Disease Prevention

Standards addressed:

Health

Standard 1

Core Concepts: Understands concepts related to health promotion and disease prevention

- HE 6-8. 1.9 Person Health and Wellness – Identify choices individuals can make to promote or harm their health.

Standard 2:

Accessing Information: Access valid health information and health: promoting products and services

- HE 6-8 2.2 Health Information, Products and services across topic areas – Use appropriate sources to access valid health information, products, and services.

Standard 3: Self-management: Practice health enhancing behaviors and reduce health risks.

- HE 6-8 3.2 Personal Health and Wellness – Explain the importance of assuming responsibility for personal health behaviors

Standard 6

Decision making and goal setting: Decision making across topic areas

- HE 6-8 6.1 Describe decision-making processes related to health-related decisions
- HE 6-8 6.2 Access health-related decisions for consequences that affect oneself and others

Standard 7: Advocacy: Advocate for personal family, and community health

Advocacy across topic areas

- HE 6-8 7.2 Use appropriate methods to communicate accurate health information and ideas

Next Generation Science

MS-LS1From Molecules to Organisms: Structures and Processes

MS-LS1-1.

- Conduct an investigation to provide evidence that living things are made of cells; either one cell or many different numbers and types of cells.

Reading for Understanding:

Hawai'i's need for food security

The State of Hawaii estimates it imports 85-90% of its food, which makes the state vulnerable to natural disasters and world events. Should there be a disruption in the shipping of food from the mainland, local food supplies would quickly run out on the store shelves. To prevent such a situation the *Increased Food Security and Food Self-sufficiency Strategy* was prepared by state agencies in 2009. This movement supports the local production of fresh fruits and vegetables, and it encourages consumers to support these efforts by buying locally grown food. Because of this statewide push to support local agriculture, many young people are becoming interested in farming and gardening. There has been an increase in the number of local farmers markets, school garden projects, and restaurants specializing in menus using locally grown foods. The passage of the Farm to School Act in Hawai'i has created a pipeline for locally grown produce to be served in school lunches. Those of us living in Hawai'i are indeed fortunate. Hawaii is blessed with the climates, soils, plant varieties, and farmers that provide us with amazing assortment of fresh, fruits and vegetables that supplement and support healthy living.

Food-borne pathogens

While fresh fruits and vegetables are so important for good health, the **pathogens** that sometimes hitchhike on them are not. Pathogens are microscopic organisms that can cause disease. Some of the more common pathogens that can cause food-borne disease include:

Bacteria

- Listeria
- Salmonella
- hepatitis A
- *Clostridium botulinum* (causes botulism
- *Escherichia coli* (E.coli)

Virus

- Norovirus

Parasites

- rat lungworm *Angiostrongylus cantonensis.*

Food-borne pathogens can cause serious illness and even death, and so as growers and consumers of food we must be conscious of them and take precautions to prevent disease.

Food preparation

Checking and cleaning

Most of us have probably heard of food recalls, sent via public messages in an effort to prevent illness. Food recalls are due to contamination by some type of pathogen. All fresh produce, which includes fruits and vegetables must be washed before it is prepared and ready for consumption. Baby slugs and snails can be very small, as seen in the picture (above). Those fruits or vegetables that have tough or bumpy skins, such as potatoes and cantaloupe, should be scrubbed with a vegetable scrub brush. Some vegetables and fruits can be peeled, removing the surface that could have been contaminated. Cutting an unwashed, contaminated piece of produce with a knife can spread pathogens into the edible parts and cause food poisoning or disease. In the case of the nematode that causes rat lungworm disease, we must all be vigilant and do our part to lessen disease risk. Carefully checking and cleaning all produce is essential. Headed vegetables, such as lettuce, bok choy, and celery, must be taken all the way apart and each leaf carefully inspected for any sign of slugs, snails, or flatworms, and then washed under running, **potable** water. It is possible that a slug or flatworm may find their way into a headed vegetable and then die and decompose. In this case the organism might be

unrecognizable, appearing only as a bit of slime or dirty water, however the rat lungworm parasites will exit the deceased organism and can survive for some time if conditions are wet. Any produce showing signs of slug damage, such as feces or chew marks, should be discarded. Slug and snail feces are brown, coiled, and ropelike. Research has shown that rinses, such as vinegar, food grade hydrogen peroxide, and grapefruit seed extract, are not effective in killing the rat lungworm. The only known vegetable washes at this time that have been shown to be effective are bleach and salt water. In the United States bleach is not approved for use on food by the FDA. The best method to ensure safety is to carefully check and clean produce and to cook food.

