square feet of recently reallocated space in the Warren G. Magnuson Clinical Center, NIH's 500-bed hospital, and the new Silvio O. Conte building, named for the late Republican congressman from Massachusetts.

When the new fiscal year starts in October, Collins hopes to boost the intramural budget to $25 million, and then to $30 million to $40 million in 1995. He will be looking for more money to spend off campus as well. "My sense is that the genome project is underfunded by a factor of two," Collins said. "One of my major tasks is to try to correct that."

If Congress agrees to these sums, Collins will hire some 180 full-time staffers by 1995, including 20 principal investigators, some working on projects that link traditional research to track down disease genes with genetic treatments. "The connection of gene discovery and gene therapy is very appropriate," said Collins, who watched his codiscovery of the cystic fibrosis gene 3 years ago turn into a gene treatment now entering clinical trials. Collins' group also codiscovered the neurofibromatosis gene that causes nerve cells to form tumors on the face and other body areas, and he pioneered gene detecting techniques that became standard lab procedures worldwide.

"This is probably the biggest recruitment that NIH ever made, in stature and resource commitment," Healy said. "He will be a magnet for other recruitment to NIH. This is a reverse of the brain drain."

While the move may be great for government research, it may not be good for Francis Collins. For one thing, he says, "I will be taking a substantial pay cut to take this job." He will also have to juggle research and a heavy administrative load. "I am determined to keep my research lab active. Yet, I am aware that in taking on this job, the stresses are going to be severe," says Collins, adding that at age 42, "it is too early for me to be stuck in some bureaucratic position." And he will have to sever a longstanding relationship with the Howard Hughes Medical Institute (HHMI), the nation's wealthiest foundation. HHMI has employed Collins since 1987, supporting him and seven other Hughes investigators at Michigan to the tune of $6.33 million last year. "We will be sad to see him leave the ranks of HHMI," said Hughes' president Purnell W. Choppin, who calls Collins "a brilliant scientist."

So why did he take the job? Collins says he jumped at the chance "because there is only one human genome program. It will only happen once, and this is that moment in history. The chance to stand at the helm of that project, and to put my own personal stamp on it is more than I could imagine."

–Larry Thompson

Larry Thompson is a science writer living in Bethesda, Maryland.

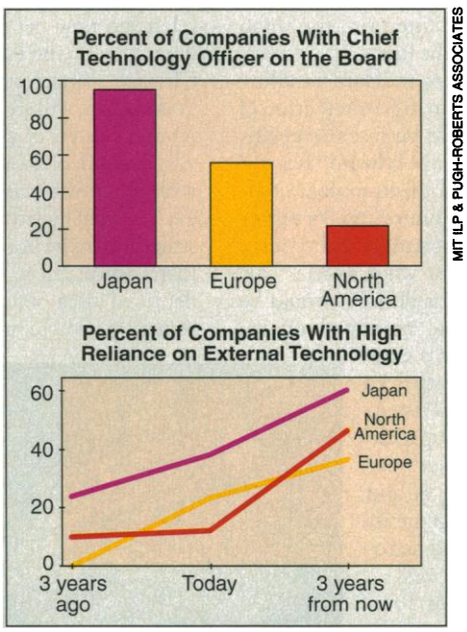
INDUSTRIAL RESEARCH

How U.S. Companies Measure Up

When International Business Machines (IBM) announced in mid-December that it will lay off 25,000 workers and slash R&D spending by $1 billion next year, IBM chairman John Akers put part of the blame on the company's slowness in adapting to changing technology. Is it just Big Blue that has lost its way, or do the computer giant's troubles reflect deep-seated problems in the way U.S. companies manage technology? A major study being conducted by the Massachusetts Institute of Technology's (MIT) Industrial Liaison Program and PA Consulting Group, a Princeton-based firm specializing in business and technology analysis, may help answer that question. At a recent symposium at MIT,* study participants presented some provocative preliminary findings from an international survey of senior technology executives, suggesting that U.S. firms in general are more likely to be blind-sided by changing technology than their competitors in Europe and Japan.

Perhaps the most striking finding of the survey, to which executives from 95 of the world's leading R&D companies responded, was the differing roles of a company's chief technology officer (CTO). In the Japanese companies that responded, 90% of the CTOs held a position on the board of directors or main managing board, whereas less than 25% of North America CTOs had similar influence. "In many [U.S.] companies, there is no such animal as a chief technology officer," says study director Edward Roberts, who is chairman of both MIT's Management of Technology and Innovation Group and Pugh-Roberts Associates, a division of PA Consulting. Even European companies fared better than their U.S. counterparts—more than half their CTOs were part of the managing elite. As a result, Japanese and European firms believe their technology strategy is much better linked to their overall corporate strategy. Roberts agrees, calling these results the "single biggest damnation" of U.S. industry found in the survey.

The survey also suggests that U.S. firms have not positioned themselves to take advantage of outside sources of technology such as suppliers, joint ventures, or university-sponsored research. Compared to North America, significantly more Japanese and European companies report they have a "high" reliance on these external sources. While Europe's dependence seems to derive, in large part, from recession-driven cutbacks in internal R&D, Japan's reliance is mostly deliberate. "It's a Japanese policy of working with their supplier," comments analyst Jeffrey Lindsay of Pugh-Roberts, explaining that firms in Japan commonly negotiate long-term contracts that allow their suppliers the security to pursue new technology themselves. In contrast, he says, until recently American companies held bidding wars between suppliers that left little margin for them to pursue R&D.



MIT ILP & PUGH-ROBERTS ASSOCIATES

Global benchmarking. In Japan and Europe, CTOs wield much more influence. And the United States still lags behind Japan in exploiting "external" sources of R&D.

But elements in that picture are already changing, as the study participants acknowledged. American companies, for example, are now looking for ways to foster R&D among their suppliers; they expect to become increasingly reliant in future years on outside technology. And the struggling global economy is eroding European strength in R&D; indeed, Lindsay warns that European firms may have irrevocably damaged their future competitiveness with the cuts made over the past few years. Only companies in Japan appear to be intensifying their R&D efforts.

He cautions, however, that specific industries, such as pharmaceuticals, which are increasing, not slashing, their R&D budgets, do belie some of the general trends found in the survey. Such trends will be grist for the continuation of the study. Over the next few years Lindsay and his colleagues plan to increase the sample size, as well as focus more on individual industries. When finished, the survey should provide a much clearer picture of how companies manage technology—and whether what's happening at IBM may be a lesson for the rest of U.S. high-tech industry.

–John Travis

*Strategic Management of Technology: Global Benchmarking, 10 December 1992, MIT.