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THOMAS F. GIERYN
Truth-Spots

*Indiana University
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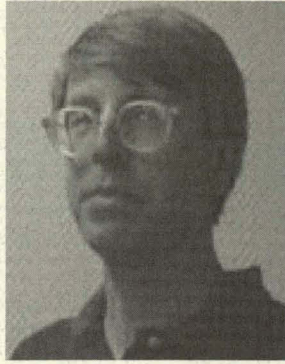
Herman B Wells Distinguished Lecturer Series 5

"Truth-Spots"

THOMAS F. GIERYN

Herman B Wells Distinguished Lecture of the Institute
and Society for Advanced Study given on
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Indiana University
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THOMAS F. GIERYN is Rudy Professor of Sociology and Adjunct Professor of History & Philosophy of Science at Indiana University. Professor Gieryn received the B.A. Magna Cum Laude from Kalamazoo College (1972) and the Ph. D. in Sociology from Columbia University in New York (1980). He joined the Department of Sociology at IU in 1978, and became its Chair in 2006. He has also taught at Nankai University (Tianjin, China), at Cornell University and given short-courses at the Universities of Maastricht and Twente in The Netherlands. In 1996-7, Professor Gieryn was The Ralph and Doris Hansmann Member in the School of Social Science at the Institute for Advanced Study, Princeton.

Professor Gieryn's research centers on the sociology of science: how can science be understood as a social, cultural, historical and human endeavor? His earliest work focussed on problem-choice—how scientists go about choosing problems for investigation. He then turned his attention to the cultural authority of science as an institution. Why is scientific knowledge routinely accepted as credible? Most recently, Professor Gieryn has investigated the epistemic significance of place. Of what consequence are geographic location and even architecture for the process of knowledge-making?

His book *Cultural Boundaries of Science: Credibility On the Line* was published by the University of Chicago Press in 1999, and won the Robert K. Merton Book Award from the Section on Science, Knowledge and Technology of the American Sociological Association (incidentally, a prize named for Professor Gieryn's mentor at Columbia). His research has been supported by grants from the Andrew W. Mellon Foundation and the National Science Foundation. In 1990-94, Professor Gieryn served on the Advisory Board of the exhibition on "Science in American Life" at the Smithsonian's National Museum of American History. He has been awarded the Edwin H. Sutherland Teaching Award from the Department of Sociology (1982), and the President's Award for Distinguished Teaching (1994). In 2006, he was Distinguished Visiting Lecturer at the University of Alberta (Edmonton, Canada). Professor Gieryn is a Fellow of the American Association for the Advancement of Science and a member of the Sociological Research Association.

“Truth-Spots”

I recently visited Delphi, in Greece, to consult with the oracle about my prospects for writing a book on truth-spots.¹

Of course, I was not the first to travel to Delphi in search of authoritative glimpses into the future. Oedipus, for one, made the trek before me—journeying from his native Corinth, to be told by the Pythias that he would slay his father and marry his mother. Oedipus believed as true what the Delphic oracle forecast, so much so that he refused to return home to Corinth (fearing that he would meet up with his father there and carry out the wicked prophecy). As fate would have it, Oedipus’ real father did not live in Corinth but in Thebes—exactly where Oedipus headed, in all innocence, after leaving Delphi, and along the road to Thebes he met a man...well, suffice it to say, the road was not big enough for the both of them. Oedipus tragically carried out the oracle’s prognostication. And the rest is ... Complex.

I am happy to report that the Gods presented me with a more favorable message, encouraging me to go forth and write that book about truth-spots—and, tonight, I offer a small portion of the project. Delphi is a truth-spot: a place that



Tourist at Delphi, seeking truth about the past.

lends credibility to claims and legitimacy to beliefs. Oedipus believed what he was told at Delphi because of *where* he heard the news: a spectacularly beautiful cleft with sacred waters near Mount Parnassus (nothing ordinary about this mountain vale), a challenging journey away from the populous Greek city-states, encrusted with temples built to honor the Gods by those whose foretold fortunes had come true, and equally encrusted with stories about the omphalos (stones dropped from above by eagles of Zeus to mark the very center [navel] of the universe). One could not take lightly the pronouncements received at Delphi—the place itself was convincing.²

The ancient Greeks traveled to Delphi to learn about the future. Tourists flock there today to learn about the past. Delphi was—and still is—a truth-spot. Walking along the Sacred Way, stepping over and around fallen columns, gawking at the treasures gathered inside at the adjacent museum, snapping obligatory pictures...the place affirms history. The tourist today cannot easily doubt—while there, in Delphi—that Greeks long ago believed in prophecies emanating from those particular vapors.³ Even the myth of Oedipus becomes credible as one drives toward Thebes on the road from Delphi, passing by the very spot (or so the guidebooks say) where the most famous patricide in all of history took place.

