

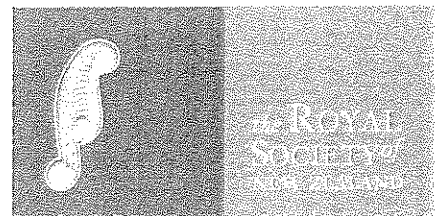
Entering the debate on ...

GENETIC MODIFICATION

... by developing a critical thinking response



New Zealand Association for
Animal Health and Crop Protection



Entering the debate on genetic modification by developing a critical thinking response

A RESOURCE FOR SCHOOLS PRODUCED BY THE ROYAL SOCIETY OF NEW ZEALAND
by Brett Clark

Since the discovery of DNA, the resultant pace of genetics research has generated a variety of issues that have provoked much social comment. Recent decades have seen the application of genetic research in two main areas of our lives – food and medicine. Both areas generate questions and debate about the ‘right’ we may or may not have to pursue these types of research, and about the consequences of doing so. There has been a corresponding increase in the level of public interest in the use of scientific research and how this research should be carried out. The availability of information written in everyday language (as opposed to scientific reports) for public consumption on many of these issues has however often been less than consistent, balanced or without bias. Each of the statements used has been taken verbatim from a publication or website to represent an authentic voice.

This resource has as its context the controversy surrounding the introduction of genetically modified (GM) crops. Objections principally centre on possible harm to human health, damage to the environment and unease with this type of technology within a wider cultural perspective. On the other hand, there are those who strongly believe that this form of genetic modification has the potential to secure and enhance food supplies for people throughout of the world. Much of the debate about GM appears to have been captured by political and personal agendas, grounded in people’s cultural values, and prejudices based on their life experiences. This can be readily seen in the material promoted through the media, particularly when written by those who serve a particular interest or commercial need.

How then, can we begin to approach this debate in such a way that we develop those skills and attitudes that allow us to construct a more informed and reasoned viewpoint? It is to this question that this resource is primarily addressed. The aspects of argumentation that are dealt with in this resource could begin a process to inform a response to the debate on GM.

This resource has been written in a format that provides templates for teachers to use to facilitate learning about the processes of critical thinking. The skills that are modelled by working within the GM context are readily transferable to any issue requiring critical thought. Other relevant contexts in which these templates could be used include cloning, sewage treatment, transport, or any of the myriad of issues that face people. The resource could easily be used as a short, concentrated block focusing on the process and skills of critical thinking in a Science or English class in order to prepare for future work. While this is probably the best way for pupils to learn the skills presented, elements of it could be interspersed through a teaching programme where and when appropriate. Whichever approach is used, the opportunity for practice and reinforcement of critical thinking is essential.

This resource has been produced with Year 10 pupils in mind, but could be easily used with young people at any level above National Curriculum Framework (NCF) Level 3. The author has successfully worked with primary school children to develop these skills, a first step in developing critical thinking which can then be built upon.

The resource has been produced in loose-leaf form to enable extra materials and updates to be inserted as they become available. Further copies of this resource may be obtained from Agcarm Inc, PO Box 5069, Wellington, New Zealand, Facsimile +64 4 499 4223, Email jack@agcarm.co.nz

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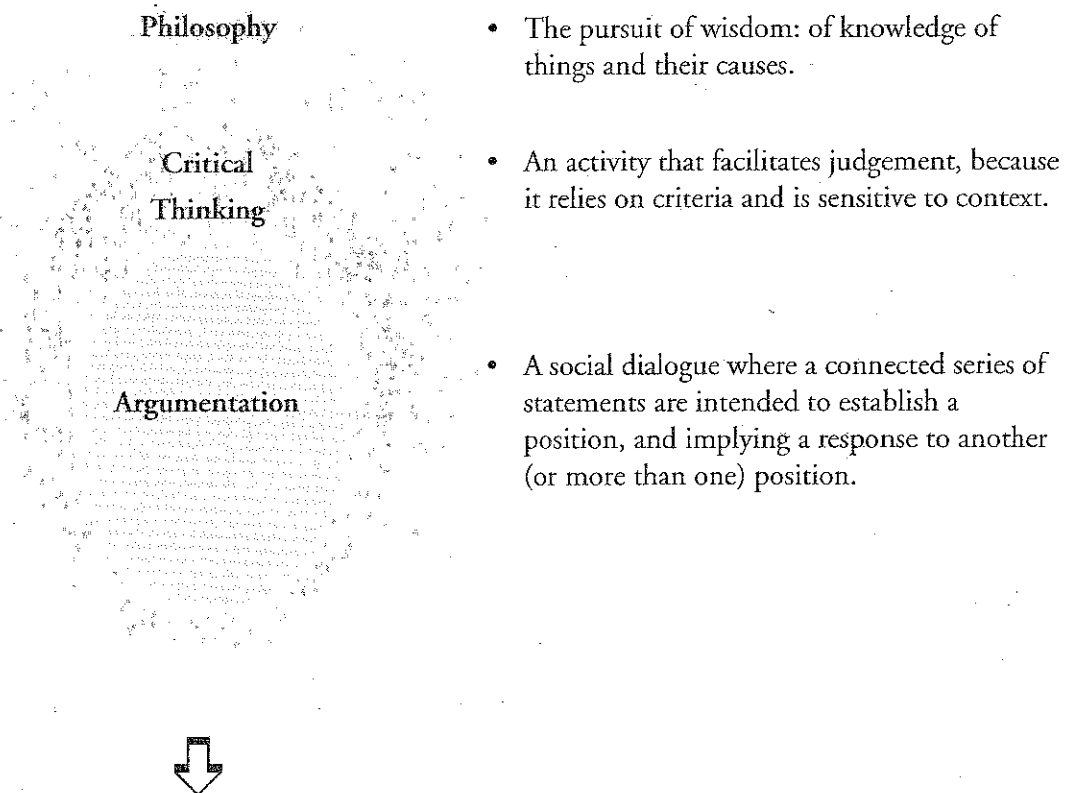
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RATIONALE

This resource develops its structure from within the New Zealand Curriculum Framework where:

'The school curriculum will foster the development of the knowledge, understanding, skills and attitudes that will empower students to take increasing responsibility for their own learning. It will provide students with satisfying and worthwhile experiences, which will motivate them to continue learning throughout life'. (Page 7)

The resource is set within this conceptual framework.



This diagram illustrates two central points.

1. **Critical thinking** is just one means by which a deeper, philosophical understanding of an issue can be achieved.
2. **Argumentation** can be one part of exploring a critical thinking response to an issue.

Critical thinking

It is intended that this resource
should encourage critical thinking in our students
by developing these abilities

Critical thinking
can be facilitated by a
collaborative working
environment that encourages
these personal dispositions:

- valuing open mindedness
- valuing fair mindedness
- respecting evidence and reason
- respecting clarity and precision
- tolerating ambiguity

Critical thinking
can be facilitated by a
collaborative working
environment that encourages
these cognitive skills:

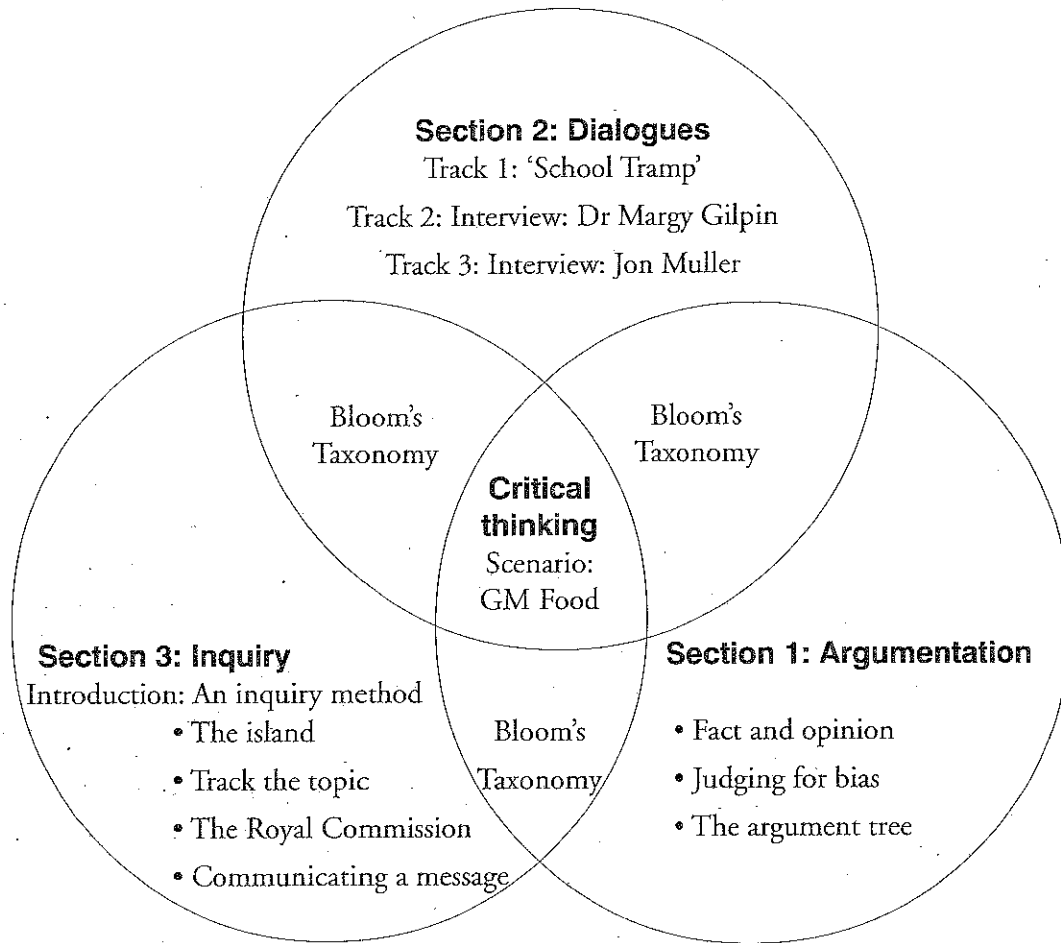
- asking questions
- examining evidence
- defining a problem
- analysing assumptions and bias
- considering other points of view

T
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moves towards
the position
where ...

**The critical thinker intentionally applies
these abilities in a variety of situations
to make reasoned judgements.**

Resource Structure



USING THE RESOURCE

This resource suggests starting points for inquiry

The sections can be used in the order given

Parts of each section can be used to thread a particular learning path for a group of students

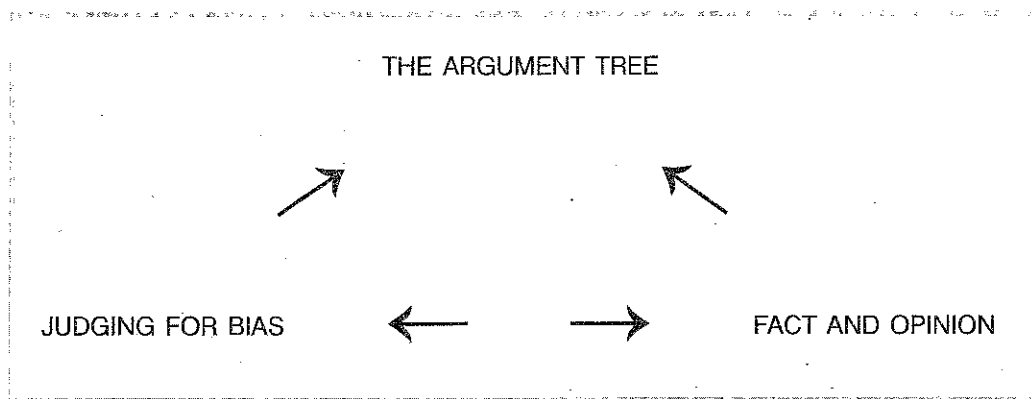
Appendix 2: BLOOM'S TAXONOMY
This is given to provide opportunities to generate a range of questions and possible contexts for study

Appendix 1: EVALUATION
This model is given as the rubric:

- moves from the low to high order thinking skills
- can provide a basis for quality feedback in a formative assessment role

Section 1: Argumentation

- This section has three parts.
- The use of 'Fact and Opinion' and 'Judging for Bias' tasks should be seen as progressing towards the ability to analyse an argument using 'The Argument Tree'.



Each part is organised in the same way:

- **Introduction:** The subject is defined and some characteristics identified by use of a graphic organiser.
- **Tasks:** The tasks use a variety of sources that range from letters, newspaper reports, magazines and websites.
- **Decide for Yourself:** These tasks invite the student to analyse a text by choosing the form of graphic organiser for themselves.
- **Templates:** A variety of graphic organisers are given to help in the analysis of a text.

