

The Lightning Rod

Robert Lanza C'78 M'83 has racked up a slew of scientific accolades—and generated an equal amount of controversy—for his pioneering work on cloning and stem cells. And then there's the private island stocked with dinosaur fossils, the *Good Will Hunting* comparisons ... and his “theory of everything.” **BY MOLLY PETRILLA**

Sixteen miles outside Boston, in the back corner of an unfinished basement, a teenage boy lowers his syringe to a chicken egg and takes aim.

It's 1969 and this is Robert Lanza's first time experimenting with embryos. He isn't yet a well-known scientist. He hasn't achieved all those cloning and stem-cell firsts, hasn't been called *genius*, *renegade*, or *quack*. He doesn't have to worry about being killed on his way to work. Journalists haven't come up with the “real-life *Good Will Hunting*” analogy or suggested that he open his own Jurassic Park. He hasn't worked with B.F. Skinner and Jonas Salk, hasn't told off the former dean of Penn's medical school. He doesn't have a private 10-acre island and a house filled with dinosaur bones. That will all come later. Today he's still just a kid, and he wants to win the school science fair.

A small 13-year-old who could easily pass for 9 or 10, Lanza has been tossed into the lowest-track classes his whole life. His older sister dropped out of high school in the 10th grade and the other two, younger than Lanza, will eventually do the same. He fought his way into an honors biology class this year—his freshman year of high school—which means he's sitting beside those A-track kids whose dads don't play poker

professionally, whose moms actually let them inside the house for more than just meals and sleep, whose parents probably speak to them, maybe even take them to museums.

His best friend's mom laughed when Lanza told her he wanted to become a doctor. “You'd probably make a very good carpenter,” she said. When Lanza announced his plan for the school science fair—he would alter a chicken's genetics and turn it from white to black—his classmates giggled and his teacher said it was impossible. It's a word he'll hear many times.

Down in the basement, wedged between the furnace and clothes dryer, a homemade Styrofoam incubator on the table in front of him, he's decided the chicken experiment is *challenging*, but not impossible. He talked his way into syringes and penicillin at local hospitals and borrowed tabletop centrifuges from a guy across town who works for the state health agency. His neighbor drove him to local farms so he could gather eggs from white chickens and black ones. Now he's been working in the furnace room for months, trying to introduce pigmented genes into white embryos while his mom stands in the kitchen telling her friends that “Robby is downstairs trying to hatch chicken eggs.” *Not quite, Mom*, he thinks.



Eventually several white chicks will emerge from their eggs with brown spots. Lanza will drop by Harvard Medical School to get help repeating the results, and in a scene straight out of the movies, he'll mistake the founder of Harvard's neurobiology department for a janitor. Stephen Kuffler, "the father of modern neuroscience," won't mind a bit. He'll introduce Lanza to a graduate student who will later become director of Harvard's Center for Brain Science, and who will spend hours chatting with the eager teen about his chicken project.

Lanza will win the school science fair after his neighbor, Barbara O'Donnell, coaches him on the presentation, even teaching him to speak in complete sentences—something he's never done before. On the night he wins first place, Lanza will run up to her, a sad look on his face, and say: "Well, there's nothing else left. What else is there to do in life? This is it."

Five years and several science-fair wins later, in December 1974—Lanza's freshman year at Penn—an article will appear on page 597 of the science journal *Nature* with the title "Alteration of melanocytes by DNA in White Plymouth Rock chickens" up top and *Robert P. Lanza* as the sole author at the end. The chicken experiment will become a fraction of his oeuvre—an output that now includes hundreds of scientific publications, more than 30 books, and a parade of "top" and "most" titles: Top Stem Cell Influencers, Most Inspiring People in the Life-Sciences Industry, and most recently, *Time* magazine's 100 Most Influential People for 2014.

Robby, the scrawny kid from Stoughton, Massachusetts, will become Bob Lanza—one of the most prominent and controversial figures in his field.

The 75-year-old man, a horse rancher from Kansas, could barely see. Macular degeneration had faded his sight in one eye to 20/400 by the time he enrolled in a clinical trial. Doctors injected retinal pigment epithelium cells, made in a lab from embryonic stem cells, into his bad eye. One month after treatment, he was no longer legally blind. His vision had improved to 20/40. He could ride his horses again.

