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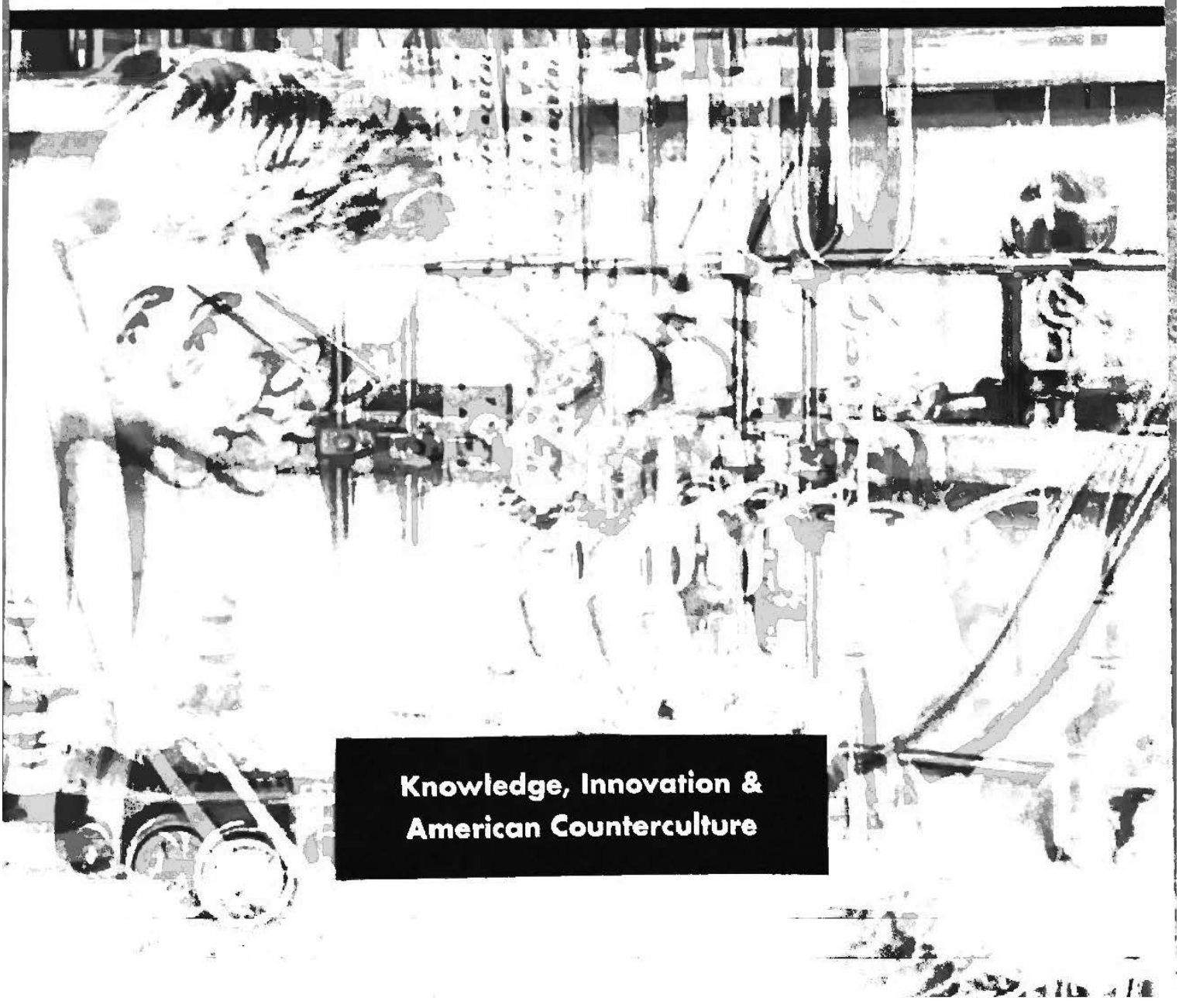
GROOVY SCIENCE



Knowledge, Innovation & American Counterculture

Groovy Science : Knowledge, Innovation, and American Counterculture

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Adult Swim: How John C. Lilly Got Groovy (and Took the Dolphin with Him), 1958–1968

D. Graham Burnett

What did it mean to be "groovy" circa 1970? It meant knowing how to hang, how to float, how to be at one with others, with animals, with the universe itself. I believe we can treat the following text as paradigmatic of the project as a whole:

> I suspect that whales and dolphins quite naturally go in the directions we call spiritual, in that they get into meditative states quite simply and easily. If you go into the sea yourself, with a snorkel and face mask and warm water, you can find that dimension in yourself quite easily. Free floating is entrancing. . . . Now if you combine snorkeling and scuba with a spiritual trip with the right people, you could make the transition to understanding the dolphins and whales very rapidly.[1]

Spiritual cetaceans? Trippy, collective, free-floating ethology of the odontocetes? Where are we?

The short answer is that we are located firmly in the head—the very heady head—of one of the most impor-

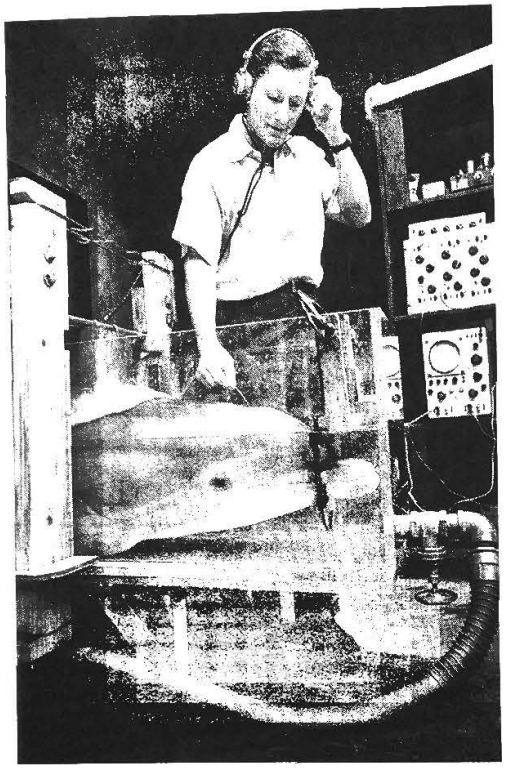

FIGURE 1.1 John C. Lilly at work in the lab. Reprinted by permission of the Flip Schulke Archives. © Flip Schulke.

tant, and one of the strangest, scientists of the 1960s: John C. Lilly, the man whose work with brains and behaviors of dolphins had lasting implications for cultural understanding of human beings' nearest aquatic kin (fig. 1.1). A pioneering neurophysiologist, a troubled military psychologist, an apostate cetologist and animal fantasist, ultimately a Pied Piper of whale hugging and cosmonaut of heightened consciousness—John C. Lilly traced a fascinating trajectory across the postwar period. Retracing a parabolic portion of his path (he rose and he fell) will allow us, I think, to catch several striking views of what we may indeed want to call "groovy science."

Lilly and the Cetacean Brain

Born in 1915, Lilly, from a well-to-do family in Saint Paul, Minnesota, took a bachelor of science degree from the California Institute of Technology in 1938 and studied at Dartmouth Medical School for two years before moving to the University of Pennsylvania, where he completed his MD in 1942 and remained on the faculty. There, under the influence of Britton Chance and Detlev Bronk, Lilly pursued research in biophysics, including applied investigations into real-time physiological monitoring—work linked to wartime service in military aviation, where techniques for assaying the respiration of airmen were needed.[2] Lilly had contact through his family with the neurosurgeon Wilder Penfield in the later 1940s and developed an interest in neuroanatomy and the electrophysiology of the brain. By 1953 he had been appointed to the neurophysiology laboratory of the National Institute of Mental Health (NIMH), where he worked under Wade Marshall as part of a joint research program with the National Institute of Neurological Diseases and Blindness.

By the mid-1950s Lilly's lab in Bethesda, Maryland, was performing in vivo electrical stimulation of the brains of macaques—work aimed at cortical mapping by means of correlating point applications of currents at varying thresholds with specific behaviors and reactions in subject animals.[3] Reporting on some of these investigations at a conference on the reticular formation of the brain, held in Detroit in 1957, Lilly would explain,

> The neurophysiologist has been given a powerful investigative tool: the whole animal can be trained to give behavioral signs of what goes on inside. . . . We are in the position of being able to guess with less margin of error what a man might feel and experience if he were stimulated in these regions.[4]

This was, in many ways, unpleasant business, Lilly acknowledged, pointing out that he had "spent a very large fraction of my working time for the last eight years with unanaesthetized monkeys with implanted electrodes." In addressing the nebulous region where neurology, psychology, and animal behavior overlapped, Lilly permitted himself some observations on the affective universe of his scientific subjects:

> When an intact monkey grimaces, shrieks, and obviously tries to escape, one *knows* it is fearful or in pain or both. When one lives day in and day out with one of these monkeys, hurting it and feeding it and caring for it, its experience of pain or fear is so obvious that it is hardly worth mentioning.[5]

It would not be the last time that Lilly would reflect on the inner lives of his experimental animals with considerable confidence. But his experimental animal was about to change. Like a number of American psychology researchers in the mid-1950s—including the echolocation researcher Winthrop Kellogg—Lilly was in the process of leaving monkeys behind for the bottlenose dolphin, *Tursiops truncatus*.

His first brush with the study of cetaceans came in 1949 when, during a visit to a neurosurgeon friend on Cape Cod, Lilly learned that a recent storm had beached a whale on the coast of southern Maine. A plan took shape for an impromptu expedition north, with a view toward collecting a novel brain.[6] As it happened, Lilly was acquainted from his days at the University of Pennsylvania with the Swedish-Norwegian physiologist and oceanographer Per F. "Pete" Scholander, who had also worked with Detlev Bronk in aviation physiology during World War II and had then moved to the Woods Hole Oceanographic Institute.[7] Scholander—something of a daredevil, and fascinated by the physiology of extreme environments—had published research on dive physiology and decompression, and while still living in Scandinavia he had conducted a number of pioneering studies on the deep-diving capabilities of marine mammals, particularly whales.[8] Lilly looked up Scholander and recruited him for the trip, and the three men suited up for a drive to Maine. Shortly after reaching the carcass (a large pilot whale), exposing the skull, and beginning to chip away toward the brain, they were joined by two other researchers who had independently made the drive up from Woods Hole: William Schevill and his wife and collaborator, Barbara Lawrence. They were, reportedly, somewhat miffed to discover that they had been beaten to the punch and were particularly concerned that the hacksaw dissection might have damaged the airways of the upper head, which they had come to examine. In the end, however, the cadaver would be theirs, since Lilly and his partners found that the brain had largely been dissolved through autolysis; the smell alone overpowered them.

