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Panel Discussion: Role of the Knowledge of High Risk Groups in Occupational Health Policies and Practices

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This conference includes people from many scientific disciplines and people concerned primarily with policy issues. None of us are experts in all of those areas. Many of us may have felt that one session or another at this conference was out of our field of interest. That's an unfortunate situation, because more and more, we're going to have to start making links between the science and the policy. Those who are concerned primarily with occupational health policy are going to have to gain a detailed knowledge of the science. Those who are in scientific research have to begin to recognize the policy implications of the work. Certainly, all of us have to have a commitment to pursuing both the science and the policy as honestly and objectively as we can. Finally, and most important, all of us have to begin to make this knowledge accessible to people who are directly concerned—workers in the mines and mills and factories and labs and everywhere else. They are the ones whose health and whose jobs are on the line. They should be the ones to make the decisions. All of us have the responsibility to see that we communicate with them in an honest and effective manner.

Let me explain my biases. In the Steelworker's Safety and Health Department we are concerned with the health of our members and of all working people and we are concerned with the economic livelihood of our members and all working people. We don't think our members or anyone else should have to choose between those things. In the past, a lot of our people have been told that they *do* have to choose between those things. There are plenty of examples of companies claiming they will have to shut down if they are forced to meet OSHA standards: in other words, they're saying "your money or your life." So, if some of us are a little worried by this issue, and if some of us want explicit guarantees that the identification of high-risk groups will not result in the loss of job or income, I hope you understand.

I agree about the need for labor–management cooperation; but let me say also that the lack of cooperation hasn't come from labor's side. Every single occupational health standard, including that for asbestos, and with the exception of DBCP, has been challenged in court by industry. I suspect that when OSHA gears up to set a lower asbestos standard, the asbestos companies will be back in court.

Having stated my biases, let me talk about some of the things I think we ought to consider this morning. The first question is to what extent industry will honestly consider the risks to so-called "nonsusceptibles" as well as the risks to "susceptibles." Unfortunately, our experience in that area has not been very good. One example of a widespread genetic screening program is found in some of the lead and chemical companies. There is a very simple screening test used to exclude certain workers from employment. You look at them and see whether or not they're female. That's a very simple program to implement. It doesn't even require an occupational physician. And if you are a woman and if you're of childbearing age, and if you have not been surgically sterilized, you are not allowed to work around lead or certain chemicals. In other words, the industry has determined that there is a risk to potentially pregnant women. The problem is that many of these companies have not considered the possibility that male workers are also at risk of passing on genetic damage to their offspring, and that men may also suffer reproductive problems. In other words, these companies are screening out women and ignoring whatever reproductive effects may occur in men.

Another, more subtle example of ignoring the risk to "nonsusceptibles" is shown by the search for a good screening test for increased susceptibility to

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toluene diisocynate. There does seem to be a segment of the population with increased sensitivity to TDI. Recent work by John Peters and others at Harvard indicates that the current OSHA standard is inadequate, even for the "nonsusceptibles." This research has been widely ignored. So I think one of the questions we have to ask is to what extent industry will consider and eliminate the risk to so-called "nonsusceptibles."

Second, to what extent will the policy implications of the research be honestly discussed and honestly implemented? Again, I think our experience with that is not the best. One example is the discussion which took place yesterday. It was evident that in some of the population studies presented, the most important variable genetics, it was exposure. The clear implication of that research is that the appropriate action is to reduce environmental exposure, in that it is the greatest risk factor. Yet, that particular implication wasn't discussed. We want to know to what extent the implications of the research will be honestly presented.

Third, to what extent will the negative aspects of screening be considered? In that light, I'd like to read from a letter in the *New England Journal of Medicine* of August 25, 1977. Let me give you the history of this letter. The authors of the letter had written a paper on α_1-antitrypsin screening and had indicated that screening for the MZ phenotype might not be useful. One of the people who was involved in MZ screening wrote them and said, in effect, "how can you say this, the screening programs may actually help us identify a few people, and we shouldn't be against knowledge." And in reply, the authors, James Morse of the Veteran's Administration and Michael Lebowitz and Michael Knudson of the University of Arizona College of Medicine discussed one of the negative aspects of screening: "Even if the MZ phenotype could be shown to be one factor predisposing to the development of lung disease, it would only be a minor one compared to the effects of smoking. Although knowledge of the MZ phenotype could at best scare 4 percent of the population into not smoking, the other 96 percent may only be confirmed in their habit, now confident that they do not belong to the unfortunate group of susceptibles." To give another example, what about a plant manager who might think: "OK, now we've got rid of the susceptibles, we don't have to worry as much about environmental control." And if you don't think that's a consideration, let me tell you about a discussion I had with a plant manager in a small chemical company some weeks ago during which I pointed out that some of the chemicals they use have reproductive effects. He said: "Reproductive effects? No, we don't have to worry about that, no women work here." Here was a plant manager who thought they had screened out the susceptibles, and therefore, was not worrying about the effects of the chemicals in use. I think that's a real concern for any screening program. So the third question is, to what extent do we consider the negative aspects of screening?

