Judicial Attitudes Towards Legal and Scientific Proof of Cancer Causation

I. INTRODUCTION

In recent years, considerable public interest and money have been devoted to scientists' attempts to find out what causes cancer. Cancer is the second-leading cause of death among Americans today,[1] and, despite advances in the technology of treating the disease by means of surgery, radiation, and chemicals, of the approximately 50 million living Americans who will probably contract cancer, 34 million can be expected to die from it.[2] The hope has been that once scientists understand the cause of cancer, they will be able to prevent or cure it.

In the meantime, concern about cancer pervades society.[3] As evidence accumulates that much of human cancer is caused or induced by substances in the environment,[4] it is likely that there will be more attempts to assign legal liability for causing such cancer, either in workmen's compensation claims[5] or in suits for damages.[6] There may even be a possibility of instituting a class action for damages when a large group of people are exposed to the same carcinogen.[7] However, since the onset of cancer can occur long after the exposure to the alleged carcinogen began, and sometimes long after

1. Cairns, *The Cancer Problem*, SCIENTIFIC AMERICAN, November, 1975, at 64 [hereinafter cited as Cairns].

2. A.C. BRAUN, THE BIOLOGY OF CANCER 1 (1974) [hereinafter cited as BRAUN].

3. For judicial recognition that a person with leukemia is not in good health, *see* Travis Life Ins. Co. v. Rodriguez, 326 S.W.2d 256 (Tex. Ct. App. 1959), *error ref.*, 328 S.W.2d 434 (Tex. 1959).

4. According to one estimate, 70 percent or more of all tumors in man are caused by substances in the environment. BRAUN, *supra* note 2, at 11.

5. Discussed at text accompanying notes 54-104 *infra*. Several states, *e.g.*, Virginia and Nevada, have made a limited number of specified cancers recoverable as occupational diseases. *See* VA. CODE § 65.1-53 (1950); NEV. REV. STAT. § 617.450 (1975).

6. *See* the cigarette cases, discussed at text accompanying notes 105-20 *infra*.

7. For a description of one current case, see N.Y. Times, Mar. 29, 1976, at 16, col. 2.

it has ended; since it has been shown that cancer can develop spontaneously, without the presence of any known carcinogen;[8] and since the state of scientific knowledge of cancer essentially requires an expert witness to testify that "the cause of cancer is unknown," plaintiffs' counsel in such cases face formidable problems in attempting to prove causation.

Nevertheless, in a number of reported cases, plaintiffs have attempted to prove, with varied results, that a particular substance or action caused cancer. As a matter of judicial method, these cases have two things in common: (1) a basic lack of understanding, particularly in the earlier opinions, of what cancer is, and (2) a disinclination to treat *scientific* proof of causation as germane to *legal* proof.

Cases involving cancer causation fall into two categories: those involving a physical trauma to some part of the body (usually a single blow, but sometimes repeated blows), and those involving the effects of some toxic substance (either a chemical or radiation). This Comment will examine these cases and judicial attitudes toward cancer causation as expressed therein in the light of a scientific model of cancer causation, examine the kinds of proof of causation courts have required in such cases, and compare these standards with the scientific model. The Comment will also discuss some implications of the model for possible recovery for exposure to a carcinogen in cases where cancer has not yet resulted.

II. The Model

Cancer, in its simplest sense, is a failure in the regulation of cell growth, division, and function.[9] Scientists do not completely understand how this regulation works in a normal cell, and are even less clear as to how and why it fails in a cancer cell. They have, however, amassed empirical and experimental data and, in trying to explain this data, not all of which is consistent, they have constructed models. These speculative models are not to be confused with the far more certain scientific statements that a given substance is capable of causing cancer; they are merely scientifically useful methods of analyzing otherwise diffuse empirical and experimental

8. Braun, *supra* note 2, at 20. The effect was seen in cell cultures, presumably under precisely controlled conditions.

9. *Id.* at 3, 26.

data. As will be shown in this Comment, they may also be a useful basis for legal analysis of cancer causation.

Numerous theories (models) of carcinogenesis are extant in the literature,[10] and although some theories explain more data and are more widely accepted than others, it is difficult to say that any model commands the backing of the majority of researchers. One may therefore select any reputable model for use in *legal* analysis of carcinogenesis on the basis of its utility for that purpose. In so doing one is constrained primarily by the intrinsic reasonableness and generality of the model.

There is one particular model of carcinogenesis which, although perhaps not the model most widely accepted by scientists,[11] is of considerable utility in legal analysis. It postulates that cancer is a result of a series of identical and discrete genetic changes in a cell or its progeny caused by a carcinogen or carcinogens (or occurring spontaneously at random and statistically infrequent intervals) over a period of time.[12] For the sake of simplicity, we will refer to these events as mutations, although an event may be any genetic change capable of being "inherited" by the cell's progeny;[13] we will further assume that the required number of mutations is five,[14] although any number larger than one would not substantively change this model. Since it is believed that a given cancer arises from a single cell,[15] the model further postulates that once all five mutations have

10. *See generally* BRAUN, *supra* note 2.

11. Interview with Dr. Jesse F. Scott, Associate Professor of Oncologic Medicine and Tutor in Biochemical Sciences, Harvard Medical School, in Boston (Mar. 14, 1977). I would like to thank Dr. Scott for his scientific criticism and advice, not all of which was followed.

12. For the model and a mathematical justification thereof see Cairns, *supra* note 1, at 67.

13. The mutational idea is consistent with the fact that many carcinogens are also mutagens, *e.g.*, ultraviolet light, which causes skin cancer. *See* H.V. MALLING & E.H.Y. CHU, *Development of Mutational Model Systems for Study of Carcinogenesis*, in PART B, CHEMICAL CARCINOGENESIS 545 (P.O.P. Ts'o and J.A. DiPaolo eds. 1974). For a general discussion of the mutational theory of cancer and the role of other genetic changes in cancer, *see* BRAUN, *supra* note 2, at 60-79, 99-128. *See also* YA. G. ERENPREIS, THE FUNCTION OF NUCLEIC ACIDS IN THE DIFFERENTIATION OF NEOPLASTIC PROCESSES, 69-70 (1964). For a general discussion of genes and mutations, *see* J. WATSON, THE MOLECULAR BIOLOGY OF THE GENE (3d ed. 1975).

14. Cairns, *supra* note 1, at 67.

15. Nowell, *The Clonal Evolution of Tumor Cell Populations*, 194 SCIENCE 23 (1976) [hereinafter cited as Nowell].

taken place in one cell, the individual has cancer. There may or may not be a period of latency between the last mutation and the clinical appearance of cancer. However, since spontaneous mutations may occur,[16] there may be an apparent period of latency if later mutations are caused by these spontaneous events. It should be understood that most mutations do not contribute to carcinogenesis, but may instead cause such traits as albinoism, sickle-cell anemia, or simply the death of the cell. It is postulated that there is no threshold level below which a carcinogen is incapable of causing a mutation;[17] the probability that a mutation will occur rises as some function of the carcinogen concentration. Finally, the carcinogen may be organ specific: for example, it may be capable of causing a carcinogenic mutation in a liver cell but not necessarily in a kidney cell.[18]

In essence, then, the model is as follows: A cell has five "switches" which independently restrain it from becoming cancerous. They may be "thrown" or "turned on" by carcinogens—for example, radiation or chemicals—or (at statistically infrequent and random times) spontaneously. Any level of carcinogen may turn on a switch or switches, but the probability that one or more switches will be turned on is directly related to the duration and level of exposure to the carcinogen. When a population is exposed to a carcinogen, a statistical distribution of thrown switches among the individuals of the group will result.[19] When in any human cell all five switches

16. *See* note 8 and accompanying text *supra*.

17. This is merely a restatement of the universal belief among scientists that there is no safe level of a carcinogen. N.Y. Times, Mar. 13, 1977, § 1, at 57, col. 2.

18. Druckrey, *Organospecific Carcinogenesis in the Digestive Tract*, in TOPICS IN CHEMICAL CARCINOGENESIS 73 (1972).

An alternative model set out in Nowell, *supra* note 15, postulates that cancer is the result of a series of three types of events: a preliminary one-step genetic change in the cell caused either by a carcinogen or spontaneously, one or more events caused by the carcinogen or one of a large number of other sources which cause the cell to divide (if it is not dividing already), and a nondescript series of internal cell events. There may be a substantial latent period between the initial genetic change and the onset of cancer. Since only the first event requires the carcinogen, and since the initiation of cell division is not of itself detrimental to the organism, this model, at least for purposes of legal liability, essentially involves only a single step, and will be referred to hereinafter as the "one-step model." Significant differences between this model and the multi-step model will be discussed where appropriate. The one-step model has considerable support among scientists. Scott Interview, *supra* note 11.

19. This follows from the postulated random action of the carcinogen. An analogy here may be useful: Imagine a lottery drum with an arbitrarily large number of cards,

have been thrown, the individual has cancer.[20]

This model is consistent with the apparent period of latency after exposure to the carcinogen observed in many cases, and with the common experience that cancer frequently appears only after a person is exposed to one or more carcinogens for a long period of time. It can also explain the observation that the rates of some types of cancer in a population are related to the population's exposure to certain carcinogens many years before.[21]

This model has a number of important implications with respect to the legal issues discussed in this Comment. First, since more than one switch must be turned on before an individual has cancer, more than one party may in some cases be said to have "caused" the cancer. Second, since an individual is exposed to a large number of carcinogens and it is statistically possible that any or none of these will throw one or more switches, or that a switch or switches will be thrown spontaneously, it is impossible to say in a specific case that a given carcinogen, or a given exposure thereto, *did* cause a cancer. However, it may be acceptable to say that a carcinogen *could have caused* an individual's cancer, or that a given percentage of an identified group of people did contract cancer as the result of a certain exposure. Third, since an exposure to a carcinogen may throw one or more switches, thus making it more likely that an individual will contract cancer in the future, an exposure to a carcinogen may cause a "present injury" even if it is not sufficient to cause cancer by itself. That is, the increased possibility of future cancer resulting from the turning on of one or more switches is a "present injury."[22]

half of them black and half of them white. One hundred people draw six cards apiece. On the *average*, each will have approximately three black cards and three white cards, but some will have other distributions of cards, perhaps even all black or all white. The number of people with a given number of, say, white cards will approximate a pre-calculable distribution, and the accuracy of the correspondence will increase with the number of people drawing. In the presented analogy, it is impossible to predict how many white cards one particular person will have.

20. This model is of necessity oversimplified, and neglects such matters as the possibility of carcinogens acting synergistically and the phenomenon of remission in certain cancers. Ultimately, the complexity of cancer defies any simplistic analysis, and any complaints on that score will perforce have to be addressed to higher authorities. *Cf. Psalms* 92:5-7.

21. Cairns, *supra* note 1, at 67.

22. In the case of the one-step model, only one party may be said to have caused an individual's cancer. However, as in the multi-step model, since a person is ex-

The model and its implications can now be used as the basis of an analysis of the reported cancer cases. It will be seen that of the reported cases, those involving the action of some toxic substance generally follow this model, while those concerned with a physical trauma rarely do so.

III. Trauma Cases

The majority of reported cases involving cancer causation deal with the cancerous effects of a single blow (or sometimes of repeated blows) to a part of the body.[23] The cases arise when, after a period of time ranging from two weeks[24] to at least fourteen months,[25] cancer is found at the point of impact or in a proximately related position,[26] but generally only if the blow itself caused some physical injury at the point of impact.[27] Usually, there is some proof that plaintiff had previously been in good health;[28] the possibility of a

posed to a large number of carcinogens, it will ordinarily be impossible to tell just who has caused the cancer. In addition, although a person may be said to have cancer after the initial genetic change, a long period of latency may precede the onset of cancer. In any event, this initial genetic change is a "present injury," as in the multi-step model.

