**How Do Insects Survive the Winter?**

1. **ENGAGE your curiosity**: Watch [How Do Insects Survive the Winter?](https://www.youtube.com/watch?v=JSEQvyjACyA). Answer the following questions.
2. Can insects regulate their own body temperatures?
3. What three options do insects have when confronted with freezing temperatures?
4. What kinds of insects migrate to escape winter?
5. What kinds of insects “hunker down and wait for things to warm up again”?
6. What is **diapause**?
7. What happens to the insects during diapause?
8. How do insects like crickets, grasshoppers, and praying mantises contend with winter?
9. How is climate change affecting the overwintering strategies of some insects? Are they all worse off now that Earth’s climate is heating up overall? Explain.
10. **EXPLAIN the following ideas:** *Do some research to define the following terms:*

Chill Coma:

Chill Coma Recovery Time:

Diapause (how does it differ from Chill Coma?)

1. **EXPLORE a scientist’s thinking**: Read/highlight/annotate the following Research Background; answer the questions at the end. Be ready to discuss and ask questions in class.

***Research Background****:*

Walking across a snowy field or mountain, you might not notice many living things. But if you dig into the snow, you’ll find a lot of life!

Until recently, climate change scientists thought warming in winter would be good for most species. Warmer winters would mean that species could avoid the cold and would not need to deal with freezing temperatures as often or for as long. Dr. Caroline Williams is a scientist who is thinking about winter climate change in a whole new way. Snow covers the soil, acting like an insulating blanket. Many species rely on the snow for protection from the winter’s cold. When temperatures climb in the winter, snow melts and leaves the soil uncovered for longer periods of time. This leads to the shocking pattern that warmer temperatures actually means the soil gets colder!

Caroline is interested in how species that rely on the snow will respond to climate change. She studies a species of insect called lady beetles. You might know them as “ladybugs” - however scientists prefer lady beetles because they reserve the word “bug” for a particular family of insects, with a long sucking mouthpart like a straw. Lady beetles are **ectotherms**, meaning their body temperature matches that of their environment. Because climate change is reducing the amount of snow in the lady beetle habitat, Caroline wanted to know how they would respond to these changes.

When soil temperatures drop below freezing (0℃), lady beetles go into a **chill coma**, or a temporary, reversible paralysis. When temperatures are below freezing, it is so cold that they are unable to move. When temperatures rise back above freezing, they wake from their chill comas. When lady beetles are in chill comas, they are easier for predators to catch because they can’t escape. They are also unable to find food or mates. Scientists can measure how fast it takes lady beetles to recover from chill coma, called **chill coma recovery time**, and use this as a measure of their performance.

Caroline thought that beetles that spend the winter in different geographical locations would show variation in the mean chill coma recovery time (CCRT) for each population. She and her team measured the CCRT for beetles from the states of Washington, Arizona, Northern California, and Southern California.

 **Predict and explain**:

1. Based on what you have learned, do you think there will be variation in the mean CCRT for populations of beetles from different geographic locations?
2. Explain and justify your prediction.