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Bending Nature, Bending Law

David G. Owen

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BENDING NATURE, BENDING LAW

*David G. Owen**

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* Carolina Distinguished Professor of Law. Thanks to Karen Miller, William Mills, and Douglas Rushton for research and editorial assistance.

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Science has transformed the way we live, how long we live. It has meant the steady spread of improvements of a kind new to human experience, and it has brought a level of fear that is also new.

*–David McCullough***

I. INTRODUCTION

Human relationships with one another are extraordinarily complex, yet that complexity pales in comparison to their relationships with nature. Carbon, air, water, sunlight, and various organic nutrients provide us with the essential stuff of life. Yet lightning, floods, volcanoes, earthquakes, tornadoes, tigers, viruses, and other natural phenomena can snuff out human life in the twinkling of an eye. Advances in civilization over the millennia are largely a result of men and women putting science (understanding nature) and technology (applying nature) to work, of bending nature to serve human will. Just as fire, water, and other natural elements on the planet produce suffering as well as succor to human beings, so too do the fruits of science and technology. While facilitating the hunt for food, spears and gunpowder are also used to injure and subjugate other persons. Even the wheel, which so greatly expands our ability to gather resources, also extends our capacity for destruction when attached to chariots and tanks. A list of how technology has been put to use to advance the human race, while also causing it great hardship, could fill ten thousand volumes.

Over the last two centuries, explosive advances in science and technology have propelled production of a dizzying array of new tools reducing work, expanding human potential, and enriching lives in myriad ways. Developments in lamps, medicines, mechanical engines, railroads, gas and then electric lights, radios, televisions, and cell phones represent just a small sampling of the profusion of technological enhancements to human life. Today, persons to a large extent accomplish their individual and collective objectives, and relate to one another, through the products of science and technology—such as automobiles, punch presses, drain cleaners, tractors, airplanes (civilian and military), prescription drugs, medical devices, computers, frozen foods, tennis rackets, and perfumes.¹

** DAVID MCCULLOUGH, BRAVE COMPANIONS: PORTRAITS IN HISTORY 211 (Simon & Schuster 1992).

1. See generally Anita Bernstein, *How Can a Product Be Liable?*, 45 DUKE L.J. 1, 9 (1995) (explaining how the law embraces a theory of product dynamism).

Yet, sometimes, such products cause collateral damage, injuring and killing human beings.

It is the job of law, drawing from customs, morals, and practical politics, to prescribe who bears the economic risk of harmful consequences from bending nature—those who exploit it or those who are harmed thereby. Early law had simple rules of strict (if limited) accountability for harm from human enterprise.² Over the last couple of centuries, the law has bent that early notion, reshaping doctrine with principles of foreseeability and fault in order to shelter actors from excessive responsibility for harm from putting nature to productive use. As enterprises have harvested science and technology, foisting new and sometimes unknown risks on human beings, the concept of unforeseeability has served to protect firms from legal responsibility for harmful consequences beyond those they reasonably should anticipate. Fault itself, of course, grounds this limitation on responsibility for harm in basic moral theory.³ Yet, foreseeability is a more elemental concept that swirls throughout fault and other aspects of private law, assuring that accountability for the harmful consequences of behavior is rooted in human will.⁴

Scholars of private law have long framed the central issue of responsibility for harm, whether generally⁵ or as applied to science and technology,⁶ in terms of the great divide between fault and strict liability.

2. See, e.g., NORMAN F. CANTOR, *IMAGINING THE LAW: COMMON LAW AND THE FOUNDATIONS OF THE AMERICAN LEGAL SYSTEM* 225 (HarperCollins Publishers, Inc. 1997) (“From the fifteenth century down to the Industrial Revolution around 1850, the common law adhered to a principle of strict liability.”); see also MORTON J. HORWITZ, *THE TRANSFORMATION OF AMERICAN LAW, 1780–1860*, at 85 (Harvard Univ. Press 1977); W. PAGE KEETON, DAN B. DOBBS, ROBERT E. KEETON, & DAVID G. OWEN, *PROSSER AND KEETON ON THE LAW OF TORTS* 21–22 (5th ed. 1984) [hereinafter *PROSSER AND KEETON ON TORTS*]; Charles O. Gregory, *Trespass to Negligence to Absolute Liability*, 37 VA. L. REV. 359, 364–65 (1951). Other scholars argue that early law more robustly embraced a complex combination of liability concepts. See, e.g., ALAN CALNAN, *A REVISIONIST HISTORY OF TORT LAW: FROM HOLMESIAN REALISM TO NEOCLASSICAL RATIONALISM* 3–4, 63–66 (Carolina Academic Press 2005); Gary T. Schwartz, *The Character of Early American Tort Law*, 36 UCLA L. REV. 641, 679 (1989).

3. See ERNEST J. WEINRIB, *THE IDEA OF PRIVATE LAW* 171 (Harvard Univ. Press 1995); DAVID G. OWEN, *Philosophical Foundations of Fault in Tort Law*, in *PHILOSOPHICAL FOUNDATIONS OF TORT LAW* 201 (David G. Owen ed., Oxford University Press, Clarendon 1995); Arthur Ripstein, *Justice and Responsibility*, 17 CAN. J.L. & JURISPRUDENCE 361, 362 (2004).

4. See generally David G. Owen, *Figuring Foreseeability*, 44 WAKE FOREST L. REV. 1277, 1278, 1281–90 (2009) (explaining how moral responsibility for consequences is grounded in their foreseeability).

5. See, e.g., JULES L. COLEMAN, *RISKS AND WRONGS* 212 (Cambridge Univ. Press 1992) (examining the divide between fault and strict liability in the law of torts); ERNEST J. WEINRIB, *THE IDEA OF PRIVATE LAW* 171 (Harvard Univ. Press 1995) (“[S]trict liability [is] often regarded as the great competitor of negligence liability.”); Peter M. Gerhart, *The Death of Strict Liability*, 56 BUFF. L. REV. 245, 246–47 (2008).

6. “Technical information relevant to the issue of due care lies at the uncertain frontiers of modern science and technology.” Harold L. Korn, *Law, Fact, and Science in the Courts*, 66 COLUM.

No doubt the comparative merits and frailties of these opposing systems of accountability are fundamentally important. Yet, the spotlight shone on economic and philosophic aspects of these competing ideologies has left in the shadows the analytic fulcrum that properly defines the outer bounds of responsibility for harm from technology gone awry. That fulcrum is foreseeability.

This Article begins to fill that gap, by illuminating foreseeability's sometimes hidden role over the last half century in framing the debate on whether private law should hold actors accountable for the harmful effects of new technology, even if those consequences are unforeseen. This Article also opens debate on how a role for foreseeability might be fashioned for this context where consequences become ever harder to predict as science peels back the essential building blocks of nature, and as technology reconstructs nature in uncharted ways. The issue explored here is one that private law increasingly will confront: whether actors (usually firms) should bear, or be protected from, legal responsibility for the unforeseeable risks of bending nature. Put otherwise, the question addressed here is whether and how the law should bend itself to address accountability for harm in this brave new world.

Penetrating to the heart of responsibility for harm, the problem of unforeseeable risk forces courts and policy makers to reexamine the goals of private law, including a host of fundamental questions: Who should bear the costs and benefits of changes in science and technology that develop over time? How should the law deal with changes in public attitudes toward risk, producer liability, individual responsibility, and legal doctrine? Are jurors of varying ages capable of fairly judging products made before they were born, or made just last year, according to the science, technology, values, and standards of the time when those products were invented, made, and sold? Is the judicial system capable of resolving these problems in a principled manner through the development of common law, or is the legislature a preferable forum for drawing basic liability lines? Should the law place primary (or exclusive) jurisdiction in regulatory agencies to try to discover and prevent these types of hazards before the fact? These are just a few of the many perplexing questions with which courts and policymaking institutions increasingly will have to grapple, questions that lie on the cutting edge of modern science and the law. The purpose of this Article is to begin that journey.

L. REV. 1080, 1097–98 (1966); see also Li Han, *The Product Quality Law in China: A Proper Balance Between Consumers and Producers?*, 6 J. CHINESE & COMP. L. 1 (2003); Siddharth Khanijou, *Patent Inequity?: Rethinking the Application of Strict Liability to Patent Law in the Nanotechnology Era*, 12 J. TECH. L. & POL'Y 179, 183 (2007); David G. Owen, *Defectiveness Restated: Exploding the "Strict" Products Liability Myth*, 1996 U. ILL. L. REV. 743, 744–46; William Powers, Jr., *A Modest Proposal to Abandon Strict Products Liability*, 1991 U. ILL. L. REV. 639, 639.

Part II of this Article probes the underlying problem: how the accelerating pace of science is opening up a vast universe of unknown risks. Part III examines private law's initial, blunt efforts to address the consequences of technology twisting nature into harm. This Part chronicles the law's experiment, beginning in the 1960s, in holding producers "strictly" liable for unforeseeable risks from the products of technology, an experiment that expelled foreseeability from its classic anchoring role in private law. Part IV then explains how the law began to heal itself by reviving foreseeability, as various features of the great strict liability experiment unraveled, one by one. Part V next explores how foreseeability presents the greatest challenge to private law in a modern world where science and technology can be expected to go awry in many ways that cannot specifically be predicted, but where unexpected consequences, sometimes harmful, are inevitable. The Article concludes that the moral power and flexibility of foreseeability render it superior to a rule of strict liability in setting the boundaries of responsibility for harm from rapid advances in science and technology.

II. BENDING NATURE AND THE PROBLEM OF UNFORESEEABLE RISK

Foreseeability, long a central feature of private law, helps define and delimit responsibility for causing harm.⁷ Harmful action can hardly be viewed as "wrong" if the actor could not possibly have contemplated that the action might produce the harm. Moreover, because the effects of all behavior extend forever,⁸ "no coherent conception of responsibility can suppose that a person is responsible for everything that could be called a consequence of her actions."⁹ If roughly stated, it is largely true that "a defendant is responsible for and only for such harm as he could reasonably have foreseen and prevented."¹⁰ In short, foreseeability is the moral thread that helps define and bind together interpersonal obligations, personal wrongdoing, and the extent of responsibility therefor.¹¹

7. In 1850, for example, Baron Pollock opined that "no defendant should ever be held liable for consequences which no reasonable person would expect to follow from the conduct." PROSSER AND KEETON ON TORTS, *supra* note 2, at 280–81 (summarizing *Greenland v. Chaplin*, (1850) 5 Exch. Rep. 243, 243–48 (U.K.)). See generally P.A. LANDON, POLLOCK'S LAW OF TORTS: A TREATISE ON THE PRINCIPLES OF OBLIGATIONS ARISING FROM CIVIL WRONGS IN THE COMMON LAW 21–45 (15th ed. 1951) (1887) (examining foreseeability's role in tort); Patrick J. Kelley, *Proximate Cause in Negligence Law: History, Theory, and the Present Darkness*, 69 WASH. U. L.Q. 49 (1991) (tracing history of foreseeability in proximate cause); Owen, *supra* note 4 (probing foreseeability).

8. "In a philosophical sense, the consequences of an act go forward to eternity, and the causes of an event go back to the discovery of America and beyond. 'The fatal trespass done by Eve was [the] cause of all our woe.'" WILLIAM L. PROSSER, HANDBOOK OF THE LAW OF TORTS § 41, at 236 (4th ed. 1971) (paraphrasing lines from JOHN MILTON, PARADISE LOST Book IX (1667)).

9. Ripstein, *supra* note 3, at 374.

10. H.L.A. HART & TONY HONORÉ, CAUSATION IN THE LAW 231 (2d ed. 1985) (1959).

11. See Owen, *supra* note 4.

Current advances in technology, however, may strain foreseeability's vaunted place in the pantheon of tort. In recent decades, humans have moved beyond merely harnessing energy to "bending" it—reconfiguring the way in which atoms and genes normally are put together, altering the natural constructs of physics and biology, sometimes with explosive results. Most conspicuous, of course, was the development of atomic and then hydrogen bombs in the middle of the twentieth century. More recently, scientists have changed the genetic makeup of food, cloned animals, spliced genes, dispersed cell phones to all corners of the globe, developed new drugs, and have begun to manipulate the atomic construct of everyday products through the marvels of nanotechnology. A few examples illustrate how very fast and far science and technology are pushing the kinds of products humans use and consume on a daily basis, often with unknown risks.

Re-engineered Food. Scientific meddling with nature in recent years has wormed its way into the most fundamental of all products—food. Over the past few decades, scientists have put growth hormones to substantial use in beef production and developed biotech crops. The marketing of such re-engineered food products has rapidly increased in America and other nations in recent years.¹² American farmers now routinely implant cattle with synthetic hormones that mimic natural steroids, such as testosterone, in order to accelerate weight gain and enhance the efficiency of cattle feed.¹³ Biotech crops (genetically modified organisms or "GMOs") are the result of inserting an organism's genes into the DNA of a plant, for such purposes as insect and weed resistance.¹⁴ As of 2007, more than 90% of all soybeans (and 87% of cotton) planted in the United States was genetically engineered in this manner, as was nearly three quarters of all corn.¹⁵

12. Growth hormones are now used in about 80% of the beef produced in the United States. The Center for Food Safety, *Other Hormones*, <http://truefoodnow.org/campaigns/rbgh-and-hormones/other-hormones/> (last visited Mar. 30, 2010). By 2007, 282 million acres were devoted globally to biotech crops, up from just 7 million acres in 1996. Press Release, Biotechnology Industry Organization (BIO), *Agricultural Biotechnology Continues to Increase Crop Yield and Farmer Income Worldwide While Supporting the Environment* (Feb. 13, 2008), available at http://bio.org/news/pressreleases/newsitem.asp?id=2008_0213_01. Quite recently, China approved genetically modified rice, opening the door for the first large-scale production of this staple crop in a genetically enhanced form. Andrew Batson & James T. Areddy, *Beijing Gives Nod To Modified Rice*, WALL ST. J., Dec. 1, 2009, at A13.

13. The United States Mission to the European Union, *A Primer on Beef Hormones* (Feb. 26, 1999), http://useu.usmission.gov/Dossiers/Beef_Hormones/Feb2699_Primer.asp; U.S. DEP'T OF HEALTH & HUMAN SERVS., U.S. FOOD AND DRUG ADMINISTRATION (FDA), CENTER FOR VETERINARY MEDICINE, *STERIOD HORMONES* (2002), <http://www.fda.gov/AnimalVeterinary/SafetyHealth/ProductSafetyInformation/ucm055436.htm>.

14. Debra M. Strauss, *Feast or Famine: The Impact of the WTO Decision Favoring the U.S. Biotechnology Industry in the EU Ban of Genetically Modified Foods*, 45 AM. BUS. L.J. 775, 777 (2008).

15. *Id.* at 778–79. The U.S. Department of Agriculture Economic Research Service publishes

While hormone-spurred beef and biotech plants improve upon nature in some respects, they harm it in another. Resulting toxins in such food products are eaten by humans, animals, and insects, and the long-term effects on human health and safety quite simply are unknown.¹⁶ For this reason, Europe remains skeptical of whether the benefits of such modified foods are worth the costs. The European Union first banned the import of meat containing growth hormones in the 1980s,¹⁷ and it still maintains its ban despite sanctions imposed by the World Trade Organization (“WTO”).¹⁸ In keeping with the “precautionary principle” that governs decisions of the European Commission,¹⁹ “the Directive seeks to avoid . . . the potential for [adverse health] effects to occur.”²⁰ Although the European Commission began to allow the sale of genetically modified sweet corn for human consumption in 2004,²¹ a number of European

annual statistics on the adoption of genetically engineered crops in the United States. See U.S. DEP’T OF AGRIC. (USDA), ECONOMIC RESEARCH SERVICE, ADOPTION OF GENETICALLY ENGINEERED CROPS IN THE U.S., <http://www.ers.usda.gov/Data/BiotechCrops/> (last visited Mar. 30, 2010).

16. See, e.g., Strauss, *supra* note 14, at 779; see also Debra M. Strauss, *Defying Nature: The Ethical Implications of Genetically Modified Plants*, 3 J. FOOD L. & POL’Y 1, 18 (2007) (cataloguing risks, including toxicity, allergenicity, antibiotic resistance, negative nutritional impact, unintended health effects, insect resistance, harm to nontarget organisms, outcrossing, and damage to the balance of the ecosystem). “Long-term scientific studies in humans have not yet been done [and there is] substantial scientific uncertainty concerning these substances . . .” Strauss, *supra* note 14, at 779–80.

