CORRESPONDENCE

Guidelines for HIV in court cases

In many nations it is a crime to infect someone with HIV by intention or non-disclosure. As phylogenetic experts who advise courts worldwide, we are calling for guidelines on how phylogenetics should be used in criminal HIV investigations. The inappropriate use of such evidence in suspected transmission cases can have dire legal and social ramifications.

The scientist's job is not to argue for or against a defendant's guilt: that is a task for lawyers. Phylogenetic investigators should limit themselves to an expert opinion on what information about viral transmission can be deduced from their analysis. This must be derived impartially, for example by blinding the identities of case subjects.

Scientists must explain to courts that phylogenetic analysis cannot 'prove' any particular hypothesis, such as 'person A infected person B'. Rather, results may be compatible with several hypotheses, or support one over another.

An a priori hypothesis should be formulated by different independent epidemiological experts, based on contact possibilities between the purported victim(s) and the defendant, and on any additional contacts or risk factors.

Phylogenetic analysis alone cannot exclude the possibility that HIV was transmitted from A to B through unsampled persons. Although the direction of viral transmission can sometimes be supported, it does not prove direct transmission.

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**A full list of co-authors is available online at http://dx.doi.org/10.1038/473284a.*

PhDs: what's left if science abdicates?

I disagree that we have a glut of scientists with PhDs (www.nature.com/phdfuture). The corporate view of PhD numbers in terms of what the market will bear ignores the major problems that only science can solve in the coming century.

The list is long: natural disasters, such as earthquakes and incoming celestial objects; environmental degradation; sustainable energy; famine and violence; untreatable medical conditions; and threats such as antibiotic resistance. If science abdicates, there is nothing else.

The urgency of these problems requires a large cadre of trained individuals to be enlisted to defend our planet. The size of the military is dictated by our defence needs, not the market. In science, by analogy, our global defence needs are soaring.

Spending a few years in the service of science and the greater good, being rewarded with an advanced degree and, for example, going on to teach in high schools is an honourable fix.

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PhDs: Israel also trains plenty

You contend that few PhDs are trained in the Middle East outside Egypt (*Nature* **472,** 276–279; 2011). Israel is a sizeable contributor as well.

In 2008–09, Israel had more than 10,000 students enrolled in doctoral programmes (Central Bureau of Statistics, Israel). This is fewer than Egypt's 35,000 for the same period, but many more per capita.

Given ongoing tensions in the region, the scientific press has a responsibility to report data related to higher education and research transparently and accurately (see also *Nature* **471,** 37; 2011).

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Crop failure signals biodiversity crisis

Crop failures have pushed up food prices globally (*Nature* **472,** 169; 2011). Human well-being depends on biodiversity and natural habitats as a source of food. Ironically, the countries harbouring these vital natural assets are also those currently facing the most severe food crises.

A report from the investment bank Nomura (go.nature.com/pwrlc9) introduces a global index for measuring nations' food vulnerability. The most vulnerable depend totally on imported food, and citizens spend more than one-third of their salaries on it.

Of the 35 most vulnerable countries, 15 contain tropical biodiversity hotspots. To produce more food, these countries may lease out their biodiversity-rich land to farm cash crops. Liberia, for example, intends to add 220,000 hectares of oil-palm plantation (go.nature.com/xblcjz) to its existing 1.6 million hectares of agricultural land in the southeast, one of the last strongholds of tropical forest in western Africa.

Vulnerable nations need better cooperation among governments to address the structural causes of imbalances in the international agricultural system; more research into new technologies that incorporate the food-production requirements of the rural poor; and stronger protection of natural systems by linking biodiversity preservation to increased food security.

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OLIVER MUNDAY

China must reduce fertilizer use too

Environmental damage caused by reactive nitrogen is not just a European problem (*Nature* **472,** 159–161; 2011). China must also rein in its overuse of nitrogen fertilizers — which accounts for 40% of global production since 2006 — to balance food-security requirements with the protection of human health and the environment.

Despite China's nitrogen consumption almost doubling between 1990 and 2009, its grain production increased by just 22%. Although the research community widely recognizes the problem of fertilizer overuse, farmers in China continue the practice, which is promoted by some agricultural-extension advisers and by sellers of fertilizer.

Chinese farmers need to be taught how, when and in what quantities fertilizer should be applied. The existing agricultural-extension system must revert to its role of assisting farmers by methods other than promoting fertilizer sales.

Establishing an environmental-extension system at the township level could also help to prevent overuse of fertilizers and pesticides.

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Data archiving is a good investment

We have found that ongoing financial investment in data-archiving infrastructure yields an impressive scientific return, and believe that it should be wholeheartedly supported by research funding agencies (see, for example, go.nature.com/nzftf3).

