Legislation Concerning Chemical Carcinogens in Several Industrialized Countries

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Summary

A survey was carried out on legislation in 14 industrialized countries relating to the prevention of occupational cancers. Two types of legislation were considered in particular: that dealing specifically with chemical carcinogens in the working environment, and that relating to compensation for occupational cancers. The survey revealed that legislation prohibiting the manufacture of chemicals known to be carcinogenic in humans or known to represent a possible cancer hazard to humans exists only in a limited number of the 14 countries considered and does not cover the same chemicals in each country. Legislation concerning monetary compensation is more common in these countries than is legislation providing for primary prevention. There are two fundamental deficiencies in even the more comprehensive legislation. First, some chemicals for which carcinogenicity in humans has been proved are still produced in large quantities and are not covered by legislation. Second, the criteria used to determine which chemicals may be hazardous to humans when only experimental evidence of carcinogenicity exists are overinclusive, while the allowed concentrations of some of the chemicals recognized as possibly hazardous to humans appear to be very high.

Introduction

It has often been stated that occupational cancer may account for 1 to 2% of all cancers. This statement is probably a misleading underestimation. The real significance of the occupational problem is lessened by relating the percentage due to exposure at work to the total number of cancer cases. A number of investigations of cancer of the urinary bladder, one of the most frequent target organs in humans, have revealed that 20% or more of cases are due to occupational exposure (1, 5).

One might expect that, once a factor carcinogenic to humans has been identified, it would be removed or its presence would be reduced to the minimum obtainable by present technology so that exposure to it is avoided. However, this is not the case. People are still exposed to a number of known carcinogens, for instance, asbestos and vinyl chloride. The situation, however, is not the same in all countries, and it is for this reason that we carried out a survey of legislation relating to the prevention of occupational cancer in 14 representative countries. Two types warrant particular consideration: (a) legislation dealing specifically with chemical carcinogens in the working environment, and (b) legislation relating to compensation for occupational cancers. All of the 14 countries selected were highly industrialized. Legislation on ionizing radiation was purposely not considered.

Sources of Information

Copies of laws were obtained from ministries of health or labor in the various countries. The World Health Organization, International Digest of Health Legislation, and the International Labour Office were valuable sources of information. Assistance was also provided by several colleagues (see “Acknowledgments”). Although we have tried to be as comprehensive and up to date as possible, some errors and/or omissions are unavoidable. Future revision of this survey would seem appropriate if more comprehensive information were made available to us.

Comparative Legislation

Table 1 summarizes legislation dealing with carcinogens in the working environment in the 14 countries considered. Details of the actual legislation are reported in the “Appendix.” This legislation can be conveniently divided into 3 categories.

The 1st category consists of general legislation on toxic substances which does not include any special provisions for carcinogens. This legislation includes some measures for environmental and personal protection and medical prevention, and it sets maximum allowable concentrations of the chemicals in the working place. Such measures are taken on the basis of the general toxicological effects of the chemicals, with no specific reference to cancer risk. This type of legislation exists in 6 of the 14 countries considered. During the last few years, some of the countries, including Sweden, Belgium, and the Federal Republic of Germany, have specifically mentioned carcinogenic chemicals in their general legislation and have divided them into subgroups according to their carcinogenic effects in humans and/or animals (see “Appendix”).

The 2nd category of legislation consists of standards or codes of practice for individual carcinogens; it is effective in the United Kingdom, the United States, the USSR, Ireland, and Japan. These standards are based on an assessment of...
Legislation on Chemical Carcinogens in 14 Countries

Table 1

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<th>Countries in the sample</th>
<th>General legislation on toxic substances, with or without reference to individual carcinogens</th>
<th>Legislation on the manufacture and use of individual carcinogens</th>
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* See also “Appendix.”
# Legislation that does not refer to individual carcinogens.

the carcinogenic potency of each chemical. The legislation establishes maximum tolerated concentrations of the carcinogen in the working environment and provides for regular monitoring of that environment. Provisions are made for eventual use of closed systems for production of the chemicals and for medical supervision of the workers. In some countries, maintenance of a register of people exposed to the carcinogen is required (see “Appendix”).

