

# JURASSIC PARK HIGHLIGHTS TOUR

YALE PEABODY MUSEUM

JUNE 2018

## WELCOME TO (PEABODY'S) JURASSIC PARK

- Welcome to the Peabody's Jurassic Park tour. Over the next half hour, we are going to visit the real dinosaurs featured in the movie franchise. The Peabody's scientists discovered the first Stegosaurus and Triceratops and we'll see the first Tyrannosaurus rex fossil ever discovered. The Peabody has the true raptor, but the movies made a few big mistakes in bringing this dinosaur (and others) to life. But first, let's start where the original movie begins...

## STOP 1 – AMBER

Location: Temporary gallery before Great Hall (get specimen from IP, otherwise Ryan can provide)

### TOUR MATERIAL:

- In one of the opening scenes of the original Jurassic Park movie, miners in the Dominican Republic are searching for amber, or fossilized tree resin.
- Tree resin is a thick, sticky liquid material secreted by trees. Over millions of years, it hardens to a transparent orange stone called amber.
- Sometimes, the resin covered insects and other small animals as it moved along the outside of the tree, permanently trapping them in the amber. Recently scientists have even found amber specimens containing the tail of a feather dinosaur and others with engorged ticks.
- In Jurassic Park, John Hammond and his team extract the stomach contents of mosquitoes trapped in the amber, hoping that some of them had eaten before getting trapped in the resin and the fossil will contain the blood (and DNA) of dinosaurs. John Hammond and InGen use this DNA to clone all the dinosaurs in the park.
- This method for cloning dinosaurs is pure science fiction, though. DNA is a fragile molecule and does not survive very long in most conditions. A recent study looking at 10,000-year-old insects in fossilized tree resin could not extract any useful DNA. The most recent non-avian dinosaurs were alive 66 million years ago.
  - <http://www.sci-news.com/paleontology/science-dinosaur-dna-amber-01383.html>

## STOP 2 – THE AGE OF DINOSAURS

Location: In front of Archelon with enough room for group to view the mural

### TOUR MATERIAL:

- Q: Does anyone know what the "Jurassic" in Jurassic Park and World refers to?
- Dinosaurs first started appearing on the earth approximately 240 million years ago, during a geological period known as the Triassic Period.

- Dinosaurs lived through 3 of these geological periods, collectively called the Mesozoic Era, dying off around 66 million years ago during the Cretaceous Period, likely from an asteroid impact in Mexico and prolonged volcanic activity in India.
- The middle of the three periods is called the Jurassic Period, lasting from 201 million years ago to 145 million years ago. The four fossils in the middle section of the Great Hall are all from the Jurassic Period.
- Though some of the dinosaurs in the Jurassic Park movies are from the Jurassic Period, the most famous ones lived during the Cretaceous Period.

### STOP 3 – BRONTOSAURUS & SAUROPODS

Location: Entrance of Great Hall, in front of incorrect 1930's Brontosaurus head

#### TOUR MATERIAL

- After arriving on Isla Nublar, the first dinosaur Dr Grant and Dr Sattler see is the giant Brachiosaurus. (The scene where they stand up in the Jeeps and Grant dramatically takes off his sun glasses.)
- Brachiosaurus was a sauropod: four-legged dinosaurs with long tails, long necks, and small heads. They are some of the largest animals to ever walk the earth.
- At the Peabody, we don't have a Brachiosaurus fossil, but we do have another large sauropod who lived during the same period: Brontosaurus.
- Both animals lived during the Jurassic period, the middle of the three ages of dinosaurs. Fossils of each have been found in the western North America in an area called the Morrison Formation.
- This Brontosaurus is the first fossil of the animal ever discovered, and the first nearly-complete sauropod fossil discovered. As mounted, it is 65 feet long, but we now know that it is missing about 5 feet of neck bone and 15 feet of tail bone, making it 85 feet long when alive.
- One major difference between the Brontosaurus (in the museum) and the Brachiosaurus (in the movie) is the proportions of the forelimbs and hindlimbs. Brachiosaurs had forelimbs that were longer than the hindlimbs, inclining its body. Brachiosaurus would have been taller than the Great Hall's ceiling. The Brachiosaurus also had a much shorter tail than the Brontosaurus.
- In the movie, the Brachiosaurs are shown rearing up on the hindlegs to reach leaves on the top of the tree. Given its anatomy, scientists do not think that was possible.
- Both Brontosaurus and Brachiosaurus were herbivorous, meaning they only ate plants. Among other ways, we know this because of their teeth. Brontosaurus had thin, pencil-like teeth, well-suited for clipping leaves off trees.
- In the movies, the Brachiosaurs chew their food before swallowing, but if you look at the skull, you won't see any molars or flat teeth in the mouth. Scientists think that these large sauropods swallowed the leaves whole after snipping them off.
  - <https://www.livescience.com/9838-gulp-long-necked-dinosaurs-bother-chewing.html>

