Introduction: Bad Ideas

No one in the history of the world has ever self-identified as a pseudoscientist. There is no person who wakes up in the morning and thinks to himself, "I'll just head into my pseudolaboratory and perform some pseudoexperiments to try to confirm my pseudotheories with pseudofacts." As is surely obvious, "pseudoscience" is a term of abuse, an epithet attached to certain points of view to discredit those ideas, complemented by "pseudoscientist" to designate the practitioner. Just as no adherents of a religious doctrine ever really consider themselves "heretics," alleged pseudoscientists have a very specific understanding of their activities. To their minds, they are doing science, full stop. This does not mean they are necessarily correct—lots of people are mistaken about what they are actually doing—but it should give us pause to think a bit harder concerning what the word "pseudoscience" really does.

Does, not means. "Pseudoscience" is a term, I maintain, without real content, and yet the notion performs active work in the world, separating off certain doctrines from those deemed to be science proper. On the imagined scale that has excellent science at one end and then slides through good science, mediocre science (the vast majority of what is done), poor science, to bad science on the other end, it is *not* the case that pseudoscience lies somewhere on this continuum. It is off the grid altogether.[1] The process of demarcating science from non-science is a central and quite general aspect of all scientific activities, but pseudoscience attracts particular vehemence as compared to, say, non-science. Scientists rarely spend much energy arguing that the Catholic Church or Vietnamese literature is pseudoscience; they are just not science—and devotees of those domains are quite happy with that designation. Pseudoscience is different. This is a combative notion deployed to categorize (and, its users

hope, weaken or eliminate) doctrines that are non-science but pretend to be, aspire to be, or are simply mistaken for scientific. The effect of this demarcation through use of the moniker "pseudoscience," when it works, is to preserve the accepted boundaries of knowledge from intrusion.[2] In the end, pseudoscience is a bad idea. I do not mean that one should not practice phrenology, astrology, or what have you, but that the very notion of "pseudoscience" lacks a core.

Although pseudoscience is a fairly common epithet, it is not exactly universal. Scientists do not just call anything they do not like "pseudoscience." They are perfectly happy to declare many of their peers' work to be "bad" or "substandard" science. "Pseudoscience" is used in a targeted way, at certain times, and against specific enemies. This implies that there is no unified pseudoscience; the various doctrines labeled "pseudosciences" over the last two centuries actually have very little in common with one another besides being hated by assorted scientists. Ever since the term was introduced into the English language—at roughly the same moment as the word "scientist,"[3] which is surely no accident, for how could you mimic a category that does not exist?—skirmishes over designating certain fields as pseudosciences have escalated and de-escalated along with the general perception of the threatened or secure status of science. The *Oxford English Dictionary* tells us the term, meaning "a spurious or pretended science," entered the English lexicon in 1796 to refer to "alchymy," and then popped up again around 1823 concerning blazonry (the interpretation of heraldic insignias), of all things.[4] Surely those two fields were not related then, as they are not now. We are faced with a variant of the classic story of three blind men encountering an elephant. One holds the tail, and thinks it is a piece of string; another grabs a leg, and thinks he is holding a tree; the third holds the trunk, and believes he grasps a snake. Only, in the case of pseudoscience, they really are holding a piece of string, a tree trunk, and a snake. There is no elephant.

What unifies the so-called pseudosciences is that scientists in various fields have chosen to ostracize them in this particular way (as opposed to declaring them incorrect scientific theories). It is a core argument of this book that individual scientists (as distinct from the monolithic "scientific community") designate a doctrine a "pseudoscience" only when they perceive themselves to be threatened—not necessarily by the ideas themselves, but by what those ideas represent about the authority of science, science's access to resources, or some other broader social trend.[5] If one is not threatened, there is no need to lash out at the perceived pseudoscience;

instead, one continues with one's work and happily ignores the cranks. This means that we can examine the history of debates over pseudosciences past in order to explore not what disqualified a particular doctrine (say, astrology[6]) from membership in the scientific club, but rather to understand *science* and what scientists thought about their standards, their position in society, and their future. Pseudoscience, as historian of science Mark Adams points out in an essay on the history of eugenics, is "less interesting as a mode of historical explanation than as an object of historical study; it is not part of the solution, but part of the problem."[7] Each use of pseudoscience is tied intimately to its historical context. If you want to know what science is or has been, show me the contemporary pseudoscience.[8]

