One day in 2008, Scott Flaherty felt something go wrong in his throat. A retired operatic tenor who was working as a teacher, Flaherty had been giving instructions over twenty-five students singing in full voice. “It was injured then, and I was quite aware of it,” he says. His speaking voice took on a slight rasp and, when giving classroom demonstrations, he could no longer move seamlessly from a low to a high register. His voice tired easily. The disability did not greatly affect his teaching, but it became a concern, last fall, when he began to think about returning to the stage.

Flaherty had had an unconventional career as a singer. As a teen-ager, in Andover, Massachusetts, he discovered that he could sing only when he was recruited to perform in a high-school musical. He had no formal training, and until he was twenty his paid work was limited to Elvis impersonations, performing in rock bands, and a job as a singing waiter. Then a co-worker persuaded him—“almost as a joke,” he says—to audition for Beverly Sills at the New York City Opera. Flaherty had never seen an opera, and could not read music; he learned his piece by ear, from a recording by Plácido Domingo. He passed the audition, and toured the world for more than a decade, singing major dramatic roles.

In 2001, when Flaherty was thirty-six, his wife became pregnant. Eight months later, the World Trade Center was attacked; Flaherty was in Hong Kong, singing the lead in “I Trovatore,” and for hours he was unable to contact his wife. He decided to retire from performing, so that he could stay close to home as his daughter grew up. He started teaching voice at New York University’s Tisch School of the Arts and at the Actors Studio. But, as his daughter grew older and became more independent, he began to think about performing again. With careful technique, he still had most of his range, and, at forty-eight, he believed that he had ten good years in him. When he tried his old repertoire, though, his vocal injury made it impossible to sing fluently. He had offers to return in prestigious roles, but “I knew I wasn’t able to do those,” he said. “For a few years now, this has plagued me and made me very unhappy.”

Last November, Flaherty travelled to Boston to meet with Dr. Steven Zeitels, the founder and director of the Massachusetts General Hospital’s Center for Laryngeal Surgery and Voice Rehabilitation. A surgeon and a Harvard Medical School professor, Zeitels, in 2011, operated on the singer Adele, removing from her vocal cord a benign polyp that had reduced her voice to a raspy whisper. Three months after her operation, Adele debuted her restored voice at the Grammy Awards, with a rendition of her hit “Rolling in the Deep,” and thanked Zeitels from the stage—a moment that helped cement his reputation as one of the most skilled throat surgeons in the world. In the following weeks, he received a hundred messages a day from ailing patients everywhere.

Flaherty took a seat in one of the Voice Center’s examining rooms, and a few minutes later Zeitels arrived. A stocky man of fifty-five, whose frizzy red hair, freckles, and goatee recall the comedian Louis CK, Zeitels has a warm and chatty bedside manner, with none of the imperiousness often associated with surgeons. “How are you feeling?” he asked. “Fine—a little nervous,” Flaherty said.

Flaherty was scheduled for surgery the next morning, and he and Zeitels had to make a final decision about whether to go through with the procedure. Although Flaherty’s voice problems suggested a benign growth on a vocal cord, an exam two months earlier had shown no such growth. Zeitels, who suspected hidden scarring beneath the membrane that covers the vocal cord, warned Flaherty that an operation might not help—and could make his voice worse. “For informed consent,” he said, “I need to make sure you fully understand the risks.”

Flaherty understood, but he was convinced that Zeitels was his only chance at a return to opera—or, at least, to singing in a show with his daughter, who was now eleven years old and had begun training as a singer. “If it turns out to be a positive result, then I’m pleased beyond belief,” Flaherty said. “If it goes the other way, it doesn’t change where I am right now. I can still teach.”

Great singing depends on several factors. A smooth, pure tone calls for supple vocal cords. A pleasing timbre is the result of the specific anatomy of the throat, chest, and head, which amplify and shape the sound. But Zeitels points to another critical component: the brain circuitry that controls the vocal cords. The recurrent laryngeal nerve has some of the most complex and dense wiring in the body, roughly fifty times as dense as the nerves to the hand or the tongue—the result, perhaps, of an evolutionary adaptation that turned a simple valve for preventing food from going down the airway into an instrument of speech, and of song. Zeitels, in his office, demonstrated by sweeping his voice from low to high, like a slide whistle. That act, he explained, requires a complex interplay between the ligaments and muscles that run through the vocal cords, stretching the vibratory layers. In a movement similar to varying the tension on an elastic band, the stretching changes the cords’ vibrations from roughly seventy-five to fifteen hundred cycles a second almost instantaneously—and on a pitch determined in the singer’s cerebral cortex. “Nothing transmits motor function with more speed and precision,” Zeitels said. For this reason, he theorizes, the people
with the greatest vocal control in early human societies became religious leaders. "It's primal," Zeitels said. "A complex neural motor function creating happiness, elation, sadness—whatever happens to human beings when they listen to music. It lifts them."

