

論文審査の結果の要旨および担当者

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論 文 題 目

Age-dependent Functional Remodeling in Thermosensory Neurons and Behaviors
of the Nematode *Caenorhabditis elegans*

(線虫温度受容神経細胞の老化に伴う機能と行動の再構築)

論文審査担当者

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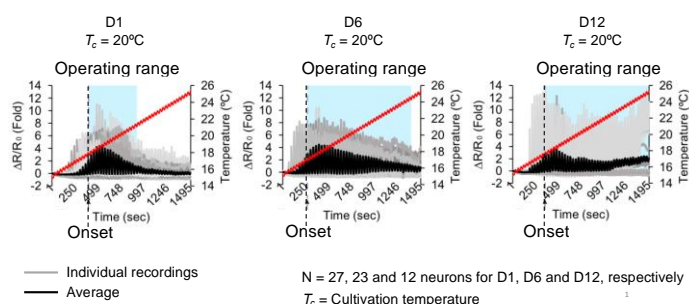
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論文審査の結果の要旨

Age-dependent cognitive and behavioral deterioration may arise from defects in different components of the nervous system, including those of neurons, synapses, glial cells, or a combination of them. Huang found that AFD, the primary thermosensory neuron of *Caenorhabditis elegans*, in aged animals is characterized by loss of sensory ending morphology, including reduced actin-based microvilli abundance and aggregation of thermosensory guanylyl cyclases. At the functional level, AFD neurons in aged adult animals are hyper-sensitive to high temperatures and show sustained sensory-evoked calcium dynamics, resulting in a prolonged operating range (右図).

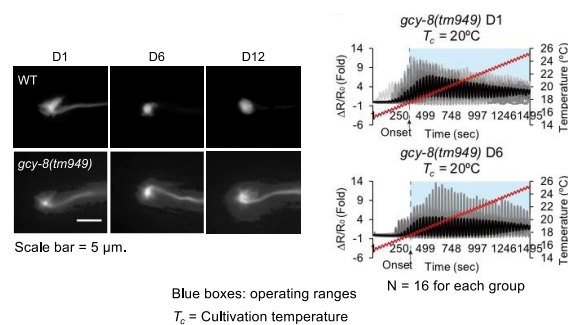
AFD in aged animals showed an early activation onset and extended operating range across a wide temperature range



At the behavioral level, aged adult animals display cryophilic behaviors that remain plastic to acute temperature changes. Excessive cyclase activity of the AFD-specific guanylyl cyclase, GCY-8, is associated with developmental defects in AFD sensory ending and cryophilic behavior.

AFD in D1 and D6 animals showed a wide operating range along with a loss of GCY-8 cyclase activity

Surprisingly, loss of the GCY-8 cyclase domain reduces these age-dependent morphological and behavioral changes while a prolonged AFD operating range still exists in *gcy-8* animals (右図).



The lack of apparent correlation between age-dependent changes in the morphology or stimuli-evoked response properties of primary sensory neurons and those in related behaviors highlights the importance of quantitative analyses of aging features when interpreting age-related changes at structural and functional levels. Our work identifies aging hallmarks in AFD receptive ending, temperature-evoked AFD responses and experience-based thermotaxis behavior, which serve as a foundation to further elucidate the neural basis of cognitive aging.

以上の理由により、申請者は博士（理学）の学位を授与される十分な資格があるものと認められる。