Letters

Science Planks and Party Platforms

The time is once again approaching when the political parties choose their candidates and construct their platforms. Adlai Stevenson called it "the liberal hour"—a time when new ideas may find oasis in previously sterile political sand. The revolutionary changes of the past two decades and those in prospect make it mandatory that the political parties open up avenues of communication to the scientific community. Good stout planks need to be hammered into the platforms of both parties.

A group of illustrious scientists took the initiative in the field of scientist-to-politician communication in 1959–60 when the Democratic Advisory Council was served by a Committee on Science and Technology. During these years a score of scientists mingled with top-ranking Democrats and prepared a series of policy recommendations on science and technology. It was in this interaction of science and politics that the concept of a National Peace Agency was formed. As senator, John F. Kennedy introduced this concept as a legislative proposal, and as president, he saw it converted into the U.S. Arms Control and Disarmament Administration. Clearly, this single example illustrates the value of informed discourse in the area of science and politics.

The Democratic Advisory Council is not now in existence, having fulfilled its objective with the election of a liberal Democratic president in 1960. It ceased operations after President Kennedy's election.

The Republicans have created a Gettysburg Council which corresponds to the original Democratic Advisory Council in function, if not in structure, but to date there has been no announcement of a significant scientific component. (I have not heard of any Scientists-for-Goldwater or-for-any-other-Republican group being organized.) It is safe to say that the party out of power could profit from the advice of qualified scientists, and it can be argued that the party in power could also use advice free from the bias of officeholders. Issues having a basic technological content are likely to enter into the political arena this year. The fact that the Republicans composed a critical report on space activities last spring indicates that the moon race might become a political dogfight this summer and fall.

Research and development is now a $16 billion-per-annum budget item for the United States, and the future funding of science and technology should be a matter of concern to every scientist and to every citizen. Apart from national security considerations, the nation depends upon modern science and technology for the efficient use of natural resources, the production of energy, and improvements in transportation and communication. The health and well-being of our citizens is keyed to the scientific revolution. But the cornucopia of modern science also spills forth upon society an abundance that requires control. The problems of pollution, contamination, untoward effects, and excess productivity are largely unsolved in political terms.

Given the power of science and its impact upon society, it seems appropriate to suggest that some organization poll the scientific "community," determine its views on current issues, such as Project Apollo, high-energy physics funding, and R&D emphasis in the various fields, and report on these to the platform committees of both parties. The AAAS is in a strategic position to circularize its membership and conduct a referendum on scientific and technical matters of interest to the Congress and to the public.

Presumably few scientists will rub elbows with the politicians when the Republicans convene at San Francisco in July and the Democrats gather at Atlantic City a month later; all the more reason for the scientific community to make its inputs to the conventions by way of a nonpartisan statement of the issues which science and technology present to our democracy.

RALPH E. LAPP
1315 Park Terrace Drive,
Alexandria 7, Virginia

Jargon of Genetics

I find myself in possession of exceptionally useful jargon but lack concepts to hangthemon. Perhaps someone can help with conceptions like cistron, recon, muton, operon, replicon, polaron, codon, hypotheson, complon, and the like. I particularly would like to find uses for: genon, polyon, chiasmatron, copyon, crossingoveron, and on. I can suggest:

Offnon: a factron in phase variation.

Factron: a unit of mutation, recombination, and function, to replace an obsolete word which does not end in -on. Perhaps unitron or even trion would be better.

Morgon: an old-time geneticist, I think.

Pion: factron at the end of a circular chromoson (unpublished).

Chromoson: home of all the -ons, including on itself.

Oneron: simultaneous publication or function of two morons.

Moron: the smallest unit of new information.

And, for a unit of frustration (*1*):

FULTON
44 Riverside Drive,
Waltham 54, Massachusetts

Note

1. *Publication No. 1 of the Cistrionics Institute,* which recommends conservative replication of cistron and operon, and dispersive replication of the reston. A portion of this work was not supported.

Chemical Inhibition of Viruses

Tamm and Eggers have recently summarized work on various chemical substances which specifically inhibit the replication of certain animal viruses [*Science* **142**, 24 (1963)]. Work from my laboratory [*Science* **141**, 1065 (1963)] has dealt with a specific inhibitory effect of streptomycin on certain bacterial viruses. Tamm and Eggers suggested that their antiviral agents acted on the nucleic acid of the virus, and we intimated the same possibility. I would now like to suggest an alternative hypothesis that seems to me more agreeable to the biological and chemical facts, namely that these antiviral agents work by combining with a virus-specific protein.

An important aspect of both reports was that among a group of related viruses attacking a single host, certain viruses were sensitive whereas others were completely resistant to the drugs

in each case. If we assume that the drugs act on the nucleic acid of the virus, then we must assume that these low-molecular-weight substances are able to detect differences in the base sequence or the secondary structure of nucleic acids, since the fundamental chemical nature of the nucleic acids of both drug-resistant and drug-sensitive viruses is similar. But it is hard to envision in chemical terms how a molecule as small as guanidine (one of Tamm and Eggers's compounds) might recognize differences in nucleic acid base sequence. The development of drug-resistant mutants is also difficult to explain.

