# Lab Girl

## INTRODUCTION

### BRIEF BIOGRAPHY OF HOPE JAHREN

Hope Jahren was born in the small town of Austin, in southwestern Minnesota, to a professor father and a homemaker mother. As a child, she spent much of her free time in her father's laboratory at the local community college, and tending to the garden with her mother. She graduated from the University of Minnesota in 1991, going on to receive her Ph.D. in Soil Science at the University of California, Berkeley, in 1996. She has worked at the Georgia Institute of Technology, Johns Hopkins University, and the University of Hawaii; she now lives in Oslo, Norway, with her husband and son, where she works as a professor at the University of Oslo. Her memoir, *Lab Girl*, was published in 2016, while she was in Hawaii.

### HISTORICAL CONTEXT

Published in 2013, *Lab Girl* is set mainly in the late 1990s and early 2000s, as Hope Jahren was studying, and later researching and teaching science at the college level. While the number of women in science is slowly increasing, women are still in the minority in the field. While women earn more than half of all bachelor's degrees, they make up about 39% of degrees in the sciences and only 15% of engineering degrees at the undergraduate level. Those numbers decrease in graduate programs—women account for 24% of chemistry and 11% of physics Ph.D. degrees awarded—and in faculty positions, where only one in ten science professors is female. Jahren's anecdotes about systemic imbalances, lack of financial support, and mistreatment of working mothers are all supported by ongoing research by the National Science Foundation and the National Institutes of Health.

### RELATED LITERARY WORKS

*Lab Girl* has been compared to the work of Stephen Jay Gould and Oliver Sacks, whose popular science writing has effectively changed the way the general public interacts with the scientific world. However, the interweaving of science writing and personal struggle in *Lab Girl* brings to mind scientific memoirs like Neil DeGrasse Tyson's *The Sky is Not the Limit*, Mary Leakey's autobiographical *Disclosing the Past*, and Janna Levin's *How the Universe Got its Spots*. In addition, readers looking for women's voices in science might try the novels of Sy Montgomery, whose books *Search for the Golden Moon Bear*, *The Good Good Pig*, and *Soul of an Octopus*, as well as Helen McDonald's *H is for Hawk* and Juli Berwald's *Spineless*, all of which connect personal experience with scientific discovery.

### KEY FACTS

- **Full Title:** *Lab Girl: A Story of Trees, Science, and Love*
- **When Written:** 2010s
- **Where Written:** Hawaii
- **When Published:** 2016
- **Literary Period:** Contemporary
- **Genre:** Memoir, science writing
- **Setting:** United States and Norway
- **Climax:** Jahren finally sets up the very first Jahren Lab in Atlanta.
- **Antagonist:** Sexism in the sciences
- **Point of View:** First person

### EXTRA CREDIT

**Manicure Monday.** In November 2013, Jahren made a bold statement about women in science simply by posting a photo of her hands on Twitter. Seventeen Magazine posted a hashtag, #manicuremonday, requesting that young women post images of their manicured hands; Jahren posted a photo of her hands—clean but not manicured—holding a beaker in her lab. She used Seventeen's hashtag, of course, but added that her goal was to "contrast real #Science hands against what @seventeenmag says our hands should look like. All nails welcome." Her rebellion against this traditional image of femininity prompted many other women to post images of them working with their hands, manicured or not.

**More Than Just a Lab Girl.** In addition to writing a bestselling novel, Hope Jahren is one of the most respected scientists in the United States. She is one of only four people—and the only woman—to receive two Young Scientist Awards from the Geological Society of America. She has received three Fulbright fellowships for her research, and in 2016, she was named one of *Time Magazine*'s 100 Most Influential People.

## PLOT SUMMARY

*Lab Girl* is Hope Jahren's memoir, tracing her trajectory from a curious child in her father's **lab** to her career as a successful science researcher, wife, and mother. Jahren grew up in a small town in southern Minnesota, where she would spend her evenings playing in her father's science laboratory at the local community college. Even at such a young age, Jahren viewed the lab as a sanctuary, and felt more comfortable there than she did in her own home. She describes her family as distant and unemotional: Jahren and her father would walk home together

each night in silence, and her mother always seemed to be frustrated and angry. This frustration may have stemmed from the fact that the elder Mrs. Jahren was forced to drop out of college for financial reasons, returned to her hometown, got married, and raised four children.

Jahren admits that she felt like she needed to complete her mother's unfinished business, and so she attended the University of Minnesota, majoring in science. She worked hard in college, taking classes and studying during the day, and working at the university hospital all night. This round-the-clock activity was fueled partly by a desire to succeed, and partly by her chronic insomnia. After working at the hospital for a few months—where she was tasked with the painstaking work of filling intravenous bags with different medications—Jahren began to work in one of the science labs on campus, bringing her back to her most beloved space. Encouraged by her professors, Jahren decided to attend graduate school, and immediately after her graduation from the University of Minnesota, Jahren donated her winter clothing and got on a plane to California, where she began a doctoral program in soil science at the University of California, Berkeley.

Jahren met Bill, the man who would become her closest friend and research partner, on a field excursion to study soil in the Central Valley of California. As the graduate assistant on the trip, Jahren's job was to supervise the work of the undergraduate students, and answer any questions they had. When she noticed that one of the students would consistently work on his own, digging his own hole separate from the others, she checked in on him, and almost immediately recognized a wit and intelligence similar to her own. She secured him a position as an assistant in the lab, and the two began a working relationship that would last for their entire professional careers. More importantly, they developed a profound platonic bond that went far beyond the relationship that either of them had with their own families. Later on, when Jahren introduced him to Clint, the man she had fallen in love with and married, Bill was initially reluctant to accept this change to his social world; however, the three of them quickly developed an easy, symbiotic relationship.

Jahren finished her Ph.D. in 1997, the same year that Bill received his bachelor's degree. She had applied early to faculty positions, and was hired to teach at Georgia Tech immediately after graduation; it did not take much effort to convince Bill to join her as her lab assistant. In Atlanta, Jahren was overjoyed to finally achieve her dream of running her own research lab, but also stressed and overworked from the competing demands of research, teaching, and the constant search for funding. She explains that scientists live off of a three-year funding cycle, and there is not nearly enough grant money to fund every researcher, so the competition is fierce and the pressure for success is intense. Jahren admits that she ate very little, rarely showered, and spent most of her time working; Bill literally lived in the lab for a time, wearing "pajakis" (a t-shirt and khakis as pajamas) in case a secretary or custodian happened upon him, so that he could use the excuse that he was working late and had simply fallen asleep.

Meanwhile, what had previously seemed like a combination of nervous energy, stress, and anxiety had transformed into bipolar disorder, as Jahren suffered the intense highs of manic episodes and the crushing lows of the depression that followed them. Fortunately, Jahren was able to find a doctor who started her on medication that helped to balance her mental state.

Jahren and Bill threw themselves into their research, garnering bigger and better grants, but they also had a lot of fun along the way. Jahren tells the story of their field excursion for a soil science class, which involved a gourmet dinner of Hungarian dumplings at 3 A.M., and was topped off with a visit to Monkey Jungle, where the group could see themselves reflected in the primates in the enclosures. She and Bill also established a ritual of visiting a particular tree stump, where Bill regularly stashed his hair whenever he cut it. This led them to co-write a strange yet intriguing children's book called *The Getting Tree*, about a tree that cannibalizes a young boy. As each other's closest friend, Bill and Jahren consistently accepted each other for all of their faults, peculiarities, and shortcomings. Bill moved with Jahren to Johns Hopkins, where they set up another lab, and where Jahren would eventually meet and marry Clint. While she was pregnant with her son, she had to stop her medication regimen, and soon ended up in the hospital, in the throes of depression. What's more, Jahren found herself banned from her own laboratory during her maternity leave—her safest and most comforting space—by her department chair, deeming her a liability.

Once her son is born, Jahren begins to gain some balance in her life. She is able to manage her bipolar disorder by resuming her medication, and begins to enjoy the novelty of motherhood. After her experience being banned from the lab at Johns Hopkins during maternity leave, Jahren, Clint, and Bill all move to Hawaii to work at a university with a more positive view of women in science.

When her son is young, Jahren receives a Fulbright fellowship and the family moves to Norway for a year; this gives her an opportunity to reflect on the peculiarities of her childhood, Scandinavian culture, and even her role as a working mother. When Bill's father dies, Jahren knows that words of condolence are not enough, and she buys him a flight to Ireland—he has been back in Hawaii, running the lab while she is in Norway—and they mourn and grow together in the way that only they know how to do, by digging in the dirt.

## CHARACTERS

**Hope Jahren** – The author and narrator of *Lab Girl*, Hope

Jahren is an award-winning paleobiologist and research professor. She conducts her research with her **lab** partner, Bill, whom she met as a graduate student and with whom she has a close, platonic relationship. Jahren grew up in a small town in southern **Minnesota**, where she was a precocious student, graduating high school a year early to study science at the University of Minnesota, going on to receive her doctorate from the University of California, Berkeley, and then immediately taking a teaching position at Georgia Tech. While Jahren has had a very successful professional career, she discusses the sexism inherent in the male-dominated field of science, and the personal and systemic obstacles that she had to overcome. For example, in response to mistreatment by her department chair at Georgia Tech during her pregnancy—she was essentially banned from her own lab while pregnant with her son, as her male colleagues deemed her a liability—Jahren and her mathematician husband Clint left in search of a more inclusive workplace, taking up positions at the University of Hawaii. She also writes about her struggles with mental illness, covering some of her earliest symptoms of anxiety and bipolar disorder, describing a manic episode in minute detail, and discussing the medical treatment she finally received. Overall, Jahren is open and honest, giving readers a glimpse into the personal side of a brilliant scientist, and demonstrating that even very intelligent and successful people are prone to self-doubt, mistakes, and fear of failure.

**Bill** – Bill is Hope Jahren's **lab** partner and closest friend. The two met when Bill was an undergraduate at the University of California, Berkeley, and Jahren was a graduate student, assisting on a field trip through the Central Valley of California. Bill is a loner, and Jahren would consistently find him on the fringes of the group of students, conducting fieldwork on his own. The smartest student in the class and a tireless worker, Bill was soon hired to work in the lab with Jahren, where they quickly developed an excellent working relationship. Despite their closeness, however, Jahren notes that Bill remained something of a mystery to her for a long time: she did not know where he lived, for example, and when he made vague comments about his childhood, she was left to wonder. Later on, Jahren would meet Bill's father, an Armenian filmmaker who produced documentaries about the genocide in his homeland, and would learn that a childhood injury to Bill's hand—resulting in the loss of a finger—left him feeling like an outsider throughout his adolescence. Bill did not attend his senior prom, and somehow Jahren convinced him to dance for the very first time on a remote island in the Arctic, where they were working on a research project. Bill and Jahren trusted each other implicitly, and Jahren mentions that she was amazed at the depth of his loyalty to her. When she got her first position after graduate school, Bill moved to Atlanta with her, sleeping in his van or in the lab at night because he could not afford a place to stay. He moved with her to Baltimore, to work at Johns Hopkins, and again to Hawaii. Although Bill was initially uncomfortable with Clint, they became fast friends, and Bill, Clint, and Jahren functioned as a happy, albeit nontraditional, family unit.

**Clint** – Clint is Hope Jahren's husband, a mathematician who also works at the University of Hawaii. The two met at a party in Baltimore, while Jahren was working at Johns Hopkins University. After they got married, they returned to Baltimore, where Jahren introduced Clint to Bill, the other important man in her life. Although Bill had met many of Jahren's boyfriends in the past, he had never taken much interest in them; he was hesitant to accept Clint, but when Clint offered to let him drive to Fort McHenry, Bill relented. Jahren, Bill, and Clint attended Family Day, symbolizing the unconventional family relationship they would develop over time. Clint is portrayed as balanced and thoughtful, and very loyal to Jahren. When Jahren is pregnant with their son, her department chair decides that Jahren cannot be present in her own **lab**, deeming her a liability. Instead of relaying this message himself, the chair sends Clint—who is a math professor at the university—to speak with Jahren, who is understandably upset. But unlike Jahren, Clint does not raise his voice or fight the chair's decision; instead, when the time is right, he and Jahren quit their jobs at Johns Hopkins and take up positions at the University of Hawaii, where the find their colleagues more understanding and inclusive. Throughout the last third of Jahren's memoir, Clint is a constant background presence, keeping his wife balanced and grounded.

**Jahren's Father** – Jahren's father is the source of her first experiences in science: she spent nearly every evening of her childhood in her father's science **lab**, at the local community college where he worked. He let her play with all of the supplies and instruments in the lab, and she helped him set up for the next day's class. Afterwards, they would lock up the building, walking down the empty hallways in a way that made young Jahren feel like she owned the place. They would then walk home in silence—Jahren notes that being silent was what her family did best. Her father had grown up in the small town in southern **Minnesota**, and had taught science to students who would eventually become the teacher's in Jahren's school. After she leaves home to attend the University of Minnesota, Jahren does not mention her father again, except for a vague reference to a phone call about the death of her favorite tree; she also mentions that no one attended her graduation when she received her doctorate. While he was an inspiration for Jahren as a young girl, her father does not seem to have played a big part of her life as an adult.

**Jahren's Mother** – Jahren dedicates *Lab Girl* to her mother, yet notes in the memoir that the two women had a strained relationship. Jahren's mother was also intelligent and interested in science at a young age, and she won an Honorable Mention for a national science prize, but that was not enough to get her a scholarship to the University of Minnesota.

Determined to attend anyway, the elder Mrs. Jahren worked long hours to afford college, but ended up dropping out and returning to her hometown, getting married, and raising three children. She spent time with Jahren, tending her garden, and studying for a correspondence degree in English Literature—Jahren recognizes that she inherited her mother's tenacity, as well as a love of reading and writing. When Jahren goes off to college, she feels that she is fulfilling her mother's frustrated ambitions, and whenever she encounters bumps along the road to success in her career, Jahren expresses fears that she will end up like her mother, a failed academic, raising for children at home.

**Jahren's Son** – Before her son was born, Jahren was worried that she would not be able to give a child all of her love; however, she adores her son, and he has changed her outlook on parenting. After a grueling pregnancy that involved hospital stays and electroconvulsive therapy (she couldn't take her bipolar medication during pregnancy due to health risks for the baby), Jahren delivered a healthy nine-pound baby boy, whom she immediately fell in love with. Her son is different from her in many ways: he uses his favorite tree, the foxtail palm, for batting practice rather than scientific inquiry, and is more emotionally balanced like Clint, while Jahren is more emotionally tumultuous.

**Jahren's Brothers** – Jahren refers to her older brothers only to mention that she hardly noticed when they left home for college, because they hardly spoke to her when they lived at home. Growing up, Jahren's family life was fairly cold and detached, a sharp contrast from the emotional warmth and closeness Jahren later shares with her husband, Clint, and her **lab** partner, Bill.

**Walter, the Department Chair** – When Jahren was working at Johns Hopkins University, she and Clint had a baby. While she was pregnant with her son, her department chair banned her from her own **lab**, citing liability issues related to her pregnancy. Jahren was irate, and years later, she and Clint moved to Hawaii in search of a more inclusive set of colleagues.

**Teri** – One of the undergraduate students in her **lab** at Georgia Tech, Teri agrees to join the group on a trip to California to get Jahren to a conference in San Francisco. She is the one driving the van as they come upon a winter storm (the group is crunched for time and thus can't avoid it). Since she has little experience driving in inclement weather, Teri ends up flipping the van upside down, forcing the group to spend the night in a motel. Scared and angry, Teri demands to be taken to the airport so she can fly home, and Bill berates her for her lack of loyalty, reminding her that *she* was the one who crashed the van in the first place. She stays with the group the whole time, and is back to her usual self by the time they return to campus.

**Ed** – Ed is an older professor and science researcher who is very close to retirement. He was a friend of Jahren's dissertation advisor, and she considered him like an uncle to her. After she set up her own **lab**, she ran into Ed at a conference, where he ended up offering to let her take all of his old supplies from his lab, as they would just be thrown out. She and Bill rent two U-Hauls to bring the supplies back to their lab, and are thankful for all of the money they have saved.

## THEMES

In LitCharts literature guides, each theme gets its own color-coded icon. These icons make it easy to track where the themes occur most prominently throughout the work. If you don't have a color printer, you can still use the icons to track themes in black and white.

### LIFE CYCLES

In essence, *Lab Girl* is a coming-of-age story, following Hope Jahren's intellectual and personal growth from her childhood in rural **Minnesota** to an adulthood spent in science **labs** in Hawaii. What is most notable about this memoir is that plants take center stage, as living beings that are just as important as humans. She uses the life cycle—both plant and human—to structure the book, and the different phases of the life of plants serve as metaphors for the milestones in her own life. The memoir itself is separated into three major sections, titled "Roots and Leaves," "Wood and Knots," and "Flowers and Fruit," all corresponding to different phases of Jahren's life. Ultimately, Jahren's memoir argues that people and plants aren't all that different, and that through a careful study of plants and their life cycles, people can actually come to better understand themselves and the people around them.

From the outset, Jahren illustrates that plants and humans are more similar than they may appear. In the first section of her memoir, aptly titled "Roots and Leaves," Jahren explores her own roots—her childhood—and how she grew into a science professor, clearly linking her early years to that of a budding plant. Jahren focuses on beginnings by explaining that "every replete tree was first a seed that waited." This process is not unlike Jahren's childhood in Minnesota, as she spent countless hours in her father's laboratory, mentally preparing for the day when she too would conduct her own experiments. She compares a plant's inclination towards sunlight to her choice to pursue science because it offered her the intellectual nourishment she needed to survive. She then moves on to the risk-taking phase of plant life, when a root must anchor itself into the ground, ending "mobile phase" during which it had the opportunity to seek out more fertile soil or better conditions. In a parallel process, Jahren took a number of academic and personal risks to establish herself as a scientist. Not unlike the seed that takes root and begins to grow into a tree, the

successful Ph.D. student riskily stakes her claim and waits patiently for her work to catch on. Jahren also describes her first professional experiences in the context of plant competition, in which each plant must work harder than its neighbors to access light and water, their essential resources. She discusses how some of the most successful plants are able to prosper by traveling far from where they began their lives. When she notes that the *ferrissii* plant is found from California to Georgia, she compares this cross-country travel to that of a "newly minted Ph.D. moving to a sprawling technical university" in order to establish her own lab and begin her professional career. Like the *ferrissii*, Jahren spends much of her youth competing with herself and others to find the right place to take root and grow.

Jahren further conflates plant life cycles with that of humans in "Wood and Knots," as she moves on to her professional life, with its mixture of intense intellectual and personal growth—the wood—and embarrassing failures and frustrating obstacles—the knots. Jahren moved to Atlanta in 1996, when "every kind of growth seemed possible," to begin her career at Georgia Tech. During this section, she discusses the budget of a research scientist by detailing the "budget" of a deciduous tree—that is, its quota of leaves that can receive sunlight. Like a scientist vying for one of very few national grants to support her research, the deciduous tree "has no alternative to succeed this year, and every year after" if it is to survive the competition for valuable resources. During her time at Georgia Tech, Jahren likens herself to both a kudzu vine and desert cactus—she was "hopelessly ambitious" like the vine, even in the face of "life-threatening stresses" like the cactus. Jahren's life was conspicuously unglamorous: in an attempt to get ahead in her work, she rarely showered, subsisted on protein drinks, lived in a trailer on the outskirts of town, and later in an apartment that she dubbed the "Rat Hole." While she had achieved her dream of creating a functioning lab with her name on it, her life was a series of hidden struggles for survival. With the help of her study of plants, however, Jahren is able to place this period of her life in perspective, as time when she had to flourish professionally, even with little to no nourishment.

In "Flowers and Fruit," Jahren seems to find her way, both personally and professionally, ushering in an immensely productive period in her life. Her study of plants seems to have helped her understand the cycles of her own life and allowed her to reflect on her roles as a research scientist, wife, and mother. Jahren prefaces one of her research trips to Northern Canada by discussing a tree's process of "hardening" in order to survive the cold of winter. Her own hardening process is a method of shielding herself from the disdain of her fellow researchers on the trip, whom she believes will never consider her a true scientist. She has learned to ignore those who doubt or discount her, instead focusing on her work and the lessons it offers her. Also during this section, Jahren discusses the sexual reproduction of plants as a lens through which to see her relationship with her husband, Clint, but it is her discussion of growth patterns in adult plants that provides the key to her adult life. When she notes that the creation of "the new generation comes at a significant cost to the parent," she is largely reflecting on the son she will carry at great risk to her mental health, given her struggles with bipolar disorder. Throughout Jahren's memoir, it is clear that observations of trees and plants have given her the kind of perspective she was not able to glean from other people. As she notes, her scientific work has taught her that "everything is more complicated than we first assume," referring equally to the complex set of growth processes within a tree, and to the mysterious psychological development going on within each person.

## WOMEN AND SCIENCE

Jahren struggles to integrate her roles as a woman and as a scientist, announcing at one point in her memoir that "the realization that I could do good science was accompanied by the knowledge that I had formally and terminally missed my chance to become like any of the women that I had ever known." Criticizing the scientific sphere for its marginalization of women and lamenting the lack of female role models in her professional world, Jahren is forced to create her own image of what a female scientists is, and how to balance that with the expectations of her as a working wife and mother.

