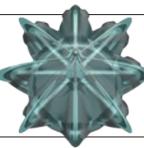


THIS WEEK

EDITORIALS

EDUCATION The changing needs of science pupils and teachers p.256

WORLD VIEW Indonesian research shows danger of national pride p.257



ALL SET Ancient comb jellies had rigid spokes and skeleton p.258

Unholy alliance

An independent report on the American Psychological Association reveals the extent to which some psychologists colluded with US military and intelligence agencies to allow torture of prisoners.

In 1917, when the field of psychology was young and struggling to gain acceptance in science, the American Psychological Association (APA) needed a friend. Like many at the time, it decided to assist the war effort by working with the US military. The collaboration was largely benign: efforts to assess which recruits were fit to be soldiers led to the first formal study of variation in human intelligence. Later, psychologists studied the effects of war on soldiers returning home, fuelling the case for making the First World War “the war to end all wars”.

That was not to be, but psychology, and the APA in particular, continued its close bond with military and intelligence agencies. The relationship is not inherently problematic: indeed, the US Department of Defense (DOD) spends tens of millions of dollars each year on research into post-traumatic stress disorder and other psychological and psychiatric complications of war. The DOD, which employs around 700 psychologists, was a key ally in psychologists obtaining the authority to write prescriptions in the 1980s. And the APA has at times taken a stand against DOD policies: as early as 1991, the organization protested against the Pentagon’s policy of stopping openly gay people from serving in the military by banning DOD advertisements in APA publications.

Nevertheless, the tone of the alliance between US agencies and psychologists has darkened over the past century. Most famous is the Central Intelligence Agency’s (CIA) mind-control programme MKUltra during the cold-war era, in which psychologists helped the CIA to develop and test interrogation techniques involving the use of hallucinogenic drugs and hypnosis.

Given this history, it should be no surprise that the APA has continued to cultivate a close relationship with the agencies. Last week, a long-awaited external report confirmed suspicions of the APA’s involvement in the torture of detainees following the terrorist attacks of 11 September 2001 and the ensuing ‘war on terror’ (see go.nature.com/4vpdob). Starting in 2005, the report found, APA officials worked with the DOD to keep the organization’s ethics guidelines loose enough to justify the participation of psychologists in the DOD’s ‘enhanced interrogation’ programme. As a result, the DOD and CIA could easily brush aside the ethical concerns of their own psychologists: the APA had given the programme its imprimatur.

The story is rife with conflicts of interest: according to the report, six of the nine voting psychologists on the APA task force that wrote the guidelines had consulting relationships with the DOD or CIA, and one former APA president owned a financial stake in the consulting company that oversaw the CIA interrogation programme. As criticism surfaced, the APA defended itself by formally condemning torture while doing nothing to stop its members from participating. Meanwhile, Guantanamo Bay’s chief military psychologist told an APA meeting: “If we removed psychologists from these facilities, people are going to die.” It is an assertion that does more to reveal the disgraceful state of the programme than to offer a moral defence.

Not only did APA psychologists deem the torture programme

ethical, but they also gave it a patina of legitimacy by trying to cast it as research. The “studies” — which violate every consent rule for human subjects, including the CIA’s own — involved questions about the acceptable limits of human suffering and how well various techniques could yield useful information from a prisoner. There is no evidence that the United States gained any useful information in this way.

The scientific basis for the interrogation programme was questionable from the start. The theory of ‘learned helplessness’ was developed to test psychiatric drugs by measuring how long mice will try to swim in a bucket of water — depressed animals will give up sooner and allow themselves to be rescued. The psychologists who developed the CIA’s interrogation techniques reversed this idea, theorizing that simulating the experience of drowning, or waterboarding, could induce despair in human detainees until they gave up their story.

The APA has apologized for its failings and has indicated that it will revise its policies to prohibit psychologists from participating in military interrogations. It has also parted company with its ethics director, who the report named as leading the collusion with the military. More heads are likely to roll, and some psychologists could even face prosecution.

The American Psychiatric Association and the American Medical Association forbade their members in 2006 from participating in the interrogation programmes. This is in keeping with the Geneva Convention, an international agreement signed in 1929 and revised nearly 70 years ago to do away with torture and abusive experimentation on prisoners of war. The APA deserves all the criticism it receives and more, for its willingness to forswear global consensus in the interest of making a deal with the devil. ■

Austerity bites

If the UK government is serious about science, now is the time to prove it.

Guess the year. With a major international ‘make or break’ climate summit scheduled to take place in a European capital, campaigners protest against plans to build a third runway at London’s Heathrow airport. Greece faces a debt crisis, prompting political upheaval across the continent and fears for the future of the euro currency. Serena Williams and Roger Federer play in their respective finals of the Wimbledon tennis championships in London.

Plus ça change. That was — in fact — 2009, but it describes 2015

equally well. And the two years have something else in common: political investment in science sits at a crossroads.

On 9 July, a group of scientists set up to advise the United Nations secretary-general Ban Ki-moon startled many researchers with a bold assertion: nations should invest up to 3.5% of their gross domestic product (GDP) in science.

