Theranos was a high-flying blood test startup. Founded in 2003 by 19-year old Stanford dropout Elizabeth Holmes, Theranos raised over $700 million in investment at a $9 billion valuation. It promised to run hundreds of common blood tests with just drops of blood. Holmes was celebrated as the youngest self-made female billionaire in the world and put on magazine covers.

Then it crashed. The Wall Street Journal reported that Theranos vastly overstated its claims and were putting patient lives at risk. **The technology was fake.** As more reports were published, government regulators prohibited Theranos from operating; the SEC sued Theranos with fraud. Today the company is limping alone, virtually worthless.

What led Henry Kissinger to join its board, 4-star general Mattis to say Elizabeth Holmes had “one of the most mature and well-honed sense of ethics” he’d ever seen, and pharmacy giant Walgreens to partner in rolling out Theranos in its stores? What led professional investors to ignore the fact that Theranos had no peer-reviewed data, and that Holmes had little medical or scientific training to speak of?

**Bad Blood: Secrets and Lies in a Silicon Valley Startup** by John Carreyrou, the very journalist who first exposed Theranos, covers the known history of how Theranos started, maintained its lies, and fell.
The story is an incredible demonstration of the weaknesses of human psychology. Even very sophisticated investors, whose job is to sniff out these exact situations, fell completely for the fraud until it was exposed. This Bad Blood summary covers three major questions:

- How did the deception begin?
- How was the deception allowed to continue?
- What finally led to Theranos’s downfall?

In this Bad Blood summary, I won’t repeat the chronology of what happened when - that’s already well documented in the actual Bad Blood book and elsewhere online. Instead, I want to focus on the themes of why so many sane, professional people were completely taken in and ignored the warning signs until it was too late.

At the end, I walk through Charlie Munger’s 25 Cognitive Biases to show how many biases applied, and how strong their effects were.

How did the deception begin?

- It has to start with Elizabeth Holmes, who dreamed big
  - She clearly had large ambitions. When asked what she wanted to be at 10 year old, she answered “a billionaire.”
  - When her dad suggested she get a PhD, she demurred: “I want to make money.”
  - It might be reasonable to assume Holmes started with good intentions. After a summer in Asia during the SARS period, she researched the patent literature and proposed a way to test blood with small amounts of blood. Her adviser was impressed and encouraged her to start a company.
  - But in her megalomania, she fell down a slippery slope of deception.
- Theranos had a vision people wanted to believe in - “detect diseases early so no one has to die unnecessarily.” People saw what they wanted in it - they wanted, needed it to be true - allowing large suspension of disbelief.
  - Investors saw a huge financial opportunity.
  - Patients and their families saw better decisionmaking and less pain.
  - The public saw a thrilling female founder who could be the next Steve Jobs. They wanted to celebrate a brilliant female in the age of Lean In.
  - Partners like Walgreens and Safeway saw a way to compete against competitors like CVS, and to rejuvenate their financials.
  - Senior mentors like George Schultz, General Mattis saw a granddaughter-like figure to mentor.
  - Anyone with equity (advisory board included) had a huge incentive to believe the company would work.

YouTube Video
Elizabeth Holmes practiced charismatic techniques to win over supporters

- Elizabeth spoke sincerely and enthusiastically about the mission. It gave the impression that there was no way someone with this sincerity could be beguiling.
- To the Walgreens CFO, Elizabeth gave a gift of an American flag “flown over Afghanistan” with a dedication to Walgreens written on it.
- Many people repeated: “she had this intense way of looking at you while she spoke that made you believe in her and want to follow her.” Here’s an example.
- She apparently affected her voice to be a strikingly low baritone, possibly convinced it would lead to better results in a male-dominated world.

- Relying on pattern matching to jump to wrong conclusions.
  - On paper, the technology fit the pattern of disruption - dramatically lower cost replacing the dinosaur incumbents, leading to massive adoption and market expansion.
  - Holmes looked like the stereotypical genius dropout founder. She even affected a resemblance to Steve Jobs with black turtlenecks.
  - They crafted a cohesive narrative. From childhood, Elizabeth had a phobia of needles that led to the breakthrough technology.

- [Likely, Theranos justified its early deception with the knowledge that many notable companies faked it til they made it. Microsoft sold software that didn’t exist until they made the sale. But this doesn’t work in medicine when patient health is dependent on things working.]

How was the deception allowed to continue?

It’s common for early stage startups raise money without a product. But typically, when they don’t show meaningful progress, their investors back out and they shut down.

How could Theranos continue its operations for over a decade when its product did virtually nothing it claimed?

In summary, it was a combination of [active deception by Theranos management] combined with [psychological biases preventing outsiders from pushing further for the truth].

