

Louisiana Believes

Distance Learning Support for inquiryHub Biology

Unit 1 Bend 2: Juncos - Why don't antibiotics work like they used to?

This resource is designed to support teachers in implementing distance learning for iHub Biology Unit 1 Bend 1. It is intended as a supporting document and should be used in conjunction with the [Inquiry Hub High School Biology Curriculum Resources](#). The resources contained in this document have been adapted from [inquiryHub Biology](#) with permission under [Creative Commons 4.0 licensing](#).

The Remote Learning Resources linked below contain detailed information about adapting specific routines to a remote learning environment and a wide variety of options including those for students who do not have internet access:

- [Fostering Productive Norms](#)
- [Anchor Phenomenon Routine](#)
- [Navigation Routine](#)
- [Supporting Discourse](#)
- [Problematizing Routine](#)

This guidance document is considered a “living” document as we believe that teachers and other educators will find ways to improve the document as they use it. Please send feedback to STEM@la.gov so that we may use your input when updating this guide.

Updated August 31, 2020



Norming Language	
Term	Description
Virtual Class Pre-Work	Assignments that students should do prior to virtual class meetings in order to be prepared to engage in discussions, there may be multiple assignments throughout a given lesson
Virtual Class Post-Work	Assignments designed for students to apply learning from virtual class meetings, there may be multiple assignments throughout a given lesson
Virtual Class	Live sessions with students through any digital conferencing platform, teachers may choose to allow students without internet to call in during these sessions and record virtual class sessions to share with those who cannot join. Sample Virtual Class Norms
Lesson Slideshows	Lesson progression specific to each lesson that can be shared with students in their entirety at the beginning of the lesson or broken into small portions and shared as needed. They will contain assignments for students to complete before, during, and after virtual classes, discussion boards, and home investigations. They are intended to replace the SAS documents from iHUB. These can be copied and delivered directly to students using google classroom or another platform, modified for use in your platform of choice, or printed and delivered to students without internet access.
Assignment	An assignment should be posted on a virtual platform (Google Classroom, Schoology) that can be accessed and edited by students. Assignments should have the option to “make a copy” for each student so that students can individually complete work and turn in that individual work to the teacher for review, feedback, and assessment.
Discussion Boards	Assignments designed for students to share ideas and engage in discussion with one another over time rather than a live environment. Students should use documents from individual work to plan their public discussion. Usually students will post some original comments into a group discussion and respond to a specified number of others. Ensure that norms are established for appropriate posting behavior, just like you would set norms for your classroom discussion. Teachers may choose to allow students without internet access to text in responses and may screenshot/download and share portions of or full discussions via text (ex. through apps like Remind)
Home Investigations	Investigations with readily available materials designed for students to perform at home; teachers may choose to substitute videos or photos of data collection for students who cannot complete investigations at home

Unit 1 Bend 2	
Resources Students Will Need	Additional Materials for Students Without Internet Access
<p>Lesson Slideshows/documents for each lesson:</p> <p>Lesson 14, Lesson 15, Lesson 16, Lesson 17, Lesson 18, Lesson 19, Lesson 20, Lesson 21, Lesson 22, Lesson 23, Lesson 24, Lesson 25, Lesson 26, Lesson 27 Lesson A Slideshow, Lesson B Slideshow (optional), Lesson 28, Lesson 29, Unit Assessment</p> <p>Additional Documents:</p> <p>Incremental Modeling Tracker (IMT) or IMTv2, L14 SEET, L15 SEET, L16 SEET, L19 SEET, L20SEET, L23 SEET, L24 SEET, L24 Survey Form,</p>	<p>Prior to Lesson: (videos and documents) *Print Copies of All Slideshows and SEETs*</p> <p>Incremental Modeling Tracker (IMT) or IMTv2</p> <ul style="list-style-type: none"> ● Lesson 15: Juncos Video #1 --whole story, Juncos Video #2 --short clip ● Lesson 18: FID Raw Data, Methods Document ● Lesson 19: Bee Article, Baboon Article ● Lesson 20: Readings for prework ● Lesson 21: Prework Reading ● Lesson 22: Student Work Evidence Table and Essay, Lesson 14 slides 12-15 ● Lesson 23: Lesson 23 Data Packet ● Lesson 25: Junco Diversification Video (also used in L27) ● Lesson 26: Lesson 26 Reading ● Lesson 28: Lesson 28 Student Reading #1, Lesson 28 Student Reading #2 , Lesson 28 Home Learning: Mass Extinction Event <p>After Lesson Completion:</p> <p>Virtual Class recordings (<i>Teacher should record Virtual Class Meetings and share with absent students or those who do not have home internet.</i>)</p>
<p>Students should ideally join VIRTUAL CLASS for the following lessons:</p> <p>14, 15, 16 (2 sessions), 17, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29</p> <p><i>Could be altered for discussion board if virtual class time is limited: 16, 21, 22, 27</i></p>	

Formative and Summative Assessment Opportunities:

All Slides where students fill in answers and notes can be used for formative assessment. These are to be turned in to the teacher. Feedback can be delivered through comments and work revised if needed.

All Discussions (whether live or on a board) can be used for formative assessment

IMTs updates - check for understanding

SEETs - focus quiz type assessments

Lesson 22 - summative assessment

[Unit Assessment using iHUB documents and rubric](#) (delivery via your assignment platform)

Lesson List

[Lesson 14](#)

[Lesson 15](#)

[Lesson 16](#)

[Lesson 17](#)

[Lesson 18](#)

[Lesson 19](#)

[Lesson 20](#)

[Lesson 21](#)

[Lesson 22](#)

[Lesson 23](#)

[Lesson 24](#)

[Lesson 25](#)

[Lesson 26](#)

[Lesson 27](#)

[Lesson 28](#)

[Lesson 29](#)

[Unit Assessment - Deliver your choice of iHub docs with your platform](#)

Lesson 14 - Which aspects of our natural selection model apply to other organisms?

In this **Lesson**, students will need the following materials to appropriately engage in learning:

- [Lesson 14 Slideshow](#)
- Driving Question Board Question Assignment - *teacher made*
- [L14 SEET](#)

In this **Lesson**, students who don't have home internet need the following print-outs or files to best engage in learning:

- [Lesson 14 Slideshow](#)
- Virtual Class recording - *after completion of virtual class, or prepare a video to support students in completing the slides independently*
- Printed copy of [L14 SEET](#)

Lesson 14 - Which aspects of our natural selection model apply to other organisms?