When Lanza saw him last year, the rancher was crying. He gave Lanza a hug, then quickly said he'd never hugged another man before. But he couldn't help

himself. According to Lanza, stem cells had saved the man's sight. "We're not supposed to use the term *miracle patient*," Lanza says, "but ..."

The cells came from Advanced Cell Technology (ACT), a biotechnology firm in Marlborough, Massachusetts. Lanza has been the company's chief scientific officer for 15 years, and he tells this anecdote from the ongoing, ACT-led clinical trial with pride. He considers it proof that the ideas he's been championing for more than a decade are valid—that scientists can create stem cells and use them to treat, or maybe even cure, diseases in humans.

He says his company is the only one in FDA-approved clinical trials using embryonic stem cells—cells that are *pluripotent*, meaning they are able to divide and become almost any type of cell in the body—to fight human diseases. ACT has been tracking and treating adults with macular degeneration and children with Stargardt's macular dystrophy for three years now.

Lanza claims the trial has recorded multiple improvements and, so far, no ill effects. In 2012, ACT reported in *The Lancet* scientific journal that a woman who could detect only hand motion had begun reading letters on a visual acuity chart after treatment. Lanza also mentions participants who can now read their watches or go shopping alone or recognize colors.

"This trial is giving us hope that pluripotent stem-cell therapies are safe and that we can actually use these new methods to really help people," he says in his pronounced Boston accent—the source, along with his rough upbringing and the Harvard/Kuffler story, of numerous comparisons to *Good Will Hunting*, the 1997 film about a young math genius who works as a janitor at MIT. He and ACT are planning the next trial phase now. "We could be treating very large numbers of patients within a few years, easily, if it all goes well," he adds.

To some critics, Lanza may glide too quickly over that *if*. John Gearhart, the James W. Efron University Professor and director of Penn's Institute for Regenerative Medicine—who at Johns Hopkins University led the research team that first identified and isolated human embryonic stem cells in 1998—calls Lanza "a very smart guy and a good player in this field." But he emphasizes that he's been critical of Lanza and ACT in the past for announcing their results prematurely.

Gearhart sees this retinal trial as an important test case for the field. "Can you do stem-cell grafts? Will you have a good outcome as far as restoring function? We'd love to get that information," he adds. "I have often felt very strongly that the eye was one of the best places to begin, so I think Bob's head was screwed on right here."

"The field, at least the translational part of the field, is looking at that trial with a lot of interest," adds Christopher Scott, a bioethicist at Stanford. "We're all still waiting for a study to come out of the clinic that validates the use of cells derived from embryonic stem cells."

Lanza joined ACT in 1999—just two years after scientists announced that they'd cloned Dolly the sheep. Advanced Cell was an animal-cloning company back then, and before he arrived Lanza had been working for a biotechnology firm nearby, trying to reverse diabetes in dogs through cell transplantation. The cells were rejected over and over. As the news about Dolly and then John Gearhart's stem-cell isolation broke, Lanza began to wonder if cell cloning might be the solution for those transplant rejections. "I thought there was great human potential," he adds, "but at the time it was very, very controversial. *Embryonic stem cell* was almost synonymous with *murder*."

He pressed on with the work, helping ACT clone the first human embryo in 2001—and sparking a major panic about human clones as a result. (Gearhart cites that announcement as his biggest gripe with ACT, while bioethicist Art Caplan lambasted it as "a major setback for rational discussion of the ethics of stem cell research and cloning.") The cloned-embryo panic overlapped with a new right-to-life debate that was also disrupting the fledgling stem-cell community. In a nationally televised speech in August 2001, President George W. Bush restricted federal funding for research on embryonic stem cells, citing his belief that "human life is a sacred gift from our creator."

As a national debate continued into the 2004 election cycle, protesters from the Westboro Baptist Church picketed outside Lanza's office and a pipe-bomb exploded inside a stem-cell lab several towns over from ACT. "I thought for sure I was going to be shot or killed," Lanza

says matter-of-factly. “But there was no one else doing this. I figured, if I don’t do it, who’s going to do it?”

