

Hyperoxia avoidance and aggregation behavior in *C. elegans*

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Abstract

Living in the soil, *C. elegans* can move in three dimensions in search for food. To navigate, it partly uses oxygen levels as a description of its habitat. Oxygen tension may indicate presence of microbial food and location with respect to the surface, where oxygen is 21%. The N2 groups of *C. elegans* strains differ in their oxygen responses from other strains of this species collected in the wild. This difference is due to a polymorphism in the NPY receptor homologue, NPR-1. The result is two distinct feeding strategies; solitary feeding and feeding in groups (aggregation). NPR-1 antagonizes hyperoxia avoidance on food and N2-like strains, carrying a gain of function mutation in the receptor, feed alone and do not respond strongly to changes in ambient oxygen. In contrast, strains carrying the ancestral form of the receptor, NPR-1 215F, exhibit robust hyperoxia avoidance. These animals aggregate on food, at least in part because animals create a low oxygen environment as they form groups.

In paper I we examined how hyperoxia avoidance can trigger aggregation. We showed that when animals encounter a rise in oxygen they initiate a reversal and turn. We showed that similar behaviors direct the animal to stay in an aggregate, and that aggregated animals create a sharp oxygen gradient. We further showed that soluble guanylate cyclases, expressed in the body cavity neurons, and TRPV channels expressed in the nociceptive neurons ASH and ADL, regulate these behaviors.

---text removed from public version--- In paper III we showed that a polymorphic locus, encoding the neuroglobin *glb-5*, regulates hyperoxia avoidance. The ancestral allele, *glb-5(Haw)*, acts in the body cavity neurons and tunes the dynamic range of these neurons to a narrow range close 21% oxygen. ---text removed from public version---

The data presented in this thesis thus provide novel insights into oxygen sensing in a metazoan, and highlight how oxygen responses promote aggregation behavior of a nematode.

Keywords: behavior, aggregation, oxygen, avoidance, oxygen sensor, *glb-5*

ISBN 978-91-628-8181-8

Akademisk avhandling

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som för avläggande av filosofie doktorsexamen vid Naturvetenskapliga fakulteten, Göteborgs universitet kommer att offentligen försvaras i sal Ivan Östholm, Medicinargatan 13, Göteborg, onsdagen den 10:e november 2010, kl 13.00

Fakultetsopponent: Dr. William Schafer
MRC Laboratory of Molecular Biology, Cambridge, UK



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