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Climate of suspicion

With climate-change sceptics waiting to pounce on any scientific uncertainties, researchers need a sophisticated strategy for communication.

Climate science, like any active field of research, has some major gaps in understanding (see page 284). Yet the political stakes have grown so high in this field, and the public discourse has become so heated, that climate researchers find it hard to talk openly about those gaps. The small coterie of individuals who deny humanity's influence on climate will try to use any perceived flaw in the evidence to discredit the entire picture. So how can researchers honestly describe the uncertainty in their work without it being misconstrued?

The e-mails leaked last year from the Climatic Research Unit of the University of East Anglia, UK, painted a picture of scientists grappling with this question, sometimes awkwardly. Some of the researchers' online discussion reflected a pervasive climate of suspicion — their sense that any findings they released to the public could and would be distorted by sceptics.

Over the years, the climate community has acquired some hard-won wisdom about treading this minefield. Perhaps the most important lesson is that researchers must be frank about their uncertainties and gaps in understanding — but without conveying the message that nothing is known or knowable. They must emphasize that — although many holes remain to be filled — there is little uncertainty about the overall conclusions: greenhouse-gas emissions are rising sharply, they are very likely to be the cause of recent global warming and precipitation changes, and the world is on a trajectory that will shoot far past 2 °C of warming unless emissions are cut substantially. Researchers should also emphasize that cities and countries can begin to prepare for the effects of climate change through both mitigation and adaptation, even though they do not know the exact course of the changes.

The United Nations Intergovernmental Panel on Climate Change (IPCC) has taken this approach in its ongoing series of assessment reports, and it has done an admirable job of highlighting the important conclusions while acknowledging the caveats. It has made some errors, such as its use of questionable data about the retreat of Himalayan glaciers (see page 276), but these mistakes are exceedingly rare in reports that can total more than 1,000 pages, a testament to the IPCC's rigorous peer-review process.

No matter how evident climate change becomes, however, other factors will ultimately determine whether the public accepts the facts. Empirical evidence shows that people tend to react to reports on issues such as climate change according to their personal values (see page 296). Those who favour individualism over egalitarianism are more likely to reject evidence of climate change and calls to restrict emissions. And the messenger matters perhaps just as much as the message. People have more trust in experts — and scientists — when they sense that the speaker shares their values. The climate-research community would thus do well to use a diverse set of voices, from different backgrounds, when communicating with policy-makers and the public. And scientists should be careful not to disparage those on the other side of a debate: a respectful tone makes it easier for people to change their minds if they share something in common with that other side.

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As comforting as it may be to think that the best evidence will eventually convince the public on its own, climate scientists can no longer afford to make that naive assumption: people consider many factors beyond facts when making decisions. Even as climate science advances, it will be just as important to invest in research on how best to communicate environmental risks. Otherwise scientific knowledge will not have the role that it should in the shaping of public policy. ■

Ten years of synergy

Contributions to and from basic science are the part of synthetic biology that most deserves celebration.

It was an eclectic crowd of engineers, chemists, computer scientists — and, yes, a few biologists too — that gathered in Irvine, California, in November for the US National Academies Keck Futures Initiative discussion on the future needs of 'synthetic biology'. Their very definitions of the field were correspondingly divergent. But when pressed to focus on concrete examples, most discussion groups, at one point or another, pointed to a defining pair of experiments in tailored gene regulation that were published on 20 January 2000: the first synthetic biological oscillator — the 'repressilator' (M. B. Elowitz and S. Leibler *Nature* **403,** 335–338; 2000) — and a bistable gene-regulatory network, or 'toggle switch' (T. S. Gardner *et al. Nature* **403,** 339–342; 2000). So those in the field may not agree on what it is, but they seem to know when it started.

Since then there have been ten years of vibrant interdisciplinary science, and much public discussion both in policy circles and in the media. No such fame could have been predicted at the outset. 'Synthetic biology' was not a common phrase, and many considered the gadgets merely practical extensions of genetic engineering at best, or irrelevant tricks at worst.

Both of those pioneering experiments transposed two great traditions of physics to biology: first, to understand something one must build it, and second, start from the simplest imaginable principles. These directives have set the basic-science agenda for synthetic biology: to design, and thus define, the minimal systems sufficient to produce a given function. As this multidisciplinary field grew, practitioners envisaged bolder applications, such as building collections of interchangeable parts and devices, and transforming microorganisms into factories for biofuels or drugs.

Bringing these applications to reality has proved much harder than was originally hoped (see page 288). But the difficulties have proved instructive. Indeed, the decade-old papers raised several new and fundamental issues in biology, for example by pointing to the crucial role of noise in gene expression, both as a nuisance and as a great computational opportunity. It is now an active area of research.

