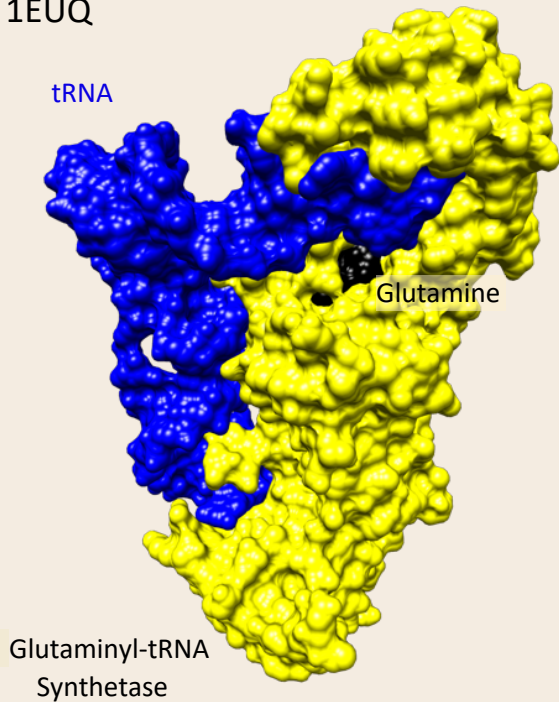


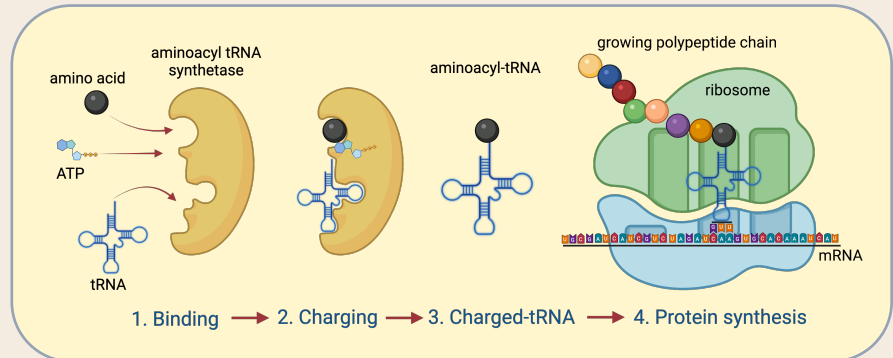
tRNA CHARGER

1EUQ



Aminoacyl-tRNA synthetase (AARS)

- an enzyme that attaches a particular amino acid onto its corresponding tRNA ("charging")
- charged tRNAs bring amino acids to ribosomes for production of proteins



STRUCTURE¹

- **Class I:** mostly monomeric; binds the minor groove of tRNA and attaches aminoacyl to the 2'-OH of tRNA; charge hydrophobic amino acids
- **Class II:** dimeric or multimeric; binds to major groove of tRNA and prefers 3'-OH; charge small and polar amino acids
- tRNA binding involves alpha helix shared by both classes
- consist of **catalytic domain**, **anticodon recognition** and **editing domain**

LOCATION

- **ubiquitously** expressed enzymes by all forms of life
- eukaryotic cells have AARSs in the **cytoplasm** and inside the **mitochondria**
- each of the 20 amino acids has its own **specific AARS**
- in bacteria mostly as free-standing proteins
- in archaea and eukaryotes AARSs assemble with accessory proteins into **mutisynthetase complexes**

FUNCTION

- link amino acids to their cognate tRNAs forming **aminoacyl-tRNAs** (aa-tRNAs)
- in the ribosome, the aa-tRNAs decode information from mRNA into a polypeptide
- also involved in regulation of gene expression, splicing of introns, and biosynthesis
- plays a critical role in the development and activation of immune system
- act as signaling molecules in autoimmune and infectious diseases

Disorders and Application to Medicine

- **Autoimmune Antisynthetase Syndrome²** - autoantibodies present in the cytoplasm begin targeting tRNA synthetases, causing myositis, polyarthritis, and lung disease among other symptoms.
- **Charcot-Marie-Tooth Disease³** – a neurodegenerative disease; results from dominant, monoallelic mutations; described for 6 different AARSs; causes nerve damage in arms and legs and muscle weakness.
- **Pharmacological targets** for development of antibiotic therapies against pathogenic bacteria and antifungal treatments⁴.

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