



Girl Scouts of Minnesota and Wisconsin River Valleys



I'M ELECTRIC! GIRL SCOUT JUNIOR BADGE

Introduction

The Bakken is a Library and Museum of Electricity in Life. The Bakken is dedicated to inspiring youth to pursue a life in science for the benefit of humanity through interactive exhibits, science programming, and special events.

Girl Scouts of Minnesota and Wisconsin River Valleys is proud to have collaborated with The Bakken since 2002 to provide program opportunities for Girl Scouts to educate and excite them about science. This badge was developed by Bakken staff in partnership with River Valleys staff.

This badge is an "Our Own Council's" badge, meaning it was developed especially for Girl Scout Juniors in our council. This badge is an earned award, meaning it may be worn on the front of the uniform sash/vest.

The purpose of this badge is to help girls learn about electricity, in particular electricity in the human body, in fun and hands-on ways. The name of this badge, "I'm Electric!" comes from this purpose.

Instructions For Adults Working With Girls

Please review the Activity Checkpoints for "Arts and Crafts" (pp. 126-128), "Computers" (pp. 128-130), and "Science" (pp. 134-135), as well as the Basic Safety Guideline for "Service Projects" (p. 43), in *Safety-Wise* before working on this award.

To earn this badge, girls must complete at least six of the 10 activities in the attached requirements packet.

The activities are designed to be easy for leaders to facilitate; the needed supplies can be found at home or in local stores. The "Beating Heart" activity requires three items that are harder-to-find; these items are available for purchase through the Girl Scout Store.

In addition, this badge may be earned in an event format. Check the River Valleys website at www.girlscoutsrv.org for information on the "I'm Electric! Badge Day" council event.

Once girls have earned the badge, the patches may be purchased through the Girl Scout Store. (If they earn the badge at an "I'm Electric! Badge Day" council event, they will receive the patches at the event.)

Your feedback on this badge is important! Upon completion, girls and adults are asked to photocopy, fill out, and turn in the attached evaluations. (If girls earn the badge at an "I'm Electric! Badge Day" council event, they will receive evaluations at the event.)

If you have questions about this badge, please contact your River Valleys Program Department staff at 651-227-8835. Additional copies of this badge requirements packet may be purchased through the Girl Scout Store.

I'm Electric Badge: Requirements

1. Beating Heart

Materials (per girl):

1 Piece Strong Card Stock (8½ x 11)	Scissors
2 Batteries (size AA)	1 Short Piece of Wire (regular; ends peeled)**
Electrical Tape	Blinking LED**
2 Brass Paper Fasteners	Battery Pack**
1 Paper Clip (any size)	Optional: Pacemaker Container Materials
Pictures of Pacemakers (p. 3)	(i.e., foam, paper, glue/tape, markers, etc.)

**The Wire, Blinking LED, and Battery Pack are harder-to-find items and therefore are available for purchase in a “Beating Heart’ Activity Materials Kit” through the Girl Scout Store.

Main Focus:

If the heart is not beating right, a pacemaker can be used. A pacemaker gives the heart pulses of electricity. These pulses make the heart muscle contract, or grow smaller, and expand, or grow bigger, allowing it to pump blood through the body.

Activity Background:

The heart is a muscle and, like all muscles, it contracts, or grows smaller, and expands, or grows bigger. When the heart contracts, it squeezes blood from one of its chambers to another and into the circulatory system. The circulatory system circulates, or sends, the blood throughout the body and eventually back to the heart. Pulses of electricity, produced by cells in the heart, tell the heart when to contract. If these cells aren't giving the electric pulses at the right time, the heart might not work right. In some cases, a pacemaker is used to give pulses of electricity to make the heart beat regularly.

Build:

Step 1

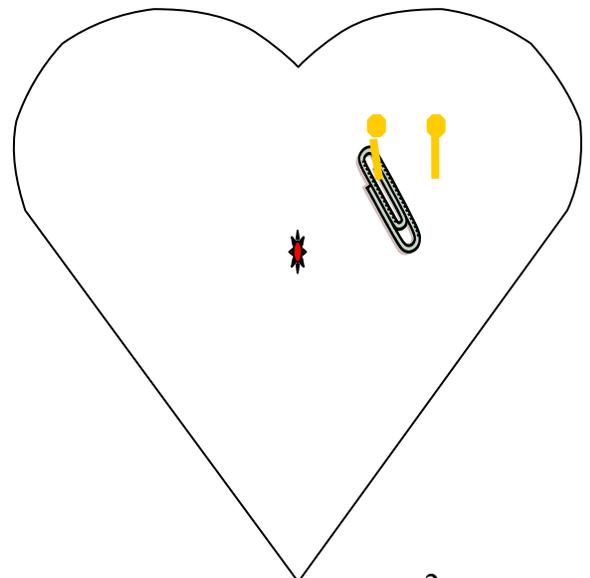
- A. Cut out a heart from cardstock.

Step 2

- A. Put batteries in battery pack.
- B. Test LED by touching its legs to the battery pack wires (the shorter leg should touch the black wire).
- C. Take batteries out of battery pack.