Footnote:

Facts and Opinions largely derive their verification from two sources:

- social validation – where meaning is socially constructed and agreed
- empirical validation – where meaning is confirmed by measuring and testing

What can an argument be?

Using the word 'argue' with students may get the immediate response of 'quarrel', 'row' – a heated exchange of opposed views.



However, the term 'argument' has the wider meaning of: 'to show', 'to prove', 'to assert', 'to make clear'.



If starting from this basis, the collaborative can replace the adversarial as a response to guide student learning.



In the context of this resource, the role of argumentation is to persuade students to seek evidence and reasons for the ideas that are held, and to take them seriously as a guide for belief and action.

Argumentation is an observable field of discourse and therefore subject to critical analysis.

The following points might then be considered

Many responses touch on the argumentation process. Underlying any analysis is the idea that feeling and intuition are not to be seen as diametrically opposed to reason.

It is the mindful, intentional application of skills and dispositions which direct students towards reflective action and the development of a point of view.

Is this an argument?

The analysis or construction an argument will follow the process of:

- identification
- analysis
- evaluation.



In analysing the language used in an argument be aware of the use of:

- opinions
- facts
- description
- questions
- jokes
- emotive expressions
- explanations.

Look for the main idea or point.
Look for a claim or judgement.
This will be the concluding statement.



Look for evidence or justification in its defence.



A statement can be described as either true or false.

The truth of a statement can be approached by referring to the types of evidence or premises used in an argument.



Evidence can be analysed and placed on a sliding scale:

- | | |
|--------|---|
| ‘Soft’ | <ul style="list-style-type: none"> • gut reaction
<i>an instinctive position on an issue</i> • anecdote
<i>a view not necessarily based on fact or research</i> • facts
<i>that can be validated</i> • statistics |
| ‘Hard’ | <i>use of percentages, graphs</i> |



Note: People can give differing “truth values” to these types of evidence when used in an argument.



You could look for ‘indicator words’ in the text which might help your analysis.

Sometimes you may need to add these to the text to gain a sense of meaning.



Premise indicators
because



Concluding statement indicators



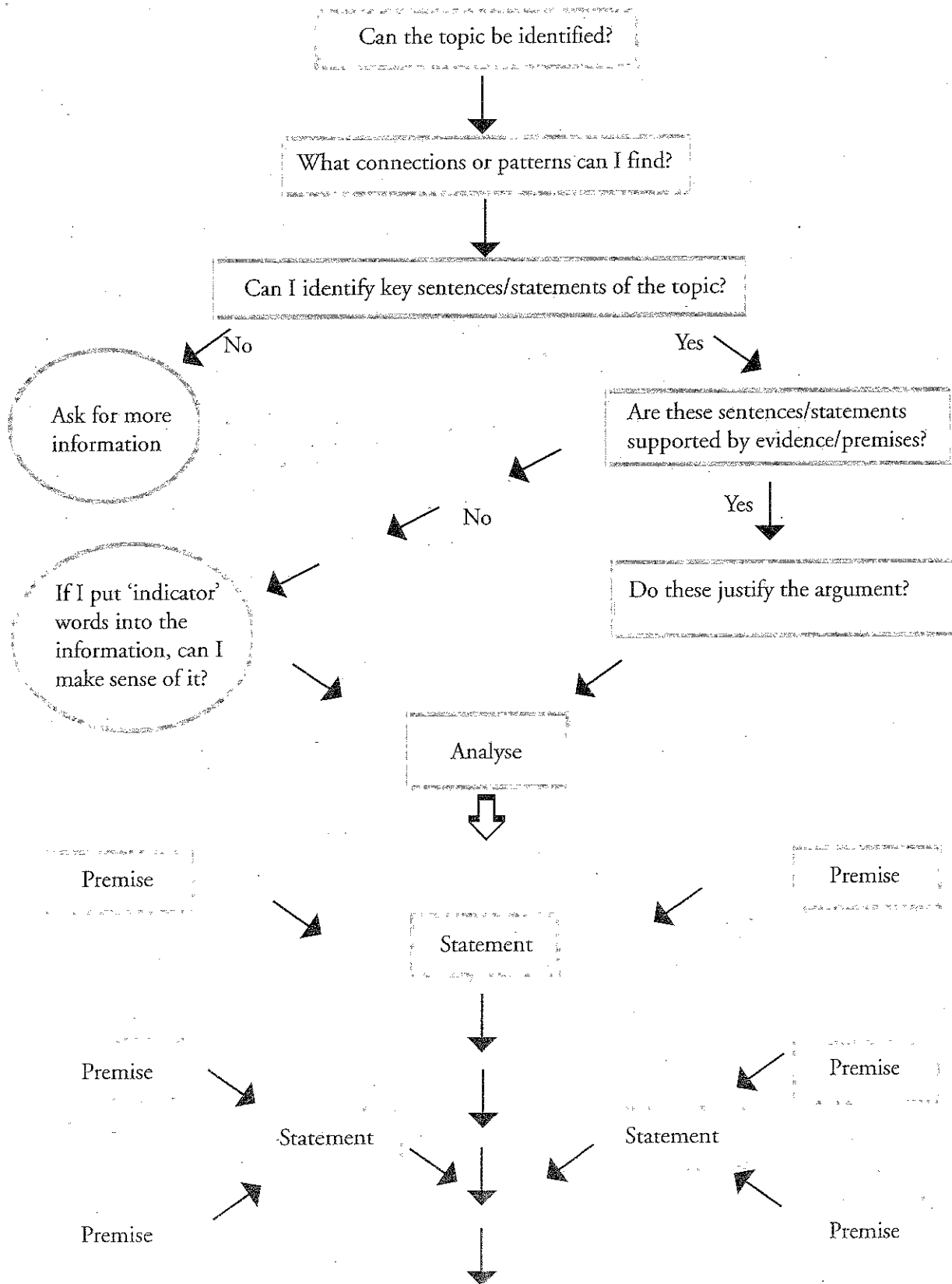
After all ...
Given that ...
Inasmuch as ...
Since ...
Likewise ...
If ... then ...
Moreover ...
In addition ...
Another ...
Similarly ...
For example ...
Also ...
Because ...



Therefore ...
In short ...
We can conclude that ...
So ...
Thus ...
In summary ...
Hence ...

The argument tree

DEVELOPING AND ANALYSING THE SUPPORTING FRAMEWORK OF AN ARGUMENT

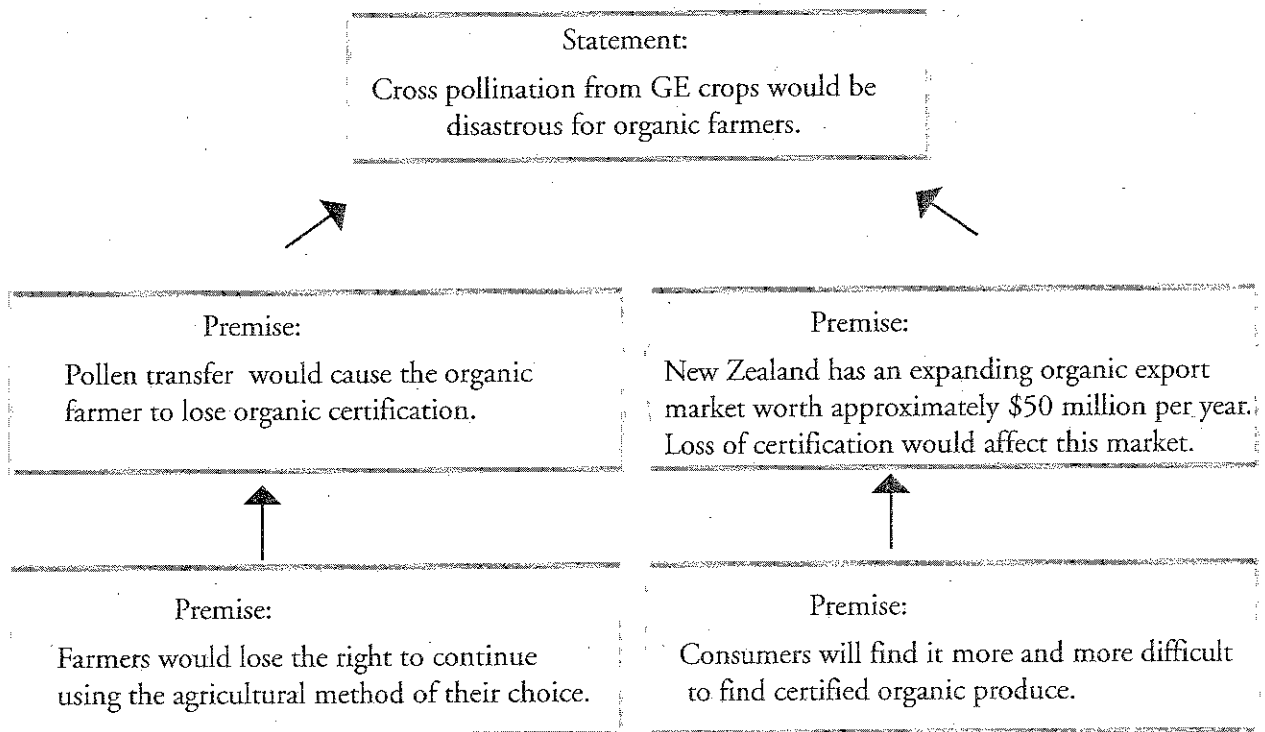


- Topic question or
- Summarising statement

The argument tree – Analysing examples 1

- In learning to analyse an argument it can be useful to split up the problem into smaller parts, and then tackle these one at a time.
- Put to one side the ‘Topic Question/Concluding Statement’, and focus on one statement/premise analysis.
- The following paragraph is taken from ‘Designer Genes’ edited by Ray Prebble (p171).

For organic growers, cross-pollination from GE crops would be disastrous. Wind and bees from neighbouring farms planted with GE crops would cause the organic farmer to lose organic certification. Not only would farmers lose the right to continue using the agricultural method of their choice, but consumers will find it more and more difficult to find certified organic produce. This could have substantial effects on the New Zealand economy. We have a steadily growing organic export market, currently worth approximately \$50 million per year. The demand for organic produce worldwide is rapidly increasing and premium prices are obtainable as against traditional produce. Loss of certification of organic produce due to cross pollination with GE plants could spell the end of a prosperous organic future.



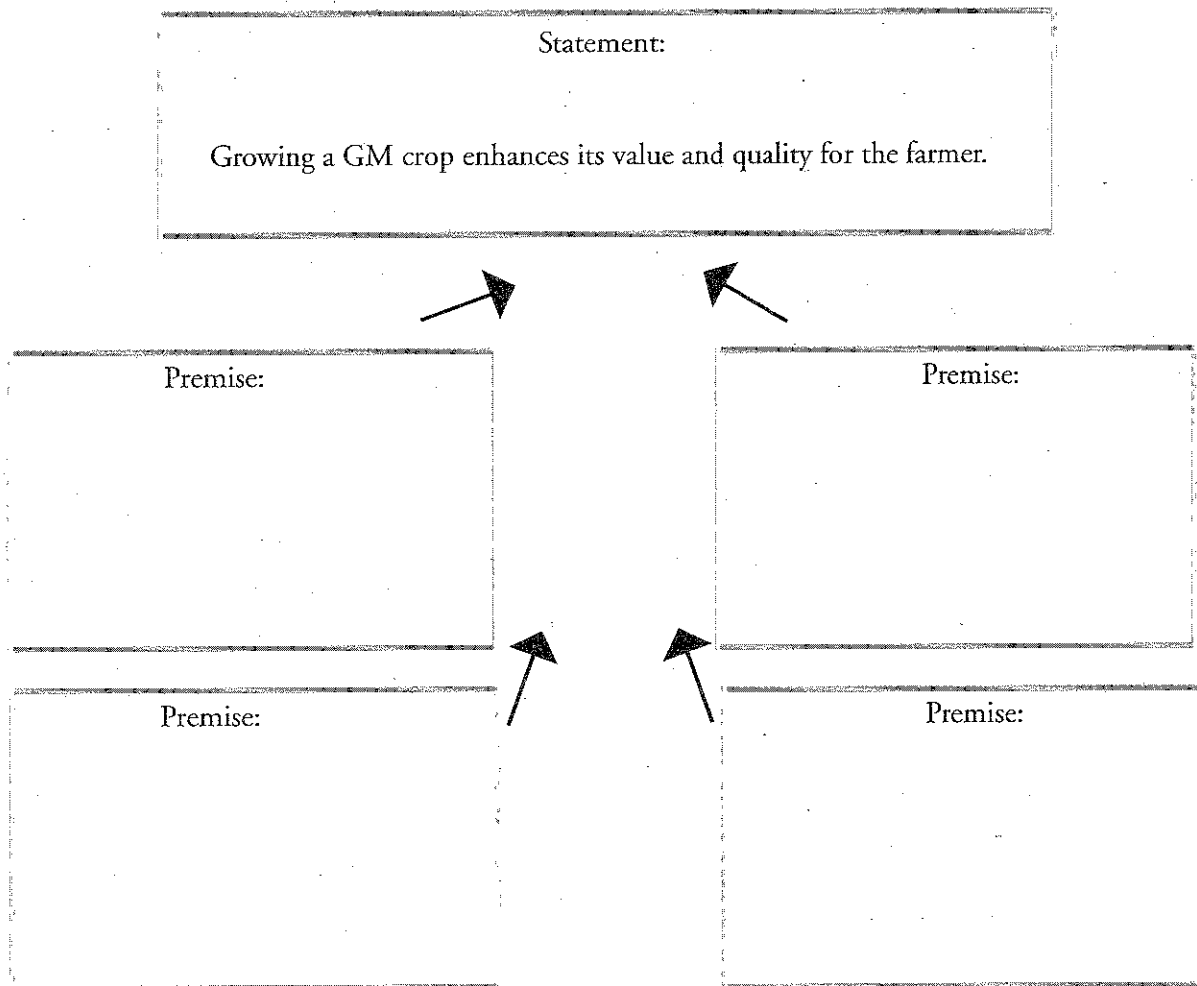
- Discuss the accuracy of the statement
 - *does it reflect the main point of the paragraph?*
- Explain the supporting premises, and expand upon them in your discussion
 - *discuss some of the consequences to each premise.*

The argument tree – Analysing examples 2

- This paragraph is taken from 'Designer Genes' edited by Ray Prebble (p160).

