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PROBABILISTIC CAUSATION IN TORT LAW

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The traditional requirement of proof of causation on a balance of probabilities is being challenged, in cases ranging from toxic pollution to medical negligence, by tort plaintiffs whose success depends on acceptance of "probabilistic" rather than "particularistic" evidence based on epidemiological and other statistical data falling below 50% probability. Courts in various jurisdictions have experimented with devices such as reversal of onus of proof against negligent defendants, recognition of mere risk of injury as a cause of action and damages proportioned to the degree of probability or chance. Recent pronouncements by the House of Lords oppose this trend.

Dans les affaires de délits allant de la pollution toxique à la négligence médicale, les plaignants dont le succès dépend de l'admissibilité de preuves basées sur des données épidémiologiques ou autres données statistiques dont la probabilité n'atteint pas 50%, preuves jugées sur leur probabilité plutôt que sur les faits allégués, remettent en question la nécessité traditionnelle de preuve de causalité basée sur la prépondérance des probabilités. Certains tribunaux de diverses compétences ont eu recours à l'utilisation de moyens tels que le placement du fardeau de la preuve sur les défendeurs négligents, l'admission d'un simple risque de préjudice comme cause de procès ou les dommages-intérêts accordés en proportion du degré de probabilité ou de risque. La chambre des Lords dans ses décisions récentes rejette cette tendance.

Introduction

The traditional test for the burden of proof of causation in tort is proof on a balance of probabilities or "more probable than not". This has been found mostly adequate in coping with the random accidents involved in typical tort litigation of the past. Although vaguely suggestive of a

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scale, there would be rarely evidence for any fine-tuning. Indeed, the task of weighing the evidence is largely intuitive and, to the extent of being transmitted to a jury, its conclusion does not even call for any explanation or justification.¹ Although spoken of as the "51% rule", there is no pretense that such scale is a useful guide; indeed there are deprecating judicial expressions that the test, properly understood, calls for more than "a mere mechanical comparison of probabilities independently of any belief in its reality", the tribunal "must feel an actual persuasion of . . . [a fact's] occurrence or existence before it can be found".² Sample testing suggests that the balance is generally understood by judge and jury to require a much greater tilt, more like 75%.³

This traditional approach has come increasingly under challenge in dealing with non-traumatic injuries such as man-made diseases linked to dust, deafness, dermatitis, asbestosis, or linked to chemical products like Thalidomide, DES, and Agent Orange. Another group of cases involves medical procedures depriving patients of a chance of survival or cure. It is often difficult to prove medical causation by "particularistic" evidence, that is direct, anecdotal, non-statistical evidence from the mouth of witnesses. Modern scientific epistemology itself rejects the Newtonian concept of physical causation; instead preferring causal concepts to set up hypotheses, and testing these by inductive reasoning and probabilistic evidence.⁴ Courts would therefore be merely accommodating themselves to the new scientific language appropriate to such evidence by accepting "probabilistic" assessment as to the likelihood of the implicated agent's contribution to the plaintiff's injury, based primarily on epidemiological or other statistics. Their reaction to such "bare" or "naked" statistics has been one of continuing discomfort and suspicion, but such data have not been ruled out at least in the absence of other evidence. In some of the cases such evidence implicates the defendant as well as other causes without reaching a magical 51% probability. For courts the problem has been how to adjust their familiar routines to this new knowledge and technology.

The dilemma is that insistence on the traditional criteria of proof will deprive many victims of any tort recovery. This result offends not only one's sense of equity as between an innocent plaintiff and multiple

¹ This is accentuated by the modern tendency of trial and appellate judges, in passing on the sufficiency of the evidence, of giving increased leeway to the jury.

² For example, *Briginshaw v. Briginshaw* (1938), 60 C.L.R. 336, at p. 361 (Aust. H.C., Dixon J.).

³ See R.J. Simon and L. Mahan, *Quantifying Burdens of Proof* (1970-71), 5 *Law & Soc. Rev.* 319.

⁴ See T.A. Brennan, *Causal Chains and Statistical Links: The Role of Scientific Uncertainty in Hazardous-Substance Litigation* (1987-88), 73 *Cornell L. Rev.* 469.

defendants whose negligence contributed in some (albeit uncertain) measure to his injury; it also leads to serious under-deterrence of the harmful activity. On the other hand, the same sense of equity shrinks from holding a defendant liable for the whole harm, although part of it was, or may have been, due to other independent causes, some perhaps "background risks" of non-culpable origin. Least complicated in terms of equity are cases where the negligence of two or more defendants alternatively or cumulatively caused the injury. Rather than denying plaintiffs all recovery obedient to the "more probable than not" standard of proof, several alternatives have suggested themselves. One is to lower the conventional standard and accept exposure to the risk of injury instead of actual injury as a compensable event. Another is to limit liability in an amount proportionate to the risk created by each individual agent. Both of these modifications have gained reluctant and by no means universal acceptance by Anglo-American courts. Failing an unlikely legislative prescription, they represent the outer limit of what judicial craft can do to modify the legal rule without too seriously straining the bounds of the traditional tort system.

An alternative solution, particularly for hazardous substance injuries, is to assign claims to a regulatory agency, perhaps on lines like Superfund (which does not, however, concern itself with compensation for personal injuries). Thus it has been suggested determinations concerning causation, attributable risks and exposure be entrusted to a Science Panel which could bring scientific epistemology to the task.⁵ For example, the compensation scheme for pharmaceutical injuries in Sweden⁶ accepts statistical causal relationships as generally sufficient. Finally, Jane Stapleton, pessimistic about all line-drawing, has taken the view that "only a non-tort scheme based on disability rather than cause would help overcome conceptual and practical problems faced by victims of man-made disease in recovering damages in tort".⁷

Causal indeterminacy is encountered in two aspects: first, in what might be called the problem of the indeterminate defendant. It is often

⁵ Brennan, *ibid.*

⁶ C. Oldertz, Security Insurance, Patient Insurance, and Pharmaceutical Insurance in Sweden (1986), 34 Am. J. Comp. L. 635, at p. 648. But under the German strict liability statute for dangerous pharmaceuticals, the traditional strict proof is assumed to apply: A. Sander, Arzneimittelrecht, Erl. para. 84 AMG p. 15 (1977-89); H. Kullmann and B. Pfister, Produzentenhaftung I, 34-38 (1988); Wolter, Haftregelung des Neuen Arzneimittelgesetzes, 29 Betrieb 2001, at p. 2003 (1976).

