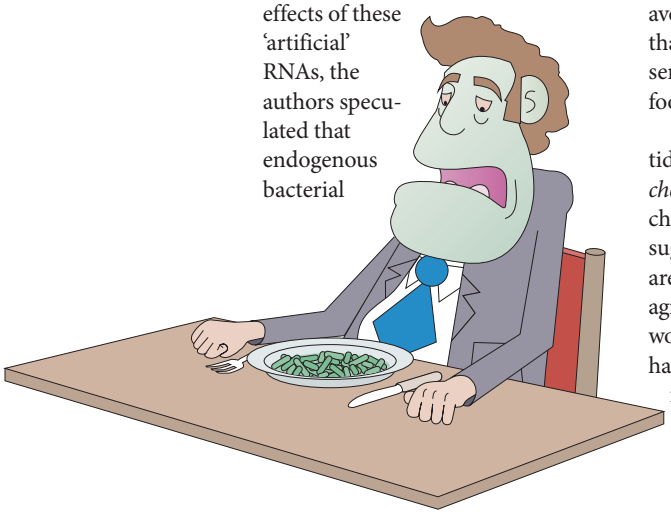
MICROBIAL ECOLOGY

Non-coding RNAs make *E. coli* unpalatable

Although food intake is known to influence gene expression and morphology in animals, in general the mechanisms underlying these effects are unknown. Writing in *Nature Communications*, Liu *et al.* now show that endogenous non-coding RNAs (ncRNAs) from *Escherichia coli* can modulate gene expression in *Caenorhabditis elegans* to protect the bacterium from foraging by the worm.

It has long been appreciated that the bacterial food on which *C. elegans* is fed can be used to influence gene expression in the worm through the inclusion of recombinant *E. coli* that expresses double-stranded RNAs (dsRNAs), which act as an environmental source for RNAi. Given the effects of these 'artificial' RNAs, the authors speculated that endogenous bacterial RNAs, and in particular small, regulatory ncRNAs, might also influence the nematode.



They began by investigating OxyS, a small ncRNA that is produced by *E. coli* under oxidative stress conditions and regulates bacterial gene expression. Using *E. coli* strains that constitutively expressed OxyS, the authors showed that although the OxyS-expressing bacteria were found and eaten by the nematode when they were present as the sole food source, the nematode did not remain on these bacteria when given the choice between these and wild-type *E. coli*. Furthermore, worms fed OxyS-expressing bacteria were impaired for both chemo-attraction to sodium chloride and chemo-avoidance of copper acetate, indicating that OxyS interferes with chemosensing in the worm, thus impeding food searching.

The authors identified 17 nucleotides of complementarity to OxyS in *che-2* (a *C. elegans* gene involved in chemosensing and food searching), suggesting that the effects of OxyS are mediated by RNA silencing. In agreement with this hypothesis, worms fed OxyS-expressing *E. coli* had less *che-2* mRNA than worms fed wild-type *E. coli*, but there was no difference in the expression of GFP from the *che-2* promoter in either group. The authors therefore concluded that OxyS impairs chemosensing and food searching in *C. elegans* by reducing nematode *che-2* mRNA levels, probably through mRNA decay rather than inhibition of transcription.

In addition to the effects of OxyS, feeding *C. elegans* with *E. coli* expressing another bacterial ncRNA, DsrA, caused a decrease in the levels of nematode *F42G9.6* mRNA (which encodes a diacylglycerol lipase orthologue) and led to a reduction in the longevity of the worm. Finally, the interspecies effects of both ncRNAs required *rde-4*, which encodes a *C. elegans*-specific dsRNA-binding protein that is involved in RNAi initiation.

Although *E. coli* is not thought to be a major food source for *C. elegans* in the wild, it is possible that these sequences evolved to protect the bacterium against opportunistic foraging or against feeding during suboptimal conditions. Indeed, the authors isolated both species from three rotten plant samples, indicating that the two do co-exist in nature. It will be interesting to see whether other bacterial species that are major food sources for *C. elegans* have similar ncRNAs with similar interspecies regulatory functions.

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ORIGINAL RESEARCH PAPER Liu, H. *et al.* *Escherichia coli* noncoding RNAs can affect gene expression and physiology of *Caenorhabditis elegans*. *Nature Commun.* **3**, 1073 (2012)