Social Studies - World Topics

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GENETIC MODIFICATION

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WHAT IS GENETIC MODIFICATION?

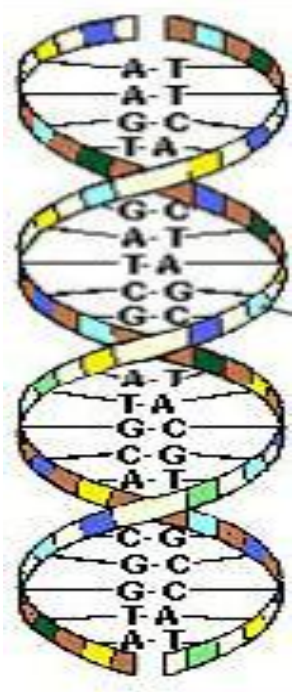
Genetics may be defined as:

the study of the way in which genes operate and are transmitted from parents to offspring.

Offspring inherit a genetic constitution from their parents. This hereditary endowment, the sum total of the genes that the individual has received from both parents, is called the **genotype**. The genotype determines the broad limits of the features of an organism. The genotype does not change during an individual's lifetime.

The essence of heredity is the reproduction of the carriers of genetic information, the **genes**. As a result, biological organisms, including human beings, reproduce organisms resembling themselves; human children are always recognizably human and have outward characteristics similar to those of their parents. On the other hand, since the offspring of sexually reproducing organisms receive varying combinations of genetic material from both parents, no two offspring (except for identical twins) have exactly the same genotype.

Genetic modification happens when scientists attempt to alter the genetic make-up of an organism, be it a plant, animal, or human. Every living thing has genetic information stored within itself and this information determines every aspect of life, from colour of hair, to resistance to certain diseases. Scientists have found in plants, that they can be made resistant to many types of diseases if the genetic make-up of the plant is altered. In the same way, they believe that many human illnesses can be overcome if the genetic make-up of humans were altered.



DNA carries a genetic code which is a sequence of the following:

A = Adenine

T = Thymine

G = Guanine

C = Cytosine

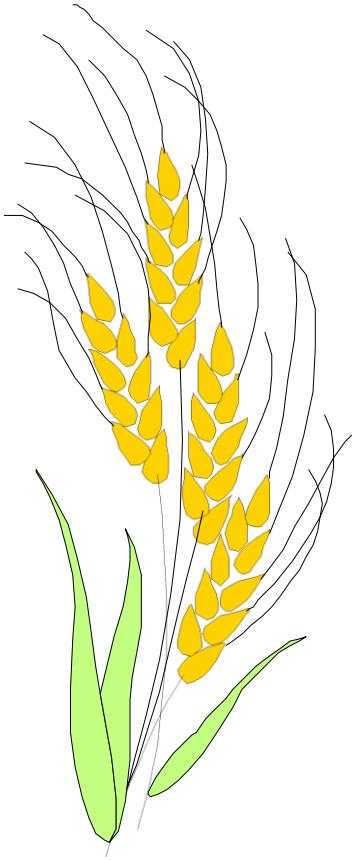
The combinations and sequencing of these determine all genetically preprogrammed functions of an organism.

Questions...

1. Write a short definition of genetics.
2. What is the difference between genetics and genetic modification?
3. How do you think genetic modification could help humans?

GENETICALLY MODIFIED FOOD

The issue of Genetically Modified (GM) food has caused a deep concern amongst many people, whilst in others it has stirred the imagination in a positive way. The science now exists to alter the genetic make-up of crops to ensure that the traditional diseases which crops succumb to can be eradicated. Not only that, but it is also possible to determine the shape, colour, and texture of foods. With GM foods we could have blue tomatoes, or extra large vegetables. Although these sorts of things are possible, the main aim of scientists at the moment is to alter crops so that they resist diseases and so ensure large crop yields.



In the 1970s, India was a poor country which was unable to feed itself. By simply introducing hardier seeds the Green Revolution in India meant that by the early 1980s it was self sufficient in wheat and rice despite a rapid increase in population. With the world population set to reach up to 20 Billion in the 21st century scientists point to the India example of how science helps to feed the world. The important distinction to remember, however, is that the Indian seeds were not genetically modified but simply cross bred to produce a better seed. Genetic Modification is a very new area of science and although it is now possible to produce genetically modified seeds and plants, no-one really knows what might happen in the long run if people start eating these products. Genetically modified soya is already in widespread use in the USA and appears in some products in the UK.

