RANDOM SAMPLES

edited by CONSTANCE HOLDEN

Predicting Performance in Graduate School

The Graduate Record Examination (GRE) is due for some changes in the coming years as its maker, the Educational Testing Service (ETS), attempts to make it more useful for predicting success in graduate school.

The GRE has not been subjected to the same criticisms (such as race and sex bias) as the Scholastic Aptitude Test, which has a redundant new moniker, the Scholastic Assessment Test, to avoid the currently unacceptable term "aptitude." However, educators and the ETS are concerned that graduate departments are placing too much weight on GRE scores.

To critics like sociologist James Wood of California State University, in San Diego, who has evaluated the results of 24 studies on the GRE and claims that in many, the scores account for "little or no variance" in graduate school performance, much of the test's current content is irrelevant for specialty study. To defenders of the test, its low predictive value is due to "restriction of range"—the studies don't include those the test has weeded out. Says Charlotte V. Kuh of ETS: "I tell people the proper experiment would be to admit people at random—then we'd find much higher predictive validity."

But everyone agrees that the test could stand improvement. To this end, says Kuh, three initiatives are in the works:

- A version of the GRE that can be taken on a computer will be introduced next year. That will make it possible to add "adaptive testing" to examine individuals more closely within their particular ability ranges.
- Because the GRE's quantitative section is too easy—and therefore not predictive—for people going into science and engineering, a tougher quantitative measure is to be introduced for these students in 1996.
- As part of tailoring the test more to individuals, a writing test may be added in 1996.

But as biologist Douglas Bennett of Reed College warns, the GRE can never be expected to predict traits critical to graduate school success such as commitment and ability to work autonomously. After all, says Bennett, often "the student doesn't even know."

More Women Among the Tenured

First, the good news. For years, the vast majority of women faculty members were to be found in the lower echelons of their profession—the untenured positions. But women are now finally cracking the tenured ranks (associate and above) in greater numbers, according to the latest "Annual Report on the Economic Status of the Profession" by the American Association of University Professors (AAUP), which declares that the increase in women faculty is "one of the most striking changes in academe in the past decade."

Percentages of Women Faculty According to Academic Ranks

Rank	1982-83	1987-88	1992-93
Professor	9.1	11.4	14.4
Associate	19.7	24.2	28.9
Assistant	33.5	36.6	42.3
Instructor	55.3	53.3	58.1
Lecturer	45.5	50.0	54.2
All ranks	23.6	25.1	29.7

Nonetheless, women continue to be paid less than men of the same rank, earning anywhere from 87.5% (for lecturers) to 94.4% (for instructors) of their male counterparts' pay. The report's author, economist Daniel Hamermesh of Michigan State University, suggests that one reason men earn more is that they tend to enter more lucrative fields such as engineering.

Similarly, increases in female representation may not apply in all disciplines. The AAUP cannot tell us whether women have advanced to tenured positions in physics as fast as in, say, psychology.

JULIE MARKES/AP

Science Vegas-style. Three of history's great brains play poker.

Putting Scientists Into Science Fiction

In the coming weeks, viewers of the popular television series *Star Trek: The Next Generation* will be treated to two special guest stars: shuttle astronaut Mae Jemison, a physician, and superfamous physicist Stephen Hawking.

In an epsiode scheduled for late May, Jemison, the first black woman astronaut, will be seen operating the starship Enterprise's matter transporter, a device NASA can only dream about. It's a fitting role, since Jemison has said her career aspirations stem in part from the original *Star Trek* series, whose cast included black actress Nichelle Nichols as Lt. Uhura.

Hawking's appearance in the season finale this June is even more far out. The Cambridge University scientist, who loves the show, will play himself trading bets in a poker game between Albert Einstein, Isaac Newton, and the android Lt. Cmdr. Data, a series regular. The scene is made possible because it takes place on the Enterprise's Holodeck, where live Star Trek characters can interact with computer-generated holograms.

Science on the Move

Off in the corner of the exposition hall—amid a sea of booths featuring bored salespeople hawking gas chromatographs, glassware, and fine chemicals—there was an oasis of enthusiasm at last month's meeting of the American Chemical Society in Denver. A fleet of four trucks and trailers had actually been driven onto the exhibition floor. They had been loaded with sophisticated instrumentation for chemical analyses. And accompanying all this expensive gear were high-energy educators promoting a new kind of commando science education.

Designed to venture into scientific no-man's lands, science vans shuttle today's laboratory standards like infrared spectrophotometers and high-performance liquid chromatographs from colleges and universities to high schools and grade schools. For nearby schools where students are scientifically impoverished, or teachers in need of rejuvenation, roving cargoes enable the ill-equipped to see and do experiments on equipment their schools could never afford.

Take Crawfordsville High School in Indiana. One of 27 secondary schools within an hour's drive of the Chemobile, Purdue University's science van, Crawfordsville became a test site where

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

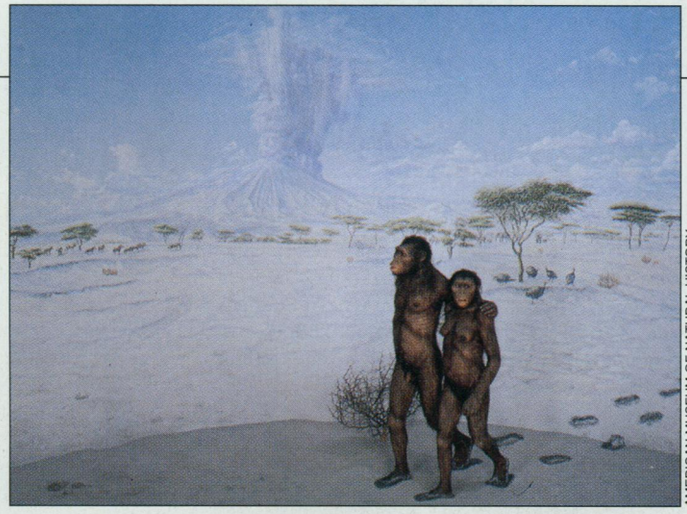
Much of the scientific community was stunned last year to learn that the heads of the National Science Foundation and the National Institutes of Health, as well as the chairman of the House science committee, all felt that the time had come for a major overhaul in the way science is funded in the United 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."

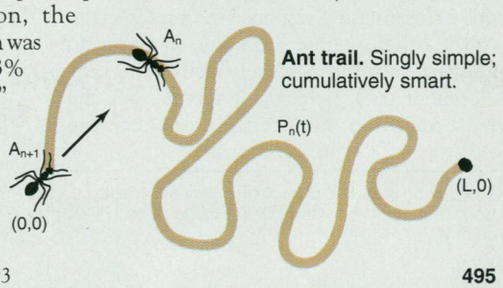
All this is merely one part of the new Hall of Human Biology and Evolution, which has three sections: biology and anatomy—featuring high-tech stuff such as three-dimensional holograms; human evolution; and origins of human creativity—including replicas of the cave paintings at Lescaux. Why would such 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