## STOP 4 - TRICERATOPS

Location: Rear of the Great Hall, ceratopsian exhibit

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### TOUR MATERIAL:

- The Peabody Museum and its paleontologists discovered and named many of the dinosaurs featured in the Jurassic Park movies. Our first paleontologist, O.C. Marsh (who's uncle was George Peabody) described and named Triceratops in 1889.
- Triceratops, meaning "three horned face", were common in the late Cretaceous period throughout the western United States and Canada. They are famous for their long horns and the large frills on the back of their skulls.
- When bones are fossilized, all the organic material is replaced by stone and minerals. This makes the fossils of animals much heavier than their bones when alive. These skulls weigh between 2,000 and 6,000 lbs each.
- Ceratopsians, the group of dinosaurs including Triceratops as well as related dinosaurs in this exhibit (*Chasmosaurus*, *Torosaurus*, *Monoclonius*), were plant eaters. However, their teeth look different than the teeth of the plant-eating *Brontosaurus*. Scientists think that the ceratopsians had complex teeth for cutting and chewing fibrous plant material. They likely were able to eat a wide variety of plants. They also had a beak in the front of their mouths for grasping and plucking.
  - <https://www.livescience.com/51108-triceratops-teeth.html>
- In Jurassic Park, a sick Triceratops is the first dinosaur that the characters interact with. Dr Sattler realizes that the park staff included a poisonous plant in the exhibit that the animals were eating.
- Trivia: Spielberg also filmed a scene where Lex rides a baby Triceratops, but then cut the scene from the film. 21 years later, they added this idea back in Jurassic World in the dinosaur petting zoo scene.

## STOP 5 – STEGOSAURUS

Location: End of Jurassic center area, Stegosaurus fossil

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### TOUR MATERIAL:

- Stegosaurus, meaning “covered lizard”, was not in the original Jurassic Park film, but Steven Spielberg added it to the sequel, The Lost World, after so many fans requested it.
- Stegosaurus was a Jurassic dinosaur, like the Brontosaurus, living about 150 million years ago in the western United States.
- This dinosaur was also first discovered and named by Yale’s paleontologist O. C. Marsh in 1887. This was at the height of a period known as the “Bone Wars”, when Marsh and his professional rival, E. D. Cope, rushed to find and name as many dinosaurs as they could. In his rush to publish Stegosaurus, Marsh incorrectly assumed the plates on the back of the animal were flat, more like a turtle shell. He corrected this a few years later.
- Complete skeleton fossils of Stegosaurus are rare. This reconstruction uses at least six different specimens, likely including animals of different genders and ages.
- The plates were not connected to the dinosaur’s skeleton but embedded in their skin. There’s some debate as to whether these plates were for visual display and / or they had some thermoregulatory purpose.
  - <https://blogs.scientificamerican.com/tetrapod-zoology/the-stegosaurus-plate-controversy/>
- Stegosaurus also had 2 pairs of spikes at the end of the tail. Paleontologists think that these spikes may have been used in combat. A study found that 10% of spike fossils show signs of combat damage, and one Allosaurus fossil was found with a wound in the same shape as a spike tail end. This Stegosaurus was mounted in 1925 and has too many tail spikes.
- If you look at up to the mural, you’ll see a Stegosaurus painted behind the Brontosaurus in the Jurassic section of the mural. If you look to the left, we enter the Cretaceous end of the mural, and here you’ll see a distant relative of the Stegosaurus, Ankylosaurus, which lived 68 to 66 million years ago.
- Ankylosaurus was featured in the movie Jurassic World, in the scene where Zach and Gray left the park in the gyrospheres. Rather than spikes at the end of the tail, Ankylosaurus had a blunt club, which it could use as defense.

