Human Health Impacts of Fire Ant Stings

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Student Survey

Each student should be required to complete the following survey before the onset of the lesson begins. Calculate the data from the survey and keep it for future references or discussions.

Imported Fire Ant Survey

1. Have you ever been stung by fire ants?
   a. YES  b. NO

2. If so, what was the largest number of stings you have had at one time?
   a. 1-5  b. 6-20  c. 21-50  d. Hundreds  e. Thousands

3. What type of reaction did the ant stings cause? Circle all that apply.
   a. No reaction at all.
   b. A tiny blister surrounded by redness with a pustule (bump filled with white material) by the next day.
   c. A large amount of redness and swelling surrounding the sting site.
   d. Hives (raised red swelling) and itching in areas of the body that were not stung by the ants.
   e. Breathing difficulty, coughing, or wheezing.
   f. Swelling in the throat.
   g. Light-headedness, dizziness, or fainting.
   h. Other (please specify the reaction)

4. Do you have an allergy to fire ant stings?
   a. YES  b. NO

5. Do you have an epinephrine shot device (EpiPen)?
   a. YES  b. NO

6. Have you received fire ant allergy shots?
   a. YES  b. NO
7. Have you ever been treated for fire ant stings at a clinic or emergency room?
   a. YES  
   b. NO

8. Have you ever been admitted to a hospital for fire ant sting complications?
   a. YES  
   b. NO
Human Health Impacts Pre/Post Test

Name: ____________________________________________ Block: __________

Date: ______________

1. From where did imported fire ants originally come?
   a. United States   b. Brazil   c. Euro   d. Canada

2. What geographical region of the United States are the imported fire ants most prevalent?
   a. north   b. southwestern   c. northwestern   d. southeastern

3. What is the diet of an imported fire ant?
   a. grasses   b. meat   c. grass and meat   d. neither

4. Can multiple stings from imported fire ants deform and possibly kill an infant?
   a. yes   b. no   c. sometimes   d. never

5. What part of the imported fire ant’s body is the stinger attached to induce the venom?
   a. mouth   b. legs   c. abdomen   d. sensory tentacles

6. What is the major damaging economical impact of imported fire ants?
   a. human reactions
   b. crop damage
   c. grass damage
   d. water pollution

7. Why does the imported fire ant now display traits of drought and cold resistance that they did
   not originally have?
   a. interbreeding with local species
   b. adaptation to environment
   c. evolution due to habit change
   d. changes in food supply

8. What is the imported fire ant’s natural predator in the United States?
   a. armadillo   b. birds   c. frogs   d. none
9. In an imported fire ant’s venom, what is the allergic portion made up of?

   a. proteins        b. alkaloids    c. lipids        d. steroids

10. What is the reaction termed that may cause redness, swelling, and itching around the sting, followed by pustule formation within 4-24 hours?

    a. normal        b. large local    c. allergic     d. toxic

11. What is the reaction termed that may cause itching, swelling, hives, coughing, wheezing, constriction of airways, increased heart rate, decreased blood pressure, vomiting, diarrhea, loss of consciousness or even death?

    a. normal        b. large local    c. allergic     d. toxic

12. Allergy shots are available for individuals with a history of anaphylaxis to IFA stings. How effective do you think the shots are to prevent an allergic reaction?

    a. 25%           b. 54%           c. 79%          d. 98%

13. What percentage of imported fire ant stings causes an allergic reaction?

    a. 0.5-1.5%      b. 2.0-3.5%     c. 4.0-5.5%     d. 6.0-7.5%

14. Allergy shots are created to gradually and effectively reduce the amount of fire ant specific IgE produced by an individual. What is the component of these shots?

    a. protein from the imported fire ant
    b. alkaloids from the imported fire ant
    c. crushed whole body extraction from the imported fire ant
    d. aqueous solution from the imported fire ant

15. What do you think is the main factor that would cause an individual to be stung hundreds of times by imported fire ants?

    a. disturbing the mound          b. immobility of individual
    c. ant’s sense of smell          d. ant’s need for food
Pre/Post Test

1. From where did imported fire ants originally come?
   a. United States  b. Brazil  c. Europe  d. Canada

2. What geographical region of the United States are the imported fire ants most prevalent?
   a. north  b. southwestern  c. northwestern  d. southeastern

3. What is the diet of an imported fire ant?
   a. grasses  b. meat  c. grass and meat  d. neither

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   a. armadillo  b. birds  c. frogs  d. none
9. In an imported fire ant’s venom, what is the allergic portion made up of?
   a. proteins       b. alkaloids    c. lipids       d. steroids

10. What is the reaction termed that may cause local redness, swelling, itching, followed by pustule formation within 4-24 hours?
    a. normal       b. large local    c. allergic      d. toxic

11. What is the reaction termed that may cause itching, swelling, hives, coughing, wheezing, constriction of airways, increased heart rate, decreased blood pressure, vomiting, diarrhea, loss of consciousness or even death?
    a. normal       b. large local    c. allergic      d. toxic

12. Allergy shots are available for individuals with a history of anaphylaxis to IFA stings. How effective do you think the shots are to prevent an allergic reaction?
    a. 25%       b. 54%       c. 80%       d. 98%

13. What percentage of imported fire ant stings causes an allergic reaction?
    a. 0.5-1.5%   b. 2.0-3.5%   c. 4.0-5.5%   d. 6.0-7.5%

14. Allergy shots are created to gradually and effectively reduce the amount of fire ant specific IgE produced by an individual. What is the component of these shots?
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15. What do you think is the main factor that would cause an individual to be stung hundreds of times by imported fire ants?
    a. disturbing the mound
    b. immobility of individual
    c. ant’s sense of smell
    d. ant’s need for food
The Muse of Fire Project

ACTIVITY AT A GLANCE

Goal:

To introduce students to the impact of fire ant envenomation on human immune system.

Learning Objectives:

Upon completion of this activity, students will understand the affect of the fire sting on human and the possible side effects that can be life threatening.

Teaching Time:

50-90 minutes (2 class periods)
*The approach to the lesson can be adapted to the amount of time of your class sessions.

Timeline for Teaching Health and Human Impact Module

National Science Education Standards Addressed:

Science as Inquiry – Students develop scientific inquiry skills in posing scientific questions and predictions, taking ownership of their research, and using varied tools and evidence to characterize the insect samples that they chose to study.

Science and Technology – The students integrate field work with taxonomic classification in the lab to determine insect Order using a computerized key

Life Science – In this activity, students use field work, classification, and basic content on symbiosis to learn about evolution and ecology of insects, the interdependence of microbes and animals, and the organization of living systems including insect body structure, life cycle, and associations with microbes.

“O for a Muse of Fire, that would ascend the brightest heaven of invention….” Henry V, Act 1, prologue: Shakespeare
ACTIVITY PROCEDURE

Opening Activity

Students should read the journal article, “Natural history of large local and generalized cutaneous reactions to imported fire ant stings in children,” by Steven A. Nguyen, MD, and Diane C. Napoli, MD, Ann Allergy Asthma Immunol., vol. 94, pp. 387-90, March 2005 (see Appendix), then proceed to answer the questions for that article.

After reading the article listed above, students should continue their reading with another article entitled, “Indoor fire Ant Sting Attacks: A Risk for Frail Elders,” by Michael R. Rupp, MD, and Richard D. deShazo, MD, The American Journal of the Medical Sciences, vol. 331:3, pp. 134-138, March 2006 (see Appendix), and answer the questions following the article.

Online Research / Debate Options

- Introducing natural predators
  - http://www.ag.auburn.edu/aaes/communications/highlightsonline/fall01/fall-graham.html

- Ethical, legal, and economic impacts of IFAs

Answer Key:

Questions & Answers for the article, “Natural history of large local and generalized cutaneous reactions to imported fire ant stings in children”

1. Doctors recommend that children who are very allergic to IFA stings undergo immunotherapy. Why? What other options, other than immunotherapy, are available for patients allergic to IFA stings? Doctors use IFA whole-body extract immunotherapy in children who are extremely allergic to IFA stings due to the chance of frequent or un-avoidable future stings in an IFA endemic area. The child must test positive for IFA antigen specific IgE before using immunotherapy, and over time the therapy will reduce the IFA specific IgE produced by the body. Other options include practicing IFA avoidance measures and carrying an EpiPen in case of a life-threatening allergic reaction.

2. Intercrossing between ant species may develop a new hybrid of ant species. Why might hybrids be beneficial for fire ant survival? New hybrid fire ant species have been found to display drought and cold resistance, which can increase the geographic expansion and survival of the new species.

Questions & Answers for the article, “Indoor Fire Ant Sting Attacks: A Risk for Frail Elders”
1. **How can IFAs be controlled without the use of pesticides?** The Department of Agriculture has released natural predators known as phorid flies from South America to use as a biological control agent. Phorid flies are a more economic and safe way to reduce the pest status of imported fire ants. See Online Research Options: Introducing Natural Predators for more information.

2. **Review the quarantine distribution map (Figure 1) in this article.** Hypothesize the economic effects this quarantine has on the states it is imposed upon. **How might farmers avoid these quarantine regulations?** This is a hypothetical question and answer. The fire ant quarantine causes economic difficulties for farmers in the quarantined area due to the limitations enforced on agricultural shipping. Farmers can no longer ship outside the quarantine area thus reducing their product distribution and ceasing achievable profits located outside the quarantined area. Farmers may avoid the quarantine by moving outside the quarantined area or by systematically checking every product shipped and using fire ant eradication methods consistently. The Department of Agriculture does not allow shipment of agricultural products outside the quarantined area therefore farmers can not truly avoid the quarantine regulations altogether.

3. **Compare Tables 1 & 2.** Separate the young and elderly cases into two groups. Give the location where each attack occurred and review the clinical consequences for each case. **What common trend can you find between the young and old victims making them more susceptible to attacks from IFAs?** Young and elderly IFA attack victims are often immobile, making them susceptible to a massive number of stings. Students should recognize that small children and elderly people with either mental impairments or surgeries causing immobility cannot escape from IFAs as a healthy person could resulting in massive IFA sting attacks.

**Background Information Questions & Answers**

1. **What does IFA venom consist of?** 90-95 % alkaloids and a 5-10 % aqueous portion that includes allergenic proteins. **What causes the skin pustules to form?** The alkaloid components. **What portion of IFA venom causes IgE to form in the body?** The allergenic proteins.

2. **Review the IFA stinger diagram.** Describe how IFA venom is directed to the stinger. A pair of coiled glands produces the venom that is discharged into the venom sac. The venom from the venom sac then travels through the venom canal and is expelled through the stinger.

3. **What is a toxic reaction and what portion of IFA venom causes the reaction?** Toxic reactions are categorized as occurring in compromised individuals, like infants or the elderly, who were stung hundreds to thousands of times. The alkaloid portion of the venom causes allergic type reactions as the body tries to eliminate the poison/alkaloids. Toxic reactions can imitate anaphylaxis.

