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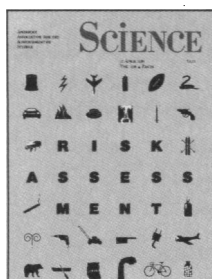
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COVER Risk implies uncertainty and is often presented as a probability, such as that of surviving or dying. In many cases, such numbers are not instinctively meaningful. The purpose of risk assessment is to help inform decisions about the hazards causing risks and whether they can be avoided, reduced, or managed. To gain perspective about the magnitude of different risks, it is often useful to compare risks that are calculated in similar ways. See page 267. [Cover illustration by Sharon H. Wolfgang, Washington, DC]

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Immortality and Risk Assessment

The time has come, it seems, when I can realistically refocus on the goal of achieving immortality. I do not refer to the old-fashioned sort of immortality earned by performing monumental works in science or art, winning historic battles, procreating children, or adhering to a simple faith in the Almighty. I am talking about living forever.

From recent reports on television and in newspapers, my impression is that we are dying like flies from exposures to toxic chemicals, nuclear power stations, drunken drivers, and incompetent physicians. If one simply avoids such hazards and has a little help from an artificial organ here and there, dying seems to be pointless. All that needs to be done is to reduce life to zero risk. To provide guidance for those who would like to be immortal, this issue of *Science* generously shares with our readers some risk assessment analyses by the experts.

In the article by Richard Wilson and E. A. C. Crouch, the comparative listing of various risks makes it evident that I will have to give up being a policeman with a 2×10^{-4} annual risk of death (AR), driving motor vehicles (2×10^{-4} AR), and being a "frequent flying" professor (5×10^{-5} AR). I was, to say the least, stunned to find that by switching from city water (6×10^{-7} AR) to what the Environmental Protection Agency considers contaminated well water in Silicon Valley, I could actually lower my risk by a factor of 300. It was also distinctly unnerving to discover that the potassium in my body, which contains a radioactive isotope, gave me 1500 times the radiation level of that from the atmosphere within 20 miles of a nuclear plant, and 6 times that from a transcontinental air trip. Should we, I wondered, abandon Superfund and find a substitute for potassium in the body? Lester Lave informs us that hazards around the house are half as likely to cause injuries as motor vehicle accidents and that asbestos poses a small risk in most appropriately constructed buildings. Astonishingly, corn contains aflatoxin at appreciable levels as does peanut butter and, for me, giving up those two delicacies is not going to be an easy trade-off for mere immortality. Bruce Ames' article is a further shocker, ranking chemicals in terms of potency rather than simply labeling them as carcinogenic and noncarcinogenic. And, lo and behold, food ranks as a major hazard. Apparently plants learned through evolutionary time that chemical warfare is an extremely effective way to fight off fungi, insects, and animal predators. Unfortunately, these species have the same type of genetic code as I do, so that whenever I eat, I am consuming mutagens and carcinogens rated everywhere as hazardous to my health.

Clearly, to get to zero risk I must give up walking up and down stairs, drinking alcohol, living in Denver or other high-altitude locations, and innumerable other temptations. I am willing to sit in a rocking chair with a lead roof over my head and be fed amino acids intravenously in order to live forever.

Still, Paul Slovic points out that a scientist does not necessarily see risk the same way that the public does. The public regards deaths caused by mysterious technology or the simultaneous deaths of a large number of people (in airplane crashes, for example) as being far worse than those from well-known causes or the same number of deaths occurring in multiple locations (as in automobile accidents). Therefore, as I sit in my rocking chair, I become uneasy that the Nuclear Regulatory Commission, as described by David Okrent, may not really be doing its job, and that the regulatory agencies described by Milton Russell and Michael Gruber are making decisions based on politics rather than quantitative scientific appraisal. The government, I note, seems determined to remove the beautiful red color from maraschino cherries while supporting subsidies to tobacco growers and allowing cigarette advertisements, although cigarette smoking may cause as many as 350,000 premature deaths a year in the United States alone. Excessive worry about the competence of others can cause peptic ulcers and lead to my death from "natural causes."

Thus, although my commitment to the goal of immortality is unswerving, I am not positive that a zero risk society is yet in the scientific cards. This thought may force me to seek immortality in the arduous old-fashioned way, doing good deeds and taking care of my children.—DANIEL E. KOSHLAND, JR.