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August 22, 2010

Texas Forensic Science Commission
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RE Review of State v Willingham

Dear Commissioners:

I write to bring your attention to what I believe is an important issue in the referenced review, namely, the obligation of scientists to correct mistakes that have appeared in their published work. By “scientists” I mean everyone who can authoritatively state conclusions about technical matters in their field of work. By “published work” I mean all public utterances, in writing or otherwise, that may affect the beliefs or actions of others. I refer here, of course, to the failure of the Texas State Fire Marshal’s Office to correct the errors in the testimony it supplied in the trial that convicted Mr. Willingham of arson-murder. Before addressing that failure specifically, I will discuss more broadly the obligations on scientists who have made significant errors.

My perspective is that of one who has spent his entire post-secondary-school life as a scientist, including 35 years as a forensic physicist. I also was a practicing attorney for 22 years. Although I am writing as a scientist addressing the obligations and practices of scientists, my legal experience is relevant because of what it has taught me of the difference between the codes of ethics of science and the law, a difference I will address.

A scientist who realizes that he or she has published a statement containing a material error is under strong professional and personal pressure to correct that error, to direct all who could have been affected by the statement to disregard it. In contrast to a judge directing a jury to ignore a statement, the scientist directs *his* audience to disregard a statement because the statement is *wrong*, not because it violated an evidentiary rule.

The errors in science that come to the public’s attention usually involve scholarly papers which are formally withdrawn (“retracted”), with the reason for the retraction being made explicit. The error is either discovered by its author or, more embarrassingly for the author, brought to the author’s attention by others. The errors can be factual or interpretive. Factual errors are the more difficult to discover, since they arise from flaws in the data reported and usually do not come to light until the author or

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others fail repeatedly in their efforts to replicate the reported research. (Although I am not including cases of outright dishonesty, I note that the inability to replicate experimental results is usually the main track to detecting such dishonesty.)

The interpretive errors can themselves be divided into two categories: mathematical mistakes and misapplications of a theory. The former are usually spotted by readers, and are often caught by referees (to be discussed below) before publication. The more fundamental interpretative error, the misapplications of theory, arises from the fact that all technical conclusions are based the *interpretation* of data using one or more theories. Thus, the interpretive errors consist of either applying a theory outside its range of validity or of using a theory that is completely wrong. They usually occur because their author was ignorant of previous research in his or her field. A conscientious scientist discovering that he or she has made such a mistake usually becomes very upset, even suicidally depressed. I mention these facts to emphasize how strongly scientists feel about publishing errors, a circumstance that can unfortunately lead to a scientist being known primarily in connection with an error that he or she published. Nevertheless, and regardless of how embarrassing it is to make the correction under these circumstances, one must do so. The alternative will usually have even more serious professional consequences. The archives of refereed technical journals¹ provide ample support for these sentiments. An article from the journal SCIENCE about a series of retractions necessitated by an innocent but embarrassing error in data manipulation accompanies this letter, as does one of the retractions the article refers to.

Although professional journals provide a useful context within which to discuss the significance of scientists' errors and they react to having made them, technical journals represent but a small part of the arena in which scientists' statements can have significant effect. In fact, in some fields, the harm done by scientists' errors can go far beyond retarding the development of a field of knowledge, the main concern regarding errors in refereed journals.

Consider the automotive industry, where design errors by scientists (usually called engineers in this role) can lead to injuries to thousands of persons on the world's roadways. How long after it is realized that an error had been made, for example, in the placement of a gasoline tank, is the error revealed and corrective measures taken? The speed with which such corrections are made is unfortunately affected by political and financial pressures, regardless of when the engineer responsible finds and announces the error. Why this is so under such circumstances was well illustrated when disaster struck the Space Shuttle program in 1986. The loss of the Challenger that year occurred because it was launched in temperatures below which an important seal had adequate resiliency. The tragedy was that the engineers responsible for the design had warned of the failure to model Space Shuttle launches at low ambient temperatures. The subsequent investigation revealed that this warning had been ignored by those responsible for making the decision to launch the Challenger in spite of the ambient temperature being below 35°F. Compounding the tragedy is the fact that the systemic error