**Overview**

The **Muse of Fire** becomes an apt metaphor for the red imported fire ant (**Solenopsis invicta**), an insect pest endemic to the southern United States. As an object to stimulate student inquiry, **S. invicta** is ideally poised. Easy to access, identified as a wide-spread nuisance, causing major economic and ecological impact, rapidly-spreading, and engendering highly publicized legal and clinical controversy (**deShazo et al., 2006**). Within its geographical distribution, the scientific, medical and educational impact of **S invicta** is exceptional. Virtually every child living below the Tennessee/Mississippi border
coast-to-coast is personally familiar with this insect, having experienced its fiery sting, which generally causes only temporary, local pain and a sterile pustule at the sting site.

Scientists, *S. invicta* possesses venom that is unique among insects, whose biological function and toxicological properties are under active investigation (*Arbiser et al.*, 2007; *Howell et al.*, 2005). Medically, cases of massive stinging attacks with thousands of stings have been associated with severe consequences, particularly in elderly, debilitated persons. The etiology of such adverse responses is under active debate. Educationally, focusing on *S. invicta* provides avenues to multiple fields of study, including evolution, systematic, ecology, health, behavior, and microbiology.

**MATERIALS**

Per activity station for two students:
- Paper
- Copy of Activity or Case Study with questions
- Computer
- Pencil/pen

**TEACHER PREPARATION**

Teachers will need to copy the Opening Activity or Case Study that you wish your students to use. Students will be more likely to retain information if they are allowed to become personally involved in the fate of the patients in the enclosed case studies. It is recommended that that the case studies be used as a bell ringer activity. This will allow the students to “read”, increasing literary, and “think scientifically”. If you wish to extend these case studies, the Journal Articles from which these scientific case studies were written can be found at [http://basepair.library.umc.edu](http://basepair.library.umc.edu).

**Classroom Management**

This lesson is intended to be taught in a specific order beginning with the two research papers, continuing into the background information, and then successive case studies. The medical papers should be assigned for the students to read before the class and questions can be answered before hand or during the class. Background information may also be assigned before class or analyzed as a whole-group setting. The case studies can be read and analyzed as groups, individuals or whole-group. The case-studies would make an excellent bell-ringer activity. It is imperative that discussion about the issues is taking place throughout the entire lesson.

**Lesson Objectives**

- Approach a scientific paper without fear, identifying and researching unknown terminology.
- Learn to form a hypothesis and research...............
- Become familiar with the red imported fire ant (IFA) and its behavior toward humans.
- Explore the complex IgE molecule and its involvement in the onset of anaphylaxis.
- Explore the ethical/legal consequences involved when massive IFA attacks occur in public health care facilities.
Medical papers

As you read the medical articles, circle all of the terms that you do not understand. You can find definitions for many of these terms using the Medline Plus Medical Dictionary (http://www.nlm.nih.gov/medlineplus/mplusdictionary.html) or the glossary of terms included in this case study lesson. Be prepared with a few definitions, as we will go over some of these new words the next time class meets. Also pay special attention to the information given in the figure and the table in the articles as we will discuss these in class along with the questions for each article.

Background Information

Thoroughly analyze the information and diagrams in the blocks of analysis section of the lesson. Information discussed will be needed to formulate hypothesis, diagnosis, and outcomes. Carefully familiarize yourself with the anatomy, structure, and attack method of the imported fire ant. Complete the end of section questions in full sentences and with a basis of the information read and discussed.

Human Case studies

Once the completion of the medical papers and the blocks of analysis read and analyze the human scenarios. As you read each case, base your hypothesis and conclusions on prior information given in the lesson. Answer the set of questions at the end of each scenario before proceeding to the next section.

Introduction:

The Muse of Fire becomes an apt metaphor for the red imported fire ant (Solenopsis invicta), an insect pest endemic to the southern United States. As an object to stimulate student inquiry, S. invicta is ideally poised. Easy to access, identified as a wide-spread nuisance, causing major economic and ecological impact, rapidly-spreading, and engendering highly publicized legal and clinical controversy (deShazo et al., 2006). Within its geographical distribution, the scientific, medical and educational impact of S invicta is exceptional. Virtually every child living below the Tennessee/Mississippi border coast-to-coast is personally familiar with this insect, having experienced its fiery sting, which generally causes only temporary, local pain and a sterile pustule at the sting site.

Scientifically, S. invicta possesses a venom unique among insects, whose biological function and toxicological properties are under active investigation (Arbiser et al., 2007; Howell et al., 2005). Medically, cases of massive stinging attacks with thousands of stings have been associated with severe consequences, particularly in elderly, debilitated persons. The etiology of such adverse responses is under active debate. Educationally, focusing on S. invicta provides avenues to multiple fields of study, including evolution, systematic, ecology, health, behavior, and microbiology.
Opening Activity

Students should read the journal article, “Natural history of large local and generalized cutaneous reactions to imported fire ant stings in children,” by Steven A. Nguyen, MD, and Diane C. Napoli, MD, *Ann Allergy Asthma Immunol.*, vol. 94, pp. 387-90, March 2005 (see Appendix), then proceed to answer the questions for that article.

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Questions:

For the article, “Natural history of large local and generalized cutaneous reactions to imported fire ant stings in children”

1. Doctors recommend that people who are very allergic to IFA stings undergo immunotherapy. Why? What other options, other than immunotherapy, are available for patients allergic to IFA stings?

2. Interbreeding between ant species may develop a new hybrid ant species. Why might hybrids be beneficial for fire ant survival?

Questions:

For the article, “Indoor Fire Ant Sting Attacks: A Risk for Frail Elders”

1. How can IFAs be controlled without the use of pesticides?

2. Review the quarantine distribution map (Figure 1) in this article. Hypothesize the economic effects this quarantine has on the states it is imposed upon. How might farmers avoid these quarantine regulations?

3. Compare Tables 1 & 2. Separate the young and elderly cases into two groups. Give the location where each attack occurred and review the clinical consequences for each case. What common trend can you find between the young and old victims making them more susceptible to attacks from IFAs?
Beware: Fire ants are known for their aggressive behavior. They will swarm over anyone or anything that disturbs their nest. Their painful stings affect about 40% of the people in invested areas each year. Approximately 20 million people are stung each year in the United States. ¹⁰
ACTIVITY AT A GLANCE

Goal:
To introduce students to the impact of fire ant envenomation on human immune system.

Learning Objectives:
Upon completion of this activity, students will understand the affect of the fire sting on human and the possible side effects that can be life threatening.

Teaching Time:
10 minute Bell Ringers each day for 5 or 6 days or 1 class period
*The approach to the lesson can be adapted to the amount of time of your class sessions.

National Science Education Standards Addressed:

Science as Inquiry – Students develop scientific inquiry skills in posing scientific questions and predictions, taking ownership of their research, and using varied tools and evidence to characterize the insect samples that they chose to study.

Science and Technology – The students integrate field work with taxonomic classification in the lab to determine insect Order using a computerized key
Life Science – In this activity, students use field work, classification, and basic content on symbiosis to learn about evolution and ecology of insects, the interdependence of microbes and animals, and the organization of living systems including insect body structure, life cycle, and associations with microbes.

Overview

The Muse of Fire becomes an apt metaphor for the red imported fire ant (*Solenopsis invicta*), an insect pest endemic to the southern United States. As an object to stimulate student inquiry, *S. invicta* is ideally poised. Easy to access, identified as a wide-spread nuisance, causing major economic and ecological impact, rapidly-spreading, and engendering highly publicized legal and clinical controversy (deShazo et al., 2006). Within its geographical distribution, the scientific, medical and educational impact of *S invicta* is exceptional. Virtually every child living below the Tennessee/Mississippi border coast-to-coast is personally familiar with this insect, having experienced its fiery sting, which generally causes only temporary, local pain and a sterile pustule at the sting site.

Scientifically, *S. invicta* possesses venom that is unique among insects, whose biological function and toxicological properties are under active investigation (Arbiser et al., 2007; Howell et al., 2005). Medically, cases of massive stinging attacks with thousands of stings have been associated with severe consequences, particularly in elderly, debilitated persons. The etiology of such adverse responses is under active debate. Educationally, focusing on *S. invicta* provides avenues to multiple fields of study, including evolution, systematic, ecology, health, behavior, and microbiology.

MATERIALS

Per activity station for two students:

- Paper
- Copy of Activity or Case Study with questions
- Computer
- Pencil/pen

TEACHER PREPARATION

Teachers will need to copy the Case Study that you wish your students to use or all 6 case studies. Students will be more likely to retain information if they are allowed to become personally involved in the fate of the patients in the enclosed case studies. It is recommended that that the case studies be used as a bell ringer activity. This will allow the students to “read”, increasing literacy, and “think scientifically”. If you wish to extend these case studies, the Journal Articles from which these scientific case studies were written can be found at http://basepair.library.umc.edu.
Medical Background:

A range of reactions can occur from a fire ant sting. The normal reaction involves local redness, swelling, and itching to the sting site initially, followed by pustule formation within 4-24 hours. Normal reactions are treated with topical hydrocortisone cream or by an oral medicine like diphenhydramine (Benadryl®). A large local reaction occurs when an 8 cm or larger area around the sting site develops swelling, redness, and itching through a 48 hour period, sometimes lasting up to one week. This type of reaction is usually IgE-mediated and is caused by the body developing IgE to the fire ant venom proteins. Large local reactions may be treated with topical or oral corticosteroids and an oral antihistamine, as well as a cold compress.

Allergic reactions occur with 0.5-1.5 % of IFA stings and can involve a skin-only reaction or a systemic allergic reaction such as anaphylaxis. Skin-only allergic reactions can include: itching, redness, swelling, and hives beyond the area of the sting site. Anaphylactic reactions are allergic reactions that involve at least 2 or more organ systems. An anaphylactic reaction may include skin reactions and/or respiratory symptoms like stridor, coughing or wheezing, cardiovascular symptoms like increased heart rate or decreased blood pressure, gastrointestinal symptoms like vomiting or diarrhea, and loss of consciousness or even death. For skin-only allergic reactions the person may be given oral diphenhydramine and observed closely for any worsening symptoms. In the case of suspected anaphylaxis the patient should be given injected epinephrine (if available) and transported immediately to a hospital. Once at the hospital, medical personnel may monitor and treat with the following: giving the patient additional doses of epinephrine; using intravenous fluids to replace intravascular volume lost into the subcutaneous tissues; give intravenous antihistamines; give oxygen and/or a nebulized bronchodilator; use intravenous corticosteroid to prevent late-phase allergic reactions; intubate if severe airway swelling occurs; or possibly give intravenous dopamine or dobutamine for severe sustained shock and hypotension.