23. The line of such cases probably begins with Jewell v. Grand Trunk Ry., 55 N.H. 84 (1874), and includes at least 100 reported cases. Since this paper aims to deal primarily with the toxic substance cases, only a representative sample of trauma cases will be cited.

24. Valente v. Bourne Mills, 77 R.I. 274, 75 A.2d 191 (1950). *See also* Emma v. A.D. Julliard & Co., Inc., 75 R.I. 94, 63 A.2d 786 (1949) (malignant lump removed from breast 7 weeks after breast hit with a can of orange juice); Hanna v. Aetna Ins. Co., 24 Ohio Misc. 27, 52 Ohio Op. 2d 316, 259 N.E.2d 177 (Dayton Mun. Ct. 1970) (lump found on breast 3 months after auto accident).

25. Daly v. Bergstedt, 267 Minn. 244, 126 N.W.2d 242 (1964); Ortner v. Zenith Carburetor Co., 207 Mich. 610, 175 N.W. 122 (1919) (30 months held to be too long for a claim that accident in which a worker's fingers were crushed and which resulted in blood poisoning caused cancer of the penis).

26. *E.g.*, Menarde v. Philadelphia Transp. Co., 376 Pa. 497, 103 A.2d 681 (1954) (the fact that breast cancer was found in the same place as the injury-caused bruise helped establish causation); Southern S.S. Co. v. Norton, 41 F. Supp. 103 (E.D. Pa. 1940) (trauma to skull and lower back held to have caused lung cancer). *But cf.* Tonkovich v. Dep't of Lab. & Indus., 31 Wash. 2d 220, 195 P.2d 638 (1948) (injury to foot held not to have caused abdominal cancer); State Compensation Ins. Fund v. Kindig, 445 P.2d 72 (Colo. 1968) (head injury held not to have caused leukemia 68 days later).

27. *E.g.*, Trapnell v. City of Red Oak Junction, 76 Iowa 744, 39 N.W. 884 (1888) (recovery denied for lack of any injury).

28. *E.g.*, Smith v. Primrose Tapestry Co., 285 Pa. 145, 131 A. 703 (1926); Shaw v. Owl Drug Co., 4 Cal. App. 2d 191, 40 P.2d 588 (1935).

pre-existing cancer has in other cases barred recovery.[29] In most cases, both plaintiff and defendant bring expert witnesses to testify as to whether or not defendant's act caused plaintiff's cancer.[30]

A typical modern case is *Daly v. Bergstedt*.[31] While shopping in defendant's store, plaintiff's decedent fell, fracturing her leg. Two days later, she noticed a bruise on her left breast. As she recovered from the fracture, the bruise healed and disappeared, but she continued to experience discomfort in the area. Fourteen months after the fall, at the site of the bruise on her breast she discovered a large lump, which proved to be malignant. Approximately four months before the accident, a medical checkup had disclosed no tumors or lumps on the breast.

Six physicians testified that there was no causal connection between the trauma and the cancer, while one physician stated that cancer *could* develop from the trauma. A jury held for plaintiff, and the Minnesota Supreme Court affirmed. It noted that the scientific and legal standards of causation were different, and that, although the preponderance of medical authority was on defendant's side, "the inferences from the proven sequence of events provide[d] a reasonable basis for the jury's verdict."[32] The court added that "it should be recognized that inferences, if rational and natural, which follow from a sequence of proved events, may be sufficient to establish causal connection without any supporting medical testimony."[33]

A threshold issue in these cases is whether or not medical testimony is needed at all. Some courts have held that since the cause

29. *See, e.g.*, Dennison v. Wing, 279 App. Div. 494, 110 N.Y.S.2d 811 (1952), where the court, in rejecting plaintiff's claim that an accident was the cause of a cancer that had developed two months afterwards, held that such cancer always took longer than two months to develop. However, in workmen's compensation cases, the possibility that a trauma aggravated a pre-existing cancer rather than caused a cancer is generally no bar to recovery. *See, e.g.*, Heppner v. Atchison, T. & S.F. Ry. Co., 297 S.W.2d 497 (Mo. 1956), a case under the Federal Employers' Liability Act (FELA), 45 U.S.C. §§ 51-60 (1970). Sometimes, plaintiff's attorneys will argue that an injury either caused a cancer or, in the alternative, accelerated the development of an existing cancer. *See* Boyd v. Young, 193 Tenn. 272, 246 S.W.2d 10 (1951); Slack v. C.L. Percival Co., 198 Iowa 54, 199 N.W. 323 (1924).

30. *But compare* Texas Employers' Ins. Ass'n v. Gallegos, 415 S.W.2d 708 (Tex. Ct. App. 1967) (workmen's compensation claim denied without medical evidence of causation) *with* Valente v. Bourne Mills, 77 R.I. 274, 75 A.2d 191 (1950) (workmen's compensation claim allowed without medical evidence of causation).

31. 267 Minn. 244, 126 N.W.2d 242 (1964).

32. *Id.* at 250, 126 N.W.2d at 246.

33. *Id.* at 250, 126 N.W.2d at 247.

of cancer is unknown, medical testimony that an injury caused cancer will not aid recovery;[34] other courts have held that even though the cause of cancer is unknown, expert testimony as to causation would be accepted.[35] And some courts, like that in *Daly*, have held that contrary medical testimony is sufficiently rebutted by facts which themselves imply a causal relationship.[36] As a Rhode Island court explained:

> We concede that in the great majority of cases such testimony ordinarily is necessary because of the seeming absence of connection between a particular accident and a claimed resulting injury. But in other cases involving special and peculiar circumstances, *medical evidence, although highly desirable, is not always essential for an injured employee to make out a prima facie case, especially if the testimony is adequate, undisputed and unimpeached.* Thus where, as in the instant case, injury appears in a bodily member reasonably soon after an accident, at the very place where the force was applied and with symptoms observable to the ordinary person, there arises, in the absence of believed testimony to the contrary, a natural inference that the injury, whatever may be the medical name, was the result of the employment. Absolute certainty is not required in any case. If the reasonable probabilities flowing from the undisputed evidence disclose a progressive course of events beginning with an external accident in which each succeeding happening including the injury appears traceable to the one that preceded it, medical evidence is not essential for an injured employee to make out a prima facie case.
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> *An inference, if rational and natural, based on proven facts will stand even though not supported by expert medical opinion.*[37]

34. Tonkovich v. Dep't of Lab. & Indus., 31 Wash. 2d 220, 195 P.2d 638 (1948).

35. Canon Reliance Coal Co. v. Industrial Comm'n, 72 Colo. 477, 211 P. 868 (1922) (death from cancer after being hit in the cheek with a piece of coal); Hanna v. Aetna Ins. Co., 24 Ohio Misc. 27, 52 Ohio Op. 2d 316, 259 N.E.2d 177 (Dayton Mun. Ct. 1970); McGrath v. Irving, 24 App. Div. 2d 236, 265 N.Y.S.2d 376 (1965).

36. *See, e.g.*, Austin v. Red Wing Sewer Pipe Co., 163 Minn. 397, 204 N.W. 323 (1925) (the court stated that, where cancer developed one year after worker was struck in the face with coal, although some medical witnesses did testify to causation, such testimony was not really needed).

37. Valente v. Bourne Mills, 77 R.I. 274, 278-79, 75 A.2d 191, 194 (1950) (citations omitted) (emphasis added).

In other words, if the "facts" of causation seem rational to the court, they may suffice even if they do not seem rational to the experts.

If a court decides that medical evidence supporting plaintiff's position is necessary for recovery, the question becomes what kind of testimony will be deemed sufficient to "prove" causation. Some courts have held that a statement that the injury could "possibly have caused" the cancer is insufficient, and that "probable" causation is necessary.[38] As will be seen, the distinction between "possible" and "probable" causation is of greatest importance in the toxic substance cases. It is less important here because, given the existence of a facile factual "cause and effect" relationship, testimony is more likely to be phrased in terms of "probability." Moreover, courts are more willing to accept "possibility" testimony when the facts themselves seem to compel a finding of causation.

These trauma cases have been reviewed[39] and have been heavily criticized on scientific grounds.[40] In many cases, particularly those involving breast cancer, the cancer may either have existed before the injury or developed even if there had been no injury since many women contract breast cancer in the absence of any physical injury. In earlier cases, no biopsy was performed,[41] and the so-called

38. *See, e.g.*, Devine v. Southern Pacific Co., 207 Or. 261, 295 P.2d 201 (1956) (in an FELA claim that a fracture of the left shoulder had resulted in lung cancer, the fact that one doctor testified in effect to "probable" causation was enough to get the case to the jury; jury verdict for plaintiff reversed on other grounds). *Contra*, Hanna v. Aetna Ins. Co., 24 Ohio Misc. 27, 52 Ohio Op. 2d 316, 259 N.E.2d 177 (Dayton Mun. Ct. 1970).

39. Comment, *Impact as "Legal Cause" of Cancer*, 20 CLEV. ST. L. REV. 409 (1971); Comment, *Sufficiency of Proof in Traumatic Cancer: A Medico-Legal Quandary*, 16 ARK. L. REV. 243 (1962).

40. Adelson, *Injury and Cancer*, 5 W. RES. L. REV. 150 (1954); Dyke, *Traumatic Cancer?*, 15 CLEV.-MAR. L. REV. 472 (1966).

41. *E.g.*, Shaw v. Owl Drug Co., 4 Cal. App. 2d 191, 40 P.2d 588 (1935). There is some question whether there was, in fact, cancer at all in this case. Plaintiff's leg was sprained and ligaments were torn in an elevator accident. Eight months later, the leg collapsed; x-rays of the leg showed a "rarefied region" where the leg had broken, a "pathological condition" the physicians diagnosed as a malignancy. With modern medical understanding, it seems likely that this condition was merely a non-malignant failure of the bone to calcify normally at one point, leaving only the soft collagen framework to support the leg. At some inopportune moment, the leg simply collapsed of its own weight. *See* L. LICHTENSTEIN, BONE TUMORS 121 (4th ed. 1972); S. JACOBSON, THE COMPARATIVE PATHOLOGY OF THE TUMORS OF BONE 37-38 (1971).

cancer could have been merely fatty scar tissue. In a number of cases, there was actually a jury question as to whether or not plaintiff's disease was cancer.[42] Cynics have suggested that one major factor producing "traumatic cancer" is insurance.[43]

In recent years, with the increasing sophistication of the medical profession in insisting that cancer be diagnosed by means of a biopsy,[44] and the increasing stridency of defendants' witnesses in proclaiming that a single trauma cannot cause cancer,[45] the trend has been for plaintiffs to claim aggravation of an existing cancer.[46] Nevertheless, as demonstrated in *Daly*, some courts, either relying on the so-called Ewing's postulates,[47] which set out the conditions under which a trauma may supposedly be said to have caused cancer in a scientific sense, or denying a need for medical evidence altogether,[48] may still hold the requirements of causation satisfied in a trauma case.

These single trauma cases, which are based on a single act allegedly causing a cancer, are not readily compatible with the multi-

42. *E.g.*, Gluckstein v. Lipsett, 93 Cal. App. 2d 391, 209 P.2d 98 (1949) (malpractice case for faulty cosmetic breast surgery).

43. TRAUMA AND DISEASE 147 (Moritz & Helberg ed. 1959).

44. As early as the case of Fortner v. Koch, 272 Mich. 273, 261 N.W. 762 (1935), a physician was held negligent in treating a patient for cancer without performing a biopsy. *See also* 5 AM. JUR. PROOF OF FACTS 2d 5-315, § 5, at 323.