My talk tonight is a sociological travelogue: a travelogue, because I have brought along pretty pictures of where I have been, of truth-spots I have seen. It is sociological because there is an argument, too. Credible claims and legitimate beliefs have a provenance: they come from somewhere, and that place—I argue—is often consequential for people's judgments about whether those claims and beliefs have authority. My sociological argument is expressed eloquently by Eudora Welty, the emplaced writer from the American South, who said: "Being shown how to locate, to place, any account is what does most toward *making* us believe it, not merely allowing us to, may the accounts be the facts or a lie..."⁴

I'm going to talk about some facts tonight, not lies—in particular, scientific facts, and how they come to be credible, how they come to be believable as facts, via (in part) the places where they are from. I begin with Linnaeus, the peripatetic eighteenth century Swedish scientist whose taxonomic schemes became the authoritative way to classify plants. Henry David Thoreau is next, whose nineteenth century musings from Walden Pond blur the lines between philosophy, natural science, ethics and politics. I end up at the Clark Center, a just-completed laboratory building at Stanford University, designed for cutting-edge interdisciplinary research in the life sciences. My argument is that the facts put forth by Linnaeus, by Thoreau, and by bioscientists at the Clark Center, become believable in part because of the truth-spots where they originated.

Each set of claims comes from a place, like Delphi, a place that legitimates beliefs, and gives them authority. As *places*, Uppsala (in Sweden), Walden Pond

and the Clark Center have a geographic location, and also a materiality of physical stuff found and built at that location—and all of this is wrapped in narrations and interpretations that give meaning to locations and buildings.⁵ Delphi is also a place, and has several features that render it especially suitable as a truth-spot: its location is remote from where most ancient Greeks lived, off the beaten path (so to speak), requiring an arduous journey that made the received prophecies particularly hard-won, and so, more valuable, even trustworthy; Delphi's materiality is unique, like no other place in the Greek world, a combination of stunning natural beauty and soaring temples attesting to its predictive accuracy; Delphi is built not just with marble (though) but also with myth, stories that give life to the stones and to that particular mountain cleft, telling us *why* this is a spot for truthful prophecy.

As I go into the details about Linnaeus, Thoreau and the Stanford life scientists, listen for these same features of place—location, materiality, interpretations—to see how they work to make an ordinary garden, a typical New England pond, and a fresh new university building into truth-spots.

* * * * *

Linnaeus (1707-1778) is famous for his “sexual system” of classification—but don't get excited: we're talking mainly about the sex lives of plants.⁶ The eighteenth century was the pinnacle of the “natural history” phase in science: a time when discovering, observing, collecting, classifying and naming every living thing became an obsession.⁷ Rival taxonomic schemes coexisted for a time—based on different classificatory principles—but Linnaeus' system eventually won out. Whatever else one might see in a flowering plant, Linnaeus zoomed in on the reproductive organs, and he made differences in the number, size, shape and location of female stamens and male pistils the authoritative basis for distinguishing one plant from another. By virtue of its sex organs (what were quaintly called “the loves of the flower”), every plant was first assigned to one of 24 classes, and then given a more specific “binary nomenclature” (a unique genus and species). The twinflower, native to Northern forests in Europe and America, is scientifically named *Linnaea borealis*—honoring our man Linnaeus twice over: it is the national flower of Sweden. Here is my puzzle: how did Linnaeus manage to get his system for botanical taxonomy accepted as the scientific standard, and how (just as interesting, I think) did his name become the genus for his country's national flower?

