

This time it's personal

The next head of the US National Human Genome Research Institute will need to be equipped to deal with the scientific, political and societal challenges presented by the burgeoning era of personal genomics.

On 28 May, Francis Collins announced that he is stepping down after 15 years as head of the US National Human Genome Research Institute (NHGRI), where he helped lead the international effort to sequence the entire human genetic code (see page 710). His departure is an opportunity to take stock of his legacy and to contemplate the future of the institute he leaves at a crossroads in its existence.

Collins took up his post in 1993, four years before the NHGRI became a separate branch of the National Institutes of Health (NIH) in Bethesda, Maryland. He proved to have a rare combination of political acumen, scientific talent and administrative skill — abilities that allowed him to steer the institute through numerous challenges and reinventions while remaining about as well-liked as it's possible for an institute director to be.

In the 1990s, for example, successful completion of the public arm of the Human Genome Project was in doubt until Collins rallied its members to respond to a challenge led by Craig Venter, a former NIH scientist who was mounting a sequencing effort for commercial purposes. After the genome project was successfully concluded in 2003, some in Washington began asking whether the NHGRI was still needed. Collins made the case — rightly — that the post-genomic era would be even more exciting and challenging than the race to sequence the genome. He and the NHGRI helped prove that by launching a variety of follow-on efforts, including the International HapMap Project, ENCODE (the Encyclopedia of DNA Elements) and, most recently, the 1,000 Genomes Project — an attempt to create an atlas of human genetic variation in unprecedented detail.

Those initiatives have been possible because of technological improvements that dramatically cut the cost of sequencing — improvements for which Collins deserves considerable credit, as he made them funding priorities. The lower costs have accelerated efforts worldwide to clarify the genetic basis of evolution by filling

out the 'tree of life'; more than 100 non-human species have been or are now being sequenced.

Collins also deserves credit for making the ethical, legal and social issues of genomics a high priority at the NHGRI. He says he is particularly satisfied with recent passage through Congress of the Genetic Information Nondiscrimination Act, for which he had long been a passionate advocate. Certainly the passage was timely: cheaper sequencing has ushered in a new era of 'personal genomics', in which companies are offering all manner of tests that claim to reveal a person's susceptibility to conditions such as Alzheimer's disease.

Although Collins says he has no concrete plans for after he steps down on 1 August, speculation is rife that he could serve as NIH director or White House science adviser in the next presidential administration. In the meantime, the future of the NHGRI is more cloudy than his own. The funding situation at the NIH has been gloomy for years, with flat budgets stifling many potentially worthy projects. And with Collins gone, the NHGRI may become more of a target for politicians who feel it has run its course.

Ideally, then, Collins's successor will display both his scientific and political skills. He or she will have to continue to pursue ambitious new projects on the scale of 1,000 Genomes. At the same time, the new director will have to ensure that the implications and applications of those projects are fully explained to all concerned, from the medical profession and insurance companies to politicians and the public. Genomics is now at a point where the science and technology are moving much faster than society's ability to assimilate and make sense of the information. Bridging this gap — a task at which Collins worked very hard — will be his successor's major challenge. ■

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On the campaign trail

It is less specific policies and more the approach to science that will distinguish the next US president.

Primary season in the US presidential race is finally over. As the dust settles, it remains to be seen how much the protracted battle between Senators Barack Obama and Hillary Clinton has hurt the Democratic party, but for now politicians of all stripes are regrouping and strategizing about how to win the election.

Those who believe that science and technology issues should be at the forefront of the campaign agenda have so far been disappointed.

The notion of a 'science debate' — itself debatable (see *Nature* 451, 605; 2008) — has fizzled out. Pleas for the candidates to address research issues seem largely to have fallen on deaf ears.

Yet there can be little doubt that the next US administration will be more science-friendly than the present one. Both of the expected nominees, Obama and Republican Senator John McCain, have put forth platforms that represent major breaks from the policies of President George W. Bush. No matter who is elected, the United States will almost certainly repeal its ban on federal funding for research on human embryonic stem cells using fresh cell lines. The new president will endorse mandatory reductions in greenhouse-gas emissions and work with Congress to enact meaningful climate legislation. And new leadership appointments at key agencies can

only mean that morale at places such as the Environmental Protection Agency will improve.