After the consultation, Flaherty told me something similar, as he explained why teaching was no longer satisfying. "I've grown a little tired of just talking about it," he said. "I mean, when you sing you're giving voice to your soul."

Although Flaherty had elected to have the procedure, Zeitels still had to decide whether the benefits outweighed the risks. He could see what Flaherty had lost. "He says he doesn't have expectations—that it's O.K. if the operation doesn't work," he told me. "But there's a sadness in him. You can see it." Zeitels decided to go ahead with the surgery.

At the Voice Center, the walls of the reception area are lined with signed photographs of singers who have been treated there. Since the early nineties, Zeitels has restored the voices of hundreds of performers: Steven Tyler, Keith Urban, Roger Daltrey, Cher, Lionel Richie, James Taylor, and scores of opera singers and Broadway belters, as well as sportscasters, actors, teachers, and other professionals who depend on their voice to make a living. But within the profession of otolaryngology—the study of ear, nose, and throat disorders—Zeitels is also known as a prolific medical innovator, who has developed influential treatments for larynx cancer and other throat diseases. Unlike most specialists, he practices both voice-restoration surgery and cancer surgery, which require very different degrees of finesse; he compares the former to fencing, the latter to "a fight with a club." Away from the operating theatre, he maintains a research laboratory, publishes copiously, lectures, trains fellows, and is developing a synthetic material to patch damaged vocal cords—"the Holy Grail," as he puts it, of voice restoration.

Zeitels is sometimes criticized by colleagues for the unorthodox nature of his practice, and for the attention it gets in the press. (He argues that publicity is necessary in order to raise funding for research.) In 2007, Dr. Eugene Myers, a chairman emeritus of otolaryngology at the University of Pittsburgh School of Medicine, successfully pleaded Zeitels's case when he served on a Harvard Medical School committee that was debating whether to promote Zeitels to full professor. "I said, 'Listen, did you ever see the movie 'Amadeus'?" Myers told me. "To me, Steve is like Mozart. Creatives are edgy, they're not regular people." Julie Andrews, whom Zeitels has treated, notes his compulsive enthusiasm for his field, which, she says, lends him a "Peter Pan" quality: "I know of nobody else who eats, breathes, sleeps, thinks, and talks about vocal cords—non-stop."

When Zeitels was growing up, in New Rochelle, his father, an orthodontist, pushed him to go into medicine. Zeitels wasn't sure; he liked science, but he had competing interests. At ten, he heard a friend's copy of The Who's "Tommy" and became fascinated with music. Soon he started playing guitar, and in the coming years he attended, he says, "hundreds of rock shows." In his teens, he took a course in leatherworking, sewing bags and belts and carving leather replicas of album covers by his favorite musicians—Joni Mitchell, Traffic, the Rolling Stones—to sell at street fairs.

In 1975, when Zeitels was sixteen, his father enrolled him in an experimental educational program for gifted youngsters who intended to go into medicine. "I had my own apartment in a dormitory as part of Hahnemann Hospital, in Philadelphia," Zeitels says. "We didn't have assigned teachers. We had to go to local Philadelphia universities and ask professors." The next year, he was accepted on scholarship into Boston University's accelerated six-year medical program, graduating with an M.D. in 1982. He knew that he wanted to be a surgeon—he loved working with his hands—but he couldn't decide on a specialty. His older brother, a plastic surgeon, told him to seek out the most esteemed surgeon at B.U.: "He'll know what to do."

Zeitels made his way to Dr. Stuart Strong, the head of the school's depart-
ment of otolaryngology. Since the fifties, Strong and his team—which included a Hungarian émigré named Géza Jako and a gifted resident named Charles Vaughan—had helped reinvent the tools of laryngology. They had pioneered the use of stereoscopic microscopes, and, in 1971, they used a carbon-dioxide laser to cut a growth from a patient’s vocal cord—the first time a laser was used to remove tissue from the body. Bob Hillman, a speech pathologist who worked in the department, says that the atmosphere was ideal for someone like Zeitels, “who doesn’t think like other people. He moves sideways with ideas, makes jumps. Strong encouraged that; other doctors would have said, ‘Shut up. You do it like this.’”

Strong, who is now retired, says that it was immediately apparent that Zeitels “was going to be a star.” He listened intently, absorbed information fast, had a feel for patients, and, perhaps most notably, possessed remarkable skills in the operating room. Vocal-cord microsurgery imposes special physical demands on surgeons. The instruments—miniaturized scalpels, forceps, and scissors—are attached to foot-long handles that are extended down the throat. The tools are famously unwieldy: the slightest movement of the fingers is magnified at the tips. (Strong says that he could see his own pulse shaking the instruments.) This, coupled with the fragility of vocal-cord tissues, requires exceptional steadiness, coordination, and fine digital motor control. Zeitels, Strong says, possessed these in abundance, and was also fully ambidextrous, a vestige of his leatherworking classes. “I could never have trained my hands to do what Steve is able to do with his,” Strong says.