*The advantage to farmers is that they can reduce the costs of weed and/or insect control and enhance the quality and therefore value of their crops. In 1998 about 70% of plantings worldwide were of herbicide-tolerant crops (mainly soybean) and about 28% insect-resistant (mainly maize). An additional, and not insignificant, advantage is that farmers do not need to handle toxic pesticides when their crops have insect resistance built into them. Even when spraying crops with pesticides approved as organic, such as *Bacillus thuringiensis* (Bt) it is necessary to wear full protective gear. The advantages for manufacturers are that they are provided with higher quality raw materials with fewer contaminants.*

- Analyse this paragraph in support of the statement.



- Does the statement reflect the main point of the paragraph?
- Read the paragraph and add the supporting premises.
- Examine each premise: do they support the statement?

The argument tree – Analysing examples 3

- In some cases it is not quite so straightforward to analyse a text for statements and premises.
- For example, when a person argues a case in a letter it might be easier to analyse its content using the method below.
- Indicate in the ‘?’ column any sentences about which you need more information.
- This letter was sent to an online site of the BBC <http://www.bbc.co.uk> where this question was posted:

‘SHOULD GENETIC ENGINEERING BE STOPPED?’

Statement	Types of Evidence/Premises				?
	Gut reaction an instinctive position on an issue	Anecdote a view not necessarily based on fact or research	Facts infor- mation that can be verified	Statistics use of percentages, graphs etc	
<i>After reading this letter, write a statement that summarises the authors’ position.</i>					
1. Genetically modified foodstuffs have no history of use – safe or otherwise.					
2. The precautionary principle should apply.					
3. It is not OK for us to be the experiment.					
4. Crops genetically modified for specific herbicide tolerance e.g. roundup ready soya contains up to 200% higher residues of roundup – so much for less chemical on crops.					
5. We have already had enough of the madness in the food supply.					
6. Government pushed by industry has failed to put human health and safety before industry profits.					
7. There are already far too many synthetic substances in our food which contribute to food sensitivities, asthma and behaviour disorders.					
8. Let us not be subject to the madness of science in something so basic as our food.					
9. Stop fiddling with the food supply.					
10. We need to get back to food grown without chemical inputs.					
11. We also don’t need additives, colourings etc that are there purely for cosmetic purposes.					
12. Clean up the food supply – would it be too much to ask that we have natural unfiddled food that will sustain and nourish us?					
13. Let us not play with gene technology in food.					
14. It is imprecise science – we don’t know enough about it e.g. the role of junk genes.					
15. Put the health of people before mad science and industry profits.					

From: Dorothy M. Bowes, Australia

Summary

- Describe the range of premises used in this letter to support the statement.

- How well do these premises defend the statement?

- Were there any sentences which need more discussion? Choose one or two to discuss further.

- What conclusion was reached?

The argument tree – Decide for yourself: Task 1

- You have been shown two ways in which you can analyse an argument.
- The letter below was sent to 'The Listener' of 17/11/01.
- Using the templates supplied, choose a method to analyse the argument in this letter.

I am intrigued by the language surrounding the GE debate, summed up well by Jane Clifton ('Politics', November 3rd):

"It sounds simple and logical. We have science and we have nature. We just keep 'em apart."

... A cow transforms grass into milk. Human beings transform that milk into yoghurt, cheese, whey, lactose and casein. Bees make honey. Human beings use it for medicinal purposes. Water, air, sunlight and minerals create timber. Oil is transformed into plastic. Food and air become flesh and blood. So, when does nature stop and science take over?

... This question takes me back to the student common room at the Wellington Polytechnic School of Design in 1964. We were enjoying a question and answer session with the great designer/scientist/engineer/architect/philosopher/guru Richard Buckminster Fuller. Someone asked him what he felt about the rampant development of 'unnatural' man-made materials and processes (plastics were still seen as 'cheap and nasty' compared to 'honest materials such as wood, wool, glass and aluminium).

... As I recall it, Bucky spent a little time wondering where to draw the line between materials that grew in the ground, those that needed some post-harvest processing and those whose processing involved a chemical change.

He then proposed that, as human beings were part of nature, anything we did was as 'natural' as a bird building a nest, a spider spinning a web or a dinosaur devastating a forest.

... I remember thinking that this seemed a cute rationalisation to get mankind off the hook. I soon came to realise that seeing ourselves as an integrated part of nature makes us more, rather than less, responsible for our actions.

... Seeing ourselves and our activities as something other than, or opposite to, nature may be more arrogant and life threatening than recognising our interdependent place in the scheme of things. As Bucky put it, anything that is not 'natural' cannot exist. Science is therefore part of nature.

From: Michael Smythe (Northcote, Auckland)

The argument tree – Decide for yourself: Task 2

- You have been shown two ways by which you can analyse an argument.
- The letter below was posted on a BBC website at <http://www.bbc.co.uk> and addressed the question: 'Should genetic engineering be stopped?'
- Using the templates supplied, choose a method to analyse the argument in this letter.

It is pathetic that some people consider ourselves an advanced species when we still have millions of people around the world starving or dying of preventable disease.

The general public in the comfortable consumer world will not give up their standard of living to improve the lives of those we so easily neglect. It would be too costly for us.

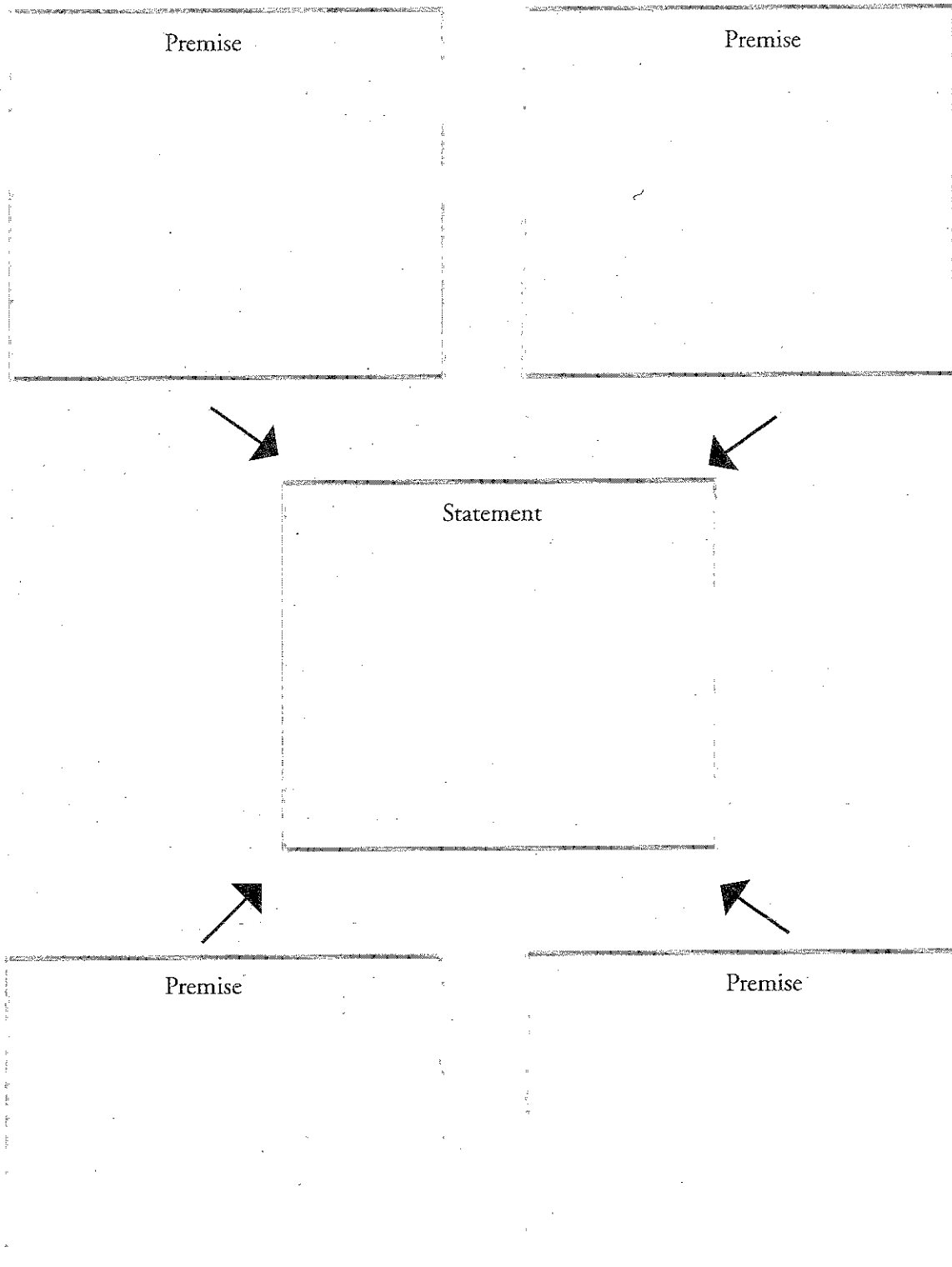
Hence, there is not the political will to change the situation using our current technology. Genetic engineering offers us some cheaper alternatives with the potential for tougher food crops, richer energy crops and cheaper production of medicines. All of these potential technologies could transform the plight of the third world.

Similarly, growing our energy could significantly increase our chances of developing truly sustainable lifestyles. For me, these are worthy goals for which GE could be invaluable as long as the potential dangers of GE are also taken seriously. Therefore, a complete ban would be excessive.

