Sciences, Inc., of Menlo Park, California. The firm's president, James H. Gregg, had hoped to sell 1.5 million shares in early November for $12 million to $14 million, but scratched the offering when the market went sour. The company is developing approaches for treating certain cancers, AIDS, and autoimmune diseases. With cash reserves down to about $8 million and clinical trials slated for 1988, Gregg says his company needs new financing in 6 to 12 months.

Analysts generally are not counting on public equity markets to pick up that soon. One result of this, says PaineWebber's Miller, is that companies "will look with some scrutiny at their capital expenditures and the programs they have got under way. They could have to kill some of them." But cost containment is unlikely to produce major savings, says Fildes, who observes that even small companies "require a certain critical mass" to operate effectively.

With venture capitalists viewing the biotechnology industry as cautiously as investors, some companies will have to set up limited partnerships, or expand alliances with established pharmaceutical and chemical concerns in order to survive. Comments Miller, "The situation is very ripe for these kinds of activities to continue and accelerate."

Larger companies may not wait for an invitation from promising biotechnology companies. Lower stock prices may spur companies to buy into some firms. Since 19 October, Baxter Travenol has purchased 300,000 shares of stock in Genetics Institute, a well-regarded company that some analysts perceive as needing additional working capital in the near future.

With the dollar down against foreign currencies, Japanese and European pharmaceutical and chemical giants also will be scouting U.S. companies for commercial opportunities. In fact, foreign investors may never again have a chance to acquire a stake in American biotechnology ventures at such low prices. Says Hubert Schoemaker, president of Centocor of Malvern, Pennsylvania, "You will see Europeans and Japanese buying heavily into U.S. companies."

Foreign companies, however, are expected to be cautious in seeking to strengthen their holdings in U.S. companies. Jim McCamant, editor of the *Medical Technology Stock Letter*, says foreign companies are not likely to try to buy out American firms but will prefer to negotiate other arrangements such as product marketing rights for the European or Japanese markets.

Outright takeovers, in fact, are not particularly effective, says Bruce Mackler, general counsel for the Association of Biotechnology Companies. "Unless it is friendly, all you may end up with is the building and some technology, but not the people," notes Mackler. "And it's the people that make the technology move."

Does such activity suggest that the industry's long-awaited shakeout will take place? Fildes of Cetus contends that not much will happen unless the current "bear" market persists for more than a year. The Arthur Young group estimates,† in fact, that a number of small companies have sufficient capital to hold out for 2 years; medium-sized companies, 4 years; and large firms, up to 10 years. In general, it appears that companies developing therapeutic and diagnostic products for health care have more capital and can survive longer than firms working in agriculture, the group notes.

Mark Dibner of the nonprofit North Carolina Biotechnology Center believes that Black Monday's effects will go beyond increasing the number of ties between biotechnology start-up companies and chemical and pharmaceutical companies. He thinks it will produce a consolidation within the industry. "The market falsely kept alive some companies," he argues, only because they were able to go to the public market two and three times.

Just as difficult to predict is how a consolidation will manifest itself. Given a choice, says Gordon of Hambrecht & Quist, financially troubled biotechnology companies are more likely to merge with another biotechnology firm than sign on with an industrial conglomerate. Centocor's Schoemaker agrees that financially strong biotechnology companies like his own will try to swallow up attractive smaller firms.

The predatory climate does not mean that small companies will be wiped out or that cash-lean companies with good ideas cannot survive or that new starts are impossible, says Gordon. "Those that have good stories to tell" will be able to find ways to secure additional capital, he predicts.

A case in point is Biosource Genetics Corporation, a Sunnyvale, California, company that plans to develop systems for enhancing yields in plants. The privately held company's board of directors met for the first time on Black Monday. Ernest T. Hubbard, Jr., the company's president, says the private investors backing the venture are proceeding because they believe the company can produce products relatively soon.

