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RADIATION AND PRECONCEPTION INJURIES: SOME INTERESTING PROBLEMS IN TORT LAW

by Charles L. Moore

With progressively increasing uses of nuclear energy and its resultant radiation risks the full legal impact of the genetic consequences of radiation exposure is an issue of present and great importance to lawyers.\(^1\)

That there are difficult and unique legal problems associated with the development and peaceful use of nuclear energy has long been recognized by academicians and commentators.\(^2\) The tort problems in this regard are intriguing and have resulted in considerable comment despite a relative paucity of reported tort cases.\(^3\) There are several factors which make this an appropriate juncture for a reevaluation of the tort problems. First, today's ubiquitous energy crisis has the potential for transforming academic and theoretical tort questions involving nuclear energy into hard cases in the not-too-distant future.\(^4\) Nuclear power generation may not be a panacea for all of the energy problems, but it appears to be considered by many to be an important source of long-term salvation from dependence on oil for electrical power production.\(^5\) Expanded use of nuclear energy for any purpose will inevitably serve to increase the exposure of the public to pos-


\(^2\) See Murphy, Atomic Energy and the Law: A Bibliography, 12 VAND. L. REV. 229 (1958). This is an excellent and exhaustive bibliography which reveals the voluminous writing in the field before 1958. For a recent bibliography of the many contributions of one extraordinary scholar, the late Dean E. Blythe Stason of the University of Michigan Law School, to this area of the law, see A Complete Bibliography of Books, Pamphlets, Major Reports, Speeches, and Memoranda of E. Blythe Stason, 71 MICH. L. REV. 467, 469-71 (1973).

\(^3\) See generally E. STASON, S. ESTEP & W. PIERCE, ATOMS AND THE LAW (1959) [hereinafter cited as ATOMS]. See also Murphy, supra note 2.

\(^4\) As an indication of this, news reports of the problems and prospects for nuclear power are becoming more frequent. See, e.g., Wall Street Journal, Nov. 6, 1973, at 1, col. 6 (Southwest ed.), in which reference is made to the theoretical impact of a major nuclear reactor accident. An AEC report is cited which estimated that in such an unlikely event, 45,000 people might be killed, 100,000 injured and $17 billion in property damage sustained. See also Wall Street Journal, Dec. 31, 1973, at 1, col. 3 (Southwest ed.), in which the AEC Chairman is quoted as saying that nuclear power plant accidents are not as great a risk as commonly believed.

\(^5\) "Although our greatest dependence for energy until now has been on fossil fuels such as coal and oil, we must not and we need not continue this heavy reliance in the future. The major alternative to fossil fuel for the remainder of this century is nuclear energy." 119 CONG. REC. H2889 (daily ed. Apr. 18, 1973) (President's message on energy resources). One particular program, the development of the so-called "fast breeder reactor," serves to highlight the expected promise and problems in this area. The concept of the breeder reactor is fairly simple; it produces, through "breeding" within the reactor, new fuel while using other fuel to produce power. The adjective "fast" refers to the fact that the particles (neutrons) which are produced inside the reactor move faster than in an ordinary reactor. This whole process sounds rather fantastic and has been referred to by the Supreme Court of the United States as "a sort of modern alchemy." Power Reactor Dev. Co. v. International Union of Electrical Workers, 367 U.S. 396, 399 (1961). Environmental issues concerning the fast breeder reactor program were recently litigated in Scientists' Institute for Public Information, Inc. v. AEC, 481 F.2d 1079 (D.C. Cir. 1973). The United States Court of Appeals for the District of Columbia Circuit noted in its opinion that the breeder reactor program has been given highest national priority in the style of the space pro-
sible accidents involving radioactive materials and, consequently, to an increase in tort claims. An interesting sidelight is that any imprudent haste to make greater use of nuclear power because of the exigencies of the energy crisis could easily exacerbate the problem. Second, the comprehensive treatisec covering the overall subject of radiation and tort law was written in 1959, and the major exhaustive treatment of preconception injuries was published over ten years ago. Significant changes in both technology and the law have occurred since then, making further analysis appropriate.6

The subject of preconception, or genetic injuries resulting from radiation is one of particular interest. This Comment examines the problems of tort law posed by such injuries, both in the historical and contemporary contexts. Technical developments are touched upon to the extent necessary, and references to the technical literature are given. The objective, however, is to avoid an overly technical discussion of this admittedly technical area. Possible solutions to the legal issues are analyzed, keeping in mind a goal of “creative continuity,”10 and a limited forecast of future developments is made.

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6. ATOMS.
7. Estep & Forgotson, supra note 1. Preconception injuries are those injuries which an individual receives as a result of damage to the genetic structure of one or both of his parents (or other ancestor) prior to his conception. These changes in the genetic structure are commonly called mutations and evidence of the injury to the descendant may not show up for several years or several generations. C. THORNBURN, ISOTOPES AND RADIATION IN BIOLOGY 204 (1972). In this Comment, the terms “preconception injuries” and “genetic injuries” are used interchangeably to denote the injury to the subsequent generation; technically, of course, the person actually irradiated suffers “genetic damage,” but the harmful effects do not really show up until the subsequent generation. Preconception injuries thus can be said to occur before there is any separate existence whatsoever of the individual. This is to be distinguished from the cases of prenatal injury, discussed infra at notes 127-44 and accompanying text, in which the child is present as a separate entity within its mother’s womb.
8. See generally A. TOFFLER, FUTURE SHOCK (1970) for an interesting, popular work which illustrates what a difference even ten years of technological change can mean under contemporary conditions.
9. Other major long-term radiation injuries include “leukaemia and other malignant diseases, cataracts, skin damage, impaired fertility, and ageing, i.e. premature death not attributable to specific causes.” C. THORNBURN, supra note 7, at 204. However, preconception injuries are probably the most difficult to deal with in the legal context, and they, even more than other radiation injuries, strain traditional tort law to its limits. Such a legal problem is more than merely hypothetical. In a recent federal district court case, Jorgensen v. Meade Johnson Laboratories, Inc., 336 F. Supp. 961 (W.D. Okla. 1972), the complaint alleged that birth control pills had altered the chromosome structure of the mother’s body to produce a Mongoloid deformity in her issue. The court dismissed the complaint, holding that the children, Mongoloid twins, one of whom was deceased, could not recover for malformations caused by injury to the ovum of the mother prior to conception. On appeal, the United States Court of Appeals for the Tenth Circuit vacated and remanded, the court being convinced that “the Oklahoma courts would afford an opportunity to present a case on these allegations.” Jorgensen v. Meade Johnson Laboratories, Inc., 483 F.2d 237, 241 (10th Cir. 1973). (Although the alleged cause of injury was a chemical one rather than radiation, it seems clear that the same result would have been reached regardless of the source of injury.) Permanent genetic damage from radiation has been alleged in at least one unreported federal district court case. Troxell v. Bendix Corp., C.A. No. 12660, Fed. D.C. W.D. Mo., tried Jan. 28, 1963, deadlocked jury Feb. 14, 1963, cited in Estep & Forgotson, supra note 1, at 1 n.2.
10. See Keeton, Creative Continuity in the Law of Torts, 75 HARV. L. REV. 463 (1962): “Any legal system, to remain viable over a span of time, must have the flex-
I. HISTORICAL DEVELOPMENT: THE LEGAL AND TECHNOLOGICAL MILIEU

A. Recognition of the Preconception Injury Problem in the Law

The special legal problems associated with nuclear energy have long been recognized, and the area has been described as "one of the remaining frontiers of development in the law." The specific problem of preconception injuries has also been recognized for some time, although it has not been discussed to the same extent that other radiation issues have been, despite the fact that it is conceivably the most difficult and disturbing of the possible injuries. It has been suggested that discussion has been avoided by many "for fear that people will be frightened away from considering some of the other problems admittedly important to the development of a nuclear industry." Coverage in the literature has tended to reach the point of posing the questions without detailed discussion of the possible answers. However, that discussion of the problems which has been advanced has often been accompanied by predictions of greatly expanded tort litigation in the future.