Though he headed home with little to show for the trip, Lilly had brushed the shores of cetology, and his curiosity did not dissipate. At a meeting of the International Physiological Congress four years later, in 1953, Lilly and Scholander again crossed paths, and Scholander suggested that Lilly get in touch with a leading expert on captive dolphins, Forrest G. Wood, who at that time handled the animals at Marine Studios. Lilly did, and as a result, he was one of eight investigators to participate in what came to be known informally as the "Johns Hopkins expedition" in the autumn of 1955. Like prewar projects, the expedition

featured a mixed crew of physiologists and medical men gearing up to vivisect some bottlenose dolphins, only this time it would be in the carnival environs of a Florida ocean theme park rather than a remote fishing village on a barrier island.[9]

In preparation for this 1955 trip, Lilly spent the summer in correspondence not only with Wood (securing access to a set of dolphins for experimental work) but also with Schevill at Woods Hole (concerning the anatomy of the airways of the common dolphin)[10] and with Scholander (concerning restraint techniques and the respiratory characteristics of the odontocetes).[11] Using this information, Lilly worked up a dolphin respirator that would, it was hoped, permit the surgeons and neuroscientists of the party to expose the brain of an anesthetized animal in order to begin the work of cortical mapping by neurophysiological techniques. It appears that no one in Europe or the United States up to this point had attempted a "surgical" intervention on a dolphin or porpoise.

The Johns Hopkins expedition of 1955 was at best a qualified success. Lilly and the other investigators were unsuccessful with their anesthetics and their respirator, and in the end they euthanized, without dexterity, five dolphins, apparently alienating a number of the Marine Studios personnel in the process.[12] But if the 1955 investigations were not a triumph, they did deepen Lilly's continuing interest in the cetacean brain.[13] Having heard a set of Wood's recordings of bottlenose dolphins at Marine Studios, Lilly was much struck—as were a considerable number of others at this time—by the range and apparent complexity of dolphin phonation. In October 1957 and again in 1958—after a visit with Schevill and Lawrence in Massachusetts, where they were conducting work on the auditory range and echolocatory capabilities of a bottlenose dolphin in a facility near Woods Hole—Lilly returned to Marine Studios. This time he was equipped to undertake investigations of the dolphin brain and behavior using techniques like those he had deployed and refined with macaques at NIMH: namely, percutaneous electrodes, driven by stereotaxis, that could probe the brain tissue of an unanesthetized, living animal.[14] Over the two visits, three more animals were sacrificed, and Lilly experienced a kind of scientific epiphany that would shape his scientific life, even as its reverberations eventually unmade his scientific reputation.[15]

Compressing a complicated encounter that took place over several days—and which continued to draw Lilly's reflections and reconstructions for years—is not easy, but we can summarize Lilly's sense of his findings this way: First, Lilly persuaded himself that, in comparison

to his experience with monkeys, the dolphins appeared to learn very rapidly how to press a switch to stimulate a "positive" region in their brains (and to turn off stimulation to a region causing pain).[16] Second, he claimed to have been much struck by the sense that an injured experimental subject, when returned to the tank with other dolphins, "called" to them and received their ministrations, suggesting an intraspecies "language."[17] Third, on reviewing the tapes made of these investigations, Lilly grew increasingly certain that his experimental subjects had been parroting his speech and other human sounds in the laboratory. These three elements—intelligence, an intraspecies language, and (perhaps most significantly) what he took to be fleeting glimpses of an attempt at interspecies communication—left Lilly with a feeling that he was on the cusp of something vast. Reflecting on the work of 1955, 1957, and 1958 in his Lasker Lecture in April 1962, Lilly tried to explain:

> We began to have feelings which I believe are best described by the word "weirdness." The feeling was that we were up against the edge of a vast uncharted region in which we were about to embark with a good deal of mistrust concerning the appropriateness of our own equipment. The feeling of weirdness came on us as the sounds of this small whale seemed more and more to be forming words in our own language.[18]

After hammering his way into hundreds of mammalian brains, Lilly suddenly heard a voice.

Odd as this breakthrough may seem, Lilly was not alone in his sense of the magnitude of what had happened in the Marine Studios laboratory in the late 1950s. One of Lilly's medical friends who had been in attendance in October 1957, during work on dolphin number six, later mused to him in a letter, "I keep thinking of that first moment when the first, clearly purposeful switch-pressing response occurred. This is one of the extraordinary moments in science."[19] Loren Eiseley, the anthropologist who had become the provost of the University of Pennsylvania, wrote publicly that "the import of these discoveries is tremendous, and may not be adequately known for a long time."[20] And in 1961 Lilly would write of the discoveries in still-grander world-historical terms, situating his own research at the cusp of the fourth "great displacement" in the history of science: citing Freud, Lilly explained that although man had, over the last five hundred years, been thrust from the center of the universe, from the center of nature, and finally from the center of his own mind, modern man still thought of himself as the

center of all intelligence. This (final?) pillar of human exceptionalism now teetered beside the dolphin tanks. It was his predilection for claims like this—sweeping, visionary, laced with self-aggrandizing enthusiasm—that eventually seriously tried the patience of Lilly's colleagues, who placed increasing pressure on him in the early 1960s to deliver some reproducible scientific results.

Those results were slow in coming. Lilly's first published report on his dolphin experiences appeared in December 1958 in the *American Journal of Psychiatry*, in an article entitled "Some Considerations regarding Basic Mechanisms of Positive and Negative Types of Motivations." It is a deeply strange document, one that opens a window obliquely on to the world of brain research during the Cold War. Because it attracted a spate of articles in newspapers and magazines across the country—and launched the writing project that culminated in *Man and Dolphin* a little over two years later—it is worth examining this initial presentation in some detail.[21]

In view of the paper's reception and impact, it is striking that the discussion of the dolphin work at Marine Studios represents less than one-third of its total length, and that this section is sandwiched in the middle of a wide-ranging discussion of the positive and negative "motivation" regions of the mammalian brain. Lilly's primary concern in this paper was to reflect on the fact that neurophysiological work over the previous five years had established the existence of brain regions that, under stimulation, trigger "negative-painful-stop" responses, whereas other regions trigger "positive-pleasurable-start" responses. At issue, finally, was the balance between the aggregate sizes (and influences) of these two "parts" of the brain. So one reads, for instance, "Of course we like to think that in the total action of the brain, the positive tends to overbalance the negative, and that the intellectual functions might be neutral ones, neither positive nor negative, found in excess of the positive and the negative."[22]

Lilly then posed a question: Would point stimulation within the neocortex and the cerebellum—the regions of "higher" brain function—generate neutral, or perhaps mildly positive, effects? It appeared, strangely in his view, that in monkeys it did neither: strong negative response zones could be found in these sophisticated regions. So what? Well, this was troubling, according to Lilly's analysis. Were the centers of *abstract reasoning* laced with "halt" zones? This seemed to raise a striking possibility: the tractability of sophisticated cognitive functioning by means of electrical stimulation. Enter the specter of "mind control."

But perhaps, Lilly went on to reason, these issues—the "positive" versus the "negative" in higher brain function and, crucially, the plasticity of subjects under electrical stimulation—could only really be addressed in a brain larger and more complex than that of the macaque. As Lilly put it, "May not a larger brain be more impervious to such tampering with its innards? May not the trained, sublimating, and sometimes even sublime human mind resist, and even conquer such artificially evoked crassly primitive impulses?" Human experimentation was the only way to get sure answers to these questions. Acknowledging that this remained too risky to contemplate, Lilly then introduced *Tursiops truncatus*: "So far we have found only one animal that has a brain the size of ours who will cooperate and not frighten me to the point where I can't work with him—this animal is the dolphin." A description of Lilly's work at Marine Studios followed, emphasizing the success he and his collaborators had had in finding both positive and negative regions in this large brain. Two paragraphs at the end of this section became the core of the newspaper articles that followed, so they are quoted here in their entirety:

> In this abbreviated account, I cannot convey to you all of the evidence for my feeling that if we are to ever communicate with a non-human species of this planet, the dolphin is probably our best present gamble. In a sense, it is a joke when I fantasy that it may be best to hurry and finish our work on their brains before one of them learns to speak our language—else he will demand equal rights with men for their brains and lives under our ethical and legal codes!
>
> Before our man in the space program becomes too successful, it may be wise to spend some time, talent, and money on research with the dolphins; not only are they a large-brained species living their lives in a situation with attenuated effects of gravity, but they may be a group with whom we can learn basic techniques of communicating with really alien intelligent life forms. I personally hope we do not encounter any such extraterrestrials before we are better prepared than we are now. Too automatically, too soon, too many of us attribute too much negative systems activity to foreign language aliens of strange and unfamiliar appearance and use this as an excuse for increasing our own negative, punishing, attacking activities on them.[23]

With that, Lilly was finished with dolphins, and he returned to the shadow subject of his presentation: "What does all this mean in

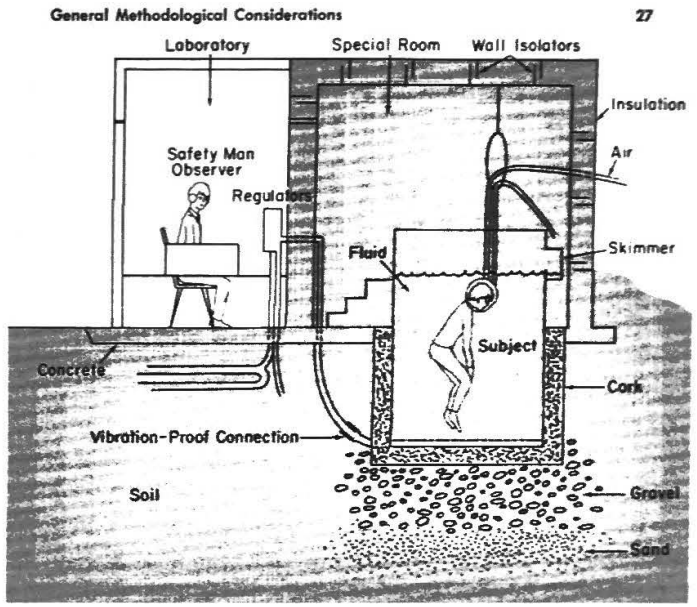

FIGURE 1.2 Sensory deprivation in a flotation tank.

terms of us, our species?" Was it possible, without percutaneous electrodes, to investigate the "positive" and "negative" systems of our own brains? "Turning inward, examining our minds, their deep and primitive workings, can we see evidence of the actions and inner workings of the positive, pleasure-like, start, and the negative, pain-fear-like, stop systems?"[24] Lilly's answer was yes, and the technology for doing so preoccupied him for the last third of his talk: isolation tanks—large, temperature-regulated tanks in which neutrally buoyant subjects were confined, in a breathing hood, in total darkness and without sound or sensory input, for as long as they could stand it (fig. 1.2).[25]

Military Minds

We may seem to be impossibly remote from the study of whales and dolphins, and yet the links are tighter and stranger than one might expect. Lilly was the inventor of the water-immersion technique of sensory deprivation, and he was a significant early contributor to the broader area of sensory-deprivation research, opening the third major center for such investigations (after McGill and Princeton) in the world and spawning a number of labs (most importantly that of Jay Shurley at the Oklahoma City VA hospital) that built tanks to his specifications.

While working on such systems for several years at NIMH (from 1955–56 forward), Lilly conducted extensive self-experimentation in his tank, developed new equipment for it, advised on the building of similar systems, and lectured around the country on their use.

