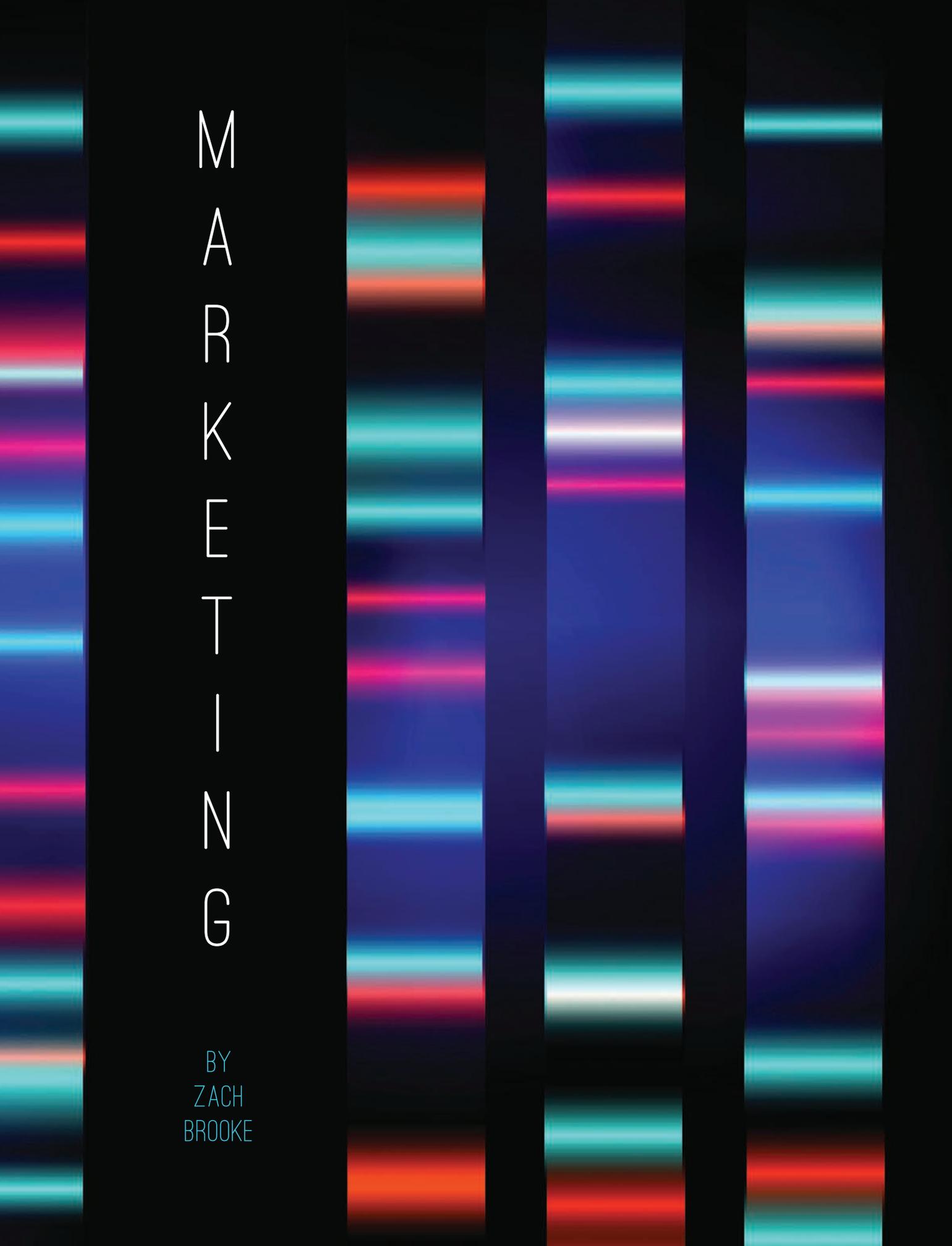


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CONSUMER GENETICS IS
POISED TO BECOME THE
NEXT BIG DRIVER OF
CONSUMER PREFERENCE
IF IT CAN SUCCESSFULLY
ADDRESS CONCERNS
ABOUT PRIVACY AND
LEGITIMACY



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THE SECOND ACT OF BENNETT GREENSPAN'S PROFESSIONAL LIFE WAS INSPIRED BY A LONG-HELD INTEREST IN GENEALOGY AND SPURRED BY A NOT-SO-FRIENDLY NUDGE FROM AN ANNOYED SPOUSE.

