

# MODERN SCIENTIFIC EVIDENCE

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**FORENSICS**  
**2008 Student Edition**

# MODERN SCIENTIFIC EVIDENCE

## Forensics

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### 2008 Student Edition

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# Dedication

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*For Lisa*  
(DLF)

*For Roselle*  
(MJS)

*For Mary*  
(JS)

*For Jenny*  
(EKC)

# Preface

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For the rational study of the law the blackletter man may be the man of the present, but the man of the future is the man of statistics and the master of economics.

— Oliver Wendell Holmes<sup>1</sup>

The intellectual life of the whole of western society is increasingly being split into two polar groups.... Literary intellectuals at one pole—at the other scientists.... Between the two a gulf of mutual incomprehension.

— C.P. Snow<sup>2</sup>

Judges and lawyers, in general, are not known for expertise in science and mathematics. Nor is science a subject given significant attention in American law schools. The reasons are manifold. Despite Justice Holmes' prescient and often-quoted statement, the legal profession has perceived little need for lawyers to have a grounding in the scientific method. Indeed, law students, as a group, seem peculiarly averse to math and science. The American educational system is partly at fault, for students routinely divide, or are divided, into two separate cultures early in their training. Students who display a talent in math and science typically pursue careers in medicine, engineering, biology, chemistry, computer science, and similar subjects. Students with less inclination toward quantitative analysis very often go to law school. It is perhaps not surprising that the student who excels in the humanities soon learns that the best job opportunities for a graduate in Nineteenth Century Russian Literature can be found through law school. Whatever its origins, the legal profession today is a particularly salient example of a literary culture that remains largely ignorant of scientific culture.

Increasingly, however, there are signs that a "third culture" is emerging in the law.<sup>3</sup> This third culture would be one that integrates a sophisticated understanding of science into legal decisionmaking. Perhaps the most visible sign of this emerging integration is the United States Supreme Court's decision in *Daubert v. Merrell*

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<sup>1</sup> Oliver Wendell Holmes, Jr., *The Path of the Law*, 10 HARV. L. REV. 457, 469 (1897).

<sup>2</sup> C.P. Snow, *The Two Cultures and the Scientific Revolution* 3 (Rede Lecture 1959).

<sup>3</sup> Cf. JOHN BROCKMAN, *THE THIRD CULTURE* (1995) (chronicling the emergence of a "third culture" in society generally, through the increasing numbers of scientists writing for a general audience); STEVEN GOLDBERG, *CULTURE CLASH: LAW AND SCIENCE IN AMERICA* (1994) (exploring the many contexts in which law and science overlap in practice).

## PREFACE

*Dow Pharmaceuticals, Inc.*<sup>4</sup> The Court, for the first time in its history, considered the standard for evaluating the admissibility of scientific expert testimony. Briefly, the *Daubert* Court held that under the Federal Rules of Evidence, trial court judges must act as “gatekeepers,” and evaluate the validity of the basis for proffered scientific expertise before permitting the expert to testify. In two subsequent cases—*General Electric Co. v. Joiner*<sup>5</sup> and *Kumho Tire Ltd. v. Carmichael*<sup>6</sup>—the Court further explicated the obligations that this gatekeeping role demands. These obligations were codified in the Federal Rules of Evidence in 2000. Moreover, states have increasingly followed the Supreme Court’s lead, with many adopting *Daubert* outright, and still others incorporating the insights of *Daubert*’s validity standard into their preexisting tests for admission of expert testimony.

Application of the *Daubert* standard requires an understanding of scientific research. Whether the Court intended to change the way the law responds to scientific evidence, or had more modest expectations, is impossible to know. Without doubt, however, the many judges, lawyers and scholars who have written on the decision have discovered a revolution of sorts. This revolution is one of perspective, and it affects profoundly not only the judges who guard the gate, but also the lawyers who seek to enter through it.

Until *Daubert*, courts had applied a variety of tests, with most courts being deferential to the scientists in their respective fields of expertise. This role was most closely associated with the general acceptance test articulated in *Frye v. United States*.<sup>7</sup> *Frye* instructed judges to admit scientific evidence only after it had achieved general acceptance in its field. The *Daubert* Court, in contrast, found that the Federal Rules of Evidence require judges themselves to determine the scientific validity of the basis for expert opinion. The shift in perspective is subtle yet profound. Whereas *Frye* required judges to survey the pertinent field to assess the validity of the proffered scientific evidence, *Daubert* calls upon judges to assess the merits of the scientific research supporting an expert’s opinion. Implicitly, as well, the *Daubert* standard contemplates that lawyers will have sufficient expertise to explain the science to judges when they make admissibility arguments. The *Daubert* perspective immediately raised the spectre, as Chief Justice Rehnquist decried it, of judges assuming the role of “amateur scientists.”<sup>8</sup> The gatekeeping role, he feared, was one most judges were ill-suited to fill.

