Marine Biological Laboratory

THE UNIVERSITY OF CHICAGO

A novel intriguing molecular mechanism of response to transition metals in diverse environments

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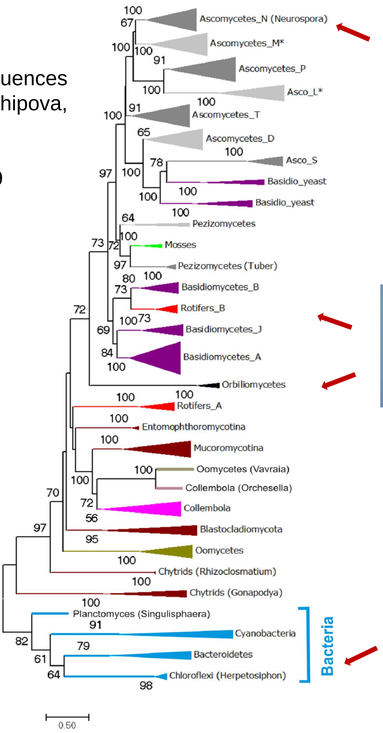
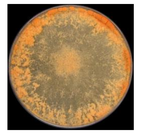
Cellular genes encoding RVT are present in different kingdoms of life

Number of *rvt* sequences (Yushenova & Arkhipova, 2018):

Fungi	249
Plants	2
Invertebrates	11
Protists	10
Bacteria	11



Only a few *rvts* in bacteria but form monophyletic clade

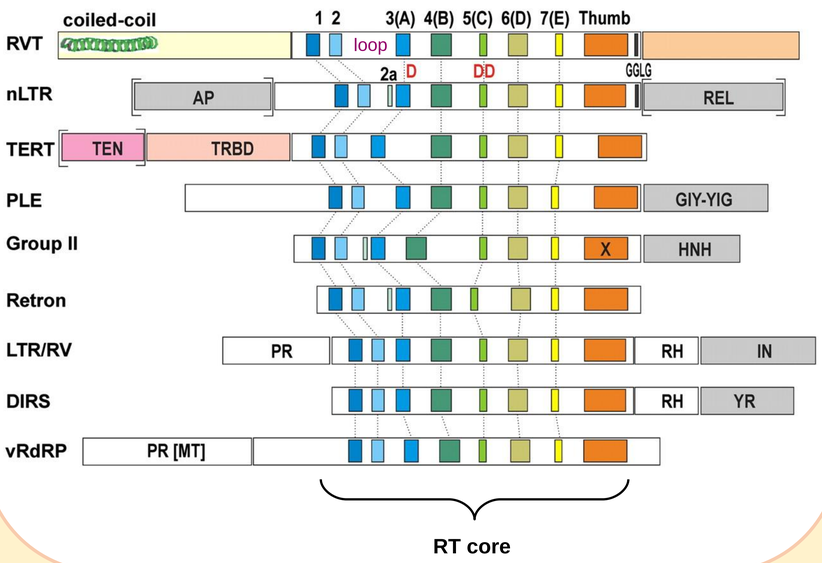


Neurospora crassa
(ascomycete fungus)

Adineta vaga
(bdelloid rotifer)

Herpetosiphon aurantiacus
(free-living bacterium)

RVT genes differ from other reverse transcriptases mostly in their N- and C-terminal domains and the insertion loop (Gladyshev & Arkhipova, 2011)



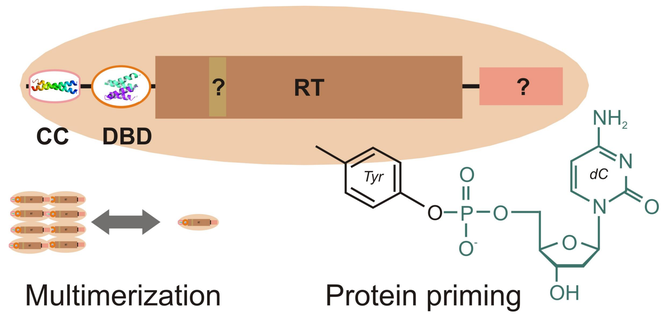
Background

A distinct class of cellular reverse transcriptases (RTs), named reverse transcriptase-related (*rvt*) genes, is the only RT type which can be found in both eukaryotes (fungi, plants, protists, certain invertebrates) and prokaryotes (selected bacteria). These genes are immobilized in genomes as single-copy genes and are preserved by natural selection. Phylogenetic analysis of more than 250 *rvt* sequences from all kingdoms of Life is more consistent with shared ancestry between prokaryotic and eukaryotic *rvts* than with interdomain horizontal exchange. These *rvt* characteristics may imply a biological function that is applicable to both prokaryotes and eukaryotes. RVT prevalence in the fungal kingdom, and their conspicuous absence from most metazoans favor the possibility that RVTs act autonomously and can occasionally undergo horizontal transfers without undermining their biological function.

