# Mechanisms of the photoreceptor LITE-1 mediating the response to high-temperature stress in *C. elegans*

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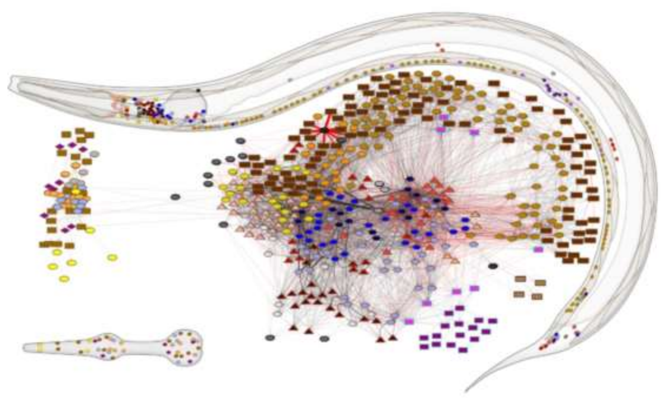
## Abstract

Temperature profoundly impacts animal behaviors and regulates various physiological processes of organisms. This study aimed to uncover the role of LITE-1 in thermosensory and its ability to help *C. elegans* tolerate heat. Here, we show that the functional deletion mutant of LITE-1 demonstrates a low survival phenotype after heat shock, which can be partially rescued by overexpressing LITE-1 in ASH, ASI, or AWB neurons. Calcium image in muscle ectopic expression of LITE-1 suggests the photoreceptor LITE-1 is a potential high-temperature sensor. Based on the transcriptomic analysis, after heat shock, LITE-1 mutant significantly upregulated the MAPK pathway. Moreover, it shows impaired nuclear translocation of DAF-16/FOXO in intestinal cells compared to the wild-type, while the heat shock transcription factor (HSF-1) remains active. **Thus, we demonstrate LITE-1 mediated neurons to perceive high temperature. The downstream pathways of LITE-1 through insulin pathways ensures DAF-16/FOXO nuclear translocation, in addition to preventing the over-phosphorylation of PMKs in MAPK.**

## Introduction

The nematode *Caenorhabditis elegans* has been widely used as a model for sensory transduction and aging studies. *C. elegans* has a compact nervous system with only **302 neurons**.



The nervous system is well characterized, many individual neurons' functions have also been identified and the entire synaptic connectome was elucidated (Steven J Cook et al., *Nature*, 2019).

**LITE-1**, an efficient short-wavelength light sensor in *C. elegans* (Jianke Gong et al., *Cell*, 2016)., and its homolog Gr28b in *Drosophila* has been reported to sense **both light and temperature** (Lina Ni et al., *Nature*, 2013). However, whether LITE-1 possesses thermosensory capabilities remains unexplored.

## Results

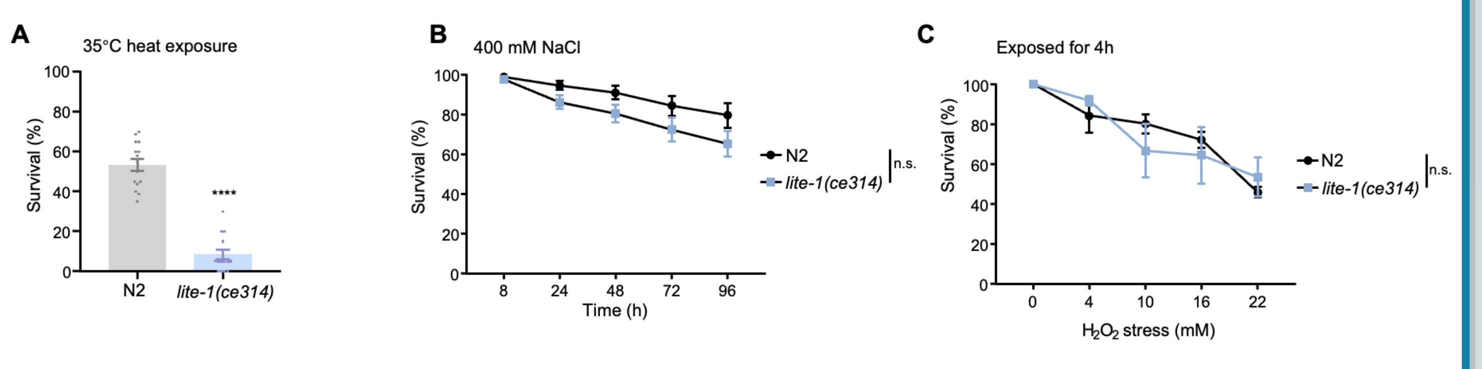


Figure 1 | Effects of high temperature, hypertonic, and $H_2O_2$ environments on LITE-1 function mutant.