17. FOREIGN AGRIC. SERV., USDA, GLOBAL AGRICULTURE INFORMATION NETWORK (GAIN), EUROPEAN UNION TRADE POLICY MONITORING EUROPEAN UNION BANS ESTRADIOL 2 (2003), available at <http://www.fas.usda.gov/gainfiles/200310/145986428.pdf>. Directive 2003/74/EC amending Council Directive 96/22/EC, signed September 22, 2003, prohibits the use of oestradiol-17 β , testosterone, progesterone, zeranol, trenbolone acetate, and melengestrol acetate in food-producing animals except for the use of oestradiol-17 β therapeutic purposes. Council Directive 2003/74/EC, art. 1, 2003 O.J. (L 262) 17–19, available at http://www.fve.org/veterinary/pdf/food/directive_2003_74.pdf. The ban is “necessary to achieve the chosen level of health protection from the residues in meat of farm animals treated with . . . hormones for growth promotion purposes.” *Id.*

18. Int’l Ctr. for Trade & Sustainable Dev. (ICTSD), *New Issues Arise in EU-US Beef Trade Dispute*, 9 BRIDGES TRADE BIORES 12, June 26, 2009, available at <http://ictsd.net/i/news/biores/49559/>; Roberta Rampton, *Beef Deal A Gleam of Hope for US-EU Trade Tensions*, REUTERS, May 6, 2009, available at <http://www.reuters.com/article/reutersEdge/idUSTRE5457S-720090506>. The World Trade Organization’s Dispute Settlement Body criticized the EU for not basing the ban on a “valid risk assessment.” See Darrell Chichester, Comment, *Battle of the Beef, the Rematch: An Evaluation of the Latest E.C. Directive Banning Beef Produced with Growth Hormones and the U.S. Refusal to Accept the Directive as WTO Compliant*, 21 AM. U. INT’L L. REV. 221, 229, 234–35 (2005).

19. Press Release, Europa, Commission Adopts Communication on Precautionary Principle (Feb. 2, 2000), available at <http://europa.eu/rapid/pressReleasesAction.do?reference=IP/00/96&format=HTML&aged=0&language=EN&guiLanguage=en>.

20. Chichester, *supra* note 18, at 256–57.

21. *European Union Lifts GM Food Ban*, BBC NEWS, May 19, 2004, available at <http://news.bbc.co.uk/2/hi/europe/3727827.stm>.

countries, hostile to this type of “Frankenstein food,”²² continue to ban it notwithstanding pressure from the WTO.²³

Electronic Cigarettes. A quite remarkable new consumer product, the electronic cigarette (“e-cig”), was developed in China in 2002 and commercially introduced in Asia in 2005.²⁴ Recently, the e-cig has spread to Europe and to the United States, although the Food and Drug Administration considers it an unapproved new drug.²⁵ E-cigs, which look remarkably like ordinary cigarettes, simulate the sensation of smoking a normal cigarette: by sucking the mouthpiece, the user activates a battery-powered microprocessor, which controls an atomizer.²⁶ The atomizer emits a nicotine-based vapor that simulates smoke.²⁷

Marketers describe e-cigs as “a healthier and cheaper alternative to traditional cigarettes,”²⁸ but there has been little testing of the health effects

22. See Marco Contiero & Mark Breddy, *Luxembourg To Become Fifth EU Country to Ban Monsanto GM Maize*, GREENPEACE, Mar. 23, 2009, available at <http://www.greenpeace.org/eu-unit/press-centre/press-releases2/luxembourg-mon810-ban-230309>; *Germany Bans Cultivation of GM Corn*, SPIEGEL ONLINE, Apr. 14, 2009, available at <http://www.commondreams.org/headline/2009/04/14-3>; Pete Harrison, *EU Upholds Austria, Hungary Right to Ban GM Crops*, REUTERS, Mar. 30, 2010, available at <http://www.reuters.com/article/environment/News/idUSTR-E5212OL20090302>.

23. Strauss, *supra* note 14, at 776. Unlike Europe, the United States “does not require labeling, segregating, or monitoring” of genetically engineered crops because the Food and Drug Administration (FDA) considers those organisms of “substantial equivalence” to naturally occurring ones. *Id.* at 779–80. The FDA also applies the concept of “substantial equivalence” to cloned animals, concluding that “there are no additional risks to people eating food from cattle, swine, and goat clones or the offspring of any animal clones traditionally consumed as food.” U.S. DEP’T OF HEALTH & HUMAN SERVS., FDA, CONSUMER UPDATE, ANIMAL CLONING AND FOOD SAFETY (2008), <http://www.fda.gov/ForConsumers/ConsumerUpdates/ucm148768.htm>.

24. See eciginfo, *What Is an Electronic Cigarette?*, <http://www.eciginfo.co.uk/whatisanecig.html> (last visited Mar. 30, 2010).

25. Danielle Dellorto, *FDA Hazy on E-Cigarettes’ Safety*, CNN, Mar. 13, 2009, available at <http://www.cnn.com/2009/HEALTH/03/13/ecigarettes.smoking/index.html> (stating that the FDA is “trying to halt importation of e-cigs, but isn’t seizing products already being sold in the United States”); see also Lyndsey Layton, *FDA Cautions Public About Electronic Cigarettes*, WASH. POST, July 22, 2009, available at <http://www.washingtonpost.com/wp-dyn/content/article/2009/07/22/AR2009072202902.html> (reporting that the FDA is concerned about carcinogens in e-cigs and has warned the public against their use); Duff Wilson, *Judge Orders F.D.A. to Stop Blocking Imports of E-Cigarettes From China*, N.Y. TIMES, Jan. 14, 2010, at B3, available at <http://www.nytimes.com/2010/01/15/business/15smoke.html> (reporting federal court order restraining FDA from blocking importation of e-cigarettes). How the FDA will regulate electronic cigarettes in view of its new authority over tobacco products remains to be seen. See Family Smoking Prevention and Tobacco Control Act, Pub. L. No. 111-31, §§ 2-3, 123 Stat. 1776, 1778–82 (2009) (to be codified at 21 U.S.C. § 387).

For an internet advertisement (a “\$99 Value,” “FREE”), see SmokeAssassin™, <http://www.smokeassassin.com> (last visited Mar. 30, 2010).

26. See eciginfo, *supra* note 24.

27. *Id.*

28. Ecig Online, *About Us*, Ecig Online, <http://www.electroniccigaretteonline.co.uk/ecig-online-about-us.html> (last visited Mar. 30, 2010).

of the substances in their vapor.²⁹ The World Health Organization has questioned the evidentiary basis of marketing claims that e-cigs help people quit smoking, and there are no rigorous, peer-reviewed studies showing that e-cigs are either a safe or effective nicotine replacement therapy.³⁰ At least the United Kingdom requires that extensive warnings accompany the sale of electronic cigarettes.³¹

Nanotechnology. Nanotechnology is miniature technology, on an atomic or molecular scale, where matter is manipulated at less than one hundred nanometers in size.³² Nanotechnology is an emerging field³³ of limitless potential because nanoscale materials possess physical, chemical, optical, electrical, catalytic, magnetic, adhesive, mechanical, and possibly even biologic properties that are fundamentally distinct from their larger counterparts.³⁴ For example, due to its antimicrobial properties, nanoparticle silver is now infused into numerous consumer goods such as clothing, toys, and personal care products to combat germs.³⁵

Some worry that the same characteristics that make nanoparticles so attractive—their tiny size, high ratio of surface area to volume, and reactivity—also pose unique and untold risks to human health.³⁶ For example, the diameter, length, and biopersistence of nanoparticles generally, and carbon nanotubes in particular, has raised concerns that, if such microscopic particles are inhaled into the lungs, asbestos-like reactions could ensue.³⁷ The miniature nature of inhaled nanoparticles also

29. Different flavors are available, but the tobacco flavor is the most popular. *See* *eciginfo*, *supra* note 24.

30. News Release, World Health Org., Marketers of Electronic Cigarettes Should Halt Unproved Therapy Claims (Sept. 19, 2008) *available at* <http://www.who.int/mediacentre/news/releases/2008/pr34/en/print.html>.

31. *See* *Ecig Online*, Electronic Cigarette Health & Safety Guide: *Ecig Online*, Electronic Cigarette Health & Safety Guidelines, <http://www.electroniccigaretteonline.co.uk/electronic-cigarette-safety.html> (last visited Mar. 30, 2010) (setting forth mandated warnings of risks of contact with the skin and eyes, harm to unborn children, and nicotine's toxicity).

32. *See* Khanijou, *supra* note 6, at 181. A nanometer is 10^{-9} meters, which is one billionth of a meter. *See id.*; Leonard Sweet & Bradford Strohm, *Nanotechnology—Life-Cycle Risk Management*, 12 *HUM. & ECOLOGICAL RISK ASSESSMENT* 528, 530 (2006).

33. There are now more than 1,000 nanotechnology-enabled consumer products available around the world. *See* The Project on Emerging Nanotechnologies (PEN), *Nanotech-enabled Consumer Products Top the 1,000 Mark*, <http://www.nanotechproject.org/news/archive/8277/> (last visited Mar. 30, 2010).

34. Sweet & Strohm, *supra* note 32, at 532; *see also* Ronald C. Wernette, *The Dawn of the Age of Nanotorts*, *Prod. Liab. Daily (BNA)*, at D3 (Apr. 23, 2009). *See generally* MARSHALL S. SHAPO, *EXPERIMENTING WITH THE CONSUMER: THE MASS TESTING OF RISKY PRODUCTS ON THE AMERICAN PUBLIC* ch. 7 (Greenwood 2009) (addressing “Experiments at the Billionth Level”).

35. Rick Weiss, *Groups Petition EPA to Ban Nanosilver in Consumer Goods*, *WASH. POST*, May 2, 2008, at A4, *available at* <http://www.washingtonpost.com/wp-dyn/content/article/2008/05/01/AR2008050103228.html?hpid=topnews>.

36. *Id.*

37. Nanoparticles might be thin enough to reach the sensitive areas of the lungs, long enough

allows them to migrate from the lungs into the blood stream and threaten vital organs, including the brain.³⁸ Nanoparticles may also damage cells and chromosomes; cause inflammation; and interfere with the signaling pathways of cells, cell division, and cardiac function.³⁹ Without sufficient toxicity data, it simply is impossible to ascertain what levels of exposure may be safe and what levels may injure human beings.⁴⁰ Risk-assessment models for nanoparticles are in their infancy,⁴¹ and, in the absence of such proven models, the risks from nanoparticles remain “largely unknown and, in all likelihood, unknowable until time passes.”⁴²

Other New Technologies. Re-engineered foods, e-cigs, and nanotech products of all types provide just a tiny sampling of the vast advances in the products of science and technology whose risks are often quite unknown. Synthetic biology is another developing field in which scientists redesign existing biological systems and even create entirely new biological components alien to the natural world.⁴³ Among its many applications, synthetic biology has developed a powerful, new anti-malaria drug⁴⁴—with risks, however, whose nature and extent remain outside

to avoid the lungs’ built-in defense systems, and persistent enough to remain without dissolving for many years. Pat Rizzuto, *Nanotechnology: Report Looks at Nanoparticle Characteristics That Could Raise Asbestos-Like Concerns*, Prod. Liab. Daily (BNA) (Jan. 28, 2009), available at <http://news.bna.com/pldm/> (search “Report looks at Nanoparticle Characteristics”; then follow “01/28/2009: Nanotechnology: Report Looks at Nanoparticle Characteristics” hyperlink) (including report from United Kingdom Institute of Occupational Medicine); see also LLOYD’S, RISKS: LLOYD’S EMERGING RISKS TEAM REPORT, NANOTECHNOLOGY RECENT DEVELOPMENTS, RISKS AND OPPORTUNITIES 14 (2007), available at http://www.nanet.nu/upload/centre/nanet/nyheder/lloydsemergingrisksteamreport_nanotechnology_report.pdf.

38. Gregory Mandel, *Nanotechnology Governance*, 59 ALA. L. REV. 1323, 1342 (2008); Wernette, *supra* note 34.

39. Sweet & Strohm, *supra* note 32, at 545. Nanoparticles also pose unknown, possibly serious, environmental risks. See *id.* at 544; Wernette, *supra* note 34.

40. Sweet & Strohm, *supra* note 32, at 544; see also Pat Rizzuto, *Cell Tests Can Produce Any Desired Result About Nanomaterial Toxicity, Speaker Says*, Prod. Liab. Daily (BNA) (Nov. 18, 2009), available at <http://news.bna.com/pldm/> (search “Tests Can Produce Any Desired Result”; then follow “11/18/2009: Science Policy: Cell Tests Can Produce Any Desired Result About Nanomaterial Toxicity, Speaker Says” hyperlink).

41. “The science needed to assess hazards of nanomaterials in the fields of toxicology, epidemiology, and industrial hygiene, let alone meeting the standards for admissibility of such scientific evidence under *Daubert*, is likely to be many years in the making.” Wernette, *supra* note 34.

42. *Id.* At least one insurer has refused to cover “bodily injury, property damage, or personal and advertising injury” from nanoparticles. Pat Rizzuto, *Insurance Group Excludes Nanotubes, Nanotechnology From Coverage as of Nov. 15*, Prod. Liab. Daily (BNA) (Oct. 10, 2008).

43. ETC GROUP, EXTREME GENETIC ENGINEERING: AN INTRODUCTION TO SYNTHETIC BIOLOGY 1 (2007), available at <http://www.etcgroup.org/upload/publication/602/01/synbioreportweb.pdf>.

44. *Synthetic Biology Can Help Extend Anti-Malaria Drug Effectiveness*, SCIENCE DAILY, Mar. 11, 2009, available at <http://www.sciencedaily.com/releases/2009/03/090306172619.htm> (reporting on the engineering of microbes to ferment artemisinin, “the most powerful anti-malaria drug in use today”).

current understanding.⁴⁵ With such complex organisms engineered from scratch, their behavioral properties, interactions, and mutational potential⁴⁶ are “difficult—if not impossible—to predict.”⁴⁷ In another startling development, scientists just recently claimed to have manipulated stem cells in a laboratory to create both human sperm and eggs, raising critical questions about how such technology might be put to use and a host of unfathomable implications for “humans” who might one day be spawned in such a way.⁴⁸ Radiation is another technology with new uses whose benefits are clear: food irradiation kills harmful bacteria, preserves food, and controls insects.⁴⁹ Yet, irradiation may alter the chemical formulations of foods in ways that cause unknown toxic risks to human beings.⁵⁰ As a final example, cell phones are a ubiquitous instrument of modern technology and modern life, but there remains a question whether they cause cancer of the brain.⁵¹

45. See ETC GROUP, *EXTREME GENETIC ENGINEERING*, *supra* note 43, at 52–55 (admitting that “[n]o one knows if synthetic biology will ultimately deliver safe and sufficient quantities of low-cost artemisinin for controlling malaria in the developing world”). The most dreadful risk of synthetic biology is the possibility that a terrorist might use a viral pathogen as a weapon, the plausibility of which was demonstrated when a university virologist built live poliovirus “from scratch using mail-order segments of DNA and a viral genome map that is freely available on the Internet.” Philip Ball, *Starting From Scratch*, 431 *NATURE* 624, 624 (2004), available at <http://www.nature.com/nature/journal/v431/n7009/full/431624a.html>.

46. Denise Caruso, *Synthetic Biology: An Overview and Recommendations for Anticipating and Addressing Emerging Risks*, *SCIENCE PROGRESS*, Nov. 12, 2008, at 2, available at <http://www.scienceprogress.org/wp-content/uploads/2008/11/syntheticbiology.pdf>.

47. Sara Goodman, *Technology: Synthetic Biology Signals Regulatory Challenges Ahead*, *E&E PUBL’G, LLC*, Mar. 26, 2009, <http://www.eenews.net/public/Greenwire/print/2009/03/26/8>.

48. Fiona Macrae, *No Men OR Women Needed: Scientists Create Sperm and Eggs from Stem Cells*, *MAILONLINE*, Oct. 29, 2009, <http://www.dailymail.co.uk/sciencetech/article-1223617/No-men-OR-women-needed-artificial-sperm-eggs-created-time.html> (“Human eggs and sperm have been grown in the laboratory in research which could change the face of parenthood.”); cf. *Donovan v. Idant Labs.*, 625 F. Supp. 2d 256, 262 (E.D. Pa. 2009) (rejecting mother’s claims against commercial sperm bank for abnormal condition of daughter spawned by defective sperm).

49. Alliance for Social & Ecological Consumer Organisations (ASECO), *Food Irradiation* (Apr. 18, 2007), http://aseconet.org/index.php?option=com_content&task=view&id=29&Itemid=31.

50. *Id.*

51. See, e.g., *Do Cell Phones Increase Brain Cancer Risk?*, *SCIENCE DAILY*, Oct. 21, 2008, available at <http://www.sciencedaily.com/releases/2008/10/081020093456.htm> (noting an epidemiologic study by a Swedish research group “suggesting an increased risk of brain cancers (gliomas) as well as acoustic nerve tumors (neuromas) in people using cell phones for ten years or longer”); Geoffrey Lean, *Mobile Phone Use ‘Raises Children’s Risk of Brain Cancer Fivefold’*, *THE INDEPENDENT*, Sept. 21, 2008, available at <http://www.independent.co.uk/news/science/mobile-phone-use-raises-childrens-risk-of-brain-cancer-fivefold-937005.html>. For the published study referenced to in the latter article, see Lennart Hardell et al., *Epidemiological Evidence for an Association Between Use of Wireless Phones and Tumor Diseases*, 16 *PATHOPHYSIOLOGY* 113 (2009). See generally Elizabeth Landau, *Scientists Debate Possible Cell Phone Link to Brain Cancer*, *CNN*, Sept. 25, 2008, available at <http://www.cnn.com/2008/HEALTH/09/25/cellphones>.