Jahren describes her **lab** as a refuge from "the professional battlefield" of the highly competitive world of science research. This relationship with science presents a double-edged sword, as the scientific community can be harsh and unforgiving for women, yet Jahren feels most herself within the concrete and unambiguous work housed in the science lab. As a young girl in school, Jahren admits that while she did not understand why, she longed for the praise and attention of her female teachers. Yet she was also frustrated by the requirements placed upon her: she was prohibited from reading ahead, and was punished when she did not speak or act "nicely." In contrast, she describes her first experiences in the science classroom as positive, "despite the fact that I was just a girl." This sense of gender-blindness would unfortunately later give way to recognition of the myriad microaggressions towards women in science as she moved up the ranks. By the time she received her Ph.D., Jahren was aware that the hardest work—getting a job as a professor—was ahead of her, and that being a woman in the male-dominated science world would not be an advantage. She notes that she applied for teaching positions well before finishing her degree, knowing that she would need to be "at least twice as proactive and strategic" as a male scientist with the same degree. As a professor at Georgia Tech, Jahren learns that as a female academic, she is being scrutinized from every angle: through the walls of her office, she can hear other faculty

members discuss her sexual orientation and rate her physical attractiveness in relation to her fellow female professors. Her early dating attempts are equally difficult, as potential mates are uninterested in her research and put off by her work ethic. Just as Jahren had little experience with female scientists, the men around her often regarded her as a strange and unsettling creature.

While her youth spent in her father's science lab helped to lay the foundation for Jahren's career as a botanist, her relationship with her mother provided a more complex and deeper form of motivation. Jahren's discontent with the traditional image of motherhood and family—as modeled by her mother—helped Jahren place her own professional success at the center of her world. Jahren's mother was exceptionally intelligent, but despite receiving a partial scholarship to attend the University of Minnesota in 1951, it was nearly impossible for her to graduate because "the university experience was designed for men, usually men with money." As a young girl, Jahren witnessed her mother return to school, absorbing the mental toughness that comes from balancing studies with full-time motherhood. As an adult, Jahren is single-mindedly focused on the pursuit of science, claiming that working in a laboratory saved her life, keeping her from "having to drop out and from then being bodily foreclosed upon by some boy back home." Her dreams are the complete opposite of the domestic fantasy of many young girls, as she understands that she would resent having to cut short her ambitions. Despite the many lonely moments that accompany her path to success, Jahren is convinced that this is infinitely preferable to a life like her mother's. During her Ph.D. research, Jahren is struck by a sense of loneliness, as she has no one to share her successes with. After one long night of research, she begins to cry from the realization that she was "nobody's wife or mother" and "nobody's daughter." While she does eventually build her own family, Jahren is resigned to the loneliness inherent in her ambition, and the pangs of regret that will accompany many of her greatest successes.

Jahren uses her own experience of pregnancy and fighting to hold down a job to further criticize the misogyny that the sciences are still steeped in. Without female role models to look to, Jahren is forced to forge her own path, tenaciously defining herself as both a scientist *and* a mother. As Jahren prepares to be a mother, she writes, "I am supposed to celebrate the ripening fruit of love and luxuriate in the fullness of my womb," and contemplates her inability to do so. Feeling disaffected by the ill-fitting images of motherhood that are forced upon pregnant women, Jahren rebels in her own highly intellectual way, determined to have her family life conform to her professional needs rather than the other way around. During Jahren's pregnancy, she finds that she is effectively banned from her own lab by Walter, the chair of her department. Angry at being expelled from the most important space in her world on the sole basis of being pregnant, Jahren can only lament the fact that "half these guys are drunk in their offices," yet *she* is considered the liability. This experience of blatant misogyny leads Jahren and her husband, Clint, to leave the university and re-establish the Jahren Lab at an institution with a more enlightened view of women in the workplace. While working on an experiment in the lab with her best friend and research partner, Bill, Jahren glances at the clock and notes casually that her son should be asleep by now, challenging of the assumption that working mothers will also take full responsibility for the child rearing, as well. This point is important, as Jahren will be the role model she never had as a child, and she has a chance to combat the unreasonable expectations that cause many women to give up on their dreams.

At the age of five, Jahren came to understand that she was "less than a boy," unable to enjoy the same freedom, wild experiments, and dangerous play that her brothers did. She was more like her father than anyone in the family, yet he also "looked just like a scientist was supposed to," while she was only a scientist on the inside. *Lab Girl* seeks to realign that narrow and limiting image of scientists with the reality of a changing landscape of students, faculty, and researchers in academia.

## FAMILY AND FRIENDSHIP

Jahren's studies and scientific research take her far from her home in rural **Minnesota**, and while she experiences long stretches of social isolation, she eventually creates her own—albeit nontraditional—family that is firmly rooted in her love of science. In this way, *Lab Girl* emphasizes the importance of chosen family, implying that a nontraditional family can be just as supportive and emotionally nourishing as a traditional one, if not more so.

Jahren's childhood in rural Minnesota sets the stage for her emotional distance from her family and friends: she comments that the "vast emotional distances between the individual members of a Scandinavian family are forged early and reinforced daily." She notes that she knows little of her ancestors beyond the fact that they arrived from Norway in the late nineteenth century, and rarely saw her extended family members during her childhood, even the ones who lived in the same small town where she grew up. Jahren writes that her family's strong suit was "silent togetherness"—like how every evening she and her father would walk two miles from his **lab** to their home in silence. Many of the families in her small town had lived there for generations, and Jahren notes that it was only when she was older, and left home for larger urban areas, that she realized that the world was populated by people she did not already know. Yet warmth, affection, and emotional openness were not culturally appropriate in Jahren's hometown, and Jahren's memoir implies that she didn't maintain close relationships with many people she grew up with. She even comments that she hardly noticed when her

three older brothers left home, as she rarely spoke to them when they lived in the same house.

Within this context, Jahren strikes up a friendship with the one person who seems less socially adept than she is; she first notices Bill in a field research trip, where he is perpetually "several meters away from the edge of the group, digging his own private hole." The deep, platonic relationship that they develop is built on a foundation that combines a love of science and intense social awkwardness—the beginnings of a chosen family that is more supportive and fulfilling than the family she's grown up with. Jahren and Bill began to seek each other out, sharing space along the margins of any social situation, maintaining a comfortable silence that may have reminded Jaren of her quiet evening walks with her father. When Bill arrives in Atlanta to join Jahren and help her build her own science lab, she recalls "the deep and simple happiness that comes from not being alone." Jahren and Bill's friendship changes only slightly when Jahren meets Clint, who will become her husband and the father of her child. At first, Bill is uncomfortable with Jahren's new relationship, especially as she and Clint show up on his doorstep, proclaiming that they are now married. According to Jahren, however, Clint ensures a smooth transition to this new situation by handing Bill the keys to his car, and the three of them enjoy Family Day at Fort Henry. She notes the significance of the so-called Family Day with no irony: Bill and Clint are her chosen family, the people who keep her safe, sane, and happy, even if they do so in different ways.

When Bill's father dies, Jahren is living in Norway and can only communicate her support for Bill from a distance, which translates to a string of unanswered emails and texts. Hoping to connect with him in the way that only she can, Jahren buys Bill a ticket to Ireland, meets him at the airport, and the two embark on a multi-day field trip through the countryside to collect soil samples. But as they have not secured the paperwork to take the samples they have collected back to the United States, they bring back only their field notes and the shared memory of the experience. More than the scientific value of the trip, however, is Bill's realization that family structures change, and while he had lost his father—who played an important role in his young life—he was not alone. Jahren's gesture ensured that Bill recognized their familial bonds, as she was there to help him grieve.

Jahren's line of work can be painfully isolating, as she spends more time surrounded by plants in the lab than she spends interacting with other human beings. That, coupled with a childhood that discouraged warmth and closeness even between family members, would suggest dismal outcomes for Jahren's social connections. Luckily, this was not the case; Jahren's infectious enthusiasm for scientific research brought her into contact with kindred spirits, giving her the opportunity to share her life's work with a true professional and platonic partner, as well as a romantic one, crafting for herself a nontraditional, chosen family.

## DEMYSTIFICATION OF SCIENCE

Jahren begins her memoir by directing herself to her readers, asking them to look at the world through the eyes of a scientist, and leads them through the process of observation and hypothesis, two central elements of the scientific method. By beginning the story of her path towards the highest echelons of the academic world with an assurance to each and every reader that "*you* are now a scientist," Jahren immediately democratizes the profession, allowing anyone with interest and dedication to enter the world of science.

Jahren makes a concerted effort to humanize the scientific process and the people involved, debunking the image of scientists as a unique group of superior minds. One of Jahren's underlying arguments is that anyone can be a scientist, and she makes that statement directly in the book's prologue, noting that some people "will tell you that you have to know math to be a scientist, or physics or chemistry. They're wrong." As a woman, she has a vested interest in eroding the traditional image of science as an elite club for men, for the especially gifted, or for those with enough money to pay their way through college. She describes her earliest science experiments as a form of child's play, like using pH testing tape to distinguish between spit, water, root beer, and urine. She describes the tools of the trade, so plentiful in her father's community college **lab**, as "serious things for grown-ups," but her childlike terminology belies the playful nature of the experience. However, personal experience has shown Jahren how easy it can be to fall into the trap of separating and elevating scientists and their role in the world. For example, at one point she distinguishes a "true" scientist as one who no longer performs others' experiments, and instead "develops her own and thus generations wholly new knowledge." This, she notes, is what often weeds many otherwise bright people out of Ph.D. programs. The promise of acceptance into that elite club is enticing yet dangerous, and underscores the importance of the larger work Jahren does in her memoir by humanizing herself and those she works with.

Overall, however, Jahren is almost more comfortable acknowledging her mistakes than her successes, an openness that further demystifies science and makes it more approachable to readers. Jahren notes that the most important thing she has learned about science is that "experiments are not about getting the world to do what you want it to do," and that multiple failures are simply a part of the learning process. One summer of field research that did not provide her with the data to support her original hypothesis, for example, was proof that her "future career was unraveling," complete with an image of herself returning to her hometown to work in the

slaughterhouse for the rest of her life. Jahren demonstrates the ways in which the image of the omniscient and infallible scientist can impede progress, as young researchers focus on their mistakes and not their successes. In baring her mistakes—and her ability to recover from them—Jahren emphasizes that all scientists are human, and that science requires mental toughness and perseverance—not perfection. Her final days as a Ph.D. student were spent in her lab, blowing glass and filling it with carbon dioxide gas for use in the mass spectrometer, a highly repetitive process that also requires intense concentration. One night after losing focus for a minute, Jahren allowed her glass ball to overfill with carbon dioxide gas and shatter everywhere, temporarily deafening her but leaving her otherwise unscathed. She berates herself for the mistake, telling herself that this is a sign that she is not a scientist, because they "don't do things like this. Fuck-ups do things like this." However, as the rest of her memoir shows, mistakes like these don't actually strip her of her status as a scientist—all scientists make mistakes. As an established scientist with numerous publications in respected journals, Jahren takes care to acknowledge the ups and downs inherent in even the most successful research. She explains that those publications, with their portrayal of a smooth process from hypothesis to conclusion, "perpetuate a disrespectful amnesia against the entire gardens that rotted in fungus and dismay, the electrical signals that refused to stabilize," and a variety of other mishaps along the way. Science, Jahren informs her readers, is messy and imperfect, despite scientists' best efforts to display only the refined version.

Jahren also demystifies science by highlighting the unglamorous, incessant, and often frustrating search for funding that rules the world of science research. Even well into her career, Jahren was chasing a rapidly shrinking pot of money to fund her work, even going so far as to ask her readers to "please give me a call" if they were interested in financially supporting the sciences. One strategy was to pitch research projects that she knew the National Science Foundation would be more likely to fund. For example, she worked on an NSF-funded grant related to forensic analysis and anti-terrorism, on the wisdom that "science for war will always pay better than science for knowledge." Her plan, of course, was to use the generous funding to work on both the forensic analysis project as well as her own work in plant biology. Jahren goes into the intimate financial details of a career in science, taking what appear to be huge amounts of grant money and chasing it down to the last penny. The 2013 budget of the National Science Foundation for paleobiology, for example, was $6 million, a number so large that it is difficult to imagine, yet Jahren notes that this money must be spread across the entire country, to each deserving paleobiologist, bringing each researcher's contract to somewhere around $165,000. Taking into account the salary and benefits of a full-time lab manager, taxes, chemicals, equipment, student help, and travel for conferences and workshops, Jahren illustrates how there is very little money left. In underscoring this bleak reality, Jahren dismantles the idea that scientific research is glamorous and lucrative. Like many other jobs, money is always an issue.

*Lab Girl* presents a very different image of both science and scientists, helping to reshape a field that for centuries has been dominated by privileged white men. While on the surface, this memoir is simply the story of Jahren's life and profession, it is also a treatise on a rapidly changing world, which will help to change her readers' ways of thinking about the role of science in the world.

## MENTAL ILLNESS AND TREATMENT

Jahren is honest and forthcoming about her mental illness, describing the effects of bipolar disorder with honesty and humor. This candid self-portrait of a highly educated and successful woman living with mental illness goes a long way towards ending the stigma surrounding mental health. This is particularly important in her field, where scientists are expected to be unemotional and clinical, separating their personal selves from their methodical, objective experiments While Jahren does not portray herself as an activist, she conducts important work by normalizing bipolar disorder, and ultimately stressing the trifold need for awareness, action, and (in her case) medication.

Just as she demystifies science, Jahren also works to demystify bipolar disorder by outlining her early symptoms in the hopes of raising awareness and opening up the conversation about mental illness. There were some early signs of bipolar disorder in her young life: As a college student, Jahren notes that she had endless energy, "which seized me in ferocious spurts, keeping me awake for days at a time." At that point, however, those early signs were easy to brush it off as youthful buoyancy, intellectual energy, and intermittent sleeplessness, and would only later become a cause for concern. She recognizes that something may be wrong when, months after she begins her faculty position in Atlanta, she finds herself at baggage claim in the airport and cannot recall how she got there. She admits that this has been happening frequently, but her concerns are brushed aside by her doctor, who simply blamed it on the stress of her job. This only exacerbates the problem by putting more pressure on Jahren to resolve her mental health issues without medical help. And although she is able to infuse many of her mental health struggles with humor, Jahren is aware of the potentially detrimental effects of her manic episodes. For example, her insistence that she, Bill, and their lab assistants drive cross-country, through a major snowstorm, to a conference resulted in a near-death experience on a highway en route to California. This was one of many signs that Jahren should not allow her bipolar disorder to go unchecked.

Besides highlighting the need for awareness surrounding mental illness, Jahren also stresses the importance of taking

action—for her, this meant finding the right doctor and the proper medication. Jahren first takes action by finding the right doctor, who tells her that she does not have to continue suffering as she has in the past. Noting with humor that she is not "afraid of anything made in a **laboratory**," Jahren gratefully accepts the medication that will keep her moods in balance for much of her adult life. She emphasizes that the medication is truly needed, as it will help her refrain from chewing on her hands and banging her head against the wall. She then returns to the question of the management of her illness when she is pregnant and consequently unable to take her medication. She explains that from the moment she knows she is pregnant until week 26, when the fetus is sufficiently developed, she "cannot take Depakote or Tegretol or Seroquel or lithium or Risperdal," all medications that are necessary to manage her mental illness. She compares the immediate cessation of medication to standing on the railroad tracks, waiting for the train to hit, as she fully expects to experience at least one major manic-depressive episode during the first six months of her pregnancy. While a doctor announces to a group of medical student that this patient "has a severe risk for postpartum psychosis," Jahren beats the odds and manages to maintain her mental health in the period after having her son. It is only with the help of others—doctors, friends, and her very supportive husband—that Jahren is able to strike a balance in her life.

While discussing the history of Arctic ecosystems, Jahren explains that they are "better characterized as 'resilient' than 'stable'"; Jahren herself embodies this distinction between stability—something she probably would have had, but never wanted, back in her small town in **Minnesota**—and resilience. Her mental illness is a part of her life, for better and for worse, but it is not something that she has to hide out of shame or fear. While Jahren has never suggested that this was her objective, her honest portrayal of living with, managing, and even thriving with bipolar disorder helps to normalize it within society, taking mental illness out of the psych ward and into the highest levels of academia.

## SCIENCE VS. LITERATURE

In *Lab Girl*, Jahren combats a traditional misconception about her field of study—that scientific thought is somehow separate from and in opposition to the study of literature. For her, science and literature are deeply connected, and scientists are every bit as enthralled by the written word as their counterparts in the humanities.

As an avid reader, Jahren mentions the influence that books have had on her daily life, and the connections she made between what she was reading and the scientific world around her. Jahren's reading of *David Copperfield* was deeply influenced by her experience working in a hospital—or perhaps, to the contrary, her work in the hospital was influenced by her reading of the novel. It was only after her first shift at the hospital that Jahren decided on the topic for her English literature term paper: "The Use and Meaning of 'Heart' Within *David Copperfield*." Her first pass through the novel revealed hundreds of uses of the word, and Jahren was overwhelmed by the project until she connected the heart metaphors to the things she saw in the hospital. She would memorize passages during the day, and as she made her way around the hospital floors at night, the words would come alive for her, giving the novel a deeper and more complex meaning. This allowed her to "go home and write pages and pages" after her shifts, as her subconscious had made the necessary literary connections while she worked. As a graduate student, Jahren was no longer taking literature courses, but continued to explore literature—and the profound analytical questions that it inspires—on her own. On her first field trip to central California as a graduate assistant, Jahren was reading a biography of Jean Genet, who had fascinated her for years. She notes that she felt Genet was an "organic writer," using a term that would not be out of place in a scientific work. Jahren was engaged in the book beyond the level of leisure reading, as well. She recalls being "obsessed with trying to figure out how Genet's early life had destined him for success," using literature to search for answers with the same tenacity she displays in her science research.

Jahren's mother would include the young girl in her adult studies in English literature, which helped Jahren to see the inherent value of literature as equal and even complementary to the study of science. Young Jahren helped her mother use a Middle English dictionary, sifted through symbols in *Pilgrim's Progress*, and was exposed to the poetry of Carl Sandberg and the essays of Susan Sontag. While Jahren would not describe them as having a strong mother-daughter bond—she recalls that their relationship "felt like an experiment that we just can't get right"—her mother taught her to nourish her body and mind through the work of gardening and reading. Most importantly, however, Jahren's mother taught her that "reading is a kind of work, and that every paragraph merits exertion." This forms the foundation of Jahren's thirst for knowledge of all kinds. For her, the mysteries of science and literature are not in conflict, as they are for some scientists; they are simply two sides of the same coin.

Jahren's love of literature even boils down to the words she uses in her scientific research, as she notes that no one "in the world agonizes over words the way a scientist does." Words are more than just a vehicle for disseminating information—they convey the exactness of scientific knowledge, and emphasize the smooth and logical transition from hypothesis to conclusion. As a scientist who is dependent on grants to fund her research, Jahren makes it clear that words are the tools of her trade just as much as the beakers and mass spectrometers in her **laboratory**. She describes the process of funding a new

project, portraying herself as a kind of salesperson for the grant world: "I cook up a pipe dream, embellish it until it is borderline impossible, pitch and sell the idea" with a well-written grant application. Once they have completed the work, Jahren returns to the written word to promote their success in their final report. In contrast, *Lab Girl* does away with the manipulations required of Jahren's science publications, allowing Jahren to present herself, and the science research she conducts, more honestly. She points to one of her personal reasons for writing this memoir when discussing the "streamlined beauty" of her scientific publications, which she describes as a mannequin, designed to "showcase the glory of a dress that would be much less perfect on any real person." *Lab Girl* is Jahren's way of communicating the imperfections and frustrations inherent in science research, and to give readers a more realistic view of her world. When reflecting on her favorite tree from childhood, which her parents had to chop down many years after she left home, Jahren notes that she learned that "carefully writing everything down is the only real defense we have against forgetting something important that once was and is no more, including the spruce tree that should have outlived me but did not." As Jahren examines the clues that plants have left behind from millions of years ago, she reflects on the importance of storytelling, whether that be through fossils, chemical traces, or the written word.

While Jahren's love of science is apparent from the first page of *Lab Girl*, her love of literature is fundamental to the existence of the book in the first place. And more importantly, Jahren's ability to interweave science and literature in such an organic way helps to break down the divisions between those areas of study, which aren't so different after all.

## SYMBOLS

Symbols appear in **teal text** throughout the Summary and Analysis sections of this LitChart.

### MINNESOTA

In *Lab Girl*, the Minnesota of Hope Jahren's childhood represented silence, emotional distance, and a sense of coldness from outside and within. While she does not question her parents' love for her, she does not feel particularly close to them, especially her mother. As a child, Jahren was convinced that her mother was perpetually angry with her, though she never quite figured out what she had done to provoke this animosity. She notes that when she came in to her house from the freezing temperatures of a Minnesota winter, Jahren felt a different kind of cold within her family home. She does not mention her brothers by name, and notes that she hardly noticed them leave home for college, as they hardly spoke to one another in the first place. This cold family dynamic is specifically linked to her life in Minnesota, especially considering Jahren never mentions her parents visiting her once she left home. For her, Minnesota—and its Scandinavian heritage—is both a place and a feeling, to be contrasted with the warmth of her new homes in southern climates like California, Georgia, and Hawaii. In addition, Jahren links those southern spaces with a new sense of friendliness and affection, as she makes new friends and finds love away from the closed emotional atmosphere of her childhood.

