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Concern for the Quality of Life and Future Importance of the Forensic Sciences (The Living and Working Environment)

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SYNOPSIS: The quality of life concerns the well-being of man and his environment. The disciplines that are an essential part of the professional activities of the forensic scientist ideally suit him to address and to find solutions for the many serious and contradictory problems facing man and his ever more complicated environment.

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The quality of life largely concerns man and his environment. The environment may be broadly defined as the sum of all the conditions and elements that make up the surroundings and influence the development and well-being of the individual. These conditions include social, psychologic, and psychiatric as well as legal, criminal, civil, and regulatory factors. The physical environment affects man through temperature, gravity, physical energy, noise, light and other radiations, and the availability of food, water, clothing, and shelter. The physical environment interacts with the chemical environment.

Pathology is a special branch of medicine that deals with the essential nature of disease, especially by using techniques to determine structural and functional changes in tissues and organs of the body that cause or are caused by disease. The pathologist is intimately concerned with the interaction of the physical and chemical environment with body organs and structures. For example, inadequate clothing or shelter combined with problems of insufficient food or a debilitated state can cause someone to become especially sensitive to a low environmental temperature. Acute ethanol or other intoxication may be a complicating factor in deaths from hypothermia. Prolonged immersion in very cold water by accident or intention is a definite threat to the continued well-being of the human body because it seriously slows bodily functions. On the other hand, hyperthermia has primarily cardiopulmonary and electrolyte effects and may develop into heat exhaustion, primarily associated with low serum sodium levels, or ultimately in heat stroke. The body temperature may rise to the very high levels of 41°C (106°F) and beyond with little chance of recovery without vigorous and

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immediate treatment. Such temperatures result from a pathologic failure of physiologic systems of temperature regulation.

Light is primarily derived from the sun. A suntan of exposed areas of the body is actually a sunburn. When present in excess, sunlight may also affect the retina and other systemic functions. Man can adapt readily to low light levels but needs protection from high light levels. Other radiations such as ionizing radiation may cause burns of the skin, retina, or other tissues. The radiation may cause delayed and initially unperceived effects that may take the form of fibrosis of structures. Fibrosis is commonly seen as a regional complication when radiation is used to treat localized neoplasms. Sterility may result, and chromosome damage has been described.

Forensic pathologists receive special training and develop experience in evaluating the acute effects of the environment on man. The forensic autopsy establishes such things as the causes of death, the time of death, circumstances preceding and surrounding the death, and, with the investigation process, the manner of death, whether by natural causes or otherwise. Establishing the medicolegal causes of death is, and in the 1980s will continue to be, of primary interest. In addition, the immediate and the remote causes of death may need to be distinguished. A precipitating, contributing, indirect, or proximate cause of death may be of special concern in certain legal jurisdictions. Some laws specifically address the exclusion or inclusion of precipitating or indirect causes of death in the evaluation of certain legal issues. The forensic autopsy must be complete, with adequate photographs and X-rays, a complete external description, an appropriately thorough dissection, routine collection of samples, and the indicated tissue and toxicologic analyses [*1*].

Proper trace evidence collection is necessary from the body as well as from the scene and is usually provided by the forensic science or police laboratory. All forensic science procedures must be carried out with the knowledge that there will be no second chance to correct initial inadequacies. Scientists contributing to this investigative program are specialists in criminalistics who primarily deal with physical samples from the scene, such as blood and other stains, clothing fibers, hair, fingerprints, firearms, gunshot residues, and evidence of drug availability and use. I believe that criminalists in the future will have special import in areas affecting the environment of man by means of their special skills in microscopy and evaluation of trace physical evidence; for example, filters routinely collect samples from the work environment and therefore fiber identification in the work space may also properly be the work of the criminalist.

Scene investigation and accident reconstruction and evaluation are special areas where the criminalists' developed skills will assure proper preservation of the scene as well as proper identification, collection, and analysis of samples. Their legalistic approach to the preparation of evidential materials for hearings or courtroom presentations is the best chance of ensuring the proper control and evaluation of evidence. It is my firm belief that a person trained and skilled in criminalistics will have a very special advantage in the future evaluation of the safety of the work place and the living environment and will assist in preventive measures.

Currently the forensic toxicologist is concerned in his major workload with routine determinations of ethyl and other alcohols, carbon monoxide, other gases, medication, and narcotics. General toxicologic unknowns are a very special challenge. Heavy metals analysis, medication monitoring, and a myriad of special topics also attract the attention of forensic toxicologists. In the future, additional important applications of forensic toxicological skills will become routine, including the analysis of a wide range of body tissues in support of environmental pathology studies and metabolic studies of substances of relatively low toxicity that are usually not the cause of sudden death but that may cause chronic intoxication.

Further development of the field of ecological toxicology is certain. Intensive studies of the industrial environment and exposure levels and the development of sensitive, specific methods for analytical analysis will become of even greater interest than at present.

