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TOXICOGENOMICS AND WORKERS' COMPENSATION: A REWORKING OF THE "BARGAIN"?

JOAN E. FLAHERTY*

INTRODUCTION

For more than one hundred years, workers' compensation insurance has been a security system for workers, providing compensation for workplace injuries no matter what the cause.¹ The creation of the workers' compensation system was the result of a "bargain" between workers and employers in which each side gave up certain legal rights in favor of a system of guaranteed but limited assistance to workers injured on the job.² Toxicogenomics threatens to create a new balance of interests in workers' compensation by providing workers, employers, and insurers with a powerful tool to predict an individual's future health.³ On one side of the scales, toxicogenomic technologies could offer employees a scientific test to show definitively that they were made ill at work.⁴ Weighing on the opposite side are the many uses employers and insurers might find in toxicogenomic technologies: the ability to screen workers for genetic predisposition before employment,⁵ access to greater information in making underwriting and rating decisions,⁶ and ultimately the possibility of using genetic tests to show that a worker's injury was not caused

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1. See Paul Raymond Gurtler, Comment, *The Workers' Compensation Principle: A Historical Abstract of the Nature of Workers' Compensation*, 9 *HAMLIN J. PUB. L. & POL'Y* 285, 288, 290 (1989) (noting that workers' compensation laws originated from nineteenth century Germany, with the goal of alleviating the burden of socio-economic injuries to industrial workers).

2. See *infra* Part I.

3. See NAT'L RESEARCH COUNCIL, *APPLICATIONS OF TOXICOGENOMIC TECHNOLOGIES TO PREDICTIVE TOXICOLOGY AND RISK ASSESSMENT* 12 (2007) [hereinafter "NRC Report"] ("Toxicogenomics may lead to information that is more discriminating, predictive, and sensitive than that currently used to evaluate toxic exposure or predict effects on human health.").

4. See Gary E. Marchant, *Genetic Data in Toxic Tort Litigation*, 14 *J.L. & POL'Y* 7, 20 (2006) (arguing that courts have relied upon genetic biomarkers as proof of exposure to toxic chemicals in the workplace).

5. See Mark A. Rothstein, *Genetic Discrimination in Employment and the Americans with Disabilities Act*, 29 *HOUS. L. REV.* 23, 52-53 (1992) (explaining that employers are permitted to require potential employees to successfully complete a pre-employment medical examination).

6. See *infra* Part IV.A.

by the workplace.⁷ Whether the historical balance of the workers' compensation scheme will continue in the age of toxicogenomics will depend on the choices of workers, employers, insurers, and legislators. Employers and insurers will have to weigh the costs of using their employees' genetic information, and workers too must consider their own interests in learning and making use of their genetic "flaws".⁸ Ultimately, legislatures will be called on to decide whether or to what extent the workers' compensation bargain should be re-worked.⁹

This Comment sets forth some of the issues surrounding the use of toxicogenomic technologies in workers' compensation and recommends that all parties consider these issues now in order to make sound and fair decisions in the future when toxicogenomic testing finds its way into the employment setting. This Comment begins with a history of workers' compensation statutes in Part I,¹⁰ followed by an overview of toxicogenomics in Part II.¹¹ In Part III, the Comment will discuss the potential workplace applications of toxicogenomics, including employment screening.¹² Part IV will discuss the application of toxicogenomics to workers' compensation underwriting, rating, and claims adjusting.¹³ Finally, in Part V the Comment will set out the ethical and policy considerations implicated by the use of toxicogenomics in workers' compensation.¹⁴

I. THE HISTORICAL DEVELOPMENT OF WORKERS' COMPENSATION STATUTES

The enactment of state and federal workers' compensation laws began in the late nineteenth century as a reaction to an increasingly industrialized economy and the workplace accidents that followed.¹⁵ Prior to the adoption of a statutory scheme, workers injured while on the job could only find judicial relief for their injuries if they could prove that their employers' actions amounted to common law negligence.¹⁶ Meeting the burden of proof was difficult for many workers because they had to show that the employer failed to provide a reasonably safe work environment.¹⁷ Furthermore, employers could fight the workers' claims with three

7. See *infra* Part IV.B.1.

8. See *infra* Part III; see also Susan M. Wolf & Jeffrey P. Kahn, *Genetic Testing and the Future of Disability Insurance: Ethics, Law & Policy*, J.L. MED. & ETHICS (SUPP. 2), Summer 2007, at 6, 6 (discussing the implications of using genetic information of employees on employers and insurers).

9. See *infra* Part IV.B.2.

10. See *infra* Part I.

11. See *infra* Part II.

12. See *infra* Part III.

13. See *infra* Part IV.

14. See *infra* Part V.

15. MARK A. ROTHSTEIN ET AL., EMPLOYMENT LAW 597–600 (3d ed. 2005).

16. *Id.* at 594.

17. Gurtler, *supra* note 1, at 286.

powerful common law defenses.¹⁸ This “unholy trinity” of contributory negligence, the “fellow servant” doctrine, and assumption of the risk made it nearly impossible for workers to receive compensation for their injuries, pushing common law courts to apply judicially created exceptions to the defenses before awarding damages.¹⁹ Eventually, by the end of the nineteenth century, states began enacting laws limiting the use of common law defenses by employers. After initial findings of unconstitutionality, the Supreme Court held state workers’ compensation statutes constitutional, opening the way to more widespread adoption throughout the country.²⁰

In enacting statutory workers’ compensation schemes, state legislatures sought to provide medical and financial assistance for injured workers while shifting the cost of workplace accidents onto the employer, and ultimately onto the consumer.²¹ Workers’ compensation statutes had other policy goals as well, including the creation of safer workplaces and the replacement of costly civil litigation with timely claims processing.²² In order to accomplish these goals, the statutory schemes reflected a “bargain” struck between workers and employers, in which employers accepted liability without fault and waived the common law defenses, but workers gave up their right to bring civil tort suits in exchange for guaranteed monetary compensation for their injuries, albeit often at a fixed and limited amount.²³ The hallmark of the bargain was liability without fault, which removed a worker’s burden of proving common law negligence on the part of the employer.²⁴

Instead of requiring a showing of common law cause-in-fact, workers’ compensation statutes require that injured employees show that their injury occurred “in the course of” employment²⁵ and that such injuries also “arise out of” the employment relationship.²⁶ The “arising out of” prong has, in itself, a causation element as workers must show that the injury was accidental and was causally

18. *Id.* at 286–87.

19. *Id.* at 287; ROTHSTEIN ET AL., *supra* note 15, at 596.

20. Compare *Franklin v. United Rys. & Elec. Co.*, 2 Baltimore City Rep. (1904), and *Ives v. South Buffalo Ry. Co.*, 94 N.E. 431 (N.Y. 1911) (striking down a New York no-fault liability workers’ compensation statute on due process grounds), with *Mountain Timber Co. v. Washington*, 243 U.S. 219 (1917) (upholding a Washington workers’ compensation law). For more general discussions of this trend, see ROTHSTEIN ET AL., *supra* note 15, at 597, 599 and Gurtler, *supra* note 1, at 293.

21. Donald G. Gifford, *The Death of Causation: Mass Product Torts’ Incomplete Incorporation of Social Welfare Principles*, 41 WAKE FOREST L. REV. 943, 963 (2006); Gurtler, *supra* note 1, at 293.

22. Gurtler, *supra* note 1, at 295–96; Ellen R. Peirce & Terry Morehead Dworkin, *Workers’ Compensation and Occupational Disease: A Return to Original Intent*, 67 OR. L. REV. 649, 653 (1988).

23. Peirce & Dworkin, *supra* note 22, at 653.

24. See Gifford, *supra* note 21, at 965–66 (describing the concept of liability without fault in the context of workers’ compensation statutes).

25. This Comment will not discuss the “in the course of” employment prong. For further discussion, see ROTHSTEIN ET AL., *supra* note 15, at 611–33.

26. Gifford, *supra* note 21, at 964.

connected to their job.²⁷ Workers have been successful in proving that their injuries “arose out of” employment based on the fact that the injuries occurred on the job.²⁸ Notably, in finding compensability, many courts have not required that the workplace be the only or principal cause of the injury, but only need be *one cause* of the injury.²⁹ As a result, injuries occurring at work that do not on their face appear to be work related, such as injuries due to acts of nature, are often found by courts to be compensable.³⁰ Furthermore, pre-existing diseases or individual predisposition to an injury that are aggravated by the work environment will often, though not always, be found to arise out of employment and thus be compensable.³¹

II. TOXICOGENOMICS GENERALLY

Workers’ compensation laws were originally conceived of and enacted in the late nineteenth century,³² long before the advent of genetic science.³³ Recent toxicogenomic technologies, however, allow scientists to determine if a particular individual has a greater risk of developing certain occupational diseases because of his or her genetic makeup.³⁴ Toxicogenomic technologies have several potential workplace applications, including in workers’ compensation insurance.³⁵

Toxicogenomics is the application of genomic technologies to the study of the effects of chemicals on human health.³⁶ These technologies allow scientists to “peer into cells” and see how chemicals and other toxic materials affect the cell on a

27. ROTHSTEIN ET AL., *supra* note 15, at 651–52.

28. Gifford, *supra* note 21, at 964.

29. John Dwight Ingram, *The Meaning of “Arising Out Of” Employment in Illinois Workers’ Compensation Law*, 29 J. MARSHALL L. REV. 153, 155 (1995).

30. *See, e.g.*, Imperial Trash Serv. v. Dotson, 445 S.E.2d 716 (Va. App. 1994) (holding that heatstroke was a compensable work-related injury that precipitated the employee’s death); Gifford, *supra* note 21, at 965. *But see* Va. Employment Comm’n v. Hale, 598 S.E.2d 327 (Va. App. 2004) (holding that a worker who was electrocuted when lightning passed through a telephone switchboard was not eligible for workers’ compensation benefits because her job did not increase her risk of being struck by lightning).

31. *See, e.g.*, Cheshire Toyota/Volvo v. O’Sullivan, 531 A.2d 714 (N.H. 1987) (holding that employee’s fatal heart attack was a compensable work injury despite his history of heart disease); ROTHSTEIN ET AL., *supra* note 15, at 652–54 (detailing the main approaches courts take to determining whether a heart attack caused by an underlying condition will be considered compensable). *But see* Augusta County Sherriff’s Dep’t v. Overbey, 492 S.E.2d 631 (1997) (holding that the employer successfully rebutted the statutory presumption that the employee’s heart disease was job-related).