Technologies such as these, and myriad others beyond current imagination, increasingly will define the unfolding world in which humans live. In such a world, where bending nature in elemental ways may unleash any number of risks, we must ask whether the traditional fault-foreseeability model of responsibility for harm is adequate to the task, or whether instead this traditional liability model fails. Mankind now has crossed the Rubicon into a brand new world, by altering the rudiments of matter and life—smashing and tearing apart atoms, the building blocks of the universe; re-engineering the foundations of plant and animal life; remaking (through cloning, cell manipulation, synthetic biology, etc.) animals⁵² and, increasingly, humans themselves. In such a world, where humans bend nature so far and fundamentally that they may be said to be “playing God,” such conduct undoubtedly will sometimes accidentally produce harmful consequences impossible to predict. Such consequences might be labeled “foreseeably unforeseeable”—the inevitable yet unknowable consequences of monkeying with nature in fundamental ways.

In this quite extraordinary, new context, where persons and firms intentionally alter the rudiments of nature, we may fairly ask whether such actors should be deemed to surrender conventional rights to have responsibility for untoward harm defined by traditional rules of foreseeability and fault. That is, when humans deliberately bend nature to the point of unforeseeability, it may just be that action, harm, and responsibility reduce to a single point.

III. FORESEEABILITY’S DECLINE

For most of the twentieth century, as so prominently proclaimed by Judge Benjamin Cardozo in *Palsgraf v. Long Island Railroad Company*,⁵³ foreseeability stood tall and proud at the center of responsibility for harm. This was the state of private law in America when the century passed its mid-point, as industry settled down to the business of putting to work the new science and technologies (including the splitting of the atom) developed in World War II. Foreseeability then was widely acknowledged to be a great moral pillar of the law, anchoring personal and firm responsibility for choices to consequences that a reasonable person should contemplate when deciding whether or not to act. The limitation of liability

cancer/index.html?iref=newssearch (discussing conflicting congressional testimony on the brain cancer risk from cell phones).

Adding to the confusion, recent animal studies suggest that cell phones may actually *enhance* a user’s cognitive abilities. *Cellphone Radiation Aids Sick Mice*, WALL ST. J., Jan. 12, 2010, at D4.

52. Hannah Devlin, *Chinese Researchers Clone Tiny the Mouse from Skin Cells*, TIMES ONLINE (London), July 24, 2009, <http://www.timesonline.co.uk/tol/news/science/article6725624.ece> (reporting that scientists have cloned mice by reprogramming adult mouse skin cells into embryo-like stem cells).

53. 162 N.E. 99 (N.Y. 1928).

on this basis—holding actors liable only for foreseeable risk, and protecting even negligent actors from harm they cannot anticipate—was then a central organizing feature of private law.⁵⁴

By the 1950s, most American states finally had completed their embrace of the rule in *MacPherson v. Buick Motor Co.*⁵⁵ that ejected privity as a bar to consumer negligence claims against manufacturers of defective products.⁵⁶ The decade of the 1950s was a time of outward calm in the law of tort, although legal theorists⁵⁷ and warranty law developments⁵⁸ were toiling and boiling below the surface, completing foundational work for the explosive developments that soon would follow. In particular, courts during these years increasingly held manufacturers strictly liable in warranty for injuries to consumers caused by defective food, cosmetics, and similar products.⁵⁹

A. *The Great Strict Liability Experiment*

In the 1960s, an ever-increasing array of products caused greater and greater harm to human beings at home, in the workplace, and in the world at large. As Senator Warren Magnuson declared in 1967, in urging Congress to establish a commission to study product safety, “today we face an unparalleled profusion of new products spawned by space-age technology” widely broadening consumer harm.⁶⁰ This growing injury toll from new technologies was the backdrop the courts confronted in this decade when private law exploded and modern products liability law burst

54. On the prominent role of foreseeability in private law, see, for example, Owen, *supra* note 4; Benjamin C. Zipursky, *Foreseeability in Breach, Duty, and Proximate Cause*, 44 WAKE FOREST L. REV. 1247 (2009).

55. 111 N.E. 1050 (N.Y. 1916).

56. For the story of *MacPherson*, see James A. Henderson, Jr., *MacPherson v. Buick Motor Company: Simplifying the Facts While Reshaping the Law*, in TORTS STORIES 41 (Robert L. Rabin & Stephen D. Sugarman eds., 2003).

57. See, e.g., Fleming James, Jr., *General Products—Should Manufacturers Be Liable Without Negligence?*, 24 TENN. L. REV. 923, 923 (1957); Fleming James, Jr., *Products Liability*, 34 TEX. L. REV. 192, 192 (1955); Dix W. Noel, *Manufacturers of Products—The Drift Toward Strict Liability*, 24 TENN. L. REV. 963, 963 (1957); see also VIRGINIA E. NOLAN & EDMUND URSIN, UNDERSTANDING ENTERPRISE LIABILITY: RETHINKING TORT REFORM FOR THE TWENTY-FIRST CENTURY 6–8, 13 (1995); George L. Priest, *The Invention of Enterprise Liability: A Critical History of the Intellectual Foundations of Modern Tort Law*, 14 J. LEGAL STUD. 461 (1985) (elegantly critiqued in David G. Owen, *The Intellectual Development of Modern Products Liability Law: A Comment on Priest’s View of the Cathedral’s Foundations*, 14 J. LEGAL STUD. 529 (1985)); see generally DAVID G. OWEN, PRODUCTS LIABILITY LAW § 5.4 (2d ed. 2008) (chronicling developments in legal theory).

58. See William L. Prosser, *The Assault Upon the Citadel (Strict Liability to the Consumer)*, 69 YALE L.J. 1099, 1103–04 (1960) (chronicling warranty law judicial developments moving toward strict producer liability).

59. See *id.* at 1104, 1107–09.

60. See NAT’L COMM’N ON PROD. SAFETY, FINAL REPORT 123 (1970).

forth, like Athena, as a warrior fully clothed in armor ready to do battle for consumers injured by the products of science and technology gone awry.

This was the decade when principles of responsibility for unexpected harm from technology quite suddenly were turned upside down—when private law ejected traditional notions of negligence and foreseeable risk from liability determinations and replaced such concepts with a principle of “strict” liability for manufacturers of defective products. This sharp turn in the law began the Great Strict Liability Experiment,⁶¹ a seismic shift in legal doctrine marked by two central, overlapping developments. The first development, and most conspicuous one, was tort law’s opening of its arms to users and consumers injured by defective products at the expense of manufacturers held strictly liable for that harm. The second development, muted yet making possible the first, was the law’s closing of the foreseeability umbrella that for so long had sheltered industry from responsibility for the unexpected consequences of science and technology.

If the start of this development must be dated, it would be May 9, 1960. On that day, the New Jersey Supreme Court issued its decision in *Henningsen v. Bloomfield Motors*,⁶² which allowed a non-purchaser who was injured in an accident caused by a defective car to sue the manufacturer despite two classic obstacles to strict liability claims brought in warranty: the absence of privity of contract and the presence of a contractual disclaimer purporting to bar such claims. A few weeks later, in the June issue of the *Yale Law Journal*, Dean William L. Prosser published his celebrated article⁶³ “describing and predicting exactly the change in the law that *Henningsen* had introduced.”⁶⁴ Not long thereafter, in 1963, the Supreme Court of California decided *Greenman v. Yuba Power Products, Inc.*,⁶⁵ the landmark case which declared that manufacturers of defective products are strictly liable in tort to persons injured by such products, irrespective of any contractual limitations that might inhere in the law of warranty. In 1964, the American Law Institute adopted (and in 1965 officially promulgated) § 402A of the *Restatement (Second) of Torts*—the rule of strict products liability in tort.

For the rest of the 1960s, 1970s, and into the early 1980s, the doctrine of strict products liability in tort, together with a miscellany of secondary principles, spread like wildfire across America. This was no trivial development. Tort law has probably never witnessed such a rapid, widespread, and altogether explosive change in a rule and theory of legal

61. See, e.g., David G. Owen, *The Evolution of Products Liability Law*, 26 REV. LITIG. 955, 955–57 (2007) (illuminating this development); Priest, *supra* note 57 (examining this development).

62. 161 A.2d 69 (N.J. 1960).

63. Prosser, *supra* note 58.

64. Priest, *supra* note 57, at 505.

65. 377 P.2d 897 (Cal. 1963).

responsibility.⁶⁶ This was the period in which the law tore down the old protections that, since the beginning of the industrial revolution, had shielded industry from most injury costs arising from its new technologies—warranty law limitations based on privity of contract, notice, and disclaimers; absolute defenses based on a victim’s conduct; and negligence law requirements of proof of fault and foreseeability of risk.

B. *Foreseeability Derogated*

As the idea of strict products liability accelerated during the 1960s and 1970s, the law in various ways stomped out unforeseeability as a “defense” that might defeat this radical theory of responsibility for injury costs flowing from new technology. Most fundamentally, “strict” liability doctrine rests on the idea that manufacturers should be liable for physical harm from defective products even if that harm is unforeseeable. That is, particularly for dangers in a product’s design or warnings, differences between negligence and strict liability are grounded in the limitation of responsibility in negligence doctrine to risks that are foreseeable—a limitation challenged by strict liability.

In these early days of modern products liability law, in an effort to distinguish the then-new doctrine of strict products liability in tort from negligence, some courts and commentators sought explicitly to expel the foreseeability limitations of negligence law from strict tort doctrine. In one early case, for example, the court remarked:

Negligence is, of course, tested in terms of foreseeability. . . . The focus of § 402A, however, is not directed to the foreseeability of a given injury, but to whether “the product is, at the time it leaves the seller’s hands, in a condition not contemplated by the ultimate consumer, which will be unreasonably dangerous to him.”⁶⁷

This view, that producers of new technology should bear responsibility for unforeseeable risks such products might contain, well reflected the populist sentiments that dominated tort law in the 1960s.⁶⁸

Only sometimes explicit, derogation of foreseeability was more often implicitly embedded in various aspects of products liability doctrine—the

66. See, e.g., Prosser, *supra* note 58, at 793–94 (proclaiming the adoption of strict products liability in the early 1960s to be “the most rapid and altogether spectacular overturn of an established rule in the entire history of the law of torts”); see also NOLAN & URSIN, *supra* note 57, at 105 (characterizing the spread of § 402A doctrine as “the strict products liability ‘revolution,’ the most spectacular episode of judicial creativity in the history of American tort law”).

67. *Eshbach v. W. T. Grant’s & Co.*, 481 F.2d 940, 942–43 (3d Cir. 1973) (quoting RESTATEMENT (SECOND) OF TORTS § 402A cmt. g (1965)).

68. See David G. Owen, *The Intellectual Development of Modern Products Liability Law: A Comment on Priest’s View of the Cathedral’s Foundations*, 14 J. LEGAL STUD. 529, 532–33 (1985).

consumer expectations liability test, the Wade-Keeton liability test, and the denial of a “state-of-the-art” defense. The first two features of the new doctrine were formulations of a liability standard that was explicitly strict, and both effectively expelled foreseeability from participation in determining responsibility for harm. The third feature rejected a manufacturer’s defensive plea based on the capabilities of the prevailing science and technology at the time of manufacture.

1. The Consumer Expectations Test

A major development curtailing foreseeability’s role in the 1960s and 1970s was the widespread adoption of a liability test for strict liability based on consumer safety expectations.⁶⁹ Although its effect on foreseeability was unheralded at the time, the development of a consumer expectations test in products liability law served to displace foreseeability by focusing entirely on the safety expectations of consumers—which meant, of course, that the inquiry shifted commensurately away from producers, whose expectations of product risks were thereby rendered moot.

The immediate source of this sudden shift in focus was textual. In interpreting the liability standard of § 402A—“defective condition unreasonably dangerous”—courts first sought guidance from the Reporter’s Comments that Dean Prosser wrote explaining that section of the *Restatement (Second) of Torts*. Comment g, entitled “defective condition,” explains that the new strict liability rule “applies only where the product is, at the time it leaves the seller’s hands, in a condition not contemplated by the ultimate consumer, which will be unreasonably dangerous to him.”⁷⁰ And comment i, entitled “unreasonably dangerous,” explains that this latter phrase means that the product “must be dangerous to an extent beyond that which would be contemplated by the ordinary consumer who purchases it.”⁷¹ Thus, for a product to be in “a defective condition . . . unreasonably dangerous” under § 402A, it must be more dangerous than an ordinary consumer would expect.⁷²

Protection of consumer expectations was a logical initial foundation for strict products liability under § 402A since modern products liability law, and § 402A in particular, evolved out of the law of warranty which by the twentieth century had been absorbed into the law of sales and contracts.⁷³

69. On the consumer expectations test, see, for example, Rebecca Korzec, *Dashing Consumer Hopes: Strict Products Liability and the Demise of the Consumer Expectations Test*, 20 B.C. INT’L & COMP. L. REV. 227 (1997); Douglas A. Kysar, *The Expectations of Consumers*, 103 COLUM. L. REV. 1700 (2003); Joseph W. Little, *The Place of Consumer Expectations in Product Strict Liability Actions for Defectively Designed Products*, 61 TENN. L. REV. 1189 (1994); Jerry J. Phillips, *Consumer Expectations*, 53 S.C. L. REV. 1047 (2002).

70. RESTATEMENT (SECOND) OF TORTS § 402A cmt. g (1965).

71. *Id.* § 402A cmt. i.

72. *Id.*

73. See William L. Prosser, *The Implied Warranty of Merchantable Quality*, 27 MINN. L. REV. 117, 118–22 (1943).

One of the most basic goals of law in general,⁷⁴ and the most fundamental pillar of contract law,⁷⁵ is the protection of the reasonable expectations of the contracting parties. Warranty law is based on the seller's explicit and implicit representations made to consumers in sales transactions, and the law fairly protects consumer expectations predictably generated by such representations.⁷⁶ Because the law of warranty that paved the way for § 402A seeks to protect a consumer's ordinary or reasonable expectations, this seemed, at the time, to be a natural liability test for the new tort doctrine.⁷⁷ Natural though it may have been, the consumer expectations test left no room in the liability calculus for the foreseeability *vel non* of risk to the manufacturers who put science and technology to work in the factories of production.

2. The Wade-Keeton Test

While Dean Prosser defined strict liability in terms of consumer safety expectations in the Reporter's Comments to § 402A, other scholars searched for alternative ways to define strict products liability in a manner that distinguished it from mere negligence. Other than Prosser, the two most prominent tort law scholars at the time who shared a special interest in products liability were Dean John Wade of Vanderbilt University and Dean Page Keeton of the University of Texas. As modern products liability law was just beginning to emerge in the 1960s, the two deans, both Advisers to the American Law Institute's *Restatement (Second) of Torts* whose products liability chapter was then in progress, offered separate yet similar definitions of product defect that distinguished negligence-based responsibility from a liability standard called "strict" in a fundamental way.

74. Harvard Law School Dean Roscoe Pound remarked:

In civilized society men must be able to assume that those with whom they deal in the general intercourse of society will act in good faith and hence . . . will make good reasonable expectations which their promises or other conduct reasonably create; [and] . . . will carry out their undertakings according to the expectations which the moral sentiment of the community attaches thereto

ROSCOE POUND, *SOCIAL CONTROL THROUGH LAW* 114 (Archon Books 1968) (1942).

75. The very first subtitle of a classic contract law treatise underscores this point: "[Section] 1.1 The Main Purpose of Contract Law Is the Realization of Reasonable Expectations Induced by Promises." See 1 JOSEPH M. PERILLO, *CORBIN ON CONTRACTS* § 1.1 (rev. ed. 1993).

76. See, e.g., *Markle v. Mulholland's Inc.*, 509 P.2d 529, 534 (Or. 1973) ("One can only determine what a purchaser had a right to expect by the implications express or inherent in the sale to him. These implications are analogous to those underlying a representation of merchantable quality.").

77. See David A. Fischer, *Products Liability—The Meaning of Defect*, 39 MO. L. REV. 339, 348 (1974). Then California Supreme Court Chief Justice Roger J. Traynor perceptively observed that the consumer contemplation test reflected the "surprise element of danger." Roger J. Traynor, *The Ways and Meanings of Defective Products and Strict Liability*, 32 TENN. L. REV. 363, 370 (1965).

The test developed by Deans Wade and Keeton, which in time became known as the “Wade-Keeton” test,⁷⁸ quite simply was a negligence test stripped of “scienter.”⁷⁹ Both scholars proposed that a product defect be defined in hindsight terms—whether a manufacturer or other seller with full knowledge of a product’s dangers would be negligent in selling it in that condition.⁸⁰ Requiring a seller to *know* its product’s risks, thereby imposing on the seller “constructive knowledge” of any dangers its products might possess,⁸¹ commensurately relieved an injured plaintiff of the burden of proving the *foreseeability* of those risks. The rise (and fall) of the Wade-Keeton test is perhaps the single—most intriguing tale of modern products liability law. An exploration of this fascinating story is examined elsewhere in detail,⁸² and it will be returned to again below.⁸³ Its importance here is to note its prominence as an early effort to distinguish strict liability from negligence in products liability theory⁸⁴ by simply stripping foreseeability from the liability standard.⁸⁵

78. *See, e.g.,* Privette v. CSX Transp., Inc., 79 F. App’x 879, 889 (6th Cir. 2003) (referring to this liability standard more fully as “the Wade-Keeton prudent manufacturer test”) (citation omitted); Brooks v. Beech Aircraft Corp., 902 P.2d 54, 62 (N.M. 1995) (recognizing the “Wade-Keeton approach”); Richard L. Cupp Jr. & Danielle Polage, *The Rhetoric of Strict Products Liability Versus Negligence: An Empirical Analysis*, 77 N.Y.U. L. REV. 874, 884 (2002) (referring to the “Wade/Keeton test”).

