HOW TO THINK LIKE A SCIENTIST

In order to grasp just how far psychiatry's brand of science deviates from established norms of credibility, it's necessary to have a basic understanding of how scientific knowledge is supposed to be acquired and confirmed. For this reason I've decided to include a brief overview of scientific principles—an introduction for those who never learned the material, and a refresher for those of us who might have forgotten some of it. A couple of colleagues have questioned my need to include this chapter at all, on the contention that the subject is boring. I'll try to avoid this pitfall by keeping it short and sweet. Hopefully by the end of the chapter any reader will be able to think like a scientist—that is, to doubt all, until that doubt is convincingly overcome.

As a child of the Sixties—a time when science had bipartisan respect, and was considered to be the best hope of both the nation and the world—I'm dismayed to see just how little science is understood by much of the general population today. The popular conception of science evokes images of laboratories, space travel, or other technological hardware with which we are all familiar. But the word "science" doesn't refer to gadgets or any of the physical trappings of research. Rather it is *a system of acquiring knowledge to describe and explain natural phenomena*, and the body of knowledge that has been attained using that system. Its defining process is *the scientific method*, a logical and rational order of steps that is used by scientists to come to consensual conclusions about the world around them.

One of the most appallingly ignorant claims spouted by science's opponents nowadays is that science is a faith in itself, when nothing could be further from the truth. Science is in its essence the *antithesis* of faith, because

its driving purpose is to doggedly question any perceived truth rather than accept it. The skepticism that its detractors despise is in fact the life's blood of science. A natural byproduct of this skepticism is disagreement among scientists, an inherent ambiguity that's accepted (often grudgingly) within the scientific community, but misperceived as weakness by onlookers who expect scientists to just figure out the truth and agree on it once and for all. Ingrained self-doubt makes for lousy sound bites on television—and thus is no match when pitted in debate with an opposition that speaks with unwavering emotional conviction, and is in dogmatic, lockstep agreement on *any* stupid old notion.

But these bogeymen of the culture wars are not the only enemies of science today. Like any other human enterprise science is corruptible, especially when a lot of money is at stake. And at a time when psychiatry lays claim to being scientifically based, it has in fact abandoned the essential incredulity that the scientific method demands, instead promulgating pseudoscientific myths to create the illusion of precision where there is none.

My use here of the term "myth" is not meant to imply outright falsehood, as it often does in casual parlance. Rather I am referring to a belief that is not firmly grounded in scientific fact, and requires an element of faith in order for one to hold it in certitude. The resurrection of Jesus is such a myth, as is the Hindu belief in reincarnation. Neither of these beliefs is based on established scientific fact or confirmatory observation, but I would be remiss in claiming either of them to be a falsehood.

Although the myths of contemporary psychiatry may have their origins in scientific observation, they are more thoroughly sustained by faith than by hard scientific proof. Countless millions in research dollars have been spent amassing evidence to prop up the biological model and promote

pharmaceutical products, generating conclusions that don't hold up to the level of scrutiny that science historically demands. The quality and quantity of data are rendered scientifically irrelevant by an interpretative process that is fundamentally flawed, with a brazen neglect of the guiding precepts that have been at the foundation of scientific study for nearly a millennium.

So how is anything ever proven at all? By rigorous application of the aforementioned scientific method—which has been described by Dr. Jose Wudka, a physicist at the University of California at Riverside, as "the best way yet discovered for winnowing the truth from lies and delusion". Introduction of the scientific method is generally attributed to the great Persian physicist and mathematician Alhazen, who in the early 11th century performed rigorous experimentation to test and verify hypotheses in his revolutionary study of optics. For the past thousand years it has prevailed as the prescribed manner in which any hypothesis, or working assumption, is put to the test and validated. Briefly stated, the steps of the scientific method are as follows:

1) **Observe and describe a phenomenon.**

2) **Formulate a hypothesis to explain the phenomenon.**

3) **Use the hypothesis to predict outcomes.**

4) **Test the hypothesis through experimentation and/or further observation, and modify the hypothesis in light of the results.**

5) **Repeat steps 3 and 4 *until there are no discrepancies between theory and results*.**

Once a hypothesis has been sufficiently confirmed by observation and experimentation that it is consensually accepted as proven by the scientific community, it is referred to as a *theory*—a conceptual framework that is now used to explain existing observations and to predict new ones. Such theories, like the *theory of evolution* or the *theory of relativity,* function as jumping off points for the creation of more hypotheses, further observation and experimentation, and the continued expansion of the body of scientific knowledge.