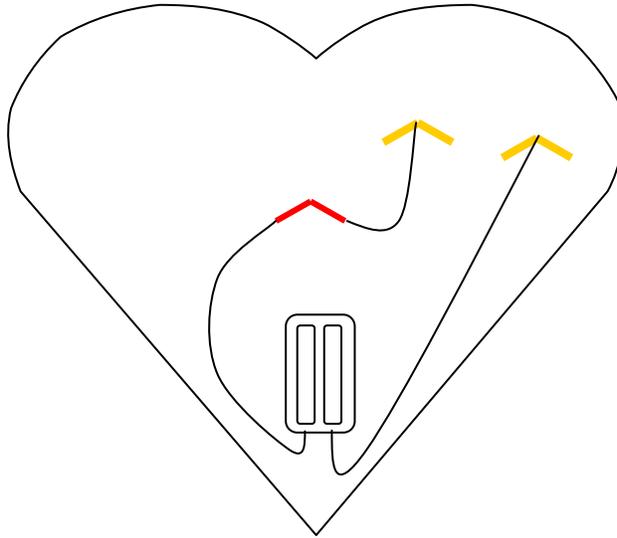
Step 3 (refer to diagram at right)

- A. Poke LED through center of heart.
- B. Thread the paper clip through one of the fasteners.
- C. Poke fasteners through upper right side of heart; they need to be about one paper clip apart so that the paperclip can touch the second fastener when it swings.



Step 4 (refer to diagram below)

- A. Attach the black battery pack wire to the short LED wire (to attach wires, simply twist them together).
- B. Attach one end of the cut (single) wire to the other LED wire.
- C. Attach the other end of the cut (single) wire to one of the fasteners.
- D. After twisting, fold the fastener's legs out to help hold things in place.
- E. Attach the red battery pack wire to the other fastener. Make sure that the two fasteners' legs don't touch.



Step 5

- A. Put your batteries in the battery pack – now you can test the circuit!
- B. Move the paper clip so that it connects the two fasteners.
- C. The LED should blink.
- D. Put electrical tape over all wire connections to prevent short circuits.

Troubleshooting Tips:

- Make sure all connections are tight.
- Make sure batteries are in battery pack correctly.
- Make sure correct LED leg is hooked up to correct battery wire.
- Make sure batteries are good.

Step 6

- A. Look at the pictures of pacemakers on the next page to see some of the different shapes and styles they come in.
- B. You could also do some research to find out more about them.

Step 7 (Optional)

- A. Design a container to shape and hold your battery pack so that it looks like a pacemaker connected to the heart. For example, cover it with foam and paper and decorate it.

A Few of the Many Shapes and Styles of Pacemakers:



2. Static and the Body

Materials (per girl):

Styrofoam Plate (9" diameter)

Disposable Aluminum Pie Pan (9" diameter)

Cardboard Square (approximately 10" by 10")

Plastic Film Canister (ask for extras from nearest photo store)

Styrofoam Cup

Aluminum Foil

2" Nail

Tape (any type)

Water

Main Focus:

You can make and store electricity in order to give off sparks and shocks.

Activity Background:

You will be building a static electricity generator, or maker (called an "electrophorus"), and a static electricity storage container (called a "Leyden Jar") to simulate, or model, how electricity moves through the body.

Build:

Step 1 - Electrophorus (refer to diagram below)

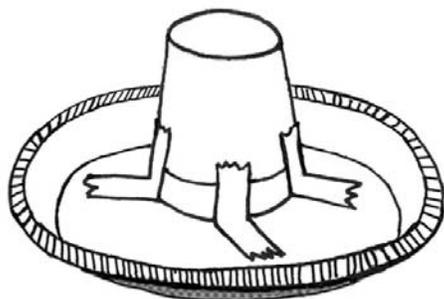
- A. Fold aluminum foil around cardboard to cover one side of cardboard. Tape foil in place on bottom of cardboard square with four small pieces of tape.
- B. Put the styrofoam plate upside down on the side of the cardboard that is completely covered with foil. Use four small pieces of tape to hold it in place.



- C. Rub the plate with your hair or fuzzy/wool clothing to generate an electrical charge. You can tell you have done it right if you feel or see your arm hair stand up when you hold the plate above your arm.

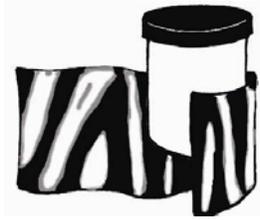
Step 2 - Transfer Plate (refer to diagram below)

- A. Tape the styrofoam cup upside down in the middle of the aluminum pie pan.
- B. The cup will be the handle for your transfer plate.