The main areas of concern include the affect that this type of produce might have on human health. If GM produce is resistant to diseases might it not be possible that it might adversely affect people as well. In the long term it might make people resistant to or susceptible to illnesses, or even make people ill in new ways.

Questions...

1. What is genetically modified (GM) food?
2. What are the advantages of GM foods?
3. List the main disadvantages.

GM FOODS - CONCERNS

Prince Charles set up a discussion forum on his web site specifically about GM foods, and found that he was swamped with viewpoints, concerns and opposition to GM produce. Ten main areas of concern were highlighted:

- **Do we need GM food in this country?** Looking at the huge food mountains held by the European Community and the subsidies paid to farmers not to plant crops because of overproduction it does not appear to be a pressing need.
- **Is GM food safe to eat?** Although there is no evidence that it is not safe there has not been enough research done to ensure that GM foods will not affect human health in a bad way.
- **Why are the rules for government approval of GM foods not as strict as for medicines which use the same technology?** New medicines have to undergo a very rigorous testing process before they are given approval for use. GM foods which use the same technology do not have to. Why is this the case?
- **How much do we know about the environmental consequences of GM crops?** In the USA, where GM crops are more common, the caterpillars of the Monarch butterfly are being damaged when they grow in GM crops. What affect might the crops have on other species, or food chains?
- **Should test crops be allowed without more stringent rules?** In the UK test crops are causing problems to nearby farmers. Some pollen from GM crops is drifting onto other, ordinary farm crops. What might the affects of this be?
- **How will consumers be able to exercise real choice?** There should be clearer labelling of GM produced foods. In any case can anyone be sure that their non GM food is not cross infected by pollen travelling in the wind from GM to ordinary crops?
- **If something goes wrong with GM foods who is responsible and who will pick up the pieces?** The government, the food companies, the growers, the consumers?
- **Are GM foods the only way to feed the growing world population?** A group of 20 African states have come out against GM food because they say it will undermine the diversity of crops, the local knowledge and sustainable agricultural systems now in place.
- **What affect will GM foods have on the poorest countries?** A Christian Aid report says that GM crops will not make any real difference to the starving because their problems are more complicated that just providing food. They need money, and to solve distribution problems, as well as have stable politics.
- **What sort of world do we want to live in?** Are we going to sacrifice the natural world and industrialize nature itself? Should we be more nature friendly and have a gentler approach to our world. Is life just a war or can we live in harmony with nature?

I for one am sick of all those people who hide under the bed every time something new comes up. It seems to me that in every person there is a frightened child who does not want to listen to any new ideas and will automatically shout NO! whenever a new idea is suggested.

GM foods are the answer if the world population is going to be fed in the 21st century. It is true that at the moment there does not seem to be a need for more food production because the world has enough to feed everyone. But if the world population is going to double during the first half of the 21st century we need to be getting ready for that now. We should be producing GM foods now so that we can iron out any complications and then we will be ready to produce more food when it is required.

We should have GM food in the UK because we are a leading member of the world community and we have the technology to help other nations which are not so fortunate. Financially, it will be a gold mine for any nation which develops the technology. As usual, at the moment, it is the USA which is leading the way. We should get our share of the market.

There is more chance of getting run down in the high street than getting ill from eating GM food. There is no evidence that GM food is harmful and it is ridiculous to argue that we should still oppose GM food because it might be harmful in the future. No-one knows about the future. We should look at the available information - there is no proven danger of GM food!

One of the issues is that GM food is not properly labelled and so people cannot exercise real choice. Go ahead and label it! In the future the price of food will drop because of larger yields and those who do not eat GM food will be paying a much higher price. It will be like organic food today - too expensive. People will be drawn to GM food because no-one likes to pay too much.

Finally, This matter about nature and being in harmony with it. Will the person who thinks we are in harmony with nature please stand up. We are not now and have not been for a long time in harmony with nature. People are destroying the rain forests, polluting the seas, and about 20% of all species are now extinct because of the way we live. GM foods mean that we will produce more, for less effort. That can't be bad can it? It's all very well having this head in the clouds view of nature, but the truth is that we have to manipulate nature for our own benefit. People who support GM food are not bad people; they're just realistic about the future.

Questions...

1. What are the arguments in favour of GM Foods?
2. If there is no evidence of the ill-effects of eating GM foods, why are some people so concerned?
3. Will GM foods help to protect the environment as argued in the last paragraph? Why?
4. Is GM food production an inevitable result of a growing world population?

