

The Story of Dinosaurs

THE STORY OF DINOSAURS

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ABAILEY

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Stillwater, OK



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This course will explore the validity of arguments and/or conclusions in dinosaur research through evaluating the scientific evidence. In this course, students will read, experiment, and evaluate scientific literature surrounding dinosaurs. Students are expected to work with others to evaluate the plausibility of the dinosaur concepts and theories, and will engage in hands-on experiments to add additional information to their interpretations. Students will be expected to participate in evaluation mechanisms to assess critical thinking and science literacy. There are no prerequisites and no laboratory component to this course, although hands-on activities will be a primary focus each week.

Goals

This course is intended to engage students in science and the fossil record through the study of dinosaurs. It is intended that students will develop ideas, evaluate existing theories, and explore evidence to support or refute dinosaur interpretations. Through this course it is intended that students develop scientific fluency and critical thinking skills.

Objectives

- Explore the scientific method and how science is conducted, communicated, and synthesized in dinosaur research.
- Develop theories behind dinosaur morphology and behavior and assess how these theories are supported or refuted by evidence from the fossil record.
- Evaluate the usefulness of modern analogues in dinosaur morphology and behavior.

Textbook

The textbook for this course is “The Story of Dinosaurs”, authored and curated by Dr. Ashley Burkett. The textbook and associated ancillaries have been intentionally created and licensed to be free for students to use and other educators to modify for use in their local contexts. Although the resource is licensed CC-BY, it is the author’s intent that students not be required to purchase the book either as a standalone resource as a package with other resources.

1.

Welcome to the Story of Dinosaurs!!!



Getting Started in this Course – Week 1

Online Obligations: This is a mostly asynchronous course, but you will have to turn in certain things in by a specific date. Meetings such as office hours or optional synchronous tutorials/lectures will be conducted through our University's online meeting platform.

Course Information: A GEOL 1003 Syllabus Template is available for educators to modify for courses using this text. Professors will appreciate students reviewing this document or their own course's modified syllabus to be sure you understand the obligations of this course. As originally presented, students were expected to ***complete all work for that week by midnight [Sunday]***.

Details: Watch the video below for information on how to get started in this course. You may follow along to the PowerPoint here: 1a_Course Expectations



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Video Introductions!

In this class, we will be communicating a lot through short video posts. To do this we will be using **our course discussion board!** Your assignment this week is to create a 30-second video introducing yourself .



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First Things First!

Each week you will begin by taking a pre-quiz where your answers will not be counted against you if they are incorrect. If you complete the quiz you will receive full credit. Take **Weekly Quiz 1a** before you move on.

Weekly Quiz 1a



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Something that is unique to the first week of this class is the **Entry Survey**. This will be used to measure how much you know and if you change any of your perceptions through the completion of this course. there are no right or wrong answers to this 100pt survey. Once you complete it you will receive the full 100pts.



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<https://open.library.okstate.edu/storyofdinosaurs/?p=28#h5p-2>

Next, we will move on to the content for the week. This class will be conducted in a mostly asynchronous format. You will be interacting with the material and your classmates mostly through video messages.

To work our way through the content you will watch lecture videos of me and other resources from all around the internet. As you scroll through the home page watch the videos and fill in the **Notes with Gaps**. It is highly recommended that you fill out the Notes with Gaps as you are able to use **ONLY** those on **ANY** tests in this class! Here are the Week 1 Notes with Gaps for the first week and the 1b Scientific Method powerpoint.

To start, let's discuss the **Scientific Method** a bit:



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What is a Dinosaur?



These images are meant to be humorous, but have you ever really taken a good look at a bird's feet? Every time I do I see dinosaurs!

BUT

What makes a dinosaur a dinosaur? Let's have a look at a few models to see if you can find any common characteristics.



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Take the *Dinosaur? Yes or No?* survey here before going down to the lecture video below.

Dinosaur? Yes or No?



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So, how did the survey go? As you go on with the Lecture Videos, be sure to fill out your Week 1 Notes with Gaps and follow along on the What is a Dino PowerPoint.

