Environmental

- The use of GM technology has the potential to alleviate environmental degradation.

- Certain GM crops, for example, are modified to be pest resistant. When planted appropriately, this would preclude the application of pesticides and could potentially reduce the amount of pesticides introduced to the environment.

- Certain plants and microorganisms can be genetically modified to produce a biodegradable plastic which could reduce the reliance on non-biodegradable types.

Did you know
Polyhydroxybutyrate (PHB) is a biodegradable plastic that can be produced by genetically modifying certain plants such as alfalfa.

- Phyto- or bioremediation can be carried out by plants or microorganisms respectively. These can be genetically modified to metabolize or store environmental contaminants, such as heavy metals.

- Alternative, cleaner-burning biofuels could potentially be synthesized at a large enough scale from GM plants or microorganisms to limit the negative effects of fossil fuels.

Ornamental

- GM technology can also be applied to the ornamental industry.

- The manipulation of genes of flowering plants, for example, can give rise to novel flower colours and scents. Other than these decorative changes, ornamental plants can also be modified to have increased disease resistance and shelf life.

- A blue rose, previously thought impossible, has been created by modifying the genome of conventional roses to include the gene responsible for the production of blue pigment.

- The fluorescent GloFish® were obtained by introducing a fluorescence gene to the fish. This gene occurs naturally in marine organisms. Current GloFish® are offspring of the original genetically modified fish and do not require the insertion of the gene.
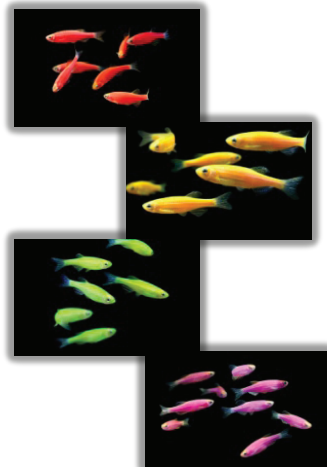
Did you know
The GloFish® were developed in Singapore and was originally meant to be used as an environmental pollution detector.

http://www.glofish.com/

GMAC
SINGAPORE

GENETIC MODIFICATION
Applications

Introduction

- All organisms are made up of cells, which contain DNA (deoxyribonucleic acid), the chemical blueprint that determines the development and function of a cell.

- DNA is organized into genes, which code for proteins. Genetic modification (GM) technology involves the direct alteration of the DNA of organisms.

- An organism that has had its DNA altered via molecular means is termed a genetically modified organism (GMO).

Overview of Industries Using GM Technology

- GM technology is an emerging field and it has great potential in a wide spectrum of applications. As the amount of knowledge and positive results obtained increases, so too would the number of potential areas for application.

- Currently, GM technology already has many applications and these span various industries:

❖Food & Feed

❖Medicine, Pharmaceuticals & Research

❖Environmental

❖Ornamental

Food & Feed

- GM technology can be utilized to improve food items such as crops and animals meant for human consumption.

- The most popular trait introduced into crops, since 1996, is herbicide tolerance. This allows crops to survive the herbicides applied for the clearing of weeds.

- Derivatives of GM crops can be included in processed foods. For instance, corn syrup can be obtained from GM corn and soy lecithin from GM soybean. These common ingredients can be found in a wide range of packaged foods.

Did you know
The Flavr Savr tomato was the first GM whole food to be released for sale in the market in 1994. It was sold in the US but later discontinued due to commercial reasons.

- GM technology has also been used to modify microorganisms to produce certain food compounds. For example, microorganisms have been modified to produce chymosin, an enzyme used in the cheese-making process.

- As the population increases and becomes more affluent, the demand for meat will likely increase. Livestock would then require a greater amount of feed to meet this demand; GM grain can be used as feed to achieve this aim.

Medicine, Pharmaceuticals & Research

- GM technology has the potential to develop novel and more effective ways to treat and research disease. Better, more accurate disease models can be created with the help of transgenic animal models.

- It could also pave the way for more affordable medication. A case in point would be the production of insulin by the genetically modified bacteria *E. coli* in 1982.

- The production of vaccines could also be aided by GM technology. The first vaccine against human disease developed with GM technology was against Hepatitis B in 1986.

- GM technology could also assist in the discovery of the functions of different genes, in the hope that a greater understanding would precede better treatment.

- For instance, gene therapy has the potential to treat and/or prevent genetic diseases based on altering/correcting the affected gene.