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Chicken oocyte transcriptome: RNAseq of nuclear and cytoplasmic long and short RNAs

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Motivation and Aim: Hypertranscription during oogenesis is responsible for transformation of the meiotic chromosomes into the lampbrush form. Ongoing transcription on the lateral loops of avian lampbrush chromosomes was demonstrated by intense and rapid BrUTP incorporation. However, spectrum of sequences transcribed on lampbrush chromosomes of birds remained unknown. Here, we systematically characterized chicken oocyte transcriptome at the lampbrush chromosome stage of oogenesis.

Methods: We performed RNA sequencing of RNA isolated from the cytoplasm and nuclei manually dissected from chicken oocytes at the lampbrush chromosome stage. We examined nuclear and cytoplasmic mRNAs, as well as long and short non-coding RNAs. To verify RNAseq data, we used RNA-FISH on lampbrush chromosome preparations with BAC-clones overlapping with genes.

Results: Similar to *X. tropicalis* oocyte cytoplasm (Garder et al., 2012), in chicken ooplasm we detected mature mRNAs and long non-coding RNAs consisting of spliced exons. Visual examination of expression profiles for hundreds of expressed genes revealed that nuclear RNA contains both full-length gene transcripts and intronic sequences. By sequencing small RNA libraries we characterized nuclear and cytoplasmic small house-keeping non-coding RNAs and short regulatory RNAs including more than 150 miRNAs. Since we detected full-length nuclear transcripts for many genes, with reads covering the entire transcription unit, we aimed to detect nascent transcripts *in situ*. RNA-FISH with BAC-clones that overlap with genes whose transcripts appear in the nuclear and cytoplasmic RNAseq data on isolated chicken lampbrush chromosomes revealed nascent transcripts along lateral loops. RNase A pretreatment eliminated all transcripts from the RNP matrix of these loops. In total, by FISH-mapping we verified transcription of 42 protein-coding genes and 8 long non-coding RNA genes on the lateral loops of chicken lampbrush chromosomes. Among them are genes essential for oocyte maturation, ovarian development and early stages of embryogenesis. Transcripts of these genes could be used for oocyte maturation and/or early embryo development.

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