

## Letters

### The Image of Mathematics

There may be a "mathematics image problem" as reported by Gina Kolata (News & Comment, 30 May, p. 1087). However, the events that she reports on, sponsored by the Board on Mathematical Sciences at the National Research Council (NRC), were aimed at alleviating this problem. Indeed, a concerted effort is also being made by professional organizations to make the public aware of the critical role of mathematics and mathematics education. One recent event, a presidentially proclaimed Mathematics Awareness Week, has brought new excitement into the long-standing efforts of emphasizing the relevance of mathematics in society.

"Mathematics: The Unifying Thread in Science," the symposium at the National Academy of Sciences on which Kolata reports, was held during National Science Week to highlight significant mathematical aspects of some important areas of science, that is, medicine, crystallography, and physics. The conference was not intended by the organizers to be primarily a news event. Its main purpose was to present to the scientific community, including policy-makers and journalists, examples of how mathematics plays a key role in important scientific work. The fact that Herbert Hauptman accomplished, using mathematics, a major breakthrough in an area that had been thought by most crystallographers to be intractable is well known and not news; that, using a classical mathematical technique, Allan Cormack was led to the CAT (computerized axial tomography) scan, is well known and not current news. However, each of these talks by Nobel laureates were gems providing the listener with exciting background information directly from the individuals who used deep mathematics in an essential and creative way to make insightful discoveries important to us all.

In reporting on the symposium, Kolata gives considerable emphasis to a minor point made by Steven Weinberg during an open discussion period that followed the talks. She expands this "image issue" to question the accessibility of a recent NRC report, *Mathematics: A Unifying and Dynamic Resource* (1). Kolata quotes from one of six vignettes in the report used to illustrate four major trends this panel identified in modern mathematics. The report, prepared at the request of the director of the

National Science Foundation, was meant for scientifically knowledgeable readership, not lay readership as reported by Kolata. The symposium, where the report was distributed, in fact, demonstrated that mathematics is becoming an integral part of much of science and engineering. This, in part, is due to the increased high level of mathematical knowledge shared by all scientists and engineers.

During the discussion period at the symposium, it was remarked that explaining much of mathematics to a general audience is very difficult. Mathematics is invariably the language of much of science and engineering, yet major themes in these areas can usually be described without using this technical language. On the other hand, major and critical aspects of mathematics often involve the essence of this technical language and, hence, are difficult to explain except to a mathematically literate audience.

Through efforts such as those reported in the article, the mathematical community is continuing to make a serious effort to convey ongoing and vital mathematical discoveries and trends to the broad scientific community. Kolata's numerous scientific articles in *Science* are also an important element in succeeding in this endeavor. Through these and related attempts, there will be a heightened level of mathematical awareness.

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#### REFERENCES

1. Board on Mathematical Sciences, National Research Council, *Mathematics: A Unifying and Dynamic Resource* (National Academy Press, Washington, DC, 1986; available upon request from the Board on Mathematical Sciences).

*Response:* Although the conference may not have been intended to be primarily a news event, there is no doubt that, by having a public relations firm contact Washington journalists, the mathematicians invited press coverage.

As for the intended audience for the NRC report, the report's preface states, "Those responsible for guiding science policy in the Congress and the Administration are the primary audience for this report. The report will be useful to other audiences too: leaders of universities, the mathematical sciences research community, and also those who are inquisitive about the mathematical sciences, about its structure and its current directions."—GINA KOLATA

### Sequencing the Human Genome

What makes Renato Dulbecco's bold vision (Perspective, 7 Mar., p. 1055) of having the total human genome sequenced so attractive is not only the expected enormous direct and fringe benefits but the fact that it is much less forbidding a task than it might appear to be on first sight. There are no new technologies required, and the procedures—some of which have already been automated—are largely routine and could be carried out by a well-trained technical staff. A task force of scientists would have to be set up to work out the overall approach of the project.

Among the fringe benefits not mentioned by Dulbecco is the impact such a project would have on ongoing research. Many scientists all over the world are now engaged in piecemeal sequencing of the human genome with an efficiency that in most cases is likely to be considerably less than that expected from a specialized project. Their efforts would be redirected to less boring and more creative tasks with corresponding savings in funds and time. These scientists could cooperate with the project by submitting samples for sequencing.

The project would make invaluable contributions to such important questions as the large-scale organization of genes into families and superfamilies and their relation to the expression and control of integrated functional assemblies, questions that are at the heart of embryonic development and neurobiology. As there is reason to believe that all genes evolved from a limited number of the ancestral genes, the results are likely to shed new light on evolution and the origin of humans.

Finally, compared with the present scale of destabilizing military expenditures, this project would require modest means; it could probably be accomplished for less than the \$100 million recently wasted in the unsuccessful attempt to put an unmanned satellite into orbit. An international effort to sequence the human genome deserves enthusiastic support; it would be a great step in the fight against disease and an important contribution to peace.

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*Erratum:* The title of the report by R. Myerowitz and N. Hogikyan on page 1646 of the issue of 27 June was incorrect. It should have been "Different mutations in Ashkenazi Jews and non-Jewish French Canadians with Tay-Sachs disease."