Step 3 - Leyden Jar (refer to diagrams at right)

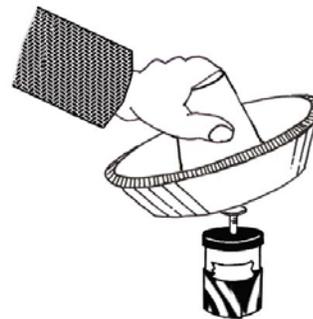
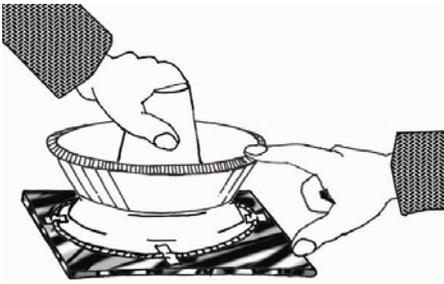
- A. Wrap an aluminum foil strip around the film canister.
- B. Make sure the top edge of the aluminum foil is only halfway up the film canister. Use one small piece of tape to hold the foil in place.
- C. Fold over and crimp the extra foil to cover the bottom (bottom must be completely covered with aluminum foil).
- D. Poke the nail into the top of the film canister and push it most, but not all, of the way down.
- E. Fill the inside with water a little higher than the aluminum foil.



Step 4 - Charge Your Leyden Jar (refer to diagrams below)

- A. Rub your plate with your hair again (remember, to generate a large charge, use your hair or fuzzy/wool clothing).
- B. Using the cup as a handle, put the pie pan on the plate.
- C. Touch your finger to the pie pan and your thumb to the foil base.
- D. Take your fingers off the pie pan and foil base.
- E. Using the cup as a handle, touch the pie pan to the nail in your Leyden Jar.

Repeat steps B-E about 10 times.



Step 5 - Use Your Leyden Jar (refer to diagram below)

- A. Hold the foil covered part of the jar in one hand.
- B. Touch the nail with your other hand.
- C. Try the experiments on the next page.



Experiment 1

Shock yourself with the Leyden Jar. Compare it to a shock made by rubbing your feet on the floor. Compare it to what you think a shock to restart a heart (700 Volts) would feel like.

Experiment 2

Become a neuron. Everything in the world contains positive (+) and negative (–) charges. When you are rubbing your plate, you are separating the charges and moving the (–) charges around. The cells of the body separate charges as well. In a cell in your body, the (+) charges are on the outside and the (–) charges are on the inside. Messages are transmitted, or sent out, by the cell walls opening and the (+) charges meeting the (–) charges. This causes a chain reaction that kicks the (–) charges out to the next cell in line. The (–) charges move from cell to cell this way all the way down to where the message is going. Simulate, or model, this using your Leyden Jars.

Ways to do it:

(Stand in a line)

- Touch jar to arm of person next to you.
- Touch jars to each other down the line.
- Can you come up with another way?

Experiment 3

Find out how quickly the body moves messages. For instance, find out how fast a shock can travel through a body:

- Charge your Leyden Jar. Hold one hand of a partner.
- Hold your Leyden Jar in your other hand.
- Have your partner touch the top of the Leyden Jar.
- Did the shock move fast or slow?

For other experiments and more background information, visit <http://www.thebakken.org/electricity/franklin-kite.html>



3. Bead Neuron

Materials (per girl):

Beads (65 per neuron; larger beads are easier for girls to work with)
String (approximately 3 feet; ensure beads can be easily strung onto it)
Needle for Stringing the Beads
Scissors
Optional: Tag Board, Writing Utensil(s), Tape or Glue, Key Ring

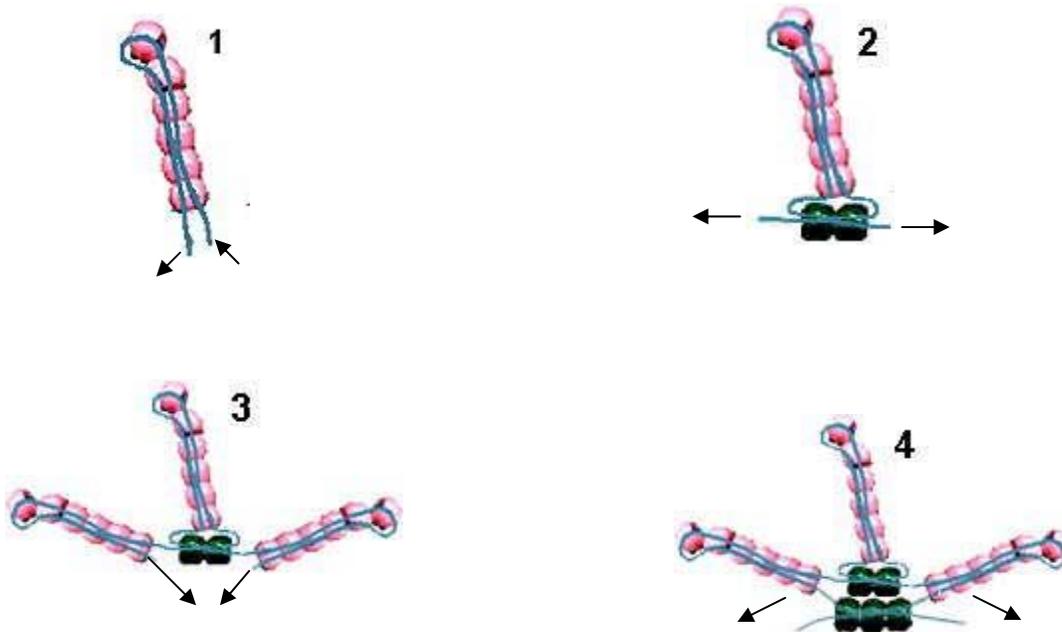
Main Focus:

