

Teaching Primate Evolution and Ethology to a General Museum Audience

Planning for *Jane Goodall's Wild Chimpanzees*

Jane Goodall Educators Institute Action Plan
July 2001

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Program Audience: General audience. School groups, families.

Program Overview: The Boston Museum of Science features the Human Body Connection, an interactive, staffed exhibit addressing human anatomy, physiology, evolution, and technology. The three year-old exhibit is home to a pair of Cotton-Top Tamarin monkeys obtained to educate museum visitors about primates, primate behavior, ethology, and primate evolution. Existing exhibitry currently challenges visitors to consider each of these topics, while a scheduled demonstration titled "Observing Primates" allows visitors to participate in an observational study of the Tamarins. We are in the developing stages of a public program on primate evolution and a field trip program for high school students on human evolution. The Boston Museum of Science will prepare for the arrival of *Jane Goodall's Wild Chimpanzees* by expanding upon these programs in the Human Body Connection, and in other life science areas of the museum. In scheduled formal demonstrations, and informal interpretations, visitors will consider primate morphology, and behavior in an evolutionary context, and learn the skills necessary to study primates. These activities will augment the Jane Goodall film, while abiding by the 'Science as an Activity' plan of the Boston Museum of Science and its mandate to teach biological evolution. These activities will also be available for related programs detailed at the end of this action plan.

Program Goals:

- To teach Museum visitors about primates, and chimpanzees, in an evolutionary context using morphological, genetic, fossil, and DNA evidences.
- To arm visitors with the scientific skills necessary to study animals.
- To address current issues in primate evolution, and primate research.
- To provide resources, additional information, and educational activities for visitors attending the *Jane Goodall Wild Chimpanzees* film.

Program Content:

1. *Interpretations in the Human Body Connection.* Some of these activities may also work for visitors in line waiting to enter the Omnimax Theatre.

- **Morphology-** What is a Primate?

***Hands.** Visitors try on different gloves that represent a chimpanzee, a tamarin, and a squirrel. Which are hands of primates? How do you know?

- *Eye Location. Visitors try on different masks that represent a chimpanzee, a tamarin, and a squirrel. Where are the eyes located? Which are primates? Are you a primate?
- *Skull comparisons. Visitors will compare skulls of a human, chimpanzee, tamarin, and squirrel. Which are the primates? What similarities allow you to group the skulls in that manner? Can the teeth help you identify the primates?
- *Nails vs. claws. Primates have at least one set of nails. Visitors will try on paper 'claws'. A cricket will be dropped on the table in front of them. Try to pick it up. What selection pressures might have caused the evolution of short claws, or nails?
- *Differences between monkeys, apes, and humans. Humans can touch their thumbs to each of their fingers, chimpanzees cannot. Visitors will try on gloves that restrict the movement of their fingers and thumbs. What implications did the evolution of this dexterity have in human history? Also, have visitors wear a sling around their shoulders that restricts their movements. Monkeys cannot 'swing', apes (including humans) can. What does this suggest about the locomotion of the common ancestors of all great apes? Is this consistent with what is found in the fossil record?
 - **Fossils**- What evidence do we have for common ancestry between the living primates?
- *Model skulls of hominids. What skeletal changes have occurred in the last 6 million years? How do scientists know these skulls are from our ancestors? Where were they found? Measure skull size- how has the brain changed over time?
- *Bipedalism. How do scientists know that these creatures walked upright? Place a hominid skull on a broomstick- the foramen magnum is under the skull as in modern humans. The recent publication in *Nature* also suggests that Hominids walked upright as early as 5.2 million years ago. This is determined from a single fossilized toe bone. Compare toe bones of humans, chimpanzees, and a bear. Can you tell from a single toe bone whether an animal walked upright, climbed trees, or was a quadruped?
- *Other fossils. What fossil evidence exists that links humans with other apes, old world monkeys, new world monkeys? Examine proconsul, aegytopithecus- available through Bone Clones, or Carolina. Contact local natural history museums, and universities to borrow primate fossils. Where do these fit into the big picture of primate evolution? How do you even know they are from primates?
 - **Genetic** - How does DNA compare between living primates?
- *Sequences. Medline (?) gives access to sequenced genes of all different species. Choose a gene that has been sequenced of both humans, and chimpanzees (perhaps an antibody). Compare the nucleotides. What percent similarities exist between humans and chimps? What do these similarities tell you about their evolutionary relationship? Galahad died during the filming of *Jane Goodall* of a respiratory illness that humans can contract and pass on. What immunological, and genetic, similarities help explain this? What is the current research on HIV, and chimpanzees?
- *DNA Hybridization. How do scientists know we are 98.4% genetically identical to Chimpanzees? Visitors will attempt to pull long (~2 ft.) DNA strips apart- representing the double-stranded DNA of humans. Another DNA strip will represent the DNA of Chimps- run this through a flame to break the velcro loops- it will then be easier to separate from the human velcro strip. The easier it is to break this bond, the lower the temperature recorded by scientists studying genetic similarities between organisms. Dr. Morris Goodman of Wayne State University in Detroit, MI is an excellent resource for genetic information about primates.
 - **Behavioral**- How can the behavior of an animal give you insight into its evolutionary past?
- *Tool use. What is a tool? Visitors will attempt to fish for termites as chimpanzees in the film do. Do all chimpanzees termite fish? What does this tell you about learned