11. A classic early case in which the unique problems associated with delayed radiation injury were apparent is La Porte v. United States Radium Corp., 13 F. Supp. 263 (D.N.J. 1935). In this case the decedent had been a watch dial painter in the employment of the defendant, using a luminous radioactive compound in the process. Decedent left the employment in 1920; in 1927 she expressed the belief that she might have contracted radium poisoning. A definite diagnosis was made in 1930; she brought a claim in May 1931 and died in June the same year. The two-year New Jersey statute of limitations was held to bar the action. For a discussion of this and associated cases see G. HUTTON, LEGAL CONSIDERATIONS ON IONIZING RADIATION 35-37 (1966). The author concludes that the case "in all probability, was correctly decided on strictly legal principles." Id. at 37. The special tort problems which he envisioned early in the nuclear era led the Chairman of the Atomic Energy Commission to note the particular interests which negligence lawyers were likely to have. Dean, The Impact of the Atom on Law, 12 U. Pitt. L. Rev. 514, 515 (1951).

12. ATOMS 200.


14. Id. at 266.

15. Injuries such as genetic damage and shortening of life span, about which much has been said in the course of the controversy over weapons testing, raise serious questions as to what kinds of injuries should, and what kinds of injuries can practicably, be redressed under our tort system. Finding the right answers to questions of this kind will require a good deal of patience and ingenuity on the part of all lawyers.

Murphy, Tort Liability, Government Indemnification and Insurance, in CONFERENCE ON ATOMIC RADIATION AND THE LAW 10-11 (1961). The particular question here discussed was used to pique the curiosity of torts students in C. GREGORY & H. KALVEN, CASES AND MATERIALS ON TORTS 4 (1969). "There should be a considerable increase in such cases with the expanded use of radiation. Exposure of potential parents undoubtedly will occur in such amounts that thereafter in all good conscience they ought to refrain from having children because of the real danger of genetic mutations." ATOMS 256. "Solutions should be agreed on before radiation cases begin to occur in considerable numbers." Estep, supra note 13, at 268. "In any event, now is the time to face these problems for radiation cases, not after greatly expanded use of this new source of energy has created a large number of cases which the law is ill-equipped to handle." Id. at 304. It is apparent that the expected number of cases has not materialized. However, for reasons already...
Before proceeding, it is necessary to define the relevant legal problems in more specific terms. These problems become almost obvious when one considers the ramifications of a tort action in which the plaintiff was not in any sense in existence at the time of the tortious conduct, and the tortious conduct consisted of the exposure of one of the plaintiff's ancestors to radiation. There are numerous physical mechanisms by which the exposure may have occurred. At one extreme is the unlikely, but possible, catastrophe associated with a major nuclear reactor accident. At the other end of the spectrum are the more feasible possibilities of exposures from X-ray machines, particle accelerators, and accidents involving transportation, handling, or manufacturing of the nuclear materials. A complicating factor to be recognized at this point is that everyone is exposed to a certain amount of so-called "background" radiation every day. Expanded use of nuclear power generating plants will inevitably increase the handling, manufacturing, and transportation of nuclear materials and the disposal of radioactive waste products, with a consequent increase in the possibility of accidents. There are other potential mechanisms for radiation exposure to the ancestor which are not detailed here.

The allegation in the type of tort action under consideration is that as a result of the exposure of an ancestor to radiation, certain alterations occurred in the genetic make-up of the germ, or reproductive cells of that ancestor. Consequently, the plaintiff, who was born one or more generations later, has incurred an injury, for example, a cleft palate, Mongolism, or other physical deformity. It is also possible that a descendant of the exposed ancestor has been born dead as a result of the genetic change, and a wrongful death action is now being pressed. For the purposes of further analysis, it is assumed that a wrong has been committed and an injury suffered. Under the current legal system, this injured plaintiff will face almost insurmountable legal problems in seeking recovery.

The most obvious legal problem encountered by this plaintiff is the bar of the statute of limitations. Unless some special provisions are made for this type of injury, his action will undoubtedly be barred because the time

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17. The genetic effects of radiation have been recognized since 1927 when it was discovered that X-rays produced a large increase in the mutation rate in the fruit fly. The mutations which occur in the body's reproductive cells are the important ones from the standpoint of damages to future generations. "When a mutation occurs it may cause damage in the first generation of children, or, if it is of the type that causes damage only in a double dose (i.e., is recessive), hundreds of generations may intervene before the damage occurs—and there are all gradations between these extremes." Crow, Genetic Effects of Radiation, 14 BULL. OF THE ATOMIC SCIENTISTS 19, 21 (1958).

18. See note 4 supra.


frame involved can be expected easily to exceed the usual one-to-three-year limitation periods.22 This problem is not unique to the preconception injury cases; it occurs in all the serious delayed-effect cases such as cancer or leukemia.23 Another problem is that of proving that the plaintiff's injury is in fact a result of the exposure of his ancestor to radiation. Many commentators have considered this to be an insurmountable obstacle under the current system24 and alternatives have been proposed to help the plaintiff.25 A third problem, one which may in fact obviate the others, is that of the very existence of a cause of action. If one considers that the so-called "unborn plaintiff," one who was conceived but not yet born at the time of the injury, has only within the last thirty years been allowed recovery for prenatal injuries,26 it becomes apparent that a major legal change is required to allow the unconceived plaintiff a cause of action.27

The result of such difficult problems is likely to be that many persons who are grievously injured through the fault of others will be denied all recovery. That there are now, or will be such persons seems well settled.28 This result is questionable because it does not comport with current tort doctrine.29 Judicial discussion of the genetic damage problem, at least until Jorgensen v. Meade Johnson Laboratories, Inc.,30 was largely confined to dictum in a relatively small number of cases.31 A reading of these cases leads one

22. G. HUTTON, supra note 11, at 35.
23. See id. at 35-44, for a relatively recent discussion of the statute of limitations problem. For a thorough discussion of these issues, see Estep & Van Dyke, Radiation Injuries: Statute of Limitations Inadequacies in Tort Cases, 62 MICH. L. REV. 753 (1964). The authors recommend an over-all limitation period of thirty years, and would apply the period to genetic injuries as well as to other delayed-effect radiation cases. "Whether or not a cause of action is recognized, the limitation statute . . . should be applied with the period commencing on the date of the exposure of the ancestor. It should be specified that the over-all limitation period cannot be tolled or suspended for any reason other than the failure of the defendant to file the required report of a nuclear incident." Id. at 793-94.
24. See, e.g., ATOMS 222.
25. See notes 147-60 infra, and accompanying text.
27. The Tenth Circuit's recent opinion in Jorgensen v. Meade Johnson Laboratories, Inc., 483 F.2d 237 (10th Cir. 1973), discussed supra note 9, may be significant in showing the potential for such change. There are two reasons for caution in drawing conclusions from this decision, however. First, the court emphasized that most favorable consideration must be given the complaint since it was disposed of on a motion to dismiss for failure to state a claim in the district court. Second, the court construed the pleading such that it was not limited to effects or developments before conception. Id. at 239.
28. "[I]f recovery is denied, we know that many individuals, often through no fault of their own, will go through life uncompensated for the infirmity, inconvenience, and financial sacrifice caused by another's actions for which he would be legally liable but for the lack of an identifiable legal entity and specific proof of causal connection." Estep & Forgetson, supra note 1, at 46.
29. "The purpose of the law of torts is to adjust these losses, and to afford compensation for injuries sustained by one person as the result of the conduct of another." PROSSER § 1, at 8, quoting Wright, Introduction to the Law of Torts, 8 CAMB. L.J. 238 (1944).
31. See notes 33-44 infra, and accompanying text. The district court's decision in Jorgensen was significant in that it involved a holding on the issue (although denying recovery) rather than dictum.
to conclude that recovery would probably be denied today, even assuming that the formidable hurdle of proving causation could be surmounted. The district court in Jorgensen concluded: "We find no holding by any court that a child may recover for injury to the sperm of its male parent or the ovum of its female parent before the two unite in conception. One authority states unqualifiedly that there is none such."32

