

New Frontiers in *Biotechnology*

Samanthi Geethika Rabbadigala

Year 13 E

Mahamaya Balika Vidyalaya

Kandy

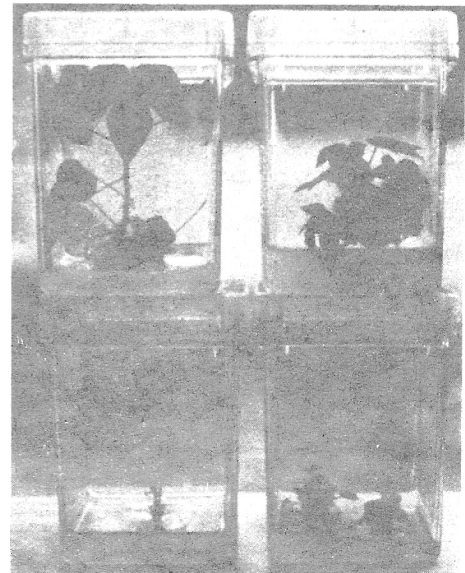
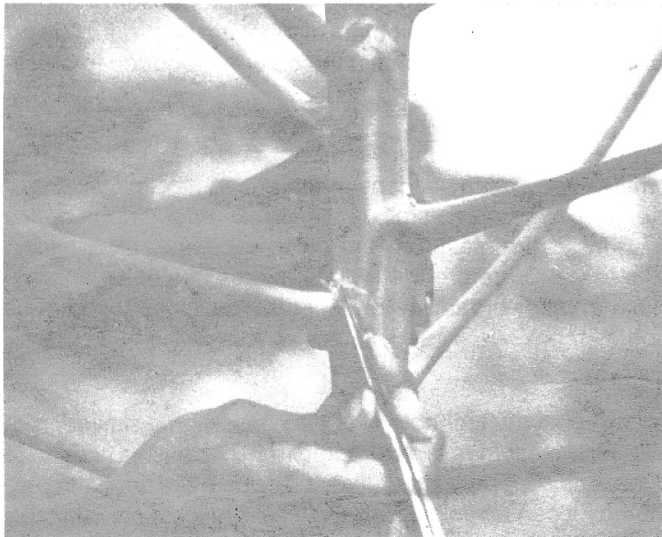
(This article was received for Young Writer's Competition -1993)

It is clear that in an age such as the present, in which science and technology, at the highest rung of the ladder of development, is paving new avenues for the benefit of the world, we as the inheritors of tomorrow's world, should remain vigilant.

We who are at the threshold of the 21st century will be the owners of that century. Even a little knowledge of biotechnology, which is a subject receiving much attention in the field of modern science today, will be helpful to us in the serious task of taking over the responsibilities of future.

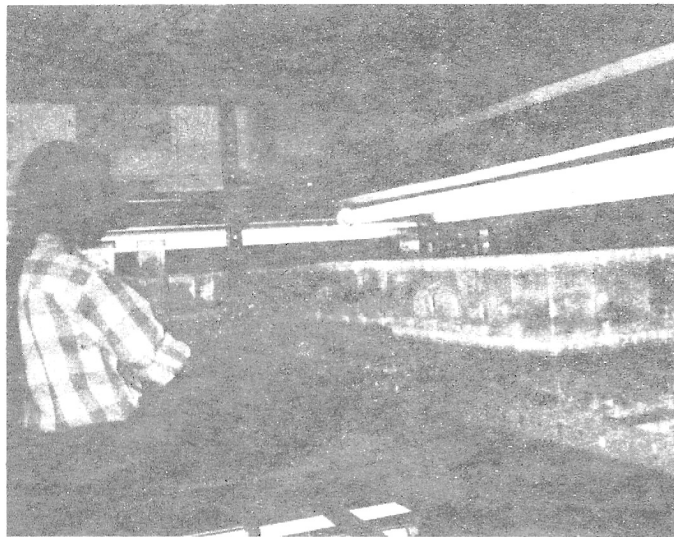
Biotechnology is the practical use of an organism or a subcellular organism to assist some production or production process and for managing the environment. This definition of biotechnology was adopted by the SPINK Committee on Modern Biotechnology which met in London in 1980.

Although Bio Technology has made considerable practical progress in modern times, its history goes as far back as around 6000 B.C.. The ancient Sumarians and the Babylonians knew about wine manufacture and Egyptians from around

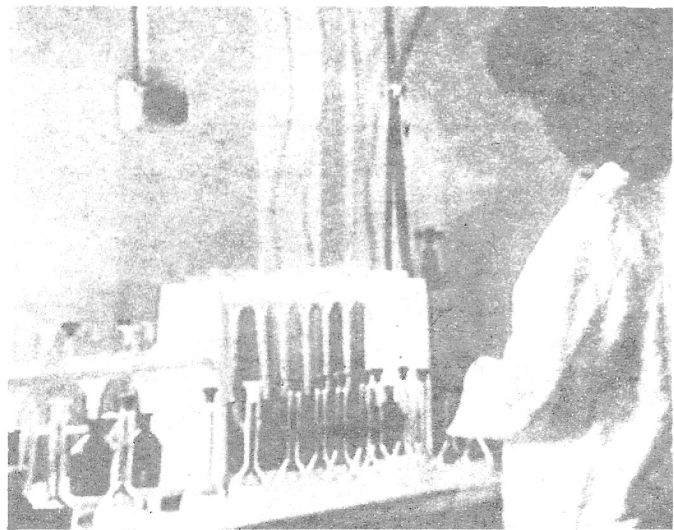


Tissue culture of papaw

4000 B.C. knew about yeast which is important for fermentation and about making bread. If we take a look at the history of Sri Lanka, there is evidence to show that our ancestors knew how to produce toddy.