Workmen's compensation, work-related deaths, special studies of selected groups such as those who work with coal dust and asbestos, and the screening of workers for effects of environmental materials of all kinds are of ever-increasing importance. Histories of exposure and large medicolegal data bases are needed to help detect and to avoid hazards. The use of medicolegal data bases will allow statistical analysis of the incidence and location of different causes of death. Excess morbidity or mortality in a certain occupation or industry should lead to the suspicion that the excessive incidence may be job-related. Early suspicion of hazardous material (as with vinyl chloride) and the monitoring of the effectiveness of preventive methods will become routine responsibilities of trained forensic toxicologists.

The additional skills that the forensic pathologist can bring to the study of environmental pathology will be of increasingly greater importance. These skills will lead to a greater number of analyses of delayed deaths in certain categories and automatic evaluations of deaths in certain job categories, such as the atomic, asbestos, and chemical industries, to determine whether acute or chronic factors affect those workers. The pneumoconioses have attracted great interest recently because of alleged widespread exposure of the population to particulate matter. The experience of many workers will be analyzed, and experimental studies will be initiated to simulate the work environment, commonly by the use of long-term animal exposure experiments.

The areas of forensic and environmental pathology are obviously closely linked. They are a natural combination of closely associated topics, one representing acute effects and the other, chronic effects; both types of effects are often brought about by the same or similar agents. Certainly the tools and the study methods are similar if not identical. They should be equally exacting and precise. The forensic pathologist will contribute heavily to the study of environmental pathology with better follow-up through repeated clinical studies of exposed and nonexposed healthy subjects. Good baseline data on unexposed persons studied in detail will be important in comparisons with diseased patients. Medicolegal data bases contain large numbers of "normal" cases for comparison to abnormal cases. Future medicolegal systems will have the forensic pathologist dealing primarily, as he does now, with sudden deaths of all types, including those caused by hostile environments such as carbon monoxide and toxic fumes. The environmental pathology applications will address the effects of chronic exposure to environmental fumes, fibers, additives, and other substances.

A note of caution involves the problems of regulatory agencies. The typical regulatory agency tends to be overly protective. In some instances actual objective facts may not be established or even establishable. The public may perceive that a pronouncement is a fact, whereupon public pressures may build (including lawsuits) against the regulatory agency for being too lax. Public criticisms of such agencies are common. A further problem in the scientific establishment of a cause-effect relationship is the official denial of the dose-effect relationship. The approach taken is that if large doses of an agent are harmful in experimental animals no amount of that agent is tolerable to man. This may be practical for the use of regulatory agencies. It does not, however, establish the cause and effect relationship in scientific or legal terms. Substances are emphasized that are to be avoided in exposures of human individuals who are under the control of that regulatory agency.

It is important for the forensic science specialists to assist to an ever-increasing degree in the establishment of truth and objectivity in areas of their own expertise. A certain amount of "nonscience" is inevitable when actual scientific studies are lacking or are inconclusive in areas of importance to the public and therefore to the media. For example, a disease state and the presence of a chemical may coexist; someone notices the coexistence; someone wonders if there is any causal relationship; the scientists are asked if there is any relationship and (in honesty) respond, "Yes, it's possible." Writing and rewriting of quotations in and out of context can change "possible" to "probable" in some instances, and the more discussed and written about an idea is the more fixed it becomes even if unproven or false. Scientific reminders that facts do not exist may even elicit responses of disbelief and derision

and claims of cover-up. True science, objectivity, and truth, however, are always our principal goals as forensic scientists.

Proven hazards must be made public and removed, or minimized if there are important trade-offs involved. Suspected hazards should be carefully evaluated. These evaluations are best performed by neutral observers (such as university research teams) with scientific peer review and publication for all to see and criticize constructively. Industry may be suspected by consumer groups, and consumer groups may be accused of nonscientific or self-serving stances. New products, of course, need to be evaluated. The newer laws and guidelines seem to promise considerable progress in this important area of protection of the worker and the consumer.

One of the greatest problems in the application of environmental principles is the concern with latency and the potential emergence of an effect some years after exposure. Some exposures can be harmful to some people after some time, and some individuals use this information to claim they have been injured when they actually show no signs of injury at the time the claim is made. This latent period seems to absolve them from the responsibility to establish scientifically the fact of the ill-effect of the exposure. It should be remembered further that the presence of a chemical or a particulate in tissues does not automatically prove any injury has been caused by the agent. We as forensic scientists will play an increasingly important role in the future evaluation of man and his environment. We as individuals trained in the scientific and legal preparation of evidential material are in a unique position to provide objective information on these important subjects. We must be ready and willing to provide leadership based on our special skills when called upon by the needs of mankind in our future.

Reference

[*1*] Gantner, G. E., "The Autopsy and the Law," *American Journal of Clinical Pathology,* Vol. 69, No. 2, Feb. 1978, pp. 235-238.

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