The 3rd type of legislation, prohibiting the manufacture or importation of individual chemicals, exists in 4 of the countries considered, namely, the United Kingdom, Ireland, the USSR, and Japan.

Occupational Cancers for Which Compensation Is Provided

Those occupational cancers for which some countries provide compensation are listed in Table 2. Only legislation in which the words “cancer,” “tumor,” or “neoplasm” were specifically mentioned is included. The Netherlands and Sweden are not listed in the table, since neither country maintains an official list of profession-related diseases. Instead, each case is considered individually, and compensation is granted if an association between exposure and cancer can be demonstrated. Information from the United States could not be included, since each state has its own workmen’s compensation act, and these vary widely. For the USSR, we were able to collect only fragmentary information which did not justify inclusion in the table.

The manner in which lists of profession-related diseases are drawn up differs from country to country. For instance, some lists give descriptions of specific cancer types associated with specific exposures or with particular types of exposures. Others do not. These differences lie at the heart of lengthy legal debates over rights to compensation.

The differences among the 14 countries in recognizing occupational cancers are evident from Table 2. In general, public authorities have taken a conservative attitude in this area. The United Kingdom and Italy are the 2 most progressive countries on this issue, as indicated by the number of occupational cancers they recognize. However, there are a number of incongruities even in their legislation. For example, with regard to asbestos, no mention is made in Italian law of its association with any cancer; in the British list, mesotheliomas of the pleura and peritoneum are mentioned, but not lung cancer. That leukemia is associated with exposure to benzene is not recognized by any countries except Italy, France, and the Federal Republic of Germany. Another example of inconsistency is that in Italy cancer risk due to arsenic is recognized for industrial but not for agricultural workers.

Cigarette smoking is often brought forward as a confounding factor in the etiology of respiratory cancers due to industrial carcinogens. Smoking certainly plays a major role in the induction of lung cancer in humans. However, this role may have become exaggerated to such an extent that it obscures the effects of other etiological agents, such as asbestos and chromate, that by themselves are responsible for respiratory cancer in humans. Hueper (10) in 1966 commented as follows on this subject: “It should be obvious that any wide acceptance of such scientifically unsound and socially irresponsible claims concerning the principal role of cigarette smoking in the causation of cancer, especially respiratory cancers, would paralyse not only a legitimate and urgently needed pursuit into the various environmental factors inducing such cancers, particularly the many industry-related pollutants of the urban air, but has provided already effective legal arguments before civil courts and compensation boards for denying justified claims for compensation of occupational respiratory cancers . . . .”

Discussion

Examination of the various legislations reveals a number of aspects worthy of discussion: the criteria for inclusion of
Table 2

Recognized occupational cancers for which compensation is given in various countries

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Australia


^b In some states only.

^c Compensation is awarded following substantial exposure to crocidolite dust only.

Belgium

^d Arretés Royals of March 28, 1969, May 28, 1969 and July 10, 1973. Other substances are considered under the section Professional diseases caused by arsenic, cadmium, chrome, nickel, benzene, and aromatic amines, with no specification as to the type of disease.

^e In association with asbestosis.

Denmark

^f Lovtidende for Hongeriget Danmark, Act No. 137 of April 26, 1968. This order requires notification of cases of occupational diseases to the Labour Inspectorate. The text specifies as follows: "... Malignant neoplasms and similar disorders caused by the action of arsenic, chromium or organic compounds..."