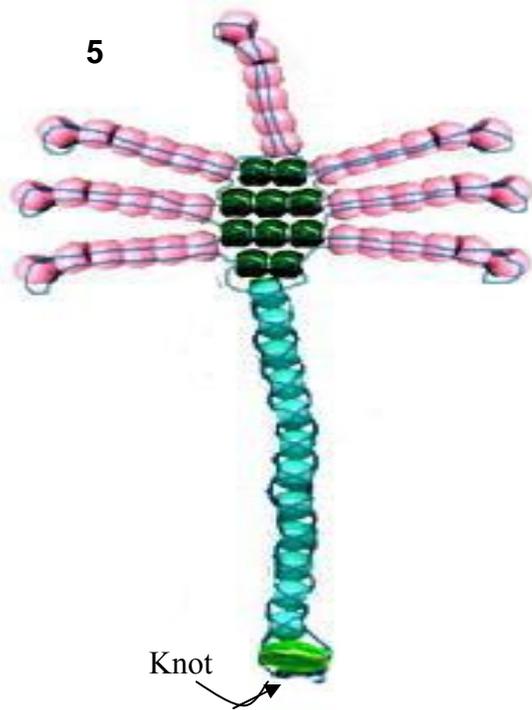
What are the parts of a neuron?

Activity Background:

The body uses nerve cells, or “neurons,” to send messages from the brain to the muscles and back again. Messages enter the neuron as a chemical signal through the “dendrites.” The cell body processes the messages and converts, or changes, them into electrical messages. These messages are passed through the “axon.” At the end of the axon (the “synaptic terminal”), the signal is changed back into a chemical message and passed to the nearby dendrites of other nerve cells. The process continues in this way until the message is delivered to a muscle.

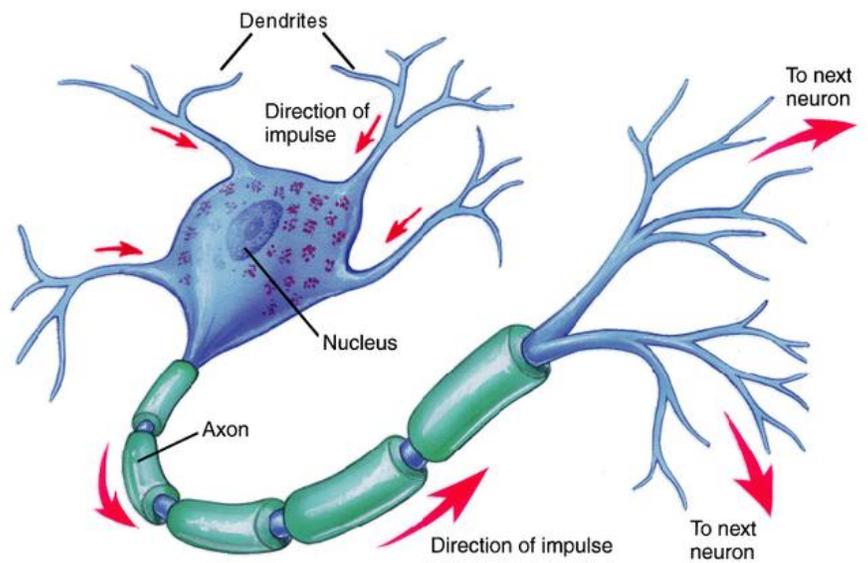
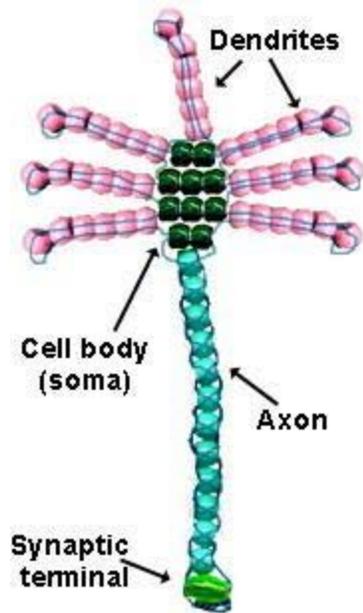
Build:





Optional Activity:

Label and display your nerve cell. Tape or glue your Bead Neuron to a piece of tag board and label each part as follows (a diagram of a real neuron is included, too); find a place to display it:



Optional Activity:

Attach a key ring to your Bead Neuron and carry it with you to share what you've learned with others.

4. Getting the Nerve to Act

Materials (per group):

Pictures of Scientists/Doctors (from books, the Internet, etc.)

Pictures of Nerves and Neurons (pp. 10-11)

Random Objects

Optional: Camera or Videocamera

Main Focus:

What does a nerve cell look like?

Activity Background:

Neurons are the cells that make up the nervous system. They are found in the brain, the spinal cord, and all nerves. Neurons use electrical impulses to pass signals through the body.