Toxic reactions are categorized as occurring in compromised individuals, like infants or the elderly, who were stung hundreds to thousands of times. Such attacks have been documented in nursing homes and baby cribs where the victims were unable to escape by themselves from the ants. The effects of a toxic reaction may mimic anaphylaxis and treatment is similar to those listed above.
The Venom of the Fire Ant

The venom of the fire ant is unique among that of venomous insects because it contains only about one percent protein. Venom proteins are responsible for host immunologic responses to the venom, including the production of venom specific immunoglobulin. The venom is complex, initiating histamine reactions and other adverse effects. It contains dialkylpiperidine hemolytic factors. Damage is expressed in hemolytic, cytotoxic and neurologic reactions. These hemolytic factors induce the release of histamine and other vasoactive amines from mast cells. The venom also contains several allergenic proteins that can mean trouble for sensitive individuals. Some those stung are hyperallergic to the venom and can react quite strongly, with chest pains, nausea, dizziness, shock or even coma.

Because some people have received many stings with no obvious effects, the mechanism of adverse reactions reported in patients who have experienced cardiac dysfunction, pneumonia, cerebrovascular accident, and other complications in the absence of signs of anaphylaxis remains unclear. These reactions could represent toxic non-immunologically mediated responses in venom sensate people. Fire ant venom contains the enzyme hyaluronidase, which could activate the complement, coagulation, or kinin systems in some persons. The stress of the sting attacks or the use of antihistamines, IV fluids, and steroids to treat these reactions may also play a role in the deterioration of already debilitated patients. This is important because steroids, Bendaryl, antibiotics and epinephrine do not alter the course of the pustule formation.

Allergy vs. Anaphylaxis:

Allergic reactions (hypersensitivity reactions) are inappropriate immune responses to a normally harmless substance.

Normally, the immune system—which includes antibodies, white blood cells, mast cells, complement proteins, and other substances—defends the body against foreign substances (called antigens). However, in susceptible people, the immune system can overreact to certain antigens (called allergens), which are harmless in most people. The result is an allergic reaction. In most allergic reactions, the immune system, when first exposed to an allergen, produces a type of antibody called immunoglobulin E (IgE). IgE binds to a type of white blood cell called basophils in the bloodstream and to a similar type of cell called mast cells in the tissues. The first exposure may make a person sensitive to the allergen but does not cause symptoms. When the sensitized person subsequently encounters the allergen, the cells that have IgE on their surface release substances (such as histamine, prostaglandins, and leukotrienes) that cause swelling or inflammation in the surrounding tissues. Such substances begin a cascade of reactions that continue to irritate and harm tissues. These reactions range from mild to severe.
Symptoms and Diagnosis

Most allergic reactions are mild, consisting of watery, itchy eyes, a runny nose, itchy skin, and some sneezing. Rashes (including hives) are common and often itch. Swelling may occur in small areas of the skin (with hives) or in larger areas under the skin. If the person is allergic to substances such as the venom of the Red Imported Fire Ant, the person has a wheal and flare reaction: A pale, slightly elevated swelling—the wheal—appears at the pinprick site within 15 to 20 minutes. The wheal is surrounded by a well-defined area of redness—the flare. The resulting area is about ½ inch in diameter. Allergies may trigger attacks of asthma. Certain allergic reactions, called anaphylactic reactions can be life threatening. The airways can constrict (causing wheezing), and blood vessels can dilate (causing a fall in blood pressure).

Treatment:

The drugs most commonly used to relieve the symptoms of allergies are antihistamines. Some antihistamines are available without a prescription, and some require a prescription. Nonprescription (over-the-counter) antihistamines are a particular problem for older people. Often, prescription antihistamines have fewer side effects (such as sleepiness, dry mouth, blurred vision, constipation, and difficulty with urination). Antihistamines block the effects of histamine rather than stop its production. Taking antihistamines partially relieves the itching and reduces the swelling due to hives or mild angioedema.

Anaphylaxis:

Anaphylactic reactions (anaphylaxis) are sudden, widespread, potentially severe and life-threatening allergic reactions.

Anaphylactic reactions can be caused by any allergen. Like other allergic reactions, an anaphylactic reaction does not usually occur after the first exposure to an allergen but may occur after a subsequent exposure. However, many people do not recall a first exposure. Any allergen that causes an anaphylactic reaction in a person is likely to cause that reaction with subsequent exposures, unless measures are taken to prevent it.

Anaphylactic reactions begin within 1 to 15 minutes of exposure to the allergen. Rarely, reactions begin after 1 hour. The heart beats quickly. The person may feel uneasy and become agitated. Blood pressure may fall, causing fainting. Other symptoms include tingling (pins-and-needles) sensations, itchy and flushed skin, throbbing in the ears, coughing, sneezing, hives, and swelling (angioedema). Breathing may become difficult and wheezing may occur because the windpipe (upper airway) constricts or becomes swollen. An anaphylactic reaction may progress so rapidly that it leads to collapse, cessation of breathing, seizures, and loss of consciousness within 1 to 2 minutes. The reaction may be fatal unless emergency treatment is given immediately.
Treatment

If an anaphylactic reaction occurs, an epinephrine, (adrenaline), injection should be given immediately, and an antihistamine and steroid to reduce inflammation. Usually, this treatment stops the reaction. Nonetheless, after a severe allergic reaction, such people should go to the hospital emergency department, where they can be closely monitored and treatment can be adjusted as needed.

http://www.merck.com/mmhe/sec16/ch185/ch185a.html

Treatment of the Elderly:

As people age, the amount of water in their body decreases and the amount of fat tissue relative to water increases. Thus, in older people, drugs that dissolve in water reach higher concentrations because there is less water to dilute them, and drugs that dissolve in fat accumulate more because there is relatively more fat tissue to store them. Also, as people age, the kidneys are less able to excrete drugs into the urine, and the liver is less able to metabolize many drugs. Because of all these age-related changes, many drugs tend to stay in an older person's body much longer than they would in a younger person's body, prolonging the drug's effect and increasing the risk of side effects. For these reasons, older people need to take smaller doses of certain drugs or perhaps fewer daily doses. Also, other, safer drugs can often be substituted.

Older people are more sensitive to the effects of many drugs. For example, older people tend to become sleepier and are more likely to become confused when using sleep aids or antianxiety drugs. Drugs that lower blood pressure by widening (dilating) arteries and reducing the amount of work the heart has to do tend to lower the pressure much more dramatically in older people than in the young.

Many commonly used drugs, such as some antidepressants and diphenhydramine, (Benadryl), have anticholinergic effects. Older people are particularly susceptible to these effects, which include confusion, blurred vision, constipation, dry mouth, light-headedness, and difficulty with urination or loss of bladder control.

Drugs may produce a side effect because of interaction between the drug and a disease other than the one for which the drug is being taken (drug-disease interaction) or between the drug and another drug (drug-drug interaction), food (drug-food interaction). Because older people tend to have more diseases and to take more drugs than younger people, they are more likely to have drug-disease and drug-drug interactions.

http://www.merck.com/mmhe/sec02/ch014/ch014a.html
Fire Ant Treatment Recommendations for Texas:

Texas Allergy, Asthma and Immunology Society Addresses Fire Ant Allergies in a leaflet entitled

“Are you allergic to fire ants?”

The text reads:

Fire ants cause severe, life-threatening reactions in people allergic to them. More people have died from allergic reactions to fire ants in Texas than anywhere in the U.S. If you are allergic to fire ants, find out where you can get effective treatment and reduce your risk of a serious reaction to a fire ant sting. Fire ants are the most common cause of allergic reactions to stinging insects in Texas”; “Severe allergic reactions (anaphylaxis) occur in 1 - 6 % of people stung by fire ants and occasionally these reactions may be fatal”.

So what should we do?

“If fire ants are removed as they are biting, but before they can sting, venom will not be injected and a pustule will not form. Conversely, once venom has been injected, pustules will usually form regardless of treatment: “Topical steroids, diphenhydramine, antibiotics, or epinephrine do not alter the course of pustular reactions” Regardless, action should be taken as soon as possible after the attack to obtain maximum benefits from treatment. In patients without anaphylaxis, we suggest a conservative approach based on observation and treatment of symptoms. This treatment is similar to that used for small numbers of stings, which, more often than not, are only associated with acute itching and burning followed by development of sterile pustules. In such cases, the ants should be removed by washing with an antiseptic soap. Itching may be relieved by the use of non-sedative antihistamines. Two of these, cetirizine (Zyrtec®) and loratadine (Claratine®), are available in liquid form for use in children and patients with feeding tubes. Itching can also be treated with application of topical corticosteroids, such as 1% hydrocortisone (0.1% triamcinolone), and topical anti-itch agents, such as pramoxine HCl 1 % (e.g., Anusol®, Cacoryl®). Care must be taken not to rupture the sterile pustules, because the resulting lesions

Occasionally become infected. Intravenous fluids or parenteral corticosteroids for fire ant stings are not recommended unless evidence of hypersensitivity to fire ant venom is present; these agents may lead to fluid retention and cardiovascular compromise in patients with preexisting cardiovascular insufficiency. Site of ant stings rarely become infected and antibiotic prophylaxis is therefore not routinely required.” “Symptoms of anaphylaxis should be treated with epinephrine, parenteral corticosteroids, and antihistamines”

Bastiaan M. Drees, Professor and Extension Entomologist and Kim Schofield, Extension Program Specialist - Urban IPM Department of Entomology, Texas A&M University, College
Examples of Lesion Development:


Images below show photos of a person's finger after a fire ant sting (normal reaction):^{11}

**Stinging photo:** A worker female fire ant in the act of stinging a human thumb.

**30 minute photo:** There is a slight swollen bump where each sting occurred, surrounded by redness.

**One hour photo:** The bumps persist, and the surrounding redness gets deeper red.

**24 hours photo:** A pustule is now present where each sting occurred. Lesions are still surrounded by a deep red halo.
**72 hours photo:** Pustules are at their peak, with a deep red halo, and some tissue death inside the tiny pustule domes.

![72 hours photo](https://fireant.tamu.edu/img/ants/img0053_med.jpg)

**One week photo:** By now the pustules have ulcerated; the red halo persists.

![One week photo](https://fireant.tamu.edu/img/ants/img0053_med.jpg)

**One month:** Only superficial scars remain where the stings occurred.

![One month](https://fireant.tamu.edu/img/ants/img0053_med.jpg)

Photo B

Photo B from [http://fireant.tamu.edu/img/ants/img0053_med.jpg](http://fireant.tamu.edu/img/ants/img0053_med.jpg); accessed 6-25-08
Grandma and the Tobacco Farm
Grandma Jennings had lived in Brookville her entire life. She and her husband Bill had reared seven children on their small isolated farm. Their crops included vegetables that they sold at the local farmer’s market, lumber for the local paper mill and tobacco. Both Grandma and Bill liked an occasional smoke on the back porch after a hard day on the farm, and so they kept some of the tobacco that they grew for their person use. This habit would turn out to be a bad one. Bill died at the age of 50 from lung cancer and related cardiovascular problems that they doctors said were directly related to his long term use of tobacco.

