Table 1. Lesson sequence outline

Lesson	Duration of Lesson	Resources used during lesson	Question(s) we had	What we did	What we figured out
L1 Anchoring Phenomenon	2, 45-minute class periods	Student note taking sheet Army ant phenomena videos [slides 4–12] Teacher tool: initial modeling guide Chart paper and markers for each group		Watched videos of army ant miniature society Recorded observations and questions Modeled in groups of 2–3 initial ideas on chart paper Shared out models and brainstormed related phenomena	Army ants live and work together as a group Other organisms might do the same (related phenomena such as: birds, sharks, schools of fish, etc.)
L2 Discussion / Related Phenomenon Investigations	45 minutes	Student activity sheet	Why do ants exhibit these kinds of behaviors? Do other animals exhibit this kind of behavior?	Reading on penguins Video on bird migration Independent research on related phenomena of your choice	Working / living together as a group increases chances of survival of the group
L2 Putting pieces together			Can we use our initial model of group behavior to apply it to other groups?	Recording similarities and differences between ants and related organisms and sharing out as a class. Comparing those organisms to see if they would fit on our model of our army ants.	We can use key ideas from our model and apply those ideas to other groups to explain related phenomenon
L3 Discussion	45 minutes	Army ants and their guests videos [slides 22, 23 and 26]	Why would bird watchers look for army ants to find birds?	Discuss Watch ant bird video	Army ants have guests that live with them because they benefit from being near the ants somehow
L3 Discussion		Slide 24	What do you think would happen to the ant bird if the army ants went extinct?	Discussion	Ant birds are guests that rely on army ants for survival They would go extinct if army ants went extinct
L4 Discussion/ Related Phenomenon		Related phenomena relationships	Do we think ants are the only animals that have	Image of crocodile and bird	Bird eats food/cleans crocodile teeth

		[slides 28–33]	guests?	Image of army ant and guest mite Discussion	Other animals also have guests Beneficial to both
L5 Anchoring Phenomenon	45 minutes	Army ant and ant beetle videos [slides 36–42]	How does a beetle come to resemble an army ant over time?	Image of army ant and guest beetle (comparing, they look very similar) Video of guest beetle rubbing itself on the army ant Modeled initial ideas as to both why and how this could have happened	Army ants have guests (beetle) that look very similar to the ants Guest beetle rubs itself on the army ant to transfer scent We think this is to blend in for survival but are unsure how the change occured
L5 Discussion/ Related Phenomenon Investigations			What are other examples of a change in an organism over time?	Brainstorm related phenomenon	There are other animals we think have changed over time (different kinds of bears, foxes, humans, etc.)
L6 Investigations	45 minutes- chicken simulation 45 minutes- peppered moth simulation 2, 45-minute periods- beaks of finches	Related Phenomena: Peppered Moths Peppered moth simulation Student activity sheet - moth Student modeling	How does an organism change over time? How did the guest beetle come to look like the army ant?	Chicken Simulation Beaks of Finches Activity	Offspring have slight variations in traits compared to parents Depending on the environment, some moths were better at blending in than others. Traits of a population changed over time

		template - moth Teacher tool: notes Related Phenomena: Beaks of Finches Teacher tool: activity outline Student activity sheet - beaks of finches		Peppered Moth Simulation	depending on which traits were favorable in the environment Pressures of the environment dictate advantageous traits Food / competition can be environmental pressures as well as blending in
L6 Putting pieces together	2, 45-minute periods	Modeling template Final "gotta have/ explain" list	How can we revise our models to show how our thinking has changed?	Previous phenomenon from L5	We developed a model for how a species can change over time depending on the environmental pressures (natural selection)
L6 Putting pieces together		Slide 75	Can we use our model to explain other phenomenon?	Picture of guest mite mimicking ant larva	We can use the key ideas from our model to explain related phenomenon
Summative Unit Assessment	45 minutes	Assessment #1- Group Behavior & Natural Selection Rubric- Group behavior Rubric- Natural selection Assessment #2- Group Behavior & Natural Selection Additional Assessment Resources	Can we demonstrate what we have learned through a summative assessment?	Summative assessment	

Note: L= Lesson (e.g., L1, L2, . . .)

Disciplinary Core Ideas- DCI(s)

LS2:D Social interactions and Group behavior - Group behaviors are found in a diverse network of organisms. These species place specific focus on social affiliations, genetic relatedness, physical proximity and other recognition mechanisms. Group behavior has evolved over time due to the increased chance of survival. This reflects the common phrase "Safety in numbers". Groups can either be fluid or stable, and there are several factors that contribute to their success.

- ***By the end of grade 8.*** Groups may form because of genetic relatedness, physical proximity, or other recognition mechanisms (which may be species specific). They engage in a variety of signaling behaviors to maintain the group's integrity or to warn of threats. Groups often dissolve if they no longer function to meet individuals' needs, if dominant members lose their place, or if other key members are removed from the group through death, predation, or exclusion by other members.

- ***By the end of grade 12.*** Animals, including humans, having a strong drive for social affiliation with members of their own species and will suffer, behaviorally as well as psychologically, if reared in isolation, even if all of their physical needs are met. Some forms of affiliation arise from the bonds between offspring and parents. Other groups form among peers, Group behavior has evolved because membership can increase the chances of survival for individuals and their genetic relatives.

LS4:C Adaptation - Adaptation is the process by which an organism becomes fitted to its environment due to natural selection acting upon heritable variation. In a specific species, abiotic and biotic differences in ecosystems contribute to a change in the gene frequency over time, leading to adaptation in these populations.

- ***By the end of grade 8.*** Genetic variations among individuals in a population give some individuals an advantage in surviving and reproducing in their environment. This is known as natural selection. It leads to the predominance of certain traits in a population and the suppression of others. In artificial selection, humans have the capacity to influence certain characteristics of organisms by selective breeding. One can choose desired parental traits determined by genes, which are then passed onto offspring.
- ***By the end of grade 12.*** Natural selection occurs only if there is both (1) variation in the genetic information between organisms in a population and (2) variation in the expression of that genetic information—that is, trait variation—that leads to differences in performance among individuals. The traits that positively affect survival are more likely to be reproduced and thus are more common in the population.

Each of the bends uses different combinations of crosscutting concepts. These are listed below:	**Bend**	
	1	**2**
Cause and Effect: Empirical evidence is required to differentiate between cause and correlation and make claims about specific causes and effects.	Yes	Yes
Scientific Knowledge Assumes an Order and Consistency in Scientific Systems: Scientific knowledge is based on the assumption that natural laws operate today as they did in the past and they will continue to do so in the future.		Yes