⁷ J. Stapleton, Disease and the Compensation Debate (1986), p. 3. The New Zealand Accident Compensation System would assist part of the way in so far as it obviates identifying the cause of an injury, provided likely alternatives are all linked to an "accident". It would fail, however, in cases like *Wilsher v. Essex Area Health Authority*, [1988] 2 W.L.R. 557, [1988] 1 All E.R. 871 (H.L.), where one of the two alternative causes is non-"accidental".

the case that all that can be said with some confidence is that the defendant negligently created a risk of the injury rather than that he caused the injury itself. This uncertainty may be due to the fact that it cannot be established on a balance of probability who of several actors caused the injury or whether the defendant's negligence made any difference, given other "background risks". Secondly, there is the problem of the indeterminate plaintiff. Especially in pollution cases, the plaintiff can often rely only on general statistical information to suggest that the defendant's emission merely increased the number of sufferers beyond those who would have contracted the disease in any event from other human agents or perhaps legally non-responsible background risks. Does this sufficiently identify the plaintiff as one injured, rather than merely endangered, by the defendant?

I. *The Indeterminate Defendant*

A. *The Sindell Case*

An example of the first type of case, that of the indeterminate defendant, is the now celebrated DES case of *Sindell v. Abbott Laboratories*.⁸ The plaintiff was one of several hundred young women whose mothers had, while pregnant, ingested the drug which was assumed to have been responsible for vaginal cancerous lesions that appeared in the daughters after puberty. Because of the long latency in many of the cases it could no longer be determined which one of more than 200 manufacturers had produced the one their mothers had taken. The defect being in the generic make-up of the drug, any one (or more) of these could have been the culprit.

1. *Alternative Liability*

The plaintiff could, and did, invoke several precedents for relaxing the traditional standard of proving the identity of the culpable defendant on a balance of probabilities. The earliest, so-called "alternative liability", theory originated in the case of *Summers v. Tice*,⁹ followed in Canada in *Cook v. Lewis*¹⁰ on substantially similar facts, where two hunters, using shotguns, fired simultaneously in the direction of the plaintiff, one shot putting out his eye. The court reversed the conventional burden of proof, holding that where a single injury had been inflicted by one or the other of two negligent defendants, but the plaintiff cannot prove which one, it was for each of them to exculpate himself by estab-

⁸ 26 Cal. 3d 588, 607 P. 2d 924 (Cal. S.C., 1980).

⁹ 33 Cal. 2d 80, 119 P. 2d 1 (Cal. S.C., 1948).

¹⁰ [1951] S.C.R. 830, [1952] 1 D.L.R. 1.

¹¹ See generally L.H. Tribe, *Trial by Mathematics: Precision and Ritual in the Legal Process* (1970-71), 84 Harv. L. Rev. 1329.

lishing on a balance of probabilities that he was not the one. The rationale of this decision was that the equities between an innocent plaintiff and two negligent defendants, each one of whom could have caused his injury, favour placing the risk of proof uncertainty on the latter.

It has been questioned whether this principle should be confined to two defendants. In the case of two, the odds on either one being the culprit are 50:50. True, judgment against either one will be for 100% of the loss (the "joint and several liability" rule), but contribution could ensure that each bore 50% of the loss, so that the extent of each one's liability would in effect reflect the probability of his having caused the injury. Matching the extent of liability to the degree of probable causation is an accepted rule for assessing damages for *future* contingencies. Thus the chance of future arthritis or epilepsy, even if less than "more probable than not" (51%?), justifies an award, not for 100%, but for the discounted value of its probability (which may be more or less than 50%). Applying the same rationale to proof uncertainty on causation is therefore not as great a departure from conventional premises as might first have appeared. The distinction has been defended with the argument that future loss is always uncertain, while past loss is, at least in theory, susceptible of ascertainment. But it may be questioned whether one should adhere to it when in a particular case the assumption of ascertainability fails. Proportional liability would also dispel concern if the rule in *Summers v. Tice* were extended beyond two defendants. Although the chance of any one being the responsible hunter would in that event decrease below 50:50, each one's share of liability would also be reduced proportionately, thus not affecting the equity of the formula.

The preceding argument assumes, however, that all possible defendants are before the court and financially responsible, for otherwise proportional distribution might be impaired. It was for this reason that the California court declined to apply the principle against the five DES manufacturers sued in the *Sindell* case.

A major objection sometimes voiced against *Summers v. Tice* is the unfairness of relying on "bare" statistical evidence for identification.¹¹ This objection has certainly precluded conviction in criminal cases.¹² So also Lord Mackay in *Hotson v. East Berkshire Area Health Authority*,¹³ a case to be developed later,¹⁴ cited an American hypothetical of a town in which there were only two taxi companies, one having three blue cabs, the other one yellow cab. If a person was knocked down by a cab whose colour could not be observed, it would be wrong to hold the first

¹² For example, in the well-known case of *People v. Collins*, 68 Cal. 2d 319, 66 Cal. Rptr. 497, 438 P. 2d 33 (Cal. S.C., 1968).

¹³ [1987] A.C. 750, [1987] 2 All E.R. 909 (H.L.).

¹⁴ *Infra*, at p. 672 *et seq.*

company liable solely because of the seventy-five per cent statistical probability. But *Summers v. Tice* is not such a case for two reasons: first and most important, because both defendants were independently proven to have been negligent; secondly, because—as already emphasized—both were before the court and contribution would assure that they would share the loss.

It is not a necessary condition, any more than for the procedural rule of *res ipsa loquitur*, that the defendants are in a better position than the plaintiff to know what actually happened. On occasion, the desire to loosen the defendant's tongue has played a role in imposing the burden of exculpation on him. As in the famous decision of *Ybarra v. Spangard*¹⁵ where, in order to break the "conspiracy of silence", the burden of proof was shifted to all members of a surgical team to explain what accounted for an external injury to the patient's shoulder during an appendectomy. Since none could explain, all were held liable. The converse, however, does not apply. Thus in the case of the hunters, neither one had any more knowledge than the victim as to who had caused the injury. So also in the DES litigation, the fact that the manufacturers were unable to identify which, among them, had produced the drugs taken by the plaintiff's mother (indeed, if anything, the latter would have been in the better position to remember) did not by itself preclude the application of this principle.

2. Concerted Action

Next is the classical theory of joint liability that persons acting in concert are held "jointly and severally" liable for each other's acts performed pursuant to their agreement to commit a tort against the plaintiff. The latter is therefore absolved from identifying who of the conspirators actually caused his injury. Although the stock situation contemplates an agreement to injure the plaintiff intentionally, its application to other tortious conduct, while rare, is not in serious doubt. Thus an agreement to engage in conduct fraught with unreasonable risk to the plaintiff will be sufficient, as would also perhaps concerted action fraught with strict liability, like marketing dangerous drugs or other defective products under American law.