So far, McCain and Obama have set out relatively different platforms on science and technology issues. For his part, Obama has yet to give a substantive speech on science issues, as Clinton did on the 50th anniversary of Sputnik. But he has adopted many of the traditional Democratic platforms, such as increasing federal funding for biomedical research and improving the jobs pipeline for young scientists. He has put a strong emphasis on the importance of technology for improving the lives of everyday Americans and their access to government. And he has been remarkably successful at using the Internet to turn his supporters into active participants in the political process. An Obama administration might well mean that more technologically savvy people will be drawn into public life — and perhaps that more young people will choose science and engineering careers.

In contrast, McCain has revealed few details of his science and

technology agenda. But in some areas he has been quite outspoken. Last week, for example, he called for a new treaty to reduce the US and Russian nuclear arsenals, suggesting he would lower the number of weapons even beyond the cuts planned by the Bush administration.

And on 12 May he outlined a detailed plan for controlling greenhouse-gas emissions — the centrepiece of which is a cap-and-trade system of the type he has been advocating since at least 2003, when he co-sponsored the first meaningful bill on that subject.

In the end, the main factor is not how Obama or McCain feels about specific science-related issues.

What American voters deserve to know is how each candidate's mind works. Does he listen to a handful of ideology-driven advisers in making key decisions? Or does he look facts in the face and base his conclusions on all the available evidence? If it's the latter, then that is the candidate who is in sync with science at a level far more meaningful than any immediate argument over research budgets or competitiveness. ■

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A flood of hard data

Social scientists have a new handle on group behaviour — but its causes remain a challenge.

Every human being makes choices, takes action and is affected by the environment in a way that seems utterly idiosyncratic. Yet in the aggregate, as the British philosopher John Stuart Mill put it a century and a half ago, human events “most capricious and uncertain” can take on “a degree of regularity approaching to mathematical”. A case in point is the analysis of mobile-phone data discussed by González *et al.* on page 779 of this issue. It reveals just such a mathematical regularity in the seemingly unpredictable way people move around during their daily lives (see also page 714).

As remarkable as this result is — and it is still not completely understood — the research is just as notable for its methodology. Social scientists have long struggled with a paucity of hard data about human activities; people's self-reporting about their social interactions, say, or their movement patterns is labour-intensive to collect and notoriously unreliable. In this case, the researchers obtained objective data on individuals' movements from mobile-phone networks (albeit without access to any individual's identity, for privacy reasons). This gave them a data set of proportions almost unheard of for such a complex aspect of behaviour: more than 16 million ‘hops’ for 100,000 people. The resulting statistics show a strikingly small scatter, giving grounds for confidence in the mathematical laws they disclose.

The mobile-phone technique is simply the latest example of how modern information technologies are giving social scientists the power to make measurements that are often as precise as those in the ‘hard’ sciences. By analysing e-mail transmissions, for example, or doing automated searches of publication databases,

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social scientists can collect detailed information on the network structure of scientific collaborations and other social interactions. And by allowing their subjects to interact online, researchers can do large-scale studies of, for example, the role of social interactions in opinion formation, complete with control groups and tuneable parameters.

It's not an overstatement to say that these tools are fostering a whole new type of social science — with applications that go well beyond the conventional boundaries of the field. There is sure to be commercial interest in the detailed patterns of usage for portable electronics, for example, and the nature of mass human movement could inform urban planning and the development of transportation networks. Epidemiologists, meanwhile, will no longer be forced to work with highly oversimplified models of infection rates and disease spread: recent work has clarified how the transmission of disease depends on the precise structural details of the network of person-to-person contacts.

For all their promise, making sense of these new data sets requires a rather different set of statistical skills than those needed in conventional social science — which may be one reason why studies such as that by González *et al.* are so often conducted by researchers trained in the physical sciences. To some extent this ‘physicalization’ of the social sciences is healthy for the field; it has already brought in many new ideas and perspectives. But it also needs to be regarded with some caution.

As many social scientists have pointed out, the goal of their discipline is not simply to understand how people behave in large groups, but to understand what motivates individuals to behave the way they do. The field cannot lose focus on that — even as it moves to exploit the power of these new technological tools, and the mathematical regularities they reveal. Comprehending capricious and uncertain human events at every level remains one of the most challenging questions in science. ■