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Blood, Simpler

Condé Nast

12-15 minutes

Holmes counters that Theranos is only trying to protect itself from competitors while it tries to do something unique. “There isn’t a company that does what we do,” she told me. “We’re creating a new space. We’re in a market for people who don’t like having a needle stuck in their arm.”

The day after her *TEDMED* talk, I met with Holmes in a conference room at the Theranos headquarters, a single-story building two blocks from the Stanford campus. (In November, Theranos moved its main offices to a larger space a few miles away.) Her home is a two-bedroom condo in Palo Alto, and she lives an austere life. Although she can quote Jane Austen by heart, she no longer devotes time to novels or friends, doesn’t date, doesn’t own a television, and hasn’t taken a vacation in ten years. Her refrigerator is all but empty, as she eats most of her meals at the office. She is a vegan, and several times a day she drinks a pulverized concoction of cucumber, parsley, kale, spinach, romaine lettuce, and celery.

Growing up, Holmes was in constant motion. Her father, Chris, worked for government agencies, including, for much of his career, the U.S. Agency for International Development and the State Department, often travelling abroad, overseeing relief and disease-eradication efforts in developing nations; today, he is the global water coördinator for U.S.A.I.D. Her mother, Noel, worked for nearly a decade as a foreign-policy and defense aide on Capitol Hill, until Elizabeth and her brother Christian, two years younger, were born. The family moved several times, which meant there was little opportunity to develop lasting friendships. Holmes describes herself as a happy loner, collecting insects and fishing with her father.

“I was probably, definitely, not normal,” she said. “I was reading ‘Moby-

Dick' from start to finish when I was about nine. I read a ton of books. I still have a notebook with a complete design for a time machine that I designed when I must have been, like, seven. The wonderful thing about the way I was raised is that no one ever told me that I couldn't do those things."

Chris Holmes's great-grandfather Christian Holmes emigrated from Denmark, studied engineering, settled in Cincinnati, and became a physician. When Elizabeth was eight, she was given a tour of the local hospital where he worked and which was named in his honor. He had married the daughter of a patient, Charles Fleischmann, who pioneered packaged yeast and built a baking empire around it. (A nephew, Raoul Fleischmann, started this magazine in 1925, with Harold Ross.) Not all of Fleischmann's children shared his entrepreneurial drive, and this was a common subject of conversation in the Holmes household. "I grew up with those stories about greatness," she said, "and about people deciding not to spend their lives on something purposeful, and what happens to them when they make that choice—the impact on character and quality of life."

In 1993, when Elizabeth was nine, her father took a job in Houston, as executive assistant to the C.E.O. of Tenneco, which was then a manufacturing and energy conglomerate. She knew that her father felt guilty for uprooting the family, so she wrote a letter to console him: "What I really want out of life is to discover something new, something that mankind didn't know was possible to do." She reassured him that Texas suited her, because "it's big on science."

For several years in the nineteen-eighties, Chris Holmes spent two weeks a month in China, helping American companies invest in large-scale development projects. Soon after the family moved to Houston, Elizabeth started studying Mandarin; by the summer following her sophomore year of high school, she was intent on taking summer classes in Mandarin at Stanford. She repeatedly called the admissions office for information, only to be told, each time, that the program did not enroll high-school students. One day, her father recalls, the head of the program became so annoyed that he grabbed the phone from the employee who was talking to Holmes. "You've been calling constantly," he told her. "I just can't take it anymore. I'm going to give you the test right now!" He asked questions in Mandarin; she answered fluently, and he accepted her on the spot. She completed

three years of college Mandarin while still in high school.



“O.K., one last big rhubarb score. But then I’m out of the pie game for good.”

In 2001, in her senior year, Holmes applied to Stanford, was accepted, and then was named a President’s Scholar, which came with a small stipend to select her own research project. Her parents sent her off with a copy of Marcus Aurelius’ “Meditations,” her father said, “to convey to her: Live a purposeful life.” Holmes elected to study chemical engineering. She was drawn to the work of Channing Robertson, the chemical engineer and, at the time, a dean at the engineering school. Robertson is seventy-one and fit, with thinning hair and a relaxed smile; I visited him in his home on campus. Holmes’s first class with him was a seminar on devices designed to control the release of drugs into the human body. One day, in her freshman year, Robertson said, she came to his office to ask if she could work in his lab with the Ph.D. students. He hesitated, but she

persisted and he gave in. At the end of the spring term, she told him that she planned to spend the summer working at the Genome Institute, in Singapore. He warned her that prospective students had to speak Mandarin.

"I'm fluent in Mandarin," she said.

"I'm thinking, What's next? She's already coming into the research group meetings at the end of her freshman year with my Ph.D. students. I find myself listening to her more than to them about the next experiments to be done and the progress that's been made. I realized she's different."

That summer, at the Genome Institute, Holmes worked on testing for severe acute respiratory syndrome, or *SARS*, an often fatal virus that had broken out in China. Testing was done in the traditional manner, by collecting blood samples with syringes and mucus with nasal swabs. These methods could detect who was infected, but a separate system was needed to dispense medication, and still another system to monitor results. Holmes questioned the approach. At Stanford, she had been exploring what has become known as lab-on-a-chip technology, which allows multiple measurements to be taken from tiny amounts of liquid on a single microchip. "With the type of engineering work and systems I had been focussing on at Stanford, it was quite clear that there were much better ways to do it," she said.

