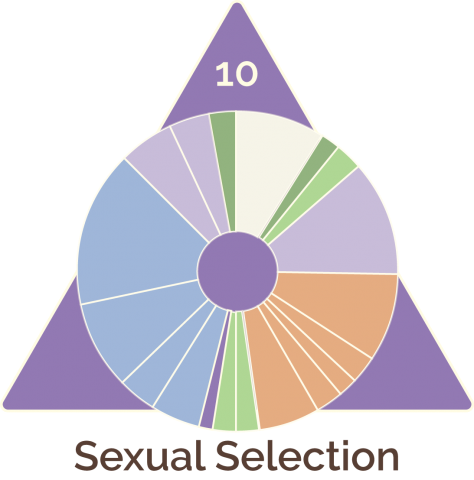
# Sexual Selection



## Summary:

We will reinforce the model of natural selection and expand it to include sexual selection. Through investigating the ring-necked pheasants students will learn that traits that might seem disadvantageous for an individual can actually be of an advantage when finding a mate and reproducing. Ultimately, what matters for a species to survive is reproductive success.

## Transition in:

In previous models we have learned about what an organism needs to survive, but is individual survival enough to ensure species survival? Looking back at our model of natural selection we are reminded that the continuation of a species is only possible if those who survive also mate and reproduce to pass their traits to offspring.

In this pass back through natural selection we go deeper into the idea of fitness. We pose the question: *Is fitness defined only by an organism’s ability to survive?* To motivate this discussion, we consider the phenomenon of the ring-necked pheasant. Male pheasants have bright coloring that makes them more visible to predators, thus less likely to survive in their environment. Students examine this surprising phenomenon and craft explanations that (hopefully!) reinforce the primacy of reproductive productivity in defining "fitness". Students develop and deepen the natural selection model to incorporate the idea that survival only drives population change when it leads to reproductive advantage.

In simple words, the coloration of the pheasants is an example of sexual selection, an advantage that certain individuals have over others of the same sex and species that exclusively relates to reproduction. Sexual selection drives the persistence of traits (physical or behavioral), sometimes even traits that are disadvantageous in terms of individual survival. The pheasant males are more susceptible to predation because of their coloration, however that coloration increases the probability that they will mate successfully so it persists in the population.

A short clip of the phenomena of Sexual Selection can be found in the PBS documentary: “[Why Sex?”](https://youtu.be/trtyH77Kopk?t=1053) Since we don’t want to feed answers to students show them only minutes 17:32-20:13. If the link doesn’t work, copy-paste: https://youtu.be/miiRmrZX3XM?t=1052

## Transition out:

Fitness is the ability to survive, find a mate and reproduce, and as an organism reproduces the more of its traits get passed to the next generation.

# Phenomenon:

Sexual dimorphism: differences in morphology between male and female individuals of the same species. These traits seem to be disadvantageous. We provide few examples but feel free to add others.

* Ring-necked pheasants males compared with dull colored females
* Extravagant and colorful tails in male peacocks
* Big horn size in Hercules beetles

# Questions:

How can we explain the presence of traits that clearly give the organism a disadvantage for survival?

# Model:

We are adding to our model of natural selection to be clear that:

* Differential survival is not enough to drive population change over time.
* Differential **reproductive success** is what matters.

# Learning segments a glance:

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| --- | --- | --- | --- | --- | --- |
|  | Model move | Est time  (min)\* | Overview | Resources\*\* | What we figured out |
| 1 | M | 10-15 | We come back to the model of natural selection and reinforce the concept of fitness by examining data from three variants of cave salamanders. | * SS 01 Sexual Selection Doodle sheet * SS 01 Cave salamanders | We reviewed natural selection and discussed fitness in more detail. |
| 2 | P->Q | 10-20 | We examine the phenomenon of sexual dimorphism across a number of species and go a bit more in depth on ring-necked pheasants. We generate questions to guide us going forward. | * SS 01 Sexual Selection Doodle sheet * SS 02 Ring-necked pheasant background information | We generated some questions about characteristics that would seem to put the organism at a disadvantage. |
| 3 | Q->M | 5-10 | We develop initial model ideas about why male pheasants have bright colors. | * SS 01 Sexual Selection Doodle sheet | We surfaced our initial ideas about the ring-necked pheasants. |
| 4 | P->M | 25-30 | We examine more information about the ring-necked pheasants, their closest relatives and their mating behaviors. We return to our model and revise and then come back to the cave salamander question. | * SS 04 Pheasants and their relatives reading * SS 04 Pheasants courtship and mating * SS 01 Sexual Selection Doodle sheet | We found out more about ring-necked pheasants and used that information to refine our model. |
| 5 | M->P | 20-30 | We read about another example of mating behavior and apply our model to make sense of it. | * SS 05 Survival of the sneakiest reading & questions | We applied our model to another species. |