¹ Before a manuscript can be published in a refereed journal, it must be reviewed by one or more persons knowledgeable in the manuscript's field. The hope is to prevent erroneous papers from appearing in the journal. The reviewers, the "referees," perform their work voluntarily as a contribution to their profession. Knowing that papers published in a refereed journal have been reviewed beforehand gives readers of the journal a certain degree of confidence that, though they may disagree with some of the conclusions published in the journal, reading the papers in the journal will not be a waste of time. It *would* be a waste of their time, for example, to devote the effort needed to understand paper which turned out to be based on theories already shown to be incorrect.

identified by Challenger Disaster Commission member physicist Richard Feynman--failure to permit the input to launch decisions from those most intimately familiar with the shuttles' operation—did not lead to the indicated modification in NASA's behavior. Fourteen years later, the Shuttle Columbia and another seven brave men and women were lost because of the same failure. In the latter disaster, the ignored warning ignored dealt with the significance of losing heat-shielding tiles on launch.

The field relevant to the Commission's inquiries, forensic practices in criminal investigations, is another where scientific error can lead to injury and death. In fact, the probability that devastating results will follow from an error in criminal forensic work is immeasurably higher than it is in all other fields imaginable. This is because, alone of all scientific fields, forensic science as practiced in the nation's crime laboratories, produces conclusions that are implemented with *no* review or effective oversight. Because of this, it is the least reliable of sciences. Other scientific/engineering fields insist on rigorous testing and review before the results of research and investigative work are made public. In one case, this control is exerted by the refereeing process for manuscripts submitted for publication. In another, the results of engineering design work are repeatedly reviewed by other engineers. However, when it comes to forensic conclusions, the only barrier against flawed work determining the outcome of criminal and civil trials is the adversarial system of the U.S. courts. In spite of the directives of the US Supreme Court in *Daubert*, I have repeatedly observed trial judges allowing nonsense to be introduced as evidence, presumably in the hope (which they occasional express) that skillful cross examination will destroy it. Reflecting the worthlessness of the adversarial process for correcting errors in science, the federal judge who co-chaired the recent National Academy of Sciences (NAS) committee on forensic science² commented to me that until he served on that NAS committee, he had no idea that so many practices followed by crime laboratories had never been validated. During his long career on the bench, he had presumably heard assertions often to that effect by defense attorneys but, because the assertions were in the context of the adversarial process, had given them little credence. Even as a sitting judge, and an excellent and intelligent one at that, he had no more feeling for the potential for errors in the forensic evidence than do those who get their forensic science education from forensic television shows produced for entertainment. These are the people who make up most juries in this country.

Although I fervently hope for the day when forensic science as practiced in crime laboratories and in our justice system in general is changed in a way to make it above reproach, my harsh comments about the present system are not directed toward achieving that goal. They are, rather, to show why-- of all categories of persons practicing science--those assisting in criminal investigations have by far the greatest obligation to correct their errors. And to correct them in a timely fashion, which means as soon as they discover them. Persons unwilling to meet this obligation, to comply with its requirements, should not be working in forensic science in any capacity, least of all where their testimony can send people to prison and even to their death.

Finally, I turn to the forensic work leading to the conviction of Cameron Todd Willingham for arson-murder. The fire declared to be arson by the State's investigators occurred December 23, 1991. Mr. Willingham was charged with murder the following month and tried and convicted in August, 1992. He was executed eleven-and-a-half years later, on February 17, 2004.

