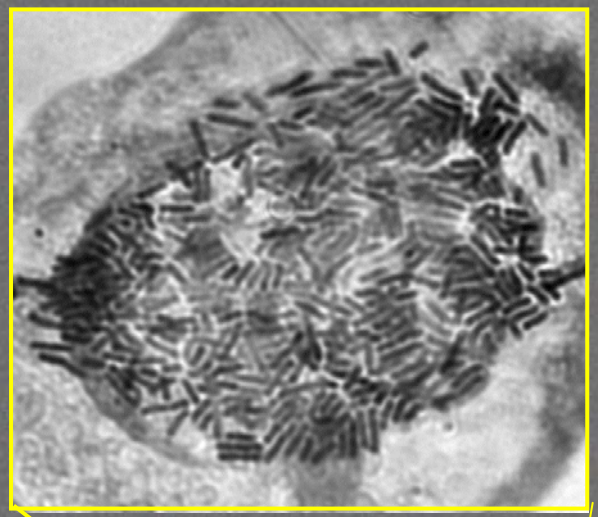
Give and Take: Exploring the Basis of Mutualism Between *Steinernema carpocapsae* Nematodes and *Xenorhabdus nematophila* Bacteria

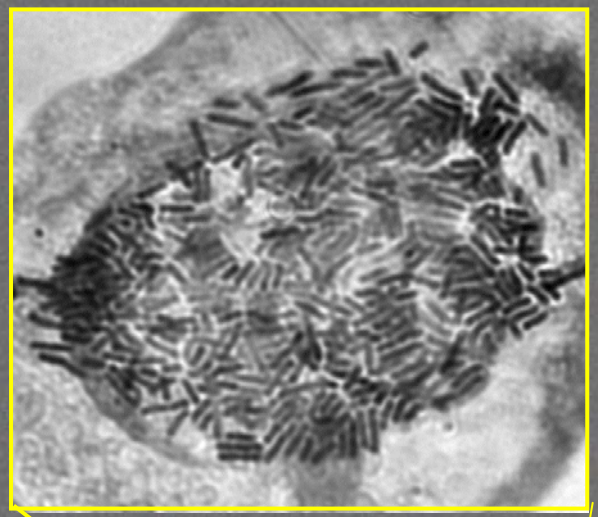
Xenorhabdus nematophila



Steinernema carpocapsae
(infective juvenile stage)

What is the cellular structure of the colonization site?
What bacterial genes are required to initiate colonization?
Do these genes dictate host range?

Xenorhabdus nematophila



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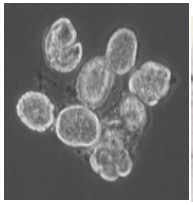
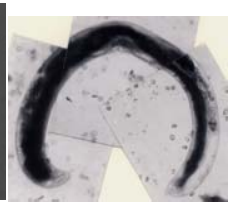
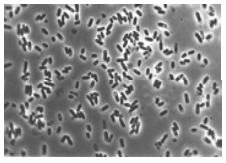
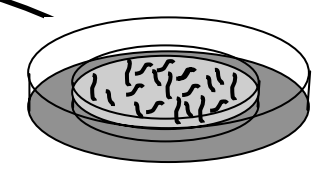