One of the early cases with dicta relevant to preconception injuries is Hornbuckle v. Plantation Pipe Line Co.,33 in which the court abandoned the criterion that a child had to be quick34 at the time of the prenatal injury in order to recover. One member of the court expressed disapproval of this holding, and stated his particular concern that extension of the new rule might lead to recovery for preconception injuries: "If a baby can sue for injuries sustained five seconds after conception, as the majority rules, why not allow such suits for injuries before conception, even unto third and fourth generations?"35 Other language in the special concurring opinion helps to illuminate the preconception injury problem:

The ruling of the majority in this case extends [the quickening criterion] to allow the child to maintain a suit for damages to the cell from which it came, even though the cell had been conceived ten seconds. It ignores reality and fact. It simply by-passes the inflexible rule of law that for one to maintain a suit for personal injury, the injury must be either to the person of the suer or that of a relative or one upon whom he is dependent. This indispensable requisite is completely absent here. The cell is not the person of anyone, and whether it becomes such is dependent upon the processes of nature which raises it from a mere cell to a human being.36

Although speaking in terms of a viability criterion rather than a quickening criterion, a similar distinction has been proposed as a desirable basis for denial of recovery for preconception injuries from radiation:

By holding that a cause of action accrues when the injury or disease might reasonably have been discovered, one opens the door to lawsuits based on mutations which may occur two or even three generations after the ancestor was exposed to radiation. While the descendant may have a legitimate claim against the defendant for the injury to his ancestor, it is felt that the trial of such a claim would be unwarranted.

In an effort to insure that such very stale claims will not frustrate the primary purpose of the statute of limitations, it is suggested that

32. 336 F. Supp. at 962. The authority to which the court alludes is 9 Am. Jur. Proof of Facts Prenatal Injuries 523-24 (1961). It is interesting to note that the Tenth Circuit's decision in Jorgensen may invalidate this assertion; however, see note 27 supra for discussion of the reasons for caution in drawing conclusions from the Tenth Circuit opinion.
33. 212 Ga. 504, 93 S.E.2d 727 (1956).
34. The "quickening" criterion has reference to the first movements of the fetus felt in the mother's uterus. This occurs on the average at about the sixteenth week of pregnancy. Taber's Cyclopedic Medical Dictionary Q-2 (9th ed. 1963). The other commonly used criterion for recovery for prenatal injuries was that the child had to be "viable" at the time of the injury, i.e., the child must be capable of living on its own; this occurs at about seven months. Id. at V-17.
35. 93 S.E.2d at 729.
36. Id. (emphasis added).
the test which was laid down by the Ohio Supreme Court in the case of Williams v. The Marion Rapid Transit District, Inc., 152 Ohio St. 114, 87 N.E.2d 334, (1949), might be adopted. The court distinguished between a viable and a nonviable fetus, the former having a cause of action. If the cause of action for radiation poisoning were similarly limited to persons 'in being,' the problem of liability for mutations would conceivably be eliminated.\footnote{37}

Another of the few cases to touch upon preconception injuries is Morgan v. United States,\footnote{38} a federal district court case which was decided in the same year as Hornbuckle. In Morgan the allegation was made that an infant was injured as a result of a negligent blood transfusion to his mother. The transfusion was alleged to have occurred in February 1953, while the infant was not born until June 1955. The court took judicial notice of the nine-month human gestation period, then concluded that no action accrued to the infant who was not a viable fetus or even in its mother's womb at the time of the tortious conduct.\footnote{39}

This case has been cited as "very likely to be the forerunner of many cases that will be brought to the courts as the result of extensive use of radioactive materials."\footnote{40} However, this prediction has fortunately not materialized. Reference is made in the literature to at least one case (which reached the trial stage) in which permanent genetic damage from radiation was alleged.\footnote{41}

A widely discussed case which has relevance here is Zepeda v. Zepeda,\footnote{42} which has been described as a suit for "wrongful life."\footnote{43} The suit was by a minor against his father for damages because the plaintiff had been born illegitimate. The Appellate Court of Illinois in a thorough opinion recognized that a wrong had been committed but declined to allow recovery because of the potentially sweeping results envisioned. The court concluded that any such creation of a new tort should be undertaken by the legislature. The court alluded specifically to the possibility of preconception injuries from radiation:

So let us go still further and take a third suppositive case, where the wrongful act also takes place before conception but the injury attaches at the moment of conception. Physicists and geneticists declare that thermonuclear radiation can so affect the reproductive cells of future par-

\footnote{37. McNeal, Bloom, Christovich, Cope, Cull & DeJarnette, The Statute of Limitations Problem in Relation to Atomic Energy Liability, 26 Ins. Counsel J. 347, 350 (1959). Whether this reasoning can be sustained on the basis of more recent prenatal cases is discussed in text accompanying notes 135-39 infra. See Wolfe v. Isbell, 280 So. 2d 758 (Ala. 1973), for a very recent case in which the viability criterion is rejected.}
\footnote{38. 143 F. Supp. 580 (D.N.J. 1956).}
\footnote{39. Id. at 584. In support of its statement that no cause of action accrued under Pennsylvania law, the court cited a 1940 Pennsylvania case which had denied recovery for prenatal cases in general.}
\footnote{40. ATOMS 226.}
\footnote{42. 41 Ill. App. 2d 240, 190 N.E.2d 849 (1963), cert. denied, 379 U.S. 945 (1964).}
ents that their offspring may be born with physical and mental defects.

If a child is born malformed or an imbecile because of the genetic effect on his father and mother of a negligently or intentionally caused atomic explosion, will he be denied recovery because he was not in being at the time of the explosion?44

Probably the case of greatest current significance is Jorgensen, in which the district court concluded that there was simply no cause of action for preconception injuries.45 The court cited Morgan as being “persuasive.” The plaintiff had apparently emphasized the above statements in Zeppeda, but the court distinguished it because it was not a products liability case. The court also declined to follow the reasoning of Zeppeda because the language relied on by the plaintiff was dictum, and the court was only an intermediate appellate court. In a concluding statement the district court said: “Any right of a child arising out of injury to the chromosome of its mother through the use of such pills prior to its conception should be created by the Legislature and not by judicial decision.”46 This would not appear to be a satisfactory answer. As Professor Keeton has noted in his classic article on “creative continuity”:

Unhampered by a rigid theory of precedent like that adhered to in England, American courts have a great responsibility for participating in the creative adaptation of law to current needs. Though some types of reform are beyond the judicial function, primarily because of the distinctive investigating facilities of legislatures and their distinctive role in relation to reforms of comprehensive character, it is never a satisfactory answer to an argument for judicial creativity that the need for change is one that could be accomplished by statute.47