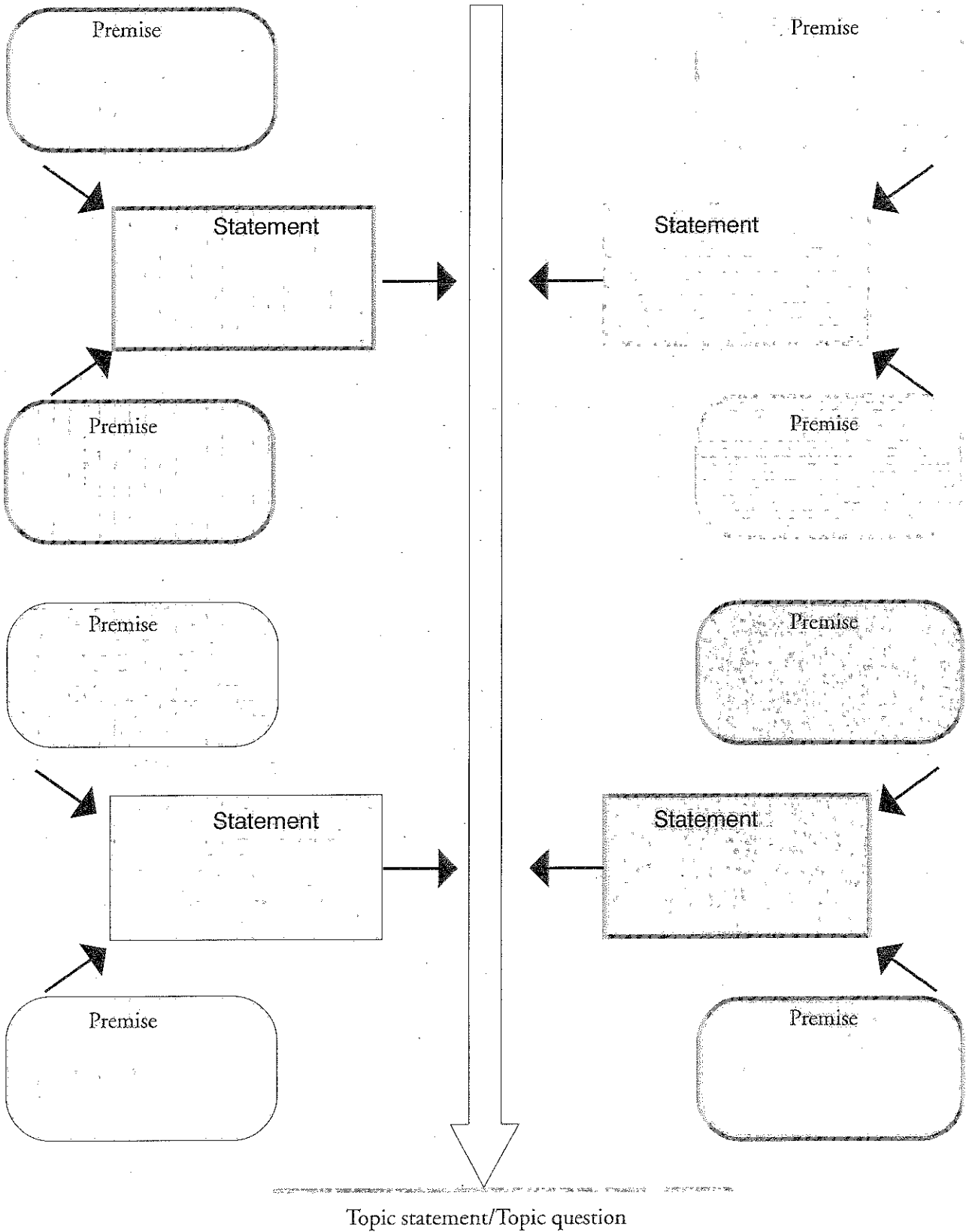
However, tight regulation is imperative and I am not convinced that this is happening yet. If tight regulation means that the use of GE becomes commercially unviable, so be it. I would rather the research and the use of GE was funded by governments for non-commercial humanitarian uses anyway.

From: Oliver Sharpe UK

Argument analysis – The argument tree – Template 1a



Argument analysis – The argument tree – Template 1b



Argument analysis – The argument tree – Template 2

Statement	Types of Evidence/Premises				
<i>After reading this letter, write a statement that summarises the author's position.</i>	Gut reaction an instinctive position on an issue	Anecdote a view not necessarily based on fact or research	Facts information that can be verified	Statistics use of percentages, graphs etc	?
1.					
2.					
3.					
4.					
5.					
6.					
7.					
8.					
9.					
10.					
11.					
12.					
13.					
14.					
15.					

Summary

- Describe the range of premises used in this letter to support the statement.

- How well do these premises defend the statement?

- Were there any sentences which need more discussion? Choose one or two to discuss further.

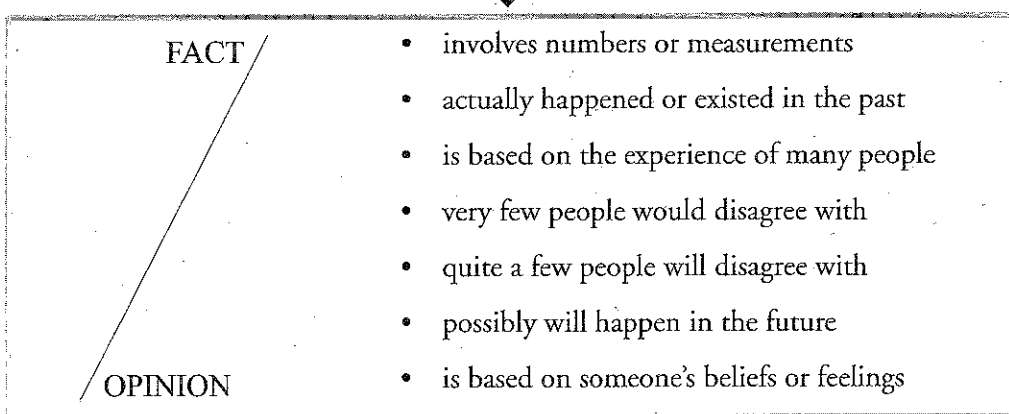
- What conclusion was reached?

Distinguishing fact from opinion

Through radio, TV, newspapers and just speaking and listening to people we become the target for a vast amount of information.

To formulate an argument of our own, or evaluate the argument of another person we need to be able to tell the difference between a fact and an opinion.

A statement to be assessed is likely to be a *fact* or an *opinion* if it concerns something that:



Analyse

Statement	Fact	Unsure / Neutral	Opinion
<i>After reading the text, write a statement that summarises the viewpoint of the author.</i>			

Footnote:

Facts and Opinions largely derive their verification from two sources:

- social validation – where meaning is socially constructed and agreed
- empirical validation – where meaning is confirmed by measuring and testing

Fact and opinion – Task 1

Read these statements and indicate if they are a **fact** or an **opinion**.

- | | |
|--|-------|
| 1. The USA is a larger country than New Zealand. | ..... |
| 2. Cats make better pets than dogs. | ..... |
| 3. Paris is the capital city of France. | ..... |
| 4. Percentages are more useful than fractions. | ..... |
| 5. Mt Everest is the highest mountain above sea level. | ..... |
| 6. The Beatles were the best group ever. | ..... |
| 7. All dangerous snakes should be killed. | ..... |
| 8. Mercury is the nearest planet to our sun. | ..... |
| 9. It is better to travel by car than train. | ..... |
| 10. A sentence starts with a capital letter. | ..... |

Write out your 'facts' below

- _____
- _____
- _____
- _____
- _____

Verification

- To verify something as being 'factual' you may need to refer to something more than your own direct experience.
- What makes the above statements factual? What would you use, or how would you go about verifying the accuracy of your 'facts' written above?

- _____
- _____
- _____
- _____
- _____

Fact and opinion – Task 2

- The following text is taken from the beginning of 'Dialogue: 'Non-violent direct action a tradition of jaywalkers' by Logan Petley (18/01/02 at www.nzherald.co.nz/)
- Read the text and indicate if you think each sentence could be a FACT or an OPINION.
- If you are unsure or think a sentence to be neither fact nor opinion then tick the middle column.
- Be prepared to discuss your responses in a small group.

<i>After reading the text below, write a statement which summarises the view of the author.</i>	Fact	Unsure / Neutral	Opinion
1. The sabotage of genetically modified potatoes at Lincoln University was for the greater good and showed a healthy disrespect for the law.			
2. Last year, in the space of just three hours, 350 people passing a small table in central Wellington stopped and signed pledges to pull out genetically modified crops.			
3. In the following weeks almost 3500 pledged to take direct action against genetic modification.			
4. Occupations and ages ranged over the whole spectrum: retired dentists, courier drivers and young parents.			
5. Each one of these people understood they were signing up to pull crops en masse, in broad daylight, and that they would quite possibly be arrested.			
6. Why are people prepared to do this?			
7. As early as 1998, concern about GM was rising.			
8. There were reports of experiments going wrong and independent scientists were outlining the huge risks.			
9. Ethical and legal concerns were mounting.			
10. Typically, large numbers of New Zealanders responded.			
11. Ninety-three thousand called for a royal commission of inquiry into genetic modification.			
12. When the commission began work, more than 92% of the 11,000 submissions opposed the release of GM organisms into the environment.			
13. Money was begged and borrowed to fly in independent geneticists to testify.			
14. At the end of the process, the commission's conclusions were scientific and logical nonsense.			
15. The independent scientific advice was disregarded and informed public concern dismissed.			
16. In short, the democratic process failed.			
17. Two days after the release of the report, hundreds started signing up for non-violent direct action.			
18. Typical of the response was one woman who wrote: "I never thought I'd break the law but we've tried everything. What choice do we have now?"			

- Look at the summarising statement. Look at your analysis. Is the extract supported by 'fact' or 'opinion' based evidence?
- Share your response within a small group.
- Are there any points of difference?
- Can you reach a consensus, or an agreed position?
- Now read and analyse the rest of the article. How would you now assess the article?

Fact and opinion – Task 3

- The following text is taken from: 'Protests seen as threat to GE research' (NZPA 14/01/02 Acknowledgement New Zealand Herald www.nzherald.co.nz/)
- Read the text and indicate if you think each sentence could be a **fact** or an **opinion**.
- If you are unsure, or think a sentence to be neither fact nor opinion then tick the middle column.
- Be prepared to discuss your responses in small group.

<i>After reading the text below, write a statement which summarises the view of the author.</i>	Fact	Unsure / Neutral	Opinion
1. Investors will stay away and scientists will do their research overseas if anti-genetic engineering protesters continue to attack research crops, says a pro-GE lobby group.			
2. Protesters last week destroyed a crop of genetically modified potatoes at Lincoln, preventing Christchurch scientist Dr Margy Gilpin from presenting the results of her research to a prestigious conference in the United States later this year.			
3. Dr Gilpin will now be able to talk to the International Association of Plant and Tissue Culture and Biotechnology conference only about her preliminary results.			
4. Fellow researcher Tony Connor also lost hundreds of genetically modified plants in the raid.			
5. The executive director of the pro-GE group Lifesciences Network, Francis Weavers, said attacks would not only deter investors in New Zealand science and innovation, but cause New Zealand scientists to travel overseas because they felt threatened.			
6. "The point is that none of this work is being done without having been approved by the appropriate statutory authorities in the first place, who have assessed it as being safe to conduct," he said.			
7. Groups who for their own 'fundamental reasons' opposed the work were setting out to destroy science and knowledge, he said.			
8. While there were heavy penalties available if saboteurs were caught, the heaviest penalty was felt in the science community.			
9. Environment Minister Marian Hobbs condemned the attack as senseless vandalism.			
10. But Green MP Nandor Tanczos warned of more attacks if the research continued.			
11. He said direct action was justified where people's legitimate grievances were not being addressed by the government.			
12. Mr Weavers said Mr Tanczos' comments were no surprise, given that he was a former member of the Wild Greens, whose members destroyed another potato crop at Lincoln in March 1999.			

- Look at the summarising statement. Look at your analysis. Is the statement supported by 'fact', 'opinion' or a balance of both?
- Share responses within a small group.
- List and describe any points of difference

Fact and opinion – Task 4

- The following text is from ‘*GM vital for world hunger*’ (Tim Radford interviewed by Simon Collins, 23/03/02 www.nzherald.co.nz/)
- Read the text and write a summarising statement.

Now analyse the text.

- A statement can be a fact or opinion for different reasons.
- Use these indicators to help focus your analysis.
- Bear in mind that idea of ‘verifiability’, or ‘how can we know something to be a fact or opinion’.

Read the text and write a statement below that summarises the viewpoint of the author.	Fact/Opinion indicators						
	← Verifiability →						
	Measurement – involves numbers or other measurements	Past – actually happened or existed in the past	Experience – based on the experience of many people	Agreement – most people would agree with	Disagreement – quite a few people would disagree with	Personal – based on beliefs or feelings	Future – event could possibly happen in future
1. A New Zealander who is science editor of Britain’s Guardian newspaper is home with a grim message: the good times are over.							
2. Hokianga-born Tim Radford, who is here for a British Council media seminar, believes that genetic research will be needed to improve plant productivity to help a deteriorating environment.							
3. “It’s about feeding as many people as you can”, he says.							
4. “The number of people who will be hungrier in the decades ahead is going to increase for all sorts of reasons, including global warming and because land is going out of production because it’s been degraded and desiccated.							
5. “It’s obvious that probably the good times are over, even for America, where the amount of land available to feed the world is going to start falling.”							
6. Radford, a former New Zealand Herald journalist went to Britain in 1961.							
7. He says that genetic modification became unpopular in Britain when officials decided in 1996 not to require GM soybeans to be labelled as such on the grounds that they were used in 60% of all supermarket products.							
8. “That was the decision not to be up-front that put the fat in the fire.”							
9. Most of the dissatisfaction in Britain over nuclear power, nuclear waste, the handling of the BSE crisis, and most of all GM foods, is because people had not known what was being done until it was too late.							
10. Radford believes the public is entitled to be suspicious of GM food manufacturers which have been the main beneficiaries of the new products so far.							
11. He cites Monsanto as an example.							

