Building Structurally Correct Animal Models

ANIMAL SCIENCE ANYWHERE

Skill Level:
- Intermediate to Advanced

Life Skills:
- Critical thinking and decision-making

Setting:
- An indoor room with a large desk that allows objects to rest on it and easily be seen; seating is recommended.

Time:
- 20-30 minutes

Materials:
- ❑ A set of building block materials (such as Legos or similar type of building blocks) for each team of participants
- ❑ Small weights (such as flat rocks) to test strength of models
- ❑ Flat, level tables for display and construction
- ❑ Large copies of image examples of cattle (consider laminating images)*:
  - 1 bow-legged, or pigeon-toed animal (Figure 1)
  - 1 cow-hocked animal (Figure 2)
  - 1 frail-boned animal (Figure 3)
  - 1 heavy-boned animal (Figure 4)
  - 1 ideally structured animal (Figure 5)
  - *Special note: If you are not studying beef cattle, consider finding different images to match the animal species you choose to discuss.
- ❑ Markers
- ❑ Flipchart paper or other large paper
- ❑ Easel or other display space
- ❑ Masking tape
- ❑ Clock or stopwatch

Overview:

The *Importance of Structural Correctness in Livestock – Building Structurally Correct Animal Models* lesson is designed to emphasize the significance in understanding the value of livestock with proper structure. This lesson provides a hands-on component to help increase awareness about this crucial topic. Using building blocks, participants work in teams to create structurally correct animal models. As a group, participants will discuss why they think structural integrity is important and then draw comparisons between the building block demonstrations and their favorite species.

Objectives:

After completing this activity, participants will be able to:
- Describe the major points of emphasis in structural correctness.
- Demonstrate why structural integrity is important.
- Discuss the benefits of raising livestock with a good structural foundation.
- Recognize the value and importance of structure.

PROCEDURE:

Before the meeting:

1. Review the lesson and gather any supplies you will need.
2. Print as large a copy of each handout (figures 1, 2, 3, 4 and 5) as you can. (Note: If you don't have access to a copier that can enlarge the images, you could use a computer or projector to increase the image size so you can trace it onto larger paper. You may want to laminate the images so you can use them repeatedly.)
3. Assemble supplies for each team including building blocks and small weights.
4. Recruit an adult or older teen volunteer to act as the structural correctness tester. Work with that person to identify a smooth, consistent method of adding weights to the teams' models so that all of them are tested in the same way.

During the meeting:

1. Introduce the activity by reading aloud or paraphrasing the following:

   Today we're going to make models of livestock animals to display and compare. We will look at some of the common faults/unsound traits often found in various species. This will help us think about why structural correctness is so important in making sure our livestock can thrive in the production environments.

We will draw comparisons using building blocks to replicate how some of these animals may be put together and reveal the danger in common faults.

2. If there are participants with less knowledge regarding animal structure, consider reading aloud or paraphrasing the following:

   Animals, like people, are all built differently. However, we all use similar behaviors to accomplish the same basic goals to stay healthy and support us for growth, reproduction and anything else we do in our daily lives. We are going to talk about how the differences in structural correctness play a role in an animal's daily life, using building blocks to demonstrate its importance. It is important to note that when we discuss correctness, we are looking for the ideal. An animal can still be sound, that is, travel with enough ease to perform its daily activities off the front and rear legs, but may not be fully ideal in regard to its skeletal angles.

3. Next, ask the participants the following questions and discuss their responses. (You may want to record their answers on flipchart paper and display the paper where everyone can see it. You may want to give participants a moment to write down their answers first before opening up the discussion. This will give quiet members a chance to think before they speak.)
   - What is structural soundness? *(It is a function of the animal's skeleton and the ability for the animal to walk around correctly.)*
   - Why do you think it is important for animals to be structurally sound and correct in their angles? *(There are no specific answers. Allow them to begin expressing thoughts and to continue to give examples of good and bad cases, including more details as the discussion proceeds. If they haven't already, make sure to place emphasis on the correct placement and angles of joints and the value of having enough circumference of bone. Stress that the stride of the animal should appear long and fluid.)*

