



The Evolution of Man & Machine

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AACA Museum
www.aacamuseum.org

Biology:
The Evolution of Man vs. Machine

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Prior Knowledge: Cell structure & function, biological processes & systems, and mechanisms of genetics

Knows: Evolution, natural selection, deep time, population growth/limits, acquired traits, uniformitarianism, adaptation, fitness, survival, genes, genetic drift, gene flow, mutation, traits, species, genotype, phenotype, alleles, homozygous, punnett square, natural selection, biogeography, fossils, homologous, vestigial and analogous structures, homologous proteins, Hox genes, evolutionary tree.

Dos:

- Compare and contrast the evolution of biology and cars.
- Draw and diagram a timeline of events and individuals who contributed to evolution.
- Distinguish between historical perspectives and understand their specific view point.
- Debate who made the biggest impact on evolutionary theory.
- Debate who/what made the biggest impact on the automobile today.
- Analyze the importance of genes and their effect on inheritance
- Compare and contrast the effects of genetic drift and gene flow
- Distinguish how mutations affect the inheritance of genes
- Evaluate and defend the evidence for evolution through several areas of study
 - In terms of specific organisms and with cars
- Synthesize an Evolutionary Tree that maps out a car brand of choice and compare and contrast the car brand to the Mercedes Benz car brand

Standards:

3.1.10.C4

- Compare and contrast scientific theories.
- Know that both direct and indirect observations are used by scientists to study the natural world and uni
- Identify questions and concepts that guide scientific investigations.
- Formulate and revise explanations and models using logic and evidence.
- Recognize and analyze alternative explanations and models.
- Explain the importance of accuracy and precision in making valid measurements.

3.1.B.C3

- Compare and contrast various theories of evolution.
- Interpret data from fossil records, anatomy and physiology, and DNA studies relevant to the theory of e
- Discuss the implications of a universal genetic code for evolution.

3.1.10.C1

- Explain the mechanisms of biological evolution.

Essential Questions:

What are different theories of evolution?

How can evolutionary theory be connected to cars?

Benchmark #1: (For use after Lesson 1)

Timeline Assignment: Students will compare and contrast evolutionary theorists and car contributors by creating a timeline.

- Highlight the greatest influences on car evolution and support your responses on the timeline.

Benchmark #2: (For use after Lesson 2)

Socratic Circle: For the first portion of the discussion, have students take a stance on what they consider to be the most important contributing theories to the current view on evolution. For the second portion of the discussion, have students consider who/what made the greatest impact on

making the automobile what it is today. Each student should make a minimum of two contributions to the discussion.

Performance Task: Mapping the Road

We are taking a road trip, but before we start, we would like to consider the routes that engineers and mechanics have taken to create the automobiles that we drive each and every day.

Consider this: Automobiles have been around since 1885, which is roughly a little over 130 years!!!

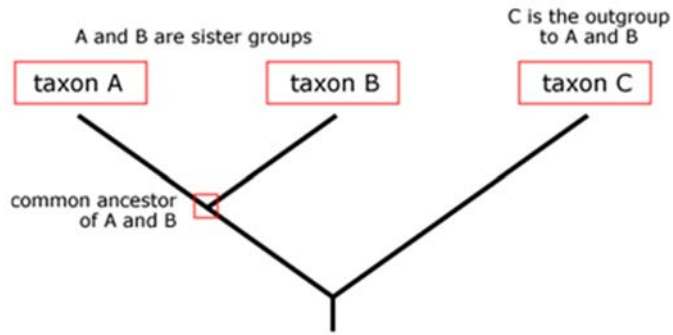
Through trial and error, these vehicles have stood the test of time to be what they are today!

Each of you are given the task to choose **ONE** automobile brand, listed below to determine its evolutionary tree **AND** compare and contrast it with one of the original automobiles powered by an internal combustion engine, Mercedes Benz.

