

Animals as Monitors of Environmental Quality

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A herd of feedlot cattle being fattened for slaughter suddenly sicken and many die. Many exhibit convulsive seizures and other signs of illness. Investigation reveals that their feed has accidentally been contaminated with an insecticide.

A herd of swine becomes ill, and many die with a high fever. Investigation reveals that they are infected with the virus of hog cholera.

A small urban community experiences the death of many dogs and cats in a localized neighborhood. Investigation reveals that someone has been placing strychnine in wieners and hamburger, then deliberately feeding it to neighborhood animals in order to reduce their population.

A Midwestern farm family experiences continuous poor health in their children manifested by tiredness, frequent respiratory infections, and poor eyesight. Their animals do not reproduce well, and the young animals that are born fail to grow efficiently. Investigation reveals a water system contaminated with coliform bacteria and nitrates.

Horses and cattle grazing near a smelter sicken and die because of the contamination of the forages with lead emitted into the air from the smelter. Several dairy farmers in the vicinity of a phosphate mineral producing plant observe extreme lameness and emaciation in their cows. Closer examination reveals that the cows' teeth are mottled, soft and worn into the gums so that they cannot chew their food, thus, drastically reducing their milk production. Further investigation reveals that high levels of fluoride are being emitted into the air from the phosphate plant which contaminate the forages consumed by the cows.

A swine producer experiences an outbreak of abortion in sows about to farrow. Discouraged with his problem he send them to market for slaughter. In the slaughtering operating the packing house worker unknowingly exposes himself to the bacterial agent which causes undulant fever.

In each of these reports a health problem exists which reflects a breakdown in environmental quality. Although potentially hazardous to man, either directly or indirectly, these disorders are first manifested in animals. The member of the medical team who first confronts these problems is the practicing veterinarian. By nature of his training and experience, he is best able to recognize the importance of these problems as they relate to man, his food supply, and his environment. Although the practicing veterinarian has the first contact with these problems, he has a host of specialists to assist him in laboratory diagnosis and interpretation of the findings. These include state and federal regulatory veterinarians and other public health officials; epidemiologists, toxicologists, pathologists, and microbiologists in veterinary diagnostic laboratories; and finally the backing of animal researchers in federal and state laboratories.

These events recall the coal miner's canary. Caged canaries were taken into coal mines. More vulnerable than man, their death by unseen and unsmelled gases drifting into the mine shaft gave miners time to race to the surface. Today's food-producing animals, pets, and wildlife are man's moder-day "canaries." The atmosphere around the earth is analogous to the coal mine. It is limited in space and has a finite tolerance for pollutants in order for life to continue. Our animals breathe the same air as man, drink the same water, are exposed to the same chemicals in our environment, are subject to many of the same infectious disease organisms, and experience similar difficulties as man from crowding. Thus, our animals became sentinels or indicators of the quality of our environment.¹

The veterinary profession has a major role in monitoring the effects of environmental quality on animals and, in cooperation with medical and other allied professions, assessing the potential hazards to man. Being trained in

comparative animal medicine, the veterinarian is charged with the primary responsibility of caring for and preserving the health of our animal populations. Whether it be man's companion animals, wildlife in their natural habitat or in confinement, or the production of animals for food, the veterinarian, along with animal scientists, nutritionists, geneticists, economists, agronomists, and biologists, is dedicated to the task of improving their well-being and, indirectly, that of man.

Animals as Sentinels

The following are some specific examples of how our knowledge of animal health serves to preserve the well-being of man and warn him of potential environmental hazards.

a) Chemical Pollutants -- Many species of animals are equally or more susceptible than man to the toxic effects of chemical pollutants. Lead poisoning is frequently diagnosed toxicosis in cattle. Lead poisoning is also frequently seen in dogs living in the urban environment. Lead poisoning is one of the most frequently diagnosed toxicosis in children that results in permanent damage or death.² Therefore, by comparing the epidemiological findings pertaining to lead poisoning in cattle, dogs and other animals with that in humans, we are able to determine that lead is an important contaminant of our environment. Armed with these facts, it then becomes a matter of convincing our society that the emission of lead through automobile exhausts and industrial smokestacks must be curtailed and that the use of lead in paints and other materials in close association with man and animals must be curtailed.

Another example may best be given with the following case history: A poultryman had 20,000 laying hens for egg production. He purchased a feed mixture from a local feed company. The company, in mixing the feed, accidentally contaminated the mixture with granules of insecticide which had been stored in a warehouse in the vicinity of other feed ingredients. After feeding the insecticide-contaminated feed for several days, the poultryman noticed his birds were more excitable than usual but, because no other signs of illness were apparent, did not recognize that a problem

existed. The eggs produced from these birds contained several parts per million insecticide but went undetected into consumer use. Subsequently, the poultryman decided to replace his hens with a new flock of younger birds. He sold 10,000 of them to a soup manufacturer. During the processing of the meat for soup, the birds were found to be contaminated with several parts per million of the insecticide. This finding resulted in the alerting of the poultryman, the local veterinary practitioner, the feed company, the state and federal regulatory officials, the Federal Food and Drug Administration, and other public health officials. With the aid of a chemist in a veterinary diagnostic laboratory, the source of insecticide in the feed was chemically confirmed; and subsequent investigations revealed how the insecticide had been accidentally incorporated into the poultry feed. All 20,000 birds were destroyed instead of being made into chicken soup.

