

But with this progress in labs, there has been a huge setback with Theranos, the company that was framed as the creative destruction of laboratory medicine. In Chapter 6 of the book, I highlighted my experience on October 30, 2013, when I visited Elizabeth Holmes at Theranos and had to give only a nanotainer of blood to have many test results almost instantly available. It was certainly impressive, and I suspect many other people had a similar experience to account for the \$9 billion valuation that the company reached. However, I remained concerned by the total lack of transparency of the company's technology (I was never allowed to even see it during my visit) and the fact that there was not a single peer-reviewed publication, much less a head-to-head trial, comparing Theranos with LabCorp or Quest conventional lab testing. When the *New Yorker* interviewed me for the December 15, 2014, issue, I was quoted as saying, "When Theranos tells the story about what the technology is, that will be a welcome thing in the medical community. Until it does that, it can have the big labs saying Theranos is not real, or is not a threat. But if I saw data in a journal, head to head, I would feel a lot more comfortable."

Well, that story was ultimately told not by Theranos but by John Carreyrou, a two-time Pulitzer Prize-winning journalist, who had a series of *Wall Street Journal* articles beginning in October 2015. Still, Theranos has never revealed its proprietary technology, nor has any study been published. But it is clear from Carreyrou's investigative reporting that Theranos lab data were laden with errors, its proprietary technology wasn't even used for most (nearly all?) of the assays, and the company is dealing with potential banning by Medicare and even federal criminal charges. Its survival is questionable.

Nonetheless, the idea of inexpensive, rapid, direct-to-consumer lab testing will not go away. For example, I had a one-droplet of blood, nine-minute

microfluidic assay of fifteen different sophisticated autoimmune tests via Genalyte, a company in San Diego. This company has extensive peer-review publications, with full disclosure of their technology, and is just one example of the exciting real progress in lab testing. There remain some uncertainties as to whether a droplet of blood can yield consistently accurate lab results, just as there are new technologies evolving to extract a droplet without any finger stick or pain using microneedle discs applied anywhere on the skin surface. As asserted in the book, there are many companies that are preparing assays that can be run directly through a smartphone attachment, and it is fully expected that these will attain regulatory approval (with transparency and publications) in the next couple of years. The only good part of the Theranos debacle, besides its laudable mission, is that the world will not tolerate another lab emperor with no clothes.