MicroRNA: A glimpse into the past

February 1 2010

The last ancestor we shared with worms, which roamed the seas around 600 million years ago, may already have had a sophisticated brain that released hormones into the blood and was connected to various sensory organs. The evidence comes not from a newly found fossil but from the study of microRNAs - small RNA molecules that regulate gene expression - in animals alive today.

Scientists at the European Molecular Biology Laboratory (EMBL) in Heidelberg, Germany, have discovered that these molecules are found in the exact same tissues in animals as diverse as sea anemones, worms, and humans, hinting at an early origin of these tissues in animal evolution. Their findings, published today in *Nature*, also open new avenues for studying the current functions of specific microRNAs.

Animals from different branches of the evolutionary tree - different lineages - possess specific microRNAs that evolved only in their lineage. But they also have microRNAs in common: ones which they inherited from their last common ancestor, and which have been conserved throughout animal evolution.

The EMBL scientists looked at the marine annelid *Platynereis dumerilii*, which is thought to have changed little over the past 600 million years. They visualised where these conserved microRNAs are expressed, and compared Platynereis with other animals. They found that in Platynereis these microRNAs are highly specific for certain tissues and cell types and, what is more, discovered that tissue specificity was conserved over hundreds of millions of years of evolutionary time.

The scientists reasoned that if an ancient microRNA is found in a specific part of the brain in one species and in a very similar location in another species, then this brain part probably already existed in the last common ancestor of those species. Thus, they were able to glean a glimpse of the past, an idea of some of the traits of the last common ancestor of worms and humans.

"By looking at where in the body different microRNAs evolved, we can build a picture of ancestors for which we have no fossils, and uncover traits that fossils simply cannot show us," says Detlev Arendt, who headed the study: "But uncovering where these ancient microRNAs are expressed in animals from different branches of the evolutionary tree has so far been very challenging."

"We found that annelids such as *Platynereis* and vertebrates such as ourselves share some microRNAs that are specific to the parts of the central nervous system that secrete hormones into the blood, and others that are restricted to other parts of the central or peripheral nervous systems, or to gut or musculature", explains Foteini Christodoulou, who carried out most of the experimental work. "This means that our last common ancestor already had all these structures."

Knowing where microRNAs were expressed in our ancestors could also help scientists understand the role of specific microRNA molecules today, as it gives them a clue of where to look.

"If a certain microRNA is known to have evolved in the gut, for instance, it is likely to still carry out a function there", explains EMBL scientist Peer Bork, who also contributed to the study.

Next, Arendt and colleagues would like to investigate the exact function of each of these conserved microRNAs - what genes they regulated, and what processes those genes were involved in - in an attempt to determine what their role might have been in the ancient past.

Provided by European Molecular Biology Laboratory