4. Next, introduce the image examples (possibly laminated) by reading aloud or paraphrasing the following:

   ***Now we that we have talked about structure, let's identify and visualize some examples across various species.* (Reminder: Any species can have any of the displayed cases, not just what's affiliated with the picture example.)**

   Hold up each image individually and have participants guess what structure each example depicts until they answer correctly. After they guess correctly, use the information describing each figure given in the following bullets to talk more about each structure type. Discuss how the structure might affect the animals' ability to move and longevity. Consider having the participants walk with their toes pointed in or out, or on tiptoes and notice how that changes their ability to move. Show the ideally structured animal image (Figure 5) last have participants ponder how each animal species would look in an ideal scenario.

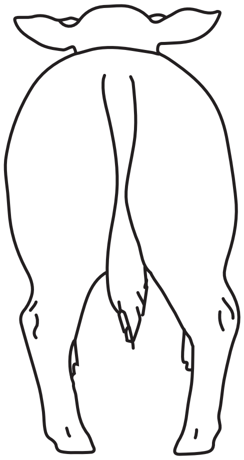

Figure 1:
bow-legged, or pigeon-toed animal

Figure 2:
cow-hocked animal

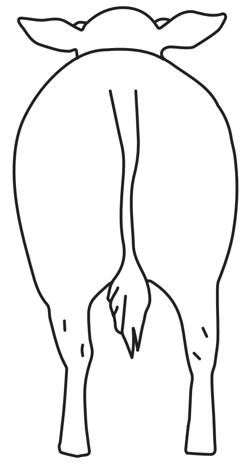

Figure 3:
frail-boned animal

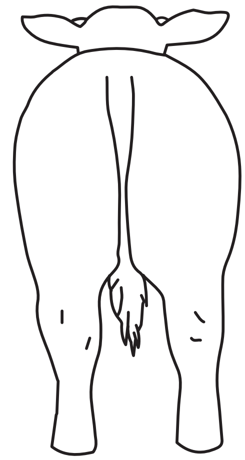

Figure 4:
heavy-boned animal

- **Figure 1: bow-legged, or pigeon-toed animal –** The terms *bow-legged* and *pigeon-toed* mean the same thing. In this case, the knee (when viewed from the front) or hock is set too far out of the alignment of the body and therefore the toes point inward. An animal with this fault may begin to show signs of lameness and an inability to easily navigate in its environment. This problem may persist and worsen with age and weight gain.
- **Figure 2: cow-hocked animal –** When viewing the animal from behind, the hocks are turned inward forming the appearance of a bowtie without the exterior edges. This causes the toes to point outward and in extreme cases, the hocks even potentially touch. An animal with this fault will have alignment issues and potentially more difficulties navigating its pen and accessing resources. This fault may also make the animal more susceptible to injury, especially with natural breeding. If looking at the animal from the side, the incorrect curvature would be called sickle-hocked. Most animals having this alignment issue are both cow- and sickle-hocked.
- **Figure 3: frail-boned animal –** An animal that looks unproportioned will most likely be considered frail boned, a negative trait. This condition may increase the likelihood of injury or lameness and potentially prevent the animal from reaching market weight or successfully reproducing. One analogy that best describes extremely frail-boned animals is that they appear to be walking around on toothpicks.
- **Figure 4: heavy-boned animal –** A large circumference of bone (large diameter) is a positive trait as it is an indicator of durability. This condition lessens the chance of injury or lameness in any setting.
- **Figure 5: ideally structured animal –** An animal with ideal structure and bone development will be more likely to be efficient in its growth pattern and have more longevity within the operation.