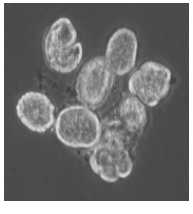


Association/Migration

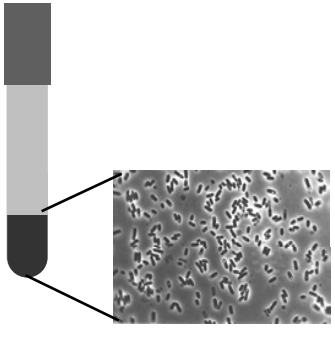
Growth/ Development



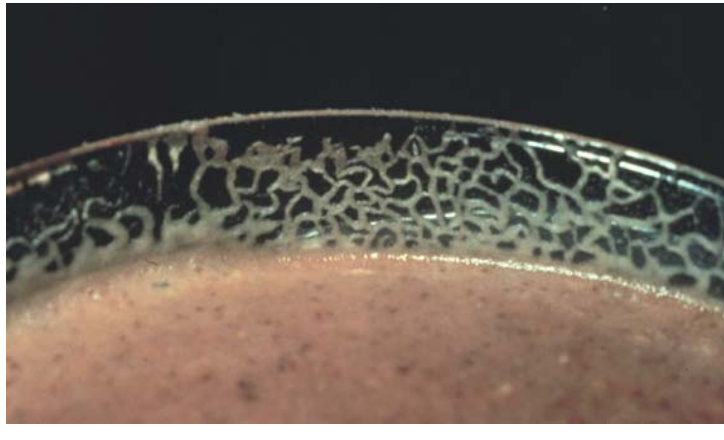
Nematodes/ Nematode eggs



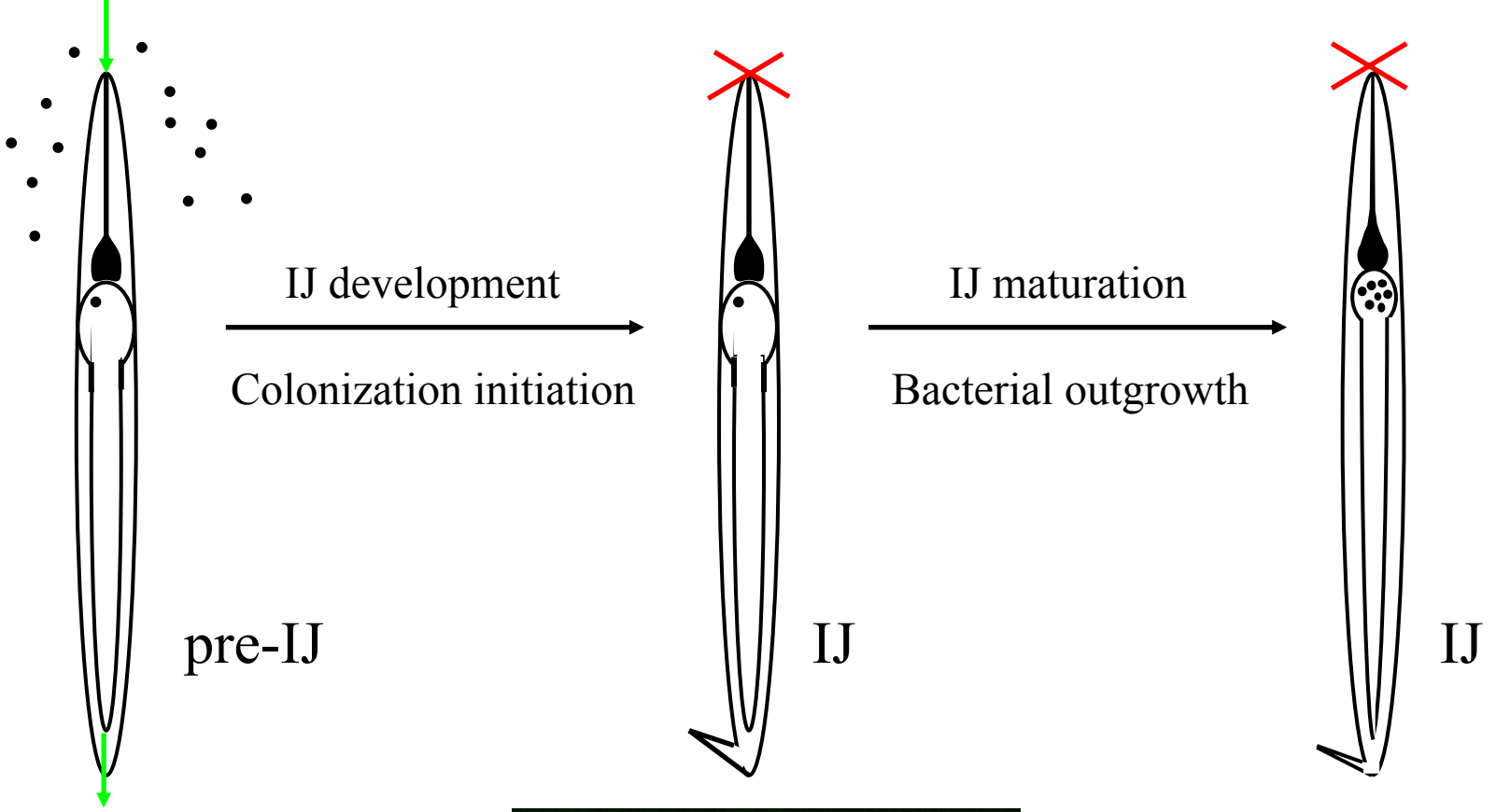
Bacteria

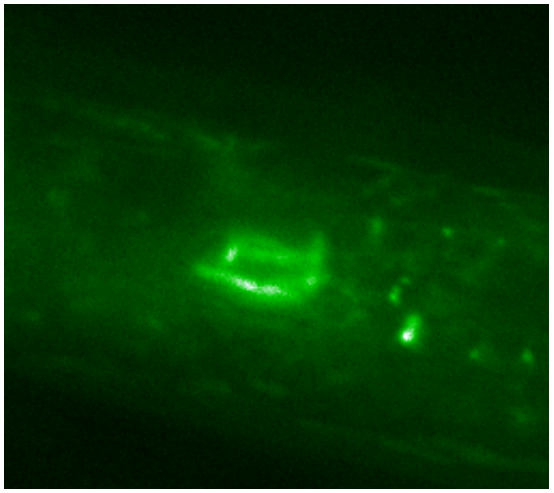


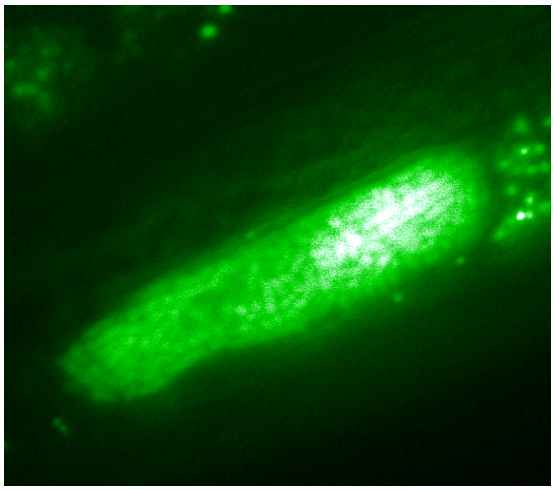
Bacteria / Nematode Complex

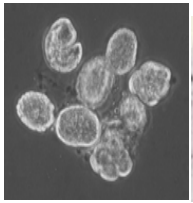


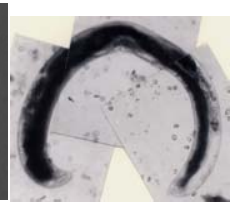
picture courtesy Dr. Harry Kaya

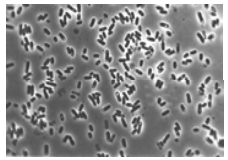

IJ development
Colonization initiation
IJ maturation
Bacterial outgrowth
pre-IJ
IJ
IJ





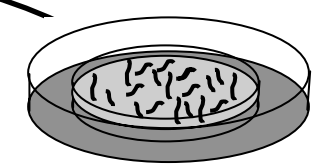






Growth/ Development

Association/Migration



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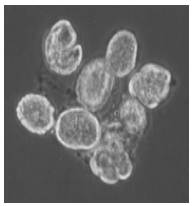
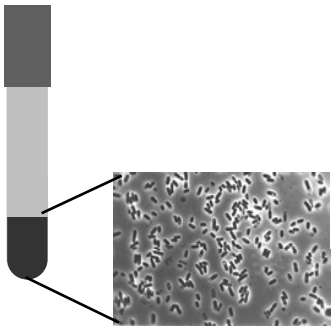
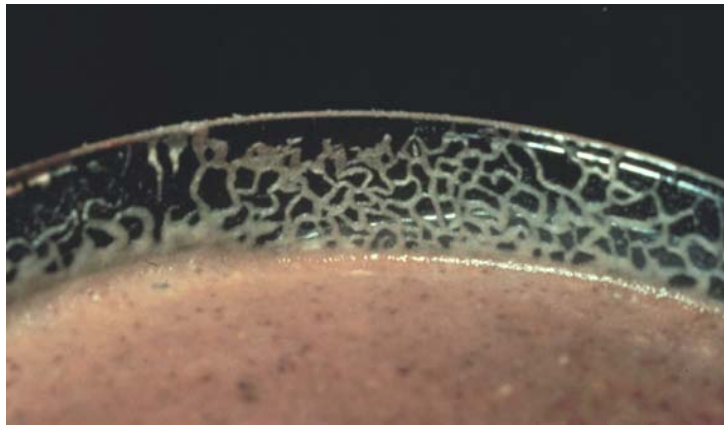


Colonization-defective Bacteria



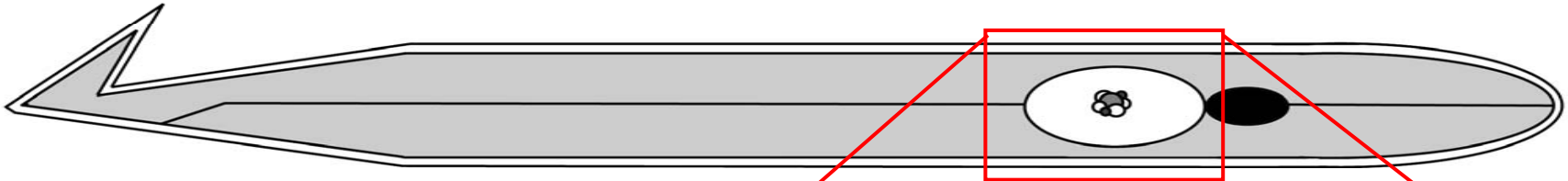
Uncolonized Nematodes

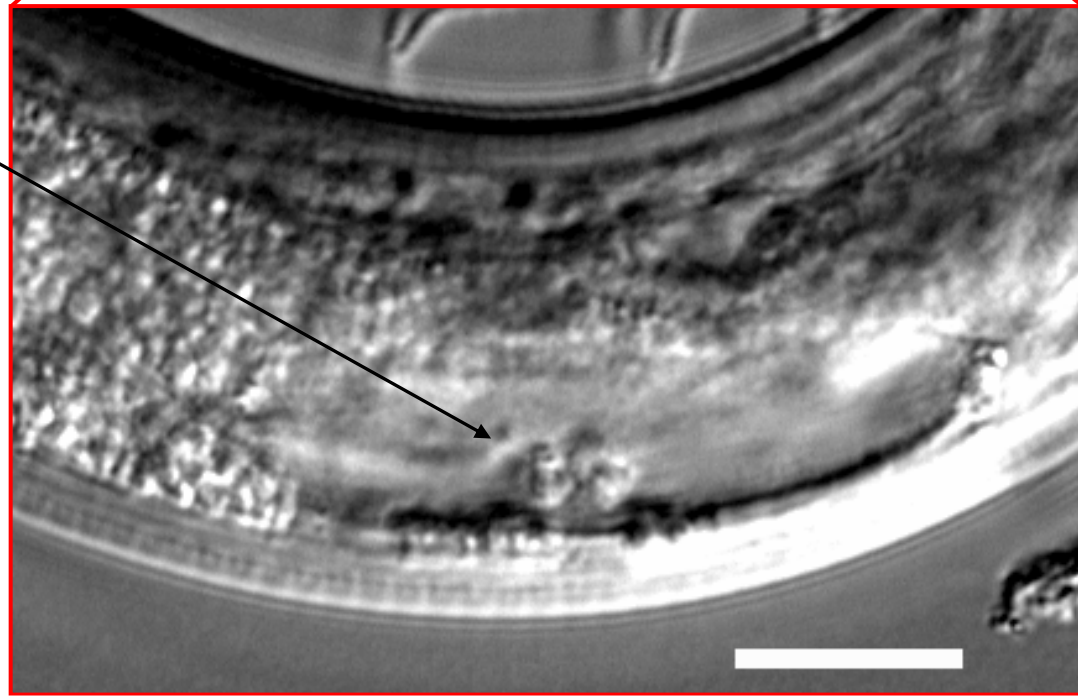


picture courtesy Dr. Harry Kaya

olonization-deficient mutants:
vas and Goodrich-Blair. 2001 *J. Bacteriol*. 183(16): 4687-4693
eungens, et al. 2002 *Mol. Microbiol*. 45(5): 1337-1353