The fourth question is, to what extent do we consider the elimination of risk factors rather than the elimination of workers characterized by the risk factor? I want to support Dr. Kotin's words, that to the greatest extent possible, we should try to eliminate the risk factor rather than the worker. I'm a little concerned at some of the smoking bans in Johns-Manville and other companies. It seems to me that simply banning smoking at work is not the best way to eliminate the risk factor. That's a little like the Volstead Act. And it could be used to penalize workers who have trouble quitting. The best way to eliminate smoking is through an effective educational campaign. Certainly, the experience with trying to ban smoking in high school—and all of us were high school students at one time—supports that view. I have a question for Dr. Kotin as to how much he will sit down with the unions which represent workers in his plants and discuss the best way to eliminate smoking in that population. It may not be by simply banning it on the job.

Some companies have stated an intention not to hire workers with a history of smoking. And some unscrupulous companies may find excuses to get rid of workers with risk factors, like smoking or mild pulmonary disease, that might affect the company's compensation costs. So to what extent will industry attempt to eliminate the risk factors rather than the workers?

Number five, to what extent will industry use this susceptibility argument as a way to avoid cleaning up the workplace? Now, certainly no one will explicitly say we should use screening as a way to avoid cleaning up the workplace. On the other hand, there are indications that some companies may have that in mind. Certainly, eliminating smokers from asbestos exposure does not eliminate the risk of asbestos-induced lung cancer and it does not seem to affect the risk of mesothelioma. Johns-Manville accepts those facts and has made great efforts to reduce exposure. But in other companies, workers have been told that asbestos will not hurt you unless you smoke. Another example is calcium's effect on lead absorption. There still exist lead smelters where the plant manager goes around saying, "Drink lots of milk, because calcium protects you from lead." No responsible corporate physician would say that, but plant managers do, and they're the ones who count. Another example is

provided by a large chemical company which manufactures acrylamide. One of the early signs of acrylamide toxicity is peeling of the skin at the fingertips. This particular company has a rule that if you undergo skin peeling three times, you have to be removed from the acrylamide area. In some cases this can result in a substantial loss of seniority and income. The company is assuming that this is a risk factor of the individual, rather than a result of differential exposure, and is screening out individuals rather than tracking down the exposure. So the fifth question is to what extent will companies use susceptibility as a way to avoid cleaning up the workplace?

Sixth is the question of jobs. Industry representatives have indicated that there is no reason for any of us to believe that screening should cost anyone their job. I would like to believe that, but consider the case of women exposed to substances which may affect reproductive health. Many women have lost their jobs because of that. One question I hope Dr. Kotin addresses today is to what extent Johns-Manville is willing to guarantee a job to people removed by screening programs—a job with the same rate of pay, the same seniority, and the same benefits. Is the company willing to guarantee jobs and earnings protection to those workers? If not, it seems to me our fears are completely legitimate.

The final question I'd like to ask is to what extent these things are being done now? Charles F. Reinhardt, of DuPont, in the May 1978 issue of the *Journal of Occupational Medicine*, indicates that DuPont is now screening for α_1-antitrypsin deficiency, G-6-PD, and sickle cell trait. There's another gentleman here from DuPont. Maybe during the discussion, he can tell us more about what that company's doing. Perhaps Dr. Kilian can tell us what Dow Chemical Co. is thinking. Those are some of the questions that I hope we can discuss today. I'm sure all of you have others.

D. Jack Kilian*

We cannot examine questions about occupational health policies and practices in relation to high risk groups without first reminding ourselves that occupational medicine is essentially preventive medicine. Preventive medicine takes two forms: Primary prevention is concerned with the prevention of the occurrence of disease, while secondary prevention tries to prevent the consequences and sequelae of disease or its precursors. While primary prevention leans heavily on the results of epidemiological research, secondary prevention, with which we are concerned today, entails the definition and identification of "at risk" and "high risk" groups.

It follows, then, that questions about occupational health policies necessarily involve questions about the concepts of risk and biologic thresholds. While it is recognized that reasonable people can disagree over the concept of zero-threshold for some substances, we must realize that there is no such thing as zero risk. Each of us, from moment to moment, is a person at risk; as intelligent beings, the most we can do is to minimize the probability of adverse effect, without unnecessary sacrifice of genuine benefit to ourselves and our society.

Following the reasoning of Higginson (In: Persons at High Risk of Cancer, J. Fraumeni, Jr., Ed., Academic Press, New York, 1975), we can define the term, "high risk group" as a population, or set, that differs from the general population, or universe set, because it is composed of either individuals who show an unusual frequency of a specific disease process or individuals who are exposed to an unusually high concentration of a suspected disease stimulus. In the real world, of course, a high risk group may be identified by both characteristics. In addition, we may find that the concept of a group, rather than being representative of a discrete collection of individuals, is merely a descriptive category for persons who are, in fact, scattered throughout the general population.

In recent years, a number of relatively simple and inexpensive tests have been developed for the purpose of singling out high risk groups and subgroups. Some of these tests—serum α_1-antitrypsin (SAT), glucose-6-phosphate dehydrogenase (G-6-PD), lymphocyte transformation for isocyanate sensitization, and the sickle cell assay—hold great promise in that they will allow identification of those individuals who are hypersensitive, hyperreactive, or hypersusceptible to certain environmental stimuli and, thus, permit initiation of effective protective and educational intervention strategies.

