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The end of the beginning

The joint announcement of the completion (well, just about) of draft sequence on 26 June by Francis Collins and Craig Venter—on a platform shared by President Clinton and Tony Blair (by video link)—was welcome for several reasons. The definition of 'completion' is clearly a moveable feast, with 87% of estimated sequence at approximately 7× coverage obtained by the Human Genome Project (HGP) and a substantial proportion of it (about 40%) yet to be placed in physical context. Celera's sequence is not generally available for scrutiny and so it is difficult to comment with surety on its features, but if press releases are to be believed, it has covered 99% genome to a depth of 4.6×. The fact that so much has been gained so quickly and—with respect to HGP sequence—is there for the taking, is a great thing, and worthy of high commendation.

What of access? With respect to sequence generated by the HGP, there is nothing to discuss. Celera is in the process of negotiating subscriptions to its database of human sequence with various parties, and has recently come to an agreement with Vanderbilt and Harvard Universities and the Australian National Health and Medical Research Council, among others. It is speculated that the Howard Hughes Medical Institute may sign up; should they decide to so, one imagines a smoother ride than that experienced by Vanderbilt University (the first of the subscribers). According to Mark Magnuson (of Vanderbilt), coming to a set of mutually agreeable terms was akin to negotiations "between the Palestinians and Israelis". Whereas he would not divulge financial details, it is said that Vanderbilt laboratories are expected to pay $5,000 per annum for access to the database, and it is hoped that 100 laboratories will pay for access. To what extent the database will be useful remains to be determined. As we go to press, shotgunned fragments with sparse annotation are available to researchers at Vanderbilt.

With the majority of the genome charted and the bulk of the sequence in hand, now is the time to communicate to the world at large that biomedical science is soon to experience a paradigm shift—and that the shifting may quickly slide into a reality that is quite different to the one to which we are accustomed. Now is the time to push with vigour public discussion of ethical, legal and social issues (ELSI) further into the political and public arenas, as powerful technologies are not immune to abuse. It is notable that Tony Blair, in answer to a question from the press, emphasized the distinction between scientific knowledge and application of that knowledge; the former being morally neutral, and the latter, sometimes fraught with moral value.

His response should come as no surprise, given a substantive degree of distrust and suspicion of science and its regulation by government in sizeable sectors of the European population. Some of this is down to perception that government acts in its own interests (which in most countries, are short-term) at the expense of the long-term interests of the populace. The televised image of John Selwyn Gummer (ex-minister for Agriculture, Fisheries and Food) stuffing a hamburger into the mouth of his daughter, Cordelia, to allay public fears about inter-species transmission of bovine spongiform encephalitis in 1990 is one that endures in the memories of many British people. And one need not spend too many words hypothesizing as to why German regulations on genetic manipulation of the human are some of the strictest in the world. That said, the short-term benefits of messing with the gene pool are not obvious, never mind potential long-term benefits. As argued by Jürgen Brosius (an evolutionary biologist at the University of Münster) in July's issue of *Nature Genetics*, perceived 'benefits'could end up being quite the opposite.

Clinton's call for international coordination on 'ELSI' issues is apposite, but an international set of regulations that govern the law of signatory countries is even more so. What is less than clear is the mechanism by which such regulations could be established. But the fact that the safety of GM foods appears high on the agenda on the G8 summit meeting of world leaders as we go to press illustrates an awareness of the need to address public concern.

Much has been made of the finding that 99.9% of DNA is conserved between individuals with the view of allaying fears that genetic information may be used to justify discrimination. The motive is noble and one can only hope that the emphasis will have the desired effect. Humans, however, are all too capable of discriminating on the basis of differences effected by 0.1% of the genome and it is clear that there are genetic differences between populations. As Mark Stoneking (of the Max Planck Institute) points out in his book review on page 379, as did Rodney King in the aftermath of his ordeal with the Los Angeles police department, the main thing is to respect (if not love) each other despite our differences.

Another positive aspect of the announcement was its joint nature. If appearances are to be believed, it signals a genuine cease-fire between Collins and Venter, a cease-fire that has come not a moment too soon. The unseemly, public, and at times acrimonious disputes between the two may have provided grist for the mill of the kind of journalism that thrives on discord, but were oppressive, distracting and counterproductive. As Eric Lander (of the Whitehead Institute) has commented: "one tires of the squabbling". Lander headed an effort that resulted in approximately 30% of the HGP sequence, perhaps qualifying him for his role of peacebroker. It is fitting that the armistice was mediated by a senior member of the Department of Energy, Ari Patrinos, given the critical role of the department in the project's inception 14 years ago. One hopes that the cordial relationship on display in the East Room of the White House on 26 June will endure at least until publication of the sequence later this year.