After Bill died, Grandma continued their nightly ritual of a cigarette on the back porch, and after all of her children moved away from the farm her health began to deteriorate rapidly. During the year after her husband’s death, Granny was admitted to the local hospital several times for fall injuries and a case of pneumonia. Her family doctor was becoming increasingly concerned about Granny living by herself, and despite her objections he felt obligated to contact Granny’s eldest daughter, Melanie. After her conference with the doctor, Melanie decided to call a family meeting and the Jennings children decided that a skilled nursing facility might be the best and safest place for Granny. As luck would have it, Brookville had just built a brand new nursing home less than two years before.

Melanie and several of her siblings visited the nursing home and decided it was a clean well staffed facility that was near Granny’s church and several of the places that she liked to visit. So the decision was made and Granny was moved to the facility. But being away from the farm had a real psychological impact on Granny and her health continued to decline. Granny just celebrated her 67th birthday, and was suffering from COPD, congestive heart failure, and had great difficulty getting around without help. As her health continued to decline, she became bed bound or confined to her bright red wheelchair.

The children and grandchildren came to visit Granny as often as they could and they had held a huge celebration in honor of her birthday. They were pleased with the care that she was receiving. The assistants and staff checked on the patients every three hours during the day and every four hours at night. On this fateful night things were not going to be a celebration for Granny.

During a routine 4 a.m. bed check, the nurse discovered fire ants covering Granny’s bed and on her left arm, chest, neck, stomach, and back. There had been no ants in the room during the last bed check and the staff had no idea where the ants were hiding. Their facility had been inspected and treated by a pest service 4 days before the incident. On further examination, an ant trail was discovered that led from the floor to the foot of Granny’s bed.
After the ants were washed from Granny and she was moved to a new room, doctors performed a thorough examination. Fire ant induced wheal and flare reactions too numerous to count were discovered. Granny’s vital signs were stable and unchanged from those recorded earlier in the day. No symptoms of anaphylaxis, (sudden drop in blood pressure, difficulty breathing), were observed. But 24 hours later, when Granny was examined again more than 500 of the characteristic sterile pustules were observed covering her extremities, chest, and back.

The doctors at the nursing home treated Granny with injections of diphenhydramine (Benadryl), methylprednisolone, (Medrol), and topical corticosteroids for the localized treatment of skin inflammation. As she was being treated her breathing became more and more labored so she was taken by ambulance to the local hospital and her children were notified. When she reached the hospital she was given corticosteroids by IV diphenhydramine, (Benadryl), and ceftriaxone, (Rocephin), a broad spectrum antibiotic. Her sting sites gradually began to improve, but her congestive heart failure became progressively worse. Unfortunately, Granny died five days after her encounter with the fire ants.
Food for thought:

1. From what do you believe that Granny died?
2. If fire ant envenomation was a contributing factor to her death, how would you know?
3. What are the possible side effects for diphenhydramine (Benadryl), methylprednisilone, (Medrol), corticosteroids, and ceftriaxone, (Rocephin) that may have contributed to Granny’s death?

The family has decided to sue the nursing home, the pest control company, and the contractor who built the assisted living facility.

4. Should they have also sued the doctors at the nursing home?

5. Should they have sued the doctor’s at the hospital?

6. In a patient in which there is no evidence of anaphylaxis, and for whom there is a pre-existing complicating disease. Should the doctors use potentially life threatening aggressive treatments?

7. Is there a difference between a “medical cause of death” and a “legal cause of death”? 
Answers:

Food for thought:

1. What are the possible side effects for diphenhydramine (Benadryl), methylprednisolone, (Medrol), corticosteroids, and ceftriaxone, (Rocephin) that may have contributed to Granny’s death?

   **Note:** some of the effects of histamine, including itching, flushing (redness), urticaria (hives), and angioedema (swelling). Corticosteroids are given to reduce the likelihood of having biphasic anaphylaxis, and late-phase asthma symptoms. Large volumes of isotonic fluids are given intravenously to those with low blood pressure because those patients lose a lot of intravascular fluid into the subcutaneous tissues (angioedema), and need to have the intravascular volume replaced to help restore normal blood pressure. Oxygen levels are monitored, and oxygen is given if the levels are low.

   Anti-histamines can reduce the swelling of the sting, make patients sleepy and mask the presence of an aneurysm. The steroids can increase blood pressure.

2. From what do you believe that Granny died?

   Granny may have had an aneurysm which could be masked by the anti-histamines. Or with granny’s congestive heart failure, the increase in blood pressure may have caused an aneurysm or heart failure.

3. If fire ant envenomation was a contributing factor to her death, how would you know?

   Granny would have died sooner showing a more immediate reaction to the stings. Generally anaphylaxis occurs within 24 hours.

The family has decided to sue the nursing home, the pest control company, and the contractor who built the assisted living facility.

4. Should they have also sued the doctors at the nursing home?

   Yes, there was no anaphylaxis. Preexisting congestive heart failure was exacerbated due to medication given by the Nursing home doctor who should have read her chart or known her condition.

5. Should they have sued the doctor’s at the hospital?

   Yes. They did not check her records and gave her the medication twice which may have caused an overdose.

6. In a patient in which there is no evidence of anaphylaxis, and for whom there is a pre-existing complicating disease. Should the doctors use potentially life threatening aggressive treatments?

   No.
7. Is there a difference between a “medical cause of death” and a “legal cause of death”?

**Medical Cause** of Death is defined as the cessation of all vital functions of the body including the heartbeat, brain activity (including the brain stem), and breathing.

Today, both the legal and medical communities use “brain death” as a legal definition of death. Using brain-death criteria, the medical community can declare a person legally dead even if life support equipment keeps the body’s metabolic processes working.

The diagnosis of brain death needs to be rigorous to determine whether the condition is irreversible. Legal criteria vary, but it generally requires neurological exams by two independent physicians. The exams must show complete absence of brain function, and may include two isoelectric (flat-line) EEGs 24 hours apart. The widely-adopted Uniform Determination of Death Act in the United States attempts to standardize criteria. The patient should have a normal temperature and be free of drugs that can suppress brain activity if the diagnosis is to be made on EEG criteria.
Associated Press Archive

September 25, 1998

Nursing home patient dies after being bitten by fire ants GINA HOLLAND

A 66-year-old nursing home patient died after being bitten hundreds of times by fire ants that swarmed over her while she lay in bed. Nell Rein, who had Alzheimer's disease, was found covered in fire ants when employees checked on her during the early morning of Aug. 30. She died four days later from heart failure brought on by physiological stress, according to her physician. The death has prompted a grand jury investigation into the Silver Cross Nursing Home in Brookhaven for possible criminal prosecution.

"I've never seen anything like this before. She was covered, her entire body, with ant bites," Coroner Morris Henderson said Friday.

Fire ants pack a burning sting and attack when threatened. They travel in colonies of several hundred to several thousand. Although they usually avoid homes, dry weather and heat such as that which Mississippi has been experiencing lately can drive them indoors. "What happened was utterly horrible," said George Jobe, president of the Mississippi American Association of Retired Persons.

Jobe said the one-floor nursing home, where 60 people reside, had a good reputation and it was premature to assign blame until the investigation is complete.

Nursing home administrator Gussie Ashley was unavailable for comment Friday, but at the time of the death defended the care given patients. She said patients were checked hourly and that since Rein's death she had hired a new exterminator."We didn't have a major fire ant problem," Ashley said. "She was a very sick lady."Many in the surrounding community have been complaining about fire ants.

"They're tough," said W.L. Rayborn, a state senator and farmer who has battled the ants for years. "I wonder if they built (the nursing home) right on a big fire ant mound. It's right in the middle of a pasture. "Vedia Givens said the weekend before the nursing home attack; she awoke to the screams of her daughter.

"There were thousands of ants in the bedroom. They were all over her housecoat. They were all over the bed, bed posts. It was scary," Givens said.
Associated Press Archive

November 7, 1998

Family sues over man's death by ant stings in nursing home

The family of a 66-year-old woman who died after being stung by hundreds of fire ants in her nursing home bed is suing the home and its pest control company.

Nell Rein was found Aug. 30 covered with ants at Silver Cross Nursing home. She died four days later from heart failure caused by physiological stress, according to her physician. State health officials said in October they found no evidence of negligence. Family lawyer Shane Langston, who filed suit Friday against the home and Ace Pest Control, says the state's report was incomplete and that ants also were found in other patients' beds at the home in Brookhaven.

Ace general manager George Lee said the home's contract expired two years ago, and since then his company has been serving it on a month-by-month basis and is responsible only for the building's exterior.

Nursing home administrator Gussie Ashley would not comment.

Associated Press Archive

October 24, 1998

State probe finds no wrongdoing by nursing home

State health officials found no evidence of negligence in the death of a 66-year-old nursing home resident who was stung by hundreds of fire ants.

A health department report released Friday said that Silver Cross Nursing Home complied with all regulations prior to the attack on Nell Rein. Rein, who was found Aug. 30 in her bed covered with ants, died four days later from congestive heart failure brought on by physiological stress, according to her physician.

Attorney Shane Langston, who represents the Rein family, said the state's report was released without a proper review of all sworn statements. He claimed some of those statements reveal that ants were discovered in the beds of two other patients at the Brookhaven, Miss., facility a week prior to the attack.

Still pending is a grand jury investigation into the nursing home for possible criminal prosecution. Fire ants, which travel in colonies of several hundred to several thousand, usually avoid homes, but dry weather and heat can drive them indoors. They pack a burning sting and attack when threatened.
The Professor Who Loved the Night
The Professor Who Loved the Night

Dr. Richard Richards had been a professor at MSU in Starkville for all of his adult life. He had recently become the chair of the department and enjoyed filling the minds of his new students with all of the information that he had learned during his career. But this year had been particularly stressful, state budget cuts had forced him to dismiss several of his graduate students, and his wife had been killed in a car accident in January.

He really needed a vacation, but one of the associate professors in his department had recently had a baby. So Dr. R. was filling in for her and teaching the dreaded freshmen “non-majors” class. He had heard from some his friends in the other departments that this year’s class was a particularly rowdy bunch and that several of the students were not the ‘brightest bulbs in the box’. After a lecture on apoptosis, cancer, and chemotherapy, one of the less than stellar students in the group asked, “So what is it that pops in the cell? Is it like my favorite bubble gum?” After the laughter in the room subsided, Dr. R. had to consider a response.

He was so taken aback by her question that he was speechless. He could feel his blood pressure and heart rate beginning to rise. Had he remembered to take his medicine this morning? Then as he began to process the question and formulate his answer, he developed an intense stabbing pain in the left side of his head. He closed his eyes and took a deep breath. All the while he was trying to ignore his impending feeling of doom and come up with a credible answer for his student who was drumming her fingers on her desk and violently chewing her bubblegum. Dr. R. tried to answer but no sound would come from his mouth. The harder he struggled to answer the more frustrated he became. Suddenly the room began to spin, and Dr. R. collapsed in front of the podium that his son Ross had built him in honor of his recent promotion.

