

ARTICLE***THE SEARCH FOR "SCIENTIFIC KNOWLEDGE" IN FEDERAL COURTS IN THE POST-FRYE ERA: REFUTING THE Assertion THAT "LAW SEEKS JUSTICE WHILE SCIENCE SEEKS TRUTH"****Howard A. Denmark †***Table of Contents**

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I. INTRODUCTION

A number of authors have attempted to define the differences between legal and scientific methods of finding facts.¹ More than an academic exploration of two separate ways of defining truth, this comparison highlights some difficulties in using scientific evidence in court. In the words of Forensic Science Professor John Thornton:

Without law there are no enforceable standards dealing with any scientific problem; without science there are no feasible means to resolve conflicts that inevitably accompany the many technical aspects of civilization. Law and science have become bedfellows.²

The use of expert and scientific testimony has increased in recent years.³ Until quite recently, the decision of whether to admit novel scientific evidence was governed by *Frye v. United States*,⁴ a 1923 decision that required courts to examine whether the basis of any given expert opinion was generally accepted by experts in the field from which the novel evidence came.⁵ Since the adoption of the Federal Rules in 1975, however, the *Frye* test has lost adherents,⁶ and was recently declared incompatible with the Federal Rules of Evidence by the United States Supreme Court in *Daubert v. Merrill Dow Pharmaceuticals*.⁷

The Court in *Daubert* faced the issue of whether a plaintiff, alleging harm from exposure to a prescription drug, could introduce into evidence a controversial technique of mathematical analysis in order to show causation.⁸ The Court undercut the *Frye* requirement that trial judges look to general acceptance of the technique by experts in the relevant field. The Court did, however, admonish judges to explore carefully the expert testimony proffered.⁹

Trial judges are left with a difficult task—as scientific, mathematical, and technical lay persons, they must analyze opinions involving matters far beyond their knowledge. When the evidence comes from scientific sources, judges will be required to understand not only the specific scientific evidence, but also the world of science, since the Supreme Court has now instructed trial judges to determine, as an admission threshold, whether the evidence is in fact "scientific knowledge."¹⁰ The Court directed judges that scientific knowledge must be learned through scientific methods, and referred to several books on the philosophy of science that are not likely to be found in courts' libraries.¹¹

A judge searching the legal literature for guidance on how scientific fact-finding differs from legal fact-finding will encounter numerous statements that science exists for the pursuit of truth, whatever its source and wherever it may lead, while law uses truth only as a stepping-stone toward its true goal of justice.¹² One particularly articulate formulation comes from Professor Milton R. Wessel:

The two disciplines [law and science] have different objectives: Science seeks to find truth, making it possible to cure or prevent disease, develop new technologies, and make better predictions. Law seeks to find societal accommodation, making it possible for people to live together peacefully. Truth is a *desideratum* in legal process, not a *sine qua non* as in science.¹³

The commentary on this issue can be reduced to the following heuristic: Science exists to find truth, while law exists to serve justice.¹⁴ According to this understanding, the law is willing to ignore facts to achieve a just result, while science will not ignore relevant data because the mission of science is to describe the world.¹⁵

This article will compare fact-finding in a courtroom with fact-finding in science. The scientific fact-finding focus will not be on how individual scientists conduct experiments or convince themselves of scientific facts. Rather, the inquiry will be how the institutions of science determine the state of scientific knowledge. The article will then explore the heuristic found in the legal literature and in court decisions that the difference between legal and scientific inquiry is that law seeks justice while science searches for truth. The basis of the heuristic, the myth that science is entirely factual, cold, and separate from other human endeavors, will be explored and rejected. Finally, the article will conclude that some useful comparisons and contrasts may be drawn to help those familiar with legal fact-finding identify scientific knowledge. However, the heuristic "science seeks truth; law seeks justice" should be rejected.

Many articles have contrasted the individual scientist's approach to fact-finding with the law's approach.¹⁶ These analyses have compared courtroom procedures by which parties to litigation convince the neutral trier of fact, with the way in which *individual scientists themselves* become convinced of scientific facts. This focus appears less useful than contrasting courtroom fact-finding with how "science," as opposed to an individual scientist, adopts certain information as fact.¹⁷ A given scientist can come to believe many things that science as an institution does not accept.¹⁸ Particularly in light of the Supreme Court's recent directive that novel scientific evidence should be admitted only if the trial judge finds it is "scientific knowledge"—which seems to imply that the trial judge should find it acceptable to science generally rather than to a given scientist who could be persuaded to act as a witness—an exploration of how "science" decides what is fact is far more valuable than an analysis of how individual scientists make that determination.

II. FINDING FACTS IN LAW AND SCIENCE

A. Finding Facts in Law

In law, facts are found in court, mostly by the testimony of witnesses. The American legal system places great faith in face-to-face confrontation as the principal source of the reliability of testimony.¹⁹ In ringing phrases, Dean John Wigmore declared cross-examination "the greatest legal engine ever invented for the discovery of truth."²⁰ The United States Supreme Court and a number of state courts have adopted Wigmore's view.²¹ Thus, courts believe that a reliable fact-finding process depends upon the ability of the parties to ask hostile questions designed to find flaws in a witness's testimony.²²

Trial judges exclude objectionable evidence so that the trier of fact will not be allowed to hear it or, if it is heard, instruct the trier to ignore that evidence.²³ In an extreme case the admission of such evidence would be grounds for a mistrial which would bring in a new trier of fact whose decisions would not be tainted by exposure to the faulty evidence.²⁴ Courts of appeal review trial judges' evidentiary rulings and juries' findings (albeit under very deferential standards of review),²⁵ acting as the final arbiters of what evidence is admissible. The courts of appeal act not only to achieve just results in the cases before them, but also to set down rules for cases yet to come.²⁶

B. Finding Facts in Science

Scientific data are developed in the less adversarial atmosphere of the laboratory or observation station. Scientists communicate their findings through science journals. Publishing one's research in a peer-reviewed journal is the accepted avenue by which scientists announce their findings to the profession.²⁷ The editors of scientific journals distribute submitted articles to panels of scientists working in the relevant discipline for expert criticism.²⁸ Peer review is designed to block publication of sloppy, trivial, or fallaciously premised work. Moreover, once an article is published, scientists concerned with those results may analyze the work and refute it if possible.²⁹ Publications are extremely important to scientists, since their professional reputations rise and fall with the perceived merit of their articles.³⁰ While there are scientific conferences, and it is not uncommon for scientists holding opposing positions to argue or question each other in a public forum, this type of confrontation is not considered the source of scientific reliability.³¹ Ultimately the view of the scientific community defines what is a "scientific fact," which is determined by scientists' publications rather than by the outcome of debate or cross-examination in an oral forum.³²

The institution of journal science imposes at least two barriers to publication. First, given that professional reputations rest on the quality and quantity of one's publications, scientists may hesitate to submit what they consider inadequate work to peer-reviewed journals. Second, an editor may choose not to publish a piece, preventing it from coming before the community of professionals with the same authority as information published in reliable, peer-reviewed journals.³³

Publication alone cannot elevate a scientist's work to the level of an accepted scientific finding; rather it merely begins the critical process by which the transformation is possible.³⁴ Because even competent, well-trained, honest experimenters make errors in experimental procedures or in drawing deductions from their data, science journals publish much that will someday be revealed as misleading or untrue.³⁵ Only when a scientist places work in professional, peer-reviewed journals so that its limitations can be tested by other scientists, and only when it passes those tests, does the view of the scientist rise to the level of "accepted scientific fact."³⁶

C. The Exclusion of Unreliable Evidence

Both law and science have rules excluding evidence that is insufficiently convincing to form the basis of a conclusion. Indeed, it would be difficult to imagine any profession that did not have some mechanism for deciding what is and what is not authoritative knowledge.³⁷ Nonetheless, these rules of proof do not enjoy wide application in our daily lives. For example, we may listen to many people's opinions about the reliability of certain automobile models when we consider buying a car, but never ask for the speaker's source of knowledge. If we were to ask, we might be satisfied with the fact that some relative of the speaker had a bad experience with such a car.

1. The Exclusion of Unreliable Evidence in Law

In law, fact witnesses are not permitted to testify unless they have personal knowledge of the subject on which they are to speak.³⁸ Courts refuse to hear about the speaker's relatives' cars secondhand from the speaker. Rather, a court will accept testimony from the person who directly perceived the facts, or make its decisions without those facts. The speaker who merely relates the personal experiences of a third party is offering evidence usually deemed unreliable.³⁹ This problem is not only one of hearsay, but also of the competence of the witness.⁴⁰

2. *The Exclusion of Unreliable Evidence in Science*

Science also considers certain kinds of information too unreliable to count as proof. For example, anecdotal evidence is not scientific proof, but is, at best, a reason to do further research. Thus an isolated report consisting of some observation made under noncontrolled conditions might find its way into a science journal to open discussion or stimulate research on a topic.⁴¹ However, it is not deemed proof.⁴²

The scientist, when told that the speaker's relative had a bad experience with a certain car model, would not necessarily deny the truth of the story, but would reject it as proof that other models of the car also would be defective. The result would be "proved" to the scientist's satisfaction if sufficient tests were conducted on other cars of the same model or if further data were obtained and analyzed.⁴³ Then the scientist typically would issue a statement of probability about how likely a car of this model is to have certain problems, since science tends to express its findings mathematically and probabilistically.⁴⁴

3. *Conclusion*

Law and science take the following common approach to fact-finding: certain evidence is unreliable and should be excluded from consideration. The search for truth, or justice, is not advanced by accepting uncritically what anyone may wish the arbiter of facts to consider. In law, the judge may keep information from the jury or refuse to consider it if acting as the trier of fact. The courtroom is the locus of fact-finding and the jury or judge decides which version of the story told in court is true. Science journal editors, as the gatekeepers of information in the world of science, refuse to publish research that does not appear reliable, denying it the legitimacy normally required for it to become an accepted scientific fact.⁴⁵ Unpublished research may be disseminated through other media, but the trier of fact in this case the community of scientists will discount that evidence because it believes that such non-reviewed media lack reliability.⁴⁶

III. THE MYTHOLOGY OF "COLD SCIENTIFIC FACT"

Numerous articles have discussed the idea that law and science speak different languages.⁴⁷ A 1973 analysis of lawyers' sources of information about science revealed that many lawyers learned what they knew of science from newspapers or newsweeklies.⁴⁸ Lawyers may find it even harder to discover information about the everyday practice of science, as opposed to the substance of science.⁴⁹ One problem arising from lawyers' lack of knowledge of the operation and activities of science is that they tend to bring mistaken notions of science with them into dispute resolution.