Under what condition this theory could be invoked against manufacturers of a generic drug has been considered with varying results in DES litigation. The *Sindell* court, like most other courts following it, declined to find a common plan or design merely in parallel or imitative conduct. True, express agreement is not necessary and all that is required is a tacit understanding. But mere reliance on each other's testing and promotion methods did not qualify, since that is a common practice in industry and would render virtually any manufacturer liable for the defec-

¹⁵ 25 Cal. 2d 486, 154 P. 2d 687 (Cal. S.C., 1944).

tive products of an entire industry even if he could demonstrate that the injurious product was not made by himself.

A forerunner of enterprise liability applied against multiple manufacturers was the ambiguous decision in *Hall v. E.I. Du Pont de Nemours*.¹⁶ In one of two consolidated cases thirteen children had been injured in separate incidents by blasting caps. Being unable to identify the particular manufacturer, the plaintiff sued six domestic producers, comprising virtually the whole industry, with the complaint that they had all failed to attach a suitable warning, that they knew about the risk but jointly decided against labelling and lobbied against it. Weinstein J. held that these allegations stated a cause of action for joint liability based on joint control of the risk. It was sufficient that the defendants, though acting independently, had adhered to an industry-wide practice with regard to the safety features of the blasting caps. Despite this liberal opening to parallelism, the court hedged in two respects which departed from the traditional theory of joint tortfeasorship. First, it allowed exculpation to any defendant who could prove that he did not manufacture the cap that injured the plaintiff. Secondly, it cautioned against application to a large number of producers. Moreover, the judge later unravelled his own decision by remanding the individual cases to different districts where the accident had occurred.

In DES litigation, the *Hall* principle of enterprise liability has been consistently rejected on the ground that the fact that hundreds of drug companies entered and left the market over many years fatally weakened the assumption that the defendants jointly controlled the risk. In the *Agent Orange* case,¹⁷ where only seven manufacturers were involved, the same judge who decided *Hall* declined to find parallelism merely in a deliberate failure by all defendants to reduce the dioxin level of the herbicide used by the United States forces in Vietnam. It showed only that the defendants had not taken adequate action, not an industry-wide decision to take inadequate action. On the other hand, parallelism would apply to an understanding among the manufacturers to keep the government in the dark about the danger of dioxin.

3. Market Share

The most innovative theory was launched by the California court in *Sindell*.¹⁸ Having rejected all the precedents as unsuitable for application against the more than 300 manufacturers of DES because they would have exposed each of them to joint and several (100%) liability for every injury caused by a defective generic drug, the court discerned a

¹⁶ 345 F. Supp. 353 (E.D.N.Y., 1972).

¹⁷ *In re 'Agent Orange' Product Liability Litigation*, 597 F. Supp. 740 (E.D.N.Y., 1984).

¹⁸ *Supra*, footnote 8.

more equitable solution in limiting each manufacturer's liability merely to his market share. That way, when all claims had been satisfied, no one defendant would have had to pay for more injuries than were statistically attributable to him.¹⁹

A number of objections have been raised against this solution. Some of these are technical, for example the problem of finding "the market". By far the most formidable is that it departs from the prior art not merely by lacking all precedent but by being incompatible with the traditional notion of tort as a system of individual responsibility. This was not corrective but distributive justice. Despite the court's disavowal, it was indeed an industry-wide liability, which did not conform to basic notions of individual justice. Such a break from the whole tradition of our culture should be at best a program for legislation, not for judicial reform.²⁰

The decision, however, may be defensible in terms of economic efficiency. It satisfies what Guido Calabresi has called "causal linkage" or elsewhere is called "probabilistic linkage".²¹ A specific act is probabilistically linked to a specific injury, whether or not it contributed to it, if the occurrence of the act is believed to *increase the chances* that the injury will also occur. This concept which should be accepted as an alternative or even preferable test of causation, as Calabresi contends, is based on the economic theory that maximization of social wealth is best served by reducing accidents by collective or market deterrence.²² A defendant should be held liable for a particular injury if and only if this will create, *ex ante*, incentives for the defendant and others to act more efficiently in the future. The traditional concept of causation does not serve this goal as well. For example, negligence that does not result in injury entails no liability nor does negligence when proof of causation falls below the level of "more probable than not". That is because the

¹⁹ *Brown v. Superior Court*, 44 Cal. 3d 1049, 751 P. 2d 470 (Cal. S.C., 1988), clarified that the defendants' liability was several, not joint. The very reason for rejecting the *Summers v. Tice* analogy, which would have imposed joint and several (100%) liability was that, while in *Summers* each defendant could have caused the whole (single) injury, no one defendant in *Sindell* could have caused all the injuries.

²⁰ This insight was undoubtedly behind the subsequent gutting of *Sindell* by the reformed court (three justices having been replaced by popular vote). *Brown v. Superior Court (Abbott Laboratories)*, *supra*, footnote 19, held that DES could not be attacked for design defect, being a prescription drug certified by the FDA. Earlier *Mullen v. Armstrong World Ind.*, 246 Cal. Rptr. 32 (Cal. App. 1 Dist., 1988), had held that *Sindell* was inapplicable to asbestos, not being "generic" because of its widely varying ranges of toxicity.

²¹ G. Calabresi, *Concerning Cause and the Law of Torts* (1975-76), 43 U. Chi. L. Rev. 69. For a sympathetic analysis of English pre-1984 case law (now largely overtaken) in terms of what the authors prefer to call "actuarial causation", see J.D. Fraser and D.R. Horwarth, *More Concern for Cause* (1984), 4 Leg. St. 131.

²² See G. Calabresi, *The Costs of Accidents: A Legal and Economic Analysis* (1970).

traditional concept of causation is individualistic and backward looking, as is the corrective theory of tort law which calls for restoration of the pre-accident equilibrium.²³ By contrast, the economic orientation of tort policy, directed to collective social goals, is forward looking, and can therefore be content with proof that the defendant's conduct merely entailed a risk of injury rather than insist that the risk actually resulted in proven injury.

B. *Is Creating Risk Sufficiently Causal?*

The aforementioned risk theory also enjoyed some vogue for a time in England, though influenced more by a view of the comparative equities between a negligent defendant and an innocent plaintiff than by any abstract theory of welfare economics. It surfaced in a case where there were two sources of risk, each independently capable of producing the injury, but their relative contributions could not be assessed. In *McGhee v. National Coal Board*,²⁴ an employee was exposed at his working site to brick dust with a risk of dermatitis, for which the employer was found not responsible. The employer was, however, negligent in not providing after-work showers with the result that the employee was at risk for an additional period and at an increased risk because of the effect of wind and weather on his sweaty, dust-caked face. But experts were unable to estimate the relative contributions to the total risk of these two causes. Nonetheless the House of Lords allowed the plaintiff to recover on the basis (per Lord Wilberforce) that, on these facts, no useful distinction could be drawn between a source materially contributing to the risk of dermatitis and a source materially contributing to the dermatitis itself. In effect, therefore, the plaintiff succeeded without proof that more probably than not it was the negligent source that had caused his injury.