32. *E.g.*, Workmen’s Compensation Act, 1897, 60 & 61 Vict., c. 37 (Eng.).

33. *See generally* Jamie A. Grodsky, *Genetics and Environmental Law: Redefining Public Health*, 93 CAL. L. REV. 171, 174–76 (2005) (tracing the history of genetic science from the discovery of DNA in the 1950s to the significant advances that began in the 1990s due to the growing power of computers).

34. *See* NRC Report, *supra* note 3, at 182 (discussing employers’ use of toxicogenomics to determine the extent that genetic variability has on occupational diseases).

35. Chris MacDonald & Bryn Williams-Jones, *Ethics and Genetics: Susceptibility Testing in the Workplace*, 35 J. BUS. ETHICS 235, 235–36 (2002).

36. NRC Report, *supra* note 3, at 2.

molecular level.³⁷ Researchers can also see how differences in gene sequences or gene mutations affect an individual's susceptibility to chemicals,³⁸ and may result in far more accurate means of determining the potential effects of toxins on health than currently available.³⁹

In order to determine the connection between chemicals and genetic susceptibility, scientists look for biomarkers, or some measurable indication of an exposure to or effect of a substance on human tissue.⁴⁰ Biomarkers work in two principal ways: to show susceptibility, or to show exposure.⁴¹ Susceptibility biomarkers are genetic variations that cause a particular sensitivity to chemicals.⁴² Exposure to the same type and amount of chemical may manifest itself to varying degrees in different people.⁴³ A susceptibility biomarker essentially modifies the risk of having a reaction when exposed to a chemical or other trigger.⁴⁴ Identifying which gene variations correlate to a given reaction raises the possibility that physicians can determine, before exposure, that a person will have a negative reaction to an agent, and therefore act to avoid such exposure.⁴⁵ For example, one study explored the relationship between variations in a gene responsible for DNA repair and development of lung cancer in both smokers and non-smokers.⁴⁶ The results of the study showed that non-smokers with the mutant genotype had a greater risk of developing lung cancer than those who had the more common genotype; whereas smokers with the mutant genotype, who inhale DNA-damaging carcinogens in smoke, had a 50% reduction in the risk of lung cancer as compared to smokers with the common genotype.⁴⁷ The study concluded that "the protective effect of these genetic variations in heavy smokers may be caused by the

37. Grodsky, *supra* note 33, at 180.

38. *Id.* at 181.

39. NRC Report, *supra* note 3, at 11–12.

40. Grodsky, *supra* note 33, at 181. The concept of biomarkers is not new to genomics, but has been refined. The biomarker concept was at use in measuring the level of lead in blood, for example. *Id.* at 181.

41. *Id.* at 183–85. There are also biomarkers of effect or response, which the National Research Council (NRC) defines as biomarkers that "indicate the response of an organism to an exposure." NRC Report, *supra* note 3, at 60. Grodsky defines these as biomarkers of effect, which show changes in cells in order to predict health effects. Grodsky, *supra* note 33, at 186. She also notes, however, that the difference between biomarkers of exposure and biomarkers of effect are not clearly distinguishable. *Id.* at 186. Therefore this Comment will discuss only the two principal biomarkers.

42. Grodsky, *supra* note 33, at 183–84.

43. See NRC Report, *supra* note 3, at 92 (noting that genetic differences between individuals causes variation in reactions to different environmental agents).

44. Grodsky, *supra* note 33, at 184.

45. See NRC Report, *supra* note 3, at 92 (discussing the association between gene modification and toxicity in patients taking irinotecan, an anticancer drug, and noting that doctors could screen patients before chemotherapy to identify potential toxicities).

46. *Id.* at 95.

47. *Id.*

differential increase in activity of these protective genes stimulated by heavy smoking.”⁴⁸ These results demonstrate that genetic differences between individuals can have serious implications for susceptibility to toxins, and that the ultimate effects of toxins on the body may be counterintuitive.⁴⁹

Biomarkers of exposure show that a person has been exposed to a chemical by detecting a certain amount of that chemical or its derivatives in bodily tissue.⁵⁰ Unlike susceptibility biomarkers, the technology to locate exposure biomarkers is not as well developed, has not undergone significant human subject research, and faces many challenges.⁵¹ Toxicogenomic technology has been used in a study that evaluated the exposure of a group of welders to metallic fumes.⁵² The welders were separated out by smoking status, and non-smokers showed altered gene expression in eight functional pathways, raising the possibility that the variations were caused by exposure to workplace fumes.⁵³ In another study, workers exposed to high levels of benzene showed twenty-nine genes with altered expression.⁵⁴ These results may show genetic indicators of exposure to benzene⁵⁵ that could eventually be developed into tests for an array of occupational toxic exposure.

In order to discover these biomarkers, scientists utilize gene arrays that permit observation of thousands of genes or parts of genes at the same time to see if they have been affected by exposure to toxins.⁵⁶ The potential of such technologies is significant. Not only do gene arrays speed up the process of studying biomarkers, but they may also allow scientists to see the effects of multiple chemicals on genetic material at the same time.⁵⁷ Given the speed and efficiency of these tests and the potential for low-cost genotyping in the future, the development of individual, personalized assessments for susceptibility or exposure may not be too far off.⁵⁸ A personalized assessment would allow individuals to understand, based on observation of their own gene expression, whether they are susceptible to a given chemical or even if they have unknowingly been exposed to a toxic substance.⁵⁹

48. *Id.*

49. The NRC cautions, however, that “more studies of the combined effects of multiple mutations are needed . . . to understand[] the distribution of genetic and genomic risks in human populations.” *Id.*

50. Grodsky, *supra* note 33, at 184. The NRC defines biomarker of exposure as “a chemical, its metabolite, or the product of an interaction between a chemical or some target molecule or cell that is measured in humans.” NRC Report, *supra* note 3, at 55.

51. NRC Report, *supra* note 3, at 71.

52. *Id.* at 70.

53. *Id.*

54. *Id.* at 71.

55. *Id.*

56. Grodsky, *supra* note 33, at 190.

57. *Id.* at 190–91.

58. *Id.* at 197.

59. *Id.* at 197–98.

In addition to new technologies to test for susceptibility or exposure to chemicals, there are also approximately a thousand genetic tests available for other genetic conditions or predispositions,⁶⁰ including predictive tests for colon and breast cancer,⁶¹ heart disease, and diabetes.⁶² Such genetic tests are increasingly commonplace and affordable, and will likely expand to cover predispositions to more conditions in the coming years.⁶³ It is not difficult to imagine a day when the average person would have, along with his or her traditional medical file, a comprehensive analysis of the likelihood of developing a condition either naturally or because of an interaction with environmental or pharmaceutical chemicals.⁶⁴

It is important to recognize that both toxicogenomic tests and genetic tests for disease predisposition are, for the most part, not fool-proof indicators of an eventual outcome.⁶⁵ Although genetic tests for certain conditions, namely Huntington's disease, are near certain indicators of eventual disease onset,⁶⁶ many other factors may influence whether exposure to a chemical, or genetic predisposition to natural disease, will actually turn into a symptomatic condition.⁶⁷ Diet, lifestyle, age, gender, and previous medical conditions all can contribute to, or work against, disease onset.⁶⁸ Diseases produced by exposure to environmental stimuli may result from both genetic factors and environmental factors, making it difficult to determine to what degree genetic characteristics caused the condition's development.⁶⁹ Furthermore, toxicogenomic tests themselves are in their infancy and must still undergo a validation process to test their reliability.⁷⁰

60. GeneForum, What Kinds of Genetic Tests Are Available?, http://www.geneforum.org/genetic_testing_a_resource_guide_for_con (last visited Nov. 29, 2009).

61. Francis S. Collins, Director, Nat'l Human Genome Research Inst., A Brief Primer on Genetic Testing at the World Economic Forum (Jan. 24, 2003), <http://www.genome.gov/10506784>.

62. See Univ. of Wash., Seattle, GeneTests: Laboratory Directory, <http://www.ncbi.nlm.nih.gov/sites/GeneTests/lab?db=GeneTests> (last visited Nov. 29, 2009) (for a searchable database of currently available genetic tests).

63. See generally Collins, *supra* note 61 (noting the likelihood of expanded testing in the coming years); see also Univ. of Wash., Seattle, GeneTests: Gene Reviews, <http://www.ncbi.nlm.nih.gov/sites/GeneTests/review?db=GeneTests> (last visited Nov. 29, 2009) (for a searchable database of current research on potential genetic tests).

64. See generally Office of Biological & Env'tl. Research, U.S. Dep't of Energy, Pharmacogenomics: Medicine and the New Genetics, http://www.ornl.gov/sci/techresources/Human_Genome/medicine/pharma.shtml (last visited Nov. 29, 2009) (discussing the possibility that pharmacogenomics may identify and decrease adverse drug reactions in individuals and remove the trial-and-error method of prescribing pharmaceuticals).

65. MacDonald & Williams-Jones, *supra* note 35, at 237.

66. HUNTINGTON'S DISEASE SOC'Y OF AM., GENETIC TESTING FOR HUNTINGTON'S DISEASE (1996), available at <http://www.lkwdpl.org/hdsa/hdtest.htm>.

67. Grodsky, *supra* note 33, at 188-89.

68. *Id.* at 188.

69. *Id.* at 188-89.

70. See NRC Report, *supra* note 3, at 135 (explaining that the utility of toxicogenomic technologies depends on their reliability).