Intestinal vesicle and sub-structure



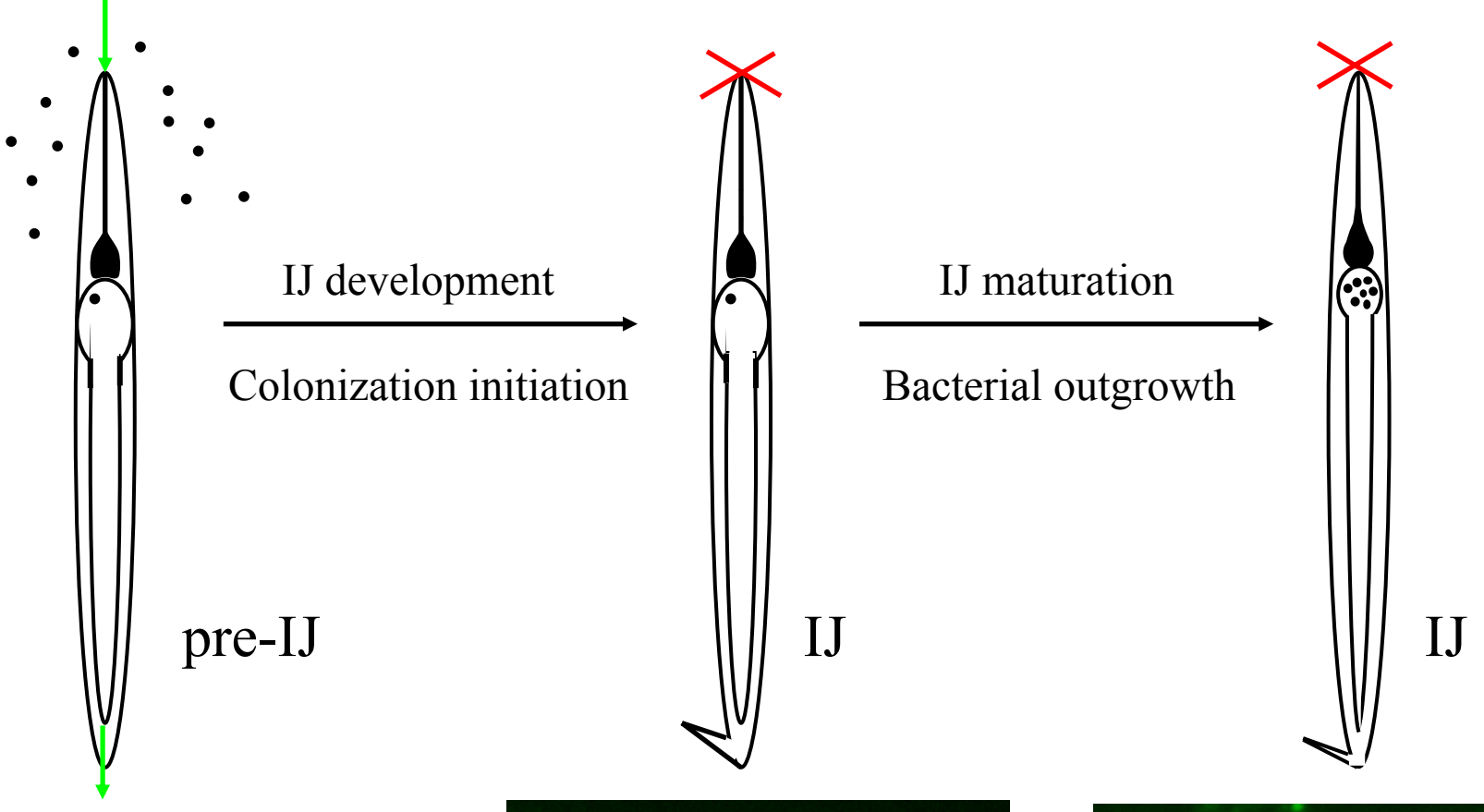


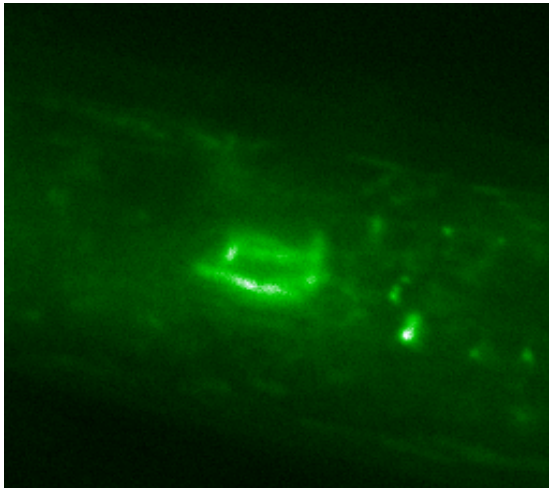
Intra-vesicular structure (IVS)

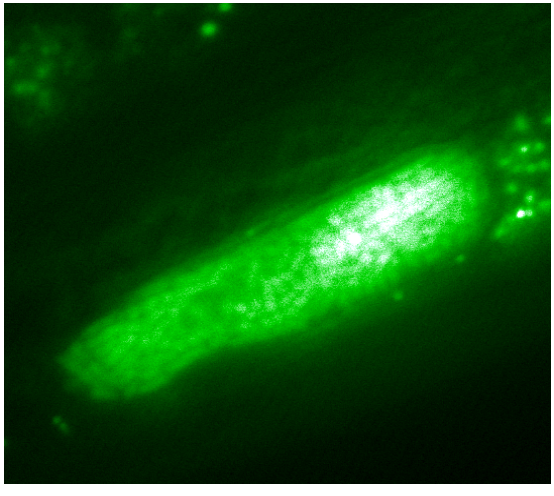
1 or 2 per IJ
~4-6 µm diameter
cluster of smaller spheres
moves in vesicle

10 µm

Martens and Goodrich-Blair, Cellular Microbiology. In press

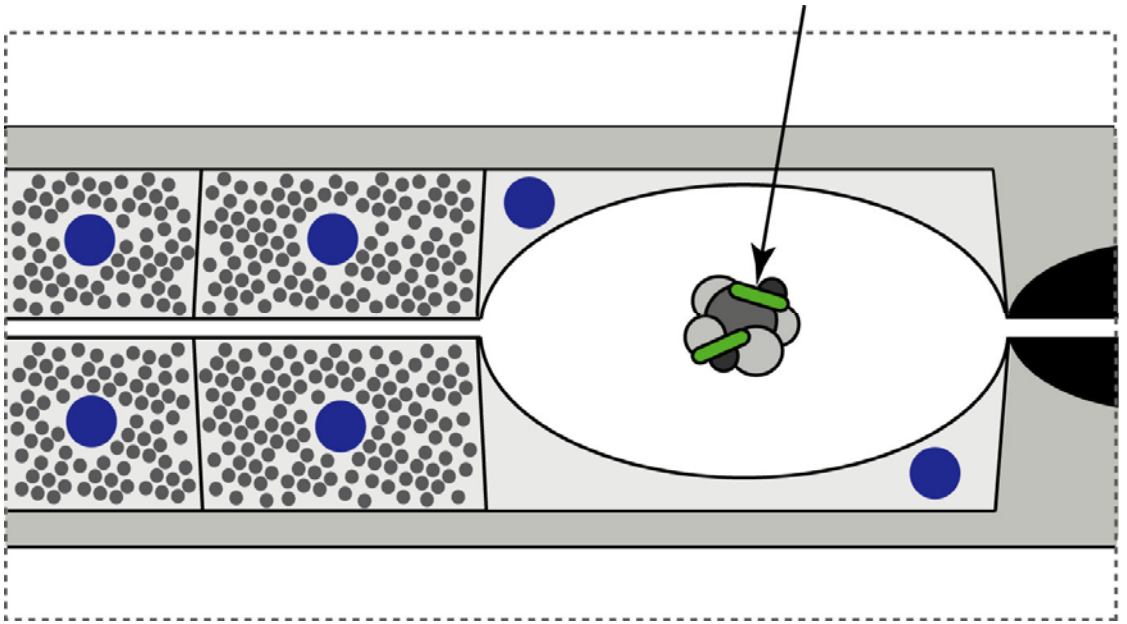






artens *et al.* 2003 J. Bacteriol. 185:3147
artens *et al.* 2005 Mol. Microbiol. In press