Hubbard, who headed Sungene Technologies Corporation of Palo Alto until 2 years ago, has seen the biotechnology industry evolve. To survive, fledgling companies in health care and agriculture sectors of biotechnology, he says, need to start producing marketable products more quickly than the industry's first wave of entrants, who encountered a more patient investment community. In this harsh financial climate, says Hubbard, "You have to force yourself to think in terms of 6 to 18 months, instead of 2 to 10 years." For evolving companies without vast treasuries, he says it means they have to "put the technology to work or go play another game." ■ **MARK CRAWFORD**

†Arthur Young, *Biotech 88: Into the Marketplace*, (published San Francisco, 1987).

Wyngaarden to Chair Biotech Council

After weeks of rumblings that the 2-year-old Biotechnology Science Coordinating Council (BSCC) would be reconfigured or abolished, the White House has given the organization a new lease on life. The council's mission remains essentially the same—to coordinate regulatory actions by the five federal agencies that fund research or oversee experimental and commercial applications of genetically altered organisms.

The BSCC, however, will have a new leader—James B. Wyngaarden, director of the National Institutes of Health. John H. Moore, deputy director of the National Science Foundation will serve as assistant director of the council. David Kingsbury, NSF's assistant director for biological sciences, who chaired the BSCC until 1 October, is off the council.

Kingsbury's departure appears to have been driven partly by infighting within the executive branch and by concerns about allegations that Kingsbury did not fully disclose his relationships with biomedical subsidiaries of a British holding company, Porton International (*Science*, 6 November, p. 742). The Justice Department is currently investigating Kingsbury's ties to the biotechnology industry

Kingsbury told *Science* in October that he was involved in a "power struggle" over the future shape of the BSCC with Beverly J. Berger, assistant director for life sciences of the Office of Science and Technology Policy (OSTP) under presidential science adviser William R. Graham, Jr. Berger joined OSTP in April on detail from the Department of Energy (DOE), where she worked in the office of Biological Energy Research. Prior to that she was director of biofuels and municipal waste technology at DOE.

Graham, however, is reported to have been worried about the Justice Department's probe of Kingsbury and its potential

for damaging the BSCC's credibility. According to White House sources, several months ago OSTP urged NSF officials to find a replacement for Kingsbury on the BSCC. Kingsbury submitted a letter to OSTP on 17 September stating that he would abstain from taking part in BSCC activities until Justice completed its investigation, but he did not resign from the council.

The BSCC was first established in October 1985 by former presidential science adviser George Keyworth. Its charter included a "sunset" provision that automatically disbanded the organization on 1 October 1987, unless the White House chose to extend its life. Graham, who has succeeded Keyworth at OSTP, decided this summer that BSCC should continue to operate in some capacity. But there was debate within the White House about whether the membership, mission, and duties should be broadened to take on policy issues.

The debate has ended with the creation of a Committee on Life Sciences (CLS), which will handle interagency policy issues. It will be chaired by OSTP's Berger and will include most cabinet departments and key independent agencies—EPA, NASA, and NSF. The following White House offices also will be represented: the Office of Management and Budget, the Office of Policy Development, the Council of Economic Advisors, Council on Environmental Quality, and the Office of the U.S. Trade Representative.

The establishment of the policy committee is being received favorably by House and Senate congressional aides and environmentalists. They view it as a step toward "balancing the physical sciences tilt" at OSTP. Wyngaarden's appointment to the BSCC also is viewed positively. "Wyngaarden is an all right guy and knows the biomedical side of these issues," says Jack Doyle of the Environmental Policy Institute.

Environmentalists are disappointed that OSTP did not revamp the BSCC's structure, however. "The problem is that the council has been dominated by the biomedical community," says Doyle." They want the council to be more sensitive to environmental science and ecological issues.