The strongest blowback came from profilers who vilified Lanza and his peers for destroying embryos to obtain stem cells. “It all got caught up with the abortion politics,” he says now. The embryos in question were unneeded ones from in-vitro fertilization clinics, where they would have been destroyed in any case. But such objections went a long way toward stalling progress in stem-cell research.

In response, Lanza helped pioneer a new way to obtain embryonic stem cells in 2006. Borrowing a genetic-health diagnosis technique from IVF labs, Lanza and his team removed a stem cell without harming the embryo. They used that cell to start an embryonic stem-cell line, and since stem cells are immortal—they can grow forever—ACT now has a master bank with “billions and billions and billions” of embryonic stem cells from that single source, Lanza says.

“Once you do this with one cell,” he adds, “you could use it to treat everyone on the planet for every disease.”

He’s working on that part now. In June, ACT announced that its new approach to making mesenchymal stem cells—cells found in bone marrow—from embryonic ones showed promise for treating multiple sclerosis. “We went into animals that were paralyzed and one injection of our cells completely reversed that,” Lanza says with enthusiasm. “They were jumping around almost normally.” He says they’ve also used the mesenchymal stem cells to treat mice with advanced Alzheimer’s disease and lupus. He’d like to eventually launch clinical trials treating all three diseases with the company’s MSC cells.

Lanza and ACT are creating blood, too. They’ve made platelets that he says are “absolutely normal, form clots, and do all the things transfusable platelets do” from both embryonic stem cells and induced pluripotent stem cells (iPS)—cells that can be generated directly from adult cells. The platelets may soon be tested in hospitals and could treat a variety of disorders.

Each of these endeavors makes national headlines, with one Robert Lanza quoted early and often. “He’s not a shrinking violet, that’s for sure,” says Evan Snyder C’73 M’78 Gr’80, who directs the Sanford-Burnham Medical Research Institute’s

stem-cell research center and has collaborated with Lanza in the past. “Bob has a tendency to be very proud of his accomplishments and thoughts and to push things quickly and far. He can sometimes be a lightning rod for criticism.”

Mahendra Rao, founding director of the National Institutes of Health Center for Regenerative Medicine, lands on the same phrase. “He’s seen as a bit of a lightning rod,” he says. “Sometimes people have felt that he’s way ahead of the curve and that we should be slower and more cautious in doing things. The risk is that when you’re a pioneer, if something goes wrong, you sort of hold the whole field up.”

But Anthony Atala, director of the Wake Forest Institute for Regenerative Medicine, where Lanza has an appointment, declares that “the proof is in the facts,” with regard to the macular-degeneration clinical trial. “People thought they were announcing these things too early,” he adds, “but guess

“I learned to think for myself early on. Just because everyone says *no, no, no*, that doesn’t mean anything to me.”

what? They didn’t. If the long-term outcomes are as good as the early ones have been, I think it’s a therapy that can be used on patients worldwide.

“Any time you’re treading new ground, controversy’s certain to be associated,” Atala continues. “In science and in general, people are not comfortable with change.”

Lanza knows that. He cops to being “a bit of a rebel” and says that means “lots of arrows in the back,” launched by his peers. But it also means that when anyone tells him something is impossible, “all it does is make me try twice as hard,” he says. “I learned to think for myself early on. Just because everyone says *no, no, no*, that doesn’t mean anything to me.”

He holds up his stem-cell work as an example. “In those early days, I did everything I could to push this work forward,” he adds. “Now here we are in the clinic for the first time, showing we can actually do something with these cells.”

Lanza lives alone on a 10-acre island in Massachusetts, about an hour west of Boston. Just inside his front door, there’s a six-foot-long, 800-pound brachiosaurus femur that shows signs of a T-Rex attack. It’s part of his massive dino collection: fossil plates on almost every wall, display cases with nests of eggs, even a 12-foot-long track of dinosaur prints.

When another scientist encouraged Lanza to work on the West Coast near him—ACT had a branch in California until earlier this year—Lanza passed. “He said, ‘I can’t leave because my island’s here,’” Evan Snyder recalls. “It turns out he needs an island because he collects dinosaur bones and they’re too big to store anywhere else. I thought, that’s really typical Bob—that his hobby would be collecting giant dinosaur bones on his own island.”

