

Appendix A
List of Abbreviations
Appendix B
List of Figures
Appendix C
List of Tables

Appendices

Appendix A
List of Abbreviations

Appendix B
List of Figures

Appendix C
List of Tables

Appendix D
List of Equations

Appendix E
List of Symbols

Income Replacement for Individuals Disabled by Immunotoxicants

INTRODUCTION

Even the best efforts to prevent harmful exposures to toxic substances are imperfect. When regulations or other precautions fail to prevent toxic exposure, permanently or temporarily disabling illnesses sometimes result. Federal and State level programs have evolved to provide a continuing source of income for disabled individuals. This appendix presents a brief overview of Social Security, State workers' compensation programs, and toxic tort. The initiatives described in this appendix were not specifically designed to compensate individuals for exposure to toxic substances, but they are available, within certain limits, to immunotoxicant exposure victims.

SOCIAL SECURITY BENEFITS

If an illness or injury interferes with a person's ability to work and lasts, or is expected to last, for more than a 12-month period, it can give rise to full Social Security benefits, either disability benefits (SSDI; 42 U.S.C. 423) or Supplemental Security Income (SSI; 42 U.S.C. 1381-1383a). To secure these benefits, a claimant must prove inability to work. It is not necessary for a Social Security claimant to prove that illness or injury occurred because of a work-related incident.

SSDI benefits are available to persons who would otherwise be qualified for Social Security benefits had they paid into the system for the requisite number of quarters (as established by 20 CFR 404.130). The SSI program guarantees a minimum level of cash income to needy aged, blind, and disabled persons who may not otherwise be eligible for Social Security.

A Social Security claimant files an application with the Social Security Administration (SSA), which then turns it over to the State administering agency. The State assesses the claim and medical evidence presented against a standard set by law, which defines disability as the inability to do any substantial gainful activity by reason of any medically determinable physical or mental impair-

ment which can be expected to result in death or which has lasted or can be expected to last for a continuous period of not less than 12 months (4).

For purposes of SSDI and SSI benefits, a medically determinable diagnosis of an immune-system injury— including an injury or illness caused by an immunotoxicant — would be compensable. A diagnosis should be supported by a medical history, clinical findings, laboratory findings, and information regarding treatment and prognosis. Well known immune system disorders, such as a severe allergy, asthma, or autoimmune disease (e.g., rheumatoid arthritis) could be medically determinable to result in a disability.

More problematic for Social Security claimants and the SSA is the issue of environmental illness. In its Program Operations Manual System (POMS), SSA now recognizes the claim of some medical practitioners that exposure to toxic substances can damage the immune system, and the SSA identifies this claim as environmental illness (POMS 24515.065, Evaluation of Specific Issues-Environmental Illness). In the POMS, the SSA states that while there is no evidence that claimants with this type of claim have immune deficiency, immune complex disease, autoimmunity, or abnormal functioning of their immune systems, evaluation should be made on an individual case-by-case basis to determine if the impairment, whether or not immune system related, prevents substantial gainful activity. Some legal and medical practitioners claim that this standard should increase claimants' success in obtaining Federal benefits after exposure to immunotoxic substances.

WORKERS' COMPENSATION

Workers' compensation laws vary among the States, but all laws share the requirement that the injury or illness occur on the job and that the claimant be temporarily or permanently disabled as a result. This section briefly describes worker's compensation programs and concludes with a short summary of some workers' com-

pensation claims based on damage to the immune system, and a synopsis of recent congressional interest in workers' compensation.

Basic Workers' Compensation Law

State workers' compensation programs represent a compromise reached 80 years ago between labor and business, before many of the chemicals in common use today were developed or their hazards understood. Under the common law, the basic duty of employers was to act with due care for employee safety, as a reasonably prudent person would, and to furnish a sufficient number of safe tools and equipment, as well as a sufficient number of qualified employees to do the work. Employers were responsible for issuing and enforcing rules for workplace safety, rules that with ordinary care would prevent reasonably foreseeable accidents. Finally, employers had a duty to warn workers of unusual hazards.

