THIS WEEK

EDITORIALS

Too close for comfort?

Relationships between industry and researchers can be hard to define, but universities and other institutions must do more to scrutinize the work of their scientists for conflicts of interest.

What sort of industry connections could buy influence over a scientist's research results? Research grants as small as US$5,000? Money to support outreach that bolsters the industry's image? Equity in a spin-off company founded by the scientist? Defining what constitutes a conflict of interest — much less regulating it — continues to vex funding agencies, journals and institutions. Last month, for instance, *Nature* revealed that an activist organization had filed freedom-of-information requests to see the e-mails of researchers who work on genetically modified crops (see *Nature* **524,** 145–146; 2015). Among other findings, their haul revealed that plant scientist Kevin Folta at the University of Florida in Gainesville had accepted a no-strings-attached $25,000 grant from the agriculture giant Monsanto to fund travel for a communications training programme about biotechnology, as well as other travel reimbursements from the biotech industry. In his defence, Folta argued that he had complied with the disclosure rules set out by the University of Florida. There is no evidence of any wrongdoing or that his research was compromised.

Solar physicist Willie Soon, a climate-change sceptic at the Harvard-Smithsonian Center for Astrophysics in Massachusetts, also seems to have been operating within institutional policy when advocacy groups revealed in February that he had accepted more than $1 million from the energy industry, among other funders. (However, his failure to disclose those relationships might have violated the policies of some journals in which he published; see *Nature* http://doi.org/2jx (2015).)

In trying to navigate such complexities, the US National Institutes of Health (NIH) has been ahead of the curve — presumably because of long-standing concerns about physicians' industry relationships and the high stakes for protecting patients. Its parent agency, the Department of Health and Human Services (HHS), was the first to establish conflict-of-interest disclosure rules in 1995 and is still beyond many of its counterparts in maintaining unified regulations that include yearly reports to the government. By contrast, as one example, the US National Science Foundation's grants policy suggests that institutions look to scientific societies for ideas on how to manage a conflict of interest, and to report back to the foundation only if institutions cannot handle it themselves.

But even the HHS rules were not enough to guarantee full transparency. In 2009, a congressional report and subsequent media coverage found that some NIH-funded researchers had quietly accepted millions of dollars from industry. Again, the blame kept shifting: the universities said that the researchers had not reported the conflicts, the NIH received only bare-bones reports from institutions, and the researchers said that they did not know they were breaking any rules.

The HHS updated its policies in 2011, but pleased no one. The government underestimated the time and money that institutions would spend implementing new rules. And some aspects of the reforms have proved to be window dressing: a *Nature* investigation this week reveals that these reforms have uncovered few conflicts of interest that would have escaped the original regulations (see page 300).

The reforms may not be perfect, but they address real issues and others should take note. They make it clear that institutions are accountable, that they must educate their researchers on financial disclosure and that they should evaluate whether an industry relationship is problematic. The reforms also enlist a second pair of eyes by requiring institutions to report details of the conflict and its management to the NIH. Perhaps most importantly, the reforms remove the excuse of plausible deniability by clearly stating the kinds of financial relationship that could be considered conflicts.

"The reforms may not be perfect, but others should take note."

One thing has become clear: conflicts are slippery to define, so it is important for as many funders, institutions and journals to make as many demands as necessary. Had Kevin Folta been funded by the NIH, the HHS guidelines would have required him to report the Monsanto money. And if Willie Soon had had an NIH grant, his institution would have designed a 'management plan' that could have required his industry relationships to be stated in publications and lectures.

The HHS rules could backfire. Institutions do not want the publicity and work that accompany an identified conflict. Because they hold the power to decide whether a relationship presents a conflict, they could theoretically give their researchers a pass. *Nature*'s investigation suggests that institutions use vastly different standards to evaluate such relationships, meaning that the rule is unevenly applied. And the current system makes it difficult for the public to access the conflict reports.

Still, the HHS should be commended for at least attempting to address the problem, even if it was forced into doing so. Other funders and institutions could do worse than to learn from its successes and mistakes if they define and strengthen their own policies. ■

Mind meld

Interdisciplinary science must break down barriers between fields to build common ground.

In Castlegar, Canada, there is a golf shop that also offers vacuum-cleaner repairs, and in the Czech Republic town of Kostelec nad Orlicí, a business will sell you both wine and underwear. Such odd couplings are humorous because of their curiously limited scope. There is nothing funny, after all, about a megastore that repairs equipment and sells golf

clubs, wine, underwear and everything else under the Sun.

The binary combinations also lead us to assume something about the shop's owners. Faced with a specific set of circumstances, these businesses redefine what we expect from a shop and offer something distinct.

There are greater problems in the world than what to do with your vacuum cleaner while you decide what make of balls to buy, but the principle is worth remembering as you browse this week's special issue of *Nature*, which we dedicate to interdisciplinary science.

Most scientists are aware of the term, and many will have used it. But how many are truly engaged in it? Done correctly, it is not mere multidisciplinary work — a collection of people tackling a problem using their specific skills — but a synthesis of different approaches into something unique. It is the wine and underwear shop, not the hypermarket.

The best interdisciplinary science comes from the realization that there are pressing questions or problems that cannot be adequately addressed by people from just one discipline. Witness the gathering of the scientific tribes — and the merging of approaches — for the Manhattan Project to work on the atomic bomb. More recently, *Nature* has reported on 'implementation science', which combines medical expertise with local knowledge on how best to carry out programmes to improve public health (see *Nature* **523,** 516–518; 2015).