Commentators were rather puzzled by this decision.²⁵ One reason was the court's failure to distinguish clearly between alternative and cumulative causes, by relying on its own earlier decision in *Bonnington Castings Ltd. v. Wardlaw*,²⁶ a case of cumulative causes—the plaintiff's lung condition being the result of the combined effect of work-place dust from two sources, for only one of which the defendant was responsible. In a more recent case, *Wilsher v. Essex Area Health Authority*,²⁷

²³ See R.W. Wright, *Actual Causation vs. Probabilistic Linkage: The Bane of Economic Analysis* (1985), 14 J. Leg. St. 435.

²⁴ *McGhee v. National Coal Board*, [1973] 1 W.L.R. 1, [1972] 3 All E.R. 1008 (H.L.).

²⁵ For example, E.J. Weinrib, *A Step Forward in Factual Causation* (1975), 38 Mod. L. Rev. 518.

²⁶ [1956] A.C. 613, [1956] 1 All E.R. 615 (H.L.).

²⁷ *Wilsher v. Essex Area Health Authority*, *supra*, footnote 7. The case is considered, *infra*, p. 670 *et seq.*

Lord Bridge sought to justify *McGhee* as having been based on an inference that the defendant's fault not merely increased the risk of dermatitis but had actually contributed cumulatively to the causation of dermatitis. This explanation is weakened, however, by the absence of any reason for drawing an inference of cumulative rather than alternative causation.²⁸

Moreover, the assumption underlying *Wardlaw* and *McGhee* (as interpreted), that a defendant could be made to pay for part of the total loss for which the plaintiff was unable to establish his cause of responsibility beyond that his negligence increased an already existing risk, has often come up against a court's sense of fairness to defendants. A way out was by accepting a crude estimate of the respective contributions, in effect treating the damage as divisible, for example into separate time periods or volumes of pollutants.²⁹ But where this escape is not possible on the evidence, *Wardlaw* and *McGhee* may be viewed as compromising the orthodox requirement of causation for the sake of compensating plaintiffs against defendants who at all events had negligently increased a risk of the injury, though their precise contribution to the injury remains unproven. This inclination, or temptation, was the stronger when the alternative risk was of the same kind as the defendant's (both being the risk of dust which could be treated as cumulative on a common sense view), even more when the alternative cause was also under the defendant's control as in *Wardlaw* and *McGhee*.

Such however was not the case in *Wilsher v. Essex Area Health Authority*,³⁰ where a new-born baby suffered incurable damage to the retina, which could have been caused either by its premature birth or excessive oxygen administered by the defendant hospital. The dimension of either risk was unknown, but the plaintiff argued that, just as in *McGhee*, it was sufficient merely to show that the defendant's negligence had increased the risk before the burden of proof shifted to the defendant. This contention was rejected by the House of Lords.

That proof of causation in medical cases is especially difficult for patients has been a subject of concern voiced on numerous occasions. The Pearson Report (Royal Commission on Civil Liability and Compensation for Personal Injury) in 1978 noted a proposal to reverse the onus of proof but agreed with the fear, often expressed in England, that it would increase claims, many of them groundless, and result in an increase of defensive medicine.³¹ German law, to which comparative lawyers often

²⁸ J. Stapleton, *The Gist of Negligence: Part II* (1988), 104 *Law Q. Rev.* 389, at p. 404.

²⁹ For example, *Gray v. Smiths Shiprepairers*, [1984] Q.B. 405, [1984] 1 All E.R. 881 (Q.B.D.); *Wallhead v. Ruston & Hornsby Ltd.* (1973), 14 K.I.R. 285 (Q.B.D.).

³⁰ *Supra*, footnote 7.

³¹ Royal Commission on Civil Liability for Compensation for Personal Injury, Cmnd. 7054-1 (1978), para. 1336.

look for answers, reverses the onus of proof against doctors guilty of gross error in treatment ("grober Behandlungsfehler") and is otherwise rather sympathetic to a form of *res ipsa loquitur* ("Anscheinbeweis") which, as in California,³² reverses the burden of producing evidence though not the burden of proof.³³ The first mentioned rule is justified on grounds of equity, all the more because the physician's very fault created the difficulty of proof.³⁴ Suggestively enough, the German Civil Code³⁵ itself places the onus of disproof on negligent defendants in cases of alternative liability like *Summers v. Tice*.³⁶

In *Wilsher* the alternative background risk had been of innocent origin in the sense of not connoting negligence by a third party. But what if the alternative source was culpable as in *Summers v. Tice*, the case of the two hunters? In *Fitzgerald v. Lane*³⁷ a jaywalker was hit successively by two cars, but there was no balance of probability whether one or the other or both had caused his tetraplegia. The Court of Appeal, by a majority, relying on *McGhee*, as it had just done in *Wilsher* prior to its reinterpretation by the House of Lords, held both drivers liable. It is arguable that the plaintiff's equities here overwhelmed the defendant's, for unlike the situation in *Wilsher*, where the actual cause (for all one knew) might just as well have been innocent as guilty, here both defendants were negligent so that neither could contend that to allow recovery would conceivably give the plaintiff a windfall. Rather, to deny recovery would let him—to coin a phrase—fall between two guilty tortfeasors. Moreover, if *Wilsher* could be already criticized for under-deterrence, its extension from innocent to guilty alternative risks could be all the more.

The situation bears comparison with that of *supervening* alternative causes. In *Baker v. Willoughby*³⁸ the plaintiff in 1964 suffered a severe permanent injury to his leg as a result of the defendant's negligent driving; in 1967 he was shot in the same leg during a hold-up, and his leg

³² Evidence Code, s. 646.

³³ See O. de Lousanoff, *Facilitations of Proof in Malpractice Cases* (1982), pp. 98-108; D. Giesen, *Arzthaftungsrecht - Medical Malpractice Law* (1981), p. 131; W. Wussow, *Unfallhaftpflichtrecht*, (13th ed., 1986), pp. 858-859.

³⁴ This was adopted as a sufficient ground in *Haft v. Lone Palm Hotel*, 3 Cal. 3d 756, 91 Cal. Rptr. 745, 478 P. 2d 465 (Cal. S.C., 1970).

³⁵ B.G.B. para. 830 I. On this, and its application to *Sindell*, *supra*, footnote 8, see T. Bodewig, *Probleme alternativer Kausalität bei Massenschaden*, 185 AcP 505 (1985); A. Pfeifer, *Produktfehler oder Fehlverhalten des Produzenten* (1987), pp. 214-221.