Note that this use of the word "theory" is very different from the way that it is used in everyday language, where it conveys doubt and speculation. The common interpretation of "theory" is in fact synonymous with that of "hypothesis" as defined above, which contributes significantly to the popular misconceptions surrounding science today. While in science no theory is unquestionable—keep in mind that almost *nothing* in science is actually unquestionable—it is by definition a proposition that is widely accepted, and certainly enough to hang one's scientific hat on. Unfortunately, critics of science have exploited this ambiguity, and the public's general ignorance of how science works, to cultivate disbelief. After all, the theory of evolution is "just a theory"—and if your personal definition of "theory" is a dubious supposition rather than a generally accepted fact, then a scientist's unqualified endorsement might indeed appear imprudent.

To return to the method itself, note that the intention of the last two steps could casually be described as "the identification and elimination of all bullshit"—as implied by the strict and unforgiving standard set in step 5 for confirmation of a theory. This ceaseless process of refinement is customarily sidestepped by those who are ideologically or economically invested in achieving a desired outcome, rather than allowing the truth to reveal itself. I

euphemistically refer to such advocates as “true believers”—which admittedly is giving them the benefit of the doubt—and wherever pseudoscience rears its ugly head they are usually around, generating “alternative” theories to counter established ones. Thus when religious opponents of evolution promote the concept of *intelligent design*—a feelgood hypothesis that maintains that there *must* be an engaged Creator because it *seems* like there is—they scorn any effort to test or modify this supposition, an act which is in itself a tacit admission that the proposal is based on faith rather than science. The theory of evolution, on the other hand, is validated every time a drug-resistant strain of bacteria emerges. Likewise those who disclaim the role of carbon emissions in global warming eagerly grasp at hypotheses that don’t implicate human commerce, such as increased solar activity. The fact that such a hypothesis may not be complete malarkey makes it a better brand of b.s.—but it still hasn’t been put through the scientific wringer of “observe, predict, test, modify, and repeat” that the carbon emissions hypothesis has, which is why the latter is gradually becoming an accepted scientific theory.

This cyclical pattern of reinventing a knowledge base is particularly prevalent in medical science, where life-or-death challenges frequently impel the use of technologies whose scientific mechanisms are not yet completely understood. Even after extensive pre-release testing, the rollout of a new pharmaceutical product marks the beginning of more extensive clinical study of its efficacy and safety, which may eventually lead to withdrawal of the drug from the marketplace, or the discovery of alternate uses for the drug. Surgical techniques and other technologies undergo a similar process of examination under fire, necessitated by the wondrous complexity and unpredictability of the human body. When I began medical school in San Antonio the entering class was addressed by the Dean of Academic Affairs, Dr. Carlos Pestana, who

informed us that half of everything we would learn there was wrong—but unfortunately we did not know yet which half that was. This is the evanescent character of proper science, a natural result of consistent application of the scientific method to our existing body of knowledge.

The scientific challenges facing psychiatry are even greater than that of other medical specialties, in large part because the brain is even *more* wondrously complex and unpredictable than the rest of us is. This knowledge deficit has historically led psychiatry to play fast and loose with science, often making up theory as it goes along with little if any evidence to confirm its validity. Although our knowledge base has exploded in the wake of recent technological advances, this bounty has been a magnet for the intrusive interests of the pharmaceutical industry, managed care companies, and others. The flawed science of yore largely resulted from the confluence of blind ignorance and ego; more corrupt and sinister influences are contributing to its modern counterpart.

The sad truth is that most of psychiatry's scientific knowledge today is in a state of developmental arrest, stuck on a warped rendition of step 3 which could be restated as: "Use the hypothesis *to market psychiatry and its products*". Like the advocates of intelligent design, psychiatry's research institutions are bent on producing data that supports a myth—specifically, the one that psychiatric disorders are caused by chemical imbalances. (We'll explore the scientific validity of this hypothesis later.) Rather than submit this hypothesis to reexamination and modification *until there are no discrepancies* as dictated by steps 4 and 5 of the scientific method, marginal findings are instead accepted as confirmatory, and inflated in significance so they can be used to generate pharmaceutical sales pitches.

