cigar is a Smoke" ("The Betrothed").

When cigarettes were first introduced they were regarded as very effeminate —in fact "fag" is an early slang term for cigarette. Real he-men preferred the weed in more rugged form. Thus cigarette manufacturers have felt an urgent need to create and maintain an image of virility.

Perhaps the Surgeon General would get better results from his campaign against smoking if he were to emphasize the anaphrodisiac, rather than the carcinogenic, effects of the habit!

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1. R. Magnus, "Nicotiana, Nicotin," *Real Encyclopädie der Gesamten Heilkunde*, vol. 10, ed. 4 (1911), p. 651.

Project Hindsight

The commentaries on Project Hindsight (18 Nov. 1966, p. 872; 2 Dec. 1966, p. 1123; 23 June, p. 1571) are a valuable contribution to the discussion of "directed" and "undirected" research. In the advocacy of basic versus applied research, or science versus invention and engineering, the proponents of any one segment of the continuum of research, development, testing, and engineering are in competition for funds, and usually are also expressing managerial preferences. What is so disheartening in this continuing controversy is the popular assumption that the end product of *all* scientific and productive efforts are measurable in terms of an "end item—a piece of equipment, a process, or an operational procedure" (*1*). The profitability of transportation systems can be compared very effectively by using numbers, mileage, tonnage, and dollars. However, no matter how effectively funds are spent for prevention of pollution, or a more healthy environment, it is not possible to present comparable figures. The benefits from prevention of sickness, the prevention of wars, the cost of "undirected" science can be measured, but not in terms of technology—medicines, military hardware, or scientific instrumentation. Quite the contrary, the less medicine, military and scientific hardware or money you have to use, the more effective the campaign.

It is self-evident that the systems studied in Project Hindsight, Polaris, Minuteman, Lance TBM, radar, navigation aids, nuclear warheads, and so on resulted or benefited greatly from the advances of "undirected" science. Credits simply have not been given to preceding concepts and ideas. In a subsequent report, one may anticipate that the military applications of masers and lasers will be attributed to teams of weapon systems engineers, although these truly revolutionary tools, offering order of magnitude differences in ways of doing things, received generous and "undirected" Department of Defense support.

Sherwin and Isenson find that "Despite the very applied nature of the work leading to the innovations, 5 or 10 years often elapsed before an Event was used" (*1*, p. 1575). They apparently had the layman's misconception that research ideas are quickly transformed into consumer goods or weapon systems. Historically, it often takes many years to make new things practical: witness the airplane or Goddard's rockets . . . .

There are two very good reasons to include fundamental research in mission-oriented programs. The first is that such research attracts many outstanding scientists and young investigators to important problem areas. Second, for practical agencies to be receptive to new concepts, approaches and solutions to problems and thereby speed innovation, there have to be people within the agencies who are aware and eager to translate and introduce new ways of doing things to the technologist who may argue against risk and that present solutions are good enough. There is the real question of how one measures the productivity of "undirected" research programs aside from the publication of new knowledge. Perhaps productivity can also be judged by the rate at which technological innovations are incorporated into practice with resulting social improvement. From this standpoint, the shorter time period now between the attainment of new knowledge and its use in many fields, including new systems for which no conceivable requirement existed even 10 years ago (that "scientific toy" satellite), indicates that emphasis on basic research has been healthy.

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1. C. W. Sherwin and R. S. Isenson, *Science* **156**, 1571 (1967).