³⁶ *Supra*, footnote 9.

³⁷ [1987] Q.B. 781, [1987] 2 All E.R. 455 (C.A.). The House of Lords allowed an appeal on unrelated grounds, [1988] 3 W.L.R. 356, [1988] 2 All E.R. 961.

³⁸ [1970] A.C. 467, [1969] 3 All E.R. 1528 (H.L.). Followed in *Hicks v. Cooper* (1973), 41 D.L.R. (3d) 454, [1973] 1 O.R. 221 (Ont. C.A.); and see U. Wagner, *Successive Causes and the Quantum of Damages in Personal Injury Cases* (1972), 10 Osg. H.L.J. 369.

had to be amputated. The House of Lords held that the defendant's responsibility did not cease after the amputation but remained a concurrent cause of the plaintiff's loss. To say that the amputation relieved the plaintiff of his stiff leg lost sight of the fact that his claim was for loss of earning capacity which had not been obliterated, but rather increased, by the amputation. Later the House of Lords disavowed this causal approach and preferred to explain the decision at best by the perceived inequity of letting the victim fall between two tortfeasors. It had no bearing on a supervening cause of innocent origin as in *Jobling v. Associated Dairies Ltd.*³⁹ In that case the plaintiff first sustained a back injury in an industrial accident caused by the defendant's negligence and was later found suffering from an unrelated condition that proved totally disabling. To ignore the later event would have been incompatible with the established principle of discounting the vicissitudes of non-compensable events; here the vicissitude of developing a disabling disease in the future had indeed already become a fact by the time of trial.

Though *Baker v. Willoughby* is perhaps a vulnerable authority, the case for applying the culpable/non-culpable distinction is stronger in the *Fitzgerald/Wilsher* situation where otherwise the plaintiff would have to absorb the whole, not just part of, the loss. Moreover, it does not involve over-deterrence, as *Baker* arguably does.⁴⁰ For was not the risk in *Baker* of being shot at least as random as the chance of disease in *Jobling*? Besides, a claim against the criminals was as forlorn as blaming fate for the disease.

C. Discounted Liability: The Hotson Argument⁴¹

In the DES case of *Sindell*,⁴² it will be recalled, the California court was prepared to hold the defendants liable not for the whole injury but only for the proportion corresponding to their respective market shares. It waived the orthodox requirement of proof of causation on a balance of probabilities in favour of the mere chance that the particular defendant's product had been causal. And instead of holding him liable for the whole injury, in effect it discounted his liability by the statistical chance of his being the actual cause. A similar proposition was advanced by the plaintiff and accepted by the Court of Appeal in *Hotson v. East Berkshire Area Health Authority*.⁴³ The plaintiff had sustained a hip injury in a fall with a high risk of vascular necrosis. That risk was increased by the

³⁹ [1982] A.C. 794, [1981] 2 All E.R. 752 (H.L.).

⁴⁰ See especially Fraser and Howarth, *loc. cit.*, footnote 21.

⁴¹ Adopting Stapleton's (*loc. cit.*, footnote 28, at p. 390) naming of the Court of Appeal ratio in *Hotson v. East Berkshire Area Health Authority*, [1987] A.C. 750 (C.A., H.L.), [1987] 2 All E.R. 909 (H.L.), [1987], 1 All E.R. 210 (C.A.).

⁴² *Supra*, footnote 8.

⁴³ *Supra*, footnote 41.

defendant's negligent delay in treating the symptoms of the disease. The court accepted expert testimony which put the risk of the original, innocent cause at 75% and that of the malpractice at 25%, and awarded the plaintiff 25% of his damages. The plaintiff had stated a good cause of action for loss of a chance to avoid the necrosis, a loss that ought to be compensable in tort just as loss of a chance had been recognized in contract.

The House of Lords rejected this approach and insisted on the necessity of proof on a balance of probabilities, that is more than fifty per cent, that timely treatment would have avoided the necrosis. Lord Bridge discerned "formidable difficulties" in accepting loss of a pure chance as compensable. Lords Mackay and Ackner considered that the chances of necrosis had to be considered before the defendant's negligence; those chances being 75%, the plaintiff was "doomed" and therefore never had a 25% chance of recovery, properly (legally?) speaking. This argument failed to do justice to the plaintiff's case; viz. that his loss, which he *had* established on a balance of probabilities, was of the chance of avoiding necrosis rather than the necrosis itself.

One may suspect that one of the reasons for their Lordships' resistance to recognizing loss of chance as an actionable tort was their aversion to speculative claims.⁴⁴ Once admitted in a case like *Hotson*, the argument could support a claim even before necrosis had set in.⁴⁵ Yet, as previously mentioned, it has long been accepted that the chance of future increased injury is compensable, such as the possibility of future arthritis or epilepsy developing from injuries in an accident. What is more, compensation is discounted in such cases by the probability of its occurrence: the chance need not exceed 50% nor, if it does, are damages assessed at 100% on the assumption that the injury will occur.⁴⁶

Also, loss of chance has been specifically recognized as a compensable loss once a cause of action has been independently established. For example, a model deprived in breach of contract of an opportunity to enter a competition was awarded damages proportionate to the chance of success she had lost.⁴⁷ On occasion, this principle has also been applied to actions in tort, as when a professional golfer suffered injury to his hand and was unable to compete in tournaments; he recovered for his lost chance of income and reputation.⁴⁸ To distinguish these situations

⁴⁴ Stapleton, *loc. cit.*, footnote 28, at p. 395.

⁴⁵ Two of the judges in *Hotson* would have awarded only nominal damages.

⁴⁶ See *Davies v. Taylor*, [1974] A.C. 207, at pp. 212-213, [1972] 3 All E.R. 836, at pp. 838-839 (H.L.), per Lord Reid.

⁴⁷ *Chaplin v. Hicks*, [1911] 2 K.B. 786 (C.A.).

⁴⁸ *Mulvaine v. Joseph* (1968), 112 Sol. J. 927 (Q.B.D.). Canadian decisions to the same effect are noted by K. Cooper-Stevenson and I. Saunders, *Personal Injury Dam-*

from cases like *Hotson* on the ground that they deal with quantification of damages, not with causation, does not make the one less speculative than the other. Or does a claim become more believable once some unrelated threshold injury has been proven? If a mere breach of contract is sufficient, why not also a defendant's negligence?