This book examines a specific contentious period for the status of science—Cold War America, from the late 1940s to the late 1970s—by exploring a series of debates over what counted as real science. (I exclude the cases of so-called pseudomedicine or quackery, which is a vastly larger topic and quite amenable to a similar investigation.[9]) These "pseudoscience wars," as I call them, raised scientists' anxiety over the incursions of "pseudoscience" among their students and the public at large to a fever pitch. Before 1950, debates over pseudoscience ran hot, but they did not in general exhibit the character of conspiracy theorizing. During the pseudoscience wars, doctrines that were relegated kicking and screaming to the "fringe" began to respond by deploying new arguments against the establishment, claiming not just that mainstream science was incorrect or incomplete (as, for example, in the controversies over J. B. Rhine's parapsychology experiments in the 1930s), but that scientists were engaged in a conspiracy to suppress new knowledge. It was no accident that this transition unfolded in the early 1950s, when America was gripped in the frenzy of McCarthyist red-baiting and nationwide panic about conspiracies to undermine the West. Through the contingent juxtaposition of a new bout of disputes over the boundaries of science and this tense domestic Cold War context, features of the paranoid style of the moment became rooted into the discourse of the fringe, a pattern that has stuck with us long after the passing of anti-Communist hysteria.[10] Arguments from the fringes of science today carry some of the last vestiges of this particular moment of American history, fossilized in amber.

This transformation was large, but it began with a specific controversy over one work and its author, and the chapters below will follow both from 1950 to 1980 to show how this one controversy carried along other pseudo-

science conflicts with it, as a mishmash of diverse doctrines began to gel, if not into a single pseudoscience (for there is no elephant), certainly into the coherent conflict of the pseudoscience wars. It started with a book and a man. The book was *Worlds in Collision*, and the man was Immanuel Velikovsky (1895–1979).

If anyone has ever been tarnished by the accusation of pseudoscientist, it is Immanuel Velikovsky, a Russian-born psychoanalyst who arrived on American shores in 1939 after several convoluted peregrinations. In many of the accounts of this man and his life, the word "pseudoscience" crops up.[11] He has been variously dubbed one of the "deans of modern pseudoscience,"[12] the "first grand wizard of the Universal Order of Mass Pseudo-Scholarship,"[13] "an almost perfect textbook example of the pseudo-scientist,"[14] one of the "triad of pseudoscience gurus" (along with L. Ron Hubbard and Charles Fort),[15] and "the very model of a crank."[16] These allegations were not uncontested, and his supporters—who began to assemble in force by the mid-1960s—insisted with Frederic Jueneman that "Velikovsky's efforts are not the labors of a pseudoscientist, because his work has touched on too many things which preemptively have been proven correct, or with furthered knowledg[e] might be proven one way or another."[17] But Velikovsky was not just a combatant in the pseudoscience wars. He and his doctrines were ground zero.

At this point, you may very well be scratching your head. Depending largely on your age, the name Velikovsky recalls fond memories of college, waves of outrage, or a complete and utter blank. In my informal (and profoundly unscientific) polling of individuals over the last few years, I have almost never found a person under the age of fifty who has heard the name. (The exceptions were astronomers, intense science-fiction fans, or aficionados of scholarly arcana.) And yet, in the 1970s, his writings were mainstays of college bookstores, and the man himself cycled through campuses, the pages of popular journals, and the columns of newspapers. He was, as such things go, a household name, a celebrity from the world of scientific controversies whose books went through over seventy editions in English alone during his lifetime (and were translated into dozens of languages).