The Court of Appeals for the Tenth Circuit vacated and remanded in Jorgensen,48 recognizing that the district court had not satisfactorily resolved the matter. The court specifically stated that “the trial court was incorrect in concluding that recognition of such a cause of action must await legislative action.”49 The court pointed to the common law developments in the area of prenatal injuries in support of this conclusion.50 The court’s language appears to support recognition of a cause of action for preconception injuries: “We are persuaded that the Oklahoma courts would treat the problem of the injuries alleged here as one of causation and proximate cause, to be determined by competent medical proof.”51 The significance of this language is reduced because it can be considered as dictum. The court was

44. 190 N.E.2d at 854. Although it is not entirely clear, the court seems to be implying that recovery should be allowed in such a situation. The court says later in the opinion that it is not very important that the plaintiff is not a “person” as historically understood in the law of torts. The court is “not concerned with some abstract ontological proposition as to the instant a human entity becomes a person.” 190 N.E. 2d at 855.
45. 336 F. Supp. at 962-63.
46. Id.
47. Keeton, supra note 10, at 484 (emphasis added).
48. 483 F.2d 237 (10th Cir. 1973).
49. Id. at 240.
50. Id. at 241.
51. Id. at 240.
considering the complaint most favorably because it was dismissed by the trial court on a motion to dismiss, and the court concluded that the pleading could be construed so as not to be limited to "effects or developments before conception."  

Much attention in this area has been focused on the difficult problems of proof of causation\textsuperscript{52} and the statute of limitations problems associated with the delayed effects of radiation.\textsuperscript{53} There are conflicting views as to whether existing legal principles are even capable of meeting these challenges. One commentator has said: "The advent of the Atomic Age will scarcely cause a ripple on the even surface of the principles of tort liability. Lawyers can rely with confidence on all the familiar doctrines and precepts. This will remain unchanged."\textsuperscript{54} More recently, in the workmen's compensation context, it has been concluded that: "Radiation injuries are not now sufficiently numerous to justify special methods of compensation, and until our society is prepared to make more comprehensive changes in disability compensation we should endeavor to apply intelligently the old rules in this new area. They are not inadequate for the just resolution of the problems."\textsuperscript{55} A contrary conclusion is that "the present system must be modified when applied to radiation injuries."\textsuperscript{56} Similarly, it has been concluded that the present system cannot meet these problems and that "[t]he means and guidelines for correcting the legal system must be worked out by the cooperative efforts of the legal profession, the medical profession, industrial hygienists and health physicists."\textsuperscript{57}

Evaluation of these polar views and conclusions as to what should be done depend on an analysis of technological and legislative factors and certain common law developments. In dealing with preconception injuries in particular, it is important to keep in mind the admonition that "[s]ome imaginative thinking is indicated."\textsuperscript{58}

B. The Technological Setting

Mention has already been made of the expanded future use of nuclear energy and technological developments in that field. This section focuses on the technological developments which more directly affect the legal problem of proof of causation of genetic injuries from radiation.\textsuperscript{59} Attention is also given to a related technical issue, the assessment of the probable num-

\textsuperscript{52} Id. at 239.
\textsuperscript{53} See, e.g., Keyes & Horvath, Approaches to Liability for Remote Causes: the Low Level Radiation Example, 56 Iowa L. Rev. 531 (1971); O'Toole, Radiation, Causation, and Compensation, 54 Geo. L.J. 751 (1966).
\textsuperscript{54} See, e.g., Estep & Van Dyke, supra note 23.
\textsuperscript{56} O'Toole, supra note 53, at 776.
\textsuperscript{57} Estep & Forgotson, supra note 1, at 46.
\textsuperscript{58} Forgotson, The Significance of Health Physics Testimony in Radiation Injury Litigation, 9 Health Physics 741, 745 (1963).
\textsuperscript{59} ATOMS 30.
\textsuperscript{60} For an interesting, recent treatment of genetic technology and the law generally, see Green, Genetic Technology: Law and Policy for the Brave New World, 48 Ind. L.J. 559 (1973).
ber of persons who are likely to be affected by the resolution (or lack of resolution) of the legal problems.

If the factual assumptions are made (1) that the plaintiff's ancestor was in fact exposed to damaging radiation through the fault of the defendant, and (2) that the plaintiff-descendant was subsequently born with a defect of the type which is associated with radiation-induced genetic injuries, then an analysis can be made of the severe problem of proving the causal link between the two events. It has been concluded that in most cases proof of causation under classic tests will be impossible: "[I]t can be asserted safely that on the basis of the present state of medical, scientific, and genetic knowledge, the causal connection between a specific radiation exposure and a particular genetic injury is not capable of clear medical proof in the normal legal sense of the term."61 The difficulty of the proof problem arises from the statistical nature of the injury: "Delayed radiation effects, in general, are a probability phenomenon. Although they can be demonstrated on a statistically significant basis with a sufficiently large population group, the presence or absence of these effects in any given individual may be impossible to establish."62 In other words, it is possible to show that "if a group of sufficient size is exposed to radiation a larger number of offspring born to this group of individuals will have these diseases or defects than would be expected from the spontaneous rate; there is no way to determine specific causation in any one case."63 Compounding the problems of proof is the fact that radiation does not produce new kinds of genetic defects but merely increases the frequency of gene mutations which occur naturally.64

Despite these obvious difficulties, there has been considerable optimism about improvements in scientific knowledge so as to allow proof of causation.65 However, it appears that the millennium has not yet arrived. Although much progress has been made, the same problems exist today and are likely to continue.66 The statistical nature of the injury cannot be

61. Estep & Forgotten, supra note 1, at 45.
63. Estep & Forgotten, supra note 1, at 46-47.
65. "[W]ithin the next few years much more will be known about the possible genetic contribution radiation mutations will make for many other types of injuries . . . ." Estep & Forgotten, supra note 1, at 47. "[A]s our knowledge of radiation exposure and genetic damage increases, it may well prove possible to satisfy the causation-in-fact requirement." Atoms 203. There is also optimism as to the ability of the law itself to cope with the proof problem: "The problem of proof is, of course, peculiar to the given situation. The ingenuity of the advocate and the master of us all, the law, will combine, as they have in the past, to overcome this rather serious obstacle." Dooley, Nuclear Energy—An Evaluation from the Viewpoint of the Public Weal, 1971 ABA Sect. Ins., Neg. & Comp. Law 272, 285.
66. "In spite of the tremendous advances in our knowledge of genetics in recent years, no significant change has occurred in the underlying concepts upon which the medical uses of radiation with regard to genetics are based. This new information has reemphasized the far reaching effect of genetic damage which may occur to individuals and their progeny who are exposed to radiation." C. Behrens, E. King & J. Carpender, supra note 64, at 429. See generally USAEC DIVISION OF TECHNICAL INFORMATION, BIOLOGICAL IMPLICATIONS OF THE NUCLEAR AGE (1969).
avoided, and there is a lack of sufficient genetic data on man. "The generations for man are too long and the 'experiments,' if they could be done at all, are too costly and too time-consuming for us to have any considerable fund of information on the effects of radiation on genetic processes in man himself." Considerable research with insects and animals has been conducted, but extrapolations to man must be done with caution.

In view of these technological shortcomings in the ability to prove causation, the question that should be addressed is whether the problem is worthy of further legal consideration at all. Should the law attempt to accommodate this difficult problem? The second technological consideration is relevant in answering this question, that is, the assessment of the potential magnitude of the problem.