### LABS

For Hope Jahren, the laboratory is a space of safety, comfort, and a symbol of home in its most spiritual sense. Her most beloved memories from her childhood—which was otherwise dominated by a sense of loneliness and frustration—were the late afternoons she spent in her father's science laboratory at the local community college in small-town **Minnesota**. She felt both free and in control when she played with the instruments and helped her father prepare for the following day's class; it was one of the reasons why Jahren ended up studying science in college. As an undergraduate, Jahren took a position as a lab assistant at the University of Minnesota. She proclaims—perhaps hyperbolically—that this job saved her from the terrible fate of having to return to her hometown, get married, and become a stay-at-home mother. All of these early experiences contributed to Jahren's lifelong dream to run her own lab, just as her father did. And while her first years at Georgia Tech were difficult and money was extremely tight, Jahren found that running her own lab was exactly as fulfilling as she had hoped it would be. She considers her lab a refuge from the stresses of the professional world, and most evenings after tucking her son in, she returns to the lab where, as Jahren herself notes, she uses the other half of her heart.

## QUOTES

Note: all page numbers for the quotes below refer to the Knopf edition of *Lab Girl* published in 2016.

### Prologue Quotes

❝ Guess what? You are now a scientist. People will tell you that you have to know math to be a scientist, or physics or chemistry. They're wrong [...] What comes first is a question, and you're already there. It's not nearly as involved as people make it out to be.

**Related Characters:** Hope Jahren (speaker)

**Related Themes:**

**Page Number:** 4

**Explanation and Analysis**

Jahren begins her memoir by conversing directly with her readers, whom she considers fellow scientists. She asks readers to look outside, find a leaf, and ask themselves question about the leaf in order to understand it better. That leads her to this passage, in which she debunks the myth that scientists must first excel at math, or even science itself, in school. She links science with wide-eyed curiosity about the world, and the ability to ask the right questions. Jahren has a vested interest in dismantling the traditional image of the scientist, as she has suffered throughout her career from the underestimation of her colleagues, based purely the fact that she is a woman in a male-dominated field. She notes that she had no female role models in the sciences when she was young, and part of the reason why Jahren has written this memoir is to show the human side of science, which many scientists are afraid to reveal to the general public.

## Part 1: Roots and Leaves Quotes

❝ As much as I desperately wanted to be like my father, I knew that I was meant to be an extension of my indestructible mother: a do-over to make real the life that she deserved and should have had. I left high school a year early to take a scholarship at the University of Minnesota—the same school that my mother, father, and all of my brothers had attended.

**Related Characters:** Hope Jahren (speaker), Jahren's Brothers, Jahren's Mother, Jahren's Father

**Related Themes:**

**Related Symbols:**

**Page Number:** 17

**Explanation and Analysis**

Jahren spent much of her childhood playing in her father's science lab, and this is where she developed her love of science and experimentation; yet as a girl, Jahren was not necessarily expected to become a scientist, as there weren't many women in the field at that time. Her own mother had also taken an interest in science as a young girl, and briefly attended the University of Minnesota, but was unable to graduate for financial reasons. Coming back to the town where she grew up, getting married, and staying home to raise four children was not what the elder Mrs. Jahren wanted from her life, and Hope could feel her mother's dissatisfaction with life, and felt like it was her job to succeed where her mother did not. Jahren dedicates her memoir to her mother, and it seems clear that although she is much more like her father in terms of her intellectual pursuits, she is as indestructible as her mother.

❝ Science has taught me that everything is more complicated than we first assume, and that being able to derive happiness from discovery is a recipe for a beautiful life. It has also convinced me that carefully writing everything down is the only real defense we have against forgetting something important that once was and is no more [...].

**Related Characters:** Hope Jahren (speaker)

**Related Themes:**

**Page Number:** 29

**Explanation and Analysis**

Jahren is both a scientist and a writer, and she views the world around her from a dual perspective—both scientific and literary. As a deep analytical thinker, she is ready to dig beneath the surface of things to expose the more complex systems beneath. Yet she views discovery as much more than a means to an end, and revels in the process itself, noting that it is her path to happiness. As a writer, Jahren is also dedicated to the idea that the written word is the best "defense" against loss. She writes this specifically in reference to her favorite tree from her childhood, which died many years after she left home. While Jahren studies trees from a scientific point of view, she is also capable of connecting emotionally to the memory of the tree from her backyard, and memorializing it in her memoir.

❝ Each beginning is the end of a waiting. We are each given exactly one chance to be. Each of us is both impossible and inevitable. Every replete tree was first a seed that waited.

**Related Characters:** Hope Jahren (speaker)

**Related Themes:**

**Page Number:** 31

**Explanation and Analysis**

Jahren uses examples from the life cycle of plants to

illustrate the ups and downs of her own life, using her expertise in plant life to understand something that is much more complex to her—human psychology. She sees her childhood as a drawn-out waiting period: she must endure the silence and cold of her small town in Minnesota, bide her time until she can find her place, plant new roots, and grow into the person she eventually wants to be. She discusses the fact that seeds can wait inside their hard, impenetrable shells for weeks, months, even thousands of years in some cases. Similarly, Jahren portrays herself as something of a misfit when she was younger, unable to act exactly as her teachers expected, angering her mother for reasons unknown, and just a little too smart for her own good. All of this will change when she succeeds in college, and is propelled towards a doctorate and a career in science research—but first, she was that carefully protected seedling.

❝ I started working in a research laboratory in order to save my own life. To save myself form the fear of having to drop out and from then being bodily foreclosed upon by some boy back home. From the small-town wedding and the children who would follow, who would have grown to hate me as I vented my frustrated ambitions on them.

**Related Characters:** Hope Jahren (speaker)

**Related Themes:** 

**Related Symbols:**  

**Page Number:** 50

**Explanation and Analysis**

Jahren takes a position in a research laboratory on her college campus after a few months of working in the university hospital, first as a "runner" and then "shooting bags" of medicine for intravenous use. While Jahren seemed to enjoy this job in the beginning, and was very good at it, she sees the transition to the lab as a stroke of luck, in large part because it will get her closer to her lifelong goal of running her own research lab. Beyond that, however, this statement is a direct reflection of Jahren's fears that she will follow in her mother's footsteps by dropping out of college and return home to small-town Minnesota. As a young adult, Jahren sees herself as fulfilling her mother's frustrated ambitions and running away from the life her mother had. Jahren notes how unhappy her mother seemed, and will go to any lengths to avoid a similar future.

❝ "Hey, you guys! Want a cold one?"

"No, I don't. That stuff you are drinking tastes like piss."

"Well, I don't really like beer, but that stuff does seem pretty awful."

"Jean Genet wouldn't have even stolen that shit."

**Related Characters:** Hope Jahren, Bill (speaker)

**Related Themes:**  

**Page Number:** 59

**Explanation and Analysis**

This conversation between an unnamed student, Bill, and Jahren happens while they are on a field research trip to the Central Valley of California. Jahren is the graduate assistant on the trip, assigned to watch over the undergraduate students and answer any questions that might come up. She notices that Bill is always off on his own, and after talking to him, she quickly realizes that he is both antisocial and very intelligent, and they become friends almost immediately. They are sitting on their own one evening, and Jahren is telling Bill about a biography of Jean Genet that she is reading. She goes on about how Genet was a thief, despite not needing the things he stole, and Bill listens patiently. When they are interrupted by the undergraduate student—who is attempting to get them to join in their social activities—Bill refuses roughly, while Jahren tries to be more diplomatic. Bill completes the exchange by making a private joke about Jean Genet, cementing his friendship with Jahren.

❝ I was convinced that the trees were giving me a sign and that my future career was unraveling. I was panicking, picturing myself on the assembly line, trimming the jowls off of dismembered hog heads, one after the other, for six hours a day, just as the mother of my childhood friend had done for nearly twenty years.

**Related Characters:** Hope Jahren (speaker)

**Related Themes:**   

**Related Symbols:** 

**Page Number:** 74

**Explanation and Analysis**

Jahren was a Ph.D. student, and had chosen to study the hackberry tree as part of her dissertation research. She made an impressive discovery about the hackberry seed, and won a grant to do further research on the trees, leading her out to Colorado for a summer to observe the cycle of the hackberries there. Unfortunately, that summer, the hackberries of Colorado did not bloom, and Jahren was left with absolutely no data to use in her dissertation. This was anomalous, of course, and just about any other summer would have provided Jahren with the data she needed; she took this as a sign that she was not destined for a career as a scientist, and once again envisioned herself returning home to southern Minnesota to raise children and work in the slaughterhouse at the center of her small town. This breakdown prompted Jahren to rethink not only her hypothesis for his particular research project, but also her entire way of thinking about plant growth, which eventually helped her become a better scientist overall.

❝ For all the time that we spent together, Bill had mostly remained a mystery to me. I had been around him enough to know that he didn't do drugs, skip class, or litter on the street—incongruously enough, considering his disaffected comportment—but I didn't know anything beyond that.

**Related Characters:** Hope Jahren (speaker), Bill

**Related Themes:**

**Page Number:** 82

**Explanation and Analysis**

Jahren and Bill had become close friends by this point, as she landed him a job in the lab where she was working as a graduate student, and they developed a good working relationship. But beyond their many hours in the lab together, Jahren did not know much about him, including where he lived or what he did in his free time. Their friendship was completely focused on their work in the lab, and when Bill made comments about his life—in this case, he notes that he doesn't want to listen to NPR because he has enough to worry about in his own life—it causes Jahren to wonder what his life has been like. The two will go on to work together for years, and she will eventually learn more about his family and his childhood, and will share her stories as well. But at this moment, as they are finishing their studies at Berkeley, Bill is opaque to Jahren.

## Part 2: Wood and Knots Quotes

❝ Why are they together, the tree and the fungus? We don't know. The fungus could certainly live very well alone almost anywhere, but it chooses to entwine itself with the tree over an easier and more independent life [...] perhaps the fungus can somehow sense that when it is part of a symbiosis, it is also not alone.

**Related Characters:** Hope Jahren (speaker)

**Related Themes:**

**Page Number:** 105

**Explanation and Analysis**

In this passage, Jahren is explaining the deeply interconnected relationship between trees and a specific type of fungus. These fungi build an underground web around the roots of the tree, and help bring more water and minerals to the tree. Scientists are not entirely sure why the fungi choose to do this, and what benefit the relationship has for them. Jahren sees this connection in more poetic terms, however, personifying the fungi. To her, the fungi need this relationship to feel connected, and fend off loneliness; she also uses this relationship as a metaphor for her connection to Bill, her lab partner, who is supportive and protective of her, even when he could probably work somewhere else for a better salary. Bill, like the fungus, is loyal and giving, while Jahren provides him with a sense of human connection that he treasures more than anything else in the world.

❝ Thus splitters and lumpers are both productive only when forced into bickering collaboration, and though together they produce great maps, they rarely return from field trips on speaking terms.

**Related Characters:** Hope Jahren (speaker), Bill

**Related Themes:**

**Page Number:** 110

**Explanation and Analysis**

Jahren and Bill are leading a field trip to study soil composition in the greater Atlanta area, and have developed a new way to teach soil science that is much more hands-on than the way it was previously taught. Once they have arrived at the site of a dig, Jahren and Bill get to

work, while their students stand around looking at their phones. When it comes to separating the layers of soil to show to students, Jahren and Bill are on opposite ends of a spectrum—Bill is a splitter, focusing on smaller details within the soil, while she is a lumper, standing back and looking at the bigger picture. This difference of opinion forces them to compromise, and may sometimes lead to a fight, as Jahren notes, but is for the best, as they negotiate a happy medium between them. One of the most significant parts of the relationship between Jahren and Bill is their ability to disagree, and even fight, while still maintaining a deep and meaningful friendship.

> America may say that it values science, but it sure as hell doesn't want to pay for it.

**Related Characters:** Hope Jahren (speaker)

**Related Themes:**

**Page Number:** 123

**Explanation and Analysis**

Jahren makes this claim in the midst of her discussion of funding for science research, which is a major concern for nearly all scientists, especially those working on what is called "curiosity-driven" research. Jahren's work does not usually result in a lucrative, marketable item, and therefore has less monetary value in terms of grant funding. To illustrate the scarcity of funding, Jahren breaks down the numbers, starting with the $7.3 billion budget for the National Science Foundation. This seems like a huge amount of money, but when that is divided up among the many scientists requesting research funding, it is hardly enough. In addition, Jahren mentions the popular belief that there are not enough scientists in the United States, arguing that this is a myth, and that there are actually way too many scientists considering the scarcity of funding. This brings Jahren to the conclusion that America supports science in name only, as too many research projects go unfunded every year.

> I learned that female professors and departmental secretaries are the natural enemies of the academic world, as I was privileged to overhear discussions of my sexual orientation and probable childhood traumas from ten to ten-thirty each morning through the paper-thin walls of the break room located adjacent to my office.

**Related Characters:** Hope Jahren (speaker)

**Related Themes:**

**Page Number:** 129

**Explanation and Analysis**

Jahren is in her first years as a professor and research scientist, and she is learning how difficult it can be to succeed as a woman in science, while still maintaining her sanity. Even when she is working to gain the respect of her fellow scientists, Jahren feels that she is failing in some way, because there are other people who are judging her. To the departmental secretaries, she is not feminine enough, and not like them. She can hear their gossip through the walls of her office, but Jahren seems to take this in stride—she continues to do her best work, and while this judgment bothers her on some level, she does not allow it to derail her from the work that she loves. And while Jahren is particularly outspoken and socially awkward, this is an issue that is shared among female scientists, as they are inherently unique in a male-dominated field, and often judged for being too feminine by their male colleagues, while they are judged for not being feminine enough by the women around them.

> While this great cosmic fire hose bathes you in epiphanies, you are overtaken by your urgent need to document them and thus are an inspired manual for all perfect tomorrows. Unfortunately, this is when reality closes ranks and conspires to thwart you in earnest. Your hands shake such that you can't hold a pen. You pull out a tape recorder and push "record" and fill cassette after cassette.

**Related Characters:** Hope Jahren (speaker)

**Related Themes:**

**Page Number:** 145-146

**Explanation and Analysis**

In this section, Jahren narrates some of her struggles with mental illness, and specifically with bipolar disorder, which causes her to have manic episodes, followed by a deep and all-encompassing depression. Her mania often involves an obsessive desire to learn, discover, and write to excess—she notes that she is overcome by ideas that she considers brilliant, and must record those thoughts before she loses them. In her mania, however, Jahren has little control over her body, and cannot even use a pen to write, therefore

forcing her to record herself on tape. Many years later, Jahren will come upon these tapes and destroy them, noting that the recordings were more like unhinged ramblings than brilliant coherent thoughts. And while she is able to relate this story of her manic episode with critical distance and even some humor, at the time, this illness was often debilitating, keeping Jahren away from the lab for days at a time.

## Part 3: Flowers and Fruit Quotes

"The discovery of trees that could live in the dark is akin to a discovery of humans that could live underwater.

**Related Characters:** Hope Jahren (speaker)

**Related Themes:**

**Page Number:** 196

**Explanation and Analysis**

Jahren's study of the history of trees has brought her to the Arctic Circle, where she is studying the remains of a forest that existed fifty million years ago. This discovery was groundbreaking because this helps scientists to establish a timeline in terms of the Arctic climate—clearly, the climate was quite different at that time, allowing trees to thrive where they could not possibly grow today. But the much better question is how these trees managed to grow during the dark periods of winter, when there are at most a couple of hours of sunlight. As Jahren has mentioned more than once, plants need sunlight to survive, as it is their main source of energy; therefore, a forest that thrives under such dark conditions is the mystery that brings Jahren to Axel Heiberg Island in Canada. Just as humans need oxygen to breathe, plants need sunlight to grow, and Jahren would like to find out why this entire forest somehow adapted to a world bereft of light.

"Look at those guys. I'm going to do this job for thirty more years, work as hard as any of them, accomplish just as much or more, and not one of them will ever look me straight in the eye like I belong here.

**Related Characters:** Hope Jahren (speaker), Bill

**Related Themes:**

**Page Number:** 200

**Explanation and Analysis**

Jahren and Bill are on Axel Heiberg Island, conducting their experiments on the landscape that, fifty million years ago, produced a forest of deciduous trees. In this moment, however, Jahren and Bill are taking a break from work, and have separated themselves from the other researchers, as they often do. They have come to the tiny island along with ten paleontologists from the University of Pennsylvania, and it is clear to Jahren that they will never quite see the value in her work. She and Bill are looking at the forest from a different perspective, and instead of examining each tree fossil individually, they are looking at the layers of soil to find larger shifts in climate and soil composition. For this reason, and also because Jahren is a young female scientist, the other researchers do not take her seriously. Jahren is coming to terms with this reality, and while it bothers her, she has hardened herself against it, and simply throws herself into the research in response. The conversation that she has with Bill about this—in which he notes that he too feels marginalized within the larger research community—brings them together even more.

"I discover within a second context that when something just won't work, moving heaven and earth often won't make it work—and similarly, there are some things that you just can't screw up.

**Related Characters:** Hope Jahren (speaker), Clint

**Related Themes:**

**Page Number:** 207

**Explanation and Analysis**

Jahren has just met Clint, the man she will marry, and is surprised by how easy their relationship is. She has dated other men in the past, but most of those relationships did not last long. She notes that when she met Clint, she had a lot of love to offer him—everything that had been saved up from a childhood bereft of warmth and affection, and years of failed romances, was showered onto Clint. In response, he loves her just as easily, and she often appreciates it all the more because she does not feel that she deserves it. She compares this love to her scientific research: there are some experiments that doe not work, no matter how much effort she puts into them. On the other hand, there are some experiments that are just right, designed to work out

from the very beginning. This is how she feels about her connection to Clint, which quickly turns into marital bliss and then a happily uneventful family life. For Jahren, who is used to obsessing over every detail and staying up at night worrying, the simplicity of this relationship surprises her.

"C'mon, Bill, you're with us now. Why don't you drive?"

**Related Characters:** Clint (speaker), Hope Jahren, Bill

**Related Themes:** 

**Page Number:** 209

**Explanation and Analysis**

This brief conversation between Clint and Bill takes place when Jahren and Clint return from a trip to Norway, having gotten married on the spur of the moment. Jahren demands that they go straight to Bill's house and let him in on the good news; Bill is surprised and taken aback, unsure of how to respond to this information. Jahren and Bill have been friends since their early twenties, and during that time, Bill has been able to ignore Jahren's boyfriends for the most part, because they did not stay around for long. The two had settled into a comfortable routine that did not involve anyone else, and Bill is uncomfortable with the change to that routine that Clint represents. Clint has taken Bill's distance in stride, however, and assures Jahren that he just needs time to adapt to the change in their dynamic. He is right, of course—as soon as Clint offers Bill the keys (a sign of cooperation and willingness to cede control at times), Bill accepts Jahren's marriage, and the three of them attend Family Day at Fort McHenry, because they are now a family, even if a nontraditional one.

A manic-depressive pregnant woman cannot take Depakote or Tegretol or Seroquel or lithium or Rsiperdal or any of the other things that she's been taking on a daily basis for years in order to keep herself from hearing voices and banging her head against the wall. Once her pregnancy is confirmed she must cease all medications quickly (another known trigger) and stand on the train tracks just waiting for the locomotive to hit.

**Related Characters:** Hope Jahren (speaker)

**Related Themes:** 

**Page Number:** 213

**Explanation and Analysis**

Jahren has been on medication for her bipolar disorder for years now, and has managed to balance her moods and maintain a healthy lifestyle. However, nearly all of the medications that she takes are dangerous to the child growing inside of her, and she knows that she must stop her medication for the sake of the fetus. She also knows, however, that quickly stopping her medications will prompt withdrawal symptoms, and will also bring back her manic episodes, followed by drawn-out periods of depression. Jahren takes her doctor's advice and ceases her medications, and the first two trimesters of pregnancy are awful for her, and she is regularly hospitalized, and even undergoes electroconvulsive therapy to balance her moods until she can resume her medication. The symptoms of her mental illness are bad enough in and of themselves, but Jahren is also upset to recognize that her own body is the one thing she cannot control. She must just wait for the episodes to begin, knowing that because of the baby, there is nothing she can do to protect herself.

I know that I am supposed to be happy and excited. I am supposed to be shopping and painting and talking lovingly to the baby inside me. I am supposed to celebrate the ripening fruit of love and luxuriate in the fullness of my womb. But I won't do any of this.

**Related Characters:** Hope Jahren (speaker)

**Related Themes:**  

**Page Number:** 217

**Explanation and Analysis**

Jahren is not waiting in joyful anticipation for the baby, like she feels that she should be doing; instead, she is mourning the loss of the life she had before becoming pregnant, and worried about how her life will change with a child. All of this is exacerbated by the fact that she cannot take her medication and will likely have a number of manic and depressive episodes before she can resume medication. But this is also a common issue with mothers, especially highly educated working mothers, who feel that they are failing in every way, even before they give birth. Jahren struggles with the fact that she knows—from the messages about motherhood that are all around her—that she should be enjoying this time, and should be daydreaming about what

her child will be like, and should be happily anticipating the birth of her child. She is not feeling any of those things, however, and she also feels guilty about not even having the "correct" feelings about her impending birth. Once again, Jahren's life and outlook are in direct conflict with the traditional image of women and femininity, making her feel like less of a woman.

> When I wake, I hold my baby and I think about how he is my second opal that I can forever draw a circle around and point to as mine.

**Related Characters:** Hope Jahren (speaker), Jahren's Son

**Related Themes:**

**Page Number:** 228

**Explanation and Analysis**

After a difficult pregnancy and childbirth, Jahren is finally face to face with her son, whose mere existence will change her life, and wipe away many of her concerns about parenthood. She is immediately in love with her son, and they quickly bond. As she holds him and thinks about how precious he is to her, she is reminded of the time when she made her first significant scientific discovery as a Ph.D. student. She was studying the seeds of the hackberry tree, and found that the seeds contain opals—and she was the first person to know this information, making her feel unique and extremely privileged. This moment, as well, makes Jahren feel unique in her ability to create a new life that is part of her, but separate. At that moment when she discovered the opal in the hackberry tree seed, however, Jahren was struck by a profound sense of loneliness, as she had no one to share her newfound knowledge with. At this moment, in contrast, Jahren is bringing another person into her very close circle of beloved people, creating her own family and future.

