**ACTIVITY: Vitamin C and the future**

**Activity idea**

In this activity, students use the Futures thinking tool to investigate vitamin C and new fruit varieties.

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

* describe the role vitamin C plays in human metabolism
* state the approximate vitamin C content of two or more common fruits
* state the recommended daily dose value
* discuss possible future vitamin C-enriched fruit cultivars.

Download the Word file (see link above) for:

* introduction/background notes
* what you need
* what to do.

[Introduction/background](#Introduction)

[What you need](#need)

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**Introduction/background**

Vitamin C deficiency was one of the first recognised nutritional deficiencies because sailors who were out at sea longer than perishable fruits and vegetables could be stored suffered from scurvy. En route to New Zealand, Captain Cook solved the problem by forcing his crew to drink lime juice or eat pickled cabbage.

Through the evolutionary process, humans lost the ability to produce vitamin C. Humans lack the key enzyme L-3 gulonolactone oxidase necessary for the biosynthesis of vitamin C, so humans could not survive without eating fruit and vegetables. Good sources of ascorbate (vitamin C) are blackcurrants, guava, citrus and kiwifruit as well as broccoli and sprouts. Vitamin C content can be affected by season, transport, shelf life, storage time, cooking practices and chlorination of water.

In this activity, students use the Futures framework to think about changes in the recommended daily intake of vitamin C and what might happen in the future. The framework asks students to think about the existing situation, trends or changes there have been over time, drivers or what has been behind the changes, what might be available in the future and who might have access to it, and what students think should be available and why.

**What you need**

* Access to the article [Plants and vitamin C](https://www.sciencelearn.org.nz/resources/530-plants-and-vitamin-c) and the timeline [Vitamin C history](https://www.sciencelearn.org.nz/resources/1690-vitamin-c-history-timeline)
* Access to the articles [The power of C](http://www.otago.ac.nz/otagomagazine/issue42/features/otago598454.html) and [Kiwi scientist unpeel secrets of Vitamin C](http://www.stuff.co.nz/national/42350/Kiwi-scientists-unpeel-secrets-of-Vitamin-C)
* Access to the YouTube clips [The story of the red fleshed apple](http://www.youtube.com/watch?v=CpmycbNqgjM) and [Under the skin of the red-fleshed apple](http://www.youtube.com/watch?v=w4uGw48OYDI&feature=related)

**What to do**

1. Have students undertake background research using the web resources listed above, then use the Futures framework to think about changes in the recommended daily intake of vitamin C and what might happen in the future. Students could do this in groups or individually.

**Existing situation –** what happens now and why?

**Trends –** how does this differ from the past and why?

**Drivers –** what is causing the changes and why?

**Possible futures –** what might happen in the future?

**Preferable futures –** what do you want to happen in the future and why?**Futures thinking tool example**

***Existing situation:***

The recommended daily dose of vitamin C is 45mg/day. Fruits like apples, bananas and tomatoes have only about 20mg of vitamin C per 100g of fresh fruit. Some people take vitamin C as a supplement. Diseases like scurvy caused by vitamin C deficiency are no longer a problem in developed countries. However, in the developing world, particularly in the nations of Africa and southern Asia where supply of fresh fruit and vegetables can be unreliable and the availability of vitamin supplements is limited, there is widespread vitamin C deficiency.

***Trends:***

Vitamin C was identified in the 1930s but it has take taken until now for scientists to learn how plants naturally create vitamin C. A team at HortResearch studied the kiwifruit, a plant naturally high in vitamin C, and isolated the last undiscovered enzyme in the pathway to vitamin C biosynthesis and proved the enzyme (L-galactose-guanyltransferase) controlled vitamin C in plants. This knowledge could then be used to breed new fruit varieties that offer consumers natural and convenient ways to increase their vitamin C intake – you might be able to eat one piece of fruit that supplies your whole recommended daily dose of vitamin C.

***Drivers:***

1. Scientists are working to identify molecular markers that enable them to recognise high levels of vitamin C biosynthesis. These markers can then be used by breeders to identify plants that promise high levels of vitamin C. These plants can then be used in breeding new varieties that offer consumers natural and convenient ways to increase their vitamin C intake.
2. Scientists at the University of Otago School of Medicine say they have proof of a link between vitamin C and the successful treatment of cancer. Their research shows that, when vitamin C is introduced to a [tumour](http://www.biotechlearn.org.nz/about_this_site/glossary/tumour), it can decrease in size and lose its [resistance](http://www.biotechlearn.org.nz/about_this_site/glossary/resistance) to treatments aimed at getting rid of the [cancer](http://www.biotechlearn.org.nz/about_this_site/glossary/cancer), like [chemotherapy](http://www.biotechlearn.org.nz/about_this_site/glossary/chemotherapy).
3. The New Zealand fruit and vegetable industry’s two main exports are kiwifruit and apples. Growers are continually seeking to enhance the products they sell in the international market and come up with new varieties that anticipate and meet the needs of consumers (for example, braeburn and royal gala apples, golden kiwifruit). They are also seeking to pack health benefits into apples – aiming to grow apples with red, gold and green flesh – more anthocyanins, with high antioxidant activity.

***Possible futures:***

1. Red fleshed apples.
2. A high vitamin C apple – apples are commonly consumed and with a vitamin C boost, they would be more beneficial.
3. Vitamin C used in the treatment and prevention of cancer.
4. Kiwifruit – wild variety.