THIS WEEK

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A slow road for stem cells

The steady and careful development that has guided treatments using embryonic stem cells should be applied to therapies derived from adult stem cells, too.

Regulators in the United States last week sought an injunction to stop a Florida company selling a controversial adult-stem-cell treatment for age-related macular degeneration (AMD). The move comes after three women treated by the company in 2005 went blind. The firm, now called US Stem Cell, hailed the cells as a therapy for AMD, which causes vision to blur so much that people affected can no longer recognize faces.

In the same year, two other people with AMD received a different stem-cell treatment at a London hospital. Those patients had patches made from embryonic stem cells implanted into their retinas. The scientists behind that therapy reported on the patients' progress earlier this year: their eyesight had improved beyond expectations (L. da Cruz *et al. Nature Biotechnol.* **36**, 328–337; 2018).

The conflicting outcomes highlight a difference between many treatments that use adult stem cells and those based on embryonic stem (ES) cells. ES-cell therapies emerged from a slowly built body of knowledge on how cells should be created and implanted, whereas adult-stem-cell treatments have too often been propelled by empty promises rather than by evidence.

Research with human ES cells has been slow because it was forced to be. Since scientists first created the cells 20 years ago, they have faced restrictions on funding and a need to pass through extra review committees, because of the sensitive nature of research based on donated human embryos. The path was difficult to navigate and full of setbacks, but something good came out of it.

Those who dared to proceed were few, but they were committed. Working under intense scrutiny, they progressed steadily, even if the work was too sluggish for some. Enter adult stem cells. Scientists, clinics and companies lined up to capitalize on the opportunity; many compared the 'unethical' nature of human ES cells with the ethical choice of adult stem cells. Some advertised, without evidence, how they were harnessing the body's own power of rejuvenation. Some even kept a score card of adult-cell therapies marketed, versus zero for those from ES cells.

Adult stem cells can certainly be valuable. Bone-marrow transplants are a stem-cell therapy, and a tremendously successful one. Transplant of limbal stem cells found in the eye has fixed the corneas of hundreds of people. And last November, physicians in Italy reported using another kind of adult stem cell — epidermal — to save a German boy with a usually fatal skin disease (T. Hirsch *et al. Nature* **551**, 327–332; 2017).

But in too many other cases, progress has been crippled by a lack of any proof of efficacy — in particular, when it comes to therapies based on mesenchymal stem cells taken from a person. Too many companies seeking a quick profit have exploited lax regulatory frameworks — in the United States and elsewhere — and the needs of desperate people facing sometimes terminal illnesses. Patient need has been presented as an excuse to forgo clinical trials. Careful bench experiments that were needed to reveal how the therapies might work have not been done.

The situation could get worse. An article last week argued that crowdfunding campaigns to drum up money for treatments accelerate the dissemination of inaccurate information (J. Snyder *et al. J. Am. Med. Assoc.* **319**, 1935–1936; 2018).

Contrast that with solid scientific work that has shown, for example, how to use ES cells to derive retinal cells, pancreatic cells and dopamine-producing cells. Techniques based on years of rigorous work to characterize and develop ways of delivering these cells are now in or nearing clinical trials.

"Adult-stem-cell treatments have too often been propelled by empty promises."

Other positive examples are described in a special *Nature* Insight supplement this week (see page 321), which catalogues the growing knowledge base from experiments with ES cells that aim to treat diseases affecting the pancreas and brain. And it discusses innovative strategies, such as spurring ageing stem cells in the body to fight off disease.

Understandably, such progress can seem frustratingly slow to many patients. But speedy alternatives are more of a problem. Regulators have not been able to keep up. Last week's request for an injunction is being heralded as a turning point in the US Food and Drug Administration's (FDA's) crackdown on clinics offering unproven stem-cell therapies. But there are still hundreds more such operators in the United States alone.

Other new treatments already hitting the market, including immunotherapy and gene therapy, are also vulnerable to hype. If the FDA and other regulators are to have any chance of sifting the good from the bad, and so protecting some of the most vulnerable people, they need to pick up the pace. Meanwhile, scientists should remember the merits of doing the opposite. ■

Health check

Universities should ensure lab environments are supportive, productive and rigorous.

Directing academics has been compared to herding cats, animals that famously follow their own path and scorn instruction. So, while worrying, it's perhaps not surprising that two-thirds of lab heads who responded to a *Nature* survey this year said that they had received no training in mentoring or managing people. Yet two-thirds of these untrained senior scientists said they thought it would be useful.

They were right. Good-quality training is a key ingredient to building a successful research group. So, too, is the wider academic environment in which

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researchers work. If a department or institution does not encourage collaboration, celebrate success or value solid work over flashy promotion — as well as training — then group leaders will struggle to create a healthy research culture in their own laboratories.

How institutions can help lab groups to be productive, supportive and rigorous is an essential but often-overlooked topic. To try to change that, this week we have made it the focus of a special issue. This builds on discussions between *Nature* editors, senior academics and postdocs held throughout 2017, and on a day-long conference co-sponsored by *Nature* and the University of California, Berkeley, in October 2017.