> While I am too impulsive and aggressive to think of myself as a proper woman, I will also never fully shake this dull, false belief that I am something less than a man.

**Related Characters:** Hope Jahren (speaker), Jahren's Son

**Related Themes:**

**Page Number:** 256

**Explanation and Analysis**

Jahren is thinking about her son and their relationship, and she notes that he is quite different from her, both physically and in terms of temperament. Her son is more cheerful and balanced than she is, and he must have gotten those traits from his even-tempered father. She notes that her son sees the world as a race and he wants to be in the driver's seat, while Jahren is caught up in worrying about crashing. He is blond, with blue eyes, while she falls somewhere in between blond and brunette, and her eyes are somewhere between green and brown—more of a hazel. She also notes that she will not be her son's mother, she will be his father, which is what she knows how to be. She did not have many strong and affectionate female figures to model herself after, but men abound in her line of work. Finally, Jahren notes that she cannot be considered a proper woman, yet she has always known that she is not as valuable to society as men are.

> I got out my bike and looked up through the warm, tropical sky, into the terminal coldness of space, and saw light that had been emitted years ago from unimaginably hot fires that were still burning on the other side of the galaxy. I put on my helmet and rode to the lab, ready to spend the rest of the night using the other half of my heart.

**Related Characters:** Hope Jahren (speaker)

**Related Themes:**

**Related Symbols:**

**Page Number:** 267

**Explanation and Analysis**

Jahren's day is split into two worlds: she begins her day at the lab, working with Bill and conducting the business of running a science research facility. She leaves to pick up her son from school and take him to the beach, where they play and talk, hitting on the subject of science and the natural world, but also straying into other topics as well. While her son is generally interested in science, he is an athlete, and Jahren gives him the space to pursue his own interests, and supports them in every way she can. Her home life is the picture of domestic bliss, as the family has dinner together and she tucks her son in bed. When she leaves the house, she transitions back to her science mindset, looking up at

the sky and thinking critically about where the stars come from. She bikes back to work, to her lab, where she feels safe and loved as well, but in a different way. She is deeply in love with her family and home life, but she is equally in love with her work and the routine of the lab that she has created.

> It looks as if the bigger potatoes of the future might feed more people while nourishing them less. I don't have an answer for that one.

**Related Characters:** Hope Jahren (speaker)

**Related Themes:**  

**Page Number:** 271

**Explanation and Analysis**

Hope Jahren is, first and foremost, a scientist, and her memoir interlaces the stories of her personal life with the scientific discoveries that fuel her professional life. As a plant lover, Jahren worries about what the world will be like, and how green it will be, hundreds of years in the future. Her experiments during this time are focused on the effects of climate change on plant life, and she has made some startling and unsettling discoveries. In this particular experiment, she and her lab partners established that sweet potatoes, when grown under high levels of carbon dioxide (levels that will be produced on Earth in the future, if projections are correct), grow much larger in size but produce fewer nutrients. This means, as she notes, that in the future this major food staple will feed more people without offering more nourishment, contributing to malnourishment around the world as a side effect of climate change. These results are upsetting, yet Jahren's job as a research scientist is to find and publicize this information. Her role as a public figure and author, however, is to make her followers and readers care about this, and to possibly take steps to reverse the effects of climate change and plant destruction.

# SUMMARY AND ANALYSIS

The color-coded icons under each analysis entry make it easy to track where the themes occur most prominently throughout the work. Each icon corresponds to one of the themes explained in the Themes section of this LitChart.

## PROLOGUE

People always ask Hope Jahren why she doesn't study the ocean, since she lives in Hawaii. She responds that the ocean is a lonely place, while land is much more lively: the lifespan of the average ocean plant is 20 days, while the average plant on land has a lifespan of over 100 years. There are 200 trees to every person, and once Jahren discovered this, plant life is all she can see.

*In this memoir, Hope Jahren interweaves her personal story with the story of plant life, which is her passion and line of work. She wants to share that passion with her readers, just as she does with the students she teaches, and she begins by illustrating how prevalent plant life is on the planet.*

Jahren then asks readers to look out their windows, asking them what they see. Most people first focus on things that people make, like buildings and vehicles. Look again, she urges—look for something green, something that people did not make: plants began to populate the earth over 400 million years ago, well before humans. Now, Jahren continues, focus on a single leaf. A leaf is something that humans do not know how to create, but they sure know how to destroy. Jahren points out that every 10 years, humans have cut down forest areas approximately the size of France, over and over, throughout history. No one seems to care about this, but everyone should care, she argues, because these are unnecessary deaths.

*Jahren moves on to the topic of conservation, because while plant life is abundant on Earth, human activity and heavy industry are decimating it, which is of serious concern to her as a plant biologist. She personifies plants throughout the memoir for two reasons: first of all, because she feels a personal and emotional connection to them, and secondly, because she knows that if her readers think about plants as similar to humans, they will care more about their destruction and possibly take action.*

Jahren looks at a lot of leaves, and asks a lot of questions about them. She analyzes color, shape, size, texture, relationship between the leaf and the stem, and many other variables. She then urges readers to look at their leaf and ask some of the same questions. And with that, she pronounces, "you are now a scientist." Jahren disagrees with those who demand that people must know math, physics, or chemistry to consider themselves scientists. To her, that is like making knitting a requirement to be a housewife, or knowledge of Latin for biblical study. Math, physics, and chemistry are helpful, but the foundation of science is observation and asking questions. And now that the readers are scientists, Jahren prepares to tell her story, "one scientist to another."

*Jahren is also focused on making sure that her readers, and the public in general, do not fall prey to the myth that scientists are a group of superhuman beings or that the work she does is out of reach. Not only does she promote the image of women in science, she suggests to her readers—male and female—that they can consider themselves scientists based on their activities, like asking questions about the things they see around them. While she notes that formal study is "helpful," she defines a scientist by his or her ability to express curiosity about the world.*

## PART 1: ROOTS AND LEAVES

Jahren spends her evenings in her father's **laboratory**, playing with the scientific instruments she finds in the drawers. She particularly likes the slide rule, which she uses as a sword, imagining herself in the biblical story of Abraham, sacrificing his son Isaac. She plays with the silver nozzles of the air and gas lines, makes use of the miscellaneous tools she finds in drawers, and tests the pH of spit, water, root beer, and urine. Having the privilege to play with these grown-up instruments makes Jahren feel special, and contributes to the feeling that she and her father own the entire science building. Her father teaches her how to fix broken equipment, and she carefully sets out the items needed for the next day's experiments in her father's class.

*Jahren traces her love of science back to her childhood, and specifically to the time she spent in the lab with her father. This was not a time of official "learning," but rather an opportunity to play and explore, reinforcing Jahren's belief that curiosity and enthusiasm fuel scientific research just as much as concrete knowledge of facts and figures. In addition, the fact that she is working with her father, and emulating him and his work, will be part of Jahren's lifelong concern about her role as a woman in science.*

Jahren and her father walk home every night at 8 P.M. through the frozen landscape of small-town southern **Minnesota**, in complete silence. She notes that her family, like many Scandinavians, have developed the habit of not speaking to one another for long stretches of time. This is a trait they have inherited from their Viking ancestors, who emigrated from Norway in the 1880s—she notes that things must not have been going very well in Europe for them to move to Minnesota to work in the local slaughterhouse, so she can understand why they might not share much of their personal history.

*Outside of the playful atmosphere of her father's lab, Jahren depicts her childhood in Minnesota as cold, lonely, and empty of emotion. Although she relates this to her Scandinavian background, later in her life she will return to Norway to live, and will find comfort in a similar social and cultural atmosphere. This childhood experience also makes its mark on her social life as an adult, as she maintains a small circle of close friends.*

Located 100 miles south of Minneapolis, **Minnesota**, Jahren's town is the home of the community college where her father would go on to work for 42 years. Most of the people in town have lived there all their lives, as have their parents and grandparents: on her walk home with her father, Jahren passes the local school, where her teachers had once been her father's students; the church where her parents met, married, and had their children baptized; and the office of the doctor who had delivered her and treated her every childhood ailment. Jahren cannot remember a time when she didn't know all of the other children in the homes she passes on her walk, and it would only be years later, in college, that she realizes that the world is filled with people she doesn't know.

*This small-town upbringing is in direct contrast to Jahren's life as an adult, in which she takes jobs around the country and conducts research across the globe. She often fears that she will have to return to her little town and settle there, surrounded by people she has known all her life, taking Part 1n the time-worn rituals that her parents and grandparents have taken Part 1n. Her love of science is paired with a desire to see and experience new things, which were not available to her as a child, and to escape the continuous loop of life in a small town.*

In addition to the community college, the slaughterhouse is one of the economic centers of the town, as most of the local families are employed there or somehow associated with it. Jahren notes that it processed around 20,0000 animals per day, whose meat was placed on a train north to the city of Saint Paul, which left promptly at 8:23 P.M. every night. Jahren and her father can often hear the train leaving the station from the other side of town as they walk down the street to their house. Jahren notes in hindsight that while her fingers were so cold they would hurt, as they walked into her house, she prepared to face a different kind of cold.

*While Jahren comes from a family of scientists and thinkers, they seem to be the outliers within this community, which is dominated by the meat industry. Her family is one of the only ones that is not employed by the slaughterhouse, and while Jahren does not mention this in her memoir, this may also have set her family apart from the others in her small town. While Jahren leaves for college, many of her classmates will stay and work for the slaughterhouse, as will their children.*

Every night when Jahren and her father get home, Jahren's mother is always in the kitchen, unloading the dishwasher loudly, signaling a lifelong anger that puzzles young Hope Jahren. As children do, she assumes it is her fault, and silently pledges to behave better in the future. Jahren's mother is a housewife, tending to the garden and knitting warm items for the children for winter, but she had once been a science star, winning an honorable mention in the Westinghouse Science Talent Search, and going on to study chemistry at the University of **Minnesota**. She found it difficult to attend college while working to pay her way, so she ended up moving back to her hometown, married, had four children with him, and fully assumed the role of homemaker.

*Jahren's relationship with her mother is complicated: on one hand, she dedicates her memoir to her mother, signaling a deep connection and sense of obligation. On the other hand, Jahren spent most of her childhood feeling guilty for her mother's frustration and dissatisfaction. Like many women of her generation, Jahren's mother had once yearned for a college education and a career of her own, possibly in science. But while she was intellectually capable of succeeding, she was thwarted by the social and financial obstacles that kept many women from reaching their dreams.*

The elder Mrs. Jahren never gave up her dreams of a college degree, however, and once the children were in school, she re-enrolled and took correspondence courses through the University of **Minnesota**, studying literature rather than science this time. Her mother's studies became a staple of Jahren's childhood, as the girl was included in the painstaking work of reading and analysis. In between their work in the garden and other domestic tasks, Jahren and her mother would consult the Middle English dictionary, map out symbolism in *Pilgrim's Progress*, listen to poetry by Carl Sandberg, and mull over the theories of Susan Sontag. All of her mother's energy was not wasted on young Jahren, who followed in her mother's footsteps "to make real the life that she deserved and should have had." Jahren even briefly studied literature before declaring a major in science.

*The fact that Jahren's mother returned to college after the children were in school is inspirational, especially considering that her motives were purely intellectual. The time that Jahren spent with her mother studying literature would have a profound effect on the young girl, helping her respect literature and place it on the same plane as science. In addition, Jahren inherited her mother's tenacity, which has helped her push past obstacles that might have seemed insurmountable to many other scientists. Although she considers herself much more like her father, Jahren's motivation to succeed academically is definitely linked to her mother.*

Jahren describes science as the place where she belonged, because in her science classes growing up, she *did* things, rather than just talking in a classroom. She enjoyed working with her hands, and the work paid off much more quickly. She also found that her science professors prized the characteristics that her schoolteachers had previously found frustrating, such as her extreme persistence and perfectionism. Her science professors even accepted her despite her gender, and although Jahren had never heard a single story of a female scientist up to that point, she understood that it was her destiny to have her own **lab**, just as her father had. Her work in science reminded her of her joyful evenings as a child playing in her father's laboratory.

*Rather than just a subject to study, Jahren portrays science as an ethos—she feels drawn to the concrete and physical aspects of science, and believes that it complements her personality and academic tendencies. Jahren is a scientist in mind and soul. Unfortunately, she does not have any female role models in the sciences, and therefore will have to forge her own path, dealing with a lot of sexism along the way. Even the fact that she is accepted "despite" her gender is an early indicator that being a woman scientist will be an uphill battle.*

Now as an adult, Jahren has her own **laboratory**, and she considers it her refuge from the rest of the world. The unanswered phone calls and incomplete chores are of no importance once she enters her self-contained, windowless space that is dedicated to her work. She describes it as both immensely important work—where she pursues "the noble breakthrough"—and an extension of the fun she had in her father's lab as a girl. She also notes that her lab is a place where not everything goes as planned, despite the fact that her publications include only the successful results; this clearing away of the imperfections of scientific work leaves Jahren with another story to tell, of all the "pain, pride, regret, fear love, and longing" that a scientist feels along the way.

*Jahren is reflecting on her early ambitions from the perspective of a woman who has achieved her goals. While there were many obstacles along the way—many of which she will write about in this memoir—Jahren has now become the very role model she needed as a young woman. She is also extremely honest about the imperfections of her life outside of the lab, taking care not to contribute to an unattainable image of a working woman. In contrast to her scientific publications, this memoir will include all of the pitfalls and mistakes she has made.*

When Jahren turns 40 years old, after 14 years as a professor, she and her **lab** partner, Bill, finally create a machine that will work with a mass spectrometer, which is a major breakthrough in chemistry. This is three-year project funded by the National Science Foundation, designed for the forensic chemical analysis of terrorist attacks. It is not exactly Jahren's passion, but the funding is more substantial than any she has received in the past, and she believes that she can work on this project and her plant biology work—her passion—in her off hours. They are coming to the end of their funding—in fact, Jahren has calculated the exact date on which they will run out of money for the project—when Bill announces that their experiment has worked.

*As a scientist, Jahren is both pragmatic and overly ambitious: she applies for a grant that is more likely to be funded, because of its connection to anti-terrorism, but also believes that she can work on both projects simultaneously. This speaks to the tragic funding gap in the sciences, which Jahren will reiterate many times throughout her memoir, as well as the hard work that scientists do on a daily basis. Even with this double helping of work on their plates, she and her lab partner still make a major breakthrough.*

Jahren calculates that she must make approximately four near-miraculous discoveries per year for her work to be fully cost-effective. While the university pays her salary, nearly every other aspect of her work—from the notepads to the mass spectrometer itself to the salary of her **lab** partner and any assistants—must be raised by Jahren herself, from the federal government or private organizations, which become more elusive every year. As she mentioned, forensic chemical analysis work is not Jahren's passion, but anti-terrorism work is much more likely to be funded than "science for knowledge," as she calls it. The other issue with science funding is that experiments rarely work the first time around, and this one was no exception. Jahren details the issues they dealt with in terms of the chemical reaction, turning previously simple tasks into procedures that would take days to complete.

*Jahren breaks down the costs and funding for science research, which helps to dispel the myth that scientists are rich or have plenty of funding for their work. She spends nearly as much time writing grant applications and sending out papers for publications as she does actually conducting research in the lab, which is a reality across the sciences. She also brings up the fact that for science to be well-funded by the government, it must result in something that will financially benefit the country, like a drug or a weapon. Jahren believes that her work is undervalued by the government agencies, despite its inherent value to her and her fellow scientists.*

This struggle came to an end, however, when Bill entered Jahren's office to announce "the motherfucker works" and handed her the paperwork to prove it. They worked as an effective team, with Jahren dreaming up bigger and better ideas and pitching them to potential funders, and Bill painstakingly focusing on the details to push them to success, and then Jahren writing up the final report, making the whole process look streamlined from the beginning. The two scientists triumphantly discussed what to name the apparatus they created, with Bill joking that they should call it "four hundred and eighty thousand dollars of taxpayer money." Jahren tried to find the words to thank Bill for his hard work, but she knew she didn't have to.

*Jahren and her lab assistant, Bill, make a perfect pair of researchers, as she dreams up big ideas, sells them, and markets the finished product, while Bill is content to handle the finer details required for good research. This relationship is vital to both Jahren and Bill, as they support each other and share in the joys of discovery. Their close friendship is also clear in this passage, as they joke about the work they have put into this discovery, and Jahren does not need to say out loud that she appreciates his work, because he already knows this.*

Jahren has a specific tree she remembers from her childhood: a spruce tree that stood outside her window, which she would hug, climb, and talk to like a close friend. Her studies in science have led her to realize that just like her, the tree was once a child, a teenager, and an adult. Many years after Jahren left her childhood home, her tree "made a terrible mistake," preparing for summer too early in the season, losing its branches in a snowstorm and forcing Jahren's parents to cut it down. When Jahren heard this news from her parents, months later, it reminded her of the complicated nature of life, both plant and human. It also reminded her that the written word is the only way to keep from forgetting about important things that once existed, like her childhood spruce.

*Once again, Jahren is using plants to guide her understanding of humans, and especially of herself. Other than the time she spent in her father's lab, the spruce tree is one of her few positive memories of her childhood, and a link to the joys of that time. When her parents had to chop the tree down, that signaled the death of that particular connection, and reminded her of how tenuous those links can be. She sees literature and the written word in general as a way of preserving connections.*

Seeds are very good at waiting, Jahren explains. They may wait one, 100, or even over 2,000 years for a special moment known only to them, when the temperature and moisture and light are just right to begin to grow. More than half of them will die while waiting for this special opportunity, but a single tree will produce 250,000 new seeds per year. And when the seed does begin to grow, it sheds the hard, protective coating and stretches out into the world, ready to become what it is supposed to be.

*Jahren uses the concept of the seed as a metaphor for her childhood and early adult years, when she was waiting for the right opportunity to bloom into the person she believed she should be. Her early years were marked by loneliness and isolation in her small town, and even as an undergraduate, she seemed to be waiting to blossom, both intellectually and socially.*

Jahren worked at least 20 hours per week during her entire undergraduate career, and more during school breaks, to supplement her scholarship to the University of **Minnesota**. One of her more memorable jobs was at the university hospital, where she began as a "runner," transporting IV pain medications from the pharmacy to the nursing stations around the hospital. Jahren was well-suited to this position, as she needed the constant movement to satiate her boundless energy, and the relative isolation—she would go hours without speaking directly to anyone—gave her the time and mental space to think about her schoolwork.

*Jahren worked around the clock as an undergraduate for two main reasons. First of all, she needed to make money to cover her tuition at the University of Minnesota, and did not want to have to drop out of college for financial reasons as her mother did. She also worked nonstop because she had an excess of energy and had trouble sleeping anyway, so she needed to keep herself occupied. This is one of the first signs of Jahren's bipolar disorder and anxiety, which she will discover later in life.*

Based on her experience in the hospital, Jahren decided to write her English term paper on "The Use and Meaning of 'Heart' Within *David Copperfield*." She would memorize passages from the novel during the day, allow her subconscious to work through their meaning as she walked medications around the hospital, and then go home after her shift and write her paper. This routine changed, however, when she was trained to "shoot bags," or fill the intravenous bags with exactly the right amount and combination of mediation for the specified patient. She found value in this work, recognizing that this medication might hold off the progress of a tumor or give a patient just enough relief from their pain; this slowly turned into disenchantment, however, and when she received an offer to work in a research **lab** instead, she jumped at the chance.

*As a scientist who also loves literature, Jahren found a profound connection between the assigned text in her English literature course and her evening work at the university hospital, bridging the gap between the metaphorical and the literal. And when she began working in the pharmacy lab, Jahren's mind turned from her literature course towards a constant and profound analysis of the value of her work as a technician, and the importance of medication in the lives of the patients in the hospital. Jahren needed to feel that her work had some value, even if she was just keeping patients alive for another day.*

Jahren explains that the root takes a great risk, as it anchors itself to the ground, ending its chances to move around in search of a more perfect spot. And taking root will use all of the seed's energy, with no opportunity to make new food until it grows a shoot, which could be days or even weeks later. But if it is successful, it will create a taproot, which will grow powerful enough to absorb gallons of water, intertwine with the plants around it to create an information network, and to regenerate even if its plant is ripped from the ground. Jahren references the acacia tree found along the Suez Canal, whose roots were found to be somewhere between 12 and 30 meters long, depending on the information source.

*Continuing with the plant metaphor for her personal and professional development, Jahren introduces the process of taking root, in which a plant finally finds its place in the world, just as she was attempting to do as a young scientist. The tree's root is immensely important to its success in life, despite the fact that it is invisible to most observers. Likewise, the choices that Jahren made as a young woman have had a significant impact on her success as a scientist, wife, and mother.*

Jahren was encouraged to obtain her Ph.D., and so the day after graduating from the University of **Minnesota**, she donated her winter clothes and hopped a plane to San Francisco, where she would begin her doctoral studies at the University of California, Berkeley. That was also where she met her **lab** partner and lifelong friend, Bill. Jahren was the graduate assistant on a field trip through California's Central Valley, aiding the undergraduates in their study of the soil composition; Bill was a student on that trip, known for separating himself from the group and digging on his own, dressed in jeans and a leather jacket in the searing heat of the day. He and Jahren were drawn to each other's dry sense of humor, and found themselves spending most of their free time together.