Linnaeus triumphs by virtue of his travels to a series of places that authorized his understanding of plants—a sequence of truth-spots that added, in very different ways, to the credibility of whatever he had to say about nature and its orderliness. His life was long and rich, but I'll begin with his first stay in



Frontispiece, *Flora lapponica*

Uppsala—where, for seven years starting in 1728, Linnaeus studied medicine, as a young man in his twenties, full of promise, but with little fame or accomplishment. He was poised to become a physician, which today might not seem to be a good starting point for a budding botanist—but if you think of “herbals,” you’ll recall that back then, the physician’s best cure might have depended upon a thorough and accurate knowledge of plants. Uppsala is the ancient university of Sweden, founded in 1477, the most prestigious place in the country too pursue one’s early studies—but it was a traveling year away from Uppsala that proved even more consequential for Linnaeus’ career.

In 1732, now 25, Linnaeus heads north into Lapland, for scientific purposes: to document the range of flora and fauna growing there, and to explore the lifestyles of the Saami culture. No one before Linnaeus had sought to be scientific about Lapland, and he brought back to Uppsala a wealth of new knowledge about previously unknown plants—drawings, verbal descriptions, seeds and pressed flowers. Lapland (for me) illustrates a category of truth-spot: the field

site.⁸ Linnaeus begins to be credible as a botanist because he goes out into the wild, endures there risks and privations (although historians suspect that his diaries trump up the difficulties he faced), describes and collects specimens of plants no other scientist had seen. As he walked more than 4000 kilometers through Lapland, Linnaeus also laid the groundwork for his becoming a patriotic hero—Swedes will come to revere Linnaeus less as scientific taxonomist and more as an author of travel books (celebrating Sweden's natural environment and the simplicity of Saami life). In a word, the travels in Lapland secured for Linnaeus the beginnings of a reputation—as botanist, who gathered hard-won new knowledge for science, and as local hero, who captured the heart of Swedishness. "Being there" in Lapland mattered—he was field-tested.

But it was not enough, nor was it enough for Linnaeus to come back only to Uppsala. The custom of the day required that physicians-to-be complete their education at a university outside Sweden, and so in 1735, at age 28, Linnaeus heads off to Leiden, in The Netherlands. It was a propitious destination, and no doubt chosen strategically—for Leiden in the early eighteenth century represents a different type of truth spot: the absolute center of gravity in a scientific field. Its botanical gardens—where Linnaeus studied and worked—were unrivalled in Europe, assembling in one spot more different plants than anywhere else, gathered by Dutch traders and explorers. Leiden also was the epicenter of the network of scientists who specialized in botany and medicine: they would become the toughest court for Linnaeus, for if he could convince this jury of the efficacy of his classificatory scheme, the rest of the scientific world would surely concur. If he could make it in Leiden, he could make it anywhere—and he did: in part, by publishing *Flora lapponica* in 1737, proving his botanical prowess in the field, but also by publishing his masterwork *System naturae* in 1735—which in effect provided a coherent and replicable ordering of all those many genera of plants assembled in the botanical gardens uniquely at Leiden. Did *Leiden* matter? Of course: Linnaeus could not have done what he did anywhere else.⁹

Upon completion of his doctorate in medicine, Linnaeus returns to Sweden from Holland in 1739—never again to leave his native country. After a few years in Stockholm as a practicing physician, Linnaeus is appointed to the chair of medicine at Uppsala in 1741 (at age 34), where he now creates yet a third kind of truth-spot: a place of dissemination, where his classificatory schemes can be displayed and taught to a generation of scientists from all over.¹⁰ He gathers disciples as he gathers plants, assembling them both in the University's botanical garden—which, despite its Northern latitude, nurtures 2000 different species, and where Linnaeus also nurtures 186 doctoral dissertations for students who take away from Uppsala not just a degree but a taxonomic system for ordering plants. Linnaeus described his garden as "a living library of plants," where each genera was grown in its proper place as defined by Linnaeus' sexual system—



Cultivation at Linnaeus' home and garden in Uppsala

his classificatory scheme in effect spatialized and materialized in row after row of dirt beds and paths. Uppsala is a library of sorts, but also lectern, pulpit and soap-box—authorizing spaces that lend credibility to claims that spout (and sprout!) from there.

So: Linnaeus gains credibility as a scientist as he *transits* from the wild field-site in Lapland, to the demanding but enabling research center at Leiden, and on to a spot for display and for cultivation in Uppsala. His itinerary links together places that give warrant to his taxonomic ordering of plants.