## STOP 6 – MOSASAURS

Location: Mosasaur fossil, left of Jurassic exhibit

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### TOUR MATERIAL:

- The dinosaurs weren't the only large extinct animals to live during the Triassic, Jurassic, and Cretaceous periods. Pterosaurs flew in the skies and ichthyosaurs, plesiosaurs, and mosasaurs lived in the oceans. These two mosasaur fossils were found in Kansas, which used to be covered by a large sea during the Cretaceous period. None of these animals were dinosaurs, but all went extinct by the end of the Cretaceous period.
- In Jurassic World, there's a Sea World-like exhibit containing a mosasaur. This mosasaur is huge – at least 100ft long. At the end of the movie, this mosasaur stops the hybrid Indominus rex from killing the Tyrannosaurus. (How did they get the mosasaur DNA without amber?)
- Real mosasaurs, while large, were considerably smaller. The largest known mosasaur is about 50ft long. Most were much shorter.
- Mosasaurs had two rows of cone-shaped teeth on their upper jaws. The smaller, inside row of teeth is thought to help the mosasaurs swallow large prey whole. Jurassic World did get this feature correct in the movie.
- The Peabody has two mosasaur fossils on display. The complete skeleton is mounted as the animal might have looked when alive. The other one is on the wall, displayed as it was found in the chalk deposits at the bottom of the ancient sea floor.
- Most fossils are not found as complete animals buried perfectly in the ground. A lot happens to animals when they die, and then to the rocks they are fossilized in during the millions of years in the ground. Fossils are found in small fragments scattered over a large area, and paleontologist must work with limited information to reconstruct the animals.

## STOP 7 – TYRANNOSAURUS REX

Location: T. rex skull

### TOUR MATERIAL:

- In this next exhibit, we have the skull of a Tyrannosaurus rex – one of the most important dinosaurs in the Jurassic Park series. T. rex lived between 68 and 66 million years ago, at the end of the Cretaceous Period. It reached lengths of 40ft and weighed up to 15 tons.
- At the Peabody, we have the first fossil of a T. rex ever discovered - this tooth. It was found near Denver, CO a few years before the first T. rex skeleton was found and sent to O.C. Marsh.
- Unlike the other dinosaurs we've seen so far, the Tyrannosaurus was bipedal, meaning it walked on two legs, and was a carnivore, or meat-eater. T. rex teeth were big – this is only the tip of the full tooth – and differed by shape depending on where it was found in the mouth. This tooth had the shape of a thin three-sided pyramid and was serrated on the ridges to increase strength or more easily tear flesh.
- This skull is a cast of the T. rex skull from the American Museum of Natural History. If you view it straight-on from the side of the exhibit, you can see that the skull was deformed during fossilization.
- In the first movie, John Hammond claims that they clocked the T. rex running at 32 mph. This sets up a scene later in the movie when Dr. Sattler and Muldoon rescue Ian Malcolm in the Jeep and the T. rex chases them down the road for a few hundred meters.
- Recent studies, however, suggest that the T. rex could only run between 12 and 17 mph. Anything faster would have broken the bones in its feet. By comparison, the fastest human has run 27 mph.
  - <https://news.nationalgeographic.com/2017/07/tyrannosaur-trex-running-speed/>
- Another key plot point in the movie is that the T. rex could not see anything that did not move. On the contrary, judging by the size of the T. rex's eye balls and the vision of similar modern animals, the T. rex's vision was likely better than a hawk and 13x better than a human.
  - <https://gizmodo.com/jurassic-park-lied-to-you-t-rex-had-great-eyesight-rea-1577352103>
- The Tyrannosaurus rex is undoubtedly the star (and sometimes hero) of the Jurassic Park series and makes an appearance in every movie. Steven Spielberg was nervous that the first movie didn't have enough T. rex in it, so he had the final scene of Jurassic Park rewritten to include another appearance by the dinosaur. Does anyone remember what happens in the scene? **The T. rex breaks into the visitor center and attacks the Velociraptors, allowing the humans to escape.**

## STOP 8 – DEINONYCHUS

Location: Deinonychus exhibit (Just turn the group around)