The documentation of problems in animals resulting from exposure to chemicals in the environment occurs daily. In this manner we are able to prevent the contamination of meat, milk, and eggs produced for human consumption. In addition, we are able to identify the chemical contaminants in our environment and, thus, provide a warning of possible hazards to man.

b) Zoonoses -- The term zoonosis refers to a disease naturally transmissible between man and animals. Some of the better known diseases in animals that are transmissible to man include rabies, equine encephalomyelitis, tuberculosis, brucellosis, salmonellosis, leptospirosis, psittacosis, toxoplasmosis, and histoplasmosis. Cooperative endeavors among members of the public health team and microbiologists in veterinary diagnostic laboratories enables us to identify and bring under control such disease outbreaks, thus preventing their spread to humans.

c) Food Hygiene -- A major proportion of the average American's diet consists of meat, milk, and eggs or other food of animal origin. Animals may harbor subclinical infections or may contain chemical residues in their tissues which are undetectable by the producer. For this reason we have inspection of animals in stockyards, sales barns, and packing plants prior to slaughter. Routinely, tissue specimens are obtained and analyzed for

pesticides, hormones, and chemical residues; examined for parasites such as tapeworm cysts and trichina; and in some instances cultured for infectious agents. Again, these findings reflect the environmental quality in which these animals were raised.

Animals as Models

a) Effects of Chemical Pollutants -- The acute and chronic effects of environmental pollutants on man must be predicted if acceptable criteria standards are to be established. Since it is very difficult to study these effects in humans, we turn to animals as our experimental models. It is readily understood that pathological processes can best be intensively studied in animals by controlling the environment and exposing experimental animals to specific toxicants or disease organisms. Their effects at various dosages and periods of exposure can be ascertained. Assessment of changes in physiology, cellular morphology, and behavior can be correlated with the level of exposure and resulting levels in the body tissues. By studying the effects of environmental pollutants on several species of animals, one can then predict the potential effects on man under specific conditions of exposure and duration. This information can then serve as a basis for setting criteria standards for the various pollutants in our environment.

In developing the criteria on which to base environmental quality standards, we find that the greatest paucity of data is in the area of environmental toxicology. A significant proportion of government funds allocated to health effects research has gone into specific studies in environmental toxicology. Examples of such studies include the effects of nitrogen dioxide and lead exposure on immune responses; carcinogenicity of hydrocarbons; effects of ozone on the respiratory tract; effects of long-term exposure to cadmium, lead, arsenic, and mercury; and behavioral and electrophysiological effects of insecticides and other neurotoxicants. Meaningful environmental research requires input from the integration of three approaches: (1) laboratory animal toxicologic studies, (2) clinical investigations with human subjects, and (3) epidemiologic studies under naturally occurring conditions.

b) Medical Developments -- Teamwork is the best approach, and it is here that the allied health professionals use the animal as a proving ground for untried therapeutics, the execution of surgical techniques, and the development of prosthetic aids for use in human medicine. Surgical techniques developed in animals are now being applied in the field of human medicine. The transfer of healthy organs from one individual to another is an example of this progress. The action of sweet clover poisoning in cattle was first observed by a veterinarian which resulted in the development of dicoumarol for use in treating disease of the heart and circulatory system in man.

The prevention of many communicable diseases in humans depends upon the production of biologics by official agencies and industries. This involves the use of varieties of large and small animals. It must be remembered that horses are needed to manufacture diphtheria antitoxins, tetanus antitoxin, and tetanus toxoid. Sheep are used in the preparation of whooping cough vaccine and calves in the production of smallpox vaccine. Small animals are bred for diagnostic and experimental purposes to insure the rapid development of new methods for administering the immunizing biologics. The development of chemotherapy for man and animal use has taken place largely through the advice and guidance of the veterinary profession in research laboratories throughout the world. Studies on the transfer of resistance phenomenon by bacteria in animals have far-reaching influence on public health.

Aging among animals is a much shorter process than it is in man. Man's interest in studying the aging process has led him to make observations in the animal kingdom, hoping to find important clues toward solving some of our problems associated with aging and chronic diseases. The relationship of nutrition to the degenerative processes should be an exact science in animals due to the fact that almost every facet of animal life can be controlled by the investigator.

Summary

Animals, including farm animals, pets, and wildlife, can serve as monitors of environmental quality. Just as the coal miner's canary warned

of unseen and unsmelled toxic gases, today's animals are our modern day "canaries." If we carefully observe those animals sharing man's environment, we may be able to detect when environmental deterioration becomes potentially hazardous to humans.

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