



### A15 Morphological Variation in Hair from Mammals of the Order Artiodactyla

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The goal of this presentation is to illustrate the variability and subtleties of hair structure (and its relationship to function) in mammals of the order Artiodactyla. HAIRbase™ is a valuable online reference tool that can be used by trace evidence examiners to discriminate between the hairs of many artiodactyls, including domesticated and wild game animals that are endangered and highly trafficked. Potential users will learn a fast and reliable method of accessing morphological information regarding the microscopic and macroscopic characteristics of the hair of many species across the order Artiodactyla.

This presentation will impact the forensic science community by introducing attendees to HAIRbase™, which offers a wealth of information regarding the structural characteristics of mammalian hair of the order Carnivora, and goes beyond traditional references in its coverage of both species and variability on individuals.

Artiodactyla is an extremely large and diverse order that contains approximately 220 species separated into ten families that collectively display an incredible array of morphological variation in hair characteristics. Owing to this, the microscopic examination of guard hairs is paramount to the forensic identification wildlife. Although primary guard hairs are often used, secondary guard hairs are more variable and, therefore, have the potential to be more diagnostic. Current references and atlases of hair morphology fail to illustrate the range of variation, including hair grades, and regions on the body, of the order Artiodactyla. They also tend to omit the endangered and highly trafficked, which are of the greatest forensic importance. A digital database of both primary and secondary guard hairs from three different body regions—dorsal, ventral, and tip of tail—using bright field and scanning electron microscopy images to adequately display the variation inherent in the hair of select Artiodactyls including many endangered species and African big game animals has been constructed.

Animal specimens were obtained from the collections at the U.S Fish and Wildlife National Forensic Laboratory in Ashland, Oregon and the Barry Gilcrease collection at California State University, Fresno. Hair was collected from each specimen by either plucking or cutting as close to its base as possible with a sterile razor blade. Hair was collected from three body regions: (1) the dorsal region, between the shoulder blades;

(2) the ventral region, on the midline between the forelimb and the hind limb; and, (3) at the tip of the tail. Approximately 20-25 hairs were collected from each body region of each individual, for a total collection of approximately 60-75 hairs from each animal. After the hair from each body region was collected, it was placed in separate sterile sealable bags. Approximately three to five primary and secondary guard hairs were selected from each collection bag. Several hairs of each type were then plated onto individual glass microscope slides using a commercial mounting medium with a refractive index close to that of hair. Each hair on each slide was examined and photographed in a manner that documented microscopic fields containing the most representative hair characteristics for the particular hair type and section under view. A transmitted light microscope coupled with a camera was used to acquire digital images of the basal, sub-shield and shield portions of the hair of each specimen at 200-400 X magnification. Macroscopic and microscopic evaluations of each specimen were conducted. The macroscopic characteristics recorded included hair color, form, and banding pattern. Microscopic observations, such as medullary, cuticle, and cortex characteristics were then recorded. A user interface was created that allows the publishing of website content quickly and easily.

Artiodactyls have become increasingly important to humans both as wild game and domesticated animals. With the increasing importance of artiodactyls in and around society at large, the ability to differentiate hair from these animals has increased significance to forensic examiners. Separating the hair of artiodactyls requires an aggregation of characteristics in order to make a taxonomic determination. The digital database proposed here will aid investigators by giving them a reliable reference that contains diagnostic information regarding the structure of the hair of the order Artiodactyla, such as traits of the hair shield, medullary configurations, and cuticle scale patterns that can be used for identification.

This digital database is readily available on the Internet, allowing the addition of specimens and the accommodation of the needs of the forensic trace evidence community in real time. Currently, the database contains over 73 species, 53 genera from eight families of the order Artiodactyla. Through the addition of relevant specimens and the ability to adapt to the changing needs of its user groups this digital database will remain relevant and remain a valuable resource to investigators and researchers across multiple scientific disciplines.

**Hair, Morphology, Trace Evidence**