Such experimental environments seem, in retrospect, macabre, but it is necessary to recall the impetus for this sort of work. The earliest such investigations (at McGill, from 1951 forward) were stimulated by an interest in Russian and Chinese "brainwashing,"[26] and there can be no doubt that Lilly's move into this area was linked to such preoccupations, which were firmly established on the national stage in the United States in the mid-1950s. One of the files in the Lilly papers is labeled "Indoctrination, Forced," and it contains material on solitude, isolation, and "brainwashing." An adjacent file, labeled "Solitude," contains, most interestingly, Lilly's notes on a conversation with "Dr. Sperling" in the Research and Development office of the Surgeon General's office, dated 23 April 1956. The notes read, "called this date, re: brainwashing, etc, mentioned by Dr. Felix before senate appropriations committee two weeks ago." A set of newspaper clippings makes it clear that this exchange took place at the height of *Manchurian Candidate* fears over the practices of Chinese "mind control" scientists.[27] Other correspondence reveals that systems like Lilly's were wanted for two purposes: first, as a tool for screening tests and personality assessments (in order to find individuals particularly resistant to such situations and techniques) and, second, as training instruments to improve the resistance of those who might face sensory-deprivation conditions—not just soldiers, spies, and diplomats but others subjected to the rigors of solitary environments, particularly pilots, astronauts, and those manning remote meteorological or monitoring stations.[28]

Precisely how close Lilly's ties to the world of intelligence operations actually were remains obscure. In his autobiography, he wrote that his decision to leave NIMH in 1958 was motivated by his growing unease with the encroachment of application-oriented, apparently government-linked, investigators seeking information about the work of his Bethesda laboratory.[29] Lilly was involved, well into 1959, in advising members of the security establishment about the potential uses of his neurophysiological investigations, though an unseemly flap over his security clearance in May of that year certainly added friction to those relationships.[30] As of 27 August 1959, Lilly had "Secret" clearance, and documentation in Lilly's FBI records indicates both that J. Edgar Hoover personally attended to his file and that he was to be treated as persona non grata by the bureau after 1960.[31]

What emerges from a close reading of Lilly's 1958 paper in this context is the remarkable way in which his early dolphin investigations were entangled with this set of seemingly remote preoccupations—"brainwashing," "reprogramming," and "mind control"—that were reverberating through the sciences of brain and behavior in the mid-1950s. For instance, the questions Lilly posed after reporting his work with macaques—Can humans "resist or conquer" such situations? Do different people discover different degrees of "egophilic" or "egophobic" affect in isolation tanks?—were questions wholly tied to the pressing problem of the imperviousness and durability of the Cold War human agent.

These very un-cetological matters might be of merely anecdotal value to our understanding of Lilly's work with dolphins if his 1958 paper were simply a salad of his diverse interests. But this is not the case. Rather, the paper offers palpable clues to the early ties between Cold War psychological-neurological investigations aimed at "accessing" the mind of recalcitrant (and taciturn) enemies and Lilly's research program on interspecies communication. Indeed, by the time Lilly had expanded his brief asides on the promise of dolphin-human communication into the popular book *Man and Dolphin* of 1961, the language of "psy-ops" permeated his discourse. For instance, alluding to the "less well controlled" dolphin training "of the past," which used food rewards, Lilly pointed out that as a result of his work and that of others, "we now have push-button control of the experiences of specific emotions by animals in whose brains we have placed wires in the proper places. . . . Using this 'reward stimulation' technique, we demonstrated quite satisfactorily that a dolphin can vocalize in two different ways." One of these, above the surface ("in the air"), suggested that already the animals were being brought into the sphere of their captors.

Another mind control technique was less invasive but also promising—"intraspecies solitude":

> If a human being is isolated from other humans for a month or more, and is confined to a small area geographically and a small range of activities, his interest in his surroundings and its minutiae increases radically. . . . Further, if a confined, isolated human is allowed brief contacts with other humans even without a shared language, he begins to find their presence comforting, and a pleasant relief from the "evenness" of his surroundings. If these humans control his only sources of food as well as his sources of intraspecies stimulation, he may adopt to their de-

> mands in subtle and not so subtle ways. He may, given time, learn their language, take on their beliefs, etc.
>
> When we catch a dolphin and put him alone in a small tank, we are imposing similar "solitary confinement" strictures on him. Maybe we can thus capture his loyalty, and his initiative.[32]

Later, in his effort to break through to (or perhaps simply to "break") a dolphin, Lilly would deploy this and other techniques borrowed from the margins of the world of the mind control "spooks"—including a set of extended "chronic-contact" experiments and, finally, experimental psychopharmaceuticals, particularly D-lysergic acid diethylamide (LSD 25), which in the early 1960s was closely linked to the clandestine work of the CIA's "Artichoke" project.[33]

This strange imbrication of the techniques of mind control and animal communication in the late 1950s and early 1960s suggests at least one way in which the isolation tank and sensory-deprivation research fitted with Lilly's program of cetological investigations in this period. But there were others. Among Lilly's papers, in his "Solitude" file, I discovered his copy of the English translation of Jacques-Yves Cousteau's 1953 best seller *The Silent World*, a book (and, in 1956, a film) that introduced Cousteau and deep-sea scuba diving to hundreds of thousands of Americans. Lilly's annotations in the margins of this volume suggest that he read the text with care and took particular interest in Cousteau's reflections on the experience of weightlessness and isolation in the silent suspension of the underwater world. The development of the actual mask and breathing technologies of Lilly's isolation tank must thus be seen in the context of a growing interest in scuba diving and undersea environments.[34] In fact, in describing his efforts to communicate with dolphins in this period, Lilly spent a good deal of time on the need for the experimenter to attempt to commensurate him- or herself—imaginatively, even physically—with the subject. And here, Lilly explained, the flotation/isolation tank could be of considerable use, since it offered a glimpse of the dolphin's perceptual universe.[35] It was for this reason, apparently, that Lilly saw to it that an isolation tank was built at the Saint Thomas lab of his Communication Research Institute (CRI), adjacent to the indoor dolphin tank. In the early 1960s Lilly's isolation technology appeared poised to give him insight into the "mind in the waters" that had become, by 1958, his new experimental subject.[36]

Dolphin Discussions

It was with an eye on dedicating himself to this new experimental subject that Lilly, in 1958, departed from NIMH, in the glow of widespread interest in what this hard-driving scientist planned to accomplish with the dolphin. He was jumping several ships at once, in that he simultaneously separated from, and subsequently divorced, his wife of two decades, mother of two of his children. By 1959 Lilly not only had a trade contract for a pair of books on dolphins but had also begun work on opening what would become a dedicated research facility for the study of these animals. From the start, Lilly—keen to reinvent himself at some distance from middle-class respectability (and the smell of monkey cages)—had his eye on the Caribbean, and visits to the Bahamas, Jamaica, and, finally, Puerto Rico gave him the lay of the land. He secured a position at the University of Puerto Rico in pharmacology during 1959–60 as he continued his reconnaissance of the region, and by the end of that year he was remarried, to Elisabeth Bjerg, a former fashion model from Saint Croix. He had also settled on Saint Thomas as the location for his new institute, found real estate and agents to help him secure it, and was in a position to entertain visits from two grant makers from the Office of Naval Research (ONR), including, significantly, Sidney Galler. ONR announced that it was willing to top up the funding of his recently incorporated institute (CRI), depending on how the National Science Foundation (NSF), National Institutes of Health (NIH), and Department of Defense responded to his grant requests. Meetings in Washington, DC, followed, and by 13 June, Lilly could write to his friend Orr Reynolds at NASA that "the Institute has been given a grant by the N.S.F. (with help from O.N.R. and D.O.D.) to build the world's first laboratory devoted to the study of the intellectual capacities of the small, boothed [*sic*, for "toothed"] whales." The institution's budget was set at about $100,000 a year, though expenses went up when, later that year, Lilly decided to open a second lab in Miami—what he called a "bipedal" arrangement, allowing the work to be "close to our supply of animals."

Shortly thereafter, NASA money was forthcoming through Reynolds, under the Office of Space Sciences' Biosciences Program, which sponsored a "behavioral sciences division" dedicated to, among other things, "investigations on the mechanisms of inter- and intra-species communication of intelligent information, emotional status, and basic drives, in an attempt to discover the mechanisms which nature has evolved, and to supplement these mechanisms by technological devices."[37]

FIGURE 1.3 The Communication Research Institute.

Meanwhile, the building itself was well under way. Navy Underwater Demolition Team frogmen excavated the dolphin pool below the laboratory building with the help of six hundred pounds of TNT (fig. 1.3). By March 1960 Lilly was ready to bring his first two dolphins—secured through Wood at Marine Studios—down to Saint Thomas. Media coverage of the transfer included a front-page piece in the *Herald Tribune*, but the enthusiasm was short-lived: both dolphins died in a matter of weeks, and Lilly returned to Florida in what was, at least in part, an effort to learn more about how to maintain dolphins in captivity. To this end, he spent time at Theater of the Sea and the Marine Laboratory of the University of Miami. All the while, Lilly was pulling together the manuscript of *Man and Dolphin*, which would be published in August 1961.

Interestingly, Lilly's talking dolphins beat him into print. In April 1961 the Hungarian physicist Leo Szilard published his biting satire on the arms race, *The Voice of the Dolphins*. This futuristic tale—written in the summer of 1960 (as Szilard fought cancer in Memorial Hospital in New York City) and circulated in various forms among nuclear-armament negotiators in 1960—apparently emerged out of Szilard's conversations with Lilly in the late 1950s at NIH.[38] In the story, Lilly's name is explicitly invoked and linked to the founding of a Soviet-American scientific research institute, located in Vienna, which succeeds—it claims—in "breaking through" to dolphins, which prove, according to the scientists, to be brilliant thinkers. Over the next two decades, the Vienna Institute's dolphins serve as (yes) modern "Delphic" oracles who guide the world, via their scientist mouthpieces, through the moves of a chess-like game of nuclear disarmament (using Szilard's controversial scheme for de-escalation). In the end, their work done, the dolphins all die mysteriously, the Vienna Institute dissolves, its records vanish in a fire, and the world has been pulled back from the brink of nuclear annihilation. Szilard winks at the end, alluding to the doubts of some concerning whether the guiding intelligence behind the whole miraculous process had indeed been the dolphins or merely the crafty community of international scientific adepts. The success of this book, which over the next three years sold over thirty-five thousand copies in the United States alone (it was translated into six other languages, becoming a "minor classic of the nuclear age"), makes it clear that the nebulous idea of dolphins as an alternative intelligence—and as potential interlocutors for human scientists—was very much in the air by the time *Man and Dolphin* appeared, and that these ideas were firmly linked to the name John C. Lilly.[39]

And *Man and Dolphin* delivered. Its opening sentence made an extravagant prediction: "Within the next decade or two, the human species will establish communication with another species: nonhuman, alien, possibly extraterrestrial, more probably marine, but definitely highly intelligent, perhaps even intellectual." Lilly's money (quite literally: he had invested his own resources in CRI) was on the dolphin. In a closing chapter he explored the potential legal, moral, and social problems that would be confronted, going so far as to suggest that in the distant future the world might confront a crisis comparable to that of racialized global human inequality: "For a long time, presumably, they [the educated dolphins] will be in the position of the Negro races who are attempting to become Westernized."[40] At the same time, the encounter with this parallel oceanic intelligence would give human be-

ings "a perspective of which we can be only dimly aware at the present time. Our own communication among ourselves will be enhanced and improved by such contact."[41]

This unstable froth of *Planet of the Apes* futurism and Cold War development theory met with popular enthusiasm (fired in part by an appealing photo-essay in *Life* magazine at the end of July) and a guardedly positive review by the well-known turtle biologist Archie Carr in the *New York Times*. Largely laudatory assessments in a variety of other papers in the United States and the United Kingdom followed. Even the *Quarterly Review of Biology* praised the text for putting "forth in a very readable fashion a study that many people have heard about."[42] Within a year, the initial run of ten thousand copies had sold out, and a second printing was under way.

