

# Transcriptional and translational regulation by RNA thermometers, riboswitches and the sRNA DsrA in *Escherichia coli* O157:H7 Sakai under combined cold and osmotic stress adaptation.

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### Abstract

The enteric pathogen *Escherichia coli* O157:H7 Sakai (EHEC) is able to grow at lower temperatures compared to commensal *E. coli*. Growth at environmental conditions displays complex challenges different to those in a host. EHEC was grown at 37°C and at 14°C with 4% NaCl, a combination of cold and osmotic stress as present in the food chain. Comparison of RNAseq and RIBOseq data provided a snap shot of ongoing transcription and translation, differentiating transcriptional and post-transcriptional gene regulation, respectively. Indeed, cold and osmotic stress related genes are simultaneously regulated at both levels, but translational regulation clearly dominates. Special emphasis was given to genes regulated by RNA secondary structures in their 5'UTRs, such as RNA thermometers and riboswitches, or genes controlled by small RNAs encoded in trans. The results reveal large differences in gene expression between short-time shock compared to adaptation in combined cold and osmotic stress. Whereas the majority of cold shock proteins, such as CspA, are translationally downregulated after adaptation, many osmotic stress genes are still significantly upregulated mainly translationally, but several also transcriptionally.

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### KEYWORDS:

EHEC; RIBOseq; RNA thermometer; cold stress adaptation; osmotic stress adaptation; riboswitch