# Phenomenal Video: Entomology Animated

**Instructor Background**: In this animation, artist Eric Keller, brings to life the biomechanics and chemistry of the fire ant sting. The animation is rich in science and valuable for science instruction. In this activity our main goal is to show students the many ways to engage in scientific thinking and join the science community. First, students will explore the structure and function of the fire ant. Second, students will explore the role of 3D animation within the study of fire ants. Art, particularly 3D animation in this case, is a powerful way to explore and reveal complex processes in biology, evolution, and ecology.

**Learning Sequence:**

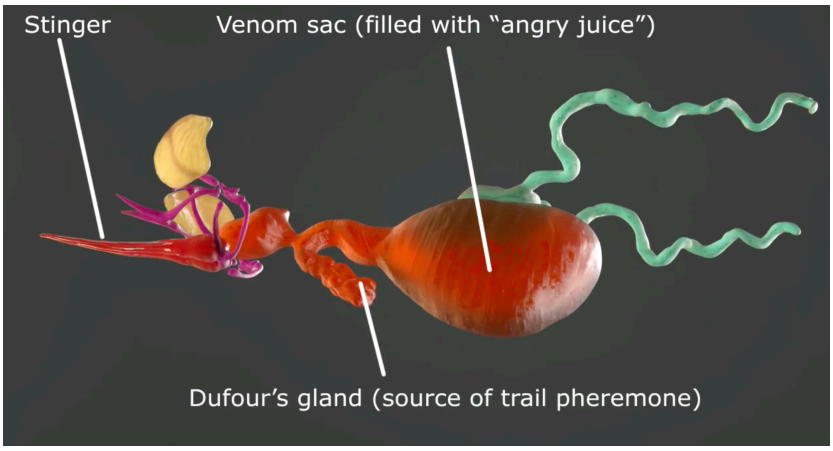
**Part 1: Structure and Function**

1. Think-Pair-Share: Ask students to brainstorm individually what they already think they know about fire ants and what they want to know about fire ants. Maybe cue them to think about ants in general, photos could help too. Next, Students discuss this with a partner and share with the whole class in a way visible to all. (Note: After watching the animation once or twice, students can revisit the list and see if anything they mentioned was confirmed, corrected or clarified.)

2. Prediction Questions: Have students write or draw their answers to the following questions prior to watching the animation. These questions will be revisited after watching the animation.
    - What might be the benefit of being able to both bite and sting? (Example student response: having two weapons to use.)
    - How/when might ants use their biting ability? How/when might ants use their stinging ability? How/when might ants use their bite and sting at the same time?
    - Make a quick sketch of what you think an envenomation system might look like (draw how the venom leaves the ants body). While you sketch consider…
        - What parts or components might be in the system?
        - Where does the venom come from and how does it get into the victim? (Example student response: might draw a needle attached to a bag of venom or might draw the venom coming from the mandibles where the ants bite)

3. First Viewing: Show students the animation Fire Ant Venom by Eric Keller. While students watch, ask them to consider how this compares to their sketch.

4. Small group discussion: Pull a frame (such as the one below) as a visual for your students. Have students discuss in small groups the following: Are you surprised at how detailed this venom anatomy is? What does it make you think about biochemical versus anatomical traits? (Instructor note: Be prepared to provide definitions to support student thinking.) During their group discussion all students (or a group note taker) should record responses with brief supporting sentences.




5. Small Group Share Out: Have students share their thoughts with the whole class.

**Part 2: The Role of Animation**

6. Connection Activity: Emphasize that this cool job, 3D animation and visual effects, can help us think about the role of fire ants in the ecosystem. Ask students, how does it help you or others to see what's happening rather than just reading a description or even seeing a still graphic? Revisit the prediction questions, again emphasizing how the animation helps us understand the fire ant better:
    - What would be the benefit of being able to bite and sting? (Answer: The bite allows them hold on to their target so they can insert the stinger and then keep it in place.)
    - Compare your sketch of the envenomation system to the actual system the ant uses, how is it similar/different? What surprised you? Name one similarity and one difference.

7. Second Viewing: In this viewing, students can dig deeper into the scientific processes at play. Keep in mind the following questions while viewing and have students answer/discuss them after watching the animation a second time. Instructor Note: The animation can be used to open up a conversation about the different levels of organization and how they are interconnected. The adaptation the fire ants have to their environment is to deliver a toxin to prey (to kill for food/energy) or an enemy (as a defense.) Specific cells support the secretion, storage and delivery of this venom and these cells, organized as tissues and organs, support the function of storing and delivering venom to the prey or enemy.

- What microscopic or invisible processes is Eric bringing to life? How does this increase your understanding of fire ant anatomy, physiology, and behavior in the context of the ecosystem?
    - Student prompt: How does the animation increase your understanding of the relationship between the genetics, chemistry, and anatomy of the fire ants and its venom? (Leveled option: How did the animation help you learn how the ant's body helps it make venom?)
    - Student prompt: Based on your understanding of the fire ant behavior from the animation, how would you describe its role in the ecosystem? How might the fire ant impact its environment and other living things? (Leveled option: Who does the fire ant help in its habitat? Who does the fire ant hurt in its environment?)
- Instructor Note: Encourage your students to perform additional research about the fire ant's role in its ecosystem. Is it a predator? a scavenger? a forager? a competitor? Scientists do know that fire ants are an invasive species - competing with native species by voraciously consuming other insects and all of the food sources. How might the adaptations observed from the animation influence their functional niche?

8. Why do you think we are trying to understand organisms at all these scales? (chemical, cellular, organismal, ecological). Note: The key idea is to see that an ecological adaptation effects an organism at the molecular genetic level, cellular level, and at the level of gross anatomy all in concert, each depending upon and enabling the others.

9. Extension: Watch the Bombardier Beetle Chemistry animation from Eric Keller. How does the defenses of the bombardier beetle compare to the fire ant? How does Eric connect the chemical, cellular, organismal and ecosystem scales together through his animation?