It was the late 1990's, and Greenspan's 16-year-old company, Industrial Photographic Supply, had just been sold. He was mired in an idle period between gigs when, one afternoon, his wife came home with a car full of groceries.

"I opened up the cupboard, and it was a mess," he says. "The whole-peeled tomatoes were on the top shelf. Spaghetti sauce was on the next shelf. You couldn't even find the tomato paste, and tomato sauce was on a different shelf yet. I asked my wife, 'Would you mind if I reorganized your cupboard?'"

Big mistake.

“She told me I should pick up golf or go back to my genealogy, but I needed to get the ‘expletive’ out of her kitchen.”

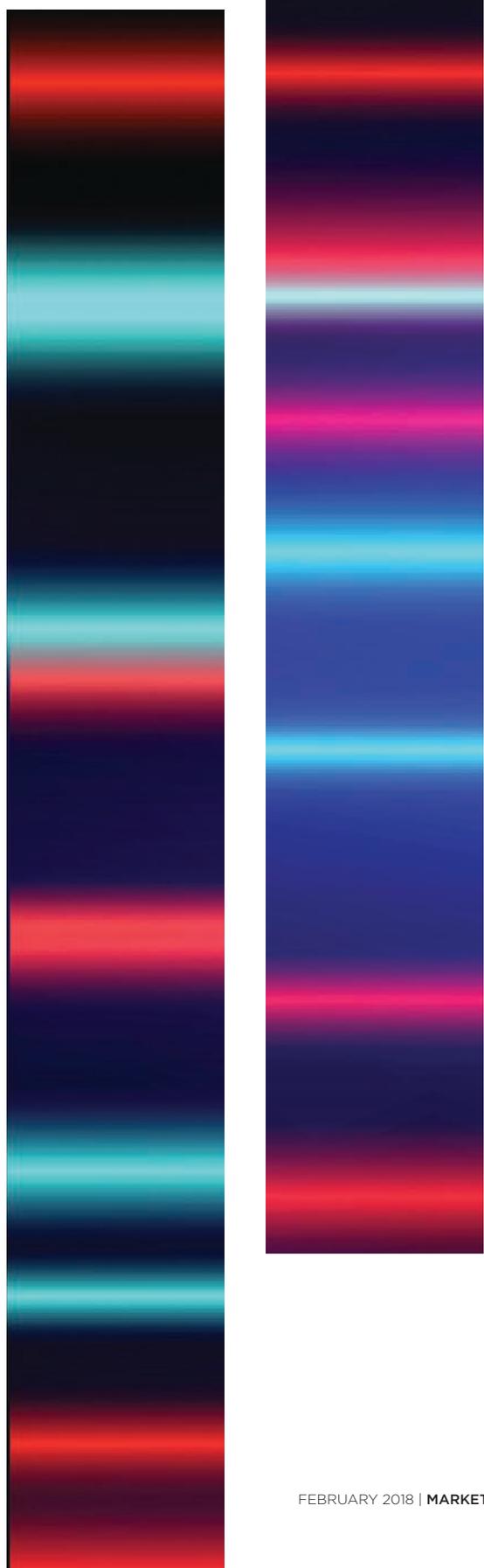
Greenspan opted for the latter. Long an enthusiastic chronicler of his family’s history (he first sketched a family tree as a teenager in 1965), Greenspan devoted the next month to exploring the lineage of his lone unmapped grandparent, only to bump into an online researcher from Buenos Aires tracing the same person. It wasn’t long before the pair channeled their efforts to uncover a probable familial relationship between them, and though they succeeded in linking their respective ancestors to the same village and set of surnames, they fell short of producing a single connecting historical record—then considered the gold standard of genealogy.