X. nematophila association (adherence?) with IVS



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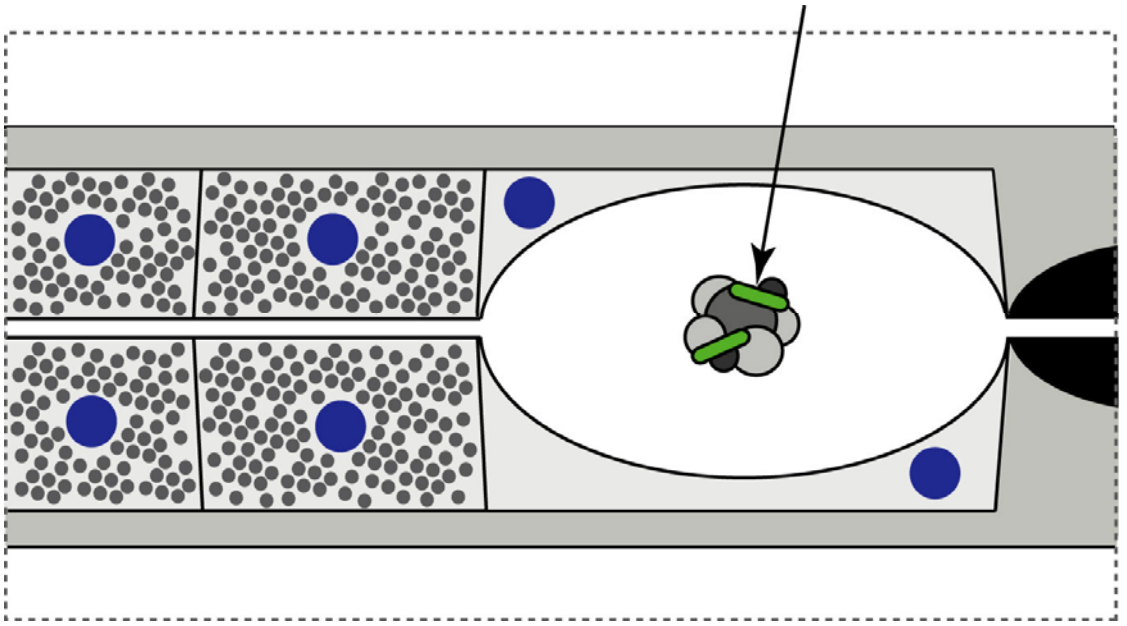

What genes does *X. nematophila* require to colonize infective nematode intestines?

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- mutagenize bacteria
- screen for loss of colonization
- characterize disrupted loci

olonization-deficient mutants:
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X. nematophila nilA, B, C mutants are impaired in colonization

lABC:
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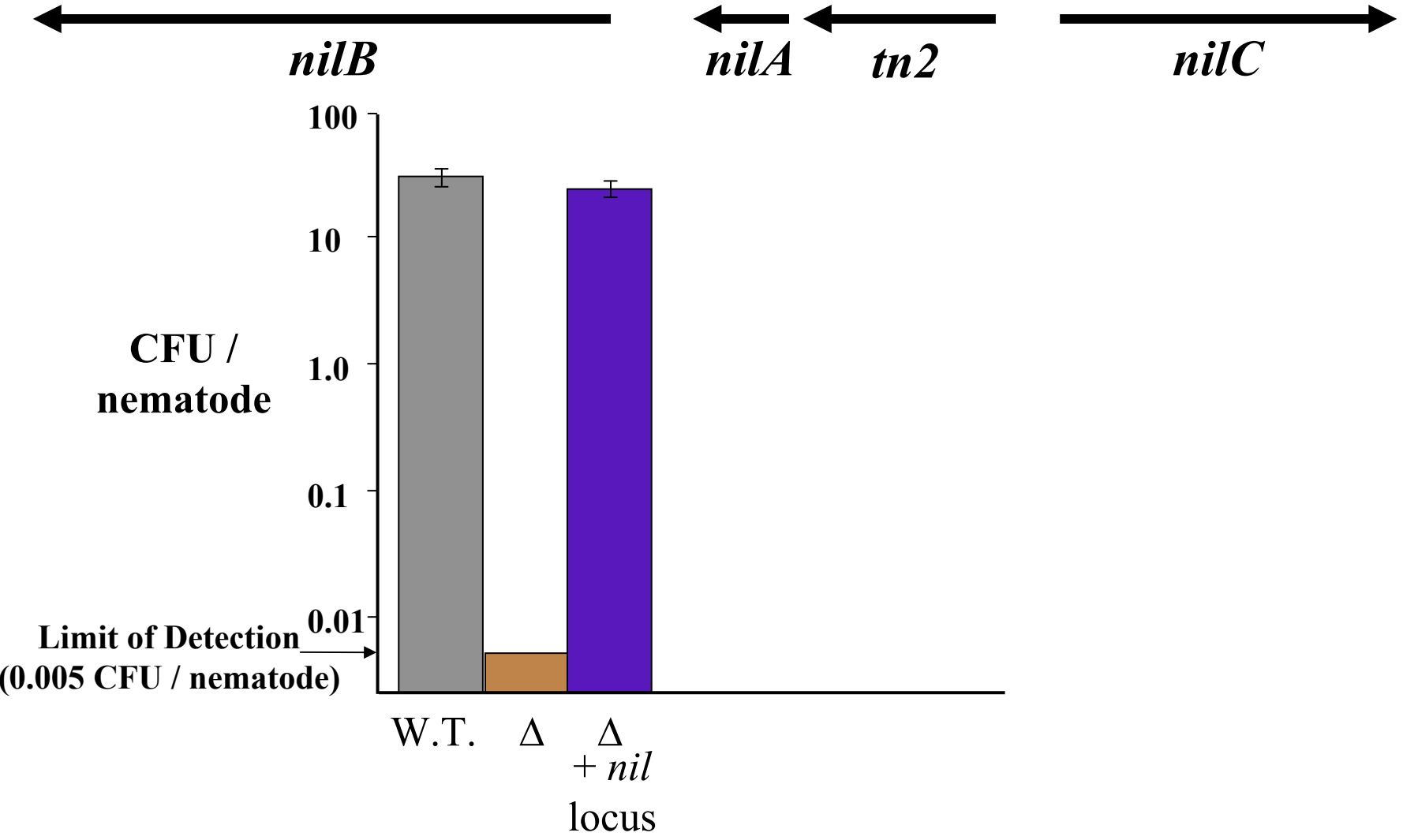

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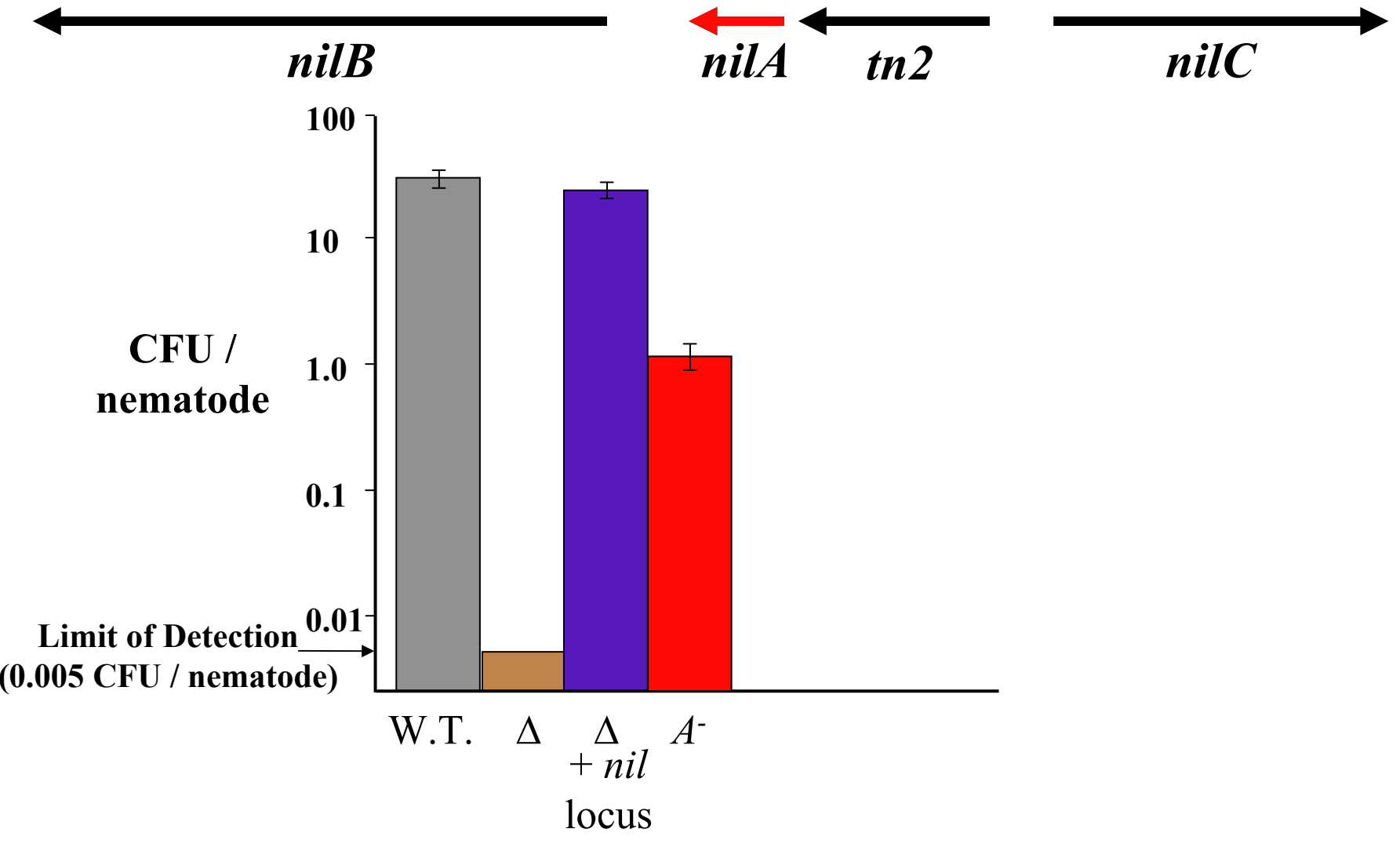