In theory, if the employer failed to live up to this standard of conduct, an injured employee could sue for damages under the common law. This was seldom easy, however. The first difficulty was simply proving the employee's case. Other employees might be crucial witnesses, but when few governmental or union job protections existed, anyone who testified against an employer risked being fired. The common law also established three powerful defenses that employers could use against lawsuits brought by employees: negligence of other servants or co-workers; knowledgeable assumption of risk by the employee; and contributory negligence by the injured employee. Just prior to enactment of the workers' compensation statutes, however, some States began to ease the claimant's burden of proving employer negligence, and a few workers began to win sizable judgments (16).

Workers' compensation substituted a regular, fixed, and predictable compensation payment, previously unavailable to most workers, for uncertain, potentially ruinous liability judgments, which were becoming uncomfortably frequent for employers. The first State law to withstand challenge passed in the State of Wisconsin in 1911; all States had worker compensation laws by 1948. Initially workers' compensation laws only covered acci-

dental injury and excluded occupational disease. However, all States covered occupational disease by 1977.

Three basic approaches to occupational disease coverage have been adopted. States generally elect either to:

- establish a schedule of covered diseases (which minimizes problems of proof but excludes unlisted diseases);
- establish a schedule and a residual clause that allows claims for unlisted disease to be made, with the burden of proof on the claimant; or
- cover diseases "peculiar to" or "characteristic of" relevant trades.

Most States exclude coverage of the ordinary diseases of life (even where risk of ordinary disease maybe notably increased by an occupation) and require that a worker face a hazard greater than that to which the general public is exposed.

Disease claims that are readily connected to workplace exposure and are relatively inexpensive (e.g., acute dermatoses) are compensated like accidental injuries. Disease claims involving serious disabilities that are less clearly linked to workplace exposures (e.g., chronic respiratory disease) are marked by extended controversy and long waiting periods between the time a claim is filed and a decision on that claim. For these claims, the system retains many of the undesirable features of the tort system that workers' compensation was supposed to supplant.

Some observers believe that workers' compensation systems have failed to keep pace with knowledge of the hazards of chemical agents (9,11). According to OSHA, occupational diseases from chemical exposures represent a continuing complex problem for workers' compensation programs. Disabilities resulting from occupationally induced illness often are less clearly defined than those from occupationally induced injury. As a result, OSHA finds that workers' compensation is often a weak remedy in the case of occupational disease (52 FR 26843). This finding is used as partial justification for OSHA's decisions to regulate certain chemical exposures rather than rely on

market-based incentives or other Federal programs to ensure worker health and safety.

Disease claimants face extended conflict over the issue of causality, in part due to meager scientific evidence to show a relationship between exposure and disease. The fact that many years often intervene between exposure and disease also plays a role (19). In addition, proof of causality may be ambiguous where cases are aggravated by lifestyle choices (e.g., smoking) or other non-workplace exposures to hazardous substances. Some States have opted for a statutory presumption that a claimant's disease is work-related, but that is not the prevalent approach. One study found that 60 percent of occupational disease claims are contested, and 15 percent of challenged claims result in an award for the worker (9).

Occupational disease now accounts for about 1 percent of all workers' compensation claims. The insurance industry expects the number of occupational disease claims to rise significantly during the 1990s if medical research more clearly shows a link between illness and workplace exposure to harmful substances (18). Thus the results of future research on immunotoxicity could greatly affect the number and success of workers' compensation claims based on exposure to immunotoxicants.