Federal Republic of Germany

^g Siebente Berufskrankheiten-Verordnung, June 20, 1968. Bundesgesetzblatt, Teil I, No. 42, Seite 721. Malignant neoplasms are compensated as professional diseases when they are caused by a disease mentioned in the list of professional diseases (part of the order) and if they are induced by professional activities. This also applies to malignant neoplasms that are not caused by any of the listed diseases, if scientific evidence can sufficiently justify it for each individual case (Paragraph 551, Abstract 2 Reichsversicherungsordnung).

^h In association with asbestosis.

^i Includes the entire urinary system as well as the bladder.

France

^j Décret No. 46-2959 of December 31, 1946 as amended up to Décret No. 74-354 of April 26, 1974.

^k Only if associated with asbestosis.

German Democratic Republic

^l Verordnung über Melde- und Entschädigungspflicht bei Berufskrankheiten, Ministry of Health, September 18, 1968. Cancers of the skin and lung due to professional exposure to carcinogenic agents, with no reference to which agent, are also included in the list of professional diseases.

^m Includes cancer of the urinary tract.

Ireland

^n Factories Act, 1955 (Application of Section 76 to Certain Diseases) Regulations, S.I. No. 262, 1972. Chronic diseases due to arsenic, cadmium, and benzene are also included in these regulations, with no specification as to the type of disease.
a carcinogen in legislation, the different legislative measures taken with regard to various carcinogens, the differences among the legislation of the various countries, and the time lag between the discovery of a carcinogenic agent and the implementation of legislative measures.

In the 4 countries (see Table 1 and "Appendix") that prohibit or control individual carcinogens, chemicals that are allegedly no longer used (such as acetylaminofluorene, 4-nitrobiophenyl, and 4-aminobiphenyl) are included in the legislation, but compounds that are widely utilized and that have been proved to be carcinogenic in humans (such as chromates, nickel, and benzene) are omitted. In addition, certain carcinogens are covered by the legislation of some countries but not by that of others; this is the case, for instance, with methyl(chloromethyl)ether, bis(chloromethyl)ether, and 4,4'-methylene bis(2-chloroaniline). Such discrepancies are certainly not due to lack of information or dispute over the carcinogenicity of these compounds. They are more likely the result of the economic importance of certain compounds in particular countries and/or the inertia or insensitivity of governmental bodies concerning this problem.

Regulatory measures differ when a chemical has been found to be carcinogenic in both humans and animals rather than just in animals. In the regulations of the United States (see "Appendix"), solid or liquid mixtures containing less than 0.1% of 4-aminobiphenyl, benzidine, 4-nitrobiophenyl, β-naphthylamine, bis(chloromethyl)ether, or methyl(chloromethyl)ether are allowed, whereas for other carcinogens, such as dimethylnitrosamine, β-propiolactone, and acetylaminofluorene, the acceptable concentration has been set at 1%. Adoption of these 2 different standards is based on the fact that the chemicals in the 1st group are considered to be potent human carcinogens, while those in the latter group are chemicals for which only experimental evidence of carcinogenicity exists. Similar criteria were used for establishing legislation in other countries, including the Federal Republic of Germany. It is perhaps worthwhile to emphasize that the inclusion of dimethylnitrosamine among the chemicals for which regulatory standards exist implies the recognition that experimental data can be indicative of possible human hazard. Since dimethylnitrosamine has been shown to be carcinogenic at very low levels of exposure, following single exposure as well as prenatal exposure, it can be classified as a potent carcinogen. The 1% concentration presently allowed therefore appears to represent a high exposure level.

This difference in regulatory measures is based on the assumption that human and animal carcinogens are not the same, an assumption that is not supported by scientific data. Chemicals proven to be carcinogenic in humans and chemicals for which only experimental evidence exists do not pertain to or constitute 2 different categories of chemicals; they only represent different levels of evidence. All of the chemicals found to induce cancer in humans, with the possible exception of trivalent inorganic arsenic, also produce cancer in experimental animals. There is little evidence from the available scientific literature to support the concept that a chemical found to be carcinogenic in experimental animals will not, under any circumstances, produce cancer in humans (8, 24, 25, 27).

