

2006

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Recommended Citation

Girup, Kyle and Klein, Mike (2006) "Winging It: Exploring Form and Function using Chicken Wings," *Iowa Science Teachers Journal*: Vol. 33 : No. 3 , Article 3.

Available at: <https://scholarworks.uni.edu/istj/vol33/iss3/3>

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WINGING IT



Exploring Form and Function using Chicken Wings

By Kyle Girup & Michael Klein

ABSTRACT: This article presents a modification of a “cookbook” laboratory activity addressing the structure and function of a chicken wing. While the original activity was interesting, it did most all the thinking for students. The problem solving, creativity, and cooperative learning demanded in the modified activity requires students to think deeply about what they are doing and the relationship between structure and function. In doing so, students develop a better understanding of this important concept and the nature of scientific work. *This activity promotes National Science Education Content Standards A and C and Iowa Teaching Standards 1, 2, 3, 5, 6, and 7.*

Introduction

The relationship between structure and function is an important scientific concept in many disciplines. Pollen dispersed from wind-pollinated plants is relatively small and can be easily carried by the wind; the functions of proteins and catalysts are determined by their molecular shape. The National Science Education Standards label 'form and function' one of its unifying concepts, calling it an “integrative [scheme] that can bring together students' many experiences in science education across grades K-12” (NRC, 1996).

In teaching science, the form of an activity is significantly related to its function in promoting deep cognitive thinking. The structure of an activity may be such that students merely need to follow directions, or its structure may promote the function of engaging students' minds in wrestling with investigating a natural phenomena, collecting data, and the scientific concepts that make sense of those experiences and information. Moreover, if we want students to understand how scientists work and think, they must be placed in positions to work and think like scientists. This activity encourages students to practice a number of skills associated with inquiring, like posing questions, designing and implementing investigations, collecting and making sense of data, and communicating ideas (NRC, 1996).

common dissection activities, like the one we modified, simply tell students how to cut and what to observe. Questions posed at the end primarily ask for responses about vocabulary presented, and can often be answered from information given in the procedure. The original activity we modified asked only one question about form and function. Students can easily perceive this mindless approach to dissection as a seek-and-slash experience. Some students enjoy these experiences, while others find them upsetting and may opt out of dissection. In both cases, little if any meaningful value comes from such experiences with dissection.

The Modified Activity

The first part of the modified activity is designed to stimulate curiosity and mental engagement before the actual dissection begins. Students that are mentally and physically engaged are more apt to learn from classroom activities. The first portion of the modified activity ensures that students enter the dissection phase having already thought about form and function. And having speculated on the structure of the chicken wing interior, they are more motivated and mentally engaged as they move onto part two of the modified activity. This provides students focus during the dissection and motivates them to consider the questions posed by instructor as well as those questions they develop.

DAY 1: Safety is paramount when working in the laboratory, and necessary precautions must be discussed before distributing any chicken wings (Figure 1). Students must wear gloves whenever they touch the chicken or anything that the chicken or fluids have contacted. To prevent salmonella or other microorganism from being carried throughout the school, pencils and worksheets should be distributed and collected before the students leave. When they are done, they must wash their materials, lab-stations, and hands. These are standard safety precautions, but in our modified activity we have students think about these safety rules by having them convey in writing the rationale for each expectation. This not only mentally engages students, but teachers now have evidence that students have noted and understand the safety procedures.

FIGURE 1

Laboratory Safety Requirements

Uncooked chicken carries the risk of Salmonella poisoning, a condition that can severe illness. The following safety rules must be followed:

- » Wear provided gloves.
- » Keep the chicken wing and tools in the provided dissecting pan.
- » Do not touch any part of your face with your gloves.
- » When done with the activity, wash your hands and table with antibacterial soap.
- » One member of your group is to have control of the dissecting tools, and only one of you may be cutting at a time.

Before beginning the activity, work with students to help them understand the rationale for each of these rules.

Students are not initially informed that they will dissect the chicken wing. Rather, they are given their chicken wings and asked a series of initial questions to initiate their observation of the wing. However, the procedures and questions appearing in the modified activity are simply a beginning point to mentally engage students. Teacher interactions are of crucial importance during this activity. While students are working, the teacher should walk around the room observing what students are doing, and listening to what they are saying. Stopping at appropriate times to ask a question that draws students' attention to certain peculiarities of the chicken wing will make this observation period a tool for inquiry for further investigation during the lab. Examples of such questions include, "Why are there bumps on the skin?", "What is the purpose of the 'meat'?", and "How does the muscle move the bones?". Asking questions rather than simply telling students what to look for or to do is crucial. When teachers simply tell students what to do, compliant students will do what they are told, but often do not understand the rationale or importance of what they are being told. Such teacher directions can kill curiosity and turn the activity from an investigation to one of following directions.