[Embed polling resource window asking ‘what terms can be used to define a dinosaur? (2-3 words only)]



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So, now that you know a little bit about the grouping of dinosaurs based on their hip structures, color the 3 hip bones in the dinosaur schematics in your **Notes with Gaps**. use that information to group the dinosaurs in the Exploring Dinosaur Phylogeny activity.



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Candy Cladistics

This exercise is intended to get you to think about how things are grouped. So, go to your kitchen and get some food items. it would be good to ensure that at least some have shared characteristics. I'm going to use candy in the video, but you can use whatever you want. Gather your items and follow along with the video, when you are done take a photo of your food cladogram and submit it to your course LMS.



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Wrap-up Candy Cladistics



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online here:

<https://open.library.okstate.edu/storyofdinosaurs/?p=28#h5p-7>

Look Here!

1. Create a 30 second video introducing yourself!
2. Weekly Quiz 1a – The first thing you will do every week is to complete the pre-quiz. You will get full credit for participating.
3. Entry Survey- 100 points and is participation based.
4. Dinosaur? Yes or No? survey
5. Exploring Dinosaur Phylogeny Activity
6. Food Cladogram
7. Weekly Quiz 1b – At the end of every week, you will complete a graded quiz based on the week's topic. This will be graded based on your answers. This quiz is open for you to take as many times as you want

Please note: there are ~2 extra exercises in this week because it is the first week. Later weeks won't be quite as packed.



Dr. Ashley Burkett

Assistant Professor of Geology

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Hello all! I am excited to have you exploring this resource! I appreciate all feedback from content and delivery to typos and broken links. Please feel free to contact me via email! I would love to hear from you.





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A Little About the Author

I am a paleontologist specializing in single-celled invertebrates, that make a shell about the size of a grain of sand, called foraminifera. These organisms are still around in modern oceans today and have existed since the first hard parts appeared in the fossil record about 500 million years ago. They also were around and experienced some major changes in their shell morphologies while dinosaurs were roaming the earth! Because I study these marine organisms I get to go to sea once or twice a year to collect samples. I love being at sea and am very passionate about foraminifera!

I am a faculty member in the Boone Pickens School of Geology. In addition to this course, I teach GEOL 1224: Evolution of the Earth, and GEOL 3103: Paleontology.

2.



Due to their immense size, it was assumed in the past that large sauropod (long-necked) dinosaurs could have only existed in swamps to help regulate their body temperature and support their immense weight.

This Week

Start with Weekly Quiz 2a.

Weekly Quiz 2a



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<https://open.library.okstate.edu/storyofdinosaurs/?p=29#h5p-8>

Hey all! This week, we will be working in groups. I know this can be challenging given our varying distance and time commitments, but let's give it a try!

I would suggest that **at the beginning of the week** you identify what each group member will do, and identify a means you will use to communicate.

Midweek you should all have read and discussed the paper with other members of your group (or at least clarified questions or points of interest through something like a discussion board). You should have a plan of how you will work together to identify the questions, shoot, and post a video as its own thread through the Discussion Board Dinosaur Metabolism.

By the video due date you need to shoot and post the video on behalf of your group. At the beginning of next week you will all individually view and comment on each group's videos.

Group-work participation will be assessed through viewing your discussion boards and information exchange and (possibly) an anonymous survey of your group members.

On your own (each person) should view the videos between **during the time window specified by your professor**, comment on 2 videos and get to know each other.

Weekly Quiz 2b



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What is Metabolism?

Let's put this argument to the test this week! When I (Dr. Burkett) was a kid, dinosaurs did not have feathers. It was also certain if they were warm-blooded or cold-blooded. We now have a bit more evidence to go off of, so let's heat things up (or cool them down . . . depending on which side of the argument you are on).

So, you can find the Notes with Gaps for this week and Power Point here. What are some ways that animals fuel their bodies? Watch the videos below on how reptiles and birds regulate their body temperatures. Let's find out!