A recent report on aryl hydrocarbon hydroxylase inducibility (AHH) concluded that the proportion of high inducers of this enzyme was significantly greater among patients with squamous-cell carcinoma of the lung than among matched controls [A. E. Emery et al. Lancet (i): 470 (1978)]. The proportion of high inducers among patients with other types of cancer was not significantly greater than that of controls. In view of these results, which confirm the observations of Kellerman et al. [New Engl. J. Med. 289: 934 (1973)] it was suggested that there may be some individuals who are genetically

* Dow Chemical Co.

predisposed to lung cancer should they smoke tobacco cigarettes. Since cancer of the lung, especially in males, is the condition most responsible for a steady rise in the cancer death rate, the potential usefulness of this test for persons in both the industrial environment and the community cannot be overestimated.

Another recent study reported significant changes in the circulating blood lymphocytes of Michigan residents exposed to PBBs [J. Bekesi et al., Science 199: 1207 (1978)]. Abnormalities included decreases in the numbers and percentages of peripheral blood lymphocytes that form rosettes with either sheep erythrocytes alone or with sheep erythrocytes sensitized with antibody and complement, increases in lymphocytes with no detectable surface markers ("null" cells), and altered responses to tests, such as reduced lymphoblastogenic response to mitogenic stimulation, designed to evaluate functional integrity of the cells. The meaning of these changes, not found in the blood of matched controls, is presently unclear, and their value as a predictor of future health status for the individual is unknown. It is clear, however, that the presence of such changes signals the need for careful, followup observation of the PBB-exposed group.

In recent years, it has become known that many bacteria and physical states will produce mutations in plants, bacteria, and animals [M. W. Shaw, Ann. Rev. Med. 21: 409 (1970)]. Although it is difficult to prove that specific agents are mutagenic in the human being, the evidence of mutagenicity in lower life forms and the prospect that similar processes might occur in the human species have become matters of serious concern to many occupational physicians. The question of possible chemical mutagenicity is troubling, first, because of the risk of damage to the unique genetic heritage that each of us has received from our ancestors and that we can pass on to our children and children's children. Since the human being is a finely-honed product of many eons of evolution, any change in our genetic constitution is likely to be disadvantageous. The possibility of mutagenic response to various stimuli is also a matter of concern to many researchers because it has been claimed that agents that can cause mutation are also likely to cause cancer [B. N. Ames et al., Proc. Natl. Acad. Sci. (U. S.) 70: 228 (1973)].

There are a number of tests available to evaluate for mutagenic properties in various substances [Committee 17, Science 187: 503 (1975); A. Hollaender, Chemical Mutagens: Principles and Methods for Their Detection, Vol. 4, Plenum Press, New York, 1976]. Most of these tests rely on experimental changes induced in plants, bacteria, and animals. Many investigators consider any extrapolation from these observations to the complex metabolism of the human being to be of doubtful validity.

One method of evaluating for mutagenicity, however, is based upon the direct observation of genetic material from persons exposed to possible mutagens and, thus, may have more than experimental relevance to the concerns of occupational medicine and environmental health. This method is human cytogenetic evaluation [D. J. Kilian et al., Ann. N. Y. Acad. Sci. 269: 4 (1975)]; it is the observation of chromosomes for visible abnormalities of structure or number.

Most of us have chromosomal aberrations present in the cells of the body from time to time; some people, as a result of exposure to a chromosome-breaking agent like ionizing radiation, have a great many that persist for years [K. E. Buckton et al., Lancet ii: 676 (1962)]. While in almost all cases, the body manages to repair chromosome aberrations, in some instances, abnormal cell lines are established [A. A. Awa, in: Chromosomes and Cancer, J. German, Ed., Wiley, New York, 1974)]. It has been found that these abnormal cell lines are sometimes statistically associated with increased incidence of serious disease.

Except in a few cases, evaluation of the chromosomes of an individual will not allow prediction of future health status for that person or his/her children. On the other hand, evaluation of the frequency of chromosome aberrations in a group has sometimes revealed an apparent association between exposure of the group to a chromosome-breaking agent and an increased frequency of aberrations [I. F. H. Purchase et al., Lancet ii: 410 (1975)]. This association warrants concern if comparison with a suitable control group shows significant differences in aberration rates. The concern is warranted because it is known that some groups with a greater-than-usual average number of chromosome aberrations also have, as a group, a statistically increased risk of developing cancer. This association has been seen in atom-bomb survivors, some worker groups, and in patients treated for various conditions with chromosome-breaking drugs and/or radiation; the association is also found in some disease states, most of which are relatively rare (J. J. Mulvihill, in: Persons at High Risk of Cancer, J. Fraumeni, Jr., Ed., Academic Press, New York, 1975).

Much more study is needed before the value of cytogenetic evaluation can be widely accepted. One area of current interest is the sometimes marked degree of cytogenetic variability from person to

person and in the same person over time [L. G. Little-field and K.-O. Goh, Cytogenet. Cell Genet. 12: 17 (1973)]. Investigations of this phenomenon are now under way in our laboratory.

