

Uncertainties of climate change

SIR — To resolve the uncertainties enveloping global climate change, the United States and, to a lesser extent, Europe have embarked on an extensive research effort. We believe that these research programmes will do little to provide a solid scientific foundation for policy decisions in the next decade.

Marginal improvements in current models, or additional runs of the global circulation models, will not resolve the fundamental uncertainties paralysing international negotiations. Research is at present focused on predicting the extent of climate change, a question that is unlikely to be resolved for at least another decade. More likely to be resolved and of greater importance in determining policy are the cost of abatement and the effects of climate change. In our view, scientific research is destined to remain largely irrelevant to political decisions about global climate change as it is not designed to produce answers when needed by policy makers.

These problems were the downfall of the decade long, half-billion-dollar National Acid Precipitation Assessment Project (NAPAP). Its important scientific findings had virtually no effect on policy and legislation. Research on the greenhouse effect is following the same path. If science is to be relevant to social decisions about global climate change, the programme's management and focus must be changed. The focus should be on informing policy decisions over the next decade or two, not on abstract research. Fundamental research is needed, but the agenda must be structured to answer crucial policy questions, not simply to advance knowledge.

The United States is spending \$1,200 million on climate change research this year, but only 25 per cent of these resources are focused on the core issues. Even these programmes were generally

Good heavens!

SIR — I was alarmed to read in your editorial on Olbers' paradox (*Nature* 352, 554; 1991) that "the brightness of receding stars will be diminished by the recession". While I have observed numerous effects on science of the current economic downturn — from cuts in research council budgets to increased applications for PhD places from graduates squeezed out of the job market — I had hitherto assumed its consequences to be confined to the merely terrestrial.

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designed to answer other questions. If scientific research is to inform political decisions, administrators need to exercise tough control. An integrated assessment is needed to identify the priority research and coordinate individual projects.

In our judgement, several independent assessments should be undertaken in parallel. Integrated assessments can spot the critical gaps in the current research agenda, discover research that isn't on target or is wasteful, and detect the mismatches between the inputs that each group is expecting and the outputs that will be produced by other researchers. Global climate change is too important to repeat the same mistakes that crippled the \$500-million NAPAP programme.

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The grant racket

SIR — Science advances by the independent thinking of nonconformists. Today, nonconformists have a hard time in US academic research. For instance, PHS (US Public Health Service) funding is based on peer review, but only about 15 per cent of all approved new requests are now funded¹. Each request takes months to prepare and submit; revisions can add years of delay. Pressure to get funding supervenes the drive to test new ideas. Success is determined by mastery of idiom more than by scientific vision. Departure from accepted views guarantees derailment in peer review. Tight money imposes conformity where independent thought is required.

Behind this are scientific and grant administrators who contribute little to science and often impede it. While grant money now pays 'soft' salaries and overhead, universities pay administrators 'hard' money and let them control endowments. 'Blue-collar' scientists who founder in peer review risk more than 'white-collar' administrators who do not even work in the laboratory. The system favours the wrong group because administrators, not bench scientists, influence policy: foxes guard the chicken coop. To cure this, Congress should set the following PHS policies.

(1) *Harden 'soft' money.* Limit PHS research support to \$70,000 per year per investigator above salary until all approved applications are funded. Congress recently gave pay rises to upper-

grade civil service scientists (and to itself) when productive laboratories are dying and only 15 per cent of good new ideas are being studied. Instead, let PHS augment salary to, say, \$50,000 per year maximum and exempt those making more than that from PHS support. As an incentive to get outside money, let any extra salary be used for research.

(2) *Set PHS guidelines on technology ownership and transfer.* Most universities claim all inventions conceived within their walls. However, the inventor's share of licensing and royalties ranges from zero to half. The even split (i) stimulates inventiveness, yet bypasses the stifling academic bureaucracy; (ii) deters inventors from walking off with a super idea; and (iii) frees salary money to less lucrative research areas. This does not sully pure research: fiscal strain is killing basic research, and this may preserve it. New approaches to technology transfer are also needed.

(3) *Soften 'hard' money.* Today, the award rate for approved individual investigator grants is in sharp decline. Yet 33 per cent of NIH funding is 'indirect costs', the fastest growing category¹. The increase is largest in private universities whose endowments once paid overhead instead of paying for money-acquisition machines and administrator slush funds. PHS should let endowments pay 'indirect costs'. The increased funds could nearly double the diversity of independently run PHS projects.

(4) *Researchers should sign papers only when they do the work.* Before US science became big business, authorship was obvious. The feudal structure of academic institutions encourages ambitious bureaucrats with fiefdoms to exact credit as fealty for resources. This stimulates fraud. Perhaps we need a 'secondary authorship' line for technical services. But when administrators can no longer exact credit for science they did not do, it will be easy to fix the blame for bad work. This will inhibit fraud without data auditors in trenchcoats.

PHS will not take these initiatives voluntarily, because it is a bureaucracy. But, if Congress forces it to, private funding agencies will agree: they often limit overhead to little or nothing. Fiscal reform will show if science is really underfunded in the United States. Support many, small laboratories, not a few big ones; protect rare breeds in academic research, as in wildlife conservation. Trade each \$100,000 per year fox for two independent scientists to spur science and squelch fraud.

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1. Extramural Trends, FY 1980-1989. Information Systems Branch, Division of Research Grants, National Institutes of Health.