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The university of the future

The traditional model of the US research university — based on the pre-eminence of the single-discipline department — needs to be stretched and challenged.

The American research university is a remarkable institution, long a source of admiration and wonder. The idyllic, wooded campuses, the diversity and energy of the student populations, and, most of all, the sheer volume of public and private resources available to run them, have made them the envy of the world.

Seen from the inside, however, everything is not quite so rosy. Setting aside the habitual complexity of medical schools, which have separate healthcare and finance issues, the structure of these institutions is straightforward and consistent. The bedrock of each university is a system of discipline-specific departments. The strength of these departments determines the success and prestige of the institution as a whole.

This structure raises a few obvious questions. One is the relevance of the department-based structure to the way scientific research is done. Many argue that in a host of areas — ranging from computational biology and materials science to pharmacology and climate science — much of the most important research is now interdisciplinary in nature. And there is a sense that, notwithstanding years of efforts to adapt to this change by encouraging interdisciplinary collaboration, the department-based structure of the university is essentially at odds with such collaboration.

A second set of issues surrounds the almost static nature of the departmental system. In a country where most things are highly fluid, the fields covered by departments, as well as the pecking order between them, have remained largely unchanged for many years. As people and money have flowed, particularly over the past twenty years, to the south and the southwest, the strongest US universities and departments remain embedded in the northeast and in California. League tables drawn up by the National Academy of Sciences and others show little movement in this pecking order, even over several decades.

Another, perhaps more contentious, issue concerns the relevance of the modern research university to the community it serves. The established model, whatever else its strengths and weaknesses, reflects the desire of the middle classes for undergraduate training that prepares their offspring for a stable career. But how does it serve a society in which people may have to retrain and recreate their careers throughout their adult lives?

These questions are being asked throughout American academia, but nowhere more searchingly than at Arizona State University (ASU), a huge public university that is expanding to meet the needs of the United States' fastest-growing major city (see page 968). Michael Crow, its president, is executing an ambitious plan to replace the traditional model with one in which both influence and research excellence are concentrated not in departments, but in large, broadly based interdisciplinary centres with clear commercial or societal goals.

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Whatever its outcome, this experiment will not of itself uproot the traditional university system. Incremental change, notably the establishment of stronger multidisciplinary entities such as Bio-X at Stanford University in California, and several new centres at Harvard, may have a greater bearing on the overall development of the system.

But ASU's effort already tells us plenty about the likely direction of the research university in the up-and-coming regions of America. The university of the future will be inclusive of broad swaths of the population, actively engaged in issues that concern them, relatively open to commercial influence, and fundamentally interdisciplinary in its approach to both teaching and research. ■

Taking the first step

China will join efforts to cut carbon emissions, but should not be expected to lead them.

With a new coal-fired plant coming online about once a week, China is on course to overtake the United States as the world's leading carbon dioxide emitter this year or next, an official at the International Energy Agency said last week (see page 954).

This means, of course, that unless China and other major nations such as India and Brazil join a global effort to mitigate the effects of climate change, tough targets and sophisticated carbon markets across the developed world will eventually pale into insignificance. But the onus is still on the developed nations, who created the problem, to lead that effort.

China is now working on a national plan that will lay out the measures it intends to take to deal with climate change. Despite all the new power stations and the usual difficulty in discerning China's real intentions, there is one good reason to accept that its efforts are sincere: it is in China's self-interest to confront the problem. Assessments by both China and the Intergovernmental Panel on Climate Change have made clear that the nation is likely to be hit hard by climate change, which will increase pressure on water supplies and cut agricultural yields.

In the United States, momentum for domestic action on carbon emissions is growing. As it does so, the issue of how to ensure that China and other developing countries are on board — the issue that prevented the US Senate from ratifying the Kyoto Protocol in the

first place — has resurfaced. Again, those who favour doing nothing are citing possible inaction in developing countries as an excuse for their own refusal to exercise leadership on the issue.

As before, attempts to force China and India into accepting caps on their carbon emissions by refusing to take action without them are doomed to fail. Developing countries have not played a significant role in raising levels of greenhouse gases in the atmosphere in the past, and their per-capita emissions remain far lower than those of the wealthier nations.