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How to Read a Scientific Article

To dive into the dinosaur literature in the most efficient way possible we will be splitting up into groups, reading a scientific paper, and reporting our findings. Before we get that far, let's review how to interpret a scientific article. Check out the video below:





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Group Readings

To find your group assignment go to People>Groups>Dinosaur Metabolism. Once you have done that you can communicate with your group on your personal group page by clicking on the appropriate link below. You can post to the message board to communicate who reports on each question. Then post your video of your reading findings to [LINK Discussion Board Dinosaur Metabolism] and comment on 2 other groups' video. Each group only needs one video but you can post in parts if needed, just make sure the labeling is clear (include part 1 of 2, or whatever, in the video title).

1. Sauropod Gigantism [LINK to group]
2. T-rex Skull Morphology [LINK to group]
3. Evidence for Mesothermy [LINK to group]
4. Shortfalls of Mesothermy [LINK to group]
5. Biomechanics [LINK to group]

After your group has met or exchanged information, create a video sharing your findings. Once everyone has posted, review the videos and comment on at least 2 videos (with a response video). You will be graded on your group participation and your reading findings.

Review All Groups on Discussion Board

Make sure you have gone to the discussion board and commented on at least 2 videos. What is your conclusion about how dinosaurs regulated their body temperature? Complete your assessment on the survey here:



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<https://open.library.okstate.edu/storyofdinosaurs/?p=29#h5p-10>

After you are done, complete both parts of Weekly Quiz 2b.

Weekly Quiz 2b part 1



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Weekly Quiz 2b part 2



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Wrap up!



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Look Here!

Complete

1. Weekly Quiz 2a
2. Reading Activity
 - Post video of your reading findings
 - Reply to 2 posted videos and complete Dinosaur Metabolism survey
3. Weekly Quiz 2b parts 1 and 2

3.



Let Me Introduce: Stegosaurus!

First, get in your Weekly Quiz!

Weekly Quiz 3a



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<https://open.library.okstate.edu/storyofdinosaurs/?p=33#h5p-13>

Who doesn't love the Stegosaurus? So many unanswered questions. Was it unintelligent given its tiny brain cavity? What's with the plates? Did they live together or apart? Most importantly, how epic were their battles with *T. rex*?



This week we will answer, or at least try to figure out, answers to all these burning questions about one of the most iconic dinosaurs ever. Plus everyone loves Spike in *The Land Before Time*. Here are the Notes with Gaps and the PowerPoint for the week.

This week is all about Stegosaurus! Let's dive into the details.



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Now let's get into the basics of the features Stegosaurus has!



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[INSERT lecture video, plates?]

Before you continue, print out the Stegosaur Plates exercise, cut out the plates and spikes, and arrange them in the top view of the Stegosaurus.

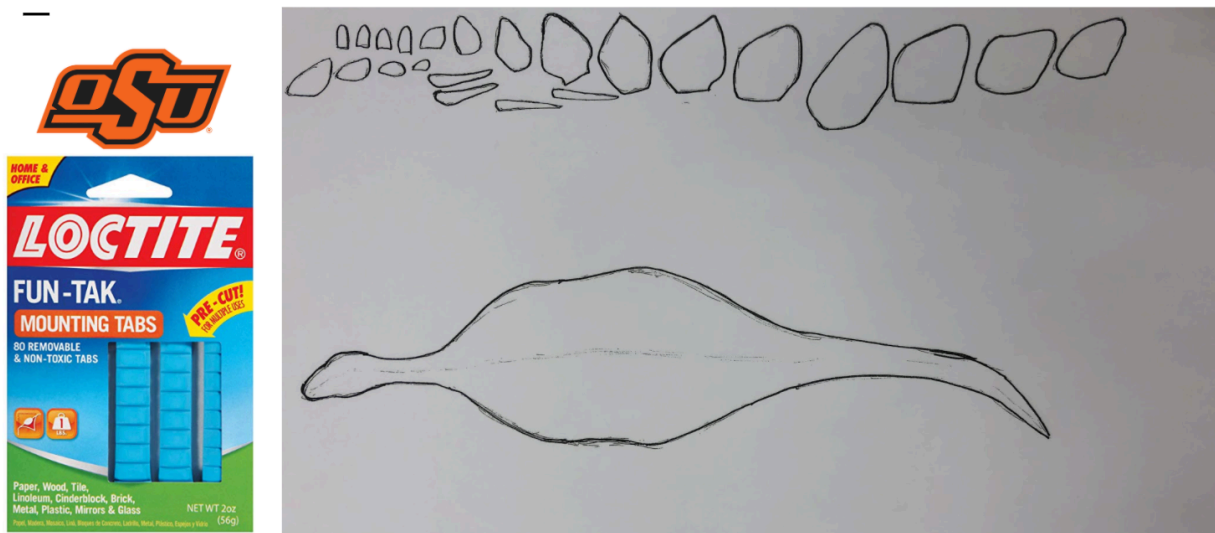
How will you arrange the plates? Are they in 2 parallel lines or staggered? Remember, you have to make them all fit! This model is to scale! Once you have completed putting your plates on (with glue, sticky tac, or tape) take a picture and upload it to the course dashboard.