*When she leaves the University of Minnesota, the college that every member of her family has attended, Jahren is finally departing from her childhood environment and taking a step towards independence. The fact that she donates her winter clothes before flying to California marks this move as permanent, signaling to Jahren that she has succeeded where her mother did not, and proving to herself that she can make it on her own, far from home. The fact that she meets Bill almost immediately is significant, as he becomes her new family, providing her with the support she needs on her own.*

While the other students giggled and gossiped about the possible romantic relationship they saw blossoming, Jahren and Bill developed a strong platonic bond that would last beyond the California field trip. Before the trip ended, Jahren approached her advisor and asked him to hire Bill in the **lab**, as he was clearly one of the smartest students she had met up to that point. Her advisor agreed, and as Jahren dropped off Bill after the trip was over, she offered him the job. He casually mentioned that he had nowhere else to go, so he would prefer to start immediately.

*Jahren and Bill would have to put up with rumors about their relationship at times, but they were drown to one another by their shared love of science and nature, and their very similar dispositions. Both introverts, they found themselves separated from the group on that first field research trip, enjoying a comfortable silence. His semi-homelessness means that he will spend a lot of time at the lab, which will also bring him and Jahren together.*

Jahren returns to her explanation of a plant's growing process. Once the seed has anchored itself in the ground, its energy shifts in the other direction, reaching up towards the sun, its source of energy and fuel. The plant begins to make leaves, which have only one job: to make sugar out of inorganic matter, something that only plants can do. The veins of the plant bring water to the leaf, where its is transformed, with the help of sunlight, into sugars, which are then transported back down to the roots and stored for later use. The plant then uses that sugar to grow deeper roots and absorb more water, reinvesting its energy in further growth.

*The metaphor for Jahren's developmental years continues, as she, too, has found somewhere appropriate to put down roots and begin to grow into the adult she has always dreamed she could be. She has found a support system in the form of her lab assistant Bill, and is able to focus all of her energy on her doctoral research. And like a plant, she is always working, rarely taking a moment to rest, reinvesting all of her time and energy in her research.*

For Jahren, the definition of a true scientist is one who creates her own experiments, generating new knowledge. She recalls the day she became a true scientist, marveling at the new piece of knowledge that she had generated via the research for her Ph.D. dissertation. She was studying the hackberry tree, and more specifically the hard seed it produces, to unlock the secrets of the climate between glacial periods in the Midwest of the United States. The first step in this larger project was to find out what a hackberry seed was made of. She dissected the pit, bathed it in acid to break down the harder parts, and examined them using an x-ray diffraction machine. She discovered that the pit was made of opal—and she was the first person in the world to discover this.

*While for the most part, Jahren works to debunk many of the myths of the superiority of scientists, in this moment, she creates the important distinction of the "true" scientist. For her, the ability to devise her own experiments, and not simply contribute to another's work, is what set her apart during her Ph.D. program. This is the first step towards being in complete control over a research lab, and thinking of science from a broader perspective, from start to finish, rather than simply focusing on the details of the experiments themselves.*

This discovery would usher in a host of conflicting feelings for Jahren, who was completely alone in Berkeley, far from her family, with few connections outside of her **lab**. She felt like she should call to tell someone about her discovery, but had no one to call. Years later, she would get married and have a child, would mentor scores of students in her own laboratory, and most importantly for her, she would have a friend she considered closer than any family member, who would understand the importance of discoveries like these. But in that moment, Jahren cried. She then packed up her work and went back to her office, and shared her discovery with Bill, who turned off the radio he was listening to, and gave her his full attention.

*In this first moment of discovery, when Jahren can finally consider herself a true scientist, she is plagued by all of the things that she left behind in pursuit of professional success. Jahren seems to have lost all of her family connections—it would seem that she would want to call her father, the one person capable of understanding the importance of this discovery—and feels some pangs of regret for this. But this feeling changes when she shares this information with Bill, and found that he offers the support she needs.*


Jahren received a grant from the National Science Foundation for the second part of her research, and spent the summer in Colorado, monitoring hackberry trees. Unfortunately for her research, that year, the hackberry trees did not bloom, and Jahren was panicking. She returned in the fall, feeling a distinct sense of failure. Bill's suggestion, presumably made in jest, was to set one of the trees on fire as a threat to the others, or to go into the woods and shoot a BB gun at leaves and branches for an afternoon. Jahren did not take this advice, and used her failed summer to learn something about science: experiments, she explains, are not about making the subject fall in line with expectations. With this, she changed her mindset and began to see the world from the perspective of a plant.

*Jahren's trip to Colorado for field research acts as a counterbalance to her miraculous discovery, and illustrates very clearly that even "true" scientists—or perhaps* especially *true scientists—are not immune to failures, and that the more complex the science, the more likely that it will not yield perfect results the first time around. Bill is available to her as emotional support, and will be there for Jahren every time after this. But the most important lesson from this was to learn to think differently, which Jahren has done.*

Plants contain three parts, Jahren explains: leaves, stems, and roots. The stem's job is to move water from one part of the plant to another—it moves water from the roots to the leaves, and brings sugar water back to the root. For trees, the stem is made of wood, which is an amazingly strong, durable material. In addition, a tree's wood can tell its story: arborists read the rings of a trunk to learn how old a tree is and what might have happened during its development. Finally, wood is resilient, repairing and replacing broken limbs and branches as necessary. The monkeypod tree that stands in the middle of Honolulu might look as though it has achieved perfection, but if someone were to cut it down and read its story, they would see the history of branches lost and repaired.

*Jahren returns to the topic of plant development, focusing on trees and the amazing qualities of wood as a material and as a tree's stem. Mainly, Jahren portrays wood as a storyteller for the tree, in which every growth spurt and setback are marked down for an astute observer to read. Yet like a book, this information can only be read by opening up the tree and knowing what to look for; while the tree is standing, the wood continues to grow and repair itself, not showing any indications of its history or internal struggles.*

Jahren speeds through the four years of her Ph.D. program, and she and Bill both graduate in May 1996. Jahren had applied for jobs early, and by graduation she has secured a position at Georgia Tech. She and Bill spend graduation day together, in the absence of their own families, and once the ceremony is over, they head back to the **lab** and continue working. They spend the night filling glass tubes with carbon dioxide, which they would later use as references for their mass spectrometer. The work is tedious, but requires their full attention to fill each tube with exactly the right amount of gas. As they work together, Jahren begins daydreaming about her future, enjoying the thought of even the most mundane tasks as they pertain to her larger dream of running her own lab.

*As they complete their degrees together, Jahren and Bill continue to serve as each other's family, celebrating their successes together in the absence of any other familial connections. It is not surprising, then, that they return to the lab and continue working, as neither of them seems to have any other obligations or interests at this point, and the lab is where they feel most at home. In addition, as Jahren has secured her first job already, she is feeling enthusiastic about the future, imagining herself running her own lab in the very near future.*

As she finishes filling a tube, Jahren looks up at Bill, who is also fixated on his work. Jahren asks if he wants to listen to the radio, and walks over to turn it on. Bill comments that he will listen to anything but NPR, as he has enough of his own problems to worry about, which leads Jahren to wonder about his life, about which she has learned very little in their time working together. As she is considering this, and fiddling with the knobs on the radio, she hears a earsplitting pop, and then can hear nothing for about five minutes after that. She looks around the lab, which is now covered in broken glass, and doesn't see Bill—luckily, he jumped under a desk to shield himself from the explosion of glass.

*Much of the work they do in the lab is mundane and tedious, yet at the same time it requires a great deal of concentration and focus. It can be easy to get distracted by other thoughts, especially as Jahren's mind never seems to stop. She begins by thinking about her future at Georgia Tech, and then when she takes a break, she is thinking about Bill and his life, which she knows little about. It is in the middle of this daydreaming that something explodes in the lab, nearly injuring both Jahren and Bill.*

Jahren then realizes that she had been distracted while filling her glass tube, and had overfilled it with carbon dioxide, causing it to explode after she placed it on the counter. As she considers the damage around her, Bill ushers her outside for a cigarette break, helping her calm down. Jahren chews on the back of her hand, overtaken by anxiety and self-doubt. Bill comments that he once had a dog that chewed on her paws, but they loved her just the same. Back in the **lab**, they clean up the glass together, and Jahren asks Bill what he plans to do, now that he has graduated. He jokes that he will live in a hole in his parents' backyard, but Jahren asks him—in all seriousness—if he will come with her to Atlanta to work in his lab.

*A self-proclaimed perfectionist, Jahren is disappointed to realize that she was the cause of the disaster in her lab, and that she could have avoided it by focusing on the work at hand, rather than daydreaming. It is in this moment that Bill fulfills his role as her closest friend and emotional support, as he calmly ushers her out of the lab and reminds her that she is still a competent scientist. Jahren realizes quickly that she needs Bill in Atlanta, as both a lab partner and a friend.*

Jahren moves out to Atlanta first, dropping Bill off with his parents in Southern California along the way. She meets Bill's father, an Armenian filmmaker who spent his adult life documenting the genocide in his home country. Jahren then embarks on her career as a science professor. After teaching class, she orders supplies for her new **lab**, and generally prepares for Bill's arrival in January. When he arrives, Jahren drives to the airport in Atlanta, and finds herself standing at the baggage claim—the wrong one, in fact—in a daze, with no recollection of how she has gotten to that point.

*This is a significant moment of transition for both Jahren and Bill, as they prepare for a new phase of their partnership. She meets Bill's father, which helps her understand who Bill is as a person and deepens their friendship immensely. The time before Bill arrives in Atlanta is a whirlwind for Jahren, but when she picks him up from the airport, it is already clear that the stress of the first few months has had a negative effect on her mental health.*

Bill comments that she looks different, and Jahren informs him that she is one of the 25 million Americans with anxiety and later shows him her prescription for lorazepam. As they leave the airport, Jahren offers to let Bill stay on her couch until he finds a place, but he is unconcerned about where he sleeps—he wants to go straight to see the **lab**. Despite the fact that it is a dingy and abandoned space, Bill can see its potential and begins planning immediately. With that, the two get down to the business of setting up the first Jahren lab.

*Bill notices the changes in Jahren's behavior, and she is forced to admit that she is suffering from anxiety, though she attempts to be casual about it, joking about her prescription medications. As always, Bill takes her suffering in stride, and transitions the conversation to the lab, which is where they have always thrived. He is as excited as she is to create the lab of Jahren's dreams and ambitions.*

Trees have developed ways to be in more than one place at the same time. Willows, for example, will strengthen their lower branches and then allow them to drop off; one or two of those branches will then replant themselves, becoming the trunk of a new willow tree, genetically identical to the original. There is a hybrid strain of the horsetail plant, known as *ferrissii*, that is sterile and can only replicate itself by sending out branches to be replanted, like the willow. In this way, there are *ferrissii* plants from California to Georgia—tracing a path similar to that of Dr. Jahren, the newest professor of science at Georgia Tech.

*Jahren ends the first section of her memoir by commenting on trees' amazing ability to travel, despite being rooted in place. This cycle of growth, loss, and replanting is very similar to the semi-transient life of an academic—Jahren must be ready to move across the country to take on a job, starting her life anew in a different climate and culture, in order to eventually achieve professional success.*

## PART 2: WOOD AND KNOTS

Plants thrive in the American South, Jahren explains, thanks to hot and humid summers and temperate winters. The life cycle for trees is well organized, ushering in spring in February with lush new growth, only to drop it again in the fall to prepare for winter. Jahren describes this as a courageous act of faith: these trees leave everything behind each year, secure in the belief that it will all be replaced only months later. She also notes that in the 1990s, businesses were also thriving in Atlanta, where the influx of corporations like Delta Airlines and Coca-Cola sparked a population boom that filled up the classrooms at places like Georgia Tech.

*Once again, Jahren situates her life changes within the history of plant life, and this time, she is both literally and figuratively a transplant from a different climate, ready to thrive and expand in the warm and abundant American South. Just as the heat and humidity support the variety of plants in the area, the influx of new businesses to Atlanta support the boom in colleges and universities in the city, which in turn supports both Jahren and Bill.*

Jahren returns to the story of her life as a new professor: she and Bill are fully engrossed in the work of building the new Jahren **lab**, filling it with the supplies she ordered, as well as surplus supplies that Bill found at the Salvation Army in preparation for the lean financial times that he fully expects to face. They are joined by Jahren's Chesapeake Bay retriever Reba, whom she adopted on a whim, while lost on the road trip from California to Georgia. Jahren and Bill spend many of their evenings running gas samples for a larger, busier lab across campus, run by a more senior faculty member whom they had dubbed "Professor Santa." Once they have gotten into this professor's good graces, Jahren asks him for a new air compressor to replace the old one they have been using.

*This section of the memoir follows Jahren through a period of early adulthood, when she is just beginning to set up her own lab for the first time. Bill's obsession with hoarding materials and preparing for financial downturn are sometimes comical, but he and Jahren will do just about anything to ensure the success of their lab, including doing work for other labs in exchange for a share of the wealth. This also lends credence to Jahren's claims that science funding is tight, and the competition fierce.*

Plants have a host of enemies, as they are considered food for most living beings, from humans to fungi. Yet the relationship between trees and fungi is complex: while white-rot and black-rot fungi will rot right through a tree trunk, there are about 5,000 species of fungi that could be considered a tree's best friends. They weave their underground webbing through the roots of trees, bringing it more water and precious minerals. They work together while remaining physically separate. No one knows why this happens, but Jahren wonders if the fungus feels less alone when engaged in this symbiotic relationship.

*The relationship between fungi and trees is a unique one, that not many people know about because it happens underground, and only between a few thousand species. Likewise, the symbiotic relationship between Bill and Jahren is unique, especially considering there has been no romantic connection between the two. In addition, it is a quiet connection that does not involve a lot of conversation, just a sense of being less alone.*

Jahren and Bill have decided to teach their soil class differently from the way it has been taught in the past, focusing less on the cataloging of data, and instead letting students explore the secrets that soil has to share. In the summer of 1997, they lead a small group of students on a field trip to study soil, camping out in the evenings. Each student has to cook for the group one evening—including one undergraduate who spends hours laboring over Hungarian potato dumplings, which are not ready until 3 A.M. According to Jahren, the meal was well worth the wait, and earned the student the nickname "Dumpling."

*Bill and Jahren find ways to enjoy their time together, and to make science fun for the students they teach. Like many good professors, Jahren is determined to make the study of science less about checking boxes on paper, and more about active, hands-on learning in the field, where students can imagine themselves as scientists. This leads to interestingly personal experiences with their students, such as the incident with the Hungarian dumplings.*

They are in Atkinson County, which only soil scientists would find remarkable—while most travelers would not take much note of it, Jahren and Bill consider it soil nirvana for its rust-red oxidized strip of soil. They arrive at the site, and Jahren and Bill dig as a highly efficient team, because most of the students are uninterested in this kind of work. Once they have finished digging, they separate the layers of soil with old railroad spikes. This is one area where Jahren and Bill differ—she is a "lumper," looking at the bigger picture of the soil, while Bill is a "splitter," focusing on the more subtle details. They negotiate the soil boundaries, and then remove samples, test them, and note them all down.

*Bill and Jahren take their students on a field trip to the outskirts of Atlanta, where they will dig into the soil and analyze it. This is much of what Jahren does in her own research, and therefore helps students see themselves as real soil scientists. It also gives students an idea of the physical activity involved in this kind of science, though few are interested in the digging on this trip. Luckily, Jahren and Bill have established their own method for digging and observing.*

The field excursion lasts about five days, which gives students a good idea of the variety of soils in the area, as well as a clear indication of whether or not they would enjoy majoring in soil science. Jahren considers these trips a more effective teaching tool than classroom time, and Bill is both an excellent driver and a patient and caring teacher, even after five days in the field with students. The final day is usually reserved for an "enrichment" trip, and while they usually went to a museum called Southern Forest World, this year they decide to go to Monkey Jungle—"where humans are caged and monkeys run wild!"—instead.

*Once again, Jahren gives her students an idea of what it would be like to study soil science as a career, and she acknowledges that this is as effective for weeding out uninterested students as it is for attracting interested ones. Bill also plays an important role in the trip, as he does much of the driving and supports the students in much the same way he does for Jahren. In addition, their enrichment trip is a good way for the students to bond with each other.*

After passing a black billboard bearing the words "BUTT NAKED" in pink letters and wondering what it could possibly be advertising, the group finally makes it to Monkey Jungle at 1 A.M., and decides to camp out in the parking lot. Jahren wakes in the middle of the night to find a police officer shining his light into her tent, and explains how they ended up camping out in front of the gates to Monkey Jungle. She charms the officer, who then offers all manner of police protection and assistance to the group. The next morning, they offer up their final $57 as admission, and are immediately overwhelmed by the sound of screaming monkeys.

*The bonding that happens on a field trip is important, as many of the students who go on these trips are the ones who will be working in the labs, or possibly even going on to study soil science at the graduate level, and a positive group dynamic is essential to a successful lab. This means that their trip to Monkey Jungle is nearly as important as the soils they have been studying all week.*

Jahren notes the similarities to their research **lab**, with many of the monkeys performing animal versions of their various activities: there are macaques puzzling over an unsolvable problem, a gibbon sleeping, a pair of monkeys fighting, another pair in the throes of romance, and a howler monkey screaming and gesticulating at no one in particular. Jahren then looks over at Bill, who has found his mirror image in primate form, and doubles over laughing. They finish their visit by passing a gorilla named King, who passes his time drawing on paper with a crayon and looking incredibly bored. The group decides not to buy any of his art, and after Jahren reminds everyone to use the restroom one more time—musing that she must get herself an "I AM NOT YOUR MOM" t-shirt—they make their way back to campus.

*While Jahren usually uses plants as a metaphor for human development, here she compares the lab group to the primates they are observing, finding humor in the strange behaviors they share with her lab assistants and students. This contributes to a sense of family for Jahren, whose only deep connection at this point is Bill. Just as she did as a child, Jahren is able to view her lab as a place of comfort and refuge, and she is beginning to fill it with people she cares about. She even jokes about making a shirt to remind her students that she is not their mother, but this joke belies the deep familial connection she is feeling.*

Jahren describes a deciduous tree's efforts to grow new leaves during the spring and summer as its "annual budget." It must succeed in this endeavor every year, or risk encroachment by a competing tree. This is because these leaves are capturing the tree's sole source of energy, sunlight, which will help convert the water in those leaves to sugar. Similarly, a research scientist has an annual budget that determines whether or not she is able to survive in academia. In three-year cycles, she must solicit grant money to pay her employees, buy equipment for her **lab**, and do all of the necessary traveling. Like a tree, she must succeed every year, or risk losing future funding to produce the scholarship she needs for tenure. To make matters worse, there are fewer grants than scientists who apply for them.

*Jahren returns to the topic of budgets, this time comparing her financial concerns with that of a tree, which is always competing with those around it for all of the necessary nutrients. Just as trees seem to be jostling for position, all hoping to catch rays of sunlight, scientists are working to find the financial support to fuel their labs. The only difference is that a tree is constantly working on this, while scientists are on a three-year cycle. This gives researchers a short window in which to conduct actual research before returning to ask for more money.*


Jahren's work is of relatively low priority, as it will not result in anything marketable for war, business, or medicine. Therefore, most of her funding comes from the National Science Foundation, whose annual budget was $7.3 billion in 2013. While this number seems nearly astronomical to most people, it is only a third of the budget for the Department of Agriculture, one fifth of the Department of Homeland Security, and one sixtieth of the Department of Defense's discretionary budget. And the NSF's budget must fund all "curiosity-driven" research—generally defined as research that will not result in financial gains—across the country. In addition, while most Americans have heard that there are not enough scientists, academic researchers like Jahren strongly disagree: with respect to the available grant funding, there are too many scientists, and even more graduate every year, while the NSF budget stays essentially the same.

*One of the biggest and most destructive myths about science is that there are not enough scientists, and that there is a lot of funding available that is not being used. Jahren combats that myth by breaking down the actual numbers, and also by noting that most of the funding for science research is focused on the development of products for business or medicine, which have a high return on investment, and for war, which has long been a priority in the United States. The kind of research that simply advances knowledge is not considered as important, despite the fact that it lays the most basic foundation for that more lucrative research later on down the line.*

Jahren breaks down this number even further: because her work focuses on the past development of plants, it falls into the category of paleobiology, which had a budget of $6 million in 2013. And while there are hundreds of paleobiologists across the country, the NSF funds around 30 to 40 projects per year, which brings the average funding of a single contract to around $165,000. This would allow Jahren, for example, to pay her assistant, Bill, about $25,000 per year, with an extra $10,000 to cover his benefits, and an extra $15,000 that goes back to the university to cover their overhead (heating, electricity, building upkeep, and so on). Over three years, this leaves Jahren with a total of $10,000 in cash to spend on supplies and equipment, student **lab** workers, and travel to attend conferences or workshops.

*To drive home her point, Jahren brings the huge numbers into perspective, and noting that after paying all of the people involved in the work, she only has a few thousand to spend on all of her expenses. And of course, this is all assuming that she receives an NSF grant every three-year cycle, and there is still plenty of competition for those funds. Thus, as a science researcher, Jahren must also worry about her budget, and dedicate a large chunk of her time searching for funding to keep the lab running.*

Vines are some of the most ambitious species in the plant world. Not stiff enough to grow tall like a tree, the vine must find a way to reach the light by any means necessary, wrapping around other plants and trees to climb upwards, or growing sideways to steal patches of light not being used by others. They are also efficient, sometimes growing a foot per day, and absorbing water at a higher rate than any other plant. And while they cannot take over a forest on their own, with a little help from humans, they have been able to take hold. As humans disturb the land through agriculture, industry, and exploration, they have opened up spaces where only weeds can thrive. Jahren notes that in every space modified by humans, invasive species are taking the place of native plants.

