





THE PSYCHONAUT YOU NEVER HEARD OF

John C. Lilly's very long, very strange trip from Penn's Medical School to the outer fringes of science—and consciousness.

By JoAnn Greco

ILLUSTRATION BY JONATHAN BARTLETT

In his 70s, John C. Lilly M'42 still held fast to the Catholic faith instilled in him during his childhood. Sort of. He continued to believe a divine being was watching over him, only he referred to it as ECCO—for the Earth Coincidence Control Office. How Lilly—born in 1915 on January 6 (the feast of the Epiphany) into a prominent St. Paul, Minnesota, family and groomed early in life to become a successful scientist—arrived at this conclusion makes for one very long, very strange trip.

Lilly did achieve great acclaim as a neuroscientist, inventing several devices and methods for measuring brain activity. And even when he spun off in other directions, he gained national recognition and a kind of celebrity status for his quixotic quests to explore sensory deprivation, establish communications with dolphins, and experiment with hallucinogenic drugs to reach the deep recesses of the unconscious—often all at the same time.

PIK Professor Jonathan D. Moreno, the David and Lyn Silfen University Professor of Ethics in the Department of Medical Ethics and Health Policy, offers a tantalizing snapshot of Lilly's career. "He did his early and important brain research at Penn while he was training in psychoanalysis," he says. "My buddy Werner Erhard [founder of est, the once hugely popular self-help program] was in [Lilly's] isolation tank. Lilly was stoned on ketamine, or 'Special K' as he called it, for much of the end of his life. Then there are the stories of sex with dolphins ..."

(Not quite, but we'll get to that later.)

While always originating from very serious questions and interests, Lilly's adventures and avowals skewed kookier and kookier as time passed. (He would serve as the inspiration for *two* notably outlandish Hollywood movies.) His career suffered as he rejected government involvement in his research on brain stimulation, became plagued by paranoid delusions, and, in addition to nearly killing himself several times, earned the mockery of his peers.

"Penn has a rich tradition in mapping and imaging the brain," observes John A. Detre, a professor of neurology and radiology, vice chair for research in the Department of Neurology and director of the Center for Functional Neuroimaging. "After looking

into Lilly, I feel I should have heard of him. He would have fit nicely into that narrative, but the reason he doesn't is because he shifted into popular science and more and more unusual experimentation."

"My own beliefs are unbelievable," an elderly and soft-spoken Lilly once offered, with the hint of a sly smile, in an interview for the PBS series *Thinking Allowed*. On that show, he wore a coon-skin cap, pearl earring-studs, and a black latex glove on one hand.

But even at his most eccentric, Lilly commanded a certain level of respect. He traded jibes with Nobel Prize-winning physicist Richard Feynman. *Psychology Today* referred to him as a "cartographer of altered states in consciousness, a rare combination of scientist and mystic." Lilly's much more famous fellow psychonaut, Timothy Leary, praised him as one of the first scientists to "send back systematic and useful data from his explorations of inner geography." When Lilly died in 2001, *The New York Times* summed him up as someone who combined the "showmanship of P.T. Barnum and the infectious zeal of Jacques-Yves Cousteau."

That latter characterization was a nod to Lilly's research on dolphin communication, as refracted in *The Day of the Dolphin*, a 1973 movie directed by Mike Nichols in which a silly Lilly-like scientist played by George C. Scott frolics with dolphins whose moving mouths emit plaintive voices that produce English words. Lilly hated the movie. (He would later guilt-trip its producer into donating to his Human Dolphin Foundation.)

He felt less antipathy toward director Ken Russell's wildly weird *Altered States*, a 1980 film in which William Hurt, playing a mild-mannered academic, is transformed into a hairy ape-man who rampages through a local zoo hunting for animals to eat. Despite such lurid over-the-top scenes, Lilly was moved by the film. Still, he noted that he'd received neither credit nor money for this depiction of his work.

"There are two John Lillies living in parallel universes," he once quipped. "The other one is very wealthy, because he patented all of our inventions." In counting only "two" John Lillies, the scientist was being modest. In reality—or *alternity* (an array of alternate realities), as he would come to call it—there were at least sev-

eral. In a wide-ranging career that somehow exhibited a clear trajectory, Lilly was a psychoanalyst, neuroscientist, inventor, consciousness-explorer, biophysicist, and dolphin researcher. He showcased his groundbreaking research in a dozen or so books, while also publishing regularly in academic journals.