Reminder:

Evolutionary (aka Phylogenetic) Tree

- This is used to determine specific models based on traits
 - e.g. Evolutionary tree for Honda car brand



Performance Task Rubric	EXCEEDS	MEETS	ADEQUATE	DOES NOT MEET
Characteristics 28	<ul style="list-style-type: none"> Exceptional representation of material The student provides 6-8 different observable characteristics 	<ul style="list-style-type: none"> Appropriate representation of material The student provided 4-6 different observable characteristics 	<ul style="list-style-type: none"> Partial representation of material The student provided 2-4 different observable characteristics 	<ul style="list-style-type: none"> Inaccurate representation of material The student provides 0-2 different observable characteristics
Structure & Layout 18	<ul style="list-style-type: none"> Easily readable Easily understandable Progression/flow from one division to the next is effortless 	<ul style="list-style-type: none"> Readable Understandable Progression/flow from one division to the next makes logical sense 	<ul style="list-style-type: none"> Somewhat readable or understandable Progression/flow from one division to the next makes little logical sense. 	<ul style="list-style-type: none"> Unreadable &/ or not understandable Progression/flow from one division to the next makes no logical sense

Branching Points 10	<ul style="list-style-type: none"> • Tree is easy to evaluate • Branching points easily distinguish between characteristics. 	<ul style="list-style-type: none"> • Tree is functional for evaluating • Branching points distinguish between characteristics. 	<ul style="list-style-type: none"> • Tree is partially usable to evaluate • Branching points vaguely distinguish between characteristics. 	<ul style="list-style-type: none"> • Tree is difficult to evaluate • Branching points are difficult to distinguish between characteristics.
MUGS 4	<ul style="list-style-type: none"> • 0-1 different spelling or grammatical errors. 	<ul style="list-style-type: none"> • 2-3 different spelling or grammatical errors 	<ul style="list-style-type: none"> • 4-5 different spelling or grammatical errors 	<ul style="list-style-type: none"> • 6 or more different spelling or grammatical errors.

Car Unit	Lesson 1: Evolution Contributors
Knows	<p>Biology: James Hutton (1785), Thomas Malthus (1798), Jean-Baptiste Lamarck (1809), Charles Lyell (1830), Charles Darwin (1859)</p> <p>Cars: Nicolas-Joseph Cugnot (1769)-Self propelled vehicle, Karl Benz (1886)-Two-stroke engine, Ford (1908)-Model T, Dodge Brothers (1914)-Dodge Model 30, Richard Spikes (1932)-Automatic gear shift</p>
Does	<ol style="list-style-type: none"> 1. Compare and contrast the evolution of biology and cars. 2. Draw and diagram a timeline of events and individuals who contributed to evolution.
Essential Question	What are the comparisons and contrasts between the contributors of biological evolution and the contributors of car modifications?
Activating Strategy	<p>Word Cloud: Students will work cooperatively as a class by brainstorming words that apply to evolution. Each student may hand-write words on the board, or type them into a collaborative Google Docs document. The teacher will then input the words into an online “Word Cloud” program to create an aesthetic document to electronically project to the class or print out for each student. The goal is for the teacher to assess students’ understanding of evolution and draw upon their prior knowledge.</p> <p>Word Cloud Programs include: Tagxedo and Wordle</p>

	Example evolution words may include: modification, improvement, deviate, branch, change, etc.
Teaching Strategy (1 to 2 days)	<p>Jig-Saw Method:</p> <p>Students will grouped into 8 groups. Each group will be responsible for researching information on either a biology or car contributor.</p> <p>What they are looking for:</p> <ul style="list-style-type: none"> • Determine the time frame in which their contributions were made. • Fun facts about how they got into the field of study. • People who they were influenced by or influenced. • Their top contributions or theories. <p>Students will then will leave their group and partner up with an individual who is not in their subject group. For example, a biology contributor will match up with a car contributor.</p>
Summarizing Strategy	<p>Venn Diagram: link</p> <p>Students will return to their original groups. They will have 2-3 minutes to fill in a Venn Diagram to compare and contrast the similarities and differences with the person they shared. Afterwards, the group can share their ideas with the class and the teacher will fill in a larger Venn Diagram on the board.</p> <p>Students will then be introduced to Benchmark #1: Timeline Assignment due within one week.</p>
Standards	<p>Standard - 3.1.10.C4</p> <ul style="list-style-type: none"> • Compare and contrast scientific theories. • Know that both direct and indirect observations are used by scientists to study the natural world and universe. • Formulate and revise explanations and models using logic and evidence. • Recognize and analyze alternative explanations and models. <p>Standard - 3.1.B.C3</p> <ul style="list-style-type: none"> • Compare and contrast various theories of evolution.
Assessments	<p>Pre-assessment- Word Cloud (see above)</p> <p>Post-assessment- Venn Diagram (see above)</p>
Differentiation	<p>Specific roles may be assigned within the groups</p> <p><u>Biology</u> Student-documents the information Researcher-looks up the information</p>