45. *E.g.*, Elgin v. United States, 89 F. Supp. 195 (W.D. Mo. 1950); Lopresti v. Community Traction Co., 160 Ohio St. 480, 117 N.E.2d 2 (1954).

46. *See* the numerous cases cited in Comment, *Impact as "Legal Cause" of Cancer*, 20 CLEV. ST. L. REV. 409, 411 n.17 (1971).

47. Hanna v. Aetna Ins. Co., 24 Ohio Misc. 27, 52 Ohio Op. 2d 316, 259 N.E.2d 177 (Dayton Mun. Ct. 1970). *Cf.* Dennison v. Wing, 279 App. Div. 494, 110 N.Y.S.2d 811 (1952). These postulates state that a trauma may be said to have medically caused cancer if and only if: (1) the site was free of cancer before the injury; (2) the trauma was sufficiently severe; (3) the area is positively diagnosed to contain cancer; (4) the cancer originated at the site of the injury, and not at some other place in the body; (5) there was a reasonable time relationship between the injury and the onset of cancer; and (6) the structure of the cancerous tissue is such as to show that the cancer has not merely metastasized from elsewhere. *See* Comment, *Impact as "Legal Cause" of Cancer*, 20 CLEV. ST. L. REV. 409, 411 n.20 (1971), after J. EWING, NEOPLASTIC DISEASES (4th ed. 1940). *Cf.* Warren, *Criteria Required to Prove Causation of Occupational or Traumatic Tumors*, 10 U. CHI. L. REV. 313 (1943).

48. *See* Daly v. Bergstedt, 267 Minn. 244, 126 N.W.2d 242 (1964). A rough count of trauma cases reported in the 1950's and 1960's reveals the number to be decreasing, but courts have allowed recovery for cancer allegedly caused by a single trauma as recently as 1970. Commercial Ins. Co. of Newark, N.J. v. Wright, 457 S.W.2d 141 (Tex. Ct. App. 1970).

step model.[49] They have been continually condemned on scientific grounds. But they well illustrate the tendency of courts, faced with a disease which neither they nor the medical profession understands, to follow the evidence of their senses. What the courts do when even this evidence is lacking we shall see in the toxic substance cases.[50]

IV. TOXIC SUBSTANCES

The toxic substance cases, involving cancer allegedly caused by a chemical or radiation, are analogous to the trauma cases in some of the causational problems raised, but have generally different results. As in the trauma cases, the courts are divided as to the efficacy of "possibility" rather than "probability" testimony. However, since toxic substance cases involve cancer contracted without a proximately related physical injury, there exist no compelling inferences from which a court which would ordinarily require "probability" testimony could find causation with mere "possibility" testimony or with no medical testimony at all. In short, given identical medical testimony, the nature of a court's notions about cancer in a trauma case makes recovery there more likely than in a toxic substance case.

Ironically, both the model and currently accepted scientific knowledge imply that recovery should be allowed in many toxic substance cases but *not* in trauma cases: while the trauma cases generally involve a single act preceding cancer, the model speaks of a series of acts leading to cancer, and while a single trauma is generally acknowledged not to cause cancer,[51] many substances are widely recognized carcinogens.[52]

Trauma cases differ from toxic substance cases in another way.

49. The one-step model speaks specifically of things capable of inducing genetic changes, of which a trauma is not one.

50. Cases which explicitly distinguish trauma and toxic substance cases are discussed at notes 84-104 and accompanying text *infra*.

51. J. BROOKE, IN THE WAKE OF TRAUMA 220 (2d ed. 1974); K.L. BROWN, MEDICAL PROBLEMS AND THE LAW 108-10 (1971).

52. *E.g.*, uranium and asbestos, R.E. ECKHARDT, *Occupational Cancer Now* in ENVIRONMENT AND CANCER 94-95 (1972); benzene, W. DAMESHEK & F. GUNZ, LEUKEMIA (Gunz & Baikie ed. 1974); coal tar, PA. STAT. ANN. tit. 77, § 27.1(h) (Purdon Supp. 1976); nicotine, BRAUN, *supra* note 2, at 10-11, 13 (1974). *See generally* W. HUEPER & W. CONWAY, CHEMICAL CARCINOGENESIS AND CANCERS (1964).

In the former, because of the closeness in time between injury and the onset of cancer, questions rarely arise about possible intervening causes of cancer; in the latter, because of the extended time between "injury" and the onset of disease, the possibility of intervening causation is frequently an issue.

A. *Workmen's Compensation Cases*

Unlike the trauma cases, there are relatively few toxic substance cases, and, with the exception of cases involving liability for cigarette-induced lung cancer,[53] they generally involve workmen's compensation claims. This may be due both to the difficulty of proving causation and the comparatively recent public realization that some chemicals cause cancer. Among the few jurisdictions in which there are such reported decisions, California, New Jersey, Pennsylvania and Arkansas seem to be liberal in allowing recovery, and New York, Texas, West Virginia, Kentucky and Florida seem to disapprove, as a rule, of recovery in such cases.

1. *Jurisdictions Favorable to Plaintiff.* In California, the leading case allowing compensation is *McCallister v. Workmen's Compensation Appeals Board.*[54] After McCallister, a fireman for 32 years and a pack-a-day cigarette smoker for 42 years, died of lung cancer, his wife filed for death benefits on the theory that the cancer had been caused by smoke from fires he had fought. One witness, Dr. Benioff, testified to a statistical correlation between air pollution or cigarette smoke and lung disease, and stated that smoke from burning tar or creosote "may well" contain the same type of carcinogen found in cigarette smoke. Plaintiff introduced testimony by a fireman that fires which decedent had fought involved burning creosote. The Workmen's Compensation Appeals Board denied compensation, but the California Supreme Court reversed. The court was willing to infer from the testimony that the smoke inhaled by the fireman was carcinogenic, and "reasonably probably" caused his death.

The result of this liberal decision allowing recovery is consistent with the implications of the model. The court did not require testimony that the smoke actually *had* caused the cancer, but rather held as sufficient testimony that it was "reasonable that decedent's

53. *See* text accompanying notes 105-20 *infra.*
54. 69 Cal. 2d 408, 71 Cal. Rptr. 697, 445 P.2d 313 (1968).

prolonged occupational exposure *could* lead to cancer."[55] Particularly in a case involving lung cancer, which is a relatively common type of cancer in the population, the sufficiency of this kind of testimony is dictated by our model, since, according to the model, it is statistically likely that some lung cancer switches were turned on by non-employment-related carcinogens. Therefore, the most to which one could testify, under the model, is that the employment-related carcinogens could have turned on other switches, *i.e.*, that the smoke "could have caused" decedent's cancer.[56]

Moreover, the court allowed recovery despite proof that decedent was a heavy smoker, and despite the court's acknowledgment that such smoking increased the danger of cancer. It held that decedent's employment need be only a "contributing cause" of his injury,[57] and that it sufficed that the disease was *more* common among his fellow employees than among the general public.[58] In terms of the model, the court is holding that if the employment could have turned on any switches, the employer is to be liable, notwithstanding the fact that another substance may have turned on other switches.[59] The court said that, "[g]iven the present state of

55. *Id.* at 416, 71 Cal. Rptr. at 701, 445 P.2d at 317 (emphasis added).

56. The court noted:

> We have held "reasonable" or "probable" causal connection will suffice; it is to be distinguished from the merely "possible" . . . . [I]ntellectual candor may at times require expert testimony in terms of mere probability. . . . For that reason alone we cannot demand that experts be more certain, particularly when industrial causation itself need not be certain, but only "reasonably probable."

Id. at 416-17, 71 Cal. Rptr. at 701, 445 P.2d at 317.

Note that under a one-step model of carcinogenesis, the court would be saying that if either a non-occupational or an occupational carcinogen could have caused the carcinogenic mutation, but it is impossible to say which did, the employment-related carcinogen will be presumed to have done so.

57. In general, workmen's compensation statutes provide that an employer is liable for the aggravation of any pre-existing injury, and is liable for death benefits if the aggravation results in the worker's death. Under the "majority" rule, the aggravator of an injury is liable for the entire injury. Under the "minority" rule, the aggravator is liable only for that part of the injury attributable to the aggravation. *See* 1 LARSON, WORKMEN'S COMPENSATION LAW § 12.20 (1972).

58. Although decedent's wife had not made such a showing, it was enough that the Board had not challenged it.

Note that under a one-step model, it does not make sense to talk about a "contributing cause" of cancer. Under such a model, only one of the carcinogens could have caused the cancer, and the notion of a "contributing cause" would merely be a legally useful, if scientifically imprecise, way of assigning liability in the absence of knowledge as to which of several parties had actually caused the damage.

59. We assume the theoretical possibility of predicting the average number of

medical knowledge, we cannot say whether it was the employment or the cigarettes which 'actually' caused the disease; we can only recognize that both contributed substantially to the likelihood of his contracting cancer."[60] If this language were extended beyond workmen's compensation cases, it would mean that a person exposed to a carcinogen over an extended period of time who later contracts cancer while no longer so exposed could sue the disseminator of the carcinogen, irrespective of other carcinogens to which the victim of cancer has, in the interim, been exposed.[61]

A New Jersey court followed *McCallister* in 1970 in *Bolger v. Chris Anderson Roofing Co.*,[62] affirming a workmen's compensation award for death due to lung cancer. While working for several employers (of whom Anderson was the last) over 23 years, Bolger was subjected to the fumes of tar, pitch, asphalt and asbestos "in large and intense volume," at the same time smoking two packs of cigarettes daily. The court noted that the chemicals were "known carcinogenic agents," and quoted the testimony of Dr. Lieb to the effect that tobacco was also recognized as a carcinogen. The same Dr. Lieb testified that it was "reasonable to assume" that the combination of all of these deleterious materials "contributed" to plaintiff's cancer, but that it was "speculative" whether the man would have contracted cancer had he not been smoking. The court nevertheless granted recovery, explicitly rejecting one contrary New York case,[63] and, in a novel approach, treating plaintiff's smoking as a "pre-existing condition"; under existing workmen's compensation law, the defendant would be liable for the aggravation of such a condition.[64] The court held finally that it "must also find from the

"switches" turned on, once the exposure to the carcinogen is known. The average would be necessary because it is impossible to predict how many "switches" will be turned on in a given person after exposure to a carcinogen.

60. 69 Cal. 2d at 418, 71 Cal. Rptr. at 703, 445 P.2d at 319.

61. *Cf.* Summers v. Tice, 33 Cal. 2d 80, 199 P.2d 1 (1948) (where two hunters negligently and simultaneously fired at plaintiff, but only one bullet hit him, defendants were held jointly liable); Hagy v. Allied Chemical and Dye Corp., 122 Cal. App. 2d 361, 265 P.2d 86 (1953) (the court upheld a workmen's compensation award on the theory that sulfuric acid smoke had aggravated plaintiff's pre-existing lung cancer).

62. 112 N.J. Super. 383, 271 A.2d 451 (Essex County Ct. 1970).

63. Amoroso v. Tubular and Cast Products Mfg. Co., 13 N.Y.2d 992, 194 N.E.2d 694, 244 N.Y.S.2d 787 (1963), *aff'g* 17 App. Div. 2d 1003, 233 N.Y.S.2d 909 (1962), discussed at note 89 *infra*.

