

NIH

The world on the outside is blurred by the walls of the bubble.

BIOMEDICAL ENGINEERING

Beyond the Life Island

When cancer victims are treated with drugs, they sometimes become so susceptible to bacteria that the slightest contaminant in the air can be the cause of serious infections and even death.

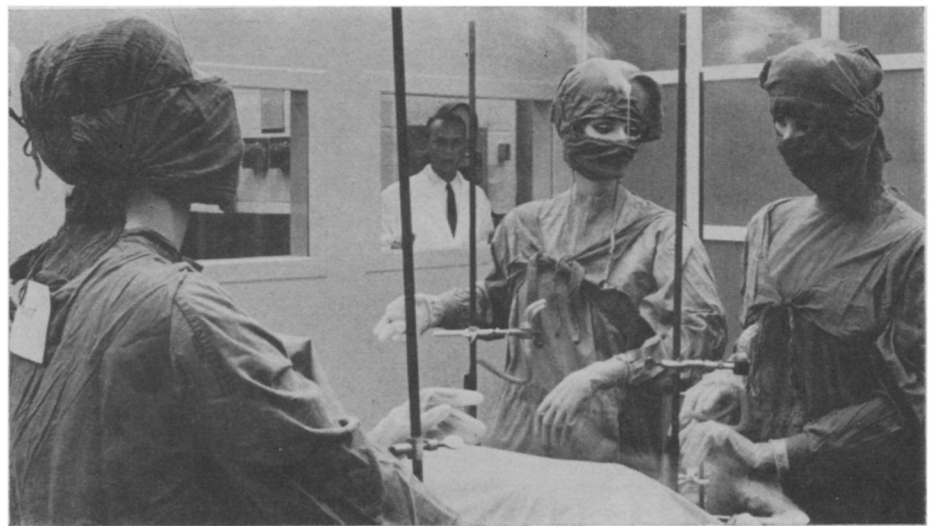
The powerful drugs used in cancer chemotherapy to knock out cancer cells also weaken the body's natural immunity to many bacteria by depleting the granulocytes and lymphocytes, white blood cells that fight off foreign invaders. To guard against bacterial attacks, patients in the chemotherapy unit of the National Institutes of Health, Bethesda, Md., are isolated in great plastic bubbles called life islands where they live encapsulated in a germ-free world, receiving massive doses of anticancer drugs. Food and medicine are passed through ultraviolet locks; nurses perform their duties wearing special gloves sewn right into the bubble's side and visitors look in at patients as if they were figures inside a balloon.

So far, less than 20 patients have been isolated in life islands at NIH and less than 50 in the entire country. Although the concept of isolating patients in a protective bubble has been around for about five years, it is still considered experimental.

Dr. John F. Burke of the Massachusetts General Hospital recently reported the development of a portable island that seems to have some advantages over the one at NIH because its design gives the patient an impression of having more space in which to live, of being closer to the outside world, as it were, but even the new model is not ideal.

The least appealing, and perhaps least readily handled, feature of isolation in these giant bubbles is isolation itself. Though some physicians claim that

children find it most nerve racking, others are beginning to challenge them on this point. Adults encapsulated in a life island are suddenly made totally dependent on other people. There is nothing, but nothing, they can do for themselves. There is nothing they can eat or touch unless someone sterilizes it first.



NIH

Smoking mannequins illustrate the use of laminar airflow.

For an adult, total dependency is hard to take and experience has shown that some patients regress to child-like reactions. Nurses are seen as mothers who must take care of every need. Impatience and frustration are likely to lead to intensely hostile feelings, and when this happens, the patient is in real psychological trouble. The fact of the matter is, psychiatrists are beginning to find out that people in plastic bubbles need someone to swear at and

they don't dare swear at the nurse; when you're as dependent as they are, they can't afford the risk. So at an NIH symposium on life islands last week psychiatrists suggested the addition of a psychiatrist or social worker to the medical team as a hospital-supplied punching bag.

Engineers, on the other hand, have another, better answer, and that is to blow the bubbles away with a downwind stream of sterile air that will free and protect these highly susceptible patients.

Using the concept of laminar or horizontal airflow, scientists under the direction of Donald Fox at NIH's Division of Research Services have designed a ventilation system that acts like a gigantic broom sweeping bacteria out of hospital rooms.

In operation, a horizontal flow of air passing through a wall of high efficiency filters rapidly removes all dust particles and bacteria down to 0.3 microns in size from the air. When the laminar airflow system is built in rooms at the NIH hospital, the wall of continuously moving sterile air will be behind the patient's bed. Contaminants from nurses, doctors, visitors or objects simply will be swept out of the room before they can travel upwind to the patient.

In the 20-by-15 foot experimental airflow room at NIH, tests show that

the stream of horizontal air keeps the room at least 10 to 20 times as clean as an operating room. There are 240 complete air changes an hour compared to the maximum of eight to 12 possible changes in a room the same size with standard ventilation. Sterile air filters through a \$6,500 wall at a rate of about 80 feet per minute, is carried out through ceiling vents at the opposite end of the room and is re-filtered and recirculated.