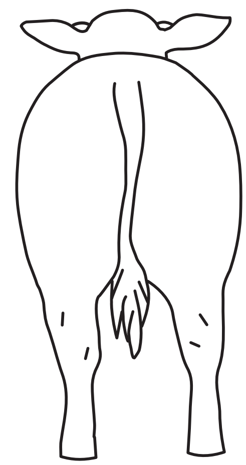

Figure 5:
ideally structured animal

5. Now ask for the participants to move into teams. (Select the size of the teams based on the amount of blocks and materials you have available.) Have the teams spread out around the room, and ask one person from each team to collect supplies.

6. Read aloud or paraphrase the following:

   You'll have 5 minutes to work together in your group. Use the time to think of and build an animal structure with the idea of creating the soundest, most structurally correct model using only the building materials you picked up from the supply station. You can alter (break or split apart) the supplies however you would like as you build your model. Use as many of the supplies as you can. We will test your models to see how they function by placing weights on them.

7. Walk around the room as the teams work, answering any questions they may have. At the 3-minute point, warn the teams that if they're still planning, it's time to switch to building.

8. After 5 minutes or before if the teams seem to have finished their creations, call time and tell the teams to stop working. When the participants have returned their attention to the whole group, ask for one volunteer from each team to answer the following:

   - What does your team's design have to do with animal structure?
   - Why did your team choose this particular design?

9. Continue having team volunteers share until all of the teams have participated. If time and space allow, have the participants walk around the work space to look closely at the models created by other teams.

10. Read or paraphrase the following:

    Some teams may have used different strategies to construct their models, building what they feel will be the soundest, most structurally correct model. In the real world, some animals might be structured a little differently than others, but may still be considered sound and functional if they are able to move with ease (in a relaxed way) and can easily perform all daily functions. If all animals were built the same, there would be no variation in genetics, allowing little opportunity for a species to progress and change. A lack of variation can be limiting. As long as structural correctness is a priority, some differences in style are accepted and may be beneficial.

    Now it's time to test the structural integrity of your models.

11. Next, bring out the small weights. Select one volunteer to be the person who consistently adds the weights to the model so that it is done in a consistent manner. (If it is a larger group, consider having two stations and volunteers to add weights.) Read or paraphrase the following:

    I'm going to ask each team to bring its model to the front and place it on this table. We will have one volunteer stack weights one by one on top of the model until it can't hold anymore, or until it breaks. He or she should remember to place the items on the models in the same order each time. (Call each team up one at a time and have the volunteer stack the weights. Remember to congratulate each team on its attempt.)

12. Ask each group: Are there any concerns of having too solid of a structure? (Examples: Animals that are post legged have sound structures just like houses, which can't move. Animals need to have flexibility to move around their pens. They need to be able to lie down and get back up easily.)

13. Read aloud or paraphrase the following:

    The structures that you built were very sound and structurally correct. One additional item to consider is that although we want animals to have a square and solid structure, they also need to be able to move easily and be able to lie down and then stand back up. Having this flexibility is important for animal health and physical well-being. If an animal is too square and solidly designed where they have no angle to their structural design, they are called post legged. A post-legged animal has joints too straight or stiff, restricting movement. More post-legged animals become unsound than those having other structural challenges.

14. Reiterate the importance of sound, structurally correct livestock by reading or paraphrasing the following:

    As you can tell, some of the structures you built are sounder and more correct than the others are. They can withhold more weight and stress than the other structures. The importance of having sound, structurally correct structures carries over to the animal industry as well. Each team wanted its structure to last the longest and withstand the most weight and stress. We want the same for our livestock. We want our livestock to be made to last and continue to perform profitably.

    A sound, structurally correct animal is more likely to excel in its daily life functions as compared to an unsound animal. As a result, it has the potential to be more efficient and profitable as a production animal. It also should prosper in a reproduction setting with increased longevity.

TALKING IT OVER:

Ask the group the following questions.