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For this assignment:

1. Print out the Stegosaur Plates exercise. This is also available in your Notes with Gaps.



Stego Plate Arrangement Exercise

The large round shape below the plates is a top view of the Stegosaurus. Imagine you were in a (non-flowering) tree looking down as it walked by on the ground below you. How would the plates and spikes be arranged? Hint: Try using the sticky tack wrapped around the bottom of the plates to stick them perpendicular to the cut out shape of the dinosaur. The line down the middle of the dinosaur outline is about where its backbone should be.

- Cut out the plates and spike and arrange them in the top view of the Stegosaurus.
 - How will you arrange the plates?
 - Are they in 2 parallel lines or staggered? Remember you have to make them all fit! This model is to scale!
- Once you have completed putting your plates on (with glue, sticky tac, or tape) take a picture and upload it to the course dashboard.

What's with the Plates?

There are 4 main proposed uses of the plates. in this video I will review those uses. Which proposal grabs your attention the most? You can use this video to help you generate your “stegosaurus experiment” for the weekly assignment.



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What Do YOU Think? Design an EXPERIMENT!

[INSERT Stegosaurus_StegoAssignment.mp4]

So, what you will do this week for the hands-on activity you will be designing a scientific experiment to assess the uses of the Stegosaurus' plates! You have a couple options, the experiment you design could be field-based (e.g., go into the field and look for a certain fossil structure) or lab-based (where you “build” and design something in the lab to test) experimentation. Check out this video for more info:

To submit your experiment you can either submit a video of you explaining your experiment or submit a written report. To obtain full credit your submission should include:

Part 1: EVERYONE

1. Identification of which “proposed uses of the plates” idea you are testing.
2. A stated hypothesis your experiment will test (see the Week 1 Scientific Hypothesis video to remind yourself of how to construct this).
3. What you expect the results of the experiment to be.

Part 2A: Field Paleontologist- If you do the field-based experiment be sure to include:

1. What you are going to look for in the fossil record
2. The likelihood that you will be able to find it
3. Potential dig site location

Part 2B: Lab Paleontologist- If you do the lab-based experiment be sure to include:

1. What will you **build** to test your hypothesis?
2. What variables or parameters that you will be measuring?
3. Likely outcomes of your experiment.
4. How you would modify it based on the results?

Submit your experimental designs to your course dashboard.

Weekly Wrap-Up!



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Look Here!

Complete::

1. Weekly Quiz 3a
 2. Stegosaurus Plate Arrangement
 3. Stegosaurus Experimental Designs
 4. Weekly Quiz 3b
-

Links

- Previous Week – [Week 2 Dinosaur Metabolism]
- Next Week – [Week 4 Dino Parents]

4.

An cartoon of an adult Stegosaurus rocks back and forth on the plates on its back while a juvenile Stegosaurus runs around it.

Dinosaur Parenting

First, complete Weekly Quiz 4a.