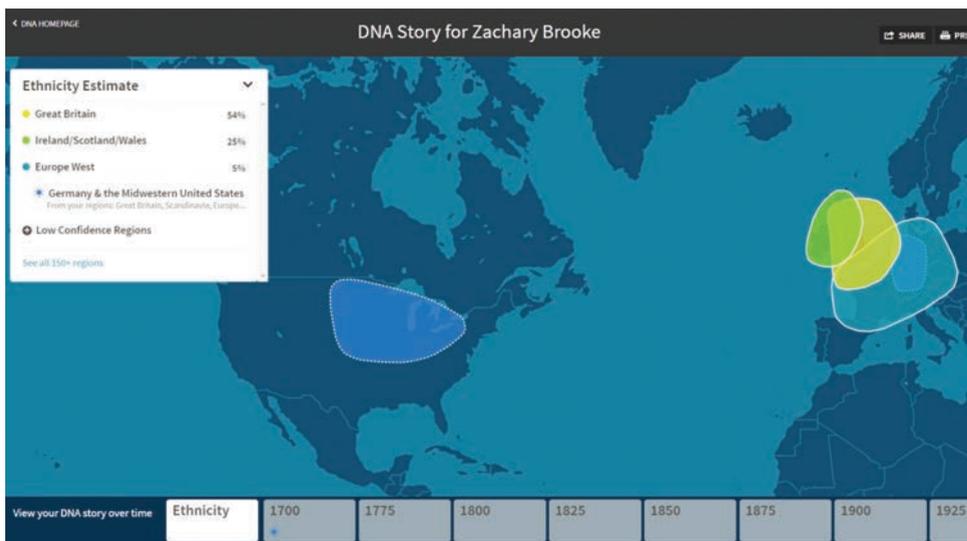
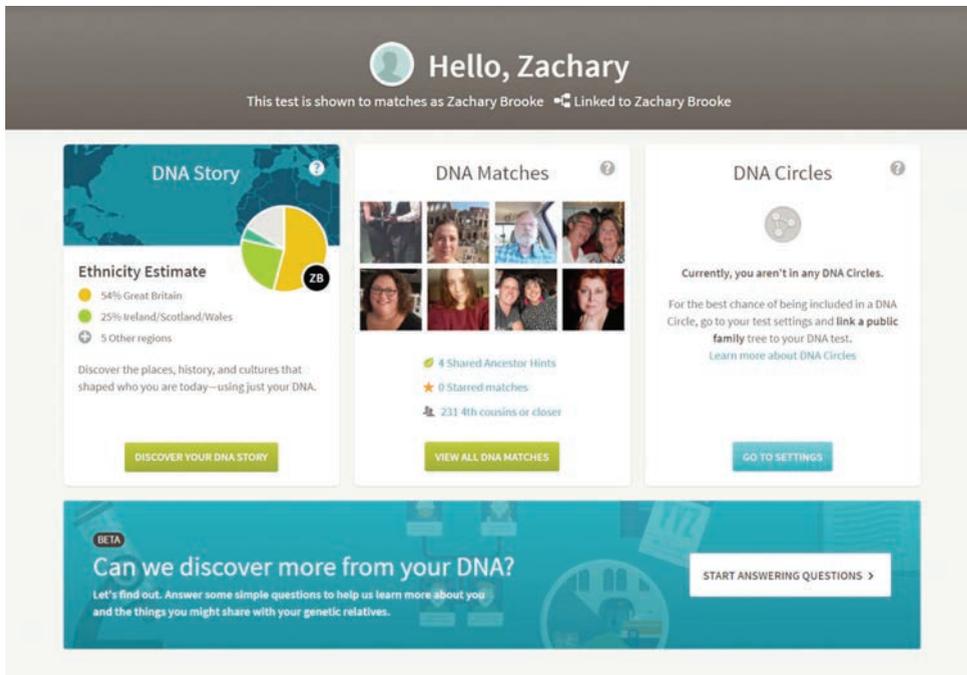
The search normally would have stopped there, if not for a burst of inspiration on Greenspan’s part. “It dawned on me that I could use molecular biology,” Greenspan says, as if it’s something he’s done his whole life. Except Greenspan is not a molecular biologist. He doesn’t even have a

general science background. His bachelor’s degree is in political science, and at the time he’d spent the bulk of his life selling photographic film. But he was determined. And he’s a voracious reader.

