

Short RNAs show a long history

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MicroRNAs, the tiny molecules that fine-tune gene expression, were first discovered in 1993. But it turns out they've been around for a billion years.

Evidence reported in *Nature* on October 1 by scientists in the lab of Whitehead Member and Howard Hughes Medical Institute investigator David Bartel provides a window into the early evolution of these key regulators, placing their origin within the earliest of animal lineages. The research also suggests that microRNAs present early on have undergone extensive changes, which likely have altered their functions across various lineages.

"This is the first evidence that microRNAs were present within the earliest animal lineages and are not just characteristic of more complex animals," says Andrew Grimson, a postdoctoral fellow in Bartel's lab. Scientists knew that microRNAs existed within bilaterians, an evolutionary group that includes everything from worms to fruit flies to humans, he explains. "Remarkably, we discovered their presence within sponge, a member of the earliest diverging group of animals."

The scientists used high-throughput sequencing to probe samples from animals that diverged before the origin of bilaterian animals. The sponge (*Amphimedon queenslandica*) represents a group of animals that split off in evolution very early, whereas the starlet sea anemone (*Nematostella vectensis*) split off more recently.

The sequences of microRNAs within each lineage were different from

each other, suggesting that microRNA functions are almost certainly very different in these different lineages. "In a relatively narrow spectrum of evolution microRNAs are often conserved," says Grimson. "But in a broader spectrum they have completely changed. This suggests that microRNA evolution is more flexible and may be evolving more rapidly than suspected."

Researchers also pinpointed piRNAs, another class of small RNAs, among these two species. Although less is known about piRNAs, they characteristically have longer sequences than microRNAs and are thought to dampen the activity of transposons—chunks of DNA that can move around the genome, causing mutations.

"It appears that both microRNAs and piRNAs have been available to shape gene expression throughout the evolution of animals and perhaps even helped to usher in the era of multicellular animal life," says Bartel.

Citation: "The Early Origins and Evolution of microRNAs and piRNAs in Animals", *Nature* on-line, Oct. 1, 2008

Source: Whitehead Institute for Biomedical Research

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