Even if a claimant establishes a right to workers' compensation, the amount collected may not be perceived as adequate recompense for the illness. In a majority of States, the maximum amount paid a temporarily disabled worker is at least 100 percent of the State's average wage, but 22 States pay less than that. Table A-1 shows the maximum weekly benefits paid by each State and the percentage of the State's average wage this amount represents. These temporary disability benefits are paid in addition to medical expenses, but obviously represent a substantial decline in income for many workers (18). While this problem is not peculiar to claims based on exposure to toxic substances, it may serve to discourage claims that have less than a certainty of success, like toxicant-caused illnesses, since the rewards for the claimant and a legal representative are relatively low.

immunotoxicity Claims

The legal literature includes some published cases of workers' compensation awards to individuals claiming an immune system disorder following exposure to a toxic substance. In *Grayson v. Gulf Oil Company*, 357 S.E. 2d

Table A-1-State Workers' Compensation Disability Benefits, 1989

The first column shows the maximum weekly benefit paid to workers whose disability is total but temporary. The second column shows that payment as a percentage of the State's average weekly wage.

	Maximum weekly benefit	Maximum benefit as percentage of State's average weekly wage
Alabama	357.98	104
Alaska	700.00	130
Arizona	276.15	74
Arkansas	209.08	67
California	224.00	51
Colorado	371.28	94
Connecticut	671.00	144
Delaware	280.64	71
District of Columbia	513.00	102
Florida	362.00	102
Georgia	175.00	47
Hawaii	358.00	101
Idaho	193.80	60
Illinois	604.73	142
Indiana	274.00	73
Iowa	684.00	207
Kansas	271.00	77
Kentucky	343.02	100
Louisiana	267.00	75
Maine	471.83	143
Maryland	407.00	102
Massachusetts	444.21	103
Michigan	409.00	92
Minnesota	391.00	100
Mississippi	206.60	68
Missouri	289.75	78
Montana	318.00	103
Nebraska	245.00	78
Nevada	368.82	99
New Hampshire	600.00	162
New Jersey	342.00	75
New Mexico	283.70	85
New York	300.00	63
North Carolina	376.00	110
North Dakota	313.00	102
Ohio	400.00	102
Oklahoma	231.00	66
Oregon	388.99	108
Pennsylvania	399.00	103
Rhode Island	360.00	100
South Carolina	334.87	102
South Dakota	289.00	103
Tennessee	252.00	72
Texas	238.00	61
Utah	347.00	101
Vermont	544.00	161
Virginia	393.00	105
Washington	389.32	102
West Virginia	367.89	103
Wisconsin	363.00	100
Wyoming	354.00	99

SOURCE: U.S. Department of Labor, based on laws in effect on July 1, 1989.

479 (South Carolina Court of Appeals, 1987) total disability benefits were awarded under south Carolina's workers'

compensation statute on the basis of petrochemical hypersensitivity, which led, according to the claimant's physician, to a cascade of dysfunction of the claimant's immune system.. The treating physician wrote that, "... the constant exposure over 19 years to the petrochemicals in her workplace dysregulated [the claimant's] immune system resulting in an allergic or hypersensitivity cascade to her total environment, including all foods, chemicals, and her own microbiological flora." The court found that the plaintiff's hypersensitivity was created by her workplace and left her unable to function properly in any environment.

A Florida appeals court also upheld a workers' compensation award based on an immune injury. In *Dayron Corporation v. Morehead* 509 So. 2d 930 (Florida 1987), the claimant developed a permanent sensitivity to a coolant used in his workplace. Although the claimant showed no signs of illness when outside of the workplace, the sensitivity was deemed a permanent disability for purposes of entitlement to workers' compensation. Workers' compensation benefits were also awarded in *Kyles v. Workers' Compensation Appeals Board* (California Court of Appeals, 1st Appellate District, Division 4, 1st Civil No. A037375, Oct. 21, 1987), where long-term PCB exposure was found to have led to chemical hypersensitivity.

These cases indicate that courts will entertain a claim for workers' compensation based on an immune injury if the claimant establishes a work-related cause. Some States, most notably California, are considering an insurance system that would compensate employees regardless of the work-relatedness of their illness or injury, but such plans remain in a very preliminary stage at this time.