Production of resistant plant varieties



Genetic Engineering - fast developing area

What is known as modern biotechnology is a process carried out under sterile conditions. In biotechnological processes carried out to obtain economic advantages the objective is to

change the genetic pattern of the organisms used in order to make the process concerned more effective. In genetic engineering which can be called a fast developing area today, the genetic structure of an organism is reconstituted in a manner which is economically important to us. Recombination or mutations are used for this purpose. The transmission of the bacteria known as *Escherichia coli* which is the insulin producing gene in the human body, was the first step in genetic engineering. Today there are wonderful inventions such as tobacco plants which shine like fire flies, super quality pigs with high meat content and low fat content.

Further, as a result of genetic engineering, a paddy plant which is totally free of leaves has been developed by a group of scientists in the John's Inn Institute at Norwich. This discovery has made it possible to grow paddy in areas which have strong winds. The paddy seeds of this strain also have a shorter maturing period. Harvesting is easy and there is sufficient photosynthesis through the stems and panicles of this variety.

Protoplast fusion and Tissue Culture could be cited as two frequently used principles of genetic engineering. In Tissue culture, plants can be reproduced in acidic cellular solutions.

Enzyme technology can be considered an area which is developing as quickly as the science of genetic engineering. The purpose of this technology is to make optimum use of the different enzymes in the leaf.

A particular product could be obtained from a series of biochemical reactions in a cell because the cell does not contain the enzyme which is required to break down that product. For instance, if we consider the production of alcohol from a yeast cell we can obtain alcohol as the product only if the yeast cells do not contain the enzyme required to break-down the alcohol.

Further, the termite cannot digest cellulose because the termite's body does not contain the enzyme cellulase. However the microorganism known as *Trochonympha* which exists inside the intestine of the termite is capable of producing cellulase. Therefore the termite makes use of an enzyme within another organism to digest the cellulose found in its food.

Modern enzyme technology is also based on a similar process. First, enzymes are extracted from organisms or parts of organisms. Thereafter such enzymes are immobilized. Thereby it can be linked to the necessary location. Immobilization of enzymes can be done in several ways. Enzymes can be immobilized into a total enzyme. Or else it is done to part of the cell or to an organism. Then the enzymic activity could be carried out and the required economic purpose

achieved. An example of such an activity is the production of high fructose syrup. This syrup has a very high percentage of fructose.

These are important for the manufacture of cordials. Their production is carried out by using the enzyme called glucose isomerase found in bacteria.

In biotechnological reactions, conditions under which the reaction is carried out invariably affect the speed of the reaction. Therefore bioreactors or fermenters are important for the provision of such conditions during biochemical engineering activities. Bioreactors have been designed in such a way as to enable the use of computers to control factors such as the temperature and pH value of the site where the biochemical production is being carried out. By this method the quantum produced is increased and a higher percentage of the product could thereby be obtained.

Successful results could be obtained by using mechanisms like biosensors for processes for which modern devices cannot be fabricated. Biotechnology can be used for medical treatment in addition to its use for the production of medicine. Further, it also helps to cure the side effects arising from treatment with drugs.

Biotechnology makes it possible to produce plant varieties which are resistant to natural hazards such as droughts, and damage by insect pests. Agriculture in the modern world faces a serious problem with regard to nitrogenous fertilizer, because of the high price of petroleum products or due to their scarcity. Genetic Engineering has provided an answer to this problem. Rhizobium genes capable of fixing gaseous nitrogen in leguminous root nodules can be used for this purpose. Different plants can be drafted using the genetic system called Nifsystem consisting of around 17 genes which has the ability to fixate gaseous nitrogen.

Biotechnology is a process which should be monitored systematically and closely. There should be a standard policy so that countries may be prevented from acting arbitrarily in this regard.

In a biochemical production the production process is called an upstream process and the process for the separation of the products is called the downstream process. Bio reactors and fermenters are widely used in the production of wine and beer and antibiotics. This technical process, constructs units by combining biological molecules, such as enzymes and antibiotics through processes such as protein technology and cell immobilization. These units are known as biosensors. Mechanisms can be arranged by combining these biosensors. For instance, if we need to isolate foreign matter or to remove some chemical from an alcoholic solution which is being prepared, the solution should be passed through a biological sensor. Thereby the undesirable chemicals in the solution can be removed.

There is a bad side as well as a good side to every thing. This universal characteristic doubtless applies to biotechnology as well. Just as a large amount of money spent on machinery could be saved through the use of biotechnology, it also reduces energy consumption. Organisms used in biotechnology sustain themselves and essential products are obtained, using as raw materials, inexpensive substances which are freely available in the environment. Furthermore,

Further, biotechnology can also pose threats to humanity. Large numbers of lives can be destroyed by destructive weapons such as microorganic weapons. *Clostridium botulinum* is such a destructive microorganic weapon. The dangerous organisms which could be produced by drafting the gene called Bangaratoxin produced by the reptile *Bangarus circulus* to other animals, can pose a real threat to human beings.

Biotechnology is a process which should be monitored systematically and closely. There should be a standard policy so that countries may be prevented from acting arbitrarily in this regard. Further, it is common place nowadays for developed countries to pilfer genetic resources from underdeveloped countries. This is taking place on a large scale. Steps should also be taken to prevent this.

However it is true that biotechnology is extremely beneficial to man. Yet if such developments are used for the detriment of man it will bring us to harm like the proverbial razor in the monkey's hand. Not only biotechnology for that matter, any scientific discipline should progress with a human approach and not with the intention of destroying the world.