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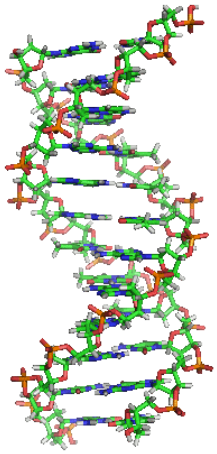
Patuxent Wildlife Research Center

Identifying the Genetic Basis of Avian Susceptibility to Mercury

The Challenge: Mercury is a highly toxic element found throughout our environment. Although it occurs naturally in some environments, human industrial pollution has greatly increased the amount of mercury and the range of environments in which mercury is found. Recent studies have confirmed clear differences in the sensitivity of various bird species to methylmercury. Because the causes of these differences are unknown, prediction of mercury sensitivity in birds that have not or cannot be studied in the lab is difficult. Therefore, a method is needed that can predict sensitivity to mercury in poorly studied birds and can help identify susceptible populations.



The Science: Organisms have a variety of mechanisms that protect against mercury toxicity. Genetic variations and gene expression patterns related to these processes influence susceptibility and allow less sensitive species to survive, while their more sensitive counterparts succumb. Recent advances in molecular biology, particularly the advent of next-generation sequencing, allow for comprehensive analysis of RNA transcript profiles (transcriptomes). This method, commonly known as RNAseq, has opened up exploration of the genomic effects of contaminants on non-model organisms, such as most birds, and can be used to identify pathways that play a role in species survival and susceptibility.

The Future: In order to clarify the molecular basis for species-specific sensitivity to mercury, we are using RNAseq to compare hepatic RNA expression patterns and RNA sequence variations in three bird species that show varying sensitivity to mercury: laughing gull (*Larus atricilla*- low sensitivity), American kestrel (*Falco sparverius* - high sensitivity) and osprey (*Pandion haliaetus* – high sensitivity). These analyses will identify differentially expressed genes and affected pathways within each species and will allow us to make comparisons between species. Understanding the molecular mechanisms involved in a bird's response to mercury provides a foundation upon which variations in susceptibility to mercury may be predicted and assessments of risks to exposed population can be based.

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