do not develop diabetic vascular disease (*3*). In contrast, GH-induced diabetes in dogs is accompanied by diabetic vascular lesions, and in diabetic rats GH injections resulted in increases in vascular basement membrane thickness (*4*). There is a correlation between GH levels and increased skin capillary fragility in diabetics (*5*). Dilman *et al.* (*6*) feel that "paradoxic responses" wherein GH rises during glucose loading may be significant to the clinical pathology of aging.

Pituitary tumors associated with GH production are present in high incidence in aging rodents, and age-related kidney damage (glomerulosclerosis) in the rat was greatest in those animals with such tumors (*7*). Pituitary tumors are frequently found clinically at autopsy in aged patients where an incidence of 20 out of 152 unselected subjects (*8*) has been reported.

The loss of GH (pituitary ablation) can reverse the clinical retinopathy and renal complications of diabetes (*9*). Hypophysectomy in rats can reverse age-related glomerulosclerosis (*10*), and there is evidence for a hypothalamic pituitary neuroendocrine clock that programs aging with hypophysectomy-producing levels of rejuvenation in rats and mice (*1*), although in contrast, GH may be responsible for maintenance of protein synthesis in aging rodents (*11*).

We have to be concerned about not only the potential promiscuous clinical use of GH for cosmetic effects but also the current related "health food" use of arginine, which has GH-releasing activity. The latter is purportedly used to increase muscle mass cosmetically, without exercise. The action of GH on aging is not clear, and we need good studies in animal models to determine the effects of GH or GH-releasers to avoid premature clinical cosmetic use that could lead to long-term injury such as is seen in acromegaly or diabetes.

WILLIAM REGELSON
Medical College of Virginia,
Post Office Box 273,
Richmond, VA 23298

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SDI Research Funds

The 7 November article "Mathematicians look to SDI [Strategic Defense Initiative] for research funds" by Gina Kolata (News & Comment, p. 665) distorts my comments at a 7 October briefing held at the National Academy of Sciences.

I did not ask any question at that briefing. Instead I rose to comment on the need to strike a balance in government-sponsored basic research in mathematics between group research and the research of individual mathematicians pursuing their own ideas, especially in view of the past tendency to fund group activity at the expense of individual projects.

In short, new money for mathematics does not contribute to the long-term health of our discipline if, in aggregate, it tends to diminish the incentive of gifted mathematicians to develop their own ideas.

G. D. MOSTOW*
Department of Mathematics,
Yale University,
New Haven, CT 06520

*President-elect, American Mathematical Society.

Net Primary Production: The Tomato Example

Roger Lewin's News & Comment article "A mass extinction without asteroids" (3 Oct., p. 14) quotes Paul Ehrlich as saying that 40% of the net primary production (NPP) on Earth is consumed directly or indirectly by the human population. I find this unbelievable.

As an example, our research at Public Service Electric and Gas Company indicates that, with respect to annual tomato production per acre of greenhouse, yields of almost 300,000 pounds per acre are now being approached. If we assumed a U.S. population of approximately 240 million people, and if the only food available to them were tomatoes, with each person consuming 16 pounds of tomatoes a day (1 pound of tomatoes equals 100 calories) for 365 days a year, per capita consumption would be 5840 pounds per year per person; this leads to an estimate that the United States would need 16 pounds $\times$ 240 $\times$ 10^6 people $\times$ 365 days a year, which equals 1401.6 $\times$ 10^9 or 1,401,600,000,000 pounds of tomatoes a year to feed its population. (Note that this would not be the most balanced diet.)

If the annual tomato consumption in this case (1401.6 $\times$ 10^9 pounds per year) were divided by the acreage production of tomatoes (300,000 pounds per acre per year), only 4,672,000 acres of greenhouses would be required to feed the entire population of the United States. The area of the U.S. land mass is approximately 3,920,000 square miles. If we figure that one-third of the continental land mass is tillable, there are 836,268,800 tillable land acres. If we divide 4,672,000 acres by 836,268,800 acres, only 0.56% of the U.S. tillable land would be required to keep the U.S. population supplied on a mono-diet of tomatoes all year long. The above percentage (0.56%) should be increased slightly, since about 25% of the total light in this particular environment on an annual basis is supplied by artificial, supplemental photosynthetic lighting.

I therefore suspect that the estimate of 40% consumption of NPP by the human population is exaggerated by several orders of magnitude.

BRUCE L. GODFRIAUX
Public Service Electric and Gas Company,
80 Park Plaza,
Newark, NJ 07101

Forest Restoration in Costa Rica

I would like to polish Constance Holden's excellent coverage of the tropical dry forest restoration project in northwestern Costa Rica (News & Comment, 14 Nov., p. 809). Holden reports that "the forested area of Costa Rica has shrunk from 20 to 2% in the past two decades," but in fact it is the *dry* forest area that has so shrunk in area; overall, Costa Rica has an excellent conservation record, with approximately 20% of its area in explicitly conserved national parks and reserves.

Holden says that local wild animal populations "might be jacked up to commercially exploitable levels." Such an action is being taken in some wildlife management projects