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GEOL 104 Dinosaurs: A Natural History
Video Assignment

DUE: Mon. Oct. 29

Documentaries represent one of the main media by which scientific information reaches the general public. For this assignment, you'll be looking a series of three different TV documentaries that reflect our changing knowledge of dinosaurs (and changing styles of presentation over the last three decades or more!)

These videos are available for watching via Dial Access in the NonPrint Media lab in the basement of Hornbake Library during the week of October 14-20. (Dial Access is a program by which the videos are shown on a continuous basis during open hours: see <http://www.lib.umd.edu/NPRINT/dialaccess.html> for more details. Should you miss this, you'll have to go to the NonPrint Media lab and watch them in the week following. (NOTE: these videos are not generally available for rental or purchase nor are they on YouTube: you will actually have to go to the library!)

The three documentaries are each about one hour long. They represent changing ideas about dinosaurs over the past thirty-some years. Each has a particular different emphasis. The documentaries in question are:

- “The Hot-Blooded Dinosaurs” *Horizon* (BBC) 1976. (Shown in the US on the PBS program *Nova* in 1977.)
- “The Great Dinosaur Hunt” *Infinite Voyage* (PBS) 1988.
- *The Mystery Dinosaur*. (Brave New Pictures) 2006.

(A side note: some researchers appear in two or more of these documentaries. In particular, paleontologist Robert T. Bakker shows up in all three, so you can see his transformation from young Harvard graduate student to University of Colorado faculty member to freelance paleontologist.)

For each documentary, watch the video and answer the questions as you go along. You may want to see them more than once if you miss part of the question.

Name: _____

“The Hot-Blooded Dinosaurs” *Horizon* (BBC) 1976. (Shown in the US on the PBS program *Nova* in 1977.)

This program documents the dawn of the “Dinosaur Renaissance” of paleontology. The version you will see is the original British version. When I was a kid, I saw the version shown on American PBS stations.

After scenes in the Badlands of Alberta with Dale Russell and the obligatory *Lost World* clips, Robert T. Bakker discusses some aspects of changing view of dinosaurs. In particular, he deals with different ideas about the posture and habitat of “brontosaurus” (sauropods) debated in the early 20th Century.

1) What evidence did Holland use to demonstrate that the European model of sprawling was wrong?

Extra Credit) What evidence was there that “brontosaurus” (sauropods) were not aquatic snorkelers?

On a beach, R. McNeill Alexander discusses dinosaur locomotion.

2) Based on his footprint studies and comparisons with the relative motions (Froude numbers) of modern animals, what speed did Alexander find for sauropods?

Extra Credit) Based on his work with the mechanical strength of bone, what did Alexander suggest was the maximum speed of sauropods?

John Ostrom discusses his great discovery: the dromaeosaurid *Deinonychus*.

3) Two major sets of adaptations led Ostrom to suggest that *Deinonychus* had a more energetic lifestyle than cold-blooded animals. One adaptation was related to the foot; the other to the tail. Identify both these specializations:

Name: _____

After a discussion of the basics of endothermy and ectothermy with Philip Regal, we move to the work of Armand de Ricqlès on bone cross section.

4) Which type of bone had abundant oval-shaped reworked zones and many blood capillaries: modern cold-blooded animals like lizards or modern warm-blooded animals like foxes?

5) Which of the two types of bone tissue (cold-blooded or warm-blooded) did dinosaur bone resemble?

After a look at stegosaur plates and tyrannosaur feeding, the program moves on to a discussion of the food requirements of warm-blooded vs. cold-blooded animals.

6) Which needs to eat more per unit time, cold-blooded animals like crocodiles or warm-blooded animals like lions?

Bob Bakker used the above information to test fossil communities.

7) Were the communities of primitive “reptiles” (really synapsids!) and amphibians show cold-blooded style predator:prey ratios, or warm-blooded style predator:prey ratios?

8) What were the predator:prey ratios of “mammal-like reptiles” (therapsids) like?

9) What were the predator:prey ratios of dinosaur communities like?

Name: _____

“The Great Dinosaur Hunt” *Infinite Voyage* (PBS) 1988

This documentary was part of a series of PBS science documentaries from the late 1980s. This reflects some of the new understanding of dinosaurs that had happened by the time I had finished up as an undergraduate, and started my graduate work.

After a look at the Paluxy, Texas dinosaur tracks, and hadrosaurids eggs in Montana, Robert Bakker with the animatronics designers at Dinamation, and the obligate scenes from the silent movie *The Lost World*, we look a bit at the origins of the science of paleontology in 18th Century France. Stephen Jay Gould (who made an appearance in an episode of *The Simpsons!*) puts some of this in context.

1) What important aspect about the history of life did the fossils (like French *Palaeotherium* and Dutch *Mosasaurus*) reveal to Georges Cuvier?