III. POTENTIAL APPLICATIONS OF TOXICOGENOMICS TO THE WORKPLACE

When the day arrives that every worker carries in his or her hand a prediction of the effect certain substances might have on his or her health, it will no doubt empower both workers and employers to make more informed employment decisions. As already mentioned, new toxicogenomic technologies hold the promise of pinpointing when certain individuals might have a biological response to a particular chemical.⁷¹ Reliable tests would likely have many salutary effects: workers would have the opportunity to avoid exposure to chemicals in order to preserve their health, employers could redesign manufacturing processes in order to eliminate unnecessary toxins in the workplace and provide protective equipment to prevent exposure, doctors could anticipate negative effects in workers and prepare a treatment plan in advance.⁷² However, knowledge of such risk factors in the employee population could bring with it potential discriminatory uses on the part of employers.⁷³

Many employers undoubtedly would like to know if their workers are susceptible to developing a work-related disease even before making a hiring decision.⁷⁴ Eliminating at-risk workers would likely lower employer health insurance and workers' compensation premiums.⁷⁵ Furthermore, employers are required under the Occupational Safety and Health Act⁷⁶ to maintain a workplace free of dangers that are likely to cause serious injury to employees.⁷⁷ Knowing in advance the genetic risks their employees face would give employers a head start in making necessary workplace modifications.⁷⁸ In fact, employers already use a variety of tests in making hiring decisions, including medical examinations and

71. Grodsky, *supra* note 33, at 196–98.

72. See generally NRC Report, *supra* note 3, at 59–151 (discussing the potential applications and validation of toxicogenomics).

73. See generally Rothstein, *supra* note 5, at 25–30 (describing discriminatory uses of genetic information by employers).

74. See Joanne L. Hustead & Janlori Goldman, *Genetics and Privacy*, 28 AM. J.L. & MED. 285, 293–95 (2002) (stating that most large employers require new hires to take medical exams and twenty percent of major U.S. firms gather an employee's family medical history, which allows firms to make decisions based on risk of disease).

75. See Susannah Carr, *Invisible Actors: Genetic Testing and Genetic Discrimination in the Workplace*, 30 U. ARK. LITTLE ROCK L. REV. 1, 2 (2007) (stating that employers have a "strong economic incentive to screen out" workers perceived as high cost healthcare users).

76. Occupational Safety and Health Act of 1970, 29 U.S.C. §§ 651–667 (2006).

77. ROTHSTEIN ET AL., *supra* note 15, at 491.

78. It is not clear that OSHA requires or allows employers to consider genetic factors to meet OSHA standards. See Mark A. Rothstein, *Genetics and the Work Force of the Next Hundred Years*, 2000 COLUM. BUS. L. REV. 371, 400 (indicating that OSHA lacks specific standards regarding genetic testing).

drug screening.⁷⁹ Pre-placement medical exams are widely used today, especially in industrial workplaces.⁸⁰

The Americans with Disabilities Act (ADA) prohibits discrimination in hiring based on medical exams or medical inquiries.⁸¹ As a result, under the ADA, an employer cannot require a medical exam or inquire into an individual's genetic status before making a conditional offer of employment.⁸² An employer also would be unable to access an applicant's personalized assessment of his or her genetic predisposition to disease or interaction with chemicals before extending a job offer.⁸³

The ADA does permit employers to condition an offer of employment on the successful completion of a medical exam.⁸⁴ It is important to note that, although this provision of the ADA would give an employer access to an employee's previously ascertained genetic status and to conduct genetic testing,⁸⁵ an employer would still violate the ADA if it then withdrew an offer of employment based on the worker's genetic status alone.⁸⁶ The employer may, however, use the results of the medical exam, including information about genetic predispositions, to deny employment if that genetic information reveals that the worker cannot perform essential job duties.⁸⁷ For example, a worker may have a genetic predisposition to a given chemical that will cause him or her to lose consciousness. If the worker's job duties require interaction with that chemical, the employer could argue that he or

79. *Id.* at 382.

80. Rothstein, *supra* note 5, at 52–53; Daniel Schlein, *New Frontiers for Genetic Privacy Law: The Genetic Information Nondiscrimination Act of 2008*, 19 GEO. MASON U. CIV. RTS. L.J. 311, 316 (2009) (noting that a 2001 survey from the American Management Association revealed that sixty-eight percent of major American firms required medical examinations for new hires, current employees, or both).

81. Americans with Disabilities Act of 1990 § 102, 42 U.S.C. § 12112 (2006).

82. *Id.* § 102(c)(2), 42 U.S.C. § 12112(d)(2).

83. *See* 42 U.S.C. § 12112(d)(2) (prohibiting an employer from discriminating against an employee by asking an applicant whether the applicant has a disability, except for “inquiries into the ability of an applicant to perform job-related functions”); *see also* Pauline T. Kim, *Genetic Discrimination, Genetic Privacy: Rethinking Employee Protections for a Brave New Workplace*, 96 Nw. U. L. Rev. 1497, 1514 (2002) (noting that the ADA would prohibit an employer's inquiry into an applicant's genetic information prior to making an offer).

84. 42 U.S.C. § 12112(d)(2).

85. *See* Rothstein, *supra* note 78, at 386 (noting that the ADA permits employers to require individuals to sign a release authorizing the disclosure of all medical information in the files of the individual's treating physicians).

86. Schlein, *supra* note 80, at 320 (noting that the EEOC would conclude that an employer treated an employee as “substantially limited in a major life activity,” thus violating the ADA, if the employer withdraws a job offer based on knowledge of the employee's genetic profile).

87. Rothstein, *supra* note 5, at 55 (citing Americans with Disabilities Act of 1990 § 102(b)(6), 42 U.S.C. § 12112(b)(6)).

she cannot perform the basic job functions based on the likelihood of losing consciousness.⁸⁸

An employer may also legally screen out an employee under the “direct threat” provision of the ADA.⁸⁹ The statute permits an employer to refuse to hire an individual if it can show that the person presently poses a direct threat to the “health or safety of others” in the workplace.⁹⁰ EEOC regulations,⁹¹ upheld by the Supreme Court’s decision in *Chevron U.S.A. Inc. v. Echazabal*,⁹² also allow an employer to refuse to hire a person posing a direct threat to his or her *own* health.⁹³ In order to qualify as a “direct threat,” the individual must create a “significant risk of substantial harm to the health or safety of the individual or others that cannot be eliminated or reduced by reasonable accommodation.”⁹⁴ An individualized assessment of the person’s condition, relying on current medical knowledge, is required in determining if the individual in fact poses a threat.⁹⁵

An employer may find a defense in the “direct threat” provision if it refuses to hire an employee following a pre-placement medical exam that revealed a susceptibility to a workplace chemical.⁹⁶ An employer could argue, using a scientifically accepted toxicogenomic test, that the applicant’s genetic status posed a “significant risk” of “substantial harm” to the employee’s own health.⁹⁷ Though a genetic test is not a fool-proof indicator of a future reaction, a court could find that having a susceptibility biomarker for a workplace chemical amounts to a “substantial risk” of a negative reaction upon exposure.⁹⁸ Furthermore, the employer could argue that a reasonable accommodation for that individual is not feasible because any position in the workplace would expose the individual to interaction with the chemical.⁹⁹ A defense under the “direct threat” provision has

88. See PDRHealth, Complete Diseases and Health Conditions Index A-Z, <http://www.pdrhealth.com/disease/disease-a-z.aspx?letter=L> (follow “Loss of Consciousness” hyperlink) (last visited Nov. 29, 2009) (explaining how certain chemicals can cause loss of consciousness).

89. Americans with Disabilities Act of 1990 § 103(a)–(b), 42 U.S.C. § 12113(a)–(b). This provision operates as a defense if an employer is charged with violation of the ADA.

90. *Id.* § 101(3), 42 U.S.C. § 12111(3).

91. 29 C.F.R. §§ 1630.2(r), .15(b)(2) (2008).

92. 536 U.S. 73, 76–77 (2002).

93. *Id.* at 76.

94. 29 C.F.R. § 1630.2(r).

95. *Id.*

96. See *Chevron*, 536 U.S. at 76–79 (explaining that an employer may rightfully terminate an employee based on that employee’s vulnerability to a chemical within the workplace).

97. 29 C.F.R. § 1630.2(r).

98. See, e.g., *Chevron*, 536 U.S. at 76–79 (permitted termination based only on an employee’s vulnerability to workplace chemicals).

99. THE LAW OF ENVIRONMENTAL JUSTICE: THEORIES AND PROCEDURES TO ADDRESS DISPROPORTIONATE RISKS 722 (Michael B. Gerrard ed., American Bar Association 2d ed.) (2008) (noting that employers are relieved of their obligation to accommodate disabled individuals “if the

historically been hard to prove,¹⁰⁰ however, and the use of recently developed toxicogenomic technologies to substantiate such a claim could meet a certain degree of judicial resistance.¹⁰¹

It is unlikely, however, that the “direct threat” provision or any other ADA protection would apply to individuals who have a susceptibility biomarker for a workplace chemical.¹⁰² The Supreme Court has limited the definition of a disability qualifying an individual for ADA protection to a presently-existing physical or mental impairment, not a condition that could “potentially or hypothetically” limit a major life activity.¹⁰³ Therefore, an individual with a heightened risk for developing an illness in the workplace, but suffering no current symptoms, would not be protected by ADA at all.¹⁰⁴ As a result, an employer legally could exclude an individual from employment based on a pre-placement medical exam that reveals an individual’s genetic predisposition.¹⁰⁵

The Genetic Information Nondiscrimination Act of 2008 makes it illegal, with limited exceptions, for an employer to even request genetic information about an employee.¹⁰⁶ The new law allows employers to collect genetic information about employees for the limited purpose of monitoring the effects of workplace toxins on employee health, but would not permit the employer (other than the employer’s health care professionals) to see the individual results of such tests.¹⁰⁷ Although this provision purports to protect an individual employee by limiting the use of genetic information by his employer, the results of genetic tests could still become part of the employee’s medical records.¹⁰⁸ Currently there is no system in place to separate

accommodations would result in undue hardship or if the accommodation would not enable the employee to perform the essential functions of the position.”).

100. See Rothstein, *supra* note 5, at 72.

101. Mark A. Rothstein, *Legal Conceptions of Equality in the Genomic Age*, 25 L. & INEQUALITY 429, 445 (2007) (“[C]ourts have construed the reasonable accommodation requirement in the ADA as mandating a much greater level of effort and expense on the part of employers than is required by the comparable language applicable to religious discrimination under Title VII.”).

102. Kim, *supra* note 83, at 1514.

103. *Toyota Motor Mfg., Inc. v. Williams*, 534 U.S. 184, 194–95 (2002); *Sutton v. United Air Lines, Inc.*, 527 U.S. 471, 482 (1999).