The observation that a risk of bladder cancer existed among aniline dye workers goes back to 1895, and subsequent reports have confirmed this initial study (15). In 1938, Hueper et al. (11) reported the induction of bladder cancer in dogs by p.o. administration of commercial β-naphthylamine. In the United Kingdom in the decade 1930 to 1940, efforts were made to have bladder cancer included in the Workmen's Compensation Act. However, as reported by Case (3), "...many large firms in the British chemical industry thought this step premature until a proper epidemiological survey had been carried out." The results of this survey appeared in 1954 (4), and bladder cancer due to exposure to aromatic amines was included in the Prescribed Industrial Diseases Regulations in 1962 (see Table 2). Legislation prohibiting the manufacture of certain aromatic amines was enacted in that country in 1967 (see "Appendix"). However, β-naphthylamine and benzidine are still manufactured today in other countries where no legislation controlling or prohibiting these substances exists.

**Italy**

* Gazzetta ufficiale No. 269, October 9, 1975, pp. 7139–7143. The localization of the cancer is not specified, except in the cases of pulmonary cancer due to chromium and skin cancer due to soot, tar, etc. Cancer due to arsenic is recognized for industrial workers but not for agricultural workers.

**Japan**

* Enforcement Ordinance Article 35 of Labour Standard Law (as amended up to Law No. 99 of June 15, 1968), Article 75, Paragraph 2. Diseases caused by chrome, nickel, arsenic, benzene, and aromatic amines are also mentioned in the ordinance, with no specification as to the type of disease. Item 38 of this ordinance includes other diseases apparently caused by work.

**Switzerland**


**United Kingdom**

* Also includes primary epithelial neoplasms of the renal pelvis, ureter, and urethra.

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The following is an example of the double standard used in evaluating the significance of animal experimentation. It is known that exposure during certain industrial processes (e.g., leather and rubber manufacture) has increased the risk of urinary bladder cancer (9) or of nervous tissue tumors (23). No measures have been taken in these cases, allegedly because no specific agent(s) capable of producing the tumors in animals has yet been identified. It seems, therefore, that at times the necessity of having experimental evidence is played against observations made in humans, resulting in a sort of vicious circle.

Two points seem to be clear. First, it is not always necessary to await the identification of a particular agent or of a chemically pure substance capable of producing tumors in animals before implementing preventive measures; these can be taken solely on the basis of human observations (7). Doll (6) stressed the point that "...there should be no question of waiting for proof that a particular factor causes cancer in man before acting to remove it." Second, waiting for epidemiological evidence when experimental evidence already provides a strong suspicion of risk for humans means acceptance of criteria by which prevention can be implemented only a posteriori. Such a delay would mean, in the extreme, that human experimentation must continue until overwhelming evidence of a cancer hazard imposes the adoption of immediate measures.

Data on 272 chemicals have been reviewed as part of the International Agency for Research on Cancer program on the evaluation of carcinogenic risk of chemicals to humans (12–22). Of these, 20 were found to be associated with the occurrence of cancer in humans (26). For 15 of these 20 chemicals, exposure was solely or mainly occupational. Experimental evidence of carcinogenicity has been confirmed for 137 of the 272 chemicals considered. Evidence of human exposure exists for 131 of the 137. For 111 of these chemicals, exposure occurs because of occupation. Production figures for 19 of these chemicals are well over 500,000 kg/year, and for some the production is over 10 million kg/year.