During this period Lilly completed work on a handful of scientific papers reporting the results of his dolphin researches (up to the publication of *Man and Dolphin*, Lilly's only published scientific articles mentioning dolphins were the 1958 essay in the *American Journal of Psychiatry* and a brief note in *Science* with Alice Miller, "Sounds Emitted by the Bottlenose Dolphin," which appeared in May 1961). He also expanded his research enterprise at CRI, securing more dolphins, cultivating the board of trustees, and writing grants for new research programs and staff. These years, 1961–63, represent the waxing of CRI and Lilly's program. Sending out complementary copies of *Man and Dolphin* to a who's who of old-guard cetology, movie celebrity, and national political power, Lilly soon found himself not only receiving laudatory letters from the respected ethologist-anthropologist Gregory Bateson (who would join CRI shortly thereafter) but also entertaining, in Saint Thomas, President Kennedy's personal physician and a host of other distinguished visitors who wanted to meet the dolphins and the dolphin doctor.[43]

A typescript draft of a program description for CRI, which can be dated to late 1962, captures Lilly's vision for the institute in this heady period, and annotations in his hand indicate his careful efforts to position CRI between psychology, medicine, neurology, and animal behavior:

> The institute is studying intensively one of the unusual creatures of the sea—the bottlenose dolphin. This is a mammal with a brain larger and more complex than the human brain. The unexplored biological territory of the large mammal brain affords an unequaled opportunity for tests in neurophysiology, brain function, communication, and intelligence.[44]

What follows is a list of benefits and objectives of this work, which Lilly carefully renumbered to accord with his sense of their significance, moving "improved techniques of human brain surgery" from first to last and replacing it with, first and second, "improved understanding of human learning and educational processes" and "a more systematic approach to the measurement of interspecies intelligence."

Writing an entry on interspecies communication in the McGraw-Hill *Yearbook of Science* in 1962, Lilly would briefly mention the work of Catharine Hayes and Keith Hayes with chimpanzees before moving on to say that "insofar as the author knows, there have been no systematic and serious attempts to date on the part of the human to learn to speak with another species in its own tongue." This, and the teaching of human language to dolphins, were the work, Lilly reported, of CRI.

This brief entry captures the combination of dynamic enthusiasm, medicoscientific gravitas, and thinly veiled self- (and CRI) promotion that pervaded Lilly's production in the bustling period that followed the publication of *Man and Dolphin*. During this time Lilly's NSF Career grant came through, and his trips to Europe and Washington were frequent. Lilly appeared to be in the vanguard of a vigorous new area of well-supported (and popular) research.

The air of gravitas and possibility that surrounded dolphin work in these years must be linked to rumors (and realities) of military interest. In *Man and Dolphin*, Lilly himself alluded presciently to these "implications" of future work on communication with the small odontocetes:

> Cetaceans might be helpful in hunting and retrieving nosecones, satellites, missiles, and similar things that men insist on dropping into the ocean. They might be willing to hunt for mines, torpedoes, submarines, and other artifacts connected with our naval operations. They might also be willing to do scouting and patrol duty for submarines or surface ships, and they might carry their protagonist activities to the point where they can be used around harbors as underwater demolitions team operators.[45]

His speculations on these matters had rapidly reverberated through popular channels as well as through communities of specialists.[46]

In fact, in the summer of 1963 Forrest G. Wood quit his position as the curator at Marineland of Florida (the former Marine Studios) and accepted a new job—as the head of the newly formed Marine Biosciences Facility of the Naval Missile Center (NMC), where he would jointly administer (with Thomas G. Lang, from McLean's Naval Ordnance Test Station, NOTS) the emerging Cetacean Research Facility being constructed at Point Mugu. It was this nascent institution that would grow, through several changes of name and location, into the US Navy's Marine Mammal Program, and it was under the auspices of this program that Wood and his collaborators would succeed, over the next decade, in realizing a not-insignificant number of Lilly's seemingly bizarre ideas about the potential military uses of dolphins and porpoises. As early as 1964 the navy trainers and cetacean researchers (with help from commercial animal-training guru Keller Breland) succeeded in getting a dolphin to work untethered in the open ocean and to return when signaled; in 1965 a navy-trained bottlenose aided the "aquanauts" living in the experimental underwater habitat Sealab II by shuttling matériel and messages to and from the surface; over the next three years several marine-mammal deepwater marking and recovery programs were developed, and at least two of these were operationalized as navy "systems"; and finally, by 1970–71, a number of navy dolphins accompanied a specialized team of navy divers to Cam Ranh Bay, in Vietnam, where they were deployed in a program to stop Vietcong sappers.[47]

Lilly himself was, in the early 1960s, closely connected to this research program. A remarkable memo in Lilly's papers dated 17 October 1961 records Lilly's notes on a long telephone conversation with US Navy physicist William B. McLean, in which the latter sketched the rapidly shifting profile of West Coast cetacean research. Lilly learned of the work of the Lockheed group and discovered that they were at odds with the China Lake / Tom Lang group, who were investigating laminar flow (Lilly noted to himself, "We have a copy of their report," indicating how closely he was connected to this hydrodynamic research). Moreover, McLean gestured at others who were trying to attract research funding for work on porpoises and dolphins: Kenneth Norris at UCLA, Peter Scholander at UCSD, and several people at UCLA's Brain Research Institute (all of whom had separate plans afoot for cetacean research programs), not to mention the momentum gathering behind the proposed new cetacean research facility at Point Mugu, about which Lilly was informed when the whole program was still aborning. In a marginal

note one senses Lilly's despair at keeping track of who was who: "There are as many plans as there are groups."[48]

A few months later, Lilly would have an even clearer sense of the situation, because in February 1962 McLean invited him out to NOTS for several lectures. It appears that Lilly made a considerable impression there, since he subsequently received a number of letters from NOTS personnel enthusiastically pressing several very curious lines of inquiry. For instance, T. W. Milburn (the head of the psychology division at NOTS and the director of Project Michelson) followed up in April with some brainstorming:

> Reasoning that the machine is such an integral part of man's culture, and that many men find it enormously pleasant to interact with machines, I have wondered whether it might not be possible to develop some mechanical equipment that a dolphin might use. Again, you will see how indegted [*sic*] I am to you for the short conversations we have had thus far, thinking in terms of the short drive, I wondered whether it might be at all feasible (and I realize that the idea may sound a little fantastic) to arm dolphins with some sort of weapon that would enable them more easily to attack shark.

He continued the letter with further thoughts:

> Bill McLean and I have been discussing the possibility of developing some dolphin toys, large, complex, mechanical devices, that might be of interest to dolphins even in the open seas, that would involve some kinds of buttons to push that would generate running water, perhaps with one trained dolphin teaching others. I would very much appreciate your own reflections as to whether [this] sounds too wild to contemplate.[49]

These missives seem so odd that it is difficult to resist the speculation that they are in fact written in some sort of circumlocutory code—a suspicion enhanced by a single NOTS-NMC Off-Base Authorization Form that appears in this file of Lilly's correspondence, indicating that in the fall of 1962, Lilly was scheduled to receive a registered "Secret" visit at CRI from "Louis R. Padberg," a navy electronics engineer working through the NOTS-NMC life sciences department.[50]

Even as Lilly's network of military and intelligence connections,

medical associates, biophysics colleagues from wartime service, and old Caltech friends (several of them in powerful positions within the new institutions of postwar scientific funding) kept him, and CRI, plumped with research contracts and grants in the early 1960s, the established experts in animal communication, on the one hand, and captive-dolphin handlers, on the other, began to undermine his standing and his claims. If they could not deny him the fanfare that often attended his showy science, they could snipe, and they did. Already by the end of 1961, several reviewers had grumbled. James W. Atz (an ichthyologist at the American Museum of Natural History), writing in the bulletin of the New York Zoological Society in December, was at pains to explain—as several hostile reviewers would be—that there was nothing wrong with radical scientific theories and that Lilly, if correct in his central claims, would rightly take his place beside Darwin as "one of the greatest, most creative innovators in biology." Who could criticize originality and breadth of imagination? However, *Man and Dolphin* presented not a "single observation or interpretation" that could withstand scrutiny. Where this was the case, visionary hypothesis crossed the line into irresponsible delusion of the gullible populace: "Scientists and educators who believe that it is important for members of a democratic society to have a rational view of animal life can only wish that Dr. Lilly had not felt called upon to put himself so prominently in the public eye."[51]

The first shot had been fired, and more blasts were to come, particularly as 1962 came and the scientific papers backing up the "discoveries" described in *Man and Dolphin* were not forthcoming. (Lilly alluded there to a number of manuscript articles, but the published papers that eventually emerged did little to buttress his more extravagant claims.) The Cornell-based professor of linguistics and anthropology Charles Hockett, who had written several long essays on the relationship between animal communication systems and the evolution of human language, gave Lilly's book a terse and damning review in *American Anthropologist*, where he acknowledged that dolphins were fascinating but worried out loud that Lilly might have "dealt a body blow to the important program of research in which he wishes to play a part."[52] The most extensive critique appeared simultaneously, in *Natural History*, jointly authored by Margaret C. Tavolga (a specialist in animal behavior in the Biology Department at Fairleigh Dickinson University who had also worked with Wood's dolphins at Marine Studios) and her husband, William N. Tavolga (who, as it happened, had chaired the symposium on marine bioacoustics held at Lerner Marine Laboratory, in the Bahamas, in April 1963). The Tavolgas declared the book a primer

for a young scientist seeking guidance on "how not to do scientific research," and they went after Lilly's "unsound and naïve grasp" of terms like "language," "speech," and "communication." Drawing on the very fields Lilly had disregarded, the two animal behavior researchers wrote,

> Dr. Lilly takes the view that "those who speak are those who are capable of learning language." If "one two three" said with very poor intelligibility by a dolphin is indicative of the giant-brained animal's ability to speak, and therefore to learn language, what is to be said of a parrot's clear-cut, if bird-brained, "Polly wants a cracker"? Furthermore, if the parrot is then given a cracker, have we established communication with an alien species?

In their assessment, the director of CRI needed to do some more thinking about "communication": "There is no doubt in the minds of most of us that dogs, dolphins, and many other animals are able to communicate by sounds or other means (to us or to each other) their relatively simple needs and wants, but this remains a far cry from language."[53]

Sex, Drugs, and Dolphins

As these assessments make clear, Lilly increasingly found himself on the defensive in the early 1960s. For instance, though he was one of the organizers of the First International Symposium on Cetacean Research in Washington, DC, in 1963—a watershed gathering of scientists studying whales and dolphins—Lilly's presentation at the gathering was marred by a shout-down kerfuffle in which his work at CRI (and before) was dismissed as trumped up, unethical, and possibly dishonest. His antagonist in this showdown was none other than Forrest Wood, the head of the fast-growing navy program. It was an indication of the way things were going: Lilly was losing friends fast by 1963. Lilly the star was about to become Lilly the shooting star—and his descending streak would trace a significant trajectory across the counterculture.