104. See *Sutton*, 527 U.S. at 482 (noting that a “disability” under the ADA exists only where an impairment substantially limits a major life activity, “not where it ‘might,’ ‘could,’ or ‘would’ be substantially limiting if mitigating measures were not taken.”).

105. See 42 U.S.C. § 12112(d) (2006) (permitting employers to conduct pre-employment medical examinations and to condition offers for employment on the results of such examinations).

106. Genetic Information Nondiscrimination Act of 2008, Pub. L. No. 110-233, § 202(b), 122 Stat. 907 (2008).

107. *Id.*

108. Patricia Alten, Note, *GINA: A Genetic Information Nondiscrimination Solution in Search of a Problem*, 61 FLA. L. REV. 379, 389 (2009).

out genetic information from other health information.¹⁰⁹ Therefore, even if nondisclosure of genetic information were required by law, as a practical matter nondisclosure would be difficult when many patient records are paper-based files containing a lifetime of records for a variety of medical conditions.¹¹⁰ Furthermore, disclosure of medical records—which may include genetic test results—could be compelled in workers' compensation suits.¹¹¹ How the new law affects the ADA allowance for pre-placement medical exams, where the individual is not yet an employee, is not clear.¹¹² In addition to the recent federal legislation, about two-thirds of the states have also enacted legislation prohibiting the request or collection of genetic information in making hiring decisions.¹¹³

Beyond legal hurdles there are other reasons why an employer may choose not to engage in predictive genetic testing of potential employees. As noted above, toxicogenomic technologies are still in their developmental stages.¹¹⁴ The results of

109. See, e.g., Mark A. Rothstein & Meghan K. Talbott, *Compelled Disclosure of Health Information*, 295 JAMA 2882, 2882 (2006) (indicating that paper-based records may combine both routine medical data with sensitive information, such as genetic test results).

110. *Id.* Medical records “may intermingle routine clinical data with sensitive information such as mental health, genetic test results, sexually transmitted diseases, sexual history, history of abortions and other reproductive matters, domestic violence, and drug and alcohol abuse.” *Id.* Furthermore, under GINA, it is not unlawful for an employer to inadvertently gain access to information about an employee's family medical history. Pub. L. No. 110-233, § 202(b)(1), 122 Stat. at 907 (2008). The EEOC's proposed regulations extend GINA's carve-out for inadvertent acquisition specifically to genetic information about the employee or his family. Genetic Information Nondiscrimination Act of 2008, 74 Fed. Reg. 9066, 9068 (proposed March 2, 2009). The proposed regulations provide several examples of how an employer could inadvertently—and therefore legally—obtain an employee's genetic information. *Id.* GINA also does not apply to the acquisition of genetic information during an examination made for a purpose other than determining fitness for a particular job, and therefore would not apply to medical examinations made for the purpose of settling workers' compensation claims. *Id.*

111. Rothstein & Talbott, *supra* note 109, at 2883; see also *infra* Part IV (discussing genetic testing in workers' compensation claims). GINA does not apply to the use of genetic information in processing and litigating workers' compensation claims. See Mark A. Rothstein, *Currents in Contemporary Ethics: GINA, the ADA, and Genetic Discrimination in Employment*, 36 J.L. MED. & ETHICS 837, 837 (2008) (noting that GINA “prohibits discrimination in employment and health insurance” but “does not apply to life insurance, disability insurance, long-term care insurance, or other potential uses of genetic information”).

112. In fact, GINA may have no effect upon the collection of genetic information as part of a pre-placement medical exam that is lawful under the ADA. Rothstein, *supra* note 111, at 838 (“GINA does not affect a key provision of the [ADA], under which an employer may, after a conditional offer of employment, lawfully require an individual to sign an authorization to disclose all of his or her health records to the employer.”).

113. NRC Report, *supra* note 3, at 181. See also MINN. STAT. ANN. § 181.974 (West 2007) (prohibiting employers from requiring the production of genetic information as a condition of employment). For a comprehensive survey of state genetic anti-discrimination laws, see Nat'l Conference of State Legislatures, Genetic Employment Laws, <http://www.ncsl.org/IssuesResearch/Health/GeneticEmploymentLaws/tabid/14280/Default.aspx> (last visited Nov. 30, 2009).

114. NRC Report, *supra* note 3, at 135.

these tests are at times counterintuitive¹¹⁵ and misunderstood by health care professionals and the public alike.¹¹⁶ Furthermore, locating a susceptibility biomarker in an individual's genetic material shows only that the individual has an increased likelihood, though not a certainty, of an adverse reaction.¹¹⁷

Based on current statutes, employers are restricted in their use of genetic information to screen out employees who might be a liability to the employer in the future.¹¹⁸ However, even in circumstances where pre-placement screening would violate the law, employers may gain access to workers' genetic information for other purposes, such as disputing workers' compensation claims.¹¹⁹

IV. APPLICATION OF TOXICOGENOMIC TECHNOLOGIES TO WORKERS' COMPENSATION INSURANCE

Toxicogenomic technologies potentially could be applied in the arena of workers' compensation insurance.¹²⁰ Workers' compensation coverage is currently compulsory for employers in nearly every state.¹²¹ Because workers' compensation insurance provides relief for workplace accidents or disease,¹²² the ability to predict susceptibility or exposure to such a disease could be of great use to insurers in underwriting policies and to employers in defending against workers' compensation claims.¹²³

A. Toxicogenomics in Workers' Compensation Underwriting and Rating

Most state workers' compensation systems allow employers to self-insure (to cover all the costs of workplace injuries and subsequent litigation) or to purchase

115. *See id.* at 95 (noting that counterintuitive findings are likely to emerge from studying gene-environment interactions).

116. Wolf & Kahn, *supra* note 8, at 8.

117. *See* Grodsky, *supra* note 33, at 184 (noting that a susceptibility gene is "neither necessary nor sufficient to cause disease" because the genes "modify risk").

118. *See, e.g.*, 42 U.S.C. § 12112 (2006) (limiting the use of medical tests and screenings before hiring employees).

119. *See* Kim, *supra* note 83, at 1510 (noting that employers can access genetic information that is part of the employee's medical file).

120. *See* Jennifer Girod & Andrew R. Klein, *Personalized Medicine and Toxic Exposure*, 9 HOUS. J. HEALTH L. & POL'Y 163, 174 (2009) (quoting Mark Hansen, *DNA Poised to Show Its Civil Side: After Changing Criminal Law, Tests Are Ready for Workers' Comp, Toxic Tort Cases*, A.B.A. J., Mar. 2008, at 18, 19, available at http://www.abajournal.com/magazine/article/dna_poised_to_show_its_civil_side/ (discussing the use of toxicogenomics dozens of California workers' compensation cases)).

121. Ishita Sengupta & Virginia Reno, *Recent Trends in Workers' Compensation*, SOC. SECURITY BULL., Aug. 2007, at 17, 18 (2007), available at <http://www.ssa.gov/policy/docs/ssb/v67n1/v67n1p17.pdf> ("Every state except Texas requires employers to provide workers' compensation coverage.").

122. *E.g., id.* at 18–19.

123. *See generally* Girod & Klein, *supra* note 120, at 172 (discussing possible uses of information regarding disease susceptibility, including by employers defending against employee lawsuits).

coverage, either through a state operated system or from a private insurer.¹²⁴ For employers that purchase insurance, each employer's total workforce is separated into industrial classes and assigned a rate.¹²⁵ These initial class rates are state-regulated, and often require advance approval to be changed.¹²⁶

To allow room for competition, states permit insurers to engage in experience rating, a process by which insurers adjust an employer's overall coverage rate either up or down based on its previous claims experience, usually over the preceding three years.¹²⁷ An employer that has filed many claims in the past three years is more likely to have its rate increase; an employer that has a relatively short claims history will probably get a premium discount, and pay less than a comparable employer that filed more claims.¹²⁸ Under the experience rating system, employers clearly have an economic incentive to keep claims, and therefore workplace injuries, to a minimum.¹²⁹

Toxicogenomics might factor into workers' compensation insurance rating in two ways. On the one hand, employers that understand how experience rating works will naturally want to minimize the number of people they hire who are likely to suffer a workplace illness and file a claim.¹³⁰ Employers in industries where many potentially toxic substances are used will likely expand the use of conditional offers of employment subject to medical exams.¹³¹ As noted above, the ADA most likely would not protect individuals who discover a genetic predisposition to workplace illness through a pre-placement physical exam.¹³² If such an individual did have an existing condition that would qualify as a disability under the ADA, an employer could still try to argue that due to a genetic condition the worker currently could not perform a basic job function, such as a task requiring close interaction with a chemical.¹³³ Alternatively, an employer could

124. Emily A. Spieler, *Perpetuating Risk? Workers' Compensation and the Persistence of Occupational Injuries*, 31 HOUS. L. REV. 119, 189 (1994).

125. *Id.* at 189–90.

126. *Id.* at 190.

127. *Id.* at 192–93.

128. *Id.*

129. In fact, experience rating has been viewed as an incentive to prevent injury by making workplaces safer. *See id.* at 193.

130. *See* Keith N. Hylton & Steven E. Laymon, *The Internalization Paradox and Workers' Compensation*, 21 HOFSTRA L. REV. 109, 154 (1992) (explaining that employers that reduce the number of injury claims without investing in new equipment, training, and supervision can enjoy lower premiums and improve their rating without incurring new costs).

131. *See infra* notes 134–136 and accompanying text (showing that while rational to precondition employment offers, any prerequisite to an employment offer based on a medical exam must fall into either the category of direct threat, or be for a legitimate business purpose).

132. *See supra* Part III.