12. But he also believes the world needs the latest genetic techniques to accelerate traditional plant-breeding programmes to cope with a global population that is growing by 10,000 people every hour.							
13. "There are now 23 countries which are facing an acute water shortage," he said.							
14. "Supposing the essence of science was not to make Monsanto richer, supposing it was to make people's lives better, what would we want most?"							
15. "What about millet that could withstand drought?"							
16. "Why not a wheat that could grow in ground that is too salty for wheat at the moment?"							
17. "So inside GE laboratories in Cambridge and Cornell and places like that, there are people working on really useful crops that might not actually need transgenic [cross-species] engineering – there will be the gene for drought resistance in the wheat family somewhere."							
18. "It might be that if newspapers had done their job more aggressively – and in that I have to include me – then we might have persuaded people to be more interested in the direction of genetic engineering."							
19. "They might have put pressure on governments, laboratories and biotech firms at the beginning of the process and not at the end."							
Total							

- Add the ticks in each column.
- Write a summary of your analysis below.

Consider these questions in your answer.

- Is the text mostly based on fact, opinion or is there a balance between the two?
- What types of facts or opinions show in your analysis?
- Do these types strengthen or weaken the text statement?

- Compare your analysis (A) with someone else's (B).
- What similarities or differences can you find?
- Complete the diagram below.

Analysis A		Analysis B
Different	The same	Different

Fact and opinion – Decide for yourself: Task 1

- You have been shown two ways to analyse a text for ‘fact and opinion’.
- Choose a template and analyse the text.
- The text below is taken from the beginning of ‘*To GE or not to GE*’ by Bernie Napp (The Evening Post 29/06/02).

On one side are the Greens and their view of a genetically engineered world. It is an apocalyptic vision of landscapes mutated by rogue genes, multinational corporations holding the planet's poor to ransom and of mankind paying the price for meddling in God's domain. On the other are the scientists and the companies the Greens distrust so much. Their vision is a world where sickness is all but a thing of the past, where the planet is well fed by disease and pest-resistant crops and humans are no longer at the mercy of nature. Genetic engineering has become the biggest election issue, but it is one that has occurred in what is largely a public knowledge vacuum. Because the science of GE is so complex and so new, all theories hold some water. Facts can be found to support views for and against GE. It's become a question of politics more than science, and it's hard to know who's right. A \$6.5 million, 14 month Royal Commission on Genetic Modification investigation attempted to put GE into a New Zealand perspective. Hundreds of interested parties made submissions to the commission which recommended last year that New Zealand proceed with caution on GE. A five-year moratorium on commercial release of New Zealand GE produce is due to end in October 2003 and Labour no longer wants to extend it by an extra two years, as it had earlier promised. The Greens, who had asked for the Royal Commission, clearly weren't satisfied with its findings. Green co-leader Jeanette Fitzsimons says her party still won't support any government which allows this to happen before the risks are understood. They're fighting words and now Prime Minister Helen Clark has called an early election. In doing so she's given GE a high profile – just what the Green Party would have wanted. Voters are having to think about GE before putting their ticks on the ballot paper. But it's a murky field in which to dig for answers. One of the most vocal groups in the Royal Commission's report, and the one which claims to lose the most if the GE moratorium is lifted, is New Zealand's burgeoning organics industry. Last year organic exports were \$70 million, a fraction of total agri-exports, but forecast to grow to \$500 million a year by 2006, says Seager Mason, chief executive of Bio-Gro, New Zealand's largest organic certification agency, representing about 700 growers.

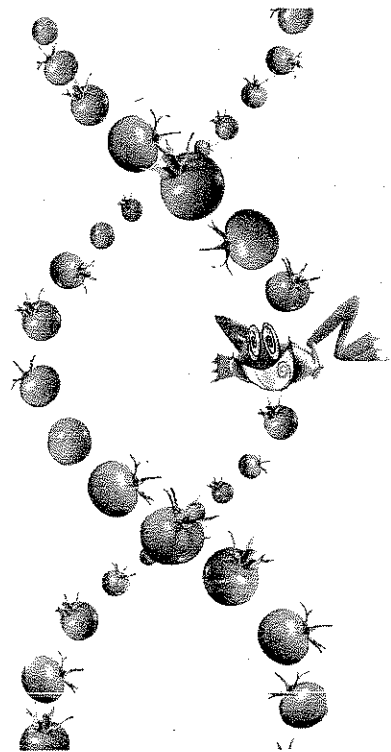


Illustration: Michael Mulheron

Fact and opinion – Template 2

- Read the text and write a summarising statement.

Now analyse the text.

- A statement can be a fact or opinion for different reasons.
- Use these indicators to help focus your analysis.
- Bear in mind that idea of validation or verification, or ‘how can we know something to be a fact or opinion’.

	Fact/Opinion indicators Verification						
	←						→
<i>Read the text and write a statement below that summarises the viewpoint of the author.</i>	Measurement – involves numbers or other measurements	Past – actually happened or existed in the past	Experience – based on the experience of many people	Agreement – most people would agree with	Disagreement – quite a few people would disagree with	Personal – based on beliefs or feelings	Future – event could possibly happen in future
1.							
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11.							
12.							
13.							
14.							
15.							
16.							
17.							
18.							
19.							
Total							

Read the text and write a statement below that summarises the viewpoint of the author.

Fact/Opinion indicators
Verification

- Add the ticks in each column.
- Write a summary of your analysis below.

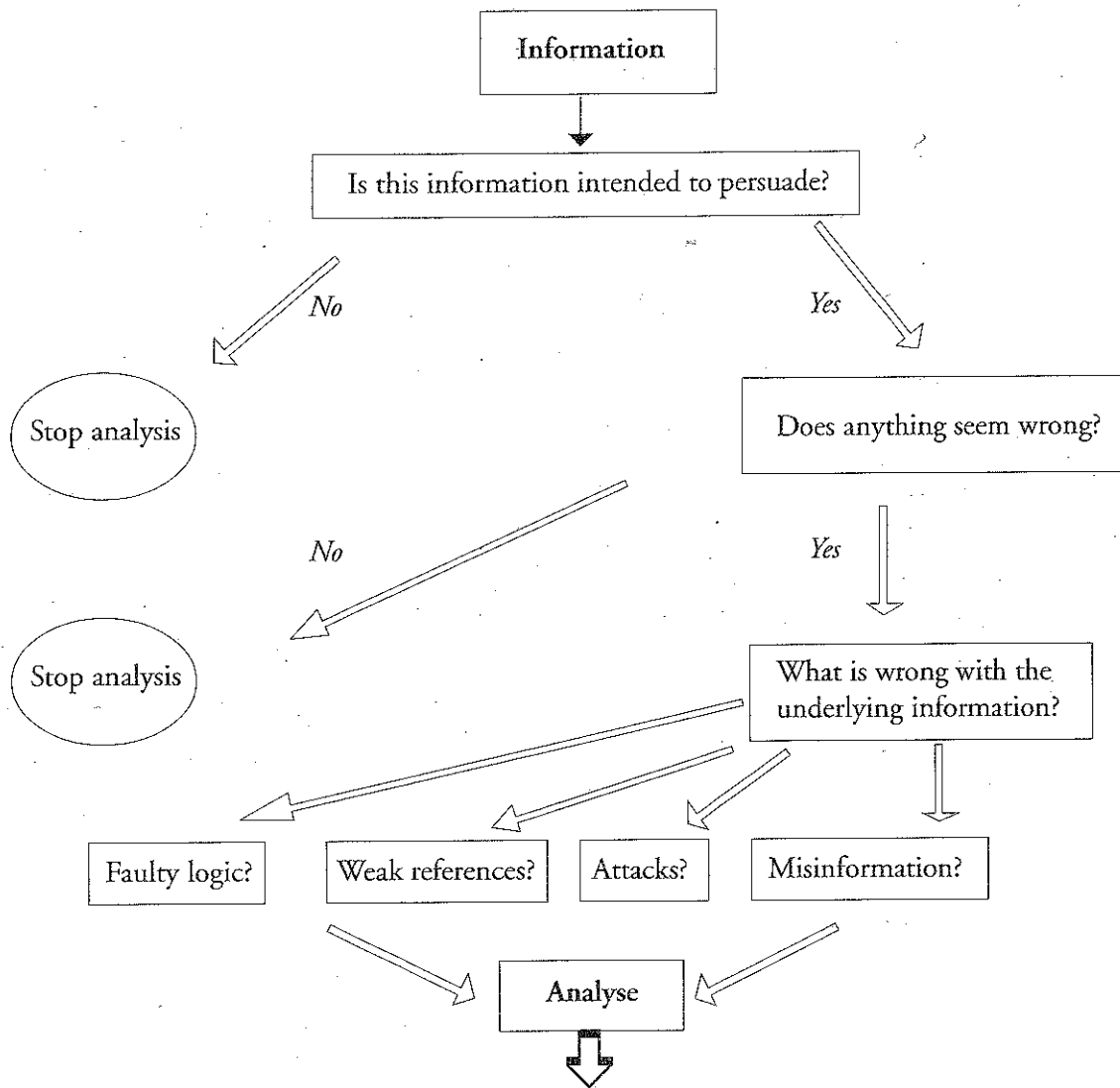
Consider these questions in your answer:

- Is the text mostly based on fact, opinion or is there a balance between the two?
- What types of facts or opinions show in your analysis?
- Do these types strengthen or weaken the text statement?

- Compare your analysis (A) with someone else's (B).

• What similarities or differences can you find?		
• Complete the diagram below.		
Analysis A Different	The same	Analysis B Different

Judging for bias – Identifying and analysing errors in thinking



Statement	Bias indicators					
<i>After reading the text, write a statement that summarises the author's position.</i>	Emotive words the use of excitable and temperamental vocabulary	Opinion as fact presenting an opinion as a given fact	Irrelevancies the use of anything to divert attention away from the issue	Generalisation to make a very broad interpretation of an issue	Exaggeration to describe something beyond the limits of truth	
<i>Copy the text into the template boxes sentence by sentence.</i>						

Judging for bias – Task 1

- This letter is taken from <http://www.bbc.co.uk> (click) *Message Board* (click) Science

Statement	Bias indicators				
	Emotive words the use of excitable and temperamental vocabulary	Opinion as fact presenting an opinion as a given fact	Irrelevancies the use of anything to divert attention away from the issue	Generalisation to make a very broad interpretation of an issue	Exaggeration to describe something beyond the limits of truth
<i>After reading the text, write a statement that summarises the author's position.</i>					
1. However much you dislike it, it is a fact that world population is going to dramatically increase.					
2. I don't know the exact estimate but I'm sure it's something like double in the next 50 years.					
3. Most of this is in the third world.					
4. The land available for arable farming is decreasing due mainly, I think, to bad agriculture.					
5. Whilst the best solution to overpopulation is probably not to make more food it is probably the easiest and also there's the potential to make money out of it.					
6. Countries such as India and China face overpopulation problems, but also these countries have the resources to develop their own GM crops.					
7. The majority of the population in these countries is less well educated than western populations and also less well off and so their priorities are different.					
8. Caring about the environment is a luxury of the developed world.					
9. These people's main priority is to make sure their families are fed and healthy and therefore this is the government's priority as well.					
10. This means that they will put more effort into making food than deciding it is safe.					
11. As a more developed country we have a responsibility to these people and the rest of the world to carry out the research that they cannot or will not do into the safety of GM crops.					
12. We cannot take an argument to these countries that what they are doing might be dangerous without evidence would they stop?					
13. I don't think so.					
14. GM is inevitable.					
15. We have to stop hiding our heads in the sand and carry out trials of GM crops even at the risk of our own environment as we are the best equipped to deal with any problems.					
16. Our countryside is in a bad way anyway.					

17. How much of it is natural and unpolluted in some way anyway?					
18. I don't think we can keep the country GM free either.					
19. If other countries develop better tasting cheaper foods the consumer is going to choose them preferentially especially without evidence to show they're not safe.					
20. After all people smoke and they know that's bad for your health.					
21. We might be worrying about nothing anyway.					
22. After all, there is no evidence that GM is in any way bad for us or the environment.					
23. Surely a GM crop is more natural than a crop covered in man-made chemicals that we know don't do us any good and may be doing us harm but we still eat them.					
24. Really the main deciding factor in what we eat is if it tastes good.					
25. GM is inevitable as we have been messing around with the environment for years and there's no reason to stop now.					
26. The only thing we can do, and it is our responsibility to do, is to research and regulate it to make sure it's safe and kept under control.					
Total					

From: Pierre Bezuhov 10/06/02

- Add your total number of responses for each type of bias.
 - Note any sentences which you have been unable to include in your analysis.
-
- Share these un-analysed responses with a partner. Choose one each to discuss further.
 - Of your analysed responses which two types of bias appeared most?
-
- What is your opinion of this letter?
 - Consider these questions in your answer.
 - How do the types of bias affect the meaning of the letter?
 - Is there one type of bias which the author regularly uses?
 - How 'fair' do you think the author is in putting his case?
 - What points in this letter would persuade a person towards the author's view?
 - Do you think there are types of bias which are particularly persuasive?