- What types of issues can arise if an animal is not structurally correct such as a cow-hocked, bow-legged (pigeon-toed) or frail-boned animal? *(Many issues can arise from an unsound animal, but some common issues are frequent lameness, poor breeding success rates and even difficulty reaching food and water.)*
- What are the advantages of using structurally correct animals in a breeding program? *(A farm that uses structurally correct animals in its breeding program will be more likely to have sounder animals in the herd that will last longer and require less treatment to be maintained.)*
- Why is it important to know what a structurally correct animal should look like? *(It is important to be able to detect a structurally correct animal so you can tell the difference between a structurally sound, correct animal and an unsound animal. You'll be able to detect when an animal may be injured and need treatment, or if that is its natural design. Additionally, it is important when evaluating which animals should be kept as replacements for the breeding herd.)*
- After seeing how your model held up as compared to the designs of other groups, how would you build your model differently?
- What was the most challenging part of this activity?

ADAPTATIONS & EXTENSIONS:

- Use the Internet to bring up videos of sound, structurally correct animals and structurally unsound animals so participants can recognize differences. This allows them to see a real-life scenario and learn how structure plays a role in an animal's daily life.
- Bring in two live animals of the same species and have participants compare their structures. Allow participants to see (and feel if needed), the structural differences. Then have participants work as a team to describe how they would change each animal to improve its structure.
- Use the Ohio State University *Learning Lab Kits (http://www.ohio4h.org/books-and-resources/learning-lab-kits)* to look at additional structural images for each species.
- If your group includes a mix of ages and experience levels, have the older or more experienced members group together with the younger or less experienced participants to create mentoring conversations and discussions.

For Older or More Experienced Participants:

Look at one dam and several possible sires – actual animals or animals in photos. Have participants discuss the advantages of how the offspring may appear based on its parents. Talk about which is the best sire to improve future offspring.

For Younger or Less Experienced Participants:

- Have each team construct a building or simpler structure to understand the concept of stability. (The participants can be creative with the building blocks and come up with their own design. Then have participants record why their model is strong rather than testing each team's creation.)
- Gather extra building block materials in order to build a sample set for the participants to observe.
- Make copies of the included images and laminate them. Purchase dry-erase makers and have participants draw the angles of the bones on the images to reinforce structural correctness.

ALIGNMENT TO SCIENCE AND ENGINEERING PRACTICES

How does 4-H increase science literacy?

4-H has a long-standing reputation of engaging youth in experiential, inquiry, hands-on activities. These activities enhance formal (public school) science education through their alignment to the eight Science and Engineering Practices identified by the National Research Council on page 42 in their report *A Framework for K-12 Science Education* (*http://www.nap.edu/catalog/13165/a-framework-for-k-12-science-education-practices-crosscutting-concepts*). Alignment to the practices was determined by Tracy D'Augustino, Michigan State University Extension educator.

Alignment to the National Research Council Science and Engineering Practices

	Science & Engineering Practice	Action	Activity Step Number
1.	Asking questions and defining problems	Youth brainstorms structural correctness and its importance. Youth discuss images of structurally correct and unsound livestock.	(3) (4)
2.	Developing and using models	Youth explain how their design (model) connects to animal structures. Youth discuss the limits of their models – lack of flexibility of blocks.	(8) (10 & 12)
3.	Planning and carrying out investigations	Youth plan, build and test structures.	(6-9)
4.	Analyzing and interpreting data	Youth look at and discuss images of structurally correct and unsound livestock.	(4)
5.	Using mathematics and computational thinking	If testing data is recorded and/or graphed for use in discussions	(11)
6.	Constructing explanations and designing solutions	Youth explain why they chose their design.	(8)
7.	Engaging in argument from evidence	Youth discuss the structural correctness based on their tests and the provided information.	(12)
8.	Obtaining, evaluating, and communicating information	Youth test structures and discuss features and limits of the designs – flexibility.	(12 & 13)

REFERENCES & RESOURCES:

National Research Council. (2012). *A framework for K-12 science education: Practices, crosscutting concepts, and core ideas.* Washington, DC: National Academies Press.