Nor does loss of the chance of economic profit appear to be ruled out as a cause of action in the limited, but increasing, situations where liability for negligence can be founded on pure economic loss, for example where a negligent representation has deprived the plaintiff of bidding on a valuable contract or where, as in the *Takaro* case,⁴⁹ the defendant's negligence in refusing the grant of a license deprived an investor of the chance of his business ever becoming profitable. Such situations are really indistinguishable from breach of contract, previously noted. Moreover, in the commonly recurring situation of a client suing his solicitor for failing to commence an action in time, damages for loss of the chance of winning such action have been consistently awarded. Earlier cases, it is true, proceeded on the view that such claims could only be based on breach of contract,⁵⁰ but the practice has not changed since the cause of action became recognized as also sounding in tort. Whatever view might now be taken if the matter were one of first impression, the relation engendered by the assumption of professional services is now acknowledged to raise a duty in tort not to cause the client economic loss.⁵¹ Loss of a chance of successful litigation is such a loss.⁵²

In sum, all that *Hotson* interdicted was the attempt, in a case where the cause of action depended on physical injury, to circumvent proof of such injury by proof of a lost chance to avoid it.⁵³ The distinction may

ages in Canada (1981), pp. 93-94. Among more recent cases see: *MacKay v. Franks* (1989), 56 D.L.R. (4th) 346 (P.E.I.S.C.) (horse winning races); *Hearndon v. Rondeau* (1984), 54 B.C.L.R. 145 (B.C.C.A.) (becoming helicopter pilot).

⁴⁹ *Takaro Properties v. Rowling*, [1986] N.Z.L.R. 22 (H.C., C.A.) (reversed on other grounds: [1988] A.C. 473, [1988] 1 All E.R. 193 (P.C.)). See also *Craig v. East Coast Bays C.C.*, [1986] 1 N.Z.L.R. 99 (C.A.), awarding damages against municipal council for negligently depriving plaintiff of a chance of successfully objecting to a planning dispensation.

⁵⁰ For example, *Kitchen v. Royal Air Force Association*, [1958] 1 W.L.R. 563, [1958] 2 All E.R. 241 (C.A.). For the contemporary view that the action was solely contractual, see *Cook v. Swinfen*, [1967] 1 W.L.R. 457, [1967] 1 All E.R. 299 (C.A.), but Lord Denning M.R. dramatically changed his mind in *Esso Petroleum Co. Ltd. v. Mardon*, [1976] Q.B. 801, [1976] 2 All E.R. 5 (C.A.).

⁵¹ *Midland Bank Trust Co. Ltd. v. Hett, Stubbs & Kemp*, [1979] Ch. 384, [1978] 3 All E.R. 571 (C.A.); *Moore v. Ferrier*, [1988] 1 W.L.R. 267, [1988] 1 All E.R. 400 (C.A.); *Day v. Mead*, [1987] 2 N.Z.L.R. 443 (C.A.); and see, *Central Trust Co. v. Rafuse*, [1986] 2 S.C.R. 147, (1986), 31 D.L.R. (4th) 481.

⁵² *Nickolaou v. Pappasavas, Phillips & Co.*, [1988] V.R. 682 (F.C.); *Vulic v. Bilinsky*, [1983] 2 N.S.W.L.R. 472 (S.C.).

⁵³ Somewhat parallel to the decision in *Ketteman v. Hansel Properties*, [1987] A.C. 189, at pp. 205 (Lord Keith), 208 (Lord Brandon), that in case of physical damage to a

not appeal to everybody. Professor Coote has sought to justify it by contending that:⁵⁴

... the loss of a chance of financial gain goes to establishing the existence of the actionable tort only where the nature of the tort or, as regards negligence, the category of the case is such that economic loss is sufficient for the purpose. Loss of the chance complies with the requirement because the chance itself has an economic value. No artificiality is involved. There would be such artificiality, though, if the chance of physical injury or the loss of a chance of physical recovery were to be treated by the courts as amounting to a form of injury in itself.

D. *The American Experience*

American courts have faced similar problems in recent years. Loss of chance has made a tentative beginning. In one line of cases recovery has been consistently allowed, viz. where negligent failure to attempt rescue of a seaman overboard diminished his chances of survival.⁵⁵ But here the peculiar dependency of ship's crew on their employer for safety and welfare has undoubtedly added pressure to induce every conceivable effort to attempt rescue.

The record in the field of medical malpractice is spotty, partly no doubt because of the countervailing tradition of protecting the medical profession against facile claims. A modest concession by some courts has been to relax the standard of proof from "reasonable medical certainty" to "reasonable probability" or "substantial possibility". Thus, in the leading case of *Herskovits v. Group Health Cooperative of Puget Sound*,⁵⁶ the Washington court held that a 14% reduction, from 39% to 25%, in the chance of the deceased's survival from lung cancer was sufficient evidence of causation to allow the jury to find that the doctor's failure to diagnose his disease in a timely fashion was the proximate cause of his death. The court relied on an earlier decision by the Pennsylvania court departing from its customary "reasonable certainty" test in a case of no more than 51% probability of a successful operation.⁵⁷ Here, the issue was not what had but what might have happened. It also cited the Restatement, which declared that one who has undertaken to render services to another incurs liability if his failure "increases the risk of such harm".⁵⁸ The decision is even more noteworthy, however, for a concurring opinion, subscribed by four justices, advocating a per-

defective building the owner cannot, in a claim against the builder, base his claim on economic loss rather than damage to property.

⁵⁴ B. Coote, *Chance and the Burden of Proof in Contract and Tort* (1988), 62 A.L.J. 761, at p. 772.

⁵⁵ *Gardner v. National Bulk Carriers*, 310 F. 2d 284 (4 Cir., 1962).

⁵⁶ 99 Wash. 2d 609, 664 P. 2d 474 (Wash. S.C., 1983).

⁵⁷ *Hamil v. Bashline*, 481 Pa. 256, 392 A. 2d 1280 (Pa. S.C., 1978).

⁵⁸ Restatement, Second, Torts, s. 323. (Emphasis added). But this rule addresses only the "duty" issue, not causation.

centage award. This "lost chance" doctrine of percentage awards has since been adopted by a substantial number of other jurisdictions as an appropriate response to the oft-recurring problem of medical malpractice.⁵⁹

The problem of causal indeterminacy has also proved troublesome in cases with long latency periods between exposure and symptoms of injury, such as groundwater contamination or toxic waste in landfills adjacent to residential neighborhoods. These cases pose problems not only as to when the statute of limitation begins to run but also whether claims can be raised, in a class action or otherwise, by persons not yet able to prove that their exposure has caused cancerous symptoms. The American judicial response has not been any more consistent than the English. On the one hand, most courts stick to the traditional requirement of proof on a balance of probabilities even in application to future loss after a threshold injury, awarding 100% if probabilities exceed 50%, but awarding nothing if they fall below. Only recent criticism has questioned this tradition,⁶⁰ which is even less forthcoming than the English approach. On the other hand, recent American cases dealing with toxic pollution have charted a new course more sympathetic to plaintiffs armed only with epidemiological or other statistical evidence of possible future injury.