When students have developed this deep understanding, the accepted scientific vocabulary can be introduced. Nobel Laureate Richard Feynman (1966) once noted that knowing the name of something tells you what people decided to call that thing, but it rarely tells you anything about the thing being named. Introducing vocabulary before students understand what is being named diverts their attention from understanding the phenomena to using vocabulary. This can lead to a discussion on the nature of science regarding how scientific vocabulary is developed, the role it plays, and how vocabulary comes to be accepted.

At this point in the activity, have students share their drawings, observations, and predictions. As students provide their predictions, ask them to provide a rationale for their speculations. As the discussion winds down, ask students how they can determine the accuracy of their predictions. Rather than being told to dissect the chicken wing, students see the purpose and merit of digging deeper, much like scientists inquiring into an aspect of the natural world. You will find that some students who originally might have resisted dissection, are now motivated to see the inside of the wing and compare it to what they predicted. This nature of science point is referenced in one of the conclusion questions at the end of the activity.

Day 2: Chicken wings are, compared to common organisms for dissection, inexpensive, and this provides an opportunity for students to investigate dissection procedures without the fear of ruining the learning experience. Questions should be posed on how to cut the skin so that the internal structures aren't destroyed. For instance, "How should we cut the skin so that we don't ruin the structures beneath?" and "How will we know if we have cut too deep?" Students should implement their ideas and share with each other what worked and what didn't. If a student cuts through the muscles or other important structures, a new wing can be provided. This experience is extremely valuable for understanding appropriate dissection techniques that you may then apply to future dissections.

As this activity proceeds, students use the provided worksheet and questions posed by the teacher to further investigate the form and function of the items they see in the chicken wing. The instructor guides students to look for evidence of their initial observations in what they see in the physical wing, and for new items and tissues. The interaction of the instructor is essential during this activity to promote deep mental engagement and desired learning. For example, if students are not writing down their observations, the teacher could ask "How will you remember your ideas and observations to share with the class?" Effective questions are also essential for drawing students' attention to important aspects of the wing anatomy. For instance, drawing attention to muscle attachment and the difference between muscles and tendons, demands questions like:

- » Where do the muscles attach to the bone?
- » How does where they attach determine the movement of the wing?
- » What are some differences between the muscle and the tissue where the muscle attaches to the bone?

Such questions make students wrestle with the content and this helps them forge the link between form and function. Students will need to think about such questions, so wait-time I and II is essential. Also crucial are using encouraging non-verbals, and effectively playing off students' responses.

The concluding questions in Figure 2 ask students to apply what they have learned during this activity to their own anatomy. These concluding questions are mentally engaging since, unlike the original activity, the information is not given away in the procedure. Instead, students are observed moving their arms and comparing it to the movement of the chicken wing. The mental engagement is easy to see, and students enjoy trying to figure out how their structures are the same and different than a chicken's wing. The teacher's role here includes reminding the students to consider those similarities and differences in terms of structure and function. Rather than copying and regurgitating information, students are earnestly thinking about form and function.

Conclusion

Through this lab activity, students use inquiry skills to come to an understanding of form and function. An instructor who prepares for this activity by thinking through effective questioning and interaction strategies, like the examples provided in this article, will be in a much better position to facilitate a meaningful learning experience for students. Laboratory experiences for students are often much too rigid, and this discourages curiosity and inquiry that are important for developing a deep understanding of science concepts. Understanding students' prior conceptions and experiences with lab topics, effective teacher behaviors and interaction patterns, and promoting further inquiry are all important features that will enhance student understanding of form and function in this activity. This exercise will provide a lasting experience that students can revisit every time they eat chicken and maybe even share what they have learned with their family.

FIGURE 2

Part One: Observing the Exterior of the Chicken Wing

Equipment: Dissecting Tray, Gloves, and Blunt Probe

1. Observe the outside of your chicken wing and record your observations.
2. Move and manipulate your chicken wing and take notes on interesting findings.
3. Investigate the cut end of your chicken wing. What items do you find interesting or surprising about the chicken wing?
4. After making observations of the outside of the wing, speculate what the inside of the wing contains and make a drawing. Label each distinct body part and write a short description of its function.

Part Two: Investigating the Interior of the Chicken Wing

Equipment: Dissecting Tray, Gloves, Blunt Probe, and Dissecting Scissors

1. Make a set of observations as you peel back the skin. Record the new structures you see.
2. How does the inside of this chicken wing compare to "Cooked" chicken wings you may be accustomed to seeing?
3. What different categories of tissue do you observe in the chicken wing? After categorizing them, write a description explaining what makes that category different than the others.
4. Investigate and describe the function of each of your tissue categories. Decide on an appropriate name for each tissue group.
5. What side of the chicken body did the wing come from? How did you determine this?
6. Compare parts of the chicken wing to parts of the human arm. If you could see the inside of a human arm, what would be similar? What would be different?
7. What tissues could you determine the function of from previous experiences with chickens or anatomy subjects?
8. In what ways did this lab more accurately reflect how scientists work? In what ways did it not reflect how scientists work?

References

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