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What we have learned from structures of the ribosome

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The determination of the atomic structures of the ribosomal subunits in 2000 revolutionized the field of translation. I will describe our contributions to this field by focusing first on the structure of the 30S subunit and its complexes, and then on high-resolution structures of functional complexes of the entire ribosome. These studies have led to an understanding of the structural basis of the accuracy of translation, during which recognition of the codon by the correct tRNA leads to incorporation of an amino acid to the growing polypeptide chain.

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The spectacular architecture of the ribosome and clues about its origin

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Ribosomes are the universal cellular universal machines with stunning intricate architecture accompanied by inherent mobility, which facilitate their smooth performance as polymerases that translate the genetic code into proteins. The site for peptide bond formation, which is composed of RNA moieties is located within a universal internal semi-symmetrical region connecting all of the remote ribosomal features involved in it functions. The elaborate architecture of this region positions ribosomal substrates in appropriates stereochemistry for peptide bond formation, for substrate-mediated catalysis, and for substrate translocation. The high conservation of the symmetrical region implies its existence irrespective of environmental conditions and indicates that it may represent a prebiotic RNA bonding machine, which is still functioning in the contemporary ribosome.