Greenspan remembered a pair of studies he’d seen that used DNA to confirm suspected lineages. In 1997 researchers analyzed the Y chromosomes of Jewish men and found that members of the Cohanim, or Jewish priests who claim to be descendants of Moses’ older brother Aaron, possess distinct genetic traits that suggest they share a common male ancestor who lived approximately 3,000 years ago. A separate study published a year later linked the modern-day descendants of Sally Hemmings to Thomas Jefferson, seemingly confirming historical suspicion that Jefferson had fathered some of Hemmings’ children. Perhaps, Greenspan thought, he could use the same methods to search for a genetic link between himself and his Argentine counterpart. He also wondered if this quest could form the foundation of a business model.

He reached out to Dr. Michael Hammer, author





(Above) The author's AncestryDNA results.

of the Cohanim study, with a plan to commercialize DNA ancestry tests. Greenspan would sell the tests, and Hammer and the University of Arizona would perform the analysis. The partnership proved so successful that Greenspan

eventually opened his own lab company in Houston to increase processing volume. Nearly two decades later his company, Gene by Gene, offers three types of genetic ancestry tests through a subsidiary, Family Tree DNA, and performs

genetic analysis for a host of competitors.

Greenspan's idea captivated genealogy enthusiasts and has been copied by reams of competitors, some of which have scaled enormously. One industry snapshot, published by Credence Research last May, found that the market for direct-to-consumer genetic testing topped \$70 million in 2015 and is expected to grow nearly fivefold to \$240 million by 2022. AncestryDNA, arguably the most visible player in the consumer ancestry space, sold an estimated 1.5 million units of its at-home testing kit over the 2017 Black Friday weekend.

Part of the industry's growth is attributable to technological breakthroughs. Greenspan's company began by offering Y-chromosome testing, which traces only direct male lineages. The subsequent development of a test for autosomal (nonsex chromosomes) DNA allows geneticists to make links between distant relations. This broader test is largely what backs today's ancestry offerings.

Greenspan's idea has also evolved to encompass products he never dreamed of offering. The same genetic material consumers submit to determine their ancestry can yield troves of information about a person's physical traits. 23andMe, a chief rival to AncestryDNA, whose Health + Ancestry Personal Genetic Service was one of Amazon's top

five 2017 Black Friday items, offers kits that can reveal predisposition to genetic diseases such as Alzheimer's and Parkinson's.

Other competitors are pitching DNA testing as a means to customize and enhance lifestyle aspects. Everything from optimal sleep schedules to wine preferences, some say, are written in a person's DNA and can be suss'd out with a simple test. If consumers could harness and apply insights about their biology captured in their own DNA, this line of thinking goes, their potential for self-improvement would skyrocket. With promises like these, many believe DNA insights are poised to become a great driver of consumer behavior.

"I knew that DNA testing was going to be a big deal. ... But I didn't realize it was going to become ubiquitous such that every single person would eventually end up with a DNA test, just as they will end up with a cellphone," Greenspan says.