79. *See, e.g.,* John W. Wade, *On the Nature of Strict Tort Liability for Products*, 44 MISS. L.J. 825, 834–35 (1973). The Wade-Keeton test is examined generally in OWEN, *supra* note 57, § 8.7, and from a state-of-the-art perspective in *id.*, § 10.4, at 706–07, 715.

80. *See, e.g.,* Page Keeton, *Products Liability—Current Developments*, 40 TEX. L. REV. 193, 194, 200 (1961); Page Keeton, *Products Liability—The Nature and Extent of Strict Liability*, 1964 U. ILL. L.F. 693, 702; John W. Wade, *On the Nature of Strict Tort Liability for Products*, 44 MISS. L.J. 825, 834–35 (1973); John W. Wade, *Strict Tort Liability of Manufacturers*, 19 SW. L.J. 5, 15 (1965).

81. *See, e.g.,* Phillips v. Kimwood Mach. Co., 525 P.2d 1033, 1036 (Or. 1974).

82. *See* OWEN, *supra* note 57, § 8.7, at 546–47.

83. *See infra* notes 110–15 and accompanying text.

84. A number of courts, themselves searching for a basis by which to distinguish strict liability design (and warning) claims from those in negligence, picked up quite early on the Wade-Keeton hindsight test. *See, e.g.,* Dorsey v. Yoder Co., 331 F. Supp. 753, 759–60 (E.D. Pa. 1971) (applying this test), *aff’d*, 474 F.2d 1339 (3d Cir. 1973); Phillips v. Kimwood Mach. Co., 525 P.2d 1033, 1036 (Or. 1974) (“A dangerously defective article would be one which a reasonable person would not put into the stream of commerce if he had knowledge of its harmful character. The test, therefore, is whether the seller would be negligent if he sold the article knowing of the risk involved. Strict liability imposes what amounts to constructive knowledge of the condition of the product.”); Cepeda v. Cumberland Eng’g Co., 386 A.2d 816, 829 (N.J. 1978) (discussing and endorsing the Wade-Keeton test).

85. *See* W. Page Keeton, *Products Liability—Design Hazards and the Meaning of Defect*, 10 CUMB. L. REV. 293, 314–15 (1979). Dean Keeton pointed out that the difference between negligence and strict liability was the requirement in negligence that the danger be foreseeable, whereas, under his “strict” liability test, “it is irrelevant that the defendant did not know or had no reason to know of the danger.” *Id.* at 315 n.87.

3. Rejection of the State-of-the-Art Defense

A third way courts muted foreseeability during the 1960s and 1970s was by rejecting a so-called “state-of-the-art” defense. Early in the development of strict products liability law, considerable attention was placed on whether manufacturers and other sellers should be able to defend strict liability claims with proof that they could not foresee a risk or otherwise avoid it under the science and technology prevailing at the time. The state-of-the-art issue arises most pointedly in cases involving defective warning claims where the manufacturer contends that it was incapable of warning of a danger, not only because it did not recognize the risk itself, but because the risk was unknowable under then-existing science and technology.

This form of defense logically had been conclusive on negligence claims for some time, since a manufacturer hardly could be faulted for failing to foresee or eliminate a risk that was not reasonably foreseeable under the state of scientific knowledge then available.⁸⁶ Yet, the relevance of state of the art to *strict* liability claims was more problematic. “Strict” liability implies that liability is imposed for merely selling a product that is too dangerous, according to some standard of excessive danger, not whether the manufacturer or other seller should be faulted for selling the product in that condition.⁸⁷ If fault indeed is irrelevant to this form of liability, state-of-the-art evidence logically would seem irrelevant to whether a manufacturer is “strictly” responsible for selling a defective product. This was the ruling in *Johnson v. Raybestos–Manhattan, Inc.*,⁸⁸ which held in an asbestos case that state-of-the-art evidence on the foreseeability of the risk is inadmissible on a strict liability tort claim, reasoning that whether the seller knew or reasonably should have known of a product’s dangers, though relevant to negligence, simply has no bearing on claims based on liability that is strict.⁸⁹ Other early courts agreed.⁹⁰ By rejecting evidence of an industry’s technological limitations, early state-of-

86. *Pontifex v. Sears, Roebuck & Co.*, 226 F.2d 909, 910 (4th Cir. 1955). More recently, *see, e.g., Sappington v. Skyjack, Inc.*, 512 F.3d 440, 452 (8th Cir. 2008); *Zavala v. Powermatic, Inc.*, 658 N.E.2d 371, 374 (Ill. 1995).

87. This is axiomatic. *See OWEN, supra* note 57, § 5.3.

88. 740 P.2d 548 (Haw. 1987).

89. *Id.* at 549.

90. *See, e.g., Wagner v. Coronet Hotel*, 458 P.2d 390, 392–93 (Ariz. Ct. App. 1969) (rejecting manufacturer’s arguments on its best efforts to make a rubber shower mat safe from the risk of slipping in a tub as irrelevant state-of-the-art argument under § 402A); *Lunt v. Brady Mfg. Corp.*, 475 P.2d 964, 966 (Ariz. Ct. App. 1970) (“It does not matter that the seller has done ‘the best he can’ if the product is defective and unreasonably dangerous.”); *Cunningham v. MacNeal Mem’l Hosp.*, 266 N.E.2d 897, 902 (Ill. 1970) (“To allow a defense to strict liability on the ground that there is no way, either practical or theoretical, for a defendant to ascertain the existence of impurities in his product would be to emasculate the doctrine and in a very real sense would signal a return to a negligence theory.”).

the-art decisions such as these seriously obstructed foreseeability's role in limiting responsibility for harm.

IV. FORESEEABILITY'S RESURGENCE

A. *Foreseeability's Embers*

To many observers in the late 1960s and 1970s, foreseeability's flame appeared to have been effectively stomped out of modern products liability law by the rapid and widespread adoption of strict liability, with its powerful combination of doctrine and policy. Stunned by the onslaught of these developments, foreseeability remained largely dormant, smoldering, for some time. Though dormant, foreseeability's sparks never were extinguished, but lay quietly glowing in the embers. Quite soon, these sparks began to pop, and eventually to spring, if slowly and with hesitation, into tiny flames of light. Indeed, the rekindling of foreseeability was evident before the ink on § 402A had even dried. Ironically, these stirrings of foreseeability's revival drew succor from § 402A itself.

Notwithstanding the general "strictness" prescribed by § 402A's liability standard, two comments to that section, comments j and k, explained that the duty to warn under § 402A was limited to foreseeable risks.⁹¹ Most prominently, addressing warnings of possible allergic reactions, comment j provided that warnings are necessary only if the seller "has knowledge, or by the application of reasonable, developed human skill and foresight should have knowledge" of the danger.⁹² Emphasizing pharmaceutical drugs, comment k also suggested that the duty to warn was limited to foreseeable risks.⁹³ Together, these two comments appeared to run directly counter to § 402A's unstinting, black-letter strictness and the Wade-Keeton test's hindsight approach.

So, by the late 1960s, the stage was set for courts to begin to address this fundamental clash of opposing notions as to whether producers have a strict liability duty to warn of unknowable risks. Comments j and k to § 402A provided that the strict liability duty, as in negligence, was limited to foreseeable risks; yet the Wade-Keeton hindsight test, imputing knowledge of such risks to suppliers, required manufacturers to warn of hazards whether foreseeable or not, buttressed by § 402A's powerful underlying idea that liability must somehow be "strict."

91. Unrecognized until quite recently, these comments were drawn narrowly to cover the warning duty only for products containing inherent, unavoidable risks. See David G. Owen, *The Puzzle of Comment j*, 55 HASTINGS L.J. 1377 (2004). Even so, the unknown risks of new science and technology often fall largely in this narrow category.

92. For a full examination of comment j to § 402A, see *id.*

93. Comment k to § 402A is examined in OWEN, *supra* note 57, §§ 6.2, 8.10.

At least two cases during this early period addressed these issues. In *Helene Curtis Industries, Inc. v. Pruitt*,⁹⁴ the plaintiff's scalp was burned by a combination of chemical bleaching products manufactured by the defendant.⁹⁵ Endorsing the Wade-Keeton test, the court remarked that a design, to be unreasonably dangerous, "must be so dangerous that a reasonable man would not sell the product if he knew the risks involved."⁹⁶ But, similar to so many other courts that in time endorsed the Wade-Keeton constructive knowledge standard, the *Helene Curtis* court seemed only to be doing so for academic purposes, for it failed to apply the test to the facts before it and instead reversed a plaintiff's judgment in part upon the unforeseeability of the risk.⁹⁷ Another early case, *Oakes v. Geigy Agricultural Chemicals*,⁹⁸ relied on comment j for a similar result. There, the plaintiff suffered a serious skin reaction to the defendant's weed-killing chemical products, a danger the defendant's warnings did not mention. Citing comment j, the court ruled that the complaint was defective for failing to allege that the defendant knew or should have known that its products could cause the plaintiff's condition. Affirming the defendant's demurrer to the claim, the California Court of Appeal reasoned that a producer is strictly liable only for risks of which it was or should have been aware, for otherwise such firms would unacceptably become insurers against all risks, no matter how unforeseeable.⁹⁹

As other courts increasingly applied the new "strict" products liability principles during the early 1970s, they too sometimes proudly crowed that they were applying § 402A's strict standard of liability while they simultaneously restricted responsibility to consequences that were foreseeable, sometimes drawing on comments j and k. One such case was *Borel v. Fibreboard Paper Products Corp.*,¹⁰⁰ the first decision to uphold a verdict for an installer of asbestos insulation materials against manufacturers of such products.¹⁰¹ The plaintiff's claim was based on strict liability for failing to warn of the dangers involved in handling asbestos.¹⁰² Citing Dean Wade's early article and two of Dean Keeton's articles, Judge Wisdom prominently quoted the *Helene Curtis* court's adoption of the Wade-Keeton test, set forth above.¹⁰³ But, when it came to resolving the

94. 385 F.2d 841 (5th Cir. 1967).

95. *Id.* at 847.

96. *Id.* at 850 ("This definition demonstrates that the only change from the traditional negligence analysis is that the maker cannot be excusably ignorant of the defect . . .").

97. *See id.* at 856 (citing *Lartigue v. R. J. Reynolds Tobacco Co.*, 317 F.2d 19 (5th Cir. 1963)).

98. 77 Cal. Rptr. 709 (Ct. App. 1969).

99. *Id.* at 713-14.

100. 493 F.2d 1076 (5th Cir. 1973).

101. *Id.* at 1088.

102. *Id.*

103. *Id.*

knowability issues in the case, the *Borel* court ignored the Wade-Keeton test and instead applied the foreseeability-limitation principles of comment j,¹⁰⁴ holding that “[a] product must not be made available to the public without disclosure of those dangers that the application of reasonable foresight would reveal.”¹⁰⁵ Thus, while purporting to apply liability principles that were strict, a few early courts simply refused to banish unforeseeability as a limitation on responsibility.

B. *The Decline of Competing Doctrine*

1. The Consumer Expectations Test

Notwithstanding powerful moral reasons for protecting consumer expectations,¹⁰⁶ this ideal proved incapable of serving as an adequate standard of products liability that could provide appropriate relief to consumers in a variety of important situations. In particular, this standard unduly frustrated recovery in cases involving obvious dangers, complex products, and bystanders. In each of these contexts, this test operated to protect manufacturers rather than consumers, even when a product was quite clearly defective from a risk-utility perspective.¹⁰⁷ And so the consumer expectations test withered over time, particularly in the 1980s and thereafter, as more and more courts abandoned it for a comparative (cost-benefit) evaluation of the benefits of a manufacturer’s decision to forego untaken precautions in light of the foreseeable risks its product might contain.¹⁰⁸ Just as the rise of the consumer expectations test during

104. *See id.*

Here, the plaintiff alleged that the defendants’ product was unreasonably dangerous because of the failure to give adequate warnings of the known or knowable dangers involved. As explained in comment j to section 402A, . . . [t]he requirement that the danger be reasonably foreseeable, or scientifically discoverable, is an important limitation of the seller’s liability. In general, “[t]he rule of strict liability subjects the seller to liability to the user or consumer even though he has exercised all possible care in the preparation and sale of the product.” Section 402A, Comment a. . . [But] a seller is under a duty to warn of only those dangers that are reasonably foreseeable.

Id.

105. *Id.* at 1090. Because the jury was properly instructed, the court affirmed the verdict for the plaintiff. *Id.* at 1090–92, 1103.

106. *See* David G. Owen, *The Moral Foundations of Products Liability Law: Toward First Principles*, 68 NOTRE DAME L. REV. 427, 463–65 (1993) (explaining how the law’s protection of consumer expectations powerfully protects autonomy and equality).

107. *See, e.g.,* *Vincer v. Esther Williams All-Aluminum Swimming Pool Co.*, 230 N.W.2d 794, 796, 798–99 (Wis. 1975) (ruling against a toddler severely brain-damaged when he climbed into un gated above-ground pool, access to which could easily have been blocked by self-closing gate).

108. The virtues of cost-benefit evaluation of product dangers, and how cost-benefit analysis is preferable to consumer expectations as a standard of liability, involve a host of considerations examined elsewhere. *See, e.g.,* OWEN, *supra* note 57, §§ 5.7, 8.4; Dominick Vetri, *Order Out of*

the 1960s and 1970s had opened manufacturers to responsibility for harm from unforeseeable product risks, its decline after 1980 served to restore unforeseeability as a liability shield for industry.¹⁰⁹

2. The Wade-Keeton Test

By the 1980s, courts and commentators with increasing frequency were challenging the logic and fairness of the Wade-Keeton test's abandonment of foreseeability. Finally recognizing the problems in eliminating foreseeability's indispensable role in liability determinations, Deans Wade and Keeton themselves both repudiated the test that bore their names: Dean Wade asserted in a journal article in 1983 that he never meant what he had said,¹¹⁰ and Dean Keeton, in his tort law treatise the following year, admitted that he no longer believed what he had said.¹¹¹ Explicitly rejecting the Wade-Keeton test, the *Products Liability Restatement* notes with pith: "The idea has not worn well with time."¹¹² Most courts focusing on the Wade-Keeton approach have agreed, rejecting hindsight analysis and limiting a manufacturer's liability to risks that are foreseeable.¹¹³ While a few courts continue rotely to restate in dictum earlier liability formulations in Wade-Keeton terms,¹¹⁴ this test—and its rejection of foreseeability—is now widely consigned to the trash heap of defunct doctrine.¹¹⁵

Chaos: Products Liability Design-Defect Law, 43 U. RICH. L. REV. 1373, 1373–79 (2009).

109. The rise and fall of the consumer expectations test is detailed in OWEN, *supra* note 57, §§ 5.6, 8.4.

110. See John W. Wade, *On the Effect in Product Liability of Knowledge Unavailable Prior to Marketing*, 58 N.Y.U. L. REV. 734, 764 (1983).

111. See PROSSER AND KEETON ON TORTS, *supra* note 2, at 697–98 n.21, 701–02.

112. See RESTATEMENT (THIRD) OF TORTS: PRODUCTS LIABILITY § 2 Reporters' Note to cmt. 1 (1998).

113. See, e.g., *Powers v. Taser Int'l, Inc.*, 174 P.3d 777, 779–84 (Ariz. Ct. App. 2008) (declining to extend Arizona's hindsight test from design to warning defect cases and holding by implication that the duty to warn extends only to foreseeable risks); *Anderson v. Owens-Corning Fiberglas Corp.*, 810 P.2d 549, 557–58 (Cal. 1991); *Brown v. Superior Court*, 751 P.2d 470, 477 (Cal. 1988); *Vassallo v. Baxter Healthcare Corp.*, 696 N.E.2d 909, 922–23 (Mass. 1998) (holding that duty to warn of hazards of silicone breast implants is limited to foreseeable risks); *Owens-Illinois, Inc. v. Zenobia*, 601 A.2d 633, 641 n.8 (Md. 1992); *Feldman v. Lederle Labs.*, 479 A.2d 374, 386 (N.J. 1984); *Wagner v. Roche Labs.*, 671 N.E.2d 252, 256 (Ohio 1996); *Young v. Key Pharm., Inc.*, 922 P.2d 59, 68 (Wash. 1996).

114. See, e.g., *Clinton v. Brown & Williamson Holdings, Inc.*, 498 F. Supp. 2d 639, 645 (S.D.N.Y. 2007); *Blue v. Env'tl. Eng'g, Inc.*, 828 N.E.2d 1128, 1153 (Ill. 2005) (Fitzgerald, J., specially concurring); *Denny v. Ford Motor Co.*, 662 N.E.2d 730, 735 (N.Y. 1995) (citing *Voss v. Black & Decker Mfg. Co.*, 450 N.E.2d 204 (N.Y. 1983)); *Sipes v. General Motors Corp.*, 946 S.W.2d 143, 156 (Tex. App. 1997).

