data not otherwise accessible in such a compact form. Several other chapters discuss the biological actions of interferons on cell growth (Ito and Buffett), on viral infections (Billiau and DeSomer), and on the immune system (Johnson). A chapter on the effects of interferons on cell growth reviews some data on interferon-induced inhibition of the growth of tumors in mice; such findings led to current efforts to treat human cancers with interferons. At best, it would seem at present that interferons will serve as adjuncts to chemotherapy of tumors, although it is still possible that some human tumors will be found to respond to interferon alone. One advantage of interferon treatment of tumors is that interferon has very limited toxicity. However, we still do not know whether the possible anticancer properties of interferons are based on their growth-inhibitory, immunoregulatory, or antiviral effects—or some combination of them.

In the chapter by Billiau and DeSomer herpes B virus is given the designation HB (p. 114); then, HB is used throughout the chapter to refer to what is clearly work on hepatitis B virus. Also on p. 114, the authors suggest that perhaps interferons should not be used to treat chronic hepatitis B infections, since an efficient vaccine for preventing hepatitis B infection is being developed. The millions of patients now afflicted with the disease will not be helped by the vaccine, however, and interferon treatment might prevent them from suffering the worst consequences of the disease as well as from spreading it. On p. 116, the authors state that exogenous administration of interferon "should not achieve more than what is achieved by interferon spontaneously produced during virus infections, a delay in virus replication and virus spread and an alleviation of symptoms." With a natural substance, however, it is sometimes possible to achieve desirable pharmacological effects not seen with the normal physiological production of the substance; take for instance the therapeutic application of adrenal steroids.

The strength of this volume is a series of six chapters on interferon inducers. There is a general chapter on interferon inducers by Stringfellow, and there are chapters on polynucleotides (Levy), tilerone and related compounds (Mayer and Krueger), propanediamines (Betts and Douglas), and polyanions and other polymers (Breinig and Morahan). These chapters are a compilation of useful information on interferon inducers and as such are valuable.

Although therapy with interferon inducers sounds like a good idea, this book points out a number of problems associated with their use. Many inducers are not terribly effective in humans; they tend to be very toxic; it is sometimes not clear that their therapeutic activity is due to their ability to induce interferon; their use is often followed by a period of hyporeactivity during which interferon production cannot be induced by the particular chemical involved; and potentiation of virus disease, a paradoxical response, sometimes is associated with their use. With all of these problems, it is no wonder that many have opted to work on the application of exogenous interferon as a form of therapy. With the cloning of the genes for alpha and beta interferons, there should soon be enough interferon available to carry out the critical studies that will establish whether it indeed has a role in the therapy of human diseases.

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Factors Predisposing to Cancer

Genetic and Environmental Factors in Experimental and Human Cancer. Proceedings of a symposium, Tokyo, 1979. HARRY V. GELBOIN, BRIAN MACMAHON, TAIJIRO MATSUSHIMA, TAKASHI SUGIMURA, SHOZO TAKAYAMA, and HIRAKU TAKEBE, Eds. Japan Scientific Societies Press, Tokyo, 1980. (U.S. distributor, ISBS, Forest Grove, Ore.). xvi, 370 pp., illus. $49.

This volume contains the papers presented at the 10th international symposium of the Princess Takamatsu Cancer Research Fund. The subject is approached predominantly through epidemiologic studies, with additional papers on carcinogen metabolism, DNA repair, and the genetics, pharmacogenetics, and immunogenetics of human and experimental examples. The extremely important but little appreciated topic of the genetics of carcinogen metabolism in the human is discussed by E. S. Vesell. The role of the immune system in ultraviolet carcinogenesis of the skin, a topic of recent interest and importance, is covered by M. L. Kripke. Equally interesting and timely is a report by a group from the People's Republic of China headed by M.-H. Li on experimental investigations of the carcinogenicity of presumed fungal products found in contaminated food obtained from Linxian County, where the incidence of esophageal cancer is extremely high. These studies should serve as a model for the investigation of the role of dietary contaminants in human disease.

The discussions of specific examples and systems of DNA repair are good but somewhat dated because of the rapid advances that have been made in this field since the time of the symposium. Papers on several genetic conditions in the human predisposing to cancer as well as a paper on cancer mortality and morbidity among 23,000 unselected twin pairs are highlighted by an interesting new look at hereditary retinoblastoma by Matsunaga. He suggests that the development of this disease may be the result of altered differentiation rather than of somatic mutation as was originally postulated by Knudson.