	<p>Teacher-organizes how to present the information Professor-generates questions to lead the sharing</p> <p><u>Car</u> Test Driver-documents the information Mechanic-looks up the information Engineer-organizes how to present the information Race Driver-generates questions to lead the sharing</p>
<p>Additional Resources:</p>	<ul style="list-style-type: none"> • Quizlet : Evolution Contributors • NPR: <ul style="list-style-type: none"> ◦ When Did We Become Mentally Modern? ◦ Evolving Culture: Where Do We Go From Here? • Case Study for the search of intelligent design: And now what, Ms. Ranger?
<p>Supply List:</p>	<ul style="list-style-type: none"> • White board markers and eraser. • Utilize Smartboard (if accessible) • Print Venn Diagrams (quantity/class) • Acquire technology for research and Word Cloud activity (i.e., iPads, computers, etc.)
<p>History of Evolution Example Resource Links</p>	<p>James Hutton (1785) Plutonic geology; Deep time; Live Earth</p> <p>Thomas Malthus (1798) Population growth and limits</p> <p>Jean-Baptiste Lamarck (1809) Evolution; inheritance of acquired characteristics; Philosophie Zoologique</p> <p>Charles Lyell (1830) Uniformitarianism</p> <p>Charles Darwin (1859) Evolutionary Theory</p> <p>Resource Link for Evolution Timeline: https://ogremk5.wordpress.com/timeline-of-creationism-and-science/</p>

Car Unit	Lesson 2: Theories of Evolution
Knows	Evolution, natural selection, deep time, population growth/limits, acquired traits, uniformitarianism, artificial selection, adaptation, fitness, survival
Dos	<ol style="list-style-type: none"> 1. Distinguish between historical perspectives and their specific view points. 2. Debate who made the biggest impact on evolutionary theory. 3. Debate who/what made the biggest impact on the automobile today.
Essential Question	How have the prominent theories of evolution created lasting impacts on current views of evolution?
Activating Strategy	<p><u>3-2-1 Writing Activity</u>: Students will be asked to: List: 3 themes you already know about evolution, 2 things you would like to know about or learn more about, and 1 question related to evolution. Students will share their responses with their seat partner. After partner sharing, a student will share what they wrote down for the 3-2-1 categories to the class. Comments from the teacher will be made in regards to the written questions and additional content may be added to answer student questions or learning requests in future lessons. Content that is already known by the students is also gleaned from this activity so the teacher can make lesson adjustments.</p>
Teaching Strategy (1 to 2 days)	<ol style="list-style-type: none"> 1. Theories of Evolution PowerPoint (Students will follow along and take any additional notes on printouts of the PowerPoint slides) 2. Benchmark #2: Socratic Circle (Should take place within the remaining time)
Summarizing Strategy	<u>Ticket-Out-The-Door</u> activity on a half sheet of paper. Students will answer the essential question with a minimum of one sentence. These will be handed back to the teacher upon exit.
Standards	Standard - 3.1.B.C3 <ul style="list-style-type: none"> • Compare and contrast various theories of evolution.

