SCIENCE

22 NOVEMBER 1991
VOLUME 254
NUMBER 5035

Cancer Research: Prevention and Therapy

Cancer is now one of the major causes of death in the United States, despite the fact that great advances are being made in its prevention and therapy. The reason is the precipitous decline in the heart disease mortality rate since 1950, as well as the harsh reality that we have not yet discovered the gene for immortality. Nevertheless, decreases in mortality and incidence of such cancers as Hodgkin's disease, cervical cancer, and stomach cancer are typical of dramatic improvements through life-style changes, diagnosis, and treatment. However, lung cancer, which was rare in 1900, is now the current leading cause of cancer-related death, largely due to the legacy of widespread smoking.

In this special issue on cancer, assembled under the excellent editorial supervision of Senior Editor Barbara Jasny, changes in incidence and mortality for various types of cancer, preventive measures that have already had appreciable effects, and the possibilities of intervention to reduce risk of hormone-related cancer are discussed by Henderson, Ross, and Pike. Their review points out that changes in life-style, such as better nutritional choices or avoidance of tobacco, alcohol, and ultraviolet light, can have major effects on our risks of developing some of the most common cancers.

Aaronson discusses the correlation of oncogenes with growth factors and components of their signaling pathways. Research has shown that many oncogenes are simply growth factors gone wrong—either overproduced or mutated so that they are active at inappropriate times. Applications of basic research are extensive; for example, inhibitors of tyrosine phosphorylation, the tyrphostins, have been devised to inhibit the overactivation that can lead to uncontrolled cell growth. Weinberg discusses the inverse of overactivated growth factors—tumor suppressor genes that may communicate growth inhibitory signals to cells. The recognition that loss or inactivation of a tumor suppressor is an integral event in the development of many diseases, such as colon cancer and neurofibromatosis, has increased our knowledge and led to new treatment possibilities. In some cancers there is a chromosomal rearrangement, and the molecular biology and genetics of the altered chromosomal material, as explained by Solomon, Borrow, and Goddard, can reveal important clues to the genes involved in cancer.

Virus infections are associated with 15% of cancers in the world. As described by zur Hausen, modification of host genes or production of viral oncoproteins is involved in the cancers caused by the papilloma virus, Epstein-Barr virus, and hepatitis B virus; immunosuppression because of HIV infection increases the risk of Kaposi sarcomas and B cell lymphomas. Adams and Cory review the exciting advances in transgenic mice, in which the introduction of tumorigenic genes makes possible the identification and elucidation of the pathways by which tissue-specific cancers arise. In addition, the production of mouse strains that are predisposed to develop cancers provides invaluable tools for testing the carcinogenic potential of chemicals or evaluating possible new therapies. Pastan and FitzGerald discuss the targeted missile approach to cancer therapy; the attachment of a toxin to a growth factor or an antibody generates a lethal fusion protein that is specifically directed to the tumor cells.

The reader of this summary of the state of the art cannot help but be impressed by the enormous contributions made by basic research in general and molecular biology in particular. Many of the dramatically improved techniques in prevention and therapy derive from the general knowledge in such areas as nutrition, genetics, radiation effects, cell biology, and protein structure. A great deal of this knowledge has been focused and applied through recombinant DNA approaches to transgenic animals, viral infections, and hybrid protein construction. There are no problems more complex than cancer and few that are as important. The dramatic decreases in mortality and incidence for some types of cancer are a wonderful testimony to the success of these basic research approaches, but the remaining high mortality rate indicates there is still a great need for more research and more application.—DANIEL E. KOSHLAND, JR.