Zeitels also had a creative bent. “He was figuring things out, thinking it over, then saying, ‘Maybe we could do it another way,’” Strong told me. When Zeitels finished his residency, he went to work at a Veterans Affairs hospital in Boston, operating on cancers of the head and neck. There he designed and patented several tools, including an unusual kind of surgical laryngoscope—the device that holds the throat open during operations. Typical scopes had an oval viewing area, even though the vocal cords, viewed down the throat, form a triangle. Zeitels’s laryngoscope has a triangular opening, allowing doctors to see areas that had previously been obscured. Trained with the old equipment, Zeitels had been taught that cancers in the front of the vocal cords were especially deadly. “The reason was, they didn’t see them in the first place,” Zeitels says. “They attributed a biologic process to the fact that they never saw them!”

The vocal cords, made up of layers of soft, highly elastic tissue, are often compared to guitar strings, but they do not produce sound by stirring the air, as a plucked string does. Instead, they act as a valve, which rapidly opens and closes, chopping airflow from the lungs into pulses that are magnified by the resonating chambers of the throat, nose, and mouth to become audible sound. To change the pitch, muscles and ligaments control the tension on the vocal cords, speeding or slowing the pulses.

A clear tone is the result of symmetrical vocal cords with straight edges that meet evenly, without gaps. But the act of producing sound tends to mitigate against perfect symmetry. During normal speech, the vocal cords clash about a hundred times a second in men and two hundred times in women; in an operatic soprano, they clash as many as a thousand times a second. The collision forces and shearing stresses can produce bumps of scar tissue or calluses on the vocal cords. The result is breathiness, rasps, rattling, hoarseness, and other sound imperfections, called perturbation. Most professional singers, in the course of a career, sustain some injury to the vocal cords, much the way professional tennis players get tears in the tendons of their elbows. “Singers are elite vocal athletes,” Zeitels says. “Plus, the people who get to the top of the profession are driven—they perform sick, they perform tired.” Because of their superior brain wiring, Zeitels says, singers adapt to small imperfections in a vocal cord, subconsciously retaining themselves to “sing around” lesions. But when a node, a cyst, or a polyp becomes big enough this kind of adjustment is no longer possible.

In the early nineties, Zeitels was recruited by the Massachusetts Eye and Ear Infirmary, the seat of Harvard’s ear, nose, and throat program, and there he operated on his first singer. He liked the challenges of the subtle and precise surgeries, which played to his unusual hand-eye coordination. When he started in phonosurgery, as voice restoration is called, some surgeons were still crudely stripping off growths with forceps—often leaving scar tissue, or a divot, in the vocal cord. Others used lasers, which are precise and easy to control, but can create burns and scarring that affect voice quality. The best results, Zeitels learned, came from the far more difficult “cold instrument” surgery, of the type he had perfected as a cancer surgeon.

Zeitels quickly built a reputation for restoring damaged voices. He became a consulting laryngologist for the Berklee College of Music, the Boston Lyric Opera, and the Boston Symphony Orchestra. He also recruited Bob Hillman, the pathologist from Strong’s group, to measure outcomes. Today, Hillman is a co-director, with Zeitels, of the Voice Center. He says that Zeitels is rare in seeking objective measures of surgical results. “In clinical write-ups of vocal surgery, surgeons would say, ‘I was happy with the voice, and so was the patient,’” he says. “Steve insisted on rigorous, objective analysis.” Zeitels keeps a record of each phonosurgery, with a camera rigged to his microscope. Between 1992 and 2001, he shot more than forty thousand photographs, many of which he included in a book called the “Atlas of Phonosurgery.” He and Hillman also test results. Hillman’s clinical research lab includes a soundproofed chamber: a room suspended within a room, with an inch of air between the walls to insulate the interior from low-frequency vibrations, including those of the subway eleven stories below. The chamber is equipped with an ultrahigh-speed digital video camera developed for crash tests and ballistics studies. When
attached to an endoscope, it produces startlingly clear color images of the vocal cords’ wavelike ripples. Earlier devices could not accurately capture the vocal cords’ fastest movements; the new camera, which can shoot ten thousand frames a second, allows Zeitels to see precisely how a tumor affects the motion of a patient’s vocal cords. In 2002, Zeitels and Hillman published one of the first objective studies of phonosurgical results in singers, analyzing a hundred and eighty-five performers by comparing images of their vocal cords before and after surgery, along with sound recordings. Of the hundred and twenty-singers who returned for analysis, a hundred per cent had zero or minimal perturbation. All the singers in the study returned to performing.