There is no doubt that radiation exposure does cause genetic damage; that there will be greatly expanded use of radiation sources in the future; and that the number of persons likely to be afflicted with genetic injuries is significant. One of the most alarming recent estimates is one based not on accidental overexposure to radiation but rather on exposure to allowable levels under federal regulations:

How serious are the genetic effects of radiation? No one knows! It is possible that exposure to the present allowable levels could result in a 5% to 50% increase in the death rate, producing some 150,000 to 1,500,000 additional deaths each year in a future population of 300,000,000 people. Moreover, the evidence suggests that there would be (over and above the fatal diseases) a 5% to 50% increase in such crippling diseases as diabetes, rheumatoid arthritis, and schizophrenia.

This is admittedly an extreme view of the problem. However, when one considers such estimates, along with the certain increase in the various uses of nuclear energy and the large number of persons that would be affected by a single catastrophic reactor accident, then it is reasonable to conclude that the issue is worthy of consideration. Unless the legal system can find a solution, there will probably be a large number of individuals who "will go through life uncompensated for the infirmity, inconvenience, and financial sacrifice caused by another's actions . . . . Their loss will be no less painful, costly, or real because the impact occurred before conception."
II. LEGISLATIVE CONSIDERATIONS

The district court in Jorgensen suggested that any relief for the plaintiff in preconception injury cases should come from the legislature. Thus, it is appropriate to examine significant legislative developments which might have an impact on the preconception injury issues. Generally, of course, the law of tort is common law. Nuclear energy and radiation, however, are areas which are extensively regulated by statute, so it is particularly important to take statutory law into consideration.

Before an examination of the applicable United States statutes, a brief discussion of two British statutes is instructive. The Nuclear Installations (Licensing and Insurance) Act of 1959 imposed a statutory duty on the operators of nuclear installations to insure that no ionizing radiations "cause any hurt to any person or any damage to any property, whether that person or property is on the site or elsewhere." The Act did not explicitly make it a tort to violate the duty, although it would undoubtedly be a tort based on a statutory duty by virtue of which liability would be absolute, requiring neither intentional nor negligent conduct on the licensee's part.

The scope of this duty vis-à-vis genetic damage has been stated as follows:

It might happen that ionising [sic] radiations would have caused genetic changes in persons neither born nor even conceived at the time when the parent was exposed to the radiations; for instance, their fertility or life expectancy or resistance to disease might have been reduced in consequence of the mutated genes. It may safely be said that those not even conceived at the time when the wrong was committed would not have been able to sue in ordinary torts. Yet the answer might have been different under the Act. The Act imposed a duty to any person; it did not require that the hurt be sustained when the radiations were emitted; moreover . . . it contemplated actions being brought even thirty years later. These factors lend support to the view that (if it could be proved) persons not conceived at the time of the occurrence could eventually have sued for genetic harmful mutations suffered by them.

Thus, this Act arguably changed the British common law rule of no cause of action for preconception injuries caused by radiation.

The Act was substantially amended by the Nuclear Installations (Amendment) Act of 1965, and the two Acts were consolidated in the Nuclear Installations Act of 1965. The amendment has been criticized for not clarifying the duties owed to unborn persons or persons not conceived at

73. 336 F. Supp. at 962-63. The Tenth Circuit disagreed on this point. See text accompanying note 49 supra.
74. 7 & 8 Eliz. 2, c. 46.
75. Id. § 4. See H. STREET & F. FRAME, LAW RELATING TO NUCLEAR ENERGY 33-34 (1966) [hereinafter cited as STREET & FRAME].
76. STREET & FRAME 34.
77. Id.
78. Id. at 36-37 (emphasis added).
the time of the occurrence. Under the new Act, "it is possible, but far from being certain, that [the latter] may be able to sue within the limitation period for genetic harmful mutations suffered by them in consequence of their parents' having been exposed to ionising [sic] radiations."81 Thus, it is arguable that these Acts have conferred a cause of action for preconception injuries, at least for those injuries which manifest themselves within the thirty-year statute of limitations period.82 This period, which runs from the date of the defendant's act, in essence strikes a balance between the interests of the plaintiff who may suffer delayed effects such as genetic damage or cancer, and the interests of the defendant in not facing stale claims.83 However, even this extended limitations period certainly does not provide relief for all genetic injuries which may occur. The claim is barred after thirty years even though the harm may have been undiscoverable during that period.84 In addition, the plaintiff still faces the major problem of proving causation and must meet the ordinary civil standards of burden of proof.85

The British statutes are of interest because of their similarity to the United States statute which now, in effect, establishes absolute liability for nuclear power catastrophes.86 Before discussing the details of this legislation, it is necessary to cover briefly the background of federal atomic energy legislation.87

The original Atomic Energy Act of 194688 established the Atomic Energy Commission and established the framework for development, control, and use of atomic energy.89 The Atomic Energy Act of 195490 revised and superseded the 1946 Act, made possible private participation in nuclear power,91 and empowered the Commission to prescribe rules and health and safety requirements.92 Probably the most important federal statute relevant to this discussion is the Price-Anderson Act of 195793 which amended the Atomic Energy Act of 1954. This legislation encouraged the development of nuclear power by providing indemnity to any person who might be liable as a result of a nuclear incident.94 Licensing is required, and the licensee must carry liability insurance in the maximum amount available from private sources.95 A second important provision was the requirement that the

81. STREET & FRAME 54.
82. Nuclear Installations Act 1965, c. 65, § 14(1).
83. STREET & FRAME 67.
84. Id.
85. Id. at 68.
87. For a thorough treatment of the relevant history of the Atomic Energy Act see generally Green, supra note 86, at 479-510.
89. Green, supra note 86, at 479.
91. Id. §§ 2131-2140.
92. Id. §§ 2035, 2051, 2201; see Dooley, supra note 65, at 276.
95. This was $60 million in 1957 and applied to facilities with a rated capacity of 100,000 electrical kilowatts or more. This was subsequently increased to $95 million by 1972, although aggregate liability remains the same at $560 million. Green, supra note 86, at 487, 498.
licensee enter into an agreement with the Commission in which the Comis-

sion agreed to indemnify and hold harmless the licensee and other persons

indemnified in the amount of five hundred million dollars. A ceiling on

the aggregate amount of liability was created which was equal to the amount

of indemnity plus the amount of private financial protection, that is, five

hundred sixty million dollars in 1957. In essence, then, the nuclear indus-

try was insulated from any possible liability that was not covered by the

insurance and indemnity arrangements.

The most significant facet of the legislation from the standpoint of precon-

ception injuries was the fact that neither the indemnification nor insurance

coverage applied unless persons were found liable under the applicable state

law. Thus, if no cause of action existed under state law, the elaborate

system would be of little assistance to the injured plaintiff. Changes to

the Act were then considered because of the potential problems which a

claimant might have in establishing liability. The possibility of creating a

federal tort based on absolute liability for nuclear power catastrophes was

considered and rejected. Instead, new legislation was passed which provides

for a system of waivers of defenses. The waivers are to be contained in

indemnity agreements and may be required by the Commission to be incor-

porated in insurance policies or contracts. The net effect of the waivers

is to establish absolute liability. Specifically waived are:

(i) any issue or defense as to conduct of the claimant or fault of per-

sons indemnified, (ii) any issue or defense as to charitable or govern-

mental immunity, and (iii) any issue or defense based on any statute

of limitations if suit is instituted within three years from the date on

which the claimant first knew, or reasonably could have known, of his

injury or damage and the cause thereof, but in no event more than

ten years after the date of the nuclear incident.

By waiving defenses rather than establishing a federal tort or cause of action,

this statute is inadequate where no cause of action exists under state law.

