for business aspects, to broaden the joint venture." Immunorex's staff of approximately 15 is expected to grow as its laboratories and offices expand along with Centocor over the next year. All but $200,000 of the new funds, however, will be directed toward research.

Centocor's president, Michael Wall, projects a profitable future in immunoregulation research, but says the company wanted to expand its joint venture with FMC because it was unwilling to divert large amounts of its own money to the project. Says Wall, "This is a way for Centocor to reduce the risk. It enables Centocor to get a foothold in the field through a 50 percent joint venture."

Patrick C. Kung, Centocor's vice president of research, says that the new work at Immunorex will center on assessment of immune responses. Researchers also want to identify, define, and characterize the T cell mediators, but Kung declined to elaborate because the research is still in a preliminary stage.

Immunorex is headed by a two-man board of directors consisting of Centocor's Wall and Tom Banford, vice president of R&D at FMC. In Immunorex's two-year lifetime, no products have been brought to market, but the new research may be more focused on this goal. Wall concedes that the joint venture will probably not market anything in 1983, but hopes in 1984 to "come out with a product to diagnose the status of a person's immune system." Diagnosis is just the first step in developing new markets. Wall says that its therapeutic products will not be ready before 1985 or 1986.

Specific marketing arrangements for future Immunorex products have not yet been determined, and officials at both companies say that such decisions will depend on the types of products developed and on the markets to be entered. Possible arrangements being considered include having the joint venture market its own products, bringing in a third company for this purpose, or having Centocor or FMC take on this additional responsibility.

Centocor's marketing history indicates that FMC may eventually get the nod to market Immunorex products. Centocor typically sells a partner the rights to market a product for a number of months, and after this period the partner buys the specific monoclonal antibody used. It holds agreements with a number of companies worldwide, including Hoffmann-LaRoche, Warner Lambert, the Commissariat à l'Energie Atomique in France, Toray Industries in Japan, and the Sorin Biomedica division of Fiat in Italy. **—Arthur Klausner**

MONOCLONAL ANTIBODY PRODUCTION

GENETIC TECHNIQUES IMPROVE HYBRIDOMA SELECTION

LOS ANGELES, California—A new selection strategy makes it more efficient to isolate stable antibody-producing hybridomas. Hybridoma cells that lack the information to make antibodies can be eliminated selectively from cultures by linking a selectable gene to one that codes for antibody production.

Not all genetic engineering involves clones, vectors and isolated genes. Researchers at the Veterans' Administration Center and the University of California, Los Angeles, have exploited classical genetic linkages to develop this new strategy for selecting hybridomas. R. Thomas Taggart and I. Michael Samloff reported in the 11 March issue of *Science* that their strategy both increases hybridoma selection efficiency and promotes growth of antibody-producing cells.

Taggart and Stamloff developed a scheme to genetically link a selectable marker, adenosine phosphoribosyltransferase (APRT), to the immunoglobulin heavy chain gene, one of the genes for antibody production. They used a mouse strain that has both these genes on the same chromosome to make antibody-producing cells, then fused these cells to APRT-deficient tumor cells to produce hybridomas. All the hybridomas that survived selection also possessed one of the genes essential for antibody production. Current selection strategies utilize selectable marker genes located on chromosomes without antibody-producing genes; thus, not all the "selected" hybridomas have the information to produce antibodies.

Hybridomas are produced by fusing antibody-producing cells, which cannot grow in culture, with tumor cells, which can grow and multiply in culture but do not produce antibodies. In order to isolate the hybridomas, the unfused tumor cells must be killed selectively. The unfused antibody-producing cells die on their own.

The tumor cell lines used for hybridoma production have one or more selectable markers, a mutation that is lethal under certain growth conditions. If a hybridoma culture is exposed to these lethal conditions the fused cells will grow because the antibody-producing cells have a normal gene that can complement the tumor cell deficiency. The unfused cells do not grow.

This selection strategy is simple in principle, but it can be complicated in practice. Fused cells, which contain twice the normal number of chromosomes, tend to eliminate some of their extra chromosomes over time. If a hybridoma loses the chromosome that contains the selectable marker gene, it will not survive the selection even though it can grow in culture and produce antibody. Loss of chromosomes containing antibody genes results in selection of non-producer hybridomas.

By genetically linking the APRT and the immunoglobulin heavy chain, Taggart and Samloff were able to increase the efficiency of hybridoma selection by 37 percent. Furthermore, their technique solves a problem in long term hybridoma cultures because it can be applied at any time to eliminate cells that have lost the selectable marker.

"This approach is both clever and elegant," said Richard Bankert, an immunologist at Roswell Park Memorial Institute in Buffalo, New York. He suggested that the basic strategy can be applied and expanded in other hybridoma selections. For example, if researchers can link different selectable markers to each of the genes required for antibody production, then the selection procedure would isolate only cells that have all the information for antibody production.**—Tazewell Wilson**

BIOTECH UPDATE

W. R. Grace & Co. announced the completion of its $36.5 million purchase of Amicon Corp. of Lexington, KY (see BIO/TECHNOLOGY, 1:1, p. 30).

Biogen has entered into a joint venture with Shionogi of Japan. Under the terms of the agreement, Biogen will provide interleukin-2, a lymphokine, for clinical trials to be performed by Shionogi.

Cornell University, Ithaca, NY, is forming a biotechnology institute. Over the next four-to-six years Corning Glass Works, Union Carbide Corp., and Eastman Kodak will contribute $2.5 million each to the project. Cornell is expected to invest about $4 million a year, and over 400 scientists and faculty will participate, emphasizing basic research in several areas, including molecular genetics, cellular biology, and cell reproduction.