A. The Myth of Science as "Just Facts"

There are a number of references in legal literature to science as cold and unconcerned with the broader implications of its work. One frequently cited article published in Federal Rules Decisions asserted that:

Science is neither fact nor law. It is a search. At the cry of 'eureka,' science stops. Science is learning-the search for knowledge. . . . *The purpose and function of science is to learn physical facts. . . .*

When understood as the source of the just society, law, to remain law, must be humanistic. When understood as the search for facts, *science, to remain science, must never be humanistic.*⁵⁰

Legal literature identifies science with facts and with certainty.⁵¹ Scientific facts are supposed to arise from objective examination of indisputable evidence, leading dispassionate scientist-observers to conclusions beyond reasonable challenge.⁵² This view of science, one among a cluster of perceptions that some commentators on the sociology of science have labeled "The Storybook Image of Science,"⁵³ is false.

Science is far more than a collection of facts, mechanically displayed.⁵⁴ Rather, science always includes a search for order among facts.⁵⁵ A given set of scientific observations can support any number of alternative hypotheses which the scientist must eliminate from consideration.⁵⁶

In the works of Charles Darwin, for example, one finds the organization of facts far more important than the physical facts themselves.

In Darwin's time there was little doubt that physical characteristics of animals had changed over time and varied with geography.⁵⁷ Fossil records showed that species exhibited change and that whole species had disappeared. A lively debate existed as to why this should be so.⁵⁸

One possible explanation was that acquired characteristics of individual animals could be passed on to their young.⁵⁹ This theory posits, for example, that animals living in cold environments will give birth to offspring with thicker fur or skin because the animal so desires. Thus, an animal's desires cause it to change or select the characteristics it passes on.⁶⁰ An Australian scientist, Paul Kammerer, attempted to prove this hypothesis in the 1920s through his work on "midwife toads."⁶¹ These toads breed on land, but a few of them are born with rough pads on their front feet which are necessary for mating in water. To prove that the needs of one generation cause genetic alterations in the next, Kammerer forced the toads to live in a water environment. He raised the eggs of the few toads that were able to breed under these difficult conditions and repeated the process for a few generations, after which a large percentage of the toads were born with the rough pads rare in midwife toads living in nature.⁶²

Kammerer thought he had proved his hypothesis—that the toads in some way understood that pads were necessary, and so actively passed on to future generations this useful anatomical change. However, Kammerer's work just as easily, and more accurately, illustrates the Darwinian model of evolution. In Darwin's terms, Kammerer imposed a strong selection pressure that allowed only those toads that carried the gene for rough pads to survive. After a few generations of mating only toads carrying the relevant gene, the population had a much higher incidence of rough pads. Understood in evolutionary terms, the experiment confirmed natural selection as the mechanism of change in species rather than some desire to pass along useful traits.⁶³

Charles Darwin fit the physical facts known to many "naturalists" of his generation into a framework that explained them in terms of natural and observable forces.⁶⁴ His pivotal work, *On the Origin of Species*, contains a hodgepodge of facts about pigeons, woodpeckers, plant seeds, blind cave fish, ants, bees, and the predator-prey relationship between deer and wolves.⁶⁵ Mere facts, however interesting, could not have won for Darwin's book its status as a world-changing scientific work.⁶⁶ Rather, Darwin's enduring contribution to science was the organization of diverse data into a general theory that explained how species developed. Without adding a single new fact of any consequence, *On the Origin of Species* became the cornerstone of modern biology.⁶⁷

The attempt to reduce science to a collection of facts, or to reduce the work of scientists to seeking physical facts, ignores the important role of theory in science. Just as history is far more than a list of dates paired with occurrences, science is broader than a gathering of facts. One could know the date of each event in the life of a country and still know little of its history.⁶⁸ Similarly, the ordering of facts into a theory reflects the goal of science far more than the discovery of the facts themselves.

The job of science does not end even after the theory is developed. Some sciences, like meteorology, then seek to predict future events.⁶⁹ Finally, some sciences seek to enable us to exert control over our world.⁷⁰ In no way, however, can one say that the ultimate purpose of science is to collect and display facts, or that the process of science stops as to a given question when enough physical facts are unearthed.

B. The Myth of the Disinterested Scientist

Another flaw in the legal literature's storybook image of science is its picture of the scientist as utterly nonpartisan.⁷¹ According to this view, scientists assiduously avoid formulating theories, but rather collect facts and proceed by pure induction until enough facts exist to provide a comprehensive understanding of the problem under investigation.

One of the most extensive explorations of the neutrality of scientists was conducted by Professor Ian Mitroff, who undertook interviews with scientists involved in lunar research just before the first American moon landing.⁷² Scientists had theorized for years on what moon rocks would reveal about the origin of the moon, our solar system, and perhaps the rest of the cosmos. The chance to record people's beliefs first in the absence of crucial data, and then again after the rocks were analyzed, was an ideal way to study how scientists change their views as new evidence develops.

Professor Mitroff asked scientists a series of questions, including one about whether scientists were objective, engaged in a disinterested search for truth. He reported:

All of the 42 scientists interviewed indicated in one way or another that they thought the notion of the objective, disinterested scientist was naive. The vocal and facial expressions that accompanied the verbal responses were extremely revealing and important. They ranged all the way from mild humor and guffaws to extreme annoyance and clear expressions of anger. The respondents felt that the only people who took the idea of the objective, disinterested

scientist literally and seriously were the general public. . . . Certainly no working scientist, to quote one of the respondents, "believed in that simple-minded nonsense."⁷³

Scientific non-objectivity may stem from the nature of scientific inquiry itself. Research begins with selection of a hypothesis, even if it is only a temporary one, to guide the scientist in looking for and evaluating data.⁷⁴ The selection of hypotheses, vital to the growth of scientific ideas, forces scientists to become partisans for their particular ideas.⁷⁵ For many researchers, partisanship to ideas is a way of life.⁷⁶ While the storybook image of science portrays scientists as willing to abandon their views at the first sign of contrary data, world-renowned physicist Max Planck stated an opposite view that seems more in accord with human behavior:

A new scientific truth does not triumph by convincing its opponents and making them see the light, but rather because its opponents eventually die, and a new generation grows up that is familiar with it.⁷⁷

C. The Myth of Science as Detached from All Other Human Endeavors

A final perception of science is that science and scientists live outside of our everyday world.⁷⁸ The scientist may be seen as a different sort of person than most of us, living withdrawn from worldly concerns.⁷⁹ However, in reality scientists do not conform to the image of the middle-aged white man in a white lab coat, happily closeted away from human companionship with his test tubes.⁸⁰ And as for the world of science, it is shaped by social, political, and economic forces, and it, in turn, helps to shape society.⁸¹

Even if it were true that the institution of science is withdrawn from worldly concerns,⁸² modern ethics would not exempt it from moral obligations. Science is treated as part of society and remains subject to society's ethical rules. At the Nuremberg trials that followed the Second World War, some Nazi medical researchers whose experiments killed or crippled unwilling subjects argued that they were ordered to conduct certain experiments for the good of the state and in the pursuit of useful knowledge.⁸³ They claimed that judging the morality of research was not part of their roles as scientists. If society needed knowledge and their government ordered them to get it, then they had met their ethical obligations by doing the research.⁸⁴

This attempt to apply logical positivism to justify the murder of unwilling experimental subjects was rejected, and the doctors who killed their experimental subjects were convicted of crimes against humanity.⁸⁵ Those scientists and doctors indeed sought facts, but their actions were to be judged within a broader social context. As this extreme example shows, science is considered part of the larger world outside the laboratory walls.⁸⁶

IV. THE BELIEF OF "LAW SEEKS JUSTICE AND SCIENCE SEEKS TRUTH"

The misperception of science as an exclusively factual, emotionless world, detached from the rest of human endeavor, leads legal commentators to conclude that the main difference between law and science is that law exists for the purpose of serving justice, while science is a pure search for truth.⁸⁷ The support offered for this conclusion, when it is discussed and not merely asserted, is that the law excludes certain facts from consideration of guilt or liability, while science presumably reviews all relevant facts in its inquiries. Again, Professor Milton Wessel stated this view succinctly:

The legal process seeks societal accommodation through "justice," which it equates with "fairness" and "equity." It does not necessarily always seek the truth, which is the final objective of science. Indeed, sometimes the law blocks the search for truth. The law may preclude inquiry into matters protected by attorney-client, physician-patient, priest-penitent, or Fifth Amendment privilege. It may prevent the introduction of evidence violating a statute of frauds or the parol evidence rule; it may exclude evidence of a confession coerced or obtained by unlawful search or wiretap, or in many other ways prevent an arbiter from receiving information a scientist would insist upon having before coming to judgment.⁸⁸

A number of other commentators have also drawn this distinction between the disciplines. For example, one author asserted, "[t]he scientific and legal systems both stem from a common historical purpose-ascertaining the truth-but the conceptual approach differs markedly between them. Science seeks truth with impartial objectivity; law seeks a truth tempered with justice."⁸⁹ Yet another legal commentator wrote,

[t]he objectives of science are those of understanding natural phenomena and gaining control over the complex determinants related to man's biology, behavior, and his relationships to the world. In this system, "scientific truth" holds the highest priority. . . . [L]egal process is also defined as legal justice, and this justice, as a value, holds the highest priority as a positive value in the legal system. . . . But for legal justice many factors come into play; and justice is not

dependent solely upon 'scientific truth.' In fact, for the purpose of legal justice, social policy concerns may outweigh and override the weight of "scientific truth."⁹⁰

In analyzing scientific disputes, some courts have adopted—with citations to the legal literature—the simple equation of law with justice and science with truth.⁹¹ For example, in *Rubanick v. Witco Chemical Corp.*, the New Jersey Supreme Court expressly relied on a "law seeks justice; science seeks truth" analysis to justify creating an exception to the state courts' limitations on the admissibility of expert testimony in toxic tort litigation.⁹² Thus it appears that this simple formula has the intellectual force to alter, or perhaps justify alteration of, American law. Two recent federal court decisions accepted the "law seeks justice; science seeks truth" analysis, but left unclear how this analysis influenced the decisions.⁹³

IV. LEGAL RULES THAT EXCLUDE RELEVANT EVIDENCE

The heuristic that law seeks justice while science seeks truth is based on the existence of legal rules excluding relevant, probative evidence.⁹⁴ Accordingly, an exploration of those rules and any analogous rules in science, together with the policies underlying those rules, is necessary to assess the validity of the heuristic.

A. The Nature of the Exclusion

In American courts, relevant evidence is presumed admissible for consideration in determining factual issues.⁹⁵ However, facts discovered by certain illegal or unethical means are excluded to preserve the dignity of judicial institutions or to discourage future misconduct.⁹⁶

Governments create laws, and then create courts to adjudicate and administer laws. Courts in America then dictate to law enforcement agencies that certain techniques of gathering evidence are impermissible. No judge or court marshal is present when law enforcement agents decide to gather evidence in an impermissible way. In the sense of direct intervention, courts cannot stop certain kinds of misconduct. Nonetheless, they purport to dictate behavior to agents in the field.

