**ACTIVITY: Social issues and nanotechnology**

**Activity idea**

In this activity, students realise that they are growing up in a world in which [nanotechnology](http://www.sciencelearn.org.nz/About-this-site/Glossary/nanotechnology) could make a huge impact and social issues need to be thought about before changes happen without controls.

By the end of this activity, students should be able to:

* explain which existing products containing nanotechnology components they consider good or bad
* explain which future products that may contain nanotechnology components they consider good or bad
* develop a response to a possible future products like ‘nanodocs’ that will enable medical tests or ‘nanocleaners’ that will enable cleaning of teeth, hair and skin throughout the day
* discuss the positive and negative factors of nanotechnology enabling people to live to 200 years in the future.

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**Introduction/background**

It is important for scientists to know what the public thinks as well as for people to know what scientists are doing. Nanotechnology is new, and many of the applications already on the market seem useful but harmless. However, some of the things that science and industry are hoping to achieve with nanotechnology in the future have some people very concerned.

Recent public debate about [genetic](http://www.sciencelearn.org.nz/About-this-site/Glossary/genetic) engineering showed that the values that drive science and industry sometimes conflict with the views and attitudes of the public. As a result of the genetic engineering debate, controls were put in place that have restricted the research that can be done. Some people think that this should happen for nanotechnology too.

The activities below make use of an actual piece of New Zealand research into public opinion about nanotechnology. The reference to the published article is Cook, A.J. and Fairweather, J.R. (2005) *Nanotechnology – ethical and social issues: results from New Zealand focus groups*. Research report No 281, Agribusiness and Economics Research Unit, Lincoln University. This 56-page report can be found online at <https://researcharchive.lincoln.ac.nz/bitstream/handle/10182/153/aeru_rr_281.pdf?sequence=1>.

Further work is reported in Cook, A.J. and Fairweather, J.R. (2006) *Nanotechnology – ethical and social issues: results from a New Zealand survey*. Research report No 289, Agribusiness and Economics Research Unit, Lincoln University. This 56-page report can be found online at  
<http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.505.6412&rep=rep1&type=pdf>.

These are long reports but have very useful summaries at the beginning.

This activity is suitable for students who have at least a basic knowledge of what nanotechnology is.

**What you need**

* Copies of student handouts [1A, 1B, 2, 3A, 3B and 4](#Handout) for each small group of students

**What to do**

1. The activities are arranged in four parts, with students working in small groups. It is important that students don't receive the next step before finishing the current one. The sequence includes students looking at other people’s ideas as well as debating their own:

* Part 1: Students consider actual nanotechnology already in use (sheet 1A) and under development (sheet 1B). They decide if things are good or bad ideas. Give out sheet 1A for students to complete before going on to sheet 1B.
* Part 2: Students look at other people’s responses, both positive and negative, to a development in nanotechnology that might exist in the near future, and they can add new ideas. Give out sheet 2.
* Part 3: Students look at other people’s responses to a possible development in nanotechnology from one point of view, positive or negative, and they will defend these views in a debate. Give out sheet 3A to half the groups and sheet 3B to the other half.
* Part 4: Students discuss the social issues of a nanotechnology situation that could occur in the distant future, based solely on their own ideas. Give out sheet 4.

**Extension idea**

Encourage your students to try and decide if scientists should be allowed to do research like this. Should there be rules telling scientists and industry what they can and can’t do?

**Student handout: Sheet 1A**

Here is a list of products that already exist. They contain at least some nanotechnology components. Discuss each item, and decide if your group thinks they are a good idea, a bad idea or a bit of both. Tick the appropriate boxes.

|  |  |  |  |
| --- | --- | --- | --- |
| **Products containing some nanotechnology** | **Good idea** | **Bit of both** | **Bad idea** |
| Sunscreens – titanium dioxide nanoparticles absorb UV light |  |  |  |
| Car catalytic converters – more efficient with [platinum](http://www.sciencelearn.org.nz/About-this-site/Glossary/platinum) [nanoparticle](http://www.sciencelearn.org.nz/About-this-site/Glossary/nanoparticle) catalysts |  |  |  |
| Antibacterial bandages that contain [silver](http://www.sciencelearn.org.nz/About-this-site/Glossary/silver) nanoparticles |  |  |  |
| Glass with a [nanofilm](http://www.sciencelearn.org.nz/About-this-site/Glossary/nanofilm) that cleans itself |  |  |  |
| Scratch and wear-resistant paints |  |  |  |
| [Nanoscale](http://www.sciencelearn.org.nz/About-this-site/Glossary/nanoscale) [electronics](http://www.sciencelearn.org.nz/About-this-site/Glossary/electronics) components – faster and smaller computers, iPods |  |  |  |
| Longer-lasting tennis balls |  |  |  |
| Stain-resistant clothing |  |  |  |
| Display screens for computers and [cell](http://www.sciencelearn.org.nz/About-this-site/Glossary/cell) phones – brighter, use less power |  |  |  |