More importantly, the difficulties encountered when building such basic circuits announced the demise of intuition as a reliable guide to biological understanding. It took endeavours in synthetic biology to illustrate what systems biology perhaps should mean: to enlist mathematical formalism in producing biological insights that are beyond the reach of mere intuition. In that aspect, synthetic and systems biology now seem indissociable, a theme illustrated by the selection of 'synthetic systems biology' papers published in *Nature* over the past ten years, and gathered in this week's web focus (http://go.nature.com/Dq38zq).

Undoubtedly some strands of synthetic biology are media friendly and run the risk of hype. But it is not an overstatement to say that the potential of synthetic biology remains enormous: clean and sustainable biofuels, cheap drug production and synthetic organs are just a few of the applications that have been advanced, albeit through small, painfully incremental steps, in the past decade. Full realization of such elating prospects demands patience as well as the efforts and ingenuity of a rich diversity of biologists, physicists, chemists, mathematicians and engineers.

New gadgets will not be the only outcome. One goal of synthetic biology is to synthesize larger and more complex biological systems, as exemplified by the quorum of genetic clocks displayed by Tal Danino *et al.* in this issue (see page 326). As it develops along this and other paths, synthetic biology itself will demand more by way of new fundamental biological knowledge — quantitative, systematic, computational and biophysical. And conversely, one of the deepest lessons from these first ten years is that biological knowledge will require synthetic approaches if it is to become a mature and reasonably predictive science. ■

Self-inflicted damage

The autocratic actions of an institute's founder could destroy a centre of excellence for brain research.

The 2002 launch of the European Brain Research Institute (EBRI) in Rome was a joyous occasion. Spearheaded by Italy's Rita Levi-Montalcini, a Nobel laureate, the EBRI was intended to be a haven from the bureaucracy and cronyism that suffocates Italy's public research system. It would operate solely on the basis of research excellence, not the administrators' personal interests, and appointments would not be for life. It would be a unique opportunity to create an institution of truly international stature in Italy.

Enthused by that prospect, high-ranking scientists from across Europe agreed to join the EBRI's board of directors. Its International Science Council includes no fewer than three Nobel laureates. And with the guidance of these groups, the EBRI has blossomed.

But now the institute may be disintegrating. The EBRI has always had to scratch around for funding, but a spectacular and potentially lethal blow has just been delivered by Levi-Montalcini herself.

Levi-Montalcini, who will be 101 this year, is the EBRI's president. In November, she began unilateral procedures to sack the EBRI's board of directors and to substitute a commissioner, whom she would appoint.

The move has left board members aghast and angry. They say that it is actually against the EBRI's own by-laws. Certainly the formal and informal reasons Levi-Montalcini has given for her action are unconvincing. For example, she maintains that foreign board members could not be expected to follow important discussions or documents in Italian. But international scientific institutions routinely conduct their high-level business meetings in English, the international language of science, and translate documents as necessary.

Levi-Montalcini has also referred to board members' supposed unreliability when it comes to attending meetings — a charge that has caused deep offence among hard-working and enthusiastic members who say that they have had to rise before dawn on many occasions to join meetings called at short notice.

There has been one clear-cut dispute with a board member: Luigi Amadio, the director of the Santa Lucia Foundation, which owns the building in which the EBRI is housed on a rent-free basis. Amadio cut off amenities to EBRI scientists in a dispute over alleged late payment of bills last year (see *Nature* doi:10.1038/news.2009.888; 2009). But this argument hardly applies to the whole board.

Whatever Levi-Montalcini's motivation, if her changes to the EBRI's governance go through, as seems likely, then the international loss of goodwill towards the institute may be irreversible. The outraged science council members are already discussing possible resignation.

The demise of the EBRI would be a huge disappointment for the talented young researchers who work there, one of whom recently won a highly prestigious grant from the European Research Council. It would also be disappointing for Italy, whose none-too-good scientific image can do without being sullied further. And it would be a tragedy for the much-loved and much-respected Levi-Montalcini herself, who has done so much for science in her long life (see *Nature* **458,** 564–567; 2009), and who now risks losing the goodwill of some of the world's best neuroscientists who have supported her.

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The only remaining hope is that the Prefect of Rome, the local official who must approve the change, will reject her arguments. Levi-Montalcini needs to allow the board of directors to continue meeting and to sort out with those directors whatever concerns she has in a formal and open way. She would be better served by heeding advice from this board than by acting on the impulses that are moving her now. ■