I have read that part of the transcript from the 1992 trial that includes the testimony of the experts from the Texas State Fire Marshal's Office. Reviewers far more skilled in the field of fire

² This is the committee that issued "Strengthening Forensic Science in the United States: A Path Forward," a report that has disturbed the forensic community from the day of its release, in February 2009.

investigation than I have refuted this testimony point by point; I will say little more about it. I will say, however, that in addition to being wrong, many of the State Fire Marshal Office's strongest assertions³ at the 1992 trial had been experimentally disproven by the early 1980s at the latest. I base this assessment on my own experience in investigating fires in the 1980s and my resultant acquaintance with the professional literature that then existed. So, not only was the key testimony from the State Fire Marshal's Office based on incorrect theories, that Office would have known that it was wrong had its practitioners sought out information then available in the professional literature.

I was aware that many fire investigators, even including those employed in an official state capacity, continued to use certain investigative "rules of thumb" long after they had been disproven by experiment.⁴ Given the atmosphere of error in the field as it existed in 1992, I was not surprised to learn that the investigators of the Texas State Fire Marshal's Office continued to rely upon incorrect theories. They were emulating the practices of others who had failed to keep up with the scientific findings in their field. Also not surprising, unfortunately, was that those investigators were allowed by the trial judge to use what I call the Sherlock Holmes fallacy: *the explanation remaining after all others have been eliminated must be the correct one*. Although many persons, including some pseudo-scientists⁵ and perhaps Sherlock Holmes' creator⁶ himself subscribe or subscribed to this philosophy, it would be a very strange scientist who did. What it really means is that, if I cannot think of an explanation other than the one I have settled on, my explanation must be the correct one. Applied in the field of criminal investigation, it presumes that the investigator's list of innocent explanations is an exhaustive one and that if that investigator can, rightly or wrongly, eliminate all on the list, then a criminal act must have occurred. This approach is fundamentally anti-scientific and should have no role in any type of analysis, let alone forensic analysis, which shapes our criminal justice system.

The Texas Forensic Science Commission has found (only tentatively, I hope) that although the Texas State Fire Marshal's Office investigators committed many errors of analysis on which they based flawed testimony regarding the Willingham fire, the fact that the Office was following local practice means that the Office was not negligent. This reasoning is reminiscent to what was once common in civil tort law. For example, if, in a medical malpractice trial in 1992, the defendant physician could show that, though he made errors that injured the plaintiff, he was following local medical practice, he could obtain a defense verdict. This made sense in the civil arena during an era in which the flow of information among local communities was minimal. It probably does not do so any longer during our era of easy communication. In any event, civil law is different from criminal law. In the former, it is only money that is at stake. In the latter, human freedom and life can be at stake. Persons providing scientific testimony in criminal matters have an obligation to do all that they can to ensure that their theories and practices are in accord with the latest knowledge in the field. The Texas State Fire Marshal's Office failed to do this in 1992 and, in my opinion, that failure constituted negligence. The greater the harm that can result from a scientist making an error, the greater the obligation on the

³ I refer, for example, to Mr. Vasquez's insistence that the temperatures observed in the Willingham fire could not have been achieved by the burning of the normal contents of the building that they could only have followed from the use of an accelerant.

⁴ Most of those rules seem plausible in the same sense that it seems plausible that a ten-pound weight falls ten times as fast as a one-pound weight. It probably this plausibility that led to their use long after they should have been discarded as scientifically disproven.

⁵ One such pseudo-scientist guilty of the Sherlock Holmes fallacy asserted that the Nazca lines in Peru must have been created by visitors from another planet, since he ruled out all the explanations he could think of that did not involve.

⁶ Arthur Conan Doyle believed for decades, and went to his death believing, in fairies in the grass. One of the alternative explanations for reports of such creatures he eliminated was that the little girls making the reports were lying.

scientist to *not* make an error. To fail to recognize and act in accordance to this obligation is unethical as well as negligent.