Lesson Components	Distance Learning Plan	
	Teacher	Student
<p>DISCUSSION BOARD VIRTUAL CLASS PREWORK</p> <p>(Slides: 4-6) Part 1</p>	<ol style="list-style-type: none"> 1. Share Lesson Slideshow 2. Set up Discussion Board Assignment to help reorient students in the storyline 	<ol style="list-style-type: none"> 1. Summarize learning about aphids from the last lesson 2. Compare aphids to bacteria
<p>VIRTUAL CLASS</p> <p>(Slides: 8-15)</p> <p>Part 2, 3a-c Sharing Initial Ideas</p> <p>Part 3a-b</p>	<ol style="list-style-type: none"> 1. Slide 8: Facilitate Sharing initial ideas discussion *Teacher and student prompts/responses are located in iHub teacher docs 2. Slide 9: Consensus Building Discuss: In what ways did the bacteria population change when all these mechanisms were at work together? 3. Slide 10: Allow students to complete the text box on their own. 4. Slide 11: Discuss question. Refer to iHub teacher guide for prompts and student responses. 5. Slide 12-15: Guide students through slides using the iHub teacher guide. **option to use breakout rooms for grouping** 6. Slide 17: update with information specific to your class. 	
<p>VIRTUAL CLASS POST-WORK Wrap Up/Exit Ticket (Slides: 16-17)</p>	<ol style="list-style-type: none"> 1. Make a copy of the exit ticket and link to Slide 17 in the slideshow. 	<ol style="list-style-type: none"> 1. Complete Exit ticket

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Lesson 15 - What is happening in this new case of the UCSD juncos?

In this **Lesson**, students will need the following materials to appropriately engage in learning:

- [Lesson 15 Slideshow](#)
- [Incremental Modeling Tracker \(IMT\)](#)
- [L15 SEET](#)

In this **Lesson**, students who don't have home internet need the following print-outs or files to best engage in learning:

- [Lesson 15 Slideshow](#)
- [Incremental Modeling Tracker \(IMT\)](#)
- [Juncos Video #1](#) --whole story
- [Juncos Video #2](#) --short clip explaining behavior differences
- Virtual Class recording - *after completion*
- Printed copy of [L15 SEET](#)

Lesson 15 - What is happening in this new case of the UCSD juncos?

Lesson Components	Distance Learning Plan	
	Teacher	Student
VIRTUAL CLASS PRE-WORK (Slides: 4-7) Part 1	<ol style="list-style-type: none"> 1. Share Lesson Slideshow & Incremental Modeling Tracker (IMT) 2. Deliver pre-work assignment in your preferred format 	<ol style="list-style-type: none"> 1. Watch the video and complete Notice/Wonder Chart and reflection questions on slides 4-7
<p>VIRTUAL CLASS</p> <p>(Slides: 9 - 15)</p> <p>Part 1 (5min) Part 2-3 (15min) Part 4-5 (15 min)</p> <p>(Slides: 13-15)</p> <p>Part 4-5 (15 min)</p>	<p>Facilitate sharing Ideas discussion.</p> <ol style="list-style-type: none"> 1. Students share out what they noticed from the Junco video prework and their thoughts about how juncos could be useful to study natural selection--to orient them to the work that was done in the previous lesson. Refer to iHub lesson for discussion guidance 2. Reinforce the facts from the video--by making a simplified group model--students will be asked to modify this to make their own models explaining behavioral and physical trait differences during the Post-work section of this lesson. 3. Begin Bend 2 IMT--Sample teacher script in iHub teacher materials. 4. Fill in the text boxes with answers to questions 1-4 on the slide. 5. Get students ready to build their own models by facilitating a group discussion of explanations and familiarize students with the migration model. This could be done in whole group discussion, or break out rooms where students can come back and share out. 6. Note: Slide 12 **you will return to this slide again and again in future lessons, and students will modify copies of this slide to generate their own models** 7. Slide 14: point out that while migration is a behavior, we also need to discuss how the birds behave day-to-day in their environments. Show the short video clip to introduce the boldness trait before discussion of behavior on slide 15. 	

<p>VIRTUAL CLASS POST-WORK</p> <p>(Slides: 16-19)</p> <p>Parts 6-7, 10-13</p>	<p>1. Make a copy of the Exit Ticket and link to Slides 16 & 17 in the slideshow.</p>	<p>1. Do exit ticket and complete two models (slides 18-19)</p>
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Lesson 16 - Just how different are these two populations of juncos from one another?

**Note for converting this lesson to be entirely asynchronous: Have students submit their pre-work to check for understanding. Convert slides 10 and 17 to be discussion boards--these should happen consecutively, not simultaneously. Create videos and/or hold live office hours to support students through the more challenging components of the lesson on slides 11-16.

In this **Lesson**, students will need the following materials to appropriately engage in learning:

- [Lesson 16 Slideshow](#)
- [Incremental Modeling Tracker \(IMT\)](#)
- [L16 SEET](#)

In this **Lesson**, students who don't have home internet need the following print-outs or files to best engage in learning:

- [Lesson 16 Slideshow](#)
- [Incremental Modeling Tracker \(IMT\)](#)
- Printed copy of [L16 SEET](#)
- Virtual Class recording - *after completion*
- Consensus Model - *after completion*

Lesson 16 - Just how different are these two populations of juncos from one another?

Lesson Components	Distance Learning Plan	
	Teacher	Student
<p>VIRTUAL CLASS PREWORK</p> <p>(Slides: 4-7)</p> <p>Part 1 (10 min) IMT</p>	<p>1. Share Lesson Slideshow</p> <p>2. Share Incremental Modeling Tracker (IMT)</p>	<p>1. Begin filling out the Incremental Modeling Tracker (IMT) for this unit</p> <p>*Table on slide 7 has students explicitly list the characteristics that make the junco story different from the bacterial evolution story: Migration, Mating, and Learning/behavior differences. The three items in the table should be added to the IMT (boxes F, G, H) *</p>
<p>VIRTUAL CLASS</p> <p>(Slides: 8-15)</p> <p>Parts 2-4, 8</p> <p>(30-40 min)</p> <p>*note*</p> <p>This lesson content is technical and may require significant math scaffolding. It may be necessary to break this up into 2 sessions</p> <p>Alternatively the teacher may want to create a video explaining the statistics ideas and procedures, then meet to discuss results.</p>	<p>1. Slide 8: Check in with students at the beginning of virtual class to ensure students understand how the IMT is filled out</p> <p>2. Slide 9: Show images of junco, ask students to decide whether the bird was seen on campus, or in the mountains. Slide 10: **If time allows**</p> <p>3. Slide 11: Explain to students that we have collected wing-length data from juncos. video instructions for the interactive are embedded into the slide **note: - This could be given as an assignment for prework to shorten virtual class time. Move the “A, B, C” markers to the correct spot on the histogram. (Key to histogram) A = between 70 and 72, B = between 76 and 78, C = between 86 and 88</p> <p>4. Slide 12: fill in table.</p> <ol style="list-style-type: none"> Additional Technical Guidance Optional: Provide the link to the free desmos calculator (the same calculator provided in the LEAP2025 exams https://www.desmos.com/scientific) <p>5. Slides 14-16: Analyze tail length together, allow student to complete slides 15-16 independently or in small groups.</p> <p>6. Slide 17: Have a group discussion (or breakout rooms that share out) regarding what students think are causing the differences. Use “cause and effect” language and CER prompt</p> <p>7. Wrap up the three main differences between populations. (Wing Length: Mountain Longer, Campus shorter; Tail Length: Mountain longer, campus shorter; Tail White: more white in mountain, less white on campus)</p>	

<p>VIRTUAL CLASS POST-WORK: (Slide: 17) Part 14 (5 min)</p>	<p>1. Make a copy of the Exit Ticket and link to Slides 16 & 17 in the slideshow.</p>	<p>Complete exit ticket for post work, or work on more descriptive statistics practice problems if necessary for practice.</p>
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Lesson 17 - How are physical traits like wing color or wing length inherited?

