**Table 1**. Lesson sequence outline

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| 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](https://docs.google.com/document/d/1kxVj39I40OT72voA4WTVYkIgSBR-4zvVaH_VrND1oks/edit)  [Army ant phenomena videos](https://docs.google.com/presentation/d/1FQzykWSN1h4rMsV7cgZKKNHaiW4CDeThWXVyrgW3Q3A/edit?usp=sharing) [slides 4–12]  [Teacher tool: initial modeling guide](https://drive.google.com/open?id=1a42gucxUCd2qIe0inWcFUpMOsAlRXT-z)  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](https://drive.google.com/open?id=1iMKYA_HPXle28puI0Z4jTdh2usHRj9Ioj6kRB1MWd5c) | 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](https://docs.google.com/presentation/d/1FQzykWSN1h4rMsV7cgZKKNHaiW4CDeThWXVyrgW3Q3A/edit?usp=sharing) [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](https://docs.google.com/presentation/d/1FQzykWSN1h4rMsV7cgZKKNHaiW4CDeThWXVyrgW3Q3A/edit?usp=sharing) [slides 28–33] | Do we think ants are the only animals that have guests? | Image of crocodile and bird  Image of army ant and guest mite  Discussion | Bird eats food/cleans crocodile teeth  Other animals also have guests  Beneficial to both |
| L5 Anchoring Phenomenon | 45 minutes | [Army ant and ant beetle videos](https://docs.google.com/presentation/d/1FQzykWSN1h4rMsV7cgZKKNHaiW4CDeThWXVyrgW3Q3A/edit?usp=sharing) [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](http://peppermoths.weebly.com/)  [Student activity sheet - moth](https://docs.google.com/document/d/1Gc7Zxijf9LQdFotpkIQP01LW77fnIn6vMmB27dif22s/edit?usp=sharing)  [Student modeling template - moth](https://docs.google.com/document/d/1V-wjAMyYd-taewoqd1WnXz9nHnwQAeb91fChO7xJkmQ/edit?usp=sharing)  [Teacher tool: notes](https://drive.google.com/open?id=1Z_m3wsjfGc0bNWrJKOLGgg60X86lX9RP)  Related Phenomena: Beaks of Finches  [Teacher tool: activity outline](https://docs.google.com/document/d/1-Aw2jbOZr6_kQjZVJzL_TMvQSmqs3MrwFzqwpJj8_44/edit?usp=sharing)  [Student activity sheet - beaks of finches](https://docs.google.com/document/d/1VfgzFW12Cp0u8BFEhzpjiliGiBtO-WRww0wBD2uxrHc/edit?usp=sharing) | 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    Peppered Moth Simulation | 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 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](https://drive.google.com/open?id=1o9bKNEZLO5SzPX5fpYgLiFM4xJStJPb2)  [Final “gotta have/ explain” list](https://drive.google.com/open?id=144PPcNjK7BXmPHtOrS9ZAnorI6LEQFv-) | 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](https://drive.google.com/open?id=1q3i6X9BmITZ5LZq-RUAoCfzBQp7S4HedcHSt5MyENxE)  [Rubric- Group behavior](https://drive.google.com/open?id=1Esvv5n6cDxG8UCn4yYMvOIBwHwdmt87LVkeJ2A_TE6E)  [Rubric- Natural selection](https://drive.google.com/open?id=1iE2GbKcHqiYSRx1hUH_ED7YG86RNVW2aJPbFX5CYi0M)  [Assessment #2- Group Behavior & Natural Selection](https://drive.google.com/open?id=1L1YUhnG7L1p_Irj19VtfNI7HWXACIvAiSt0sWwpJ2_I)  Additional Assessment Resources | Can we demonstrate what we have learned through a summative assessment? | Summative assessment |  |

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

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| 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. |

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| **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 |