133. *See* Americans with Disabilities Act of 1990 §101(3), 42 U.S.C. §12111(3) (2006) (permitting employers to refuse to hire individuals that presently pose a direct threat to the "health or safety of others" in the workplace).

also engage in screening of workers and, if sued for discrimination under the ADA, could invoke the "direct threat" defense.¹³⁴ Due to the limited application of the ADA to individuals with biomarkers of susceptibility,¹³⁵ and the defenses for employers in cases where individuals do qualify for ADA protection,¹³⁶ an employer could essentially screen out an entire class of workers who have a higher risk of contracting a workplace disease and filing a claim for compensation.¹³⁷

Workers' compensation carriers could also require policyholders to gather genetic information about their employees before agreeing to provide coverage.¹³⁸ Currently there is no legislation preventing the use of genetic information in workers' compensation or other disability underwriting, unlike in health insurance.¹³⁹ Many states have enacted genetic privacy laws that would prohibit an employer from disclosing genetic information to a workers' compensation carrier without the employee's consent.¹⁴⁰ However, giving such consent could be made a condition of employment as disclosure, in itself, would not be discrimination under the ADA.¹⁴¹ Workers, especially in the face of a declining number of industrial jobs, would have little bargaining power to refuse to consent to such a request.¹⁴² Furthermore, workers' compensation carriers have no obligation to continue to write policies in any given state. Carriers likely would be highly resistant to any

134. An employer would only have to use the direct threat defense if the employee in question first had an ADA-qualifying disability. *Id.*

135. See Rothstein, *supra* note 111, at 839 (noting that the ADA does not address biomarkers).

136. 42 U.S.C. § 12113(a).

137. See *id.* (allowing a covered employer to, at its discretion, screen out individuals from employment as long as the screening is job-related and consistent with business necessity).

138. NAT'L COUNCIL ON COMPENSATION INS., BASIC MANUAL FOR WORKERS COMPENSATION AND EMPLOYERS LIABILITY INSURANCE 66 (2001) (allowing insurance administrators to gather any information they demonstrate is necessary to process employers' applications to determine eligibility).

139. See Wolf & Kahn, *supra* note 8, at 6 (noting that some states limit health insurers' access to genetic information).

140. For a detailed description of state health privacy laws, see JOY PRITTS ET AL., THE STATE OF HEALTH PRIVACY: A SURVEY OF STATE HEALTH PRIVACY STATUTES (2d ed. 2002).

141. EQUAL EMPLOYMENT OPPORTUNITY COMM'N, NOTICE NO. 915.002, ENFORCEMENT GUIDANCE: DISABILITY-RELATED INQUIRIES AND MEDICAL EXAMINATIONS OF EMPLOYEES UNDER THE AMERICANS WITH DISABILITIES ACT (2000), available at <http://www.eeoc.gov/policy/docs/guidance-inquiries.html> (explaining that employers are permitted to make disability-related inquiries and carry out medical examinations on potential employees, so long as the inquiries are made for all entering employees). Further, GINA likely has no effect upon such a disclosure requirement by employers. See generally Rothstein, *supra* note 111 (discussing the scope of GINA).

142. See generally CTR. FOR ECON. DEV., UNIV. OF WIS.-MILWAUKEE, CURBING INDUSTRIAL DECLINE OR THWARTING REDEVELOPMENT? AN EVALUATION OF CHICAGO'S CLYBOURN CORRIDOR, GOOSE ISLAND, AND ELSTON CORRIDOR PLANNED MANUFACTURING DISTRICTS (2005), available at <http://www4.uwm.edu/ced/publications/pmdstudy1.pdf> (analyzing the decline of manufacturing jobs and employers in Chicago); Lori B. Andrews & Ami S. Jaeger, *Confidentiality of Genetic Information in the Workplace*, 17 AM. J. L. & MED. 75, 104 (1991) (commenting that employees susceptible to disease may be forced to pursue private insurance in some instances when their genetic information is monitored in the workplace).

legislative attempt to prevent collection of genetic information, and could theoretically threaten to cease providing coverage in a state should such legislation be enacted.

B. Toxicogenomics and Workers' Compensation Claims

To establish the compensability of a work-related injury, an employee need not prove that the employer was at fault in causing the injury, but only that the injury arose out of employment.¹⁴³ However, an employer may be able to escape liability if it can offer rebuttal proof that the injury was not caused by the workplace but by a genetic predisposition.¹⁴⁴ Consequently, toxicogenomic tests for biomarkers of exposure could be used by both employer and employee to show either that an exposure did or did not occur.¹⁴⁵

1. The Model of Toxic Tort Litigation

The past and potential use of toxicogenomic technologies in toxic tort litigation provides a helpful example of how biomarkers may be used in workers' compensation claims disputes.¹⁴⁶ Although workers' compensation statutes do not require the same proof of causation as common law torts,¹⁴⁷ tort litigation is still a helpful indicator of the uses of toxicogenomics.¹⁴⁸ Some state workers' compensation statutes, as described below, allow an employer to escape liability if it can demonstrate that some factor other than work substantially caused the worker's injuries.¹⁴⁹

143. See generally Ingram, *supra* note 29 (explaining the requirement that workers' compensation injuries "arise out of" the worker's employment).

144. See Gifford, *supra* note 21, at 96 (noting that the employer's conduct must be a cause of the worker's injuries in any workers' compensation claim).

145. See Marchant, *supra* note 4, at 22 ("[G]ene expression microarrays have tremendous potential to provide objective, individualized data on exposure, which both plaintiffs and defendants will be able to use in appropriate cases.").

146. See, e.g., *id.* at 20–21 (citing *In re TMI Litigation*, 193 F.3d 613, 622 (3d Cir. 1999)) ("[G]enetic markers can, in principle, be used to demonstrate and quantify exposure to a toxic agent, but the temporal dimensions of when the exposure occurred and when the exposure biomarkers were assayed will be critical to the admissibility of such evidence."); *id.* at 10–12 (citing *Easter v. Aventis Pasteur, Inc.*, 358 F. Supp. 2d 576 (E.D. Tex. 2005)) (examining the potential for genetic susceptibility claims to circumvent causation barriers to recovery).

147. Gifford, *supra* note 21, at 96–66 ("The workers' compensation system thus allows the injured worker to receive benefits without satisfying any requirement of proof as a causal connection between a particular injurer and a particular victim comparable to that traditionally required by the common law of torts.").

148. See Marchant, *supra* note 4, at 12–13 (discussing litigation in which defendants have sought genetic testing of plaintiffs "for the purpose of showing potential alternative causes of the claimants' condition").

149. See *infra* Part IV.B.2.

In the past plaintiffs in toxic tort litigation have used genetic susceptibility studies to try to prove causation.¹⁵⁰ In some of these cases, the genetic data did not successfully prove causation because the data were from a generalized study and were not specific to the plaintiff's own genetic susceptibility to the toxin.¹⁵¹ In cases where the data were plaintiff-specific, they in fact showed a lack of susceptibility.¹⁵² Therefore individualized susceptibility biomarkers have already been used in toxic tort litigation to both prove (though unsuccessfully) and disprove causation.¹⁵³

Toxicogenomics may also be used in toxic tort litigation to show exposure to chemical toxins.¹⁵⁴ Measuring exposure to a chemical substance by traditional testing is often difficult, especially when the plaintiff does not realize they have been exposed until long after the incident of exposure.¹⁵⁵ Biomarkers of exposure could give plaintiffs the measurable proof of exposure required by courts.¹⁵⁶ In the same way, biomarkers of exposure could be used by injured employees to show that they were exposed to a chemical specific to the workplace, and therefore establish that their injury arose out of employment.¹⁵⁷ Alternatively, an employer could utilize such technology.¹⁵⁸ If a genetic test found no exposure to a chemical, or exposure only to a substance not contained in the workplace, the employer would have further proof that the injury did not arise out of the employment relationship.¹⁵⁹

Biomarkers of exposure could also help workers who suffer from latent onset diseases that were caused by work activity.¹⁶⁰ In toxic torts, plaintiffs can sue based

150. Marchant, *supra* note 4, at 10–11 (discussing cases where plaintiffs sought to prove causation by reliance on genetic susceptibility to certain substances, including: silicone, in a breast implant suit; ionizing radiation, in a suit brought by an individual with thyroid cancer; and mercury, in a claim involving autism allegedly caused by a chemical preservative in vaccines).

151. *Id.* at 11.

152. *Id.* (citing *Easter v. Aventis Pasteur, Inc.*, 358 F. Supp. 2d 576 (E.D. Tex. 2005)).

153. *Id.* at 10–11.

154. *Id.* at 19–20.

155. *Id.* at 20.

156. See Marchant, *supra* note 4, at 20 (describing the advantages and disadvantages of using biomarkers to prove exposure).

157. See *id.* at 20–21 (quoting *In re TMI Litigation*, 193 F.3d at 690) (“The Court of Appeals for the Third Circuit validated the general approach of using such biomarkers to prove exposure, holding that such use of genetic markers ‘is an accepted method, not simply for determining if the subject of the analysis was irradiated, but also for estimating radiation dose to the individual.’”).

158. Girod & Klein, *supra* note 120, at 174; Tamar Lewin, *Commission Sues Railroad to End Genetic Testing in Work Injury Cases*, N.Y. TIMES, Feb. 10, 2001, at A10 (discussing the use of genetic testing by a railroad company for workers' compensation purposes).

159. See Hansen, *supra* note 120 (indicating some California workers' compensation cases have been dropped after biomarker tests established that a claimant had not been injured by workplace chemical exposure as alleged).

160. Cf. Marchant, *supra* note 4, at 27–30 (discussing the use of biomarkers as they relate to plaintiffs' recovery for exposure and latent onset of disease in toxic tort cases generally).

on exposure to a toxin even if they have yet to manifest symptoms of disease.¹⁶¹ Use of toxicogenomic technologies in those cases might allow plaintiffs to make a showing of the prerequisite conditions to state a claim in latent risk.¹⁶² For example, courts may require a plaintiff in such a case to show a *present* injury, which is difficult to do if no symptoms are present.¹⁶³ A positive test for exposure may suffice to support a latent risk claim.¹⁶⁴ Likewise, a test that proves exposure to a chemical agent may help an employee show that a condition is work-related even if the condition develops well after exposure or over a long period of time.¹⁶⁵ Traditionally some courts would deny workers' compensation coverage for such latent onset conditions.¹⁶⁶

2. State Statutory Modifications to the "Arising Out Of" Prong

Workers' compensation statutes were initially enacted at a time when most workplace injuries were the result of a sudden accident with a piece of machinery.¹⁶⁷ Since that time, however, many workers' compensation claims are for injuries without one clearly defined cause, that develop over a long period of time, or whose work-relatedness is difficult to measure.¹⁶⁸ Some of the most difficult cases in which to determine the work-relatedness of an injury are those for conditions to which the employee was predisposed but which may have been aggravated by working conditions.¹⁶⁹ These cases represent an opportunity to use toxicogenomic technologies to either establish or refute compensability by employers, insurance companies, and employees.¹⁷⁰

161. *Id.* at 27.