Activities:

1. Become a Picture

Instructions for Leader:

- A. Put girls into groups of three or four.
- B. Give each group a picture of doctors or scientists at work.
- C. Have the girls recreate the picture in a “tableau” (frozen picture).
- D. Have the other groups guess which picture the chosen group is recreating.
- E. Alternatively, have the girls invent their own tableaux of a scientist/doctor at work. You may want to have them brainstorm a list of scientists/doctors and places that they work before they create their tableaux. Remember, the tableaux are the girls acting a scene out but frozen into position at one moment in time, like a snapshot. Have other groups guess what the scientist/doctor is doing/studying.

2. Become a Picture Again

Instructions for Leader:

- A. Pass out the more abstract pictures of nerves and neurons.
- B. Have the girls act these pictures out.
- C. Again, have the other groups try to guess what they are looking at.
- D. Tell them what the pictures are at the end of the activity.

3. Now Learn the Nervous System

Instructions for Leader:

- A. Explain how the body uses electricity to communicate. The brain sends an electrical signal, which is passed from one neuron to the next down the spinal column and into the nerves of whatever part of the body needs to move.
- B. Hand out some random objects to each group (spoons, odd junk, hats, whatever you have around).
- C. Have the groups act out how the nervous system works using the objects.

Optional Activity:

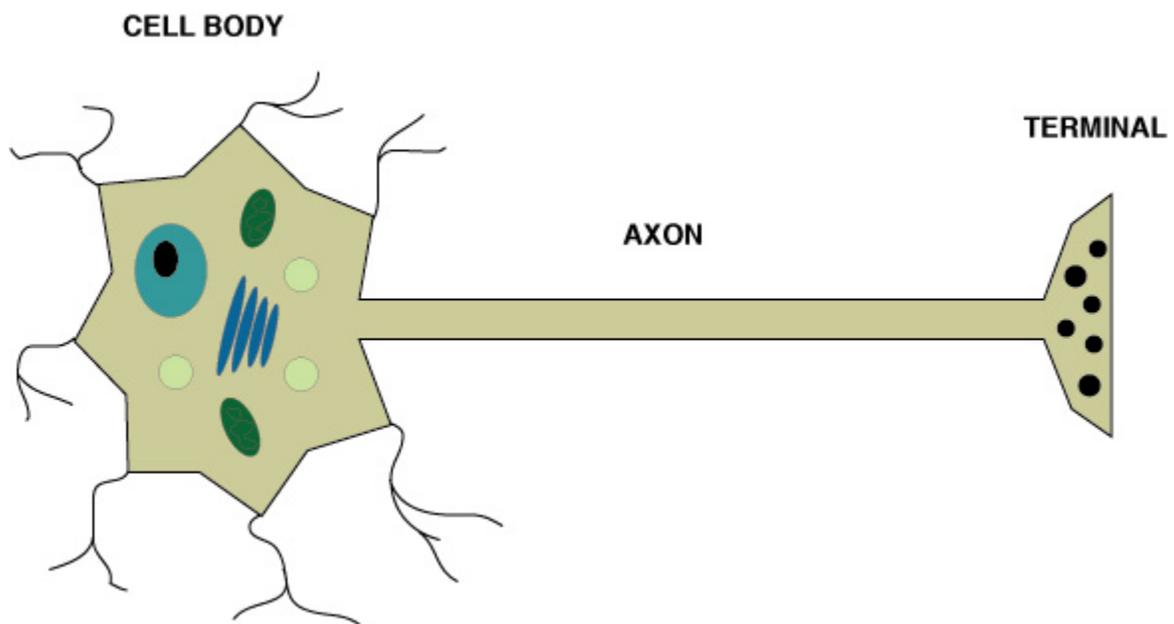
As a whole group or in small groups, research how the nervous system works and present the system in a skit.

Optional Activity:

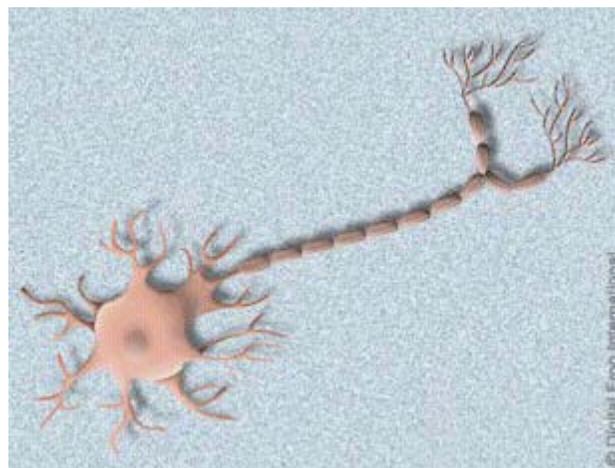
Photograph or videotape the groups doing the various tableaux and skits in this requirement.