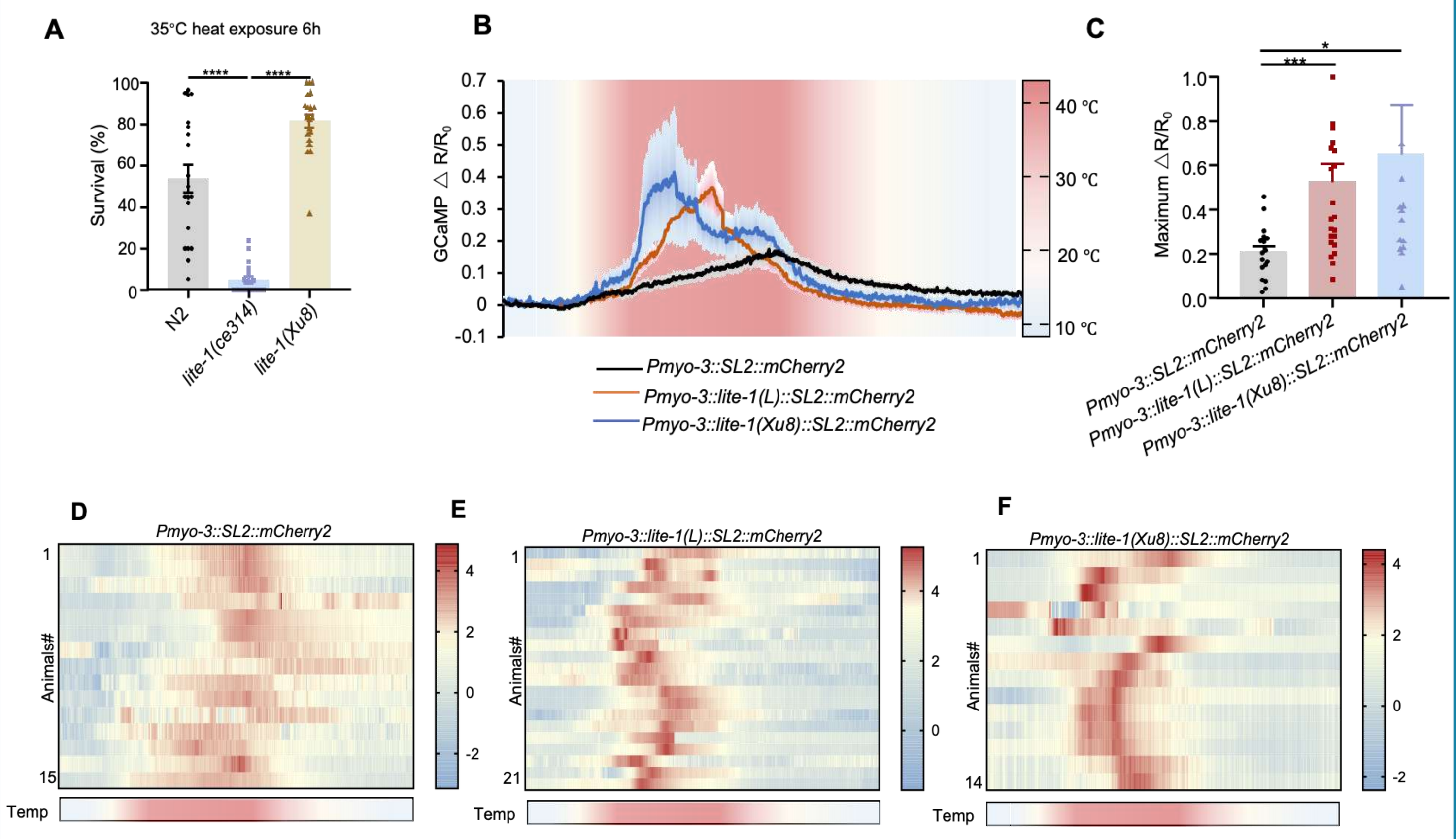


Figure 2 | LITE-1 is a potential temperature-sensitive receptor with specific amino acid site functions.