The ultimate significance of some tests for inborn or acquired hypersusceptibility, such as for AHH inducibility and chromosome aberrations, remains unclear, but there is enough evidence accumulating, particularly in regard to cytogenetic evaluation, to suggest that there is reason for cautious optimism about their value in the future. Still other tests—like those to measure immune competency [J. J. Costanzi and A. L. Goldstein, Am. Fam. Physician 8: 150 (1973)]—are presently of uncertain value for purposes of practical intervention, but remain deserving of much greater investigatory interest.

In any discussion of occupational health policies and practices, it is useful to remember that the basic purpose of preplacement/preemployment examination is to determine the individual's capacity to perform a specific range of job-related activities, with evaluation being directed toward abilities, not disabilities. Periodic examinations are directed to the earliest possible detection of health changes in an essentially healthy person, changes that are to be expected as part of the inexorable process of aging (B. D. Dinman, in: The Industrial Environment—Its Evaluation and Control, NIOSH, GPO, Washington, D. C., 1973). In regard to both types of examination we know that the best of engineering devices can sometimes fail and that the ultimate in protective equipment is sometimes not used; for these reasons, competent evaluation of health status is only prudent. Health and capability determinations, however, are always subject to the inherent limitations of the physician's ability to detect biological risk factors and individual susceptibility. In order to overcome these limitations, the first and foremost tool that the occupational physician can employ is the taking of an adequate history, that is, the ascertainment and recording in usable form of the pertinent events—occupational, social, familial, and medical—in the worker's past. Such a history is invaluable for both initial assessment of an individual's health status and in evaluation of any future risk.

The advent of specific tests for hypersusceptibility has lessened the physician's limitations and augmented the value of a good history by improving, at least in some situations, the physician's ability to make judgments of benefit to worker and management alike. Testing, then, whether for hearing loss, hernia, or G-6-PD deficiency, is not for the purpose of "blaming the victim," "protecting the worker out of his job," denying employment, or restricting opportunity, but rather to facilitate proper and appropriate job placement.

The widespread belief that cancer, for the most part, is caused by environmental, or exogenous, factors has tended to shift attention away from the need to investigate those endogenous factors that predispose to the development of cancer, and other grave diseases as well. Now, however, as the convening of this conference attests, there is growing interest in the identification of these endogenous factors and elucidation of their mechanisms, in the determination of the degree to which they interact with exogenous factors, in the isolation of unambiguous biologic markers, and, perhaps of greatest interest to us all, in the development of inexpensive, simple laboratory tests suitable for large-scale screening.

Stokinger and Scheel [J. Occup. Med. 15: 564 (1973)] gave four prerequisites for hypersusceptibility testing in the industrial environment. The first is that the test should detect an abnormality that is of relatively high prevalence in the worker population; the second is that the abnormality is known to be affected by substances that are commonly encountered by worker populations. The third prerequisite is that the abnormality should appear to be compatible with normal living until occupational factors enter the picture, and, fourth, that the test itself should be simple and cheap enough to permit large-scale use. It should be obvious that the availability of such tests would be immensely valuable to the occupational physician in his/her role as a practitioner of preventive medicine, particularly if it is kept in mind that the purpose of the tests should be the enhancement of proper placement.

For a variety of reasons, however, including the problem of costs and fears about employability, the available tests for metabolic variation—SAT and G-6-PD deficiency, CS_2 and isocyanate sensitivity, and for sickle cell trait/anemia—are not widely used. Other tests, such as cytogenetic evaluation and lymphocyte transformation, are rarely employed outside of the clinical setting, and their significance in terms of the future health status of the individual remains to be demonstrated. Unfortunately, the lack of utilization has had a chilling effect on occupational health research and has tended to perpetuate misconceptions and fears about the overall aims of preventive medicine and occupational health.

Although the applicability of a test for AHH inducibility to large-scale screening has not yet been shown, the potential value of such an assay is very great. Unfortunately, because of fears about employability and other societal concerns, it is quite possible that a test for AHH inducibility or a similar marker (even if shown to be fast, simple, cheap, and

valid) will be underutilized. Furthermore, in view of the lack of success of anti-alcohol and anti-tobacco campaigns in the developed countries, it is even possible that successful introduction and full utilization of a valid test for hypersusceptibility to pulmonary irritants will have no appreciable affect on morbidity and mortality rates of the general population.

As stated earlier, there is no such thing as zero risk. The natural history of the human being in nature and in civilization is fraught with danger. It is clear that the acceptance of the reality of risk, the desire for benefit, the rational determination to balance these two factors has characterized civilization from the first purposeful use of fire to the discovery and use of electricity. Unfortunately, the modification of present behavior because of a threat to future well-being has never been easy for most persons, and attempts to regulate the life style of individuals when they themselves do not perceive a present risk is often regarded as intolerable. Keeping these facts in mind and within these constraints, we in occupational medicine and environmental research must still manage to carry on with the business of life and the protection of health, using science and art to reach rationally determined goals.