In April 1950 the Macmillan Company published *Worlds in Collision*, which rocketed to the top of nonfiction best-seller lists nationwide.[18] In this book, Velikovsky argued that ancient mythological, scriptural, and historical sources from a variety of cultures contained repeated homologous descriptions of major catastrophes: rains of fire, immense earthquakes,

tsunamis, dragons fighting in the heavens. These passages had long been interpreted by rationalist readers as metaphors or ecstatic visions. Not so, argued Velikovsky: when compared and synchronized, they pointed toward real and massive global catastrophes. Velikovsky tracked two of these: one that happened around 1500 B.C., during the Exodus of the Children of Israel from Egypt; and another in the eighth century B.C., which changed the length of the year from 360 days to its current 365¼ days, stunning the prophet Isaiah and depicted in Homer's *Iliad* as the battle between Athena and Ares.

This was the first salvo of the pseudoscience wars, an invasion into the heavily fortified domain of American science, at the time enjoying peacetime prosperity and elevated prestige due to its triumphs during World War II. The incursion was not completely without warning—earlier attempts to dissuade Velikovsky or his publishers from releasing the book had broken down, a failure of diplomacy—and the defensive maneuvers were rapid and, in retrospect, surprisingly vigorous. Scientists expressed significant doubts about the reality of such catastrophes in historical times, but the greatest sticking point was his mechanism for their occurrence. Velikovsky claimed that the first (at the time of the Exodus) was caused by a comet that had been ejected from Jupiter and almost collided with Earth, remaining trapped in gravitational and electromagnetic interaction with this planet on two separate incidents separated by fifty-two years, raining petroleum from its cometary tail, igniting the heavens, and tilting Earth's axis. Eventually, the comet stabilized into the planet Venus. Thus, Earth's nearest planetary neighbor was a comet born in historical times, as attested by proper interpretation of the records of the collective memory of humanity. Venus's movements had, however, displaced Mars, which threatened Earth in the second series of catastrophes. Velikovsky's arguments presupposed a reformulation of geology, paleontology, archaeology, and celestial mechanics, not to mention ancient history.

From the point of view of the defenders of science on the front line, Velikovsky had not only set up beachheads in their domains, but he incited a fifth column of humanist intellectuals and the broader public, who eagerly read his book and called for scientists to take his arguments seriously. This they were not about to do, and after a series of literary volleys—including a threatened boycott of Velikovsky's publisher—*Worlds in Collision* was transferred to a more commercial press and the guns began to go silent. The beachhead remained, however, and Velikovsky dug in during the 1950s, attempting to recruit allies among mainstream scientists through

a series of renewed diplomatic overtures to broker a longer-lasting peace. For the most part, scientists ignored these efforts, opting instead for a return to normalcy, as if Velikovsky were not continuing to launch his books across the demilitarized zone.

In the mid-1960s, hostilities re-erupted, but this time not because Velikovsky rolled out his tanks for another assault. Rather, insurgents behind the scientists' own lines—undergraduates at their institutions, the "counterculture," and even humanist academics—marched forth under Velikovsky's colors, in many ways appropriating for themselves a cause that was different from the author's own. For two decades, a heated debate persisted in the United States: Was Velikovsky right? Had the discoveries of the space age confirmed or refuted his picture of the solar system's history? Counterinsurgency measures, and even one high-level attempt to negotiate with Velikovsky's forces at the American Association for the Advancement of Science annual meeting in 1974, came to naught, and the quagmire deepened. Unlike in 1950, however, this time there was no clear front line. The pseudoscience wars persisted as low-intensity conflicts, and they burned in a plethora of redoubts of American culture.

And then, sometime in the early 1980s, Velikovsky dropped out of the collective consciousness, and his name is now a distant memory—when it is a memory at all. The war did not so much end as fade away. A main emphasis of the pages that follow is on finding out why he became well known in the first place. How did *Worlds in Collision* assume such a prominent position in the public imagination? Why was Velikovsky the target of so much ire from the scientific community? And what does his story tell us about science in American culture during the height of the Cold War?