	<p>Standard - 3.1.10.C1</p> <ul style="list-style-type: none"> Explain the mechanisms of biological evolution.
Assessments	<p>Pre-assessment- 3-2-1 Writing Activity (see above) Post-assessment- Ticket-Out-The-Door (see above)</p>
Differentiation	Pre and post assessments
Additional Resources	<ul style="list-style-type: none"> NPR: <ul style="list-style-type: none"> Un-Natural Selection: Human Evolution's Next Steps Autism Gives Woman An 'Alien View' of Social Brains Case Study: When Fred met Wilma
Supply List:	<ul style="list-style-type: none"> Technology access (i.e. computers, projector access) for Theories of Evolution PowerPoint Graphic organizers for 3-2-1 Writing Activity Sheets of paper for the Ticket-Out-The-Door Theories of Evolution PowerPoint slide printouts

Car Unit	Lesson 3: The Inheritance of Evolution
Knows	Genes, genetic drift, gene flow, mutation
Dos	<ol style="list-style-type: none"> Analyze the importance of genes and their effect on inheritance Compare and contrast the effects of genetic drift and gene flow Distinguish how mutations affect the inheritance of genes
Essential Question	How do organisms change over time in response to biological and environmental changes?
Activating Strategy	<p>Article: Genetic Drift and Founder Effect</p> <p>Students will read an historical article on genetic drift and summarize the article in <u>one sentence</u>. Students will also create an analogous scenario to the Old World Order Amish to help them make sense of this example of genetic drift. Students will then share what they have written to their seat partner and be prepared to share with the class. Several student examples will be shared with the class.</p>

<p>Teaching Strategy</p> <p>(1 to 2 days)</p>	<p>Role-Play Activity:</p> <p>Students will form groups of three to four students based on class size. Each group will be assigned a concept/vocabulary term to research and Role-Play in front of the class. (These concepts include genes, genetic drift, gene flow and mutation.) Students may create props and/or incorporate other forms of technology into the Role-Play if they so choose. Students are expected to accurately represent the term/concept AND also apply the term/concept to evolution.</p>
<p>Summarizing Strategy</p>	<p><u>Questions to the teacher:</u></p> <p>Write two questions that you would like to ask the teacher to clarify for tomorrow's class.</p>
<p>Standards</p>	<p>Standard - 3.1.B.C3</p> <ul style="list-style-type: none"> • Interpret data from fossil records, anatomy and physiology, and DNA studies relevant to the theory of evolution. • Discuss the implications of a universal genetic code for evolution. <p>Standard - 3.1.10.C1</p> <ul style="list-style-type: none"> • Explain the mechanisms of biological evolution.
<p>Assessments</p>	<p>Pre-assessment- <u>Genetic drift article and writing activity</u> (see above)</p> <p>Post-assessment- <u>Questions to the Teacher</u> (see above)</p>
<p>Differentiation</p>	<p>Differentiation may take place during the Role-Play Activity in which the grouping process may be completed through student choice or through teacher-assigned groups based on student learning abilities/styles.</p>
<p>Additional Resources</p>	<ul style="list-style-type: none"> • NPR <ul style="list-style-type: none"> ◦ From Grunting to Gabbing: Why Humans Can Talk ◦ A Handy Bunch: Tools, Thumbs Helped Us Thrive • Case Study: Of Mammoths and Men
<p>Supply List:</p>	<ul style="list-style-type: none"> • Printouts and/or computer access for students to read the Genetic Drift and Founders Effect article • Necessary props for Role-Play activity

Car Unit	Lesson 4: Variation of Evolution
Knows	Traits, species, genotype, phenotype, alleles, heterozygous, homozygous, punnett square
Does	<ol style="list-style-type: none"> 1. Determine which traits are dominant or recessive 2. Be able to discern between genotype and phenotype 3. Distinguish the characteristics that make up a species
Essential Question	How can you distinguish one species from another? Does this hold true for distinguishing between cars?
Activating Strategy	<p>Personal Trait Inventory:</p> <p>Students will follow along with a PowerPoint presentation that asks them to inventory their physical traits. After inventory completion, the teacher will lead a brief class discussion, determining the most common traits among the class. The teacher may also describe their own traits during the discussion.</p>
Teaching Strategy (1 to 2 days)	<p>Video: Speciation</p> <p>Active engagement: Sticky Notes</p> <p>Students will watch the following video clip and write onto their sticky note three important facts that stuck out to them and two things they wanted to be explained in more detail. and one connection they made with cars.</p> <p>Afterwards, the students will be asked to place their sticky note on to the board. The teacher will survey the various topics and generalize the ideas shared. In addition, the teacher can expound on a particular topic of confusion that might have been more recurring than others.</p>
Summarizing Strategy	<p><u>Car Connection:</u></p> <p>Ask students to write two paragraphs, 5-7 sentences each, on whether or not speciation can be correlated with cars (e.g., make or model). They must support their stance based upon class discussion or the video they just watched.</p>
Standards	<p>Standard - 3.1.B.C3</p> <ul style="list-style-type: none"> • Interpret data from fossil records, anatomy and physiology, and DNA studies relevant to the theory of evolution. • Discuss the implications of a universal genetic code for evolution. <p>Standard - 3.1.10.C1</p>