Always he sought to understand the difference between the brain and the mind. Always he lived by a guiding mantra, he told *Omni Magazine* in 1983: "There are really three departments in science: experiment, theory, and experience," he said. "Experience is the part that doesn't get into the scientific journals."

In diving deep into the world of drugs like LSD and ketamine (used medically as an anesthetic and horse tranquilizer), Lilly may have been a product of his time but there's no doubt that he was also way, way ahead of it. "What he was trying to do in all the aspects of his work was to understand and change the way the brain operates," says Moreno. "He wanted to shake it out of its normal routine, to find out more about it. You can see him in retrospect as a pioneer, someone who saw where things could go."

Science called to Lilly early. In *The Scientist*, his 1988 "metaphysical" autobiography, he remembers a chemistry experiment going awry when he was 13—he injures a friend of his brother Dick after dropping a match into a Coke bottle filled with sulfur, sodium chlorate, and charcoal. Later, when Dick dies following a fall from his horse, Lilly resolves to formally pursue science by becoming a doctor to "prevent this from ever happening again to anyone that I love." He vows to "make myself fit for doing the kinds of things that a young scientist should learn to do ... Father's bank and the idea of working in banks appalled me."

(Lilly's father, also named Dick, was president of the First National Bank of St. Paul.)

By age 16, Lilly was bored with his science classes at the elite St. Paul Academy and had begun thinking about the hard questions of physics. "How can the mind render itself sufficiently objective to study itself?" he asked in an essay published in the school magazine. Photos from around this time show an earnest, sharp-featured young man with curly black hair and round wire-framed glasses.

He doesn't seem like the kind of kid who would battle with his father about choosing a business career, but he sticks to his guns. When his father drives off an embankment and lands in the hospital in a coma, John, by then a senior at CalTech, rushes home to be with him. He's still there, three weeks later, when Dick wakes up, ready to continue an argument he had been having with his son: where John would be going to medical school.

"You're going to Harvard!" Dad thunders.

"No, Dad, I'm going to Dartmouth. Welcome back!"

"Two things particularly impressed John about this incident," writes Francis Jeffrey in *John Lilly, so far ...* the 1990 authorized biography he co-wrote with his subject. "For one, he observed that while in coma, the brain was just like a machine that had been switched off in the middle of some action. Once switched back on, it continued the action from where it had left off ... The other significant aspect was the unusual sequence of coincidences that saved Dick's life. The chances of plunging one hundred feet in a car, hitting the ground, and surviving are actually quite small ... In later years, when John Lilly found himself in the middle of some death-defying stunt, he would reflect on his father's accident as his first intuition that some higher power can arrange coincidences very precisely."

John had become convinced that Dartmouth was the right place for him after his father arranged a meeting with William James Mayo—a founder of the famed Mayo Clinic, another Minnesota institution with which Dick had close ties—and Mayo praised the New Hampshire Ivy's medical school as the only institution in America that adequately taught anatomy. After just that one chat with the great doctor, Lilly was brazen enough to invoke his name as he worked to convince the bank's wary board that his examination of his father had revealed no evidence of brain damage and that Dick was indeed fit to return to work: for good measure, he said, he would be happy to bring in Dr. Will Mayo to confirm the diagnosis. The easy declaration was an early show of the bull-meets-balls confidence that would stay with Lilly throughout his life.

So, off to Dartmouth Lilly went, along with his young bride, Mary, and their infant

son. His first instruction in basic anatomy came quickly. "Lying on a table is a cadaver covered with a sheet," Jeffrey describes. "Beside it, Professor Frederick Lord begins his introduction: 'One of the first [things to learn] is the difference between a dead body and a living person. The body on the table is at the end of its social career.' He pulls off the sheet. Half the class faints. It's their beloved professor of music ... It's the first they have heard of his dying."

After two years, though, Lilly was ready to move on to pursue his true interest: research; specifically, research on the brain. That brought him to Penn.

"MY BODY IS MY OWN LABORATORY."

The year was 1940 and the School of Medicine was a hotbed of inventors and innovators. One of the first professors Lilly met was H. Cuthbert Bazett, of the Department of Physiology and mainly interested in the body's circulatory system. Bazett was working on ways to record blood pressure as test pilots were subjected to high-altitude, combat-like conditions, and he asked Lilly for feedback. The young doctor-in-training felt that the device Bazett was using wouldn't hold up under the strain. He suggested improvements that drew on the expertise in physics he had gained at CalTech and borrowed from developments in the new technology of high-frequency electronics. When they proved successful, Bazett encouraged Lilly to publish his first solo scientific paper, "The Electrical Capacitance Diaphragm Manometer." The new instrument would prove to be the first of several inventions Lilly created while at Penn.