When the standards of conduct courts establish are violated, courts may respond by excluding illegally obtained evidence from consideration. It is not the underlying facts themselves that a court refuses to consider, but rather the court excludes certain facts because of the way in which they were discovered.⁹⁷ Evidence obtained illegally might be excluded, but evidence relating to the same ultimate issue would be admitted if it had been obtained in a proper manner.⁹⁸

B. The Rationale for the Exclusion

Why does the legal system exclude evidence that might have assisted the trier of fact in reaching a truthful determination? The following review of several areas of evidence illuminates the rationale behind certain exclusionary rules in the law.

1. Coerced Confessions.

The United States Constitution guarantees that "No person . . . shall be compelled in any criminal case to be a witness against himself."⁹⁹ Thus, the Constitution is violated if a coerced confession is used to convict a criminal defendant.¹⁰⁰ In *Stein v. People of State of New York*,¹⁰¹ the United States Supreme Court explored the bases for excluding coerced confessions from evidence. This 1953 decision explained that:

Coerced confessions are not more stained with illegality than other evidence obtained in violation of the law. But reliance on a coerced confession vitiates a conviction because such a confession combines the persuasiveness of apparent conclusiveness with what judicial experience shows to be illusory and deceptive evidence. A forced confession is a false foundation for any conviction, while evidence obtained by illegal search and seizure, wire-tapping, or larceny may be and often is of the utmost verity.¹⁰²

The Supreme Court held in *Stein* that one powerful reason to bar coerced confessions from evidence is their unreliability. This case was consistent with the early common law, which relied upon the unreliability of coerced confessions as the sole basis for their exclusion.¹⁰³

The law, like any profession or area of specialized knowledge, defines what is and what is not reliable information, and will exclude the unreliable with little anguish.¹⁰⁴ But if the only reason to exclude coerced confessions is their unreliability, as *Stein* held, then a

reliable coerced confession should be admitted into evidence. Even if a confession wrung from torture-battered lips is inherently untrustworthy because the victim might say anything to stop the pain, such a confession might nevertheless be reliable if it contains details known only to the perpetrator. Exclusion is more difficult to justify when a coerced confession is reliable.¹⁰⁵ The law is not removing unreliable evidence in such a case, but rather excluding valuable evidence in order to serve some other, presumably higher, goal.

The *Stein* case was followed for less than a decade. In 1961 the United States Supreme Court retreated from any suggestion that reliable coerced confessions might be admissible.¹⁰⁶ By 1964, the Court held explicitly that admitting involuntary confessions against a criminal defendant would not be allowed because of the "strongly felt attitude of our society that important human values are sacrificed where an agency of the government, in the course of securing a conviction, wrings a confession out of an accused against his will. . . ." ¹⁰⁷ The Court went on to reiterate its belief that " 'in the end life and liberty can be as much endangered from illegal methods used to convict those thought to be criminals as from the actual criminals themselves.' " ¹⁰⁸ Thus, the Court justified excluding possibly probative, reliable evidence by saying that failure to do so would result in a decline in our life, liberty, and level of civilization.

Another concern cited by courts as a primary reason for excluding involuntary confessions is that police must be deterred from violating the rights of those who are questioned in the future.¹⁰⁹ The exclusion of evidence thus acts to deter the police, whose job is to discover facts to be presented to the courts, from acting in ways the law deems undesirable.¹¹⁰

2. *Unreasonable Searches and Seizures*

The rationale for excluding evidence obtained by illegal searches and seizures is similar to that for excluding involuntary confessions.¹¹¹ In *Elkins v. United States* the United States Supreme Court considered whether evidence should be excluded from federal court if obtained through an unconstitutional search conducted by a state, rather than a federal, officer.¹¹² Before *Elkins*, federal courts would have heard such evidence.¹¹³ In *Elkins* the Court decided to ban the use of such evidence in federal courts by invoking a basic rationale underlying the exclusionary rule: the desire to deter violations by officers seeking evidence.¹¹⁴ The majority explained that the purpose of the rule is not to let a guilty party go free because the police made a mistake, but rather "to deter-to compel respect for the constitutional guaranty in the only effectively available way-by removing the incentive to disregard it."¹¹⁵ This is the most frequently expressed reason for the exclusionary rule's existence.¹¹⁶

Another reason for the rule was advanced in *Elkins*. The Court noted that "the imperative of judicial integrity" required exclusion of unconstitutionally obtained evidence.¹¹⁷ That is, courts and agents of the government must act within the law to foster respect for laws. Like the doctrine of unclean hands, by which courts will not sully themselves by considering the arguments of litigants who have misbehaved in relation to the conduct underlying equitable claims, the Court did not wish to become a partner in the misconduct of police who deprive a defendant of the right to freedom from unreasonable searches.¹¹⁸ The Supreme Court feared that if the government refuses to obey its own laws, then disregard, disrespect, and decay must surely result.¹¹⁹

V. THE EXCLUSION OF EVIDENCE IN SCIENCE

If, as some legal commentators have suggested, the difference between legal and scientific fact-finding is the willingness of law, but not science, to ignore wrongfully acquired evidence for policy reasons, then one would not expect to find exclusions of evidence in science grounded in the same kind of logic employed by the courts in excluding involuntary confessions and the fruits of illegal searches. However, as is shown by the examples below, science does exclude evidence for policy reasons, and it does so using the same reasoning that courts have used.

A. Scientific Self-Restraint

Scientific bodies, like courts, purport to regulate the behavior of members of their profession by promulgating codes of conduct. No official of the National Academy of Sciences or American Association for the Advancement of Science is physically present when fellow scientists' experiments take place to ensure that the Academy or Association rules are followed. Nonetheless, organizations' codes influence scientists.¹²⁰

Some of the rules followed by scientific researchers interfere with their finding scientific truth. For example, the American Medical Association promulgated a code of conduct in 1946 regarding human experimentation.¹²¹ The code provided that research involving human subjects is ethical only if (1) voluntary consent of the subjects is obtained; (2) the danger of each experiment has been explored through animal experimentation; and (3) the experiment is performed under "proper medical protection and management."¹²² At least thirty-three codes of experimental ethics have been drafted since the Second World War, and informed consent is a generally accepted

element of those codes.¹²³

The requirement of voluntary informed consent is a substantial barrier to human research. First, when asked whether one would like to be the subject of an experiment, one would most likely answer no. Few of us wish to be manipulated or treated as commodities, and that is precisely what many fear from agreeing to be an experimental subject. Second, genuine consent requires that the researcher give the potential subject a great deal of information and a genuine choice about participation in the study.¹²⁴ Not only does this procedure burden researchers with a time-consuming task, but it also reduces the population of those willing or able to become research subjects. The requirement of consent eliminates easy access to research subjects otherwise easiest to use—the poor who come to medical clinics but have no private doctors, prison inmates, and those who are institutionalized and unable to make their complaints heard.¹²⁵

One consequence of ethical research codes is that researchers must not test drugs on pregnant women.¹²⁶ A serious concern is that any drug given to pregnant women might harm their babies. The most direct way to find out whether a given drug harms babies in utero would be to give the drug to some pregnant women, give a placebo to other pregnant women, and monitor differences in the health of their offspring.¹²⁷ This procedure would undoubtedly lead to valuable and reliable scientific knowledge. It is, however, morally repugnant, since it places at risk innocent children whose welfare is not enhanced by this type of experiment. Scientists choose not to seek information about drugs pregnant women may use in this reprehensible way.¹²⁸ Instead they do animal studies; chemical analyses of drugs to compare drugs known to cause harm with the drug under investigation;¹²⁹ or complicated statistical analyses of public health data to determine whether a given drug can damage fetuses.¹³⁰ The ethical limitations on testing these drugs leave questions unanswered about the safety of some drugs.¹³¹ Nevertheless, scientists stay within those guidelines, sacrificing a certain amount of knowledge for higher moral values.¹³²

Codes of conduct that make scientific information gathering less efficient parallel legal rules that prevent law enforcement officers from seeking evidence in certain efficient but undesirable ways. In both cases a profession is limiting the flow of information it needs to make accurate decisions because accepting the information violates a duty higher than that represented by seeking truth. Law, in seeking justice, may deny itself the information learned from involuntary confessions and illegally seized evidence. Science denies itself the opportunity to study certain problems directly in deference to moral values. Thus, legal authors who claim that science recognizes no values higher than truth have overlooked research ethics and their codification—the scientific codes of conduct that limit researchers' truth-seeking abilities.¹³³

B. Scientific Responses to Unethically Obtained Data

When the legal limits for information gathering are violated, courts have determined not to derive benefit from the violation¹³⁴ As shown below, there are trends in science to do the same thing.¹³⁵

1. Phosgene Gas Research

In 1988, the United States Environmental Protection Agency (E.P.A.) considered rules limiting exposure to phosgene gas, a toxic agent used in manufacturing plastics and pesticides.¹³⁶ The gas had been used as a weapon in World War I, and in the 1940s, the Nazis, anxious to test a supposed antidote, exposed prisoners in France to the gas.¹³⁷ The data are available to modern scientists, but when a draft E.P.A. report made reference to the Nazi research, twenty-two scientists at the agency wrote a letter to E.P.A. Administrator Lee Thomas, who ordered the reference deleted from the report.¹³⁸

The twenty-two scientists raised questions about the reliability of the data and the ethics of using it.¹³⁹ Like the court in *Stein*, the scientists argued that the data were "almost certain to be inherently flawed" because they were obtained through unethical human experiments.¹⁴⁰ If one accepted the proposition that unethical experiments were very likely to yield unreliable data, then the question of whether to cite such experiments ceases to be a moral issue and is resolved in the relatively comfortable context of excluding unreliable evidence.¹⁴¹ The scientists' first argument was based on the morally neutral issue of reliability of data, not the ethics of citing them.

The letter further argued that using the Nazi data implicitly encourages others to perform unethical human experiments.¹⁴² Like courts seeking to discourage police from abusive practices, the scientists feared that using unethically obtained information would encourage future abuse, since the data obtained might be considered useful to the scientific community and thus bring the researchers career-enhancing recognition.¹⁴³

Another argument presented in the letter is that the use of such data debases the society using them.¹⁴⁴ This argument is

indistinguishable from the courts' reasoning to exclude illegally obtained evidence because doing so would dishonor courts and debase society.¹⁴⁵

The controversy over the E.P.A. phosgene gas report demonstrates that scientists may react much as judges do in the face of information gathered unethically. Not only do they seek to "exclude" the data from the legitimate sources of information in their profession, but they justify their exclusion using the same arguments that have long been a part of legal analysis.