Weekly Quiz 7a



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<https://open.library.okstate.edu/storyofdinosaurs/?p=36#h5p-14>

Let's be honest, when you think about a Mama T-rex it doesn't make your heart all warm and fuzzing feeling does it? It probably shouldn't, as the t-rex could fit your entire torso in its mouth in one bite! BUT! Despite that terrifying thought, more evidence is showing that many Dinosaurs were actually great parents! Those that laid eggs and bounced may surprise you. Grab your Notes with Gaps and Power Point for Week 4 and let's explore.

[INSERT Dinosaur Parenting_Part 1]

Crocodile Parenting



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Bird Parenting



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Relating this to Dinosaur and Reproductive Strategies

In this section we will cover some of the different reproductive strategies employed by different animals. This relates to dinosaurs because we can use some of this information when we examine fossilized dinosaur nests.



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Evidence of Dinosaur Parenting

Select a dinosaur and do your own research on evidence of parenting. Keep in mind, that choosing a dinosaur (like Stegosaurus) where there is little to no evidence might make for a difficult research subject. Try to do a quick search prior to selecting your dinosaur!

Select a dinosaur species you would like to investigate what evidence we have of their parenting abilities. answer the questions listed and submit a written or video report of your findings.

Dinosaur Parents

What **EVIDENCE** is there?

In the lecture videos for the week, we spent a lot of time looking at the modern analogues of crocodiles and birds to see how they employ various parenting strategies. Now, you will investigate the dinosaur fossil EVIDENCE. You have the freedom to choose any dinosaur you would like, but you have to be able to report something about dinosaur parenting. I suggest you look at dinosaurs with nests preserved.



Discovered Dinosaur Nests

- Only the following dinosaurs have preserved intact dinosaur nests:
 - *Troodon* from L. Cretaceous in Montana
 - Unidentified therizionsaurs from L. Cretaceous of Mongolia which may have formed nesting colonies.
 - Titanosaur sauropods from L. Cretaceous in Argentina and Spain.
 - Prosauropod *Massospondylus* from the E. Jurassic in S. Africa
 - Ceratopsian *Psittacosaurus* from E. Cret in china and *Protoceratops* from L. Cret in Mongolia (although not nests, but hatchlings, tightly packed in a small space)

Check out Google Scholar and reputable scientific journalism sources (such as LiveScience.com) to gather data regarding your dinosaur. Please do not cite Wikipedia (but feel free to use it as an annotated bibliography).

You may submit your findings in the form of a video or submit a written report. To obtain full credit your submission should include:

Be sure to include in your report:

1. What is the dinosaur starring in your reading?
2. What is parenting strategy?
 - K or R Selection?
 - What is the evidence
3. What additional evidence is needed to be sure?
4. Do you think this applies to all or only some dinosaurs? Why/Why not?

Keep in mind to cite things correctly.

Finishing up

Finally, finish up with your Weekly quiz 4b.

Weekly Quiz 4b



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<https://open.library.okstate.edu/storyofdinosaurs/?p=36#h5p-16>



One or more interactive elements has been excluded from this version of the text. You can view them online here: <https://open.library.okstate.edu/storyofdinosaurs/?p=36#video-36-1>

Look Here!

Complete:

1. Weekly Quiz 7a
2. Dinosaur Parenting Research Project
3. Weekly Quiz 7b

5.




The Time Traveler's Guide: How to Outrun a T-Rex!

First off, don't forget the Weekly Quiz 5a!

Weekly Quiz 8a



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 here:

<https://open.library.okstate.edu/storyofdinosaurus/?p=39#h5p-17>



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Yes, this is how we will introduce this topic for the week. **It is awesome!** By the end of the week, you will know if scenes like this one and the original are accurate and why/why not.



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Here are your Notes with Gaps and PowerPoint for this week.



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First, How Dinosaurs Make Tracks

Some dinosaurs, like people, walk primarily on two feet, but others walk on all fours. So what do dinosaur tracks look like? Well, it depends on the dinosaur. In this section, we will focus on the trackways of 2 types of dinosaurs: Bipedal and Quadrupedal.