The cases also indicate, however, that such claims often proceed to court after they fail to be settled at the administrative level. This increases the costs of the system and delays workers' receipt of benefits. If the inability to work extends for a prolonged period, workers can quickly become impoverished. Most State workers' compensation statutes also foreclose a worker's ability to bring a tort case against the employer unless the worker can reasonably claim that the employer intentionally caused the injury or illness.

Congressional Interest in Workers' Compensation

Congress has been concerned with the workers' compensation system for many years. In 1970 Congress created a National Commission on State Workmen's Compensation Laws, which concluded, in a 1972 report, that State laws in general were "inadequate and inequitable." The Commission urged Congress to impose national standards if the States did not act quickly on the Commission's key recommendations. On average, States now comply with just over 12 (out of 19) of these recommendations (18). No Federal standards have been enacted.

Hearings were held in 1979 on the National Workers' Compensation Standards Act, which would have guaranteed minimum compensation levels nationwide and created an advisory panel to look at causation issues. Then Secretary of Labor Raymond Marshall, and several other witnesses, testified to the peculiar problems of compensating occupational disease, especially issues of causation and long latency (24). Hearings were also held in 1981 and 1983 on bills that would have created Federal standards of compensation for work-related exposure to toxic substances (21,22). None of those bills was enacted. No bills introduced in the 101st Congress attempted to reform the workers' compensation system as it relates to toxic exposures.

TORT CLAIMS

This section briefly describes how tort law provides compensation for injuries due to exposure to toxic substances. It also summarizes a few cases based on evidence of immune system damage, and briefly discusses recent congressional activity related to tort law.

Basic Tort Law

Tort law is part of the common law system. Its purpose is to compensate persons injured as the result of the conduct of another. In order to receive compensation for an injury through the tort system, a claimant, or plaintiff, files suit alleging tortious (wrongful) conduct on the part of the defendant. To prove a case, the plaintiff must show

that he or she has suffered damage, that the damage was caused by the defendant, and that the defendant had no sufficient justification or legal right to cause this damage (13). If the plaintiff convinces the jury (or the judge in a non-jury trial) that the defendant was more likely than not the cause of the plaintiff's damages, compensation is awarded to the plaintiff.

Claims for damages based on exposure to hazardous substances are called toxic torts. As part of the required proof, the plaintiff must show that the defendant caused him or her to be exposed to a toxic substance, that the substance is capable of causing the type of damage suffered by the plaintiff, and that the particular exposure caused by the defendant was, more likely than not, the cause of plaintiff's damage. Toxic tort cases are difficult to prove in general, and present special difficulties when immune-system impairment is claimed since immunotoxicology has only recently been developed, some of its methods remain controversial, and agreement has not been reached about what constitutes immune system damage.

immunotoxicity Claims

Cases involving damage to the immune system began appearing in the early 1980s and have increased in the intervening years. Some attorneys now estimate that hundreds, and perhaps thousands, of cases incorporating claims of immune system damage now stand in State and Federal court systems. Since the immune system is intimately connected with the body's capacity to respond to foreign substances, a large range of cases exist for which a claim of immune damage maybe relevant.

Despite the difficulties of proving a case, several tort suits have claimed damages from exposure to immunotoxicants. OTA found the following cases in published databases. These cases are not presented as an exhaustive listing of immunotoxicity case law, but as illustrative of the circumstances in which individuals can be exposed, the damages alleged, and the compensation recovered.

It should be noted that many of the plaintiffs in these cases claim to have a disease or syndrome commonly referred to as multiple chemical sensitivity (MCS). MCS is a poorly understood and controversial phenomenon. Its proponents claim that exposure to certain chemicals, even at

very low levels, can create immunological, neurological, and other problems for its sufferers. Its opponents argue that no scientific evidence supports such claims. Proponents and opponents agree that additional research will be required to prove or disprove the existence of MCS and its cause or causes. This background paper does not attempt to weigh the merits of claims by MCS proponents or opponents and presents these cases solely because of their use of immune system evidence.