Practical considerations, as well as moral ones, preclude the rapid introduction of emissions caps and associated carbon-trading schemes in developing countries. Cap-and-trade schemes are only going to be effective in reasonably advanced economies, where accurate monitoring and reporting of emissions is feasible.

One starting point may be to push developing countries to sign up to more realistic goals than a blanket emissions cap, which as well as addressing the problem of climate change will also deliver associated benefits of high national priority. For example, building-efficiency standards can simultaneously tackle problems of energy security, materials shortages and air pollution in China. Bilateral agreements between rich and poor nations to share clean-energy technologies could help to ensure that these goals are met.

The Chinese government has taken some tentative steps towards managing its energy consumption. It has pledged, for example, to cut its energy intensity — the amount of energy used per unit of economic growth — by 20% between 2005 and 2010 (it isn't, so far, on course to meet this target). It has also put some fairly stringent vehicle-efficiency standards in place. Consistent pressure to step up efforts to meet such commitments could add up to significant reductions in emissions.

Carefully designed incentive mechanisms that encourage developing countries to engage in a global carbon market could also play a role. The Kyoto Protocol established the Clean Development Mechanism (CDM) in 2003. This allows industrialized nations to reduce the costs of complying with Kyoto, essentially by paying individuals in developing countries to adopt lower-polluting technologies than they otherwise would.

Currently, the CDM is rather limited in scope. However, as interest in a global carbon market grows, mechanisms of this type hold out some promise for delivering real global emissions reductions. The major developing nations are increasingly dependent on global economic integration and cannot afford to become outliers in any new global energy strategy that emerges.

In the short term, the best thing that wealthy countries can do to motivate action in the developing world is to take action themselves. Congress should note that a demonstration of good faith will be needed before the United States regains the credibility to engage seriously with countries such as China on this issue. ■

Conflicted contractors

Government agencies should act to ensure the neutrality of research contractors.

Private contractors play a discreet but increasingly important role in the research operations of government agencies. These companies are generously paid to do everything from surveying endangered species to collecting and reviewing toxicology studies of potentially dangerous chemicals. The information is then used by research agencies or regulators to make critical decisions on public health or the environment.

The relationship can be mutually beneficial: the contractors make money, and the agencies can meet their research needs without assembling a large army of government employees. But many contractors also have private clients — and these are sometimes the same companies that their public-sector clients are trying to regulate.

On page 958 of this issue, we report on an example of the problems this can create. Last year, the US National Institute of Environmental Health Sciences (NIEHS) hired a private firm, Sciences International of Alexandria, Virginia, to help it review a chemical called bisphenol A, which may affect the endocrine system. The contractor, it turns out, also had private clients that produced bisphenol A. Environmentalists cried foul, and the NIEHS has been forced to withdraw the contract. This week, it announced that it would re-review all 20 chemicals that Sciences International had examined.

Under the original contract, a panel of external scientists was due to have the final word on the chemical's safety — and there is no evidence that the contractor was trying to manipulate them. But the potential for a conflict of interest still seems to exist. In this case, although the NIEHS required individual scientists on its advisory panel to sign statements about possible conflicts, it didn't place the same requirement on the contractor.

The NIEHS is hardly alone in this. Individual researchers are often screened quite rigorously for potential conflicts before they participate in government reviews, but contractors are rarely asked to disclose possible conflicts. Many agencies have standard warnings about conflicts in their contracts, but few have comprehensive rules about how companies should segregate their public and private work. There is also little active oversight of declarations that the contractors make, or fail to make.

In the United States, as elsewhere, reliance on contractors has been steadily rising. The time has come for agencies to re-examine how they use contractors, and how they screen for potential conflicts. Agencies should create explicit conflict-of-interest guidelines similar to those already in place for individual scientists. Contractors should be required to divulge potential problems and should be given explicit instructions on how to segregate government and private clients. Agencies should also conduct periodic audits to ensure that contractors are delivering high-quality information.

The vast majority of contractors are honest brokers, and many employ former government officials who are fully aware of what their public-sector clients need and expect. But the system seems to be open to abuse. By taking the right steps now, regulatory agencies can prevent wasteful episodes such as the one at the NIEHS. More importantly, they can ensure that they are receiving the data they need to perform their missions. ■