

**A New DNA Test Will Look for 190 Diseases
in Newborn's Genetic Code**

Using a swab of saliva from a newborn's cheek, a new DNA test will probe the baby's genes to search for 193 genetic diseases, like anemia, epilepsy, and metabolic disorders.

The \$649 test is meant for healthy babies, as a supplement to existing screening tests.

In the US, the government recommends a newborn screening test that looks for a minimum of 34 disorders (though some states have additional requirements as well). The standard test involves a small sample of blood taken from a baby's heel.

Eric Schadt, CEO of Sema4, the company behind the test, says some parents may want more information about their child's genes than this standard testing delivers. Some people suffer for years before getting a proper diagnosis for some of the diseases that his company's test covers, he says.

"If you can, at birth, canvass some of the most common disorders, you get a better understanding of the health of your child," Schadt says. "We think parents want the best for their children and are going to do whatever they can so that their child can have the healthiest life possible."

Reading the DNA of fetuses is the next frontier of the genome revolution. Do you really want to know the genetic destiny of your unborn child?

All the conditions the Sema4 test looks for—it uses DNA sequencing to examine a subset of genes, rather than the whole genome—have some kind of treatment already available. The test also analyzes how a baby is likely to respond to 38 medications commonly prescribed in early childhood.

Schadt says anyone can order the Sema4 test online, and a doctor with the company approves it. The test isn't covered by insurance yet.

The trouble is, even if a baby has a mutation in a gene, it could take years for symptoms to appear. And sometimes a child can carry a mutation but never develop the corresponding disease. That's one reason DNA sequencing isn't yet routine for children and adults who are currently healthy.

That raises a big question: is a test like Sema4's always a good thing? "For many families, this is the kind of thing that can open up a can of worms where it doesn't end up necessarily benefitting the parent or child," says Laura Hercher, a geneticist at Sarah Lawrence College.

In some cases, the results of the test could cause anxiety and confusion for parents and lead to unnecessary tests and procedures for children, she says: "You put parents in a terrible position, because they don't know if they should wait until the child is sick, to do, in some cases draconian treatments."

Becoming a Swarm Technology Researcher

Swarm intelligence, or swarm theory, refers to decentralized, self-organizing systems, such as flocks of birds, whose actions "enable relatively simple individual entities to produce complex behavior when operating with other simple entities," says Michael Campobasso, CEO of Embedded Control Designs (ECD). The field is quickly moving from theory to practice as specialists like Campobasso seek to adapt these behaviors to swarms of drone aircraft and for other aerial and aerospace applications. Embry-Riddle Aeronautical University (ERAU), the University of Pennsylvania and MIT are among the academic institutions where researchers are applying swarm theory to drones.

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Intel applies swarm theory to create airborne entertainment spectacles with its Shooting Star drones.
Intel

Major defense contractors, including Northrop Grumman and Lockheed Martin, have government contracts for swarm research, and federal Small Business Technology Transfer Research (STTR) grants are available to firms working with academic institutions on important topics in the field.

Florida-based ECD, which Campobasso, a recent ERAU graduate, co-founded last year, has teamed with the controls group in ERAU's physical sciences department and is building quadrotor small unmanned aircraft systems (sUAS) and developing the control algorithms that will allow them to operate in swarms safely. "We are conducting state-of-the-art research in creating and advancing fault-tolerant systems that actively learn how to handle flight failures in a safe and procedural manner," says Campobasso.

The FAA requires a waiver for commercial drone swarm operations, and Intel became the first company granted the waiver, for a pre-recorded performance using 300 of its Shooting Star drones operated by a single individual, featured in the 2017 Super Bowl halftime show with Lady Gaga. But most researchers are interested in applications beyond entertainment.

ECD is focusing on agricultural applications, such as inspecting crops, where operations over farmland reduce risks to humans.

"In almost any drone operation, using a swarm would make it cheaper, better, faster," says Campobasso.

As Natalie Cheung, director of drones marketing at Intel, says, "If you inspect a bridge, if you can have more than one drone to do it, you have a faster way of inspecting the bridge. If you were doing search and rescue and you have one drone out there searching for you, it's much better to have a fleet of drones searching."

Swarm theory is also applicable to satellite constellations, and in the healthcare industry, where swarms of nanotech bots could be harnessed for medical procedures. "When you allow entities to cooperate, they can become more powerful or capable than a single entity, and that's the true power of swarm technology," Campobasso says.

Anyone interested in entering the field "should focus on control systems and computer science," Campobasso says. "Typically, a position in this field will require a bachelor's degree related to one of these disciplines, and experience working with embedded systems. A solid foundation in mathematics is a must."

With the current state of the technology, most job opportunities are with government entities and military contractors working with sUAS and UAS. Expect entry-level salaries comparable to that of a related engineering discipline, ranging from about \$60,000 to \$85,000 annually.

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