The arc of Lilly's fall can be concisely traced on a plane defined by two of the era's significant axes: sex and drugs. Let's do sex first. In 1961 *Man and Dolphin* presented the Saint Thomas laboratory of CRI as a kind of scientific *Swiss Family Robinson*, where Lilly and his beautiful wife and their six children (five from their combined previous marriages, one of their own) shared the labor of scientific life with bottlenose dolphins (this sort of thing was already a commonplace in

primate work like that of Keith and Catharine Hayes). As the jacket copy on *Man and Dolphin* explained:

> A large fraction of the family home is taken up with the work of the program on the dolphins. The whole family participates: the elder boys have taken motion pictures of the animals in the experimental situations; the younger group have been involved in feeding and in swimming with the animals.
>
> Elisabeth handles a major portion of the administrative load of the institute, and helps with the research and writing.

But this scenario proved more advertising than reportage. Unhappy in their island fastness, Elisabeth and the children had decamped for Miami for good by the end of 1963, and the Saint Thomas lab promptly began its drift from the outer orbit of the military-industrial complex on to the hyperbolic arc of what would come to be called, in a general shorthand, "the sixties."

Absent the straitening forms of domesticity, the CRI facility in the Caribbean began to look less and less like an outtake from a wonkish version of *Flipper* and more and more like a bachelor crib for randy scientists seeking sun and surf.[54] The aging roué Aldous Huxley visited in these years, and Bateson (known for his rakish open shirts and nonconformist sensibility, and having recently embarked on a third marriage, to Lois Cammack, twenty-five years his junior) often presided in the dolphin pool, entertaining an irregular flow of the rich, brilliant, and/or curious. A youthful Carl Sagan made his way down from Harvard, having gotten to know Lilly through their mutual interest in "breaking through" to nonhuman species (he and Lilly together created a semisecret society of SETI researchers who called themselves "The Order of the Dolphins," wore a tie clip–like dolphin insignia, and sent each other coded messages to test their readiness for extraterrestrial contact).[55] Sagan thoroughly enjoyed himself and later claimed that while doing so he made the acquaintance of a young woman named Margaret Howe, then working at one of the resorts on the island.[56] Invited into the loose CRI community, the attractive and tomboyish Howe would eventually be hired by Bateson to "manage" the establishment when he decamped for Hawaii. She would play the crucial role in Lilly's program of "chronic-contact" experiments in 1964 and 1965—experiments (if this is the right term) that would appear prominently in *The Mind of the Dolphin*, Lilly's 1967 sequel to *Man and Dolphin* (fig. 1.4). The published account of this research—which narrates the way Howe, in

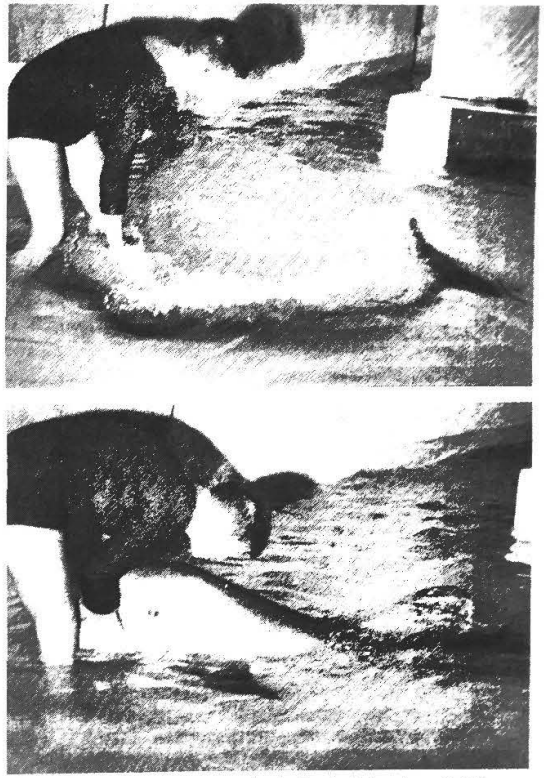

FIGURE 1.4 Margaret Howe in the flooded laboratory of CRI.

a skintight leotard, spent several weeks with a male *Tursiops* in a living facility flooded to thigh depth (her mouth brightly painted, to help the dolphin read her lips)—wends its way to a "climax" of sexual contact, offered as something like a proxy for increased interspecies mutuality.[57]

The book, quite possibly because of this frisson of aquatic bestiality, received more public attention than its weaknesses (of organization, clarity, and purpose) perhaps merited, but it was nevertheless not the sort of monograph from which a conventional scientific reputation could easily recover. Not only did the text entertain the notion that dolphins incline toward a "Polynesian" rather than an "American" model of sexuality, but it did so in the context of a sweeping indictment of the impoverishingly limited worldview of the human species, particularly its North American variety. The difficulties of communicating with dolphins are laid firmly at the feet of humanity, who are presented as a sickly lot, driven by fear and violence, inclined to deception and repression.[58]

Our only hope, Lilly suggested, was to listen to the dolphins, since (as he put it in an epigraph), "Through dolphins, we may see us as others see us."[59] There is a lingering sense throughout the book that dolphins offer humans a kind of higher psychotherapy.[60] Dredging up everything from Montaigne to William James to the Kinsey reports, Lilly presented sexual liberation and what he called "wet courage" as the preconditions for transcending the species barrier: "The purpose here is to free up one's own mind to see the new possibilities of feeling and thinking without the dry civilized structures."[61] The process amounted to a kind of ecstatic ethnography, one that made use of "hypnosis, drugs," and technology to conjure up the *Umwelt* of creatures that see with sound and can therefore (?) speak in images.[62] It was necessary to develop our own "latent 'acoustical-spatial thinking,'" Lilly asserted, and to this end he sketched the notion of "a dolphin suit with built-in, three-dimensional, sonic and ultrasonic emitters and receivers" and further imagined a fully synesthetic approach to the translation of dolphin phonation:[63]

> The internal picture which the dolphin can then create while sounding slash calls, the internal picture which he creates of his surroundings in terms of beat frequencies coming stereophonically combined from the two ears, must be a very interesting kind of picture. It is as if to us the nearby objects emitted a reddish light and the further objects emitted a bluish light, with the whole spectrum in between. We might see, for example, a red patch very close by and then a dimmer, blue patch in the distance farther away . . . a blue background downward symbolizing the bottom, a red patch up close meaning a fish nearby, and a large green object swimming between us on the bottom meaning another dolphin.[64]

Lilly—suspended in his flotation tank, listening to the whine of the hydrophones—was drifting into the trippy world of stereophonic psychedelia.

And trippy is meant here in the literal sense. By his own account Lilly first took LSD late in 1963, with Constance Tors (wife of Ivan, director of *Flipper*), on a visit to Los Angeles.[65] He wrote subsequently that this initial exposure consisted of a pair of "classic, high-energy" trips "filled with fantastic personal and transpersonal revelations and terrific intellectual breakthroughs."[66] A less fantastic trip followed (complete with an unhappy psychodrama of his failing second marriage), and then, in May 1964, shortly after addressing the annual meeting of the Acoustical

Society of America, a near-death experience linked to LSD experimentation.[67] Undaunted—indeed, it would seem, fascinated—Lilly apparently secured additional LSD through his links to NIMH and began a series of some twenty self-dosing experiments at the CRI laboratory in Saint Thomas between 1964 and 1965.[68] These seem to have included at least some injected exposures during which Lilly isolated himself in his flotation tank, Margaret Howe (who refused to try LSD with him) apparently serving as his "safety man [*sic*]." Sources suggest that by January 1965 Lilly was also injecting the dolphins with the drug, nominally to test whether it had any effect on their vocalizations, though these experiments do not seem to have been closely controlled.[69] In this period he drafted several versions of research protocols along these lines, which served as applications to Sandoz Pharmaceuticals for relatively large shipments of additional LSD-25.

I think it is important to acknowledge the difficulty of entirely freeing these aspects of Lilly's story from a slightly ludicrous taint: LSD? To *dolphins*? And a woman in a *tank*, giving them *hand jobs*?[70] Having presented lectures on this material on several occasions, I am familiar with the collective smirk by which an audience reflexively relegates the endgame of the Lilly saga to the unproblematic category of period burlesque, and I am myself not wholly immune to this reaction. Nevertheless, it is worth making the effort to see these most extravagant aspects of Lilly's work without the distorting glaze of hindsight. In the early 1960s there were quite a few researchers in biology and psychology departments giving LSD-25 to various animals and observing the effects.[71] There were also, of course, formal experimental investigations with the drug that made use of human subjects, and self-dosing was considered by many a necessary preparation for therapeutic or investigative prescription. Furthermore, as I have suggested above, both Lilly's LSD experiments and the chronic-contact experiments with Howe can be understood not as madcap "1960s-style" *antitheses* to the buttoned-down world of military bioscience but rather as their very apotheosis. LSD was a notable tool in the kit of Cold War scientists of mind and behavior, and they understood it to be an instrument for reducing the inhibitions of those with whom they wanted to talk. Lilly wanted to talk with dolphins; therefore, LSD presented itself as a very plausible approach. Similarly, "chronic contact" was a recognized technique for "winning over" recalcitrant or taciturn persons of interest, and careful management of erotic potentials was a nontrivial element of some of these protocols.[72]

These contextualizing observations aside, there can be no doubt that

Lilly crossed a set of lines between 1963 and 1966. Were they invisible lines? Perhaps, though a proper answer to this question would thrust us firmly into the middle of some very serious and difficult historical debates about the cultural upheavals of the second half of the 1960s—debates that on the whole have yet to extricate themselves from the political stalemates the era itself did much to define. We do not need to resolve those thorny matters to know that things were changing quickly in these years and that the transgressive passages of figures like Lilly were doing much to clarify new boundaries. Timothy Leary, of course, is paradigmatic here, and his own story parallels (and ultimately intersects) that of Lilly in interesting ways.[73] It was in the spring of 1963, right about the time that Lilly was getting ready to participate in the First International Symposium on Cetacean Research, that Leary and Richard Alpert (later Ram Dass) were dismissed from Harvard under a cloud of opprobrium that had gathered over what appeared to be their overzealous promotion of LSD experiences. Legal restrictions on the drug followed, and by 1966 LSD-25 was so tightly regulated in the United States that there were effectively no legitimate research programs making use of the product. By that time Sandoz had issued a recall for outstanding orders of the drug, and a rising district attorney named G. Gordon Liddy was working overtime to stamp out the Leary-centered experiment in drug-addled alternative living centered at Millbrook, in upstate New York, subject of Tom Wolfe's *The Electric Kool-Aid Acid Test*. Leary himself would soon be jailed. In one sense, the party was over. In another sense, it was just getting going.