	<ul style="list-style-type: none"> • Explain the mechanisms of biological evolution.
Assessments	Pre-assessment- Personal Trait Inventory (see above) Post-assessment- Car Connection (see above)
Differentiation	None
Additional Resources	<ul style="list-style-type: none"> • Genetics Video: Pea Plants • NPR: <ul style="list-style-type: none"> ◦ Baby Steps: Learning to Walk, the Hominid Way ◦ The Human Edge: Finding Our Inner Fish • Case Study: The Dating Game
Supply List:	<ul style="list-style-type: none"> • Print outs • Lined paper • Sticky notes • Dry erase markers • PTC paper

Car Unit	Lesson 5: The Evidence for Evolution
Knows	Natural selection, biogeography, fossils, homologous, vestigial and analogous structures, embryology, homologous proteins, Hox genes
Dos	<ol style="list-style-type: none"> 1. Evaluate and defend the evidence for evolution through several areas of study <ol style="list-style-type: none"> a. In terms of specific organisms and with cars
Essential Question	How do different types of evidence support our understanding of how organisms have evolved over time?
Activating Strategy	<p><u>Caption This:</u> Natural Selection Image</p> <p>Create a caption that depicts the following image. In addition, create a brief explanation, 4-6 sentences, of your understanding of natural selection and correlate it with the image given.</p>
Teaching Strategy (1 to 2 days)	<ol style="list-style-type: none"> 1. Natural Selection Game Introduce the concept of natural selection. Teacher may either utilize video or provide own examples. Afterwards, students may be permitted to play the natural selection game to reinforce the concept. a. Supplemental Video: What is natural selection?

	<p>2. Evidence for Evolution PowerPoint (Students will follow along and take any additional notes on printouts of the PowerPoint slides)</p> <p>a. Supplemental Video: What is the evidence for evolution?</p>
Summarizing Strategy	<p><u>The Tree of Evolution:</u> Create a genealogical tree based upon your family. Start with your immediate family and extend to your aunts, uncles, and so on. If you are unsure of a relative then leave it blank. Otherwise, provide your students with examples (e.g., family tree).</p> <p>For homework, students will consider and write in the phenotypic traits that have been passed on between one generation to another. Students may refer to prior lessons. Next, students will ask their family for their known family health history. Try to track what issues have been present for each generation (eg., heart disease, Alzheimer's, and diabetes). Lastly, consider what vehicles each family member (e.g., you, your parents, and your grandparents) have driven. Ask them why they purchased that specific vehicle.</p>
Standards	<p>Standard - 3.1.10.C4</p> <ul style="list-style-type: none"> • Compare and contrast scientific theories. • Know that both direct and indirect observations are used by scientists to study the natural world and universe. • Identify questions and concepts that guide scientific investigations. • Formulate and revise explanations and models using logic and evidence. • Recognize and analyze alternative explanations and models. <p>Standard - 3.1.B.C3</p> <ul style="list-style-type: none"> • Compare and contrast various theories of evolution. • Interpret data from fossil records, anatomy and physiology, and DNA studies relevant to the theory of evolution. • Discuss the implications of a universal genetic code for evolution. <p>Standard - 3.1.10.C1</p> <ul style="list-style-type: none"> • Explain the mechanisms of biological evolution.
Assessments	<p>Pre-assessment- Caption This (see above)</p> <p>Post-assessment- The Tree of Evolution (see above)</p>
Differentiation	<p>Pre-assessment: Teacher may allow students to design an image that demonstrates their understanding of natural selection (tactile and visual learners).</p>