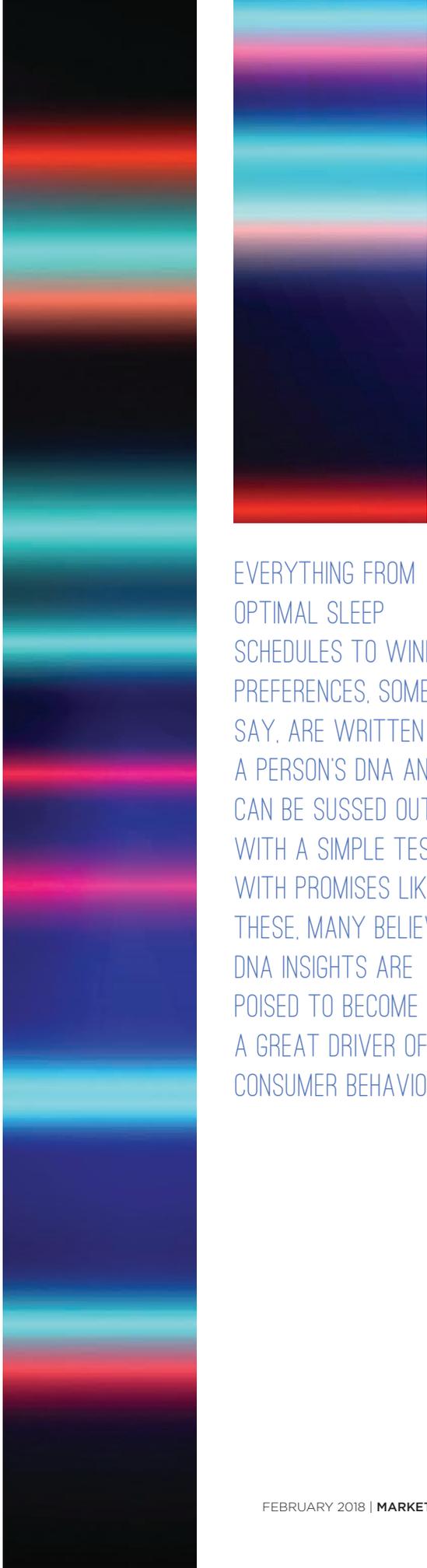
That's still a big if, though. Even as the field of consumer genetics approaches widespread cultural resonance, experts are questioning the science behind some of the products. And as DNA-collecting companies start to treat genetic information as they would any other piece of consumer data, government watchdogs are taking a closer look at the practice. These pitfalls, if not properly navigated, carry the potential to squash the market for

consumer genetics just as it's on the precipice of a breakthrough. Thus far, the threats aren't scaring away any opportunists.

Consumer DNA testing for the world's largest for-profit genealogy company, Ancestry (parent company of AncestryDNA), works like this: Consumers order collection kits online, deposit a teaspoon of saliva into a plastic tube, mix it with a bonding agent and mail it to a laboratory for analysis. As they await their results, which are typically delivered in four to six weeks, they can search for the origin of their last name or begin mapping family trees using traditional genealogy methods on the company's website.

Unlike Greenspan's initial products, AncestryDNA doesn't purport to link individuals with specific ancestors. Rather, it provides estimates of a person's ethnicity, showing the regions of the world where their ancestors once lived. The service also checks a person's sample against the 6 million users stored in its DNA database to determine whether there are any familial links between customers.

That ability to offer consumers a profound sense of self creates a unique marketing proposition that has allowed the service to thrive, says Ancestry's vice president of U.S. marketing, Caroline Sheu. "DNA testing is no longer a niche interest, it's a mass consumer market



EVERYTHING FROM OPTIMAL SLEEP SCHEDULES TO WINE PREFERENCES, SOME SAY, ARE WRITTEN IN A PERSON'S DNA AND CAN BE SUSS'D OUT WITH A SIMPLE TEST. WITH PROMISES LIKE THESE, MANY BELIEVE DNA INSIGHTS ARE POISED TO BECOME A GREAT DRIVER OF CONSUMER BEHAVIOR.



with millions of people wanting to experience the emotionally powerful, life-affirming discoveries that can come from simply spitting in a tube,” Sheu said via e-mail. “Our product is in a cultural and human space that very few brands are in. We’re pairing science and technology with creative, emotional marketing strategies to spark a new dialogue focused on the interplay of genetics and culture.”

Of course, it doesn’t hurt that Ancestry enjoys a \$175 million marketing budget to push that message. A year ago, most of its marketing dollars were spent on television advertising, but with the arrival of former Johnson & Johnson exec Vineet Mehra as CMO in early 2017, the company deployed a new strategy that saw heavier investments in programmatic, social, influencer and mobile categories. Mehra’s onboarding was quickly followed by the appointment of Droga5 New York as Ancestry’s lead creative agency.

Ancestry’s heavy marketing investments underscore the high-stakes jockeying taking place in the ancestry market. DNA databases are at a premium, not because of what they can tell researchers about anthropological patterns, but because of what they say about consumers’ lifestyle traits.

Consider the following set of questions Ancestry asks as part of a beta project to learn

about shared genetic traits:

- Are you more of an extrovert or an introvert?
- Are you a vegetarian?
- Do you like to go to sporting events?
- Do you play a musical instrument?
- Do you burn when you don’t wear sunscreen?