ENVIRONMENTAL CONSEQUENCES

It seems to some people that the consequences of GM foods in particular could have devastating effects on our environment. If a crop is modified to be resistant to certain diseases that resistance might affect other types of plants and animals as well. The Monarch butterfly's caterpillar is proven to become de- formed when in contact with GM crops. This has an immediate effect on the food chain because the predators which eat the caterpillar might not get enough food to eat if the caterpillar dies out, or if the predator eats the caterpillars it may in turn affect that animal as well. The effects of this could be passed right up the food chain into humans.

The other big danger is that the pollen from GM crops might infect non GM crops and create a hybrid species of other crops. The choice that the consumer should have about whether to eat GM foods or not will disappear if farmers cannot guarantee that their crops have not been in contact with pollen from GM crops, or that their crops have not been influenced by nearby GM crops.

The danger in humans from eating GM foods is that the GM factor may in some way affect the body structure of humans. There are dangers of people becoming resistant to certain antibiotics for instance and then they would be harder to treat if they became ill.

The whole debate about GM foods falls into two main areas:

- Do we need GM foods?
- Have sufficient tests been carried out on them before they are approved for use?

On the first point, some people do not think we need GM foods. The European Union already has food mountains and already pays farmers not to plant crops in some of their fields because of overproduction.

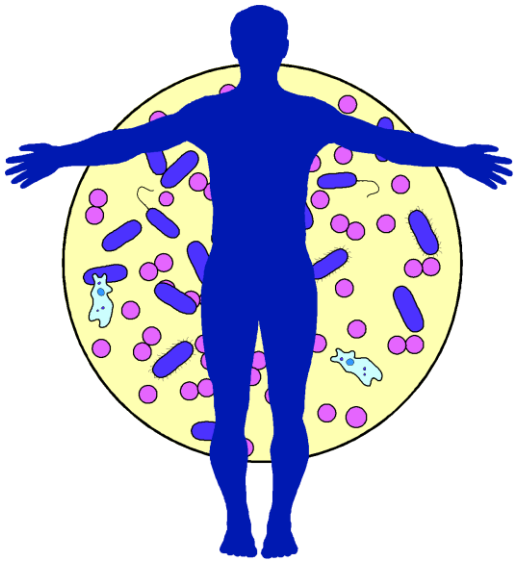
On the second point, it is clear that tests have not been carried out on a stringent enough basis to guarantee that GM food poses no threat. The government says that it is satisfied that GM food tests are adequate but it was also a British government that hid the truth about beef for many years until it was forced to admit that there was a problem.

Questions...

1. What are the main arguments against GM foods?
2. What scientific facts are there to support the banning of GM foods?
3. Are people who oppose GM foods just being old fashioned?

GENETICS AND HUMAN REPRODUCTION

In some families certain illnesses and diseases are passed down each generation. Scientists believe that if the genetic make-up of these people can be changed slightly it would be possible to eradicate these hereditary illnesses. Furthermore, it is possible, by the same technique to make other people resistant to certain illnesses and diseases.



Some people now want the foetuses of their children to be adapted so that they have massive intelligence or an expertise for creativity. This type of genetic intervention can also determine height, hair and eye colour, as well as other physical features. A recent scientific experiment on slices of Einstein's brain indicate parts of the brain which are bigger than average and which possibly explain his genius. Similar adaptations may be possible on humans so that parents can be fairly sure that their child will be a genius.

Scientists now have the technology to start reproducing some human organs by implanting them into or onto animals until they grow large enough and to the correct dimensions for use in human transplant operations. One example is growing a human ear on the back of a living rat. Other traditional ways of transplanting organs present difficulties including shortage of organs and some incompatibilities of using animal organs.

The most controversial use of human reproduction in genetics is the ability to clone. Clone means to reproduce an exact copy. It has already been successful in mice and sheep. The moral and ethical implications of reproducing human beings is huge. Some scientists claim that they have the technology to do it but no government has allowed any human cloning experiments to happen. If cloning is possible then it would be possible to create very artistic or scientific people to solve the problems of humanity. On the other hand we could also re-create Hitlers and Stalins!

Questions...

1. How does the use of genetics differ between the use in GM foods and in human reproduction?
2. Do you agree with the use of genetic intervention in:
   - curing hereditary illnesses,
   - producing organs for transplant,
   - cloning people?

Explain why.

EXERCISE 7

Imagine a world where all the major illnesses were eliminated

Imagine a world where everyone was clever

Imagine a world where people lived until they were 140 years old

Assuming that governments around the world no longer restricted work on any genetic modification experiments, write a short piece below highlighting the **advantages** which this work would bring for the world.

Why we should use genetic modification...