Nicholas A. Ashford*

Let us begin by asking what it is that we can all agree upon with regard to high-risk groups. Let us start there before we ask where we disagree. I think that it is important to understand and separate the facts from the policy. First of all, I think Dr. Kilian's division of high-risk groups into two areas is useful: those which are called, for short, "hypersusceptibles," and those which are highly exposed groups, the latter being in occupational settings where the exposure is very high and everyone is said to be at a high risk. The scientific focus of this conference is on the former group, but we cannot ignore the latter in discussing policy issues.

We heard this morning from Dr. Kotin that hypersusceptibility has its origins in genetic factors, in factors related to life style such as smoking and nutrition, and in environmental factors. Past occupational history is also an attribute of a worker that would affect his susceptibility to current occupational exposure. If he worked in a chemical company for the first 30 years of his life, and then moved on to another company which used different materials or some of the same materials, the worker's past history certainly would affect his susceptibility to further development of disease. It is important to realize that environmental factors and past occupational history are both traceable to the industrial process. Therefore, I would caution you against the logical fallacy of concluding that if we identify a worker today who is hypersusceptible due to factors not related to his current work environment, this means that his susceptibility is not traceable to the industrial process as a result of perhaps environmental pollutants or his past history of employment.

What else can we agree upon? The usefulness of tests for detecting hypersusceptible workers which identify factors clearly related to occupational disease is in its infant stage. I would ask: how many tests that we have heard about at this conference or that we know of meet the Stokinger criteria? There are not very many, and I think that it is interesting that Dr. Kotin chose to quote this morning from my book the things that he did not like very much, but did not quote the next paragraph which says (and it is a quote from Stokinger), "of the 92 human disorders for which a genetically determined specific enzyme deficiency has been identified, only *five* are reported to meet the prerequisites for industrial application for better job assignment and improving coverage of the industrial air limits and hence reducing risk to worker health."

Dr. Kilian points out that the use of tests for hypersusceptibility is not widespread, even for those few that might be more reliable. The worker himself would indeed benefit from knowledge that he is in a susceptible group with regard to a specific occupational hazard, i.e., if the worker himself knew before he entered a job that it would not be good for him, particularly, to take the job, that would be useful knowledge to the worker. At the same time, labor resists the use of these techniques in placement exams. It is important to understand why this is the case. In order to maximize profit, management has an incentive to use the best quality factors of production, whether they are feedstock or pieces of metal in metal-stamping plants, or workers. We scrutinize metal parts for defects before we use them to engineer them into parts, and spend extensive resources in the production process. Workers are also considered factors of production; and it is in the best interest of management to use the highest quality, highest performing, least defect-ridden factors of production. That is not meant to be a nasty statement. It is a statement of economic rationality. Management not only has an incentive to maximize profits, it has an incentive to reduce costs—especially workers' compensation costs. It has three ways that it can reduce workers' compensation costs. One way is by removing occupational hazards, and in so doing, management re-

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duces risk for the entire population. The second way in which management meets its goal to reduce occupational workers' compensation costs is by removing potential victims of occupational disease. And here, you can reduce high-risk groups by removing the susceptibles. Whether or not reliable tests can be devised is the focus of this conference. The third way that one can reduce the workers' compensation costs is to remove potential claimants—in other words, by firing or not hiring workers with identifiable disease or precursors of disease prior to the stage where compensability would be required. Thus, for example, if a worker has a chronic respiratory disease but it has not reached the point of compensability, it is in management's financial interest to make sure that that worker no longer works for the corporation.

These are undeniable economic incentives; whether management chooses to act contrary to its economic interests in adopting a more ethical position is a different issue. I am not saying that all firms act this way, but I think that we ought to recognize the stakes and the existing incentives. Is it any wonder that workers resist taking medical examinations?

What else can we agree on? Physicians working for management have no common law duty to inform workers either that they have a predisposition to disease, that they have a disease precursor, or that they have in fact an occupational disease. There is no common law obligation of the physician employed by management to tell workers these things. Management itself, as opposed to the physician, has a duty to warn workers of their condition, but only if the disease will be exacerbated by the employer's occupational environment. Let me tell you about a case of an airline pilot who took his annual physical. He was found to have leukemia and was not told by the company physician that he had leukemia. He discovered it three or four years later and sued the company and the physician for not informing him that he had leukemia. The case went against the airline pilot because being employed in the airline industry has nothing to do with whether or not his leukemia would be exacerbated. That is the state of the law. You may not like it, but that is the way it is.

It is management, and not the physician, that has the duty to warn, unless the physician assumes a duty of care for the worker. Then, he is liable for malpractice if he commits malpractice. So the safest thing for the industrial physician to do is not to give advice to the worker. Not assuming a duty of care puts him under absolutely no obligation to tell the worker anything. Workers, having no warning of ill health from the firm, may think they are in fact very healthy because they incorrectly assume that they would be told if there were problems. These are the realities. I have not talked about motivations, in terms of ethics; I have only talked about what the economic incentives are and what behavior is required under the law. The realities should be well understood before one bemoans the fear of employability on the part of labor, as Dr. Kilian has expressed, or before one asserts that these tests do not endanger the worker's employment status, as Dr. Kotin would have us believe. The point is that occupational health policies and practices regarding high-risk groups—that is the title of this session—are inextricably entwined with management-labor relations. The ethical duty of the management physician or the industrial hygienist, in my view, cannot be discharged with the statement, "I only conducted the screening tests. I am not responsible for the way my company exercises its employment policy."