This is not a biography of Velikovsky, or an attempt to debunk him or exonerate him, or even a judicious weighing of the arguments in favor of and against the picture of the world that he built up in many writings over the course of his career. An interested reader can turn to many other places for such accounts.[19] Rather than merely reprise the Velikovsky debates—as fascinating as those are—I mean to explore this notion of the "pseudoscience wars." Every chapter after the first (which lays out the context of the controversy over *Worlds in Collision*) juxtaposes Velikovsky's case with that of one or more purported pseudosciences: Freudianism, *Welteislehre*, Lysenkoism, eugenics, parapsychology, creationism, orgone theory, ancient astronauts, and finally contemporary debates about science and public policy. In order to see how different theories became imbricated with his, set the stage for the reaction to his ideas, or in some instances provided

an alternative trajectory toward greater legitimacy than he ever achieved, I will at times veer rather far off the Velikovskian path. This book is primarily an exploration of the concept of pseudoscience in postwar American culture, and for that purpose Velikovsky provides an exceptionally sharp analytical lens, one that enables us to scrutinize *science* by looking at that which scientists reject as resembling themselves, but not quite. I take Velikovsky and other struggles over so-called pseudoscience as entry points into what philosophers have called the "demarcation problem."

The term "demarcation problem" was coined by a young Austrian philosopher named Karl Popper in 1928 or 1929, a decade after he had already begun to muse over what differentiated what he considered the most impressive scientific achievement of his day—the confirmation in 1919 of Albert Einstein's general relativity through the measurement of the deflection of starlight around the sun during an eclipse—and a rather more local scientific practice: psychoanalysis. Popper was distinctly impressed with the *audacity* of Einstein's case. This physicist boldly set forth a quantitative prediction of the consequences of his theory, as if daring scientists to prove him wrong. Had the deflection not been measured, so Popper reasoned, Einstein's general relativity would have been proven wrong, and the theory would have died. With Sigmund Freud's and Alfred Adler's psychoanalysis, on the other hand, Popper saw something different. These doctrines did not thrive on prediction, but on *confirmation*: they would examine a case of neurosis, and then explain it in terms of their own theoretical framework (Oedipus complex or inferiority complex, say). The difference between the two examples interested him, and by the late 1920s he believed he had come up with a solution to demarcate science from non-science; "pseudosciences" were doctrines that claimed to be sciences but failed a crucial test.

Popper's demarcation criterion was publicly articulated in a 1953 lecture at Peterhouse, one of the constituent colleges of the University of Cambridge, and published in his 1963 volume *Conjectures and Refutations*. Ever since, its popularity has grown, and it has been widely quoted to me (especially by undergraduates) as a solution to the problem of how one identifies a pseudoscience. According to Popper, "*the criterion of the scientific status of a theory is its falsifiability, or refutability, or testability*."[20] The notion is appealing in its simplicity. For a variety of technical philosophical reasons, it is not possible to simply confirm that a theory is true; all we can know is that we have another confirming instance of what we suspect

to be true. (This was, for example, Popper's problem with psychoanalysis: its claims were amply *confirmed*, but he considered the bar for what counted as confirming the theory to be set unacceptably low.) All that we can say about scientific theories, Popper argued, is that they were *not yet shown to be false*. Thus, science progresses by advancing claims and subjecting them to rigorous efforts at falsification. A statement that claimed to be scientific but was immunized from such rigorous examination by ad hoc hypotheses or vague articulation was, for Popper, unfalsifiable, and would thus be clearly marked as pseudoscientific.