Our profession's susceptibility to this sort of corruption stems in large part from a larger social phenomenon—the growing disparity between our understanding of science and our familiarity with *technology*, which is the means by which people provide material objects for human sustenance and comfort. The main impact that science has on our day-to-day lives arises from the technology that is derived from it, rather than from the science itself. The ability to utilize a technology does not typically require any knowledge of the underlying science, especially as "user-friendliness" of the technology is perfected. The resultant sense of comfort can lull us into a deluded state of "understanding" the familiar technology, while knowing little or nothing about the science that makes it possible. This scenario is common with workers in technological careers, where the skillful use of high-tech tools can confer significant power to those who lack any scientific background. In such cases the scientific knowledge has been "outsourced" to those who designed the technologies—who presumably have done all the scientific reasoning for us, just so we don't have to.

Unfortunately this is largely the case in contemporary psychiatric practice. Sure, psychiatrists are expected to have a cursory understanding of brain physiology, and the ability to drop the names of neurotransmitters that are known to be involved in psychiatric illness—but there's little way that this knowledge can be applied directly to patient care in our day-to-day practice, since the physiology can't be directly observed and the neurotransmitters can't be measured. (This stands in direct contrast with other medical specialties such as internal medicine, where the science is observable and intimately connected to clinical practice.) A passably mediocre psychiatrist today doesn't actually need to understand neurophysiology—or feelings, marital stressors, job dissatisfaction, or much of anything else it seems—all he

or she really needs to know is what pills are supposed to be prescribed for what symptoms, the medical risks of those pills, and how to execute the patient management challenges of psychiatric practice without getting sued. That's because practicing psychiatrists today are more technicians than scientists, relying on a knowledge base that is spoon-fed to them by the institutions of academic psychiatry and the pharmaceutical industry.

A lot of psychiatrists will resent this characterization, but it's readily substantiated by the evident lack of skepticism and intellectual curiosity in our profession today. In past decades psychiatrists held a reputation for being oddballs with their heads in the clouds. This may have been related in part to the utter dearth of hard science data available to apply to their clinical challenges, requiring them to use their imagination to fill in the voids. But at least no one accused them of being *thoughtless*. In this book I raise serious questions about what passes for conventional wisdom in psychiatry today—questions that would be superfluous if the academic institutions of psychiatry rigorously applied the scientific method to their conclusions, and if practitioners were themselves more inquisitive.

Despite the ubiquity of technology in our society, the general public seems to have little understanding about the nuts and bolts of scientific process. A large segment of the population views scientists as a smug bunch of know-it-alls, with ambivalence giving way to outright hostility in certain quarters. In the past doctors functioned as an important conduit of scientific education to the community, often the only scientifically-minded individual one might find in a rural community. (Like, say, The Professor on "Gilligan's Island".) Contemporary media have taken up much of the slack in dispensing scientific information, but have done little to demonstrate the process of scientific *reasoning*. Reengagement of the healthcare community in

education of the lay public, and demystification of the scientific method, would contribute greatly to the rehabilitation of science's frayed reputation. For this reason alone it would be beneficial if doctors could take it upon themselves to maintain firm adherence to the scientific method in their clinical judgments and communications—rather than dutifully swallowing a pharmaceutical sales pitch, and then regurgitating it to their patients.

A thousand years ago Alhazen described the core mission of science to be the acquisition of *truth*—and even in his time he recognized that this mission was extremely vulnerable to distraction, or even corruption. As he stated:

> Truth is sought for its own sake. And those who are engaged upon the quest for anything for its own sake are not interested in other things. Finding the truth is difficult, and the road to it is rough.

With no scientific knowledge at all you can still *think* like a scientist, simply by pursuing the truth to the exclusion of all other considerations, while exercising all the skepticism you can muster. You will find little in this book that attempts to assert any hard scientific truths—because the determination of scientific truth occurs through the exhaustive efforts of a community, rather than the musings of an individual. I'm limited to shooting intellectual spitballs at an edifice that by my reckoning has even less to do with real science than I do, because it is no longer engaged in the pursuit of truth. With that in mind, I invite you, the reader, to do your worst in scrutinizing every observation that I offer for your consideration.