About a year and a half ago, I attended a New York Academy of Sciences meeting of occupational physicians, most of whom were industrial physicians. The organizer of the conference stood up and said, "We are a closed group of people here, and this is an unofficial meeting. It is not open to the press. Is there anyone among you in your years of practice who has ever felt compromised with regard to his practice of medicine in the industrial setting?" Dead silence. And he continued, "Just as I thought—another myth shattered!" I hope that I have convinced you here that there is, in fact, a conflict of interest. However, if the management health professional does not believe that he has to be responsible for the consequences of his science or practice, then of course he does not feel compromised. That is a tautology. It is not, as has been suggested, the aims of preventive medicine that are at question here. It is the aims of employment policy. The fact is that the worker has a rationally-based and real fear that (1) he will be discharged from his job if he is found to have a disease or a predisposition to disease, (2) he will be transferred to a lower-paying job or lose other benefits, and (3) he will not be employed in another firm once he has been discharged for health reasons, even if the new place of employment is Free from occupational hazards. The latter may not be rational industrial policy, but that is the way it works. Companies do not want to assume other companies' workers' compensation costs.

We are the only industrialized country in the world without a jobs policy or job security policy. We have 25% of our workers belonging to unions. It is probably in labor's interest to have knowledge of high-risk groups. I stated earlier that it would be

good if workers knew they should not work in a chemical industry if, for example, they have prior liver damage. But it would be foolish to let management do the testing without legally guaranteeing full disclosure to the worker, a job at equal pay within the firm, and an aggressive policy of job redesign by management and labor to provide a reasonable number of places for hypersusceptible workers within the firm. Are these things parts of an aggressive employment policy today? No, they are not. Should it be a concern of people concerned with the relevant science? In my view, yes.

The Toxic Substances Control Act requires firms which give these kinds of tests or perform epidemiology to transmit the health information associated with toxic materials to EPA. If they do not, they are in violation of the law for which EPA and the worker can bring an action, providing of course that the worker knows. The trouble is that the information goes to EPA, EPA has to give it to OSHA, and nobody has to give it to the worker. Now it is interesting that management advocates screenings to identify susceptible workers. You hear this advocated today, even with the paucity of knowledge and even though techniques are in an infant stage, according to Stokinger's definition. At the same time, the very same management groups resist using Bruce Ames' mutagenicity test to indict suspect carcinogens. While the screening certainty is not perfect, it is significantly better than these screening tests for genetic factors and environmental factors. Isn't it interesting that there is not an even-handed approach with regard to what one is willing to indict on what evidence. That should tell you something about the likelihood that these tests are motivated purely by concern for the worker. These are the realities. Until we either have a national policy of job security or unless the union contract protects hypersusceptibles, these tests will not and, in my view, should not be used by management to place or replace the worker.

Let me suggest that from a social policy perspective, we may be focusing on the wrong pathology. The most serious pathology is misguided industrial practices. Perhaps we should have or should find a way to "screen out" the firms which are especially susceptible to unfair, unethical practices. The recent attention on discriminatory practices under various pieces of legislation, including the OSH Act, the Labor Act, the National Rehabilitation Act, and the Civil Rights Act, is on the increase because discriminatory practices are on the increase. I agree with Dr. Kotin that it would be better to solve problems in a cooperative and nonadversary manner. Unfortunately, with the great imbalance in both power and knowledge between labor and management, this is just not possible on a wide scale. Until the full reality of the consequences of the policies are realized, we are not going to go very far.

Paul Kotin*

Let me begin by commenting on some statements that were made that I think will benefit from elaboration. I think Dr. Ashford did not listen when I indicated that indeed management has a responsibility for a worker, and the issue of the worker who brings pre-existing environmentally determined disease. I think I did address when I said the second broad issue is the employer vis-a-vis the government, particularly the federal government. Who has responsibility for a worker not rehireable in his own field because of occupational injury? Miners are the best example of this dilemma. The employer cannot be held responsible for failing a social obligation when he refuses to hire a miner with respiratory impairment even when due to his past mining employment considering what the current employer's responsibilities are in the face of the legislation that exists. I think that there is enough in the way of existing deficiencies and inadequacies in legislation in this field of physical qualifications and hypersusceptibility for all constituencies to take constructive and positive steps to correct. It is a real problem and I did emphasize that there is significant element of the problem that is not being faced. I suggest that perhaps it might be something that should be explored promptly with legislative and regulatory entities of government. Dr. Ashford persists, and I'm sorry I'm not a better teacher than I am, in defining and equating hypersusceptibility with genetic abnormality. All of the genetic abnormalities, when weighed against environmental but non-occupational contributions, represent only a limited segment of workers at high risk. Actually, nonoccupational though still environmental contributions are the prime reservoir of high risk. I'm not talking exclusively about those deficiencies which are socio-economically related. Certainly, we would be hard-put to find any abnormality related to diseases above the diaphragm or below the apical pleura which did not include again and again references to the major determinant that cigarette smoking represents. So I would hope you will not leave with the idea that I equate hypersusceptibility with genetic abnormalities.