The problem with this elegant proposition is that it utterly fails. First, there is a logical conundrum: How do you determine whether a theory has been in fact falsified by a particular experimental result? Suppose you are using a mass spectrometer to test a specific claim about the composition of a compound and get an anomalous result. Is the claim now proven false, or is your mass spectrometer on the fritz? In practice, we do not actually test single statements, but rather groups of statements and assumptions that travel together, embedded in our instruments and experimental setup.[21] The clarity of falsifiability thus becomes a lot murkier. The standard also proves problematic in that this is not what scientists actually *do* when they conduct experiments or make observations. What Popper dismissed as the "unscientific" generation of ad hoc hypotheses to immunize a theory turns out to be one of the most common practices of scientific work. It would be silly to toss out a theory just because you found a single experimental result at variance; better to assemble more data and reserve judgment.[22]

Second, the falsifiability criterion does not perform the task demanded of it. If all a theory has to do in order to count as a scientific is make bold claims that might be proven false, then many doctrines widely deemed pseudoscientific pass muster. This was true even of older doctrines, like alchemy, which had their heyday before Popper wrote, but became even more problematic after falsifiability achieved broad currency. Now that there was a standard, advocates of fringe doctrines just had to make sure they met it. Creationists, for example, routinely make predictions about what kinds of geological structures one should find; parapsychology is nothing but a series of falsifiable statements; and, as we shall see, Velikovsky staked a great deal on the predictive claims of his cosmic catastrophism. Even more embarrassing for Popper's bold attempt, many sciences, such as the more "historical" sciences of evolutionary biology and geology, explain natural phenomena with tools and theories that do not fit

nicely into Popper's schema, despite various Procrustean attempts to save the situation. Popper's falsifiability test provides a poor map of the kingdom of pseudoscience. The criterion is neither necessary for demarcation nor, as it turns out, sufficient.

If Popper—despite his popularity outside the realm of philosophy of science (where falsificationism has been long abandoned)—is no help, could we come up with another bright line to distinguish the scientific from the pseudoscientific? After the 1962 publication of Thomas Kuhn's widely read historical-philosophical manifesto, *The Structure of Scientific Revolutions*, many looked to his central argument of paradigms as a possible site of demarcation. According to Kuhn, science consists of periods of stasis ("normal science"), in which scientists solve puzzles within the framework of a general schema of reasoning, which he called a paradigm. As anomalies—experimental findings that prove difficult to reconcile with the dominant paradigm—pile up, occasionally a rupture occurs ("paradigm shift"), and the old paradigm is replaced by a new one, and normal science then continues apace in this framework.[23]

Kuhn rarely invoked the demarcation problem—when he did it was to criticize Popper's solutions—and for good reason.[24] If paradigms *by definition* decide what is scientific and what is not, then any statement outside the paradigm could conceivably be designated pseudoscientific. The only problem is that the later paradigm would also meet that criterion and thus be ruled out of court, which is a nonsensical result. Likewise, individuals that are widely accused of being pseudoscientific could simply claim that they represent a new paradigm, and thus are not to be judged within the frame of reference of contemporary science.

They not only *could* do this; they in fact did and do, as the case of Velikovsky demonstrates. In the 1960s and 1970s, Kuhn lived in Princeton, New Jersey, and taught at the town's eponymous university. Immanuel Velikovsky also lived there (although with no university affiliation), and he offered Kuhn the opportunity to use his personal files to examine the scientific status or merely the history of his revolutionary claims. "You may have access to all these papers," Velikovsky wrote Kuhn, "whenever you wish."[25] Kuhn, for his part, studiously avoided commenting on the Velikovsky affair.[26] Lynn Rose, a philosopher of science at the State University of New York–Buffalo and an extremely vocal supporter of Velikovsky's theories, damned Kuhn for his silence. "It is questionable whether Kuhn would be able to recognize a scientific revolution even if there were one in his back yard. As a matter of fact, he has *already* overlooked a ma-

jor scientific revolution right in his own back yard," he quipped. "Kuhn will perhaps be remembered, if at all, as the orthodox and unimaginative student of scientific revolutions who lived for a number of years in Princeton, New Jersey, never even noticing the Velikovsky Revolution that was centered there."[27] And, meanwhile, some Velikovsky acolytes tried their own hand at remedying Kuhn's silence with Kuhnian readings of cosmic catastrophism.[28]

