CORRESPONDENCE

Gene data for endangered species have limitations

SIR — Your News story 'Time to sequence the "red and the dead"' (*Nature* **458,** 812–813; 2009) reports on plans to sequence the genomes of endangered and extinct species. Supporters claim that these sequences could help us learn why some species became extinct and provide a scientific argument to warn politicians and the public about which species are endangered, resulting in improved policies. Unfortunately, their claim has several flaws.

Conservation biologists studying a change in genetic diversity over time need many specimens to understand the process of extinction, as you imply. However, a limited set of markers would be adequate for this undertaking, so there is no compelling scientific reason for collecting hundreds of complete genomes.

Although DNA samples may be useful in solving some extinctions attributable to pathogens, genome data would not have helped the now-extinct Chinese river dolphin (*Lipotes vexillifer*), which needed improved habitat — better water quality and a reduction in fishing and boat traffic. Nor would they have helped the northern white rhinoceros (*Ceratotherium simum cottoni*), which, now probably already extinct in the wild, needed better protection from poaching.

The wrong policy decisions could be made on the basis of population genetic data if these are ambiguous or uninformative about a species' prospects. Take the case of the mammoth and the bison: based on no evidence for a change in mammoth population size over time and the steep decline in bison over some 20,000 years, it might be inferred that bison was at risk of extinction whereas mammoth was not; the reality was the reverse.

For the global preservation of species, it is much more important to reach a timely understanding of ecological requirements and the effects of invasive species and climate, for example, as well as population parameters that influence responses to harvesting. Otherwise, proposals to sequence "the red and the dead" may quickly be reduced to sequencing just "the dead".

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How science upholds civilization, human rights and democracy

SIR — I would like to add two important points to the discussions of C. P. Snow's 'two cultures' (*Nature* **459,** 10 and 32–39; 2009).

First, it is not ignorance of the second law of thermodynamics that is the most serious gap in the education of many non-scientists, but a lack of basic understanding of how science works. For example, a recent UK survey, *Public Attitudes to Science 2008*, by Research Councils UK (http://tinyurl.com/o96lwg) showed that, although the public overwhelmingly believes that science makes the world a better place, a strong majority also maintains that no innovation should be licensed unless science has first proved it to be safe. As if it could! The controversy over the mumps–measles–rubella (MMR) vaccine showed that large sections of the public and, worse, the media either fail to understand the importance of evidence or have no respect for it.

Second, science is one of the pillars of civilization and liberal democracy, as that eminent philosopher of science, Karl Popper, convincingly argued. It is, he said, "one of the greatest spiritual adventures man has yet known". Because science rejects claims to truth based on authority and depends on the criticism of established ideas, it is the enemy of autocracy. Because scientific knowledge is tentative and provisional, it is the enemy of dogma. Because it is the most effective way of learning about the physical world, it erodes superstition, ignorance and prejudice, which have been at the root of the denial of human rights throughout history, whether through racism, chauvinism or the suppression of the rights of women.

Nothing could have better illustrated the gap between cultures than literary critic F. R. Leavis's view that science is concerned only with "productivity, material standards of living, hygienic and technological progress".

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Stick as well as carrot needed to solve age-old gender bias

SIR — Your Editorial 'The female underclass' highlights the problems faced by women scientists in many European countries (*Nature* **459,** 299; 2009). I'd like to comment on the situation in the United States.

Taking the biological and medical sciences, for example: from 1990 to 2004, the percentage of traditional research awards from the US National Institutes of Health (NIH) allocated to women grew from a paltry 17% to just 24% (see http://tinyurl.com/kvtvhc). Only 19% of tenured principal investigators at the NIH are women. These figures have hardly changed over the past decade and are dishearteningly similar to those at most academic research institutions in the country (see http://tinyurl.com/kpav3j).

Yet there have been more female than male graduate students in these fields over the same period. In 2005 the number of doctorates awarded to women overtook the number awarded to men (see http://tinyurl.com/nemfs6). Although women make up nearly half of all scientists nationwide, many abandon academic research after a decade.

What is happening to these female graduates, and what can explain the startling drop-off in figures? It's simple. Report after report has documented gender bias. For example, the 2007 report from the US National Academies, *Beyond Bias and Barriers: Fulfilling the Potential of Women in Academic Science and Engineering*, categorically affirms bias against women applying for grants, employment and tenure. It asserts that a woman must have a significantly superior record to be rated on a par with a man. And it rejects out of hand the purported meritocracy that determines hiring, promotions and rewards in academic institutions.

The loss of women scientists has also been attributed to their relative lack of confidence in seeking positions and securing tenure (*EMBO Reports* **8,** 977–981; 2007). Of course they are less confident — a woman is only too aware of the time and energy she must invest in overcoming bias and building up a "significantly superior record".

If we ask what has worked in those European countries that have managed to curtail destructive habits of bias and exclusion, again the answer is simple. As you point out, it takes "sticks as well as carrots". No sensible man would give up his advantage by conceding that he is intellectually inferior to a female colleague. And no university yet seems prepared to remove men who are guilty of blatant acts of bias.

What is at stake is not only justice: it is the competitiveness of science in the United States. When half of our brightest scientists leave academic research because their intelligence and common sense tell them they are wasting their considerable skills, how can we possibly generate the best science?

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