Judging for bias – Decide for yourself: Task 1

- Bias can be shown in a variety of ways.
- Analyse the article below.
- From: 'Destination Hawkes Bay News Archive' (31/5/02 <http://www.hawkesbay.com>).

Co-existence of organic and GE production impossible

Green co-leader Jeanette Fitzsimons today said the concerns of many New Zealanders had been confirmed by a new EU report showing organic farming will be shut down if genetically engineered crops are grown commercially. The report which has been drawn up after two years of studies in Britain, France, Italy and Germany shows that contamination from GE crops makes co-existence of organic and GE production impossible.

"This report is simply damning and confirms the fears held by environmentalists, farmers and ordinary people in New Zealand," said Ms Fitzsimons. It is particularly relevant to New Zealand as the Labour-Alliance government is drawing up new legislation to permit 'conditional release' of genetically engineered organisms using, among other things, buffer zones designed to protect organic and GE-Free farmers. The report shows this is a waste of time. Even the Royal Commission said that co-existence of GE and organic crops would be possible only if the organic standard was downgraded to allow one per cent GE contamination. This report shows that the one per cent would eventually become two per cent which would become three ...



The Prime Minister has used GE Foods for years, with little or no side effects!

"This is precisely why the Greens are taking such a strong line on this issue. The moratorium on release into our environment will end next year unless the Greens can stop it. This report shows how dangerous this would be."

The report was so controversial that top European Commission officials tried to stop it being made public and is a major embarrassment for Prime Minister Tony Blair who on Friday denounced GE opponents as using emotion to drive out reason'.

"This report shows that if only a tenth of a country or a region was in GE crops, keeping contamination at a level to allow organic farming to continue would be 'extremely difficult'," she said. "In the light of the increasing international evidence we would be absolutely crazy to lift our moratorium. Our GE-Free environment is becoming more precious by the day."

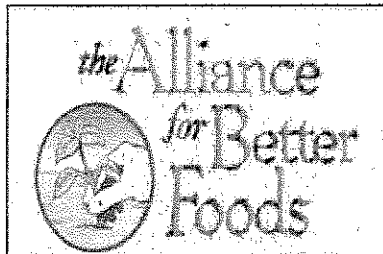
Source: <http://www.independent.co.uk/story.jsp?story=299036>

- Why do you think the picture was added to this article?

- How is the bias of the article affected by the comment of Tony Blair?

Judging for bias – Decide for yourself: Task 2

- These pictures are at the top of the home page of ‘*the Alliance for Better Foods*’ ([http:// www.betterfoods.org/](http://www.betterfoods.org/))
- The article comes from within the site.
- Read and analyse the material below.



Biotechnology has the potential to provide a wide range of benefits to consumers, the environment and the developing world. Researchers are developing varieties of crops that have more essential nutrients, resist harmful pests and diseases, and that can flourish in harsh climate conditions.

Biotech varieties of crops like pest-resistant corn and herbicide-tolerant soybeans are planted widely throughout the world. In 2001, American farmers alone planted nearly 80 million acres of biotech corn, cotton and soybean crops. In 2002, US farmers are expected to increase their use of biotech corn, cotton and soybeans by an additional 13%.

For Florence Wambugu, Kenyan researcher and former director of the International Service for the Acquisition of Agri-biotech Applications AfriCenter, biotech crops are “technology in the seed” allowing farmers to grow better, more nutritious, and hardier crops with fewer inputs. And, in developing countries, where hunger and malnutrition are ever-present threats, these crops offer new tools in the fight against harsh climates and poor soil conditions.

Scientists are also investigating the viability of nutrient-enriched crops that provide direct benefits to consumers. Continuing research focuses on methods to increase the level of vitamin A in rice, a staple food for much of the world and a critical nutrient in disease prevention. Researchers also hope to develop nuts, wheat and other foods with reduced levels of allergens.

With the continued advances in biotechnology, producers can provide consumers with a more nutritious, abundant and higher quality food supply.

The middle picture shows children playing in a field of genetically modified maize. Why do you think the picture was added to this article?.

Remember!

- Using your ‘Judging for bias template’ write a statement which summarises the ‘message’ or ‘viewpoint’ of the page.
- Examine the whole page for type(s) of bias and record them on the sheet.
- You could examine the text by sentence and by paragraph.

Judging for bias – Template

Statement	Bias indicators				
<i>After reading the text, write a statement that summarises the author's position.</i>	Emotive words the use of excitable and temperamental vocabulary	Opinion as fact presenting an opinion as a given fact	Irrelevancies the use of anything to divert attention away from the issue	Generalisation to make a very broad interpretation of an issue	Exaggeration to describe something beyond the limits of truth
1.					
2.					
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9.					
10.					
11.					
12.					
13.					
14.					
15.					
Total					

- Add your total number of responses for each type of bias.
- Note any sentences which you have been unable to include in your analysis.

- Share these un-analysed responses with a partner. Choose one each to discuss further.
- Of your analysed responses which two types of bias appeared most?

- What is your opinion of this text?

Consider these questions in your response.

- How do the types of bias affect the meaning of the letter?
- Is there one type of bias which the author regularly uses?
- How 'fair' do you think the author is in putting his case?
- What points in this text would persuade a person towards the authors view?
- Do you think there are types of bias which are particularly persuasive?

- Are there any types of visual bias in this material?

Consider these questions and points in your response.

- Read the summarising statement at the beginning of the template.
- Identify the main features of the picture.
- Which of these features relate directly to the summarising statement?
- Which features bear indirectly on the statement?
- What response are these features designed to affect in you?

Section 2: Dialogues

Some suggested activities

Track 1: 'School Tramp' (a play acted by four year 11 and 12 students at Onslow College 2002).

- Summarise the position of each student.
- Analyse the arguments of students 1 and 4.
- Examine the questions of student 3. What do you think of these, and what others would you have asked?
- Block out key areas of dialogue, or individual responses and write in new dialogue.
- Devise and write the script for an alternative ending to the play.
 - Would you introduce another character?
 - The scientist whose crop you are discussing?
 - Another student, or the teacher?
- What do other members of your class think about the views of these students? Conduct a poll of your own to discover other people's views.
- Do views change over age groups?
- This could be part of a further research project.

LINK → Section 3

Track 2: Interview with Dr Margy Gilpin

Track 3: Interview with Jon Muller

The following questions can be addressed to both interviews.

- How well do the questions cover the topic?
- How well are the questions answered?
- What follow-up questions would you have asked?
- Choose a section of dialogue and analyse its content.
- Follow up some of the points raised in the interviews with research of your own.
- How 'fairly' does each interviewee describe the other point of view.
- Identify points which both interviewees talk about. Analyse the responses made and use this as a basis for further research.

LINK → Section 3

LINK → Section 3

The baseline interview questions were:

1. We hear a lot about genetically modified food. Can you describe your work/interest in this area?
2. GM food seems to stir up quite a lot of emotions in people. What is GM food all about?
3. How new is GM food?
4. Why do people think this technology would be harmful/beneficial to human health? (*This question was asked so that each subject could attempt to describe the case of the other.*)
5. How would you counter these arguments?
6. What are the environmental concerns with GM crops?
7. Are there other things in our food that we should worry about?
8. What is the most important information that we need on the labels of the food we buy?
9. Who controls GM food?
10. Can New Zealand afford to be GM free?

Section 3: Inquiry – An Introduction

- This section focuses on different types of activities and contexts within which the skills practised in Sections 1 and 2 can be further developed.
- Below is an 'Inquiry model' which could be used to structure the direction of student research.
- There are many published models of 'Inquiry' or 'Action learning'. Here, I suggest an adapted matrix where the four inquiry steps are linked to those attributes of critical thinking defined at the beginning of this resource.
- The use of Bloom's Taxonomy within the matrix can further direct and specify the types of inquiry undertaken by the student.
- Whilst all students, if using the model, would pass through each of the four steps in their chosen area of research, they would not need to meet every critical thinking characteristic.
- This model could act as a tracking sheet so that over a series of topics a balanced approach to student research could be achieved.
- Some defining questions for each step could include:

Step 1: 'Tuning In'

- What do I already know?
- How can I help myself remember more?
- What am I being asked to do?
- What skills do I need, so as to discover more about this topic?

Step 2: 'Find and sort'

- What kinds of information can I use?
- Where do I go to find out about this information?
- Is this information relevant to my study?
- What do other people think about this topic?
- What skills do I need to analyse this information?

Step 3: 'Communicating'

- Who is my audience?
- How am I going to present my work?

Step 4: 'Moving on'

- What skills did I learn during this topic?
 - How did I feel and behave during this topic?
 - What skills can I transfer to my next topic?
- Specific assessment tasks could be given at any step. For example, use could be made of the templates given in Section 1 to assess a student's ability to analyse any 'assumptions' that might be made in a piece of evidence.
 - The process of evaluation is ongoing, and is developed by the student's use of a process of self-questioning.
 - How am I using this information?
 - How am I thinking about this information?
 - How am I feeling and behaving during this topic?

Inquiry model: How am I thinking about this information?

	Asking questions	Examining evidence	Defining a problem	Analysing assumptions and ideas	Considering other points of view
1. Tune in					
2. Find and sort					
3. Communicate					
4. Moving on					

How am I using this information?

How am I feeling and behaving?

- being open-minded
- being fair-minded
- tolerating ambiguity
- respecting evidence and reason
- respecting clarity and precision

Activity 1: The Island

- This activity constructs a scenario and asks the students to research certain roles to investigate the problem.

The following extract is from a letter sent to 'The Listener' of 10/11/01

There may be a way in which organic agriculture and genetic modification can co-exist within New Zealand.

For biotechnology to progress here, I appreciate that field trials must at some stage proceed for the true risks of side-effects to be assessed, and these trials must be conducted under local conditions.

One possible solution to the dilemma is to restrict the testing of GM-crops and animals to carefully quarantined offshore islands. We have a few left that are not yet nature reserves. Such islands could be left to revert to nature if things do go wrong.

If we can delay planting modified crops or rearing modified animals on our mainland, this allows a breathing space while we conduct the research that really matters.

That research is vital, as the Royal Commission said, and will surely progress, both here and overseas, over the next few years.

From: Ian Popay (Hamilton)

Scenario: The government has been approached by the international seed company GenGrow, who in collaboration with a local university, want to conduct an open field trial of a genetically modified crop of maize on an offshore island.

The Island: This is situated 2 km off the western side of the mainland. It is presently occupied by about forty people. There is a range of occupations, mostly focused around agriculture. There are two farms – one using the usual full range of pesticides to grow corn, the other is a small dairy unit of about 35 cows.

Also on one end of the island is an organic vineyard of about 5 hectares. There is the beginning of a tourist industry which centres around visits to the vineyard, the site of an old Pa and burial ground, and the local seabird and seal populations.

There is one small hotel on the island.

The task: The Government Science and Technology Minister has called for submissions about the proposed request for a field trial.

'Should GenGrow be allowed to grow their maize on this island?'

The Minister has called a meeting of all interested parties to decide on the proposal. The Minister has said that his decision will be guided by the outcome of this meeting.

Organisation

- The students will be divided up into teams of 3–4 people.
- Teams would choose to represent the viewpoint of one of the interest groups.
- Teams would have two weeks to prepare a group response in time for the meeting.
- After one week each group should submit a paper to support their position and to show their progress.

Interested groups

- Mainstream farmer
- Organic vineyard owner
- Hotel owner
- Local iwi representative
- GenGrow representative

Preparing your position

- Read any background information: Use the links under resources below.
- Summarise the information which builds your argument.
- A group should come to a consensus about their position. Remember you should remain true to your group role and not to your personal feelings.
- Design a two minute presentation.
- Choose how you will present your views at the meeting. (speech, diagrams, pictures)

Resources:

http://www.safe-food.org	Views about dangers of GM foods.
http://www.context.co.nz	Short newspaper/opinion articles giving variety of views
http://www.truefoodnow.org	Greenpeace site against GM foods
http://www.lifesciencesnetwork.com	Pro GM site
http://www.cropgen.org	Site publicises benefits of GM foods
http://www.ucsus.org	Union of Concerned Scientists – dangers of GM foods
http://www.aotearoalive.com	Go to the 'Forums' section for 'Māori discussion online' with GE views on a message-board format
http://www.inmotionmagazine.com	Go to 'QA Interviews' section. Various Māori interviewed about GE.