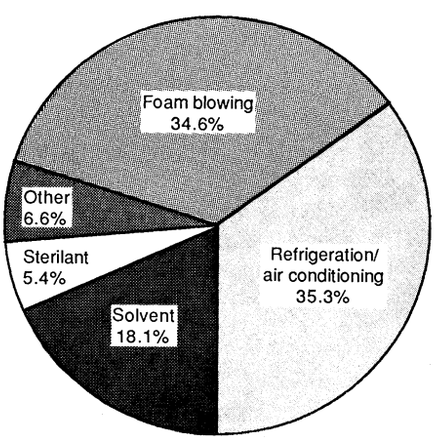
The first meetings of the new BSCC and the CLS are not expected to take place before January. While there is no tentative agenda for either organization, the BSCC has a backlog of unfinished business. This includes defining what is a "deliberate release" or what constitutes "containment" for genetically altered organisms that are the subject of greenhouse experiments. Says one USDA official, "I see a lot of the same problems that were around a year and one-half ago." ■ **MARK CRAWFORD**

EPA to Cut U.S. CFC Production to Protect Ozone in Stratosphere

The Environmental Protection Agency (EPA) is proposing to freeze and then halve emissions of chlorofluorocarbons (CFC) in the United States over the next decade. The agency's 1 December announcement complies with a federal court order, the result of a lawsuit brought by an environmental group, that requires it to issue rules to protect the stratospheric ozone layer. Production of the chlorine-emitting compounds would not be reduced uniformly. Output of CFCs would be cut according to their capacity for destroying ozone, which shields animal and plant life from excessive levels of ultra violet radiation.

CFCs are used extensively in the United States and in major western industrialized countries, primarily as cooling agents and solvents, and in manufacturing plastic foam products. EPA, however, in its draft rules suggests that American industry will be able to shift to substitute products or reduce use of CFC compounds substantially in most cases. Use of bromine-based Halon compounds, which are most destructive to ozone, also can be reduced greatly, EPA says. The Halon gases are used primarily for fire control and their production would be frozen at 1986 levels in mid-1992.

EPA's proposed rules, which the agency is mandated to publish in final form next August, are consistent with the plan for protecting the ozone layer that was worked out in September by the United Nations Environment Program (UNEP) (*Science*, 25 September, p. 1557). More than 23 nations have endorsed the treaty on a preliminary basis. It will go into force in 1989, or as soon as enough of the industrial nations responsible for the bulk of CFC emissions worldwide ratify it. In line with the treaty, EPA proposes that production and use of CFC compounds be frozen first, then cut by 20% by 1993 and by 50% by mid-1998.



Chlorofluorocarbon use. *CFCs are used intensely in U.S. industry for a range of purposes. EPA says substitutes can be adopted for most purposes within 10 years.*

David Doniger, an attorney for the Natural Resources Defense Council (NRDC), says the agency's proposed action does not appear to meet the requirements of the Clean Air Act. "In our view the regulations will be legally inadequate unless they prevent ozone depletion." The environmental group, which went to court in 1985 to force the agency to regulate CFC emissions, could initiate new legal action against EPA after final rules are issued in August.

Lee Thomas, EPA's administrator, defended the agency plan before reporters on 1 December, stating that the concentration of CFC compounds in the upper atmosphere is not projected to rise to a level where ozone levels will erode beyond natural variations. NRDC's Doniger, however, says the statement only may be true if the world does nothing to curb emissions of carbon dioxide, methane, and other gases that contribute to global warming. These gases help buffer the cholrine elements in the upper atmosphere as CFC compounds degrade.

Some key members of Congress also believe the measures proposed by EPA and UNEP are inadequate. On 12 November, five members of the Senate Subcommittee on Environmental Protection asked Mostafa Tolba, UNEP's director, to convene an international meeting within 6 months to consider imposing stiffer measures to control CFC emission in light of new data gathered from Antarctica.

Thomas says the agency has not ruled out taking tougher action. Analyses of the accuracy of the statistical models used by EPA to forecast ozone depletion trends and a review of research data gathered in September and October on the growing ozone hole in Antarctica (*Science*, 9 October, p. 156) could alter the agency's position.

But for the immediate future, Thomas is reluctant to push Japan, the European Community, and other countries to accept deeper cuts—at least not until the treaty goes into force. He fears that if countries are pushed too hard, the UNEP treaty could crumble. Says Thomas, "I don't want to give anybody the excuse to say we don't need to go forward with the process right now because it looks like we have more data coming forward in 6 months." ■

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