CASE: *Woodrow Sterling et al. v. Velsicol Chemical Corp.*, 647 Fed. Supp. 303 (W.D. Term. 1986); affirmed in part, reversed in part, 855 F 2d 1188.

Claim: Plaintiffs (community residents) claimed that immune system injury accounted for present disorders (including pulmonary disease, respiratory problems, seizures, and learning disabilities) and increased the future risk of developing disease. Immune system injury was claimed to have been caused by exposure to various chemicals, including carbon tetrachloride and chloroform, in well water contaminated by Velsicol.

Evidence: Immunological tests consisted of a white blood cell count, a lymphocyte count, a total T cell count, a B cell count, a null cell count, and a breakdown of the T cell count into T helper and T suppressor cell counts. (See chapters 2 and 3 for descriptions of the immune system and immunotoxicological tests.) Plaintiffs' experts testified that the data was consistent with a diagnosis of chemically induced immune dysregulation.

Outcome: The trial court awarded damages of \$75,000 to four of the five plaintiffs for impairment of the immune system and \$500,000 to the fifth plaintiff, a child. The appeals court reversed the district court's award of damages for immune system impairment, finding that the plaintiffs' experts' opinions were insufficient to sustain the burden of proof. The award for immune system damage constituted only a portion of the total award (\$5,273,492 in compensatory damages; \$7,500,000 in punitive damages; interest on compensatory damages at 8 percent annually). The case has now been settled (5).

CASE: *Elam v. Alcolac*, 765 S.W. 2d 42,4 TXLR 167 (W.D. Mo. Ct. of Appeals)

Claim: The plaintiffs (community residents) claimed that immune system injury was partially responsible for

numerous adverse health conditions. Injuries were attributed to exposure to toxic waste originating in an Alcolac chemical plant.

Evidence: Tests of immunological parameters included a mitogen challenge, total T cell counts, total T helper and T suppressor cell counts, and natural killer cell counts. The plaintiffs' expert witness testified that each of the 31 plaintiffs was suffering from immunosuppression.

Outcome: The jury awarded a \$49 million verdict to the plaintiff for claims including immunotoxicity. The trial court judge set aside this verdict; an action affirmed by the appeals court (which found that the term "chemical AIDS" used in association with the plaintiffs' condition was inflammatory). The case was then settled out of court for an undisclosed amount (25).

CASE: *Barth v. Firestone Tire and Rubber Co.*, 673 F. Supp. 1466 (N.D. Cal. 1987).

Claim: The plaintiff (a worker at the Firestone plant) claimed that he suffered injury to his immune system and onset of diseases in their latency stage as a result of Firestone's fraudulent concealment of hazardous substances at the workplace and lack of required safety devices and protective clothing. He also claimed emotional distress. The plaintiff alleged exposure to benzene, heavy metal compounds, and other industrial chemicals used in the manufacturing of tires. Plaintiff sought creation of a medical monitoring fund as remedy for the class.

Evidence: The case has not reached the trial stage and no evidence has been presented.

Outcome: The Federal district court denied a motion by defendant to dismiss the claim on grounds that there was no legally cognizable injury. The California Superior Court has ruled that the class is unascertainable (17).

CASE: *Moore v. Polish Power, Inc.*, 720 S.W. 2d 183 (Tex. Ct. App. 1986).

Claim: The plaintiff (who purchased a carpet from the defendant) claimed neurological and muscular problems as a result of exposure to formaldehyde off-gassing from Polish Power's carpet.

Evidence: The plaintiff's expert witness testified that the plaintiff suffered from damage to her immune system from exposure to formaldehyde, which led to the neurological and muscular problems.