Activity 2: Track the topic 1

- In reporting issues regarding genetic modification, the media, political parties, other groups and individuals will refer to evidence/premises to support their claims/statements.
- The purpose of this activity is to track and investigate how a specific example of 'evidence' is reported by a cross-section of groups who are variously involved in this issue.
- Specifically, this activity examines the reports surrounding 'The Monarch Butterfly', and the ways in which the reports reflected an interpretation of the original research.
- Read the following quotes:

1. From: 'Food fight – a beginner's guide to Genetic Engineering' (She Magazine – August 2000)

There are also concerns that GE crops could lead to irreversible harm to the environment. These concerns are backed up with the emergence of superweeds and the cross-pollination of GE crops in the UK. There are concerns that crops engineered to kill harmful insects could also wreak havoc on beneficial insects – and there is some cause for alarm. For example, Bt maize has been genetically modified to make it produce a protein which kills the corn borer insect. Already tests have found that the protein in the plant that kills the corn borer also kills the larvae of the monarch butterfly and because of this Austria has banned the growing of Bt maize.

2. From: 'Less spin, more science' – Editorial (Sunday Independent (London) 23/05/99)

Next there was the first clear evidence that these crops pose a threat to wildlife: researchers at Cornell University had discovered that one of the world's most beautiful butterflies died when it came into contact with pollen from maize with a pest-resistant toxin engineered into it.

3. From: 'Much ado about nothing' (New Scientist – 18/05/02, www.newscientist.com)

Many also feared the worst the following year, when researchers in the US reported that in the lab, monarch butterfly caterpillars died after eating milkweed leaves dusted with pollen from GM corn. The corn had been engineered to contain a gene for a form of Bt, a bacterial toxin that acts as an insecticide. Suddenly, it seemed possible that all those waving fields of corn could be killing off one of the best loved species of butterfly in North America. But two years of follow-up studies showed that the pollen of most varieties of Bt corn wasn't very toxic and that, in the field, caterpillars didn't eat enough of it to harm them. That seemed to settle the main question – and helped convince the US Environmental Protection Agency to re-approve Bt corn for another five years. The case isn't closed though. For instance, how often do butterfly larvae accidentally eat corn anthers (the pollen producing structures), which contain high levels of toxin, when these fall onto the leaves of their food plant? And even if the pollen doesn't kill the caterpillar, are there harmful long-term effects? No one knows, even as farmers plant Bt corn on millions of hectares across the US.

4. From: 'What about monarch butterflies? Isn't there evidence to show that they have been adversely affected by GM crops?' (<http://www.cropgen.org> 'Questions and Answers')

The experiment

The laboratory experiment with the monarch caterpillars was designed to show what might happen in the worst imaginable situation. Such a worst case scenario is a bit like crash testing a car: it is not intended that cars as a rule should crash but we have to know what happens if they do.

Although monarch caterpillars would not normally choose to eat maize pollen in the wild, in the experiment they were encouraged to eat high levels of pollen from GM maize containing Bt toxin. Not surprisingly, some of the caterpillars died – but remember that current agriculture uses insecticides which kill caterpillars and other insects outright regardless of whether or not they are the pests.

(continues next page)

Caution from scientist

Dr John E. Losey (the scientist who led the monarch study) said: "Our study was conducted in a laboratory and, while it raises an important issue, it would be inappropriate to draw any conclusions about the risk to monarch populations in the field based solely on these initial results."

So the next question was: although they would not choose to eat maize pollen, would monarch caterpillars be exposed to lethal levels of Bt toxin in the field where the wind and rain can disperse the pollen? Experiments showed that plants just one metre from the Bt corn field were not covered in enough pollen to kill them: Monarch caterpillars would almost never be exposed to lethal levels of Bt toxin. Although these and similar studies were presented at a Monarch Butterfly Research Symposium in November 1999, they received little publicity.

In 1998 the amount of Bt corn grown in North America was 20%, this rose to 30% in 1999. In this time monarch butterflies have been doing very well and are actually on the increase. Jeffrey Glassberg, president of the North America Butterfly Association, said that caution must be exercised when introducing new variables into the ecosystem. But he also said he thought the danger was overstated. "I think there are a lot more dire threats than that (Bt corn) to Monarchs", he said. "In the Midwest, mowing roadsides and using herbicides is probably much more devastating actually."

5. From: 'Monarch butterflies and toxic pollen' (Union of Concerned Scientists – <http://www.ucsusa.org/>)

Bt corn

*Bt corn produces a specific toxin, originally from a soil micro organism, *Bacillus thuringiensis*. In its natural form the toxin, when eaten, is fatal to caterpillars of moths and butterflies. Industry scientists engineered corn plants to produce this Bt toxin in order to kill European corn borers that feed on corn plants.*

- In many Bt corn varieties, the toxin is produced in most plant tissues, including pollen. Since monarch caterpillars do not feed on corn, they might be expected to be in no danger to Bt corn. But Bt corn pollen, like any corn pollen, is blown by the wind onto milkweed and other plants in the vicinity of Bt corn fields.*

The 'Nature' article

In laboratory tests, Cornell entomologists have shown that pollen from Bt corn kills monarch caterpillars. They found that:

- Nearly one-half of the monarch caterpillars that ate milkweed leaves dusted with Bt corn pollen died after four days – compared with no deaths among caterpillars that ate leaves with normal corn pollen or no pollen at all.*
- Bt corn pollen also altered the eating behaviour of the caterpillars that survived – they consumed far less – after four days they had eaten about one-half as much as caterpillars on leaves with normal pollen, as a result, they grew much more slowly.*

If the laboratory results reported in the May 20th Nature article extended to the field, then monarch caterpillars, and perhaps many other moth and butterfly caterpillars, including endangered ones, eating in the vicinity of Bt corn fields, are at risk. The US Endangered Species List names 19 species of endangered or threatened butterflies and moths.

6. From: 'Spiritual and ethical considerations' in Designer Genes (Brown 2000)

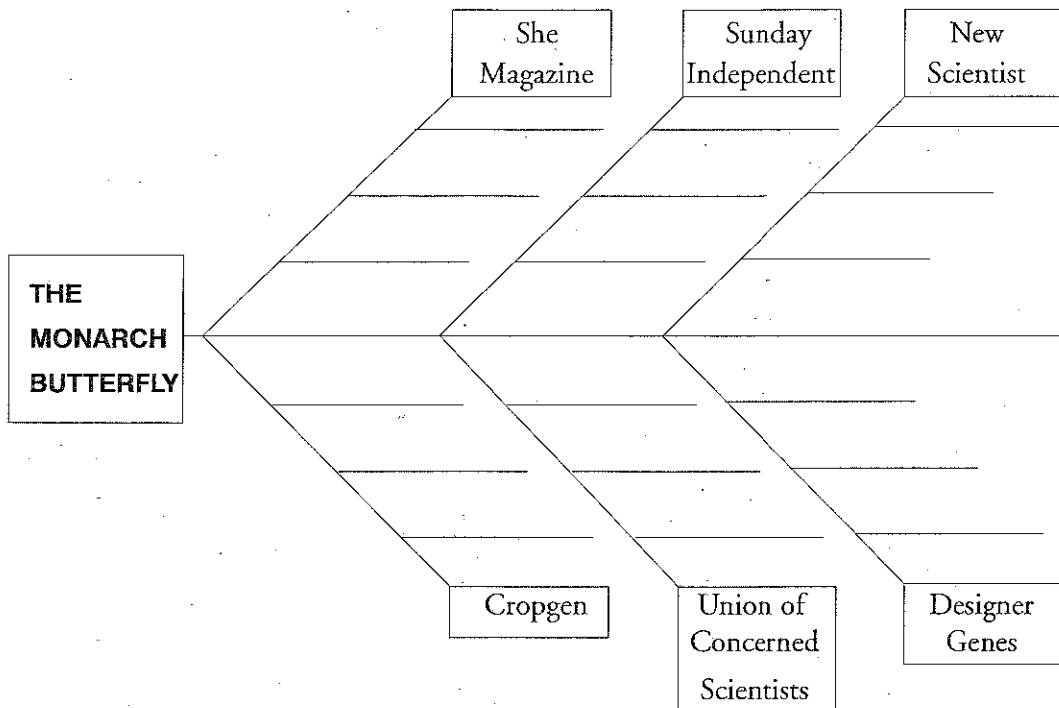
Who will look after the butterfly?

Prince Charles asks the question: If something goes wrong with a GM crop, who will be held responsible?

In North America grave concerns have been raised about the effect GM crops are having on the survival of monarch butterflies. Whether the species survives or is eliminated remains to be seen. However, that a form of life is threatened should come as a wake-up call to the potential risks GM poses.

Each of the statements used has been taken verbatim from a publication or website to represent an authentic voice.

- This 'Fishbone' diagram can be used when trying to analyse various points of view about the same subject.
- Read the articles, identify the points of importance and place these onto the 'Fishbone' organiser.



- Write your summary points on the horizontal lines for each text.
- You may need to draw a larger diagram if a text has a number of points.

What do these texts say about 'The monarch butterfly'?

- Form and write a view of your own on the way this issue has been reported.
- Look for similarities and differences between reports.
- What has been included and what left out?
- What 'impressions' of the issue could various readers get from these texts?

Track the topic 2

- The following topics could also be approached in this way.
 - The views surrounding 'Golden rice'. This issue was brought up by Dr Margy Gilpin and Jon Muller when interviewed. Look at the interview transcripts. Summarise their position on the issue, and then use the internet to do further research. Typing 'Golden rice' into a search engine will give you plenty of responses.
 - The destruction of the research crop of genetically modified potatoes at Lincoln University in January 2002. A range of views can be found at <http://www.nzherald.co.nz>

Activity 3: The Royal Commission of Inquiry on Genetic Modification

Students could prepare a poster or leaflet which shows the:

- events leading up to the forming of the Royal Commission.
- processes involved in carrying out such an exercise:
 - formation of commission
 - membership
 - terms of reference
 - calling of submissions
 - reporting
 - recommendations.
- public reaction.

Resources

<http://www.gmcommission.govt.nz>

<http://www.nzherald.co.nz>

<http://www.lifescienz.com>

<http://www.otd.co.nz>

The Royal Commission website

A good site for concise articles that cover a range of views and topics

Takes a Pro-GM stand but publishes a wide range of viewpoints. This site also has a 'clippings' section where you can find a wealth of newspaper articles and letters

The site of 'The Otago Daily Times' gives a selection of background material including the following list of commission recommendations.

31/07/01

The 49 main recommendations from the Royal Commission on Genetic Modification, released yesterday, included the following key issues.

- Create a new level of approval for "conditional release" of genetically-modified organisms, between the present choices of full release or banning.
- First application for release of GE strain of specific crops to be a political decision.
- Require environmental impact reports on soil organisms and ecosystems before allowing release of GE crops.
- Boost research funding to allow support for organic and other sustainable agriculture.
- Fund public science to check socio-economic and ethical impacts of release of GE organisms.
- Develop a strategy for use of the organic toxin Bt in both sprays and GE plants.
- Develop labelling for GE seeds and plants in nurseries.
- MAF to develop strategy for retaining GE-free honey/bee products.
- Allow creation of GE-free areas for specific crops.
- Stronger ecological checks on development of GE forestry trees.
- Where possible, use non-food animals instead of sheep or cows as "bio-reactors" to produce GE proteins.
- Where possible use synthetic gene sequences instead of genes directly from humans.
- Change patent law so human cells and processes cannot be patented.
- Change new-organism and agricultural remedies law so all "commercially-sensitive" information in applications can be suppressed.
- Require formal ethical oversight for all gene therapies.
- Draw up ethical guidelines for xeno-transplantation such as pig hearts into humans.
- Let Health Ministry, not ERMA, approve medicine and foods containing live GE organisms.
- MAF to re-think the buffer zones between GE and conventional crops.

Each of the statements used has been taken verbatim from a publication or website to represent an authentic voice.

- Simplify regulatory approval for low-risk genetic engineering in containment, or low-risk imports of engineered organisms.
- Extend approvals to import or engineer organisms to also cover breeding them or holding them in captivity.
- Make it clear GE legislation covers experiments on human tissue or cells.
- Change legislation to cover cloning technology used on mammals.
- Local Māori to be represented on the in-house bio-safety committees that approve low-risk GE research.
- Make “cultural offence” a valid reason to refuse intellectual property rights.
- Create Bioethics Council, protect against genetic discrimination.
- Appoint Parliamentary Commissioner of Biotechnology to “future-watch”, audit genetic engineering issues and “educate” the public.
- Charge the Science Ministry with developing a biotechnology strategy for the nation.