Marketers will at once grasp the relevance of these surveys. The data gathered can be used to build personas and inform campaigns. But what happens when these personality traits are linked to DNA profiles? The answer is found in the field of genomics, which considers how relationships throughout the entire human genome influence personal development, rather than searching for a specific gene that determines a certain trait.

“Genomics is the next major consumer market, and it will change all of our lives,” Sheu wrote. “We are leading this revolution and provide opportunities for anyone who wants to play a key role in building this new frontier.” Genomic testing was the bread and butter of 23andMe when it launched in 2008, offering clients a battery of screenings to determine their propensity to develop more than 90 genetic-related conditions, such as migraines and baldness. And while that remains true today, a 2013 ruling by the Food and Drug Administration curtailed several of the company’s

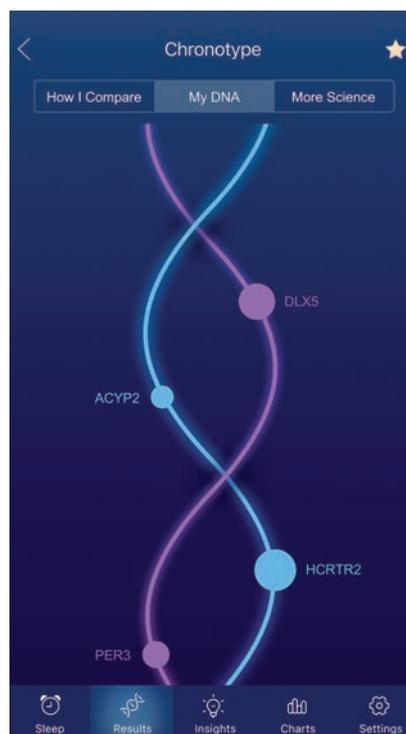
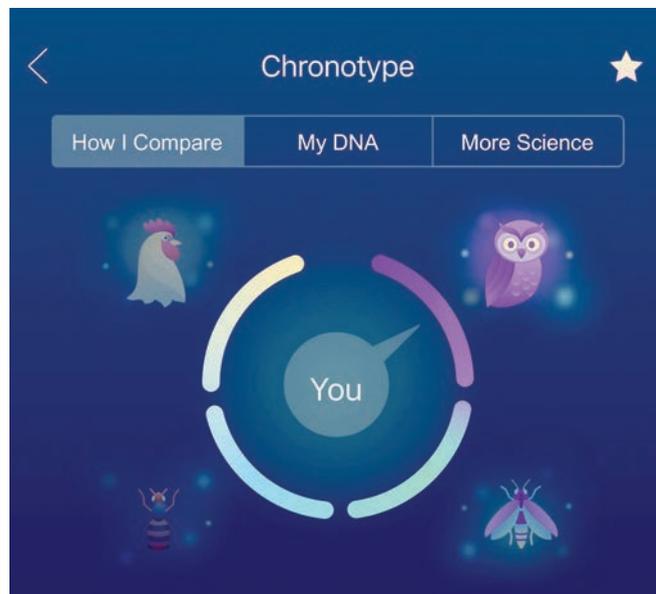
offerings, limiting its scope and confining it more narrowly to the ancestry space. That changed last April when the FDA revisited its 23andMe decision and allowed the company to market 10 tests for inheritable genetic conditions. Following that high note, 2017 closed with the news that 23andMe is embarking on one of its most ambitious projects yet: offering 1.3 million current customers the ability to participate in a weight-loss study searching for a link between genomes and diet success. After initially agreeing to answer questions for this story, 23andMe communication manager Christine Pai stopped responding to repeated requests for comment.

The sum of these moves suggests the market for consumer DNA tests is moving beyond ancestry into the realm of health care-adjacent products. 23andMe might be first, but it won't be alone for long. Ancestry's Sheu wrote there is "nothing to report today" in regard to potential steps her company might take into lifestyle and wellness genomics, but she also admits the company is looking at ways to integrate health information over the long-term, a sentiment that is echoed by Ancestry's chief privacy officer, Eric Heath. "We have expressed interest in the health space," Heath says, "but we are not doing that now."