- Active deception/lying by omission
  - To press and investors, Elizabeth embellished claims level of accuracy and number of assays that could be run on their proprietary machine.
    - In truth its accuracy was poor and it could run much fewer tests than claimed. They relied on third-party devices to run most of their assays, meaning Theranos was far less innovative than believed.
  - They ran fake demos for pharma partners when devices didn’t work live
- Requests from a Walgreens employee to run validation tests were dismissed
- Revenue projections to investors were vastly embellished by >5x
- Outsiders had the impression that devices were in the back of Humvees in partnership with the military, Theranos had plenty of secure partnerships with big name firms, and they were cash flow positive - Theranos naturally didn’t care to correct them
- They blocked regulators from accessing the room containing their new machines, misleading them into believing their third-party machines were the only ones operating

- Stretching limits of scientific legitimacy
  - To process microliters of blood on standard machines, they had to dilute the blood sample, which lowered the analyte concentrations below what the machines could support.
  - In coefficient of variation studies, deviant results were repeated until they got satisfactory results. Also, they used only the median values of 6 replicates, guaranteeing a tighter CV.
  - In quality control checks, outliers were inappropriately thrown out - basically a form of changing the answer to get what you want.
  - In sensitivity tests for syphilis, results that fell into an “equivocal zone” weren’t included in the calculations, letting Theranos widen the zone until sensitivity reached whatever number it wanted.
  - When running proficiency testing for clinical lab accreditation, they ran the samples on third-party analyzers instead of their Edison machines. The justification was that Edison’s technology was unique and had no peer group, so its results couldn’t be compared to the accrediting body’s machines.
  - These gray contortions of best practices let people sleep at night

- Dissent and doubt was quashed
  - Elizabeth to employees, multiple times: “This is the most important thing humanity has ever built. If you don’t believe this is the case, you should leave now.”
  - Non-believers were quickly fired for being disruptive, then bound by an NDA. Sycophants and order-followers were promoted
  - Theranos retained a powerful legal team that dissuaded dissent, and made a public show of punishing former employees. It was easier not to fight the moral fight and just leave quietly.
  - People in partnered companies with negative opinions (like a technology auditor at Walgreens) were removed from update calls for being disruptive to progress, further insulating the partnering company’s executives from the truth.
  - Former employees who were suspected of leaking bad information were threatened legally and monitored by private investigators.

- Information was kept opaque
  - Teams at Theranos were siloed in the name of security. Communication was stifled, internet access was monitored
  - New devices and lab spaces were kept under heavy security. Many people never had a chance to look at the device’s innards
  - Departing employees were bound by NDAs. Visitors to the building were bound by NDAs.
  - Only the best news were shared with team. Negative results were stifled

- Weird practices were explained away
  - Heightened security and siloing were justified by the paranoia that Quest Diagnostics and Laboratory Corporation of America were actively undermining Theranos; by their
supposed military work; and suggested that there was in fact something valuable to
protect.
- Any negative press could be blamed on the incumbents trying to block their disruptor.
- [Not publishing peer-reviewed papers was likely explained away as not wanting to publish
trade secrets for competitors to learn from.]
- People easily form their own conclusions, especially in support of their preexisting beliefs.

Elizabeth’s continuing charisma
- In 2008 the board decided she was in over her head and wanted to replace her as CEO. She
gave mea culpas, saying she promised to change and persuading them to relent. This never
seemed to come up again.
- To Tyler Schultz: “Elizabeth’s stirring speech made his budding concerns melt away.” her
strength of conviction and sincerity likely made many people overlook shortcuts in pursuit
of the larger goal.

Mental biases: FOMO/Sunk cost
- Walgreens couldn’t pull out despite reservations - it couldn’t risk CVS taking it if the
innovation proved real. It shouldered the money of the building out new clinics, and once
it got deep enough it couldn’t pull out
- Investing rounds were hot, so investors didn’t have a chance to pause for deep diligence. If
they did, they’d likely be excluded from the deal

Virtuous cycles and critical mass
- Once you have a critical mass of investors, press, and big-name supporters, it becomes
easier to attract more of all, leading to further entrenchment of opinion
  - First her professor Channing Robertson vouched for her, which got her early
    credibility. Then she got Donald Lucas on board; then she got George Schultz on
    board. Each of these people opened doors to their own supporters, who heavily
    trusted their judgment.
  - Likewise, Rupert Murdoch invested big money after seeing Cox Enterprises and
    Walmart’s Waltons invest as well.
- To reject Theranos as a fraud meant rejecting every pillar of strength - the investors,
  partners like Walgreens, AND its advisory board must not have done due diligence; the
  gushing press must be hoodwinked; government regulators must be ignoring the
deception; the data shown would have to be lies, which meant Elizabeth would have to be
a psychopath
  - It becomes easier to believe the naysayers must be wrong than to reject this entire
    monumental facade.
  - What is less obvious is that each card in the house of cards is built on each other;
    each pillar is not an independent vote of truth, but strongly dependent on what
    came before

How did the deception end?