On a Tuesday morning last November, Scott Flaherty, the retired opera singer, lay on a gurney in an alcove outside an operating room at Massachusetts General Hospital, about to go into surgery. At around ten o’clock, Zeitels, decked in blue scrubs and surgical cap, arrived after finishing another operation. “Ready to go?” he asked. “Yes,” Flaherty said. “I’m just eager to get on with it.”

Zeitels patted his shoulder and smiled, then went down the hall, out of earshot. He admitted to feeling uneasy. He did not like facing surgery when there was no clear target. Earlier, he had told me about the array of psychological voice ailments, ranging from self-induced hoarseness and laryngitis to “puberaphonia,” a condition in which grown men speak at an artificially high pitch; the syndrome is sometimes psychological, brought on by fear of the voice changes of adolescence. “I’m not putting Scott in the psychosomatic category,” Zeitels said. “The exam showed something, but you can’t completely rule out a mental component.” He seemed close to questioning the operation. “Going into this, I don’t know the outcome,” he said. “Which is not where you want to be as a surgeon.”

Flaherty had been moved into the O.R., and lay supine on an operating bed. The tiniest reflexive movement during microsurgery would be disastrous, so he had been not only put to sleep but also given a paralyzing agent. Zeitels sat at the end of the bed, Flaherty’s head upside down in front of him. With a practiced gesture, he slipped the laryngoscope down Flaherty’s throat.

He grasped the handles of a stereo microscope and adjusted it until he could see the vocal cords clearly. A camera on the microscope projected Zeitels’s view onto two large screens on the walls. Whitish pink, with a translucent sheen, the vocal cords were open, forming an inverted V. To the untrained eye, they looked healthy—no lumps or masses. But Zeitels, seeing them under high magnification and brightly lit, spotted something. “He’s hitting pretty hard,” he said, pointing with a forceps to an area on the right cord, where a series of vertical striations were faintly visible. He sounded slightly heartened. “There’s a big varix—a swollen blood vessel—from collision trauma on the left side. I think I’ll start on the right vocal cord, because it looks a little worse.”

Zeitels began with a procedure that he developed in his twenties, and which is now a standard part of voice surgeries. To facilitate removal of a growth, he injects a saline solution under the vocal membrane. This puts the membrane under tension, making it easier to slice open, and limits trauma to the delicate vibratory tissue underneath. As Zeitels injected the saline, Flaherty’s membrane ballooned dramatically. “Wow,” Zeitels said. “He’s really bogy. Singers have a really elastic layer.” He touched the cord with a forceps. “Dead center, he’s got scar,” he said. “The question is, am I going to be able to remove it? It’s such a long zone.”

He took up his microsurgical tools, flimsy-looking instruments with scissors-like handles and foot-long extension shafts thinner than knitting needles. One was a minuscule forceps with tiny serrations on its jaws; the other was a miniature scalpel. He positioned his elbows on the armrests of the operating chair and passed the instruments down the laryngoscope. His gloved hands were surprisingly small, with tapering fingers. He lightly palpated the vocal cord with the instruments. “He can still do stuff as a singer that tons of

"Can you come by Table Seven? They have some edits for the chicken."
others can't do,” Zeitels said. “He just can’t do what he wants to do. This is not a badly injured vocal cord. He just thinks it's holding him up—and he may be right.”

The vocal cord is encased in a thin outer membrane called the epithelium, which vibrates in tandem with the gelatinous layer below. Polyps, cysts, and nodules grow beneath the epithelium, adhering to its underside. The best surgical results derive from painstakingly opening the epithelium and scooping out the mass with the absolute minimum of damage to any tissues. This is difficult, given the fragility of the epithelium, which Zeitels described as having the consistency of wet wrapping paper. “It’s just six cells thick,” he said.

He cut a slit in the membrane, then eased it open. Beneath were many shallow, tan-colored ridges. “These are all scar bands,” Zeitels said. “Boy, that’s a war zone. That’s all those years of singing.” Using miniature scissors, he snipped away fibers of scar tissue.

With his fingertips barely resting in the instruments' holes, he moved all ten fingers (“like a piano player,” he said), in motions so subtle that his hands seemed still. The screen showed that he was performing hundreds of complicated, choreographed moves as he peeled away jelly-like pieces. He then used a “cup”—a set of forceps with hemispherical tips—to remove strands of scar tissue attached to the epithelium. In a teacher or an actor, Zeitels might have been content to remove ninety per cent of the scarring, rather than risk tearing the epithelium. But, to restore an opera singer’s pristine tone, every bit of scar tissue must be removed. He passed the cup over the epithelium repeatedly. It grew so thin as to become transparent.

“I have to make a judgment about how far to go without cutting the membrane,” he said. He reached to grasp the edge of the flap and missed. “I’m trying to grab that with one serration. This is at a level of detail that I haven’t put in a paper. Insane number of movements.”

He worked for several minutes. The membrane grew more gossamer with each pass of the cup. “Rich,” Zeitels said to Dr. Richard Vivero, one of his fellows, “ever seen something like this before?”