My 20 years as a professor of pathology makes it most difficult for me to accept one thing: I still have

* Johns Manville Corp.

not been able to resolve the sequestration of the workforce from the rest of the population exposed to environmental stresses and the assumption that workers are immune to the established principles of biology. Inborn errors of metabolism are very limited in terms of the population. However, the increased susceptibility associated with premalignant lesions are, in part, genetically determined. The work of Warkany, Miller, and Fraumeni is opening up a whole new frontier in this area in terms of the relationship of congenital abnormalities to risk of cancer. The latter day reflections of childhood infectious disease of the lung in terms of the reactivity of the lung in the adult is also a factor in hypersusceptibility. And then of course, there are the habits of cigarette smoking and ethanol ingestion.

Well, I think this adds up to a personal opinion, as denigrated as the opinions of industrial physicians have been this morning, that even with virtually zero exposure, there is no way that these biologically determined high risks can be eliminated as much as anybody in this room or as much as I would like to have them eliminated. It is just not the nature of the beast. For example, congenital polyposis is a relatively common congenital abnormality that should be of concern in relation to cancer of the colon in those industries where there are suggestions that colon cancer may be occupationally related. There are, in fact, all sorts of diseases of the gastrointestinal tract in a large segment of the population who are at high risk despite their never having seen the inside of an industrial facility. A second thing that distresses me is this facultative use of data, and I can reduce it to one sentence, elaborating on what I said this morning: occupational medical surveillance and monitoring data are viewed differently than the same data obtained immediately prior to employment. We are told to ignore data in the preplacement exam but be responsible after even the briefest period of employment. It would be nice if biology and the principles of medicine and health were as accommodating as we would like them to be in terms of what constitutes responsible, and to use your word, Dr. Ashford, ethical behavior once disease is recognized.

To answer what Mr. Wright asked, yes, we have a no-smoking program. And let me correct what I think might have been a misstatement or a partial statement on my part. Smoking is a hypersusceptibility factor and is going to be a determinant, not in whether a person keeps a job, but it does determine whether he gets the job. We will hire no smokers in any activities in which any level of exposure to pulmonary irritants exists. The corporate policy is that indeed we do underwrite a kick-the-habit program, whether its Smokeenders or one of the generally accepted smoking clinics. We underwrite them not only for the worker but for his or her spouse, as the case may be. We've been at it long enough so that there have been backsliders and we've instituted a second course. Ultimately, there may be somebody who is just constitutionally unable to abandon smoking, where, as a physician, I might deem that he's a lot worse off by giving up smoking; it would be hard to think of, but I can accept that as a possibility. This kind of person would be in no jeopardy of losing his job as a corollary of that.

Now, let me answer another question I think you raised, and that is the negative aspects of screening. They exist, but they are far outweighed by the positive aspects.

Let me just make one more quick comment in relation to the issue of genetic screening. These were notes I was taking while Dr. Ashford was speaking because, again, maybe I can use it as an example or as an element pertinent to the charge that it is an excuse to avoid cleaning up the work place. I work for one company and can't really speak for all of American industry, but I'll be right behind you on this.

Now the last thing I want to talk about—and I wish it hadn't been brought up—is the nonsmoking asbestos worker with lung cancer. Dr. Selikoff indeed reported a four- to fivefold risk of lung cancer in a nonsmoking nonasbestos worker. The fivefold increase is, I think, a bit misleading. The figure results from a ten-year follow-up of 18,000 asbestos workers in the Insulation Union, which represents some 300,000 man years. I think the expected figure was 1.8, the observed was 8.2. The ratio of 8.2 to 1.8 of four to five to one is legitimate, but with a population of 300,000 man years and a 10-year follow-up, it is less than a cancer/year. I'm not justifying or defending the one cancer a year, but basically, one cannot seriously equate that the double digit, well-established, multiply confirmed observations that Selikoff has on the relationship of cigarette smoking to lung cancer in asbestos workers. Since you brought up asbestos as unique, there are cases of uranium miners who have cancer of the lung who don't smoke. But again, the ratios of smokers and nonsmokers are orders of magnitude. And while the data for coke-oven workers are not as detailed, we again see great differences. This 5:1 ratio really has to be more carefully examined and not just accepted at face value.

I would like to conclude by saying that in principle, I have heard nothing from Mr. Wright or any of the panelists this morning with which I disagree. I think we must retain discrimination and discipline in addressing science. If Dr. Ashford, as he's pointed out, really wishes to address these issues from the

point of view of socioeconomic or sociocultural or ethical attitudes, I would be delighted to do so. But I think, then, we would probably do a disservice to that approach by the use of superficial science.

General Discussion

DR. DAWSON (*Harvard Univ.*): I would like to get a little bit more of the feel of the comparison between environmental health considerations and occupational health considerations. The particular question I have deals with two standards. It's my understanding that the industrial standard now for a short-term NO_2 exposure is 10 ppm, and there's a proposal in to have it become 1 ppm. On the other hand, it has been advocated by the World Health Organization and others, that the environmental standard should be 0.1 ppm and I should say, by the way, that EPA is discussing a range of 0.25 ppm of NO_2. I just wonder a little bit about the difference I see in industrial discussions and environmental discussions.

