BIOLOGY

Youth for Living Cells

Tissue culture keeps cells young for years. Time, space and money seem only limits to their longevity. Quick freezing also preserves organs and tissues for later use.

A TOMATO root has been steadily growing for 21 years, its cells still young and vigorous; a bit of a chick's embryonic heart grew for many years before "euthanasia" was performed on it.

Does this mean that modern science can find man's long-sought goal of eternal youth and immortality?

Tissue culture seems definitely to have made a kind of immortality theoretically practical. Animal and plant cells have been kept alive for years in special cultures. Only time, space and money impose limits on the life-span of the cultures.

A culture of heart cells from a chick embryo was started in 1912 by the late Nobel prize-winner, Dr. Alexis Carrel. The tissue was not discarded until many years later when its scientific usefulness had ended.

Last spring a culture of tomato root cells, eternally young in a sense, celebrated its 21st birthday. The youth and continuance of this culture comes from the scientific care and imagination of Dr. Philip R. White, not from a drink at the magical Fountain of Youth. Dr. White is at the Roscoe B. Jackson Memorial Laboratory, Bar Harbor, Me.

He started a tiny bit of tomato root, cut off from a germinating seed, growing in a solution containing plant nutrients, and the root has been growing at the rate of about one-third of an inch a day since March, 1933.

Periodically Destroyed

Paradoxically, partial destruction of the culture periodically is one of the secrets of this kind of cellular immortality. The rate of growth of these cells is so great that only by destroying much of the culture each week can a scientist keep the culture in bounds. Without this destruction, the tomato root would have grown to astronomically huge lengths by this time, assuming there was some way to keep it growing.

People are sometimes surprised when something about a plant turns out to be more complicated than an animal. Dr. Carrel used a combination of chicken blood plasma and chick embryo fluid as the nutrient for his heart tissue culture.

Plant cells, however, are not bathed in a free nutrient fluid when they grow naturally. Each cell receives its food by diffusion through neighboring cells. For this reason, plant cell culture had to wait for the development of man-made nutrient solutions that would sustain cell life.

Dr. White was the first scientist successfully to design such a solution. Its complexity can be somewhat indicated by the number of ingredients: oxygen, hydrogen, carbon, calcium, potassium, magnesium, nitrogen, sulfur, phosphorus, iron, manganese, zinc, boron, iodine, carbohydrates, vitamins, hormones, amino acids and organic complexes.

Mixed in proper proportions, these substances formed a successful nutrient. Eternal youth is much more complicated than seekers for the Fountain of Youth imagined.

Another problem to be overcome in tissue culture investigations is that of infection. Bacteria, viruses, fungi and other infectious agents would quickly kill off any cultures they reached. All the nutrients are sterilized and every precaution is taken to keep the cultures in a sterile condition.

In 1946, Dr. White was able to make a nutrient solution for chick embryo heart cells. Heart tissue has been kept alive and pulsing for 12 weeks in this medium.

Synthetic Nutrient

This synthetic nutrient fl[illegible]imal cells eliminated one of the gre[illegible]difficulties that had faced experimenters with the Carrel-type culture.

The chemical structure of body fluids is not completely known. This meant it was impossible to be exact in analyzing the effects of substances on cell growth. The synthetic nutrient solution for animal cells was made up of dextrose, mineral salts, 11 vitamins and 12 amino acids. By varying the composition of this solution the effect of nutrients on cell growth and division can be studied directly.

Such tissue culture work has been used in cancer studies in an attempt to differentiate between the biochemical requirements and structure of cancerous and normal cells. Dr. White is now growing mouse tumors in this medium.

Hopes in Quick-Freezing

This kind of immortality and eternal youth probably will not satisfy man's dream, but it does point up the fact that individually and in tissues the cell seems to be capable of living a very long time—provided enough scientists are around to protect it from the world.

Quick-freezing techniques offer more hope to those who want a Fountain of Youth to help the middle-aged business man who has discovered his arteries are older than his ideas.

Two London University scientists discovered that skin from a rabbit's ear could be transplanted after four months in a freezer. The rabbit skin was first impregnated with glycerine and frozen at 70 degrees below zero, Centigrade.

"ETERNAL" TOMATO ROOT — Dr. Philip R. White, Jackson Memorial Laboratory, Bar Harbor, Me., examines a flask holding part of his tomato root culture that has been steadily growing since 1933. The root is about the size of store twine.

This led to the suggestion of a skin or artery bank in which a person could deposit some of his own youthful body tissues for later withdrawal. The frozen tissues would then replace arteries worn out by years of tension, or skin wrinkled by the advance of age.

In similar experiments, Drs. A. S. Parkes and A. U. Smith of the British National Institute for Medical Research succeeded in grafting male sex glands in rats when the glands had been stored in a frozen state for as long as 22 weeks.

They hinted in their report that the special freezing method might make possible transplants of human gland tissue. The glands were frozen in a material containing glycerol.

The same method was used successfully for grafts of rat ovarian tissue.

The most serious problem facing any surgical attempt to transplant organs from one individual to another is the reaction of the body to a foreign protein substance. Grafts to be successful must be from the subject's own body or an identical twin.

At the University of Kansas Medical Center, surgeons have succeeded in transplanting quick-frozen lungs from one dog to another. Using dogs which were litter