And that sums up Lilly's position by 1967 as well. Mounting scandal and critical scientific assessments of CRI's work by increasingly hostile peers (including Kenneth Norris and others in attendance at the First International Symposium on Cetacean Research) backed Lilly into a defensive posture and left him lashing out at his opponents.[74] But to no avail. With the emerging revelations about his unconventional experiments and no stream of peer-reviewed publications to back up his showboating public claims, his allies could no longer defend him. With his NSF monies soon terminated and other federal agencies requesting the return of loaned equipment, financial matters at CRI reached a critical point. By the end of the year, Lilly had been forced to shutter both the Saint Thomas and Miami laboratories, though not before five of his captive dolphins died (Lilly called it the result of a "hunger strike" on their part; neglect seems more likely); three others were later released into Miami Harbor. By May 1968 Lilly, separated from Elisabeth (they would later divorce), wrote to his literary agent in New York that he

was "looking for a job." He headed out to the West Coast, for mind-expanding peripatetic trajectory from Berkeley to Esalen and eventually well beyond; he and Leary would meet up on this trip.[75] Interestingly, as he was winging into the California sunset, Lilly stopped by the navy's Point Mugu dolphin laboratory for a quick lunch with an old friend who was working on a vocoder that could "translate" human speech into "dolphinidese" (and vice versa)—Lilly and the navy had both been working on such devices for several years.[76] Wood, discovering him on base, had a cow.[77]

Conclusion

Wood's reaction speaks volumes. He and Lilly were emphatically headed in different directions in May 1968. And in this sense their confrontation back in August 1963, when they traded barbs at the First International Symposium on Cetacean Research, must be understood as the first cracking sound of what rapidly opened into a splitting fissure in cetacean research in the United States in a critical decade. Tectonic plates ground menacingly under that local flare-up of scientific infighting: Lilly, increasingly preoccupied in the mid-1960s with erotic and ecstatic exploration of his own mind and those of his animal subjects, eventually came to feel that the dolphins—sexually liberated, stereophonic, nonmanipulative superintelligences—were leading him to a new kind of self. Turning on, tuning in, and effectively dropping out, John Lilly left the world that made him—the world of the Cold War biosciences—behind and went on to become a major-minor figure of the pacifist, drug-friendly, ecosensitized counterculture. Wood, by contrast, still clipped his hair close, and his well-trained dolphins had serial numbers. They, too, possessed remarkable abilities, but about them he and his fellow scientists and trainers could not speak.

It must be said that the parting of their ways has about it the air of a fairy tale for the era—which is in fact what it promptly became. Right after the First International Symposium on Cetacean Research, Lilly entertained four of the European participants down at CRI in Miami: the two whale ear specialists Reysenbach de Haan and Peter Purves; the Dutchman Dudok van Heel, who was participating in a new effort to keep captive porpoises in the Netherlands; and the French bioacoustics expert René-Guy Busnel. Did conversation among this rump of the symposium in Miami return to Lilly's showdown with Wood? There is no way to be sure, yet it would appear that Busnel, at least, returned to Europe with an acute sense of what the final scene in Washington

represented and a view of the matter quite sympathetic to Lilly. Back in France, Busnel would be in communication with the French novelist and English professor Robert Merle (a recent winner of the Prix Goncourt), and in this period Merle would turn his hand to a dramatic tale that pitted a Lilly-like character (named "Dr. Sevilla") against a navy porpoise-training establishment under the direction of a Wood-like "M. D. Morley"; intelligent dolphins are caught in the middle, and World War III is narrowly averted. Published in 1967 in French as *Un animal doué de raison*, and two years later in English as *Day of the Dolphin*, this thriller would go on to become a major motion picture starring George C. Scott. It would, in a way, immortalize the conflict between Lilly and Wood, fixing it as a confrontation between the forces of peace and war, eros and thanatos, as nothing less than a showdown between the age of Aquarius and the age of the hydrogen bomb.[78]

Tremors along this strange new fault line would continue for years, and in the smoke and rattle (the miasma of the Vietnam conflict, the mounting quakes of antiwar protest, and increasingly truculent environmentalism), dolphins, and their larger cousins, would come to symbolize the aspirations of many who hoped to defy the cultures of death. And it was Lilly who had led them, John C. Lilly—the Eisenhower-era, pocket-protector-wearing, right-stuff engineer who emerged from the complex decade that separated 1958 from 1968 as a guru-sage of countercultural enlightenment.

Acknowledgments

The material in this essay is adapted from chapter 6 of *The Sounding of the Whale: Science and Cetaceans in the Twentieth Century* (Chicago: University of Chicago Press, 2012).

Notes

1. Lilly, cited in Joan McIntyre, comp., *Mind in the Waters: A Book to Celebrate the Consciousness of Whales and Dolphins* (New York: Charles Scribner's Sons / Sierra Book Club, 1974), 83.

2. This work was done through the E. R. Johnson Foundation for Medical Physics, which was run by Bronk, and which had contracts with the army and navy air forces through the Committee on Medical Research of the Office of Scientific Research and Development. Interestingly, in light of Lilly's later work on underwater breathing masks at the National Institute of Mental Health, these gas-monitoring technologies were applied, among other things, to detect mask leakage. For a discussion of the nitrogen meter that Lilly apparently helped to develop, see "Curriculum Vitae, John Cunningham Lilly, M.D., 1968," p. 2, file "CRI personnel," box 3C2[D1], Lilly Papers, Stanford University Library (hereafter cited as Lilly Papers). See also John C. Lilly and Thomas F. Anderson, "The Nitrogen Meter: An Instrument for Continuously Recording the Concentration of Nitrogen in Gas Mixtures," Report 299, 28 February 1944, Division of Medical Science, Acting for the Committee on Medical Research of the Office of Scientific Research and Development, Committee on Aviation Medicine, National Research Council. This device used photoelectric monitoring.

3. It is important to emphasize the novelty of this sort of work in the period. It was in 1954 that Olds and Milner demonstrated that a rat could learn to stimulate its own brain, and later investigations by Delgado and others demonstrated similar behavior in cats, as well as the reverse—namely, learning to turn off a current that apparently caused pain/fear/discomfort.

4. John C. Lilly, "Learning Motivated by Subcortical Stimulation: The Start and Stop Patterns of Behavior," in *Reticular Formation of the Brain*, ed. Herbert H. Jasper et al. (Boston: Little, Brown, 1958), 705.

5. Ibid., 719.

6. Lilly recounts this story in *Man and Dolphin* (Garden City, NY: Doubleday, 1961), 40–47.

7. Much can be learned about Scholander's work from his autobiography, *Enjoying a Life in Science: The Autobiography of P. F. Scholander* (Fairbanks: University of Alaska Press, 1990), and from a shorter memoir published earlier, "Rhapsody in Science," *Annual Review of Physiology* 40 (1978): 1–17. In 1963 Scholander attended the First International Symposium on Cetacean Research. His papers are held at Scripps Institution of Oceanography. I have consulted these holdings (five boxes), which contain some interesting material on his work with whales and dolphins, including a set of photographs depicting his visit to Brødrene Saebjørnsen's whaling station in Steinshamn, Norway, in the 1930s. These papers also contain a folder of his notes on the hydrodynamics of dolphin bow riding, work that resulted in a pair of articles in *Science* in 1959: "Wave-Riding Dolphins: How Do They Do It?," *Science* 129, no. 3356 (24 April 1959): 1085–87; and, with Wallace D. Hayes, "Wave-Riding Dolphins," *Science* 130, no. 3389 (11 December 1959): 1657–58.

8. The most substantial early piece of this work was the monograph published in 1940 in *Hvalrådets skrifter*: P. F. Scholander, "Experimental Investigations on the Respiratory Function in Diving Mammals and Birds," *Hvalrådets skrifter* 22 (1940): 5–131. I write about this work in "Self-Recording Seas," in *Oceanomania: Souvenirs of Mysterious Seas*, ed. Mark Dion and Sarina Basta (London: Michael Mack, forthcoming). A valuable discussion of Scholander's research in this area, along with a full bibliography, can be found in John W. Kanwisher and Gunnar Sundnes, eds., *Essays in Marine Physiology, Presented to P. F. Scholander in Honor of His Sixtieth Birthday*, *Hvalrådets skrifter* 48 (Oslo: Universitetsforlaget, 1965). Some of the early experiments involved the use of pressure gauges affixed to whaling harpoons.

9. The investigators, in addition to Lilly, were J. Rose, V. Mountcastle, and L. Kruger from Johns Hopkins Medical School; C. Woolsey and J. Hind,

University of Wisconsin; Karl Pribam, Institute for Living, Hartford, CT; and Leonard Malis, Mount Sinai Hospital. The full records of this work can be found in box 6A1–B1, Lilly Papers.

10. Ibid.

11. As early as 1940 Scholander had done respiratory analysis on several restrained and submerged *Phocoena*.

12. Ibid. These records include minute-by-minute logs of each operation and phonograph disks recording the interactions of the scientists during each intervention. Given the broad disagreements that erupted later over this work, closer attention to these materials might prove interesting.

13. The 1955 investigations also set in motion the research that would lead, almost a decade later, to the first successful techniques for major surgery on the small whales. See E. L. Nagel, P. J. Morgane, and W. L. McFarland, "Anesthesia for the Bottlenose Dolphin, *Tursiops truncatus*," *Science* 146, no. 3651 (18 December 1964): 1591–93.

14. See John Cunningham Lilly, John R. Hughes, Ellsworth C. Alvord Jr., and Thelma W. Galkin, "Brief, Non-injurious Electric Waveform for Stimulation of the Brain," *Science* 121, no. 3144 (1 April 1955): 468–69; and John C. Lilly, "Electrode and Cannulae Implantation in the Brain by a Simple Percutaneous Method," *Science* 127, no. 3307 (16 May 1958): 1181–82. Note that Lilly alleged that Schevill and Lawrence were working in a navy facility; William Watkins, a navy bioacoustics researcher close with both men (interview by the author, 9 August 2003), insisted that the work was done in a private pool on Nonamesset Island, owned by the Forbes family.

15. It was also on these trips that Lilly became interested, through Wood, in the apparent ability of these animals to control the direction of their sound. Using an early AMPEX stereo tape recorder (on loan), Lilly and Wood were able to hear clearly that the click trains emitted by captive dolphins had directional specificity. Wood discusses this finding in his *Marine Mammals and Man: The Navy's Porpoises and Sea Lions* (Washington, DC: Robert B. Luce, 1973). See also Gregg Mitman, *Reel Nature: America's Romance with Wildlife on Film* (Cambridge, MA: Harvard University Press, 1999), 248.

16. This was done by means of a switch, placed within reach of the animal's beak. While I have never seen a reference to this problem, it must be asked whether contact with the switch could have been a product of convulsions and/or efforts by the animal to escape its constraints. Lilly's repeated emphasis on the "purposive" could perhaps be read as special pleading.

17. This issue of the "distress call" was central to later disputes; trainers and animal handlers were well aware of "epimeletic," or caregiving, behavior among these animals. Wood, and before him McBride and Hebb, had raised the subject of the "language" value—"language in the sense that a dog's barking or growling is a language"—of these whistlings. See F. G. Wood, "Underwater Sound Production and Concurrent Behavior of Captive Porpoises, *Tursiops truncatus* and *Stenella plagiodon*," *Bulletin of Marine Science of the Gulf and Caribbean* 3, no. 2 (March 1953): 124–25.

18. McIntyre, *Mind in the Waters*, 71.

19. Lawrence S. Kubie to Lilly, 31 July 1961, file "Kubie, Lawrence S.," box 3A1–C1, Lilly Papers.

20. Loren Eiseley, "The Long Loneliness: Man and the Porpoise; The Solitary Destinies," *American Scholar* 30, no. 1 (Winter 1960–61): 58.

21. For a discussion of the flurry of headlines prompted by the original presentation (at the San Francisco meeting of the American Psychiatric Association in May 1958), see Wood, *Marine Mammals and Man*, 3, 12n1. William Evans also takes up some of this publicity in *Fifty Years of Flukes and Flippers: A Little History and Personal Adventures with Dolphins, Whales, and Sea Lions, 1958–2007* (Sofia, Bulgaria: Pensoft, 2008).