Encountering Bazett was formative for Lilly in other ways, too. For one, Bazett passed on to Lilly his belief that no scientist should subject anyone to experiments that he wasn't willing to undergo himself. This do-unto-others philosophy would guide Lilly throughout the rest of his long career. Whether it meant jumping into dark tanks full of salt water or dropping copious amounts

of LSD, Lilly firmly stuck to the principle that "my body is my own laboratory."

It was also Bazett who sent Lilly to Britton Chance Ch'35 Gr'40 Hon'85, who in addition to having advanced degrees in chemistry and biology was also a talented electrical engineer. Chance helped Lilly figure out the more technical aspects of his invention, and brought him into the fold of the University's Eldridge Reeves Johnson Foundation, which Chance would direct from 1949 to 1983. Founded in 1929, this institution was dedicated to research into physical principles fundamental to medicine and its clinical practice—reflect-

ing its namesake's inventiveness in perfecting the disk-playing phonograph and forming the company that ultimately became RCA Victor.

The Foundation was a "pretty interesting place, and it would have been a very fertile environment for Lilly," observes Detre, who adds that he himself "knew about Penn because of it—it still had a reputation as being particularly conducive to scientists looking to push frontiers. It was the first place I worked when I arrived in the mid-1980s; I came here to work with Britton Chance." (When Chance died in 2010, at the age of 97, Detre was one of his physicians at the Hospital of the University of Pennsylvania.)

Upon Lilly's graduation from the Medical School in 1942, the then-head of the Foundation, Detlev Bronk, invited him to join the faculty of the Department of Biophysics, a new discipline that applied physics to the problems of biology. As part of a Foundation contract with the US Air Force, Lilly studied the dangers—including decompression, oxygen starvation, and the bends—faced by military aviators; giving himself over to exhausting simulations on the lab's tilt tables and centrifuges. "During these years, he learned many things about his own functioning in extreme states," he wrote in *The Scientist*, switching to the

third-person voice. “He [also] learned about the wartime support of university research by governmental agencies ... he saw that scientific research was forced to become pragmatic, task-oriented.”

In other words, it was time to move on. When the war ended, Lilly opted for independence—of a sort—staying on at Bronk’s lab, but working on his own independently funded (thanks, Dad!) effort to build a device he called a *bavatron*, a television-like monitor that would portray the activity of the intact, un-anesthetized brain.

In 1953, Seymour Kety M’40, an acquaintance from his student days at Penn who had recently become scientific director at the newly formed National Institute of Mental Health (NIMH), invited Lilly to join him there. The family, now with two children, moved to Chevy Chase, Maryland.

Lilly continued working on a device he invented to measure electrical activity in live brains. Placing electrodes on the surface of the cerebral cortex of a macaque, he watched how the wavelike forms changed depending on what the monkey was doing or the stimulus it was responding to. Known as *electrocorticography*, the technique had been used in the treatment of epileptic patients but had required that surgeons open the skull to probe the brain. Lilly described his much less invasive version in *The Scientist*: “With this technique electrodes could be implanted in the brain without using anesthesia. During the process of implantation, there was no more pain in the animal than that of a needle prick in the scalp. Short lengths of hypodermic needle tubing ... were quickly pounded through scalp into the skull. These stainless steel guides furnished passageways for the insertion of electrodes ...”

In 1955, Lilly published a paper that documented research begun at Penn. By implanting electrodes deeper still, below the cortex, he could stimulate the living brain without hurting it. The result was an early form of brain mapping, as Lilly precisely located the pain and pleasure centers of the monkeys’ brains. Around the same time, he completed his training program to gain certification as a psychoanalyst. Lilly’s fervent quest to understand the brain-mind dichotomy had reached its apex.

But once again the government was sniffing around. Lilly balked at a request

for a briefing on his brain-stimulation work, agreeing only on condition that the meeting not be secret or classified. When he finished his presentation a few weeks later, he reports in *The Scientist*, “there was a long silence.”

One man in uniform asked the only question: “What are the medical indications for the use of brain electrodes in human patients?”

“The only current medical indications are two rather severe diseases: epilepsy which cannot be controlled by chemical means and Parkinson’s disease,” Lilly answered.