An interdisciplinary approach should drive people to ask questions and solve problems that have never come up before. But it can also address old problems, especially those that have proved unwilling to yield to conventional approaches.

Enough of the rhetoric, what about the reality? It is hard to deny that the scientific system — from funding streams and academic rewards to university departments and journals — does not encourage much overlap between disparate subjects. It is easy to set up a 'Centre for Interdisciplinary Research', but who will be prepared to join it? If governments, funders and universities want to encourage more basic researchers to leave their trenches, then they need to make the no-man's-land of interdisciplinarity a more welcoming place to build a career. The obstacles are many, as we discuss in the pages that follow.

Some groups have found ways to overcome these obstacles, and some high-quality interdisciplinary work is under way. What are the key lessons from these successes?

"True interdisciplinary science cannot be rushed."

Interdisciplinary science takes longer than conventional projects, and that makes it more expensive. Funders most accept and embrace this and hold their nerve if the pay-off from individual projects takes longer than expected.

True interdisciplinary science cannot be rushed, not least because the best course of investigation is rarely clear at the outset. Research questions must be assessed and decided with input from all involved. An interdisciplinary project cannot exist as one main subject that sucks in the majority of the resources and leaves the partners as orbiting satellites.

Communication is crucial. The varying use of language across disciplines might seem a superficial problem, but it is one that must be solved, or misunderstandings will undermine the foundations of the project. There must also be no hierarchy, or perceived hierarchy. All involved must be confident that colleagues from other disciplines use equal academic rigour and scientific standing, even if the methods used in rival fields seem alien. It takes time to see the value in other approaches. It takes an open mind to appreciate an appliance-mending golf shop. ■

Protection priority

All involved in animal research must ensure that rules for ethical experiments are observed.

More than a million people in Europe signed a petition earlier this year to halt research with animals. One reason why *Nature* and many scientists are able to defend these experiments is that all involved do everything they can to minimize pain and suffering. Animal experiments are approved only after thorough discussion and are carried out according to strict regulatory controls. Society sees the benefits of animal research, but it does not seek them at any cost.

When breaches of the strict rules that govern animal research occur, it is vital — to both supporters and opponents — that they are investigated thoroughly, and that lessons are learnt and shared. This week, *Nature* publishes a correction on its website that details such a breach of experimental protocol in a previously published paper (L. Raj *et al. Nature* http://dx.doi.org/10.1038/nature15370; 2015).

The relevant experiments grew tumours in mice as a way to test possible treatments. This type of study is common, as is the way they are approved and regulated. Researchers typically plan the experiments and then submit details to an institutional review board for approval. In making its decision, the board follows guidelines set out by a separate body charged with oversight of animal procedures — an institutional animal care and use committee. These guidelines are country-specific, and in the case of tumour experiments should include limits on the maximum tumour size allowed, and instructions to the researchers to monitor both tumour size and signs of distress.

In this case, prompted by a complaint from a reader and following consultation with the authors and the relevant bodies, *Nature* has established that the scientists did not carry out the required monitoring properly. As a result, some of the tumours grew larger than permitted. These mice could therefore have experienced more pain and suffering than originally allowed for.

As well as writing to correct their paper to mark the breach of animal-welfare guidelines, the authors apologize for the breach. They are right to do so. Cases such as this could provoke a justifiable backlash against animal research. All involved — scientists, institutions, funders and journals — must do more to ensure that regulations are strictly observed.

Nature's policy is that the corresponding author on a paper that reports experiments with animals must confirm that the research was carried out in accordance with the relevant rules (see go.nature.com/a9pjym). As a result of this case, we are increasing the amount of information we request from authors. In experiments in which tumours are grown, we now require authors to include the maximal tumour size permitted by the institutional animal-use committee, and to state that this was not exceeded. Authors must also provide the source data for any figures that analyse tumour growth.

Nature does not want to publish the results of experiments that have not been performed under ethical guidelines. As such, the authors in this case are correcting their paper to withdraw the portion of the data collected in experiments that the institutional committee concluded were in breach. The scientific conclusions of the paper remain valid and useful, and still stand.

Institutions should do more to make sure that the guidelines they set are respected. At the very least, on completion of each project — and before data are submitted — institutions should verify that approved protocols were followed. Funders and institutions must consider better training for young researchers doing work with animals. And the broader community should continue to scrutinize and improve how it carries out these types of experiment. Discussions are already under way, for example, on whether the control arms of similar cancer studies truly need to let (untreated) tumours grow as large as they currently do. *Nature* is happy to join these discussions and to help to improve practice. ■

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CORRECTION

The Editorial 'Too close for comfort?' (*Nature* **525,** 289; 2015) incorrectly stated: "In his defence, Folta argued that the money supported only travel and outreach, not research, and he was therefore under no obligation to disclose it". Folta did not say this. He said that he had complied with his university's disclosure rules.

CLARIFICATION

The Editorial 'Protection priority' (*Nature* **525,** 290; 2015) made reference to the fact that the mice in the experiments showed no visible sign of distress. That statement referred only to the animals for which the data were not withdrawn. The committee did not comment on whether or not the animals in the withdrawn experiments showed distress.