2. Nazi Hypothermia Research.

Scientists also resisted the use of data from Nazi hypothermia research because of the unethical way in which the data were obtained. The German air force lost many planes over the English Channel; lives were lost to hypothermia even if rescue teams arrived in time to pull the air crews out of the water alive.¹⁴⁶ In an attempt to improve treatment techniques for exposure to cold water, the Nazis immersed prisoners in ice water at the Dachau concentration camp. They kept meticulous records of their experiments, through which many prisoners died. Dr. Leo Alexander, an American physician who discovered and interpreted the data, had them published under his name in an American medical journal in 1946.¹⁴⁷

In the late 1970s the question of the ethics of citing the Dachau hypothermia data surfaced when a researcher at the University of Minnesota, Dr. Richard Pozos, was working on the question of how best to treat people immersed in cold water for long periods of time.¹⁴⁸ Dr. Pozos had access to the Nazi data, as did anyone interested in hypothermia, but found it troubling that the data were in use.¹⁴⁹ He consulted a bioethicist at his university, and much publicity resulted from their subsequent investigation of the problem.¹⁵⁰ Eventually a bioethics conference was held to air all sides of the dispute.¹⁵¹

One fact is clear from captured German records—the principal investigator, Sigmund Rascher, conducted both scientific and personal fraud.¹⁵² For example, Rascher faked results in a test of a supposed anti-infection drug.¹⁵³ He and his wife also denied having had a miscarriage and instead substituted another couple's child as their own so they would receive a customary gift from Himmler.¹⁵⁴

Predictably, articles written by participants at the bioethics conference disagree on whether the Nazi hypothermia data are useful¹⁵⁵ and if useful, whether they should be cited. Scientists and ethicists spoke on both sides of the dispute. Some argued that using the data to save lives would be the only fitting tribute to what would otherwise have been meaningless suffering. Others argued that trying to squeeze a profit out of the torture of innocent lives is no tribute at all.¹⁵⁶ Some argued for the use of the data, but only with a full explanation of the wrongs done to the victims.¹⁵⁷ Some stirring statements against using the data came from survivors of brutal experiments.¹⁵⁸

Perhaps no consensus was reached, but concern for these issues has continued after the conference closed.¹⁵⁹ And while it is not possible to conclude that journal science, the gatekeeper of what is and is not scientific fact, has decided to ban unethically obtained evidence, there is a high level of discomfort with publishing such information. Dr. Pozos proposed republishing the Nazi data in the *New England Journal of Medicine*. The editor of the *Journal*, one of the world's most prestigious medical and scientific journals, responded:

I don't see how any credence can be given to the work of unethical investigators. . . . Given the source of the information and the way in which it was obtained, *how can anyone believe it? How can anyone want to believe it?*¹⁶⁰

If the editor's comments are taken seriously, they form a *per se* rule against publishing data obtained unethically. In most science fields, scientific knowledge consists of what is published in peer-reviewed journals.¹⁶¹ Without publication in peer-reviewed journals data will remain peripheral to scientific research.¹⁶² Exclusion from the literature will remove data from consideration when scientists analyze available information and form judgments about their fields.¹⁶³ If the statement by the editor of the *New England Journal of Medicine* reflects the views of other journal editors and reviewers, then data obtained unethically will be excluded from the body of scientific literature and will not enter into scientists' conclusions about the nature of our world, just as evidence kept out of court will not affect the conclusions of the trier of fact.

The editor's statement is grounded in the language of reliability, but nevertheless retains an air of moral judgment. The statement may be a convenient way of wrapping a difficult moral issue in the more secure logic of excluding unreliable evidence. The statement, "how can anyone believe it? How can anyone want to believe it?" is not the bland wording of a letter rejecting an article because its data appear insufficient.

It is most likely that if faced with proof that the data were reliable and valuable, the *Journal* would have shifted to the moral dimension

of citing the Nazi data, much the way that the Supreme Court changed from rejecting coerced confessions because of their unreliability to rejecting them on ethical policy grounds.¹⁶⁴ Thus, as with the phosgene research example, science may ultimately deny unethically obtained evidence a place in the literature out of a desire to achieve a higher moral objective.

3. *Virus X.*

Several years ago a study regarding "virus X"¹⁶⁵ was submitted to *The New England Journal of Medicine* for publication.¹⁶⁶ Virus X is present in many normal adults and causes no symptoms. The virus can, however, kill newborns, who may be exposed through blood transfusions. For this reason, newborns should not be given blood that tests positive for virus X.¹⁶⁷ A group of researchers tested a method they thought would protect newborns by filtering the virus out of contaminated blood.¹⁶⁸

The research design included giving untested, untreated blood to children in the experiment's "control group." Predictably, some of these children died as a result of their exposure to virus X. *The New England Journal* refused to publish the report on the grounds that the researchers knowingly exposed some of their subjects to unacceptable risks.¹⁶⁹

The researchers pled that their article should have been published to disseminate information about their new, lifesaving technique. They also pointed out that, in their geographic area, blood was not routinely tested for virus X; thus the experiment benefited some children while leaving the rest no worse off than if the experiment had not been conducted.¹⁷⁰ Despite these arguments, the *Journal's* editors refused to publish a study that exposed some children to a risk that could have been avoided. The *Journal's* editors felt that the researchers' ethical duty was to change the local practice of giving untested blood to vulnerable newborns rather than to attempt to secure for themselves a publication credit in an international journal.¹⁷¹

4. *Voluntary Enforcement of Ethical Codes by Journals.*

The New England Journal of Medicine is not alone in refusing to publish unethical research. Animal research done in the United States and human-subject research done with federal funds are required by law to adhere to certain ethical standards.¹⁷² Because these rules are imposed upon researchers by the government, one might assume they represent ethics external to and imposed upon science. However, a number of scientific journals proclaim that they will publish only human-subject or animal-subject research conducted ethically and humanely, as judged by United States regulations, regardless of where in the world the research took place.¹⁷³ In these journals one finds research conducted outside the United States and without United States federal funds, therefore not legally bound by the codes.¹⁷⁴ Yet these journals, the gatekeepers of legitimate scientific knowledge, are applying the codes to research conducted beyond the codes' jurisdictional reach. It is logical to deduce that the journal editors agree with the codes and are willingly enforcing ethical standards on researchers. Thus, science limits its search for truth in the pursuit of ethical conduct.

VI. CONCLUSION

This article mentioned briefly a number of differences between the legal and scientific approach to fact-finding. Law relies primarily on what scientists would consider unreliable anecdotal evidence in the form of oral testimony.¹⁷⁵ Science finds its truths by making generalizations from a mass of events. Thus, its focus is often at a population level.¹⁷⁶ In contrast, law seeks to resolve disputes between certain named parties. Scientists publish findings to begin a process of review by professionals in the field.¹⁷⁷ Ultimately, those professionals decide what is and is not a scientific fact.¹⁷⁸ Law seeks to guarantee the accuracy of its fact-finding process by face-to-face confrontation between the accuser and accused and between witnesses and questioners.¹⁷⁹ In the United States, the arbiter who decides the facts of a case is often a jury of citizens who, in most cases, know nothing of significance about the case except what they learn at trial.

In addition to the differences between the two disciplines stated above, the legal literature includes numerous statements implying or asserting that science is just a cold collection of facts, neither touching nor touched by the society in which it develops. This view leads to the notion that science exists in a vacuum, dispassionately seeking facts whatever the consequences, while law strives toward justice. The "law seeks justice; science seeks truth," analysis, announced by many legal authors and applied by several courts, masks some striking similarities between legal and scientific fact-finding.

Just as courts refuse to hear certain evidence deemed unreliable, so science journals, the gatekeepers of scientific information, strive to eliminate unreliable evidence. Courts block admission of illegally obtained evidence for two policy reasons: first, to discourage future misconduct by those, such as police officers, who must find facts, and second, because allowing the evidence to be used would degrade our courts and society. Science applies precisely the same logic in banning unethically obtained data from publication: the desire to deter unethical research and to preserve the moral integrity of the institutions of science underlies scientific "exclusions of

evidence." One finds in both law and science the desire to avoid excluding evidence solely on moral grounds by looking initially to questions of reliability. Only when evidence cannot be shown unreliable are the necessary moral judgments made.¹⁸⁰

The law's increasing reliance on expert testimony, and the Supreme Court's recent mandate that federal judges decide what is and is not "scientific knowledge," require that the legal literature present an accurate and informed view of science and the ways in which its logic may differ from the legal analysis with which judges and lawyers are familiar. Rejecting the "law seeks justice; science seeks truth" heuristic will aid in providing the legal community with a more accurate understanding of the differences between legal and scientific fact-finding.

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. See *infra* notes 13, 16, 50-51, 71, 87-90, and accompanying text.

2. John I. Thornton, *Uses and Abuses of Forensic Science*, 69 A.B.A. J. 289 (1983).

3. See, e.g., ELIOT FREIDSON, PROFESSIONAL POWERS: A STUDY OF THE INSTITUTIONALIZATION OF FORMAL KNOWLEDGE 102 (1986) ("There is little doubt that the role of expert testimony is becoming more and more important in the courts."); FAUST F. ROSSI, EXPERT WITNESSES xiii (1991) ("The use of experts in modern litigation has grown enormously in the last several decades. It shows no sign of abating. The creation of new and complex theories of liability, the growing sophistication of science and technology, and liberalized modern evidence rules have together combined to enhance the renown of the expert witness."); MICHAEL J. SAKS & RICHARD VAN DUIZEND, THE USE OF SCIENTIFIC EVIDENCE IN LITIGATION 3 (1983) ("In litigation, as elsewhere in contemporary society, we have come to advert to scientific and technological information with increasing frequency and even dependence.").

4. 293 F. 1013 (D.C. Cir. 1923).

5. *Daubert v. Merrell Dow Pharmaceuticals*, 113 S. Ct. 2786, 2792 (1993) ("In the 70 years since its formulation in the *Frye* case, the "general acceptance" test has been the dominant standard for determining the admissibility of novel scientific evidence at trial.") (citation omitted).

6. See, e.g., *United States v. Williams*, 583 F.2d 1194, 1198-1200 (2d Cir. 1978); *State v. Hall*, 297 N.W.2d 80 (Iowa 1980); *State v. Williams*, 388 A.2d 500 (Maine 1978).

7. 113 S. Ct. 2786 (1993).

8. *Id.* at 2791-92. For a discussion of the controversy surrounding the mathematical technique, see Kenneth E. Wachter, *Disturbed by Meta-Analysis?*, 241 SCIENCE 1407 (1988).

9. *Daubert*, 113 S. Ct. at 2798-99.

10. *Id.* at 2796.

11. *Id.* at 2796-97.

12. See *infra* notes 13, 50-51, 71, 87-90, and accompanying text.

13. Milton R. Wessel, *Adversary Science and the Adversary Scientist: Threats to Responsible Dispute Resolution*, 28 JURIMETRICS J. 379, 380 (1988).

14. See *infra* notes 50-51, 71, 87-90 for citations to authors asserting the heuristic in the legal, public health, and scientific literature. See *infra* notes 92-93 for citations to courts that have accepted the heuristic and purported to apply it.