Cooking

We should remember that Hawai'i has a tropical climate and in most countries with tropical climates the cultural practice is to only eat cooked foods. The reason for this is that pathogens are not killed off by cycles of freezing temperatures experienced in **temperate** climates and pathogens can flourish. However, the high temperatures reached in the cooking process kills pathogens. Cooking vegetables, either by steaming, boiling, frying, or baking, will destroy pathogens including the rat lungworm. Vegetables should be cooked for three to five minutes. At altitudes above 1000 meters you must boil foods longer, as an increase in altitude requires an increase in cooking time (water boils at a lower temperature at higher altitudes). In Asia, cases of rat lungworm disease are usually from eating undercooked snails, which are a part of the diet. Paratenic hosts that might be consumed, such as shrimp, prawns, crabs, and frogs, therefore must be thoroughly cooked. The consumption of shrimp or prawns “cooked” in lemon juice, similar to ceviche, have also been the cause of cases of rat lungworm disease in Asia and Tahiti. It is important to remember that acid excites the infective, third stage *A. cantonensis* larvae, and lemon juice, like vinegar, is an acid. Freezing foods prior to preparation of foods meant to be eaten raw may be a good strategy for preparation leafy greens, like kale. More tests need to be done to determine how long to freeze food for after washing. Blanching (quickly dipping in boiling water) of leafy greens that have been checked and cleaned can be an extra precaution. Drying foods will also kill any rat lungworm nematodes.

Covering food and beverages

Food and beverages that are consumed or stored outside must be covered. There are cases of rat lungworm disease that have resulted from a slug, especially the effective semi slug host *P. martensi,* crawling into a beverage that was taken or left outside. Beverages in which people have reported finding a drowned slug included ice tea, lemonade, and kava. It is important to cover your beverage with a lid if it is to be left outside and unattended for any length of time. Covering food at potlucks and picnics is also important as there have been reports of finding slugs in dishes and salads at these events. Never leave food outside unattended. Food should always be stored inside or in a sealed container. Pet dishes should be brought inside at night as slugs and snails, as well as rats, are attracted to pet food. Slugs and snails will also crawl into water, and may crawl into water bowls for pets, or tanks for livestock. If it is not feasible to cover the surfaces then they should be checked regularly and cleaned if any slugs or snails are found in them.

Rainwater catchment tanks:

Rainwater catchment is the primary source of household water for many residents of Hawai'i. In the Puna District of Hawai'i County, where a number of cases of rat lungworm disease have occurred, up to 75% of residents are dependent on rainwater catchment for their household water supply. Hawai'i County allowed large subdivisions to be created in the Puna and Kau Districts with no infrastructure for water. Because of the volcanic geology of Hawai'i Island and few **aquifers**, wells are not as common in some areas as rainwater catchment. Slugs and snails will crawl into rainwater catchment tanks and die. There has been research that shows that infected, drowned, slugs and snails can shed rat lungworm parasites. Rainwater catchment tanks can also contain harmful bacteria such as salmonella, *E.coli*, and leptospirosis. It is important to keep catchment tanks tightly covered and cleaned regularly. It is also important to have filters and **ultraviolet** (UV) lights to purify the water. Change the filters regularly and check and clean or replace UV light bulbs when they become dirty. We must remember that a house should have **potable** water at every tap, and so the filters and UV should be for a whole-house system. Rainwater catchment systems are not regulated by any state or federal agency and therefore the homeowner is responsible for the design and maintenance of the system. Besides **oral** (by mouth) transmission of rat lungworm disease there is a potential for infection through cuts on the skin and eyes. It is very important for those living on rainwater catchment systems to keep them properly

maintained. During times of power outages, it is not advisable to s**yphon** water by mouth from a catchment tank and would be better to dip the water out with a bucket. This unfiltered water can be boiled for several minutes, which will make it safe for consumption.

Other risks to be aware of:

Remember to always wear gloves when handling slugs and snails. Slugs have been found inside garden hoses, as these provide dark and moist hiding spots. Slugs can crawl inside a hose and they may shed rat lungworm larvae. There have been cases of rat lungworm disease that occurred from a person drinking from a garden hose. It is advisable to keep a nozzle attached to the hose to prevent entry of slugs and snails. If using a weed-eater it is advisable to wear a protective face shield or safety glasses.

Control, control, control!

It is essential that we control the hosts of rat lungworm disease around our homes. The high rates of infection in Hawai'i can only be lessened by community action. We all need to get involved and control these pests to reduce the risk of disease.

Learning Activity:

Keep the bacteria out of the cafeteria

Team activity: 3-5 students per team

Students will divide into groups to research and find information on the following:

- Listeria
- Salmonella
- hepatitis A
- *Clostridium botulinum* (causes botulism)
- *Escherichia coli* (E.coli)
- Leptospirosis

Student groups will presentation to the class on the organism assigned to their group. This should include information on the characteristics and biology of their

organism, how the bacteria effects human health, and preventative measures one can take to reduce disease risk.

Virus versus bacteria

Students learn the differences between bacteria and a virus. Norovirus is a virus that is a common agent of food-borne illness. In what ways, if any, does disease transmission differ between a virus and bacteria?

Prevention points

Student teams identify the actions that can be taken to prevent food or water-borne illness. Students report to the class the actions they identified.

Prevention posters

Students can work in groups or as individuals

Students design and produce posters with information relating to food and water-borne illnesses, including rat lungworm disease, and the steps we can take to prevent disease transmission. These informational posters can be placed in viewable locations around the school or in community to increase and spread awareness.

Expand your knowledge

Can students identify any other food or water-borne pathogens besides those listed here? Students conduct research and report their findings.

This material is written by Kathleen Howe and produced by the Hawaii Island Rat Lungworm Working Group with funding from the Hawaii Invasive Species Council and support from the Daniel K. Inouye College of Pharmacy. Photo credit: Jarvi lab