Sally, the gum chewer, screamed and fainted and another student dialed 911 as the remaining students ran from the class room. When the paramedics arrived Dr. R. was alive but his breathing was slow and shallow and his pulse was weak and thready. Dr. R. was rushed to the hospital where an emergency CT scan was performed. He was administered aspirin and warfarin to help dissolve the clot, but his condition remained unchanged. Nurses examined his personal effects to identify family members they could contact. Dr. R.’s son Ross was called and asked to come immediately to the hospital. Ross sat with his father in ICU for seven days hoping that his condition would improve, but at the end of the week the doctors advised Ross that a permanent care facility might be the best place for Dr. R.’s continued treatment.

Ross investigated the treatment options in the area and found a skilled nursing facility just around the corner from the college campus. Dr. R. was transferred the next day so that he might receive the long term care that he would require. As a result of the stroke Dr. R. had marked muscle weakness, (hemiparesis), on his right side could no longer speak, (disarthria),
and could no longer swallow (dysphagia). As a result of the complications that he suffered, a feeding tube was inserted. Ross never lost hope that his father would recover and hire a physical therapist to begin sessions with his father. He was pleased with the care that his father was receiving at the nursing home. The staff performed bed checks every three hours during the night. Prior to the stroke, Dr. R. really enjoyed the night hours. He and his wife Helen used to sit by their outdoor fireplace and gaze at the stars. Little did he know that this nightly fire would not be one that he would enjoy.

At midnight, the nurses came in to check on Dr. R. and his nurse commented on the joyful but crooked smile that was on his face as they took his vital signs. When the nurse returned at 3 a.m., he certainly had nothing more to smile about. A trail of ants was noted coming from the baseboard of his room toward the dresser and the footboard of Dr. R.’s hospital bed. The ants that covered his body were washed off quickly and his vital signs were taken again. Thankfully they had remained unchanged from the midnight reading. Dr. R. was visited by the staff doctor and was given the antihistamine diphenhydramine, (Benadryl), and a skin emollient ointment was applied to the wheals on his skin.

By the next morning, Dr. R. had clusters of pustules on his head, back, arms, and chest. He was immediately rushed to the hospital, and his son Ross was called. After admission, he was treated with IV corticosteroids, antihistamines, (Benadryl), and topical steroid ointment. During the next several days, he developed swelling and pain at the sites of the stings, but as several days passed the stings appearance and surrounding redness improved. Just when things for Dr. R., were looking up he developed pneumonia and congestive heart failure for which he remained in the hospital for the next three weeks. Several days after his release, he was readmitted for additional treatment of recurring respiratory and heart problems.

Dr. R. was never the same after his nighttime rendezvous with the fire ants. He died 13 months after the attack. The cause of death was sepsis.

The nursing home had a contract with the local pest control service and the facility had been inspected on the day of the attack. No evidence of fire ant infestation had been noted during this or any other of the inspections.
Food for thought:

1. From what do you believe that Dr. R. died?

2. If fire ant envenomation was a contributing factor to his death, how would you know?

3. What are the possible side effects for diphenhydramine (Benadryl), methylprednisilone, (Medrol), corticosteroids, and ceftriaxone, (Rochephin) that may have contributed to Dr. R.’s death?

4. How could the side effects of these drugs have contributed to the death of Dr. R.?

The family has decided to sue the nursing home, the pest control company, and the contractor who built the assisted living facility.

5. Should they have also sued the doctors at the nursing home?

6. Should they have sued the doctor’s at the hospital?

7. In a patient in which there is no evidence of anaphylaxis, and for whom there is a pre-existing complicating disease. Should the doctors use potentially life threatening aggressive treatments?

8. Do you think that the medications that Dr. R. is taking for his pre-existing conditions could have mediated the effects of the fire ant venom and caused a delayed reaction to the attack?

9. Is there a difference between a “medical cause of death” and a “legal cause of death”?

10. Does the fact that Dr. R. died 13 months after the fire ant attack affect your decision on whether or not the family should proceed with a lawsuit?
ANSWERS:

Food for thought:

1. From what do you believe that Dr. R. died?

   Complications of treatment administered to the patient.

2. If fire ant envenomation was a contributing factor to his death, how would you know?

   Patient would have died sooner showing a more immediate reaction to the stings. Generally anaphylaxis occurs within 24 hours.

3. What are the possible side effects for diphenhydramine (Benadryl), methylprednisilone, (Medrol), corticosteroids, and ceftriaxone, (Rochephin) that may have contributed to Dr. R.'s death?

   Note: some of the effects of histamine, including itching, flushing (redness), urticaria (hives), and angioedema (swelling). Corticosteroids are given to reduce the likelihood of having biphasic anaphylaxis, and late-phase asthma symptoms. Large volumes of isotonic fluids are given intravenously to those with low blood pressure because those patients lose a lot of intravascular fluid into the subcutaneous tissues (angioedema), and need to have the intravascular volume replaced to help restore normal blood pressure. Oxygen levels are monitored, and oxygen is given if the levels are low.

   Antihistamines can reduce the swelling of the sting, make patients sleepy and mask the presence of an aneurysm. The steroids can increase blood pressure.

4. How could the side effects of these drugs have contributed to the death of Dr. R.?

   Dr. R may have had an aneurysm which could be masked by the antihistamines. The increase in blood pressure may have caused an aneurysm or heart failure.

The family has decided to sue the nursing home, the pest control company, and the contractor who built the assisted living facility.

5. Should they have also sued the doctors at the nursing home? Yes, the doctor should not have given these drugs to Dr. R.

6. Should they have sued the doctor's at the hospital? Yes, the hospital should have read his records and known which drugs had already been administered to Dr. R. The repeat of drugs could very well have caused an overdose.
7. In a patient in which there is no evidence of anaphylaxis, and for whom there is a pre-existing complicating disease. Should the doctors use potentially life threatening aggressive treatments? No.

8. Do you think that the medications that Dr. R. is taking for his pre-existing conditions could have mediated the effects of the fire ant venom and caused a delayed reaction to the attack? Over medication can cause an aneurysm.

9. Is there a difference between a “medical cause of death” and a “legal cause of death”?

Yes.

*Medical Cause* of Death is defined as the cessation of all vital functions of the body including the heartbeat, brain activity (including the brain stem), and breathing.

Today, both the legal and medical communities use "brain death" as a *legal definition* of death. Using brain-death criteria, the medical community can declare a person legally dead even if life support equipment keeps the body's metabolic processes working.

The diagnosis of brain death needs to be rigorous to determine whether the condition is irreversible. Legal criteria vary, but it generally requires neurological exams by two independent physicians. The exams must show complete absence of brain function, and may include two isoelectric (flat-line) EEGs 24 hours apart. The widely-adopted Uniform Determination of Death Act in the United States attempts to standardize criteria. The patient should have a normal temperature and be free of drugs that can suppress brain activity if the diagnosis is to be made on EEG criteria.

10. Does the fact that Dr. R. died 13 months after the fire ant attack affect your decision on whether or not the family should proceed with a lawsuit?

Yes. Poor treatment could have been the cause that determined length of life.
The Sleepy Texas Cowboy
**The Sleepy Texas Cowboy**

Clint was a 49 year old Texas cow hand who had just finished the spring branding roundup on his bosses 100,000 acre ranch. Clint had been around animals and ranches his entire life. He loved the out of doors and the freedom that he felt as he rode his horse Max across the prairie. Max was his best friend and confidant. He had never been that lucky in his relationships with humans. He had been married several times and even had a son, Scotty, with his first wife, but his relationships never seemed to last. He attributed his lack of interpersonal skills to his time spent alone on the range and his love of Jack Daniels.

In addition to participating in the branding and the round up, Clint's other job was to make sure that the newly born calves in the south pasture were protected from predators and from the Red Imported Fire Ants that had taken up residence in the area.

It was Friday night and Clint was ready to “blow off some steam”. He had just been paid and was headed to the ‘Bucket of Beer’ to have a beer with his new girlfriend, Millie. They were scheduled to meet at 7, but Millie was late and was not answering her cell phone. The longer Clint waited the angrier he became and the more he drank. Finally at about 3 a.m. Willie the bar owner was ready to close and he kicked Clint out of the bar. Clint decides Willie is not mood to argue so he stumble out toward his truck. All he wants is a nice quiet place to sleep but he can’t seem to find his keys, so he decides to walk back to the ranch. Along the way, he becomes increasing tired and slow. He has just passed the cattle crossing at the entrance to the ranch so he is on familiar ground. Sleep would be welcome so he carefully climbs the barbed wire fence and looks for a place to nap. He notices a nice soft new patch of grass and there is even a lump of soil that he can use as a pillow.

The next morning, the ranch foreman, Earl is driving back from town and notices Clint asleep in the pasture. Clint was so intoxicated that he was not aware that the soft soil on which he had slept was an active fire ant mound. Earl rushed Clint to the hospital where doctors discovered Clint had received more than 5000 stings without detectable adverse effects, other than the characteristic pustules covering his head, neck, and extremities. He was treated with topical hydrocortisone and zinc oxide ointment and was observed for several hours before being released.
Food for Thought:

1. Why do you believe that Clint had no adverse reaction to the stings of so many fire ants?

2. Could the fact that he had multiple exposures to ants as a part of his job allow for him to have become desensitized to the effects of the fire ant venom?

3. Could the alcohol, (a depressant), in his system have had an effect on the rate of assimilation and metabolism of the venom?

4. What should be the next step in this investigation?
ANSWERS:

Food for Thought:

1. Why do you believe that Clint had no adverse reaction to the stings of so many fire ants?
   a. He was desensitized due to his outdoor work as a cowboy. He probably had been stung by many things.
   b. Alcohol slows the metabolism.
   c. Alkaloids are phospholipids. When the fire ant stings the victim, the alkaloids are broken down and diffuse in the capillaries directly under the skin which results in swelling or edema. No swelling was present which indicates there was no adverse effect to the stings.

2. Could the fact that he had multiple exposures to ants as a part of his job allow for him to have become desensitized to the effects of the fire ant venom?
   Yes.
   
   Explanation: Immunotherapy defined as Treatment to stimulate or restore the ability of the immune (defense) system to fight infection and disease. Biological therapy is thus any form of treatment that uses the body's natural abilities that constitute the immune system to fight infection and disease or to protect the body from some of the side effects of treatment.

3. Could the alcohol, (a depressant), in his system have had effects on the rate of assimilation and metabolism of the venom?
   
   There is no evidence that supports that the venom would have any effect. However, someone under the influence probably would not be as sensitive to a sting as those that are not.

4. What should be the next step in this investigation?
   Currently, there are no studies to verify how alcohol would affect the assimilation or metabolism of venom in patients. This would be a starting point in researching this data.
**Associated Press Archive**

March 6, 2001

Family of woman bitten to death by fire ants sues nursing home

The family of a woman stung more than 1,600 times by **fire ants** in her nursing home bed has filed suit, charging the home with negligence in her death.

