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Science benefits from diversity

Improving the participation of under-represented groups is not just fairer — it could produce better research.

Lab groups, departments, universities and national funders should encourage participation in science from as many sectors of the population as possible. It's the right thing to do — both morally and to help build a sustainable future for research that truly represents society.

A more representative workforce is more likely to pursue questions and problems that go beyond the narrow slice of humanity that much of science (biomedical science in particular) is currently set up to serve. Widening the focus is essential if publicly funded research is to protect and preserve its mandate to work to improve society. For example, a high proportion of the research that comes out of the Western world uses tissue and blood from white individuals to screen drugs and therapies for a diverse population. Yet it is well known that people from different ethnic groups can have different susceptibility to some diseases.

Many people are working to improve diversity in science and the scientific workforce. Some have been trying hard for decades, but not all are succeeding. This week, *Nature* highlights examples of success from across the world. They are inspiring, and show what can — and must — be done.

To boost recruitment and participation in science among some under-represented groups is difficult. Statistics from the US National Science Foundation show that the representation of minority ethnic groups in the sciences would need to more than double to match the groups' overall share of the US population.

As we highlight in a Careers piece this week (page 149), there are steps that groups, departments and institutions can take to try to draw from a broader pool of talent. Some of these demand effort to reach out to under-represented communities, to encourage teenagers who might otherwise not consider science as an option. Even the wording of job advertisements can put people off — candidates from some backgrounds might be less likely to consider themselves 'outstanding' or 'excellent', and so might not even apply. Yet diversity efforts should not stop when people are through the door. To retain is as important as to recruit — mentoring and support is essential for all young scientists, and especially so for those who have been marginalized by academic culture.

Projects to boost participation are often the passion and work of a few dedicated individuals. More institutions and funders should seek, highlight and support both the actions and the individuals.

There are moral and ethical reasons for institutions to act. And there are other potential benefits, too. Firms are recognizing that diversity — and associated attitudes and behaviours — is a business issue. A report from consultancy firm McKinsey earlier this year was just the latest to set out the healthy relationship between a company's approach to inclusion and diversity and its bottom line. The report, *Delivering through Diversity*, reaffirms the positive link between a firm's financial performance and its diversity — which it defines in terms of the proportion of women and the ethnic and cultural composition of the leadership of large companies.

Could something similar be true in science? As we discuss in a News Feature this week (page 19), some studies suggest that a team with a good mix of perspectives is associated with increased productivity.

"The lack of diversity in science is everyone's problem."

Concerted action to effect change on recruitment and retention can and does make a difference (see T. Hodapp and E. Brown *Nature* **557**, 629–632; 2018). More effort across the board is overdue. The lack of diversity in science is everyone's problem. Everyone has a responsibility to look around them, to see the problem for what it is, and to act — not just to assume it is someone else's job to fix it. ■

Targeting cancer

Cancer treatments tailored to individual tumours must not be oversold.

Cancer specialist Leonard Saltz received a letter earlier this year from someone who had watched a television programme about the promise of 'precision oncology'. A patient had taken a few pills and seen his tumour disappear, the letter said. Could the same be done for his sick father?

Saltz, who works at Memorial Sloan Kettering Cancer Center in New York City, was distressed. "That's what people think precision oncology is," he says. "And, gosh, I wish that were so."

It's not unusual for the promise and perception of new cancer treatments to run ahead of the reality. And it's true that precision oncology is promising. The practice — which relies on finding weak spots in a particular tumour's genetic make-up that can be targeted by drugs — is growing, and new results feature strongly this week at the annual meeting of the American Society of Clinical Oncology in Chicago, Illinois — cancer medicine's biggest annual meeting. But talk of potential benefits must be tempered by clinical reality.

Over the past decade, advances in genomic sequencing and analysis have yielded a steady stream of information about the genetic mutations that can drive cancer. The studies have revealed that even cancers of the same type, such as breast tumours, can be very different genetically. From that has grown the hope that drugs can be tailored to a tumour's genetic anomalies, resulting in a treatment with, ideally, fewer side effects and greater efficacy than conventional therapies. A handful of such drugs are already on the market. One, Herceptin (trastuzumab), has already increased survival rates for women with particular types of breast cancer.

This model of precision oncology is now at a turning point, as some

of the long-anticipated changes to cancer care work their way from bench to bedside — ones that would allow precision oncology to be scaled up. In the past year, the US Food and Drug Administration has issued its first approval of a genetic test that can detect mutations in hundreds of cancer-associated genes. Also a first, the agency approved a drug for the treatment of any solid tumour bearing a particular genetic signature, regardless of what tissue the tumour originated in.

Health services around the world are talking up the role of DNA and genomics in a new era of personalized medicine. But the utility of increasingly expensive cancer tests and medications that will help only a minority of patients is also being fiercely debated. Some 30 or so cancer drugs have so far been linked to a specific genetic signature. Many people have benefited, but some will relapse later as their tumours become resistant to the therapy.