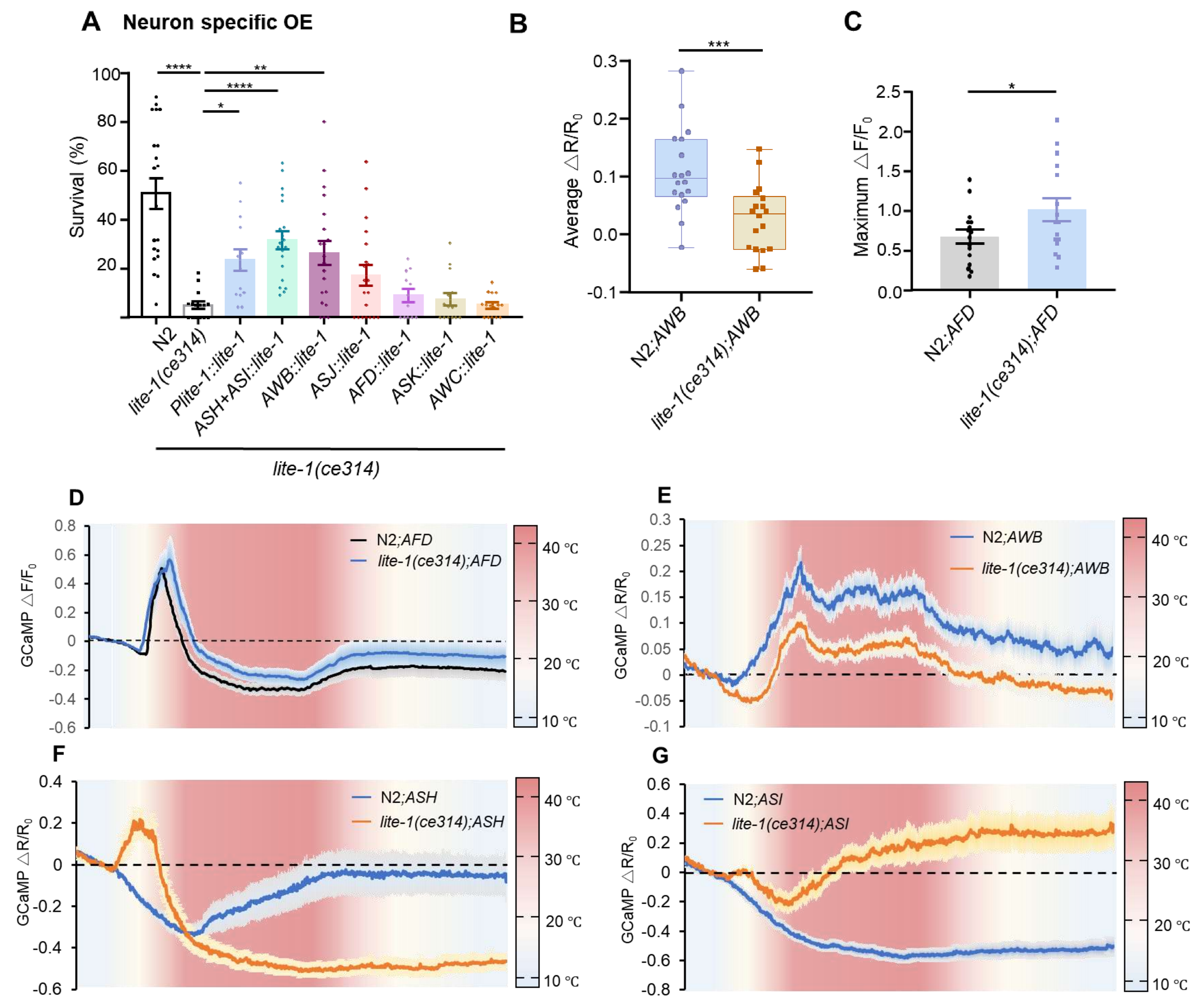


Figure 3 | LITE-1 mediated heat stress response in ASH, ASI and AWB, independent of AFD in *C. elegans*.