We used Dryad (see http://datadryad.org), an international, open, cost-effective data repository for the biological sciences, to estimate the cost of archiving data from more than 10,000 publications. We found that these could be curated and the data preserved at an annual cost of about US$400,000.

As an example of how much research is typically published per grant dollar, core grants in population and community ecology from the US National Science Foundation averaged 3–4 publications per $100,000 of grant between 2000 and 2005 (S. Reyes, A. Tessier and S. Mazer, unpublished results). That is, $400,000 invested in original research resulted in about 16 papers.

Dryad cannot yet tell us how effective data archives are in facilitating primary research publications, but the Gene Expression Omnibus (GEO) database at the US National Center for Biotechnology Information offers some insight. To estimate data reuse, we searched the full text of articles in PubMed Central for mention of any of the 2,711 data sets deposited in GEO in 2007. We excluded articles whose authors' names overlapped with those depositing the data set. Extrapolating the 338 hits in PubMed Central to all of PubMed, we estimate that the GEO 2007 data sets made third-party contributions to more than 1,150 published articles by the end of 2010, and reuse continues to accumulate rapidly (H. A. Piwowar, T. J. Vision and M. C. Whitlock *Dryad Digital Repository* doi:10.5061/dryad.j1fd7; 2011).

Assuming that Dryad has a comparable rate of reuse and collects at least 2,500 data sets annually, an investment of $400,000 in one year should contribute to more than 1,000 papers in the next four years — far more than the accepted value for a research dollar.

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Noisy oil exploration disrupts marine life

Fossil-fuel operations in the Arctic will inevitably compromise habitat — regardless of spills (*Nature* **472,** 163; 2011).

The seismic airgun surveys used for hydrocarbon exploration and for monitoring deposit conditions can disrupt foraging behaviour of bowhead whales at long distances. They also seriously diminish fisheries catches of haddock and other Arctic species, and have halted the migration of fin whales (a non-Arctic species) at a range of more than 175 kilometres.

Bowhead and beluga whales avoid oil-derrick operations. Many other noises associated with fossil-fuel exploration and production — such as construction, shipping, transport helicopters and underwater acoustic telemetry — have a deleterious impact on the marine acoustic environment.

We do not yet know about the impacts of noise from thruster-stabilized exploration platforms and from sea-floor processing equipment such as wellhead chokes, separators and re-injectors, which operate out of sight and under extreme pressures.

In collaboration with the World Wildlife Fund and the Natural Resources Defense Council, we are developing a peer-reviewed website that can be understood by a lay audience in order to explore some of these issues (see go.nature.com/5vuebe).

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Address education inequality in India

Narrowing the educational achievement gap between different social groups in India remains a major challenge, despite 60 years of affirmative-action policy (*Nature* **472,** 24–26; 2011). Using publicly available data from the country's top medical school, the All India Institute of Medical Sciences (AIIMS), we found that performance was poor among students admitted under a government scheme for socially disadvantaged groups.

All government and government-aided institutions in India allocate a fixed percentage of places on educational courses to socially and economically disadvantaged students. But in 1995–2005, out of more than 600 indigenous tribes with access to such positions, one small group from northern India accounted for 36% of students admitted to the AIIMS.

Between 1998 and 2006, socially deprived students accepted into the AIIMS scored 13.6% less in the entrance exam than students from non-disadvantaged social classes ($P < 0.001$). In 1989–98, such students also had double the dropout rate of non-disadvantaged students (6% versus 3%; $P > 0.05$). In the ten years for which data are available (1995–2005), 61.4% of students admitted to government-reserved positions had to resit examinations in at least one subject, compared with 15.2% of non-disadvantaged students ($P < 0.001$).

To address such inequality, India should adopt measures that have proved successful in other countries. These include wider access to quality primary education; standardized assessment of students; and academic support for students who are lagging behind. More research to assess this inequality is also needed to inform education policy.

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Fund experiments on atmospheric hazards

The radioactivity released from Japan's damaged Fukushima Daiichi nuclear power plant has increased the urgency to fund tracer experiments that will improve models of atmospheric dispersion and reinforce confidence in emergency procedures.

The last major tracer experiments were conducted in the mid-1990s. So the predictive capabilities of current atmospheric-dispersion models have not been properly tested, hindering their evaluation and development.

To generate more observational data, multiple-scale atmospheric tracer experiments should use non-hazardous, climate-neutral substances and a realistic release term with varying source strengths. Modellers could estimate emissions in real time using a limited set of observations without knowing the actual release rates, and later improve their models and data-reconstruction methods on the basis of the real source terms and measurements.

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