

The paradox of Pakistan

How to avoid the mistakes of the past.

Next year will be the 50th anniversary of Pakistan's first fully fledged military coup. In 1958, it fell to General Mohammad Ayub Khan to "save the nation" from what he called "discredited politicians", and later to offer himself up for election to consolidate his power. Today's general is a different one, but the justification for continued martial law sounds depressingly familiar.

Such governance may be undemocratic, but both science and education tend to receive more investment when the generals — backed by generous aid from the United States — are in power than when an elected party is in control. It is no accident that many of the country's scientifically most productive institutions were established during the US-backed army rule of General Ayub Khan, again under Zia ul-Haq's rule in the 1980s and now under Pervez Musharraf.

Elected governments led by both Benazir Bhutto and Nawaz Sharif placed science among their lowest priorities. That reflected mistaken thinking that science is an unnecessary luxury in so poor a country, as well as the tendency of these rulers to fill science and education posts with friends in need of patronage. But it is widely accepted that science should have an important role in countries such as Pakistan, helping to develop a skilled population, build robust institutions and assist rational policy-making.

Washington's relationship with Pakistan has been dictated mostly by US priorities in foreign policy. Today, Musharraf is favoured because of his opposition to the Taliban and al-Qaeda. Back in the 1980s, Pakistan under military rule was rewarded by the Reagan administration for taking a frontline role in the war against the Soviet-backed takeover of Afghanistan.

Although Pakistan has pressed ahead with its nuclear-weapons programme, the country's administrations have proved reluctant to spend much of their own money on non-military research, relying instead on US largesse. But this creates problems, as one former minister of agriculture puts it: "When the Americans need us, they shower us with riches. We spend like there is no tomorrow. When they leave, we are unable to maintain our new scientific palaces, and our institutions begin to crumble."

And so, with yet another US-backed Pakistani military ruler in trouble, will history repeat itself? General Musharraf has shown that he is a ruthless military dictator. In the past four weeks, he has shut

down the country's independent media, locked up thousands of his political opponents and sacked an increasingly independent-minded judiciary.

But there is another side to the eight years of his rule. In that time, some 2,000 students have been sent abroad for PhD training; there has been a 60-fold increase in the science budget. Pakistan has 12 million Internet users, and mobile phones are in the hands of 65 million people. And a large university building programme is under way. Some of this is down to Atatur-Rahman, Musharraf's right-hand man and head of the country's Higher Education Commission.

Yet, if the past is to be our guide, then entities that will see their budgets cut after elections on 8 January could include the university expansion scheme and the science ministry. The money set aside for maintaining information, computer and telecommunications infrastructure might also be redeployed. An innovative scheme to invite foreign faculty members to Pakistan might be in trouble. And some of the students sent abroad for PhDs will be reluctant to return home if the research environment reverts to what it used to be.

There are, of course, many important differences between today's Pakistan and the military dictatorships of old: for the moment, General Musharraf, who was expected to step down as head of the army this week, may remain a player in any future political scenario. If this happens, Rahman is likely to stay in his job and continue with the reforms. And Musharraf has appointed the highly regarded Shams Kassim Lakha, former president of the Aga Khan University in Karachi, to head the Ministry of Science and Technology.

But Musharraf's survival in any position of power is by no means assured. There is talk of his removal by the army in a counter-coup. There have also been several attempts on his life. None of his military-president predecessors had any lasting democratic role.

The bottom line is that both Pakistan's incoming rulers and their foreign supporters want a stable and secure Pakistan. Many of the existing reforms to science and higher education are crucial to both these aims. If these reforms were allowed to stagnate or die, no one's interests will be served, least of all those of Pakistan. ■

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An inconvenient truth

Research on human embryonic stem cells must go on.

The top item on prime-time television news in Germany on 21 November featured a statement from research minister Annette Schavan. She was responding to the publication of two studies in which scientists had reprogrammed mature adult human

cells to behave in a similar way to embryonic stem cells. The findings, she said, vindicated her preference for adult stem-cell research and reprogramming over work on human embryonic stem cells. After all, who needs embryonic cells if it is possible to flick a switch in skin cells to make them a source of virtually any type of cell for perfectly matched tissue replacement?

In the studies in question, researchers at two laboratories reprogrammed mature skin cells, giving them the characteristics of human embryonic stem cells so that they could be coaxed to differentiate

into other cell types, such as neurons or heart cells (K. Takahashi *et al.* *Cell* doi:10.1016/j.cell.2007.11.019; 2007 and J. Yu *et al.* *Science* doi:10.1126/science.1151526; 2007).