The lawsuit against Quality Health Care Center in North Port does not seek specific damages. It names the nursing home and the home's assistant director of nursing as defendants. Mary Gay, 87, died last May after being bitten 1,625 times by **fire ants** chewed through a wall at the nursing home, then swarmed Gay's bed. State regulators have faulted the nursing home for not providing proper care for the **stings**.

An official who answered the telephone at the nursing home Monday declined comment. The family's attorney did not immediately return telephone calls seeking comment.

**Associated Press Archive**

March 16, 2001

Fla. nursing home cleared in death of woman stung by ants

A judge cleared a nursing home of any wrongdoing in the case of an 87-year-old woman who died after being stung more than 1,600 times by **fire ants** in her bed.

Administrative Law Judge Jeff Clark called the **stings** "unfortunate and unexplained," but found that Quality Health Care Center did not err in its treatment of Mary Gay. A state agency's sanctions against the home weren't justified, the judge ruled. Gay died May 19, 33 hours after the **ants** chewed through a wall of the home, swarmed her bed and stung her.

State regulators faulted the nursing home for not providing proper care for the **stings** and for failing to follow a doctor's orders to treat the **stings**. The home was closed temporarily and its owners fined.

The state agency can appeal the judge's March 9 ruling.

Still pending is a civil lawsuit by Gay's family seeking more than $30,000 in damages, charging the nursing home with negligence and causing her death.
Lawyer Don Greiw, representing Gay's family, said he hopes the agency appeals: "I think the administrative judge is wrong."

Karen Goldsmith, representing the nursing home, did not immediately return calls seeking comment.

Associated Press Archive

May 26, 2000

Woman dies after being bitten 1,625 times by ants in nursing home bed

VICKIE CHACHERE Associated Press Writer

An 87-year-old nursing home patient with Alzheimer's disease died a day after she was bitten 1,625 times by ants as she lay in her bed, authorities said Thursday.

The Sarasota County medical examiner's office is investigating the case of Mary L. Morales Gay, who died Friday at the Quality Health Care Center in North Port. The official cause of death had not been determined, pending toxicology tests, but Gay was bitten by either fire ants or red ants on her chest, upper arm, abdomen and back, Wilson Broussard, deputy chief medical examiner, said Thursday.

Fire ants, which travel in colonies of hundreds and even thousands, usually avoid homes, but dry weather and heat can drive them indoors. They pack a burning sting and attack when threatened.

Loraine Baeringer, administrative assistant at the home, had no comment. Pat Glynn of the state Agency for Health Care Administration said the home has had satisfactory ratings.

North Port police, state regulators and the Department of Children and Families were also investigating.

Gay had been co-owner of a trucking company. Her son, Edgar W. Gay of Sarasota, declined to comment.

North Port police Detective Stephen Lorenz said Gay was checked at 6:30 a.m. May 18 and was fine. At 8 a.m. a housekeeper came into her room, noticed the ants on her and called for help. It appeared the ants had built several colonies in a courtyard at the nursing home and burrowed through a wall to Gay's room, Lorenz said.

Lorenz said even though he is only half way through his investigation it does not appear any crime was committed. "The staff in our opinion at this point in our investigation did everything to the best of their capabilities," he said.

While they do not anticipate any criminal charges, police said they will await autopsy and toxicology results.

Gay had a roommate, but she was not bitten.
In 1998, hundreds of fire ants killed a 66-year-old nursing home resident in Jackson, Miss. Health officials found no evidence of negligence.

Associated Press Archive

May 26, 2000

Police say no crime apparent in ant attack death VICKIE CHACHERE Associated Press Writer

When a nursing home aide looked in on 87-year-old Mary Morales Gay one morning last week, police say, the Alzheimer's patient appeared to be fine. An hour and half later, she was covered with ants.

Gay died a day after she was bitten 1,625 times by the insects as she lay in her bed, authorities said Thursday. The Sarasota County medical examiner's office is investigating the May 19 death at the Quality Health Care Center in North Port. The official cause of death had not been determined, pending toxicology tests, but Gay was bitten by either fire ants or red ants on her chest, upper arm, abdomen and back, said Wilson Broussard, deputy chief medical examiner.

Fire ants, which travel in colonies of hundreds and even thousands, usually avoid homes, but dry weather and heat can drive them indoors. They pack a burning sting and attack when threatened.

Detective Stephen Lorenz said Gay was checked at 6:30 a.m. May 18 and was fine. At 8 a.m. a housekeeper came into her room, noticed the ants on her and called for help. It appeared the ants had built several colonies in a courtyard at the nursing home and burrowed through a wall to Gay's room, Lorenz said. The woman's roommate was unharmed.

Loraine Baeringer, administrative assistant at the home, had no comment. Pat Glynn of the state Agency for Health Care Administration said the home has had satisfactory ratings.

Lorenz said even though he is only half way through his investigation it does not appear any crime was committed. "The staff in our opinion at this point in our investigation did everything to the best of their capabilities," he said.

State regulators and the Department of Children and Families were also investigating.

Gay had been co-owner of a trucking company. Her son, Edgar W. Gay of Sarasota, declined to comment.

Researchers say fire ants are responsible for 10 deaths in indoor attacks since 1989, including two elderly nursing home patients in Mississippi. One died six days after the attack, the other within 13 months.

University of Mississippi Medical Center researcher Dr. Richard D. deShazo and his team in Jackson documented the deaths in the "Annals of Internal Medicine" last fall.
Associated Press Archive

June 4, 2004

Woman awarded $1.2 million for ant attack at nursing home

A jury has awarded $1.2 million to a 93-year-old woman who was stung by a swarm of fire ants in her nursing home bed.

Pearl Smith had blisters on her arm, neck, back and upper torso from the scores of stings she suffered in 2002 at the Surrey Place nursing home. She could not get out of bed to escape the ants. Her attorney, Michael Kohl, said she is unlikely to collect any money because the company that operated the nursing home, Consulting Management and Education, had no liability insurance, and its debts exceed its assets.

There were no attorneys for the company in court Thursday when the jury awarded the damages.

Surrey Place is now under new management.

Associated Press Archive

August 19, 2000

Criminal charges won't be filed in North Port ant bite death

Criminal charges will not be filed in the case of a nursing home patient stung to death by fire ants.

Police investigators and the Florida attorney general's office said they found no crimes were committed. The nursing home still faces fines from the Agency for Health Care Administration and Medicaid officials for their treatment of Mary Gay. Gay, 87, died in May at Quality Health Care Center after being stung more than 1,600 times by fire ants that burrowed from an outdoor nest into her room. State regulators said the nursing home did not provide proper care because nurses did not tell a doctor how serious the attack was.

The nursing home has since changed its policies and is appealing a $3,000-a-day fine levied by state regulators.

Associated Press Archive

March 11, 2005

Family of Florida nursing home patient who died of ant bites gets $1.8 million

The family of a bedridden nursing home patient who died after being bitten by hundreds of fire ants will get almost $2 million under a settlement with the home's owner.
Georgia-based Mariner Health Care, the nation's third largest long-term health care company, agreed this week to pay Earl Dean Griffith's widow and children $1.875 million, a week before their lawsuit was to be tried, the newspaper Florida Today reported Friday. "After several years of fighting and denying responsibility despite the overwhelming evidence, (Mariner) went ahead and settled the case," said Chip Barger, the family's attorney. A spokesman for Mariner Health Care did not return a call Friday seeing comment.

Griffith, 73, had been recuperating from surgery at the Atlantic Shores nursing home for a month when ants swarmed the retired postal worker's bed and bit him during the early hours of July 26, 2001.

Forty hours later, Griffith died of shock from the amount of ant poison in his body, the medical examiner's report said. His back, arms, chest, neck, head and shoulders were covered in bites.

It was the second time in recent years that a Florida nursing home has settled with a family after a patient died of fire ant bites. A North Port home paid an undisclosed amount to the family of an 87-year-old woman who was attacked in 2000.

The settlement should send a message to other nursing homes to follow federal law requiring them to keep their facilities free of pests, Barger said "They've got to put patients' care and security and protection ahead of the almighty dollar," he said.

**Associated Press Archive**

June 29, 2002

**Alabama jury award $5.3 million in lawsuit by ant-bite victim**

A jury awarded $5.3 million to an elderly woman bitten hundreds of times by fire ants that swarmed in her room at an assisted living facility.

The verdict went against the Greystone Retirement Community, where the woman lived, and Terminix International, hired to control pests in the facility. Jurors ruled Greystone and Terminix should together pay compensation of $1.85 million and punitive damages of $1.75 million each.

A Terminix spokesman said the company would appeal Thursday's verdict.

Lucille Devers, 79, survived the 1999 incident and now lives in another elderly care home. The lawsuit was filed by Devers' daughter, Jeanne Hupfer.

Attorneys for Greystone said controlling pests was outside the expertise of facility managers. Terminix lawyers told jurors there was no way the company could exterminate all the ants or foreseen any danger of an infestation.
The Accidental Meeting with Baby
The Accidental Meeting with Baby

Tim and Chelsea were married for several years and were finally planning for the birth of their first child. Chelsea was making a list of all of the last minute items that she would need to complete the nursery. Baby Boutique was having a sale on several items that she and Tim had planned to buy to use with this baby and the future children that they were planning. Chelsea was on her way home and rounded the corner of their street when a man in an SUV ran the stop sign and slammed into the driver’s side of Chelsea’s car. Tim heard the sirens from inside the living room of their house and instinctively seemed to know something was wrong. He ran toward the sound and saw that it was Chelsea’s car that had been involved in the accident. A neighbor had called an ambulance and they arrived just as Tim reached the car. Chelsea was extricated from the car and was taken to the hospital. She was battered and bruised but the doctors believed that the baby was safe. Or so they thought. Little Jessie was born three months later in an uneventful natural birth.

For the first several months everything seemed fine with Jessie. Chelsea and Tim were thrilled and were looking forward to having a brother or sister for Jessie. One night Tim’s mother Helen was babysitting when she noticed that Jessie seemed to be napping with his eyes partially open, but then dismissed the idea. As Jessie began to grow, he seemed to be having trouble lifting his head and was becoming more and more irritable. Chelsea too noticed the strange way that Jessie slept and he seemed to be spending more and more time napping, he was also having trouble keeping his food down. Chelsea made another appointment with the pediatrician and he attributed the problems to the virus that was making the rounds.

Jessie was now 10 months old and was still not walking, talking and seemed to be having difficulty focusing. Chelsea was not satisfied with the help she was getting from the local clinic and made an appointment for Jessie to see a specialist. Dr. Chin attentively listened to all of Chelsea’s concerns and scheduled a series of tests. She also performed a routine exam and was concerned by the conformation of Jessie’s head. The left side of his skull seemed slightly more swollen than the right, so a CT scan was ordered in addition to the other tests. Dr. Chin asked Chelsea if Jessie had fallen recently or if he had hit his head on anything. He had not.