*Daubert* has not come to mean that judges must be trained as scientists to carry out admissibility decisions. No one expects judges to join physicists soon in the

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<sup>4</sup> 509 U.S. 579, 113 S.Ct. 2786, 125 L.Ed.2d 469 (1993).

<sup>5</sup> 522 U.S. 136, 118 S.Ct. 512, 139 L.Ed.2d 508 (1997).

<sup>6</sup> 526 U.S. 137, 119 S.Ct. 1167, 143 L.Ed.2d 238 (1999).

<sup>7</sup> 293 F. 1013 (D.C. Cir. 1923).

<sup>8</sup> 113 S.Ct. at 2800 (Rehnquist, C.J., concurring in part and dissenting in part).

## PREFACE

search for grand unified theories.<sup>9</sup> But there is considerable space between being a trained scientist and being ignorant of science. Although *Daubert* does not expect judges and lawyers to be scientists, it does expect them to be sophisticated consumers of science. This book was formulated with that goal in mind. It is intended to introduce students to the rigors and details underlying scientific expert testimony, to offer an entry point to a host of scientific fields that are highly relevant to the law. It is not intended to provide simple “answers” or final “conclusions.” Instead, it is designed and organized to acquaint aspiring lawyers with scientific fields that will be crucial to their practices.

This volume is part of a special student edition of a much larger work intended for a professional audience, our five volume treatise, *MODERN SCIENTIFIC EVIDENCE: THE LAW AND SCIENCE OF EXPERT TESTIMONY* (2008). There are two volumes in the student edition. The first volume, *Standards, Statistics and Research Issues*, concentrates on the background issues in both law and science that lie behind the sundry contexts in which experts are employed. The second volume, *Forensic Science Issues*, concentrates on an array of important forensic subjects. We hope that the two volumes will be of service either standing alone or as companions to regular texts in a variety of classes. If *Daubert* stands for the proposition that judges and lawyers must henceforth understand science well enough to integrate it successfully into the law, then the educational process that will allow this to occur must begin in law school.

The chapters follow one of two formats. Several chapters provide general overviews of the subject. Most chapters, however, are divided into two sections, one dedicated to the legal relevance of the particular field and the second concerned with the state of the art of the research in that field. The first section is authored by the editors and the second is authored by one or more eminent scientists. The sections on the state of the science are all written largely following a similar organizational scheme. We asked the contributors to discuss the scientific questions or hypotheses posited by the researchers, the methods brought to bear to study these hypotheses, the areas of scientific agreement, the areas of scientific disagreement, and the likely future directions for scientific research in the area. Some scientific topics lend themselves to this scheme better than others. Nonetheless, our guiding objective was to make the science accessible to the non-scientifically trained generalist.

*Daubert*, perhaps, represents nothing more, nor *less*, than that the legal culture must assimilate the scientific culture. As compared to the sciences, the law obviously has different objectives, values, and time tables in which to work. The law should not, nor could it, adopt the scientific perspective wholly and without qualifications. Science is merely a tool that the law can and must use to achieve its own

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<sup>9</sup> See generally STEVEN WEINBERG, *DREAMS OF A FINAL THEORY: THE SEARCH FOR THE FUNDAMENTAL LAWS OF NATURE* (1992).

## **PREFACE**

objectives. Science cannot dictate what is fair and just. We can confidently conclude, however, that science has become, and will forever more be, a tool upon which the law must sometimes rely to do justice.

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EDWARD K. CHENG

February, 2008



## Acknowledgments

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At the conclusion of *The Adventures of Huckleberry Finn*, Huck states, “. . . and so there ain’t nothing more to write about, and I am rotten glad of it, because if I’d a knowed what a trouble it was to make a book I wouldn’t a tackled it and ain’t agoing to no more.”<sup>1</sup> We, perhaps, suffer Huck’s lament more than he, for he never knew the pain of periodic supplements, as are planned for these volumes. However, we have had the immeasurable assistance of a score of colleagues and students who have made our task less trouble. We wish to thank all of the people who contributed so much to both the first and second editions.

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<sup>1</sup> Mark Twain, *Adventures of Huckleberry Finn* 363 (Random House 1996).

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