Against this backdrop, clinicians are left facing ill people and trying to work out what to do. Whose tumours should be sequenced, and when? How often should one patient's tumour be sequenced? What kind of sequencing should be done — 50 genes, 400 genes, a full genome? How should physicians interpret genetic variants and conflicting data?

And over it all hangs the painful question that health-care systems everywhere must grapple with: at what point does the potential for benefit outweigh the cost of sequencing and the treatment that follows?

Researchers can help to pave precision oncology's path to the clinic. More research on cancer genetics might reveal roles for as-yet-unexplained genetic variants. Such studies would also help researchers to unpick the effects of combinations of genetic variants, a consideration that is likely to become more important as clinicians sequence larger sets of a tumour's genes. Also useful is the growing emphasis in cancer research on testing targeted therapies in combination with one another, and together with drugs that provoke immune responses to cancer. From a clinical perspective, better and more-thorough screening should identify the people most likely to benefit.

"Clinicians are left facing ill patients and trying to work out what to do."

Precision oncology increases the range of treatment options — but so far for only a relatively small number of people. Yet clinicians say that media reports of miracle cures have painted a much rosier picture, fuelled by anecdotes about exceptional responders who experience dramatic, but highly unusual, responses to treatment. In the United States, the problem is compounded by advertisements — from pharmaceutical companies and treatment centres — aimed directly at people with cancer. Enthusiasm for the possibilities of precision oncology has led too many involved to present the option with too much optimism. By its very nature, each precision cancer drug is destined to help only a fraction of people. Everyone with cancer wants, understandably, to be in that fraction. Hope is important. But all parties need to be sensitive to how the promise of precision medicine is communicated to patients — and to their physicians. ■

Food chain

European advisers set out a path to a sustainable future for food production.

When Europe scrapped its chief scientific adviser role and instead installed a committee of experts in 2016, there were questions about how well the system would function. Very well indeed, is the answer — at least if a report released by the expert group on 4 June is anything to go by.

Ostensibly, the opinion document from the European Union's Group of Chief Scientific Advisors discusses how the EU authorizes plant protection products (chiefly insecticides and herbicides). But it goes further, offering sound advice on how to reform aspects of the EU's infamous bureaucracy and convoluted decision-making mechanisms for agriculture. And written between the lines is a clear and simple message, which Europe needs to take on board sooner rather than later: that the region's approach to food production is fragmented and hopelessly unsuited to future needs.

The report is the latest in a series of papers by the group, all "from a scientific point of view". It will feed into specific discussions about, for example, how the commission can better integrate the functions of its agriculture, food, environment and research directorates. That is important if Europe is to set out a coherent plan for a sustainable future. At present, it is too easy for policy-making on a continent-wide level to be paralysed, as seen with research into and applications for genetically modified (GM) organisms. And, as shown by a controversy late last year over the approval of the herbicide glyphosate by the EU, there is insufficient public trust in the process.

The committee was tasked by the European Commission (EC) to work out whether the current system for approval of these products could be more effective, efficient and transparent. The report makes some sensible suggestions for improving transparency, some of which can and should be implemented quickly in the existing approval process. It recommends a new public IT platform to store the relevant data, case studies and information on cultural and historical differences in agricultural practice that need to be built into models that assess risk. It calls for more systematic updates to the assessment of active substances when new data become available. It supports more monitoring and analysis of how pesticides and herbicides accumulate in the environment and in wildlife. And it suggests that mandatory pre-registration of the lab studies that companies will rely on to show their chemical is safe (including the lab location, the types of test planned and what will be learnt from them) would help to address concerns about the independence and objectivity of industry-sponsored studies.

More fundamentally, the report suggests some structural and systemic changes to the approval process. These range from clarifying levels of acceptable risk (current regulations invoke the precautionary principle to demand no harm to health or the environment, which is unachievable in practice), to recognizing that taking no action (for example, not applying a pesticide) also carries risks. Furthermore, the report recommends bringing the risk-assessment process within the control of the EC (it is currently outsourced to member states).

These types of change are more difficult to implement — not least because, at present, nations have control over the process (and, in the GM case, a de facto veto). National politicians will not surrender that control lightly, particularly in countries such as Germany, where anti-GM feeling has huge influence.

The particular wisdom of the latest report is in its recognition that, for such political changes to become possible, the focus of the public debate must shift from single issues in agriculture to the bigger question for society — how do we want to create sustainable agriculture in Europe and ensure quality food production, and how much are we prepared to pay for it? Pesticides and herbicides have a part to play, but so do complex and sometimes conflicting issues that have a relationship to agriculture: fertilizers, food chains and environmental protection in general. Tighter controls of pesticides, for example, will affect these other aspects and have costs and benefits to society. Such a discussion will go beyond a strictly scientific point of view, and must account for values and human judgements.

A good start would be for the commission to arrange a high-profile workshop for all relevant parties — including the public, non-governmental organizations, scientists and companies — to kick-start the process. Good advice alone is not enough. ■