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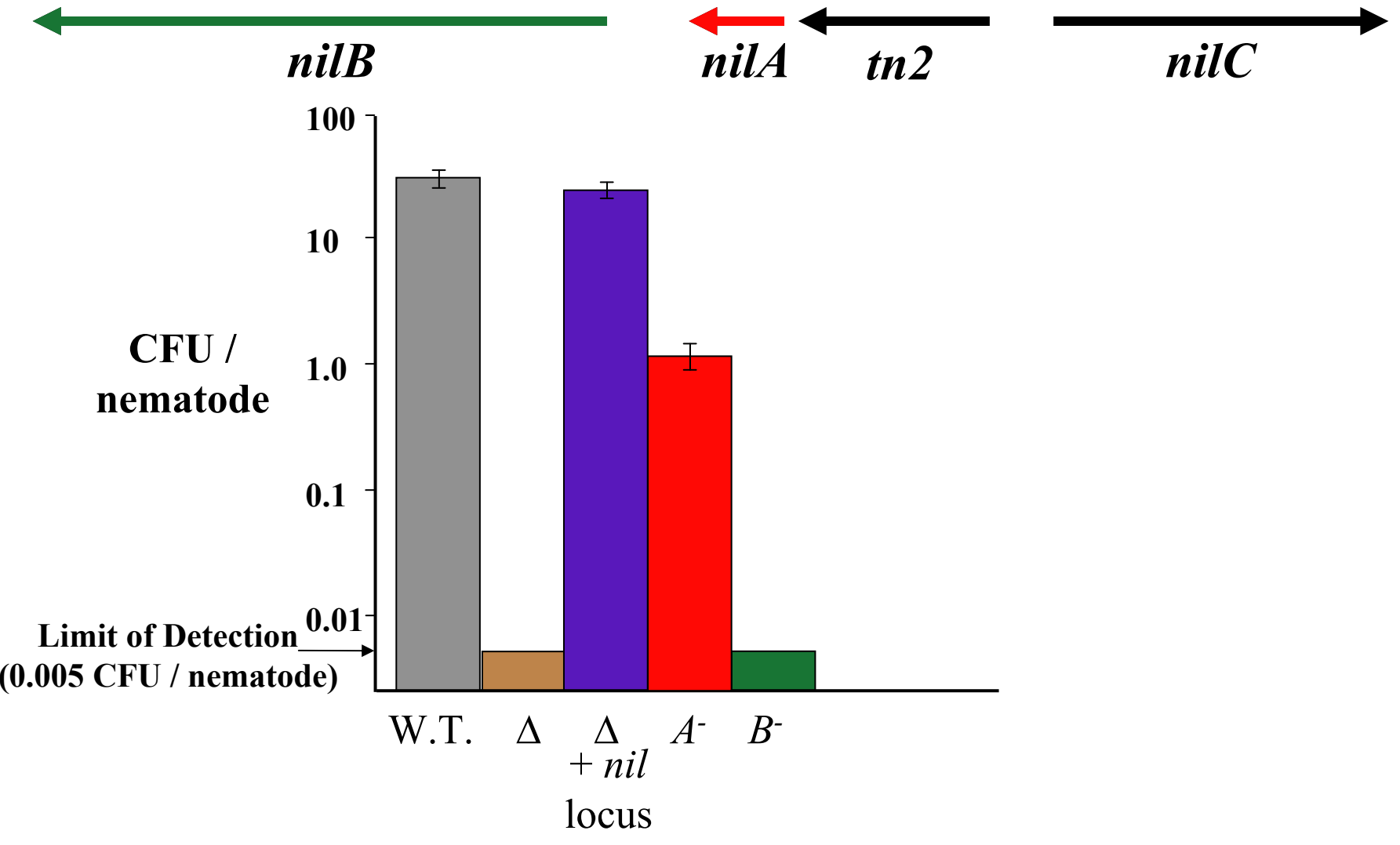

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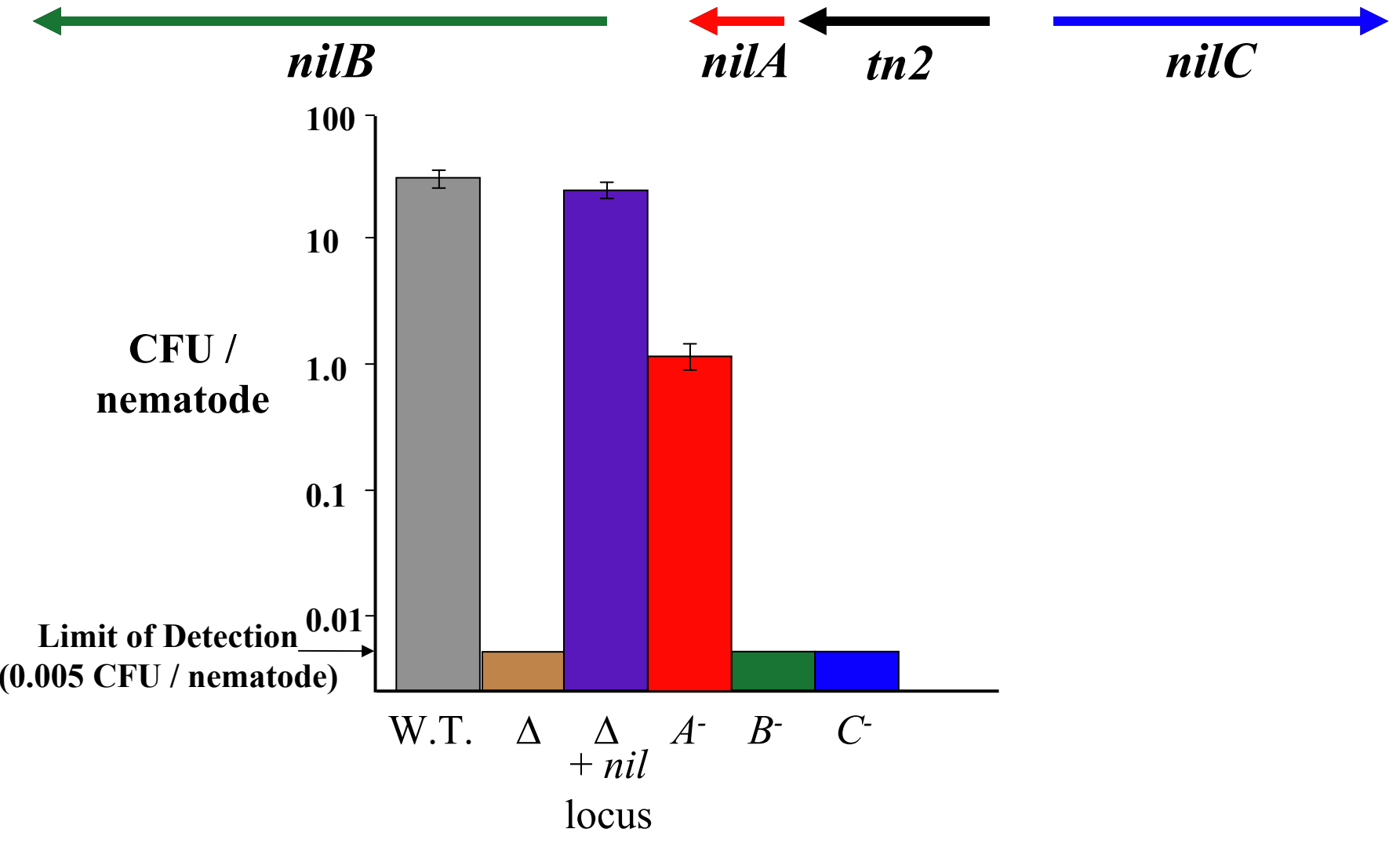