In addition, the waivers do not apply to all cases of nuclear incident but

only to “extraordinary nuclear occurrences.” Thus, the waivers do not

solve the problem of preconception injuries. Even the extended statute

of limitations would be of no assistance where there was no original cause

of action under state law. The United States statute is thus distinguishable

97. Id. § 2210(e).
98. Green, supra note 86, at 489.
99. Id. at 488.
100. “Neither genetic injury nor life-shortening is presently adequately cognizable in

American courts as giving rise to liability.” Green, supra note 86, at 495. Green also

notes: “The genetic effects of radiation have generally been ignored by the AEC

and the Joint Committee in their pronouncements on nuclear power plant hazards.” Id. at

495 n.77.
101. Green, supra note 86, at 496.
103. See Green, supra note 86, at 497.
104. “The difficult problem of proving a causal link between a nuclear incident and
delayed radiation injury remains, as does the problem of financial compensation for

 genetic injury . . . ." Green, supra note 86, at 498 (emphasis added).
from the British statutes\textsuperscript{106} in which a statutory duty was explicitly created; here, the statute goes to the defenses rather than to the duty or cause of action itself.

Also important in federal statutory considerations are the extensive regulations which have been promulgated pursuant to the Atomic Energy Act of 1954.\textsuperscript{106} Detailed standards for protection against radiation have been established by the regulations\textsuperscript{107} which set permissible levels of radiation but caution that licensees should “make every reasonable effort to maintain radiation exposures, and releases of radioactive materials in effluents to unrestricted areas, as far below the limits specified . . . as practicable.”\textsuperscript{108} The regulations make provisions for injunctive relief, civil penalties for violations, and criminal punishment for willful violations.\textsuperscript{106}

The standards\textsuperscript{110} are relevant to tort liability when consideration is given to negligence per se and breach of statutory duty. Tort liability based upon violation of statute is well known in the law.\textsuperscript{111} A great majority of the courts hold that an unexcused violation of a statute, once it is determined to be “applicable,” is conclusive on the negligence issue.\textsuperscript{112} A minority of courts holds such violation to be only evidence of negligence.\textsuperscript{113} Generally, compliance with a statute or administrative regulations does not necessarily lead to an inference that there is no negligence.\textsuperscript{114} The same rules would seem to be as applicable with regard to radiation standards as with other regulations, i.e., compliance with governmental radiation regulations “should be accepted as evidence of having acted reasonably but should not be used as conclusive proof because there are too many variables in such a rapidly developing field.”\textsuperscript{115}

The implications for the plaintiff in a preconception injury case are significant. If the injured plaintiff’s ancestors were not exposed to any levels
of radiation greater than allowed by the standards, or if he cannot prove that they were so exposed, then his chances of recovery would seem to be nil, even assuming that a cause of action is recognized. By analogy to the law of workmen's compensation, this conclusion would appear to be as valid under a system of strict liability as under a system based on negligence. In workmen's compensation suits, proof that "the measured exposure has been within guide standards, unfortunately, has almost always meant a finding that the claimant's injury or disease, whatever its nature, could not have been an effect of radiation."116

The federal statute contains an express provision for cooperation with the states and coordination in the development of radiation standards.117 Thus, a consideration of state statutes at this point is appropriate. At the outset, it should be noted that the National Conference of Commissioners on Uniform State Laws has specifically promulgated a Model Nuclear Facilities Liability Act,118 but no jurisdiction had adopted the Model Act as of 1972.119

In spite of this, an examination of the Model Act is useful because of its relevance to the preconception injury problem. In particular, the problems faced by the plaintiff in a radiation injury suit are recognized by the Act, and the Act imposes strict liability on the operator of a nuclear facility "for an injury arising out of or resulting from a nuclear incident."120 Provisions are also made for an extended statute of limitations period.121 The language of the Model Act would at first appear broad enough to encompass the preconception injury problem;122 however, this expectation appears to be nullified by section 6, which makes it clear that the Act does not expand the types of injuries for which damages may otherwise be awarded.123 Thus, if recovery is denied for these injuries under current state law, recovery would also be denied under the Model Act.

State workmen's compensation statutes have been involved in a considerable number of radiation injury cases.124 Such statutes would appear, how-

116. O'Toole, supra note 53, at 761-62. The author also notes a "tendency to award compensation to a claimant who proves an exposure beyond guide limits even though his claim is considered in other respects a doubtful one." Id. at 762.
118. HANDBOOK OF THE NATIONAL CONFERENCE OF COMMISSIONERS ON UNIFORM STATE LAWS 228 (1961) [hereinafter cited as 1961 HANDBOOK].
119. HANDBOOK OF THE NATIONAL CONFERENCE OF COMMISSIONERS ON UNIFORM STATE LAWS 404 (1972).
120. 1961 HANDBOOK 231. "Nuclear incidents" and other terms are defined so as to limit the Model Act in its application to the more hazardous atomic energy activities. Id. at 224. Exceptions to the general rule of strict liability are made for injuries covered by workmen's compensation and for property damages on the site of the nuclear facility. MODEL NUCLEAR FACILITIES LIABILITY ACT § 2 (1961) [hereinafter cited as MODEL ACT].
121. This covers three years after the injured person knew or reasonably could have known the cause of the injury, or ten years from the date of the incident, whichever first occurs. MODEL ACT § 5. In the prefatory note the commissioners explicitly state: "Because of the delayed impact of the effects of radiation overexposure, the typical period of limitations is not apt to be adequate." 1961 HANDBOOK 227.
122. For example, it applies to "an injury arising out of or resulting from a nuclear incident." MODEL ACT § 2. Also, "person" is given a broad definition. MODEL ACT § 1(7).
123. MODEL ACT § 6, Comment.
124. See generally O'Toole, supra note 53, for a recent, exhaustive coverage of the workmen's compensation statutes and their relationship to radiation injuries. See also Hutton, Workmen's Compensation and Radiation Injury, 12 VAND. L. REV. 145 (1958).
ever, to be of little benefit to the plaintiff alleging preconception injuries, even if the exposure of the ancestor was work related, because the plaintiff is not the employee. Hence, neither the irradiated ancestor (unless he is otherwise disabled) nor the injured descendant may be able to recover under workmen’s compensation.

Other state statutory provisions which are relevant are the statutes of limitation which have already been discussed. The general conclusion as to these statutes is that they make it difficult if not impossible to recover "many meritorious claims arising from delayed manifestation injuries." Overall, it appears that current state and federal statutory provisions, and even such proposed legislation as the Model Act, are inadequate to cover the preconception injury; it also appears that the tendency of the meager existing case law on genetic injuries is toward denial of recovery because there is no cause of action. It is questionable, however, whether this result is inevitable, especially in view of the common law development of the rationale underlying the recovery of damages in prenatal or fetal injury cases over the last twenty-eight years. The conceptually sound premises of these cases provide a useful analogy which, by extension, may help solve the preconception injury problem.

III. A Significant Common Law Development: The Prenatal Injury Cases

It seems that elementary justice requires that recovery be allowed to the injured in mind or body who come into court and establish by a preponderance of the evidence that such impairment was cause by action of the defendant which, had it been toward the born, would be the basis of recovery.

These words, written in reference to the prenatal injury cases, would seem on principle to be equally applicable to the preconception injury problem under consideration. The preconception cases extend the time frame back before the point of conception, wherein, of course, lies the distinction between the two situations. It remains to be seen how significant this distinction is. One prefatory note is that the legal development with regard to prenatal injuries has been as rapid and as spectacular, and has occurred over basically the same time period, as the technological development in nuclear energy.

