Open-source work even more vital to genome project than to software

Sir — We note with dismay and alarm the controversy concerning access, distribution and patenting of the human genome sequence (*Nature* **404,** 317 & 324; 2000). We wish to point out some analogies between the human genome sequencing efforts and 'open-source' software development, which have implications for the data-release policy of the public sequencing effort.

Since introduction of the open-source concept, a global network of volunteer programmers is developing and maintaining freely available, sophisticated software that can be modified and redistributed by anyone. The validity of the open-source model has been proved over decades. Its best known achievement is GNU-Linux, the fastest-growing operating system on the major hardware platforms, which is widely thought to be more powerful, stable and flexible than proprietary commercial products.

The reasons why the Linux project could succeed against commercial wisdom have been analysed by Eric S. Raymond in his book *The Cathedral and the Bazaar* (O'Reilly, 1999). Most of these findings are of relevance to academic and commercial benefits arising from human genome sequencing.

The first key feature of open-source programming is the ethic behind it: sharing of ideas and results, distribution of an otherwise unmanageable workload and unwritten, but very strict rules for assigning credit. The strong analogy to public sequencing projects is obvious.

Crucially, the second main feature is the licensing strategy. The program source code is released under a licence, frequently the GNU Public License (GPL), that allows everybody to see, modify and redistribute the code, with the one restriction that it cannot be sold as part of a proprietary package. These licensing restrictions are crucial because they secure open distribution and unrestricted use, which are vital for the project, as a condition of access and copying. Faced with the size and complexity of the task, it is the obvious choice for the participants to play by these rules, making fraud or the splitting of projects into private, closed subprojects very uncommon.

This licensing strategy has not prevented the successful commercialization of open-source software, shown by the endorsement of the Linux operating system by most major players in the industry. Basing commercial products on open code requires only that the commercial entities acknowledge that they are dependent on many voluntary contributors, and adjust their business models by contributing to development rather than bullying the market into using outdated products.

Unfortunately, the public genome-sequencing centres have not distributed their 'source code' under a similar GPL licence in the past. This has now allowed a commercial entity to incorporate these data into a closed product with the apparent aim of market domination.

The commercial success of open-source software development shows that secrecy and legal restrictions to access and redistribution of data are not necessary, if the business is adding value by continuing refinement and service provision. So Celera does not need to restrict access to raw sequence and redistribution if it bases its business model on providing superior software tools and analysis services. In contrast, it would profit from the value added by the thousands of researchers worldwide. In our view, any legal restrictions to use and redistribution must be viewed as an attempt to establish a monopoly for the use of genome data.

The market dominance of a technically inferior computer operating system is only a nuisance, but a genome monopoly — which would impair medical progress — is morally unacceptable. The publicly funded sequencing community should consider releasing any further data only under a copyright licence that encourages broad commercial application and prevents monopolization. The pharmaceutical industry should take great care not to assist in establishing a monopoly by repeating the mistake that IBM made with nascent Microsoft. With the establishment of the SNP consortium, industry leaders have already demonstrated that their interests are best served by creating a level playing field that allows rapid medical and scientific progress. Celera could set a milestone by adopting the open-source model, realizing that it can be good business to work with the community and harnessing its potential.

Andreas P. Russ*, Samuel A. J. R. Aparicio†, Mark B. L. Carlton*

** Wellcome/CRC Institute of Cancer and Developmental Biology, Tennis Court Road, Cambridge CB2 1QR, UK*

† Department of Oncology, Wellcome Trust Centre for Molecular Mechanisms in Disease, Addenbrookes Hospital, Cambridge CB2 2XY, UK

Mayo and the mouse

Sir — We wish to clarify your News report (*Nature* **404,** 319–320, 2000) about transgenic mice patents. The Mayo Clinic conducts research to improve patient care and to benefit society. We believe this is best accomplished by freely and openly sharing our ideas and research tools with all academic researchers and by interacting closely with the commercial sector. For not-for-profit institutions such as Mayo, interaction with the commercial sector has two benefits. It is generally the only practical way to translate scientific ideas and research tools into improved diagnosis and therapy for the public; and it provides additional resources through licensing and sponsored research agreements.

Karen Hsiao Ashe deserves enormous credit, not only for her development of the Tg2576 mouse model of Alzheimer's disease but also for her decision to distribute this mouse promptly and freely to academic researchers. Mayo has covered the cost of breeding and genotyping Tg2576 mice that are free of specific pathogens. As pointed out in your News report, many mice have been distributed to academic researchers. Recipients were asked only to pay a nominal fee, primarily to defray the shipping charge. Despite the lawsuit, we will continue to support Hsiao Ashe in distributing Tg2576 mice to academic researchers.

The material transfer agreement (MTA) under which Tg2576 was distributed initially to academic researchers did not contain a 'reach-through' provision enabling Mayo to receive automatically a specified percentage of revenues generated by new scientific developments involving Tg2576. Rather, this MTA contained a provision that, if any intellectual property was developed using Tg2576, Mayo would be given an opportunity to purchase rights to this through a negotiated agreement with mutually acceptable terms. Although we continue to welcome the opportunity to license new developments involving Tg2576, this provision has been eliminated from our current MTA, and we are allowing academic centres that signed the initial MTA to transfer to the current MTA.

In distributing Tg2576, it was important to involve the commercial sector, as it is best positioned to develop novel therapies. To achieve maximum therapeutic impact, we wanted to license the mouse to any interested company.

Mayo performed considerable due diligence with respect to licensing Tg2576. We trust that the many companies to whom we gave a licence performed their own due diligence. None of us expected to be sued. We regret the hardship that some academic researchers have suffered because of Elan's decision to subpoena and depose them.

It is essential that we defend ourselves successfully if Elan continues to pursue this lawsuit. We are confident that we can do so. We would prefer, however, to resolve this matter amicably, outside the courtroom.

Steven G. Younkin*, Susan Stoddard†

** Department of Pharmacology,*
† Office of Technology Transfer
Mayo Foundation for Medical Education and Research, 4500 San Pablo Road, Jacksonville, Florida 32224, USA

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