In this **Lesson**, students will need the following materials to appropriately engage in learning:

- [Lesson 17 Slideshow](#)

In this **Lesson**, students who don't have home internet need the following print-outs or files to best engage in learning:

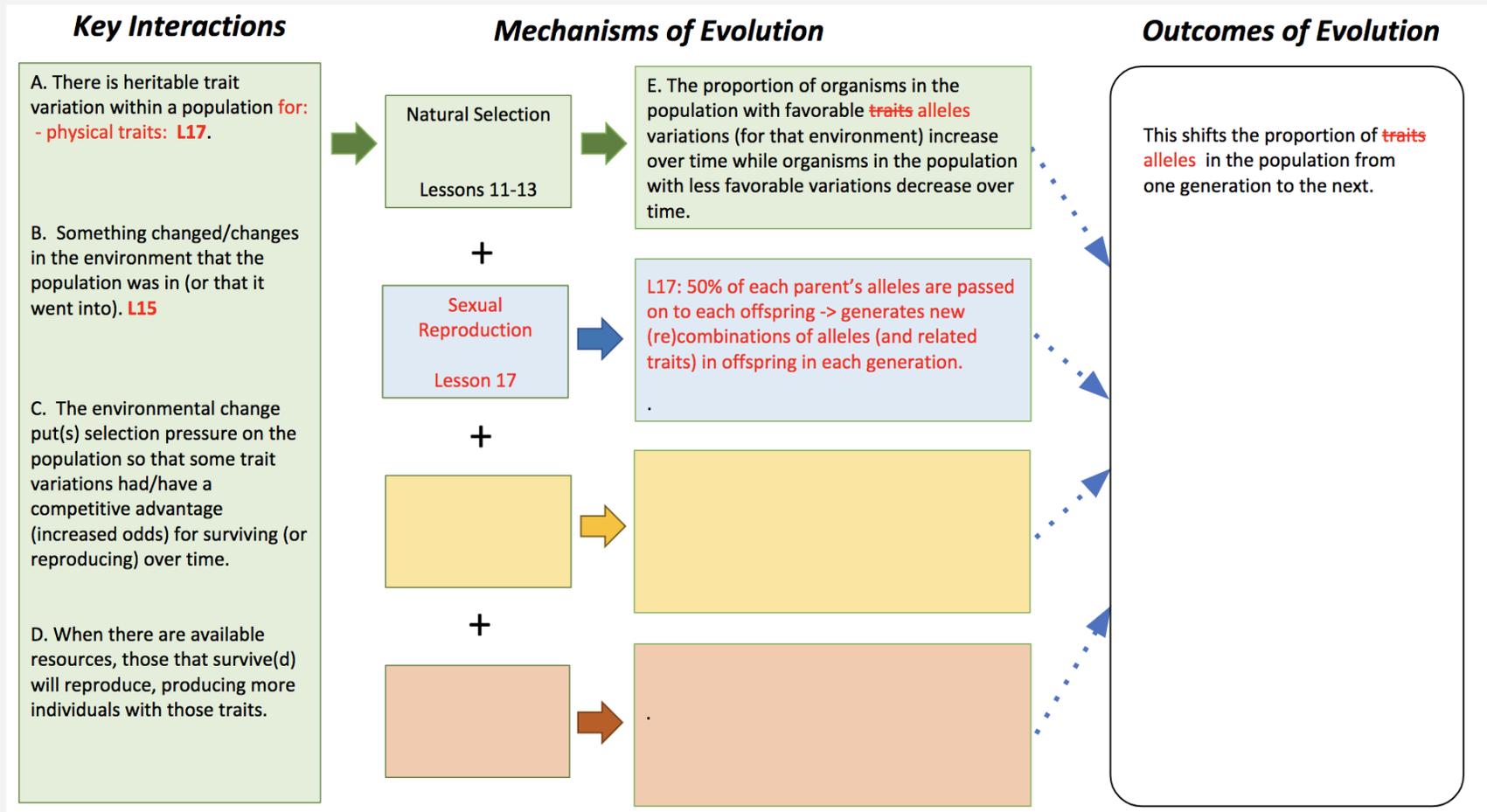
- [Lesson 17 Slideshow](#)
- [Incremental Modeling Tracker \(IMT\)](#)
- Virtual Class recording - *after completion*
- Consensus Model - *after completion*

Lesson 17 - How are physical traits like wing color or wing length inherited?

Lesson Components	Distance Learning Plan	
	Teacher	Student
VIRTUAL CLASS PREWORK	Share Lesson Slideshow (prework is linked in lesson slides)	Play pigeonetics game: https://learn.genetics.utah.edu/content/pigeons/pigeonetics/
VIRTUAL CLASS Part 1-2 (Slide: 6) 10 min Part 3b Slide 7-8 Part 6 (Slides 9-11) 10 min	<ol style="list-style-type: none"> 1. Slide 6: Facilitate sharing ideas discussion <ol style="list-style-type: none"> i. <i>*note*</i> Students were introduced to alleles in the pigeonetics game. Reinforce idea that “gene” is found in a specific location, or locus--and that never changes--but the DNA in the location may vary (allele), and that gives rise to differences in traits--we call variants “alleles” 2. Slide 7: Build annotated karyotype model with students. Refer to iHub teacher materials for important components, and misconceptions to look out for. <i>*note*</i> Students may need support in adding text boxes or arrows to their slides. If preferred, this could be added to pre-work to decrease virtual class length. 3. Slide 11: Exemplar response: “Mountain and campus birds must have different alleles because their traits are different, but we don’t know what gene controls the trait” 	
VIRTUAL CLASS POSTWORK (Slides: 12 & 13)	<ol style="list-style-type: none"> 1. Instruct students how to submit IMT updates <p>If you’re using google classroom with individual copies of the IMT, check students' IMTs to make sure they understand the relationship between sexual reproduction and differences among individuals--as well as the role alleles play in determining differences among individuals. See IMT update exemplar below.</p>	<ol style="list-style-type: none"> 1. Update IMT

10B

(8 min) During the consensus discussion, have students update their **Incremental Modeling Trackers** to include the ideas shown in red in the language the class decides upon.