115. See OWEN, *supra* note 57, § 8.7 (chronicling the rise and fall of the Wade-Keeton test, and opining that its time "has come and gone").

C. *The Rise of State of the Art*

While manufacturers of most products are at least generally aware of the kinds of hazards that lurk within their products before they are sold to consumers and cause harm, dangers are sometimes simply unknowable before a product is sold and put to use. Blood infected with serum hepatitis, formerly undetectable before transfusion into a person, was a prime example in earlier times,¹¹⁶ as was the AIDS virus in blood products prior to the development of reliable tests during the early 1980s.¹¹⁷ Similarly, pharmaceutical drugs, chemicals, and other substances—such as asbestos products in former times and nanotech products today—may only be discovered to have toxic effects long after such products are marketed and harm consumers, sometimes generations later. If such dangers prove to have been foreseeable, discoverable with appropriate pre-market testing or analysis, and if the hazards were avoidable by appropriate warning, processing, or redesign, then manufacturers of such products may be held responsible for the harmful consequences of failing to discover or avoid those risks under ordinary principles of negligence, warranty, and strict liability in tort. But if the risks were in fact unforeseeable—“unknowable”—before consumers began to suffer harm, the question of responsibility for failing to warn about (or otherwise address) such unforeseeable risks becomes more complicated.

As science and technology evolve over time, and as new and improved methods for discovering and eliminating hazards are developed, public attitudes toward risk and responsibility also evolve. In the second decade of the twenty-first century, people expect much more safety in machine guarding, automotive crash protection, and fabric flammability than they did in 1900, or even in 1950.¹¹⁸ Yet it is difficult to know what the safety expectations of consumers are (or should be) with respect to food, biologics, and other products whose most basic properties have been fundamentally and microscopically reconfigured in ways that generate unknown risks that even scientists and engineers cannot fathom.

In the early 1960s, before § 402A of the *Restatement (Second) of Torts* was promulgated and adopted by the courts, the few courts considering the issue held that a manufacturer had a duty to warn only of such risks “the

116. See, e.g., *Cunningham v. MacNeal Mem'l Hosp.*, 266 N.E.2d 897, 902 (Ill. 1970) (rejecting state-of-the-art defense). While various screening and testing approaches in recent years have substantially reduced this risk, an undiscoverable residuum remains. See Centers for Disease Control, *Public Health Service Inter-Agency Guidelines for Screening Donors of Blood, Plasma, Organs, Tissues, and Semen for Evidence*, www.cdc.gov/mmwr/preview/mmwrhtml/00043883.htm (last visited Mar. 30, 2010).

117. See OWEN, *supra* note 57, § 16.9.

118. “A consumer would not expect a Model T to have the safety features which are incorporated in automobiles made today.” *Bruce v. Martin-Marietta Corp.*, 544 F.2d 442, 447 (10th Cir. 1976).

manufacturer knew, or by the application of reasonable developed human skill and foresight should have known.”¹¹⁹ And then, in 1965, came the strict liability standard of § 402A which appeared to preclude any possibility of a “state-of-the-art” defense based on the unforeseeability of a product risk, as previously discussed.

As the risk-utility test for design defectiveness increasingly displaced the consumer expectations standard around the nation,¹²⁰ and as the Wade-Keeton constructive knowledge test fell into desuetude, the relevance of state-of-the-art evidence in design defect cases became increasingly clear. In balancing the costs and benefits of a design feature that would have prevented the plaintiff’s injury, courts widely came to recognize the salience of state-of-the-art evidence on the issue of the defectiveness of a product’s design.¹²¹ In warning cases involving “unknowable” risks of harm, state-of-the-art evidence played an even more central role. Notwithstanding the approach of a few early decisions,¹²² most courts, even on strict liability claims and often under a state-of-the-art umbrella, eventually recognized the need to shield manufacturers from an obligation to warn of risks that are unforeseeable, a critical development to which we now turn.

D. *Foreseeability’s Pivot*

America’s experiment in strict producer responsibility experienced a sharp pivot in the early 1980s, completely reversing direction. It was 1982

119. *Howard v. Avon Prods., Inc.*, 395 P.2d 1007, 1011–12 (Colo. 1964) (en banc) (so stating the duty to warn in negligence law, yet drawing from a tentative draft of § 402A comment j). This was true in both negligence and implied warranty. *See, e.g., id.* (concerning both claims); *Ross v. Philip Morris & Co.*, 328 F.2d 3, 13–14 (8th Cir. 1964) (concerning both claims); *Cudmore v. Richardson–Merrell, Inc.*, 398 S.W.2d 640, 644 (Tex. App. 1965) (concerning implied warranty).

120. *See Owen, supra* note 61, at 987–89 (examining this development).

121. *See, e.g., Folsom v. Kawasaki Motors Corp. U.S.A.*, 509 F. Supp. 2d 1364, 1378 (M.D. Ga. 2007) (noting that “the state of the art at the time the product is manufactured” is one factor in the risk-utility analysis); *LaBelle v. Philip Morris Inc.*, 243 F. Supp. 2d 508, 517–22 (D.S.C. 2001) (noting no design defect if plaintiff unable to prove availability of technology to make safer cigarette); *Potter v. Chi. Pneumatic Tool Co.*, 694 A.2d 1319, 1347 (Conn. 1997) (holding that such state-of-the-art evidence is “relevant and assists the jury in determining whether a product is defective and unreasonably dangerous”); *Fibreboard Corp. v. Fenton*, 845 P.2d 1168, 1174 (Colo. 1993) (en banc) (“State-of-the-art evidence is clearly admissible and is a factor to consider in determining whether a product is defective and unreasonably dangerous due to a defective design.”); *Falada v. Trinity Indus.*, 642 N.W.2d 247, 250 (Iowa 2002) (holding state-of-the-art statutory defense inapplicable to defectively welded product that injured plaintiff); *Hughes v. Massey–Ferguson, Inc.*, 522 N.W.2d 294, 295–96 (Iowa 1994). Some courts allow defendants to introduce state-of-the-art evidence in rebuttal of a plaintiff’s proofs of the feasibility of an alternative design. *See, e.g., Murphy v. Chestnut Mountain Lodge, Inc.*, 464 N.E.2d 818, 823 (Ill. App. Ct. 1984); *Cantu v. John Deere Co.*, 603 P.2d 839, 841 (Wash. Ct. App. 1979). This is only logical, since “state of the art refers to what *feasibly* could have been done.” *Mercer v. Pittway Corp.*, 616 N.W.2d 602, 622 (Iowa 2000) (external citation and internal quotation marks omitted).

122. *See supra* notes 88–90 and accompanying text.

when the New Jersey Supreme Court decided *Beshada v. Johns-Manville Products Corp.*,¹²³ one of the landmark cases of products liability law. *Beshada* was the first state high court case in the United States to apply the Wade-Keeton test and, more generally, the principles of strict products liability to a warning claim defended on the ground that the risk was unforeseeable. This was the first such case, that is, which squarely confronted the question of whether manufacturers should have a duty to warn of unknowable product risks. *Beshada* was another asbestos case brought by insulation workers who suffered asbestosis and mesothelioma from working with asbestos insulation products over many years.¹²⁴ The workers claimed that the manufacturers had breached their strict liability duty to warn of these dangers, and the defendants responded by asserting a state-of-the-art defense—that they had no duty to warn because the danger to such workers of low doses of asbestos was “undiscovered at the time the product was marketed and that it was undiscoverable given the state of scientific knowledge at that time.”¹²⁵ The trial court denied the plaintiff’s motion to strike the state-of-the-art defense, but the New Jersey Supreme Court reversed, holding that compliance with the state of the art is not a defense to a strict liability claim for failure to warn.¹²⁶

Reaffirming its prior endorsement of the Wade-Keeton test,¹²⁷ the court observed that state of the art is essentially a negligence defense, and that the defendants’ argument was that, by failing to warn of an unforeseeable risk, they were not at fault. “But in strict liability cases,” the court explained, “culpability is irrelevant.”¹²⁸ That the product “was unsafe because of the state of technology does not change the fact that it was unsafe. Strict liability focuses on the product, not the fault of the manufacturer.”¹²⁹

123. 447 A.2d 539 (N.J. 1982).

124. *Id.* at 543.

125. *Id.* at 542.

126. *See id.* at 543, 549.

127. *See Freund*, 432 A.2d at 931.

128. *Beshada*, 447 A.2d at 546.

129. *Id.* (citing W. Page Keeton, *Products Liability—Inadequacy of Information*, 48 TEX. L. REV. 398, 408 (1970)). The court explained:

When the defendants argue that it is unreasonable to impose a duty on them to warn of the unknowable, they misconstrue both the purpose and effect of strict liability. By imposing strict liability, we are not requiring defendants to have done something that is impossible. In this sense, the phrase “duty to warn” is misleading. It implies negligence concepts with their attendant focus on the reasonableness of defendant’s behavior. However, a major concern of strict liability—ignored by defendants—is the conclusion that if a product was in fact defective, the distributor of the product should compensate its victims for the misfortune that it inflicted on them.

Id.

After considering the duty to warn of unforeseeable risks from a doctrinal perspective, *Beshada* turned to an inquiry of the compatibility of the policies underlying its strict products liability principle with a rule imposing liability on manufacturers for failing to warn of dangers that were undiscoverable when the product was made and sold.¹³⁰ The court explained that holding producers liable for harm caused by undiscoverable risks achieves the risk-spreading goal by spreading the costs of injuries to all who benefit from a product's distribution.¹³¹ As for deterrence, the court reasoned that forcing manufacturers to absorb the costs of all such harms, foreseeable or not, should spur investment in safety research, thereby advancing product safety.¹³² Finally, the court sought to avoid the expense and "vast confusion" that would arise from requiring plaintiffs to prove at trial "the concept of scientific knowability" inherent in the state-of-the-art defense.¹³³ For all these reasons, the Supreme Court of New Jersey in *Beshada* ruled that strict liability in tort imposes a duty on manufacturers to warn of all significant product hazards, knowable and unknowable alike.

The New Jersey court may have expected its unanimous decision to be largely noncontroversial: after all, it merely applied the Wade-Keeton test (still, then, widely accepted) to a warning claim, which it and other courts had done before; it applied the doctrine to defendants in a singularly unpopular industry; and it merely held that its rule of "strict" products liability was truly strict, rather than just negligence rehashed. But the opinion unleashed an immediate and powerful storm of academic protest.¹³⁴ The commentators complained that, by imposing a duty on manufacturers to warn of unknowable dangers, the New Jersey Supreme

130. *Id.* at 547.

131. *Id.*

132. "By imposing on manufacturers the costs of failure to discover hazards, we create an incentive for them to invest more actively in safety research." *Id.* at 548.

133. *Id.* Such proof—of what kind of knowledge could have been discovered with more or better research—would require costly, confusing, and time-consuming expert testimony on "the history of science and technology to speculate as to what knowledge was feasible in a given year." *Id.* The court doubted that juries would "be capable of even understanding the concept of scientific knowability, much less be able to resolve such a complex issue," and it was reluctant to allow the judicial system to suffer the resulting costs. *Id.*

134. See, e.g., Joseph A. Page, *Generic Product Risks: The Case Against Comment k and for Strict Tort Liability*, 58 N.Y.U. L. REV. 853, 877–82 (1983); Victor Schwartz, *The Post-Sale Duty to Warn: Two Unfortunate Forks in the Road to a Reasonable Doctrine*, 58 N.Y.U. L. REV. 892, 901–05 (1983); John W. Wade, *On the Effect in Product Liability of Knowledge Unavailable Prior to Marketing*, 58 N.Y.U. L. REV. 734, 754–56 (1983); William R. Murray, Jr., Case Comment, *Requiring Omniscience: The Duty to Warn of Scientifically Undiscoverable Product Defects*, 71 GEO. L.J. 1635, 1635–37 (1983); Robert D. Casale, Comment, *Beshada v. Johns Manville Products Corp.: Adding Uncertainty to Injury*, 35 RUTGERS L. REV. 982, 1008–15 (1983); Robert D. Towey, Note, *Products Liability—Strict Liability in Tort—State-of-the-Art Defense Inapplicable in Design Defect Cases*, 13 SETON HALL L. REV. 625, 634–42 (1983).

Court had adopted an unfair standard that was impossible to meet; that it would lead to inefficient corporate behavior that could lead to strategic and unnecessary declarations of bankruptcy;¹³⁵ that it revealed ignorance of how liability rules affect corporate behavior; and that it applied anachronistic strict liability rationales that had become discredited over time.¹³⁶ And at least in part because of *Beshada*, Deans Wade and Keeton both repudiated the Wade-Keeton test, as previously discussed.¹³⁷

A scant two years after rendering *Beshada*, the New Jersey Supreme Court in 1984 had an opportunity to reconsider its now-battered decision in another products liability case, *Feldman v. Lederle Laboratories*,¹³⁸ which involved a claim against a pharmaceutical manufacturer for a possibly unforeseeable risk that a tetracycline drug could discolor an infant's teeth.¹³⁹ In one of the most striking pivots in the history of the law of torts, the New Jersey court, again unanimously, effectively overruled *Beshada*,¹⁴⁰ holding that "drug manufacturers have a duty to warn [only] of dangers of which they know or should have known on the basis of reasonably obtainable or available knowledge."¹⁴¹ Turning *Beshada* completely on its head, the *Feldman* court not only ruled that state of the art was a good defense to a warning claim, but it also largely equated strict liability and negligence in the warning context. Most significantly, *Feldman* abandoned Wade-Keeton's hindsight approach to gauging risk and endorsed comment j's restriction of the warning duty to risks that are foreseeable.

By holding that manufacturers have no duty to warn of risks that are unknowable at the time,¹⁴² the New Jersey court in *Feldman* made a complete about-face from the position it had so proudly endorsed in *Beshada*, just two years earlier. In dramatic fashion, the *Beshada*–*Feldman* duo marks the pivot of the duty to warn of unknowable hazards—and more broadly, industry's responsibility for dangers that are unforeseeable—not only in New Jersey, but widely in American law.

135. Indeed, in 1983, the year following *Beshada*, Johns-Manville itself declared bankruptcy, followed by the bankruptcy of scores of additional asbestos companies in later years. See generally Alan Schwartz, *Products Liability, Corporate Structure, and Bankruptcy: Toxic Substances and the Remote Risk Relationship*, 14 J. LEGAL STUD. 689, 736 (1985).

136. See David G. Owen, *Rethinking the Policies of Strict Products Liability*, 33 VAND. L. REV. 681 (1980).

137. See *supra* notes 110–11.

138. 479 A.2d 374 (N.J. 1984).

139. *Id.* at 376–77.

140. The court denied that it was "overruling" *Beshada*, but it subjected the decision to house arrest, explicitly restricting it to its facts. *Id.* at 388.

141. *Id.* at 376.

142. Reasoning that information on the knowability of risks in a particular field is more accessible to manufacturers than to plaintiffs, the court also ruled that defendants should bear the burden of proof on the availability of information about a risk at the time a product was made and sold. *Id.* at 388.

E. *The Triumph of Foreseeability*

Feldman may have been the turning point in foreseeability's revival, but much work remained. It took another fifteen years or so before foreseeability was widely (if incompletely) restored across America to its rightful place at the center of private law. This process included ongoing reform efforts by courts, state legislatures, and the *Restatement (Third) of Torts: Products Liability*—a process that also occurred in Europe and spread around the globe.

1. Judicial Reform

Four years after *Feldman*, across the continent, the California Supreme Court decided *Brown v. Superior Court*,¹⁴³ another pharmaceutical drug case, which involved the duty of manufacturers to warn of the possibly unforeseeable risk that a drug, diethylstilbestrol (DES), administered to pregnant women could cause birth defects in their unborn children. Following *Feldman* and the principles of comments j and k,¹⁴⁴ the California court ruled that manufacturers of the drug were not accountable for failing to warn of risks “that were neither known by defendants nor scientifically knowable at the time the drug was distributed.”¹⁴⁵ Three years later, the California Supreme Court completed the loop in an asbestos case, *Anderson v. Owens-Corning Fiberglas Corp.*,¹⁴⁶ by extending the holding in *Brown* beyond pharmaceutical drug products to products generally.¹⁴⁷ Like *Feldman*, *Anderson* adopted the requirement of the *Restatement (Second) of Torts* that strict liability for failure to warn is grounded upon the foreseeability of risk.¹⁴⁸

Despite these developments, a handful of states continued to cling fast to the Wade-Keeton idea that strict liability should be defined in hindsight terms so as to impute to manufacturers constructive knowledge of all product dangers, even risks that are entirely unknowable. In 1987, answering a certified question in an asbestos case, the Hawaii Supreme Court ruled that “in a strict products liability action, state-of-the-art evidence is not admissible for the purpose of establishing whether the seller knew or reasonably should have known of the dangerousness of his

143. 751 P.2d 470 (Cal. 1988).

144. The court interpreted comment k in terms of foreseeable risk: Comment k “provides that the producer of a properly manufactured prescription drug may be held liable for injuries caused by the product only if it was not accompanied by a warning of dangers that the manufacturer knew or should have known about.” *Id.* at 475.

145. *Id.* at 481; *see also* *Carlin v. Superior Court*, 920 P.2d 1347, 1354 (Cal. 1996) (“Drug manufacturers need only warn of risks that are *actually known or reasonably scientifically knowable*.”).