64. 112 N.J. Super. at 393, 271 A.2d at 457.

evidence that whether the smoking contributed to the end result or not, petitioner's exposure to pitch, tar and asphalt contributed in a major way to the onset or precipitation of the lung cancer."[65] Defendant was held liable for the entire injury, under the workmen's compensation rule that where an occupational condition could have been caused by a series of employers, the last employer bears the full responsibility.[66]

Factually, *Bolger* resembles *McCallister* (except for the even greater dearth of evidence held adequate to show causation), but it also raises two additional points concerning the model. First, in treating plaintiff's smoking as a "pre-existing condition," the court is apparently recognizing, at least theoretically, that such smoking has caused actual injury short of producing cancer; *i.e.*, in terms of the model, that smoking has turned on some number of switches fewer than five. In other words, the court is recognizing that having even fewer that five switches turned on is a recognizable "condition," essentially a "present injury."[67]

Second, the "last employer rule" implies, in terms of the model, that if pulling five triggers is necessary to cause cancer, the one who pulls the last trigger is liable for the entire injury, even though the first employer may have pulled as many as four triggers. While the rule makes sense as a matter of administrative ease, it is not consistent with the common-law doctrine[68] that one is liable only for the injury one has caused.[69]

65. *Id.* at 395, 271 A.2d at 458.

66. *Id.* Similar rules are followed in other states: *see, e.g.*, State Compensation Fund v. Joe, 25 Ariz. App. 361, 543 P.2d 790 (1975). Yet query whether the rule is appropriate here where the employee is in a sense self-employed, *i.e.*, where the injury due to the "last employer" may be cancer caused by the cigarette smoking. Note also that, according to the one-step model of carcinogenesis, the "last employer" rule makes no sense at all: since the carcinogenic mutation is postulated to occur before a long period of latency, one of the first employers would presumably have been more likely than one of the later ones to have caused the carcinogenic mutation. Thus, under the one-step model, a "first employer" rule would appear to be more reasonable.

67. The significance of this will appear at text accompanying notes 121-28 *infra*, where recovery for the possibility of future cancer is discussed.

68. *See* PROSSER, THE LAW OF TORTS 320 (4th ed. 1971).

69. For a more recent New Jersey case granting compensation, *see* Shepley v. Johns-Manville Products Corp., 141 N.J. Super. 387, 358 A.2d 485 (Super. Ct. App. Div. 1976). There, when plaintiff's witness testified that "in reasonable medical probability the cancer of the larynx was 'both caused and aggravated' " by the employment, *id.* at 390, 358 A.2d at 486, an award for asbestos-caused cancer of the

In contrast with the response of the *McCallister* and *Bolger* courts to the fact that plaintiff's lung cancer could have been caused by either smoking or an occupational factor, in *Utter v. Asten-Hill Mfg. Co.*[70] the Pennsylvania Supreme Court, forced by statute[71] to consider such a problem, simply avoided the need for a solution. Both of the claimants in the case had been employed as weavers before they died, allegedly of lung cancer due to asbestos exposure. One of the deaths occurred after 20 years of employment, when the worker was 44; one of the workers was a smoker. The controlling statute listed a number of specific diseases, not including asbestos-caused cancer,[72] as "occupational diseases," and then added a catch-all section allowing recovery for "[a]ll other occupational diseases (1) to which the claimant is exposed by reason of his employment, and (2) which are peculiar to the industry or occupation, and (3) which are not common to the general population."[73]

larynx was affirmed even in the face of contrary testimony that there was no evidence that related asbestos exposure to carcinoma of the larynx. *Id.* at 392, 358 A.2d at 487. The court did not cite *Bolger*, 112 N.J. Super. 383, 271 A.2d 451 (Essex County Ct. 1970), and did not seem overwhelmingly happy about the decision. Nevertheless, it upheld causation.

Cf. Bollinger v. Wagaraw Building Supply Co., 122 N.J.L. 512, 6 A.2d 396 (1939) (the court reversed the workmen's compensation bureau, the court of common pleas, and the state supreme court in allowing a claim brought on the theory that irritation of a building-trade worker's pigmented mole by sand and ashes over 14-15 months had caused cancer).

70. 453 Pa. 401, 309 A.2d 583 (1973).

71. PA. STAT. ANN. tit. 77, § 1208 (Purdon 1939).

72. *Id.* The opinion is confused by the fact that, before the case was decided, the Pennsylvania legislature had amended the statute to include cancer resulting from asbestos exposure. The court, in a footnote, cited this fact but commented no further upon it. It is impossible to say what effect the legislative pronouncement had on the opinion.

73. *Id.* § 1208(n) (Purdon Supp. 1976). Although it is beyond the scope of this Comment to examine workmen's compensation statutes in any detail, a brief word about occupational diseases is appropriate here. Initially, workers were compensated only for injuries arising out of accidents; any disease not traceable to an accident was an "occupational disease" and not compensable, presumably on the theory of assumption of risk by the worker. Then, legislatures began adding specific lists of diseases which, if arising out of the employment, were treated equally with accidental injuries. *E.g.*, N.C. GEN. STAT. § 97-53 (1975). Then, legislatures added catch-all sections for diseases not listed, with rather strict standards of proof provided. *E.g.*, GA. CODE ANN. § 114-803(5) (1973) (which catch-all section was added only in 1971); IDAHO CODE §§ 72-102(17)(a), -438 (1947). Some states then dropped the enumerated list. *E.g.*, ARIZ. REV. STAT. §§ 23-901(9), -901.01 (West Supp. 1976). Other states apparently maintain a vestige of the old form by defining a compensable "injury"

The court accepted "probability" testimony as sufficient proof that the cancer had resulted from the employment. Yet, under the statute, plaintiffs still had to show that the lung cancer was peculiar to the industry. A lower court decision, *Scott v. U.S. Steel Corporation*,[74] had held that lung cancer simply did not fit the statutory definition of "peculiar to the industry."[75] Here, however, there was testimony that asbestos-caused lung cancer differed from ordinary cancer.[76] Since such lung cancer could thus be considered peculiar to the industry, the court granted recovery.

In terms of the model, the *Scott* court disallowed recovery where some switches were probably turned on independently of the work-related exposure, even though some switches probably were turned on by the work-related exposure; the statute seemed to deny recovery even in the case of a disease more common among workers than among the general public, but still extant among both.[77] The *Utter* court avoided this restrictive language by allowing recovery when plaintiff could show that the victim's lung cancer somehow differed from other kinds of lung cancer, and thus that

to include a disease arising out of employment. *E.g.*, CAL. LAB. CODE § 3208 (West 1971); HAW. REV. STAT. § 386-3 (1968). Some states explicitly include skin cancer caused by certain chemicals as occupational diseases. *E.g.*, NEV. REV. STAT. § 617.450 (1975); VA. CODE § 65.1-52 (Cum. Supp. 1976), and statutes of Pennsylvania and North Carolina, *supra*. Virginia even includes angiosarcoma due to vinyl chloride exposure. VA. CODE § 65.1-52 (Cum. Supp. 1976). However, the strictness of proof required to get in under a catch-all clause varies from statute to statute, and as the Pennsylvania Supreme Court showed in *Utter*, it is never easy.

74. 203 Pa. Super. Ct. 459, 201 A.2d 243 (1964).

75. The court said:

> The burden of proof under [the statute] . . . is a heavy one. [The employee] most prove that the disease, in this case, lung cancer, is a hazard of his employment and that he was exposed to it; that cancer is a disease which is peculiar to the industry or occupation; and that it is not common to the general public. There was evidence in this case that cancer could have been a hazard . . . , but there was no evidence that lung cancer is a disease which is peculiar to this industry and that it was not common to the general public. We must take judicial notice of the fact that lung cancer is not peculiar to this industry and that it is common to the general public. We might just as well say that this claimant was exposed, in this industry, as he might very well be, to the common cold and that it is peculiar to the industry and not common to the general public.

Id. at 462, 201 A.2d at 244.

76. *Cf. Bolger*, 112 N.J. Super. 383, 271 A.2d 452 (Essex County Ct. 1970), where one witness had been unable to say that lung cancer caused by smoking was any different from that caused by coal tar or asbestos.

77. In terms of the one-step model, the *Scott* court disallowed recovery when the carcinogenic mutation could have been caused by a non-work-related carcinogen.

the newly-cancerous cells were not the same as those switched on in ordinary lung cancer.[78]

Utter, even in granting recovery, points up the difficulty plaintiffs have in toxic substance cases: even when there is adequate testimony of causation, either the statute or the court may require something more. One would suppose this difficulty could be alleviated by a simple rule, perhaps limited to workmen's compensation cases, that once plaintiff has satisfied a burden of producing evidence that the substance to which he was exposed could cause cancer, defendant would have the burden of proving that it had probably not done so in the case at hand. The Arkansas case of *Scobey v. Southern Lumber Co.*[79] seems to have done just this, and is apparently unique in this respect. There, the sole issue before the court was whether the inhaling by a lumber worker of emery dust, fumes, and sawdust over 24 years had resulted in his contracting lung cancer.[80] Both the Workmen's Compensation Commission and a circuit court had found as a matter of fact that it had not.

Testimony was, at best, of the "possible" variety. Two doctors testified that emery dust or general irritation of the lungs were or might be capable of producing lung cancer.[81] On the other side, there was testimony that there was no evidence that emery dust could cause lung cancer, and that the cause of cancer was unknown. One doctor, under cross-examination, said that exposure to such fumes "might" in some cases accelerate or aggravate a cancerous

78. Recall that under either model, a carcinogen capable of acting in one kind of cell is not necessarily capable of so acting in another kind of cell. Therefore, if this is a correct description of carcinogenesis, the *Utter* decision implies that there must be more than one kind of lung cell affected by carcinogens, and that these different cells may be affected only by different carcinogens.

79. 218 Ark. 671, 238 S.W.2d 640 (1951).

80. The court put the issue as "whether death was due to accidental injuries which arose out of, and in the course of, his employment." *Id.* at 671, 238 S.W.2d at 640.

81. The court stated:

> Dr. Burton further testified that, in his opinion, the inhalation of any irritant would aggravate a cancerous condition. Normal tissue has a tendency against cancer. If you destroy or damage tissue you make cancer worse. Irritation of a cancer would bring about earlier death. . . . The fact that it took the cancer about a year and a half to kill Scobey after it started, does not make it any less an accident.

Id. at 675, 238 S.W.2d at 642. In view of the fact that the opinion makes no mention of any pre-existing cancer which the exposure to irritants was supposed to aggravate, one must consider the court's language to be at least puzzling.

condition.[82]

The court concluded that this was not substantial evidence to support the lower court's determination that the substances had *not* caused the cancer. Since defendant's evidence of lack of causation in this case does not appear to have been insubstantial, and may in fact have been more substantial than plaintiff's evidence, the only apparent explanation for the decision is that the court was *sub silentio* shifting the burden of proof to the defendant.[83]

2. *Jurisdictions Unfavorable to Plaintiff.* A number of other jurisdictions have not been nearly so accommodating to plaintiffs as the Arkansas Supreme Court. One example is New York, where the leading case of *Miller v. National Cabinet Co.*,[84] besides showing the conservative tendency of some courts in these cases, also serves to illustrate the different standards courts may apply to proof in toxic substance cases as opposed to trauma cases.

Plaintiff's decedent, employed as a piano finisher for five employers over 22 years, died from leukemia, allegedly due to exposure to benzene (Benzol) in varnish remover. A referee denied an award, relying on a report by the Division of Hygiene and Safety Standards of the New York State Department of Labor saying that there was no causal relationship between leukemia and benzene exposure, and on the testimony of two physicians that they had no idea what caused leukemia. The New York Court of Appeals affirmed the decision of the referee, and reversed both the Workmen's Compensation Board and an appellate court, holding that causation had not been established. It summarized the testimony of the expert witnesses as having said that causation was "possible,"[85]

82. *Id.* at 674, 238 S.W.2d at 642.

