letters

journal *Physics Letters*. Then, why are they so far apart in rank? The relatively low subscription price made possible by collecting page charges gives our journals an advantage by having a wider circulation. This, in my opinion, is the principal reason why they are quoted more often. The lesson to learn is that authors who want to be cited should see to it that their institutions honor page charges.

S. A. GOUDSMIT
Editor-in-Chief
American Physical Society

Candidate for Congress

Compared to the number of lawyers in Congress, the number of scientists in this body is very small. So, it is good news to learn that Lloyd Allan Wood is now running for Democratic candidate for US Representative from the Sixth Congressional District of Ohio. As he was formerly in charge of Physical Sciences at the Air Force Office of Scientific Research, he is extremely well aware of problems and activities in this field. Let us hope Lloyd will get all the help possible.

BERND T. MATTHIAS
University of California
San Diego

Competitive running

"A Theory of Competitive Running" by Joseph Keller (September, page 42) is an amusing article, but shows little familiarity with competitive running itself. In this regard he is given away by his choice of references for running records.

The constant D_c, the longest race that can be run at maximum acceleration, is not a new concept in Keller's theory. Those with experience in competitive track put the distance somewhere between 100 and 200 meters, depending on the individual. This is about half of Keller's value. Some runners, such as Herb Washington, even seem to have an optimal sprinting distance of less than 100 meters.

Keller's theory certainly does not "determine the optimal race strategy." He clearly ignores one of the most important effects, the presence of the other runners! The importance of other runners is demonstrated by the frequent use of a "hare" in a record attempt. The "hare," another good runner, will set a fast pace for the early part of the race. Then, the runner making the record attempt will take over. The "hare" often does not even complete the race.

A slower runner who can sprint can often beat a faster runner who can't. The slower runner follows the faster for most of the race, then spurts past him at the end. This is why Ron Clarke never won the big races, although he set world records from two miles to 10 000 meters. For an even-paced runner to beat a sprinter, he must have a sufficient margin of superiority that his competitors cannot keep up with him. Such great runners are rare, although in the early 1950's Emil Zatopek showed this superiority in the 10 000-meter run.

The suggestion that the last bit of the race be run while decelerating is not realistic, as the condition where $E(t) = 0$ is not well defined. A runner can often dig a little deeper to finish his race with an extra spurt. He draws on resources that he could not have employed for the entire race. A case in point is Tom Courtney's victory in the 800 meters in the 1956 Olympic Games. He so exerted himself at the end that it was not known if he was aware he had won.

The condition where it is clear that $E(t) = 0$ is familiar to most observers of track. A race is lost when the leader collapses within a few yards of the finish line. Another situation where obviously $E(t) = 0$ is found in the description of the 1948 Olympic Marathon in the official report of the British Olympic Association. I quote only a portion:

> "Gailly was first man back on the red track in the Wembley Stadium, but under the cruel strain of that spurt over the 25th and 26th miles with only one aim in mind ('I must be first at the Stadium!') he forgot all about the lap which had still to be run at the Stadium itself. He arrived 'all in,' and to this day neither Gailly himself nor anyone who watched him knows how, with waxen face and the tottering shuffle of utter exhaustion, he managed to finish those few hundred metres with a body that had practically ceased to function consciously. Only after crossing the finishing line third did Gailly's unflinching determination allow him to collapse, to be carried off on a stretcher."

For more in-depth information on competitive running, as well as more recent listings of world records, I would recommend the January, 1973 issue of *Track and Field News* or the latest edition of the *International Athletics Annual* published by World Sports.

Keller has obviously failed to appreciate the significance of individual differences even at the world-record level. No two greater milers have appeared in recent years than Jim Ryun and Filbert Bayi. Jim Ryun would sprint past his competitors on the final lap. Filbert Bayi attempts to "kill off" his opposition by running a first lap as fast as Ryun's last. Would they have done