muscle. Deaths from cardiac or circulatory complications are unknown among the Tarahumara (*4*).

I agree with Young. It is the marathoner's life-style that protects him. The race only quantitates the benefits. Rehabilitation centers in Honolulu and Toronto have a formal distance-running program for those cardiac patients who wish to adopt this life-style. The marathon run becomes the natural "graduation ceremony" (*5*). The Hawaii Heart Association presented trophies to five such patients at their recent Honolulu Marathon (16 December 1973). These patients had trained for the marathon after recovering from one or more myocardial infarctions (*6*).

The American Medical Joggers Association was one of the cosponsors of the Honolulu Marathon. Only time will tell whether these marathoning heart patients will share the coronary protection of the Olympic athletes.

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Rainfall in the Amazon Basin

Portig (Letters, 26 Jan. 1968, p. 376) and Feininger (Letters, 5 April 1968, p. 13) presented evidence that average annual rainfall in certain tropical Latin American countries was decreasing dramatically and that this decrease (as much as 24 percent from 1942 to 1967 in Colombia) was correlated with widespread felling of the Amazon basin forest. New data obtained in Ecuador in July 1973 suggest a disturbing major change in the overall picture of climatic changes in the western Amazon basin of South America.

On 10 July and 13 July 1973, during flights between Quito and Limoncocha (a missionary outpost in the Amazonian rain forest on the Río Napo in eastern Ecuador), a strong and widespread haze of smoke particles was observed

over the Amazon basin at an altitude of about 2000 feet. According to pilots and residents subsequently interviewed in this area, the haze has become a daily weather feature over the past 2 years, coinciding with the discovery of major oil fields in northeastern Ecuador and the burning-off of the new wells. Columns of smoke from burning wells were observed and photographed across the entire horizon on these flights. Rainfall records kept at Limoncocha indicate that the average annual rainfall has increased from about 100 inches (1961 to 1970) to 140 inches today. It seems likely that particulate matter in the haze is serving as nuclei for condensation and thus leading to greater levels of precipitation, as occurred in the area of La Porte, Indiana, which is east of Chicago and Gary (*1*).

This ecological change, whether it is caused by air pollutants released by the burning oil wells or by unknown long-term cyclical factors, should be carefully studied by scientists working in the western Amazon basin in future months. The consequences of widespread rainfall changes in the tropics are of obvious economic, agricultural, and ecological importance to the developing countries.

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Radiation Effects

Harald Trefall (Letters, 23 Nov. 1973, p. 776) raises questions about the effects of radiation as represented in Gillette's review (News and Comment, 1 Dec. 1972, p. 966) of the BEIR (Biological Effects of Ionizing Radiations) report (*1*). A careful reading of the report would answer most of Trefall's questions, particularly his semantic difficulties with the expression "extra deaths," which incidentally was not used in the report (illogically or otherwise). However, there is an urgent need for the public to understand about the biological costs of the side effects of technology (including radiation), particularly about the comparative risks of available options, so that logical decisions about new or expanding technologies can be made and accepted.

Trefall oversimplifies in stating that agents can "cause *premature* deaths, no more and no less" and in proposing that effects of radiation exposure be expressed in terms of average reduced life-span. The ethical ideal that every being has a right to be born without man-induced defects and to die from old age (the natural wearing out of the body) is fully recognized. However, it is obvious that all early deaths do not have the same societal and personal impact. For example, the death of an embryo before anyone even knows about it or the death of an elderly person a few years before he or she would otherwise die of old age would not penalize the individual, the persons left behind, or society, as would the death of a young adult with family responsibilities on the brink of a productive career. In addition, genetic effects can produce a variety of suffering and health costs over a lifetime which, while they do not necessarily cause early deaths, do constitute a biological cost. At present, it is not possible in the formulation of radiation risk values to estimate the number of person-years lost because of the agent and somehow to weight them so that societal and personal considerations are taken into account. With more data and competence we hope to move in this direction.

In the meantime, the genetic risk estimates in the BEIR report refer to the production per year by additional radiation of cases of serious, dominant, or X-linked diseases and defects plus congenital abnormalities and constitutional diseases that are partly genetic. The somatic risk estimates refer to annual excess mortality from cancer that could be produced by the additional radiation. It may be that such numbers, used by themselves out of context, do sound "horrible" and tend to overemphasize the risk; on the other hand, the calculations of average life-span reduction proposed by Trefall do not seem to convey an easily understood sense of reality, especially in terms of the possible effects on individuals.

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