He knew full well what was really being asked. “These techniques could become the most powerful brainwashing methods devised by man,” he writes.

He abandoned that research.

Perhaps you remember the isolation-tank fad of the early 1980s.

A company called Samadhi (a Hindu word referring to the highest stage of concentration) began manufacturing the tanks after its founder, Glenn Perry, took a five-day workshop with Lilly in California and went on—with the scientist’s blessing and input—to adapt the idea for commercial use. Soon celebrities began extolling their time afloat, and businessmen routinely spent \$20 and their lunch hours for the opportunity to detach from the art of the deal. The tanks were ultimately done in by qualms about their cleanliness and the rise of AIDS, when unfounded fears of just how easily it might be transmitted were rampant. In recent years, however, the concept has made a comeback, rebranded as “Floating.” According to FloatationLocations.com, about 350 centers across America now offer the experience for anywhere between \$50 and \$100 a pop.

For Lilly, the idea of a sensory deprivation tank began as an intellectual exercise: how to test which of two prevailing theories on consciousness was the correct one. Without outside stimulation, would the brain cease activity? Or was the opposite case—that deprived of all external stimuli the brain’s cells would still “oscillate”?

“After a long and protracted study of these various sources of stimulation,” he wrote in his autobiography, “the scientist received an inspiration to attempt the use of water flotation. Water would have the advantage of supporting the

body without stimulating the skin ... If the water temperature were adjusted to soak up the heat given off by the metabolism of the body and the brain, the temperature problem could be solved ... He sketched out the necessary apparatus and began to talk to his colleagues.”

As luck would have it, someone told him about a little-used tank languishing in an out of the way building on the NIMH campus, a holdover from experiments on the metabolism of swimmers conducted during World War II by the Office of Naval Research.

Lilly would spend the better part of a year fine-tuning his chamber, mainly in devising and testing masks for underwater breathing that would be comfortable for relatively long periods. He indulged in lots of time in the tank himself, coming to the conclusion that the brain did not need external stimulation to stay conscious. “He discovered that two hours in the tank gave him the rest equivalent to eight hours of sleep on a bed,” Lilly writes in *The Scientist*. “The two hours were not necessarily spent in sleep. He found that there were many, many states of consciousness of being ... He found that he could have voluntary control of these states; that he could have, if he wished, waking dreams, hallucinations; total events could take place in the inner realities that were so brilliant and so ‘real’ they could possibly be mistaken for events in the outside world.”

Eventually, though, Lilly became a “bit anxious” about these “events”: “He experienced the presence of persons who he knew were at a distance from the facility. He experienced strange and alien presences with whom he had no known previous experience. At the time his belief system was such that the brain contained the mind; there were no possibilities such as distant sources communicating with him in the tank.”

And this was long before Lilly even tried LSD, although his peers were suggesting he experiment with the drug while in the tank. But he resisted, fearful of “contaminating the results with drug studies.”

Twenty years after having invented the tank in 1954, he had long abandoned any such misgivings. But he still took the tank seriously, as indicated by his 1974 flare-up with physicist Richard Feynman—who had

his own idiosyncrasies (congo playing, safe cracking) and a wicked sense of humor. In his best-selling book, *Surely You're Joking, Mr. Feynman* the Nobel-winner devotes several pages to his exploits with Lilly:

"Mr. Lilly introduced me to the tanks as he must have done with other people. There were lots of bulbs, like neon lights, with different gases in them. He showed me the Periodic Table and made up a lot of mystic hokey-poke about different kinds of lights that have different kinds of influences. He told me ... all kinds of wicky-wack things, all kinds of gorp. I didn't pay any attention to the gorp, but I did everything because I wanted to get into the tanks, and I also thought that perhaps such preparations might make it easier to have hallucinations."

Feynman says he had never taken hallucinogenic drugs. ("I love to think, and I don't want to screw up the machine.") But he allowed Lilly to convince him to take one-tenth the normal dose of ketamine—and finally got the hallucinations that had brought him to Lilly in the first place.

"One of the things that perpetually bothered me, psychologically, while I was having a hallucination," he writes, "is that I might have fallen asleep and would therefore be only dreaming." Nevertheless, he was sufficiently impressed by his experiences that when he sent Lilly a copy of his newest book he inscribed it by writing, "Thanks for the hallucinations."

Lilly shot back. "Thanks for the book, Dick—but you stopped being a scientist the instant you said that word, hallucinations."