Pictures of Nerves and Neurons:

1. Nerve Cell



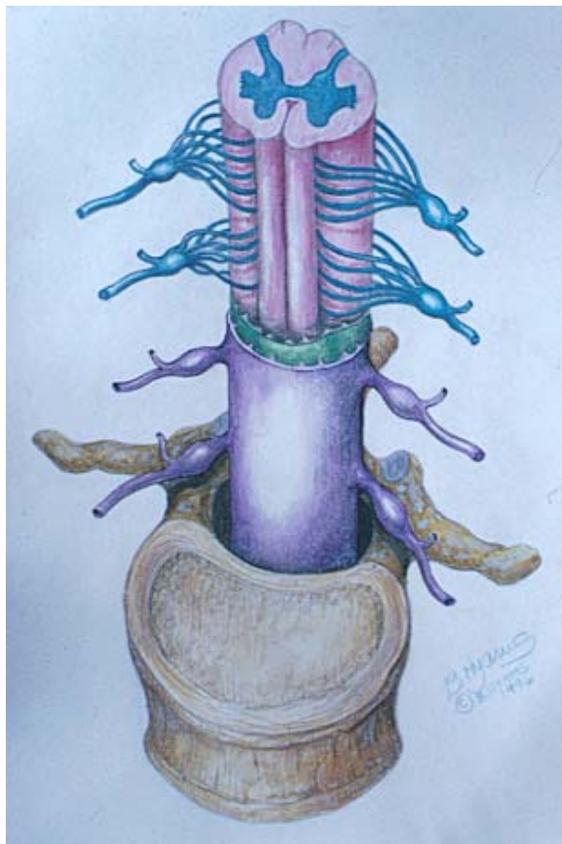
2. Nerve Cell with Less Detail



3. Nerve Cells Connecting to Each Other



4. Spinal Cord Cross Section



5. Static Frog

Materials (per girl):

Frog Model (copy or trace the model on p. 13)

Paper Towel Tube

String (approximately 2"; any type)

Aluminum Foil Strip

Scissors

Pencil

Thumb Tack

Masking Tape

Glue Stick

Tissue Paper

Cardboard Square (approximately 4" x 4")

Balloon**

**Before using latex balloons, ensure that none of the girls has a latex allergy. Any balloon or anything plastic is an "insulator" and provides a good charge and will work, so if you need an alternative to latex, use another type of balloon, or a beach ball or other plastic toy.

Main Focus:

Electric shocks make muscles contract, or grow smaller. This contraction is what makes your arms and legs move, for example.

Activity Background:

About 200 years ago Luigi Galvani, an Italian scientist, was experimenting on frog muscles. It was known at that time that muscles moved if tapped with a hammer. Galvani discovered that muscles shocked by electricity also moved. This experiment (which we will recreate using fake frogs with aluminum foil nerves) led to a deeper understanding of how electricity in the body works and, indirectly, to the invention of the battery. Today electricity is often used to stimulate muscles for physical therapy.

Build:

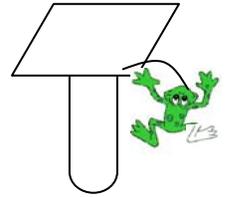
Step 1 - Prepare the Frog (refer to diagram below)

- A. Cut out the frog.
- B. Trace one of the frog's legs onto tissue paper.
- C. Cut out the traced leg.
- D. Cut off the frog's leg from the paper frog (leave some thigh to attach the tissue paper leg).
- E. Glue a piece of tinfoil to the tissue paper leg (this will represent the nerve).
- F. Attach the tissue paper leg to the frog using a thumb tack. The tack will be a pivot point, which will allow the leg to kick (you may want to put a bit of foam or tape on the back of the tack so you don't stick yourself by accident).



Step 2 - Prepare the Stand (refer to diagram at right)