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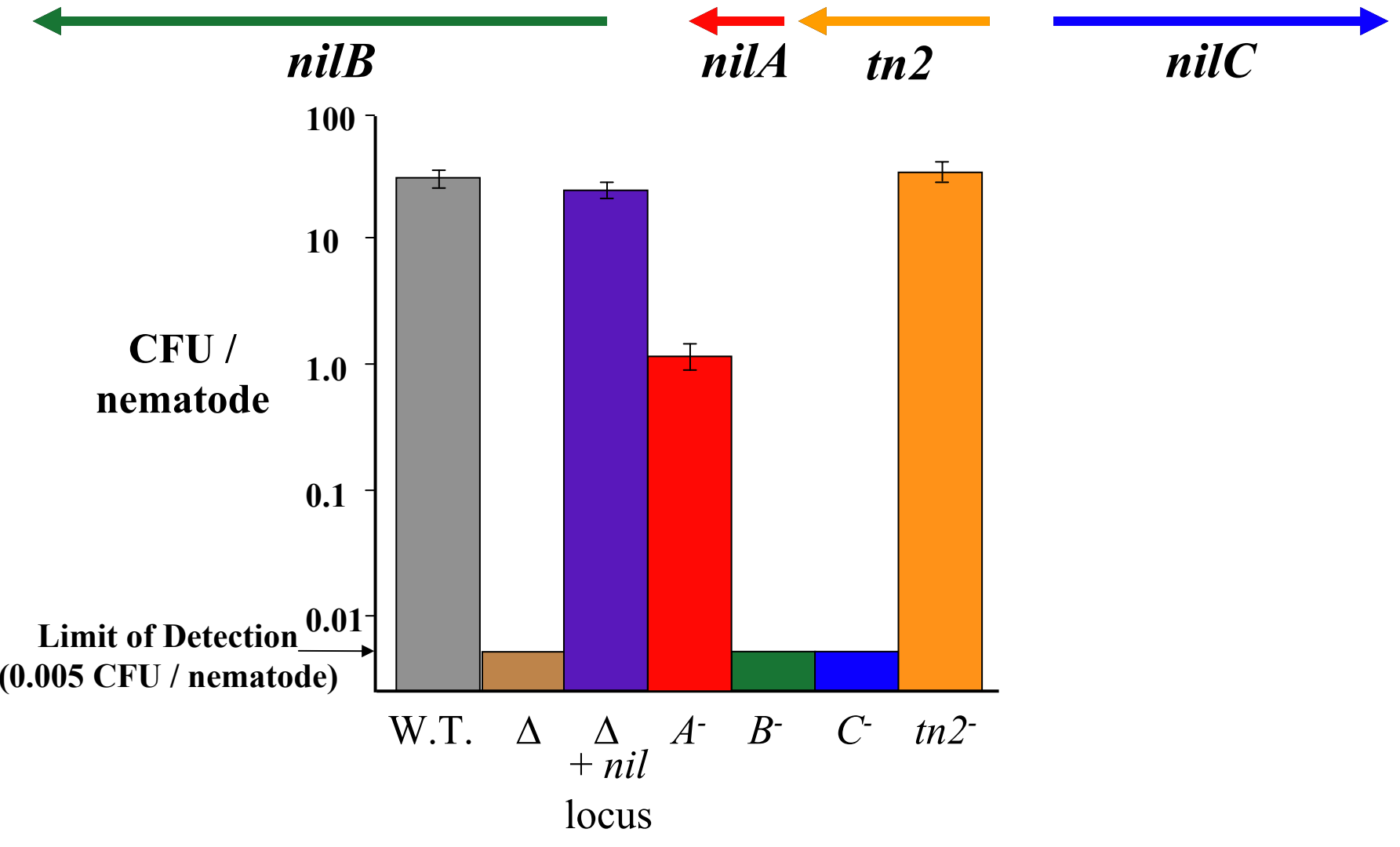

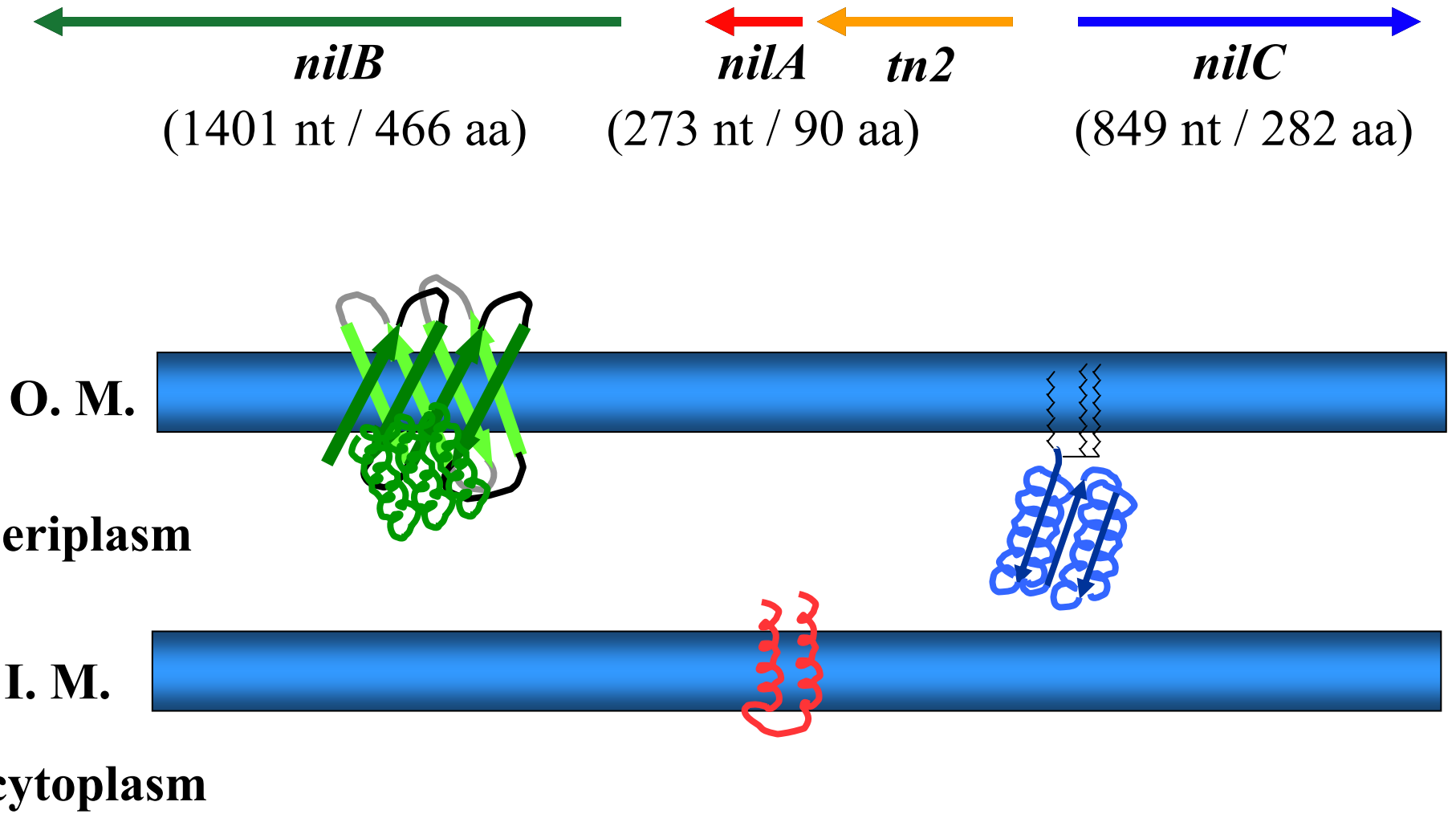

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Do *nilA*, *B*, and *C* contribute to species-specificity?