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Lesson 18 - Just how different is the UCSD birds' behavior?

In this **Lesson**, students will need the following materials to appropriately engage in learning:

- [Lesson 18 Slideshow](#)

In this **Lesson**, students who don't have home internet need the following print-outs or files to best engage in learning:

- [Lesson 18 Slideshow](#)
- [FID Raw Data](#)
- [Methods Document](#)
- Virtual Class recording - *after completion*
- Consensus Model - *after completion*

Lesson 18 - Just how different is the UCSD birds' behavior?

Lesson Components	Distance Learning Plan	
	Teacher	Student
<p>VIRTUAL CLASS PREWORK (Slides: 4-10) Parts 2, 3, 5, 8 (30 min)</p>	<ol style="list-style-type: none"> 1. Share Lesson Slideshow 2. Provide Discussion board space for students to share pre-work 3. Ensure students understand the FID measurement- lower numbers = more bold(via discussion board/thread). 	<ol style="list-style-type: none"> 1. Complete slides 4-8 independently 2. Engage in discussion on the discussion board
<p>VIRTUAL CLASS PREWORK (* could be adapted to virtual class if time allows) (Slides: 11-17) Parts 6-7B, 9-11 (15 min)</p>	<ol style="list-style-type: none"> 1. Assign Slides 11-17 2. Be available with "office hours" or chat session to provide scaffolding struggling learners with data analysis 	<ol style="list-style-type: none"> 1. Analyze Data 2. Write CER Statements 3. Turn in Assignment
<p>VIRTUAL CLASS PREWORK</p>	<ol style="list-style-type: none"> 1. Provide feedback on CER statements, allow revision as needed 	<ol style="list-style-type: none"> 1. Revise CER statement as needed

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Lesson 19 - How do scientists tell if a behavioral trait is inherited or learned?

**Note: This lesson is designed as a Virtual Class, but could be modified to be delivered asynchronously with live teacher support available to troubleshoot difficulties during reading. Slides 6 and 12 should be modified to use as discussion board assignments or work submitted for feedback.

In this **Lesson**, students will need the following materials to appropriately engage in learning:

- [Lesson 19 Slideshow](#)
- [L19 SEET](#)

In this **Lesson**, students who don't have home internet need the following print-outs or files to best engage in learning:

- [Lesson 19 Slideshow](#)
- [Bee Article](#)
- [Baboon Article](#)
- Virtual Class recording - *after completion*
- Printed copy of [L19 SEET](#)

Lesson 19 - How do scientists tell if a behavioral trait is inherited or learned?

Lesson Part Lesson Components	Distance Learning Plan	
	Teacher	Student
VIRTUAL CLASS PREWORK (slides 4-9) Parts: 1, 2A and 3	1. Share Lesson Slideshow with students *NOTE: There are two articles to read for this lesson (one about bees, one about baboons). The slides instruct students to choose one article. Teachers can assign students to a specific article, or allow students to choose. *	1. Complete slides 4-9
VIRTUAL CLASS (slides 10-12) Parts 2B, 4, 5, 6 30 min	1. Guide students in discussion of prework including bee and baboon readings. 2. Support/reinforce their understanding of the methodology. Ensure they can identify the bee example as an inherited behavior (because scouts always scout) and the baboon example as a learned behavior (because baboons change their behavior in new groups). 3. Spend a majority of the time discussing how students could design an experiment to test junco behavior and determine whether it is learned or inherited. (slide 11)	
VIRTUAL CLASS POSTWORK (slide 13-14) Part 4	1. Make a copy of the Exit Ticket and link to Slide 12 in the slideshow	1. Complete exit ticket, submit slides

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Lesson 20 - Do juncos learn to be bolder or is this behavior something they inherited?

In this **Lesson**, students will need the following materials to appropriately engage in learning:

- [Lesson 20 Slideshow](#)
- [L20SEET](#)

In this **Lesson**, students who don't have home internet need the following print-outs or files to best engage in learning:

- [Lesson 20 Slideshow](#)
- [Readings for prework](#)
- Printed copy of [L20SEET](#)
- Virtual Class recording - *after completion*
- Consensus Model - *after completion*

Lesson 20 - Do juncos learn to be bolder or is this behavior something they inherited?

Lesson Components	Distance Learning Plan	
	Teacher	Student
VIRTUAL CLASS PREWORK (slides 4-6) Parts: 2, 3	1. Share Lesson Slideshow with students (Link to prework readings embedded)	1. Complete Slides 4-6
VIRTUAL CLASS (slides 8-17) Parts: 4-7 30 min	<ol style="list-style-type: none"> Sharing Initial ideas/Building understanding. Students share their ideas about data collection and experimental design related to determining if boldness is learned or inherited in juncos. Reinforce the common garden methodology and the data analysis (persistent behavior = inherited, change in behavior = learned) refer back to baboon/bee experiments as necessary. Prepare students to look at data from the common garden experiment by reinforcing how FID and novelty seeking behavior data corresponds to “bold” or “shy” behaviors. Prompt students to predict what the graphs from the common garden experiment will look like. Analyze and compare the graphs from the field studies and the common garden experiments. [*note*Make sure to check axis--data presented is different in the two charts.] Have student volunteers describe patterns they notice in the data, and what the new evidence tells us. Prompt students to attempt to explain how behavior can be inherited. Focus on cause-effect relationships. Share ideas on what types of tests might be used to detect the presence of a hormone, or adrenaline, or a behavior-altering drug in a person. *note* this could be assigned as a discussion board assignment for post work 	
VIRTUAL CLASS POSTWORK (slide 18-19)	1. Make a copy of the exit ticket and link to Slide 18 in the slideshow.	1. Complete exit ticket, submit slides

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Lesson 21 - Are there differences inside the birds that would explain why they behave differently?

**Note: This lesson could be delivered entirely asynchronously by modifying the following components: Have students complete Slides 4-5 as pre-work, complete Slide 6 as a Discussion Board. Then, have students complete Slides 8-12 as pre-work (modify slide 12 to include boxes for student responses to the questions) and Slide 14 as a Discussion board.

In this **Lesson**, students will need the following materials to appropriately engage in learning:

- [Lesson 21 Slideshow](#)

In this **Lesson**, students who don't have home internet need the following print-outs or files to best engage in learning:

- [Lesson 21 Slideshow](#)
- [Prework Reading](#)
- [Incremental Modeling Tracker \(IMT\)](#)
- Virtual Class recording - *after completion*
- Consensus Model - *after completion*

Lesson 21 - Are there differences inside the birds that would explain why they behave differently?