- Theranos overreached in ambition, causing them to require
  - Elizabeth wanted to achieve the vision of a small device that did everything
(immunoassays, general chems, hematology, DNA). The form factor came before the underlying technology worked

○ They promised too much to Walgreens and had to deliver. This prompted them to cheat.
  ■ Why not wait until the miniLab was ready? Elizabeth: “When I promise something to a customer, I deliver.”

• Falling too far down the slippery slope of deception
  ○ Embellishing results in prototyping phase was somewhat acceptable. Lying about real patient data, which affected clinical decision making, crossed the line for many employees.
    ■ Many employees left; most stayed quiet due to fears of reprisal; some brave whistleblowers let conscience override fear, and they reported to regulators and reporters.
  ○ Doctors were increasingly furious about incorrect lab reports leading to inappropriate patient treatment. They cooperated with the reporting.

• The journalist who fought for the story
  ○ Despite continuing threats of litigation, harassment of his sources, and personal surveillance by private investigators, John Carreyrou pressed forward with his story, knowing it would be big. Arguably without his story, Theranos would have been allowed to persist for years longer, harming many more patients.

• Vicious cycle effects were as punishing on the downfall
  ○ Once the evidence of Theranos’s failure became clear, the flywheel effect worked in the opposite direction. Walgreens dropped the partnership; regulators fixated their attention on Theranos; the public lambasted her and the gullibility of Theranos’s supporters; sources readily reached out to reporters to share useful information; investors sued Holmes for fraud.

**Applying Charlie Munger’s 25 Psychological Biases**

Charlie Munger is famous for his 25 psychological biases. He noted that when multiple biases are in play simultaneously, a “lollapalooza” would happen leading to extremely distorted results. This is as true in Theranos as it is in cults.

As exercise, here’s a rundown of major biases that played into perpetuating Theranos’s fraud:

- **Reward tendency** - anyone who had a financial stake in Theranos clearly wanted it to succeed. This included its advisory board, investors, and employees.
- **Liking tendency** - Elizabeth Holmes was charismatic and seemed genuine. People wanted to follow her and execute her vision.
- **Disliking tendency** - Its supporters disliked incumbents like Quest Diagnostics and wanted to depose them.
- **Influence from mere association** - Holmes surrounded herself with powerful people, starting with Channing Robertson and going up to Rupert Murdoch and Henry Kissinger. Their prestige rubbed off on Theranos.
- **Social proof tendency** - Likewise, seeing other people support Theranos lowered the defenses of
new supporters. How could so many people be wrong?

- Overoptimism tendency - Holmes and Theranos supporters were overoptimistic about the technology, underestimating the amount of work needed to execute their vision.
- Availability misweighting tendency - You use what little data you have available. For Theranos, little technical data was released, meaning supporters had to draw only on the positive press that Holmes carefully cultivated.
- Inconsistency avoidance tendency - Once people publicly voted for Theranos, it was hard to backpedal. If they were wrong, they’d look foolish.
- Deprival superreaction tendency - Investors and partners couldn’t imagine losing their entire investment if Theranos were fraudulent. So they avoided the painful truth and doubled down, hoping for the best.
- Stress influence tendency - Employees who had a crisis of conscience were threatened by Theranos’s legal team, preventing them from assessing the situation fully and choosing to adopt the less risky path of keeping quiet.

Criticism of Bad Blood

Not enough is done to attribute the deception to Elizabeth Holmes. For much of the book, her romantic partner Sunny Balwani is cited as the direct cause of the most egregious violations, like the dilution protocols and submitting false info to regulators.

The most generous reading of this is that Elizabeth was insulated from the real world and was fed misinformation while other managers made bad calls. Sunny was a bad influence, and she was deceived.

While possible, this seems too convenient to be totally true. It’d be laughable to think the CEO of the company didn’t know its main invention wasn’t working and that its blood tests were being run on third party machines is laughable. I wouldn’t be surprised if Holmes intentionally outsourced her dirty work to Sunny so she retained plausible deniability.

I understand that Holmes gave little direct information to Bad Blood, and she might continue to be deluded. ( Shockingly, she’s reportedly raising funds for a new company. ) But I wish the book commented more on her motives and behavior. What really drove her? How much did she know about the company’s failings? We’ll have to wait to get to more of this.