Vivero, watching the screen, said that he hadn’t.

“It’s getting really thin,” Zeitels said. “Yeeeee.”

After a few final passes, Zeitels retracted his instruments. He used the laser to deliver a microsecond of targeted heat—just enough to seal the blood vessels that fed the scar on the left vocal cord—then pronounced the operation complete. “It went as well as it can, but I don’t know if this is going to get him there,” he said. Before the procedure, he had considered removing scar tissue from the left vocal cord, but now decided against it. “I want to stage them,” he said. “See how he does.”

Afterward, Zeitels talked about the pressure of knowing that a wrong move can end a singer’s career. “The night before, you feel it,” he said. “Especially in the case of someone like Adele, when the press is phoning and people are all over the Internet and radio and TV discussing it.” But, he went on, “in the operating room it’s just you and the tissue. I liken it to playing the finals at Wimbledon. If you’re the right kind of person, you actually perform better. Still, you don’t schedule two or three things on the day you do an Adele. You need to create that mental space.”

Despite an increasing focus on singers, Zeitels continues to operate on cancer patients. “You don’t go through all this training to not take care of the life-threatening diseases,” he told me. With cancer surgery, the primary goal is to cut away malignancies; voice quality is a secondary consideration. Radiation, too, can damage healthy tissue and, furthermore, can be used only once. If the cancer recurs, the only option is a partial or full laryngectomy—removal of the voice box. Zeitels has performed many laryngectomies, but, as his work on singers sensitized him to the importance of the human voice, he began to wonder if he could devise methods for preserving the voices of cancer patients, too.

In the early nineties, he began to investigate ways to remove malignancies on vocal cords while preserving healthy tissue. The Harvard scientist Judah Folkman had discovered that he could kill tumors by cutting off their blood supply, and Zeitels wondered if there was a way to adapt the concept. Dr. R. Rox Anderson, a dermatologist, had de-

“Think how ill-informed I would be if we didn’t have television.”
veloped a laser treatment for removing port-wine-stain birthmarks from babies’ skin. Anderson’s laser attacked the blood vessels that fed the stain, using a wavelength that was absorbed only by red blood cells. Could the laser kill the blood supply to vocal-cord tumors? “It was developed for maintaining the softness and pliability of a baby’s skin,” Zeitsels says. “So this seemed perfect for vocal cords.”

Zeitsels first used a laser on a cancer patient in 2003, with great success (the patient, who was facing removal of his larynx, still has normal voice function), but he soon adapted the procedure to treat a common injury in singers: swollen or ruptured blood vessels. Such injuries ordinarily called for difficult and risky surgery. But, by precisely calibrating a kind of green-light laser called a KTP, Zeitsels could destroy the damaged blood vessels without burning healthy tissue.

Aerosmith’s Steven Tyler was one of the first singers Zeitsels treated, in 2006. “I had done a show in Florida, and afterward I got into an argument with the monitor people, so I yelled at them—after a two-hour show,” Tyler told me recently. He woke the next morning hoarse, and suspected that he had broken a vessel in a vocal cord. He went to see Zeitsels, who sealed off the ruptured vein with the laser. “I fell in love with him when I asked him, ‘How does somebody become a surgeon?’” Tyler told me. “He goes, ‘I don’t know. I used to sew leather bags on Commonwealth Avenue.’”

In 2009, Aerosmith’s bassist, Tom Hamilton, had a recurrence of Stage 3 tongue cancer and was scheduled to have his larynx and his tongue removed. Instead, he went to Zeitsels, who used the KTP laser to kill the malignancies. This past November, Hamilton took a break from the band’s North American tour to visit the Voice Center for a checkup. Zeitsels examined his throat and gave him a clean bill of health to continue touring.

Hamilton, a tall, thin man dressed in a deconstructed Balmain jacket and black jeans, lingered in the hallway after his checkup, chatting with Zeitsels. An earlier course of radiation therapy had affected nerves in his neck and tongue, so Hamilton has difficulty pronouncing some words, but his speaking voice is otherwise clear. Zeitsels mentioned how hard Tyler pushes his voice as a singer. “Steven pushes himself harder in every way,” Hamilton said, dryly.

“Is there any band who has done this as long and as frequently, ever?” Zeitsels asked.

“The Stones,” Hamilton said.

“My impression is that they haven’t performed as frequently,” Zeitsels said.

“Well, plus, you can hear how Jagger just talks a lot of it,” Hamilton said. “Steven is singing the whole time.”

“Yup—he’s intrepid,” Zeitsels said. In 2007, Tyler participated in a National Geographic TV special in which Zeitsels and Hillman wired him for measurement of vocal stress during a concert. As Tyler yowled songs like “Dream On” and “Walk This Way,” his vocal cords smashed together more than seven hundred thousand times—a larger dose of vocalization than a schoolteacher takes in an entire day.