Lesson Components	Distance Learning Plan	
	Teacher	Student
VIRTUAL CLASS PREWORK (slides 4-5) Parts: 2-3	1. Share Lesson Slideshow and student copies of Incremental Modeling Tracker (IMT) 2. Make sure students have access to Prework Reading if they will be completing the lesson without internet access.	1. Read Prework Reading (embedded in slides) to answer questions on Slides 4-5 and prepare for discussion
VIRTUAL CLASS (slides 7-12) Parts: 4-5 30 min	**note** This lesson could be completed asynchronously if a discussion board is created to replace the in-class discussion. <ol style="list-style-type: none"> 1. Facilitate sharing ideas discussion to review data in prework part A and B of reading. Check that students are reading graphs and interpreting data correctly. (10 min) 2. Guide students through Part C (boldness and CORT graph), slides 8-11, and build understanding of relationship between CORT levels and bold behavior of campus juncos. (10 min) 3. Bring the evolution model back into discussion, slide 12. Walk through the components and identify each in the junco story. Ensure students understand that a trait must impact survival/fitness in order to be subjected to the force of natural selection. (10 min) 	
VIRTUAL CLASS POSTWORK (slide 14) Parts: 6	1. Assign Slide 14	1. Complete Slide 14 2. Submit slideshow.

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Lesson 22 - How did the UCSD population become bolder than the mountain population over the last 60 years?

****This lesson includes a summative assessment****

**Note: This lesson could be delivered entirely asynchronously by modifying the following components: Have students submit Pework evidence table to check for understanding, modify slide 6 to be a discussion board. After ensuring students have materials they need, assign the summative assessment through your preferred testing platform.

In this **Lesson**, students will need the following materials to appropriately engage in learning:

- [Lesson 22 Slideshow](#)
- [Incremental Modeling Tracker \(IMT\)](#)

In this **Lesson**, students who don't have home internet need the following print-outs or files to best engage in learning:

- [Lesson 22 Slideshow](#)
- [Incremental Modeling Tracker \(IMT\)](#)
- [Student Work Evidence Table and Essay](#)
- [Lesson 14 slides 12-15](#)
- Virtual Class recording - *after completion*
- Consensus Model - *after completion*

Lesson 22 - How did the UCSD population become bolder than the mountain population over the last 60 years?

Lesson Components	Distance Learning Plan	
	Teacher	Student
VIRTUAL CLASS PREWORK (slide 4) Parts: 2-3	<ol style="list-style-type: none"> 1. Share Lesson Slideshow and Assignment (copy of Lesson 22 Student evidence Table) 2. Remind students to use their IMT -- Last updated during Lesson 17 	<ol style="list-style-type: none"> 1. Complete evidence table for bacteria, juncos
VIRTUAL CLASS (slide 7) Parts: 4	<ol style="list-style-type: none"> 1. Hold a consensus building discussion to decide on the best statements for the evidence table. Share your screen and encourage students to revise their own work as needed on their own documents. (Your copy can be sent to students without internet access) 2. Ensure that the class master table is filled out correctly before moving onto the summative assessment. 	
VIRTUAL CLASS POSTWORK Parts: 5-6	<ol style="list-style-type: none"> 1. Direct students to complete the essay assignment following the directions on the Lesson 22 Student Work document 2. Assess using Teacher Key to Essay 	<ol style="list-style-type: none"> 1. Complete essay assignment and turn in. 2. Submit slideshow.

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Lesson 23 - Why did some of the juncos stay in San Diego in the first place instead of migrating back to the mountains with the rest of the juncos?

In this **Lesson**, students will need the following materials to appropriately engage in learning:

- [Lesson 23 Slideshow](#)
- [Incremental Modeling Tracker \(IMT\)](#)
- [L23 SEET](#)

In this **Lesson**, students who don't have home internet need the following print-outs or files to best engage in learning:

- [Lesson 23 Slideshow](#)
- [Lesson 23 Data Packet](#)
- Printed copy of [L23 SEET](#)
- [Incremental Modeling Tracker \(IMT\)](#)
- Virtual Class recording - *after completion*
- Consensus Model - *after completion*

Lesson 23 - Why did some of the juncos stay in San Diego in the first place instead of migrating back to the mountains with the rest of the juncos?

Lesson Components	Distance Learning Plan	
	Teacher	Student
VIRTUAL CLASS PREWORK (slides 4-12) Parts: 1-2	1. Share Lesson Slideshow with students	1. Complete Slides 4-12
VIRTUAL CLASS (slides 14-19) Parts: 3-4 30 min **including 10 min. Breakout room**	<ol style="list-style-type: none"> 1. Hold sharing ideas discussion to check for student understanding of timeline events and observations about how the campus environment changed, and how the campus is different between day and night. 2. Assign small groups of students to breakout rooms for 10 minutes or less to discuss the three pieces of evidence in the Lesson 23 Data Packet . 3. Hold a building consensus discussion and complete slide 19 as a whole class group. 	
VIRTUAL CLASS POSTWORK (slide 20-21) Parts: 5	1. Make a copy of Exit Ticket and link in the slideshow in Slide 20	<ol style="list-style-type: none"> 1. Complete exit ticket 2. Submit slideshow

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Lesson 24 - How else have these two populations changed since they split apart?

In this **Lesson**, students will need the following materials to appropriately engage in learning:

- [Lesson 24 Slideshow](#)
- [Survey Form](#)
- [Incremental Modeling Tracker \(IMT\)](#)
- [L24 SEET](#)

In this **Lesson**, students who don't have home internet need the following print-outs or files to best engage in learning:

- [Lesson 24 Slideshow](#)
- [Incremental Modeling Tracker \(IMT\)](#)
- [Survey Form](#)
- [L24 SEET](#) (last question only)
- Virtual Class recording - *after completion*
- Consensus Model - *after completion*

Lesson 24 - How else have these two populations changed since they split apart?

Lesson Components	Distance Learning Plan	
	Teacher	Student
VIRTUAL CLASS PREWORK (slides 4-7) Parts: Lesson 23 Home Learning Lesson 24 part 2	1. Share Lesson Slideshow 2. Deliver your copy of Survey Form or create Polleverywhere (or other platform) Survey	1. Complete Slides 4-7
VIRTUAL CLASS (slides 9-11) Parts: 1, 4, 30 min	1. Discuss Survey results 2. Facilitate a debate structure (slide 10) to allow students to share the evidence they collected to support their stance during the prework. 3. Guide students through using the natural selection model to explain the differences in traits between campus and mountain juncos (slide 11) 4. Update IMT boxes G, J, K on slide 2 Key: Lesson 24 IMT Update (red text)	
VIRTUAL CLASS POSTWORK (slide 12-13) Part: 5	1. Make a copy of the Exit Ticket then link it to Slide 12 of the slideshow	1. Complete Exit ticket, submit slides

Key Interactions

A. There is heritable trait variation within a population for:
 - physical traits: **L17**
 - behavioral traits: **L19**
 - physiological traits: **L20**

B. Something changed/changes in the environment that the population was in (or that it went into): **L15**

C. The environmental change put(s) selection pressure on the population so that some trait variations had/have a competitive advantage (increased odds) for surviving (or reproducing) over time. **L19, L20**

D. When there are available resources, those that survive(d) will reproduce, producing more individuals with those traits. **L20**

Mechanisms of Evolution

Natural Selection
 Lessons 11-13

E. The proportion of organisms in the population with favorable ~~traits~~ alleles variations (for that environment) increase over time while organisms in the population with less favorable variations decrease over time.