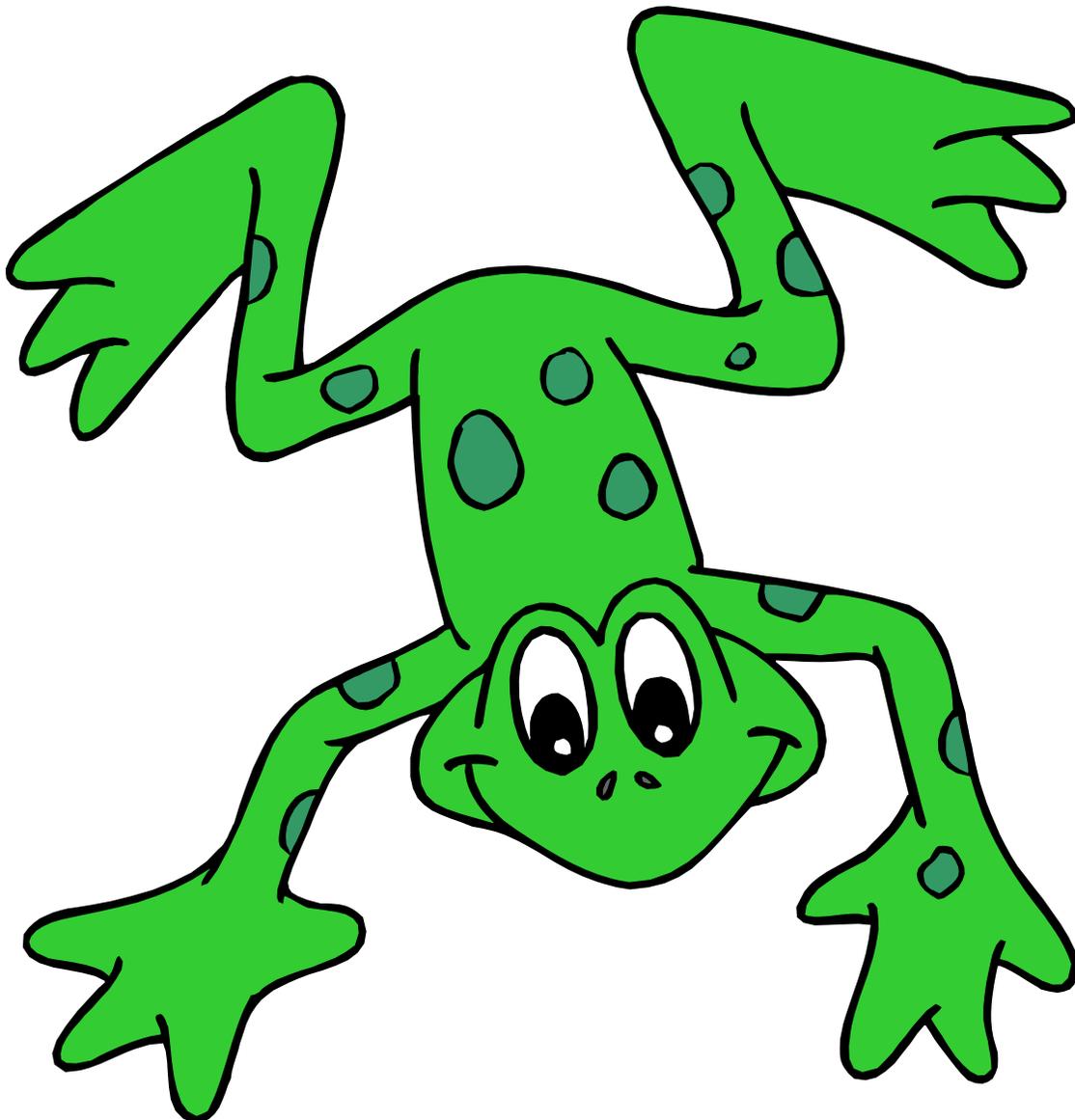
- A. Attach the paper towel tube to the square of cardboard with tape, so that it looks like a tree (with the tube as the trunk and the cardboard as the tree top).
- B. Tape one end of the string to the frog's head.
- C. Tape the remaining end of the string to the cardboard square on top of the paper towel tube so the frog is hanging in the air.



Step 3 - The Experiment

- A. Blow up the balloon.
- B. Rub the balloon on your hair to generate static electricity.
- C. Touch the balloon to the nerve of the frog (the aluminum foil).
- D. Does the frog jump?

Frog Model to Cut Out:



6. Make a Mechanical Robot Arm (How Muscles Work)

Materials (per girl):

2 Notched Craft Sticks	Brass Paper Fastener
Small Puff Ball (or crumpled piece of paper for a ball)	Scissors
2 Rubber Bands (any size/type)	Drill (1/16" bit)
Hand Model (copy or trace the model below)	Bowl

Main Focus:

Electricity in your body makes your muscles contract and relax like rubber bands.

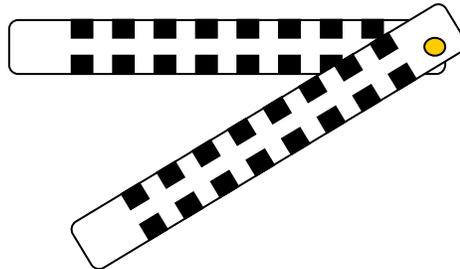
Activity Background:

The muscles in the body are stimulated, or moved, by electrical impulses, but how do they move? You will be designing a robot arm with craft sticks as bones and rubber bands as muscles. How can you hook the muscles up to make the arm throw the ball the farthest? Check the picture of how actual arm muscles work (refer to diagram below) to find out how your version compares.

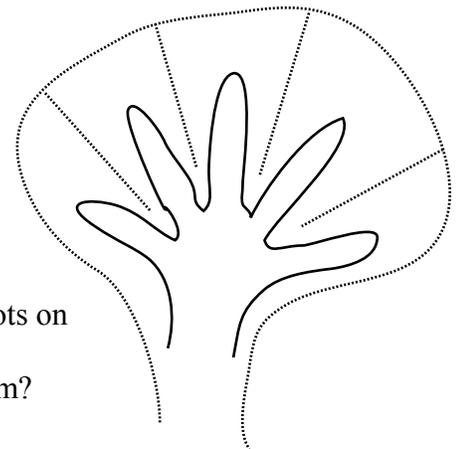
Build:

Build a Robot Arm

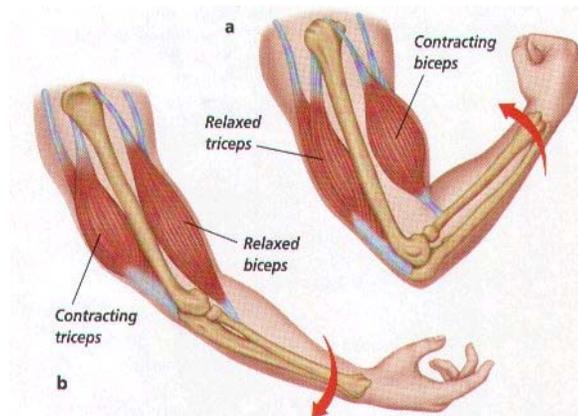
- Make a hole in the top of the craft sticks with the drill (1/16" bit).
- Attach the two craft sticks with the fastener (refer to diagram below). Now the bones are connected.