Outcome: The trial court excluded evidence from the medical expert witness relating to characteristics, formaldehyde content, formaldehyde emission rate, and dangerousness of carpet and carpet pad based on his lack of expertise on the chemistry of carpets. The court allowed the expert's opinion that formaldehyde was cause of carpet buyer's physical problems. The jury brought in a verdict for Polish Power. The Court of Appeals reversed the trial court's exclusion of the carpet evidence, and the case was sent for a new trial on the merits.

CASE: *Higgins v. Aerojet-General Corp.*, 1986 Env't Rep. (BNA) 1183 /Nos. 287147, 290449, 290450 (Cal. super. Ct. 1986).

Claim: The plaintiff alleged immune system damage, among other injuries, resulting from defendant company's disposal of trichloroethylene (TCE) and other solvents in unlined ditches on his property.

Evidence: Plaintiff's experts testified that the plaintiff suffered from immune system damage, basing their findings on a blood sample from the plaintiff. Defendant's expert countered that since there was no base line measurement, the blood tests were inconclusive. Two immunologists testified for the defendant that the medical community had not accepted the immune dysfunction theory as valid. The defendant's experts also testified that, according to the immune dysfunction theory, the plaintiff was constantly being exposed to immunotoxic substances and that it was impossible to say that a particular exposure was "more probable than not" to be the cause of a given injury (12).

Outcome: Aerojet received a jury verdict in its favor. The ease was not appealed, and the parties reached a settlement (8).

CASE: *Stites v. Sudstrand*, 660 F. Supp. 1516 (W.D. Mich. 1987).

Claim: Plaintiffs (community residents) claimed increased risk of cancer and emotional distress, partially supported by evidence of immune system injury, due to improper disposal of TCE, which was claimed to have entered drinking water.

Evidence: The plaintiffs' expert testified that the plaintiffs suffered damage to their immune systems and dysfunctions of a major enzyme system, and to his belief that those two problems resulted in a "greatly increased susceptibility to a number of future illnesses, particularly cancer." Defendants countered with an affidavit from 9 experts in immunology, stating that they could not show to a reasonable certainty that the plaintiffs would develop cancer.

Outcome: The court issued a summary judgment for the defendants on the claim for increased risk of cancer, finding that none of the plaintiff's experts were able to quantify enhanced cancer risk. The court also ruled, however, that claims for damages for fear of cancer could go to the jury. The case was eventually settled for an undisclosed amount (6).

CASE: *Lowe v. Norfolk & Western Railway Company*, 463 N.E. 2d, 792.

Claim: Forty-seven plaintiffs (railroad employees) alleged various physical ailments, including immunological damage, arising from exposure to dioxin contained in a chemical, or thochlorophenol, which was spilled while being transported by the defendant.

Evidence: The plaintiffs' expert testified that tests performed on blood samples to evaluate the body's immune system indicated that each plaintiff showed some abnormality of the immune system.

Outcome: The jury returned a verdict in favor of the plaintiffs totaling \$57,965,000. The appeals court reversed the verdict on the basis of errors in trial procedure and remanded the case for anew trial. The case was then settled for an undisclosed amount (15).

Congressional Interest in Toxic Tort

Congress has occasionally considered enacting legislation directed specifically to compensating victims of non-work-related toxic exposures. The Toxic Tort Act of 1979 would have created an independent agency within the EPA to compensate victims of pollution related injuries regardless of fault (in addition to creating a Federal cause of action for victims of toxic substances) (24). During the 98th Congress, legislation was considered in the House of Representatives that would have provided compensation for injury, illness, or death resulting from exposure to hazardous substances (23). Some Members of Congress have argued that such legislation was an implicit promise of the Superfund legislation, which requires environmental cleanup, but no bills have been enacted and none was considered in the 101st Congress, though general product liability reform legislation was proposed and debated.

