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Google's New Moonshot Project: the Human Body

By Alistair Barr

Google Inc. has embarked on what may be its most ambitious and difficult science project ever: a quest inside the human body.

Called Baseline Study, the project will collect anonymous genetic and molecular information from 175 people—and later thousands more—to create what the company hopes will be the fullest picture of what a healthy human being should be.

The early-stage project is run by Andrew Conrad, a 50-year-old molecular biologist who pioneered cheap, high-volume tests for HIV in blood-plasma donations.

Dr. Conrad joined Google X—the company's research arm—in March 2013, and he has built a team of about 70-to-100 experts from fields including physiology, biochemistry, optics, imaging and molecular biology.

Other mass medical and genomics studies exist. But Baseline will amass a much larger and broader set of new data. The hope is that this will help researchers detect killers such as heart disease and cancer far earlier, pushing medicine more toward prevention rather than the treatment of illness.

"With any complex system, the notion has always been there to proactively address problems," Dr. Conrad said. "That's not revolutionary. We are just asking the question: If we really wanted to be proactive, what would we need to know? You need to know what the fixed, well-running thing should look like."

The project won't be restricted to specific diseases, and it will collect hundreds of different samples using a wide variety of new diagnostic tools. Then Google will use its massive computing power to find patterns, or "biomarkers," buried in the information. The hope is that these biomarkers can be used by medical researchers to detect any disease a lot earlier.

The study may, for instance, reveal a biomarker that helps some people break down fatty foods efficiently, helping them live a long time without high cholesterol and heart disease. Others may lack this trait and succumb to early heart attacks. Once Baseline has identified the biomarker, researchers could check if other people lack it and help them modify their behavior or develop a new treatment to help them break down fatty foods better, Dr. Conrad said.

Google has already built one of the world's largest networks of computers and data centers to serve online-search results quickly and run other data-hungry services like the video website YouTube. This computing muscle can now be used to store and crunch medical information and let other researchers access it more easily.

So far, most biomarkers that have been discovered are related to late-stage diseases because studies usually focus on sick patients. Researchers have tried to use them to spot diseases earlier with mixed results, according to Sam Gambhir, who chairs the Department of Radiology at Stanford University's medical school and has been working with Dr. Conrad on Baseline for more than a year.

Dr. Conrad and Dr. Gambhir admit that the project is a giant leap into the unknown. That's because the human body is so complex and so little is known about the interplay between DNA, enzymes and proteins and how environmental factors like diet influence this. The initiative may reveal biomarkers that tell researchers little about diseases, for instance.

In any case, Dr. Conrad expects advances to be made in "little increments."

Google said the information from Baseline will be anonymous and its use will be limited to medical and health purposes. Data won't be shared with insurance companies, the company added.

Still, the idea that Google would know the structure of thousands of people's bodies—down to the molecules inside their cells—raises significant issues of privacy and fairness.

Baseline will be monitored by institutional review boards, which oversee all medical research involving humans. Once the full study gets going, boards run by the medical schools at Duke University and Stanford University will control how the information is used. "That's certainly an issue that's been discussed," said Dr. Gambhir. "Google will not be allowed free rein to do whatever it wants with this data."

Baseline started this summer with a clinical testing firm, through which it is enrolling 175 people in an exam that includes the collection of bodily fluids such as urine, blood, saliva and tears. Dr. Conrad declined to say which testing firm Google is working with. The study will also create a repository of tissue samples from participants.

Dr. Conrad's team will analyze results from this pilot and design a much larger study with the Duke and Stanford medical schools that will get thousands of people involved.

The clinic in the pilot study, and later similar clinics run by Duke and Stanford, will recruit volunteers for Baseline. Lead investigators at these facilities, who are not Google employees, will collect the samples and remove information that is typically used to identify participants, such as names and Social Security numbers.

Once the data has been made anonymous, Google and other researchers will get access to it, the company said.

The information will include participants' entire genomes, their parents' genetic history as well as information on how they metabolize food, nutrients and drugs, how fast their hearts beat under stress and how chemical reactions change the behavior of their genes.

Meanwhile, the Google X Life Sciences group is developing more wearable devices that may continuously collect other data, such as heart rates, heart rhythms and oxygen levels. These devices will be worn by Baseline participants, according to Robert Califf, vice chancellor at Duke University's School of Medicine, who is working on the study.

Dr. Conrad said Baseline participants will likely wear a smart contact lens that has already been developed by his team so their glucose levels can be monitored continuously for the study.