146. 810 P.2d 549 (Cal. 1991).

147. “*Brown*’s logic and common sense are not limited to drugs.” *Id.* at 556.

148. *Id.* at 557.

or her product.”¹⁴⁹ In 1995, the New Mexico Supreme Court reaffirmed the Wade-Keeton test imputed knowledge definition of design defectiveness,¹⁵⁰ and a few other decisions have continued perfunctorily to state the definition of strict products liability in tort in hindsight form.¹⁵¹ Each of these cases might be viewed as an aberration in the common law, which now for many years has been attempting to purge itself of the Wade-Keeton liability approach and the constructive knowledge standard that it spawned, and rarely does a modern court attempt to justify the hindsight test in policy terms.

But the appropriateness of a state-of-the-art defense based on the unforeseeability of a product risk was precisely the question raised in *Sternhagen v. Dow Co.*,¹⁵² a 1997 Montana Supreme Court case involving an action against herbicide manufacturers for a crop duster’s death from cancer resulting from exposure to the herbicide 2,4-D years before.¹⁵³ Carefully reexamining the nature of and reasons for Montana’s commitment to the doctrine of strict products liability in tort, *Sternhagen* concluded that manufacturers should have a duty to warn of unknowable product risks.¹⁵⁴ The Montana court’s proud reaffirmation of a pure

149. *Johnson v. Raybestos-Manhattan, Inc.*, 740 P.2d 548, 549 (Haw. 1987).

150. *See Brooks v. Beech Aircraft Corp.*, 902 P.2d 54, 63 (N.M. 1995). The New Mexico Supreme Court elaborated:

[I]n those hypothetical instances in which technology known at the time of trial and technology knowable at the time of distribution differ—and outside of academic rationale we find little to suggest the existence in practice of unknowable design considerations—it is more fair that the manufacturers and suppliers who have profited from the sale of the product bear the risk of loss. . . . If in some future case we are confronted directly with a proffer of evidence on an advancement or change in the state of the art that was neither known nor knowable at the time the product was supplied, we may at that time reconsider application of a state-of-the-art defense to those real circumstances

Id. at 63.

151. *See OWEN*, *supra* note 57, § 8.7 (collecting and examining the cases).

152. 935 P.2d 1139 (Mont. 1997).

153. *Id.* at 1140. *Sternhagen* responded to a question certified by a federal district court:

In a strict products liability case for injuries caused by an inherently unsafe product, is the manufacturer conclusively presumed to know the dangers inherent in his product, or is state-of-the-art evidence admissible to establish whether the manufacturer knew or through the exercise of reasonable human foresight should have known of the danger?

Id. at 1139.

154. The court stated:

[W]e conclude that, in a strict products liability case, knowledge of any undiscovered or undiscoverable dangers should be imputed to the manufacturer. Furthermore, we conclude that, in a strict products liability case, state-of-the-art evidence is not admissible to establish whether the manufacturer knew or through the exercise of reasonable human foresight should have known of the danger.

doctrine of strict products liability is reminiscent in many respects of the New Jersey court's ill-fated opinion in *Beshada* decided now so many years ago.

Whether *Sternhagen* eventually will suffer as sharp a collapse as *Beshada* is difficult to predict, but by the 1990s, the tide had sharply turned against a duty to warn of unknowable product risks. In that decade, the high courts of at least four other states studiously affirmed or reconfirmed the necessary role of foreseeability in duty-to-warn products liability cases—two with respect to prescription pharmaceutical products¹⁵⁵ and two with respect to products generally.¹⁵⁶ Further, all four states repudiated any notion of a duty to warn of unknowable risks. Of these four, the experience of the Massachusetts high court is most instructive.

The evolution of the unknowable-risk warning issue in Massachusetts appeared to mark the final demise of a duty to warn of unknowable risks. In 1984, four months before New Jersey repudiated *Beshada* in *Feldman*, the Supreme Judicial Court of Massachusetts specifically addressed the role of state-of-the-art evidence in warning claims for breach of that state's strict products liability doctrine, which rests on the implied warranty of merchantability.¹⁵⁷ Drawing on *Beshada*, the Massachusetts court in *Hayes v. Ariens Co.*¹⁵⁸ adopted the Wade-Keeton constructive knowledge test in no uncertain terms.¹⁵⁹ Although the Massachusetts high court reaffirmed this position in dictum in 1992,¹⁶⁰ it had occasion to confront the matter

Id. at 1147.

155. *Wagner v. Roche Labs.*, 671 N.E.2d 252, 256 (Ohio 1996); *Young v. Key Pharms., Inc.*, 922 P.2d 59, 62–63 (Wash. 1996).

156. *Vassallo v. Baxter Healthcare Corp.*, 696 N.E.2d 909, 923 (Mass. 1998); *Owens-Illinois, Inc. v. Zenobia*, 601 A.2d 633, 641 n.8 (Md. 1992).

157. Massachusetts, which never adopted the doctrine of strict liability in tort, uses the implied warranty of merchantability as its vehicle for strict products liability. *See Vassallo*, 696 N.E.2d at 923; OWEN, *supra* note 57, §§ 5.3, 5.9.

158. 462 N.E.2d 273 (Mass. 1984).

159. The court explained:

For strict liability purposes, and therefore for purposes of our warranty law, the adequacy of a warning is measured by the warning that would be given at the time of sale by an ordinarily prudent vendor *who, at that time, is fully aware of the risks presented by the product*. A defendant vendor is held to that standard regardless of the knowledge of risks that he actually had or reasonably should have had when the sale took place. The vendor is presumed to have been fully informed at the time of the sale of all risks. The state of the art is irrelevant, as is the culpability of the defendant. Goods that, from the consumer's perspective, are unreasonably dangerous due to lack of adequate warning, are not fit for the ordinary purposes for which such goods are used regardless of the absence of fault on the vendor's part.

462 N.E.2d at 277–78.

160. *Simmons v. Monarch Mach. Tool Co.*, 596 N.E.2d 318, 320 n.3 (Mass. 1992).

squarely once again in 1998, whereupon it slammed the door shut on strict liability and that doctrine's rejection of foreseeability, even more firmly than New Jersey had in switching from *Beshada* to *Feldman* in the early 1980s.

*Vassallo v. Baxter Healthcare Corp.*¹⁶¹ was a negligence and implied warranty of merchantability action against the manufacturer of silicone breast implants for atypical autoimmune disease suffered by a woman in whom such products had been implanted. The trial court denied the defendants' request for a jury instruction limiting its duty to warn to known or knowable risks, the plaintiff prevailed at trial, and the defendants appealed. While upholding the plaintiff's verdict on other grounds, the *Vassallo* Court took the occasion to reevaluate its strict liability (warranty) duty-to-warn rule which "presumes that a manufacturer was fully informed of all risks associated with the product at issue, regardless of the state of the art at the time of the sale."¹⁶² Recognizing that it was "among a distinct minority of States that applies a hindsight analysis to the duty to warn";¹⁶³ that most states follow the foreseeability limitation of *Restatement (Second) of Torts* § 402A comment j;¹⁶⁴ that the *Restatement (Third) of Torts: Products Liability* § 2(c) similarly limits the duty to warn to foreseeable risks;¹⁶⁵ that the goal of product safety is not advanced by a rule which requires the impossible;¹⁶⁶ that the minority approach "has received substantial criticism in the literature";¹⁶⁷ and that an important basis for its original adoption of the hindsight approach, New Jersey's adoption of that approach in *Beshada*, had disappeared,¹⁶⁸ the *Vassallo* court decided to revise its law to state that producers have no duty to warn of "risks that were not reasonably foreseeable at the time of sale or could not have been discovered by way of reasonable testing prior to marketing the product."¹⁶⁹

161. 696 N.E.2d 909 (Mass. 1998).

162. *Id.* at 922.

163. *Id.*

164. *See id.*

165. *See id.* at 923. The duty to warn under § 2(c) is defined in black-letter terms of "foreseeable risks of harm," and comment m provides in part: "The harms that result from unforeseeable risks—for example, in the human body's reaction to a new drug, medical device, or chemical—are not a basis of liability."

166. *Vassallo*, 696 N.E.2d at 922–23.

The thin judicial support for a hindsight approach to the duty to warn is easily explained. The goal of the law is to induce conduct that is capable of being performed. This goal is not advanced by imposing liability for failure to warn of risks that were not capable of being known.

Id.

167. *Id.* at 923.

168. *Id.* at 922.

169. *Id.* at 923.

While the *Vassallo* court's decision to shield manufacturers from responsibility for unforeseeable product hazards appeared to signal the final demise of true strict liability principles that reject foreseeability's central role in American law, the Supreme Court of Wisconsin soon made clear that any such signal was premature. In 2001, the Wisconsin high court decided *Green v. Smith & Nephew AHP, Inc.*,¹⁷⁰ in which a health care worker brought suit for a severe reaction to allergens in latex gloves manufactured by the defendant—a danger the health care industry apparently did not know about at the time the plaintiff's gloves were manufactured. Reaffirming the consumer expectations test as the proper standard for determining a defendant's responsibility for harm under the doctrine of strict products liability in tort, the court ruled that the foreseeability of risk was relevant only to negligence, not strict liability. “[U]nder no circumstance,” said the court, “must the plaintiff prove that the risk of harm presented by the product that caused his or her injury was foreseeable.”¹⁷¹ The court justified its refusal to endorse a state-of-the-art defense on the conventional (if by then largely abandoned) rationales for strict products liability in tort—promoting product safety, protecting justified consumer expectations, and the perceived fairness of placing the loss on the party that created and profited from the risk.¹⁷² While time has taken its toll on these tattered rationales,¹⁷³ their unabashed resurrection by the *Green* majority and the *Sternhagen* court shows that they still possess at least a twitch of life.

But for a smattering of rogue if robust judicial opinions,¹⁷⁴ supported by a surprising number of quixotic if enthusiastic theorists,¹⁷⁵ American law,

170. 629 N.W.2d 727 (Wis. 2001).

171. *Id.* at 746.

172. *Id.* at 749–51.

173. See OWEN, *supra* note 57, § 5.4.

174. A number of courts over the last quarter century have reaffirmed their commitment to a truly “strict” products liability doctrine uncontaminated by principles of foreseeability, fault, negligence, or state of the art. See *Golonka v. Gen. Motors Corp.*, 65 P.3d 956, 963 (Ariz. Ct. App. 2003) (imputing to manufacturer all knowledge available at time of trial); *Johnson v. Raybestos-Manhattan, Inc.*, 740 P.2d 548, 549 (Haw. 1987) (ruling that state-of-the-art evidence on the foreseeability of the risk is inadmissible on a strict tort claim); *Townsend v. Sears, Roebuck & Co.*, 879 N.E.2d 893, 899 (Ill. 2007) (stating, in dicta, that “in a strict liability action, the inability of the defendant to know or prevent the risk is not a defense”); *Sternhagen v. Dow Co.*, 935 P.2d 1139, 1144–47 (Mont. 1997) (rejecting state-of-the-art defense in strict products liability case because it raises reasonableness and foreseeability issues relevant to negligence which would abandon the core principles of modern products liability law); *Brooks v. Beech Aircraft Corp.*, 902 P.2d 54, 62–63 (N.M. 1995) (endorsing Wade-Keeton hindsight test); *Green v. Smith & Nephew AHP, Inc.*, 629 N.W.2d 727, 736–52 (Wis. 2001) (holding that foreseeability of risk is irrelevant to consumer expectations test for determining if a product is defective and unreasonably dangerous).

175. See, e.g., John B. Attanasio, *The Principle of Aggregate Autonomy and the Calabresian Approach to Products Liability*, 74 VA. L. REV. 677 (1988); Stephen P. Croley & Jon D. Hanson, *Rescuing the Revolution: The Revived Case for Enterprise Liability*, 91 MICH. L. REV. 683 (1993);

as the modern law of most of the world,¹⁷⁶ no longer holds producers responsible for unknowable risks.¹⁷⁷ Infrequent cases involving egregiously dangerous products that never should have been marketed for widespread use, such as asbestos¹⁷⁸ and thalidomide,¹⁷⁹ are likely to continue to tempt courts to hold manufacturers responsible for unknowable product risks. Yet, to the extent that such risks truly are unforeseeable, industry cannot be faulted for placing such products on the market, nor can producers effectively be encouraged by the law to guard against risks they cannot in fact foresee. While innocent victims of the excesses of science and technology often suffer economic distress therefrom, most reasoned observers conclude that the laudable objective of spreading risks (insurance) is more fairly and efficiently administered by insurance institutions—private companies and public agencies designed to compensate for accidental loss—than by the law of torts.¹⁸⁰ In sum, judicial reform over the last quarter century has shown that private law is quite surely better off without a rigid principle of strict liability requiring producers to warn or otherwise protect against the unknowable risks of modern science and technology.

Jon D. Hanson & Kyle D. Logue, *The First Party Insurance Externality: An Economic Justification for Enterprise Liability*, 76 CORNELL L. REV. 129 (1990); Gregory C. Keating, *The Idea of Fairness in the Law of Enterprise Liability*, 95 MICH. L. REV. 1266 (1997); Gregory C. Keating, *The Theory of Enterprise Liability and Common Law Strict Liability*, 54 VAND. L. REV. 1285 (2001); Douglas A. Kysar, *The Expectations of Consumers*, 103 COLUM. L. REV. 1700, 1790 (2003); Stephen F. Williams, *Second Best: The Soft Underbelly of Deterrence Theory in Tort*, 106 HARV. L. REV. 932 (1993); see also Mark Geistfeld, *Reconciling Cost-Benefit Analysis with the Principle That Safety Matters More than Money*, 76 N.Y.U. L. REV. 114 (2001).

176. See *infra* notes 195–204 and accompanying text.

177. For a recent repudiation of the hindsight test, see *Powers v. Taser Int'l, Inc.*, 174 P.3d 777, 779–84 (Ariz. Ct. App. 2008) (declining to extend that state's hindsight test from design- to warning-defect cases and holding, by implication that the duty to warn extends only to foreseeable risks). Other cases addressing the repudiation of the hindsight test are collected in OWEN, *supra* note 57, § 8.7 n.38.

178. See, e.g., *Bugosh v. I.U. N. Am., Inc.*, 971 A.2d 1228 (Pa. 2009) (dismissing defendant's appeal in asbestos case that sought to replace *Restatement (Second) of Torts* § 402A with *Restatement (Third) of Torts: Products Liability* § 2, resulting in affirmance of judgment on verdict for plaintiff on strict liability principles that excluded foreseeability and other negligence concepts).

179. Thalidomide, widely prescribed as a sedative for morning sickness in much of the world during the 1950s and 1960s, caused severe limb deformities in children born to women who took the drug while pregnant. Joseph Sanders, *The Bendectin Litigation: A Case Study in the Life Cycle of Mass Torts*, 43 HASTINGS L.J. 301, 313–14 (1992). The FDA's protracted review of the drug barely saved most Americans from this terrible tragedy. See *id.* (characterizing thalidomide as "one of the most potent human teratogens ever found"); see also Anita Berstein, *Formed by Thalidomide: Mass Torts as a False Cure for Toxic Exposure*, 97 COLUM. L. REV. 2153, 2154 (1997).

180. See Owen, *supra* note 106, at 486.

2. Statutory Reform

From the inception of the products liability statutory reform movement in the late 1970s,¹⁸¹ many state legislatures have sought to protect industry from liability when a challenged product was designed, produced, and labeled according to the state of scientific knowledge and technological capability prevailing in the industry at the time. Colorado may have been the first state to enact such a provision, in 1977,¹⁸² and Florida, so far, may be the latest, in 1999.¹⁸³ Many states afford full state-of-the-art protection,¹⁸⁴ by conditioning liability on a defendant's ability to conform to the state of the art, an approach that places the burden of proof on the plaintiff,¹⁸⁵ or by creating a state-of-the-art affirmative defense, which places the burden of proof on the defendant.¹⁸⁶ Other states have enacted rebuttable presumptions providing that products that conform to the state of the art are presumed to be nondefective and that manufacturers and sellers of such products are similarly presumed not negligent.¹⁸⁷ And some states have enacted statutes that address the admissibility of state-of-the-art evidence, either by providing that a defendant may introduce evidence of the prevailing scientific knowledge or technology at the time of manufacture or sale,¹⁸⁸ or that a claimant may not introduce evidence of improved science or technology developed thereafter.¹⁸⁹

3. The Products Liability Restatement

During the 1990s, the *Restatement (Third) of Torts: Products Liability* explicitly limited a manufacturer's principal duties in terms of foreseeable risk. Thus, a product "is defective because of inadequate instructions or warnings when the *foreseeable* risks of harm posed by the product could

181. See F. Patrick Hubbard, *The Nature and Impact of the "Tort Reform" Movement*, 35 HOFSTRA L. REV. 437, 469–70 (2006); Joseph Sanders & Craig Joyce, "Off to the Races": *The 1980s Tort Crisis and the Law Reform Process*, 27 HOUS. L. REV. 207, 212 n.21 (1990).