Zeitsels says that Tyler is still able to perform after four decades of such abuse because of a curious physical anomaly. Many singers develop temporary edemas—fluid retention under the epithelium—as they perform. Ordinarily, edemas stiffen in the course of a concert, shutting down the voice. “The crazy thing about Steven’s vocal cords is that the longer he went, the more pliable the edema got,” Zeitsels told Hamilton. “So after the show he was more pliable than halfway through. He has a paradoxical biologic reaction that allows him to keep going.”

“Along with all the other paradoxes,” Hamilton said.

Zeitsels lives in the Boston suburb of Newton, in a nineteenth-century house decorated entirely—lamps, wall hangings, furniture—with the work of the designer Gustav Stickley. (He pointed out, with some chagrin, a modern light fixture for which he had not been able to find a suitable replacement.) On an upper floor, he showed me his archive of laryngology, assembled over decades of trawling flea markets, thrift stores, and eBay. Zeitsels has used the trove to write scores of papers about the pioneers of laryngology, and today is recognized as the field’s leading historian. Floor-to-ceiling bookcases lined the room. Stacks of Tupperware containers held antique laryngologic instruments, including a harpoon-like implement for shearing off diseased tonsils, and a curved metal forceps with an end clamp which was used, in the eighteenth-eighties, to hold a cotton swab impregnated with liquid cocaine—an early method for subduing the gag reflex in patients. There were boxes of crumbling textbooks, cartoons, old journal articles, letters from nineteenth-century otolaryngologists. “I study how these people think,” Zeitsels says. “What kept them creative.”

For much of Zeitsels’s career, he was too absorbed in his work to maintain a social life. In his mid-fouries, he was still unmarried. Then, in 2001, he went to Chile, as a guest of the Chilean Society of Otolaryngology, and met a local otolaryngologist named Maria Hananias. They married in 2003. Maria, who is not licensed to practice in the United States, looks after Zeitsels’s widowed mother, who lives with them, and their children, a seven-year-old boy and a four-year-old girl. Maria told me that, because of family duties and Zeitsels’s work, they are mostly homebodies. But, in mid-November, the couple took an evening out to see The Who. The band was on tour playing its rock opera “Quadrophenia.” The singer, Roger Daltrey, had given them tickets and backstage passes.

Zeitsels first treated Daltrey three years ago, and the two have become friends. For a rocker, Daltrey had always taken reasonable care of his instrument, partly because of the challenges presented by Pete Townshend’s songwriting. “Pete was writing songs with lyrics that demanded to be understood so well—and in such high keys—that it was impossible to sing them like a normal rock singer,” Daltrey told me a week before the show. “I had to sing them a bit more operatically, and I did take lessons in vocal warmups.” Nevertheless, on a solo tour in 2009 Daltrey developed voice problems. “It was harder to get the high notes,” he says. “And harder to get anything out of it.” A doctor in San Francisco referred him to Zeitsels, who saw discolorations on the epithelium that looked like a precancerous condition called dysplasia. A biopsy came back positive.
December, Zeitels used the KTP laser to kill the problematic cells. Two months later, Daltrey sang with The Who at the Superbowl halftime show.

Dysplasia recurs, so Daltrey has periodic appointments with Zeitels. "On the whole, I'm singing better than twenty years ago," Daltrey says—although he takes precautions with certain notes, like the climactic high E on "Love, Reign O'er Me," the ballad that ends "Quadrophenia." "I don't know if I'll be going there anymore," he told me.

The show was at Boston's TD Garden, and Zeitels and Maria had seats close to the stage. As they waited for The Who to appear, Zeitels said that it felt "surreal" to see performances by singers he has operated on. Watching Daltrey onstage, Zeitels responds as a fan, he says. "I'm the ten-year-old kid again who first heard 'Tommy'—I'm that excited!" But he also recalls every move of his surgical instruments, knowing which parts of the vocal cord are compromised, which vocal registers put particular stress on a weakpoint. Seeing Adele perform at the Grammys was especially nerve-racking, he said; it was the first time she'd sung in public since the operation, and she began with a dramatic belting of the chorus of "Rolling in the Deep," with no backing instruments. "Totally silent theatre," he says. He recalls turning to Maria, sitting next to him, and whispering, "I can't believe she's starting this in dead silence. Her voice was just exposed up there." Zeitels says that he felt like neither a fan nor her doctor. "It was like being her dad."

The Who played for two hours, and Zeitels remained on his feet throughout. Daltrey's voice sounded thicker and rougher-edged than it did in the sixties and seventies, but it had power and volume, and as the night progressed he took greater chances with it, throwing back his head and holding sustained high notes. Near the end, the band played "Love, Reign O'er Me," and Daltrey went for the climactic high-E shriek in full voice—not cheating it with a falsetto. Zeitels looked at me with alarm and clutched his chest. "You're thinking, O.K., will that hold?" he said, as we walked out with the crowd.