15. *Id.*

16. E.g., Lee Loevinger, *Jurimetrics: Science in Law*, in SCIENTISTS IN THE LEGAL SYSTEM: TOLERATED MEDDLERS OR ESSENTIAL CONTRIBUTORS? 8 (William A. Thomas ed., 1974) [hereinafter MEDDLERS OR CONTRIBUTORS?]; Guido Calabresi, *Concerning Cause and the Law of Torts: An Essay for Harry Kalven, Jr.*, 43 U. CHI. L. REV. 69, 105-07 (1976); D.H. Kaye, *Proof in Law and Science*, 32 JURIMETRICS J. 313 (1992); Lee Loevinger, *Standards of Proof in Science and Law*, 32 JURIMETRICS J. 323 (1992).

17. A recent article made this point convincingly. See Sheila Jasanoff, *What Judges Should Know About the Sociology of Science*, 32 JURIMETRICS J. 345 (1992).

18. JOHN ZIMAN, RELIABLE KNOWLEDGE: AN EXPLORATION OF THE GROUNDS FOR BELIEF IN SCIENCE 144 (1978). One striking example of how the beliefs of a scientist can differ from the beliefs of science is Dr. William Shockley. Dr. Shockley was a Nobel Prize recipient in physics and a physics professor at Stanford University. He used his position to publicize his view that American Blacks are genetically inferior to the general American population. Geneticists at his own institution found his work on race, "hackneyed pseudoscientific justification for class and race prejudice." Joseph Galloway et al., *Dr. Shockley and Mr. Hyde*, 107 U.S. NEWS & WORLD REPORT, Aug. 28, 1989, at 16. For a more extensive summary of experts' rejections of Dr. Shockley's racial biology theories, see ALLAN CHASE, THE LEGACY OF MALTHUS 480-82 (1977).

19. The right of confrontation is the core value of the Confrontation Clause of the Sixth Amendment. See *Coy v. Iowa*, 487 U.S. 1014, 1014-21 (1988). While the right of face-to-face confrontation is not absolute, it is a strong preference in our system of justice. *Maryland v. Craig*, 497 U.S. 836 (1990).

20. 5 JOHN H. WIGMORE, EVIDENCE IN TRIALS AT COMMON LAW 32 (J. Chadbourne ed., 4th ed. 1974). Wigmore asserts:

The belief that no safeguard for testing the value of human statements is comparable to that furnished by cross-examination, and the conviction that no statement (unless by special exception) should be used as testimony until it has been probed and sublimated by that test, has found increasing strength in lengthening experience.

Id.

21. See, e.g., *Davis v. Alaska*, 415 U.S. 308, 315-16 (1974) ("Cross-examination is the principal means by which the believability of a witness and the truth of his testimony are tested."); *People v. Chin*, 490 N.E.2d 505 (N.Y. 1986) (acknowledging the importance of cross-examination as a truth-discovering tool); *People v. Brock*, 695 P.2d 609 (Cal. App. 1985) (reversing a criminal conviction because it was not possible to cross-examine a key prosecution witness adequately); *Collora v. Navarro*, 574 S.W.2d 65, 70 n.5 (Tex. 1978) (permitting a trial court to base a directed verdict on the uncontradicted testimony of a witness whom the opposing party had an opportunity to cross-examine, but did not do so).

22. *Id.*

23. See, e.g., FED. R. EVID. 103; CHARLES MCCORMICK, MCCORMICK ON EVIDENCE 74 (John William Strong ed., 4th ed. 1992).

24. E.g., *United States v. Brown*, 490 F.2d 758 (D.C. Cir. 1973); *State v. Randolph*, 698 S.W.2d 535, 539 (Mo. App. 1985).

25. See, e.g., *Carroll v. Acme-Cleveland Corp.*, 955 F.2d 1107, 1112 (7th Cir. 1992) ("We review a district court's decision to admit or exclude evidence for a clear abuse of discretion.") (citation omitted); *Rent-A-Center v. Canyon Television & Appliance*, 944 F.2d 597, 601 (9th Cir. 1991) ("Evidentiary rulings by the district court are reviewed for an abuse of discretion."); *Belber v. Lipson*, 905 F.2d 549, 551 (1st Cir. 1990) ("We review [rulings on admission of evidence] only for an abuse of discretion.").

26. *See, e.g., infra* notes 111-119 and accompanying text.

27. Marcia Angell, *Editorial Responsibility: Protecting Human Rights by Restricting Publication of Unethical Research*, in GEORGE J. ANNAS & MICHAEL A. GRODIN, *THE NAZI DOCTORS AND THE NUREMBERG CODE: HUMAN RIGHTS IN HUMAN EXPERIMENTATION* 280; Harriet Zuckerman, *The Sociology of Science*, in HANDBOOK OF SOCIOLOGY 511, 515 (N. Smelser ed., 1988). *But see* Debbie Indyk & David A. Rier, *Grassroots AIDS Knowledge: Implications for the Boundaries of Science and Collective Action*, 15 KNOWLEDGE: CREATION, DIFFUSION, UTILIZATION 3, 18 (1993) (suggesting that because knowledge regarding AIDS is being developed in affected communities and outside of traditional research centers, publications that are not peer-reviewed may have the most accurate information); Gina Kolata, *Medical Data: Who Should Hear It First*, N.Y. TIMES, May 22, 1990, at C1.

28. This observation has been made in the legal literature. Howard A. Denemark, *Improving Litigation Against Drug Manufacturers for Failure to Warn Against Possible Side Effects: Keeping Dubious Lawsuits from Driving Good Drugs off the Market*, 40 CAS. W. RES. L. REV. 413, 432-33 (1989-90).

29. ZIMAN, *supra* note 18, at 74-76. *But see* William J. Broad, *Fraud and the Structure of Science*, 212 SCIENCE 137 (1981) (suggesting that other researchers play a more limited role in the correction of errors).

30. Zuckerman, *supra* note 27, at 526-28; *see also* William J. Broad, *'Cold Fusion' Claimants Review Puzzling Results*, N.Y. TIMES, Apr. 3, 1990, at C1. *But see* WILLIAM J. BROAD & NICHOLAS WADE, *BETRAYERS OF THE TRUTH* 38-59 (1982) for an analysis of the limits of peer review in policing quality in scientific publications. Some sociologists of science have noted that the emphasis on peer-reviewed publication serves to protect scientists from intellectual competition from those outside the field. *See, e.g.,* Thomas F. Gieryn et al., *Professionalization of American Scientists: Public Science in the Creation/Evolution Trials*, 50 AM. SOCIOLOGICAL REV. 392 (1985).

31. Wigmore recognized this difference in approach between lawyers and scientists when he noted:

However difficult it may be for the layman, the scientist, or the foreign jurist to appreciate this its wonderful power, [*i.e.*, the ability of cross-examination to elicit truth] there has probably never been a moment's doubt upon this point in the mind of a lawyer of experience.

WIGMORE, *supra* note 20, at 32. *See also* James W. Curlin, *Law, Science, and Public Policy: A Problem in Communication, in MEDDLERS OR CONTRIBUTORS?*, *supra* note 16, at 35 ("[S]cientists in general show an aversion to the adversary process.").

32. *See, e.g.,* ZIMAN, *supra* note 18, at 124-26. This assertion is the subject of a great deal of scholarly writing in the sociology of science. The view stated above is not the only view one will find in that field's literature. *See, e.g.,* Steven Epstein, *Democratic Science? AIDS Activism and the Contested Construction of Knowledge*, SOCIALIST REV., Apr.- June 1991, at 35, 49-51.

In the law and science context this view appeared in the press coverage of the recent case of *McLean v. Arkansas Board of Education*, 529 F. Supp. 1255 (E.D. Ark. 1982). *See* Marcel C. La Follette, *Creationism in the News: Mass Media Coverage of the Arkansas Trial*, in *CREATIONISM, SCIENCE, AND THE LAW: THE ARKANSAS CASE* 189, 191-98 (Marcel C. La Follette ed., 1983).

33. *See* HAROLD KLAWANS, *TRIALS OF AN EXPERT WITNESS: TALES OF CLINICAL NEUROLOGY AND THE LAW*, 122-23 (1991) (Medical or scientific information that has not been peer reviewed is considered extremely unauthoritative; Dr. Klawans compared unreviewed articles to *Batman* comic books as authoritative medical sources.). Courts have adopted this view. *See* *Perry v. United States*, 755 F.2d 888, 892 (11th Cir. 1985); *Richardson v. Richardson-Merrell, Inc.*, 649 F. Supp. 799, 802 (D.D.C. 1986) ("[T]he totality of the published scientific literature . . . collectively represents the sum of all that can be said to be scientifically 'known' of the matter at present."), *aff'd*, 857 F.2d 823 (D.C. Cir. 1988). There may be limits to the authority of the literature in AIDS research, however, where the affected community does not trust researchers, and has the education, interest, and resources to conduct its own research. *See* Indyk & Rier, *supra* note 27.

34. ZIMAN, *supra* note 18, at 33-41.

35. ZIMAN, *supra* note 18, at 40, 130-32.

36. ZIMAN, *supra* note 18, at 39-41, 130-33.
 37. See Paul Atkinson, *The Reproduction of the Professional Community*, in *THE SOCIOLOGY OF THE PROFESSIONS* 224-241 (Robert Dingwall & Philip Lewis eds., 1983).
 38. FED. R. EVID. 602. *But see* FED. R. EVID. 703.
 39. FED. R. EVID. 602 advisory committee's note.
 40. See FED. R. EVID. 602, 801(d)(2).
 41. ZIMAN, *supra* note 18, at 131.
 42. *Id.*
 43. Loevinger, *supra* note 16, at 331-33 (1992) (noting that science prefers statistical evidence over anecdotal reports, while courts prefer anecdotal evidence).
 44. Loevinger, *supra* note 16, at 331-33 (1992).
 45. See *supra* notes 34-36.
 46. *Id.*
 47. See, e.g., Hugh Gibbons, *The Relationship Between Law and Science*, 22 *IDEA* 43, 47 (1981) and the sources cited therein.
 48. James W. Curlin, *Fostering Understanding Between Science and Law*, 59 *A.B.A. J.* 157 (1973). Similarly, one scarcely imagines scientists or other members of the legal laity poring over advance sheets and the latest law reviews.
 49. Inaccurate reporting of the motivations of science may be common. See Gieryn et al., *supra* note 30, at 392-93.
 50. Howard T. Markey, *Needed: A Judicial Welcome for Technology-Star Wars or Stare Decisis*, 79 *F.R.D.* 209, 209-211 (1978) (emphasis supplied). Judge Markey was the Chief Judge of the U.S. Court of Customs and Patent Appeals. His article has been quite influential. See *infra* notes 87, 92 and accompanying text for a discussion of courts that have explicitly adopted Judge Markey's analysis. See also *infra* notes 51, 87-90 and accompanying text for similar assertions by other authors. *But see* Hugh Gibbons, *The Relationship Between Law and Science, Part II*, 22 *IDEA* 159 (1981) (presenting a lone dissenting voice in the legal literature, stating that science and technology are inherently laden with value choices while law is merely a transmission system to control behavior according to values derived from some source external to law).
- Outside of the legal literature, a different view of science predominates. See, e.g., NICHOLAS RESCHER, *SCIENTIFIC EXPLANATION* 131 (1970) ("[S]cience does not have a single, monolithic aim, but a multiplicity of purposes, some basic and theoretical (explanation, prediction, and retrodiction), and others consequent and practical (control).").
51. See, e.g., David Berg, *Cross-Examination*, in *THE LITIGATION MANUAL* 518 (1989) ("Truth is [not for lawyers, but] for engineers, who reduce their problems to mathematical certainty").
 52. See Markey, *supra* note 50; Berg, *supra* note 51.
 53. See IAN MITROFF, *THE SUBJECTIVE SIDE OF SCIENCE* 8 (1974), (citing ROBERT K. MERTON, *SOCIAL THEORY AND SOCIAL STRUCTURE*, 16 (1968)).
 54. See JACOB BRONOWSKI, *THE COMMON SENSE OF SCIENCE* 124-30, 138-50 (1978).
 55. MITROFF, *supra* note 53, at 83.