Around the world, opponents of human embryonic stem-cell research such as Schavan have leapt on these results to justify their support of tight controls on the work. But this is exactly the wrong time to constrain research on human embryonic stem cells, which for one thing will be required to help scientists work out how best to coax adult cells into becoming new tissues. Both labs say that they could not have made their breakthrough without the work that has been done on embryonic stem cells.

Stem-cell scientists have acclaimed the latest results, while acknowledging that they represent only a first step, and that many issues need to be resolved before there is any chance of applications in the clinic. James Thomson of the University of Wisconsin-Madison, one of the scientists who first isolated human embryonic stem cells and co-author on one of the recent studies, chose this moment to expand publicly on his qualms about using human embryonic stem cells. And Ian Wilmut of the University of Edinburgh, UK, whose team created Dolly the sheep, the first cloned mammal, says that he is abandoning plans to work on human embryonic stem cells.

Many stem-cell scientists share this general unease, both because of the dilemma of working with embryos and because women must

donate eggs for the process, in a highly invasive procedure. But they have nonetheless gone ahead with such work because they see it as scientifically necessary if clinical benefits are to be derived any time soon from our growing understanding of cellular differentiation.

These scientists are not oblivious to the ethical issues and they are not merely indulging personal fascination. They have not denied the importance of doing research on adult stem-cells and reprogramming in parallel. It would be a relief for them if all the scientific problems had been solved in the papers published last week — abandoning work on human embryonic stem cells would allow them to operate with a clear conscience and without having to defend their work all the time.

From the researchers' viewpoint, the debate surrounding human embryonic stem-cell research has some parallels with that on animal research. Many would be delighted to abandon the bureaucracy, cost and general inconvenience of doing contentious work. Where genuine alternatives are available, researchers will grasp them. Just as soon as there is no scientific need to work on embryonic stem cells, researchers will design their experiments to use much easier material. But that moment has not yet arrived. ■

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The big picture

Europe needs to find a way to prioritize and build large scientific facilities.

European nations remain unable to agree on a general mechanism for the prioritization and construction of scientific facilities that are large enough to require continent-wide collaboration. One such case is the current stalemate over a proposed neutron-science facility, the European Spallation Source (ESS).

Although X-rays from synchrotrons can be used to probe structures, neutrons are particularly sensitive to light atoms and so can provide a fuller picture of important crystals and molecules. According to some estimates, Europe is home to roughly two-thirds of the world's 6,000 neutron scientists. But they lack a state-of-the-art neutron source on a par with the Spallation Neutron Source currently being commissioned at the Oak Ridge National Laboratory in Tennessee.

Germany decided back in 2002 that it would not provide the funds necessary to host the facility. Now Sweden says that it would like to host it, and a joint bid by Spain and Hungary would use European Union (EU) infrastructure funding to finance a site in one of the two countries. But in the absence of an effective framework to share the construction and operating costs for such a facility between the nations that would use it, construction is unlikely to begin any time soon.

The larger European nations have effective systems of their own for selecting and building research facilities. In Britain, for example, the scientific research councils cooperate to create a facilities road

map. But since the European Commission developed its own research policy, supplanting the patchwork of discipline-specific research collaborations that had developed between European nations, there has been no effective mechanism for the construction of larger facilities to serve the whole continent.

The seventh Framework Programme for funding research, for example, which runs until 2013, makes no provision for the construction of facilities. The European Strategy Forum on Research Infrastructures, an ad hoc group of senior research administrators from constituent countries, has already agreed on a list of European facilities, including the ESS, that scientists want to see built. But there is currently scant prospect of this list being converted into an actual construction schedule. That's mainly because EU member states — especially major ones such as Britain and Germany — are reluctant to release any of their existing national resources into a Europe-wide facilities pot.

The research ministers of the larger member states (backed by their own senior research administrators — and by many senior researchers in their own countries) are loathe to endorse a wishlist whose very existence might result in money that is currently spent on national grants and facilities being siphoned off to pay for major facilities in far-off lands.

This reluctance is perfectly understandable — but it has to be overcome if Europe is going to build large, general-purpose research facilities, such as the ESS. Another committee — the European Research Area Board — is currently being established, and should be well-positioned to prioritize the construction of such facilities and then to promote these priorities. But perhaps what is needed most is a more constructive attitude towards such collaborations from the larger EU member states. ■