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From viroids and ribozymes RNA back and forth

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One remaining crucial point in the early life history is to understand how evolution passed from complex prebiotic chemistry to simple biology. Current cellular facts allow us to follow the link from chemical to biochemical metabolites, from the ancient to the modern world. In this context, the "RNA world" hypothesis proposes that early in the evolution of life, the ribozyme was responsible for the storage and transfer of genetic information and for the catalysis of biochemical reactions. Accordingly the hammerhead ribozyme (HHR), the hairpin ribozyme, and the ribozyme contained in hepatitis-δ virus (HDV) belong to a family of endonucleolytic RNAs performing self-cleavage that might occur during replication. Furthermore regarding the ultraconserved occurrence of HHR in several genomes of modern organisms (from mammals to small parasites and elsewhere), these small ribozymes have been regarded as living fossils of a primitive RNA world. On the other hand, the existence of contemporary life in extreme conditions providing habitats for cellular and viral species, encourages us to focus on the activity, persistence and dynamics of RNAs under such conditions. Finally, studying viroids as plausible remains of ancient RNA, we recently demonstrated that viroids replicate in non-specific hosts, emphasizing their adaptability to different environments which enhanced their survival probability over the ages. All these results exemplify ubiquitous features of life, that is the plasticity and efficiency of small RNAs, viroïds and ribozymes, as well as their diversity and adaptability to various extreme conditions. All these traits must have originated in early life to generate novel RNA populations.

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