Laboratory members should feel that they are an integral part of their institutions and departments, but this is not always the case. According to the survey, one-fifth of those scientists who didn't lead research groups had a negative view of the culture or working environment in their lab. And the barrage of sexual-harassment allegations at universities around the world is sad evidence of how often institutions fail to protect junior members of communities.

Institutional support is essential during the daily grind of scientific research, not just in times of crisis. In the survey — covered in a News Feature on page 294 — research-group leaders were asked about ways departments could support them. The most common answers pointed to resources for administrative tasks, support for mentoring and managing lab members, and more use of measures of scientific productivity beyond counts of high-profile papers.

Institutions need to support lab members as well as leaders. A Comment piece on page 299 argues that institutions should implement a 'culture of structure' to give graduate students clear expectations of their progress, and to ensure contact with multiple faculty members.

But each department and institution has different needs, so how can leaders work out what support to offer and make sure it is welcome? As another Comment piece on page 297 advocates, they can collect benchmarking data on lab culture (such as student–supervisor relationships) to identify areas for improvement. They can also hold cross-lab meetings and ask faculty for explicit feedback in annual reports.

Some institutions have already taken the step of hiring staff to support community-building and rigorous research, such as scientists who help lab groups to implement quality-control practices. On page 302, we highlight how one institute created a dedicated science sustainability officer.

Examples of such innovations to boost lab health can be hard to identify. *Nature* hopes to detail more as part of continued coverage — please send examples to nature@nature.com.

Others in the research enterprise also have a part to play. Funders must stress the obligation on those who receive money to support and protect trainees. Journals can set clear requirements on how work should be reported, for example, to make sure that all authors are properly credited.

"Academic institutions must start striving to improve the health of their labs."

But institutions are in the strongest position to improve lab health — and that can be a delicate process when introducing important reforms to independent-minded researchers. Mandated steps will not produce real improvements if academics are not persuaded of the case for them. As anyone forced to sit through generic online training programs can attest, it's too easy to follow the letter of such laws without buying into their spirit.

More than edicts, making change requires many small discussions between stakeholders to air problems, and to build consensus and understanding. It also requires sustained commitment.

But academic institutions must start measuring and striving to improve the health of their labs. It is in their own long-term interest to do so. A small survey of North American postdocs found that a pleasant lab environment correlated significantly with life satisfaction, whereas their number of publications did not (go.nature.com/2rfjz6v). Departments that gain a reputation for better cultures will attract better scientists, because they frequently value the quality of colleagues and interaction more than funds and laboratory space. And, ultimately, that leads to more of the advances and discoveries on which the world turns. We at *Nature* hope that this special issue helps to stimulate a race to the top. ■

Smelting point

Industrial partnership and new technology promise a greener way to make aluminium.

The world produced more than 63 million tonnes of aluminium last year, which went into everything from kitchen foil and cans to aircraft. The metal is lightweight, fully recyclable and surprisingly strong. And now, two leading aluminium companies say that it will soon be clean and green. But just like electric cars, making aluminium can ultimately be only as clean as its source of power.

On 10 May, the US manufacturer Alcoa joined with British–Australian firm Rio Tinto to announce a new joint venture, Elysis. Based in Montreal, Canada, it plans to roll out a low-carbon technology for smelting aluminium by 2024. The world will surely benefit if it does. Aluminium production accounts for 1% of global greenhouse-gas emissions each year — roughly equivalent to emissions from France in 2016. It's a two-step process: refine aluminium oxide powder from bauxite ore and then convert it to aluminium in smelters. The bulk of the industry's climate footprint is from the smelting process, which requires prodigious quantities of electricity. More than half of its total emissions come indirectly from the electricity production itself.

Here's the opportunity: nearly 20% of the emissions are from the production and degradation of the carbon anodes used to conduct electricity during smelting. And this is where the new process focuses.

Details are scant, but observers of the aluminium industry will not be surprised to hear that the Elysis technology focuses on a long-standing issue and involves a proprietary inert anode — probably a ceramic composite. Instead of releasing CO_2 and perfluorocarbons, it emits oxygen. This would completely eliminate the direct carbon emissions, but does require more electricity. If paired with alternative cathodes and new designs for the electrolytic cell, however, it would be possible to reduce electricity consumption.

Alcoa claims that, if fully implemented at all of the Canadian smelters, the technology would reduce emissions by an estimated 6.5 million tonnes each year. That all sounds good. But this isn't the first time that a major aluminium producer has talked up revolutionary smelting technology. Russian firm UC Rusal, for instance, has been seemingly on the cusp of developing inert anodes for several years. Alcoa's work goes back several decades and included a big push around 2000. The problem has long stymied academics and government researchers, too.

Industry deserves credit for continuing to invest in long-term research and development, and for not giving up on a difficult problem. But even if Elysis does succeed, aluminium production will still yield emissions from mining, aluminium oxide processing and transport. One thing industry can do is to ensure that companies and consumers recycle as much aluminium as possible, because it doesn't need to be smelted. But the biggest question is where producers get the electricity.

Companies have already begun locating aluminium smelters near hydroelectric facilities, which provide relatively cheap and reliable power. Alcoa has even moved some of its smelting operations from the United States to Iceland, which provides cheap geothermal electricity. In the end, Alcoa and Rio Tinto are like everybody else. They need a reliable source of low-carbon power to reduce their climate impact — and the cheaper the better. ■