The documentary reviews some similar aspects to the previous documentary. But then it goes back to the Paluxy River tracks in Texas, and the work started by Roland T. Bird (who excavated the tracks). Current researcher Jim Farlow is shown measuring dinosaur tracks.

2) What particular dimensions does Farlow measure in order to calculate the speed of dinosaurs?

Extra Credit) If dinosaur tracks are further apart (more widely spaced), what does that indicate about the speed of the dinosaur?

The show moves on to the work of Jack Horner in Teton County, Montana. His work there in the late 1970s onward helped reveal a great amount of information concerning dinosaur growth and behavior.

3) Looking at the ends of the bones of the hypsilophodonts, did Horner conclude that they were stuck in their nests or that they could use their limbs like adults?

4) What feature of the ends of the bones did Horner use to conclude that?

Name: _____

[An aside: work about a decade later showed that the eggs in question were really from the small theropod *Troodon* and not the small hypsilophodonts *Orodromeus*!]

5) Horner shows that the eggs in the nests of the hadrosaurid *Maiasaura* were all broken up. What did that suggest to him about the habits of baby *Maiasaura*?

6) The ends of the bones of baby *Maiasaura* were spongy and not fully formed. Did Horner conclude that they were stuck in their nests, or did he conclude that they could use their limbs like adults?

We see the work of Philip Currie in the Badlands of Alberta. In particular, he is working with the fossils of the ceratopsids *Centrosaurus*.

7) Did he find the *Centrosaurus* fossils as isolated individuals, or as groups?

8) Because of the answer to question 8, did Currie think these dinosaurs lived as loners? If not, what did he conclude?

Extra Credit) The fossils of *Centrosaurus* show damage. What type(s) of damage do they show?

We see the work of David Weishampel (one of the co-authors of the textbook!) on the hadrosaurid *Parasaurolophus*. He created a mock-up of the hollow crest to show it might have generated low frequency sounds.

9) Low-frequency sounds have various advantages. List one of the advantages that Weishampel suggest *Parasaurolophus* would get from such a sound, with extra credit for a second.

Name: _____

The Mystery Dinosaur (Brave New Pictures) 2006

This documentary is very different from the other two. For one, this was a one-off project by a small production company rather than part of a series supported by a big network (although it has been shown on The Science Channel, the Discovery Channel, and others). More importantly, rather than dealing with dinosaurs in general, this show focuses on questions arising from a single specimen.

The first half of this documentary concerns field work and the discovery of the specimen. It gives you a feel for some aspect of field collection, but isn't really germane to questions for this project. So just relax and watch until the specimen (called "Jane") gets back to the Burpee Museum of Natural History (a little museum in Rockford, Illinois) [that's about 12 minutes or so into the program].

1) So what is the "mystery"? That is, what alternative hypotheses are the **main debate** about the specimen "Jane"?

(Circle the correct answer):

- a. Is Jane male or female?
- b. Was Jane primarily a hunter or a scavenger
- c. Was Jane an adult *Nanotyrannus*, or was "*Nanotyrannus*" just the juvenile stage of *Tyrannosaurus*?
- d. Did Jane die from disease, or was it killed by another dinosaur.

2) What is the main purpose(s) for making hard plastic casts of the individual bones of Jane?

3) Most of Jane's bones were in articulation (still joined together). What does that suggest about the time between its death and the burial of its skeleton? What about the place (environment) in which it died?

4) A series of features make Jane (or Jane plus the Cleveland "*Nanotyrannus*") skulls unique compared to other tyrannosaurs. In the list below, put a check or X next to those features which are mentioned that make

Jane/"*Nanotyrannus*" distinct:

- _____ Foramen (hole) in the quadratojugal
- _____ Squamosal/quadratojugal projection into infratemporal fenestra
- _____ Fused nasals
- _____ Scapular blade broader
- _____ Higher tooth count (17 in dentary as opposed to 13 or less)
- _____ Presence of small teeth

Name: _____

Jane was discovered (and this documentary filmed) at the same time Greg Erickson was developing his technique for determining how old individual dinosaurs were. He was able to sample Jane for comparison with his other tyrannosaurs.

5) According to Erickson, how old was Jane at the time of its death?

6) Does Jane's age/size relationship plot with the *Tyrannosaurus rex* growth curve, or does it indicate a totally different growth pattern?

As part of ongoing research, the Jane team was able to re-evaluate the features listed in question 4. Many of them turn out to be consistent with ontogenetic (that is, growth-related) changes from juvenile to adulthood.

7) After the re-evaluation, which of the characteristics from question 4 remains as a possible distinctive trait unique to Jane and the Cleveland "*Nanotyrannus*" skull?

Lawrence Witmer has been conducting a series of CT scans of the skulls of many dinosaurs, including the Cleveland skull.

8) Did Witmer's study show that the *Nanotyrannus* skulls were really juvenile *Tyrannosaurus rex*? If not, what did they find?