There is little cause for celebration in this bicentenary of Percival Pott’s first description of cancer due to occupation. A number of conclusions can be drawn from the present study. First, legislation prohibiting the manufacture of chemicals shown to be carcinogenic to humans or known to represent a possible cancer hazard to humans exists only in a limited number of the 14 countries considered and does not cover the same chemicals in each country. Second, only a few of the countries prohibit the importation as well as the manufacture of certain chemical carcinogens. Third, legislation concerning compensation, although largely deficient, is more common in these countries than is legislation that provides means for primary prevention, i.e., prohibition of the manufacture and use of carcinogenic chemicals. The fact that most countries recognize a limited right to compensation but do not provide adequate legislation for prohibiting or even limiting exposure to carcinogens indicates that the criterion of primary prevention is not yet widely accepted. At the same time, it is implicitly accepted that certain groups of citizens can be exposed to high cancer risks. Fourth, there is no reason for the great disparity in legislation among different countries, since carcinogenic chemicals represent the same risks to humans living at all latitudes. Fifth, legislation which prohibits manufacture and use but which permits importation of carcinogens allows and surreptitiously stimulates their manufacture in other countries, intimating that humans in different countries should not have the same rights to the same levels of prevention. Sixth, there are 2 specific deficiencies in even the more comprehensive legislations: (a) some chemicals for which carcinogenicity in humans has been proved are still produced in large quantities and are not mentioned in the legislation; and (b) the criteria used to select chemicals as possibly hazardous to humans when only experimental evidence of carcinogenicity exists are arbitrary and overexclusive, while the allowed concentrations of some chemicals recognized as possibly hazardous to humans are clearly too high.

It is also evident from the present survey that, in general, damage incurred by workers due to the hazard of their occupation is measured only at the monetary level. The social and moral responsibility of the person(s) concerned is not really taken into consideration (2). The recognition and subsequent compensation of a cancer due to occupational exposure to chemicals is, to say the least, a paternalistic solution to the problem and does not overrule the necessity of primary prevention through the enactment and implementation of appropriate legislation.

Acknowledgments


Appendix

Belgium

A list of carcinogenic substances is contained in Arrêté Royal, Article 4, of October 3, 1973, dealing with protection against dangerous chemicals in working places. The list comprises a total of 17 chemicals: benzidine and its salts, N,N-diethylbenzidine, N,N-dimethylbenzidine, 3,3′-dichlorobenzidine, o-toluidine, 1-naphthylamine, 2-naphthylamine, dimethylaminosamine, 2-acetylaminofluorene, 4-aminobiphenyl, diazomethane, 4-dimethylaminobenzene, hydrazine, 1,1-dimethylhydrazine, ethyleneimine, and propyleneimine. Article 4 states that it is forbidden to expose workers by inhalation, p.o., or cutaneously to products containing chemicals that have carcinogenic properties. The manufacture of these carcinogens is allowed, provided that the production takes place, for instance, in a closed system and that it is subject to an authorization by the Ministry of Employment (see Article 5 of the same Arrêté Royal). Other known carcinogens, such as arsenic, beryllium, benzene, and polychlorinated biphenyls, are not included in the list but are, however, submitted to an authorization for their manufacture.

Federal Republic of Germany

No legislation exists prohibiting the production or importation of carcinogenic substances. A special section on carcinogenic substances is contained in the publication Maximum Allowable Concentrations, which is prepared annually by a commission of the Deutsche Forschungsgemeinschaft and serves as a regulatory instrument for the competent authority to limit occupa-

tion to noxious chemicals. Carcinogenic substances are divided into 2 categories. Category A [4-aminobiphenyl, arsenic trioxide, arsenic pentoxide, arsenic acid and its salts, asbestos, benzidine and its salts, benzenediylium, chromate (calcium-potassium-sodium), bis(chloromethyl) ether, mono(chlorodiethyl) ether, 2-naphthylamine, and nickel] includes substances recognized as inducing cancer in humans: no threshold limits are given for these substances. Category B [ethyleneimine, diethylenetriamine, 3,3′-dichlorobenzidine, dimethylnitrosamine, dimethyl sulfoxide, hydrazine, cobalt, nickel carbonyl, 1,3-propanesultone, β-propiolactone, propyleneimine, 2,2′-dichlorodiethyl ether, 1,1-dimethylydrazine, 4,4′-methylene bis[2-chloroaniline], and vinyl chloride] includes substances which, in the opinion of the commission, have been proved to be carcinogenic in experimental animals under conditions which simulate possible human exposure; threshold levels are established for these substances.