83. For other jurisdictions allowing recovery, *see* McKinney v. Kline Oldsmobile, Inc., 244 N.W.2d 163 (Minn. 1976) (affirming *per curiam* on causational grounds a workmen's compensation award for histiocytic lymphoma caused by exposure to toxic fumes); United States Fidelity & Guaranty Co. v. Youmans, 49 Ga. App. 678, 176 S.E. 808 (1934) (affirming a workmen's compensation award in a suit brought on the theory that lacquer that splashed into an eye had caused cancer there). *Cf.* Hagy v. Allied Chem. & Dye Corp., 122 Cal. App. 2d 361, 265 P.2d 86 (1953) (sulfuric acid smog held to have aggravated pre-existing cancer of the larynx).

84. 8 N.Y.2d 277, 168 N.E.2d 811, 204 N.Y.S.2d 129 (1960).

85. Dr. Paul Reznikoff had testified that he believed that a person exposed to benzene may develop this kind of leukemia, and that "it is possible that this man's leukemia resulted from his alleged exposure to inhalation of benzol or benzene." He further stated that he could not possibly testify that this man's death *did* result from benzene exposure. *Id.* at 282-83, 168 N.E.2d at 813-14, 204 N.Y.S.2d at 132-33.

and that with most leukemia patients, one never found out what had caused the disease. The court said that such testimony had no probative value, and intimated that it might have accepted statistical evidence of causation. However, it refused to accept a doctor's statement that incidence of leukemia was "quite high" in patients exposed to benzene.

The court noted that it had allowed recovery in trauma cases without knowing what had "caused" cancer, but held that the complexity of leukemia made this case different in that "the immediacy of the symptoms of aggravation of the cancer by a traumatic injury . . . was accepted as a substitute for scientific evidence or understanding of cause and effect. . . . In all of the decisions where recovery has been allowed, the cancerous condition has been manifested immediately after the occurrence on which liability has depended. In the present case, the onset of leukemia did not occur until several years after his employment by appellant had ended."[86]

In terms of the model, the significance of the case lies in the difference between what plaintiff's expert, Dr. Reznikoff, said, and what the court thought he said. Dr. Reznikoff essentially testified[87] that benzene, as a carcinogen, was capable of turning on switches. In a large enough sample of workers, it certainly would turn on numerous switches, and "cause" a certain number of cases of leukemia. But in view of the fact that x-rays, for example, could also have turned on some of the worker's switches, it was impossible to say that the benzene, in this particular case, *did* turn on enough switches by itself to cause leukemia. The court, however, instead of understanding Dr. Reznikoff's "could have" as a positive statement that the benzene probably did something detrimental, interpreted it as being merely speculative. As the dissent in *Miller* noted, Dr. Reznikoff's "possible" was the scientific equivalent of "probable," meaning in this context that although nobody knows the cause of cancer, when someone is exposed to a carcinogen for a sufficiently long time, he is going to get cancer. By rejecting "possibility" testimony, the court effectively rejected most testimony consistent with the model where the cancer could have been "caused," in whole or in part, by factors outside the employment.[88]

86. *Id.* at 286, 287, 168 N.E.2d at 815, 816, 204 N.Y.S.2d at 135, 137.
87. *Id.* at 282, 168 N.E.2d at 813, 204 N.Y.S.2d at 132.
88. In terms of the one-step model, Dr. Reznikoff testified that when one is ex-

The court, moreover, based its decision partly on the fact that appellant was not the worker's final employer. In terms of the model, the court showed reluctance to grant recovery where an act turned on *only* the first switches.[89]

A more recent case in New York has allowed recovery even in the absence of "probability" testimony. In *Smith v. Humboldt Dye Works, Inc.*,[90] the appellate division affirmed, as based on "substantial evidence," an award by the Workmen's Compensation Board to a dyer of wool yarns who had contracted papillary tumors of the bladder, allegedly from 25 years of exposure to alpha and beta naphthalene, "known carcinogens," in the dyes. Two medical experts testified that there was no causal link between the occupation and the disease. However, two other doctors testified that, in their experience, exposure to aniline dyes was correlated with a high degree of risk of papillary tumors.[91] Neither doctor testified that contact with the dyes *did* cause the tumor, and neither produced statistical studies of such a connection, although one doctor did tes-

posed to benzene, there is a statistical possibility of a carcinogenic mutation. However, since there is always a possibility that no mutation will result, it is impossible to say that the benzene exposure *did* cause the leukemia. The mutation could always have arisen from other sources.

89. *See also* the subsequent case of Amoroso v. Tubular & Cast Products Mfg. Co., 13 N.Y.2d 992, 194 N.E.2d 694, 244 N.Y.S.2d 787 (1963), *aff'g* 17 App. Div. 2d 1003, 233 N.Y.S.2d 909 (1962), where the Court of Appeals affirmed a reversal by the appellate division of an award to a heavy smoker, employed in the plumbing business for forty years, who claimed that his lung cancer had been caused by fumes of nickel sulphate and chromic acid used in plating and polishing. The appellate division relied on a report by the Division of Industrial Hygiene, the same body which had denied that benzene caused leukemia in *Miller*, 8 N.Y.2d at 280, 168 N.E.2d at 812, 204 N.Y.S.2d at 131. A dissent in the Court of Appeals argued that, although all witnesses had agreed that the cause of cancer was unknown, it was "generally" accepted that the incidence of cancer was higher among those who inhale irritants.

At least two other New York cases have denied recovery in situations involving toxic chemicals. Collins v. National Aniline Div., Allied Chem. & Dye Corp., 8 App. Div. 2d 900, 186 N.Y.S.2d 979 (1959) (appellate division reversing a workmen's compensation award for cancer of the bladder allegedly caused by "benzene and/or its derivatives"; statute restricted recovery to specific list of chemical-induced occupational diseases); Leiser v. Saks Fifth Avenue, 9 App. Div. 2d 832, 192 N.Y.S.2d 848 (1959) (conflicting testimony over whether a saleswoman's use of carbon paper in sales slips "could have" induced papilloma of her bladder; denial of claim affirmed). *Cf.* Yarak v. Magnesia Asbestos Insulation Co., 7 App. Div. 2d 667, 179 N.Y.S.2d 158 (1958) (denial of claim that exposure to fiberglass dust accelerated growth and metastasis of tumor affirmed).

90. 34 App. Div. 2d 1041, 312 N.Y.S.2d 612 (1970).

91. *Id.* at 1042, 312 N.Y.S.2d at 614.

tify to the existence of such studies. Even though papillomas of the bladder would seem to be rarer among non-dye workers than either lung cancer or leukemia, sufficiently so that it would be unlikely that anything but the employment could have caused the cancer, the case might suggest a possible avenue for recovery in future New York cases.[92]

However, the fact alone that the worker seems to have been exposed to carcinogens only in his employment may not guarantee that he will recover for this exposure, as a West Virginia compensation board found out in *Clark v. State Workmen's Compensation Commissioner*.[93] For approximately 13 years prior to his death in 1963, Frank Clark worked for the Union Carbide Corporation as a pipefitter, principally in the gas and fine chemical areas of the plant. He was "in no manner associated with the actual production of chemicals," and the pipes upon which he worked were "cleaned and purged of chemicals prior to the performance of any maintenance work."[94] He was apparently "seriously exposed" to chemicals on only three occasions: in 1953 to ethylene oxide, and twice in

92. Two other New York cases have allowed recovery for exposure to toxic substances when the facts showed a proximate relationship of the kind usually found in trauma cases or when experts testified that causation was "probable." Casson v. A.C. Horn Co., Div. of Sun Chemical Corp., 27 App. Div. 2d 966, 279 N.Y.S.2d 244 (1967) (worker inhaled for slightly more than one minute fumes from burning paint containing xylol and synthetic resins; after eight years of treatment, he developed an infection of the right lung, and four years later died of lung cancer; award sustained on the ground that this single exposure to an irritant was sufficient to cause the worker's death when the substances inhaled were known carcinogens); Berman v. A. Werman & Sons, 14 App. Div. 2d 631, 218 N.Y.S.2d 315 (1961) (award to widow of worker who died from a cerebral vascular hemorrhage "precipitated" by acute myelogenous leukemia affirmed, when worker was exposed intermittently to benzene for three and one half years, and when claimant's medical experts testified, with "as much medical certainty as can honestly be expressed in cases of this type," that the exposure to benzene had resulted in the worker's death). *See also* Herr v. Niagara Shipbuilding Co., 270 App. Div. 457, 60 N.Y.S.2d 584, *modified*, 270 App. Div. 960, 62 N.Y.S.2d 624, *aff'd*, 296 N.Y. 749, 70 N.E.2d 553 (1946) (award affirmed where exposure to benzene in varnish remover for nine months was held to have caused death from "leukemia and anaplastic anemia" three months later).

A recent case has allowed recovery on broader grounds. Besner v. Walter Kidde Nuclear Laboratory, 24 App. Div. 2d 1045, 265 N.Y.S.2d 312 (1965) (physicist contracted acute myeloblastic leukemia after about a year's exposure to varying amounts of radiation; award affirmed, partly on the basis of testimony that there is no "threshold" dosage of radiation needed to cause cancer).

93. 155 W. Va. 726, 187.S.E.2d 213 (1972).

94. *Id.* at 727-28, 187 S.E.2d at 214.

1954, once to hydrogen cyanide and once to "ethylene cyanophdrin."[95] At the end of 1962, he cut his finger. The injury did not heal properly, and, nine months later, Clark died of leukemia. These were the only apparent injuries Clark suffered in the course of his employment.

Clark's widow claimed compensation on the theory that Clark had been "exposed to chemicals which ultimately caused leukemia." The commissioner allowed the award, and the appeal board affirmed despite evidence that the cause of leukemia was unknown, saying that

> leukemia cannot with some degree of certainty be attributed to anything outside of the employment of claimant's husband and that it is just as likely that the employment environment caused the fatal disease as other outside factors. Under these circumstances, we believe that presumptions should be resolved in favor of the claimant rather than against her and the claim held to be compensable.[96]

One doctor, Dr. Doan, testified that,

> [w]e felt, in the light of the history of a number of years of occupation as a pipe setter or pipe fitter in the environment of the industry that he came from, that it was possible that there had been some damage there, because *we have seen many other patients from similar occupations in which that was the case, and we thought we saw evidence of some toxicity*, in other words, changes, that at least could be accounted for by some of the chemicals and agents to which he had been exposed.[97]

The physician, however, in answer to a question, said that he could not say with a degree of *medical certainty* that the leukemia was the result of exposure to toxic chemicals.[98]

The West Virginia Supreme Court reversed, saying there was insufficient evidence to support the award, and that plaintiff had not sustained her burden of proof of causation. The decision was based on (1) the fact that plaintiff's decedent was exposed to large quantities of chemicals on only three occasions, and (2) the unwillingness

95. *Id.* at 728, 187 S.E.2d at 214. This probably should read "ethylene cyanohydrin."

96. *Id.* at 729, 187 S.E.2d at 215.

97. *Id.* at 732, 187 S.E.2d at 217 (emphasis added).

98. *Id.*, 187 S.E.2d at 217.

of plaintiff's expert witness to say with certainty that Mr. Clark's death was due to the exposure. The court noted that there was no evidence that decedent had been exposed to chemicals regularly, and that therefore testimony as to possible causation was mere speculation.