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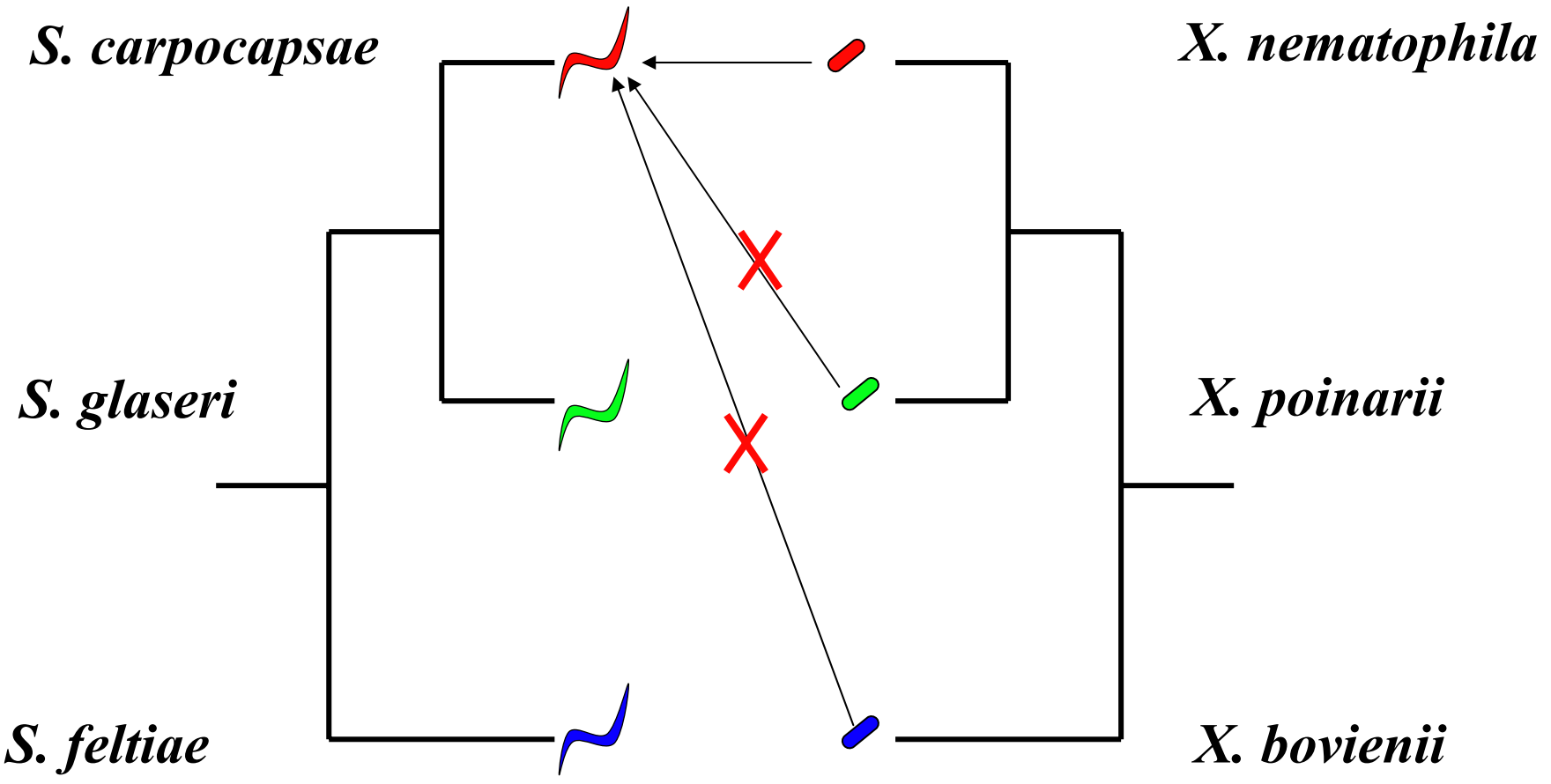


Do *nilA*, *B*, and *C* contribute to species-specificity?

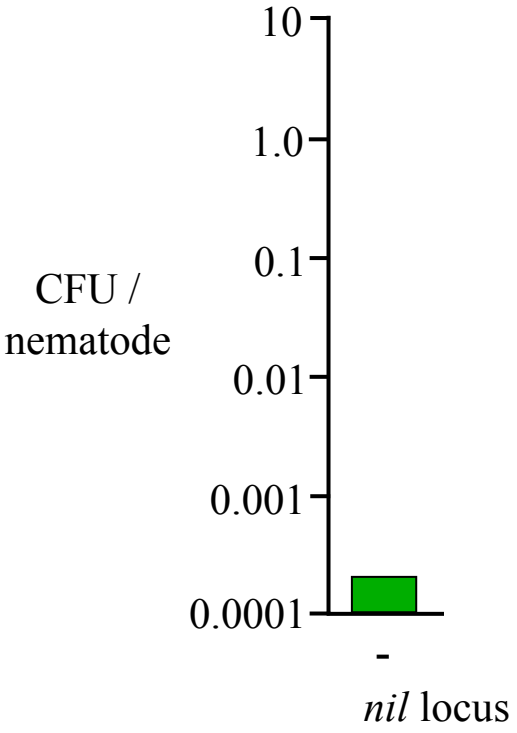
1) *nilA*, *nilB,* and *nilC* are essential for nematode colonization by *X. nematophila*.

2) NilC and NilB are (or are predicted to be) outer-membrane-localized proteins, possibly enabling a direct interaction with the nematode host.

3) *nilA*, *nilB*, and *nilC* are not found in *X. poinarii* or *X. beddingii*, as determined by low-stringency Southern hybridization and PCR. No *nil* gene-similar sequences are present in the *X. bovienii* genome sequence.