Ohio State University. (2015). *Learning lab kits*. Columbus: Ohio State University, OSU Extension. Retrieved from ohio4h.org/books-and-resources/learning-lab-kits

ACKNOWLEDGMENTS:

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Figure 1

Figure 2

Figure 3

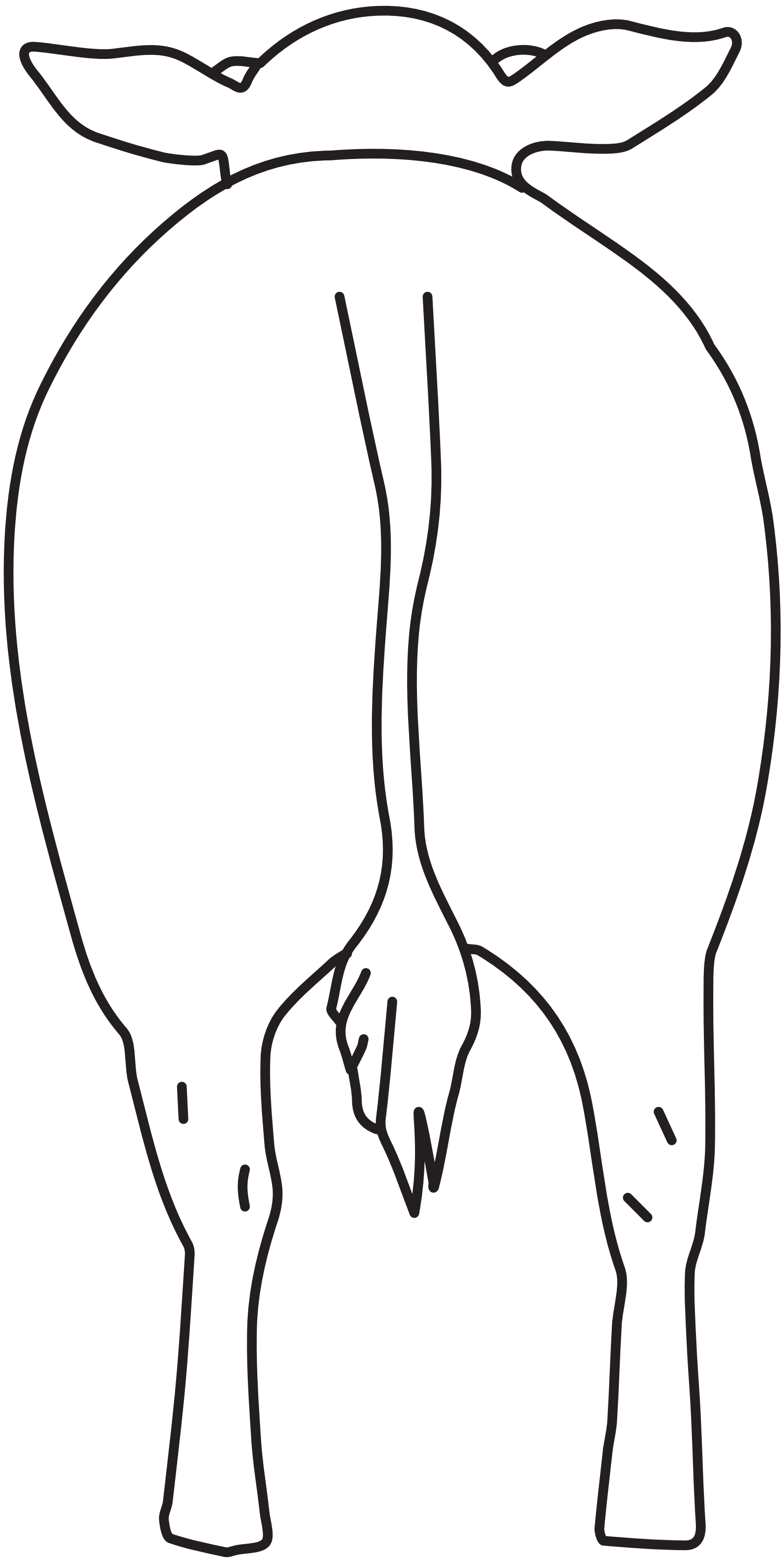

Figure 4

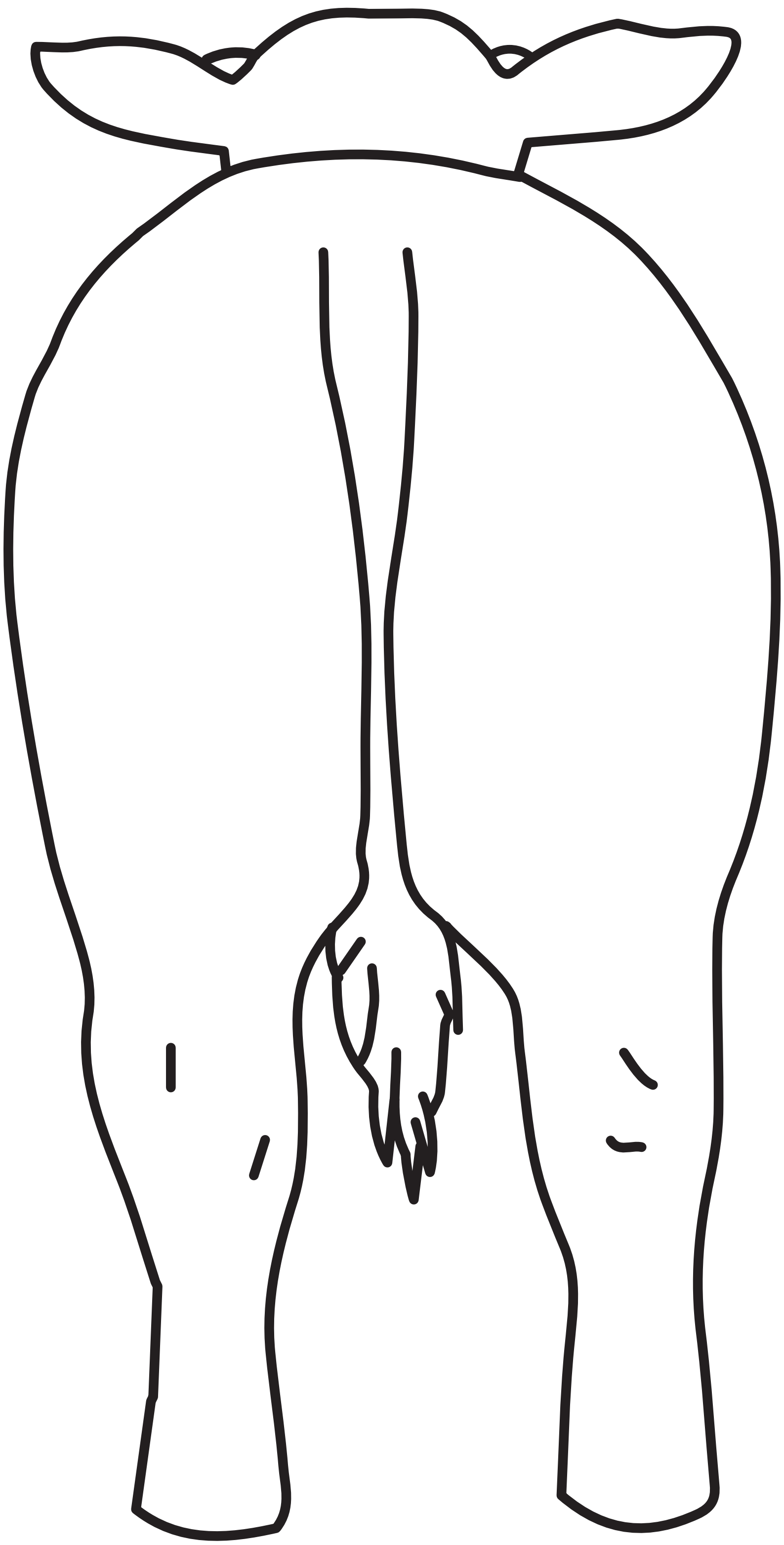

Figure 5