## Results

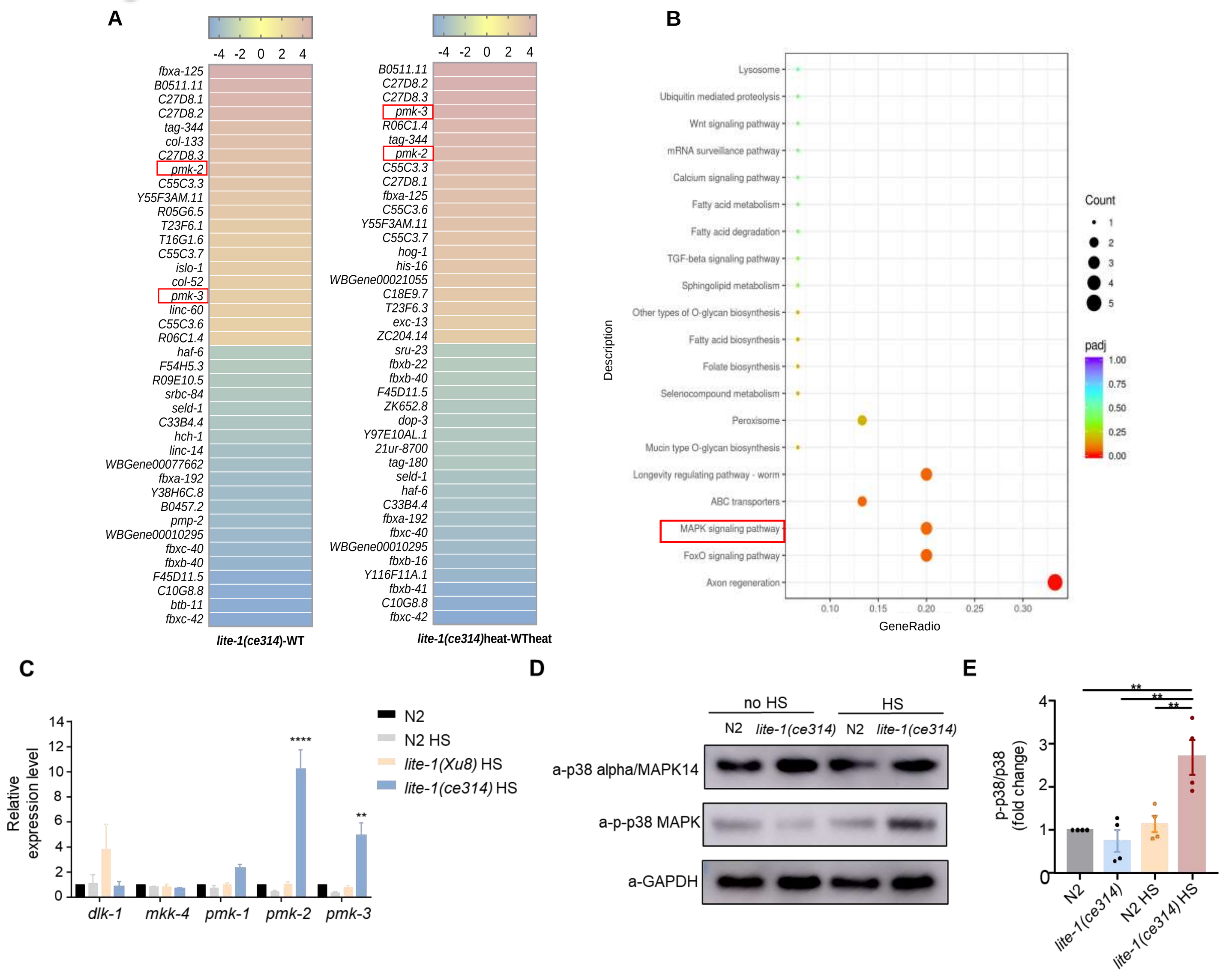


Figure 4 | Transcriptomic reveals that the low heat shock survival rate of LITE-1 mutants related to the p38/MAPK pathway.