* * * * *

Henry David Thoreau (1817-1862) convinces us in a different way: by *staying put*.¹¹ To be sure, he traveled some—to Cape Cod, and to the Maine Woods. But *Walden* (the book) is rooted—at the Pond, of course, and Thoreau faces the following challenge. How can this place, so ordinary, yield a convincing account of life, the universe and everything? How does Walden Pond, inside the text itself, become a truth-spot? Thoreau is crafty: on one hand, he makes the Pond unique, the singularly right spot for *him* to discover truth; on the other hand, he universalizes Walden Pond, makes it typical and representative of Anywhere, discoverable by Everyman, so that his assertions from there may shed their parochialism.



Solitude at Walden Pond

For several reasons, Thoreau could not have prepared for his book from any other place—or, if he had, it might not have been as credible. He plays up the fact that he is a “native to this place,” having been born in nearby Concord, Massachusetts in 1817, and having spent almost his entire life in the environs.¹² He tells us: “I was brought ... to this my native town, through these very woods and this field, to the pond. It is one of the oldest scenes stamped upon my memory.”¹³ Thoreau fashions himself the “expert on Home-Cosmography” (he writes) by passing “two years and two months” at Walden Pond, long enough for him to announce that “I can speak from an unusually complete experience.” He urges us to be distrustful of those who don’t stay as long: “he who is only a traveller learns things second hand and by the halves, and is poor authority.”

Importantly, Walden Pond is a short distance *away* from Concord, and even further from the bustle of Boston. This location affords Thoreau the solitude he needs to plumb the universe for himself, without distraction from “the society of our gossips” (as he described Concord), where the “mud and slush of opinion, and prejudice and tradition, and delusion, and appearance” thrive.¹⁴ Walden Pond is uniquely suited to Thoreau’s philosophizing—a place he has known forever, and a place where he can be alone to contemplate the universe as it really is.

The risk is that nobody outside of Concord, Massachusetts gives one wit about what Thoreau finds at Walden Pond. But if the Pond is made to be Anywhere, then Thoreau’s pronouncements will travel better—and be convinc-

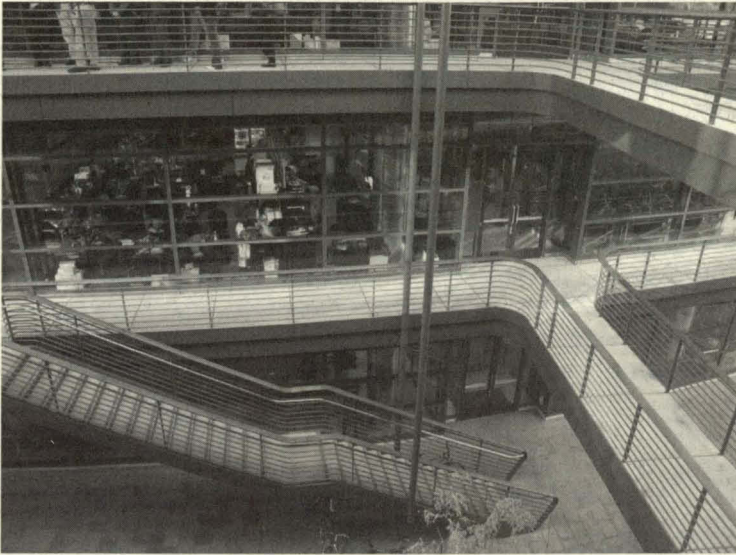
ing no matter where they arrive. When he tells us that “this one hillside illustrated the principle of all the operations of Nature,” we realize that his discoveries are not *about* Walden Pond, even if they were made there. “It is not worth the while,” he writes, “to go round the world to count the cats in Zanzibar,” because Walden Pond will do just fine as a place to find (he says) “Nature’s universals.”¹⁵

Thoreau’s truth-spot in the woods has been carefully constructed to carry some heavy epistemic freight. The author situates himself in this place—uniquely so familiar to him, but in its typicality revealing of universal truths—a place that enhances insight, objectivity, accuracy and trust.