DIFFICULTIES COMMON TO PROVING WORKERS' COMPENSATION OR TOXIC TORT CLAIMS

Workers' compensation was intended to be a no-fault system of compensation — if employment causes an illness or injury, the worker should recover. Tort is a system largely based on fault, where it generally must be proved that the defendant breached a duty owed to the plaintiff. Only employees can collect workers' compensation; tort is available to everyone except employees covered by a workers' compensation system. Despite these significant dissimilarities, claimants under either system share the common burden of proving causation. It is not sufficient for claimants to show that they have suffered an injury, they must show that the workplace or defendant caused the injury in order to collect compensation or damages. This section discusses some of the difficulties entailed in proving that exposure to an immunotoxicant caused a particular disorder.

Scientific Uncertainty

A commonly made claim of immunotoxicity, which is sometimes referred to as "chemically induced immune dysregulation," is that exposure to a chemical or substance impairs the body's immune system, thereby rendering an individual hypersensitive to chemicals and/or more susceptible to many ailments, including cancer. Many scientists doubt whether state-of-the-art

immunotoxicology can actually establish immune system dysfunction as a result of chemical exposure. For instance, there is no agreed upon definition of "normal" immunological parameters. As discussed in chapter 3, scientists do not know how great a quantity of any particular cell type is required for proper immune function. Cell counts can vary greatly among individuals that appear to have functional immune systems.

It is also the case that various environmental and host factors, such as exposure to other toxic and nontoxic chemicals, tobacco, alcohol, drugs, or radiation, cooking habits, bacteria, viruses, nutritional imbalances, obesity, and existing medical conditions, may provide alternative explanations for plaintiffs' conditions. The illnesses from which immunotoxicity plaintiffs allegedly suffer generally do not have chemical-specific pathologies and occur in the general population. It is, therefore, difficult to isolate the specific cause of such alleged findings and illnesses in light of the panoply of environmental and host factors, and to prove causation with the degree of certainty required by law (3,14).

Warring Experts

The plaintiff must rely on scientific and medical experts to establish that he or she has suffered some type of physical damage and that the toxic substance is capable of causing that damage. Experts may also be required to prove that the defendant caused the plaintiff to be exposed to the toxic substance and to attest to the extent of the plaintiff's damages. These expert witnesses must convey their highly specialized knowledge to the trier of fact (the judge or jury) who generally has little scientific training.

Most often experts who present evidence of immunotoxicity for the plaintiff are clinical ecologists. These medical practitioners are at odds with much of the established medical and scientific community. The American Academy of Allergy and Immunology has published position statements refuting the theory that any valid scientific evidence supports the theory that exposure to chemicals or pollutants in the environment adversely affects the function of T cells and rejecting the medical effectiveness of treatments prescribed by clinical ecologists (1,2). This disagreement among ex-

perts adds to the difficulty of trying immunotoxicity claims since judges and juries have difficulty sorting out the scientific evidence.

Continuing Debate Over Animal Testing

Very few substances have been tested to determine whether they are immunotoxic. Where testing has been done, it has generally been done on animals. Human evidence is available from clinical trials or case reports concerning immunosuppressive therapeutics. Very few epidemiologic studies have been conducted on immunotoxicants, and the results have been inconclusive. Recent court cases, however, have found plaintiffs' experts' opinions regarding immunotoxicity based on animal data unsupported by epidemiologic data to be inadequate to sustain the burden of proof (7,10). This absence of data presents a serious dilemma for plaintiffs.

Further scientific developments in the field of immunotoxicology should eliminate much of the scientific uncertainty and, presumably, end many of the disagreements between clinical ecologists and the rest of the medical and scientific community. The necessity of animal testing is an ongoing debate in U.S. society, and resolution lies well outside the field of immunotoxicology (20).