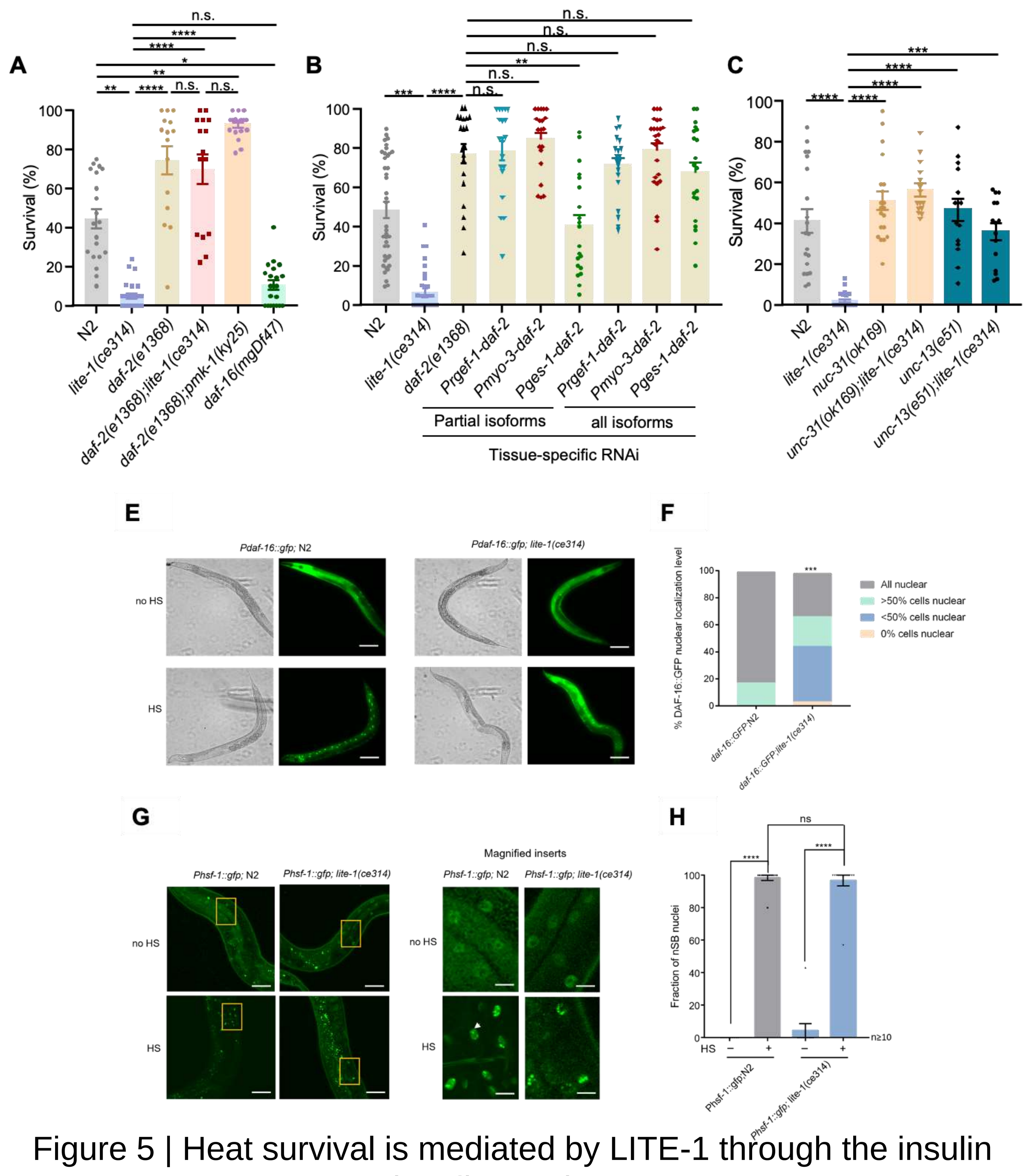


Figure 5 | Heat survival is mediated by LITE-1 through the insulin signaling pathway.