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Next, Let's Look at Some T-rex Tracks

With great difficulty, I set up some T-rex tracks for you to examine. Check out the video below and complete the first part of Can You Outrun a T-rex?

In the lecture videos I went over how animals with 2 vs 4 legs make different tracks. T-rex is a bipedal dinosaur, meaning it will only leave a maximum of 2 footprints for each set of steps it takes.

Watch the video below about the 3 various speeds at which T-rex tracks suggest they move.



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Plug the information in the activity below into the equations in the T-rex Track Ways spreadsheet. Use the information in Column G to determine how quickly the T-rex is moving in each track set. Record your answers.

[table "1" not found /]



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Could You Outrun a T-rex?

Finally, you will need to determine your walking and running speed to compare with T-rex. Check out the video below and complete the second part of Can You Outrun a T-rex?

Part 2: Can you outrun it?



The gif above is from the original Jurassic Park movie. In this film they use a Jeep to easily outrun the T-rex. By the end of this exercise you will be able to gauge the reality of this scenario. You will also be able to determine if you could outrun the T-rex with your own 2 feet.



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To complete this exercise you will need:

- a tape measure
- a long flat place where you can mark distances (like a sidewalk)
- a way to mark a start and end point (like chalk or flags)

Instructions:

1. Measure out 5m (~16.4ft)
2. Mark the start and finish lines of your 5m (~16.4ft)
3. Walk the 5m (~16.4ft) length and count every time your lead foot (the one you took your first step with) hits the ground. Note: you should only be counting either your right foot or your left. Do not count them both.

- Record the number of times your lead foot hit the ground.
- Run the 5m (~16.4ft) length and count every time your lead foot (the one you took your first step with) hits the ground. Note: you should only be counting either your right foot or your left. Do not count them both.
- Record the number of times your lead foot hit the ground.
- Use the Stride Length formula to determine your stride length for walking and running.
- Plug your stride length into the equation to calculate your speeds in MPH.
- Compare these with the speeds T-rex can walk and run (based on the information provided above)

What is the result? Can you outrun a T-rex when it is walking? Jogging? Running?



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Finally, finish up with Weekly Quiz 5b!

Weekly Quiz 5b



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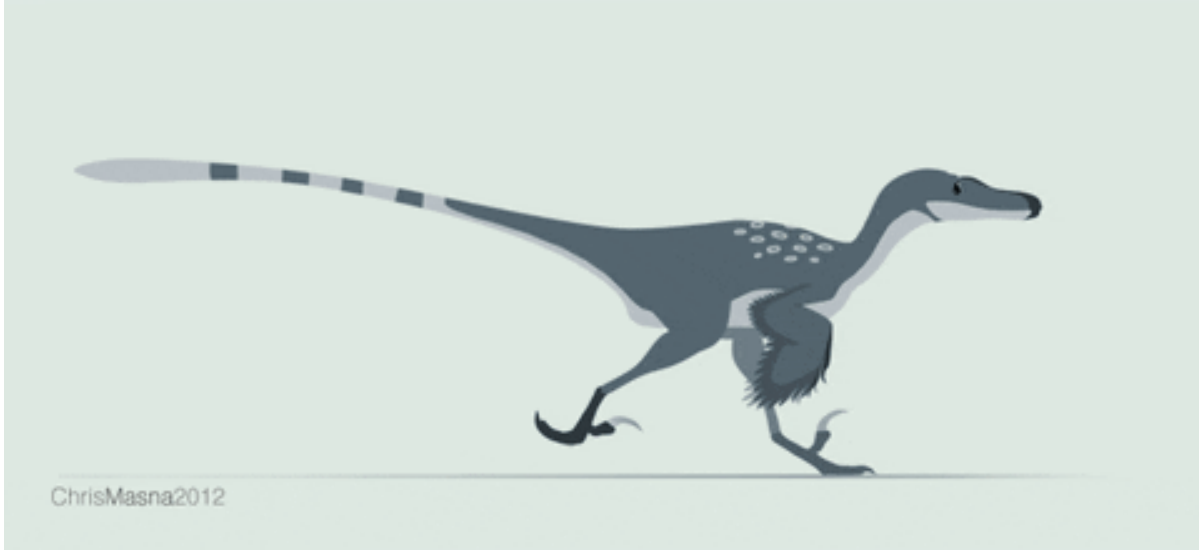
Look Here!