Japan

Legislation is similar to that in the United Kingdom. The regulations prohibit the use, importation, and manufacture of benzidine, 4-aminobiphenyl, 4-nitrobenzidine, and its salts, and their products. Products containing less than 1% of the above carcinogens are exempt. In addition, certain other substances (dichlorobenzidine, 1-naphthylamine, o-tolidine, o-dianisidine, and their salts, and benzotrichloride) cannot be manufactured without permission, and manufacture must then be carried out in a closed system. For auramine and magenta, permission is not required, but their manufacture must be carried out in a closed system. Some other carcinogens, such as asbestos, polychlorinated biphenyls, coal tar, cadium, chromates, arsenic trioxide, nickel carbonyl, beryllium, and dimethyl sulfate, are regulated by maximum allowable concentrations in the working environment.

Sweden

For application of the Workers Protection Act, the National Board of Occupational Safety and Health issued directions effective January 1975 concerning limit values for air contaminants at places of work. Chemicals found to be carcinogenic in humans and/or animals are considered in these directions and are divided into 3 classes on the basis of the following criteria. Chemicals in Class A [4-aminobiphenyl, benzidine and its salts, bis(chloromethyl) ether, methyl(chloromethyl)ether, β-naphthylamine, 4-nitrobenzidine, and crocidolite] are considered to be highly carcinogenic and capable of causing cancer even at low exposures. Class B includes chemicals (2-acetylaminofluorene, auramine, o-dianisidine, diethylenetriamine, 4-dimethylaminoazobenzene, 3,3′-dichlorobenzidine, diethyl sulfate, dimethyl sulfate, ethyleneimine, ethylenourea, methylene-o-chloroaniline, methylnitrosourea, α-naphthylamine, dimethylnitrosamine, 1,3-propanesultone, β-propiolactone, propyleneimine, and o-tolidine) which may be used according to the instructions of the Labour Inspectorate. There are no limit values for chemicals of these 2 classes, and exposure may be said to equal zero for those in Class A and be reduced to an absolute minimum for chemicals in Class B. The last group, Class C, includes carcinogenic chemicals (arsenic and its inorganic compounds, with the exception of hydrogen arsenide; asbestos dust and crocidolite; benzene; beryllium; dioxan; phenyl, 4-nitrophenyl, methylaminoazobenzene, 3,3′-dichlorobenzidine and its salts, bis(chloromethyl) ether, β-naphthylamine, benzidine, 4-aminobiphenyl, 2-acetylaminofluorene, 4-dimethylaminoazobenzene, dimethylnitrosamine, and ethyleneimine) in order to limit human exposure in the working environment. Only solid or liquid mixtures containing less than 0.1% of 4-aminobiphenyl, benzidine, 4-nitrobenzidine, bis(chloromethyl) ether, and methylchloromethyl)ether are excluded, since these substances are considered to be potent human carcinogens. The standards also exclude solid or liquid mixtures containing less than 0.1% of other carcinogens. The maximum exposure limits for vinyl chloride are an average of 1 ppm over any 8-hr period or an average of 5 ppm over a period not exceeding 15 min. The standard for asbestos is permitted exposure to an 8-hr time-weighted average of 0.5 fibers/ml or a ceiling concentration of 5 fibers/ml.