* * * * *

By contrast, the James H. Clark Center—a new research laboratory at Stanford—is a kind of “no-place.”¹⁶ The building opened in October 2003: for an investment of \$150 million, Stanford got 146,000 square feet of research space, sweeping curved glass walls enclose a roofless courtyard, overlooked by balconies on each of the three floors and crisscrossed by bridges, a prize-winning design by Norman Foster, London architect. The Clark Center houses Bio-X, an interdisciplinary program in the biosciences, and it will eventually bring together 600 faculty, students and staff from 25 departments in the life sciences, medicine, engineering and the physical sciences. The research floors are cavernous open spaces, industrial in feel, essentially without walls, and nothing is nailed to the floor: almost every piece of equipment is on wheels, allowing scientists to create—and re-create—whatever space suits their evolving work. The Center offers “Hotel Space,” bright yellow lab benches reserved for temporary occupancy by visiting researchers at early stages of collaborative projects. The ambition is a “cauldron of creativity”—an experimental piece of social and architectural engineering designed to force “happy collisions” among researchers from very different fields. A branch of Peets Coffee & Tea is in the Center, along with the full-service restaurant “LinX.”¹⁷

With its completely open floor plan and maximal portability of furniture, the Clark Center seems so different from the ordinary lab building—with plentiful walls and doors, small enclosed rooms, fixed benches dedicated for long durations to resident researchers. But I’ll hazard a sociological prediction: over the next decade, research buildings for interdisciplinary studies in the biosciences will come more and more to look like the innovative Clark Center at Stanford. Indeed, that architectural or material convergence *must* happen—given the institutional logic of modern science. At least in those fields where experiment and computation predominate, there is a “presumption of equivalence” among scientists—a tacit assumption that the kind of space *you* work in is, for all intents and purposes, identical to the space that *I* work in. The philosopher of place



Transparency at the Clark Center, Stanford University

Edward Casey points to the heightened credibility of claims from distant labs—stemming from their material sameness: “I understand what is true of other places over there precisely because of what I comprehend to be the case for this place under and around me.”¹⁸

Think about it this way: the laboratory building itself is like a piece of experimental equipment, for example, a PCR machine to amplify a strand of DNA.¹⁹ These research tools are typically standardized in their manufacture, use and interpretation—so that scientists anywhere, all over the globe, may report results based on that equipment without needing to go into details about how the PCR machine was built or how it works. That same “presumption of equivalence”—now, for the whole building—allows scientists everywhere beyond the Clark Center to infer that there are no environmental or even “social” irregularities that might be relevant for reported results. In effect, as the next generation of interdisciplinary research buildings are designed for universities all around, the Clark Center will itself be cloned (at least, its guts)—copied over and over, as universities mimic the prestigious Stanford (hoping to keep their top scientists happy in up-to-date research space), and as architects rush to design the latest thing for their clients (open design! rolling equipment! becomes their next mantra). Scientific claims from laboratories (today’s preferred truth-spot) become trustworthy because, for the researchers beyond Palo Alto who ratify those claims, they come from a place just like “this place under and around me.”

But what about the authority of scientific claims among the rest of us *hoi polloi*? How does the distinctive architecture and materiality of the Clark Center sustain the credibility of the scientific profession—precisely at a time when we seem so wary of “experts?” The Stanford building embodies *transparency*: without many interior walls to sequester research spaces, and with floor-to-ceiling exterior glass walls enabling scientists to watch their colleagues’ every move across the courtyard, visibility and observability are maximized. Privacy and secrecy have long been antitheses of science, going back to the days when early modern natural philosophers sought to demarcate their work from the alchemist hiding in his closet.²⁰ The legitimacy of scientific facts these days is premised on the assumption that they are produced in open circumstances—where all procedures and recordings could (at least, in principle) be scrutinized by informed colleagues (and maybe by competitors). The architecture of the Clark Center epitomizes such visibility and builds-in the possibility of routine monitoring of lab work, insuring the skeptical attestation of ensuing claims. Ordinary folks (along with government bureaucrats, corporate CEOs and anybody else who needs a little science to make important decisions) are thus reassured by this carefully designed place of surveillance²¹ that half-baked ideas, weakly-evidenced findings or flat-out lies will never get outside the walls. At a time when suspicions of research fraud haunt the scientific profession,²² curtains of glass and undivided work spaces may be important reminders of why we might trust most scientists when they report the truth.

