sequencing 100,000 bases a day, which he hopes to achieve in 3 years. Although the project has fallen far short of its initial aims, Soeda, who is still upbeat, says, "I'm happy with the progress so far. Three years ago, people said it's crazy to try to automate."

But Wada says with frustration, "I'm stressing the need for a huge system, but there is no need for it right now." The participating companies "are content to build small machines for small labs, but they have no interest in building huge machines until the market becomes confident."

While the automation project continues, various government agencies in the past year or so have undertaken some interesting new projects related to sequencing. Monbusho is sponsoring an effort to sequence *Escherichia coli*. It is a huge objective, but actual funding for the project is modest, according to Maynard Olson of Washington University, who recently returned from Japan where he attended a meeting on genome sequencing. Olson himself is collaborating with Riken Laboratories, which are supported by the Science and Technology Agency, to sequence a yeast chromosome. The government is also spending a small amount of money to begin mapping and sequencing human chromosome 21, Olson says.

Some scientists advocate linking a human genome project with the Human Frontiers Science Program, an international collaborative effort in basic science proposed by Yasuhiro Nakasone while he was Prime Minister. The program is now just getting started. As originally conceived, the Human Frontiers program would have included work in sequencing. But over the years, the focus has shifted to brain science and other areas of molecular biology. Okamoto, who played a leading role in developing the Human Frontiers concept, is among those who would like to see sequencing projects included. "With the start of the Human Frontier Science program," he says, "the next question is how we will tackle the sequencing issue."

But Wada argues that the two projects should be dealt with separately. He says that the Human Frontiers program "is like a newborn baby; it's very fragile. The newborn baby doesn't have the capacity to handle such a big project" as sequencing the genome.

In a society where consensus must be reached before a policy is implemented, there is too much varying opinion among prominent scientists to expect any major new initiatives by Japan in sequencing soon. Matsubara says, "Maybe 2 years from now, we'll achieve some structure" for pursuing a bigger effort to sequence the human genome. ■ MARJORIE SUN

Britain Launches Genome Program

London

Britain's Medical Research Council has announced plans to establish a major new computerized database for storing and distributing data on the structure and function of the human genome. To be located at the MRC's Clinical Research Center at Northwick Park in northwest London, it will be part of a new human genome resource center that will conduct some mapping and sequencing itself and support and coordinate efforts in other laboratories throughout the United Kingdom.

"You cannot have a successful network without a hub, just the spokes," says Sydney Brenner of the MRC's Molecular Genetics Unit at Cambridge, who is one of the chief architects of the British program. It is also hoped that the center will eventually become one of the main—if not the main—nodes in Europe for genome mapping and sequencing projects, and would link up with comparable databases in Japan and the United States. "I think that when the dust settles, there will be four or five such centers throughout the world, serving different time zones, and all connected to one another," says Brenner.

The MRC currently spends about $15 million a year on genetic mapping, with medical charities such as the Imperial Cancer Research Fund (ICRF) spending a roughly comparable sum. Funding for the new resource center will come out of an additional $19 million that the MRC is planning to spend over the next 3 years for research and development in this field.

The scientific content of the genome mapping program will be determined by a program committee. This will invite grant applications in specified topics that are considered directly relevant to the overall objectives of the resource center and its mapping program.

A scientific advisory board will be responsible for maintaining the balance of the research carried out. "The whole program will be very closely monitored, and we will be able to say if we feel there are too many grants going into one area and not enough into another," says board member Malcolm Ferguson-Smith, professor of pathology at the University of Cambridge. Overall strategy will be determined by a top-level committee consisting of representatives of various government departments as well as the ICRF, which has built up considerable experience in mapping techniques and the development of DNA probes.

The scientific strategy to be followed will initially be to construct a genetic, rather than a physical, map of the genome, concentrating on the location of identified genes. This strategy has been pioneered by Brenner at Cambridge, and some of the research that has been carried out in Cambridge will be transferred to the new center.

Brenner says he is keen that Britain's program be based on practical achievements and that it produce early results of value to researchers working on specific diseases. "Our first step will be to bring together detailed information on about 10% of the genome, working with about 100 bits of cloned DNA, and sending them out to various groups," he says.

"We are building a structure bottom up," says Brenner. "If in the next 2 or 3 years we have established a center in the U.K. which has already been of value to our research community, then we will be well placed to play an active role in international efforts."

The MRC has, in fact, already made some moves that could put London at the center of international genome mapping. It has offered to provide office space and administrative assistance for the European office of the Human Genome Organization (HUGO), a loose-knit group of researchers involved with gene mapping and sequencing, and has also said that it would be prepared to make similar facilities available in London for the nongovernmental organization the Japanese government is hoping to set up to run its Human Frontiers Science Program.

It remains uncertain whether there will be any direct relationship between Human Frontiers and genome mapping/sequencing activities, but MRC officials argue that it might be possible to share some administrative and operating costs either with HUGO or with the British genome program (or possibly even with both). If this were to happen, a single individual might be named to run two (or three) of these operations. One leading candidate for such a position is said to be John Tooze, currently executive secretary of the European Molecular Biology Organization in Heidelberg. ■ DAVID DICKSON