22. John C. Lilly, "Some Considerations regarding Basic Mechanisms of Positive and Negative Types of Motivations," *American Journal of Psychiatry* 115 (1958): 499. Note that, beginning in the 1940s, Lilly "undertook psychoanalytic training as a student in the Philadelphia Association for Psychoanalysis," where he worked with Robert Waelder, a student of Freud's. (See Lilly typescript 1968, file "CRI personnel," box 3C2[D1], Lilly Papers.) Lilly invested eight years in psychoanalysis, a period that overlapped with his neurophysiological and isolation studies. Exactly what role these experiences may have played in the ease with which he moved from electrophysiology of the brain to questions of personality is worth consideration.

23. Lilly, "Some Considerations regarding Basic Mechanisms of Positive and Negative Types of Motivations," 501.

24. Ibid.

25. The best review of this extraordinary research enterprise is John P. Zubek, ed., *Sensory Deprivation: Fifteen Years of Research* (New York: Appleton-Century-Crofts, 1969). See also Leo Goldberger, review of *Sensory Deprivation*, ed. John P. Zubek, *Science* 168, no. 3932 (8 May 1970): 709–11.

26. See Zubek, *Sensory Deprivation*, 9, for a discussion.

27. Relevant material in these files includes a typescript by Robert J. Lifton (in the neuropsychiatry division of the Walter Reed Army Institute of Research) entitled "Chinese Communist 'Thought Reform': 'Confession' and 'Re-education' in Penal Institutions," and an essay by Edgar H. Schein (at the Army Medical Service Graduate School) entitled "Chinese Brainwashing." Published materials represented as clippings include several *New York Times* pieces, including "New Evils Seen in Brain Washing," 4 September 1956, and "Two Challenge Views on Brainwashing," 22 September 1956. See files "Solitude" and "Indoctrination, Forced," box 5A1, Lilly Papers.

28. Sensory deprivation screening was used, for instance, in the selection of the astronauts for Project Mercury. In the Lilly Papers, I discovered that he was for several years in this period a dues-paying member of the Slocum Society (founded in 1955) and received its newsletter. Joshua Slocum (1844–1909), a New England captain, became an international celebrity at the turn of the century after he successfully completed a solo circumnavigation in 1895–98, the first such exploit recorded. He was lost at sea, alone, in 1909. His popular book on his successful voyage, *Sailing Alone around the World* (New York: Century, 1900), recounts several hallucinatory intervals during long crossings

(though it is difficult to assess the tone of these passages, which have a comical quality). The Slocum Society was founded (perhaps paradoxically) to create a community of solitaires, particularly those dedicated to long solo voyages.

29. See Francis Jeffrey and John Cunningham Lilly, *John Lilly, So Far . . .* (Los Angeles: Jeremy P. Tarcher, 1990), 82–100. See also a brief discussion of Lilly's situation and CIA interest in his work in (the more reliable) John D. Marks, *The Search for the "Manchurian Candidate": The CIA and Mind Control* (New York: Times Books, 1978).

30. "Dr. Lilly's problem concerned a meeting held at the Pentagon in May 1959. This meeting was called in order that ranking officers of the Office of Naval Research, the Air Force, and the Army could hear a briefing by Dr. Lilly on his work on the brain of dolphins, Dr. Lilly explained that the military was interested in this field [TEXT CENSORED] inasmuch as research by himself and other scientists had established that by the use of electrodes placed in the brains of animals and humans the will could be controlled by an outside force. He explained that if an electrode were placed in the brain of a subject. He [*sic*] could make the subject experience great extremes of joy or depression, for example. Dr. Lilly stated that the potential of this technique in 'brain washing' or interrogation or in the field of controlling the actions of humans and animals is almost limitless. He stated that our officials are aware that the Soviets are intensely interested in this field and that they are conducting extensive experiments and that their progress has roughly paralleled that of ours." "John Cunningham Lilly (Dr.)," memorandum, Jones to DeLoach, p. 2, FBI personal file. Deletion in category b2, "solely related to the internal personnel rules and practices of an agency."

31. Ibid., p. 4. Lilly apparently found himself caught in a wrangle between the security establishments of the Defense Department and the FBI in late 1959. Having been asked to leave a Pentagon briefing (as noted above) because of a security "problem" with his clearance, Lilly made a set of inquiries and learned (from an unnamed informant) that the problem had originated with the FBI. He followed up, only to be told that this was not the case, and that the FBI wanted to know who had told him this. He refused to divulge his source, despite several visits from agents, both in Miami and in San Juan. The FBI appears to have learned the identity of the source on its own and marked Lilly as "uncooperative."

32. This and the quotations above are from Lilly, *Man and Dolphin*, 190–91. Similar discussions of the importance of "isolation" and "confinement" run through Lilly's early articles on dolphins in *Science*. See, e.g., John C. Lilly and Alice M. Miller, "Vocal Exchanges between Dolphins," *Science* 134, no. 3493 (8 December 1961): 1873–76.

33. See file "Sandoz," box 3D2, Lilly Papers. On Artichoke, see Marks, *Search for the "Manchurian Candidate."* More generally on the history of LSD in this period, see Jay Stevens, *Storming Heaven: LSD and the American Dream* (New York: Grove Press, 1998).

34. The edition of Cousteau's *The Silent World* is the fourth printing, from 1961, so Lilly must have read the book in that year or later. In 1961 Lilly and Jay Shurley published their essay "Experiments in Maximum Achievable Physical Isolation with Water Suspension of Intact Healthy Persons" in *Psychophysiological Aspects of Space Flight*, ed. B. E. Flaherty (New York: Columbia University Press, 1961), 238–47. It was Lilly's last article in this area. I think it likely that the annotations in *Silent World* were made in that year, particularly as several of them deal with the rubber "Furney goggles" Cousteau describes. Lilly and Shurley discussed the form of similar latex masks in their correspondence concerning the flotation tank. Other annotations to the text include small marks next to "I turned over and hung on my back" (p. 5), and "As we submerged, the water liberated us from weight" (p. 78). For a discussion of the film version of *The Silent World*, as well as a brief treatment of Cousteau's broader importance in the growing American fascination with the undersea world in the 1950s, see Mitman, *Reel Nature*.

35. "In the course of some experiments I conducted from 1954 through 1956 I was suspended in water for several hours at a time, and I noticed that my skin gradually became more and more sensitive to tactile stimuli and an intense sense of pleasure resulted. However, if the stimulation was carried too far it became intensely irritating, I reasoned that the dolphin is suspended in water all of his life, twenty four hours a day, and possibly had developed an intensely sensitive skin" (Lilly, *Man and Dolphin*, 172). The issue of "commensurating" with the dolphin appears in many places in Lilly's published and unpublished work; see, e.g., ibid., 209. Mitman has explored this idea of experimental commensuration in the study of animal behavior in "Pachyderm Personalities: The Media of Science, Politics and Conservation," in *Thinking with Animals: New Perspectives on Anthropomorphism*, ed. Gregg Mitman and Lorraine Daston (New York: Columbia University Press, 2005), 175–95. Mitman and Daston together take up the problem in their introduction to this same volume.

36. There remains yet another link between sensory-deprivation research and dolphin study in this period: as it turns out, the pioneering figure in sensory-deprivation work in 1951 was Professor D. O. Hebb, at McGill University. Hebb, who had a simultaneous appointment at the Yerkes Laboratory of Primate Biology in Orange Park, Florida, was the very same Hebb who coauthored the foundational 1948 article (with Arthur McBride) "Behavior of the Captive Bottle-Nose Dolphin, *Tursiops truncatus*," *Journal of Comparative Physiological Psychology* 41 (1948): 111–23. This was really the first scientific paper to document behavioral observations on the captive marine mammals of the recently reopened Marine Studios. How Hebb, too, bridged the universes of sensory deprivation and cetology is not absolutely clear. One possibility is that work with captive primates in this period encouraged exploration of the behavioral ramifications of prolonged isolation and boredom, since monkeys respond rapidly and markedly to these conditions; this observation might explain both Lilly's and Hebb's early curiosity. Of the unsavory aspects of some of Hebb's other Cold War work there can be little doubt; see, e.g., Alfred W. McCoy, "Science in Dachau's Shadow: Hebb, Beecher, and the Development of CIA Psychological Torture and Modern Medical Ethics," *Journal of the History of the Behavioral Sciences* 43, no. 4 (Fall 2007): 401–17. I have found no evidence of a link between Lilly and Hebb, but it seems likely they knew each other through sensory-deprivation work, and it is surely possible that Hebb stimu-

lated Lilly's early dolphin interests. Whatever the case may be, the unlikely ties between isolation studies and dolphin studies in this period demand a revised reading of Loren Eiseley's curious and moving essay on Lilly's work, tellingly entitled "The Long Loneliness: Man and the Porpoise; The Solitary Destinies."

37. "Behavioral Biology Program—Biosciences Programs—Office of Space Sciences," sec. 3, file "Reynolds, Dr. Orr. E., NASA," box 3D2, Lilly Papers.

38. A version of the story was circulated among Soviet and American scientists at the Pugwash Conference in 1960.

39. See Barton J. Bernstein's introduction to Leo Szilard, *The Voice of the Dolphins, and Other Stories*, Nuclear Age Series (Stanford, CA: Stanford University Press, 1992), 4 ("minor classic"). See also William Lanouette and Bela A. Silard, *Genius in the Shadows: A Biography of Leo Szilard, the Man behind the Bomb* (New York: Charles Scribner's Sons, 1992). Lanouette interviewed Lilly before his death about his interactions with Szilard.

40. Lilly, *Man and Dolphin*, 217. Consider, as context, Pierre Boulle's *La planète des singes* (Paris: Juilliard, 1963) and its reception in the United States. For a study of the way race played out in the American film world, see Eric Greene, *Planet of the Apes as American Myth: Race and Politics in the Films and Television Series* (Jefferson, NC: McFarland, 1996). By 1965 Lilly was having his CRI staff read and comment on an English translation of Boulle's novel. There is a larger story to be told about the relationship between Lilly's work and the world of science fiction in these years.

41. Lilly, *Man and Dolphin*, 223.

42. Bryan P. Glass, review of *Man and Dolphin*, by John C. Lilly, *Quarterly Review of Biology* 36, no. 4 (December 1961): 311. See also "He Barks and Buzzes, He Ticks and Whistles, but Can the Dolphin Learn to Talk?," *Life* 51, no. 4 (28 July 1961): 61–66; Archie Carr, "Have We Been Ignoring a Deep Thinker?," review of *Man and Dolphin*, by John C. Lilly, *New York Times Book Review*, 3 September 1961, 3; Ted Hughes, "Man and Superbeast," review of *The Nerve of Some Animals*, by Robert Froman, and *Man and Dolphin*, by John C. Lilly, *New Statesman* 53, no. 1619 (23 March 1962): 420–21; B. A. Young, "Placid and Self-Contained," review of *Man and Dolphin*, by John C. Lilly, and *The Nerve of Some Animals*, by Robert Froman, *Punch*, 14 March 1962, 443; unsigned review of *Man and Dolphin*, by John C. Lilly, *New Yorker*, 16 September 1961, 178; and Robert C. Cowen, "Can We Converse?," review of *Man and Dolphin*, by John C. Lilly, *Dolphins: The Myth and the Mammal*, by Antony Alpers, and *Porpoises and Sonar*, by Winthrop N. Kellogg, *Christian Science Monitor*, 14 December 1961, 11.