The results of Jessie’s blood tests were normal but the CT scan revealed an obstruction in the flow of the cerebrospinal fluid on the left side of Jessie’s head. The fluid was pooling in the area around the obstruction and putting pressure on the brain and forcing the skull to protrude outward. The diagnosis was obstructive hydrocephalus and he referred Jessie to a pediatric neurologist. It would be several days before they could see the specialist and Chelsea began researching Jessie’s condition. Finally all of the little things that she and her family had been noticing began to make sense. Jessie’s inability to close his eyes completely was called lagophthalmos, and all of the other symptoms were characteristic of the hydrocephalus. But how had it happened, he had not fallen, or hit his head, and then the realization ...the car accident.
Now that they knew what was wrong, the next question was what to do about it? The specialist recommended the placement of a catheter or shunt to bypass the flow obstruction and drain the excess fluid into other body cavities, from where it can be reabsorbed. Enough tubing is left in the area it drains to, so that it can uncoil as the child grows. The specialist explained that some damage had already been done and that Jessie would be likely to continue to experience visual and special deficits and would be cognitively and developmentally delayed. But there was definitely a reason for hope.

Chelsea and read everything that they could find on assisting children with disabilities. They worked with Jessie every day and finally at 26 months Jessie began to roll over without help. He could roll so quickly and forcefully that Chelsea feared he would roll of the living room furniture while she was nit watching,, So to avoid a fall, she place Jessie on the soft area rug in front of the couch for a nap, and went into the kitchen to finish preparing dinner. About 30 minutes later Chelsea was startled by a loud mournful cry from Jessie and she ran into the living room to find his face and scalp covered with small red ants. She rushed him to the kitchen and washed the ants from Jessie’s body with cool soapy water. His face was already becoming very red, (erythema), and swollen, (edematous). So she called Tim and they rushed Jessie to the hospital.

When they reached the hospital, Jessie would not stop crying. His vital signs were within normal limits, but more than 150 pustules were found on his face, scalp, neck, chest, and extremities. No anaphylaxis was observed, but Jessie would be kept overnight for observation. His face was still very red and badly swollen. The doctors were concerned that since Jessie was unable to completely close his eyes when he slept that the ants may have been able to damage his eyes. Jessie was given a topical anesthetic and his eyes were examined. The right cornea had 20 dot sized lesions and the right cornea had 10 such lesions. Jessie was treated with oral diphenhydramine, (Benadryl), and ibuprofen, (Motrin), and a preventative salve of ophthalmic bacitracin was administered every eight hours to prevent eye infection.

Jessie was a very lucky young man and was sent home the next day with instructions to continue using the bacitracin and artificial tears every eight hours until their follow up visit the next week. When Jessie returned for his follow up visit the redness and swelling around his eyes and eyelids had improved considerably, but dot shaped areas of inflammation persisted where the ants had stung Jessie’s eyes. He was sent home and asked to return in two wee. During this exam multiple areas of opacity of the corneas had replaced the areas of inflammation in Jessie’s eyes. The doctors explained that these areas were similar to the opaque plaques that develop in the eyes of cataract patients and that at some point Jessie would require a corneal transplant.
Food For Thought:

1. The doctors in the emergency room considered reporting Chelsea to child protective services? They did not believe the timeline associated with her story? What would you have done in their position?

2. Did Jessie’s pre-existing condition contribute to his reaction to the fire ant stings?

3. Ultimately was the man in the SUV who caused the traffic accident legally responsible for the entire chain of events involving Jessie’s poor health?

4. Is there a difference between legal responsibility and moral responsibility?
ANSWERS:

Food For Thought:

1. The doctors in the emergency room considered reporting Chelsea to child protective services? They did not believe the timeline associated with her story? What would you have done in their position?

   This question is subjective to the reader. Make sure you get your students to explain why they fell the way they do about these questions.

2. Did Jessie’s pre-existing condition contribute to his reaction to the fire ant stings?

   Yes. Hydrocephalus has a condition known as lagophthalmous, which is a weakness of eye closer. Simply, the baby could close her eyes. This contributed to the stings in the babies’ eyes resulting in the loose of sight.

3. Ultimately was the man in the SUV who caused the traffic accident legally responsible for the entire chain of events involving Jessie’s poor health?

   Yes. The mother was in the third trimester of her pregnancy. The car was hit on the driver side bruising and battering the mother. A concussion to the baby in the womb during the third trimester can result in Hydrocephalus.

4. Is there a difference between legal responsibility and moral responsibility?

   Yes.

As defined by Wikipedia: Moral responsibility is both related to and different from causal responsibility and legal responsibility. People are causally responsible for events when those events are directly brought about by their actions. Often when people have moral responsibility for a situation, they also have causal responsibility for that situation. Someone who is praised for acting in a morally responsible way has usually caused some good state of affairs to occur. To see that a person can have moral responsibility without causal responsibility, however, consider that john might claim that there was nothing in his failure to keep his promise that caused his neighbor to fail to make her job interview. (She could have taken her child with her, or found some other babysitter, for example.) Nevertheless, he may still be morally responsible for her failing to attend the interview. A person is legally responsible for his or her actions when it is that person who will be penalized in the court system for an event that has occurred. Although, it may often be the case that when a person is morally responsible for some act, they are also legally responsible for some act, there are clearly exceptions to this rule. Rules of law and rules of ethics do not always overlap.
The Night in the Western Was Not the BEST
The Night in the Western Was Not the BEST

Michael Callahan and his wife Moira were looking forward to their upcoming vacation. They had not seen their grandchildren for several months and were anxiously awaiting the chance to spoil those babies. Their plans were to drive from Tallahassee to somewhere in central Louisiana and then drive the rest of the way to Austin the next day. Michael worked for a local civil engineering firm in Tallahassee and Moira had just retired after 40 years as an English teacher. Michael has just turned 69 and was not yet ready to retire. He did have a mild case of diabetes and slight blood pressure issue, but was successfully controlling both with medication, diet and exercise.

He still loved to work outside, but this year had been particularly wet and the fire ants seemed to be much worse than usual. He had been stung several times last year, but this year the stings bothered him enough to ask the local pharmacist for something to reduce the itching. The day of the trip had finally arrived the car was packed and they were ready to go. The stopped several times along the way and just were thankful for each other’s company. It was beginning to rain fairly steadily and the clouds looked really ominous. So they decided to stay at the next motel that they saw. Little did they know this was not the only storm brewing.

At about one that morning they were awakened to a commotion in the room next door. They would find out the next day that the commotion had been caused by the guest in the adjoining room who had awakened to find numerous ants on his body. He was thankfully not stung, but did notify the manager of the motel, and was moved to a new room to finish the night. If only Michael and Moira had known what the commotion was about.

Michael awoke about 6 the next morning and told Moira he was nauseated and was itching all over. Moira turned on the lights and pulled back the sheets. Michael was covered in ants and had been stung repeatedly. Moira got Michael up and dressed and hurriedly went to the front desk to get directions to the nearest hospital. It was only then that she discovered that the adjacent room had an ant problem the night before.

She rushed Michael to the hospital where the E.R. doctor noted severe left facial swelling and swelling around his eye. There was also evidence of multiple fire ant stings on his left arm and right leg. His blood pressure was only slightly elevated and there was no evidence of anaphylaxis. He was given an injection of Dexamethasone (a steroid and immunosuppressant about 40 times more potent than hydrocortisone) and Hydroxyzine, (an antihistamine and anti-anxiety drug). He was observed in the emergency room for one and a half hours with no signs of trouble and was discharged with a prescription for oral antihistamines.

They returned to the motel and picked up their luggage and resumed their trip, but Moira decided to drive for the rest of the trip. Over the next seven hours, Michael remained nauseated, vomited several times and became progressively more disoriented and had difficulty staying awake. The swelling of his face continued to develop and his tongue became...
swollen as well. Some 8 hours after his first emergency room visit, Moira and their children took Michael to St. David’s Hospital in Austin.

The E.R. doctor noted left facial and tongue swelling and evidence of multiple fire ant stings on his face, extremities, and trunk. By this time, he was very sleepy, disoriented, and unable to speak clearly. His blood pressure was still not elevated, but his glucose levels had become dangerously high. An EKG was performed and no evidence of heart attack was present. He was admitted to the hospital with a diagnosis of an allergic reaction and hyperglycemia. He was treated with insulin and fluids and was placed in ICU for observation. Even with the insulin, he was still incoherent, so a CT scan was ordered. The scan revealed a stroke in the temporal region of the brain that could have been caused by his abnormally high glucose levels. He was observed for several more days and then transferred to a stroke rehabilitation program. During the next month he suffered from pneumonia, his heart stopped twice and he finally succumbed one month after his encounter with the fire ants.
Food for Thought:

1. Who would you sue first? On what grounds would you base your lawsuit?

2. Do you believe that Michaels’ death was as a result of his diabetes or as a result of the fire ant envenomation?

3. Is there a difference between “medical cause of death” and “legal cause of death”? 

There is no evidence in the literature that indicates that Michael’s family sued anyone connected with this incident.
Answers:

Food for Thought:

1. Who would you sue first? On what grounds would you base your lawsuit?

   The owner of the motel would be sued first. He did not share with his renters that he had a fire ant problem in the adjoining room the previous night.

2. Do you believe that Michaels’ death was as a result of his diabetes or as a result of the fire ant envenomation?

   There was a delayed anaphylactic reaction due to how the chemicals from the sting messed up his body chemistry. In a diabetic, renal output can be affected. The chemicals disrupted his electrolyte balance and increased the glucose levels. Both of these are extremely dangerous to a diabetic.

3. Is there a difference between “medical cause of death” and “legal cause of death”?

   Yes.

   **Medical Cause** of Death is defined as the cessation of all vital functions of the body including the heartbeat, brain activity (including the brain stem), and breathing.

   Today, both the legal and medical communities use “brain death” as a **legal definition** of death. Using brain-death criteria, the medical community can declare a person legally dead even if life support equipment keeps the body’s metabolic processes working.

   The diagnosis of brain death needs to be rigorous to determine whether the condition is irreversible. Legal criteria vary, but it generally requires neurological exams by two independent physicians. The exams must show complete absence of brain function, and may include two isoelectric (flat-line) EEGs 24 hours apart. The widely-adopted Uniform Determination of Death Act in the **United States** attempts to standardize criteria. The patient should have a normal temperature and be free of drugs that can suppress brain activity if the diagnosis is to be made on EEG criteria.
ACTIVITY AT A GLANCE

Goal:

To introduce students to the impact of fire ant envenomation on human immune system.

Learning Objectives:

Upon completion of this activity, students will understand the affect of the fire sting on human and the possible side effects that can be life threatening.

Teaching Time:

Enrichment Activities may take another class day if chosen.

*The approach to the lesson can be adapted to the amount of time of your class sessions.

National Science Education Standards Addressed:

*Science as Inquiry* – Students develop scientific inquiry skills in posing scientific questions and predictions, taking ownership of their research, and using varied tools and evidence to characterize the insect samples that they chose to study.

*Science and Technology* – The students integrate field work with taxonomic classification in the lab to determine insect Order using a computerized key.