Even if Kuhn was no help, the transformation in the academic field of the history and philosophy of science that his book wrought opened a new avenue to potentially cracking the demarcation problem. Since Popper's strictly semantic and logical formulation would not hold water, maybe aspiring demarcationists should look instead to the community of science as a whole and observe (with a philosophical eye) how it decided what was scientific and what was not. What ensued post-Popper were a series of attempts to create not a single demarcation criterion, but a host of checklists. These consisted of characteristics that seemed to belong to many of the doctrines deemed pseudoscientific (assuming there was an elephant), from which a number of rules or properties, something like family resemblances, were extracted. These could be ticked off when trying to determine whether a candidate theory was pseudoscientific or not.[29] Such criteria included, for example, isolation from the scientific community, vigorous resistance to criticism, exaggerated claims of revolutionary innovation, the invocation of supernatural forces—and, yes, unfalsifiability. No individual characteristic was either necessary or sufficient for demarcation, but if you garnered "enough" of them, you could be suitably tossed into the dustbin of crankishness.[30] The same problems bedevil this approach as Popper's: How do you know when you should tick off a criterion, when the alarm has in fact been tripped? And, more problematically, quite a few of these characteristics are displayed by perfectly legitimate (if somewhat cantankerous) representatives of the scientific community, and plenty of supposed pseudosciences met the test of "scientific naturalism" (Velikovsky, for example). Demarcation eludes us once again.

By the late 1970s, philosopher of science Larry Laudan had had enough: "The fact that 2,400 years of searching for a demarcation criterion has left us empty-handed raises a presumption that the object of the quest is nonexistent."[31] Pseudoscience was a problem, he suggested, but it might not be amenable to a philosophical solution. In a 1983 article—controversial in that it appeared in the context of legal wrangling over the scientific status of creationism and whether it should be taught in the public schools—

Laudan laid out what a proper demarcation criterion ought to do in order to be worthy of the name: "Minimally, then, a philosophical demarcation criterion must be an adequate explanation of our ordinary ways of partitioning science from nonscience and it must exhibit epistemically significant differences between science and nonscience."[32] By Laudan's estimation—and that of many philosopher colleagues—there was never going to be a simple criterion such as Popper had imagined, and checklists were simply collections of Popperian-style criteria. Laudan has come under his own share of criticism, and debates continue decades later on this question, but even his most vocal critics concede that "we should not expect a sharp, bright pinline of demarcation."[33] Meanwhile, Laudan insisted on a transformation of language: "If we would stand up and be counted on the side of reason, we ought to drop terms like 'pseudoscience' and 'unscientific' from our vocabulary; they are just hollow phrases that do only emotive work for us."[34]

As "pseudoscience" gained currency as a term of abuse, one finds a wave of attempts beginning largely in the 1980s among academic observers of science (if not among scientists themselves) to find alternatives to the term. Some of these contenders continue to be popular: unorthodox science, non-establishment science, cryptoscience, parascience, emerging science, protoscience, unconventional science, and anomalistics.[35] (One *does* find people self-identifying under these categories.) At the same time, it became increasingly clear that "pseudoscience" picked out different phenomena from frauds or hoaxes—those displayed levels of conscious insincerity that appeared to be wholly absent in the often-cited cases of alleged pseudoscience.[36] Another common term, "pathological science," is also inappropriate. Coined by Nobel Laureate Irving Langmuir in an often-cited 1953 lecture, this described scientific claims that hovered on the edge of perception, faint effects that drifted perilously close to experimental error and were magnified by wishful thinking.[37] Pseudoscience must also be distinguished from "anti-science," movements such as those of the 1970s arguing that scientific and technical reasoning were leading civilization down the wrong path. As science studies scholar Helga Nowotny observes, this was not pseudoscience's domain, for "in many ways, the pseudo-sciences aspire to become scientific."[38] And despite the popular (in the sense of populist) character and participatory nature of many alleged pseudosciences, the notion also has to be separated from "amateur science," which is ordinary science performed by those other than professionals.[39]