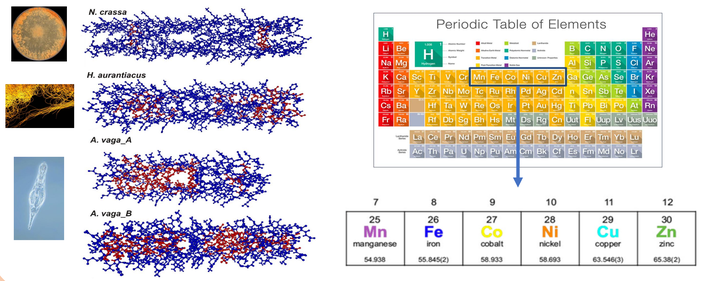
Conclusion

An ancient system of *rvt* genes could have been adopted by free-living organisms to cope with metal-induced environmental stresses.

RVT proteins tend to multimerize and may be capable of protein priming (Yushenova & Arkhipova, 2018)



The cavity in the center of tetrameric coiled-coils may have the potential to coordinate a transition metal ion



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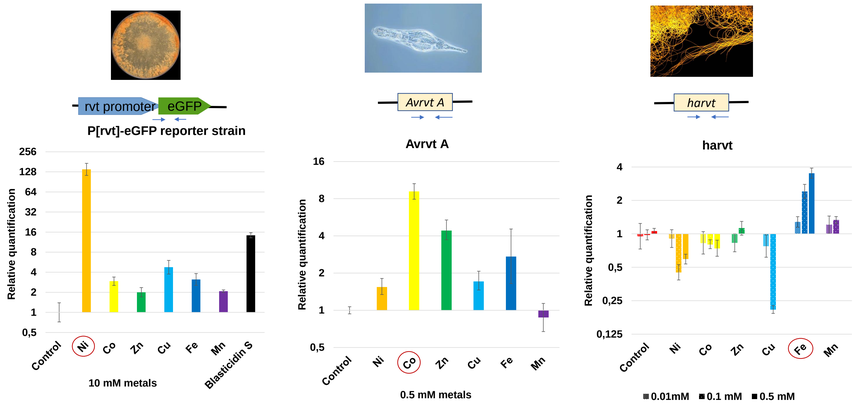
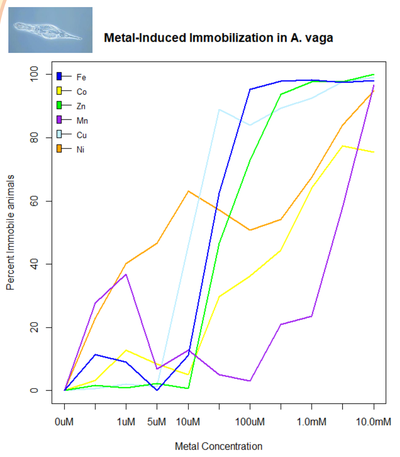
The expression of *rvt* genes can be strongly induced by treatment with transitional metals

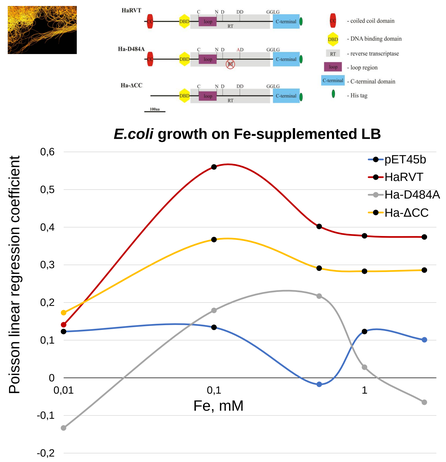


***rvt* gene expression in studied organisms reveals different patterns of induction for different metals**

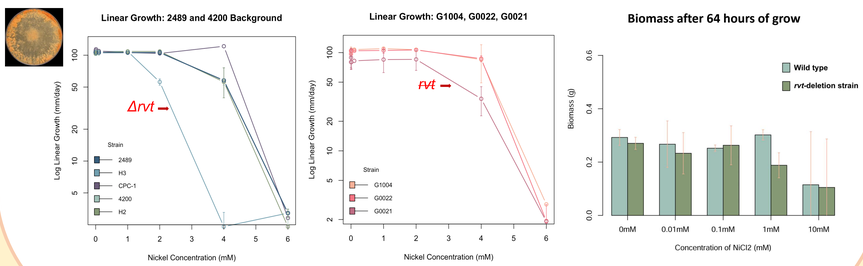
All three organisms display signs of altered growth and behavior after treatment with selected metal ions



Metals in grow media affect behaviour of *Adineta vaga*



E.coli expressing HaRVT survives better on iron-rich medium than the control strain (pET45b)



Neurospora crassa strains without *rvt* grow slower and produce less biomass than wild type when exposed to $NiCl_2$.