162. *Id.* at 28–29.

163. *Id.* at 28.

164. *See id.* at 29 (noting that an individual or class must have been exposed to a hazardous agent in toxic tort suits involving latent risks).

165. *See generally* Kelly Corbett, Comment, *Multiple Chemical Sensitivity Syndrome: Occupational Disease or Work-Related Accident?*, 24 B.C. ENVTL. AFF. L. REV. 395, 406 (1997) (discussing problems of latency in workers' compensation claims).

166. *See* ROTHSTEIN ET AL., *supra* note 15, at 656 (explaining that states that regularly award benefits to workers in such cases "may deny coverage in close cases," such as those involving "individuals who are unable to demonstrate clear employment-related causal connections or who sustain conditions that do not develop at identifiable times").

167. Martha T. McCluskey, *The Illusion of Efficiency in Workers' Compensation "Reform"*, 50 RUTGERS L. REV. 657, 767 (1998).

168. *See generally* ROTHSTEIN ET AL., *supra* note 15, at 661–69 (discussing the scope of occupational disease).

169. *See* Marchant, *supra* note 4 at 963 (noting employers in workers' compensation claims generally only prevail where they can show a "pre-existing genetic condition or predisposition was the exclusive cause of the disability, and could have occurred independent of any workplace exposure").

170. *See, e.g.*, Nigel Hawkes, *DNA Test that Could Quickly Solve Thousands of Sick Workers' Claims*, THE TIMES, Sept. 17, 2007, available at <http://www.timesonline.co.uk/tol/news/science/article2469488.ece> (exploring the use of DNA testing in civil litigation); Jeremy Smerd, *DNA Technology May Curb Bogus Disability Claims*, Workforce Management, Sept. 10, 2007, at 8, available

Over the past half century, legislatures have generally expanded statutory coverage for workplace accidents in order to compensate more workers.¹⁷¹ In many states, a worker need only show that the workplace was *one* cause of an injury, but not necessarily the principal cause.¹⁷² For example, in Alabama, to be compensated a worker must show that his job exposed him to a danger “materially in excess of that danger to which all persons are ordinarily exposed in their everyday lives.”¹⁷³ Under this standard, an Alabama court found a worker’s back injury fully compensable even when multiple doctors testified that the worker had a “genetic predisposition” or “genetic marker” for ankylosing spondylitis, an arthritic condition.¹⁷⁴ Furthermore, many courts will find compensability in such cases because aggravation of a pre-existing condition is a foreseeable result of work duties.¹⁷⁵ Under these standards, the use of susceptibility biomarkers by an employer to refute liability would likely have little effect: even if a worker was susceptible to injury, ultimately it was the workplace exposure or accident that caused the injury.¹⁷⁶ As one court noted, “where employment aggravates or combines with a latent disease . . . to produce a disability, the pre-existing disability does not disqualify the employee’s claim . . . if the employee was able to perform his job duties before the injury.”¹⁷⁷ On the other hand, an injured worker could utilize a biomarker of exposure to show that he had been exposed to a workplace chemical, and thus rule out non-work causes of the condition.¹⁷⁸

Some states have enacted statutory provisions that require employees to show more definitively that their job caused their injury.¹⁷⁹ South Dakota requires that “the employment or employment related injury is and remains a *major contributing cause* of the disability . . . or need for treatment” for a pre-existing condition to be

at http://www.workforce.com/section/00/article/25/12/44_printer.html (discussing the possibility of using genetic testing to cut down on frivolous disability claims in the workplace).

171. Thomas J. Kniesner & John D. Leeth, *Improving Workplace Safety: Standards or Insurance?*, 14 REGULATION 64, 67 (1991), available at <http://www.cato.org/pubs/regulation/regv14n4/reg14n4-kniesner.html> (“Workers’ compensation benefits rose rapidly during the 1970s and early 1980s under a threat of federal preemption of state systems.”).

172. See, e.g., Ingram, *supra* note 29, at 156–59 (discussing the various approaches taken to determine whether an injury arises out of employment).

173. Tee Jays Mfg. Co. v. Stults, 723 So.2d 684, 686 (Ala. Civ. App. 1998).

174. Brock & Blevins, Inc. v. Cagle, 775 So.2d 824, 827–29 (Ala. Civ. App. 1999).

175. ROTHSTEIN ET AL., *supra* note 15, at 648.

176. See *infra* notes 177–178 and accompanying text.

177. Brock & Blevins, 775 So.2d at 828 n.2 (citing Cagle v. Brock & Blevins, Inc., 723 So.2d 65, 68 (Ala. Civ. App. 1998)).

178. See Karen Rothenberg et al., *Genetic Information and the Workplace: Legislative Approaches and Policy Challenges*, 275 SCIENCE 1755 (1997) (discussing the purpose of 1991 Wisconsin legislation promoting employee genetic testing for determining levels of exposure to toxic chemicals in the workplace).

179. See *infra* notes 180–181 and accompanying text.

compensable.¹⁸⁰ Montana only finds compensability for cardiovascular, pulmonary, and respiratory diseases if the workplace accident is the *primary cause* of the condition, defining primary cause as being “responsible for more than 50% of the physical condition.”¹⁸¹ Arkansas measures compensability by the specificity of the accident, requiring that the accident that causes the injury be “a specific incident . . . [that] is identifiable by time and place of occurrence.”¹⁸²

Under these statutes, where a more substantial link between the injury and the workplace is required, toxicogenomics might play a central role in deciding compensability.¹⁸³ In fact, genetic predispositions are already used in workers’ compensation cases.¹⁸⁴ For example, the Supreme Court of South Dakota denied compensation for a worker’s back injury when a physician’s testimony failed to establish that his work duties, rather than the worker’s pre-existing genetic condition, were the “major contributing cause” of his injury.¹⁸⁵ This case demonstrates how the injection of even less precise, non-toxicogenomic genetic data into physician testimony can create enough doubt about the work connection of an injury to defeat compensability; an individualized test result showing a susceptibility biomarker or a disease predisposition would likely have the same or greater effect.¹⁸⁶

Toxicogenomic tests are a developing technology; it remains to be seen how courts will react to their use in showing a work origin of injury or disease. Even if courts are willing to rely on these tests on an evidentiary basis, genetic tests may be only selectively accessible for workers’ compensation claims adjudication.¹⁸⁷ Currently at least three states’ legislative codes permit the use of genetic tests in investigating workers’ compensation claims, but require the written and informed consent of the employee.¹⁸⁸ In these states the use of susceptibility or exposure biomarkers likely would be limited to use by a plaintiff to affirmatively show the injury arose out of employment.¹⁸⁹ Under these statutes, a defendant-employer or

180. S.D. CODIFIED LAWS § 62-1-1(7)(b) (2007) (emphasis added).

181. MONT. CODE ANN. § 39-71-119(5)(a)–(b) (2007).

182. ARK. CODE ANN. § 11-9-102(4)(A)(i) (2002).

183. See generally NRC Report, *supra* note 3, at 12 (noting that toxicogenomics can provide sensitive, predictive information).

184. See *infra* notes 185–186 and accompanying text.

185. Horn v. Dakota Pork, 709 N.W.2d 38, 44–45 (S.D. 2006).

186. See NRC Report, *supra* note 3, at 12 (noting the possible use of toxicogenomics in genetic risk assessment).

187. See *infra* notes 188–192 and accompanying text (discussing genetics in workers’ compensation claims).

188. IOWA CODE § 729.6(7)(a) (2006); N.H. REV. STAT. ANN. § 141-H:3(IV)(a) (2007); WIS. STAT. § 111.372(4)(a) (2006).

189. E.g., IOWA CODE § 729.6(7)(a) (permitting genetic testing by employees to determine the employee’s “level of exposure to potentially toxic chemicals or potentially toxic substances in the workplace . . .”).

insurance company could probably not even make a request for a genetic test from the employee.¹⁹⁰ Given the number of states that have already enacted genetic privacy and nondiscrimination statutes,¹⁹¹ it is not unreasonable to think that many more states may adopt similar provisions to their workers' compensation statutes, thus closing off the possibilities for using toxicogenomic technologies in workers' compensation disputes.¹⁹²

On the other hand, some states have taken a more lenient approach to the use of genetic tests in adjudicating workers' compensation claims.¹⁹³ South Carolina may be the most permissive, exempting workers' compensation insurance completely from a health insurance non-discrimination provision that prohibits the exclusion of an individual from coverage based on his or her genetic information.¹⁹⁴ Utah takes a moderate approach, allowing an employer to seek a court order compelling a genetic test when the employee has placed his or her health at issue, which a worker does when filing a workers' compensation claim.¹⁹⁵ Although the potential uses of genetic information in claims decisions are significant, the ability to use genetic information in the workers' compensation context is not assured based on current law.

V. TOXICOGENOMICS AND WORKERS' COMPENSATION: POLICY AND ETHICAL CONSIDERATIONS

The use of toxicogenomic technologies in workers' compensation insurance raises many of the same ethical and policy issues that must be considered anytime an individual's genetic information is revealed.¹⁹⁶ Privacy, confidentiality, potential discrimination, and the rights of individuals and their relatives to not know their

190. See, e.g., WIS. STAT. § 111.372(1) (allowing genetic testing upon the request of the employee only).

191. See Nat'l Conference of State Legislatures, Genetic Privacy Laws, <http://www.ncsl.org/default.aspx?tabid=14287> (last visited Nov. 30, 2009) (genetic privacy laws); Nat'l Conference of State Legislatures, Genetic Nondiscrimination in Health Insurance Laws, <http://www.ncsl.org/default.aspx?tabid=14374> (last visited Nov. 30, 2009) (nondiscrimination laws); Nat'l Conference of State Legislatures, Genetic Nondiscrimination Enforcement Laws, <http://www.ncsl.org/default.aspx?tabid=14279> (last visited Nov. 30, 2009) (insurance laws relating to genetics).

