AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

SCIENCE

23 APRIL 1993 $6.00
VOL. 260 • PAGES 461–592

children used the same equipment that practicing scientists did—a major turn-on, says chemistry teacher Prudence Phillips: "The kid that dyes his hair green gets into doing this."

The mobile science concept, which was pioneered 5 years ago at Juniata Valley High School in Huntington, Pennsylvania, has spread beyond Purdue to Occidental College in Los Angeles and Eastern Oregon State College in La Grande. Says Kathy Whitfield, a teacher-driver for the Chemobile, "It's catching on like wildfire."

AAAS Members Have Their Say

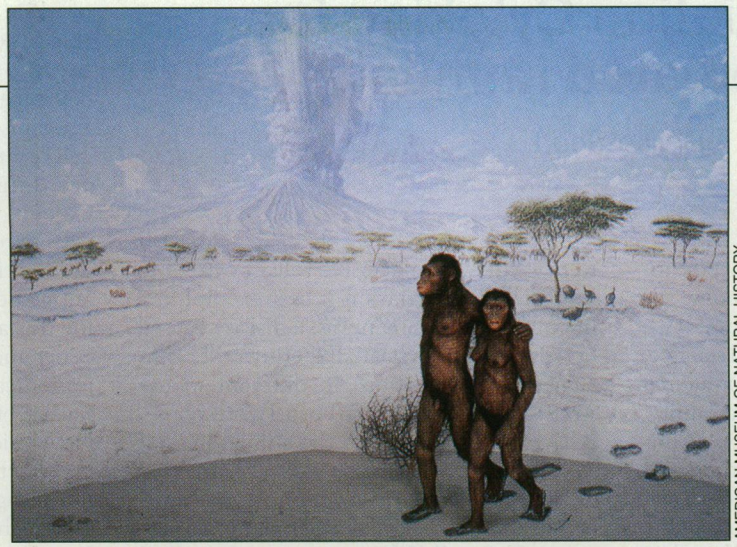
Much of the scientific community was stunned last year to learn that the heads of the National Science Foundation and the National Institutes of Health, as well as the chairman of the House science committee, all felt that the time had come for a major overhaul in the way science is funded in the United States. Their reports have been zeroing in on questions some investigators might wish had been left unsaid:

- Should research be more explicitly linked to national goals?
- Might current troubles be better addressed through structural and social reform than money?
- Should researchers have to set priorities more openly, justify their requests in terms of social goals, and be subjected to performance evaluations?

Now AAAS members have weighed in with some answers, the result of a random mail survey conducted in January. The poll yielded 1766 usable replies (a 59% response). Weighting the data to reflect differences in response rates by discipline, the AAAS found that most respondents (87%) agreed that the current federal funding system must change, although only 33% felt it needed a "major overhaul." Very few (8%) felt the system is "fine as it is."

Respondents were divided on whether scientists spend too much time talking about money and not enough about the "contribution of research to society." Thirty-five percent felt that funding levels are emphasized "somewhat too much"; another 10% said "far too much." The rest thought the emphasis on funding was just about right (30%), "somewhat too little" (11%), or "far too little" (8%).

As for linking federally funded research to national goals, 51% opposed changing the way research is supported and prefer to find ways of "putting the results …to practical use." But 68% look with favor on developing a process whereby the scientific community can identify priorities across disciplines and make recommendations to policy makers. On the topic of performance evaluation, the prevailing opinion was the classic one: 73% "strongly agreed" that "researchers are best qualified to judge the scientific quality of research."



AMERICAN MUSEUM OF NATURAL HISTORY

Steps for mankind. "Lucy" and her fellow making prehistory.

Up-to-Date Evolution

This week New York's American Museum of Natural History opened what it believes to be the nation's only large-scale exhibit on human evolution—and a lot of science has gone into its design.

On display are four new dioramas, of which the one above depicts the earliest hominids, *Australopithecus afarensis*, dating back to 3.5 million years ago. The woman is modeled on "Lucy," the nearly complete skeleton discovered by Donald Johansen in Ethiopia in the mid-1970s. The figures are shown leaving the famous trail of footprints discovered in Laetoli, Tanzania, by Mary Leakey. Exhibit curator Ian Tattersall says the diorama designers had to make numerous guesses about the physical appearance of early hominids—such as whether they had eyebrows (the couple above had ape-like features suggesting no brows to speak of). As for the modern-looking way the male has slung his arm over the female's shoulders, Tattersall explains that one pair of footprints was much smaller than the other so it could have been a woman, and the two were walking so close together they had to be touching. The couple could have been holding hands instead, but Tattersall says that would have been "even more human-like."

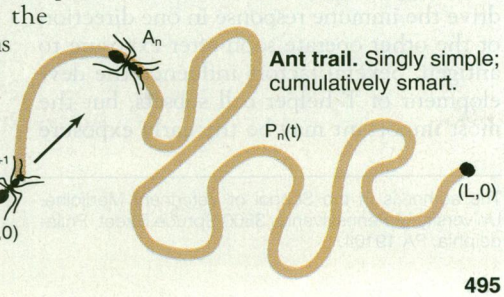
All this is merely one part of the new Hall of Human Biology and Evolution, which has three sections: biology and anatomy—featuring high-tech stuff such as three-dimensional holograms; human evolution; and origins of human creativity—including replicas of the cave paintings at Lescaux. Why would such an appealing idea be so unique in natural history museums? Tattersall says he's "totally at a loss" to explain why human evolution gets short shrift, although creationists' concerns may have something to do with it.

Follow-the-Leader Math

At ant's eye level, it ought to be extra hard to navigate. That once got the late Nobel laureate physicist Richard Feynman wondering why ant trails are always so nice and straight. In his autobiography, *Surely You're Joking, Mr. Feynman*, he describes some casual ant-watching experiments. His conclusion? The ant trail gradually gets straightened out as each ant cuts corners, so to speak, in following its predecessor.

Now, a mathematician at the Technion in Haifa, Israel, has substantiated Feynman's observations mathematically. After analyzing a simple model of ant behavior, Alfred Bruckstein reports in *The Mathematical Intelligencer* that no matter what kind of wandering path a "pioneer" ant takes in getting from point A to point B, if subsequent "follower" ants aim themselves directly at the ant ahead of them, the sequence of paths invariably converges as each follower ant's path becomes less curved than that of its predecessor. Ultimately the path from A to B becomes perfectly straight. (If one ant catches up with another, the two ants simply "merge" and continue as one.) Explains Bruckstein, the ant-trail result shows that "myopic interactions" between simple agents can lead to globally optimal solutions.

As good as it sounds, Bruckstein's "proof" may not be the real explanation for this aspect of ant behavior. But it could nonetheless prove useful in robotics, where path finding and obstacle avoidance are key problems. To researchers in other fields who become interested in his work, Bruckstein quotes the Bible, Proverbs 6.6: "Go to the ant, thou sluggard; consider her ways, and be wise."



Ant trail. Singly simple; cumulatively smart.

A. BRUCKSTEIN

Follow-the-Leader Math

Science **260** (5107), 495.
DOI: 10.1126/science.260.5107.495-b