The *nilA, B, C* locus confers species cross-specificity

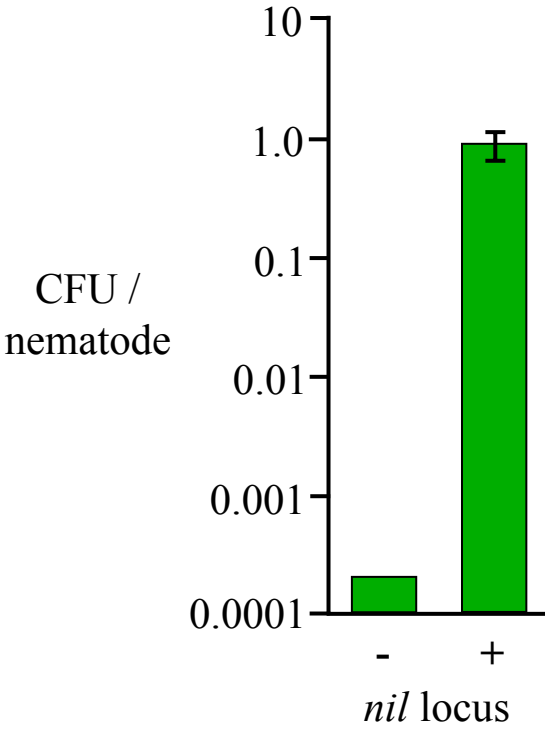
X. bovienii



***Limit of Detection: 0.0002 CFU / nematode**

The *nilA, B, C* locus confers species cross-specificity

X. bovienii



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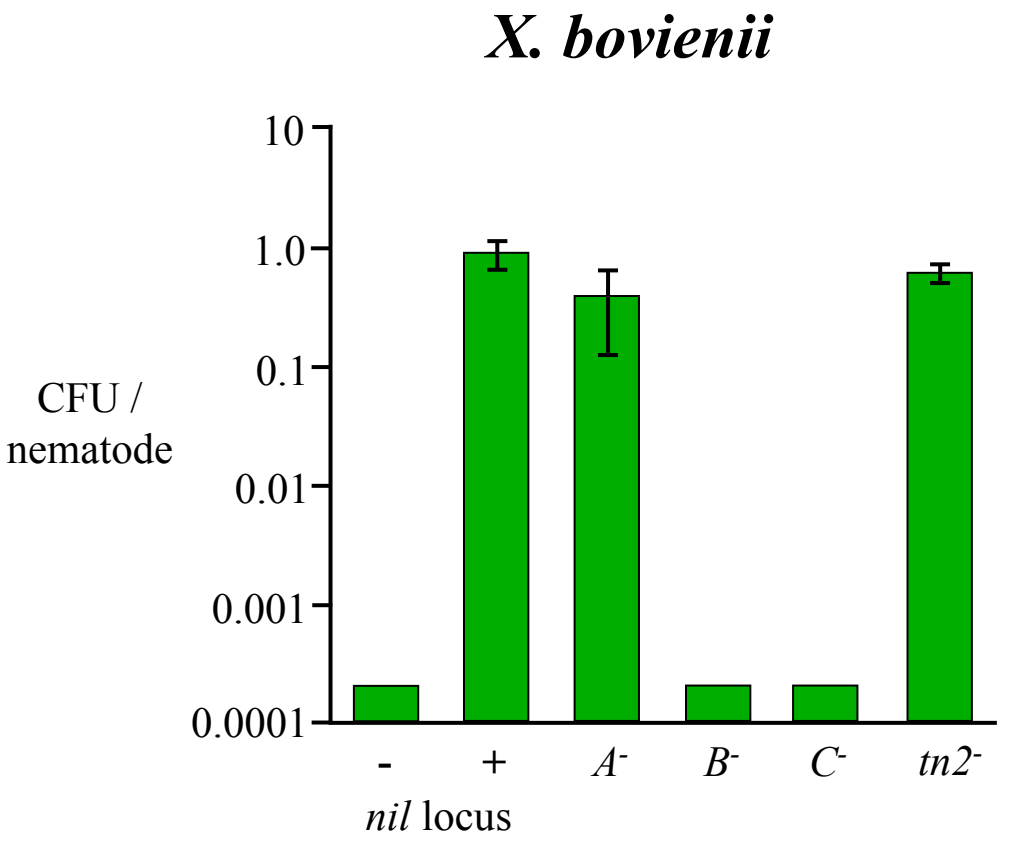
Point mutations in *nilB* and *C* impair species cross-specificity



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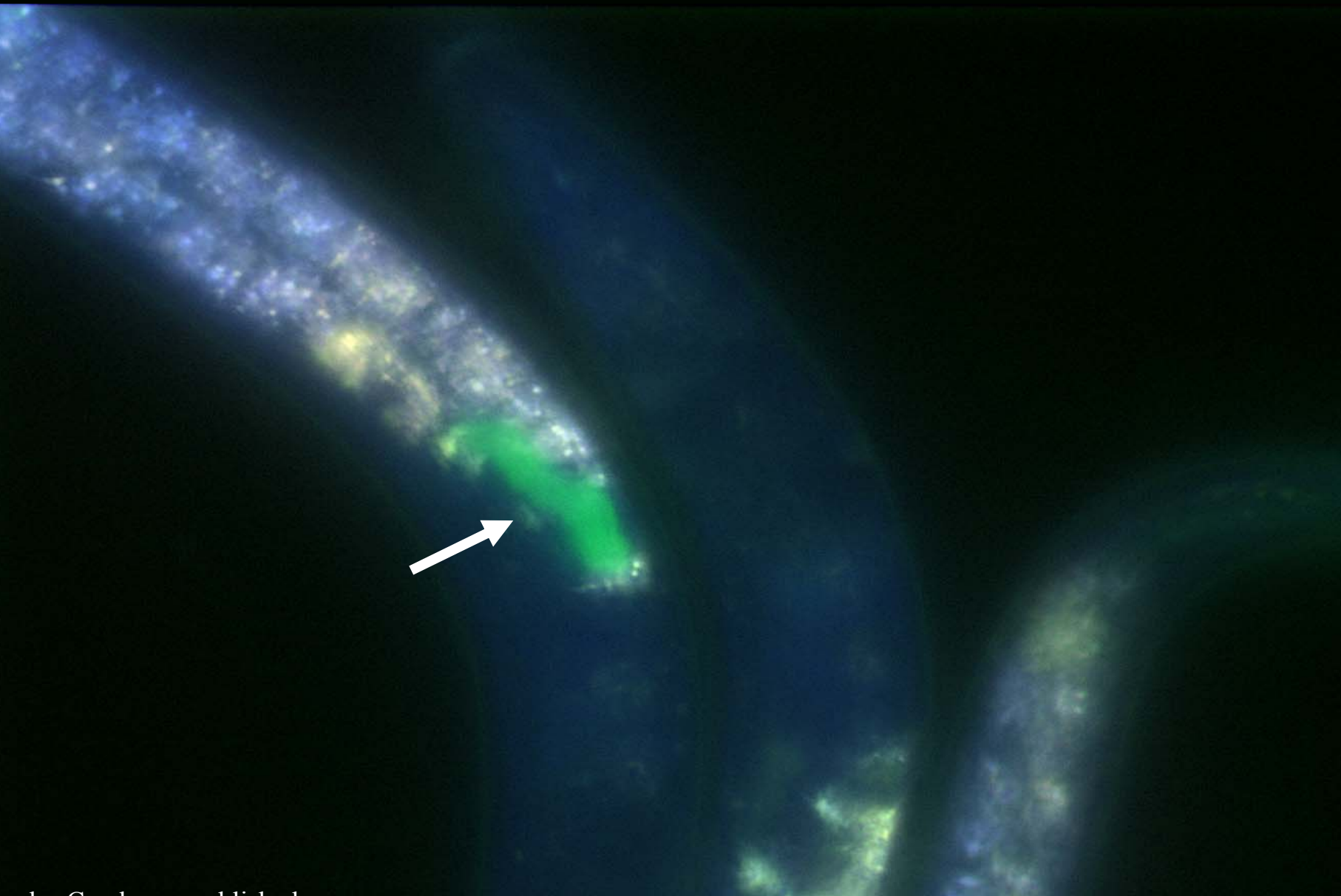
X. bovienii colonizes the *S. carpocapsae* nematode intestinal vesicle.



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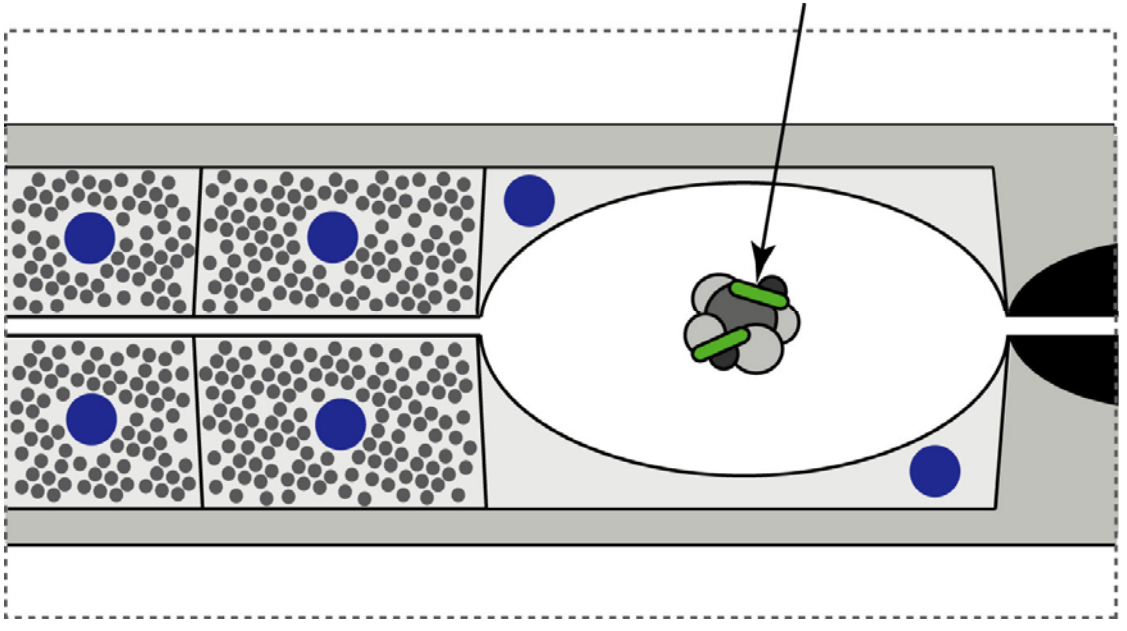
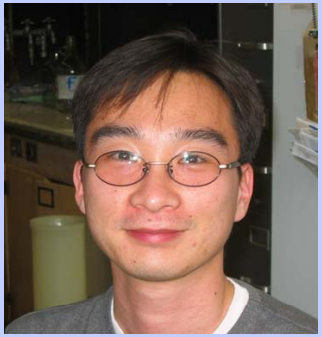


Are *nilB* and *nilC* responsible for adherence to IVS?



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Greg Richards

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Aaron Andersen

Charles Cowles

Eric Martens

Samantha Orchard