One path has been to allow toxic tort victims the cost of medical testing necessary for early detection of the disease.⁶¹ It is recognized as unfair to force such plaintiffs to postpone litigation and risk abatement of their claims by statutes of limitation or repose until a latent disease actually manifests itself.⁶² Moreover, early detection enhances the prospects of cure, so that the suggested medical expense can pose as a cost incurred in mitigation of damages. Finally allowing such costs against a culpable polluter does not raise the spectre of fabricated claims, while the expenses themselves are easily provable and of manageable dimension.

⁵⁹ For a recent review, see *McKellips v. Saint Francis Hospital*, 741 P. 2d 467 (Okla., 1987). Not that it is suggested by these cases, any more than by the English Court of Appeal judgments in *Hotson*, that a more than 50% probability would not have entitled the plaintiff to a 100% award.

⁶⁰ J.H. King, Causation, Valuation and Chance in Personal Injury Torts Involving Preexisting Conditions and Future Consequences (1980-81), 90 Yale L.J. 1353.

⁶¹ See A.T. Slagel, Medical Surveillance Damages: A Solution to the Inadequate Compensation of Toxic Tort Victims (1988), 24 Trial No. 10, p. 44.

⁶² Stapleton has suggested as a possible motivation of *Pirelli General Cable Works v. Oscar Faber*, [1983] 2 A.C. 1, [1983] 1 All E.R. 65 (H.L.), (not followed in *Kamloops v. Nielsen*, [1984] 2 S.C.R. 2, [1984] 5 W.W.R. 1), a desire to postpone running of the statute in the latent damage cases from exposure to "onset of disease"; The Gist of Negligence: Part I (1988), 104 Law Q. Rev. 213. In some jurisdictions legislation has now helped some plaintiffs over this limitation problem, for example Latent Damage Act 1986 (U.K.).

But as the court stated in the leading case of *Ayers v. Jackson Township*:⁶³

... proofs [must] demonstrate, through reliable expert testimony predicated upon the significance and extent of exposure to chemicals, the toxicity of the chemicals, the seriousness of the diseases from which individuals are at risk, the relative increase in the chance of onset of disease in those exposed, and the value of early diagnosis, that such surveillance to monitor the effect of exposure to toxic chemicals is reasonable and necessary.

Presumably, such an award would not preclude a later claim if injurious consequences actually surface, despite the traditional concept of "once and for all" awards. Legislation in England has recently authorized provisional awards for cases of possible future deteriorating health condition,⁶⁴ and German law has long provided a model for bifurcated proceedings, allowing an early declaratory judgment on liability awaiting future events for assessment of damages.⁶⁵

A more radical development has been the admission of claims for fear of disease, such as a cancerphobia. In a number of important cases starting with *Ayers v. Jackson Township*⁶⁶ in 1987 courts have by-passed their refusal to found recovery on increased risk of susceptibility to cancer by treating cancerphobia as a form of mental distress, a present injury itself provable on a balance of probabilities, for which damages can be awarded on purportedly conventional principles. The central focus is not on the underlying odds that the future disease will in fact materialize, although the prospect of the disease occurring is an element in the present distress. Implicit in this analysis is the court's readiness to find that chemical contaminants emanating from the defendant have invaded the plaintiffs' bodies causing symptoms of cellular damage or other adverse biological change, however slight (such as increased coughing, loss of memory, skin irritation). Either this itself constitutes "physical damage" or the resulting distress is considered sufficient to constitute a cause of action for psychiatric injury. Incongruously, damages have sometimes been assessed by reference to the length of exposure rather than the intensity of the mental anguish. The size of awards has also sky-rocketed, from an average of \$6,000 awarded to 339 plaintiffs in *Ayers* to between \$18,000 and \$75,000 (respectively for two and eight years exposure) in the latest case.⁶⁷

Both of these innovative claims straddle the vexing question of what precisely is required for damage to become actionable in negligence or strict liability. In several recent English asbestos cases, dis-

⁶³ 525 A. 2d 287 (N.J.S.C., 1987).

⁶⁴ Administration of Justice Act 1982, s. 6.

⁶⁵ ZPO para. 256 (Feststellungsklage). See Wussow, *op. cit.*, footnote 33, p. 799 ff.

⁶⁶ *Supra*, footnote 63.

⁶⁷ *Sterling v. Velsicol Chemical Corp.*, 855 F. 2d 1188 (6th Cir., 1988). The original awards by the trial judge ranged from \$50,000 to \$250,000.

cussed in a valuable Note in the Law Quarterly Review,⁶⁸ the plaintiffs had been exposed to asbestos many years earlier without suffering from asbestosis or other disease at the time of trial. Medical evidence revealed, however, that they had developed plaques on the membrane surrounding the lung, though without suffering discomfort. Each was awarded general damages for this injury, for the risk of future deterioration and for attendant anxiety. Significantly, as the writer points out, none of these met Jane Stapleton's more exacting standard for the "gist of negligence", namely "the production of a latent bodily condition *certain* to produce disabling personal injuries in the future".⁶⁹ For it is unquestioned that exposure to asbestos even over substantial periods causes actual disease in far from all persons. Indeed the relatively modest amounts awarded in these cases for the future risk suggest that the risk was perceived to be rather slight.⁷⁰

None of these cases seemed to have invoked for support an inference from the many-layered controversial decision in *Anns v. Merton London Borough Council*.⁷¹ In that case, it will be recalled, the plaintiff occupier of a house was held entitled to recover damages from the local authority and, *semble*, the builder for the cost of repairing defective foundations on the basis of their imminent danger to health and safety. As Lord Oliver sagaciously pointed out in the recent case of *D. & F. Estates v. Church Commissioners*,⁷² what gave rise to the cause of action was "not 'damage' in any accepted sense of the word but the perception of possible but avoidable damage in the future".⁷³ Inasmuch as the *Anns* court had been at pains to characterize the damage as "property" rather than "economic" damage, in effect it seemed to recognize that the occurrence of actual damage was not necessary, but that the creation of the risk of apprehended damage to person or property was sufficient. However, that very proposition was forcefully repudiated by their Lordships in *D. & F. Estates*,⁷⁴ thereby casting a cloud on the aforementioned asbestos cases.

⁶⁸ N.J. Wikeley, *Industrial Disease and the Onset of Damage* (1989), 105 Law Q. Rev. 19. P.L. Willmore, *In Fear of Cancerphobia* (1989), 56 Defense Couns. J. 50, reports even larger recoveries of \$200,000.

⁶⁹ Stapleton, *loc. cit.*, footnote 62, at pp. 218-219. (Emphasis added).