The literature is replete with discussions of the prenatal cases; however, discussion here is limited to a search for answers directly relevant to the

125. See notes 22-23 supra, and accompanying text.
126. Estep & Van Dyke, supra note 23, at 753.
128. The time frame for the prenatal injury legal development is basically 1946 to 1967, the year when Texas allowed recovery. Leal v. C.C. Pitts Sand & Gravel, Inc., 419 S.W.2d 820 (Tex. 1967). Prosser describes this development as “up till that time the most spectacular abrupt reversal of a well settled rule in the whole history of the law of torts.” PROSSER § 55, at 336.
129. See Prosser § 55 n.22, at 336 for a recent bibliography. See also Estep & Forgetson, supra note 1, at 28-34; ATOMS 236-41.
preconception injury problem. Dean White's introductory quotation suggests that there is such relevance. Also, Professor Keeton has noted with approval the prenatal case development as an example of creative continuity in tort law.\textsuperscript{130} Hopefully, this creative continuity can be achieved with respect to preconception injury as well.

The two principal reasons that were formerly given by courts for denial of recovery for prenatal injuries were: "First, that the defendant could owe no duty of conduct to a person who was not in existence at the time of his action; and second, that the difficulty of proving any causal connection between negligence and damage was too great, and there was too much danger of fictitious claims."\textsuperscript{131} The rule denying recovery in the prenatal cases was ultimately changed because of a clear recognition, based on medical knowledge, that there existed a separate legal entity, albeit in its mother's womb\textsuperscript{132} and a recognition that difficulty of proof of causation should not be an arbitrary basis for completely denying the plaintiff a cause of action.\textsuperscript{133}

If these standards are applied to the preconception case, it is obvious that it will be impossible to find a separate legal entity, and in fact this has been discussed as a basis for denial of recovery.\textsuperscript{134} Problems of proving causation are undoubtedly more difficult in the preconception injury cases; but by the same rationale as in the prenatal cases, this should not be asserted arbitrarily to deny the existence of a cause of action.

The tendency of the prenatal cases has been to extend the point at which to allow recovery to injuries occurring nearer to conception. The majority of courts have allowed recovery based on a viability criterion; some have said that the child must at least have been quick at the time of the injury.\textsuperscript{135} As a practical matter, almost all jurisdictions have allowed recovery even though the injury occurred during the early weeks of pregnancy, when the fetus was neither viable nor quick.\textsuperscript{136} It is perhaps significant that the concurring opinion in \textit{Hornbuckle}\textsuperscript{137} opposed this extension, particularly because of a belief that the reasoning might be extended even further back to the preconception case.\textsuperscript{138} Thus, although opposing such extension, this opinion recognizes the existence of an arguable basis for extension to preconception cases.

One of the most significant aspects of the prenatal cases is that the courts have been willing to accept scientific and medical proof as to the existence of the fetus and to discard old rules which denied recovery based on some arbitrary distinction. It would seem reasonable that the same attitude toward the preconception cases would overcome the arbitrary distinction of

\textsuperscript{130} Keeton, \textit{supra} note 10, at 485 n.51.
\textsuperscript{131} PROSSER \S 55, at 335.
\textsuperscript{132} "[T]he unborn child in the path of an automobile is as much a person in the street as the mother \ldots ." PROSSER \S 55, at 336.
\textsuperscript{133} \textit{Id}.
\textsuperscript{134} \textit{See} note 39 \textit{supra}, and accompanying text.
\textsuperscript{135} PROSSER \S 55, at 337. \textit{See} note 34 \textit{supra} for an explanation of the distinction between "quick" and "viable."
\textsuperscript{136} PROSSER \S 55, at 337. \textit{For a very recent case, see} Wolfe v. Isbell, 280 So. 2d 758 (Ala. 1973), \textit{in which the viability distinction is rejected.}
\textsuperscript{137} 212 Ga. 504, 93 S.E.2d 727, 728 (1956).
\textsuperscript{138} 93 S.E.2d at 729.
“no legal existence” and would result in at least a recognition of a cause of action: “[The courts] may follow scientific discoveries one step further and hold that so long as causation can be proved, compensation should be allowed, even though the radiation causing the abnormality occurred before conception.”

On a broader policy basis, a reason for the initial establishment of the no-recovery rule in the prenatal cases was the novelty of the claim submitted. There were simply no precedents, certainly none allowing recovery. Novelty of the claim is of particular relevance to preconception injuries. A leading opinion denying recovery for prenatal injuries was written by Mr. Justice Holmes. One factor resulting in denial of recovery was apparently the lack of precedent. Such a result has been criticized as follows:

[L]ack of precedent, in the sense of there being no favorably decided case on a fact situation similar in substantial detail to that before the court, is at most a half reason for denying an action. It is perhaps much less than that when there is no decision anywhere to the contrary and there are broad general principles of the common law which point to allowing such an action. It seems fair to say that this was exactly the situation in which the Massachusetts court found itself when it came to decide the Dietrich case. True, there were no cases allowing recovery for injuries sustained by an unborn child. But there was a broad common law rule which allowed recovery to those who suffered bodily injury because of the wrongful acts of another.

This discussion takes on particular significance when one considers that a primary reason given by the district court for denying a cause of action for genetic injuries in Jorgensen was that the court could find “no holding by any court that a child may recover for injury to the sperm of its male parent or the ovum of its female parent before the two unite in conception.”

All of this is not to say that caution should not be exercised or that a welfare theory of tort law should be adopted for these cases. The crux of the matter is that science clearly recognizes that such injuries may occur and that by analogy to the prenatal cases the law should also recognize their existence. “If the proof-of-causal connection obstacle can be surmounted and administrative difficulties can be met the law cannot afford to deny recovery for preconception injuries if a child is born and lives with a handicap created by defendant's radiation source under such circumstances that he would be liable if conception had already taken place.” As this suggests, allowance of a cause of action does not solve all of the problems in this area. Rather, an examination of the spectrum of possible solutions is necessary before forming any conclusions.

139. ATOMS 225.
141. White, supra note 127, at 390-91.
143. 336 F. Supp. at 962.
144. Estep & Forgetson, supra note 1, at 33.
IV. SOLUTION ANALYSIS

Implicit in a discussion of solutions to the preconception injury problem is a policy decision that this is a type of injury which society desires to compensate. This initial policy question should be decided without regard to the practical problems of proof. It has been suggested that if difficulty of proof prevents any workable solution now, "recovery should be denied only until scientific advances make it possible."\(^{145}\) It is submitted that on the basis of the foregoing discussion, the question of preconception injuries is potentially serious enough to warrant searching for a solution, and that a preliminary policy decision in favor of compensating this type of injury is reasonable.

The prenatal cases suggest that at least one approach to a solution is through the common law recognition of a cause of action. This results in the plaintiff's being allowed to prove his case rather than simply being denied a cause of action from the outset. However, the problems of proof of genetic injury are so great in most cases that the plaintiff would still effectively be denied recovery until scientific advances allow proof of causation. As has been seen, such developments do not appear likely in the near future.\(^{146}\)

Going beyond the initial policy decision to recognize the injury, three principal approaches to solution of the overall problem have been suggested: (1) imposition of strict liability; (2) extension of the statute of limitations; and (3) creation of a statistically based contingent injury fund.

Because of the difficulties in proving negligence in a radiation exposure situation, strict liability has been frequently proposed to assist the plaintiff.\(^{147}\) This may be by legislative action, as suggested in the Model Nuclear Facilities Liability Act;\(^{148}\) by a waiver of defenses, as under the federal Price-Anderson Act;\(^{149}\) or by extension of absolute liability under the common law.\(^{150}\) Under a strict liability rule, causation would clearly become the true legal issue to be met by the plaintiff.\(^{151}\) This is the greatest barrier facing the plaintiff in a genetic injury case, assuming that he has a cause of action. Thus, although strict liability could be of great benefit to plaintiffs in many radiation injury situations, its utility would be somewhat limited in the genetic injury situation.

