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Jeheskel Shoshani
Department of Biological Sciences at Wayne State University

et al.

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AN ABSTRACT ON THE DISSECTION OF A FEMALE ASIAN ELEPHANT (Elephas maximus maximus Linnaeus, 1758)

by **Jeheskel Shoshani et al.***

A 46-year old female Asian elephant (Elephas maximus maximus Linnaeus, 1758), named "Iki," died on July 8, 1980, at the Ringling Brothers and Barnum & Bailey Circus, Circus World, Orlando, Florida, USA. She was transported to Detroit and was dissected by the Elephant Interest Group (EIG) and friends, Department of Biological Sciences, Wayne State University. The purpose of this dissection has been to collect data supplemental to those of previous workers, hoping to enrich our knowledge of elephant anatomy, particularly in areas not thoroughly investigated in the past. The dissection and the embalming of two legs and the head lasted five consecutive days, from July 11 to July 15. A total of 136 persons were involved in the dissection project in one way or another, of which 73 individuals actually helped in the dissection (a complete list of participants will appear in the article). An estimated 1,000 man-hours were calculated for the five days. A rough approximation of costs runs between US $6,000 and $7,000 (excluding dissectors' manpower). Some of our findings were compared to those observed in "Shirley" (a 19-year-old female Asian elephant which performed with the Circus Vargas and was recently euthanized) and to the organs of "Ole Diamond" and "Hazel" (African elephants which died recently at the Knoxville Zoological Park).

Measurements and weights were taken and samples were collected, including 218 skin samples for histological studies. Most of our observations (not only on Iki but also on Shirley's and Ole Diamond's organs) correlate with those of previous workers. However, to our knowledge, some of the data collected for Elephas maximus have not appeared in previous literature. Items listed below include not necessarily new anatomical data but also some interesting findings with respect to pathology and other aspects of elephant anatomy.

1. The presence of a small ossified structure (possibly a sesamoid bone) at the proximal end and on the posterior side of the humerus between the tendons of insertion of the teres major and latissimus dorsi, and the humerus.

2. The presence of two small "joint mice" found in the elbow joint between the humerus and ulna. ("Joint mice" are common features of chronic arthritis in humans and animals; they are ossified structures representing the end result of proliferation on articular surfaces to form osteophytes, which then fall off and remain in the joint capsule.)

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*Due to lack of time, only the abstract is presented in this issue. A full report on this dissection will appear in the next issue of Elephant. There are 73 coauthors on this paper; due to the impracticality of listing all of them, only the senior author is given.

3. Deep grooves on the femur-tibia articulating surface. (The two "joint mice" and the deep grooves are believed to be associated with arthritis.)

4. Severe endometritis (the reported primary cause of death).

5. Maximum capacity of stomach (76.16 liters) and intestinal tract (616.76 liters), when filled with water. (These figures for the maximum capacity may be different from the true capacity for two reasons: (a) measurements were taken outside the animal's body allowing the organs to expand without restraint from surrounding abdominal wall and other viscera, and (b) possible loss of contractibility of the muscles of the stomach and intestinal walls due to the time elapsed between death and data-collecting. Our measurements are included for future comparisons with respect to ability to store undigested or partially digested food and also with regard to a relative indication of the amount of surface area available for absorption.)

6. Ratio of total length of the intestinal tract to the body length, excluding trunk and tail (8.05). (This ratio is related to the type of food eaten.)

7. Location of the oculomotor nerve when compared to man. (In Iki the oculomotor nerve is found anterior to the posterior cerebral artery; in man this nerve is located posterior to the posterior cerebral artery.)

8. Dry weight of eye lens of Iki is 0.7714 grams and of Shirley is 0.4619 grams. (The dry weight of eye lens of known-aged Asian elephants will be used to construct a growth curve similar to that of Laws, 1967.)

9. Finding of a tracheal-oesophageal muscle (previously described only by Harrison, 1850) and the idenfication of it under the microscope as striated (voluntary) muscle.

The last finding (Number 9) is of particular interest. Harrison (1850) noted that its function may be either as aiding in retrieving water or other matter from the stomach or in helping to dilate the trachea during expiration. See also observations by Tennent (1857) and by Douglas-Hamilton (1975). This tracheal-oesophageal muscle was sought by Watson (1872) but was not found. He therefore concluded that this muscle was ". . . exceptionally present in Harrison's elephant." Miall and Greenwood (1878) also looked for this muscle and did not find it. We searched for this muscle in three individual elephants: Iki, Shirley and Ole Diamond. In Shirley the muscle was found to be in the same position as that described by Harrison. In Iki and Ole Diamond we found connective tissues in the same locations but not the muscles themselves. From the six reported cases, it seems that the tracheal-oesophageal muscle may be inconstant in elephants. Based on our observations, as to the size, structure and location of this muscle, we believe that its major function is to dilate the trachea at the region of bifurcation and thus assist in respiration and perhaps in vocalization. Studying the soft

tissues (for example, brain, intestine and skin) on the macro- and microscopic levels has resulted in encouraging results, despite the long time between the death and the preservation of these soft tissues (60-70 hours).

It should be mentioned that our preliminary observations indicate that we have barely touched the surface of our project. We hope that further examination of Iki's and other elephants' organs and tissues will enhance our knowledge of elephant biology and will be useful in comparative studies. This elephant (Iki) was being studied for chronic rheumatoid disease (Clark et al., 1980). The pathological findings, especially with respect to the "joint mice" and the grooves on the articular surfaces, which appear to be associated with the chronic arthritis, may be of special interest since they occur in humans and in animals large and small, the elephant having a mean life span similar to that of man (Jubb and Kennedy, 1963; Robbins and Contran, 1979). We wish to acknowledge the help received from all the individuals and institutions that made this project possible. We also wish to thank the many reviewers of this abstract. A complete acknowledgment will appear with the article.

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Author's Address: Department of Biological Sciences, Wayne State University, Detroit, Michigan, 48202 USA