⁷⁰ Another asbestos case, reported in Wikeley, *loc. cit.*, footnote 68, postponed the *terminus a quo* of the statute of limitations to the "onset of disease", but in doing so again helped the plaintiff to recover.

⁷¹ [1978] A.C. 728, [1977] 2 All E.R. 492 (H.L.).

⁷² [1989] A.C. 177, [1988] 2 All E.R. 992 (H.L.).

⁷³ *Ibid.*, at pp. 212 (A.C.), 1011 (All E.R.).

⁷⁴ See I.N.D. Wallace, *Negligence and Defective Buildings: Confusion Confounded?* (1989), 105 Law Q. Rev. 46.

II. The Indeterminate Plaintiff

Now for the converse situation of the indeterminate *plaintiff*, where the claimant is one of several victims, only some of whom have been injured by a single tortfeasor, but who are unable to say which one among them. Suppose he is one of a group of persons exposed to a toxic emission from the defendant, but the same symptoms also emanate from independent "background risks". For example, in the *Nevada Nuclear Explosion* case,⁷⁵ the plaintiffs could point to a strong positive association between their cancer and exposure to ionizing radiation, but their cancer was indistinguishable from that also prevalent and attributable to unknown causes.⁷⁶ Similarly, in the *Agent Orange* case,⁷⁷ dioxin was present in the Vietnam countryside besides the amounts in the defoliant used by the United States forces, procured from seven identified American chemical companies.⁷⁸

Typically, the association of the injury with the defendant's activity rests on statistical rather than specific (anecdotal) evidence.⁷⁹ Thus the evidence may show that, after the defendant's emission, the incidence of the particular disease rose from 100 to 190 for a given population. Here, doubts about statistical proof are compounded by the fact that it does not even tip the balance of probabilities, that is 50% plus. In the wake of *Sindell*,⁸⁰ proposals have been made to apply a mirror-image⁸¹ solution to the instant problem so that the defendant would be held responsible for, and the plaintiffs as a group could recover, nine-nineteenths of their injuries. Professor Delgado was the first to advocate this modification of the traditional standard of proof as furthering the reputed objectives of tort liability.⁸² The proposed formula would exact from the defendant an amount precisely proportioned to his share of responsibility for

⁷⁵ *Allen v. United States*, 588 F. Supp. 247 (D. Utah, 1984). Reversed on ground of sovereign immunity: 525 A. 2d 287 (N.J.S.C., 1987).

⁷⁶ The same goes for adverse reactions from many drugs, without any clear distinction between iatrogenic and spontaneous illness: see C. Newdick, *Strict Liability for Defective Drugs in the Pharmaceutical Industry* (1985), 101 Law Q. Rev. 405, at pp. 420-430.

⁷⁷ *Supra*, footnote 17.

⁷⁸ A similar problem has arisen in some civil rights and labour law cases where it may be impossible to identify those members of the class who suffered loss. See, for example, *Stewart v. General Motors Corp.*, 542 F. 2d 445, at p. 452 (7th Cir., 1976).

⁷⁹ A traditional response is Croom-Johnson L.J.'s: "... a mere statistical chance will not be enough. The chance must be something lost to the individual patient": *Hotson v. East Berkshire Area Health Authority*, *supra*, footnote 41, at pp. 770 (A.C.), 224 (All E.R.).

⁸⁰ *Supra*, footnote 8.

⁸¹ The mirror image attains added focus by recalling that each *Sindell* manufacturer faced many victims, but it was unclear which ones were his.

⁸² R. Delgado, *Beyond Sindell: Relaxation of Cause-in-Fact Rules for Indeterminate Plaintiffs* (1982), 70 Cal. L. Rev. 881.

the total incidence of the disease in the area. Beside spreading the loss, it would promote deterrence and economic efficiency by internalizing the accident cost to the enterprise which is in the best position to reduce accidents and pass on the cost to its beneficiaries by means of insurance and price calculation.

Rather less satisfactory is the solution at the plaintiffs' end. Proportional recovery, by which each member of the class is compensated in proportion to the damages sustained by the class as a whole, under-compensates some (90 in the preceding example) and over-compensates others (100). But this is still better, so it is contended, than either to compensate none or to compensate all for the full amount of their injuries.

As was pointed out in *Agent Orange*,⁸³ class actions provide a procedural framework particularly suitable for implementing the proposed formula. Indeed, unless the whole class is before the court, the formula is unworkable. In recommending this approach in the context of the class action he had certified, Weinstein C.J. in *Agent Orange* suggested additional economies in order to avoid a tailor-made assessment of damages for each claimant.⁸⁴ As the price for making claims based on proportionality at all viable through aggregative procedures, a "public law" approach might also dictate economies of scale in fixing benefits. Thus if the class were certified for one type of injury, a compensation schedule to calculate average losses could be developed by sampling techniques. Better still, claims could be paid on a "fixed and somewhat arbitrary schedule" as under bureaucratic compensation programs. Perhaps most important from a practical point of view, the class action context strongly encourages settlements on an agreed basis.

On the other hand, the departure from traditional concepts, propounded in *Agent Orange*, is manifold and startling. On the basis of mere statistical evidence of a product's propensity for injury, it sanctions a cause of action by unidentified plaintiffs against unidentified defendants without specific proof of the defective nature of the product or of its having caused injury to a particular plaintiff. In short, most elements of products liability have been collapsed into mere statistical proof of causation.⁸⁵ While it is true that, strictly speaking, the court's reasoning related only to the fairness of the settlement, it sought approval for an approach to liability that would sever most links to traditional tort principles.

⁸³ *In re "Agent Orange"*, *supra*, footnote 17, at pp. 837-839.

⁸⁴ *Ibid.*, at pp. 838-839, adopting the thesis of D. Rosenberg, *The Causal Connection in Mass Exposure Cases: A "Public Law" Vision of the Tort System* (1983-84), 97 Harv. L. Rev. 849, at pp. 916-924.

⁸⁵ P. Sherman, *Agent Orange and the Problem of the Indeterminate Plaintiff* (1986-87), 52 Brooklyn L. Rev. 369.

Conclusion

Courts have now been confronted repeatedly with tort plaintiffs whose fate depends on acceptance of probabilistic evidence based on epidemiological or other statistical evidence. Modern technology has contributed to this situation in two ways, by both creating the agents of pollution and other toxic chemicals which give rise to many of these problems, and by increasing scientific knowledge enabling more confident assessments of causation and attribution of responsibility. A principal question is whether legal routines can adapt themselves to changing scientific epistemology based on probabilistic evidence. As is to be expected, the law has moved cautiously, accepting neither the extreme of categorically refusing to budge from its traditional roots nor of abandoning the conventional insistence on particularistic evidence in all circumstances. But as yet we are only on the threshold of this new territory, still in the process of probing rather than expecting definitive answers.