Different stress response strategies of an arctic breeding bird (Calcarius lapponicus) under inclement weather conditions revealed by the genome and RNA-seq analyses

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Understanding how organisms respond to environmental perturbations is essential for coping with environmental challenges, especially when extreme global weather events are becoming more frequent due to climate change. We performed RNA sequencing on samples from wild, free-living male Lapland longspurs (Calcarius lapponicus) during their arrival on the breeding grounds and during incubation on the Arctic tundra of Alaska, USA. Samples were collected during an extremely cold arrival period in 2013 and incubation during a severe snowstorm in 2016.

We performed RNA-seq analyses on liver, hypothalamus, heart, and gonad testicular tissues to understand how this Arctic species responds to an extreme weather event. influences the biological system. We present a high quality Lapland longspur genome assembly and gene annotation of Lapland longspurs, with whichand we identified differentially expressed genes associated with inclement weather events. We identified that FKBP5 was significantly up-regulated in the hypothalamus during a snowstorm, suggesting that FKBP5 is functionally important for theduring an environmental stress response. FKBP5 is reported to be a regulator of the Hypothalamic-Pituitary-Adrenal (HPA) axis during the stress-response, and acts to modulate glucocorticoid receptor sensitivity in mammals. FKBP5 acts as a co-chaperone, negatively regulating the glucocorticoid signalling pathway and provides a mechanism by which an individual can rapidly and accordingly adjust its HPA axis function in response to unpredictable environmental perturbations. Other pathways in the hypothalamus and other tissues were seen to be involved during these stressful conditions, included specifically those involved in metabolism, the immune response and the circadian cyclerhythms. Such findings will contribute to the understanding of gene expression changes in multiple physiological systems to mediate stress in wild free-living birds.