*In the context of her first year as a professor and researcher, Jahren discusses the ambitions and tenacity of vines. Though they are not always considered the most impressive plants, Jahren revels in their ability to overcome their own weaknesses and grow any way they can. She also notes that humans have really aided in the growth of vines, pointing to the unintended consequences of what most would consider progress, like urbanization and agricultural growth. Her discussion of invasive species is a plea for basic conservation efforts.*

Most of the vines in North America were brought from Europe along with imports like tea, coffee, and textiles. One of these vines, the kudzu plant, arrived as a gift from Japan in 1876, and has since covered an area the size of Connecticut. One strand of the plant can grow 100 feet long, stretching along the sides of highways and blocking the view of more attractive, and less aggressive, plants and trees.

*Jahren discusses the kudzu vine, which is one of the more plentiful plants in the United States, despite not being native to this land. This plant grows aggressively, and often blocks the growth of other native plants, colonizing any strip of land it can find.*

After her trip to Monkey Jungle with her group of undergraduates, Jahren realizes that she has found her people within the **lab**, and begins to really feel at home. She is still an outsider at conferences, among the older, male scientists, but that only inspires her to work harder when she returns to Georgia Tech after her travels. She also realizes how difficult life can be for female faculty in academia, as she overhears gossip about her sexual orientation, clothing choices, and body shape through the thin walls of the science building. Jahren has little interest in the opinions of others, however, as she works overtime just to stay afloat. She subsists on cans of Ensure protein drink, showers only occasionally, bites her nails from stress and anxiety, and has little time to deal with her sudden breakouts of acne.

*Jahren's first years at Georgia Tech are a struggle, as she makes friends within the lab, but is unable to balance the demands of an early-career academic with the other aspects of her life—she focuses all of her energy on her research, and has nothing left for herself, which is why she doesn't even have time to cook herself a meal or shower regularly. What makes this worse is the criticism she overhears from other women, who believe there is something wrong with a woman who is so singularly dedicated to professional success.*

Jahren's attempts at romance are also difficult at this point, as the men she dates are put off by her intense work schedule and constant conversation about plant life. She lives in a rented trailer outside of town with only her dog Reba for company, and has to deal with the increasingly strange behavior of her landlord and neighbor: her landlord insists on storing an unreasonable number of old VHS tapes in the trailer, and often comments to Jahren that she is brave to live out in the woods without a gun; meanwhile, her neighbor often stops by to explain to her that, given his EMT training, he could easily cut off all of her clothes in less than 45 seconds.

*Jahren's living situation is an absolute mess, and she does not have enough money or mental energy to find herself a safer and more appropriate place to live. When she imagined herself as a scientist with her own lab, Jahren likely did not see herself living in a trailer, and this is the kind of honesty that makes her memoir relatable. While later on, her personal life will improve, in Atlanta, Jahren lives a thoroughly un-glamorous life.*

When Jahren begins to have car trouble, she trades it in for a used Jeep and moves closer in to town. Unfortunately, her city apartment is not much better: Bill names it the "Rat Hole," and Jahren soon learns that she is close enough to a steel factory to hear—and feel—the rhythmic drop of metal sheets from twelve feet in the air, on a regular basis, every night. Bill, for his part, has chosen to live in a yellow mini-van that he occasionally parks in the Georgia Tech lot at night. Jahren notes that more often than not, Bill is hard to find, especially in the era before cell phones. When he isn't in the **lab** and Jahren needs him, she simply goes to the many places he usually parks his van, or to the coffee shop where he spends his Sunday mornings.

*For all of the difficulties of this part of Jahren's life, she has Bill to share these experiences with, and he helps keep her spirits up. He, too, has a less-than-glamorous living situation, though he may be living in a van as part of his desire to stay away from other people. He is used to strange living situations: as a young boy, he dug an underground cave for himself in his parents' backyard, and lived there for a while. Thus, for Bill this is partially a necessity, and partially a choice.*

Early one morning, Bill calls Jahren to inform her that he has shaved off all of his long, glossy black hair. For many years, Bill had chosen to let his hair grow out instead of enduring the uncomfortable intimacy of the barbershop, giving himself the occasional trim. The fact that he had shaved his head completely, however, is too much for Jahren, who refuses to see him for days afterwards. He finally calls her back to tell her that he has kept the hair, and if it will make her feel better, they can go and visit it together. At 4 A.M., he picks her up in the van and brings her to the reservoir, where he has stashed his hair in a hole in a tree trunk.

*Bill and Jahren have a unique friendship, as they are both introverts who fear change in many ways. Thus when Bill decides to cut off his hair, Jahren is uncomfortable with the idea and needs a few days to get accustomed to the idea of Bill without hair. They make a pilgrimage to the place where he keeps his hair, connecting to his past together. As neither of them sleeps very much, they make this trip in the middle of the night, when they are sure no one will see them. Comical and strange situations like this one emphasize the pair's closeness even beyond the confines of the lab.*

Jahren admits that it made her uncomfortable to think of Bill cutting off a part of himself and just throwing it away, and Bill agrees, which is why he has stored it in the tree trunk, adding that he is "not a barbarian, for Christsakes." He shows her the hair, and she admires it, feeling much better; thus begins a ritual for the two of them, in which Bill stashes his hair in the tree and the two of them go and visit it occasionally. They even develop a plan for a children's book called *The Getting Tree*, in which a boy begins by shaving off his hair and giving it to the tree, and ends with the boy—now a bald man with no more hair to offer—simply sticks his arm in to the tree as a sacrifice.

*The humor and irony is apparent here, as Bill notes that he is not a barbarian, yet he has created a secret spot to store (and visit) his hair because he does not want to throw it away. The children's book they write is a parody of* The Giving Tree, *a Shel Silverstein book about a child who takes from a tree until it has no more to offer and dies. It is appropriate that they envision a human who will sacrifice himself for a tree—not unlike their lifelong sacrifices for the sake of science.*

Bill's life in the van is much more difficult in the summer, when the temperatures quickly rise into the 90s by morning. He has combated this by parking in a shady area of the university parking lot, and covering all the windows with aluminum foil to block out the sunlight and heat. And because the van has no bathroom, Bill avoids having to urinate during the night by ceasing his liquid consumption early in the evening, the result of which is that Bill is desperately dehydrated upon waking in the morning. Some days, Jahren finds Bill in the **lab** as early as 7:30 A.M., consuming as much water as possible to start the day.

*Bill's need for privacy and isolation are becoming worrisome and comical at the same time, as his living situation presents more problems than he originally envisioned. The lack of a bathroom in the van is a major issue, though it does mean that Bill spends much of his time in the lab, coming in very early to escape the heat and dehydration of the inside of the van, and getting a lot done in Jahren's lab.*

One night, the Georgia Tech campus security finds Bill's van in the lot, and the officers wake him up to find out what's going on. Bill, who had managed to shave just half of his head the night before when the batteries ran out in his cordless razor, stumbles out of the van looking like he has recently escaped from a mental institution. He shows them all manner of identification to prove that he does indeed work at the university, and the security guards even call Jahren to confirm that he is her employee and to let her know that they found him in a van parked on campus. Jahren confirms his identity and acknowledges his strange living situation, which satisfies the officers.

*The story of the campus police's discovery of Bill, with half a shaved head, sleeping in a van in the campus parking lot is a perfect example of his eccentricity, but also of Bill and Jahren's deep personal connection. Jahren is happy to vouch for her best friend, and does not find his behavior strange. This is also another moment when Jahren is able to debunk the image of scientists as anything other than fallible human beings.*

Back in the **lab**, Bill and Jahren discuss the fact that he would probably be a prime suspect for nearly any kind of crime, as "a weirdo loner who periodically shoves body parts in a tree." Bill agrees, though he notes that he has nothing to hide, as he doesn't use drugs, drink, or cause any kind of trouble. Despite his strange appearance, the worst crime that Bill has committed is swearing too much. Jahren blames herself, noting that she cannot yet pay him a living wage, but she also promises him that they are close to securing a large grant. In the meantime, Bill decides to move into the lab, sleeping in a windowless office that is likely only a few degrees cooler than his van in the mornings.

*Bill is not ashamed of his behavior or appearance, and while he and Jahren agree that he could easily be mistaken for a criminal, he is dedicated to a life of solitude and the study of science, and little else. Jahren blames herself for his less-than-ideal living situation, as she does not yet have enough funding, and Bill is working for very little money. Of course, they are still starting out in the world of science research, and are still optimistic about what the future will bring, as long as they continue to work hard.*

To disguise his unofficial living quarters, Bill sleeps in "pajakis," a t-shirt and khakis, so that he can claim to have fallen asleep in the middle of his work if anyone happens to find him there at night. This seems to work for Bill, except for the lack of ventilation and the fact that it is located near the entrance to the building, and the doors would squeal loudly as students entered and exited. Bill once even puts up a sign reading "Doors Broken, Please Use Back Entrance," but that was taken down by Facilities when they found no problem with the door at all.

*Bill's move into the lab is not much better than living in the van, but as he has few other options for living arrangements, he makes the best of a difficult situation. He also seems to see it as another adventure, coming up with ways to find privacy, avoid being caught, and get a good night's sleep.*

The other issue that plagues Bill is the question of where to shower, as there are no facilities in the building. He considers using the sink in the janitor's closet, but as he cannot shut the door behind him, he is worried about someone coming in and finding him naked, washing himself in the middle of the night. Bill certainly could not come up with a good excuse for that. The side effect of Bill's new home is that he spends nearly all of his waking hours working in the **lab**, making him available to listen to students at nearly any hour of day or night. Though he often grumbles about it, Bill quickly becomes the students' greatest resource for everything from fixing their bikes to filling out tax forms.

*The lack of showering facilities is a difficult obstacle, and Bill and Jahren cannot come up with a way for him to use the janitor's sink without exposing the precariousness of Bill's financial situation. But Jahren finds a positive in this situation, noting that Bill is able to help many students outside of classes, as he is always available for them when they need him. This contributes to the overall impression of Bill as an altruistic person, despite his extreme introversion.*

Bill listens patiently to the students, not judging, and not sharing any information about his own life. And he rarely shares those stories with Jahren, with the exception of a few of the best. For example, one student named Karen aspired to work as a veterinarian, and worked for a summer in the primate enclosure at the Miami Zoo. She was assigned to massage anti-inflammatory cream onto the monkeys' genitals, which obviously brought the primates much joy. She described the plastic shell she had to wear as protection against the attention of the monkeys, and the way in which they would all stand erect, waiting for her to rub them down with cream each day. This process helped Karen to decide that veterinary medicine was probably not for her, and she returned to the botany **lab** the following year.

*Jahren often talks about how her science students should get an idea of what it is like to be a scientist through hands-on practice, and this story illustrates the importance of that practice. While the work in the lab may often be tedious and unexciting, this young woman's dreams of becoming a veterinarian are dashed when she is suddenly exposed to the unsavory aspects of the job. Just as Jahren strips science of much of its glamour throughout her memoir, this story presents the very un-glamorous aspects of veterinary science.*

A cactus survives in the desert, despite the scarcity of water, and excess heat and light; its success depends on its ability to endure repeated droughts. It has adapted itself to the conditions, however, shedding its roots and contracting itself in order to preserve the tiny amount of water it has absorbed. About 100 species are known as resurrection plants, because they will dry up and play dead as they wait for the rain. This state can last for years, and when it does rain, it takes two days for photosynthesis to resume and for the plant to come back to life.

*Jahren presents the plight of the cactus, a plant that only grows in the desert because it has to, and should be commended for its ability to survive in some of the harshest conditions, deprived of the necessary nutrients for years at a time. Again, this is a fitting metaphor for the early years of Jahren's career, when she has little support—financial, emotional, or mental.*

Manic episodes are overwhelming and visceral, Jahren explains, and filled with the sound of blood rushing through her head, so loud that she has to shout over it to hear herself. She sees the world differently, distorted like a fish-eye lens, and feels the impulse to strip naked and run outside. In this particular episode, there is someone holding her back and looking at her with concern, which Jahren does not understand because she is convinced that this is the happiest she will ever feel. She then describes the "final lifting," in which she has delusions of grandeur, feeling as though she has been rescued from the pain of this world. Immediately following this peak, Jahren falls into the depths of depression.

*Jahren is relatively casual in her description of one of her manic episodes, despite the fact that they can be physically and emotionally draining, and have kept her away from work for days at a time. All of the symptoms that have come before—the excessive energy, tendency to overthink things, the lost moments in her memory—are all coming to a head now, perhaps exacerbated by the stress of her job. Jahren recognizes the importance of publicizing this issue, however, so that others can get the help she did.*

During these manic episodes, Jahren is overtaken by the most intense need to write, to document her every thought, but that is also when she loses control of her fine motor skills: she cannot hold a pen to write, and has to record herself on a cassette tape instead, pacing like an animal the entire time. She is sure that she is close to stumbling upon a groundbreaking scientific discovery, but then suddenly everything changes, and Jahren begins to scream until someone comes in and holds her down. They clean off the hair, blood, and snot that cover her and give her a sedative, letting her sleep for days afterwards.

*As someone who already spends all of her time thinking, the manic episode pushes her beyond the realm of reasonable thoughts, and she records her ramblings only to find later that they are not the brilliant breakthroughs she thought they were at the time. It is almost as if Jahren is a different person during these episodes, out of control and incapable of getting any work done. But Jahren doesn't hesitate to recount these episodes, knowing that others will learn from them.*

In the hospital, Jahren meets a doctor who informs her that she does not have to live this way, and once she tells him all of her symptoms, he promises her that it is manageable. He puts her on medication that helps to curb her manic episodes. Jahren notes that years later, when she was packing for a move, she came upon the cassettes that she used to record her thoughts during her mania, and pulls the tape out of each one, and then buries the whole box in to backyard, under a magnolia tree.

*Medical intervention is the best option for Jahren at this point in time, and it will help her balance her moods and focus on the research she must do to survive as a scientist. She jumps forward to the moment when she stumbled upon her tapes and buried them, marking the end of that period of mental instability and manic episodes.*

Jahren recounts one of her manic episodes, which was sparked by the poison ivy medication she had taken, and ended with her crying on her bed for 36 hours. During the mania, however, Jahren runs to the **lab** to tell Bill about a scientific breakthrough she just discovered, and to inform him that they will be traveling to the American Geophysical Conference in San Francisco, so that Jahren can present her breakthrough. The fact that they will need to drive a total of 50 hours and have no travel funding are immaterial to her at that point, so convinced is she that her idea will result in a government contract.

*As an isolated incident, this story is humorous and endearing; without the necessary medical interventions, however, Jahren would have lost her job and lab if she had continued to make irrational decisions like this, not taking any of the possible consequences into account. For his part, Bill is accustomed to Jahren's outsized ideas and her ability to turn them into real science, so he trusts her implicitly.*

When Jahren returned to the **lab**, days later, Bill informed her that he had secured the van for their trip to San Francisco, and because she had spent so many days suffering from her manic episode, they would need to cover the more than 3,000 miles between Georgia and California in three day's time. They were bringing a few students from the lab, as well, and they would be able to help drive. The group arrived in Colorado with no problems, but when Jahren's friend Cal advised that they take the longer route into California to avoid a major snowstorm, she refused. Boasting that she is from **Minnesota**, and therefore used to winter weather, Jahren insisted that they take the most direct route, and they ended up driving right into the storm.

*Jahren notes in her memoir that it was her job to cook up crazy ideas, pitch them, and find funding, and for Bill to work on the small but necessary details that would ensure success in the lab. This anecdote provides another example of that symbiotic relationship, where Jahren's wild ideas become reality with Bill's help. Jahren is also very honest about the hubris she exhibited during this trip, putting the entire group at risk—her Minnesota upbringing somehow made her feel that she was an expert at navigating inclement weather.*

As they leave Colorado, an undergraduate named Teri is driving the van, and Jahren decides not to buckle her seatbelt, despite the fact that she is quite sure Teri has never driven outside of Atlanta and may not be equipped to handle the road conditions. Just as Jahren warns Teri to slow down, the van began to spin on the ice, hitting a speed limit sign and facing oncoming traffic. It then began to tip over, sending Jahren onto the ceiling of the vehicle, while everyone else was suspended upside down by their seatbelts. The car behind them stopped, and the driver managed to get them into town so they could call for a tow truck and find a place to sleep for the night.

*The way that Jahren narrates the van accident is similar to her description of her manic episode: it begins with too much speed, and a sudden loss of control, followed by a drawn-out period of inactivity, and a realization that something has gone horribly wrong. After the crash, the group is lucky to get a ride into town for the night, which gives them all a chance to rest and recover from the scare on the highway.*

The next morning, Teri demands to be taken to the Salt Lake City airport so that she can fly home, and Bill refuses. He reminds her that she was the one who crashed the van, and she can't just desert everyone at this point. Jahren is touched by this, and it dawns on her that Bill is her family, and will never leave her, no matter what disasters they encounter. After breakfast, they find that the van is still in working order despite the crash, and Bill drives the rest of the way to San Francisco. Back on campus, administrators are furious with Jahren, but she knows that there is little they can do about it.

*Teri, the undergraduate that was driving the van when it crashed, blames Bill and Jahren for bringing her on the trip in the first place, and wants to get away from them and the trauma she's just experienced. Bill demonstrates extreme loyalty to Jahren, however, when he reminds Teri that they are all in it together, and that she doesn't get to desert the rest of the group in their time of need.*

Jahren recounts the story of a major battle during the 1980s—between plants and insects. In 1977, a group of tent caterpillars nearly decimated many species of trees in a forest in Washington state, eating nearly every leaf off of some trees. Two years later, researchers fed the leaves of some of the surviving trees to the tent caterpillars, and found that these trees were producing a new chemical that was making the caterpillars sick. What really surprised the researchers, however, was that healthy trees over a mile away were also producing this same chemical—this distance was simply too far for the trees to communicate through their roots, as trees are known to do, so they wondered how these healthy trees knew to produce this toxic chemical.

*Jahren presents this story about the communication between trees as a high drama, suitable for a war documentary. She brings science alive in this way, by placing it in the context of human intrigue. This particular story explains how plants can communicate even when they are located miles apart from each other, using methods that have long been unknown to humans. It also shows that trees care for each other in their own ways, once again making them seem humanlike.*

The researchers thought this information could have been transmitted through VOCs, or volatile organic compounds, which could travel more than a mile to the areas of the forest not affected by the caterpillar attack. This allowed generations of trees to avoid destruction by the caterpillars, which eventually saved the forest by the late 1980s. Jahren describes this as an example of trees caring about each other, and working together against a common enemy.

*While Jahren will later note that plants and humans are actually quite different from one another, throughout her memoir she intentionally personifies plants, making them more relatable to her readers, and giving them an idea of why she sees them as such an important part of her world.*

Jahren describes her early years in academia as "a long, slow academic train wreck," because she spent so much of her time focusing on research that was so unorthodox that she repeatedly alienated her more senior colleagues. This led to multiple rejections for grant applications, and even to reviewers insulting her intelligence in the course of the rejections. She was running out of time to establish credibility, and her startup funds from the university were all used up, so Jahren began taking advantage of any supplies that weren't being used by other **labs** or offices in desperation. Bill's salary had also run out, and he was homeless and dependent upon Jahren for meals.

*Even after receiving her Ph.D., Jahren has a lot to learn about the world of science research, especially the political side of it. As an excellent researcher and writer, Jahren is producing good work, but she is not yet succeeding because she has not yet learned how to establish herself as a scientist in the eyes of others. This process will take a long time, and there will still be moments when Jahren feels out of place among her fellow researchers.*

Jahren began to fear that she would lose her **lab** and no longer be a scientist, which was the only concrete dream she ever had. She began to think of Saint Stephen, who was chosen as one of the seven prophets to preach the gospel, but who was strung up not long after leaving Jerusalem. She wondered at what point self-preservation kicks in, but she also considered minute details like the number of rocks each person threw at him, and where they got all of the rocks, and whether some types of rocks were considered better weapons for stoning. Her anxiety would spiral out of control at this point, and she would call Bill to talk her down. They would talk until the sun came up, and Bill would advise her to see a doctor, to get a prescription for Prozac.

*For the first time since finishing her Ph.D., Jahren worries about the future of her career, and places her concerns within a biblical context. She is not concerned about being stoned for her religious beliefs, but rather ignored or ridiculed for her new and creative ideas about paleobiology. On one hand, she is definitely at a precarious point in her career, but she is also suffering from the stress and fear, making her anxiety worse. Once again, it is Bill who helps her find her way, calmly listening without judgment*

Things got better for Jahren: she lived in Georgia for another six months, when she got a job at Johns Hopkins University in Baltimore. She did finally see a doctor and get medication, changed her eating and sleeping habits, and began to take control of her mental health. Even Bill changed—he stopped smoking. They continued to work together, and to apply for grants until they were finally successful.

*This period in Jahren's life was a mix of monumental struggles—when Bill was homeless, or she was hospitalized for manic episodes—but it was also one of her greatest learning experiences, as she found her feet and realized that she could indeed achieve her dream.*

## PART 3: FLOWERS AND FRUIT

It has taken several billion years for plant life to make its way onto land, and after that first plant, it took a few million years for all of the continents to fill up with greenery. Human activity, however, is set to reverse that process, removing plant life from the planet at an amazing rate. Urban areas will double in the next 40 years, and humans will lose an area of protected forest as large as Pennsylvania; this process is even more dramatic in the developing world. Baltimore, where Jahren moved to work at Johns Hopkins, has the fewest number of trees of any city on the East Coast, with one tree for every five inhabitants. Yet the botanist moved into the city of Baltimore, and bought a row house close to the university, and Bill moved into her attic.