DR. ASHFORD: I'm not sure I can answer your question. Historically, the fact that occupational standards have not been as protective as environmental standards is a matter of record—SO_2, lead, other things. That's because the industrial consciousness has been not prevalent, and only recently has labor collectively begun to understand the implications of occupational exposure. Now, the question of whether we should adopt a more protective standard in the occupational environment rather than the external environment goes to how much cost/benefit analysis you think you want to do. In a work place which produces a product which is necessary for society, you could see a policy being established which would tolerate much higher concentration than the effluents which could be easily collected without destroying the production of the process. I don't want to be misunderstood as advocating that. I'm just stating that the game that you play with regard to finding the acceptable standard within the workplace, as opposed to external, applies to what the social product is, and the consideration as to who is affected. It would also be perfectly consistent to make the internal environment more protective than the external environment because it's a special group of people—workers, very often in a lower socioeconomic class—that end up being the victims, rather than the population as a whole. So, depending upon what your values are, the workplace should be made either more protective or less protective; but I see those as the considerations that enter into the decision.

MR. WRIGHT: It seems like we have time for one or two more questions.

PARTICIPANT (*not identified*): Earlier this morning Dr. Kotin stated that management had a moral imperative—I think those were his words—to be concerned about the hypersensitive worker, and, presumably, by screening and change of job placement, or—as suggested by his later remarks—job denial, to deal with that. I would like to ask him if he sees perhaps an even higher moral imperative on the part of management to work to limit the exposures to as low an extent as possible in order to clean up the workplace. The other distinction he seems to be making this morning was between situations that are uncorrectable as far as management is concerned. What management can do about the health of the individual worker is limited. Certainly the exposures in the workplace ought to be correctable by management.

DR. KOTIN: Can I just answer it with one word? Yes. Management has a responsibility to apply technology and engineering controls. There is nothing that I said that would in anyway question that principle or support the contrary principle that it is either or. It must be both, and I guess what I'm concerned about is that there's too much in the way of a willingness to accept only one of the two elements, the control only, and not the other, worker selection. The practice of medicine at the highest level of preventive medicine requires recognition of the individuality of each person, in this case the worker.

PARTICIPANT (*not identified*): The single greatest risk to young nonwhites between ages of 18 and 24 is death by violence. This has a high correlation with unemployment, and these are the same people who by virtue of the concentration of genetic defects in minority groups and the exposure to such conditions as nutrition deficiency and generalized environmental pollutants would be screened out. It seems to me that they face a greater risk in having a screening program than in not having a screening program.

DR. KOTIN: First of all, you have stated a situation I wish I could articulate as well as you did; however, I must add to the position you take. I fully recognize that the ability to screen workers is not linearly related, probably has some correlation with the size of the employer and the extent and scope of his medical program; so that a person who would be denied employment might very well go to a "small business," whatever that is. He may be no less honest, no less ethically motivated than the big business, but the tools at hand for identifying the susceptible worker or the tools at hand for maintaining a maximally protective environment are probably less in scope and effectiveness. So, I'm not only agreeing with you, but I'm giving you one more arrow in your quiver, as it were to call attention to the issue of the hypersusceptible worker.

PARTICIPANT (*not identified*): Well, there's a problem though, because the number of small businesses is dropping, and our economy is such that businesses employing large numbers of people are employing a greater percentage of the populace.

DR. KOTIN: You'd have to measure the decline and disappearance of small business with the anthropologist's yardstick in the measure of time, rather than the average calendar. I think the Department of Commerce data would strongly support my position.

DR. ASHFORD: I think this only underscores the fact that we desperately need a jobs policy in this country. It's not an accident that Sweden, which has an active full employment policy, or Japan, which has a tradition of employment, in some industries has a better record with regard to these kinds of situations. I think you can't get away from looking with an employment policy with this factor.

DR. SHANKER (*New England Medical Center*): I'd like to comment on something that was touched on; that is, the use of SAT screening. I'm in favor of looking at that measure to see whether it may be significant prospectively or retrospectively in terms of interaction with industrial exposures. I think that some people may be overstating the present state of the art when they consider this to be some type—particularly the heterozygote—some type of risk for pulmonary disease that may be used in classifying those workers who may be heterozygotes as hypersusceptible. That information doesn't exist. Where these people stand in terms of developing obstructive airway disease is not known right now. I wonder if anyone would like to comment on using this marker now as a screen for so-called hypersusceptible workers.

DR. KOTIN: There is perhaps more than one reason why you would want to incorporate a screen into the program. Let me give you an example. At my corporation we have what I believe

is—and I hope I do not make too many people angry—the most sophisticated cytopathology-pulmonary cytopathology screening program in the world. We really don't know yet whether this is going to make any difference at all on the natural history of any disease that may be discovered. But, nevertheless, it serves the dual purpose of first identifying people at increased risk, and secondly it provides a high risk population which can more rapidly and perhaps, more convincingly demonstrate the utility of this screening program. I would assume the same thing may very well apply to not only SAT or AHH but to anyone of a variety of markers of hypersusceptibility whether congenital or acquired. It's again in the best time-honored tradition of application of diagnostic and clinical medical research.