* * * * *

I end with a paradox: some places are built to *erase* place, to create a placelessness that is vital (I think) for the credibility of claims in modern experimental science. Looking back, it mattered mightily where Linnaeus went—mattered for the credibility of his botanical taxonomy, as he traveled from pristine field to unparalleled collections of specimens, and then on to a place for display and dissemination. It mattered, too, where Thoreau had been as he prepared for *Walden*—at a hut in the woods beside ... not just any New England pond: Walden Pond, so familiar to him, so distant from distractions, but so typical even in its particularity. With time, I suspect, Stanford’s Clark Center will be institutionalized everywhere, as the reproduced model of its material design creates an archipelago of truth-spots—standardized spaces that no longer depend upon a certain geographical location to lend credibility to scientific claims, authorizing spaces that eviscerate all of the local idiosyncracies that make Walden Pond, Uppsala, Lapland and Delphi into *places*.

Endnotes

1. This is, more or less, a transcript of my talk delivered at Woodburn House on October 14, 2005. Its themes have been more fully developed in a series of published papers:

“City as Truth-Spot: Laboratories and Field-sites in Urban Studies” *Social Studies of Science* 36 (2006): 5-38; “Instrumentalities of Place in Science and Art” in Helmar Schramm, Ludger Schwarte and Jan Lazardzig (eds.), *Instrumente in Kunst und Wissenschaft: Zur Architektonik kultureller Grenzen im 17. Jahrhundert* (Berlin: Walter de Gruyter, 2005); “Three Truth-Spots” *Journal of the History of the Behavioral Sciences* 38 (2002): 113-32; “Two Faces on Science: Building Identities for Molecular Biology and Biotechnology” pp. 423-55 in Peter Galison and Emily Thompson (eds.), *The Architecture of Science* (Cambridge: M.I.T. Press, 1999). All of this work will eventually end up in a book titled, not unexpectedly, *Truth-Spots: How Place Lends Credibility to Claims and Legitimacy to Beliefs*.

2. Michael Wood, *The Road to Delphi: The Life and Afterlife of Oracles* (New York: Farrar, Straus and Giroux, 2003).

3. It is, of course, sociologically hazardous to assume anything about what is going on in the head of the tourist. Throughout my visit at the ruins of Delphi—perhaps four hours—I kept running into a German man fused to his cell phone, talking animatedly and without interruption, looking at his surrounds only to know where next to put his feet.

4. Eudora Welty, *The Eye of the Story* (New York: Vintage, 1983), p. 119.

5. I have discussed the sociological significance of “place” in “A Space for Place in Sociology” *Annual Review of Sociology* 26 (2000), 463-96.

6. On Linnaeus’ life and work, I have found these biographies especially useful: Wilfrid Blunt, *Linnaeus: The Compleat Naturalist* (Princeton: Princeton University Press, 2001); Tore Frängsmyr (ed.), *Linnaeus: The Man and His Work* (Berkeley: University of California Press, 1983); Lisbet Koerner, *Linnaeus: Nature and Nation* (Cambridge: Harvard University Press, 1999).

7. On natural history generally, see Nicholas Jardine, James A. Secord and Emma C. Spary (eds.), *Cultures of Natural History* (Cambridge: Cambridge University Press, 1996).

8. On field sites in science, see Henrika Kuklick and Robert E. Kohler (eds.), “Science in the Field,” *Osiris*, 2nd series, volume 11 (1996).

9. The importance of Leiden’s gardens for Linnaeus’ career is discussed in William T. Stearn, “The Influence of Leiden on Botany in the Seventeenth and Eighteenth Centuries” *British Journal for the History of Science* 1(1962): 137-59. The legitimating impact of Linnaeus’ field-work in Lapland on his welcoming reception among Dutch scientists is described in Staffan Müller-Wille, “Joining

Lapland and the Topinambes in Flourishing Holland: Center and Periphery in Linnaean Botany" *Science in Context* 16 (2003): 461-88.

10. I have also examined another truth-spot that lends legitimacy to scientific claims by putting on display a "materialization" of a theory of organic agriculture in the buildings and fields at the Indore Institute of Plant Industry in India (1924-30)—featuring compost pits designed by Sir Albert Howard, later hailed as the "father of modern composting." See *Cultural Boundaries of Science: Credibility On the Line* (Chicago: University of Chicago Press, 1999), ch. 5.