182. See COLO. REV. STAT. ANN. § 13-21-403(1) (West 2005).

183. See FLA. STAT. ANN. § 768.1257 (West 2005).

184. See 1 DAVID G. OWEN, M. STUART MADDEN, MARY J. DAVIS, MADDEN & OWEN ON PRODUCTS LIABILITY § 10:7, at 661–68 (2000).

185. See, e.g., MICH. COMP. LAWS ANN. § 600.2948(3) (LexisNexis 2004); MISS. CODE ANN. § 11-1-63(b)-(c) (LexisNexis 2002).

186. See ARIZ. REV. STAT. ANN. § 12-683 (1) (West 2003); IOWA CODE ANN. § 668.12 (West 1998); LA. REV. STAT. ANN. § 9:2800.59 (West 2009); MO. ANN. STAT. § 537.764 (West 2008); NEB. REV. STAT. § 25-21,182 (LexisNexis 2004); N.H. REV. STAT. ANN. § 507:8-g (LexisNexis 2009).

187. See COLO. REV. STAT. ANN. § 13-21-403(1) (West 2005); IND. STAT. ANN. § 34-20-5-1 (LexisNexis 2008); KY. REV. STAT. ANN. § 411.310(2) (West 2006).

188. See FLA. STAT. ANN. § 768.1257 (West 2005); MICH. COMP. LAWS ANN. § 600.2946(1) (LexisNexis 2004); S.D. CODIFIED LAWS § 20-9-10.1 (West 2004); TENN. CODE ANN. § 29-28-105(b) (LexisNexis 2000); WASH. REV. CODE ANN. § 7.72.050(1) (West 2007).

189. See ARIZ. REV. STAT. ANN. § 12-686 (West 2003); COLO. REV. STAT. ANN. § 13-21-404 (West 2005); IDAHO CODE ANN. § 6-1406 (LexisNexis 2004); KAN. STAT. ANN. § 60-3307 (2005).

have been reduced or avoided by . . . reasonable instructions or warnings . . . [the omission of which] renders the product not reasonably safe.”¹⁹⁰ A parallel provision on the duty of safe design includes a similar foreseeability limitation.¹⁹¹ Unknowable risks, these provisions make abundantly clear, lie outside a producer’s responsibility for reasons of both fairness and efficiency.¹⁹² While the *Restatement’s* foreseeability limitations alone resolves the unknowable risk question, its further requirement that a plaintiff prove that some alternative “reasonable” warning (or design) could have prevented the accident underscores the necessity that any required warning (or design) be within the scientific knowledge and technological capabilities of a prudent manufacturer seeking to make its products reasonably safe. Warning of unforeseeable hazards is impossible by any definition and so would never be required by a liability standard based on reasonableness.¹⁹³

No matter how reform-minded some *Restatements of the Law* may be, they inevitably are somewhat conservative, looking backwards to a large extent in “restating” the law that courts have declared in the past. So, it should come as little surprise that the *Products Liability Restatement* failed to address how the law might adjust to the kinds of fundamental changes to the natural order of science and technology that have sprouted up in the nearly two decades since this *Restatement* was conceived, and the dozen years since it was published. Yet, the *Third Restatement’s* clear limitation of a producer’s responsibility to foreseeable risk reflects the difficult lessons learned from the great strict liability experiment, and it reveals how plainly that experiment failed. Moreover, the complex manipulation of

190. RESTATEMENT (THIRD) OF TORTS: PRODUCTS LIABILITY § 2(c) (1998) (emphasis added).

191. *See id.* § 2(b).

192. *Id.* § 2 cmt. a.

Most courts agree that, for the liability system to be fair and efficient, the balancing of risks and benefits in judging product design and marketing must be done in light of the knowledge of risks and risk-avoidance techniques reasonably attainable at the time of distribution. To hold a manufacturer liable for a risk that was not foreseeable when the product was marketed might foster increased manufacturer investment in safety. But such investment by definition would be a matter of guesswork. Furthermore, manufacturers may persuasively ask to be judged by a normative behavior standard to which it is reasonably possible for manufacturers to conform. For these reasons, Subsections (b) and (c) speak of products being defective only when risks are reasonably foreseeable.

Id.; *see also id.* § 6(c)–(d) (limiting design and warning responsibility for prescription drugs and medical devices to foreseeable risks of harm).

193. Various comments buttress these basic provisions in § 2(c). Noting the complexities in risk assessments of prescription drugs, medical devices, and toxic chemicals, comment m states that there is no liability for selling such products if their risks are unforeseeable. Further, in addressing the duty to warn of “adverse allergic or idiosyncratic reactions,” comment k provides that there is no duty to warn of risks of unforeseeable allergic reactions. Finally, comment m makes clear that the purpose of a seller’s duty to test is to discover such risks as are reasonably capable of discovery.

doctrine necessary to “restate” the law in this *Restatement* compellingly illustrates how convoluted the law had become during the quarter century of evolving legal doctrine when courts professed that liability was “strict,” while they simultaneously restored foreseeability to the center of private law.¹⁹⁴ Be that as it may, the *Third Restatement* makes crystal clear that manufacturers should not be accountable for unforeseeable risks of harm.

4. Foreign Law

Like America, Europe in the 1970s and early 1980s hotly debated whether the law should shield industry from liability for the unforeseeable risks of science and technology. The issue was far from academic on the European continent, which then was still reeling from the ravages caused by thalidomide, a drug prescribed to pregnant women across Europe during the 1950s and 1960s, that proved to be horribly teratogenic.¹⁹⁵ Spurred by the thalidomide tragedy and by America’s widespread adoption of § 402A of the *Restatement (Second) of Torts*,¹⁹⁶ and after nearly a decade of study and debate, the European Economic Community (“EEC”) in 1985 adopted a *Directive on Liability for Defective Products*,¹⁹⁷ holding producers “strictly” liable for physical harm caused by defective products.¹⁹⁸

As drafts of the Directive circulated around the various European parliaments and legal establishments in the early 1980s, the most hotly debated provision was its state-of-the-art defense, referred to in Europe as the “development risk” defense.¹⁹⁹ By the time the EEC finally adopted the

194. See, e.g., David G. Owen, *The Graying of Products Liability Law: Paths Taken and Untaken in the New Restatement*, 61 TENN. L. REV. 1241 (1994); David G. Owen, *Defectiveness Restated: Exploding the “Strict” Products Liability Myth*, 1996 U. ILL. L. REV. 743, 748–51.

195. See *supra* note 179.

196. See Geraint G. Howells & Mark Mildred, *Is European Products Liability More Protective than the Restatement (Third) of Torts: Products Liability?*, 65 TENN. L. REV. 985, 989, 992 (1998); Geraint G. Howells & David G. Owen, *Products Liability Law in America and Europe*, in HANDBOOK OF INTERNATIONAL CONSUMER LAW AND POLICY ch. 9 (2010).

197. Council Directive 85/374/EEC of 25 July 1985 on the Approximation of the Laws, Regulations and Administrative Provisions of the Member States Concerning Liability for Defective Products, 1985 O.J. (L 210) 29.

198. See *id.*, art. I.

199. Some European commentators distinguish the development risk defense from the state-of-the-art defense. See GERAIN T. G. HOWELLS & STEPHEN WEATHERILL, CONSUMER PROTECTION LAW § 4.1.3 (2d ed. 2005); Hans C. Taschner, *Harmonization of Products Liability Law in the European Community*, 34 TEX. INT’L L.J. 21, 31 (1999). Other commentators appear to equate the two. See Manfred Wandt, *German Approaches to Products Liability*, 34 TEX. INT’L L.J. 71, 84 (1999). On the development risk defense, see generally C. JOHN MILLER & RICHARD S. GOLDBERG, PRODUCT LIABILITY ch. 13, at 489–528 (Oxford University Press 2d ed. 2004); JANE STAPLETON, PRODUCT LIABILITY 236–42 (Butterworths 1994); Howells & Owen, *supra* note 196; Geraint G. Howells & Mark Mildred, *Infected Blood: Defect and Discoverability—A First Exposition of the EC Product Liability Directive*, 65 MOD. L. REV. 95, 101–04 (2002); Jane Stapleton, *Bugs in Anglo-American Products Liability*, 53 S.C. L. REV. 1225, 1243–52 (2002).

Directive in 1985, America had already passed the *Beshada–Feldman* pivot point, restoring foreseeability of risk under the state of the art as a liability requirement. Perhaps Europe learned from this experience, for the Directive included the defense in its final draft: Article 7(e) permits a manufacturer to defend a claim by proving “that the state of scientific and technical knowledge at the time when he put the product into circulation was not such as to enable the existence of the defect to be discovered.”²⁰⁰ Still controversial at the time, the Directive made this one defense optional for the individual European states, yet only two (of the presently twenty-seven member states) elected to deny it altogether.²⁰¹

Many other nations have adopted clones of the European Directive, including its important provision shielding industry from responsibility for the harmful effects of science and technology unknowable at the time a product was developed. Japan’s products liability law adopts an identical principle,²⁰² and similar provisions exist in Korea, Australia, Israel, Taiwan, Turkey, Slovenia, and other nations around the world.²⁰³ And so, over the last quarter century, foreseeability has reclaimed its central role, not only across America but around the globe—from Trenton to San Francisco, Boston to Houston, London to Copenhagen, Budapest to Madrid, and from Rome to Tokyo, Buenos Aires, Rio de Janeiro, Sydney, Jerusalem, and Taipei—as a vital protective shield surrounding producers of new technologies with unknown risks.²⁰⁴

V. BENDING NATURE, BENDING LAW

A. *Bending Nature and the Puzzle of Responsibility for Unforeseeable Risk*

The law’s decision to construct an impregnable foreseeability cocoon around industry, sheltering it from responsibility for harm deemed unforeseeable, worked quite well from the beginning of the industrial revolution well into the century just passed. As the 1900s opened their

200. Council Directive 85/374/EEC of 25 July 1985 on the Approximation of the Laws, Regulations and Administrative Provisions of the Member States Concerning Liability for Defective Products, art. 7(e), 1985 O.J. (L 210) 29. For a discussion of Article 7(e), see, for example, Jane Stapleton, *Liability for Drugs in the U.S. and EU: Rhetoric and Reality*, 26 REV. LITIG. 991, 1018–29 (2007).

201. Only Luxembourg and Finland opted to omit this defense entirely. See Mathias Reimann, *Liability for Defective Products at the Beginning of the Twenty-First Century: Emergence of a Worldwide Standard?*, 51 AM. J. COMP. L. 751, 780 n.138 (2003). Spain excludes from the defense liability for the sale of defective medicines and food, Germany excludes pharmaceuticals, and France excludes products (like blood) derived from the human body. *Id.*

202. See LUKE NOTTAGE, PRODUCT SAFETY AND LIABILITY LAW IN JAPAN 124–31 (2004).

203. See Mathias Reimann, *Liability for Defective Products at the Beginning of the Twenty-First Century: Emergence of a Worldwide Standard?*, 51 AM. J. COMP. L. 751, 780 n.40 (2003).

204. See *id.* at 780–81 (asserting that, “on a worldwide level, the defense is, in principle, available in all but a very small number of jurisdictions”).

doors, dangers to be foreseen came mostly from a small number of contrivances and substances whose dangers were quite apparent—locomotives, industrial machinery, automobiles, oil, gas, and electricity. While the elements and forces in such products were then just beginning to be comprehended, the dangers if those forces escaped their confines could readily be understood by the scientists and engineers who conceived the products. With appropriate testing, that is, most dangers lurking in the products of the early 1900s were foreseeable (indeed, foreseen) by producers and users alike. And so private law a century ago was comfortable in bounding responsibility for the harmful consequences from such products with the concept of foreseeable risk.

Fashioning a proper role for foreseeability during the second half of the last century proved far more difficult, as the previous discussion has revealed. In the 1950s, many of the older technologies remained dominant, so that the foreseeability principles of earlier times still worked well enough. But then the Great Strict Liability Experiment, beginning in the 1960s and lasting for about a generation, turned traditional fault-based concepts of responsibility on their heads. In time, however, as the law came to recognize the frailties in “strict” enterprise responsibility for the harmful consequences of new science and technology, it restored principles of fault that rested on reasonable efforts to prevent foreseeable risks of harm. By the time the last century was drawing to a close, the private law had quite firmly reestablished foreseeability and fault as proper ideals for a fair and efficient system of responsibility for harm in modern law.²⁰⁵

Yet, quickly turns the world. Over the very recent past, radical changes in how scientists and firms use nature—now twisting its fundamental properties—raise anew old questions on the fairness and logic of allowing enterprises to escape responsibility for harmful consequences behind an impenetrable shield of unforeseeability. How can anyone know what harmful results ultimately may flow from ever-more creative applications of nanotechnology that reconstruct the atomic makeup of matter, as by

205. “[S]trict liability as a doctrinal or analytical category of accident law is dying, and should be absorbed within negligence liability.” Peter M. Gerhart, *The Death of Strict Liability*, 56 *BUFF. L. REV.* 245, 246 (2008). For a sampling of academia’s support for returning to traditional principles of foreseeability and fault, see, for example, Richard A. Epstein, *Products Liability: The Search for the Middle Ground*, 56 *N.C. L. REV.* 643, 661 (1978); Heidi Li Feldman, *Harm and Money: Against the Insurance Theory of Tort Compensation*, 75 *TEX. L. REV.* 1567 (1997); James A. Henderson Jr., *Why Negligence Dominates Tort*, 50 *UCLA L. REV.* 377, 377 (2002); Peter Huber, *Safety and the Second Best: The Hazards of Public Risk Management in the Courts*, 85 *COLUM. L. REV.* 277 (1985); Owen, *supra* note 106; David G. Owen, *Rethinking the Policies of Strict Products Liability*, 33 *VAND. L. REV.* 681, 703–07 (1980); Priest, *supra* note 57; Alan Schwartz, *Products Liability and Judicial Wealth Redistribution*, 51 *IND. L.J.* 558 (1976); Steven D. Smith, *The Critics and the “Crisis”: A Reassessment of Current Conceptions of Tort Law*, 72 *CORNELL L. REV.* 765 (1987); Ernest J. Weinrib, *The Insurance Justification and Private Law*, 14 *J. LEGAL STUD.* 681, 681 (1985). For opposing academic authority, see *supra* note 175.

fashioning synthetic microbes to ride inside nanotech submersibles injected in human blood to find and destroy bacteria attacking healthy human cells?²⁰⁶ How should the law respond if a rogue microbe in a new medicine like this diverts to reproductive regions of the patient, altering their structure unforeseeably, so that, ultimately, the patient's children's children are born with three ears instead of two? Or what if artificial-intelligence scientists succeed beyond their wildest imaginations in engineering new microorganisms to "think" and learn to adapt as they progress toward preprogrammed goals?²⁰⁷ What might be the consequence, for example, if robot "brains" are fashioned from such new technologies, leading such robots (possibly very tiny "nanobots") eventually to decide to strengthen themselves for self-protection, to replicate, and maybe even to form whole armies of robots (or nanobots) that ultimately might challenge the authority of their human creators? While consequences like these may seem far-fetched today, accelerating developments in science and technology continue to bend the fundamentals of nature with consequences that simply cannot be foretold.²⁰⁸

The question for private law in a world that includes an expanding array of products of rapidly changing science and technology is to determine the extent to which foreseeability should continue to protect producers of new products from the harm those products assuredly will sometimes cause to human beings. Most particularly, the law will have to determine if its rejection of strict liability was premature, if requiring firms to internalize *all* the harmful consequences they cause may indeed be the optimal, and fairest, principle of responsibility for harm. If so, then the law may decide to bend itself anew by banishing foreseeability once again as an element of legal responsibility. Or the law may choose instead to leave foreseeability as a requirement of liability but to bend this doctrine to suit the new environment. Of course, private law itself could be banned from this realm, leaving private markets and *ex ante* regulation by public agencies as the primary means for addressing the problem of unforeseeable harm from new sciences and technologies.²⁰⁹ While each of these approaches to addressing

206. "In the long term, some researchers envision nano-robots that are capable of navigating throughout the body, repairing tissue and injuries, destroying tumors, removing atherosclerotic plaques, and even performing gene therapy." Khanijou, *supra* note 6, at 182–83.

207. See, e.g., John Markoff, *Ay Robot! Scientists Worry Machines May Outsmart Man*, N.Y. TIMES, July 26, 2009, at A1, available at http://www.nytimes.com/2009/07/26/science/26robot.html?_r=1&emc=eta1. On how the law should treat thinking robots, see F. Patrick Hubbard, "Do Androids Dream?": *Personhood and Intelligent Artifacts*, 83 TEMP. L. REV. ___ (2010) (forthcoming).

208. "Ideas and technology that were once characterized as belonging exclusively to the realm of science fiction are now 'science reality' as scientists developed novel techniques to manipulate matter." Khanijou, *supra* note 6, at 180.

209. For example, scholars are beginning to focus on public regulation of nanotechnology. See, e.g., Albert C. Lin, *Size Matters: Regulating Nanotechnology*, 31 HARV. ENVTL. L. REV. 349, 374

responsibility for harm from bending nature is worthy of sustained inquiry, some implications of each can be briefly sketched out here.