Visitors sometimes ask Lanza if he’s going to clone the brachiosaurus. One

reporter even joked that all he needed was an electric fence and he’d be ready to open the real-life *Jurassic Park*. Lanza laughs as he re-tells that joke now. (“I said, ‘No, you can’t clone from stone,’” he adds.) Yet it brings him to an important point about his cloning work: How far is too far and what, if anything, should be off-limits?

He’s dabbled in animal cloning since late 2000, when he put a lab-engineered baby gaur embryo—an ox-like endangered species from the bamboo jungles of Southeast Asia—into the womb of a cow in Iowa. “Everyone told me, ‘Well, Bob, this can’t work because you can’t use the egg from one species to clone another,’” Lanza recalls.

“CNN was following it almost daily,” he adds, “and I was panicked because I thought, ‘What if we screw up and a cow is born instead of a gaur? That would have been so embarrassing.’” But out came Noah, definitely a gaur, and the first endangered animal ever cloned.

Noah died a few days later from dysentery, “because there are lots of problems with cloning,” Lanza acknowledges. “Everyone said, ‘See Bob, it doesn’t work.’ Our board of directors said, ‘Bob, focus on the medical things and *leave that stuff alone.*’”

For a few years, he did. But then ACT’s board turned over, and the new group told Lanza he could try again. He called up the San Diego Frozen Zoo—which houses frozen samples from more than a thousand species and subspecies—and asked which species would make a big difference, in terms of conservation, if cloned. They told him about the banteng, another endangered bovine from Southeast Asia, and provided the frozen DNA that Lanza needed to make an embryo.

Then it was back to the Iowa farm for another cow surrogate and, in 2003, “we had a beautiful baby banteng born, and it was fine,” Lanza says. “We didn’t want it to grow up to be an Iowa cow, so they took it back to the San Diego Zoo and it lived with the other bantengs there for a long time.”

Lanza helped the Spanish government when its scientists attempted to clone a wild mountain goat. Now he’s working with a team in Australia that’s trying to resurrect the gastric-brooding frog, which went extinct in the 1980s.

He likes talking about this part of his work. He’s always loved animals, from the mail-order squirrel monkey he had as a kid (“He was smarter than most of my friends”) to the two-foot-wide octopus he kept in his apartment during medical school (“It started to become a bit of a distraction”).

But after the banteng, some people accused Lanza of “playing God,” and a World Wildlife Fund conservation director told *People* magazine that his cloning was “a complete farce” as conservation because “cloning one banteng does nothing for its habitat and the wildlife that shares it.”

“I can justify preventing the loss of an endangered species,” Lanza says. “If the habitat is still there, and we can give them a fighting chance to survive, I say let’s do what we can to offset the damage we’ve done. But to go back just for ha-has and resurrect a dinosaur or a mammoth—then I’d probably join the side that would oppose it. I think there’s a line, and when you cross it, tampering might not be such a good idea.”

(As for human cloning, “there’s no reputable scientist in the world who would ever propose cloning a human

being for reproductive purposes,” he says. “That would be considered unsafe and grossly unethical.”)

These days, Lanza is trying to save animals with ACT’s stem cells. He says the company is working with Tufts University’s Veterinary School—and, he hopes, one day with Penn’s—to bring stem-cell therapies to pets, treating everything from osteoarthritis to a canine version of Crohn’s disease.

Dean Richardson, the Charles W. Raker Professor of Equine Surgery at Penn’s School of Veterinary Medicine—who also runs a stem-cell research lab at the school focused on treating osteoarthritis and tendon/ligament injuries—says stem-cell treatments are developing much faster for animals than humans. “Most people, including physicians, would be surprised at how widely used stem cells are in veterinary medicine, especially the equine world,” he says.

But while Richardson and other veterinary scientists are using the mesenchymal stem cells found in bone marrow or fat, he says Lanza’s work is “beyond that,” since it focuses on embryonic and iPS cells. With iPS cells in particular, Richardson says, “animals will be way ahead of humans once people figure out how to make them”—which is exactly what Lanza and ACT are working on now.