56. A common joke among scientists illustrates this point. A researcher trained a frog to jump at the sound of a bell. The researcher measured the distance the frog would jump, then removed the frog's legs and rang the bell again. The frog did not move, thus "proving" the scientist's hypothesis that removing a frog's legs deafens the animal. The observed facts in the joke support the hypothesis in the punchline as well as more reasonable hypotheses.

57. MICHAEL RUSE, *BUT IS IT SCIENCE?* 71-78 (1988).

58. *Id.*

59. *Id.*

60. An example of this type of analysis would lead one to conclude that giraffes have long necks because their forbearers stretched to reach leaves, and so passed on the trait of longer necks. See *infra* note 63 for a Darwinian analysis of giraffes' long necks. The example of giraffes is often mentioned when discussing the hereditary theories of Jean Baptiste Lamarck, which included the view that acquired characteristics could be passed on to future generations. See MICHAEL RUSE, *TAKING DARWINISM SERIOUSLY* 44 (1986).

61. For a brief account of Kammerer's experiment, see STEPHEN JAY GOULD, *THE PANDA'S THUMB* 76-84 ("Shades of Lamarck") (1980).

62. *Id.*

63. *Id.* Under the Darwinian analysis one could, for example, explain the long necks of giraffes by postulating that at one time some giraffes had longer necks and some shorter necks. The long-necked giraffes had the survival advantage of being able to reach high leaves on which to graze. Short-necked giraffes thus did not survive long enough to breed, so the only genes that passed to later generations gave giraffes long necks. After a sufficient number of generations, all manifestations of the shorter neck characteristic were bred out. See *supra* note 60.

64. DOV OSPOVAT, *THE DEVELOPMENT OF DARWIN'S THEORY* 113-14 (1981).

65. CHARLES DARWIN, *ON THE ORIGIN OF SPECIES* (facsimile reprint of first edition with introduction by Ernst Mayr) (1964).

66. Ernst Mayr wrote of Darwin's work:

The publication of the *Origin of Species* ushered in a new era in our thinking about the nature of man. The intellectual revolution it caused and the impact it had on man's concept of himself and the world were greater than those caused by the works of Copernicus, Newton, and the great physicists of more recent times.

Id. Introduction at vii.

67. OSPOVAT, *supra* note 64. One might support the statement that science exists exclusively to discover facts by stating that natural selection, causing changes in species over time, is a "fact." An ambiguity of the English language will permit such an assertion, but it is not what the legal authors claiming science exists for the purpose of finding facts suggest. Rather, they seem to suggest that facts are direct observations not subject to significant dispute or interpretation. "Facts," these authors imply, are not theories or complex chains of events. The words, "[t]he purpose and function of science is to learn physical facts," quoted in the text accompanying note 50, do not appear to refer to such a broad use of the word "facts."

However, if one were to include in the definition of the word "fact" complex chains of events and their consequences, then law is only interested in "facts." Whether a given individual should have to pay a judgment or suffer a criminal penalty would properly be called a "fact" under this definition. The absurdity of this use of language implies that the legal literature assumes a less inclusive definition of "fact" when it refers to science as a fact-finding regime.

68. See JACQUE BARZUN & HENRY GRAFF, *THE MODERN RESEARCHER* 148-153 (1957), which argues that studying history without analyzing the causes of events is valueless. The authors analogized to the study of science, stating:

It is the organization of the past that makes the past valuable, just as it is the organization of phenomena in scientific formulas that makes the study of nature valuable.

The ultimate question for the historian therefore is: What pattern?

Id.

69. NICHOLAS RESCHER, *SCIENTIFIC EXPLANATION* 131 (1970).

70. *Id.* Some legal authors are aware of these broader goals of science. *See, e.g.,* Wessel, *supra* note 13; Seymour Pollack, *Observations on the Adversary System and the Role of the Forensic Scientist: "Scientific Truth" v. "Legal Truth,"* 18 J. FORENSIC SCI. 173, 175-76 (1973).

71. *See* William A. Thomas, *Scientists and Lawyers: Their Obligation to Cooperate,* in MEDDLERS OR CONTRIBUTORS, *supra* note 16, at 1, for the view that science "seeks truth with impartial objectivity." However, scientists do not operate in a world of impartial objectivity, making it impossible for "science" to do so. *See infra* notes 73-77 and accompanying text.

72. MITROFF, *supra* note 53. It has been noted in the literature of the sociology of science that this study had a small sample population. *See* Zuckerman, *supra* note 27, at 517.

73. MITROFF, *supra* note 53, at 64. It is worth noting that most lawyers and judges, unlearned in science, could fairly be classed as "the general public" with regard to knowledge of science and scientists. *See supra* note 48 and accompanying text.

74. TYRUS HILLWAY, *INTRODUCTION TO RESEARCH* 129-30 (1964).

75. MITROFF, *supra* note 53, at 64-70, 99-100, 113-14.

76. MITROFF, *supra* note 53, at 64-70. One scientist interviewed by Professor Mitroff stated, "The uninvolved, unemotional scientist is just as much a fiction as the mad scientist who will destroy the world for knowledge. Most of the scientists I know have theories and are looking for data to support them; they're not sorting impersonally through the data looking for a theory to fit the data." *Id.* at 65. Another stated, "The notion of the disinterested scientist is really a myth that deserves to be put to rest One has to be deeply involved in order to do good work." *Id.* at 66.

77. MAX PLANCK, *SCIENTIFIC AUTOBIOGRAPHY AND OTHER PAPERS* 33-34 (1949). *See also* THOMAS KUHN, *THE STRUCTURE OF SCIENTIFIC REVOLUTIONS* (1962) for further discussions of the fallacy of the disinterested scientist who seeks facts alone. Max Planck's statement is paralleled by Charles Darwin. Darwin reported in his autobiography having once commented as a young naturalist that it would be a good thing to have every scientist die at age 60, because "afterwards he would be sure to oppose all new doctrines." CHARLES DARWIN, *AUTOBIOGRAPHY OF CHARLES DARWIN* 100-01 (1958).

78. The general public may share this perception. *See, e.g.,* David C. Beardslee & Donald D. O'Dowd, *The College-Student Image of the Scientist,* in BERNARD BARBER & WALTER HIRSCH, *THE SOCIOLOGY OF SCIENCE* 247 (1962) (for sources on the public perception of scientists as withdrawn); Margaret Mead & Rhoda Metraux, *The Image of the Scientist among High-School Students: A Pilot Study;* in BERNARD BARBER & WALTER HIRSCH, *THE SOCIOLOGY OF SCIENCE* 230 (1962). *See* JOHN R. BAKER, *THE SCIENTIFIC LIFE* 26-30 (1943) for claims that scientists are actually withdrawn from normal social interaction.

79. *Id.*

80. As one who is married to a working scientist I have had many opportunities to meet with scientists socially. I find them to be at least as social, involved in concerns outside their work, and informed about current events as groups of lawyers and professors with whom I have socialized over the years.

81. BERNARD BARBER, *SCIENCE AND THE SOCIAL ORDER* (1952) (noting many interrelationships between science and society).

82. Although popular culture and some science writers may portray science as withdrawn, it is not so. *See* Epstein, *supra* note 32, at 49-

51.

83. For a summary of the defenses, including this one offered at the trials by Nazi scientists and doctors, See Arthur L. Caplan, *How Did Medicine Go So Wrong?*, in WHEN MEDICINE WENT MAD: BIOETHICS AND THE HOLOCAUST 53, 71-77 (Arthur L. Caplan ed., 1992) [hereinafter WHEN MEDICINE WENT MAD].

84. *Id.* at 73-74.

85. See generally *id.*

86. Scientists' conduct, like that of all citizens, is bound by law. Certain laws exist in this country to control the behavior of researchers. See *infra* notes 120-21, 173-74 and accompanying text.

87. It is interesting that of the three courts purporting to apply the heuristic, two of them relied directly on Markey, *supra* note 50, which is perhaps the strongest article in the legal literature arguing that science is an emotionless search for facts. For a sample of other authors' assertions of the supposed consequence-neutrality of science in relation to law, see, e.g., B. Abbot Goldberg, *Teratogens and "Litogens,"* 316 NEW ENG.J.MED. 1093 (1987); David A. Rier, *Teratogen Litigation: Where Science Meets Law (and the Media)* (1989) (unpublished M.S. thesis, Columbia University, Division of Sociomedical Sciences) (on file with the author). This point has also been used in support of legal arguments in articles concerning contemporary legal problems, e.g., Nancy K. Rhoden, *Trimesters and Technology: Revamping Roe v. Wade*, 95 YALE L.J. 639, 694 (1986) (arguing, in a "postscript," for judicial scrutiny of the developing scientific technology for determining and assisting the viability of a fetus under *Roe v. Wade*. The article cautions readers that law, which is a value-enforcing agency of society, should not defer utterly to science, which "seeks to be value free." *Id.* at 696.). See also *supra* and *infra* notes 50-51, 71, 88-90, and accompanying text.

88. Wessel, *supra* note 13, at 383. See also, Loevinger, *supra* note 16, at 329-32; Hugh Gibbons, *The Relationship Between Law and Science, Part II*, 22 IDEA 283, 288-89 (1981) (not citing exclusionary rules of evidence to support its conclusion); Howard T. Markey, *Science and Law: The Friendly Enemies*, 30 IDEA 13, 14 (1989) (In the context of a long set of comparisons the author wrote, "Law seeks justice. Science describes.").