The unethical, negligent behavior that I believe the Texas State Fire Marshal's Office was guilty of at trial was nothing compared to what followed. The weak excuse available for the Office's behavior at trial – that it was simply following local (wrong) practice – ceased being available shortly thereafter. In 1992, research results that had been accumulating for years were widely disseminated in the form of the National Fire Protection Association's publication *Guide for Fire and Explosion Investigations*, also designated NFPA 921. The NFPA is the most respected authority on fire safety and investigation in North America and probably the world. NFPA 921 code has gone through many editions since 1992; however, its first edition eviscerated nearly every one of the rules of thumb relied on by the Texas State Fire Marshal's Office at the Willingham trial. These included the significance of puddle-shaped burn patterns on the floor, the idea that a simple house fire could not attain temperatures high enough to melt aluminum, the concept that fire could not "burn down" without their being an accelerant present, etc. I repeat that these were not new results, just ones that the Texas State Fire Marshal's Office investigators, including Mr. Vasquez, who asserted that he had investigated 1200-1500 fires, was not aware of. It is a chilling thought that this may be the reason that Mr. Vasquez also stated that he had concluded that nearly all of those 1200-1500 fires were of an incendiary nature.

A short time after NFPA 921 issued, the Texas State Fire Marshal's Office adopted it. From that date on, that Office has to have been aware of NFPA's severe criticism of the rules of thumb of fire investigation that the Office had relied on for years. What must Mr. Vasquez and others in that Office have thought when they read NFPA 921? Presumably, they changed their investigative practices, but what of the fate of those persons wrongly convicted of arson because of the earlier flawed work of the Office? In particular, what of Mr. Willingham, still ten years from his execution. Did the Texas State Fire Marshal's Office approach the court, or Mr. Willingham's prosecutor, or his defense attorney to reveal its earlier errors? Those forensic experts who neglected to come forward to correct the errors that they had made at the Willingham trial and, presumably others, were guilty of such violation of scientific ethics that some other phrase is needed to characterize their inaction. It is the type of negligence leading to death that in a negligent homicide trial would lead to a verdict of guilty.

One of the problems in reviewing a question such as the Texas Forensic Science Commission has before it is the potential for confusion between legal practice and scientific practice, between the guidance provided by legal codes of ethics and that provided by the scientific code of ethics. In the legal realm, from time to time, the Supreme Court of the United States rules that certain practices traditionally followed in the legal process are violations of the U.S. Constitution and that they must be halted. Usually these rulings are accompanied by a directive that they are to be applied only from that point forward, and not used to evaluate past events. For example, the *Miranda* decision found that the U.S. Constitution is violated if a criminal suspect is not allowed to remain silent in the face of police interrogation and, further, that the suspect has a Constitutional right to be informed of this. This ruling did not give to persons convicted previously following interrogations violative of these Constitutional rights a supportable claim for redress. Only procedural rights had been violated and this violation did not impinge in a clear manner on the question of guilt. Science is different. Finding that scientific evidence with no basis in fact had been used to convict a person means that the person should be exonerated. And this is true even if the realization of the error in the evidence occurs after the conviction.

It was experimentally established in the early 1990s that a puddle-shaped burn pattern that exists on the floor of a room that has been involved in a flash-over fire is, by itself, worthless evidence that an

accelerant had been used to start the fire, that is, that the fire was incendiary. Once established, that scientific fact is known to be true just as reliably at any era throughout history, be it 1910, 2010, or 1991. In particular, it establishes that the puddle-shaped marks on the floor of the Willingham house after its flashover fire could *not* be used to conclude that the fire was arson, let alone, as the State Fire Marshal's Office testified, that their *compelled* a conclusion of arson. There can be no doubt that this and other incorrect statements by the Fire Marshal's Office led to Mr. Willingham's conviction and death sentence in 1992. For the Fire Marshal's Office to permit him to remain imprisoned during all those years leading up to his execution, in spite of knowing for most of those years that the compelling testimony supporting conviction that the Office had provided at trial was solidly wrong, is to partake in unethical scientific behavior of the most extreme kind.

I thank you for the opportunity to put my views before you. I appreciate the magnitude and difficulty of the task you are engaged in.

Respectfully submitted,

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Accompanying Documents (via FedEx only)