When you write a book and declare it “the theory of everything,” you may as well announce a cattle call for every critic, skeptic, and Internet troll around the world.

Lanza published *Biocentrism: How Life and Consciousness are the Keys to Understanding the True Nature of the Universe* in 2009, but he still gets emails and tweets about it every day, some fawning, some not-so-nice. (It’s also because of the biocentrism blow-back that, as of last June, Google filled in “Robert Lanza quack” as the first suggestion when you typed his name into its search.)

Asked about the theory today, he needs a minute. “Let me just—hold on—let me see if I can find it—okay, I have my little cheat notes here.”

He launches into his spiel, presented at warp-speed:

“When you think about life now, we think everything’s just a big accident. But when you look at all the experiments, it suggests

completely the opposite. You add life to the equation, you can explain some of the biggest puzzles of science. Biocentrism explains, for instance, why all the laws and the forces of the universe are exactly fine-tuned for the existence of life. Until we recognize the role that we actually play in physical reality, attempts to understand the world are going to remain a road to nowhere. It turns out that life and consciousness are the key to understand the true nature of the universe.”

He goes on to say there’s “something a little strange” about space and time, paraphrasing Einstein (“time is what you measure with a clock and space is what you measure with a ruler”) and Kant (“they’re simply the tools the mind uses to put everything together.”)

“Is that too much?” he asks, realizing he’s rattled off the whole thing in exactly two minutes.

His website has a more succinct summary: “Life and biology are central to being, reality, and the cosmos. Biocentrism asserts that current theories of the physical world do not work, and can never be made to work, until they fully account for life and consciousness.” It’s the idea of an interconnected universe where life creates the universe, not the other way around.

He began puzzling out this theory decades ago, but when he met with two prominent New York literary agents, they warned him that writing it up was a late-career move, not an opening act. “They said, ‘Go build your scientific career, and once you’ve built it, people will listen to you,’” he recalls. “So now here I am.”

Lanza knew he was taking a risk by publishing *Biocentrism*. He admits that it’s caused “huge controversy.” Citing the German philosopher Arthur Schopenhauer’s axiom that truth goes through three stages (ridicule, violent opposition, and acceptance as being self-evident), he adds, “I think I’m in the middle right now. I’ve gotten the ridicule for sure, so now it’s being violently opposed.”

Does the criticism get to him? “I hate to say it, but I’m a sensitive guy,” he admits. “It’s tough. It bothers me. But that’s okay. It’s the price you pay. When people criticize it, I know where they’re at. I’ve thought of all that myself. But what they’re missing is that they don’t get the rest of it. It’s a paradigm shift. Anytime you try to assess it and step outside the paradigm, it’s not going to make sense. It’s going to seem silly.”

The biocentrism dust-up joins Lanza's other hot-button moves: the cloning, the cutting-edge therapies—and that time he battled the dean of Penn's medical school.

As an undergraduate at Penn, Lanza was a Benjamin Franklin Scholar and a University Scholar. (The latter funded his trip to South Africa to work with Christiaan Barnard, who performed the world's first heart transplant.) He enrolled in the School of Medicine after graduation, but even as he published papers with B.F. Skinner, the father of behaviorism, and with Jonas Salk, the polio-vaccine developer, Lanza came to feel that "there seemed to be no purpose to the universe," as he wrote in a biocentrism article for *The Huffington Post*. "There were no fountains of youth, no lost gardens to explore in far lands," he continued. "Something was missing, both from my life and from the scientific books in the library." He decided to assemble a book that would suggest "necessary changes" and provide "a multifaceted picture of where science stood and where it intended to go."

He sent out letters to Nobel laureates, the secretary general of the United Nations, the US surgeon general and others, asking them to contribute essays on global medicine, health, and policy. Soon those high-profile contributors were calling up the dean's office. They were looking for Robert Lanza.

"The Dean was convinced the project would fail and upset a lot of important people," Lanza explained in his *Huffington* article. "But to my mind it wasn't his concern. I said that in his office when he ordered me to send out letters to the contributors. When I refused, he told me I wouldn't graduate if I didn't comply. I told him I already got what I came there for—a medical education, not a piece of paper. When the conversation got heated, he said, 'I've never had a student talk to me like that.' I stood up and (finger pointed) responded, 'I find it difficult being in the presence of people like you. I'm talking to you as one human being to another.'"