89. William A. Thomas, *Scientists and Lawyers: Their Obligation to Cooperate*, in MEDDLERS OR CONTRIBUTORS?, *supra* note 16, at 2.

90. Pollack, *supra* note 70, at 175-76.

91. See *supra* notes 13, 16, 50-51, 71, 87-90, and accompanying text.

92. 593 A.2d 733, 741 (1991) (citing Markey, *supra* note 50). The court retained its version of the "general acceptance" test for scientific evidence in other sorts of litigation, but created an exception to allow a more liberal admission of expert testimony on links between disease and toxic exposure. The court also relied heavily upon *Wells v. Ortho Pharmaceutical*, 615 F. Supp. 262 (N.D. Ga. 1985), *aff'd*, 788 F.2d 741 (11th Cir.), *cert. denied*, 479 U.S. 950 (1986), which has been criticized in the legal, medical, and public health literatures. See, e.g., Bert Black, *A Unified Theory of Scientific Evidence*, 56 FORDHAM L. REV. 595, 672-74; Denmark, *supra* note 28, at 438-50; James L. Mills & Duane Alexander, *Teratogens and "Litogens,"* 315 NEW.ENG.J.MED. 1234-35, (1986); David A. Rier, *Premature Publication and Publication Bias: Case Study and Implications*, (presented at the Society for the Social Studies of Science Fifteenth Annual Meeting, October 18-21, 1990, Minneapolis, Minnesota) (conference paper on file with author); David A. Rier, *The Duty to Warn: Barrier or Gateway to New Contraceptives*, (presented at the American Public Health Association 118th Annual Meeting, September 30 - October 4, 1990, New York, New York) (conference paper on file with author).

93. *Emhart Indus. v. Duracell Int'l.*, 665 F. Supp. 549, 559, n.15 (M.D. Tenn. 1987); *Allen v. United States*, 588 F. Supp. 247, 259 (D. Utah 1984) (citing Markey, *supra* note 50), *rev'd*, 816 F.2d 1417 (10th Cir. 1987), *cert. denied*, 484 U.S. 1004 (1988). The district court opinion in *Allen* clearly stated the heuristic, but did not make explicit the legal issues, if any, to which the court found it applicable. This is somewhat understandable, given the extraordinary range of issues the court covered in discussing the possible liability of the federal government for health-related problems allegedly caused by aboveground testing of nuclear weapons. The case occupies 225 pages in the Federal Supplement, has over 200 footnotes, and includes the periodic table of elements, a diagram of how chromosomes reproduce, an explanation of scientific notation, and cites dozens of sources that this author believes would not be found in even the most extensive law library.

94. *See supra* notes 88-89.

95. *See, e.g.*, FED. R. EVID. 402, which provides:

All relevant evidence is admissible, except as otherwise provided by the Constitution of the United States, by Act of Congress, by these rules, or by other rules prescribed by the Supreme Court pursuant to statutory authority. Evidence which is not relevant is not admissible.

See also, GRAHAM C. LILLY, AN INTRODUCTION TO THE LAW OF EVIDENCE 33-34 (1987); MCCORMICK, *supra* note 23, at 338-41.

96. *See infra* notes 104-19 and accompanying text.

97. This principle was recognized by the United States Supreme Court in *Silverthorne Lumber Co. v. United States*, 251 U.S. 385, 392 (1920), and recently reiterated in *Murray v. United States*, 487 U.S. 533, 536-38 (1988).

98. *Id.*

99. U.S. CONST. amend. V.

100. This author is aware that a recent United States Supreme Court decision, *Arizona v. Fulminante*, 111 S.Ct. 1246 (1991), held that it is possible for a conviction to be upheld despite the entry into evidence of an involuntary confession by application of the "harmless error rule." Nonetheless, I have selected this area because much has been written on the logic of the rule. Whether exclusion for these Constitutional violations is currently waxing or waning does not decrease the value of an exploration of the logic used to support the exclusion of evidence as a way of probing the law's commitment to truth relative to science's commitment. Indeed, to the extent that one relies upon Fifth Amendment exclusion of evidence to support the assertion that science seeks only truth while law ignores truth to find justice (as one author has, *see supra* text accompanying note 88), the erosion of exclusionary rules might call into question the postulate that law ignores facts in the name of justice. While the primary thrust of this article is to show that science will ignore data, thus undercutting the part of the heuristic that portrays science as a purely truth-seeking institution, changes in American law may undermine the first part of the heuristic—that the law will ignore facts to achieve justice.

101. 346 U.S. 156 (1953).

102. *Id.* at 192. A dissent by Mr. Justice Frankfurter asserted that this holding was contrary to earlier decisions regarding coerced confessions. *See id.* at 199-208 (Frankfurter, J., dissenting).

103. *See*, 1 WAYNE R. LAFAVE & JEROLD H. ISRAEL, CRIMINAL PROCEDURE § 9.5 (1984).

104. *See supra* note 37.

105. *See, e.g.*, *Brewer v. Williams*, 430 U.S. 387 (1977) (a criminal defendant's involuntary confession lead police to a murder victim's body).

106. *See Rogers v. Richmond*, 365 U.S. 534, 540-41 (1961) ("[I]n many of the cases in which the command of the Due Process Clause has compelled us to reverse state convictions involving the use of confessions obtained by impermissible methods, independent corroborating evidence left little doubt of the truth of what the defendant had confessed.").

107. *Jackson v. Denno*, 378 U.S. 368, 386 (1963) (quoting *Blackburn v. Alabama*, 361 U.S. 199, 206-07 (1960)).

108. *Id.* at 386 (quoting *Spano v. New York*, 360 U.S. 315, 320-21 (1959)).

109. *See U.S. v. Bouthot*, 878 F.2d 1506, 1515-16 (1st Cir. 1989) (stating in dicta, "[A] coerced confession is suppressed primarily to deter future violations of the Constitution . . ."); *United States v. Safley*, 408 F.2d 603, 604 (2d Cir. 1969) ("The possibility that an involuntary confession may be untrustworthy is not the primary reason for excluding it. Exclusion is a sanction to deter the government from extracting evidence of guilt from a defendant by coercive means."); *Breedlove v. Beto*, 404 F.2d 1019, 1023 (5th

Cir. 1968).

110. The effectiveness of the Rule as a deterrent depends upon police conduct. Chief Justice Burger noted that there is little empirical proof that the exclusionary rule actually deters police misconduct. *Bivens v. Six Unknown Named Agents of Fed. Bur. of Narc.*, 403 U.S. 388, 416-17 (1971) (Burger, C.J., dissenting) (citing Dallin H. Oaks, *Studying the Exclusionary Rule in Search and Seizure*, 37 U. CHI. L. REV. 665, 667 (1970)).

111. The author is aware of growing limitations on the rule requiring exclusion of evidence to enforce the Fourth Amendment right to freedom from unreasonable searches and seizures. *See, e.g.*, Fletcher N. Baldwin, Jr., *Due Process and the Exclusionary Rule: Integrity and Justification*, 39 U. FLA. L. REV. 505 (1987); Craig M. Bradley, *Murray v. United States: The Bell Tolls For the Search Warrant Requirement*, 64 IND. LAW J. 907 (1989). Nonetheless, this subject of inquiry is valuable for the same reasons stated *supra* note 100.

112. 364 U.S. 206 (1960).

113. *Id.* at 206-08. This policy was known as the "silver platter doctrine."

114. *Id.* at 216-222.

115. *Id.* at 217.

116. Baldwin, *supra* note 111, at 517. A majority of the United States Supreme Court held that deterring unlawful police misconduct is the "prime purpose" of excluding illegally seized evidence under the Fourth Amendment. *United States v. Calandra*, 414 U.S. 338, 347 (1974). A strongly worded dissent by Justices Brennan, Douglas, and Marshall disagreed with what it deemed a narrow reading of the purpose of exclusion. *Id.* at 355-57 (Brennan, J., dissenting).

117. *Elkins*, 364 U.S. at 222.

118. *See* Baldwin, *supra* note 111, at 517 (exclusion of evidence pursuant to the Fourth Amendment is a sort of "unclean hands" defense). For a general discussion of the unclean hands defense, see also 1 DAN B. DOBBS, REMEDIES § 2.4(2) (2d ed. 1993). The Supreme Court's decision in *United States v. Calandra* undercuts this view of Fourth Amendment exclusions of evidence. *See supra* note 116.

119. Baldwin, *supra* note 111, at 517.

120. Skepticism regarding the worth of research codes was common in the 1960s, but gave way to acceptance by the 1980s. Also, self-regulatory codes have become the basis of legal restrictions on research, providing another source of legitimacy for the codes. BERNARD BARBER, INFORMED CONSENT IN MEDICAL THERAPY AND RESEARCH 43-44, 137 (1980). The legal restrictions governing research generally operate through government financing of research. The regulatory scheme provides for research institutions to create Institutional Review Boards (IRBs) that evaluate proposed research and prevent unethical research from taking place. *See* 45 C.F.R. § 46.101, *et seq.* (1992) ("Protection of Human Subjects"). For regulations concerning animal research, see 9 C.F.R. § 231, *et seq.* (1989) ("Institutional Animal Care and Use Committee"). *See infra* notes 173-74 and accompanying text for a discussion of how the legal restrictions have been accepted as part of the internal ethics of science.

121. 132 JAMA 1090 (1946).

122. *Id.*

123. BRADFORD GRAY, HUMAN SUBJECTS IN MEDICAL EXPERIMENTATION 7 (1975). *See, e.g.*, *The Nuremberg Code*, in ANNAS & GRODIN, *supra* note 27, at 2 ("1. The voluntary consent of the human subject is absolutely essential. This means that the person involved should have legal capacity to give consent . . . without the intervention of any element of force . . . should have sufficient knowledge . . . to make an understanding and enlightened decision. . . . [B]efore the acceptance of an affirmative decision . . . there should be made known to him the nature, duration, and purpose of the experiment; . . . all inconveniences and hazards reasonably to be expected; and the effects upon his health or person which may possibly come from his participation in the experiment."); *Declaration of Helsinki*, in ANNAS & GRODIN, *supra* note 27, at 331-342; THE NATIONAL COMMISSION FOR THE

124. *See generally*, ANNAS & GRODIN, *supra* note 27.

125. THE NATIONAL COMMISSION FOR THE PROTECTION OF HUMAN SUBJECTS OF BIOMEDICAL AND BEHAVIORAL RESEARCH, *supra* note 123 at 18-20; Maurice B. Visscher, *Ethical Constraints and Imperatives*, in MEDICAL RESEARCH 61-68 (1975) (concerning medical experiments using prisoners); *See also* Marcia Angell, *Editorial Responsibility: Protecting Human Rights by Restricting Publication of Unethical Research*, in ANNAS & GRODIN, *supra* note 27, at 278-79, and Henry Beecher, *Ethics and Clinical Research*, 274 NEW ENG.J.MED. 1354 (1966) for a discussion of some abuses by researchers' who used "helpless" populations.