**Student handout: Sheet 1B**

Now look at the list of examples of things being developed using nanotechnology that will probably be in use in the near future. Discuss each item and decide if your group thinks they are a good idea, a bad idea or a bit of both. Tick the appropriate boxes.

|  |  |  |  |
| --- | --- | --- | --- |
| **Products containing some nanotechnology** | **Good idea** | **Bit of both** | **Bad idea** |
| Faster, more powerful computers |  |  |  |
| Lighter and stronger weapons |  |  |  |
| Military lightweight armour that is bulletproof |  |  |  |
| Efficient solar cells for cheap [electricity](http://www.sciencelearn.org.nz/About-this-site/Glossary/electricity) |  |  |  |
| [Hydrogen](http://www.sciencelearn.org.nz/About-this-site/Glossary/hydrogen) [fuel](http://www.sciencelearn.org.nz/About-this-site/Glossary/fuel) cells – nanoparticle catalysts help make them cost-efficient |  |  |  |
| Nanoparticle filters for removing pollutants from air and water |  |  |  |
| Medicine that is delivered only to specific affected parts of the body |  |  |  |
| Nanoscale sensors in the body to monitor health |  |  |  |
| Tougher, harder cutting tools |  |  |  |

**Student handout: Sheet 2**

Imagine that a ‘nanodoc’ has been developed. Tiny sensors will sit under your skin all over your body and let you make medical tests whenever you want. The ‘nanodocs’ will be remotely linked to a computer, which will be able to diagnose problems and suggest treatment, even prescribe medicine, without you needing to visit a real doctor.

The comments below are actual responses people have made to this scenario. Cut out the responses and arrange them in sets of positive, negative and neutral.

Discuss the comments within your group and add any new responses you may have. You will be asked to share new responses with the whole class.

|  |  |  |
| --- | --- | --- |
| Great idea, wouldn’t need to pay to go to the doctor |  | No long wait for tests to come back from the doctor |
|  |  |  |
| People might panic if they think they have something wrong, they should check with a real doctor |  | People who are not doctors might treat something that doesn’t need treating |
|  |  |  |
| Talking to a real doctor is better than relying on a computer |  | Could identify problem early and treat before it gets serious |
|  |  |  |
| Could replace horrible home blood tests for diabetics |  | Relies on something that is not a doctor to make a medical decision |
|  |  |  |
| Good way to keep track of existing conditions but dangerous to rely on it to find new problems |  | People could become hypochondriacs, checking all the time |
|  |  |  |
| Might make people lazy about visiting a doctor when they really need to |  | It’s a good idea but would need to take into account long-term effects |
|  |  |  |
| New response: |  | New response: |
|  |  |  |
| New response: |  | New response: |

**Student handout: Sheet 3A**

Imagine that ‘nanocleaners’ have been developed. These nanoscale machines can be added to toothpaste, and will continue working to keep teeth clean throughout the day. ‘Nanocleaners’ in soap and shampoo will also actively keep skin and hair clean throughout the day.

Below are some positive responses to this scenario. Talk about them within the group – you can add any new positive responses you come up with.

You will need to defend this **positive** viewpoint, even if you disagree with it.

Debate the scenario with a group holding the opposing viewpoint.

**Positive responses**

* This is not a problem – there is always new stuff being added to toothpaste.
* You could have healthy, whiter teeth for longer.
* You could use the same idea for keeping arteries clear.
* It’s a good idea, but we need to know if there will be any long-term effects on us and the environment.
* Great, you wouldn’t have to wash your hands so often.

**Student handout: Sheet 3B**

Imagine that ‘nanocleaners’ have been developed. These nanoscale machines can be added to toothpaste, and will continue working to keep teeth clean throughout the day. ‘Nanocleaners’ in soap and shampoo will also actively keep skin and hair clean throughout the day.

Below are some negative responses to this scenario. Talk about them within the group – you can add any new negative responses you come up with.

You will need to defend this **negative**viewpoint, even if you disagree with it.

Debate the scenario with a group holding the opposing viewpoint.

**Negative responses**

* What happens to the nanomachines afterwards? They might get into my body.
* When you rinse your mouth or your hands, the water could carry the nanomachines into the environment where they might cause problems.
* I don’t like the idea of swallowing them.
* It’s just a way for companies to make more money – there’s nothing wrong with the way we keep clean now.
* How do I know the nanocleaners won’t harm my teeth or skin after using them for a long time?

**Student handout: Sheet 4**

Imagine that self-replicating ‘nanobots’ have been developed that continually travel round your body, repairing damaged and ageing cells. This will slow down the ageing of your body – you will be able to live a healthy life for at least 200 years.

What are some of the positive and negative things that might happen if people could live for at least 200 years?

You will present your ideas to the whole class.