As is well known from enzyme chemistry, small molecules readily interact in particular ways with proteins, and it would be simple to visualize ways in which a drug could acquire its specific effects by interaction with a virus-specific protein. In our work, we have shown that streptomycin inhibits nucleic acid injection, and it might be postulated that one end of the antibiotic molecule combines with the nucleic acid, and the other end with a specific site on the protein coat, thus effectively sealing the nucleic acid within the head. Tamm and Eggers cited an alternative hypothesis in their system that suggested that guanidine might inhibit the formation of an active RNA polymerase through effects on a precursor protein.

The importance of these speculations for approaches to virus chemotherapy is that they may direct thinking along new lines. To date most antiviral chemotherapeutic work has concerned itself with the virus nucleic acid. Yet each virus is endowed with a protein or group of proteins, and it is easy to conceive of the existence of drugs which will interact specifically with these proteins. In this light, successful chemotherapy of many virus diseases seems a distinct possibility.

THOMAS D. BROCK
Department of Bacteriology, Indiana University, Bloomington

The recent demonstration by T. D. Brock and S. O. Wooley [*Science* **141**, 1065 (1963)] of specific inhibition of certain bacterial viruses by streptomycin has brought into focus in another system the question of binding of small-molecular virus inhibitors to nucleic acid or protein.

The primary sites of action of 2-(α-hydroxybenzyl)-benzimidazole (HBB) and guanidine, compounds which specifically inhibit the replication of picornaviruses, are not known. Last year, in discussing the probable mechanism of action of HBB, we proposed two alternative hypotheses, namely that this compound may combine with viral RNA or may inhibit directly a virus-specific RNA polymerase [I. Tamm and H. J. Eggers, *Cold Spring Harbor Symp. Quant. Biol.* **27**, 196 (1962); H. J. Eggers and I. Tamm, *Virology* **18**, 426 (1962)]. At about the same time, A. Lwoff proposed that both HBB and guanidine may combine with a hypothetical precursor of the virus-specific RNA polymerase [*Cold Spring Harbor Symp. Quant. Biol.* **27**, 159 (1962)]. To summarize our views again, we think that a virus-specific inhibitor of virus-controlled macromolecular synthesis may combine with viral nucleic acid itself, a virus-specific enzyme, or some other virus-specific component which plays an essential role in the process of virus reproduction [*Science* **142**, 24 (1963)]. Brock has expressed similar views. In his letter, however, he emphasizes the possibility of binding of inhibitors to virus-specific proteins, whereas in our recent review we emphasized the possibility of binding to virus nucleic acid. The experimental elucidation of the primary sites of action of HBB and guanidine should provide information of considerable interest.

IGOR TAMM
HANS J. EGGERS
The Rockefeller Institute, New York 21

Serendipity—the Last Word

Most of the letters from readers sparked by your editorial "Serendipity in research" [*Science* **140**, 1177 (14 June 1963)] center about S. Stewart West's letter [*ibid.* **141** (6 Sept. 1963)] rather than your editorial. H. J. Adler's letter, in the same issue as West's, is the only one that is addressed to and takes issue with your editorial. My compliments to Adler, who expressed the essence of serendipity as Walpole defined it.

I fear that your otherwise excellent editorial was based on the dictionary definition, which differs from Walpole's and therefore led you to some erroneous conclusions. The same error may be assigned to the late Walter B. Cannon, whose celebrated chapter and conclusions on serendipity contained in his autobiography, *The Way of an Investigator*, reflect this error. Therefore his adherence to Pasteur's postulate: "Chance favors the prepared mind." I have no quarrel with Pasteur or with you, but the postulate may be encompassed in serendipity or it may not.

Compare the definition you quoted —"a gift for finding valuable or agreeable things not sought"—with Walpole's "making discoveries, by accidents and sagacity, of things which they [the princes of Serendip] were not in quest of." In the same letter he amplified his meaning by referring to "*accidental sagacity*" (his underscoring). Walpole's definition applies equally to the trained scientist and to the uneducated oddball, provided each has that mysterious quality which Adler calls "a flash of insight." It is unfortunate that the pristine character of Walpole's definition has been lost. The word is now used to cover the sort of thing that you imply is covered by "a series of happy incidents."

West feels the need for an English translation from the German of *The Three Princes of Serendip*. He believes "that the literary background of science would benefit" by such a translation. Your correspondent Bard [*ibid.* **142**, 421 (8 Nov. 1963)] agrees. Another correspondent, Zeisberg (*ibid.*), advises that there is an English translation which was from a French translation from the Persian, and that the original was, he thinks, written sometime in the 1400's. Actually, the English translation (Chetwood) was from de Mailly's (Amsterdam, 1721). Walpole read the French translation as a child. The original from which de Mailly translated was not Persian, but Italian (*Peregrinaggio di tre giovani figliuoli del Re di Serendippo* (Venice, 1557).

As a matter of fact, there never has been a direct English translation of the Italian original. This points up the lack of information generally about Walpole's contribution of "serendipity," the identity of the original *Three Princes of Serendip*, its translations, and so on. To supply these data, my forthcoming book, *Serendipity and the Three Princes*, will be published next spring by the University of Oklahoma Press. The book will contain a free-flowing translation just completed by an Italian scholar.

The scientist in general, and the physician in particular, have been fascinated by the phenomenon of serendipity, as well they may be. However, it