Zeitels, flashing his all-access pass, led Maria and me backstage to a greenroom where the band's friends and family had gathered. Townshend arrived and looked quizzically at Zeitels, who introduced himself as Daltrey's throat doctor. "Next time," Townshend said, leaning in close and making an upward stabbing gesture, "go deeper and give him some brain cells!" He laughed and strode off.

In a large dressing room down the hall, Daltrey—a small, spry rooster wearing blue-tinted granny glasses and two thick wool scarves, to ward off colds—embraced Zeitels and Maria. "It feels fine," he said of his voice. "I'm a little tired." He complained about having to start each show with "The Real Me," "It gives me no onstage warmup. Zero to sixty." He was also daunted by the heavy dose of singing he faced. The tour had three months to go. "To make this work, economically, you've got to go out four nights a week," he
said. "That's a lot of singing. And it's harder after a day off. Your voice doesn't want to do it."

Daltrey is sixty-eight, and much of his vocal fatigue was a result of decades of singing. But Zeitels stresses that vocal-cord tissue does not deteriorate with age alone. "It's tissue that has been on the earth longer and has been hit more times," he says. The constant clashing stiffens and thins the tissues, leading to the roughened tone of older singers' voices—and, later, to the creaky voices of the elderly. The collision trauma reduces pliability—a major cause of voice loss that doctors have only recently begun to attempt to solve. "People weren't addressing this concept," Zeitels says. "It was hiding in plain sight."

Zeitels started to concentrate on pliability when he began treating Julie Andrews, in 2000. Three years before, Andrews had been performing in the Broadway musical "Victor Victoria" when she developed hoarseness. At New York's Mount Sinai Hospital, she underwent surgery for removal of a benign vocal lesion. She emerged with permanent damage that gave a rasp to her speaking voice and destroyed the purity of her singing. (Andrews sued Mount Sinai, and the suit was settled for an undisclosed sum.) "It was devastating," she told me. "To feel that that would never again come my way. The huge joy—apart from singing itself—is the wonder of singing with a very big symphony orchestra. It's ecstasy," Zeitels operated on her four times and improved her speaking voice but was unable to restore her singing. Too much of the vibratory tissue under the epithelium had been removed, and much of what remained was stiffened with scar tissue. "I became intrepid, realizing that I needed to find a way to restore pliability," Zeitels says. "There was nothing there for me to take out. You needed to a solution by putting something in."

Other surgeons had tried such a tactic. Dr. Robert Sataloff, at Drexel University College of Medicine, in Philadelphia, had pioneered a procedure in which fat cells are implanted in a vocal cord. But in rare cases the fat turns to scar. In 2001, Zeitels approached Robert Langer, an M.I.T. professor who is the leading expert in creating "biosynthetics," including artificial skin. "We began discussions about how he, with his group, resources, skills, could assist us," Zeitels says. The researchers considered cryogenically preserving tissues and re-implanting them—they even took cell samples from Andrews—but discovered that the body absorbed the tissues too quickly. They wanted an implant that wouldn't degrade over time, but permanent substances are difficult to control once they're in the body. "We were, intuitively, going for a home run," Zeitels says. "Strategically, that probably wasn't the best way to go."

In 2003, Zeitels was having dinner with Andrews in Los Angeles, and she told him that she'd be happy with a temporary solution. "I'd settle for six weeks and come back and see you again," she said. He began thinking about something placed under the epithelium that would work like collagen, filling out the tissues temporarily. Zeitels brought the idea to Langer, who, in 2006, hired a postdoctoral researcher named Sandeep Karajanagi to design the material. "It was obvious we had to go to a synthetic," Karajanagi says. "Those materials last long enough and have a record of being able to pass the F.D.A." Karajanagi eventually settled on a polymer called polyethylene glycol (PEG), which is used in biomedical devices. "There are other choices, but those are not as flexible," he told me. To achieve the right pliability, Karajanagi mixed the polymer with another one he calls PEG-with-sticky-ends. "By changing the ratio of the two, I can dial in and dial out the stiffness."

Karajanagi showed me a sample of the biogel when I visited Zeitels's research lab at Massachusetts General Hospital—a suite that includes a machine shop and an animal operating room. On a workbench was a small, clear dome of gel, which Karajanagi explained was more than ninety-five percent water. It was unexpectedly light and elastic, offering no resistance when I touched it, but immediately snapping
back to its original shape when I removed my finger.

Kanjanga and the team test stiffness by implanting the gel in calf’s larynxes, which they get from local slaughterhouses, and attaching them to a synthetic windpipe. The challenge has been to design a gel that’s soft enough to mimic the almost liquid flutter of the vibratory mucous membrane but tough enough to last in the body. To test durability, they implanted the gel in dogs, whose larynxes are similar to those of humans. “We’re getting what we think to be a fairly effective eight weeks,” Zeitels says.