\* Time is an estimate and will depend on your class. Take your time if needed.

\*\*Please visit the slides (PPT presentations) and modify them as you need.

# Learning segments:

### M –Review the model of natural selection and reinforce the concept of fitness.

*There are several examples that can be used here, this is just one.*

We begin by considering the case of the cave salamanders and ask groups to identify the variant of salamander that is the fittest according to a data table. We review the model ideas for natural selection and have a discussion about what fitness means. If you are using the doodle sheet, students can write their answers in section A. Don’t give away the correct answer. Bring this example back after the model revision and see if students revise their answer.

Estimated time: 10-15 min.

Resources:

* The case of cave salamander salamanders.
* Doodle Sheet

### P->Q –Present the phenomenon of sexual dimorphism in ring-necked pheasants and generate questions.

Present students with the phenomenon of sexual dimorphism without going into much detail. It is surprising that in some species males and females can look so different and the traits that differentiate them can be so elaborate and exaggerated. Why can this be? We provide few examples: horns in Hercules beetles, feathers in peacocks, and differential coloration in ring-necked pheasants –the phenomenon we will explore in more depth. In the short video clip provided the phenomenon is described very well.

Students will read about the ring-necked pheasants and on their own write down what they find surprising or are curious about –doodle section B. When done, students will share their notes first with their group and then with the whole class. Guide them towards a consensus driving-question, which will be recorded on the board or poster. You can find some examples of questions generated by students in the Student Work file.

Estimated time: 10-20 min.

Resources:

* Sexual dimorphism PPT
* PBS documentary: “[Why Sex?”](https://youtu.be/trtyH77Kopk?t=1053) Minutes: 17:32-20:13.
* Ring-necked pheasant reading.

### Q->M –Students develop initial model ideas about why male pheasants have bright colors.

Students individually will generate model ideas to why males have bright colors that put them at risk of predators. They will record their ideas on their doodle –section C, and then share them with their group. You can then have a whole class discussion. These initial model ideas are recorded on the board or poster with the driving question to make them visible to everybody.

Remember that this is a speculative process and all ideas should be considered as valid ones. In a later segment there will be opportunities for students to revise their ideas.

Estimated time: 5-10 min.

### P->M –Data analysis to add evidence to their model and model revision.

We provide two different data sets 1) Pheasants and their relatives, and 2) Pheasants courtship. Working in groups of four, each pair will analyze one data set, summarize their findings on their doodle sheet (section D) and then share it with the whole group. They will discuss the new evidence and refine the model.

Estimated time: 10-15 min.

Resources:

* Pheasants and their relatives handout
* Pheasant courtship handout

### P->M –Application of the model: Survival of the Sneakiest

Here is a great opportunity to asses student understanding. You can find sample of student answers and an key to the activity on the web.

Students read the comic strip Survival of the Sneakiest and answer the questions on the back of the reading. An alternative is to read the comic strip with the whole class together and assign roles to few students. You can then allow students to discuss the story in groups before individually writing down their answers. Hand out the questions after the discussion.

The story explains how sneaky crickets let the other males spend energy singing and while the female is looking for the singer the sneaky one steps in and mates with the female. This story is based on research by Robin Tinghitella at Denver University and is an example of evolution in action. Really cool research!

Estimated time: 20-30 min.

Resources:

* Survival of the sneakiest comic strip PPT
* Survival of the sneakiest (word document)