A10 A Minimally-Destructive DNA Extraction Technique for Feather Barbs and Its Application to Wildlife Forensics

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After attending this presentation, attendees will be introduced to the importance of accurate species identification in regards to wildlife forensics, and describe a new minimally-destructive yet highly-sensitive technique for obtaining accurate DNA-based species identification from bird feather barbs. The attendees will also learn how this technique may be applied to a variety of bird-related wildlife forensic contexts, including wildlife law enforcement, the illegal trade of bird products, and hazardous environmental incidents.

This presentation will impact the forensic science community by providing an efficient and accurate DNA-based species identification technique for bird feathers recovered in forensic contexts. Additionally, due to its high-sensitivity, this technique will also benefit bird studies in other disciplines, including ecology, biology and archaeology, by allowing the recovery of DNA from small, damaged, or degraded bird feather samples.

The accuracy of bird species identifications is critical for wildlife law enforcement and other aspects of wildlife forensics, and may be challenging when only the feathers are available for analysis. Though accurate morphologically based identifications are possible when feathers are complete and intact, they may be unfeasible when feathers have been modified, dyed, or damaged; DNA-based species identification techniques can be far more accurate. Current DNA extraction techniques; however, require the destruction of the entire feather or are restricted to those samples that retain fresh tissue in the feather shaft. Existing techniques are not effective when dealing with damaged, modified, or antique feathers, and are extremely destructive when testing crafted items and artifacts such as headdresses and fans, including those that may be culturally valued or historically prized.

This presentation will present a new DNA extraction technique that is both minimally destructive and highly effective. This technique borrows methods and strategies from “ancient DNA” analysis to obtain accurate mitochondrial DNA-based species identification using only a few feather barbs, rather than the whole feather. The technique was tested on feathers from a variety of species, including American crow (*Corvus brachyrhynchos*), wild turkey (*Meleagris gallopavo*), a museum-curated specimen of Ruffled Grouse (*Bonasa umbellus*), and a 200-year-old archaeological magpie (*Pica pica*) feather.

DNA extraction of the feather barbs was conducted within a dedicated Forensic DNA Laboratory at Simon Fraser University. Two to seven feather barbs were removed from the feather shaft using a sterile scalpel and digested overnight in a lysis buffer. A modified silica-spin column method was followed for DNA extraction and subsequent PCR amplifications targeted mitochondrial DNA using bird-specific primers focused on either the control-region or cytochrome b gene. The obtained DNA sequences were compared to modern published reference sequences through multiple alignments and phylogenetic analyses. The successful recovery of species-specific DNA from “fresh” feathers, historic museum specimens, and archaeological samples demonstrates the sensitivity and versatility of this minimally destructive technique.

This new DNA extraction technique can be applied to a variety of national and international forensic contexts. The technique will benefit

wildlife law enforcement responsible for identifying the illegal possession of feathers (and other bird products) from species protected under the U.S. Migratory Bird Treaty (MBTA), the U.S. Endangered Species Act (ESA), and the Convention on International Trade in Endangered Species (CITES). This minimally destructive technique will be valuable for identifying crafted trade products or artifacts incorporating the feathers of protected birds. Furthermore, this highly sensitive technique can be applied to small, damaged, or degraded feathers in other forensic contexts, including the identification of species involved in bird strikes (collision between birds and man-made vehicles, usually aircrafts) or hazardous environmental incidents (e.g., oil spills).

Wildlife Forensics, DNA Analysis, Bird Feathers

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