Sexual Reproduction
 Non-random Mating
 Lesson 14-17, 24

L18 50% of each parent's alleles are passed on to each offspring -> generates new (re)combinations of alleles (and traits) in offspring in each generation.
L24: Non-random mating → some alleles being passed on more often than others.

Migration
 (Gene flow)
 Lesson 23

L23: Individuals that move out of one population and into another add/remove alleles to/from those populations.

Outcomes of Evolution

Within Species

This shifts the proportion of ~~traits~~ alleles in the population from one generation to the next.

Organisms diversify rapidly from an ancestor population into new forms, particularly when a change in the environment makes new resources available or creates new challenges. **L24**

Across Different Species?

Return to [Lesson List](#)

Lesson 25 - What other juncos do we find in North America?

In this **Lesson**, students will need the following materials to appropriately engage in learning:

- [Lesson Slideshow](#)

In this **Lesson**, students who don't have home internet need the following print-outs or files to best engage in learning:

- [Lesson Slideshow](#)
- [Junco Diversification Video](#)
- Virtual Class recording - *after completion*
- Consensus Model - *after completion*

Lesson 25 - What other juncos do we find in North America?

Lesson Components	Distance Learning Plan	
	Teacher	Student
VIRTUAL CLASS PREWORK (slides 4-12) Parts: 1-5	1. Slide 7 could be adapted as a discussion board.	1. Complete slides 4-12
VIRTUAL CLASS (slides 14-16) Parts: 6-7 20 min	<ol style="list-style-type: none"> 1. Orient students to the common ancestry model and check for understanding of diversification and descent on slide 4. You may also want to review the different types of juncos and have volunteers give recaps of the different video sections. 2. Guide students in a sharing ideas discussion--allow them to share and discuss their responses to the question on slide 12. 	
VIRTUAL CLASS POSTWORK		1. Submit slides

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Lesson 26 - Are the UCSD juncos now a separate species from the mountain juncos?

In this **Lesson**, students will need the following materials to appropriately engage in learning:

- [Lesson Slideshow](#)

In this **Lesson**, students who don't have home internet need the following print-outs or files to best engage in learning:

- [Lesson Slideshow](#)
- [Lesson 26 Reading](#)
- Virtual Class recording - *after completion*
- Consensus Model - *after completion*

Lesson 26 - Are the UCSD juncos now a separate species from the mountain juncos?

Lesson Components	Distance Learning Plan	
	Teacher	Student
VIRTUAL CLASS PREWORK (slides 4-10) Parts: 1-4	1. Share Lesson Slideshow	1. Complete slides 4-10
VIRTUAL CLASS (slides 12-16) Part: 5 30 min	<ol style="list-style-type: none"> 1. Review the karyotype model, using alleles to determine paternity, and the allele frequency data from the reading. Slides 12-13. Facilitate a discussion for students to share their claims about whether the juncos are interbreeding, and their supporting evidence. 2. Facilitate a discussion about whether offspring would ever inherit DNA that doesn't match either parent perfectly, and identify how that could be tested. 	

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Lesson 27 A-B - How can DNA help us figure out how closely related two different juncos are?

****Note:** This lesson could be delivered entirely asynchronously by modifying the following components:

Lesson 27A-B: assign the entire slide show as asynchronous work, modify slide 15 to be a discussion board. It is recommended to provide live office hours and/or tutorial videos to support students with this material.

In this **Two-part Lesson**, students will need the following materials to appropriately engage in learning:

- [Lesson A Slideshow](#)
- [Lesson B Slideshow](#) (optional)
- [Incremental Modeling Tracker \(IMT\)](#) For Lesson B

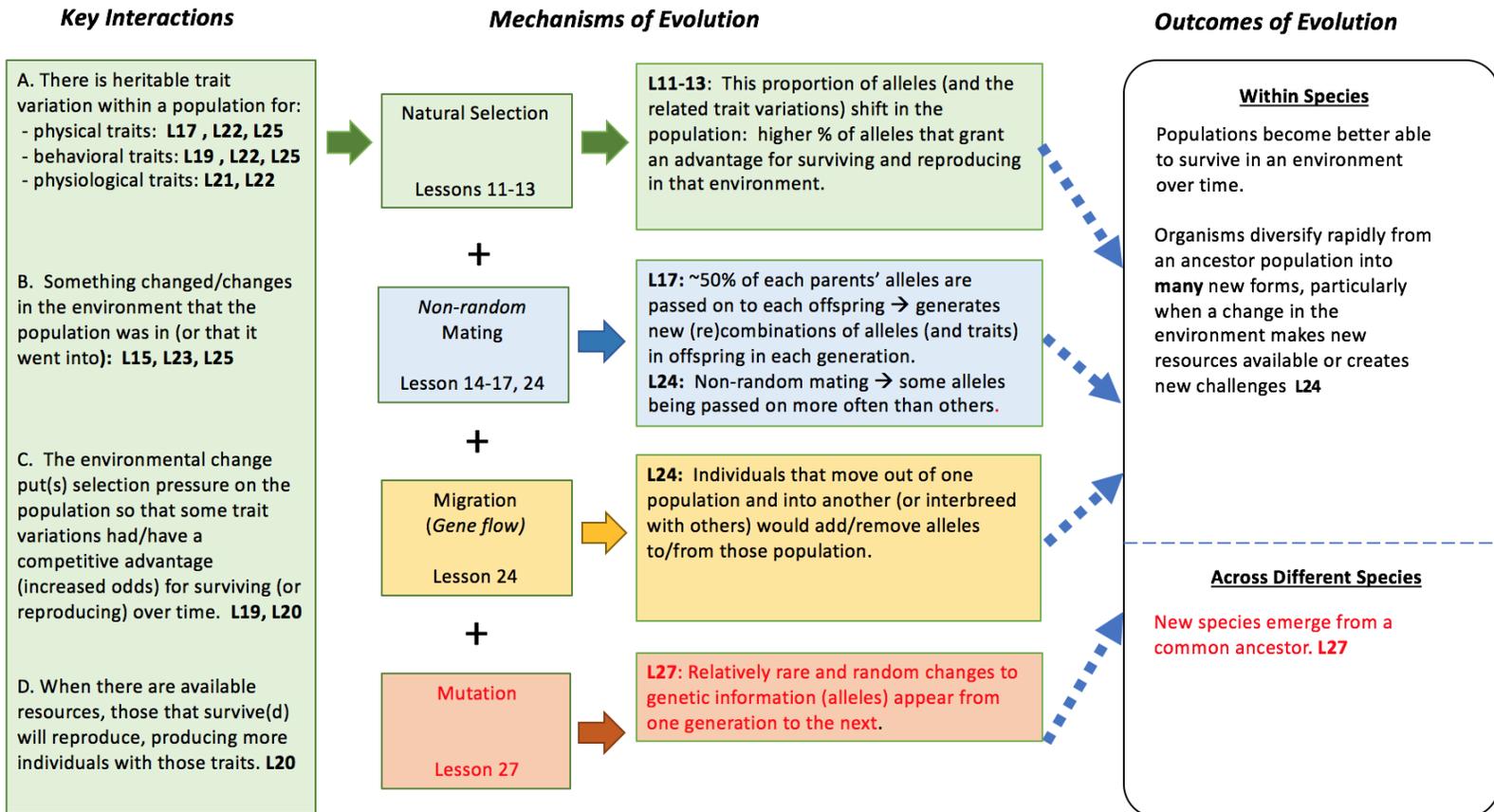
In this **Lesson**, students who don't have home internet need the following print-outs or files to best engage in learning:

- [Lesson A Slideshow](#)
- [Lesson B Slideshow](#) (optional)
- [Junco diversification video](#)
- [Incremental Modeling Tracker \(IMT\)](#)
- Virtual Class recording - *after completion*
- Consensus Model - *after completion*

Lesson 27 A-B - How can DNA help us figure out how closely related two different juncos are?

Lesson Components	Distance Learning Plan	
	Teacher	Student
VIRTUAL CLASS PREWORK (slides 4-12) Parts: 1	1. Adjust details on slide 3 for the progression of lesson components to suit your specific situation. 2. Share Lesson A Slideshow 3. Investigation 1: Refer to iHub teacher materials for step by step instructions, Mitochondrial Mutation Model KEY for virtual implementation notes	1. Complete slides 4-12
VIRTUAL CLASS A (slides 15-21) Parts: 2-7 30 min	1. Investigation 2: Emphasis on scaling models and using simpler models for understanding and more realistic models for looking at experimental data. 2. Predict which bird populations would have the most similarities/differences in mtDNA **Note** This investigation could also be assigned as prework and the virtual class could serve as a targeted Q&A support session, or could be used to demonstrate the skills required to complete Investigation 2.	
*optional Part B VIRTUAL CLASS PREWORK Slides 4-12 Parts:8-10	1. Share Lesson B Slideshow	1. Complete slides 4-12
*optional VIRTUAL CLASS B Parts: 11-12 30 min	1. Investigation 3: Using a realistic model to analyze junco data. Students completed this work during the prework. Debrief and check for understanding. 2. Guide students in a discussion of the final questions from part 11 3. Update IMT See key below.	

<p>VIRTUAL CLASS POST-WORK (slide20) Parts: 12</p>	<p>1. Assess returned slides</p>	<p>1. Complete and submit slides.</p>
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Lesson 28 - Where do new heritable trait variations come from?

In this **Lesson**, students will need the following materials to appropriately engage in learning:

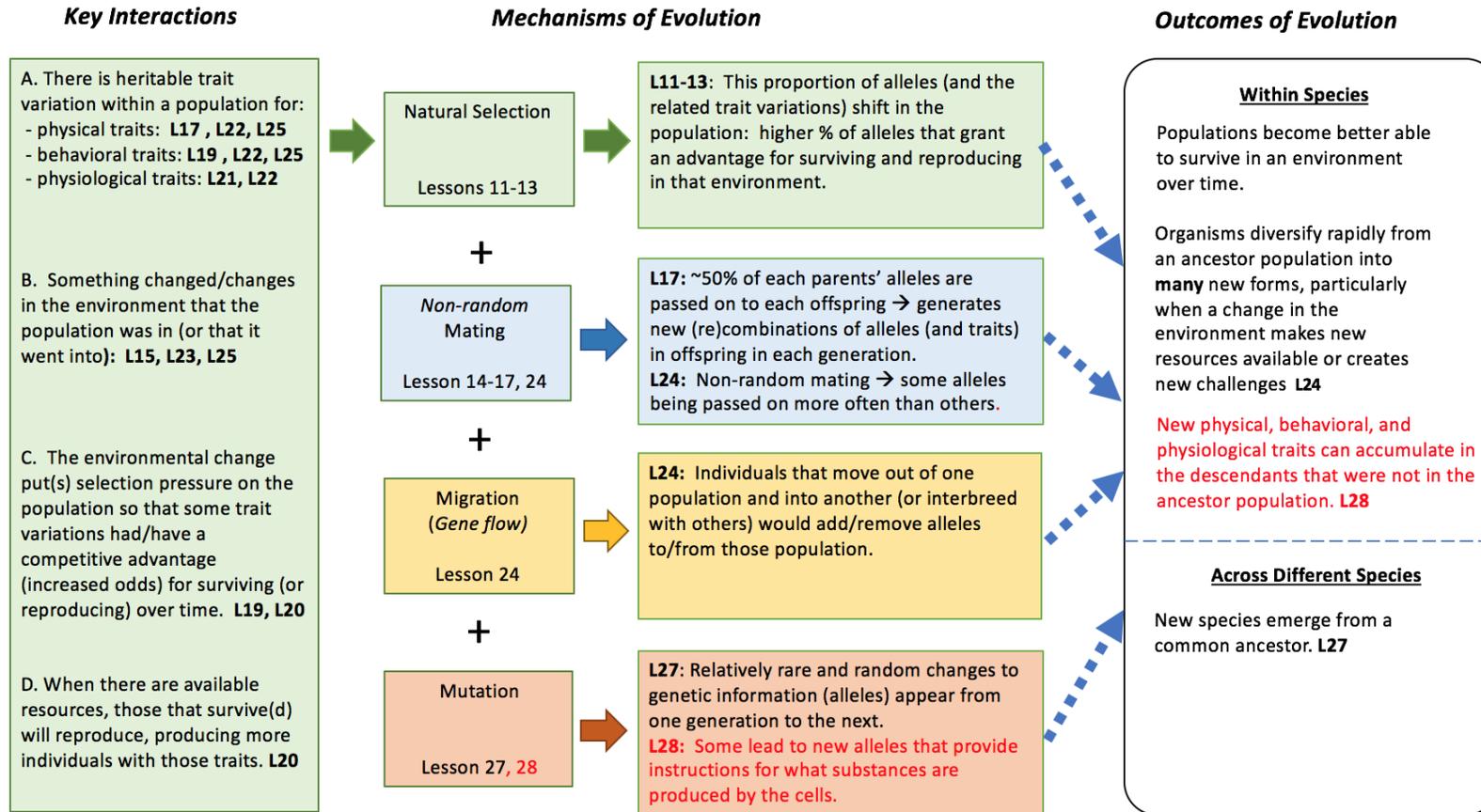
- [Lesson 28 Slideshow](#)
- [Incremental Modeling Tracker \(IMT\)](#)

