



## Function to Sequence Relations of Intein Protein-Splicing Elements

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The relation between the function and structure of proteins and their sequence is a basic problem in biology. We approach this by combining computational sequence analysis and experimental research. Our computational studies focus on the analysis and use of conserved protein regions. These studies guide our experimental research of intein protein-splicing elements.

Inteins are selfish genetic elements. They code for proteins that catalyze their excision out of host proteins, ligating the host flanks with a polypeptide bond. This protein splicing activity is autoproteolytic and is not dependant on any host specific factors. Most inteins also include a homing endonuclease domain that mediates the recombination of the intein gene into alleles lacking the intein element. We are interested in intein function and their evolution. We aim at understanding how inteins protein-splice, how they are selected, and their evolutionary origin.

Inteins are very diverse in sequence but all have a protein-splicing activity that is simple to assay.

More then 140 inteins are known from bacteria, archaea and lower eukaryotes. A common set of sequence motifs is present in all inteins and crystal structures of three inteins have been determined. Hence, inteins and protein splicing are an excellent system for studying protein sequence/function relation.

Recently we have shown that inteins with highly atypical active site residues can efficiently protein-splice. Specific mutants were created to test our hypotheses on the protein-splicing mechanism of these inteins. We also identified and showed the activity of a unique group of inteins that occur in insect viruses. These are the only inteins known to naturally protein-splice in the cytoplasm of multicellular organisms. We cloned these inteins and showed them to protein-splice in E.coli and in insect cells. One of these inteins has an endonuclease domain and we show it can cut intein-less and intein-containing alleles and thus can probably mediate horizontal genetic transfer of its gene.