government are "aid to education." The funds appropriated by Congress are based on the expectation that the country, whose taxpayers are footing the bill, will derive benefits from the research commensurate with its cost. There is a true *quid pro quo*.

Like any organization, universities must recover the costs of the things they do. Student tuitions should certainly not be raised to help pay for government-sponsored research. Endowment income, which is becoming a smaller and smaller fraction of every institution's total income, generally is restricted by the donor of the principal so that it is available only for certain other purposes, such as teaching salaries, instructional materials and supplies, and student assistance. Alumni, private foundations, and industry, the other primary sources of income for private institutions, cannot be persuaded to give money for the purpose of sharing the costs of research undertaken through government grants and contracts. As Warren Weaver very well put it [*Science* **132**, 1521 (1960)], it is absurd to insist that these costs "should be provided by 'the institution itself' out of its 'own funds,' as though colleges and universities kept printing presses in the basement."

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Experimental Cancer-Cell Implants in Patients

Your account entitled "Human experimentation: Cancer studies at Sloan-Kettering . . ." (7 Feb., p. 551) leaves the impression that certain facts have been deliberately concealed at the Jewish Chronic Disease Hospital (which cooperated on one stage of the research). Permit me to provide you with more complete information about "what happened in Brooklyn" so that you and your readers may appreciate more fully the true nature of the problem.

At the outset, I may remind you of a very important biologic fact which is not mentioned in your article, namely, that the implanted "cancer cells" represented homologous tissue, and that such tissue is regularly rejected by the recipient unless he is of the same genetic makeup as the donor (for example, an identical twin) or has been exposed to x-radiation or certain drugs that impair the immune mechanism. In view of the tremendous difficulty of transplanting organs from one human being to another, you will agree that the Southam test is about as safe as any of the routine clinical procedures of comparable nature, for example, the Menthoux test for tuberculin sensitivity or vaccination for smallpox or for typhoid fever. Indeed, the test compares favorably in potential hazard with some commonly used diagnostic procedures known to be associated with occasional serious and even fatal reactions, such as the measurement of circulation time by intravenous injection of decholin, saccharin, or ether, the BSP test for liver function, or the intravenous pyelogram. There was no practical possibility of untoward results to the patients who received injections of homotransplants consisting of tissue-cultured cancer cells derived from other patients. In addition, it should be pointed out that the three lines of cells which were used in the study at our hospital were derived from human tumor tissue 4 to 12 years ago. After such periods of growth in the laboratory, these cell cultures represent standardized biological agents having a high degree of uniformity and predictable reactions.

The injections were given by our senior resident under Southam's supervision after Southam had demonstrated the technique on three patients. Both he and his research fellow witnessed each patient's interview by the resident and found the consent satisfactory.

In accordance with standard procedure adopted earlier by the Sloan-Kettering group, the word "cancer" was not used in the explanations given to the patient. This procedure, approved by top-level executives of Sloan-Kettering Institute and Memorial Hospital, appeared justified because of the potentially deleterious effect which the dreaded word "cancer" may have upon the patient's well-being, as it may suggest to him (rightly or wrongly) that his diagnosis is cancer; and because it was irrelevant in regard to both the principle of the test and the patient's welfare. Many other scientists have endorsed this point of view. Thus, George E. Moore, Director of the Roswell Park Memorial Institute in Buffalo, was reported as fully supporting "the action taken by Dr. Southam in not using the word 'cancer' . . ." (New York *Times*, 22 Mar. 1964, p. 53). Indeed, this action was taken in compliance with conventional procedure in clinical practice. The facts that smallpox or poliomyelitis vaccines contain "live virus," that exposure to radioactive substances may increase the risk of contracting leukemia, or that the injection of certain iodinated compounds (used in renography), of bromsulphalein, or of penicillin may, on occasion, result in severe illness or even fatality, are usually not imparted to patients before they are subjected to any of these procedures.

What happened in Brooklyn was simply an extension of the Sloan-Kettering research, conducted by Southam with the same techniques used at Memorial Hospital. The medical staff of the Jewish Chronic Disease Hospital unanimously endorsed continuation of the study.

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All Mandel's comparisons are with established clinical procedures such as vaccinations or routine treatments such as penicillin. True, these procedures also carry risks. But they are designed to help the patient. What went on at Sloan-Kettering and at the Jewish Chronic Disease Hospital was not treatment of patients but experimentation on them. It seems to me that this distinction ought to be maintained, and that researchers ought to bear it in mind both when they consider the possibility, practical or theoretical, of "untoward results," and when they are judging whether a patient's consent is or is not "satisfactory."

—ELINOR LANGER

Science as News

The difficulties of covering AAAS conventions enumerated by Raymond A. Bruner (21 Feb., p. 763) may be symptomatic of a trend science is taking—it is becoming more integrated itself and also more integrated with life-in-general. Synthesis and unity may be the dominant underlying movement of this age. One aspect is brought out in a statement, attributed to Defense Secretary McNamara, I think, about the necessity of making facts manageable. In this process, many "shining nuggets of achievement," to use Bruner's phrase, may be lost or momentarily held in suspension, or even, as Bruner seems to imply, discouraged. . . .

