**Unit plan: Honey for wound healing**

**Overview**

Secondary students learn about bacteria, how the immune system responds to them and the use of honey to kill them in infected wounds.

**Purpose**

To investigate the antibacterial activity of different types of honey.

Experiments to explore the properties of different types of honey types are used to help students design their own honey wound dressing.

## Background

### Suggestions for a scenario

Honey has been noted for its healing properties for thousands of years.

Research and discover the properties that make honey a good at healing wounds.

Your students have been asked to design a test that determines how good a particular honey is at wound healing. Once they have identified which honey is best, get the students to design wound dressings that could incorporate honey. At the end of this exercise, you may want to consider the acceptability of this honey wound dressing to medical practitioners and patients.

### Where's the Biotechnology?

Chronic wounds, such as ulcers, burns or infected sores can be difficult to treat and take a long time to heal. This is because populations of bacteria become established in the wound and the body cannot repair the wound until the bacterial infection is eliminated.

Honey is a supersaturated sugar solution made by bees. It is a natural antibacterial agent. Mānuka honey has a unique property that comes from Mānuka trees, which make it particularly useful for healing wounds. Using Mānuka honey to make a wound dressing for patients with infected wounds is a prime example of biotechnology: “using living organisms, or parts of living organisms, to tackle problems or respond to opportunities”.

## Curriculum focus

### Technology

Honey used in wound dressing has to meet particular specifications. Carry out research to test and select honey to be used as a wound dressing.

### Science

Investigate factors that affect the survival of microorganisms, and how to prevent or stop their growth.

Extra for experts:

* Investigate how the beliefs and attitudes of clinicians and patients may affect the use of honey wound dressings.
* Environmental issues of making honey wound dressings .

### Focus of skill & strategy

* Students learn about the role of bacteria.
* Students learn to how to test for antibacterial action.
* Students test the antibacterial action of a variety of honeys (e.g. clover, honeydew, Mānuka, active Mānuka, etc. – whatever you can find at the supermarket!).
* Students design a wound dressing that incorporates honey.

### Health and Safety

* The HSNO Act states that students should not eat in the lab.
* Cybersafety considerations should be a part of your planning for the time you wish to direct your students to use the internet.
* You may want to teach students some OOS avoidance strategies for computer use.

