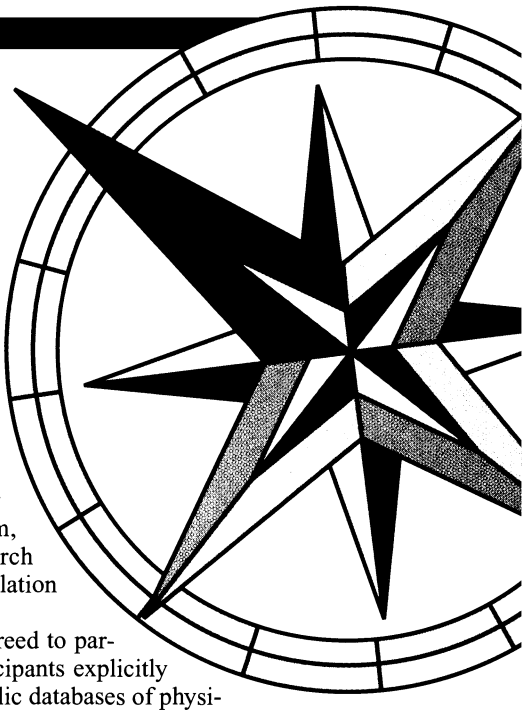

Rice, Races, and Riches

Floyd Bloom

Rice, arguably the most commonly consumed food source in the world, is eaten by 3 billion people daily. Rice crops account for about 10% of the arable land mass. The rice genome is estimated at 500 million base pairs, with some 40,000 genes over 12 chromosomes. Agricultural developers around the world are anxious to identify those genes that could improve rice yields on marginal soils and provide greater disease and pest resistance, shorter maturation times, and a wider range of tolerable climates. Rice is important not only in its own right but also as a model for improving other grain crops because wheat, rye, barley, maize, sorghum, millet, and rice have similar genetic maps. The International Rice Research Institute estimates that by 2020, 4 billion people—more than half of the population then—will depend on rice as a food.

In September 1997, participants from 10 western and Asian countries agreed to participate in an international collaboration to sequence the rice genome. Participants explicitly agreed to share materials, including libraries, and to the timely release to public databases of physical mapping information and annotated DNA sequences. By this winter, after expenditures in the participating countries of more than $200 million, about 10% of the rice genome had been mapped. In April, the Japanese Ministry of Agriculture, Forestry and Fisheries (MAFF), speaking on behalf of the International Rice Genome Sequencing Project (IRGSP), announced that a contract from Monsanto to the laboratory of Leroy Hood at University of Washington in Seattle had derived a "working draft" covering 85% of the rice genome. Monsanto will provide its rice sequence files, as well as the tools used in the process of its sequencing, to the IRGSP participants. Monsanto will also make the sequence information publicly accessible at its own Web site for researchers who register with the company. Those who make use of its data are encouraged to publish their results for the research community, but under the terms of the registration, if researchers seek to patent inventions based on direct use of Monsanto's sequence data, the company is to be given an early opportunity to negotiate a nonexclusive license to such patents.

"[A]n international collaboration to sequence the rice genome."

President Reagan signed Executive Order 12591, in April 1987, to ensure that Federal agencies and laboratories would assist universities and the private sector by moving new knowledge from the research laboratory into the development of new products and processes. The Federal Laboratory Consortium for Technology Transfer (FLC) was also created to promote technology transfer nationwide and now includes more than 600 major Federal laboratories and their agencies. Technology transfer encourages the sharing of information. For government and private-sector inventors to succeed with technology transfer, there must be an economic incentive for both sides and protection of commercially sensitive information. Examples abound of important commercial product spin-offs from government efforts, including improved airframe and auto design, a super-insulating aerogel, new tooling methods for composite materials, and rapid molecular identification of toxic bacteria (see flc2.federallabs.org/).

Rights and protections for owners of intellectual property are based on federal patent, trademark, and copyright laws and state trade secret laws. Federal laboratories active in technology transfer must be familiar with the laws and policies concerning intellectual property, to better advise participants of their rights and opportunities. A search of the IBM Intellectual Property Network Web site (www.patents.ibm.com) under patents for "Genetic engineering: recombinant DNA technology" lists some 369 issued patents for specific genes on claims as broad as "unique genes on chromosome 16" to very specific genes and their products.

The MAFF described this rice initiative as "the first time a private enterprise will share a large volume of genome information globally...The initiative is to be highly applauded." *Science* agrees. As we noted in March with the *Drosophila* "Release I" data, this spirit of cooperation benefits society, the governmental agencies charged to conduct the work, and the commercial operators eager to push the results into strategies for genetic modification. Cooperation between publicly funded and commercially funded efforts is good for the taxpayer, yielding quicker results based on the government investment. Let's see if this all works out as well as it looks.