Extension of the limitation period offers some hope to the plaintiff. Various periods have been adopted or proposed in an effort to solve the broader problems inherent in the delayed-effect radiation injury cases. The thirty-year period in the British statutes appears to be one of the longest

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145. Estep, supra note 13, at 263.
146. See notes 66-68 supra, and accompanying text.
148. See note 120 supra, and accompanying text.
149. See notes 101-102 supra, and accompanying text.
150. See ATOMS 684-86. The authors place more emphasis on a statutory solution than on a common law solution.
151. Cavers, supra note 147, at 670.
adopted.\textsuperscript{152} The Model Nuclear Facilities Liability Act provides for a maximum ten-year period.\textsuperscript{153} This has been specifically criticized as "unrealistic in view of current scientific knowledge of the delayed biological effects of nuclear radiation."\textsuperscript{154} Other periods have been proposed, generally calling for an overall limit together with a reasonable period after acquisition of knowledge of the injury in which to bring action.\textsuperscript{155} Although these are likely to help many radiation victims such as the plaintiff in \textit{LaPorte v. United States Radium Corp.},\textsuperscript{156} the preconception injury victim is still particularly faced with the problem of proving causation, and he may be barred even under the extended limitations period because the injury may not manifest itself for more than one generation. However, the interests of these claimants must be balanced against the interests of defendants who must counter these extremely stale claims. It appears that thirty years is a reasonable limitation even for genetic injuries, and should provide at least some relief for the next generation.

The factor which particularly compounds the difficulties in the genetic injury cases is the statistical nature of the injury. With a sufficiently large exposed population, it is possible to say that a significant number will be injured, but not to identify particular individuals who will be injured. A realistic solution must necessarily take this factor into consideration. Probably the most promising solution which has been proposed is the creation of a "contingent injury fund,"\textsuperscript{157} the basic theory of which is fairly simple:

\begin{quote}
[O]nce the fact and amount of irradiation and the responsibility for it are determined, however this is done, all of the defendants who irradiate others would contribute in proportion to the increased chances of some latent disease created by the radiation exposure legally charged to them . . . . [T]he fund should be sufficient to permit compensation of each exposed person who actually contracts the disease later. Those who are exposed but do not get the disease would recover nothing and the contributions made for them would be used to compensate fully those who do. This permits the law to provide compensation only for those who are damaged and to make a fair charge to each defendant based on the increased risk caused by him.\textsuperscript{158}
\end{quote}

The important result as far as the victim is concerned is that his problems of proof of causation are greatly diminished: "When the victim gets leukemia, for example, he would recover fully merely upon proof that he has the disease. Biological causation for his specific case would not have to be proved either at the initial determination of the fact of exposure and value of the injury should it occur, or at the time of onslaught of the disease."\textsuperscript{159} This has been described as the "only fair solution to a legal

\begin{footnotes}
\textsuperscript{152} See note \textsuperscript{82} supra, and accompanying text.
\textsuperscript{153} See note \textsuperscript{121} supra, and accompanying text.
\textsuperscript{154} Estep & Van Dyke, supra note 23, at 790.
\textsuperscript{155} See, e.g., \textit{ATOMS} \textsuperscript{724}, where a twenty-year over-all limitation period is proposed.
\textsuperscript{156} 13 F. Supp. 263 (D.N.J. 1935); see note \textsuperscript{11} supra.
\textsuperscript{157} See generally Estep, supra note 13, at 281-98 for a thorough discussion of the concept.
\textsuperscript{158} Estep, \textit{supra} note 13, at 281.
\textsuperscript{159} \textit{Id}.
\end{footnotes}
problem which is definitely emerging as the nuclear age progresses.\textsuperscript{160} It obviously requires a rather complicated legislative approach, however, which would represent a significant departure in the law. Perhaps the stimulus for legislatures to address such questions will be increased as nuclear energy uses increase, and some proposal similar to this will be adopted. The real significance of such proposals and their concomitant discussion, however, is that the problem is at least recognized in the legal community, and the application of a scientifically based solution is considered.

V. Conclusion and Forecast

It should be clear from the foregoing discussion that the problems of preconception injury pose interesting and puzzling questions in tort law. The fact that radiation is a major causative factor in genetic damage and preconception injuries tends to make the problems even more complex. Cases involving genetic damage from radiation have not reached the courts in the numbers which some writers had feared and predicted. Perhaps this is not so surprising when one considers the long-term nature of these particular injuries contrasted with the short time in which nuclear energy has been used to any significant extent.\textsuperscript{161}

Potentially the most disastrous peaceful use of nuclear energy is in large scale nuclear reactors, and all indications are that this usage will increase dramatically in the future.\textsuperscript{162} Potential exposure to radiation accidents will thus inevitably increase. With this increased exposure, and an increased public awareness of the hazards,\textsuperscript{163} it seems particularly likely that more suits alleging genetic damages will be brought. The recent \textit{Jorgensen} case is at least an indicator that plaintiffs and their attorneys are aware of the possibility of this approach.

Awareness and discussion of these problems now should make it easier for the courts to make the transition from prenatal to preconception concepts, and at least to allow the plaintiff to get into court with a cause of action and to have an opportunity to prove his case. The problem of proving causation will undoubtedly be the most troublesome one to be faced by the plaintiff, once he is allowed to assert a cause of action. Technological advances in genetics, although great, do not appear to offer the potential to prove genetic injury under the ordinary rules of causation because of the probabilistic or statistical nature of the injury. Even under a system of strict liability, this remains a major stumbling block which is likely to deny recovery in meritorious cases. The contingent injury fund, which takes into account the statistical nature of the injury, offers a promising legislative ap-

\textsuperscript{160} Estep & Forgetson, \textit{supra} note 1, at 52-53.
\textsuperscript{161} As an indication of this, the thirty-year limitation period contained in the British statutes, discussed in text accompanying notes 82-84 \textit{supra}, more than spans the entire nuclear era, 1945 to present.
\textsuperscript{162} One writer states that the Price-Anderson Act itself "encourages and permits industry to employ an extremely hazardous technology, fraught with the potential for catastrophe." \textit{Green, supra} note 86, at 506 (emphasis added).
\textsuperscript{163} \textit{See, e.g.,} Scientists' Institute for Public Information, Inc. v. AEC, 481 F.2d 1079 (D.C. Cir. 1973).
proach. If, however, the fate of the Model Nuclear Facilities Liability Act is any indication of the probability of success, then it would appear unlikely that such legislation will be enacted in the absence of more cases and public interest to provide an impetus.

A modest prediction of common law development would be that the courts will eventually extend the logic of the prenatal cases to the preconception cases and at least recognize a cause of action for such injuries. How soon this occurs will also depend on the volume of cases in which the question is raised before the courts; a large number of prenatal cases passed before the courts before they changed the old rules arbitrarily denying recovery for those injuries.

In any event, discussion of the problems should continue, even for those pragmatists who doubt the practical value of such discussion. This is a contemporary example in which application of Professor Keeton's "creative continuity" in tort law appears to be particularly appropriate. As stated above, "[s]ome imaginative thinking is indicated."164 The usefulness of such imaginative thinking need not be limited to the narrow issues involved here for "[t]he results of these studies might well have applicability . . . in other areas where legal systems and legal rules must solve new problems created by scientific and technical advances."165

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164. ATOMS 30.
165. Estep & Forgetson, supra note 1, at 53.