"A fourteen year discussion followed," relays Jeffrey in *John Lilly, so far ...* "John argued that the word hallucination is a trash-bin concept for a whole range of experiences that people wish to discount because they are unconventional or difficult to describe."

At this point, the mid-1970s, Lilly was full-force into what would prove to be the largest phase of his life: his attempts to establish communication with dolphins. The work stemmed from his many isolation-tank sessions—which led him to wonder more about the experiences of large-brained mammals that floated naturally. Feeling confined at the NIMH, he had resigned in 1958 to fully commit to dolphin research. He moved to the Virgin Islands for a year and scouted

sites for a lab. Having left his family behind, during that time alone he also decided to divorce his wife of 20 years.

Soon thereafter, Lilly married again. He had a daughter with his second wife, Liz, who eventually relocated to Miami to run the dolphin brain lab Lilly had set up as a complement to the "mind work" (communications with dolphins) being done in the tank he had built in the Virgin Islands. In that tank, he eventually administered LSD to six dolphins—but quickly abandoned the practice to experiment, again, on himself.

It wasn't long before Margaret Howe, a young woman who had no real qualifications beyond a recent college degree in biology and keen empathy skills, started working at Lilly's dolphin lab as a research assistant.

Howe (now Lovatt) had a bit of a moment in 2014 when she was the subject of a television documentary, *The Girl Who Talked to Dolphins*. In the film, she said, "the worst experiment in the world, I read somewhere, was me and Peter." She's referring to the so-called "sex with dolphins" incident, which occurred in 1965.

It started innocently enough.

"Every night we would all get in our cars and pull the garage door down and drive away," Lovatt told *The Guardian* in 2014. "And I thought: 'Well there's this big brain floating around all night.' So I said to John Lilly: 'I want to plaster everything [in the lab] and fill this place with water. I want to live here.'"

The dolphin she chose for this 10-week experiment, Peter, proved to have quite an amorous nature. Lovatt made a game effort to teach English to Peter, but "he was very, very interested in my anatomy. He would rub himself on my knee, or my foot, or my hand." She began to manually relieve Peter's sexual urges. "It would just become part of what was going on, like an itch ... It wasn't sexual on my part. Sensuous perhaps." And sensational, though not until 10 years later, when a popular porn magazine got wind of the story and gave it the expected lascivious treatment.

In the mid-1970s, Lilly went off the deep end. He had at last found a soul mate, though, in his third wife Toni, whom he married in 1974. Despite being an LSD user herself, she was a leveling influence on the

scientist, dismayed by his repeated accidents and blackouts—his "seduction by K."

Initially drawn to the powerful horse tranquilizer in a desperate search to relieve the migraines that had plagued him his entire life, Lilly once spent three weeks injecting himself hourly with ketamine. Eventually, several friends and assistants had him "admitted to a psychiatric hospital, under the pretense that John had asked for psychiatric help," writes Jeffrey. But "[f]riendly medical colleagues were everywhere, preventing the cosmic clown's comedy from turning into serious soap opera." In *The Scientist*, Lilly simply admits: "John signed himself in ... and was assigned to a room on a locked ward. He was interviewed by various personnel, who did a psychiatric evaluation ... He was moved to a private room in the medical section of the hospital ... and nothing was found." After promising, once again, to lay off K, Lilly was sent home.

Lilly increasingly heard voices from various alien "beings." He credited his ability to survive a terrible bike crash and a near-drowning (in a hot tub!) to the good forces ruling the world—that Earth Coincidence Control Office. He also warned against equally powerful but far less benign networks at cross-currents with ECCO. In his later years, after Toni died in 1986, he started "adopting" much younger women instead of marrying them.

While he never did establish communications with dolphins, Lilly was instrumental in promoting a newfound respect for these mammals as creatures worthy of separate study and not ones to be looped into general animal studies that included smaller-brained subjects like monkeys. He spent the last 20 years of his life advocating for cetaceans (dolphins, whales, and porpoises), traveling around the world to spread the word that they were "not someone to kill, but someone to learn from."

Science is one part discovery and one part promotion, says Penn's Detre. "Lilly didn't protect his turf, and when the military started bugging him, he said goodbye. I'm sure if he had stayed with the straight and narrow—instead of moving into dolphin communications and LSD and alternative realities—he would get a lot more credit than he does. But, I appreciate being alerted to him," he finishes. "I'm now enlightened, I'm a fan!" ♦

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