Hypothesis: ncRNA - cellular activity controller?

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Abstract

Except for DNA viruses, RNAs are widespread in biological systems and are involved in multilaterally adapted systems that control numerous cellular processes, the dimensions of which are still being explored. Principally, there are two broad categories of RNAs, namely coding and non-coding (ncRNA) and this abstract refers to the latter. The ncRNA molecules can form primary structures of approximately 22 nucleotides, as in "guided single stranded microRNAs" (ss(mi)RNA); double stranded miRNA interference segments can exist as a secondary shape; tertiary architectures are common in self-splicing group I and II introns; and, in association with proteins, quaternary structures can be formed eg RNA-induced silencing complex (RISC) and ribosomes. Such structures are multifunctional and are broadly regulatory, being involved in gene regulation as well as interfering with and the processing of both small and large RNAs. Such processing actions are well orchestrated, even to the point of efficient shredding of any unwanted RNAs - for example "used" mRNA within the cell is degraded rapidly (via RISC centres), so as to prevent them from being translated further.

Recent discoveries have also demonstrated that ncRNAs can act as riboswitches (eg glmS ribozymes), whereby they regulate their own activity; and perform genetic control by a metabolite binding mRNA. Furthermore, ncRNAs can act as triggers against invading mobile genetic elements, thereby affording protection against incoming attacks by "parasitic" nucleotide sequences, viruses, transposons, etc. ncRNAs, in addition to ribozymatic activities and carrying genetic codes such as influenza (RNA virus) are significant in that the hallmark of their modular architectural structure implies that structural and possible functional similarities exist among ncRNAs. A unique aspect of ncRNAs is that they are highly conserved and it is thought that they are molecular relics which delineated a 'hypothetical' entity called the "last universal common ancestor" (LUCA), which pre-dated the three domains of life, namely Archaea, Bacteria and Eukarya.

The conserved nature of ncRNAs allows to us to posit that it is highly probable that these molecules still have overall control of cellular activity. This is particularly relevant as there are large number of newly discovered ncRNAs whose functions are still to be explained and validated. During this oral presentation, I will put a case for ncRNAs being involved in the overall control of cellular activity and speculate that this 'cellular activity control' is passed on from one generation to the next.