11. The cultural and epistemic significance of "home" has been reinforced for me by the writings of my IU colleague Scott Russell Sanders, who delivered the Distinguished Lecture of the Institute and Society for Advanced Study in 1997. See his *Staying Put: Making a Home in a Restless World* (Boston: Beacon, 1993), along with the classic by Wes Jackson, *Becoming Native to this Place* (Washington DC: Counterpoint, 1994).

12. On Thoreau's life and work, I have found especially useful: Stanley Cavell, *The Senses of Walden* (Chicago: University of Chicago Press, 1972); David Robinson, *Natural Life: Thoreau's Worldly Transcendentalism* (Ithaca: Cornell University Press, 2004); Richard J. Schneider (ed.), *Thoreau's Sense of Place* (Iowa City: University of Iowa Press, 2000); Laura D. Walls, *Seeing New Worlds: Henry David Thoreau and Nineteenth-Century Natural Science* (Madison: University of Wisconsin Press, 1995).

13. Page references for these quotations from Thoreau are provided in my "Three Truth-Spots" (cited in note 1), from which this brief section is abridged. I used *Walden and Civil Disobedience* (New York: Penguin, 1983 [original 1854]).

14. Places serve as truth-spots in seemingly contradictory ways: Thoreau's solitude at Walden Pond was evidently vital for his ability to see the universe correctly, free from the distractions of others. However, my next example—the Clark Center at Stanford University—facilitates truth-making in precisely the opposite way: by bringing together in a single building some of the world's most talented life-scientists, who work together and (importantly) *attest first-hand* to the credibility of new discoveries.

15. The conversion of field sites into "mobile" laboratories capable of revealing nature in its "placeless" universality is discussed by Robert E. Kohler, *Landscapes and Labs: Exploring the Lab-Field Border in Biology* (Chicago: University of Chicago Press, 2002).

16. I briefly visited the Clark Center in 2004. My accounts of the building rely on diverse postings on internet websites, for example: <http://biox.stanford.edu.clark> and <http://www.rdmag.com>.

17. The importance of chance interactions for scientific or technical innovation—and the realization that different building designs can either facilitate or retard such salutary meetings—was noted by Thomas Allen, *Managing the Flow*

of *Technology* (Cambridge: MIT Press, 1977). Allen's point is different from mine: for him, science buildings matter for the *upstream* collaborative process of discovery; for me, the buildings matter for the *downstream* reception of those discoveries as credible or authoritative.

18. Edward S. Casey, "How to Get from Space to Place in an Fairly Short Stretch of Time" Pp. 13-52 in Steven Feld and Keith H. Basso (eds.), *Senses of Place* (Santa Fe NM: School of American Research Press, 1996), quotation on p. 45. See also Casey, *Getting Back into Place* (Bloomington: Indiana University Press, 1993; Casey, *The Fate of Place: A Philosophical History* (Berkeley: University of California Press, 1997).

19. Machines to do polymerase chain reactions (PCR) are an essential element in the rise of biotechnology. They facilitate the "identification of precise segments of DNA and accurately reproduce millions of copies of a given segment in a short period of time." Paul Rabinow, *Making PCR: A Story of Biotechnology* (Chicago: University of Chicago Press, 1996), p. 1.

20. For a discussion of how place lent credibility to claims during the "scientific revolution," see Steven Shapin, "The House of Experiment in Seventeenth-Century England" *Isis* 79 (1988): 373-404.

21. Although the idea of "surveillance" is often associated with robotic cameras scanning street corners or targeted searches at airports, the French theorist Michel Foucault has suggested that the transparency of social life has been "normalized"—in part, through the design and construction of buildings and spaces that make it impossible to hide anything. See his famous discussion of the "panopticon" in *Discipline and Punish: The Birth of the Prison* (New York: Vintage, 1979 [French original 1975]).

22. I made my final corrections just after a South Korean scientist (Woo-Suk Hwang) admitted that he had fudged his data on the "derivation of stem cells from cloned human embryos." Gretchen Vogel, "Landmark Paper Has an Image Problem" *Science* 310 (9 December 2005): 1595.