*Jahren begins the final section of her memoir, "Flowers and Fruit," with a note about how humans are destroying plant life all over the globe. This helps to place her work in perspective, especially as she begins to study the effects of climate change on plants later on in her career. It also demonstrates how important her research is to her—she is willing to move to the relatively tree-impoverished city of Baltimore to pursue her career and expand her lab. There is no discussion with Bill this time—he has simply become part of the package.*

Jahren and Bill were on their way to creating a bigger, better Jahren **lab** at Johns Hopkins, and while they were presenting at a conference in Denver, they bumped into a fellow researcher named Ed, whom Jahren considers her "academic uncle." He mentioned that he was retiring, and when Jahren asked what would happen to all of his lab supplies, he guessed that they would all be dumped, and then offered them to her, if she wanted to come and pick them up in Cincinnati. So Jahren and Bill rented two U-Hauls, packed up nearly everything from Ed's lab, and drove it back to Baltimore.

*Even as their institutional budget increases, Jahren and Bill are prepared to beg, borrow, scrimp, and steal to fully equip their lab as economically as possible. In this case, they feel no shame in rescuing old supplies and equipment from a lab that was about to close. Both Bill and Jahren were raised to be thrifty and careful with money, and this has proven useful for the times when they were financially strapped in their old lab.*

As they packed up the supplies, Jahren kept a running tab of the hundreds of dollars that they would save by taking Ed's old supplies. They then turned their attention to the mass spectrometer at the back of the room, which was about the size of a small car. A mass spectrometer is a little like a bathroom scale, but for atoms rather than humans, using electromagnetic fields as the method of measuring mass. The machine they were looking at in Ed's lab was much larger and more unwieldy than more modern versions, and after they examined it, they knew that they could not take it back with them. They loaded the other items onto the trucks and handed Ed an itemized list for his records. As they said goodbye, Jahren teared up, thinking about his lifelong contributions to science.

*Jahren is very appreciative of everything her friend Ed has given her, from the lab equipment to a sense of pride in her work. As a female scientist in a male-dominated field, Jahren has had to rely on the support of her older male colleagues and mentors who appreciate her work and are more inclusive. As Jahren moves on to a more mature phase of her career, Ed's gift of his old lab equipment is also a passing of the torch, as he is nearing retirement and has little interest in continuing his scientific research.*

Unlike humans and other animals, trees cannot take refuge inside or shield themselves from the cold in winter, and must endure up to six months of frigid temperatures per year. To do this, they go through a process called hardening, which involves letting the water out of their cells, leaving concentrated amounts of sugar, protein, and acid behind. This allows the tree to keep from freezing during the winter, and while it does not grow during this time, it is protected from the elements and can survive the frozen temperatures. This entire process is triggered by changes in sunlight, as the tree uses the sun like a calendar.

*Jahren often notes the difficult predicament that trees find themselves in due to the fact that they cannot relocate. In this case, she explains how they make themselves less vulnerable to the conditions to survive cold winters. Jahren will reflect on this defense mechanism, known as hardening, when she deals with the variety of male scientists who underestimate her or question her place in academic circles.*

Jahren and Bill are spending the summer on Axel Heiberg Island in Canada, and it feels like the middle of nowhere to them. Other than their fellow scientists, there are no other people for hundreds of miles, and while polar bear attacks are always a possibility in the region, they rarely see any animals at all, mainly because there is nothing for them to eat. The Canadian military checks up on them intermittently, but otherwise, they are completely alone with their research. Jahren is studying the remains of a deciduous forest that stretched above the Arctic Circle approximately 50 million years ago, when the climate was quite different in the region. Yet even if the Arctic Circle wasn't covered with ice, it was still bathed in darkness for three months, which would be a serious impediment to plant growth.

*As a paleobiologist, Jahren studies the history of plant life, and uses that to further understand the global climate throughout Earth's history. This brings her to the Arctic Circle, where she can only imagine the forest that existed millions of years ago, despite the cold and the months of total darkness. Now, it is a barren place, with the exception of the researchers and, very rarely, a single creature. Yet this is the kind of isolation that Bill and Jahren appreciate, allowing them to focus on their research.*

Jahren and Bill are on the island with 10 paleontologists from the University of Pennsylvania, who are carefully extracting fossilized trees to study. True to their rebellious nature, Jahren and Bill are using a different methodology to study the site: instead of focusing on individual fossils, they are taking out chunks and examining the layers to find changes in chemistry that will provide clues to how this forest survived on a larger scale. Jahren was resigned to the fact that the other researchers would never accept her or consider her a legitimate scientist, and she and Bill simply kept their distance, as they had back on that first field trip in California. While the other researchers slept, Bill and Jahren conducted their research, and vice versa.

*As they often are, Bill and Jahren find themselves separated from the other researchers on the island, both because they are from a different institution, and because they are using different methods to arrive at their conclusions. This is the point where Jahren accepts that she will often be an anomaly in the scientific world, with ideas that are too wild and innovative for her fellow researchers to accept or see as legitimate. She has hardened herself, and does not take it as personally as she used to.*

One day, Bill notices an Arctic hare in the distance, and the two decide to follow it. They find themselves at the top of a hill of sorts, and can still see the bright neon tents of their campsite, so they are in no danger of getting lost. Jahren mentions how the other researchers will never see her work as legitimate, and Bill is surprised to hear that he is not the only one who feels left out. He brings up the fact that he is missing part of his right hand, which kept him from making many friends as a boy. He didn't join any teams or clubs, never went on dates or to the prom, which he relates to Jahren with a mixture of regret and humor.

*Even on this nearly deserted island, far from the reaches of even the Canadian military, Jahren and Bill find a way to explore, separating themselves from their fellow researchers even more. As they find a high point that allows them to view the campsite and miles beyond, they take a moment to reflect on their lives, and especially on Bill's feelings of rejection that stem from the injury to his right hand. This gives Jahren and her readers a rare insight into who he is as a person.*

When Bill admits that he never went to prom, Jahren tells him that he should make up for it on the spot—they're in the middle of nowhere, and no one will see him dancing, except for her. She realizes why they are out there, because this is where Bill is supposed to dance, for the very first time. Instead of responding sarcastically, as he often does, Bill begins to dance by himself, in front of Jahren. She watches, accepting him for exactly who he is, and hoping that it will help her accept herself as well.

*Bill intentionally and preemptively separates himself from others, as he was often left out and rejected as a boy, ridiculed for his missing fingers, something he could do nothing about. Jahren gives him the opportunity to dance in front of her and he does, making himself immensely vulnerable but simultaneously reinforcing the strength of their friendship.*

All sex has a single, biological purpose: to bring together two separate sets of genes in order to create another individual, distinct from its parents. For plants, reproduction is managed through the spread of pollen, traveling on an insect, a bird or mouse, or simply spread by the wind. While travel on an insect helps the pollen reach its destination more directly, wind will help the pollen travel farther. No matter how it travels, however, it only takes one grain of pollen to fertilize an ovum, which then develops into a seed. If that seed does grow into a tree, it will produce 100,000 flowers, each of which will produce 100,000 grains of pollen, to start the process over again.

*Reproduction is an example of one of the ways in which plants and humans are not alike at all, yet Jahren finds a way to make a parallel between plant pollination—in which "one in a million" would be a good set of odds—and the process of finding a mate as a female scientist who is deeply dedicated to her work. She emphasizes the fact that plants do not spread their pollen very efficiently, but that only a single grain needs to be successful to begin the process of reproduction.*

When she was 32, Jahren met Clint at a barbecue, and decided that he was the most beautiful man she had ever seen in her life. She was so interested in him, she asked the hostess for his email address and asked him out. They spent their first date talking about science and math, and realized that they had attended Berkeley at the same time, and had probably been in the same seminar room more than once. Jahren recalls the moment Clint hailed a taxi for her, which seemed sophisticated to the rural **Minnesota** girl within her. They fell in love with one another easily, and to Jahren it feels like something she doesn't have to work for, and that she can't mess up.

*In the context of the pollination metaphor, Jahren finds her single grain of pollen: Clint. They revel in the fact that they could have met each other at any point during graduate school in California, and the coincidence of finding each other at this point in time, instead. And to Jahren, Clint is different from the other men she has tried to date, because he is not bored by her constant conversation about science, and he understands her love for her lab work.*

Jahren's love for Clint did not mean that she couldn't live without him—she had her own work, a meaningful plan for her life, and made her own money. But she longed for him, and fantasized about her future with him, including a wedding in a foreign land, owning a horse named Sugar, discussing theater in coffeehouses, having twins and a dog, and of course, taking taxis everywhere. Jahren describes it almost as if it is a romantic movie, but she specifies that it is "better than a movie," because it does not have to end, and it is their reality, and because she does not have to wear makeup.

*Jahren describes her relationship with Clint as easy, and he is somehow able to fit right into her life without much upheaval. She does not have to rely on him for her livelihood, as her mother did with her father, and she does not have to change who she is—by wearing makeup, for example. This allowed Jahren to fantasize about a life with Clint, linking their futures together.*

Their relationship progressed quickly: within weeks, Clint left his job in DC and moved in with Jahren in Baltimore, taking a job at Johns Hopkins as well. He was a mathematician, and from his office in the same building as Jahren's **lab**, Clint wrote computer models to predict lava flow within the Earth's crust. Jahren is amazed by Clint's ability to think theoretically, while she is a much more hands-on thinker. They balance each other out, seeing the world from different perspectives: she needs to control her work, observing it carefully in a lab, while he can simply create a model and let it go.

*Just like Bill, Clint balances Jahren out in many ways. He is a perfect combination of similarities—their love for math and science, for example—and differences. He is calm and reflective where she is anxious and active, and that will be useful to keep Jahren mentally balanced during this time in her life. Yet it is important to note that Clint does not take Bill's place in Jahren's life—he is a new addition, with his own role.*

The summer after they met, the couple took a trip to Norway, one of Jahren's favorite places. And just as she had envisioned it in her fantasies, she and Clint got married in Oslo City Hall. They returned to the United States and went straight to see Bill, who had recently moved out of Jahren's attic and bought a place of his own down the street. Up to this point, Bill had paid very little attention to Jahren's boyfriends, as he did not expect the relationships to last very long. This was different, however, and Bill had been acting strange and avoiding the two of them since they began dating. True to his easygoing nature, Clint had taken this in stride, knowing that Bill would just need to get used to the new situation.

*True to her fantasy of getting married in a language she does not understand, Jahren married Clint in Norway, only a few months after they met at the party. Like so many important events in Jahren's life, she does this on her own, without her family or even Bill as witnesses; this demonstrates her strong will, as she is determined to create her own family as an adult. And while Jahren is worried about how Bill will react to this new addition to their bond, Clint is sure that everything will be fine.*

When they arrived at Bill's house, Jahren announced that she and Clint had gotten married, and Bill's main concern was whether or not he needed to buy them a gift. And then, as if to change the subject, Jahren invited Bill to join them at Fort McHenry for the day; Bill tried to decline the invitation, but when Clint handed him the keys and offered to let him drive, Bill agreed. The three of them enjoyed Family Day at Fort McHenry, complete with carnival games, hot dogs and cotton candy, and a petting zoo. Jahren also notes that they got in at a discounted rate because they are a real, if unconventional, family.

*While Bill is worried about how Jahren's relationship with Clint will affect their friendship and professional relationship, Clint has no intention of replacing Bill or excluding him from their lives. By handing Bill the keys to his car, he offers up some of the control, acknowledging that they will establish some kind of balance. The fact that they attend Family Day is also an important signal that they see themselves as family.*

When scientists studied the growth of a corn plant in 1879, they learned that its growth took the shape of an S, with a large drop-off right before the period where the plant flowers and produces seed. This proved true for nearly all corn plants, and while not all plants have exactly the same S shape, many show a decline in growth just before flowering. When Jahren shows her students the S shape, they are confused, wondering why a plant would stop growing at the peak of its productivity. Jahren reminds them that this signals the onset of reproduction, when the creation of new life requires a sacrifice on the part of the parent.

*As Jahren places her life experiences within the context of plant development, she now focuses on the growth pattern of plants, which usually declines with the onset of reproduction. Jahren is nearing her peak years of productivity as a science researcher, with a bigger and more powerful lab, with more grant money and prestige. Like a plant, however, this is a time when she must slow her growth a bit while she has a baby.*

For Jahren, pregnancy is the most difficult part of her life, for more than one reason. She is plagued by the usual pregnancy issues: discomfort, sleep issues, and the strange feeling of the baby kicking inside of her. What's more, she is not able to take any of the medications that have kept her mentally stable for years now, because they place the fetus at risk. Jahren describes this as "waiting for the locomotive to hit," as she is seven times more likely to have a manic episode, now that she is off of her medications. Her morning sickness is followed by uncontrollable crying, and Jahren begins to hit her head against the walls to knock herself out. The doctors strap her down and give her electroconvulsive therapy instead.

*Just as Jahren has learned to manage her mental health, her pregnancy puts that in danger once again, as she is unable to take the medication that she needs so badly. While pregnancy itself is not particularly easy, it is the return of her bipolar disorder that makes it extra difficult for Jahren, who is used to being in control. This is the sacrifice that she has chosen to make, however, in order to have a child. Like a plant's S-shaped growth curve, Jahren has to lose something of herself to make another life.*

When Jahren hits the magic 26-week mark, and is able to resume her mediations, she begins to feel more like herself and tries to go back to work. She is so exhausted, however, that she often sleeps on the floor of her office, and finally decides to put herself on medical leave. She still comes in to the **lab**, though she doesn't handle chemicals or participate in the experiments—she simply needs to be there for comfort, listening to the humming of the machines. On the way to the lab, she sees Walter, her department chair, and stands at attention like a soldier. She feels faint, and has to sit down and put her head between her legs; Walter looks confused, and instead of helping her, he simply goes into his office and shuts the door.

*Jahren has not experienced a great deal of overt discrimination on the basis of her gender up to this point in the memoir (or at least hasn't recounted it), but her pregnancy changes that—up to this point, Jahren has not acted much differently from the male scientists around her, and has been able to focus entirely on her research. Her pregnancy, and the biological processes associated with it, reminds people like Walter, the department head, that she is a woman. And at her weakest point, Jahren still tries to look like she is in control in front of Walter; when she nearly faints, he does not even help her.*

Later that day, Clint comes to Jahren's office with some devastating news: Walter has requested that she not come into the building while on medical leave, citing liability issues. Jahren is angry and confused, and will always wonder why she was banned from the **lab** that she created and was the safest place in the world to her. Clint is also angry, but in a calmer way, noting that the men in the department simply do not feel comfortable with a pregnant woman around, and that Walter is afraid of Jahren, which is why he could not come and tell her himself, sending Clint as his messenger. Later, Clint would tell Jahren that his love for Johns Hopkins ended on the day she was banned from her own lab, and they would pack up and move to a different university. But in this moment, all Jahren can do is throw a coffee cup at the wall in anger.

*Jahren emphasizes that Walter is a coward who is uncomfortable with the presence of a pregnant woman in the science building. This is reinforced by the fact that he cannot even tell Jahren directly to leave the lab, and has to ask Clint to help. Pregnancy is typically one of the most difficult times for professional women, especially those in male-dominated fields, as they become more marginalized for their choice to have children. Jahren is lucky to have such a supportive husband, who agrees to move with her to a university that is more progressive and inclusive when it comes to women in science, because not all women have the freedom to leave difficult work situations like this one.*

Now that she cannot return to the **lab**, Jahren has plenty of time to think about the arrival of the baby. But she is not excited, as she believes she should be—she is instead grieving over what she will lose. She does not daydream about what this child will be like, because she is sure that it will be a boy, and he will be blonde with blue eyes, like his father. He will have Jahren's father's name, and will hate her for being an unfit mother. She eats and sleeps, focusing on giving her fetus what it needs for the moment, and trying not to wonder when she will have another manic episode. When Jahren talks to the doctor, she feels that she is being forgiven for her failures already, as she admits that she probably will not be able to breastfeed.

*Jahren spent much of her childhood dreaming of becoming a scientist like her father, and of not becoming her mother. Jahren is now conflicted by those feelings, as she wants to create a family with Clint, but she does not want to have to give up her dedication to science research, or the freedom to take on projects in foreign countries, in exchange for motherhood.*

One evening, Jahren sneaks back into her **lab** after everyone else has gone home, and sits with Reba in the dark. When Bill arrives, he is surprised to see her, makes jokes in an attempt to bring things back to normal, and updates her on everything going on in the lab. When Jahren admits that she is hungry, they go back to Bill's house and watch *The Sopranos* all evening, until Clint picks her up to bring her home. Later that evening, Jahren's water breaks, and they go to the hospital. It is a teaching hospital, so Jahren is often visited by a professor and his medical students, reminding her of the days when she wanted to become a doctor but could not afford medical school.

*Being banned from her lab has exacerbated Jahren's feelings of failure and loss, as she has defined herself by her role as a science researcher up to this point. She spends her last day of pregnancy sitting in the lab with her dog, enjoying a moment of quiet in her most beloved space. She then runs through a series of emotions as she prepares to have the baby, including anger at the medical students who she believes do not appreciate the golden opportunities they have before them.*

Once the students leave, Jahren is given an epidural for the pain, and begins labor, but when the baby's head is nearly out, the doctor realizes that the cord is wrapped around its neck. She has to deliver the baby using a vacuum extraction, which is very painful despite the epidural—but once it is done, Jahren is holding her new, nine-pound son. Surprisingly, Jahren is in love with this baby; she spends the next few days just holding him and periodically demonstrating her sanity to the doctors and nurses who come in to check on her. As she leaves the hospital, Jahren decides that she will not be this child's mother—she will be his father.

*All of Jahren's struggles and pain leading up to childbirth suddenly disappear, as she falls in love with the human being she has created through love. Many of Jahren's concerns fade away as she realizes that she does not have to feel like a failure, or take on a maternal role that feels unnatural to her. She says that she will be her son's father, meaning that she will treat him as her father treated her, and not as her mother did.*

Water is at the center of all life, and every living thing is on a constant quest for more water. Trees are at a disadvantage because they cannot move around in search of a better water source, like animals and even some plants can. Larger trees use their taproots—the ones that go straight into the ground—to bring water up towards the surface, which helps smaller plants with shallower roots as well. Mature maple trees do this for the saplings that grow nearby, helping them survive another year. Jahren notes that parents cannot do everything for their children, but they do everything they can.

*Jahren begins to see the world differently, now that she is a parent and has a young person to take care of. She will give him something of herself, but she will not lose herself in the process. Like a maple tree that uses its taproot to bring water closer to the surface to support the shallow roots of its saplings, Jahren will work hard to provide for her son, giving him everything he needs to thrive in the world.*

Jahren is living in Norway with Clint and her son, on a Fulbright grant to study tree memory. Scientists have found that saplings that have experienced cold climates, when transplanted to warmer climates, will remember and reenact the processes necessary to survive in the colder climate. In the **lab**, Jahren soaks seeds in sterile water, and works in a space where sterile air is blown at her, reminding her of her college days working in the university hospital. She places the embryo of the seed in a petri dish, closes it, and labels it; she then proceeds to do this 100 more times. She and her colleagues are growing these seeds in an incubator until they are ready to be planted in the greenhouse. Many years in the future, scientists will be able to examine those adult trees and possibly supply some answers to Jahren's questions.

*As a wife, parent, and successful research scientist, Jahren now takes a moment to reflect on her youth in Minnesota. Like a tree that has been transplanted to warmer climates, Jahren still falls back on to the patterns she learned as a girl. And just has she has done for years as a junior researcher, Jahren repeats the mundane but soothing lab processes that are the building blocks of great scientific breakthroughs. She feels deeply connected to the researchers who will one day inherit her work and take it even further than she was able to do.*

After the birth of her son, Jahren's professional life somehow got easier, and she began to receive grants from the National Science Foundation, the National Institutes of Health, the Department of Energy, and the Mellon and Seaver Foundations. This meant that they could replace old supplies, no longer needed to steal from other **labs**, and that Bill could actually have a consistent salary from year to year. This also brought down Jahren's stress level, and she was able to complete much more work than before, and began to receive awards for her research. Living in Norway was also a welcome change for Jahren, as she feels at home in the cold climate and closed culture. The only thing that Jahren found difficult about her time as a Fulbright Scholar was that she missed working with Bill.

*To return to the metaphor of the S-shaped plant growth curve, Jahren is once again peaking in productivity and achieving success after her difficult reproductive experience. The security of more funding and some sense of legitimacy is good for Jahren, allowing her to focus less on chasing funding and more on the research itself. In addition, her time in Norway helps Jahren understand her upbringing in Minnesota, which gives her even more mental balance. This is the first time she is away from Bill, however, and she feels like she is separated from part of her family.*

One morning, Jahren woke to an email from Bill, informing her that his father had died. Jahren responded by flooding him with text messages of support, but Bill did not respond to her for weeks. She knew that he was working twelve-hour days in the lab, ignoring everyone around him, as he is prone to do when he is upset about something. She imagined what it must have been like for him in California, mourning his father's death, but she also knew that she could do nothing to help, and neither could anyone else. Finally, she decided to buy him a ticket to Ireland and email it to him, with a short message about what a wonderful man his father was.