The epidemiologic studies reported in the book range from investigations of specific cancers, such as mammary carcinoma in several geographic locations, to investigations of the incidence of a variety of neoplasms in selected human populations, such as the Mormons and Hutterites and the Japanese in Hawaii. The report from Honolulu by Kolonel and his associates and from Fukuoka, Japan, by Hirohata, who has worked closely with the group in Honolulu, present interesting cancer incidence rates in Japanese migrants to Hawaii. In view of the major differences between the United States and Japan in the incidence of stomach, breast, and colon cancer, these investigations, which have been aided by the excellent Hawaii Tumor Registry and the cooperation of the Hawaii Department of Health, are among the most promising for the elucidation of specific environmental factors in the causation of these cancers.

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The Case for Conservation

Extinction. The Causes and Consequences of the Disappearance of Species. PAUL and ANNE EHRLICH. Random House, New York, 1981. xiv, 305 pp. $15.95.

In this volume Paul and Anne Ehrlich consider the soaring extinction rate and the implications for society of what could become the first major reduction in total world species number in human history. In their usual readable fashion, they have prepared a careful and well-

documented statement on the problem, replete with examples of direct and indirect endangerment and setting forth direct and indirect benefits of conservation. The book is thoughtful rather than polemic in its approach. Some may take offense at the listing in the preface of individuals and institutions contributing to the problem, yet the Ehrlichs also note that each one of us is in a sense contributing to the rise in extinctions.

The size of the biota (3×10^6 to 10×10^6 species) in one sense tends to obscure the problem. What difference can it make if there are one or two or even several fewer species? But the problem is far larger than that: loss of hundreds of thousands is imminent (in large degree owing to tropical deforestation). Unless there are major efforts to alter current trends, the biotas of Brazil's coastal forest and of Madagascar will constitute the first major waves of extinction.

This volume is particularly convincing about the consequences of species loss. The standard arguments are included, stated succinctly and dispassionately. Particularly impressive is the consideration of conflicts between development and the welfare of endangered species. At first glance, the argument for favoring the biota in such cases seems suspect and emotional. Surely it will sometimes be the sensible thing to let a species go when large social and economic benefits will accrue from doing so? The Ehrlichs explain that considered in isolation almost any conflict between endangered species and development is likely to be decided in favor of development, yielding yet one more increment to the extinction rate and the decline in the planet's capacity to support people: the global situation is the sum of all the local decisions.

While the Ehrlichs do not go so far, I believe an argument can even be made not to sacrifice the last individuals of a primate species even when through some legerdemain the sacrifice might save a single human life, on the basis of the potential of that species to save future human lives because of its general value to the biomedical enterprise. The choice becomes more difficult the greater the number of current human lives that hang in the balance, but the general argument advanced by the Ehrlichs still holds: the capacity of the earth to support society is a function of species diversity, and any attempt to integrate the welfare of future generations into our calculus will strengthen arguments in favor of protecting the biota.

The contribution that captive propagation can make to conservation is perhaps somewhat slighted as a result of the strong and proper emphasis on conservation of whole ecosystems. There are indeed difficulties and expense involved, as well as limitations to the capacity of current institutions. At the same time it is likely that because of the inadequate size of reserves some vertebrates, particularly large predators and island forms, may not be able to persist without an assist from captive propagation. They are sufficiently complex and intricate products of evolution, both in structure and behavior, to merit special attention, and it is dismaying to note that the passenger pigeon, which became extinct in 1914, had been bred successfully in Europe. The goal of captive propagation should indeed be reintroduction to the wild, but there will be times when, in Roger Payne's words, "there may not be a there" to which the organisms can be returned. In those instances some would argue in favor of writing off the species, but I would tend to agree with G. Evelyn Hutchinson that it would be marvelous had there been a 16th-century Gerald Durrell to propagate the solitaire of Rodrigues. The Ehrlichs raise the concern that removal of animals from the wild for captive propagation reduces the ability to protect that habitat. But so ultimately does allowing declining populations to go to extinction; strong efforts to protect habitat until reintroduction can take place seem a better alternative.

The above is a minor criticism, as is my wish that some attention had been paid to the inevitable contribution of dwindling and disappearing species to inflation. The Ehrlichs have done a masterly job of demonstrating that a conflict with nature can only result in a joint Pyrrhic victory (fewer species and a planet less able to support people).

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