POTENTIAL USE OF THE BIOREACTOR TO DETERMINE EFFECTS OF MICROGRAVITY AND OTHER ENVIRONMENTAL PARAMETERS ON GROWTH OF HYBRIDOMA CELLS

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The monoclonal antibody field is a rapidly growing biotechnology. Monoclonal antibodies have been hailed by many as the perfect medical weapon, the magic bullet, that will be effective against several human diseases, including cancer. Antibodies are produced by the body to defend against foreign agents such as bacteria or viruses. In the past it has not been feasible to treat patients with antibodies taken from the blood of immune individuals because of a lack of suitable donors and the expense of separating the antibodies from other blood components. There is also the risk that some patients will react adversely to these preparations.

Laboratory production of large quantities of monoclonal antibodies can be achieved by hybrid cells called hybridomas. Hybridomas are made by fusing specific antibody producing lymphocytes with laboratory-grown tumor cells, the result of which are cells that have characteristics of both parents. The ability to grow forever comes from the tumor cell--to produce antibody comes from the lymphocyte cell. This technology will allow pharmaceutical companies to make them available to patients.

Although this market is projected to be two billion dollars in diagnostics alone by the end of this decade, the technology has not kept up with demand. According to a recent article in the Wall Street Journal, some projects have made it to the market place, but in general, techniques need to be developed to overcome some of the technical problems. Most hybridoma production to date has been in the mouse system. Production of hybridomas from mouse cells has become almost routine, but the same techniques applied to human cells have not resulted in the consistent production of desirable hybridomas.

In our experience there are essentially five critical steps for producing human hybridomas. These are: (1) stimulation of lymphocytes to produce the specific antibody desired; (2) separation of specific-producing cells from nonproducers; (3) fusion of desired cells with tumor cells by membrane interactions; (4) maintaining sustained production of antibody for months; and (5) separation and concentration of antibody from the cell culture medium. It is our impression, and one held by others in the scientific community, that hybridoma technology is still evolving and significant improvements are needed to increase the efficiency of the steps listed

before we can realize our objective of mass producing monoclonal antibodies for the treatment of diseases.

Research is needed to define more completely the environmental conditions that must be met in order to successfully produce human hybrid cells. We believe the bioreactor being developed at NASA will enable us: (1) to determine the optimal conditions (e.g., pH, O_2, CO_2, nutrients) for growth of hybridoma cells, and (2) to determine whether cell growth and antibody production are enhanced in the microgravity of space.