As genetic testing companies fight for market share, a promising model

is emerging for startups to enter the DNA insights space. Helix is billed as the world's first DNA app store. For \$80, users can sequence their DNA and store it in the Helix market. Once their genetic code is uploaded, users can pay individual apps to scan bits of their DNA to produce specialized insights. Helix now offers ancestry mapping de rigueur, but the full range of apps display variety normally found in shopping malls and range from serious to silly. One fitness tracker creates workouts customized to users' DNA readings. A family-focused app lets mothers test the amount of a certain omega-3 fatty acid present in their breast milk. The most fanciful offering eschews the personal improvement pitch altogether. It's a fashion app that knits scarfs reflecting the unique sequential pattern formed by the four base enzymes found in users' DNA.

"The Helix.com store was created to give each individual a choice in how they engage with their DNA," says Elissa Levin, director of policy and genomic services for Helix. "For some, they only want to know the health-related insights. For others, they just want to start with something fun, like ancestry or a personalized scarf, and then at another point in their lives, they may have a need or newfound interest in accessing insights that tell them more about their health or nutrition." Helix formed three years



Exploragen's SlumberType app (shown above and at left) analyzes DNA to align users with one of four sleep patterns, which determine the time of day they are most productive.



ago using a \$100 million grant from Illumina, a global leader in DNA sequencing. Many business metrics are still being kept secret. Levin won't say how many users have purchased apps on the market, nor how large Helix's database of sequenced DNA samples is. What she will say is the Helix store currently lists more than 30 products for 15 different partner companies.

One such partner is Exploragen. Its debut app, SlumberType, uses Helix's sequenced DNA to determine what it claims is a person's optimal sleep schedule. Society has long promoted the concepts of morning people and night owls, believing certain people are more suited for activity at different times of the day. Exploragen's value proposition lies in addressing the uncertainty over these distinctions on an individual basis.

"There are many DNA variations that are thought to be important in influencing how well or how long a person sleeps," says Exploragen CEO Ronnie Andrews. "About 30% to 40% of the variance in people's sleep patterns is determined by DNA while the rest is influenced by other factors such as age, environment and lifestyle."

SlumberType needs access to DNA to read gene variants associated with certain sleep traits, such as sleep onset latency, or how long it takes someone to fall asleep after shutting their eyes. From there, it classifies people

into one of four categories—roosters, bees, fireflies or owls—and provides insights into how best to plan a day (and night) around this category.

Like Levin, Andrews won't say how SlumberType is performing, other than to say he's excited by the response. Exploragen plans to release a second app in 2018, which will allow people to track how their bodies respond to caffeine. After that, Andrews says Exploragen is still working on its roadmap for the ensuing years.

"Our goal is to develop apps that are not only educational but engaging as well with actionable tools and insightful features that keep customers continuously exploring their biology and habits," he says. "Consumer genomics is at a tipping point, where it becomes a normal, everyday thing to query your DNA for answers that can positively impact your life. Today, the question might be: Where did my ancestors come from? Tomorrow, it might be: What should I have for lunch, or how much coffee is too much coffee?"

There's a flip side to the proliferation of these genomics tools, however, that marketers will need to address. As genomics applications trickle ever closer to informing consumer decisions, their scientific legitimacy is attracting skepticism. Put bluntly, there's a whiff of pseudoscience emanating from some of the more

outrageous offerings that threatens to torpedo consumer genomics' budding trajectory.

Helix was a target of derisive skepticism in October when Eric Topol, a prominent cardiologist, took to Twitter to add up the cost of Helix store apps he believes lack sound science or convincing data. "Total cost = \$1,900; Value = 0," he tweeted.

Three days later, during an episode of "The Late Show," comedian Stephen Colbert mocked Wine Explorer, an app sold on Helix that recommends wine based on genetic analysis. "I'm getting notes of almond, black currant and total bullshit," he intoned while sniffing a glass of red wine.

Levin is aware of the image problem, which she says stems from people confusing serious apps with ones meant for entertainment. She also vouches for the science behind Wine Explorer.