In this **Lesson**, students who don't have home internet need the following print-outs or files to best engage in learning:

- [Lesson 28 Slideshow](#)
- [Lesson 28 Student Reading #1](#)
- [Lesson 28 Student Reading #2](#)
- [Lesson 28 Home Learning: Mass Extinction Event](#)
- Completed Slide 15 after virtual class
- [Incremental Modeling Tracker \(IMT\)](#)
- Virtual Class recording - *after completion*
- Consensus Model - *after completion*

Lesson 28 - Where do new heritable trait variations come from?

Lesson Part Lesson Components	Distance Learning Plan	
	Teacher	Student
VIRTUAL CLASS PREWORK (slides 4-12) Parts: 1-8	1. Share Lesson 28 Slideshow	1. Complete slides 4-12
VIRTUAL CLASS (slides 14-15) Parts: 9-10 20-30 Min **note** this entire lesson could be done asynchronously with virtual class being substituted with a discussion board	1. Debrief and review the natural selection concepts covered in the the NYT article (reading #1). 2. Facilitate sharing out of information from the Nature article (reading #2). 3. Come to a consensus on the effect mutation has on evolution, add this component to the IMT (see IMT update below).	
VIRTUAL CLASS POST-WORK (slide 17) Parts: Home Learning	1. Assign Lesson 28 Home Learning: Mass Extinction Event **assign through google classroom, or instruct students to make a copy before editing.	1. Submit slides and Lesson 28 Home Learning (Mass Extinction) document



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Lesson 29 - How can our model explain how life on Earth has changed over time?

In this **Lesson**, students will need the following materials to appropriately engage in learning:

- [Lesson 29 Slideshow](#)
- [Incremental Modeling Tracker \(IMT\)](#)
- Driving Question Board: Create a document, or update the slides in Lesson 29 Slideshow to reflect questions students have asked throughout the unit. Share this document with students before class or during class.
- *optional* [Further Reading on Human Evolution](#)

In this **Lesson**, students who don't have home internet need the following print-outs or files to best engage in learning:

- [Incremental Modeling Tracker \(IMT\)](#)
- Virtual Class recording - *after completion*
- Consensus Model - *after completion*

Lesson 29 - How can our model explain how life on Earth has changed over time?

Lesson Part Lesson Components	Distance Learning Plan	
	Teacher	
VIRTUAL CLASS PREWORK (slides 4-10) Parts: 3A	1. Share Lesson 29 Slideshow	1. Complete prework
VIRTUAL CLASS (slides 14-15) Parts: 1-2,3B, 4-5 30 min	<ol style="list-style-type: none"> Review Lesson 28 postwork: How does this information on mass extinction connect with what you've learned about how mutations can result in new traits appearing in populations? Refer to iHub teacher materials Lesson 29.1 Teacher Guide for target responses. Review Lesson 29 prework: allow students to share out what they learned and wondered from the readings and figures regarding human migration and neanderthals Final IMT Update to reflect new information on how extinction comes into play for evolution models. Driving Question Board check in. Review questions and rank them as answered, partially answered, or unanswered. Refer to iHub 29.1 for instructional strategies Facilitate a discussion around the reflection questions slide 15 	
VIRTUAL CLASS POST-WORK (slide 17) Parts: Home Learning	1. Unit Assessment - Deliver your choice of iHub docs with your platform	1. Complete and turn in Unit Assessment

Key Interactions

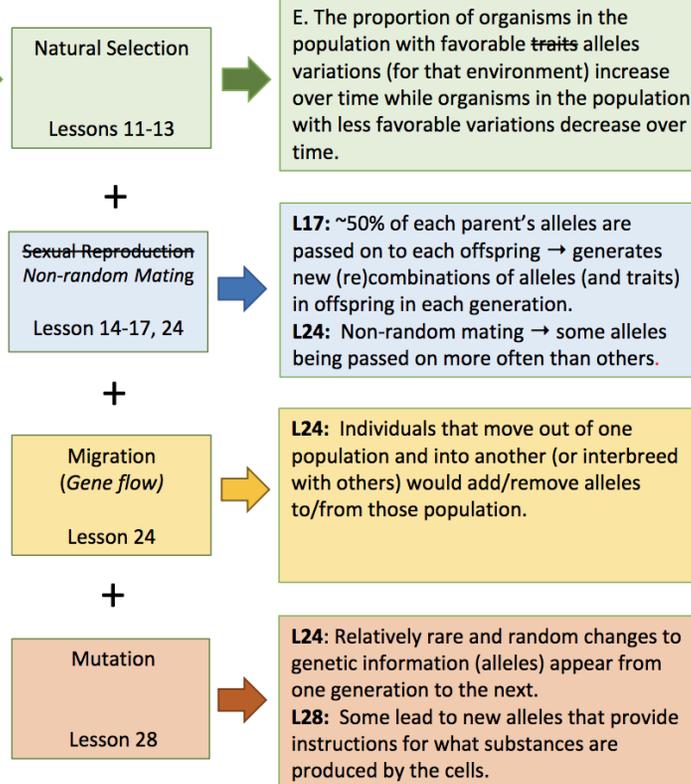
- A. There is heritable trait variation within a population for:
 - physical traits: **L17 , L22, L25**
 - behavioral traits: **L19 , L22, L25**
 - physiological traits: **L21, L22**

- B. Something changed/changes in the environment that the population was in (or that it went into): **L15, L23, L25**

- C. The environmental change put(s) selection pressure on the population so that some trait variations had/have a competitive advantage (increased odds) for surviving (or reproducing) over time. **L19, L20**

- D. When there are available resources, those that survive(d) will reproduce, producing more individuals with those traits. **L20**

Mechanisms of Evolution



Outcomes of Evolution

Within Species

This shifts the proportion of traits alleles in the population from one generation to the next.

Organisms diversify rapidly from an ancestor population into **many** new forms, particularly when a change in the environment makes new resources available or creates new challenges **L24**

New physical, behavioral, and physiological traits can accumulate in the descendants that were not in the ancestor population. **L28**

Across Different Species

New species emerge from a common ancestor. **L27**

Species go extinct when traits that are adaptive to a changed environment do not exist in the population. Rapid changes to environments tend to lead to higher extinction rates. **L29**

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