*Life Science* – In this activity, students use field work, classification, and basic content on symbiosis to learn about evolution and ecology of insects, the interdependence of microbes and animals, and the organization of living systems including insect body structure, life cycle, and associations with microbes.
Overview

The *Muse of Fire* becomes an apt metaphor for the red imported fire ant (*Solenopsis invicta*), an insect pest endemic to the southern United States. As an object to stimulate student inquiry, *S. invicta* is ideally poised. Easy to access, identified as a wide-spread nuisance, causing major economic and ecological impact, rapidly-spreading, and engendering highly publicized legal and clinical controversy (*deShazo et al.*, 2006). Within its geographical distribution, the scientific, medical and educational impact of *S invicta* is exceptional. Virtually every child living below the Tennessee/Mississippi border coast-to-coast is personally familiar with this insect, having experienced its fiery sting, which generally causes only temporary, local pain and a sterile pustule at the sting site.

Scientifically, *S. invicta* possesses venom that is unique among insects, whose biological function and toxicological properties are under active investigation (*Arbiser et al.*, 2007; *Howell et al.*, 2005). Medically, cases of massive stinging attacks with thousands of stings have been associated with severe consequences, particularly in elderly, debilitated persons. The etiology of such adverse responses is under active debate. Educationally, focusing on *S. invicta* provides avenues to multiple fields of study, including evolution, systematic, ecology, health, behavior, and microbiology.

MATERIALS

Per activity station for two students:
- Paper
- Copy of Activity
- Computer
- Pencil/pen

TEACHER PREPARATION

Teachers will need to copy the Case Study that you wish your students to use or all 6 case studies. Students will be more likely to retain information if they are allowed to become personally involved in the fate of the patients in the enclosed case studies. It is recommended that that the case studies be used as a bell ringer activity. This will allow the students to “read”, increasing literay, and “think scientifically”. If you wish to extend these case studies, the Journal Articles from which these scientific case studies were written can be found at [http://basepair.library.umc.edu](http://basepair.library.umc.edu).
Enrichment Activity 1:

Compare and Contrast Human Scenarios

In a two page typed paper, compare and contrast the elderly scenario and the infant scenario. Explain in detail why you think these IFA attacks occurred for each individual, how their age and health status affected their reaction to the IFA stings, and how the treatments affected the outcomes for each individual.
Enrichment Activity 2:

The Beginning of an Epidemic?

FOCUS: Students assume the roles of physicians, patients, and public health experts to investigate a cluster of patients with similar symptoms reporting to different hospitals within the same area. Students can be divided into groups of either “ER Physician”, “Public Health Official” or “Patient”. There are nine patient scenarios included in this packet.

MAJOR CONCEPTS: A major concern in public health is the ability to recognize clusters of related diseases and their likelihood of causing a widespread outbreak.

OBJECTIVES: After completing this activity, students will

- Recognize the variety of evidence that physicians, laboratory scientists, and epidemiologists must collect to determine the origin, infectious agent, and route of transmission of an infectious disease;
- To be able to give examples of how an infectious agent can be transmitted to humans; and
- Be able to explain how public health is monitored.

PREREQUISITE KNOWLEDGE: See NIH Curriculum Supplement Series (Emerging and Re-emerging Infectious Diseases).

BASIC SCIENCE-PUBLIC HEALTH CONNECTION: See NIH Curriculum Supplement Series (Emerging and Re-emerging Infectious Diseases).
PROCEDURE:

**Part One of the exercise:** Provide the students in the “Physician” role with forms for patient interviews, physical examination, and laboratory results. Students in the “Patient” role will be provided with a history of the current illness and answers to questions posed by the “Physician” during the interview.

**Part Two of the exercise:** Involves the collection of specimens. “Physicians” will perform throat swabs on their “Patients” with sterile cotton tipped applicator. The applicator will be used to streak a bacterial plate for culture and then placed this in the transport media provided.

**Part three of the exercise:** Allows the students to follow a flow diagram to determine the specific source of infection. They will be given Laboratory Results and asked to complete the analysis for influenza. This will involve two laboratory exercises: a rapid antigen test for Influenza A nucleocapsid protein and a Western Blot analysis to identify the relevant hemaglutination proteins (H1, H3, or H5). An additional paper exercise to demonstrate the identification of the hemaglutination genes by PCR is also included as an alternative.

**Part Four of Exercise:** An epidemiological investigation of the clustered cases will constitute part four of the module. Students will be given reports from epidemiology officers and asked to analysis the likely source of the cluster of cases. They should discuss the possible modes of transmission, the likelihood of a wider outbreak, additional resources to be requested, and potential control measures.
### Glossary of Terms

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
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<tbody>
<tr>
<td>Allergic reaction</td>
<td>A reaction to environmental substances known as allergens; these reactions are required, predictable and rapid.</td>
</tr>
<tr>
<td>Anaphylaxis</td>
<td>An allergic reaction that involves at least two or more organ systems occurring after ingestion, skin contact, injection of an allergen or, in rare cases, inhalation</td>
</tr>
<tr>
<td>Congestive heart failure</td>
<td>Heart failure in which the heart is unable to maintain adequate circulation of blood in the tissues of the body or to pump out the venous blood returned to it by the venous circulation</td>
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<tr>
<td>Dyspnea</td>
<td>difficult or labored respiration</td>
</tr>
<tr>
<td>Envenomation</td>
<td>The process by which venom is injected into some animal or human by the bite (or sting) of a venomous animal.</td>
</tr>
<tr>
<td>EpiPen</td>
<td>A registered trademark for the most commonly used auto injector of epinephrine (a.k.a. adrenaline), used in medicine to treat anaphylactic shock.</td>
</tr>
<tr>
<td>Hymenoptera</td>
<td>One of the larger orders of insects, comprising of the sawflies, wasps, bees, and ants.</td>
</tr>
<tr>
<td>IFA</td>
<td>Imported fire ant</td>
</tr>
<tr>
<td>Immunoglobulin E (IgE)</td>
<td>A class of antibody that has only been found in mammals. It plays an important role in allergies, and is especially associated with type 1 hypersensitivity.</td>
</tr>
<tr>
<td>Intermuscular</td>
<td>lying between and separating muscles</td>
</tr>
<tr>
<td>Intramuscular</td>
<td>situated within, occurring within, or administered by entering a muscle</td>
</tr>
<tr>
<td>Large Local reaction</td>
<td>Occurs when an 8 cm or larger area around the sting site develops swelling, redness, and itching through a 48 hour period, sometimes lasting up to one week.</td>
</tr>
<tr>
<td>Paraplegic</td>
<td>A person affected with paralysis of the lower half of the body with involvement of both legs usually due to disease or injury to the spinal cord.</td>
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of both legs usually due to disease or injury to the spinal cord.

<table>
<thead>
<tr>
<th>Term</th>
<th>Description</th>
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<tbody>
<tr>
<td>Somnolence</td>
<td>The quality or state of being drowsy</td>
</tr>
<tr>
<td>Stridor</td>
<td>A harsh vibrating sound heard during respiration in cases of obstruction of the air passages</td>
</tr>
<tr>
<td>Toxic reaction</td>
<td>Reactions categorized as occurring in compromised individuals, like infants or the elderly, who were stung hundreds to thousands of times by IFAs.</td>
</tr>
</tbody>
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References


Education Standards Met with Health and Human Impact Module:

National Reading Standards Addressed:

NL-ENG.K-12.1 Reading for Perspective

Students read a wide range of print and nonprint texts to build an understanding of texts, of themselves, and of the cultures of the United States and the world; to acquire new information; to respond to the needs and demands of society and the workplace; and for personal fulfillment. Among these texts are fiction and nonfiction, classic and contemporary works.

NL-ENG.K-12.3 Evaluation Strategies

Students apply a wide range of strategies to comprehend, interpret, evaluate, and appreciate texts. They draw on their prior experience, their interactions with other readers and writers, their knowledge of word meaning and of other texts, their word identification strategies, and their understanding of textual features (e.g., sound-letter correspondence, sentence structure, context, graphics).

NL-ENG.K-12.4 Communication Skills

Students adjust their use of spoken, written, and visual language (e.g., conventions, style, vocabulary) to communicate effectively with a variety of audiences and for different purposes.

NL-ENG.K-12.5 Communication Strategies

Students employ a wide range of strategies as they write and use different writing process elements appropriately to communicate with different audiences for a variety of purposes.

NL-ENG.K-12.6 Applying Knowledge
Students apply knowledge of language structure, language conventions (e.g., spelling and punctuation), media techniques, figurative language, and genre to create, critique, and discuss print and nonprint texts.

NL-ENG.K-12.7 Evaluating Data
Students conduct research on issues and interests by generating ideas and questions, and by posing problems. They gather, evaluate, and synthesize data from a variety of sources (e.g., print and nonprint texts, artifacts, people) to communicate their discoveries in ways that suit their purpose and audience.

NL-ENG.K-12.8 Developing Research Skills
Students use a variety of technological and information resources (e.g., libraries, databases, computer networks, video) to gather and synthesize information and to create and communicate knowledge.

NL-ENG.K-12.9 Multicultural Understanding
Students develop an understanding of and respect for diversity in language use, patterns, and dialects across cultures, ethnic groups, geographic regions, and social roles.

NL-ENG.K-12.10 Applying Non-English Perspectives
Students whose first language is not English make use of their first language to develop competency in the English language arts and to develop understanding of content across the curriculum.

NL-ENG.K-12.11 Participating in Society
Students participate as knowledgeable, reflective, creative, and critical members of a variety of literacy communities.

NL-ENG.K-12.12 Applying Language Skills
Students use spoken, written, and visual language to accomplish their own purposes (e.g., for
learning, enjoyment, persuasion, and the exchange of information).

**Mississippi Science Standards Correlation**

**Biology II:**

**Competency I:** Utilize critical thinking and scientific problem solving in designing and performing biological research and experimentation.

- C. Apply the components of scientific processes and methods in the classroom and laboratory investigations.
- D. Communicate the results of scientific investigations in oral, written, and graphic form.

**Competency 4:** Investigate the role that natural selection plays in maintaining diversity.

- C. Examine factors that affect populations, such as distribution, competition, migration, isolation, and disease.

**Competency 6:** Examine the behavior of organisms.

- C. Analyze the behavioral responses of an organism to internal and external stimuli.
- D. Compare the selective advantage of several behavioral responses.

**Biology I:**

**Competency I:** Utilize critical thinking and scientific problem solving in designing and performing biological research and experimentation.

- C. Apply the components of scientific processes and methods in the classroom and laboratory investigations.
- D. Communicate the results of scientific investigations in oral, written, and graphic form.

**Competency 6:** Investigate concepts of natural selection as they relate to diversity of life.

- F. Analyze the results of natural selection in speciation, diversity, adaptation, behavior and extinction.

**Competency 7:** Investigate the interdependence and interactions that occur within an ecosystem.

- E. Interpret interactions among organisms in an ecosystem (producer/consumer/decomposer, predator/prey, symbiotic relationships and competitive relationships.)