Before returning to Stanford, Holmes conceived of a way to perform multiple tests at once, using the same drop of blood, and to wirelessly deliver the resulting information to a doctor. That summer, she filed a patent for the idea; it was ultimately approved, in November of 2007. Once back on campus, she went to see Robertson in his office and announced that she wanted to start a company. Robertson was impressed by the idea but urged her to at least consider finishing her degree first.

"Why?" she responded. "I know what I want to do."

Holmes was consumed by the idea of developing a company. "I got to a point where I was enrolled in all these courses, and my parents were spending all this money, and I wasn't going to any of them," she said. "I was doing this full time." Her parents allowed her to take the money they had set aside for tuition and use it to seed her company. In March, 2004, she dropped out of Stanford; one month later, she incorporated Theranos

(the name is a combination of “therapy” and “diagnosis”). She persuaded Robertson to spend one day a week as a technical adviser to the company and to serve as her first board member. Eventually, he retired from his tenured position, and began working at Theranos full time.

Robertson introduced Holmes to several venture capitalists. She insisted that they abide by her terms, which included an understanding that she would retain control and pour the profits back into the company. By December of 2004, she had raised six million dollars from an assortment of investors. As she and the chemists and engineers dug deeper, she became convinced that they could accomplish five objectives: extract blood without syringes, make a diagnosis from a few drops of blood, automate the tests to minimize human error, do the test and get the results more quickly, and do this more economically.

A key to the company’s success was the hiring of Sunny Balwani, a software engineer, now forty-nine, whom Holmes had met in Beijing the summer after her senior year of high school. At the time, he was getting an M.B.A. from Berkeley. He had worked at Lotus and at Microsoft and been a successful entrepreneur, and in 2004 he began graduate studies in computer science at Stanford. He and Holmes spoke often, and they shared a belief that software, not just chemistry or biology, mattered. If Theranos was going to be able to analyze a few drops of blood, engineers would have to develop the software to do it. In 2009, Balwani joined as C.O.O. and president. “Our platform is about automation,” he says. “We have automated the process from start to finish.”

Theranos has managed to keep its technology a secret for much of its decade of existence in part because it occupies a regulatory gray area. Most other diagnostic labs, including Quest and Laboratory Corporation of America, perform blood tests on equipment that they buy from outside manufacturers, like Siemens and Roche Diagnostics. Before those devices can be sold, they must be approved by the F.D.A., a process that makes their tests’ performances more visible to the public. But, since Theranos manufactures its own testing equipment, the F.D.A. doesn’t need to approve it, as long as the company doesn’t sell it or move it out of its labs. Holmes said that the company has long resisted discussing how its technology works or how it makes money in order to avoid tipping off potential competitors.

The company employs seven hundred people and, in addition to its headquarters, has a two-hundred-and-sixty-five-thousand-square-foot facility, in Newark, California, that manufactures the blood-testing devices. Holmes says that Theranos has a positive cash flow; it is clearly expanding. For many years, it has earned income from large pharmaceutical companies, including Pfizer and GlaxoSmithKline, which use its tests when they are conducting clinical trials on new drugs. It also earns revenue from the “wellness centers” that it has set up in Walgreens stores, its hospital work, and the U.S. military, although Holmes would not discuss the company’s arrangements with the latter.

In 2013, Theranos announced a “long-term partnership” with Walgreens that will eventually establish its wellness centers in most of the eighty-two hundred Walgreens stores. The Walgreens in Palo Alto has one, as do forty Walgreens pharmacies in Phoenix. Holmes envisages wellness centers in most Walgreens and Duane Reade stores, which would put Theranos “within five miles of every American.” Theranos also could sign up the rival drugstore chain CVS, which has seventy-eight hundred outlets.

One morning, I went to the Palo Alto Walgreens to get my blood tested. A trained phlebotomist wrapped my finger in a warming sleeve to help the blood flow and then swabbed it with alcohol. Then, with a slight pinch from a small, square lancet containing a pricking pin, she drew two drops of blood, which she siphoned into a dime-size container. This took about two minutes. The container, marked with a bar code, was placed in a refrigerated box to be picked up and delivered to a Theranos lab a couple of miles away; the box pickup and return takes place three times a day.

The lab is a large, labyrinthine place bustling with chemists and technicians, and housing rows of machines, each easy for a single person to lift, in which the containers of blood are placed. What exactly happens in the machines is treated as a state secret, and Holmes’s description of the process was comically vague: “A chemistry is performed so that a chemical reaction occurs and generates a signal from the chemical interaction with the sample, which is translated into a result, which is then reviewed by certified laboratory personnel.” She added that, thanks to “miniaturization and automation, we are able to handle these tiny samples.”

Theranos owes its success in part to its high-powered board, which Holmes corralled with the help of George Shultz, a Palo Alto resident, who, in his long career, has held four Cabinet positions, including Secretary of the Treasury and Secretary of State. Shultz is ninety-three and a fellow at Stanford's Hoover Institution; Holmes first met him in 2011. "It was one of those scheduled ten-minute meetings that turn into a two-hour meeting," she said.