, the most comprehensive accounting to date of who these microbial residents are and what they do. Most of them are actually our friends, working hard to ensure that we digest our food, for example, and build up strong immune systems. But as they learn more about the bugs that live within us, scientists are recognizing that they may play an important role in a number of chronic diseases and conditions, including inflammation and obesity. Far from being unwelcome intruders, these microbes may eventually help us treat some of our most intractable health problems.

Electronics role: The electron microscope has greatly advanced this area of research. Live cell imaging is at the forefront. Illumina has developed some sequencers for this research as well.

Do-It-All HIV Drug
3. Do-It-All HIV Drug
It’s already a potent weapon against HIV, but Truvada, a combination of two antiviral medications, is now the first drug-based way to prevent infection against the virus among healthy people. After groundbreaking trials showed that uninfected individuals using the medication could lower their risk of acquiring HIV, the Food and Drug Administration expanded Truvada’s approval to include healthy people at high risk of becoming infected with HIV. Studies showed that high-risk gay men as well as the uninfected partner of an HIV-positive patient lowered their chances of becoming positive by anywhere from 42% to 75%. While critics are concerned that the treatment may lead to higher-risk behavior, like unprotected sex, public health experts welcome the new way of fighting AIDS: preventing infections from occurring in the first place.

**Electronics role:** Again here, the electron microscope was one of the key tools in HIV research.

**Lab-Grown Body Parts**

4. Lab-Grown Body Parts
Windpipes are not like kidneys or livers; they aren’t among the organs that routinely show up on the organ-transplant list. But thanks to stem cells, patients in need of a new trachea can grow their own. Researchers at the Karolinska Institute fashioned only the second man-made trachea, which connects the nose and mouth to the lungs, using synthetic microfibers and a bath of stem cells removed from the bone marrow of a patient whose own trachea was destroyed by cancer. In the first case, a donor trachea from a deceased individual served as the scaffold for a Spanish woman’s stem cells. In the latest advance, the scientists used a bioengineered matrix to seed the cells. Such techniques represent the future of regenerative medicine, in which stem cells of all kinds, including those made from patients’ own skin cells, can serve as the basis for generating any type of cell or tissue that needs to be replaced or repaired.

Electronics role: See how tissue engineering can be done by Jury-rigging an ink-jet printer and the electron microscope also helped in this amazing process. The bioreactor was instrumental in the human tissue growing process as well.

Hope for Reversing Autism
5. Hope for Reversing Autism
In encouraging news for parents of autistic children, researchers say early behavior therapy can help normalize brain patterns responsible for the symptoms of the condition. Children diagnosed with autism spectrum disorders who participated in the Early Start Denver Model program, which involves intensive social and linguistic engagement with toddlers, showed changes in the way their brains process human faces and objects. Autistic youngsters generally show more brain activity when they view images of an inanimate object like a toy than when they see a picture of a woman’s face. But after two years of ESDM therapy, the autistic children showed the opposite response, and these patterns came close to mimicking those found among normally developing children. It’s a hopeful sign that it’s possible to halt some of the brain changes linked to autism and possibly even reverse them. But the key to the program’s success involves early and intensive intervention with properly trained counselors who actively engage the toddlers in several hours of therapy a week.

Electronics role: Brain imaging advances in electronics enable this study to proceed.

Breaking Down Breast Cancer

6. Breaking Down Breast Cancer
Breast cancer is certainly a complex disease, driven by myriad genetic and lifestyle factors. But in the latest analysis of the DNA of breast tumors, researchers are heartened by the fact that the disease may be slightly simpler than they had thought. The Cancer Genome Atlas, a government project that is sequencing the genomes of dozens of cancers, found more than 30,000 mutations in 510 samples of breast tumors, but these fell into **four major subtypes**. One showed close ties to ovarian cancer, opening up the possibility that treatments for that cancer can also help breast-cancer patients, while another helps explain why some have better outcomes than others among women with HER-2 receptor tumors that are supposed to respond to drugs like Herceptin. The knowledge could translate into changes in the way doctors treat breast cancers and be the difference between surviving or becoming a victim of the disease.

**Electronics role:** DNA sequencing also plays a major role in this research.

**Speeding DNA-Based Diagnosis for Newborns**

7. Speeding DNA-Based Diagnosis for Newborns
Fifty hours. That’s how long it now takes to decode and interpret a newborn baby’s genome — an undertaking that used to take weeks or even months. And those two days can mean the difference between life and death for a critically ill infant. The speedier genomic analysis is possible thanks to advances in sequencing technology as well as innovative software that links the 3,500 known genetic defects to their childhood diseases, allowing doctors to quickly decide on the right treatment that could save a baby’s life. About 30% of babies admitted to the neonatal intensive care unit each year have inherited a genetic disease, and sequencing their genomes may become a critical part of improving their care in coming years — the sooner the better.

**Electronics role:** DNA sequencing saves the day again

**Decoding Childhood Tumors**

**8. Decoding Childhood Tumors**

Doctors hope that the Pediatric Cancer Genome Project, a three-year, $65 million effort to sequence major pediatric cancers, will become a rich source of new targets for therapies. Understanding the
genetic drivers of cancers can hopefully reveal common pathways among different types of cancers, allowing doctors to borrow treatments effective against one type of tumor to treat another, for example, or to generate entirely new drugs for thwarting cells that grow abnormally. It’s the future of cancer treatment that may bump survival rates even higher.

**Electronics role:** DNA sequencing saves the day again

**Man-Made Mouse Eggs**

**9. Man-Made Mouse Eggs**

Scientists in Japan used two kinds of stem cells from mice — those taken from days-old embryos and those reprogrammed from adult mouse skin cells — and created viable egg cells that they then successfully fertilized to generate the first ever pups born from stem-cell-derived eggs. The apparently healthy mouse pups are the ultimate test of the regenerative capabilities of stem cells and represent a breakthrough that could potentially lead to new treatments for infertility in human couples.
**Electronics role:** Since growing cells in a lab dish requires very precise temperature environments, electronically-controlled temperature environments are critical.

**Zit-Zapping Viruses**

10. Zit-Zapping Viruses

Scientists can send in a relatively inert virus to fight the bacteria responsible for skin blemishes. These viruses are already embedded in pores deep inside the skin and have a natural ability to infect bacterial cells, turning them into virus-making factories before causing the bacteria to self-destruct. It’s just a matter of boosting their numbers, which researchers say can be done with a topical cream that’s loaded with the viruses. Or they could simply slather the cream with the bacteria-killing agent that the viruses produce.
Electronics role: Developing these viruses entail electronically-controlled temperature environments and the electron microscope.