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Evaluation of the lead exposure situation in wild birds and
identification of novel avian renal biomarkers
(国内に生息する鳥類における鉛汚染状況の解明と、
鳥類種横断的に利用可能な新規腎障害マーカーの探索)

A decreasing number of birds is a serious problem worldwide, according to the Red List published by IUCN (International Union for Conservation of Nature) in 2017. Infectious diseases and habitat loss can be cited as some causes of this reduction in the number of birds, and chemical contamination is also a notable problem. In this study, I focused on lead (Pb) exposure in wild birds in Japan, and the necessity of novel renal biomarkers in birds.

Pb poisoning in raptors and waterbirds is an environmental pollution problem in Japan. Pb rifle bullets, Pb shot pellets, and fishing tackle are the main causes of Pb exposure in birds. The objective of this research was to evaluate Pb exposure in wild birds. The results showed that Pb contamination damage in birds occurred throughout the country. Pb stable isotope ratios showed that illegal use of Pb ammunition is still occurring in Hokkaido. Furthermore, in the areas of Honshu and Shikoku, where regulation of the use of Pb was restricted to only a limited number of areas and Pb exposure was not regarded as much of a problem, raptors such as the endangered golden eagle were exposed to Pb. In waterbirds, Pb shot was found inside the stomach, and there were high concentrations of Pb accumulated in the liver. Furthermore, as a result of analysis of Pb distribution in bone, it became clear that the Pb accumulation process differs depending on bone structure and the presence or absence of bone marrow. This study showed that bone specimens have valuable information about Pb exposure and might be useful in investigating and understanding mortalities suspected to be related to Pb poisoning.

In addition to Pb, there are many chemical substances, such as anti-inflammatory drugs and anti-cancer drugs, that cause kidney damage in birds. Birds have a special vascular system called the renal portal vein, where the renal blood flow rate is abundant, and the kidney is exposed to high amounts of chemicals via the blood. Renal disease due to these nephrotoxic chemical substances has been reported in many wild birds, but there is

currently no early biomarker for kidney injury. Therefore, the objective in this study was to identify novel renal biomarkers that will be effective in actual clinical settings for effective treatment of renal impairment, monitoring administration of drugs with renal-impairment action, and evaluation of environmental contamination by chemical substances that cause kidney damage. Acute kidney injury (AKI) includes acute interstitial nephritis (AIN) and acute tubular necrosis (ATN). Two different types of kidney injury models in chickens were created using nephrotoxic chemicals (diclofenac, which causes AIN, and cisplatin, which induces ATN). The results of glycan analysis suggest that glycans may be useful as markers for AIN. From the results of transcriptome analysis, vanin-1 was determined to be an early renal injury marker candidate, reflecting both ATN and AIN. These results have some potential to contribute to bird conservation.