

Statement of research

PROJECT: *Origin, Evolution, and Functioning of Introns*

I have a strong commitment and passion to investigate the structure, functions, and evolution of introns. I started working in this field in the early 90s. Because of my achievements in this area, in 1998 Walter Gilbert invited me to his laboratory at Harvard, where I worked until his retirement in 2003. During the last seven years I published nine papers on exon/intron structure and evolution. The most recent one, “Critical association of non-coding RNA with introns”, appeared in *Nucleic Acids Research*, 2011. In this study we performed whole-genome computations on the association of all known human ncRNAs within introns. Based on the obtained results we propose a new hypothesis on the importance of introns for the proper functioning of the human genome. Despite the permissible variations in the expression of many individual genes, the entire ensemble of genes must be highly coordinated. Only minor fluctuations in the expression of a number of genes are allowed in healthy humans. Such coordinated regulation of thousands of genes in a cell is unimaginable without numerous feedback loops engaged in the gene expression system. Intronic ncRNAs are perfect elements for such a feedback regulation system, being co-produced with the mRNA of their host genes. When a host gene is silent, its pool of ncRNAs is also not produced. However, during transcription the production of intronic ncRNAs is strictly proportional to the expression level of the host gene. It becomes clear that the fundamental significance of many introns is to provide regulatory ncRNAs for the fine control of genes within complex higher organisms. This view of the subtle yet inextricable value of introns in genomic functioning is what we term as the *Symbiotic Intron Hypothesis*. This hypothesis proposes a “non-selfish” harmony between genes, introns, and ncRNAs within higher eukaryotes. Genes provide space for introns inside of them. In turn, introns act as hosts for regulatory ncRNAs. Finally, ncRNAs provide essential regulation for the expression of genes. We conclude that there is a natural symbiosis between genes, introns, and ncRNAs—a symbiosis that is only just beginning to be discovered and properly appreciated.