### TOUR MATERIAL:

- Second to T. rex, the Velociraptor is the other most important dinosaur in the Jurassic Park series. If it weren't for the book and movies, Velociraptor would probably not be such a famous dinosaur. There's a problem though – the Velociraptor depicted in the movies is actually this dinosaur behind us, Deinonychus.
- When Michael Crichton was writing his book, he used a reference book written by an author who thought Deinonychus belonged to the Velociraptor group of dinosaurs. This mistake made it into Crichton's book and persists in the new movies. The real Velociraptor was no bigger than a turkey, and the real Deinonychus, as you can see, is smaller than those in the movies.
- Deinonychus, which means "terrible claw", lived in the early Cretaceous Period, between 115 and 108 million years ago. Velociraptor was more recent, living about 75-71 million years ago.
- Deinonychus was discovered in Montana in 1964 by Yale paleontologist John Ostrom, many years after the other dinosaurs in this room were discovered. Ostrom found a large claw and other bones in the ground, belonging to the dinosaur's hand. With this discovery, John Ostrom helped launch a new era of excitement for dinosaurs. Deinonychus, with large claws on its feet and agile-looking skeleton, did not match the popular opinion that dinosaurs were sluggish and cold-blooded.
- In the movies, the Velociraptors are pack hunters and cooperate with each other. While fossils of multiple Deinonychus specimens have been found in the same location, there's no evidence to support this. Possibly, the opposite was true – one of the tail fossils in our collection has another Deinonychus claw embedded in it, suggesting the animals may have fought and competed with one another.
- Though Crichton did not use Deinonychus in novel, he did reference John Ostrom and his work in the novel. Shortly after the movie was released, Ostrom sent letters to both Michael Crichton and Steven Spielberg expressing his excitement and sharing recent research. Crichton then called Ostrom on the phone to discuss Velociraptor and Deinonychus.
- Since the 1970s, scientists have learned that rather than dinosaurs being most closely related to reptiles, they're related to birds. Modern birds are just a subset of the larger group of dinosaurs.
- Unlike the model of the Deinonychus here, we now know that Deinonychus and Velociraptor were covered in feathers, though did not fly.
- Though the raptors in the Jurassic Park movies are not covered in plumage, the movies do hint to the relationship between dinosaurs and birds a few times. In the beginning of the first film, Dr. Grant expresses his thought about this and is met with laughs by his team. Later, when Grant and the kids are caught in the Gallimimus stampede, he remarks that they move in unison, like a flock of birds. In Jurassic Park III, the producers added small feathers to the top of the Velociraptors' heads but stopped short of giving them full plumage.

## FINAL STOP – PTERANODON

Location: Deinonychus exhibit, tell the group to look up.

### TOUR MATERIAL:

- While birds are now considered dinosaurs, pterosaurs, the flying reptiles who lived in all three Mesozoic periods, were not dinosaurs.
- The specimen mounted above us is a Pteranodon, a pterosaur that lived during the late Cretaceous period. Pteranodon fossils are the most common of all pterosaurs. The first one was found and described by Peabody's O.C. Marsh in 1870. The name Pteranodon means "winged and toothless".
- These fossils have been found in Kansas and surrounding states, which, if you remember, was covered by a large sea at the time. In addition to flying, these animals could probably swim and dive. Fish scales and vertebrae have been found fossilized in the stomachs of Pteranodon fossils.
- Pterosaurs and Pteranodons were featured in both Jurassic Park III and Jurassic World. When the pterosaurs escape the giant bird cage in Jurassic World, some of them attack the guests in the boardwalk. They swoop down, grab guests with their feet, and fly away with them. Actual pterosaurs did not have feet that could grasp prey, and this would not have been possible.
- End with a joke: There's one more interesting trait about the Pteranodon. While in the air, pterosaurs were likely safe from predators, though they couldn't stay in the air at all times. These animals probably had to land to eat, nest, and urinate. At these times, the pterosaurs might have been particularly vulnerable to predators – just like when the T. rex ate the lawyer in Jurassic Park when he tried to hide in the restroom. However, it turns out that pterosaurs had evolved a way to protect themselves while on the ground – scientists now think that predators were unable to hear the animals go to the bathroom. Any ideas why? **In pterosaurs, the "p" is silent.**

### END OF TOUR

- Thank you all for joining today and I hope you had fun learning about the real dinosaurs in Jurassic Park. This museum has a lot more to offer, including a room full of huge, extinct mammals that evolved after the dinosaurs went extinct. Upstairs, we have exhibits for space, minerals, including our new David Friend mineral hall, dioramas, CT birds, and ancient Egypt.
- If you enjoyed this tour, please feel free to leave a review on the Peabody's Facebook page. These reviews help ensure that we do more special programs like this in the future and help convince more visitors to come to the museum.
- Thank you!