192. See generally Kylie B. Crawford, *Lifeguard on Duty: Congress Patrols the Gene Pool*, Sept. 14, 2007, <http://www.hrhero.com/hl/091407-lead-genetics.shtml> (suggesting that employers consider developing new policies to comply with the increased regulation of genetic information use in the workplace).

193. See generally Kathryn J. Sedo, *Workers' Compensation, Social Security Disability, SSI, and Genetic Testing*, J.L. MED. & ETHICS (SUPP. 2), Summer 2007, at 74 (discussing the lack of genetic privacy protections in workers' compensation laws).

194. S.C. CODE ANN. § 38-93-20(C) (2006).

195. UTAH CODE ANN. § 26-45-103(2)(a)(i) (2007).

196. See generally Schlein, *supra* note 80, at 311-13 (2009) (expressing concern about the use of an individuals' genetic information by employers).

genetic makeup all become issues when workers, employers, or insurers seek to use biomarkers in making workers' compensation decisions.¹⁹⁷ Workers, employers, and legislatures must consider these potential issues now in order to make informed decisions when toxicogenomic technologies are in fact used, and potentially misused, in the employment setting.¹⁹⁸

A. Will Toxicogenomics Revive Notions of Fault and Risk Assumption in Workers' Compensation?

Workers' compensation is different from most other types of insurance and therefore creates unique policy and ethical questions surrounding the use of genetic information.¹⁹⁹ Many of these questions stem from the fact that employers "take their employees as they find them" in terms of coverage for work-related injuries.²⁰⁰ Many of the propositions discussed in this Comment, especially the potential use of predictive genomic tests to reduce insurance premiums and limit exposure to accidents, necessarily means that an employer no longer accepts an employee as they come, but conversely screens individuals for any risky condition to which they may be susceptible.²⁰¹ As more and more markers for genetic predispositions are discovered, a large percentage of the workforce could find itself in a marginalized position, pressed by employers to reveal genetic information through pre-placement agreement or exams that may then be passed on to workers' compensation insurers as a basis for rating and coverage.²⁰²

The notion that an employer takes its workers as it finds them grows out of the most important part of the workers' compensation scheme: liability, and

197. See, e.g., Marchant, *supra* note 4, at 35 (considering the issues raised when a plaintiff's genetic information is placed into evidence). See also *Norman-Bloodsaw v. Lawrence Berkeley Lab.*, 135 F.3d 1260, 1269 (9th Cir. 1998) (explaining that the information revealed by genetic tests is highly sensitive and therefore implicates privacy interests).

198. See generally MOLLY E. FRENCH & JANE B. MOORE, *HARNESSING GENETICS TO PREVENT DISEASE & IMPROVE HEALTH: A STATE POLICY GUIDE 1* (2003), available at <http://genes-r-us.uthscsa.edu/resources/genetics/geneticguide.pdf> (discussing the policy implications of the Human Genome Project).

199. See generally Max Mehlman, *Employee/Employer Interactions and Responsibilities with Special Reference to Genetically Related Sleep Disorders*, 5 *SLEEP & BREATHING* 153, 155-57 (2001) (discussing the practical policy implications of using genetic information in workers' compensation claims).

200. See, e.g., Wolf & Kahn, *supra* note 8, at 19 ("The long-standing rule governing compensation for workplace injury or illness is that employers take workers as they find them, including the workers' vulnerability.").

201. See *id.* at 154 (explaining genetic screening by employers).

202. Rothstein, *supra* note 5, at 52-53; see NAT'L COUNCIL ON COMPENSATION INS., *supra* note 138 (granting insurance companies wide latitude in gathering any information needed to determine eligibility).

compensation, regardless of fault.²⁰³ Workers receive compensation regardless of why the accident happened.²⁰⁴ The absence of a fault requirement also nullifies the notion that an employee “assumed the risk” by taking a dangerous job and should therefore be responsible for his or her injuries in the case of an accident.²⁰⁵ The use of toxicogenomic predictors of susceptibility or predisposition arguably seeks to inject fault and risk assumption back into the equation.²⁰⁶ If employers try to defeat liability by using genetic tests showing a predilection to developing a workplace-related injury or disease, the employer essentially is saying that the injury should not be compensated because the workplace did not cause the injury; put otherwise, the employer is arguing that it is not at fault.²⁰⁷ Furthermore, if testing for genetic biomarkers becomes more and more accessible to the public, will courts charge workers with a duty to discover their own genetic predispositions and act accordingly? If tests are available to determine if a person is susceptible to injury from a given chemical, will a worker who accepts employment at a factory where that chemical is processed, and who chose not to have the genetic test, be said to have assumed the risk? Could employers argue that the employee’s own genes were contributorily negligent in causing the injury? Under the current workers’ compensation structure, arguments based on contributory negligence and risk assumption would probably be disfavored.²⁰⁸

However, workers’ compensation was designed at a time when the ability to discover one’s genetic future was not contemplated.²⁰⁹ Perhaps the bargain that was struck in the late nineteenth century will be adjusted by courts or legislatures to reflect the changing scientific landscape.²¹⁰ The dangers of re-injecting concepts of

203. See Wolf & Kahn, *supra* note 8, at 18–19 (discussing the origins of workers’ compensation law and efforts to mitigate the effects of the “take the worker as you find him or her” rule).

204. Some states exempt from coverage injuries due to horseplay, intoxication, and other employee misconduct. See ROTHSTEIN ET AL., *supra* note 15, at 624–27.

205. N.Y. Cent. R.R. Co. v. White, 243 U.S. 188, 193 (1916); Jean C. Love, *Actions for Nonphysical Harm: The Relationship Between the Tort System and No-Fault Compensation (with an Emphasis on Workers’ Compensation)*, 73 CAL. L. REV. 857, 857–58 (1985).

206. See generally NRC Report, *supra* note 3, at 3 (describing the possible use of toxicogenomics in predicting future harm).

207. See Robert H. Ashford & William G. Johnson, *Negligence vs. No-Fault Liability: An Analysis of the Workers’ Compensation Example*, 12 SETON HALL L. REV. 725, 730 (1982) (describing how injuries covered under workers’ compensation must derive from work-related injuries). Cf. Marchant, *supra* note 4, at 12 (discussing the use of genetics to disprove fault in toxic tort cases).

208. See ROTHSTEIN ET AL., *supra* note 15, at 624–27 (noting that, with some exceptions, workers receive compensation regardless of why the injury occurred).

209. Compare Gurtler, *supra* note 1, at 288 (tracing workers’ compensation laws to nineteenth century Germany), with NRC Report, *supra* note 3, at 22 (placing advancements in gene sequencing technologies in the 1980s and 1990s).

210. Cf. Ashford & Johnson, *supra* note 207, at 735–36 (noting that in 1972, the National Commission on State Workers’ Compensation Laws recommended changes to workers’ compensation laws to make them more equitable to workers under a no-fault system).

fault and risk assumption into workers' compensation statutes are significant.²¹¹ As the number of conditions that can be predicted increases, employers may argue that these conditions did not arise out of employment.²¹² Assuming that courts accept this argument, workers who are denied the limited coverage of workers' compensation and unable to sue in tort would fall back on other insurance systems or remain uncompensated, in turn shifting the financial burden of workplace illness to taxpayers.²¹³ Eventually the workers' compensation system could regress to a system more closely resembling the situation that faced workers before statutory reform took place more than a century ago.²¹⁴

Others may argue that forcing the cost of workers' genetic conditions onto the employer and consumer was not within the original intent of the "bargain".²¹⁵ Workers' compensation was never intended to be a health care system,²¹⁶ but was only meant to take care of workers who were injured at work.²¹⁷ Perhaps it is not compatible with the original purposes of workers' compensation to award compensation when an injury is caused by a hard-to-dissect combination of genetics and environment rather than by a freak accident.²¹⁸

B. Will Toxicogenomics Compromise Overall Worker Safety?

Will the threat of liability for illnesses caused in part by genetic predisposition encourage employers to create a safer work environment? Prior knowledge about the predispositions of a workforce would give employers the ability to make narrowly tailored health upgrades to protect its workers.²¹⁹ However, this specificity might also work as a disservice to overall worker health, as employers might invest only in those technologies that are most cost beneficial in that they are likely to prevent the most injuries or illnesses. Alternatively, employers may feel that, if they have to contend with a myriad of genetic

211. See *infra* notes 212–214 and accompanying text.

212. See generally Paul Steven Miller, *Is There a Pink Slip in My Genes? Genetic Discrimination in the Workplace*, 3 J. HEALTH CARE L. & POL'Y 225, 232 (2000) (describing increasing use of genetic testing by employers to screen for disease prior to employment).

213. Cf. Ashford & Johnson, *supra* note 207, at 727 (describing programs such as New Zealand's that create a state-administered insurance program for the injured).

214. *Id.* at 737–39 (contrasting the common law tort system with the no-fault system of compensation).

215. See Peirce & Dworkin, *supra* note 22, at 653–54 (noting that the original intent of workers' compensation statutes was to provide for workers injured in the workplace and diminish the risk of injury in the workplace).

216. Peirce & Dworkin, *supra* note 22, at 655.

217. *Id.*

218. See Lorie M. Pesonen, Comment, *Genetic Screening: An Employer's Tool to Differentiate or to Discriminate?*, 19 J. CONTEMP. HEALTH L. & POL'Y 187, 194 (2002) (discussing the complex genetic mutations involved with certain diseases).

219. *Id.* at 190–91.

conditions in their workforce, improvements to avoid aggravating those conditions would be futile, especially if they know that workers' compensation boards are likely to find that such conditions arose out of employment. Employers might find it cheaper to simply pay higher workers' compensation premiums to cover claims than to invest in state of the art protective equipment.