The next step is human trials, which Zeitels hopes to start this year. If the trials are successful, he says, the first recipients of the biogel will be cancer patients who have had vocal-cord tissue removed. Inevitably, he believes, singers will use it, too, and it will make aging rockers like Daltrey and Tyler sound as they did in their thirties. “Is it not? Is it going to happen?” Zeitels told me. “Is it going to happen.”

After phono surgeries, Zeitels insists that his patients maintain three weeks of total silence, to avoid damaging the vocal cords as they heal. For the first week after Scott Flaherty’s operation, he stayed with his sister in New Hampshire, sleeping in a guest room at the top of the house. “I was isolated, so it was pretty easy to stay quiet,” he says. “But one morning she woke me up and, because she startled me, I answered. My voice was crystal clear.”

Still, Flaherty was anxious for the time to pass, so that he could find out definitively if the surgery had rescued his voice or irrevocably worsened it. “As we approached the end of that three-week time, I did touch it a few times,” he admits. “I spoke, varying the pitch a little so there would be less strain.” On the day before the rest period ended, he could not stop himself. “I tried it out with a little bit of singing in the shower—just individual phrases.”

He heard a slight buzz. This disconcerted him, but he knew that it might be a temporary side effect of a steroid administered during the operation. Professional singers who are suffering from colds sometimes take cortisone—a steroid—to get them through performances, and those with well-trained ears are able to detect an “artifact” in the tone. Flaherty did not know if he’d been given a steroid, but other symptoms—redness in his neck, heat in his face—suggested that he had.

His appointment was for two o’clock on a Tuesday, and he had booked a morning flight from his home, in Charleston. The evening before, there was a blizzard in Boston, and his flight was cancelled. “I jumped into the truck and drove all through the night,” he told me. He arrived in Boston at noon, took a nap in his truck in the Voice Center parking lot, and then went up to the eleventh floor. As he waited in an examining room, one of Zeitels’s fellows came in. Flaherty asked if he’d been given a steroid during the operation. He had.

Zeitels arrived and asked, “How does your voice feel?”

Flaherty said, “Quite good.” He admitted that he had tried some singing and heard a buzz, but that he hoped it was due to the cortisone.

Zeitels examined his throat through the laryngoscope. “Wow, you healed great,” he said. Then he asked Flaherty to sing.

Adele, on her first follow-up, tried out “Rolling in the Deep,” Zeitels told me. When that went well, she proceeded to sing the entire “21” album. “She would try a song and say, ‘O.K., that worked. Let’s try this one,’” Zeitels recalls. “I got a free a-capella concert in my office. It was insane.”

Flaherty found that he could not open his mouth. After a decade in retirement, he had no idea what to sing. Zeitz suggests scales, but Flaherty found even that prospect daunting. “To sing anything without the thoughtful manipulation that I’ve been doing for years almost paralyzed me,” he said. He was most concerned about what opera singers refer to as the passaggio. “The passaggio is that little zone between the upper middle and what we call the high voice, or the high notes—the money notes, which we get paid for,” Flaherty says. “It’s the area where the two start to dovetail, where the muscular dominance that produces the sound we hear in the bottom of the voice starts to yield its influence to the set of muscles that produce the head voice, the high notes. That area is acutely coordinated in a skilled opera singer.” Flaherty, despite his injury, still had his entire range. But, he says, “I didn’t have it without fatigue, without thoughtful technical manipulation. So would it be there if I just spontaneously went to the top?”

To test it, Flaherty found himself trying a song that he doesn’t ordinarily sing. “Why this particular thing came out I have no idea,” he says. “But I know of two prominent opera tenors, Franco Corelli, who was my teacher, and Mario Del Monaco, who was a famous tenor in the fifties and sixties. Both said that ‘O Sole Mio’ because it’s so popular, is not respected for its degree of difficulty. It requires as much skill as an aria. All of a sudden, ‘O Sole Mio’ started coming out of my mouth!” He reached the passaggio. “There should be a transparency—so we arrive at the high notes having the same sound that we did down in the middle of the voice,” he says. “When I got into that zone, it worked, it coordinated perfectly. I stopped and said, ‘That’s the area. It worked beautifully.’ And Zeitels goes, ‘Well, keep singing.’”

Flaherty sang phrases from Verdi’s “Othello.” Then he sang “Be My Love,” changing the key so that he climbed up to high B-flat above the staff, then B natural, and finally high C, before he came down and stopped.

It will take months of retraining before Flaherty knows whether his voice has sufficient stamina and power to sing his repertoire according to his old standard. But he knows already that enough of his voice has been restored for him to someday sing in a musical with his daughter. “If that opportunity presents itself, I’m sure I will be able to do that,” he says.

“Scott is doing things he couldn’t do,” Zeitels told me, after the follow-up. “That guy can sing. He almost blasted the roof off!”

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A conversation with John Colapinto.