Letters

Tumor Development

With reference to the report by H. K. Mitchell which appeared in *Science* [**133**, 876 (1961)], we should like to make the following comment.

That our preliminary investigations of tumor-inducing factor (TIF) have proved successful is shown by the fact that they have stimulated further related investigations in the field of mammalian carcinogenesis. These initially crude methods have led to the development of different bioassay techniques and refined purification procedures which are now being successfully applied to a broad study of tumor development in our laboratories as well as elsewhere. In addition, it has led to the study of tumor breakdown in mammalian hosts.

It would serve no useful purpose to engage in a vituperative exchange over techniques that have already served to stimulate a new approach to the cancer problem. We regret that Mitchell did not choose a more pleasant method of approaching the problem, but we will comply with his request and make no further reference to his participation in the early, historical aspects of this research.

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Satellite Communication

I think that it is unfortunate that the primary issues of satellite communication were so lost and beclouded in the news note "Space communications" [*Science* **133**, 1812 (1961)].

In principle, communication satellites could afford valuable international communication, first by linking the highly developed but inadequately interconnected common-carrier communication networks of Europe and North America, and later by improving communication with other parts of the world. Such a peaceful use of space would certainly be to our credit, and the more so the sooner it was attained.

I have noted in "Hazards of satellite communication" [*Bull. Atomic Scientists* (May 1961)] that this will not be easy technically, and that nontechnical obstacles could delay it indefinitely.

Thus, I think it is very misleading to say, with John Finney, that the direct issue is, "who shall sow and who shall reap the first big financial dividends of the space age." Much more direct issues are: Can satellite communication useful to the people of the world be brought into being quickly, and if so, how can this be done? When these questions are answered, we may then, if we wish, seek to meet reasonable standards of regulation and ownership. But, to give primarily political questions precedence over the realities of technology and the realities of international communication could delay satellite communication indefinitely.

One reality of international communication is that you can pick up your telephone and call a person in any one of over 160 different political areas in all parts of the world. Through the International Telecommunications Union, which is almost a hundred years old and which is now a part of the United Nations, and through its organs, international agreements on the use of frequencies and on standards and operating procedures have been worked out. Agreements for communication and agreements involving the shared ownership of international cables have been brought into effect. In the face of this existing international situation, it seems chauvinistic and arrogant to the point of madness to suggest that the United States Government or any purely American company or group of companies *could*, by itself, own an international satellite communication system.

The research and development necessary to make a satellite communication system possible is an entirely different matter. We cannot afford to have this wait on the formation of a new company. NASA's Project Relay is a natural step. So is the Bell Laboratories' work, which A.T.&T. is financing. Why should obstacles be put in the way of any research and development at this time?

Like ships, boosters are now among us, a resource of man. Must only the government take advantage of this resource? The electronic and communication arts, which provided the transistor and the solar cell, are largely the products of work done by private enterprise without government support. Should the government be forbidden to use transistors and solar cells in space? Who is giving away what, and to whom?

The question, "Does private industry have the capital, and so on" is completely unrealistic. A proper question is, Do the common-carrier communication systems of the world have the capital? (Most of these aren't private-enterprise systems.) The answer is yes. This is demonstrated by the continued growth in international submarine telephone cables, an art comparable to satellite communication in difficulty and cost.

Must the very first satellite communication system connect us with all the underdeveloped countries, where internal communication itself is poor? How long should we wait to make sure that these will be included? Until the Russians have satellite communication first?

The chorus of "You shan't have satellite communication unless" is already too loud. I hate to see *Science* embroiled in this windy, empty, but terribly dangerous debate.

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Communication Channels

I would like to comment briefly on certain statements made by H. H. Goldstine in the article on information theory which appeared in a recent issue of *Science* [**133**, 1395 (1961)].

After discussing the concept of channel capacity for discrete noiseless channels, defined by Shannon in his classical paper [C. E. Shannon, *Bell System Tech. J.* **27**, 379, 623 (1948)], as the limit, as $T \to \infty$, of $[\log_2 N(T)]/T$, where $N(T)$ is the number of distinct messages of duration T, Goldstine proceeds to discuss the noisy communication channel and makes the curious statement that the coding theorem for such channels, ". . .