*While Bill has served as Jahren's main emotional support for most of her adult life, the roles are reversed in this moment as Bill mourns his father's death. He is not accustomed to receiving support from Jahren, however, and she has to accept his silence as part of the mourning process. But after weeks of worrying about him, Jahren decides that the best way to connect with Bill is through scientific research, and she plans a trip for the two of them.*

There was so much more that Jahren wanted to say to Bill, about how he was the fulfillment of his father's dreams of a new life in the United States, that he was his father's favorite child and that he was just as strong as his father had been. She wanted to tell him that he would survive this—but instead, she just let him know that the rental car was in her name, so he needed to wait for her at the airport when he arrived. When she landed at the airport, Bill was there with three bags full of supplies for their fieldwork, looking tired but otherwise okay. Before leaving, Jahren bought a bag full of candy for their drive, and made sure to get full insurance on the car, just in case.

*Bill and Jahren have a unique relationship that takes into account both of their personalities—this means that they often refrain from sharing their feelings with one another, and instead appreciate the shared silence. In this case, Jahren has a lot of things she wants to tell Bill, but she knows that he will only be able to hear those things when he is ready, and that will likely be when they are in the middle of nowhere, studying plant life.*

They decided to drive through Limerick, rather than around it, and began to get lost in the narrow, winding roads of the city. Suddenly, Jahren heard a crash, and looked over to see Bill's window smashed, though he seemed to be okay. They got out and determined that Jahren had been driving too close to the curb on Bill's side, unaccustomed to driving from the right side of the car, and when she passed a streetlight, the side mirror had broken off and smashed into Bill's window. As bystanders looked on and joked about how Jahren was trying to kill him, Bill began to tape up the window, calm as usual. They got back in the car, and Bill let Jahren keep driving.

*Regardless of how focused and meticulous they are as scientists, Jahren and Bill do seem to be prone to accidents, especially on the road. Therefore, the minor accident in Limerick set the tone for their trip, reminding them of the adventures and mishaps they have had in the past. As they have full insurance on their rental car, they do not worry about the damage, and the experience lightens the mood and makes them feel like their old selves again.*

They drove back out of the city and enjoyed the incredibly green view of the hills, distinguishing between a handful of hues and shades of green. They arrived at their bed and breakfast, parked, and began to hike to the highest point they could find together. Jahren noticed that Bill still seemed weighted down, not free and content as he usually was in open spaces, so she told him that she couldn't believe that his dad was really gone. He agreed, saying that one never expects a 97-year-old man to die. But Bill's dad worked in his home studio up to the day he died, editing film for yet another documentary. Jahren imagines him barging into Heaven, asking questions and interviewing people and planting tomatoes, just as he had done in life.

*They continue their routine of wandering as far as they can together, and finding perspective in the expanse of nature. While Jahren is sure that it will only take an open space for Bill to feel better, he actually needs to have a conversation with Jahren, opening up to her in the way he did on their research trip to the Arctic Circle. Jahren has to do or say very little—she is simply giving him the space to be vulnerable, secure in the knowledge that he is with his closest "family" member at this point.*

Bill admits that he feels bad for himself, and that having a parent die makes him feel all alone in the world. Jahren wanted to tell him that he would never be alone, that he had friends that were even closer than family. She wanted to remind him that she would love him even with missing fingers, or when he was homeless, or when he smoked, and no matter how antisocial he was. But she admits that she didn't know how to say any of those things, so she kept them to herself. She just stood in the rain, knowing that she would be soaked throughout most of the trip, walking through plant life that absolutely adored the wet weather and was soaking it up.

*Again, their relationship is based on many things that they choose not to say to each other, but that they believe are understood. When Bill admits that he feels all alone in the world without his father, Jahren does not respond, but she is there with him, and her presence alone is what he needs. And of course, as a plant scientist standing in the middle of a grassy field, Jahren turns her attention to the grass at her feet, and she and Bill get down to work.*

Jahren asked Bill if he had any vials with him, because the moss on the top of the hill was soaked, despite the fact that the water should have been flowing downhill. They began to hypothesize that the moss at the top of the hill was holding on to the water that should have run off into the lowlands—essentially, the moss was actively changing the landscape to suit its needs. She then pulled out her reference book on moss in the UK and Ireland, and began to identify the moss and take samples. After they had collected, photographed, and labeled about 150 samples, and then doubled checked their work, Bill announced that he was beginning to feel better again.

*Jahren notices something special about the grass on the hill they have climbed, and she and Bill transition into science mode, leaving behind their emotions and returning to what they do best. Once again, she and Bill are engaged in the tedious work of collecting samples, which they actually seem to enjoy. The repetitive work, combined with the belief that it will lead to a meaningful scientific discovery, is a joyful and cathartic process for the both of them, and helps to heal Bill in a way that conversation did not.*

They repeated this process at seven more sites in Ireland, taking with them over 1,000 vials full of moss samples. They returned their bandaged-up car and proceeded to the terminal, where they soon found that they did not have the appropriate permits to take their samples out of Ireland. Jahren did not think they needed permits to get the samples to Norway, but she was so busy worrying about Bill that she had forgotten to check. Bill explained that they didn't need permits, as the plants weren't endangered and they were collecting them for scientific study. The security agent opened one of the vials and dumped the moss onto the ground, telling them that yes, they did need permits to take biological samples out of the country. So they were forced to leave them at the airport.

*They repeat the same process more than a thousand times over, and the trip has provided a much-needed escape for Bill and a way for Jahren to reconnect with her best friend. However, their hopes for a scientific discovery are dashed at the airport when they cannot take the samples out of Ireland. This experience would have destroyed Jahren as a younger researcher, and she would have interpreted it as a sign that she should quit, or that she was destined to end up like her mother. But at this point in Jahren's career, she is used to setbacks, and while she is still upset, she largely accepts adversity in stride.*

While Jahren stewed over the 60 hours of work that they had lost, Bill reminded her that they had photographed everything and taken meticulous notes, so all was not lost. As Bill's flight was called, Jahren watched him go with regret, feeling that something she cared about was being taken away from her for the second time that day. Once he was gone, she pulled out her map of Ireland and began to plan for another trip, when they would apply for permits before taking the moss out of the country. They referred to this trip as "the Wake," or "the Honeymoon," depending on who was talking.

*The fact that Jahren and Bill did not bring their samples out of Ireland only reinforces the idea that the trip was more about the process, and the bond between the two researchers, than it was about the data they collected. As he leaves, Jahren begins to plan the next trip, adding to the sense of continuity in their relationship. Their different names for the trip also give an idea of how meaningful it was for the both of them.*

Whenever they had a new **lab** assistant to break in, Bill and Jahren would first give him hundreds of vials to label, using complex codes. They would then discuss in front of the lab assistant whether or not the vials could be used, which then ended with one of them (playing the "Bad Cop") would dump all the labeled vials into the trash, while the other sat and watched the new assistant's reaction. They were testing whether or not the new assistant valued his time, which was a bad thing in this line of work. Jahren notes that there are two appropriate responses to such a setback: to shake it off, go home and rest, and come back refreshed the next day; or to return to the work immediately, diving even deeper into what went wrong. While both are acceptable, Jahren claims, it is only the second path that will lead to real discoveries.

*Jahren is determined to give her students a hands-on experience of science, to prepare them for the positives and the negatives of the career path she has chosen. In this case, she and Bill have students learn from their mistakes and prepare for the inevitable frustrations of science research. This is her way of building resilience in her students, which is something she has built within herself during her years in the field. Jahren jokes that it is not good to value one's own time in her line of work, but she demonstrates that science can be a long process with few rewards along the way.*

Jahren's son also has his favorite tree, a foxtail palm that he regularly hits with a baseball bat in order to strengthen his swing. Since moving to Hawaii, Jahren has learned that palms aren't trees at all, and do not produce rings of wood as trees do. They are filled with a spongy tissue, which makes them more flexible than trees. She also learned that palms are evolved from "monocots," which are similar to grasses, but which have also evolved into rice, corn, and wheat plants. Like these diverging plant species, Jahren's son is like her, but different. He is more cheerful and emotionally stable, and likes to be in the driver's seat in life. Jahren considers herself hazel in every way, stuck in between blonde and brunette, green and brown—she even considers herself not quite a "proper woman" and yet "less than a man."

*Jahren's observation about her son's favorite tree portrays the boy as his own person, and not just a replication of his mother. He is more interested in becoming a baseball player than examining the inside of the tree or playing in Jahren's lab. She is still learning about her child, the person she grew inside of her, but who has turned out to be so different from her. She also appreciates the ways in which he is different, because she feels that he is an improvement, as if he has selected the best qualities of both his mother and father. While Jahren feels stuck in between, she feels that her son knows who he is already.*

Jahren was worried that she would not be able to love her son enough, but now that he exists, she believes that she loves him more than he will ever understand. He is her one chance to be a mother, and once she dropped the expectations of motherhood, she realized that it was something she could do. She breathes him in, and knows that she must begin the slow and painful process of preparing for the moment when she must let him go. But she also knows that all of these fears, concerns, and all of this love is something that all mothers share. It was so difficult to be a daughter to her own mother, and wonders if she had a son to let the cycle skip a generation, and if she is meant to have a granddaughter.

*Jahren has long felt trapped by others' expectations of her, especially with regard to her gender. She does not feel like she embodies the social construction of a woman, in large part due to her intelligence; she also feels uncomfortable with the conventional image of motherhood, and has chosen to simply parent the best way she can. She reflects on her difficult relationship with her own mother, and is relieved not to have to reenact that dynamic with a daughter of her own.*

Jahren realizes that she may die before this theoretical granddaughter is born, but she still holds out hope. She wants to leave a message in a bottle, so that someone will remember and tell her granddaughter about her grandmother, a woman with a pen in her hand, listening to a boy outside, whacking a tree with a bat.

*Jahren likes the idea of having a granddaughter, possibly because she will no longer be under the same stifling expectations and will simply be able to enjoy the experience. She sees herself as beginning a process that will be taken up by someone far in the future.*

One morning as Jahren entered the **lab**, Bill greeted her with news of one of their specimens, known as C6. The plant was part of a larger experiment focused on the consequences of an excess of carbon dioxide on radishes, but this particular plant was doing something that surprised both Bill and Jahren, and had nothing to do with their main experiment. Bill had been recording the plants so that they could watch their growth every day, and they noticed that C6 acted differently than the other plants, despite the fact that it came from the same batch of seeds and was growing under the same conditions. Nothing official came of this aberration, but it changed the way that Jahren thinks about plants and what one might call their sense of free will.

*Back in the lab, Jahren and Bill make a discovery that impresses them both, despite the fact that it will not lead to a scientific study worth publishing. They have been observing a plant that unexpectedly behaves differently from its neighbors; they cannot establish exactly why the plant was behaving strangely, but Jahren is interested in the rogue plant for more poetic reasons. She now has the freedom to think differently about plants, and to ask questions that she does not know the answers to.*

Plant C6 was demonstrating to Jahren that he had some level of volition beyond what was programmed for him in his biology. It was so slow, however, that it was nearly impossible to recognize it as such; on the other hand, from the plant's point of view, Jahren probably moved too fast and frantically to be alive, either. Jahren was enthralled by this small discovery, which would likely never end up in a published work. But rather than becoming official scientific research, it was simply feeding her spirit, which was just as good, in Jahren's opinion.

*In all of her time observing plants, Jahren has developed a connection to them that makes her wonder about the extent to which they may be conscious beings, She even imagines the plants observing her without quite understanding her. This, of course, is outside of the realm of her scientific research, but it is part of her job as a scientist to stay curious and question everything.*

Jahren and Bill went to Whole Foods for lunch, and ended up making a series of impulse buys that brought their total up to around $200. They were shopping "like people with mutual funds," for once in their lives. Back in the **lab**, they wrapped expensive ham around caviar and microwaved it, enjoying the luxury of it, when Jahren realized that she had to pick up her son from school and take him to the beach.

*Now that they are more established scientists with homes and salaries of their own, they can enjoy certain extravagances, like high-end food at lunchtime. These are small signs that all of their work and sacrifice has paid off in the end.*

As they play in the sand, Jahren's son asks if there are animals so small they are invisible to humans, and Jahren tells him that there are, in fact, many microscopic animals in the world. He then comments that he told his teacher about the tiny animals that find each other with magnets in their bodies, and that the teacher did not believe him. Jahren reacts defensively, telling him that she even knows the person who discovered them, but he changes the subject—he wants to be a major-league baseball player when he grows up. Jahren promises to come to all of his games, if he will get her free tickets.

*Jahren brings her love of science into her relationship with her son, talking to him about science at a higher level than perhaps most people would do. She has knowledge that is far beyond what his science teacher can offer, and is proud of this, but her son is his own person, with his own interests, and changes the subject. It is now Jahren's turn to take an interest in her son's first love, baseball.*

Jahren brings her son home and makes dinner just as Clint arrives home from work as well, and they manage to get their son in bed by 9 P.M. As he is about to brush his teeth, Jahren hands him a vial of wheatgrass juice (from the $200 haul at the Whole Foods earlier that day), which he believes is a potion that he has requested, which will turn him into a tiger. As Jahren is tucking him into bed, her son asks when he will turn in to a tiger, and she tells him that it will take a long time. She promises him, however, that it has worked on a mammal called *Hadrocodium*, about 200 million years ago.

*Despite her intense dedication to her career and the research in her lab, Jahren makes time to enjoy her relationship with her son, striking a balance between her two competing roles. She mixes both in her interactions with her son, teaching him about a prehistoric animal, but also letting him believe that he will turn into a tiger, thanks to a vial of wheatgrass juice. She is not following a set of expectations, and instead is parenting in a way that makes sense to her.*

Jahren's son asks if she will be going back to the **lab** that night, and Jahren says yes, but that she will be home by the time he wakes up. Also, the boy's father (Clint) is at home, as well as their dog, so the house is full of people who love him. She leaves the room and checks her phone, seeing a message from Bill asking for ipecac (a chemical compound that will induce vomiting) and more food. She then brings her husband another cup of coffee, lets him know that she will be going back to the lab, and hops onto her bike to ride back to work for the night.

*Part of the balance that Jahren strikes between her professional and family responsibilities is due to the fact that she does not sleep much, and is able to return to the lab after her son is in bed, and spend much of the nighttime hours working on her research. This is a sacrifice she is willing to make to achieve all of her dreams, personal and professional.*

Jahren finds something very sad about ending a plant experiment. She used to be able to work for two days without stopping, sustained by the excitement of discovery; now, she has more profound discoveries that come to her when she is sitting down and relaxing a little. She was also happy to be able to stand by and proudly watch a student take a leadership role in their most recent experiment. They had discovered that sweet potatoes grow larger but less nutritious under higher levels of carbon dioxide, a major discovery with regards to climate change. But now it is all over, and Jahren feels like she has just sent a child off to college.

*Jahren's relationship to research has changed as she has matured, and while before she was able to work nonstop, possibly fueled by a fear of failure and increasing anxiety, she is now able to sit back. She is currently researching the effects of climate change on plants, and hopes that by letting some of her students take ownership of the work, she can usher in a new generation of plant lovers and, ultimately, conservationists.*


Jahren realizes that she is missing her mammogram, which is already three years overdue, and that she has rescheduled once already. Bill comes in to the **lab**, and as she is noticing that he hardly looks any different after 20 years, he tells her that she looks haggard and tired. She jokes with him, telling him that he's fired, but he pulls her outside to see a double rainbow that has appeared in the sky. They discuss the fact that as scientists, they know that the two rainbows are one in the same, and that they just give the appearance of two. They come back in to smell the orchids from another biologist's experiment, and revel in how good they have it.

*Jahren makes a point of noting that while her life has changed and improved in the past few years, she is still far from perfect, and cannot always strike a perfect balance between work and life. Bill helps her strike that balance, and their relationship has not changed much in all of the time they have been together—they still share in their love of science and nature, and have finally found a way to make that work for them.*

Jahren worries about Bill, however—he seems to have missed out on having a wife and kids, because he has dedicated so much time to Jahren and the **lab**. He seems unconcerned about this, noting that at 50, he is too young to be dating, since Armenians regularly live over 100 years. He no longer worries about money now, as he made a lot of money on the sale of his Baltimore rowhouse, which he fixed up on his own. He now owns a house on a hill overlooking Honolulu, with a flourishing garden, and jokes that women were once put off by the fact that he lived in a van, but now they only want him for his money.

*Bill's life has changed quite a bit in the past years, as well—he is no longer homeless, living in precarious conditions without a bathroom—but Jahren wonders if he has made too many sacrifices for the sake of science. He responds to her concerns in the same way he always does, with humor. What is deep within Bill may never be clear to Jahren or to readers, as he is selective about what others know about him.*

People still wonder about the nature of Jahren's relationship with Bill, as they spend so much time together, have intertwined their finances and personal lives, and seem even closer than family. Jahren is happily married, but Bill is still a part of the family that she has created, and she would never give him up. She cannot put a label on their relationship, but that is not important to her. They discuss their plans for further research, and Bill is excited about all of the possibilities that lie before them.

*Jahren reiterates the fact that Bill is part of her family, yet distinct from her romantic relationship with her husband Clint. This kind of deep, platonic relationship is rare in adulthood, though possibly because of the cultural expectations of men and women, which Bill and Jahren do not seem to care much about.*

As Jahren and Bill discuss their plans for the future, they begin to recount stories of past experiments and adventures. They realize that between the two of them, they have received three degrees, held six jobs, lived in four countries and visited 16, been admitted to the hospital five times, owned eight cars, driven over 25,000 miles, and made around 65,000 carbon isotope measurements. They have published those measurements in 40 journals, providing valuable information to the science world. But what seems to matter most in this moment is the story—and Bill tells Jahren that she should put it into a book.

*Bill and Jahren have been through a lot together, and that is part of what truly bonds them. They both believe deeply in the value of what they are doing, and they enjoy doing it together. They were happy when they were poor and struggling for legitimacy within the science world, and they built important memories during those times. And as Jahren has noted, writing down those memories will keep them from slipping away.*


Bill knows about Jahren's writing—she writes poems and stashes them in the glove compartment of her car, types out numerous stories on her computer, reads books and writes long letters to the authors, and looks through the thesaurus for fun. She needs to write, and he is now giving her permission to commit their stories to paper.

*Jahren's love of literature is due in part to her mother, who exposed her to a variety of authors and works as a young girl. This is another way that Jahren connects to the joys of her childhood, through reading and writing.*


In some ways, Jahren vows not to take her job too seriously, especially because she often feels like an ant, plugging along anonymously within the context of a huge world that may not recognize her in the moment. But she is also part of that larger context, and is helping to build something that will amaze her great-great-great grandchildren, and building on something that her great-great-great grandfathers initiated. She is a small part of the larger scientific collective, and she longs to tell her story.

*Jahren likes to step back and look at the bigger picture, whether in a research project, in her writing, or on a field trip with Bill. She finds both frustration and comfort in the idea that she is part of a larger chain of knowledge: she will not see the big discoveries in her lifetime, but she is confident that she is laying the groundwork for them to be made someday.*

## EPILOGUE

In reality, plants are not like humans—they are different in many significant ways, and the more that Jahren realizes this, the more she knows that humans cannot project their consciousness onto plants. In addition, humans have turned plant life into three things: food, medicine, and wood. This monetization of plant life has wreaked havoc on the ecosystem, and Jahren estimates that in 600 years, humans will have cut down every tree on Earth. Her job, then, is to track this destruction, making sure it does not go unnoticed. On her bad days, she feels helpless, but on her best days, she feels like she can do something to slow the process of global destruction of plant life.

*For all of her attempts to use plants as a metaphor for her life, Jahren understands rationally that plants are not humans, and that the personification of plant life can both help and hinder their survival. She hopes to bring some attention to the destruction of plant life on Earth, though she knows that she is only a single voice and often feels frustrated by the nearly insurmountable task. This book, however, will help her to spread her message far and wide.*

Jahren then directs herself to her readers again, asking that they do one thing for her: plant a tree. And then plant another. And while many people will opt for a fruit tree, like a Bradford pear, they may look nice for the first year and bloom quickly, but they are not strong or hardy, and will not last in the long term. She suggests an oak. She also mentions that many organizations have tree-planting programs and will donate trees to anyone who wants to plant one on their land. And she notes that for the first three years, the tree will need attention, as those are critical years of growth; she also suggests that readers connect the tree to their own lives, marking their children's growth on the trunk. She also begs, half jokingly, that readers carve Bill's name into the tree trunk as well.

*Jahren finishes her memoir by returning to her conversation with readers, this time focusing on their work as scientists and conservationists. As a career professor, Jahren gives readers an assignment, suggesting that they commit themselves to action beyond the confines of her book. Not only does she suggest that her readers plant a tree, she also wants them to make a personal connection to the tree, and maybe even use its development to understand their own lives, as she has done.*

Finally, Jahren notes that each reader will have his or her own tree. She asks readers to look at their trees, and wonder about them: what does it want, need, wish for? She asks that readers talk to their friends and neighbors about their trees, take photographs, count the leaves, and write it all down. That is what scientists do.

*Jahren returns to the essential skill of the scientist: questions. It is only through the process of asking questions, wondering, and exploring, that scientists make breakthroughs, and it is only through the written word that they teach others about them.*

## HOW TO CITE

To cite this LitChart:

### MLA

Sherriff, Gina. "*Lab Girl*." *LitCharts*. LitCharts LLC, 7 Feb 2019. Web. 9 Jun 2020.

### CHICAGO MANUAL

Sherriff, Gina. "*Lab Girl*." LitCharts LLC, February 7, 2019. Retrieved June 9, 2020. https://www.litcharts.com/lit/lab-girl.

To cite any of the quotes from *Lab Girl* covered in the Quotes section of this LitChart:

### MLA

Jahren, Hope. Lab Girl. Knopf. 2016.

### CHICAGO MANUAL

Jahren, Hope. Lab Girl. New York: Knopf. 2016.