Complete:

1. Weekly Quiz 5a

2. Can You Outrun a T-rex
3. Weekly Quiz 5b

6.



First off...

Weekly Quiz 6a!



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Next ...

The questions below function as a short answer quiz where I would like you to expound upon your understanding of the material (consider it your mid-term). You may use your Notes with Gaps, but no other materials. At the end you will have the option to create and save your questions in a single file.



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Dino Feathers?

Why would dinosaurs have feathers? Did all dinosaurs have feathers? Can you imagine a fluffy T-rex? Here are your Notes with Gaps and Power Points for the week.



This reconstruction of a T-rex covered in feathers uses fossil finds including where skin impressions have been found. This is why the tail and feet are oddly bare in this image.

Feathers serve a variety of purposes in modern birds. therefore it is reasonable to assume that they may have served a different purpose in dinosaurs as well. Maybe *T. rex* didn't fly, but it's possible it had these soft downy feathers!



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On the Origins of Feathers

Step 1: Watch me



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Step 2: Watch this video



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Step 3: Watch me again!



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Step 4: Watch the Britannica video at the link below!

Discover feathered dinosaurs from their fossils from the Middle Jurassic Epoch

Step 5: Watch this video!



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Step 7: Remember the online assignments for the week.

T. rex Feathers

Now that you know all about feathers in modern birds and a lot of what we know about dinosaur feathers, let's look at a hot dinosaur controversy! Was T. rex FEATHERED?!



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Look Here!

Complete:

1. Weekly Quiz 9a
2. Assignment
3. Writing Assignment 1 of 2
4. Weekly Quiz 9b

7.



The Extinction of the Dinosaurs

This week we will be looking at the extinction of the dinosaurs! But before we dive in, complete the Dinosaur Extinction pre-quiz.



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Dinosaur Doom

The first thing I would like you to do is to complete the Dinosaur Doom activity on Infiniscope. This activity is a virtual field trip where you will examine the sedimentary record above and below the K/T extinction event. I think you will all gain a lot from this exercise (I know I did!). This activity took me about 2 hours to work my way through. This exercise does take a lot of bandwidth, so if you run into issues, let me know. I do know that

there is an option to watch YouTube videos outside of the exercise (which seems to run a bit faster). You will be completing the questions. For your convenience, I included all these questions on the Notes with Gaps for Week 7.



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So, what was it like during the actual impact?

Video 1 of 2:



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Video 2 of 2:



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Don't Forget . . .



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Look Here!

1. Week 7a Quiz
2. Dino Doom- Dinosaur Doom activity on Infiniscope.
3. Week 7b Quiz

Extra Material

In my lectures this week, we discussed mass extinction and I mentioned the largest mass extinction event in the earth's history (the Permo-Triassic). While looking for interesting and engaging videos for the class I ran into this video on CuriosityStream. Since you might have access I thought it would be worth sharing: How long does it take to recover from mass extinctions?

Note: This is an OPTIONAL activity.

8.



Optional BONUS Activity: Jurassic Park

First of all, this week is OPTIONAL! If you don't want to complete this or don't have access to the Original Jurassic Park Movie you DO NOT have to complete this. BUT it is a good bonus point opportunity and many have found completing this exercise a great learning and entertaining experience!



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You will also need the Notes with Gap for Week 8 and the PowerPoint.

If you don't watch Jurassic Park, check this out!

