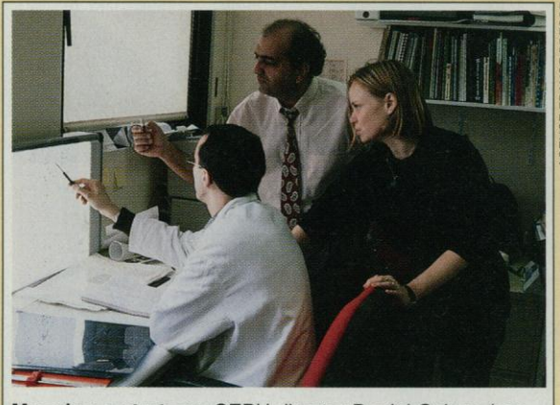
an excellent idea. But he stresses that Britain's terrible pay has been the main reason for past difficulties in recruiting the best to LMB: A doctoral student currently has to make do on $850 a month.

Increasing mobility and opening up the European research market will not be easy. Potentially the most ambitious solution comes from Tooze and Philipson with their initiative to set up a pan-European research fund, akin to NIH. "If we are to compete with the USA, we have to have a federal agency like NIH," says Philipson, who makes his own case for an independent European funding agency on p. 478. Tooze is also trying to round up support for a European predoctoral grant program that would make a start on tackling the mobility problem (EMBL already has a tiny scheme of its own). A first meeting of potential allies—heads of 10 pan-European biological societies plus Paolo Fasella, EC director general for research—took place in Heidelberg in December.

But where to turn for funding? National governments will be unwilling to relinquish their funds, said Fasella, which leaves the EC as the most likely source. A "great deal of politicking," lies ahead, Fasella warned, stress-

Gene Mapping the Industrial Way

PARIS—"By the end of the year," says Daniel Cohen, head of Paris's Centre d'Etude du Polymorphisme Humain (CEPH) lab, "we'll have mapped 90% of the human genome." And he probably will too, thanks to the monster-sized YAC chromosomes developed in his laboratory by microbiologist Ilia Chumakov, a recent arrival from Moscow, and Denis Le Paslier. The map will, admittedly, have a very coarse resolution—and there's that unforgiving rule that the last 10% of a map takes 90% of the time—but the statement typifies Cohen's unabashed enthusiasm for his research. His ultimate goal is to make CEPH the Mercator of the gene world.



AGENCE FRANCE PRESSE

Mapping a strategy. CEPH director Daniel Cohen *(center)* has big plans to create a genetic linkage map.

Together with its companion lab, Généthon, CEPH is already the world's largest combined center for human genome linkage analysis and data handling. The lab has plenty of fans in the United States. "They are powerful groups, doing fine work," says James Watson, who resigned this month as head of the Human Genome Project. But outside the human genome fraternity, few scientists know what CEPH is. Perhaps that's no surprise: In conception, funding, and even location, there is no other lab quite like it.

To find CEPH you have to head into the unfashionable northeast neighborhood of Paris and pass by the St. Martin Canal with its barges, waterfront cafes, and itinerant flea markets. There, behind the 17th-century St. Louis Hospital, you'll find a drab building and an unmarked metal and glass door. Inside is CEPH, a private research institute created by French immunologist Jean Dausset and Cohen, a Tunisian-born physician.

When Cohen joined Dausset in his immunology lab as a temporary research assistant in 1978, Dausset was 62 and Cohen 27. "A friendly father-to-son relationship quickly formed," says Cohen, and he decided to say on. In 1980, Dausset, who had just been awarded the Nobel Prize for his work on HLA groupings, decided that the fastest way to search for the genes behind genetic diseases would be to take an "industrial approach," concentrating on a small set of very large families where conventional genetic analysis could be combined with molecular biological techniques.

The pair started their efforts on a small scale, with a $100,000 grant and using DNA from the large Mormon families studied by Raymond White at the University of Utah. Soon, a bequest from an art collector brought a windfall of $9 million and partnership with the French Muscular Dystrophy Association led to the joint creation of the Généthon labs in the Paris suburb of Evry. Généthon's objective is to search for hereditary disease genes, and it has built up efforts in genetic mapping and sequencing in collaborations bringing in the Pasteur Institute's Jean Weissenbach and Charles Auffray of the Cancer Research Institute of Villejuif.

CEPH-Généthon today has a budget of $20 million (mostly from private sources) and a staff of 250. Dausset has an office at CEPH but lets Cohen run the show making him, at 41, one of the most powerful and dynamic figures in French molecular biology, with more freedom of action than the heads of government-controlled institutions. CEPH has the world's richest collection of DNA from large families (about 60 families each of three to four generations) and from families containing individuals who have developed particular diseases. CEPH collaborates with 150 laboratories around the world (70% of them in the United States), supplying samples and data free of charge—on condition that all the linkage data they generate from the DNA must be put into CEPH's data banks. One-third of CEPH's 250 staff are now "informaticiens."

Typical of one part of CEPH-Généthon's approach is its success in finding a gene closely linked to one form of non-insulin-dependent diabetes, a disease affecting 5% of the world population. The work, published in *Nature* last month, began with a campaign in 1990 to find French families with the disease. Teams of vounteers then persuaded affected family members to supply blood samples and reconstruct their family's genealogical trees. In less than 2 years, with data from 492 families, analysis of inheritance patterns linked the disease to the glucokinase locus on chromosome 7, a gene known to be involved in regulating blood glucose levels.

Eventually, the goal is to combine a genetic map generated by such linkage data—created by CEPH and by the hundreds of teams worldwide that use their large-family resources—with the Human Genome Project's efforts to make a physical map of the human genome using hundreds of restriction enzyme markers.

That's why both the Howard Hughes Medical Institute and NIH were CEPH supporters from the start. But relations deteriorated in 1988 and NIH support soon dried up. According to Cohen, "An ambitious operation such as ours, controlled in France, was unacceptable" to NIH. Elke Jordan of the NIH's National Center for the Human Genome, has a different explanation: "We didn't want to cold-shoulder CEPH....We simply decided that funding genome research abroad was counter-productive, as it would discourage other countries' contributions." CEPH-Généthon's open policy has apparently won over its American critics, however, and NIH support to CEPH has again become significant.

–Alexander Dorozynski

Alexander Dorozynski is a science writer based in Paris.