## Conclusion

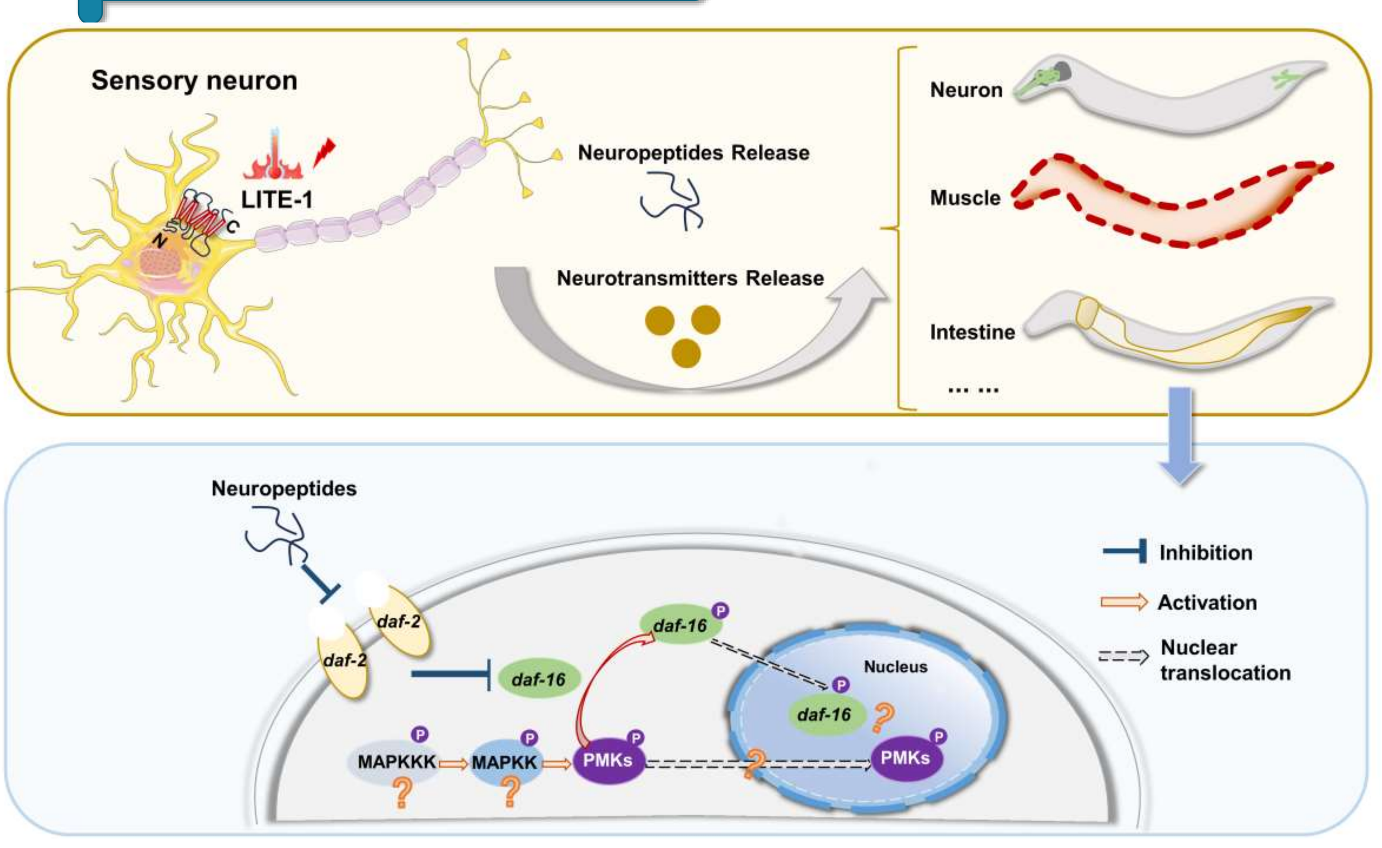



Figure 6 | Model showing the LITE-1 sensing extremely high temperatures and transmits downstream signals involving MAPK and insulin signaling pathways.

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