After watching the Jurassic Park movie check out a couple of these articles and videos about dinosaurs in movies (and some specifically, Jurassic Park):

- Check out some of the other movies this paleontologist offers his opinion on:



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- Read the article interviewing Jack Horner about the dinosaurs of Jurassic World

Influence of Pop Culture on Science

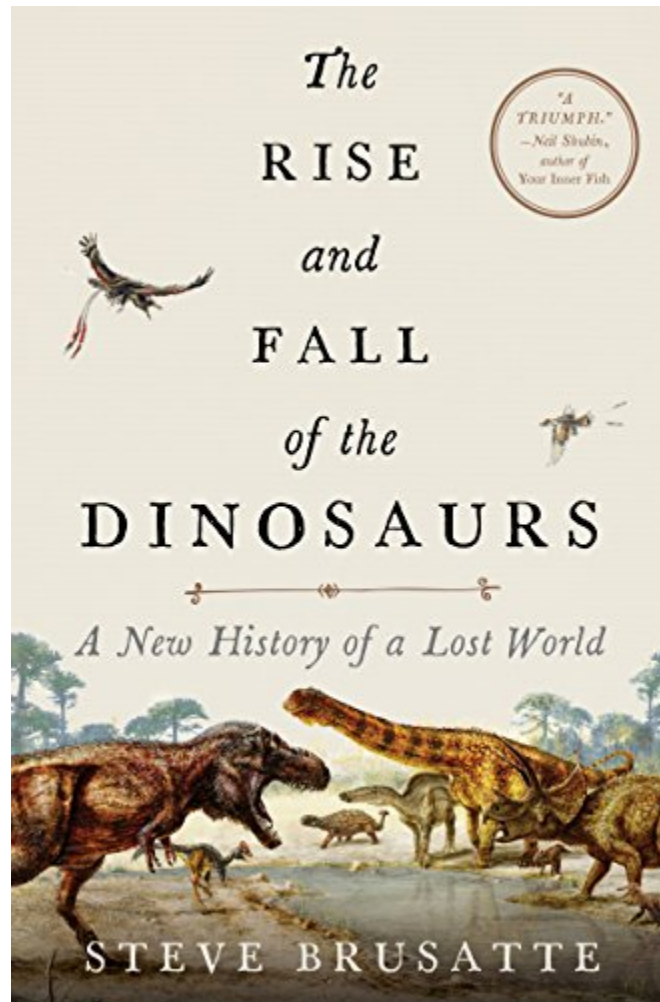
Despite the inaccuracies in Jurassic Park, it was one of the first movies to bring dinosaurs to life for the general public. It also was one of the first movies to focus on 'dinosaurs as animals and not monsters'. After the movie Jurassic Park came out, a great deal more funding became available for dinosaur research! That is why there have been so many huge leaps in dinosaur discoveries since the 1990's. You will also need the Notes with Gap (minus the JP Movie Notes) for Week 8 and the PowerPoint.



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Don't believe me? It's TRUE! Read the two articles below to help you with the Post Weekly Quiz:
 Who pays for Dinosaur Research?
 Jurassic Park and the dinosaur explosion

If you want to read more about the history of dinosaur exploration and how it has changed in the last few decades I would suggest the book:



If you don't feel like reading the entire book you can check out the interview by the author, Steve Brusatte.

Required End of the Semester Activities

- The two remaining items are required for you to finish off the semester. First is the Exit Survey. Like the Entry Survey at the beginning of the semester you will receive full credit for completing it.
- The other assignment is the Writing Assignment 2 of 2. This is a no internet written answer exam. The only item you MAY use are your Notes with Gaps.



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9.

As a woman turns a page in what is apparently an interview a
lifesize Utahraptor bursts through a paper door scaring the
woman.

I know finals week is scary! But not as scary as if you ever came
across a dinosaur!

They're here! Finals have arrived!

This Week in Dinos

FINALS!!! Everyone stay calm, please DO NOT panic!!!



Weekly Schedule



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Complete the following:

- Exit Survey
- Writing Assignment 2 of 2 (see below)

Exit Survey and Writing Assignment 2 of 2



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10.

This is where you can add appendices or other back matter.

PART I FOR INSTRUCTORS

11.

This is where you can add appendices or other back matter.