Additional Resources	<ul style="list-style-type: none"> • Evidence for Evolution WebQuest • Quizlet: Evidence of Evolution • NPR <ul style="list-style-type: none"> ◦ Signing, Singing, Speaking: How Language Evolved • Case Study of Phylogeny, Speciation, and Hominin Evolution: A Tale of Three Lice
Supply List:	<ul style="list-style-type: none"> • Technology access (i.e. computers, projector access) for Natural Selection Game, Evidence for Evolution PowerPoint • Paper for Caption This activity • Evidence for Evolution PowerPoint slide printouts

Car Unit	Lesson 6: Mapping Evolution
Knows	Evolutionary Tree
Dos	1. Synthesize an Evolutionary Tree that maps out a car brand of choice and compare and contrast the car brand to the history of the Mercedes Benz car brand
Essential Question	How can Evolutionary Trees graphically model divergence and commonality among organisms over time?
Activating Strategy	<p><u>Show and Tell:</u></p> <p>Students will share their Tree of Evolution that they created for homework with their seat partners. Students should discuss common trends and be prepared to share with the class. The teacher will then lead a brief discussion regarding common trends that the students may have found. A tally will be taken to determine the most common car brands present in the genealogical trees and the possible reasons behind this data.</p>
Teaching Strategy (1 to 2 days)	<p>Students will be introduced to their Performance Task: Mapping the Road.</p> <p>Each student will be responsible for creating their <u>own</u> Evolutionary Tree for a car brand of their choice. The teacher will briefly explain the purpose and format of an Evolutionary or Phylogenetic Tree and provide several examples. The remainder of the lesson will be utilized for student work time to complete the assignment. Questions and common misconceptions/errors can be addressed during this time by the teacher.</p>
Summarizing Strategy	<u>Aha! Moment</u>

	<p>At the end of the lesson, students will all stand up and share one thing or “Aha moment” from today’s lesson or Unit of Evolution overall. After sharing, the students will sit down. A ball, wad of paper, or object can be passed to designate who the next “speaker” will be and that all attention should be given to the speaker.</p>
Standards	<p>Standard - 3.1.10.C4</p> <ul style="list-style-type: none"> • Compare and contrast scientific theories. • Know that both direct and indirect observations are used by scientists to study the natural world and universe. • Identify questions and concepts that guide scientific investigations. • Formulate and revise explanations and models using logic and evidence. • Recognize and analyze alternative explanations and models. • Explain the importance of accuracy and precision in making valid measurements. <p>Standard - 3.1.B.C3</p> <ul style="list-style-type: none"> • Compare and contrast various theories of evolution. • Interpret data from fossil records, anatomy and physiology, and DNA studies relevant to the theory of evolution. • Discuss the implications of a universal genetic code for evolution. <p>Standard - 3.1.10.C1</p> <ul style="list-style-type: none"> • Explain the mechanisms of biological evolution.
Assessments	<p>Pre-assessment- <u>Show and Tell</u> (see above) Post-assessment- <u>Aha! Moment</u> (see above)</p>
Differentiation	<p>The goal of the Performance Task will remain the same regardless of student learning ability or learning style. However, the teacher may provide greater assistance to particular students who may need extra help completing the assignment.</p> <p>For students who may struggle with the Performance Task, the teacher may provide one-on-one assistance and provide scaffolding for the car brand evolutionary tree. Extensive assistance may also be provided when comparing and contrasting to the Mercedes Benz car brand.</p> <p>For students who may need to be challenged with the Performance Task, the teacher may have the student apply 5 evolutionary terms or concepts to their car brand evolutionary tree with a short explanation as to why the term/concept fits on the tree.</p>
Additional Resources:	<ul style="list-style-type: none"> • Lizard Evolution Virtual Lab • NPR

	<ul style="list-style-type: none">○ Monkey Business: Fairness Isn't Just a Human Trait• Case Study: The Missing Link
Supply List:	<ul style="list-style-type: none">• Technology access (i.e. computers) for students to complete their PT (if done electronically)• Posters, paper, pencils, markers, rulers for students to complete their PT (if done physically)• Ball, wad of paper, or object that can be used for the Aha! Moment activity