126. Stephen J. Ackerman, *Watching for Problems that Testing May Have Missed*, F.D.A. NEWS & WARNINGS, Oct. 17, 1988, at 13. Indeed, until quite recently, the United States Food and Drug Administration banned drug research for women who are not pregnant, but merely of child-bearing potential. This policy is scheduled to change shortly. *See* Ruth B. Merkatz, *Women in Clinical Trials: An Introduction*, 48 FOOD & DRUG L.J. 161, 162 (1993). *See also*, Marilynn C. Frederiksen, *Clinical Trials in Pregnancy*, 48 FOOD & DRUG L.J. 195 (1993) (arguing for studies on the effects of certain drugs on pregnant women).

127. Good experimental design would require random assignment of pregnant women into two groups, with neither the experimenters nor the subjects knowing whether they were receiving the drug or a placebo (known in common parlance as a "sugar pill"), so that the subjects' and experimenters' expectations could not color the data. *See, e.g.*, HILLWAY, *supra* note 74, at 166-182.

128. Ackerman, *supra* note 126.

129. *Richardson v. Richardson-Merrell, Inc.*, 649 F. Supp. 799, 800-01 (D.D.C. 1986), *aff'd*, 857 F.2d 823 (D.C. Cir. 1988), *cert. denied*, 493 U.S. 882 (1989).

130. *See, e.g.*, *Daubert v. Merrell Dow Pharmaceuticals*, 113 S. Ct. 2786 (1993); *Brock v. Merrell Dow Pharmaceuticals*, 874 F.2d 307, 311-13 (5th Cir. 1989), *cert. denied*, 493 U.S. 882 (1990).

131. *Id.*

132. There is a legitimate question about whether science itself has moral values. When observing the institutions of science behave morally, it is possible to argue that one is observing individual scientists behaving morally according to personal codes of conduct unrelated to the fact that they are scientists. It is also possible that government or other sources of funding insist upon morality in science, thus requiring that scientists conduct themselves accordingly. *But see supra* and *infra* notes 120, 173-74. It is possible that behaving morally is a way to preserve society's respect for science, hence the power science wields. While any of these theories might explain scientific conduct without positing a moral code internal to the discipline, it may not matter which explanation or explanations are true. If the institutions of science behave as if they have an internal moral code, then it is sufficient for the purposes of this analysis to assume that such a code exists.

133. *See, e.g.*, Markey, *supra* note 50; Pollack, *supra* note 70; Rhoden, *supra* note 87.

134. *See, e.g.*, *supra* notes 106-119 and accompanying text.

135. As early as 1966 the medical and scientific literature issued its first call to exclude data obtained unethically. Henry K. Beecher, *Ethics and Clinical Research*, 274 NEW ENG. J. MED. 1354 (1966) (arguing that science should follow law's example by excluding information obtained unethically). While a trend toward exclusion is developing, it is by no means universal. *See* William E. Seidelman, *Mengele Medicus: Medicine's Nazi Heritage*, 66 MILBANK QUARTERLY 221 (1988); *see also infra* note 171.

136. Phillip Shabecoff, *Head of E.P.A. Bars Nazi Data In Study on Gas*, N.Y. TIMES, Mar. 23, 1988, at A1.

137. *Id.*; *see also*, *EPA Won't Use Data From Tests Nazis Conducted On Prisoners*, CHI. TRIB. Mar. 23, 1988, at D16.

138. Shabecoff, *supra* note 136.

139. *Id.*
140. *Id.*
141. *See supra* note 37
142. *Id.*
143. *See supra* note 30 and accompanying text.
144. *See* Shabecoff, *supra* note 136.
145. *See supra* notes 106-119 and accompanying text.
146. Barry Siegel, *Can Evil Beget Good?; Nazi Data: A Dilemma for Science*, L. A. TIMES, Oct. 30, 1988, § 1, at 1.
147. Seidelman, *supra* note 135, at 229. While the fact of publication might tend to weaken the argument of this article, it might be distinguished by the era in which the data were published. While America was busily seeking the aid of Nazi scientists and preparing for what would be known as the Cold War, the use of Nazi data did not seem morally repugnant. Indeed, it was revealed recently that our own government exposed citizens to nuclear radiation to test possible battlefield nuclear weapons. Senator John Glenn, at whose request the information was revealed, explained that the government's decision to release the radiation as the result of "Cold War frenzy." Willaim Hershey, *Americans Exposed to Fallout in 1948-52; Dozen Secret Weapons Tests Reported*, HOUSTON CHRON., Dec. 16, 1993, at A5. Clearly, by the 1970s, the use of Nazi data raised some troubling ethical questions.
148. Siegel, *supra* note 146.
149. Dr. Pozos has since argued in print that using the data is ethically permissible. *See* Richard Pozos, *Scientific Inquiry and Ethics: The Dachau Data*, in WHEN MEDICINE WENT MAD, *supra* note 83, at 95, 97-108. For articles disagreeing with Dr. Pozos' conclusions that the Dachau data are reliable or that using the data is ethical, see Robert L. Berger, *Nazi Science-The Dachau Hypothermia Experiments*, 322 NEW ENGLAND J.MED. 1435, 1438-39 (1990); Velvl W. Greene, *Can Scientists Use Information Derived from the Concentration Camps? Ancient Answers to New Questions*, in WHEN MEDICINE WENT MAD, *supra* note 83, at 155, 169-70.
150. *E.g.*, WHEN MEDICINE WENT MAD, *supra* note 83; J. David Bleich, *Utilization of Scientific Data Obtained Through Immoral Experimentation*, TRADITION, Fall 1991, at 65; Ernie Meyer, *Can the End Ever Justify the Means?*, JERUSALEM POST, Mar. 2, 1990; Isabel Wilkerson, *Nazi Scientists and Ethics of Today*, N.Y. TIMES, May 21, 1989, § 1, at 34; Donald Dale Jackson, *Chilling Experiments Where Scientists Are Immersed in Helping Us Survive the Cold*, CHIC. TRIB., Jan. 12, 1989, at C1.
151. *See* Caplan, *supra* note 83.
152. Benno Muller-Hill, *Eugenics: The Science and Religion of the Nazis*, in WHEN MEDICINE WENT MAD, *supra* note 83, at 43, 49-51(1992); Berger, *supra* note 149.
153. Siegel, *supra* note 146.
154. *Id.*
155. One of the better articles revealing flaws and outright fraud in the life and works of the principal investigator, Sigmund Rascher, is Berger, *supra* note 149, at 1438-39. Dr. Berger concludes, "the Dachau hypothermia study has all the ingredients of a scientific fraud, and rejection of the data on purely scientific grounds is inevitable. They cannot advance science or save human lives." Berger at 1140. For an article defending the data, see Pozos, *supra* note 149, at 95.
156. Muller-Hill, *supra* note 152.

157. *E.g.*, Greene, *supra* note 149.

158. *See, e.g.*, Eva Mozes Kor, *Nazi Experiments as Viewed by a Survivor of Mengele's Experiments*, in *WHEN MEDICINE WENT MAD*, *supra* note 83, at 3; Sara Seiler Vigorito, *A Profile of Nazi Medicine: The Nazi Doctor-His Methods and Goals*, in *WHEN MEDICINE WENT MAD*, *supra* note 83, at 9, 13.

159. *E.g.*, Bleich, *supra* note 150.

160. Siegel, *supra* note 146 (emphasis supplied).

161. ZIMAN, *supra* note 18, at 137-142. *But see* Indyk & Rier, *supra* note 27.

162. *Id.*; *see also* KLAWANS, *supra* note 33.

163. *Id.*

164. *See supra* notes 99-110.

165. "Virus X" is a pseudonym used by Marcia Angell, an editor of the *New England Journal of Medicine*, in writing about the rejected research project discussed *infra* at the text accompanying notes 166-171. Having rejected the article for publication, the ethics of journal science preclude her identifying the research project in detail. However, it is likely that "virus X" is Cytomegalo Virus. Personal Communication with Grace M. Tannin, M.D., August 8, 1993.

166. Marcia Angell, *Editorial Responsibility: Protecting Human Rights by Restricting Publication of Unethical Research*, in *ANNAS & GRODIN*, *supra* note 27, at 283-84.

167. *Id.*

168. *Id.*

169. *Id.*

170. *Id.*

171. *Id.* *See supra* note 30 and accompanying text regarding importance of publication to scientists. There are some who doubt the practicality of banning data. No external agency will regulate the journals, and where information exists interested scientists will find some way to use it. *See* Greene, *supra* note 149 and accompanying text, at 168. Moreover, the more useful the data the lower the likelihood that a self-imposed ban will work. For example, the Tuskegee Syphilis Studies, arguably the lowest moment in American medical ethics, are too pervasively cited to root out of the literature. Arthur L. Caplan, *When Evil Intrudes*, 22 *HASTINGS CTR. REP.* 29, 31 (1992). In those studies black men in Tuskegee, Alabama who suffered from syphilis were monitored but left untreated for 37 years. Much of what is known about the disease comes from this unethical research, so to ban it would leave the field of medicine ignorant on many important clinical and public health questions. *Id.* For an excellent book on the Tuskegee research, see JAMES H. JONES, *BAD BLOOD: THE TUSKEGEE SYPHILIS EXPERIMENT* (1981).

172. *See supra* note 120.

173. *See, e.g.*, 233 *ANATOMICAL RECORD* inside back cover (1992); 132 *ENDOCRINOLOGY* 19A (1993); 40 *LABORATORY ANIMAL SCIENCE* 670 (1990).

174. *E.g.*, J.R. Smid et al., *Cytochemical Localization of Dipeptidyl Peptidase II Activity in Rat Incisor Tooth Ameloblasts*, 233 *ANATOMICAL RECORD* 493 (1992) (research conducted in Australia); Sylvie Barcellini-Couget et al. *The Regulation by Growth Hormone of Lipoprotein in Lipase Gene Expression is Mediated by c-fos Protooncogene*, 132 *ENDOCRINOLOGY* 53 (1993) (research conducted in France); J. Rothuizen et al., *Increased Neuroendocrine Reactivity and Decreased Brain Mineralocorticoid Receptor-Binding Capacity in Aged Dogs*, 132 *ENDOCRINOLOGY* 161 (1993) (research conducted in The Netherlands); D.H. Percy & K.L.

Williams, *Experimental Parker's Coronavirus Infection in Wistar Rats*, 40 LABORATORY ANIMAL SCIENCE 606 (1990) (research conducted in Canada).

175. *See supra* notes 19-26 and accompanying text.

176. *See supra* notes 27-36, 41-44 and accompanying text.

177. *See supra* notes 27-36 and accompanying text.

178. *See supra* notes 27-36 and accompanying text.

179. *See supra* notes 20-21 and accompanying text.

180. *See supra* notes 99-110, 136-64 and accompanying text.