C. Can a Compromise Be Reached in the Use of Toxicogenomics to Satisfy All Parties?

A policy of optional testing for workers contemplating entry into a dangerous workplace could adequately address the concerns of workers, employers and insurers.²²⁰ Under this model, an employer, aware of the potential for chemical hazards on the job, could offer all active and potential workers the chance to self-screen by undergoing free tests for genetic predisposition to disease caused by conditions or substances present in the workplace.²²¹ Confidentiality would be maintained by permitting the employee to choose a doctor and laboratory to conduct the testing, and the results of the test would only be seen by the worker and the worker's physician.²²²

Such a system would advance workers' autonomy interests in several ways. First, workers would decide whether to undergo testing. This choice would alleviate the issue of exposing a worker, or his or her family, to genetic information that they would rather not know.²²³ Should the worker choose to undergo the test, screening could be limited to only those conditions that might be triggered by the workplace, therefore protecting the worker from discovering non-work related genetic conditions.²²⁴ Upon receipt of results showing a predisposition, and after consultation with a genetic counselor, the worker could then choose to decline employment, or to accept it with full knowledge of the risks, in turn increasing the likelihood that the worker would take responsibility for using safe work practices, consequently decreasing the chances of suffering a work injury.²²⁵

220. Rothstein, *supra* note 78, at 394; see NRC Report, *supra* note 3, at 198 ("The decision to use toxicogenomic testing to learn about one's individual risk should rest with the individual, including risk posed by the workplace setting.").

221. See Rothstein, *supra* note 78, at 394 (describing genetic testing to be used by employees to decide whether to accept or continue in their positions).

222. See *id.* (noting that employee testing information would not be available to the employer).

223. See generally R. Andorno, *The Right Not to Know: An Autonomy Based Approach*, 30 J. MED. ETHICS 435, 435-36 (2004) (discussing the right to not know one's own genetic information).

224. See CTR. FOR GENETICS EDUC., FACT SHEET NO. 21, DNA GENETIC TESTING: SCREENING FOR GENETIC CONDITIONS AND GENETIC SUSCEPTIBILITY 1 (2007), available at <http://www.genetics.com.au/pdf/factsheets/fs21.pdf> (defining "genetic screening" and "genetic testing" as evaluations completed for *particular* conditions).

225. See *id.* (stating that employees would be free to decide whether to continue in their present positions after undergoing testing).

Employers would benefit from voluntary testing for many of the same reasons as employees: self-screening and increased attention to safety would likely decrease the number of illnesses.²²⁶ The lower number of illnesses would benefit employers most obviously in decreasing reported workers' compensation claims, thus positively affecting the employer's experience rating.²²⁷ An employer that had a voluntary testing program would also probably be favored by insurance carriers, because a fair percentage of susceptible workers would likely choose not to accept employment, thus decreasing the pool of high-risk individuals.²²⁸ Also, insurance companies would look favorably upon companies whose workers, aware of their genetic susceptibility, utilize safer work practices.²²⁹ An added bonus for an employer under a voluntary testing model would be good press:²³⁰ the employer could advertise its workplace as one respectful of workers' privacy and concerned for worker safety—two claims that could be a valuable selling point as genetic testing becomes increasingly used by employers.²³¹

Workers' compensation insurers would also benefit from optional genetic testing. Upon insuring a company that offered testing, an insurer could feel secure that it was underwriting a calculable risk.²³² Though under current rating rules insurers probably could not initially offer a monetary benefit to employers for offering optional testing,²³³ simply knowing that the worker population at such a company was self-screened to remove some of the most susceptible workers might

226. Clair Andre & Manuel Valasquez, *Read My Genes: Genetic Screening in the Workplace*, ISSUES IN ETHICS, Spring 1991, <http://www.scu.edu/ethics/publications/iic/v4n2/genes.html>.

227. See Spieler, *supra* note 124, at 192–93 (explaining that employers with fewer workers' compensation claims have better experience ratings).

228. *Id.* Cf. Crimcheck.com, What You Don't Know Can Hurt You: The Guide to a Risk Management and Violence Program Success, <http://www.crimcheck.com/background-check/employee-screening.htm> (last visited Nov. 30, 2009) (describing how a strong pre-employment screening process that emphasizes non-violence can reduce the presence of violent employees).

229. See, e.g., Spieler, *supra* note 124, at 192–93 (noting that safer workplaces receive more favorable insurance ratings in the area of workers' compensation).

230. Cf. Laura Sullivan, *Corporate Wellness: A Healthy Return on Employee Investment*, ALLBUSINESS.COM, Nov. 1, 2003, <http://www.allbusiness.com/operations/business-insurance-risk-management/1104312-1.html> (describing how a voluntary corporate wellness program generated positive publicity for an employer).

231. See Press Release, TRUSTe, Ponemon Institute and TRUSTe Rank America's Most Trusted Companies in Privacy (Sept. 16, 2009), available at http://www.truste.com/about_TRUSTe/press-room/news_truste_2009_most_trusted_companies_for_privacy.html (awarding companies based on the strength of their privacy policies); EHSToday, America's Safest Companies, <http://ehstoday.com/safety/asc/> (last visited Nov. 30, 2009) (awarding companies based on their safety practices).

232. See NRC Report, *supra* note 3, at 11 (noting that genetic testing has the potential to improve risk assessment).

233. See Spieler, *supra* note 124, at 192 (explaining that insurers determine the rating of particular employers based on a three-year period).

make an insurer more likely to underwrite that company's coverage.²³⁴ This might save some employers from being forced into the assigned risk pool, which comes with much higher premiums.²³⁵ If self-screening and targeted safety measures resulted in fewer workers' compensation claims overall, insurers would pay out less in claims and would keep a larger percentage of the premiums paid for policies.²³⁶

Those who think that employers should have unfettered access to genetic information or, conversely, who think genetic information should have no place in employment decisions, are likely to point out the issues that remain even with a moderate approach like optional testing. One likely area of criticism is the accuracy and usefulness of new toxicogenomic technologies.²³⁷ Given the relatively new means of determining worker susceptibility to toxins, toxicogenomics must go through a validation process to establish its reliability.²³⁸ Also, as with any genetic test, the results are a prediction of an interaction between an individual's genetic material and a particular toxin.²³⁹ The actual occurrence of such a reaction is not guaranteed by a positive genetic test, and raises the question of whether workers will limit themselves from certain employment that might never have negatively affected their health.²⁴⁰ Some may also argue that encouraging voluntary testing will encourage employers to focus their accident prevention resources on those illnesses that have *known* results based on chemicals that are present in the workplace, and as a result will sacrifice overall worker health.²⁴¹ Finally, some opponents might question the cost and logistics of encouraging potential employees to undergo toxicogenomic testing.²⁴² The cost of genetic testing might be worthwhile to an employer as it would likely lower workers' compensation

234. See *id.* at 192 (explaining that safer companies with fewer workers' compensation claims are rated lower by insurance providers).

235. See, e.g., Wis. Comp. Rating Bureau, Frequently Asked Questions, <https://www.wcrb.org/WCRB/FrequentlyAskedQuestions.asp#ass6> (last visited Nov. 30, 2009) (noting that employers in the assigned risk pool are not entitled to premium discounts, as are employers in the voluntary market).

236. For a general discussion of workers' compensation insurance, see John W. Ruser, *Workers' Compensation Insurance, Experience-Rating, and Occupational Injuries*, 16 RAND J. ECON. 487 (1985).

237. See Rothstein, *supra* note 78, at 394 (noting that a threshold issue in genetic testing in the workplace is whether testing has sufficient clinical and analytical utility to be used for screening purposes).

238. NRC Report, *supra* note 3, at 135.

239. See *id.* at 12 (explaining that toxicogenomics can provide information on genetic-environment interactions).

240. See generally *id.* at 95 (stating that the results of toxicogenomic tests are often counterintuitive and uncertain).

241. See, e.g., Rothstein, *supra* note 78, at 401 (describing how allowing employers to exclude workers who are genetically predisposed to occupational diseases would eliminate incentives to clean up the employers' overall workplace).

242. *Id.* at 394-95.

premiums and reduce employee turnover.²⁴³ To protect confidentiality, referrals for testing and counseling could be handled by a third party provider, much like current employee assistance programs.²⁴⁴ Clearly, the logistics of a system of voluntary employee testing have yet to be worked out, but between the two extremes, this moderate approach provides a workable and realistic framework that could satisfy all parties' concerns.

CONCLUSION

For over a century, workers' compensation statutes have maintained a balance between workers, employers, and insurers.²⁴⁵ While toxicogenomics has the potential to alter the essential ingredients of the "bargain", such a result is not assured.²⁴⁶ The present statutory trend seems to be toward greater protection of genetic information,²⁴⁷ and may signal the direction legislatures will take in the future with regard to the use of genetic testing in workers' compensation insurance.²⁴⁸ In the absence of legislation, workers, employers, and insurers themselves can control the degree to which toxicogenomics reworks the "bargain" by the policies and procedures they choose to adopt.²⁴⁹ Ultimately, how genetic information will or will not be used in workers' compensation underwriting and claims will be a policy decision and a compromise, just as the original workers' compensation statutes were.²⁵⁰

243. See Spieler, *supra* note 124, at 192–93 (explaining that employers with fewer workers' compensation claims pay less for insurance).

244. See Diana Chapman Walsh, *Employee Assistance Programs*, 60 MILBANK MEMORIAL FUND Q. HEALTH & SOC'Y 492, 503 (1982) (noting the common belief that employee assistance programs conducted by outside medical departments, rather than internal personnel, show a higher degree of respect for employee confidentiality).

245. Gurtler, *supra* note 1, at 288; Peirce & Dworkin, *supra* note 22, at 653.

246. See NRC Report, *supra* note 3, at 11 ("As biologic knowledge progresses with the science of toxicology, 'toxicogenomics' . . . has the potential to improve risk assessment and hazard screening.")

247. See, e.g., WIS. STAT. § 111.372(4)(a) (2006) (requiring informed, written consent of the employee before genetic information is used to investigate workers' compensation claims).

248. See generally Paul Steven Miller, *Genetic Discrimination in the Workplace*, 26 J.L. MED. & ETHICS 189, 194 (1998) (discussing the need for further legal protections against the use of genetic information by employers).

249. See, e.g., Americans with Disabilities Act of 1990 § 102, 42 U.S.C. § 12112 (2006) (limiting the use of genetic information by employers, not by employees); Rothstein, *supra* note 78, at 399 (explaining that without specific statutory requirements, employers may choose whether to conduct medical examinations of employees); Wolf & Kahn, *supra* note 8, at 6 (noting there is no statutory prohibition against insurers using genetic information in workers' compensation underwriting).

250. See Peirce & Dworkin, *supra* note 22, at 653 (discussing the compromise between employers and employees that characterized the first workers' compensation statutes).