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| **UNIT PLAN: HONEY FOR WOUND HEALING** | | |
| **Suggested learning intentions** | Suggested learning experiences*The following learning experiences will provide you with starting points for an exploration of this topic. You may decide to narrow your focus to one component, or include most of the ideas in a unit that incorporates science and/or technology themes* | Possible teaching/assessment activities |
| Students learn about microorganisms.  Understand that infected wounds take longer to heal.  List characteristics of wounds - it is important to think about these characteristics when designing wound dressings.  Observe wound dressing products. | **Introduction**  Learn about microorganisms, in particular bacteria.  Research how bacteria survive in different environments, and what nutrients they require to live, respire, and reproduce.  Learn how bacterial infections can prevent wounds from healing. What does this mean for treatment of the patient? What strategies are currently used in medicine to prevent or get rid of bacterial infection?  Discuss the different characteristics of wounds. For example, redness and swelling are part of the immune system’s response to damage and will be more severe when the wound is infected.  Analyse features of currently available wound dressing products and the function of these features, for example plasters, compression bandages, and silver wound dressings. | Use text books and available information on bacteria.  Use the Hub resources: [Honey to heal](https://www.sciencelearn.org.nz/resources/1700-honey-to-heal-introduction)  Arrange a visit from a nurse or medical practitioner who specialises in woundcare. |
| Investigate the wound healing properties of honey | **Introduce the scenario** **and group/class organisation**  Learn about how bees make honey, in particular New Zealand Mānuka honey.  Investigate how honey has been used for wound healing for thousands of years.  Understand the physical and chemical properties of honey that make it so good at healing wounds. For example:   * High sugar content – ties up water so that micro-organisms dry out and die * Acidity – with a pH of 3.2 – 4.5 honey is quite acidic. This can denature the enzymes in bacteria, causing them to die, however it can irritate the sensitive tissue in a wound causing pain. * Hydrogen peroxide – honey contains both glucose and glucose oxidase, an enzyme which creates hydrogen peroxide from glucose. Honey produces hydrogen at a constant, low concentration, enough to kill microorganisms. It also stimulates cell growth and tissue repair. * Unique Mānuka Factor – Mānuka honey has an additional, unique component, which kills most types of bacteria. It can activity of the Unique Mānuka Factor (UMF®) can be rated using a UMF test.   Brainstorm ways of testing the wound healing properties of different types of honey. | Find out more about why New Zealand’s Mānuka honey is so special.  Get article: [Honeybees and Mānuka trees](https://www.sciencelearn.org.nz/resources/1703-honeybees-and-manuka-trees)  Discover the scientific basis for honeys remarkable wound healing properties.  Get article: [How Honey heals wounds](https://www.sciencelearn.org.nz/resources/1702-how-honey-heals-wounds) |
| Design and carry out a test for the antibacterial activity of honey.  Establish the best type of honey for use in a wound dressing. | **Developing expertise**  Test the antibacterial properties of honey. This can be compared with other antibacterial creams, for e.g. savlon. There are several ways you can test this:   * Test whether honey can prevent milk or meat from going off (a sign of the presence of bacteria). * Or test whether honey can prevent the growth of non-pathogenic bacteria, like *E. coli*, on agar plates.   To make the experiment more rigorous you can test honey from different floral sources (Mānuka, honeydew, or mulitflora) and at different concentrations. | To see how the antibacterial activity of honey is tested in the lab get video: [UMF testing](https://www.sciencelearn.org.nz/videos/1026-umf-testing) |
| Recommend the type and concentration of honey that could be used in honey wound dressings. | **Solving the problem**  Analyse the results from your experiment and choose the best type and concentration of honey for use in a wound dressing.  Learn about the advantages and disadvantages of using honey as a wound treatment.  Brainstorm ways of making honey into a dressing that maximise its ability to help wounds to heal.  Make a design for a wound dressing that could incorporate honey and be effective at healing wounds. | Every step in the honey supply chain is monitored to keep the honey free from contamination, get article: [Processing Mānuka honey](https://www.sciencelearn.org.nz/resources/1704-processing-manuka-honey)  Find out more about making wound dressings which incorporate honey, get article: [From bees to bandages](https://www.sciencelearn.org.nz/resources/1705-from-bees-to-bandages) |
| Present ideas to an audience | Presenting your ideas Present your design for a wound dressing which uses honey to the class. Discuss the features of this dressing and the problems that had to be overcome in order to incorporate honey into the dressing. | Presentation of design |
| A presentation and/or a written report. | **Assessment** The experimental report will form the basis for assessing student learning in this unit. | Presentation or written report |
| Analyse beliefs and attitudes that may promote or constrain the use of this technology.  Consider the economic, environmental, and public health issues of this technology | **Extra for experts:**  Would you use honey wound dressings on a wound? Consider this question from the perspective of a medical doctor making a prescription to a patient, a community nurse visiting leg ulcer patients in their homes after discharge from hospital, a patient with a chronic leg ulcer facing amputation, a patient developing a leg ulcer, a person with bad sunburn.  Imagine you are the CEO of a new company producing honey wound dressings. You are just about to float your company on the stock exchange and are looking for investors to buy shares. You have arranged a meeting with interested parties and will make a presentation to them, trying to convince them to buy in to your business. To do this you will need to consider the economic, environmental and public health issues surrounding honey wound dressings. | Class discussion  There are other alternatives to honey wound dressings. These currently include taking antibiotics, silver-containing dressings, or topical creams, such as savlon. |