behaviors in chimps? This will be compared to data on tool use in cotton-top tamarins.

- *Communication. How do humans communicate? Chimpanzees? Tamarins? How do scientists interpret these behaviors? Visitors will compare how humans communicate basic messages such as 'hello' to chimpanzee and tamarin communication methods. Dr. Marc Hauser of Harvard University has been an excellent and accessible resource for this information.
- *Emotions. What does the evidence tell us about chimpanzee emotions? Visitors will measure their skin conductivity while viewing images that evoke particular emotions. They will compare this data to that obtained in Lisa Parr's research on physiological changes in chimpanzees. Facial expressions expressing happiness, anger, and other emotions will be compared to facial expressions given by chimpanzees tested under similar environmental conditions. Do the tamarins have facial expressions? What might they mean, and how would you test these hypotheses.
- *Laterality. Visitors already observe whether the cotton-top tamarins have a hand preference (the male consistently grabs for food with his left hand, the female happens to use her right.) What have scientists learned about laterality in chimpanzees? Brain images from Bill Hopkins will assist visitors to understand how handedness is studied in the brain. Is this a genetic or a learned behavior? How would you test each of these hypotheses?
- *Medicine. In the SunLab of the Museum, educators will examine the plants of Gombe- particularly *Aspilia*, which may be used by some chimpanzees for medicinal purposes. What other plants are found in Gombe, how are they used by the chimpanzees?

- **Big picture**- How does the geology, and biology of Africa help us understand primate evolution?

-Using the premise of Dr. Wayne Allen that early hominids "lost" territory to ancestral chimpanzees and gorillas, visitors will examine the location of chimpanzees, gorillas, and early fossil Hominids. The common ancestor between humans and chimpanzees existed approximately 6 million years ago- what were the environmental conditions at the time? How did the climate change over time? How did the geology of E. Africa (Great Rift Valley) affect the climate and thus the selection pressures on early Hominids? What is the evidence for all of this?

2. ***Scheduled Public Presentations in the Tamarin Viewing Area of the Human Body Connection.*** May also be adapted for the Current Science and Technology stage.

- **"Observing Primates"**. This 20-minute demonstration currently challenges visitors to consider how scientists study animal behavior. Upon the arrival of the *Jane Goodall* film, visitors will learn about the methods she used in studying chimpanzees, and the time and repetition necessary to make scientifically supported conclusions. Goodall's field notes will be available for visitors to read and interpret while attempting to fill out ethograms that address tamarin behavior. The differences between studying animals in captivity and in the wild will be considered. Preference experiments tested on chimpanzees will be replicated on the tamarins using platforms and infrared sensors. For instance, are the animals more attracted to the color red, or green? What may those results suggest?
- **"Evolving Primates"**. Many of the interpretation activities detailed above will be adapted to this 25-minute public presentation when the film is brought to Boston. We will deliver the morphological, fossil, genetic, and behavioral evidence for primate evolution while addressing the misconceptions visitors will undoubtedly have about the subject. For example, humans did not evolve from chimpanzees, but we share a common ancestor. What do the terms relative, and ancestor actually mean?