B. *The Paradox of Foreseeable Unforeseeability*

Before we return to the problem of how private law should address unforeseeable consequences of science and technology gone awry, it may be helpful to reconsider the meaning of “unforeseeability” and how a finding of unforeseeability affects a victim’s claim for harm. Although private law has largely restored foreseeability as a requisite of liability, foreseeability may be conceived in an expansive way that *protects* victims of unexpected harm from technology rather than the other way around. This is because unexpected consequences of new science and technology may be viewed in a sense as more and more foreseeable, not less. That is, the more that humans tinker with the fundamentals of nature by reshaping its basic makeup, the more we should expect the unexpected. Our present understanding of the laws of science is based on nature as it presently is constructed, not as humans choose to reconstruct it at an elemental level.

Victor Frankenstein, convinced that he had discovered the secret of life, probably did not think about how his unnatural creation might wreak havoc on the lives of those around him.²¹⁰ But, one might ask, just what *did* he think would result from tinkering with the fundamentals of life itself? Within the question lurks the answer: foreseeability includes all risks actors fairly may be deemed to expect, and the more seriously actors interfere with Mother Nature, the more serious may be the consequences of whatever type, as they well know. And so, while neither Victor nor any other scientist in his position would likely have contemplated the explosive fury of his creation, he fairly may be held accountable for all the consequences that resulted from turning nature on its head. Call this “foreseeability,” or call it something else, but responsibility for the consequences from mucking about with the rudiments of nature surely widens to embrace a wide swath of unexpected harm. Put rhetorically, what else but *unexpected* consequences might an actor fairly expect from bending nature in fundamental ways? This is the paradox of foreseeable unforeseeability.

How this paradox should affect responsibility for unforeseeable harm from bending nature is difficult to say. Certainly, if unknown consequences are reasonably expectable, at least in a general way, then their realization fairly may be viewed as “foreseeable” and, hence, as falling within the ambit of responsibility. Actors cannot complain about being held responsible for consequences of their actions they should fairly contemplate, and this principle sometimes may apply when humans twist Mother Nature in new and untoward ways. Admittedly, putting the paradox

(2007); Mandel, *supra* note 38, at 1347.

210. See MARY W. SHELLEY, *FRANKENSTEIN* (1818).

of foreseeable unforeseeability to use so expansively undermines the limiting effect of foreseeability, its defining force. For this reason, courts should cautiously and sparingly apply the paradox, perhaps limiting it to situations where industry has recklessly let loose untested new technology with frightening potential consequences.²¹¹

C. *Bending Foreseeability*

One virtue of the paradox of foreseeable unforeseeability is that it reveals foreseeability's enormous flexibility. Indeed, how more flexible can a concept be than to deny itself? Scholars long have reviled foreseeability for this very feature, complaining that its inherent vagueness provides it with so little decisional guidance that it is meaningless, vacuous, and indeterminate: "in one sense, everything is foreseeable, in another sense nothing [is]."²¹² While flexibility in a legal concept indeed weakens its predictability, flexibility ("unfair competition," "best interests of the child," "due care") also provides breathing room for decision makers to bend doctrine to individualize justice in discrete cases. This is so with foreseeability, which is strengthened by this feature, one that gives it power to mold the legal consequences from unknown risks to each new situation.

One example of the many ways in which foreseeability may flexibly expand to embrace risks that might seem to fall outside the realm of contemplation involves what H.L.A. Hart and Tony Honoré call "ulterior risks."²¹³ These are risks widely viewed as "normal and ordinary" though not "which a reasonable man would have in contemplation and take into account in planning his conduct"—such as the risk that negligent driving will endanger the rescuer of a child threatened by the driving; or that a victim of the negligent driving may "suffer further injury from negligent medical treatment, or from a fall while attempting to walk on crutches; or that the injured man may be left lying in the highway, where a second car

211. "An actor who intentionally or recklessly causes harm is subject to liability for a broader range of harms than the harms for which that actor would be liable if only acting negligently." RESTATEMENT (THIRD) OF TORTS: LIAB. FOR PHYSICAL & EMOTIONAL HARM § 33(b) (2010). See generally David G. Owen, *The Highly Blameworthy Manufacturer: Implications on Rules of Liability and Defense in Products Liability Actions*, 10 IND. L. REV. 769, 784–87 (1977) (explaining why reckless misconduct fairly expands a manufacturer's scope of responsibility for harm).

212. HART & HONORÉ, *supra* note 10, at 232 (citing WILLIAM L. PROSSER, HANDBOOK ON THE LAW OF TORTS 259 (2d ed. 1955)); see also Patrick J. Kelley, *Restating Duty, Breach, and Proximate Cause in Negligence Law: Descriptive Theory and the Rule of Law*, 54 VAND. L. REV. 1039, 1046 (2001) (stating that foreseeability is "so open-ended [that it] can be used to explain any decision, even decisions directly opposed to each other"); OWEN, *supra* note 57, § 13.5, at 890 (observing that "the innate vagueness of 'foreseeability' renders it 'virtually meaningless as a device for determining the scope of liability in actual cases'"); Benjamin C. Zipursky, *The Many Faces of Foreseeability*, 10 KAN. J.L. & PUB. POL'Y 156 (2000) ("Foreseeability is undoubtedly a muddle in the law of negligence.").

213. See HART & HONORÉ, *supra* note 10, at 263–65.

will run over him.”²¹⁴ To this list, one might add the risk that the victim will suffer unexpectedly severe injuries due to a particularly thin skull.²¹⁵ Although these hazards are not the types of consequences upon which actors normally dwell while acting,²¹⁶ the *Second Restatement* reasons, they all are “normal” consequences of negligent driving and so fairly should be included “within its scope.”²¹⁷ While one might agree with the *Restatement* that such risks lie so far outside ordinary foreseeability as to require drawing on some independent notion of scope of risk,²¹⁸ such a view ignores the broader kind of *reflective* foreseeability that many courts intuitively apply in widening the scope of consequences under the *reasonably* foreseeable umbrella. This broader, more abstract form of “foreseeability” reflects the kind of objective fairness perspective that embraces the reciprocal nature of a wrong that underlies the private law.²¹⁹ Foreseeability thus expands creatively to catch hazards that somehow seem remote but that nonetheless are ripe for capture under a liability umbrella.

Particularly in the context of unexpected harm from new sciences and technologies, damages (as well as liability) might be adjusted according to the foreseeability of the consequence: the less foreseeable the result, the lower the damages, and vice versa. By this approach, which might be dubbed “comparative foreseeability,” an actor otherwise responsible would be liable for some proportion of a victim’s harm, even if the result were highly unexpected. In fact, the law already applies this principle, indirectly, under the authority of comparative fault, since fault itself is grounded in the foreseeability of risk.²²⁰ So, as novel as a principle of comparative

214. RESTATEMENT (SECOND) OF TORTS § 281 cmt. g (1965); *see also id.* § 281 cmts. e–f. The *Restatement (Third) of Torts: Liability for Physical & Emotional Harm* addresses responsibility for injuries to rescuers in § 32 and for enhanced harm from efforts to render medical aid in § 35.

215. *See* RESTATEMENT (THIRD) OF TORTS: LIAB. FOR PHYSICAL & EMOTIONAL HARM § 31 (2010).

216. *See* Francis H. Bohlen, Book Review, 47 HARV. L. REV. 556, 557–58 (1934) (reviewing FOWLER VINCENT HARPER, A TREATISE ON THE LAW OF TORTS (1933), and arguing that applying foreseeability to such risks “strain[s] the idea of foreseeability past the breaking point”).

217. *See* RESTATEMENT (SECOND) OF TORTS § 281 cmt. g (1965).

218. This was the view of the *Second Restatement*, *see id.*, and it appears continued in the *Third Restatement*. *See* RESTATEMENT (THIRD) OF TORTS: LIAB. FOR PHYSICAL & EMOTIONAL HARM § 29 cmt. e & Reporters’ Comments thereto (2010) (explaining view that a scope-of-risk standard more comfortably embraces appropriate risks than foreseeability).

219. *See* Owen, *supra* note 4, at 1288–90. This is a Kantian, “reciprocity” conception of responsibility that links doers and sufferers of harm. *See, e.g.*, ERNEST J. WEINRIB, THE IDEA OF PRIVATE LAW 145 (1995) (positing that “negligence law unifies doing and suffering”); Allan Beever, *Corrective Justice and Personal Responsibility in Tort Law*, 28 OXFORD J. LEGAL STUD. 475, 491–92 (2008); Ripstein, *supra* note 3, at 362 (“The reciprocity conception views responsibility as a relation between persons with respect to expected consequences.”).

220. *See* David G. Owen, *Figuring Foreseeability*, 44 WAKE FOREST L. REV. 1277, 1285–86 (2009); Benjamin Zipursky, *Foreseeability in Breach, Duty, and Proximate Cause*, 44 WAKE FOREST L. REV. 1247, 1248 (2009).

foreseeability may seem at first, private law already embraces this notion to some extent.

Holding producers *strictly* liable—accountable in private law even for consequences that are unforeseeable—is one way to address the frightening prospect of nanotech robots ravaging neighborhoods and schools, but it is a rigid way to address the problem of responsibility for unexpected harm that the law rejected, for good reason, not too distantly in the past. A more flexible approach, capable of accommodating diverse technologies producing diverse consequences, is to retain foreseeability as a shield to liability, but to apply it flexibly in particular instances—perhaps with respect to damages as well as liability, as just discussed. That is, foreseeability is quite certainly best retained, but bent, as warranted by the circumstances of each new technology that goes awry, according to the ever-changing abilities of scientists and technologists to understand the consequences of their endeavors to improve the human condition by novel quests into the great unknown.

D. *Bending Private Law*

Enforcing an unforeseeability limitation on responsibility for harm from new technology shifts such injury problems from private law to other institutions. Foreseeability doctrine, that is, casts victims of unforeseeable harm from tort law into whatever other nets may (or may not) help to break their fall. Closing the arms of private law to victims of such harm finds justifications in both fairness and efficiency—in fairness, because enterprises bear no moral responsibility for causing harm they cannot foresee; and, in efficiency, because firms cannot effectively insure or otherwise guard against harm that is unpredictable. And so, when the harmful effects of science and technology are truly unforeseeable, the traditional functions of private law—especially deterrence and compensation—are best left to other institutions.

Deterrence is best addressed by private markets in which firms compete with one another for consumers of their products. Pharmaceutical companies, for example, suffer significant competitive disadvantage from publicity that their drugs or medical devices are causing harm to consumers, no matter how vigorously such firms may protest the unforeseeability of that harm. In addition, many products are subject to substantial safety regulation, both prior to marketing and once such products start misbehaving in consumer hands. Prescription drugs and medical devices are so regulated, of course, by the federal Food and Drug Administration, as are consumer products by the Consumer Product Safety Commission, automobiles by the National Highway Traffic Safety Administration, and workplace products by the Occupational Safety and Health Administration.

Compensation, often said to be the other major function of private law, is grounded in the idea of corrective justice that an actor should return a monetary equivalent of whatever health or property the actor has taken unfairly from the victim.²²¹ Although unforeseeable harm would be uninsurable by itself, first-party private insurance—of health, life, and disability—provides reasonable and efficient coverage against unforeseeable risks.²²² For many of those persons who do not have such first-party coverage, public welfare insurance can supply some basic coverage, at least for health.²²³ Moreover, public compensation schemes can be established for special types of cases to protect against particularly unfair types of harm, such as unexpected side-effects from mandatory childhood vaccines²²⁴ and loss of life from terrorist attacks.²²⁵

To the extent that people have insufficient insurance of any type, private or public, they will be unable to recover compensation for their losses. But this should not be looked at as a reason for distorting private law, which properly seeks only to correct private injustices, not to assure that no persons suffer ill effects from the many risks of life, including death from influenza and lightning strikes.²²⁶ By providing a legal umbrella for those who put science and technology to use in making products, the foreseeability limitation on responsibility for harm appropriately eliminates

221. See, e.g., ERNEST J. WEINRIB, *THE IDEA OF PRIVATE LAW* (1995) (explaining how private law rests on corrective justice); George P. Fletcher, Book Review, *Corrective Justice for Moderns*, 106 HARV. L. REV. 1658 (1993) (reviewing JULES COLEMAN, *RISKS AND WRONGS* (1992) and explaining how private law rests on corrective justice); see also John C.P. Goldberg & Benjamin C. Zipursky, *Tort Law and Moral Luck*, 92 CORNELL L. REV. 1123 (2007) (offering an internal, reparative construct of private law); Benjamin C. Zipursky, *Rights, Wrongs, and Recourse in the Law of Torts*, 51 VAND. L. REV. 1, 71 (1998) (“[T]he fundamental basis of corrective justice theory . . . is that justice requires that a tortfeasor restore those whom his wrongdoing has injured.”).

222. See Owen, *supra* note 106, at 492; Alan Schwartz, *Products Liability, Corporate Structure, and Bankruptcy: Toxic Substances and the Remote Risk Relationship*, 14 J. LEGAL STUD. 689, 736 (1985).

223. See Owen, *supra* note 106, at 484–93.

224. See National Childhood Vaccine Injury Act of 1986, 42 U.S.C. § 300aa–22 (2006) limiting private liability for vaccination lawsuits); see also Steve P. Calandrillo, *Vanishing Vaccinations: Why Are So Many Americans Opting Out of Vaccinating Their Children?*, 37 U. MICH. J.L. REFORM 353 (2004) (reviewing current trends in vaccinating children); Robert L. Rabin, *Some Thoughts on the Efficacy of a Mass Toxics Administrative Compensation Scheme*, 52 MD. L. REV. 951, 958 (1993); Whitney S. Waldenberg & Sarah E. Wallace, *When Science is Silent: Examining Compensation of Vaccine-Related Injuries When Scientific Evidence of Causation is Inconclusive*, 42 WAKE FOREST L. REV. 303 (2007).

225. See, e.g., George W. Conk, *Will the Post 9/11 World Be a Post-Tort World?*, 112 PENN. ST. L. REV. 175 (2007); Robert L. Rabin & Stephen D. Sugarman, *The Case for Specially Compensating the Victims of Terrorist Attacks: An Assessment*, 35 HOFSTRA L. REV. 901 (2007) (questioning the appropriateness of such compensation funds).

226. See Owen, *supra* note 106, at 484–93 (explaining limited realm of private law and superiority of other institutions for handling problem of compensation for injuries from unforeseeable risks).

private law's protection for victims of harm that no one reasonably could foresee, leaving such persons to find relief from whatever other private and public institutions more harmoniously embrace such misfortunes within their mandates.

In sum, the harmful consequences from bending nature are best addressed in private law by a robust principle of foreseeability. By nature limber, foreseeability bends comfortably around novel problems and is otherwise fully armed and ready to do justice in unknown future situations.

VI. CONCLUSION

A half century in the past, American law began a great experiment in holding firms responsible for unforeseeable harm from the products of new science and technology. The premise at the time—under a bold, new, “strict” standard of responsibility for producers whose products unforeseeably went awry—was that human safety expectations should take precedence over the best efforts of industry to avoid all risks it could foresee. Foreseeability, that is, was cast outside this realm of private law. Over two or three decades, the pieces of this radical effort to bend the law around the new products of human ingenuity rapidly unraveled, and foreseeability reemerged from exile to reclaim its central role in bounding responsibility for harm. By the end of the last century, foreseeability had once again become ensconced, seemingly more secure than ever, in private law governing responsibility for harm.

Yet the world in very recent years has been changing fast, with spectacular advances in how humans are bending nature in ways that serve their needs and wants. Explosive changes in how matter can be altered to serve new ends are now beginning to bear productive fruit. Modern products look strangely different from the comparatively simple products of physics, chemistry, and biology that provided humans with their pleasures, tools, medicines, and nutrition over most of the century that ended but a decade in the past. Biotech corn and soybeans have just about replaced such foods designed by nature; electronic cigarettes that deliver nicotine without carcinogenic smoke may soon displace ordinary cigarettes; scientists now pluck genes from humans, and piggyback them on viruses and bacteria, to make hormones to treat disease; nanotechnology is used ever more widely to restructure the atomic makeup of products of all types; and, most recently of all, stem cells are being manipulated to produce human sperm and eggs in scientific labs. No doubt humans across the planet will reap many benefits from these and other untold advances in science and technology in the years ahead. Yet, just as surely, bending nature so substantially will engender human suffering, sometimes grave and unforeseen.

The challenge to private law in this environment of rapid technological change will be to resist the temptation to abolish industry's protective foreseeability cocoon, as modern science and technology sometimes frighteningly go awry. America fell into this grievous trap once before, during the last half century, leading it to shackle industry with a fateful principle of "strict" producer liability, and it took at least a generation to correct the resulting legal mess. Even today, some courts and scholars continue to be allured by the seductive beauty of strict producer liability, as if to a Venus Flytrap. Yet expelling foreseeability from the rules of liability ignores the elemental value of this aspect of private law, its indispensability as a central feature of any theory of accountability for causing harm. And this mistaken effort to bend the law around the excesses of technology is also totally unnecessary, in view of foreseeability's adaptive flexibility for doing justice in novel contexts. Foreseeability well adjusts to each new problem nature throws its way, and it remains the ideal fulcrum at the center of private law for defining proper boundaries of responsibility for each new fluke that scientists fail to contemplate.

As new technologies are invented and put to use, they will no doubt continue to spew forth rafts of unexpected harms, some quite impossible to imagine. Yet foreseeability's moral grounding and robust flexibility provide the private law with full power to adapt corrective justice to fit novel situations. And, as nature bends, so can private law.