It may be that more manpower, planning, and publication outlets are

needed to cover a science convention than are now available or readily foreseeable. . . . The Information Explosion might be controlled somewhat by having a few official publications and many informal ones. . . . In framing a report, a scientist might ask himself the two questions that a city editor often asks a reporter: (i) What does this mean? and (ii) Why is it important? . . . The answers might enable one to weave together the import of many disparate papers, sometimes a help in answering the question "Where is science taking us?"

SAM LAMBERT
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Priority Questioned

We believe that Henry A. Bent has himself contributed to the mythology of the noble-gas compounds in his book review, "Birth and death of a myth" (27 Mar., p. 1425). The record is clear. The "noble myth" of the nonreactivity of the inert gases was not laid to rest by the well-advertised XeF_4 crystals, but by the salt $XePtF_6$, astutely prepared by Neil Bartlett, University of British Columbia [*Proc. Chem. Soc.* **1962**, 218 (1962)].

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Insect Control by Nontoxic Means

Insects which depend on chemical "recognition signals" for mating, feeding, or oviposition, can be controlled (at least in principle) without the use of poisons if the environment can be so permeated with a sex-attractant chemical, for example, that the small additional quantity emanating from a female is imperceptible (*1*).

Quantitatively, the process is at once technically possible and economically attractive, thanks to the very high biological potency of the sex-attractant chemicals (*2*). For example, if the threshold concentration is taken as 10^8 molecules of scent per cubic centimeter (1 molecule per cubic millimeter), and if it is assumed that a concentration a hundred times higher than this will completely saturate or fatigue the receptor organs of the male, then the concentration required is 10^8 molecules per cubic centimeter. This corresponds to 1 gram molecule dispersed in 6×10^{15} cubic centimeters, or 6 cubic kilometers of air. If we assume a wind of 5 kilometers per hour blowing steadily for 10 days across a line 1 kilometer long, and if this air stream is permeated at the postulated concentration to a depth of 50 meters, the total volume of air to be treated is 600 cubic kilometers, and the quantity of chemical required is 100 gram moles. With a molecular weight of 200, this is only 20 kilograms of chemical, and if the effect is felt for 1 kilometer downwind from the release line, the total application for the entire 100-day period is 200 grams per 1000 square meters. This is interesting both technically and economically.

The practical problems in maintaining such a condition need not be insuperable, more especially if the air does not have to be permeated 100 percent of the time—and the indications are that it would not (*3*).

In contrast with control by toxic chemicals, the process offers the prospect of complete extermination of a pest species, for two reasons: (i) insect strains "resistant" to a sex attractant are not likely to arise; and, (ii) the lower the population density the more does successful mating depend on sex-attractant scents, and the more devastating will be the effect of any interference with them.

The normal biological role of these recognition chemicals requires that they be species-specific. Moreover, they are not usually toxic, and in any event their effect can usually be duplicated if necessary by a chemically unrelated material (*4*). Therefore, it should be possible to find completely harmless chemicals to use in this way against any particular insect pest.

Notwithstanding these manifest advantages, the chemical industry is apparently reluctant to develop this technique partly (perhaps wholly) because the cost of developing a pest-control chemical and passing it through all the tests needed to satisfy the various public health authorities is between $1 and $2 million. If one wide-spectrum chemical can be cleared in this way and then used against a wide range of pests, the development cost can be recovered; but if each species is to be controlled by a different chemical, and if each chemical must be checked out at a cost of $1 million, then the development costs cannot be so recovered.

Thus it appears that regulations designed to protect the public against the indiscriminate use of toxic chemicals are quite unintentionally having the effect of inhibiting research that would be expected to replace many wide-spectrum toxicants with species-specific and nonpoisonous control agents.

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Noise, Annoyance, and Progress

The letter by H. A. Denzel ("Noise and health," 6 Mar., p. 992) reflects a prevailing misconception of human behavior. This misconception sees any kind of sensory stimulation which is other than pleasing and comforting as somehow deleterious to human health and welfare. Such stimuli would include not only noise but also cold, heat, pain, and so forth. The letter points to the low ambient noise level of a stone-age culture and a mental hospital as representative of a desirable state of affairs. The letter does not suggest the possibility that the very primitiveness of these two environments might be a price that would have to be paid for this sensory deprivation. It would be more valid to raise the issue that annoying stimuli have a constructive rather than a destructive effect on human behavior, being related to the very progress which is characteristic of civilized technology in an etiological way.

In a broader context, there tends to be an erroneous conception prevailing which equates discomfort with ill health. It would, however, be extraordinarily naive to assume that, because ill health sometimes produces discomfort, discomfort produces ill health. Sleep is often used, again erroneously, as an index of health or other desirable states of being. Actually, sleep is more profitably viewed as a consequence of boredom, and not necessarily the most desirable way to react to boredom.

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