- **Current Science and Technology demonstration.** Our newly built Current Science and Technology center may consider current research on chimpanzees upon the arrival of the film. What is being learned at Gombe today? Who are the scientists involved? What other research is being conducted on chimpanzees- behavior, medical, genetic- and what is being learned?

Implementation Procedure:

- Return ideas developed during Educators Institute to the Boston Museum of Science. These will be evaluated and discussed during a division wide "Brown Bag Lunch."
- Submit exhibit and education proposals outlined above to Director of School and Public Programs, and Manager of Life Science Interpretation program.
- Approved interpretations and supplements to existing programs will be developed by a small team of museum educators.
- Additional information and ideas may be obtained through professional development opportunities at local zoos, and research facilities.
- Ideas will be prototyped with Museum visitors, and success evaluated and discussed by education team. Evaluation must consider whether the visitor has seen the Omni film or not and what changes will be necessary.
- Educationally effective interpretations and program augmentation will be ready for the opening of the *Jane Goodall Wild Chimpanzees film*.

Internal Contacts: Vice President of Programs, Directors of Public and School Programs, Manager of Life Science Interpretation Program, Live Animal Curator, Education Associates, Manager of Public Programs, Manager of School Programs, Marketing representatives, Omni film representatives.

External Contacts: University researchers studying primates, and evolution.
Science Museums who have already exhibited the *Jane Goodall film*.
Local zoos, Franklin Park and Roger Williams Park, who exhibit primates.
Local primate research facilities.

Venue Dates for *Jane Goodall's Wild Chimpanzees*: Estimated- Winter 2002- 2003

Timeline for Planning and Implementation:

July 2001: Brown Bag Lunch with programs staff in which ideas from the Educators Institute are shared and discussed.

August 2001: Ideas for Interpretations and Programs to accompany the film will be submitted to the Directors of Public and School programs and the Manager of the Life Science Interpretation program.

September-December 2001: Further development and completion of Human Evolution school program. Initiate discussion regarding 'related programs' that may be developed to support the film.

October 2001: Continued evaluation of the *Jane Goodall Wild Chimpanzee film* and the teacher activities that accompany the film.

January 2002: Establishment of a small team of Museum educators responsible for researching, developing, and evaluating these activities.

Spring 2002: Physical construction of floor Interpretations that were discussed in detail above. Incorporation of chimpanzees into the public presentations on primate observation, and primate evolution.

Summer 2002: Prototype Interpretation activities with general public.

Fall 2002: Evaluation of Interpretation activities, and incorporation of chimpanzees in the public demonstrations. Final programs decided upon and fine tuned.

Winter 2002-2003: Programs in place for opening of *Jane Goodall Wild Chimpanzees*.

Related Programs:

- Field Trip Programs. "Human Evolution" will be offered to high school students in early 2002. Visiting groups may package this class with the *Jane Goodall* film. A class on animal behavior is being considered and may be developed and implemented as the venue date nears.
- Development of a teacher kit on chimpanzees, primates, primate evolution, or ethology.
- Camp-In focusing on chimpanzees, perhaps in cooperation with the Girl Scouts of America.
- Supplementation of a currently existing weekend course on primates with information on chimpanzees and Jane Goodall's research. Participants may also be offered a package deal that includes the film.
- High School Lecture Series. The Museum currently offers Friday lectures to a high school audience delivered by young, energetic scientists. Lisa Parr, or Elizabeth Vinson, or local researchers would be excellent presenters for this audience. Again, there could be a package visit that includes the class on human evolution, and the film.
- Evening Lecture Series. The above researchers, together with local primate researchers will speak with an adult audience regarding current work on primate research. This idea may fit into a grander vision of the Boston Museum of Science hosting a weekend symposium on biological evolution. This symposium may be timed to correspond with the opening of the *Jane Goodall* film.
- The Museum currently offers trips to East Africa. The Courses & Travel department may consider a trip to Gombe for museum members interested in chimpanzee research and conservation.