The value of appropriate review of interdisciplinary research is emphasized. In response to articles about "engineering a new green revolution," readers express concern about support for sustainable-renewable agriculture, the development of markets for crop-protection chemicals, and whether photosynthesis must be improved to increase productivity: "understanding how the whole organism responds to short-term environmental change would seem to be the better approach to improving plant productivity," says one group of letter writers. Women are said to be achieving parity in the biological sciences. A group of primatologists argue against the use of virulent HIV strains in vaccine trials in chimpanzees. And the "dreaded abbreviation syndrome" is discussed.

Reviewing Interdisciplinary Research

I applaud the proposal by Norman Metzger and Richard N. Zare (Policy Forum, *Science*'s Compass, 29 Jan., p. 642) to give increased attention to selecting and funding interdisciplinary research.

During my tenure as a research administrator in Washington, D.C., one of the biggest "scandals" discussed in the funding agency community involved the research proposed by Luis and Walter Alvarez and others relating major extinction events to collisions of the Earth with objects such as asteroids. This research was proposed to several federal funding agencies, but they declined to support it. In each instance, the proposal did not pass the peer-review process.

The proposal was interdisciplinary in nature—it contained elements of geosciences, low-level isotopic analysis, and palaeontology. The proposed research within these disciplines, by itself, was not considered novel enough to warrant funding in that specific discipline, and recommendations by experts within the discipline were uniformly negative. Only the intervention of the then director of the Lawrence Berkeley Laboratory (LBL), Andrew Sessler, led to financial support by LBL. The rest, as they say, is history.

While this cautionary tale is often cited as a failure of the peer-review system, I believe it was more correctly a failure in choosing the peer-review panels. The suggestion by Metzger and Zare that interdisciplinary proposals be judged by specially constituted and carefully selected review panels should lessen the chance that high-quality interdisciplinary research will be rejected by narrow evaluation of its components, rather than the quality of the overall project.

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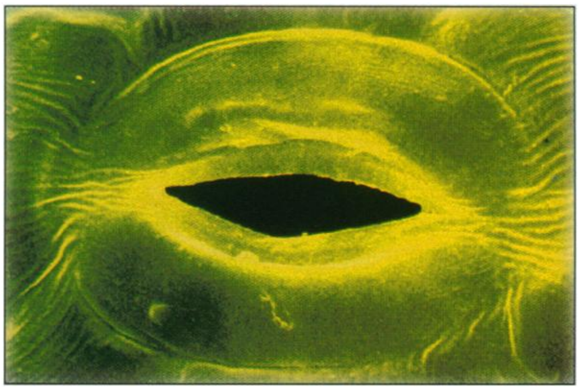

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Genetically altering the opening and closing of a plant's stomata (above) is one way researchers are trying to increase productivity

Future Food

I would like to comment on Charles Mann's article "Crop scientists seek a new revolution" (News Focus, 15 Jan., p. 310). While the current bioengineering of crop plants may be technically dazzling, it would be wise for the scientific community to recognize that neither government nor industry is targeting any significant level of resources into sustainable agriculture. During the last 40 years, nearly one-third of the world's arable land has been lost by erosion (*1*). Likewise, fertilizer runoff from Midwestern farming has been the main contributor to what may be the world's largest oceanic "dead zone" in the Gulf of Mexico (*2*), and the list goes on. Many of these problems stem from technology based on the original "green revolution." Despite two reports by the National Research Council recommending increased support for sustainable-renewable agriculture, it appears that industry and government are committed to a second green revolution based on the same assumption: that a high-tech approach will ultimately solve our crop production problems. We had that attitude about antibiotics and microbial disease a couple of decades ago.

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As we discuss crop shortages and the need for "engineering a new green revolution," two points come to mind. Today, market prices for staple food and fiber in the United States are at or near all-time lows. It is ironic how, academically, we as scientists all share the broad objective of increased crop yield for the benefit of mankind, yet the farmer finds it increasingly difficult to generate a positive balance sheet, largely because of oversupply. Second, agronomically, a key component of most high-yielding crop systems is enhancement of vegetative structures within the plant to support increased fruit loads. For years, farmers have had at their disposal benign chemicals to help modify plant growth and increase plant sturdiness. Yet this area of research often finds little official support outside industry. The markets for growth-regulating chemicals to enhance plant architecture and crop yield are small and risky. The development of crop-protection chemicals, including plant-growth regulators, has become an increasing gamble, unless huge markets are identified to justify research expense. The same governments that show concern about feeding the world's population in the years to come are tilting the balance against development of safe and efficient chemicals by focusing on biotechnology and genetics. It is becoming painfully clear how "un-integrated" the scientific community has become in its effort to find ways to feed the world.

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A major thesis presented in Mann's article "Genetic engineers aim to soup up crop photosynthesis" (News Focus, 15 Jan., p. 314) is that photosynthesis must be improved to increase productivity. But numerous studies have shown that reducing photosynthesis rates, even over several seasons, has no effect on plant growth (*1*). Growth rate may be limited by the rate of acquisition of one or more of many different resources (for example, nitrogen, phosphorus, potassium, and water), of which carbon is only one. Under optimum resource conditions, the rate at which a plant can process those resources into new biomass may be limiting. Both the rates of resource acquisition and the rate of processing are functions of temperature, salt, water, and so forth. A case for photosynthesis being rate limiting could be made if changes in photosynthesis mirrored growth-rate changes with changing environmental conditions, but in most instances this relation does not exist. Statements such as "the unexpected discovery of more efficient RuBisCO in red algae," without consideration of the conditions under which it is "more efficient," do not take into account the physical requirements imposed on the system by the environment. The "inefficiency" in carbon photosynthesis (photorespiration) is unlikely to be an uncorrected evolutionary problem, but rather is there for the purpose of allowing the energy-coupled reactions of photosynthesis to be optimized to variable temperature and light conditions. Because all of the metabolic processes of plants must be integrated together and optimized for their environment, understanding how the whole organism responds to short-term environmental change would seem to be the better approach to improving plant productivity.

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Women in Biological Sciences

The National Science Foundation's annual survey does indeed show that the proportion of earned doctoral degrees in biological sciences going to women has steadily been increasing from about 19% in 1975 to 38% in 1995 (Random Samples, 15 Jan., p. 323). However, there is more to celebrate than these numbers convey. In that same time, the proportion of bachelor's degrees in biology awarded to women has also reached parity (49.7%) from a 1975 level of 29% (see www.nsf.gov/sbe/srs/seind98/append/c2/at02-20.xls). The difference in these proportions (Ph.D. to B.S.) has remained fairly constant, with a 12% deficit at the Ph.D. level representing a 10-year lag (see www.nsf.gov/sbe/srs/seind98/append/c2/at02-30.xls). If current trends continue, we should expect parity for doctoral degrees conferred in biology by 2005. There are also telling trends in the relative proportion of those earning a B.S. in biology who later complete a Ph.D. Assuming an average of 5 years to complete a doctoral degree, only 5% of women completing an undergraduate degree in the late 1970s and early 1980s later completed a doctoral program in biological sciences. Ten years later, the proportion continuing in academia is at 11%; a value that finally is identical to the proportion of men who continue (a proportion for men which, incidentally, is down from a high of 15% in 1990). With these numbers in mind, it is now critical that universities be proactive in retaining women faculty. Only 21% of senior faculty positions in biological sciences are occupied by women (see www.nsf.gov/sbe/srs/seind98/append/c5/ at05-24.xls). The proportion of junior women faculty exceeded that level