Hand Model to Cut Out:



- Cut out the hand.
- Tape the hand onto the end of the arm.
- Bend the hand into a cup shape so it can hold a ball.
- Experiment by hooking the rubber band muscles onto different spots on the arm.
- How does where they are hooked affect the motion of the robot arm?
- Try to use your robot arm to throw the ball into a bowl.



7. Biomedical Career Exploration

Materials (per girl):

Writing Utensil
Paper

Main Focus:

Women are active in biomedical fields.

Activity:

Interview a woman scientist involved in the biomedical field. For example: engineer, electrophysiologist, doctor, medical technician, etc. Find out why she chose her career, what she had to do to become a scientist, and what she does in her work. What other questions can you think of to ask her?

Write up the interview and present the information to your troop/group or someone you know.

8. Sudden Cardiac Arrest Report

Materials (per girl):

Writing Utensil
Paper
Sign Materials (i.e., tag board, markers)

Main Focus:

What is Sudden Cardiac Arrest?

Activity:

Research Sudden Cardiac Arrest. Use at least three different sources of information. Find out:

- A. What is Sudden Cardiac Arrest?
- B. How is it related to electricity in the heart?
- C. What can be done about it?
- D. What is the “chain of survival?”

Write a paragraph answering these questions, and add anything else that you found that you felt was interesting and important. Then, make a sign illustrating the chain of survival for Sudden Cardiac Arrest and present it to your troop/group or someone you know.



9. Visit The Bakken Museum

Materials (per group):

Program Bulletin

Signed Parent/Guardian Permission Form for Each Girl

Main Focus:

Learn more about electricity and the human body.

Activity:

Explore the museum's exhibits, especially those on electricity and the human body. After your visit, discuss what you learned with each other, and share it with someone you know.

Note to Adults: Here are three options for girls to do this activity:

- A. Register for and attend a "Bakken Museum Wizard Workshop" River Valleys Council Event; for details and how to register, refer to www.girlscoutsrv.org.
- B. Register for and attend an "Electric Heart Tour" River Valleys Council Event; for details and how to register, refer to the www.girlscoutsrv.org.
- C. Visit the museum during regular museum hours and explore the exhibits on your own (check www.thebakken.org or call 612-926-3878 for current hours and directions). Girl Scouts receive a discount on museum admission (mention the Girl Scout rate when paying).

10. Spread the "Electric" Word

Materials:

For You to Determine

Main Focus:

Serve the community.

Activity:

Create and do a community service project, or volunteer for something, related to the theme of this badge. Here are just a few ideas to get you started:

- Teach younger Girl Scouts what you've learned about electricity and the human body.
- Volunteer for the American Heart Association or a similar organization.
- Start a campaign to encourage others to get certified in CPR and/or Automatic External Defibrillator (AED) use.
- Make a poster or display for your school, library or other community building showing women in biomedical careers.
- Research what people can do through nutrition, exercise, stress management, etc. to have a healthy heart; educate others about what you learned.
- Encourage your school, place of worship, health club, etc. to purchase an AED for their building.

**I'M ELECTRIC!
JUNIOR GIRL SCOUT BADGE
GIRL EVALUATION**

Troop/Group # _____ or Girl Scout Juliette Age _____

What did you like best about this badge? _____

What did you like least about this badge? _____

Were any parts of this badge too hard? Yes No

If yes, which part(s)? _____

What new things did you learn about electricity? _____

Name at least one way that your body is electric. _____

Now that you've done this badge, are you *more* or *less* likely to want to try other science activities in the future?
And, why?

How fun was this badge?



Awesome



Good



OK



Not So Good



Awful

**Thank you for doing this evaluation and returning it to
your leader/parent/guardian (to forward to the
Brooklyn Center Service Center) when you are done with the badge!**

**5601 BROOKLYN BOULEVARD
BROOKLYN CENTER, MN 55429
FAX: 763-535-7524**



Girl Scouts of Minnesota and Wisconsin River Valleys

**I'M ELECTRIC
JUNIOR GIRL SCOUT BADGE
ADULT EVALUATION**

Troop/Group # _____ (if applicable) Service Unit _____

of Girls who participated _____ Age(s) of Girls who participated _____

When did the girl(s) do this badge? _____

How did the girl(s) do this badge (i.e., number of activities completed, setting/format, etc.)? _____

Please comment on how user-friendly you found this badge. _____

What was the most satisfying part of this badge for you? _____

For the girl(s)? _____

What was the most challenging part of this badge for you? _____

For the girl(s)? _____

What did you observe the girls learning through doing this badge? _____

Other Comments _____

Thank you for completing this evaluation and returning it to the Brooklyn Center Service Center with the girl evaluation(s) upon completion of the badge.

**5601 Brooklyn Boulevard
Brooklyn Center, MN 55429
Fax: 763-535-7524**