We've made a mess of the world
everything is clinical, there's no colour
no-one dies no-one lives
in this test tube world.

Assuming that governments around the world no longer restricted work on any genetic modification experiments, list five points below highlighting the **disadvantages** which this work would bring for the world.

MY FIVE POINTS

1.

2.

3.

4.

5.

WHAT IF SOMETHING GOES WRONG?

One of the main problems with genetic modification of any type is that the question of responsibility needs to be answered. If something goes wrong who will be to blame? Many people see genetic modification like a genie in a bottle. Whilst it is in the bottle there is no danger, but once it is let out of the bottle then anything is possible. Consider the discussion points below and add your own as well:

- GM food crops are being grown in one field and the wind carries pollen across many other fields. The person who grows non GM crops now has 'infected' crops. Nothing can be done because it has already happened. Who is to blame? Is the act of pollen blowing in the wind a natural and therefore blameless process?
- Should a cloned human being have the same rights as other human beings or are they created for a specific purpose?
- A cloned human being does not want to fulfil the purpose for which he or she was created. Is he or she now useless?
- What will happen to the already soaring world population if cloning 'factories' start pumping out more people?
- Is childbirth no longer required or relevant in the age of cloning? Think of all those careers which don't need to be staggered and wasted by breaks for having babies!
- Assuming genetic modification means that no-one dies of common diseases or illnesses any more, the life-span of people becomes much longer. How can the world population increase be kept under control. If people keep being born but very few are dying surely this will spell disaster for the planet.

Add your own examples:

-
-
-
-
-

Questions...

1. Write short responses to each of the points listed above.
2. Does genetic modification just look dangerous because it is a new idea? Might people come to terms with it as time goes by?
3. Are some types of genetic modification easier to justify than others? List them in order of acceptability.

WHAT SORT OF WORLD DO WE WANT TO LIVE IN?

This is the central question which should decide the future of genetic modification. People are generally split between the ones who believe the future lies with greater and greater scientific intervention to solve the problems of the world, and others who think that the future lies in working closely with nature and compromising rather than seeing life as a struggle against nature.

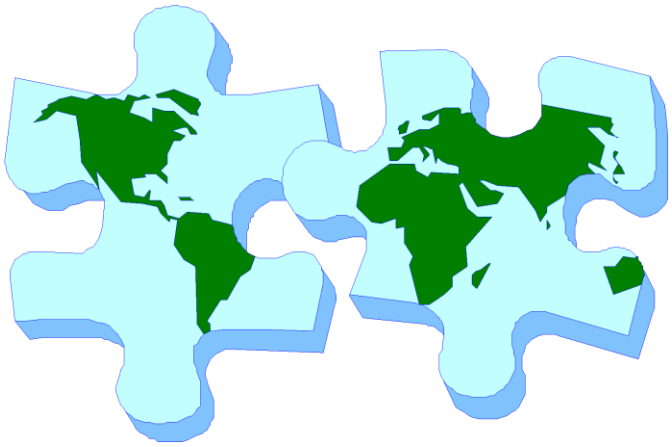
The essential problems which have faced the world for about the last 200 years is that scientific advances are ahead of cultural factors and attitudes. For instance, whilst science has reduced infant mortality in the third world substantially, families still have many children. This is because in the past it was expected that many of the children would die in their early years. People still do not understand that this is no longer the case. This has led to huge population increases. There are many examples like this one.

If attitudes could change quickly then science would be in closer accord with ordinary people. But attitudes change only slowly, and many people would argue that they should change even more slowly because at least those attitudes have stood the test of time. New viewpoints may last or may disappear very quickly.

Many people believe that we have already 'gone too far' and are on the verge of destroying the planet by over population, irresponsible use of natural resources, and negative use of science (nuclear weapons is a good example). The way forward is to slow down and work with nature to solve our problems. An example of this is the destruction of the rain forests. Many medicines have been found by testing various plants which grow in rain forests. If we relied on these methods of developing medicines there would be less need to use radical new scientific methods like genetic modifications.

It is inevitable that science will always be in the lead and attitudes will always lag behind. Science is at the cutting edge of life, always looking for more, better and faster solutions. Attitudes are by definition more traditional because it takes time to develop an attitude about something and even longer for a collective attitude to develop in a community or nation.

It is all about how we see the world and what we expect from it.



Questions...

1. Is science always one step ahead of acceptable limits, or are people always too out of date to understand?
2. Are our expectations of the future too ambitious?
3. Should there ever be any limits to our ambitions? After all humans are very curious by nature.