APPENDIX A REFERENCES

1. American Academy of Allergy and Immunology, "Position Statements: Clinical Ecology," *Journal of Allergy and Clinical Immunology* 78:269, August 1986.
2. American Academy of Allergy and Immunology, "Position Statements: Controversial Techniques," *Journal of Allergy and Clinical Immunology* 67:333, 1981.
3. Cornfeld, R. S., and Schlossman, S.F., "Immunologic Laboratory Tests: A Critique of the Alcolac Decision," *Toxics Law Reporter*, Sept. 6, 1989, pp. 381-390.
4. Cornaghi, C.A., "Evidence in Disability Claims Under the Social Security Act," *Federal Bar News & Report* 37(8):464-467, 1990.
5. Gilreath, S., Attorney, Knoxville, TN, personal communication, November 1990.
6. Gleicher, E., Attorney, Detroit, MI, personal communication, July 1990.

7. *In re Paoli Railroad Yard PCB Litigation*, 3 TXLR 843, No. 8&2229, slip op. (E.D. PA, Nov. 29, 1988).
8. **Kanner, A.**, Attorney, Philadelphia, PA, personal communication, November 1990.
9. Locke, L., "Adapting Workers' Compensation to the Special Problems of Occupational Disease," *The Harvard Environmental Law Review*, vol. 9, No. 2, 1985, pp. 249-282.
10. *Lynch v. Merrell-National Laboratories*, 830 F.2d 1190 (1st Cir. 1987).
11. Mallino, D.L., "Workers' Compensation and Prevention of Occupational Disease," *Annals of the New York Academy of Sciences*, 1987.
12. **Maskin, A.**, "Overview and Update of Emerging Damage Theories in Toxic Tort Litigation," paper presented July 14-16, 1988, Snowmass, CO, ALI-ABA Course of Study.
13. Prosser and Keeton, *Prosser and Keeton on Torts*, 5th ed. (St. Paul, MN: West Publishing Co., 1984).
14. **Rothman, R.A.**, and **Maskin, A.**, "Defending Immunotoxicity Claims," *Toxics Law Reporter*, Mar. 1, 1989, pp. 1219-1231.
15. **Schoenbeck, S.M.**, Attorney, St. Lo@ MO, personal communication, December 1990.
16. Shor, G.M., "Workers' Compensation: Subsidies for Occupational Disease," *Journal of Public Health Policy*, December 1980, pp. 328-340.
17. Stemple, G., Attorney, Century City, CA, personal communication, October 1990.
18. **Thompson, R.**, "Reforming Workers' Compensation," *Editorial Research Reports*, Apr. 13, 1990.
19. U.S. Congress, Office of Technology Assessment, *Genetic Monitoring and Screening in the Workplace*, OTA-BA-455 (Washington, DC: U.S. Government Printing Office, September 1990).
20. U.S. Congress, Office of Technology Assessment, *Alternatives to Animal Use in Research, Testing and Education*, OTA-BA-273 (Washington, DC: U.S. Government Printing Office, February 1986).
21. U.S. House of Representatives, Hearings before the Subcommittee on Labor Standards of the Committee on Education and Labor, 97th Cong., 1st sess., Oct. 6, 1981, on Occupational Disease Compensation and Social Security.
22. U.S. House of Representatives Hearings before the Subcommittee on Labor Standards of the Committee on Education and Labor, 98th Cong., 1st sess., on H.R. 3175, the Occupational Disease Compensation Act of 1983, June 13, 14, 27 and July 27, 1983.
23. U.S. House of Representatives, Hearings before the Subcommittee on Commerce, Transportation and Tourism of the Committee on Energy and Commerce, 98th Cong., 1st sess., on H.R. 2582, the Hazardous Substance Victims' Compensation Act, June 29, 1983 (Serial No. 98-45).
24. U.S. Senate, Hearings before the Committee on Labor and Human Resources, 96th Cong., 1st sess., on S. 420, the National Workers' Compensation Standards Act of 1979, Mar. 28 and Apr. 2-3, 1979.
25. **Welch, L.**, Attorney, Kansas City, MO, personal communication, June 1990.