On its face, the decision seems reasonable. The court avoided the temptation to find that three isolated exposures or the cut finger had caused leukemia, and required that a more sustained exposure be shown. The problem is, first, that there *does* seem to have been evidence of a sustained exposure. The workers who testified said merely that Clark had never been "seriously exposed" to chemicals.[99] Despite the court's protestations to the contrary, Dr. Doan's testimony suggests that there may very well have been a low level of carcinogenic chemicals perpetually in the environment around the plant, though perhaps not high enough a level to cause acute toxic effects. Second, plaintiff's medical expert testified in essence that chemical workers were prone to leukemia. One wonders if the court would have been more convinced had Dr. Doan testified to the existence of a statistical correlation between being a pipefitter in the chemical industry and contracting leukemia. Perhaps the court is merely requiring any sustained exposure to be at a high level. Since the model has postulated that even a very low level could nevertheless turn on switches, the apparent requirement of the court that any sustained exposure be at a high level would be inconsistent with the model, as would be the court's apparent lack of recognition of the validity of "possibility" testimony of causation in this kind of case.[100]

The distinction between "probability" testimony and "possibility" testimony is perhaps exemplified by the Texas case of *Parker v. Employers Mutual Liability Insurance Co.*,[101] which, like the New York case of *Miller v. National Cabinet Co.*,[102] also shows the willingness of certain courts to grant recovery in trauma cases but not in toxic substance cases. Plaintiff attempted to recover workmen's compensation for cancer allegedly caused by radioactive materials.

99. *Id.* at 728, 187 S.E.2d at 214.

100. In terms of the one-step model, since any level of carcinogen is presumed capable of initiating cancer, the longer the exposure to even a low level, the higher the probability of a carcinogenic event.

101. 440 S.W.2d 43 (Tex. 1969).

102. 8 N.Y.2d 277, 168 N.E.2d 811, 204 N.Y.S.2d 129 (1960).

The medical testimony was to the effect that extended exposure to any radioactive material can cause cancer, that persons exposed to radiation have a greater than normal risk of contracting cancer, and that in any particular case there was no way of saying that exposure to radiation did cause cancer. This, as we have explained before, is precisely the kind of testimony most consistent with the scientific model. Yet the Texas Supreme Court held it legally insufficient proof of causation in a workmen's compensation case; nothing short of testimony that the exposure had *probably* caused the cancer would suffice.

There were, however, prior Texas cases involving trauma-caused cancer, where something less than "probability" testimony had been accepted as adequate. The *Parker* court dealt with these as follows:

> [W]here an employment trauma and a cancerous condition coincide at the same point of the body, some courts have held it is reasonably probable that the cancer arises out of the course of employment. In these cases, *despite medical science's uncertainty as to the relationship between trauma and cancer, the trauma has been seen to be so related to the onset of cancer to allow a jury decision whether it was in fact the cause. In general, findings such as this occur when the trauma is an uncomplicated injury produced by a single mechanical force of which laymen can appreciate the consequences.*[103]

In short, in a case where the cause-and-effect relationship appears to be sufficiently facile, scientific testimony as to the meaninglessness of this relationship is of comparatively little weight, as long as some (and sometimes when not even one) expert testifies to the possibility of causation. Since toxic substance cases lack this facile relationship, they are not candidates for judicial leniency in the requirements of testimony.[104]

103. 440 S.W.2d at 48 (emphasis added).

104. The case is noted in Musselwhite, *Medical Causation Testimony in Texas: Possibility Versus Probability*, 23 Sw. L.J. 622, 637 (1969). Compare the formulation of the New York Court of Appeals in Miller v. Nat'l Cabinet Co., 8 N.Y.2d 277, 285-86, 168 N.E.2d 811, 815, 204 N.Y.S.2d 129, 135 (1960):

> There appear to be no decisions upholding causation in so complex a variety of the disease as leukemia. The cancer decisions in the courts where recovery has been allowed have dealt almost entirely with trauma, and there only in in-

B. *Cigarette Cases*

Perhaps the most important group of toxic substance cases are those where plaintiffs (or their heirs) have sought to recover damages from cigarette companies for lung or other cancer al-

> stances where the trauma occurred in the spot in the body where the pre-existing cancer was and the symptoms of its aggravation were immediately apparent. . . . In all of those cases the immediacy of the symptoms of aggravation of the cancer by a traumatic injury suffered in the area where the cancer was located was accepted as a substitute for scientific evidence or understanding of cause and effect. Absent that, damage claims of this nature have been dismissed on the law for lack of evidence of causation.

Note that the issue in this case was not aggravation, but rather causation. Courts have a tendency to confuse these terms. As in Scobey v. Southern Lumber Co., 218 Ark. 671, 238 S.W.2d 640 (1951), there was simply no pre-existing cancer alleged in this case.

Both Kentucky and Florida have also indicated their unwillingness to grant recovery in workmen's compensation cases involving toxic substances. In Kentucky, *see* Miller v. Olin Mathieson Chem. Corp., 398 S.W.2d 472 (Ky. 1965) (denial of claim for myelogenous leukemia allegedly caused by five years of exposure to numerous chemicals in a chemical plant affirmed because, even though plaintiff's witness testified that the exposure had caused the leukemia, he admitted that his theories were unorthodox and unsupported by statistics, and there was contrary testimony denying causation, supported by statistics, that deaths from leukemia had decreased since 1921 despite an increase in the amount of chemicals in the atmosphere); Logan Co. v. Amic, 479 S.W.2d 1 (Ky. 1972) (denial by compensation board of claim for leukemia allegedly caused by exposure to xylol fumes for three years affirmed and circuit court reversed, despite the absence of any testimony denying causation, where even though plaintiff's witness had testified to causation in the language of probability, he had conceded that medical science did not really know what caused leukemia). In Florida, *see* Braden v. City of Hialeah, 177 So. 2d 235 (Fla. 1965) (denial of compensation for life guard's skin cancer allegedly induced by exposure to the sun affirmed, where medical testimony did not exclude the possibility that plaintiff's own pigmentation had caused her to be more susceptible than the average person, and did not show that plaintiff would not have contracted skin cancer had she *not* been employed as a life guard).

See also Meeks v. Industrial Commission, 7 Ariz. App. 150, 436 P.2d 928 (1968) (denial by Industrial Commission of claim that inhaling dust for three years had caused worker's death from lung cancer affirmed, where plaintiff's medical witness testified merely that inhaling the dust "possibly" "could have" caused the cancer and defendant's witness testified that he did not believe that inhaling dust was related to lung cancer, the court holding that the Industrial Commission was entitled to believe either medical expert); Chalmers v. Dep't of Lab. & Indus., 72 Wash. 2d 595, 434 P.2d 720 (1967) (denial by Department of Labor and Industries of claim that one massive exposure to a bonding substance had caused worker's lung cancer affirmed, court holding, *inter alia*, that the mere possibility of a causal relation was insufficient to establish causation). Perhaps the oldest toxic substance case to disallow recovery is Falco's Case, 260 Mass. 74, 156 N.E. 691 (1927). A sheet-metal worker was em-

legedly caused by the victims' smoking.[105] There are no reported decisions in which the plaintiff has recovered. In addition to the fact that these cases have undoubtedly been stoutly defended by tabacco companies, plaintiffs have been plagued by the ineptness of their own counsel,[106] highly unfriendly

ployed for 36 years for, among other things, repairing copper beakers. There seems to have been little doubt that he developed some sort of metal poisoning, but he apparently died of liver cancer, and his widow claimed that his death was causally related to his employment. One physician testifed that, given these facts, "there is a possibility that there is a relation between the exposure to copper which this man had and the cause of his death." *Id.* at 76, 156 N.E. at 692. An impartial report opined that the victim's general ill-health "may at least in part be due to metallic poisoning," *id.*, 156 N.E. at 692, and defendant's witness testified that he felt the death was not related to the victim's work. The court reversed a decision awarding compensation, and decreed for the insurer, saying:

> [W]hen this evidence is given its full probative effect, none of these witnesses would go further than to say that it was possible, or perhaps probable, that primary cancer could be caused by copper or metal poisoning. The question was left in an atmosphere of such uncertainty and doubt that no causal connection between the employee's work and the disease which the commissioner found caused his death had been affirmatively shown.

Id. at 77, 156 N.E. at 692.

105. These cases have been extensively reviewed. *See, e.g.*, Wegman, *Cigarettes and Health—A Legal Analysis*, 51 CORNELL L.Q. 678 (1966); James, *The Untoward Effects of Cigarettes and Drugs: Some Reflections on Enterprise Liability*, 54 CAL. L. REV. 1550 (1966); Note, *Relation of Foreseeability of Risk to the Implied Warranty of a Cigarette Manufacturer*, 17 VAND. L. REV. 315 (1963); Comment, *Cigarette Manufacturers' Warranty: Application of Old Law or New*, 11 VILL. L. REV. 546 (1966). *See generally* 2 R.D. HURSH & H.J. BAILEY, AMERICAN LAW OF PRODUCTS LIABILITY § 14:5 (2d ed. 1974). The cigarette cases are apparently the only products liability cases involving cancer.

106. *See* Pritchard v. Liggett & Myers Tobacco Co., 350 F.2d 479, 486 (3d Cir. 1965), *cert. denied*, 382 U.S. 987 (1966) (reversing a jury verdict for defendant and remanding). The other reported decisions in this case are to be found at 295 F.2d 292 (3d Cir. 1961) (reversing a directed verdict for defendant) and 370 F.2d 95 (3d Cir. 1966), *cert. denied*, 386 U.S. 1009 (clarifying the remand order to prevent relitigation of causation). In Cooper v. R.J. Reynolds Tobacco Co., 234 F.2d 170 (1st Cir. 1956) (summary judgment order for defendant vacated), 158 F. Supp. 22 (D. Mass. 1957) (summary judgment for defendant granted), 256 F.2d 464 (1st Cir. 1958), *cert. denied*, 358 U.S. 875 (summary judgment affirmed), plaintiff attempted to argue that decedent had relied on advertisements that cigarettes were safe and that many doctors smoked them. Plaintiff could not, however, produce such advertisements. By comparison, plaintiff in *Pritchard, supra*, was able to produce these ads.

An example of outmaneuvering of plaintiff by defendant coupled with questionable legal strategy is Albright v. R.J. Reynolds Tobacco Co., 350 F. Supp. 341 (W.D. Pa. 1972), *aff'd*, 485 F.2d 678 (3d Cir. 1973), *cert. denied*, 416 U.S. 951 (1974); 531 F.2d 132 (3d Cir.), *cert. denied*, 426 U.S. 907 (1976). Plaintiff filed two actions, one in

judges,[107] and occasionally the bungling conduct of the courts.[108]

Only three reported cases have reached the issue of causation, two of which have gone for plaintiff and one for defendant on this issue. In *Pritchard v. Liggett & Myers Tobacco Co.*,[109] the Third Circuit, in reversing a directed verdict for defendant, held that the testimony of five experts that cigarette smoking did cause cancer was enough to get the case to the jury, even in the absence of proof that this opinion was shared by the bulk of the medical profession. Subsequently, the jury held for plaintiff on causation, but returned a verdict for defendant on other grounds.[110] In *Green v. American*

state court and one in federal court. The federal court suit was dismissed when defendant's attorneys showed that plaintiff had already recovered money in a settlement of an auto accident claim against the city of Pittsburgh, where one of the claims had been that the *accident* had caused plaintiff's cancer. The court also dismissed on the ground that the case lacked the requisite amount in controversy for federal jurisdiction. 350 F. Supp. 341. Plaintiff then revived the state claim, which had been lying dormant for 7 years. Defendant removed to federal court and this time successfully argued that the amount in controversy *was* satisfied, whereupon the court threw out the case on statute of limitations grounds. 531 F.2d 132.