Lanza's champion at Penn up to that point had been fellow Boston native Eliot Stellar, who was Penn's provost from 1973 to 1978 and was affiliated with the University from 1960 until his death in 1993. "He really put his neck out to get me into the University Scholars program,"

Lanza says. "They had me in the fourth percentile from the bottom [of incoming freshmen] for my English ability. I wasn't as articulate as these other people. I certainly didn't come from the same pedigree."

Stellar came to his rescue again during the med-school brawl, smoothing things over with the dean and making sure that Lanza still received his medical degree.

"He was my hero, my mentor, and the greatest man I've ever met," Lanza says of Stellar. "I really wouldn't be here if it weren't for him."

As for the book, Lanza published *Medical Science and the Advancement of World Health* in 1985—and dedicated it to Eliot Stellar.

Lanza seems to enjoy talking about challenging the dean, just as he seems to enjoy talking about the other times he defied expectations or refused to accept a *no*.

Yet by his own descriptions, Lanza is actually a camera-shy introvert who doesn't court controversy, who hates cocktail parties, and who avoids networking. He says he turned down two invitations to appear on *Oprah* in the past and rejected some 50 TV requests last year. He agreed to participate in Stephen Hawking's *Stem Cell Universe* special for the Science Channel, but four months after the program first aired, he still hadn't watched it.

"Was it any good?" he asks. "Was it okay? Did it sound okay? Did they double the canoe and make it look like I was dividing or something? I was a little embarrassed, but I was thinking, 'Okay, I'll play along if it helps explain it.'" (The canoe he was paddling alongside his island did, in fact, multiply on-screen in a demonstration of how embryonic stem cells form.)

"I want my privacy, I want to be left alone," Lanza insists. "Going on TV and having people know who I am and see my face, I'm really ambivalent about that. But I will do print media because I feel that part of my role is to educate, to explain, to try to be as honest and lucid as I can. I think that's helpful. I think that's good."

"Oh, hi!" Lanza says, answering the phone after only a few rings. He sounds giddy. "I was just chatting with someone. We were discussing an exciting experiment." Without further prompting, he dives right in, talking about test mice that are blind from retinitis pigmentosa, an eye disease that also affects humans.

"We went in with our iPS and embryonic stem cells and now they can see again, which is amazing," he continues. He's talking even faster than usual and chuckles after he says, "We always thought this blindness was irreversible, but ..."

"We're able to put in new photoreceptors and actually reverse the blindness after they're already blind," he adds. "That's huge. No one's ever done that. If you'd asked me a few years ago whether that was even biologically possible, I would have said probably not."

Before he picked up the phone, Lanza had been talking with one of ACT's scientists about the experiment. "I was just thinking that mice, they see black and white," he explains. "So I was just saying, we want to use red lights and make sure we show that we can actually make them see colors. When you called I was just discussing doing that."

Lanza is 58 years old now. He often thinks about leaving the field, maybe even retiring. "It just depends when you catch me," he adds. "I've thrown up my hands and said, 'This is enough for me,' I can't tell you how many times. Then I get a night's rest and the next day I say, 'Okay, I can't give up yet.'"

He has lost friends and family to many of the diseases he'd like to treat with stem cells. One of his sisters died from internal hemorrhaging after a car accident. Her hospital, like many, had limited units of platelets available. His childhood neighbor and mentor—the one who bought him bird books, drove him around to collect chicken eggs, helped get him into that honors biology class—is now showing signs of Alzheimer's, and her sister is suffering from the disease, Lanza says.

"My father died from pulmonary hypertension," he adds, "and I know my cells would have helped him. But I couldn't put them in. There's just so much to be done, and I've seen what these cells can do, and it's amazing. Unfortunately, other people haven't. I have always been a big believer in the potential of stem cells. I just want people to know what the potential is."

"I live on an island," he adds, "I wanted to be left alone. But on the other hand, I do want to make a difference. I want to do whatever I can to help people and to improve all the suffering and pain out there." ♦

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