"[The app maker] performed a research study to explore variations in taste and smell genes along with self-reported food preferences," she says. "The outcome was an algorithm that can take these factors and tell you the characteristics of wines that suit your genetic palate. Wine Explorer not only highlights these preferences but then connects you with unique wines that meet those preferences. It's a little bit genetic, and a lot of fun—not to mention a great way for people who are not yet motivated to learn health

insights to access the power of their DNA.”

But soundness of principle is only the second-biggest obstacle impeding widespread adoption of consumer genomics. By far, the most significant concern is privacy. Questions about user privacy have existed for as long as DNA testing has been commercially available. When Greenspan brought the first genetic ancestry test to market, consumers peppered him with dozens of concerns about the fate of their DNA sample. Indeed, it's hard to imagine a more sensitive type of data than DNA. Just using consumer DNA for its marketed purposes could expose deeply sensitive, legally protected information such as race and health status. And though providing saliva samples for diagnostic purposes would trigger Health Insurance Portability and Accountability Act protection, submitting spit tests to obtain ancestry or other genetic information is not subject to the same legislation.

This allows consumer genetics companies to treat DNA like typical consumer data, which they can sell to third parties in anonymized, aggregate form. 23andMe has two such research partnerships with drug companies Pfizer and Genentech, and Ancestry has a similar agreement with Calico, a longevity-focused subsidiary of Google parent company Alphabet.

Ancestry's Heath notes that individuals can opt to not include their DNA in the

aggregate samples and still use the service. He also says that aggregate DNA-sharing agreements are not the company's top priority.

“Generally, [third parties] come to us,” Heath says. “Unlike other DNA testing providers, [selling aggregate data] is not a main source of revenue for us. This is opportunistic engagement with companies or institutions that are researching important aspects of genetic science that, if they fit within the protocol, we will entertain.” Heath is also adamant that there are some parties that Ancestry refuses to sell to: insurers, employers or third-party marketers, for example.

His assurances, as well as those given by competitors, have yet to be enough for Sen. Chuck Schumer, D-N.Y., however. In November 2017, the Senate minority leader held a press conference where he pressed the Federal Trade Commission to investigate the privacy policies of consumer DNA kits and ensure policies are fair and transparent.

Heath believes Schumer's actions were unnecessary. “I think Sen. Schumer's comments may not have been fully researched because we're already doing a lot of what he was hoping to get the FTC involved in doing,” he says. “Our brand has a pretty high degree of trust, and we are giving users control of their data. ... We're meeting our customers' expectations, we're meeting the legal requirements, and

we're meeting the market's expectations as well.”

Nevertheless, Ancestry updated its privacy statement two weeks after Schumer's press conference.

FTC spokeswoman Juliana Gruenwald declined to confirm whether the agency would act on Schumer's request, citing organizational policy not to comment on the existence of investigations. But she referred to a blog post that highlighted a 2014 settlement with the producer of genetically customized nutritional supplements who failed to protect personal genetic information, among other transgressions.

Amid the delicate landscape of consumer data, there's at least one company that has struck out the other way: Greenspan's Family Tree DNA. The same day Schumer called for tougher FTC standards, Family Tree DNA unveiled a media campaign vowing to never sell consumers' genetic data to other entities. Greenspan isn't optimistic about the message's ability to drive business, though.

“I don't think it matters, unfortunately, either way,” he says.

Then why do it? “I think it's an important message that needs to be sent,” he reasons. He also believes the campaign will position him to be left alone should the FTC or Congress come prowling around the industry.

Perhaps he has shrewdness encoded in his genes. ■



CONSUMER GENETICS COMPANIES CAN TREAT DNA LIKE TYPICAL CONSUMER DATA, WHICH THEY CAN SELL TO THIRD PARTIES IN ANONYMIZED, AGGREGATE FORM. 23ANDME HAS TWO SUCH RESEARCH PARTNERSHIPS WITH DRUG COMPANIES PFIZER AND GENENTECH, AND ANCESTRY HAS A SIMILAR AGREEMENT WITH CALICO, A LONGEVITY-FOCUSED SUBSIDIARY OF GOOGLE PARENT COMPANY ALPHABET.