43. For a taste of this, see Lilly's file of correspondence with Dr. Janet Travell, box 3D2 (where there is also a file of replies to and letters on *Man and Dolphin*), Lilly Papers.

44. "The Programs of the Communication Research Institute," typescript, file "Worcester Foundation," box 3D2, Lilly Papers.

45. Lilly, *Man and Dolphin*, 219.

46. In fact, a newspaper article in the *Staten Island Advance* of 13 March 1962 had already "broken" the story that the navy was working with dolphins at Point Mugu.

47. See, e.g., Blair Irvine, "Conditioning Marine Mammals to Work in the Sea," *Marine Technology Journal* 4, no. 3 (1970): 47–52. See also Sam H. Ridgway, *Dolphin Doctor: A Pioneering Veterinarian and Scientist Remembers the Extraordinary Dolphin That Inspired His Career* (San Diego, CA: Dolphin Science Press, 1987); and Wood, *Marine Mammals and Man*. The actual deployment in Vietnam (a seven-month tour of duty, apparently not very successful) remains clouded in rumor. The minimal (but presumably reliable) information available appears in a historical essay by the public affairs officer at the Space and Naval Warfare Systems Center in San Diego, Tom LaPuzza, "SSC San Diego Historical Overview," accessed 3 March 2011, http://www.spawar.navy.mil/sandiego/anniversary.

48. Memorandum of 17 October 1961, file "China Lake—Dr. W. B. McLean," box 3D2, Lilly Papers.

49. T. W. Milburn to Lilly, 10 April 1962, in ibid. Note that Milburn, who would later write about the psychological dimensions of deterrence, appears to have attended the First International Symposium on Cetacean Research; in other correspondence he expressed interest in Lilly's isolation tanks. Project Michelson was an integrated research program on strategic deterrence. For a sense of some of the concerns, see Louis D. Higgs and Robert G. Weinland, *Project Michelson Preliminary Report*, Technical Progress Report 309 (China Lake, CA: US Naval Ordnance Test Station, 1963).

50. File "China Lake—Dr. W. B. McLean," box 3D2, Lilly Papers. There is, among these materials, a reference to additional documents in a "vault"; I was not able to locate those materials in the Lilly Papers, and it seems likely they were destroyed. Padberg was among the attendees of the Lerner Marine Laboratory bioacoustics symposium held in April 1963.

51. This and the quotation above are from James W. Atz, review of *Man and Dolphin*, by John C. Lilly, *Animal Kingdom: Bulletin of the New York Zoological Society* 64, no. 6 (December 1961): 190. Atz was an observer at the Washington symposium in 1963. See Symposium Program, folder 46, box 54, Hubbs Papers, Scripps Archive.

52. Charles F. Hockett, review of *Man and Dolphin*, by John C. Lilly, *American Anthropologist* 65, no. 1 (February 1963): 176–77. Hockett was the author of "Logical Considerations in the Study of Animal Communication," an invited conclusion to *Animal Sounds and Communication*, ed. W. E. Lanyon and William N. Tavolga (Washington, DC: American Institute of Biological Sciences, 1960), 392–430.

53. This and the quotations above are from Margaret C. Tavolga and William N. Tavolga, review of *Man and Dolphin*, by John C. Lilly, *Natural History* 71, no. 1 (January 1962): 7.

54. It is interesting to think about this transformation in the context of a growing literature on the question of domesticity and the laboratory. I have been inspired here in part by Deborah Harkness, "Managing an Experimental Household: The Dees of Mortlake and the Practice of Experimental Philosophy," *Isis* 88, no. 2 (1997): 247–62.

55. This would be wonderful material to pursue, and a point of departure would be the file entitled "Order of the Dolphins" in box 3C2[D1], Lilly

Papers. This group (born of the first Green Bank conference in November 1961) eventually included most of the leading figures in what would become the discipline of exobiology (Frank Drake, Melvin Calvin, J. B. S. Haldane, and others). These gentlemen (and a few women, too) entertained each other by circulating encoded messages like those "that might be received from another civilization in space" and generally mused about the possibilities for extraterrestrial life. For some context on all this, consider James E. Strick, "Creating a Cosmic Discipline: The Crystallization and Consolidation of Exobiology, 1957–1973," *Journal of the History of Biology* 37, no. 1 (2004): 131–80; and Steven J. Dick, *The Biological Universe: The Twentieth Century Extraterrestrial Life Debate and the Limits of Science* (Cambridge: Cambridge University Press, 1999).

56. Lilly himself says that Bateson "discovered" Howe (Jeffrey and Lilly, *John Lilly, So Far . . .*, 118), but Sagan's role is outlined in William Poundstone's biography *Carl Sagan: A Life in the Cosmos* (New York: Henry Holt, 1999). Margaret Howe Lovatt denies Poundstone's account (which is based, according to Poundstone, on Sagan's own writings and, Poundstone says, confirmed by an interview with Lilly) and says that she heard about the CRI work while working at a hotel on the island and went there on her own initiative, where it was Bateson who generously folded her into the research program on a volunteer basis. Margaret Howe Lovatt, interview by the author, 25 August 2009.

57. See chap. 14 of John C. Lilly, *The Mind of the Dolphin: A Nonhuman Intelligence* (Garden City, NY: Doubleday, 1967). It is interesting to note that Lilly had Howe read *Planet of the Apes* (by Pierre Boulle, trans. Xan Fielding [New York: Vanguard Press, 1963]) to prepare for her chronic-contact work. This fact, as well as the observations about lipstick and so forth, can be confirmed in the remarkable manuscript files of this work in file "1965, St. Thomas," box 6A1–B1, Lilly Papers.

58. Lilly, *Mind of the Dolphin*, 128.

59. Ibid., xvii.

60. In its original formulation, this idea came from Bateson, who wrote to Lilly shortly after reading *Man and Dolphin* to propose that, if Lilly was right about dolphin intelligence, there was reason to think that these animals had evolved to apply the bulk of their cognitive capacity to the social world rather than to the material world (roughly speaking, because they had no hands). Bateson suggested that this might mean that the dolphins would make, if we could speak to them, ideal psychotherapists for humanity, so obscenely obsessed with things and so inept in relationships. See Bateson to Lilly, 16 October 1961, file of replies to and letters on *Man and Dolphin*, box 3D2, Lilly Papers.

61. Lilly, *Mind of the Dolphin*, 170.

62. Ibid., 91.

63. Ibid., 135.

64. Ibid., 152.

65. Lilly had Hollywood links. In 1961 the glamorous actress Celeste Holm, fascinated by news reports of Lilly and his talking dolphins, sought

him out while performing at the neighboring Coconut Grove. Later, one of her sons, Ted Nelson, would spend a year working at CRI, before becoming one of the leading figures at the intersection of information technology and the counterculture. For these links, see Lawrence S. Kubie to Elisabeth and John Lilly, 14 September 1961, and Elisabeth Lilly to L. S. Kubie, 6 December 1962, file "Kubie, Lawrence S.," box 3A1–C1, Lilly Papers.

66. Jeffrey and Lilly, *John Lilly, So Far . . .*, 134.

67. In his autobiography (ibid., 135) this episode (which involved a coma, hospitalization, and, apparently, some small permanent damage to Lilly's eyesight) is blamed on an improperly washed syringe.

68. The number twenty is Lilly's own (ibid., 139); Margaret Howe Lovatt recalls many fewer (interview by the author, 25 August 2009).

69. Margaret Howe Lovatt recalls one occasion on which Lilly used a jackhammer on the rock wall of the pond in which an LSD-dosed dolphin was swimming, apparently to try to get a rise out of the animal, which was otherwise not behaving in a particularly striking way (interview by the author, 25 August 2009). Lilly himself cites a "project report" on this work that I have not been able to find in its original form (*The Human Biocomputer: Programming and Metaprogramming [Theory and Experiments with LSD-25]*, Scientific Report CRI0167 [Miami: CRI, 1967]), but it is reasonable to assume that much, if not all, of the content of this document appears in Lilly's later published writings under essentially the same title: *Programming and Metaprogramming in the Human Biocomputer: Theory and Experiments*, available in a second edition (New York: Three Rivers Press, 1987).

70. There is, of course, a fictionalized version of these events: Ted Mooney's novel *Easy Travel to Other Planets* (New York: Farrar, Straus, and Giroux, 1981).

71. Lilly corresponded with some of these scientists. See H. A. Abramson to Lilly, 23 November 1964, file "Abramson, H. A.," box 3C2[D1], Lilly Papers.

72. It should be noted that Margaret Howe Lovatt claims that she herself was the primary proponent of the chronic-contact work (interview by the author, 25 August 2009).

73. Lilly followed the Leary story with some care. See Lilly to Frederick G. Worden, 12 December 1967, with clipping, file "Worden, Frederick G., Brain Research Institute, Los Angeles, California," box 3D2, Lilly Papers.

74. Consider the suite of very hostile peer reviews he received, in file "National Institutes of Health," box 3D2–D1, Lilly Papers. Also relevant is Scott McVay's account of overhearing Norris's dismissal of the work of CRI during an on-site evaluation circa 1964: "You see what sort of cockamamie stuff is going on here?" Scott McVay, interview by the author, 7 July 2003.

75. Lilly to Peter Matson, 2 May 1968, file "Matson, Mr. Peter H.," box 3A1–C1, Lilly Papers.

76. There is a history to be done on these devices, which were the holy grail of dolphin research in the 1960s. One of them features prominently in the navy film *Dolphins That Joined the Navy* of 1964, in which a navy researcher is shown speaking *Hawaiian* into the converter device. It was apparently believed that this language was particularly well suited to dolphin

communication. For a technical account of both the (unclassified) navy work and that of Lilly, see the cover story by Richard Einhorn, "Dolphins Challenge the Designer," *Electronic Design* 15, no. 25 (6 December 1967): 49–64. Also useful is the discussion by Wood in chap. 5 of his *Marine Mammals and Man*. The great controversy here, at least among conspiracy theorists, involves the untimely death of the navy's main researcher on this vocoder project, Dwight W. Batteau. I bought (from a collector of such things) a copy of the one-hundred-plus-page report filed by Batteau's collaborator Peter R. Markey shortly after his partner was found dead in a lagoon in Hawaii: Batteau and Markey, "Man/Dolphin Communication: Final Report, 15 December 1966–13 December 1967, Prepared for U.S. Naval Ordnance Test Station, China Lake, California, Contract No. N00123–67-C-1103, Listening, Incorporated, 6 Garden Street, Arlington, MA." For a somewhat-histrionic whirl through the history of the vocoder, consider Dave Tompkins, *How to Wreck a Nice Beach: The Vocoder from World War II to Hip Hop; The Machine Speaks* (New York: Stop Smiling, 2010).

77. This is Lilly's account: Jeffrey and Lilly, *John Lilly, So Far . . .*, 150.

78. NB: Robert Merle's *The Day of the Dolphin*, trans. Helen Weaver (New York: Simon and Schuster, 1969), is dedicated to Busnel. For an expanded sense of the way this split in the field looked to a participant, consider the memoir of one of the trainer-divers who became increasingly radicalized across these years: Richard O'Barry and Keith Coulbourn, *Behind the Dolphin Smile* (Chapel Hill, NC: Algonquin Books, 1988).