107. *See* Padovani v. Bruchhausen, 293 F.2d 546 (2d Cir. 1961), where the court, in granting plaintiff's petition for a writ of mandamus directing Judge Bruchhausen to vacate an order, in which he essentially precluded plaintiff from offering any evidence, Padovani v. Liggett & Myers Tobacco Co., 27 F.R.D. 37 (E.D.N.Y. 1961), noted the "specific commitment of the court to the side of the defense." 293 F.2d at 549. The other opinion in this series may be found at 23 F.R.D. 255 (E.D.N.Y. 1959), and with deals with the doctor-patient privilege.

108. *See* the metastatic litigation of Green v. American Tobacco Co., 304 F.2d 70 (5th Cir.), *petition for rehearing granted to extent of certifying question*, 304 F.2d 85 (1962), *certified question answered*, 154 So. 2d 169 (Fla.), *rev'd and remanded following answer to certified question*, 325 F.2d 673 (1963), *cert. denied*, 377 U.S. 943 (1964), *rev'd and remanded for new trial*, 391 F.2d 97 (1968), *overruled en banc*, 409 F.2d 1166 (1969), *cert. denied*, 397 U.S. 911 (1970), which took over 10 years and involved two trials, an advisory opinion by the Florida Supreme Court, and four opinions by the Fifth Circuit, one of which was *en banc* and none of which was unanimous. After the first trial, the court managed to certify the wrong question about Florida law (whether it imposed absolute liability for breach of implied warranty when the manufacturer could not have known that cigarettes would cause cancer), and instead of certifying another question, assumed the wrong answer to the right question (whether the cigarettes were in fact unmerchantable under Florida law). *See* Brown, J., dissenting, 409 F.2d at 1168. The Court of Appeals simply never figured out what the case was about. According to William Prosser, "The whole comedy of errors inspires no confidence in any of the opinions." PROSSER, THE LAW OF TORTS 660 n.82 (4th ed. 1971).

109. 295 F.2d 292 (3d Cir. 1961).

110. *See* 350 F.2d 479 (3d Cir. 1965).

Tobacco Co.,[111] the first jury to try the case returned a general verdict for defendant, but in answer to a special interrogatory said that the smoking of defendant's cigarettes was "a proximate cause or one of the proximate causes of the development of cancer in his [plaintiff's] left lung."[112] In *Lartigue v. R.J. Reynolds Tobacco Co.*,[113] in which both causation and the foreseeability of harm were at issue, the jury returned a general verdict for defendant, but the trial judge wrote in a memorandum that he believed that the jury had based its decision solely on the causation question. The circuit court held that there was substantial evidence to support the jury's determination of causation.

It is perhaps surprising that the evidence in these cases has consisted chiefly of the testimony of expert witnesses; one might have thought that given the well-documented link between cigarettes and lung cancer, more evidence of experimental studies would be introduced. However, when in one of the two trials in *Green* counsel sought to introduce the surgeon general's report and evidence of out-of-court experiments on animals, the trial judge held such evidence inadmissible, and was upheld on appeal.[114]

We have probably seen the last of these suits, since the requirement that the cigarette industry include a warning on its packages and advertisements that its product is dangerous[115] essentially eliminates any possible implied warranty.[116] However, a person who smoked cigarettes until the warning legislation was passed, but contracted cancer thereafter, might be able to sue, on the theory that the statute of limitations runs only from the time plaintiff contracted cancer, or realized that smoking is causing, or may cause, cancer.[117]

111. 304 F.2d 70 (5th Cir. 1962). *See* note 108 *supra*.

112. 304 F.2d at 71-72. In the second trial, which again ended in a verdict for the defendant, causation was supposedly not at issue, since it had been decided at the first trial. However, voluminous evidence of causation was introduced to show that the cigarettes were or were not reasonably fit for human use, including considerable testimony that "we don't know what causes cancer." 391 F.2d 97, 103-04 (5th Cir. 1968).

113. 317 F.2d 19 (5th Cir.), *cert. denied*, 375 U.S. 865 (1963).

114. 391 F.2d at 102.

115. Federal Cigarette Labeling and Advertising Act, 15 U.S.C. § 1333 (1970).

116. Note, *The Deadly Weed: Cigarettes are in Trouble*, 5 HOUS. L. REV. 717, 730 (1968).

117. *See* R.J. Reynolds Tobacco Co. v. Hudson, 314 F.2d 776, 785 (5th Cir. 1963); Mitchell v. American Tobacco Co., 183 F. Supp. 406, 410 (M.D. Pa. 1960).

These cigarette cases follow the scientific model in that courts have been willing to recognize that a long period of cigarette smoking *can* cause cancer, even though we don't know the "cause" of cancer, and have been willing to hold, for example, that a plaintiff's smoking up to 1952 could cause a cancer discovered only in 1958.[118] In terms of the model, the court is allowing recovery when the carcinogen turned on some switches but did not turn on the final switch. However, plaintiff's witnesses in all of these cases had somewhat of a head start over witnesses in other toxic substance cases in convincing the court of causation: since the incidence of lung cancer in cigarette smokers is twenty times that in non-smokers,[119] expert witnesses could testify, completely consistently with the model, that cigarette smoking *probably*, rather than *possibly*, caused the cancer. And still, even with the advantage of such overwhelming scientific evidence, plaintiffs consistently lost.[120]

The cigarette and other toxic substance cases suggest the kind of cancer cases likely to be litigated in the future. Many of these, unlike the trauma cases, are not factually inconsistent with the scientific model. Frequently, expert testimony has also not been inconsistent with the model. When courts have recognized that such testimony was not merely speculative but was rather a valid description of the carcinogenic process, they have generally found causation established. However, when courts have instead looked for the direct, more obvious evidence of causation apparent in trauma cases but lacking here, they have disallowed a finding of causation. Likelihood of recovery in cancer cases brought in the future may depend on recognition by the courts that the trauma cases do not present a correct scientific model of carcinogenesis.

118. Mitchell v. American Tobacco Co., 183 F. Supp. 406 (M.D. Pa. 1960).

119. *See* W. HUEPER & W. CONWAY, CHEMICAL CARCINOGENESIS AND CANCERS 127 (1964).

120. *See* Ross v. Philip Morris & Co., 328 F.2d 3 (8th Cir. 1964), where plaintiff's case was based on a general relationship between smoking and cancer, rather than on a particular relationship between plaintiff's smoking and defendant's brand of cigarettes. In affirming a general verdict for defendant, the court held that this proved too much: if anything, it showed that defendant's product conformed to the general standard of the industry, and thus the numerous products liability cases involving deleterious adulterants, which cases were brought to the court's attention by plaintiff, were inapposite.

V. RECOVERY WITHOUT PRESENT CANCER

A. *"Future Cancer" Cases*

A necessary consequence of the model is that the possibility of cancer in the future, caused by exposure to a carcinogen, may be grounds for recovery in the present even in the absence of present cancer, because the turning on of one or more switches is really a present injury, and not merely a speculative future injury.[121] Very few reported decisions exist which deal directly with the problem of future cancer. The general rule in tort cases, followed in at least one cancer case,[122] is that recovery for future injury is available only when the injury is "reasonably certain"; under this rule the mere possibility that an injured area of the body may become cancerous in the future may not form an element in the awarding of damages. However, there are certain cases which treat the increased possibility of cancer in the future as a recoverable present injury. In addition, cases exist allowing recovery for the *fear* of future cancer caused by some tortious injury.

The main case supporting recovery for future cancer is *Coover v. Painless Parker, Dentist*,[123] a malpractice suit for injuries sustained as a result of overexposure to x-rays in the taking of dental pictures. A California intermediate appellate court sustained a verdict of $10,250 for severe burns which could become cancerous, and which caused plaintiff to be nervous. The court accepted the testimony of a physician that the affected area could "possibly" develop cancer,[124]

121. This is true at least insofar as it is statistically calculable that an exposure to a given concentration of carcinogen will cause a given number of switches to be turned on. Obviously, as explained at note 19 *supra*, the number of switches turned on is impossible to prove in the case of one person, but the average number turned on becomes statistically certain with a large number of persons.

In terms of the one-step model, the initial carcinogenic event is a present injury, whose manifestation as cancer depends on extrinsic factors. As in the case of a multi-step model, the major problem is proving that the individual did suffer this carcinogenic event. As in the multi-step model, this is most easily resolved on a statistical basis in a large group.

122. Hahn v. McDowell, 349 S.W.2d 479 (Mo. Ct. App. 1961), discussed at text accompanying note 126 *infra*.

123. 105 Cal. App. 110, 286 P. 1048 (1930).

124. Q. You give your professional opinion to the effect that Mrs. Coover at this time might be in danger of a cancerous growth? A. I do not say that she has a cancerous growth, she has not, but a cancer may develop on this area—it is common.

. . . .

rejecting a contention that such evidence of "possible" cancer was wholly conjectural. It noted that the predisposition to cancer was itself a present injury:

> Appellant argues that the evidence as to the possibility of cancer is wholly conjectural and uncertain and that that element could not have rightfully been considered by the jury. The court instructed the jury that they were to consider as elements of damage only such physical injury as they may find the plaintiff is certain to suffer in the near future. . . . While the actual condition of cancer may have been conjectural and uncertain, the record contains positive evidence that a condition actually exists which makes this dread disease much more likely. We think this predisposition in itself is some damage . . . [and] must be held to be a real and not a fanciful element of damage.[125]

To the contrary is *Hahn v. McDowell*,[126] where testimony of physicians that cancer could "possibly" develop in a burn scar was held prejudicial to the defendant, the court resting its decision on the principle that "[c]onsequences which are contingent, speculative, or merely possible are not proper to be considered by the jury in ascertaining the damages. . . ."[127]

> In reply to questions by the court he testified as follows:
> Q. I had more particular reference to the possibility of developing cancer. A. You say does it always? Not always.
> Q. It may happen that she can go on through life without that occurring, I suppose? A. It is possible. . . .

Id. at 113-14, 286 P. at 1049.

125. *Id.* at 115, 286 P. at 1050. *Accord*, Oklahoma Ry. Co. v. Strong, 204 Okla. 42, 226 P.2d 950 (1951) (jury verdict for personal injuries in automobile accident including damages for bruise on right breast, from which tumor developed and which would necessitate surgery to determine malignancy, affirmed). *See generally* Annot., 75 A.L.R.3d 9 (1977). *Cf.* Norwood Hospital v. Jones, 214 Ala. 314, 107 So. 858 (1926) (testimony that burn scars were "liable" to produce cancerous growths held admissible, judgment for plaintiff reversed on other grounds); McElroy v. Frost, 268 P.2d 273 (Okla. 1954) (jury award for malpractice in x-ray treatment of dermatitis upheld, where some of plaintiff's witnesses testified that the injuries would ultimately become cancerous); Sullivan v. Butte, 117 Mont. 215, 157 P.2d 479 (1945) (jury verdict for severe burns which would necessitate skin grafts to avoid cancer, upheld). *But cf.* Martin v. Pacific Gas & Electric Co., 203 Cal. 291, 264 P. 246 (1928) (jury in a case involving accident-caused scar instructed to include in the award only future consequences of the injury "reasonably certain" to take place); Waco v. Teague, 168 S.W.2d 521 (Tex. Ct. App. 1943) (testimony that sarcoma could possibly develop in plaintiff's knee held too remote to be admissible, although admission in this case was not reversible error; judgment for plaintiff reversed on the grounds that the court had failed to charge that only "probable" future consequences were compensable).

126. 349 S.W.2d 479 (Mo. Ct. App. 1961).

127. *Id.* at 482.