Cue snorts of derision. Although a tiny group of nations invests around this much — Sweden and Israel among them — most fall well below this threshold. According to the latest figures from the Organisation for Economic Co-operation and Development, the United States invests 2.7%, and China 2%. The European Union average comes in at just under 2%.

Even the UN science advisory board admits that a target of 1% is perceived as high by many governments. It does, however, say that 3.5% of GDP is necessary to put the world on a sustainable development course. If this target seems rather arbitrary, it is because it probably is. But this crude measure of support for science can still be a useful metric.

Take the case of the United Kingdom. Combined private and public spending on UK science is around 1.6% of GDP. Earlier this year, the heads of various learned societies called for politicians to increase this figure to 3%, but the plea raised little more than eyebrows.

An ambition to boost government spending on science might have received a more welcome response in 2009 — but since then austerity has dominated in the United Kingdom. The Conservative–Liberal Democrat coalition government that came to power in 2010 did fulfil its promise to protect the core UK science budget from cuts, but inflation has whittled away the amount that is available for research.

Following last week's UK budget statement, there are signs that austerity measures are being relaxed — for some at least. In the first fiscal plan produced by a majority Conservative government for nearly two decades, Chancellor of the Exchequer George Osborne announced some cuts — to welfare benefits and national broadcaster the BBC, for example — but he also unveiled significant

belt-loosening measures, including tax cuts for the middle classes.

Exactly what this means for science is not yet clear. The Conservatives say that they will cut about £17 billion (US\$26 billion) from government departments. Some of these axe blows may fall on research spending.

But the party has been vocal in its support for some scientific projects. They have championed the (nebulous) term ‘innovation’ as key to improve the Britain’s woeful workplace productivity. And cash has flowed, up to a point, to huge projects such as the Francis Crick Institute for biomedical research in London and the National Graphene Institute in Manchester.

Still, of Britain’s 1.6% of GDP spent on science, the public spend makes up just 0.44%.

Compare that with Germany, where the government contributes 0.85% of GDP out of an overall spend on science of 2.9% of GDP. And the US government spends 0.76% of GDP out of an overall investment in science of 2.7% of GDP.

If Osborne is serious about science, now is the time to prove it. At a parliamentary gathering last month, at which politicians rubbed shoulders with researchers, the subject of science funding was on the lips of many. A reference to the percentage of GDP spent on science has become de rigueur in such conversations, often with an addendum that the United Kingdom ‘punches above its weight’ in achieving what it does with its limited means. This attitude has almost become part of the political identity of UK science: ‘we do so well with so little — why not give us more money and let us show you what we can really do?’

It has a point — if there is money to cut taxes, there should be money to support the work that can drive economies.

There are, of course, many claims on public financing, and scientists must be prepared to fight for their share alongside hospital administrators, road builders and arts funders. But if the UK government wishes to continue to wear the mantle of a science supporter, pushing towards 3.5% would be a step in the right direction. ■

An education

A special issue looks at how science is taught — and why a change in methods is essential.

One of the subjects that people love to argue about, following closely behind the ‘correct’ way to raise children, is the best way to teach them. For many, personal experience and centuries of tradition make the answer self-evident: teachers and textbooks should lay out the content to be learned, students should study and drill until they have mastered that content, and tests should be given at strategic intervals to discover how well the students have done.

And yet, decades of research into the science of learning has shown that none of these techniques is particularly effective. In university-level science courses, for example, students can indeed get good marks by passively listening to their professor’s lectures and then cramming for the exams. But the resulting knowledge tends to fade very quickly, and may do nothing to displace misconceptions that students brought with them.

Consider the common (and wrong) idea that Earth is cold in the winter because it is further from the Sun. The standard, lecture-based approach amounts to hoping that this idea can be displaced simply

by getting students to memorize the correct answer, which is that seasons result from the tilt of Earth’s axis

of rotation. Yet hundreds of empirical studies have shown that students will understand and retain such facts much better when they actively grapple with challenges to their ideas — say, by asking them to explain why the northern and southern hemispheres experience opposing seasons at the same time. Even if they initially come up with a wrong answer, to get there they will have had to think through what factors are important. So when they finally do hear the correct explanation, they have already built a mental scaffold that will give the answer meaning.

In this issue, prepared in collaboration with *Scientific American*, *Nature* is taking a close look at the many ways in which educators around the world are trying to implement such ‘active learning’ methods (see page 271). The potential pay-off is large — whether it is measured by the increased number of promising students who finish their degrees in science, technology, engineering and mathematics (STEM) disciplines instead of being driven out by the sheer boredom of rote memorization, or by the non-STEM students who get first-hand experience in enquiry, experimentation and reasoning on the basis of evidence.

Implementing such changes will not be easy — and many academics may question whether they are even necessary. Lecture-based education has been successful for hundreds of years, after all, and — almost by definition — today’s university instructors are the people who thrived on it.

But change is essential. The standard system also threw away far too many students who did not thrive. In an era when more of us now work with our heads, rather than our hands, the world can no longer afford to support poor learning systems that allow too few people to achieve their goals. ■



THE 21ST CENTURY SCIENTIST
A *Nature* and *Scientific American*
special issue nature.com/stem