Note: When doing this exercise decide who your audience is going to be.

Activity 4: Communicating a message 1

- This activity looks at two different ways in which a GM viewpoint was put before a large audience of people. Site reference: <http://www.mindfully.org/GE/GE2/Biotech-And-You-Scotland.htm>
- Schools are regularly sent resources from a variety of sources. Some are funded directly through a governments’ Ministry of Education, and some are funded by particular private organisations.
- What happens when there is a clash between the resource provider and the resource consumer?
- Below is an opening quote from the site.

FURY AT PRO-GM SCHOOL MAGAZINES

Rob Edwards/Sunday Herald (Scotland) 15/04/01

More than 140,000 glossy brochures sponsored by the US corporate giants of genetic modification such as Monsanto are being pushed into Scotland’s schools by Scottish Enterprise, with the enthusiastic backing of the schools watchdog HM Inspectorate of Education.

- Part of the brochure can be read on the site.
- A fuller extract can be read at www.biotechinstitute.org under ‘Your World – Biotechnology & You’.
- After reading the article and parts of the brochure, comment on the viewpoints that are reflected in both documents. These might lead you to consider wider issues.
- Consider the following points in your analysis.
 - Should all school resources be funded by government?
 - Compare the remarks made by the people involved.
 - Note the range of organisations represented in this exercise.
 - Has anybody asked the students what they think?
 - How well do you think people construct their arguments?
 - How is the analysis of the brochure handled by its opponents?

Communicating a message 2

The second example concerns an 'advert' placed in the 'free' community newspaper 'Cook Strait News', and delivered to about 30,000 households in the Wellington region on 22 October 2001.

- The advert covered four pages, and is known as a 'wrap-around'. In effect, the newspaper was contained inside the advert. Below is one article from the 'wrap-around'.
- 'Advertorial' by Steven Price at <http://mediawatch.co.nz/> should be read as it provides the context for the activity.
- This article raises some wider issues than GM foods but, nevertheless, a view about genetic modification was transmitted to a large number of people using a particular form of communication.
- Read the Mediawatch response for an assessment of the 'Advertorial', then analyse the article below. This article was just one part of the 'wrap-around'.
- Consider these points in your response:
 - Isolate the elements of the article: picture, caption, body of text.
 - Analyse the article using the skills you have practised earlier in Section 1
 - What is your view of the article?
 - What is your view of its place within the 'Advertorial'?
 - Does one part accurately reflect another?

Genetically enhanced corn cleared in 17 food reactions

Genetically enhanced product did not trigger allergies, health officials report

The Washington Post reported on 14 June 2001, that genetically engineered StarLink corn did not cause allergic reactions in 17 people who had reported sometimes severe reactions after eating corn tacos or tortillas.

Blood tests failed to find any signs of antibodies to the protein in the genetically enhanced corn, indicating none of those tested had experienced an allergic reaction, the federal Centres for Disease Control and Prevention said. All had complained to federal agencies last year of reactions ranging from rashes to anaphylactic shock after eating products made of yellow corn that might have contained StarLink.

The results were applauded by advocates of biotechnology as confirming the safety of StarLink in particular and modified crops in general. But, predictable environmental groups called the federal effort limited and insufficient to answer the question of whether StarLink can cause dangerous allergic reactions.

Carol Rubin, an epidemiologist with the CDC's National Center for Environmental Health, said that while the test results were "only a first step" in answering questions about the safety of the corn, "it can be seen as good news for consumers."

"Based on the test methods used, it is highly unlikely that the people had an allergic reaction to it," StarLink said. "They may have experienced allergic reactions to some food, but not the protein that was tested."

But refusing to be swayed by the evidence, one of the people who suffered

anaphylactic shock after eating an enchilada made of yellow corn, Californian Grace Booth, said she was still convinced she had a reaction to StarLink.

"Everything else I ate in the 72 hours before I got so sick, I've eaten again with no problem," she said. "Frankly, I don't trust the tests."

StarLink is a variety of corn engineered to contain protein, called Cry9c, that can protect crops against several insects. While many similar modified corns have been approved for general use, StarLink was approved only for animal feed because of concerns that it broke down more slowly than many proteins and might cause allergic reactions. The corn nonetheless inadvertently entered the human food supply, triggering the recall of about 300 corn products.

Val Giddings of the Biotechnology Industry Organisation said that yesterday's results meant that the case was "slam-dunk closed".

"We are pleased, but not the least bit surprised, that the data released by the CDC today is consistent with the vast body of data we have had all along showing the safety of StarLink corn," he said.

"If the protein was allergenic, they would not have found these negative reactions."

Seemingly unhappy to let the hysteria die down, a now discredited Mark Helm of Friends of the Earth, and environmental pressure group that first brought the issue of StarLink in taco shells to public attention, said it was "borderline irresponsible to say this stuff is safe. It still has not been rigorously tested".



Photo Colin Walker

Appendix 1 – Evaluation

Holistic Critical Thinking Scoring Rubric (Facione & Facione)

4 Consistently does all or almost all of the following:

- Accurately interprets evidence, statements, graphics, questions, etc.
- Identifies the salient arguments (reasons and claims) pro and con.
- Thoughtfully analyses and evaluates major alternative points of view.
- Draws warranted judicious, non-fallacious conclusions.
- Justifies key results and procedures, explains assumptions and reasons.
- Fair-mindedly follows where evidence and reasons lead.

3 Does most or many of the following:

- Accurately interprets evidence, statements, graphics, questions, etc.
- Identifies the relevant arguments (reasons and claims) pro and con.
- Offers analyses and evaluations of obvious alternative points of view.
- Draws warranted non-fallacious conclusions.
- Justifies some results or procedures, explains reasons.
- Fair-mindedly follows where evidence and reasons lead.

2 Does most or many of the following:

- Misinterprets evidence, statements, graphics, questions, etc.
- Fails to identify strong, relevant counter-arguments.
- Ignores or superficially evaluates obvious alternative points of view.
- Draws unwarranted or fallacious conclusions.
- Justifies few results or procedures, seldom explains reasons.
- Regardless of the evidence or reasons, maintains or defends views based on self-interest or preconceptions.

1 Consistently does all or almost all of the following:

- Offers biased interpretations of evidence, statements, graphics, questions, information, or the points of view of others.
- Fails to identify or hastily dismisses strong, relevant counter arguments.
- Ignores or superficially evaluates obvious alternative points of view.
- Argues using fallacious or irrelevant reasons, and unwarranted claims.
- Does not justify results or procedures, nor explain reasons.
- Regardless of the evidence or reasons, maintains or defends views based on self-interest or preconceptions.
- Exhibits close-mindedness or hostility to reason.

Appendix 2 – Bloom's Taxonomy

Level definition	Some general instructional indicators	Illustrative verbs for stating specific learning outcomes
<p>Knowledge The remembering of previously learned material, from specific facts to complete theories. The bringing to mind of appropriate information.</p>	<ul style="list-style-type: none"> • Knows common terms • Knows specific facts • Knows methods and procedures • Knows basic concepts • Knows principals 	<p>defines, describes, identifies, labels, lists, matches, names, outlines, reproduces, selects, states</p>
<p>Comprehension The ability to grasp the meaning of material. This may be shown by translating material from one form to another; by interpreting material, and by estimating future trends.</p>	<ul style="list-style-type: none"> • Understands facts and principles • Interprets verbal material • Interprets charts and graphs • Estimates consequences implied in data • Justifies methods and procedures 	<p>converts, defends, distinguishes, estimates, explains, extends, generalises, gives examples, infers, paraphrases, predicts, rewrites, summarises</p>
<p>Application The ability to use learned material in new and concrete situations. This may include the application of rules, methods, concepts and theories.</p>	<ul style="list-style-type: none"> • Applies principles to new situations • Applies theories to practical situations • Solves mathematical problems • Constructs charts and graphs • Demonstrates correct usage of a procedure 	<p>changes, computes, demonstrates, discovers, manipulates, modifies, operates, predicts, prepares, produces, relates, shows, solves, uses</p>
<p>Analysis The ability to break down material into its component parts so that its organisational structure may be understood. This may be shown by the identification of the parts, analysis of the relationship between parts and recognition of any organisational principals involved.</p>	<ul style="list-style-type: none"> • Recognises unstated assumptions • Recognises logical fallacies in reasoning • Distinguishes between facts and inferences • Evaluates relevancy of data • Analyses the organisational structure of a work (art, music, writing, photo) 	<p>breaks down diagrams, differentiates, discriminates, distinguishes, identifies, illustrates, infers, outlines, points out, relates, selects, separates, subdivides</p>
<p>Synthesis The ability to put parts together to form a new whole. This may involve the production of a unique form of communication, the plan for a research topic, or a scheme for classifying information.</p>	<ul style="list-style-type: none"> • Gives a well organised speech • Writes a creative short story or poem • Proposes a plan for an experiment • Integrates learning from different areas into a plan for solving a problem • Devises a new scheme for classifying new objects, events or ideas 	<p>categorises, combines, complies, composes, creates, devises, designs, explains, generates, modifies, organises, plans, rearranges, reconstructs, relates, reorganises, revises, rewrites, summarises, tells, writes</p>
<p>Evaluation The ability to judge material for a given purpose. The judgements are to be based on definite criteria. These may be internal (organisation), or external (relevance and purpose) and the student determine the criteria or be given them.</p>	<ul style="list-style-type: none"> • Judges the consistency of written material • Judges the adequacy with which conclusions are supported by data • Judges the value of a work (art, music, writing) by using internal criteria • Judges the value of a work (art, music, writing) by use of external standards 	<p>appraises, compares, concludes, contrasts, criticises, describes, discriminates, explains, justifies, interprets, relates, summarises, supports</p>

Questions for inquiry	Possible activities
<ul style="list-style-type: none"> • What do I already know about this topic? • Which is true or false ...? • What happened after ...? • Who was it that ...? 	<ul style="list-style-type: none"> • Make a list of the main events of the story. • Make a time line of events. • Make a facts chart. • Write a list of any pieces of information you can remember. • Make an acrostic poem to show your knowledge of the subject.
<ul style="list-style-type: none"> • What generalisation can I make? • What picture summary can I draw? • What goes into this word summary? • What differences exist between ...? 	<ul style="list-style-type: none"> • Cut out or draw pictures to show a particular event: • Illustrate what you think the main idea was. • Make a cartoon strip showing the main sequence of events. • Write and perform a play based on the ... • Retell the ... in your own words. • Write a summary of the ... • Prepare a flow chart to illustrate the sequence of events.
<ul style="list-style-type: none"> • How can I solve this problem? • Do you know of another instance where ...? • What questions would you ask of ...? 	<ul style="list-style-type: none"> • Make an informative map. • Collect/take photos to demonstrate a point. • Make a puzzle based on the study. • Market a product using a known marketing strategy. • Write a booklet about ... for others.
<ul style="list-style-type: none"> • Is this a cause or an effect? • Can I identify the parts to this argument? • Is this fact or opinion? • Is this good or poor reasoning? • Can I draw a definite or indefinite conclusion? • How was this similar to ...? • What were some of the motives behind ...? 	<ul style="list-style-type: none"> • Design a questionnaire to gather information. • Write an advert to sell a new product. • Conduct an investigation to support a view. • Make a flow chart to show the critical stages. • Construct a graph to illustrate selected information. • Make a jigsaw puzzle. • Write a biography of the person studied. • Report about the area of study.
<ul style="list-style-type: none"> • How do I construct an argument? • How can I extend these attributes? • How can I think flexibly? • What would happen if ...? • If you had access to all resources how would you deal with ...? 	<ul style="list-style-type: none"> • Invent a machine for a specific task. • Design a building to house your own study. • Create a new product. Give it a name, plan and market it. • Write about your feelings in relation to ... • Write a TV show, play, puppet show, role play, song, or pantomime about ... • Design a record, book or magazine cover for ... • Make up a new language code and write material using it. • Sell an idea. • Compose a rhythm or put new words to a known melody.
<ul style="list-style-type: none"> • Is this information relevant? • How can I decide? • Is this information biased? • How reliable is this information? • What is the other person's viewpoint? • How do I justify my argument? 	<ul style="list-style-type: none"> • Prepare list of criteria to judge a ... show. Indicate priority and ratings. • Debate an issue of special interest. • Make a booklet about 5 rules you see as important. Convince others. • Form a panel to discuss views, e.g. "learning at school". • Write a letter to ... advising on changes needed at ...? • Write a half year report. • Prepare a case to present your views about ...

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