United States

Regulatory standards were established in 1974 for a number of carcinogens [4-nitrobenzidine, α-naphthylamine, 4,4′-methylene bis(2-chloroaniline), methyl (chloromethyl) ether, 3,3′-dichlorobenzidine and its salts, bis(chloromethyl) ether, β-naphthylamine, benzidine, 4-aminobiphenyl, 2-acetylaminofluorene, 4-dimethylaminoazobenzene, dimethylnitrosamine, and ethyleneimine] in order to limit human exposure in the working environment. Only solid or liquid mixtures containing less than 0.1% of 4-aminobiphenyl, benzidine, 4-nitrobenzidine, bis(chloromethyl) ether, and methylchloromethyl)ether are excluded, since these substances are considered to be potent human carcinogens. The standards also exclude solid or liquid mixtures containing less than 0.1% of other carcinogens. The maximum exposure limits for vinyl chloride are an average of 1 ppm over any 8-hr period or an average of 5 ppm over a period not exceeding 15 min. The standard for asbestos permits continuous exposure to an 8-hr time-weighted average of 0.5 fibers/ml or a ceiling concentration of 5 fibers/ml.
R. Montesano and L. Tomatis

USSR

The production of β-naphthylamine, 3,3'-dichlorobenzidine, α-aminoazotoluene, and dibenzylamine has been prohibited. Standards have been established for the manufacture and use of benzidine and its homologs, α-naphthylamine, and o-toluene in order to minimize exposure to these compounds. 17

Australia, German Democratic Republic, Switzerland, The Netherlands, France, and Italy

There is no legislation in these countries referring specifically to carcinogenic substances in the working environment; however, general legislation concerning toxic substances exists. In The Netherlands the manufacture, transportation, and storage of 1,3-propanesultone has been prohibited (Royal Decree of January 21, 1976, Stb. 1976, No. 97).

References


CONFERENCE ON CLINICAL PERSPECTIVES OF CEA

A Conference on Clinical Perspectives of Carcinoembryonic Antigen (CEA) will be held June 1 to 3, 1977, at the University of Kentucky Medical Center, Lexington, Kentucky. Its purpose is to assess the current clinical uses of CEA assays in the management of cancer patients and to discuss various new approaches for measuring and detecting CEA in body fluids and tissues. Emphasis will be placed on determining the value and problems of CEA tests in various clinical practices. Part of the conference will be devoted to basic questions of the immunology and chemistry of CEA, immuno-cytchemistry of CEA in the pathology laboratory, and a discussion of other new markers identified in tumors which may prove of value for cancer immunodiagnosis.

In addition to invited lectures, a number of short proffered papers will be accepted. Deadline for submission of abstracts is March 15, 1977. For further information and abstract forms, contact Dr. D. M. Goldenberg, Division of Experimental Pathology, MDRF No. 3, University of Kentucky Medical Center, Lexington, Kentucky 40506.

Erratum

In the paper entitled, "Legislation Concerning Chemical Carcinogens in Several Industrialized Countries," by Ruggero Montesano and Lorenzo Tomatis, published in the January 1977 issue of CANCER RESEARCH, the following changes should be made.

On page 310, under "Introduction," the second sentence should read: "This statement is probably as misleading in its underestimation as the statement that up to 90% of cancers are due to environmental causes is so by overestimation."

On page 315, under "Japan," the second sentence should read: "The regulations prohibit the use, importation, and manufacture of benzidine, 4-aminobiphenyl, 4-nitrobiphenyl, 2-naphthylamine, their salts, and bis(chloromethyl) ether." The last sentence in that paragraph should begin: "Some other carcinogens, such as asbestos, polychlorinated biphenyls, coal tar, cadmium, chromates, arsenic trioxide, nickel carbonyl, beryllium, dimethyl sulfate, and vinyl chloride..."

On page 315, under "United States," the last sentence should begin: "The proposed standard for asbestos..." At the end of that paragraph, add the following sentence: "A Toxic Substances Control Act was passed in October 1976 and is intended to facilitate the control of toxic substances, including carcinogens in the environment."

Legislation Concerning Chemical Carcinogens in Several Industrialized Countries

Ruggero Montesano and Lorenzo Tomatis


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