In an individual case it is easy to see the problems with allowing damages for possible future cancer, since the result might be unjust if the victim does not contract cancer. The argument is more compelling, however, when a large group of people sues a polluter in, for example, a class action, where one can postulate a statistical certainty that, as a result of tortious acts by the polluter, a given percentage of the class will contract cancer. In such a case, future injury to an individual may be only possible, but to the class as a whole it is almost certain. All of this is a consequence of the carcinogen's having actually done something; in terms of the model, the carcinogen has turned on a number of switches in each of a number of people, although possibly not enough in any individual to cause cancer immediately.[128]

Moreover, allowing such claims for possible future cancer is a way of penalizing the carcinogenic polluter immediately for the wrong he has done, rather than requiring the victim to wait until he contracts cancer, at which time the polluter may no longer be within the grasp of the law. In short, the polluter has committed a present wrong whose consequences will appear only in the future. Under the scientific model, there has been a present injury: a number of switches have been turned on. But even leaving the model aside, this present wrong should be legally recognized as a present compensable injury, at least where damages are reasonably ascertainable statistically, and where it may be useful to exact a penalty from a polluter at least for the purpose of deterrence.

B. *"Fear of Future Cancer" Cases*

Aside from the recovery for possible future cancer, there exists some authority for allowing recovery for the fear of possible future

128. In terms of the one-step model the carcinogen has already initiated cancer in a substantial number of the group, and only time and solely internal factors will determine whether or not and, if so, how soon, cancer will develop in certain members of the group.

Cf. Diamond v. General Motors Corp., 20 Cal. App. 3d 374, 97 Cal. Rptr. 639 (1971), where plaintiff claimed that defendant's cars were polluting Los Angeles County. Damages were sought for, *inter alia*, "shortening of life span, increased chances of suffering heart attack; emphysema; lung cancer." The court denied class action status, and did not reach the merits. It stated, *inter alia*, that over seven million claims for unliquidated damages were unmanageable in a single suit. This case suggests the problems to be faced in bringing a class-action suit for damages against a carcinogenic polluter.

cancer caused by some present tortious act.[129]

In the malpractice case of *Ferrara v. Gallucio*,[130] plaintiff, receiving x-ray treatments for bursitis in her shoulder, suffered severe burns. On the advice of her attorney, she saw a dermatologist who, plaintiff testified, told her that the area should be checked every six months because it might become cancerous. Plaintiff duly introduced evidence of her psychiatric state, and a jury awarded $25,000, $15,000 of which was for the cancerophobia she allegedly suffered.

The New York Court of Appeals specifically upheld the award of $15,000 for mental anguish. In so doing, it noted that the issue in the case was not cancer causation,[131] but rather only whether plaintiff had genuinely and plausibly suffered mental anguish as a result of defendant's negligence. It concluded that she had.

Cases like this would seem to be useful in tort litigation involving carcinogens. At least as long as there is some physical injury which could in the future result in cancer, plaintiff should be able to recover for the reasonable mental anxiety flowing therefrom, including the fear of cancer. For example, a victim of polychlorinated biphenyl exposure could sue for damages for his properly-shown fear of cancer in the future if he could show a present physical injury from the PCB, as long as there is sufficient proof that he reasonably believed that PCB's are carcinogenic.

It may not even be necessary to show that the substance is, indeed, carcinogenic. In *Dempsey v. Hartley*,[132] both plaintiff's breasts were injured in an automobile accident. As a result, she sought frequent x-ray treatments to guard against the development of cancer, of which she was very much afraid. The court held that an award which included damages for fear of such cancer was not ex-

129. On the issue of recovery for mental distress in general, *see* PROSSER, THE LAW OF TORTS 328-33 (4th ed. 1971).

130. 5 N.Y.2d 16, 152 N.E.2d 249, 176 N.Y.S.2d 996 (1958).

131. Indeed, plaintiff's attorney said that "we are not making any claim that this person is going to sustain a cancer. We are going on a neurosis," *id.* at 19-20, 152 N.E.2d at 251, 176 N.Y.S.2d at 998, although the court noted that "it is common knowledge among laymen and even more widely among laywomen that wounds which do not heal over long periods of time frequently become cancerous." *Id.* at 22, 152 N.E.2d at 252, 176 N.Y.S.2d at 1000.

132. 94 F. Supp. 918 (E.D. Pa. 1951) (doctrine approved by Walsh v. Brody, 220 Pa. Super. Ct. 293, 297, 286 A.2d 666, 668 (1971).

cessive, and that it was not necessary to show that the development of cancer was probable or even possible, so long as her fears were "reasonable."

However, in *Howard v. Mt. Sinai Hospital, Inc.*,[133] where the sole issue before the court was the compensability of fear of future cancer, the court held such damages were not compensable, and threw out an award which had allowed them. The majority opinion in this malpractice case did not even consider whether such fears were reasonable. A concurring opinion considered the issue of reasonableness, decided that the fears were not reasonable, and discussed the traditional policy reasons for refusing recovery in such cases: the problem of line-drawing, remoteness of injury, and the possibility of excessive burdens on the medical profession.[134]

Clearly, to allow damages for the speculative fear of future cancer in most malpractice or negligence cases would be to stretch the ambit of liability too far. But query whether this consideration would apply to a massive pollution case where the only real injury is the likelihood that in a number of years much of the exposed population will die of cancer, although none of it has cancer at the present time. In at least some jurisdictions, possible future cancer is not a presently recognized injury;[135] the only possible "present injury" on which recovery may be based in such jurisdictions may be a fear of such future cancer. The issue in such a case would not be how far to extend the ambit of liability, but rather whether to impose any immediate liability at all.

133. 63 Wis. 2d 515, 217 N.W.2d 383, *aff'd on motion for rehearing*, 63 Wis. 2d 523a, 219 N.W.2d 576 (1974).

134. Other cases allowing recovery for the fear of future cancer include Oklahoma Ry. Co. v. Strong, 204 Okla. 42, 226 P.2d 950 (1951) (nervousness caused in part by uncertainty as to whether or not accident-caused tumor was cancerous held compensable); Lorenc v. Chemirad Corp., 37 N.J. 56, 179 A.2d 401 (1962) (court affirmed $25,000 damage award to cancer-cure experimenter exposed to negligently-packed ethylene imine, despite defendant's witness' testimony that the chemical could not cause cancer and despite the fact that plaintiff's witness testified merely that the exposure could "possibly" cause skin cancer, on the ground that the jury granted compensation either on the inference that the exposure could "probably" cause cancer or that it compensated plaintiff's *fear* of future development of the disease); Flood v. Smith, 126 Conn. 644, 13 A.2d 677 (1940) (damage award affirmed, including damages for fear that plaintiff would suffer recurrence of cancer in injured breast).

135. Hahn v. McDowell, 349 S.W.2d 479 (Mo. Ct. App. 1961).

VI. Conclusion

It is not difficult to conclude that the question of causation has been wrongly decided in many of the cases in the cancer field; if the model is a valid representation of scientific cancer causation, then judges frequently deviate from the proper standards of causation. Part of the problem is the nature of an adversary determination of facts: plaintiff presents his expert witnesses, defendant his, and the fact-finder decides whom to believe.[136]

Perhaps the answer in trauma cases is to declare, that, as a matter of law, a single trauma does not cause cancer.[137] That still leaves the problem of causation in the toxic substance cases. One problem could be alleviated if judges would accept as probative testimony that a substance "could have caused" a cancer, and realize that in scientific terminology, such testimony is more than just speculative. Counsel could also raise the level of the causational discussion by introducing studies and scientific papers as evidence, rather than merely relying on "expert" testimony.[138]

Perhaps some problems could be alleviated if state courts adhered to a rule that exposure of a plaintiff to a carcinogen for a period of time reasonable for carcinogenesis shifted the burden of proof of causation to defendant.[139] This would require some central list of

136. The miscarriage of justice which may result from this system would not seem to be relieved by a rule that only a jury of "experts" would decide questions of scientific causation, in view of the ability of cigarette companies to get doctors to testify that cigarettes do not cause cancer. *See* Green v. American Tobacco Co., 391 F.2d 97, 103 (5th Cir. 1968). And the problem with court-appointed experts is that the jury is still not required to believe them and the court still hears the testimony of plaintiff's and defendant's witnesses.

137. One judge did virtually so declare. *See* Kramer Service Inc. v. Wilkins, 184 Miss. 483, 186 So. 625 (1939).

138. Thus, in Lartigue v. R.J. Reynolds Tobacco Co., 317 F.2d 19 (5th Cir.), *cert. denied*, 375 U.S. 865 (1963), the jury "had the benefit of chemical studies, epidemiological studies, reports of animal experiments, pathological evidence, reports of clinical observations, and the testimony of renowned doctors." 317 F.2d at 22-23. But there are apparently some constraints which may bar introduction of this kind of evidence. In Green v. American Tobacco Co., 391 F.2d 97, 102 (5th Cir. 1968), the Fifth Circuit upheld the trial court's denial to both sides of the opportunity to offer evidence of out-of-court experiments, and declared inadmissible the Surgeon General's report. These cases are exceptional; in nearly all of the other opinions discussed herein, there was no mention of any experimental evidence at all. This is particularly true in the trauma cases.

139. Scobey v. Southern Lumber Co., 218 Ark. 671, 238 S.W.2d 640 (1951), dis-

carcinogens, perhaps an advisory list promulgated by the Environmental Protection Agency (EPA).[140] The diligence of the EPA in such matters has not as yet been promising,[141] but at least such a list would eliminate the intrinsic conceptual anomaly of cigarettes causing cancer in Pittsburgh but not in Louisiana.[142]

As seen above, there is some authority for allowing recovery for future cancer, or the fear thereof, although admittedly the "fear of future cancer" cases seem to be a somewhat frivolous (although possibly useful) basis on which to predicate liability. But no matter what the theory is behind the recovery, public policy dictates that, in certain situations, plaintiffs should not have to wait for many years to recover for a tort.

The problem of who shall recover how much from whom is raised by the model, in that one might suppose that if multiple defendants are each responsible for throwing switches,[143] each should be liable for part of the damages. This would seem to be impossible when switches are thrown over 20 years, or when some switches might have been thrown spontaneously. In workmen's compensation cases, legislation might provide that a worker can recover from any one in whose employment he was exposed to a carcinogen, rather than from only the final employer. In damage suits, however, some contribution or apportionment would seem to be requisite, and these problems may require a legislative solution.

The human cell is exceedingly complex, and it may be years before precisely how it works, let alone why its control mechanisms fail, is fully understood. In the meantime, some scientific information is available, although generally it must be expressed in terms

cussed at note 79 *supra*. *See also* Royal Indemnity Co. v. Land, 45 Ga. App. 293, 164 S.E. 492 (1932) (blow caused or aggravated malignant brain tumor; burden on employer to show that an intervening agent had caused it). *But see* Parker v. Employers Mutual Liability Ins. Co. of Wis., 440 S.W.2d 43, 49 (Tex. 1969).

140. The recently-passed Toxic Substances Control Act, 15 U.S.C.A. §§ 2601-2629 (West Supp. 1976), would not appear to be the answer; among other shortcomings, it does not cover cigarettes or foodstuffs. *See id.* §§ 2602(2)(B)(iii), (vi).

141. *See* Roberge, *Three Lawyers Versus the Cancer Epidemic*, JURIS DOCTOR, June 1976, at 30.

142. *Compare* Pritchard v. Liggett & Myers Tobacco Co., 350 F.2d 479 (3d Cir. 1965) (Pittsburgh jury finding cigarettes cause cancer) *with* Lartigue v. R.J. Reynolds Tobacco Co., 317 F.2d 19 (5th Cir.), *cert. denied*, 375 U.S. 865 (1963) (trial judge indicating his belief that in a general verdict for defendant, New Orleans jury found that cigarettes do not cause cancer).

143. This would be demonstrable statistically, with a large enough population.

of probabilities. Courts ought to be more sensitive to this type of information, and avail themselves of it in assessing legal liability for the causation of cancer.

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