Protein Synthesis in Prokaryotes

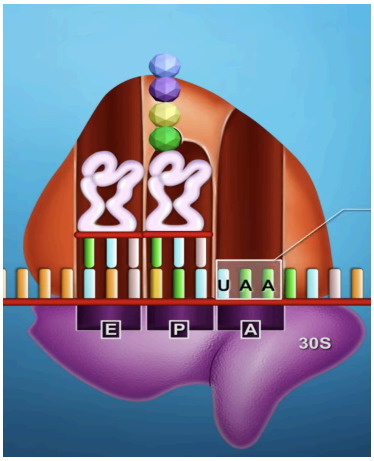
Initiation:

IF3 binds to the small ribosomal subunit (30S), keeping it from sticking to the big one too early. The 30S then binds the Shine-Dalgarno sequence (around 4–8 bp upstream of the AUG start) — this happens because the 16S rRNA inside the 30S base-pairs with the Shine-Dalgarno, lining up the AUG start codon in the right place.

Then, IF1 binds to the A site of the small ribosomal subunit (hell why the fuck am I learning this), and the initiator tRNA binds to the P site (P = peptidyl, A = aminoacyl, and the other is E = exit) of the small subunit, helped in by IF2 which carries GTP. The initiator tRNA is complementary to the AUG start codon (anticodon = UAC) and carries a formyl-methionine — the formyl group is stuck to the amino group of methionine.

Once the initiator tRNA binds, IF3 detaches, which lets the large ribosomal subunit join. This triggers GTP hydrolysis by IF2, releasing IF2 and IF1. Now the ribosome is assembled and ready to elongate.

Elongation:



Three steps, repeated over and over:

1. EF-Tu–GTP binds to the next aminoacyl-tRNA (anticodon matches the next codon after AUG) and brings it to the A site.
2. The large ribosomal subunit (really the 23S rRNA in it) catalyzes peptide bond formation between the amino acids on the P-site and A-site tRNAs.
   (this part doesn't use GTP — the energy comes from the high-energy bond between tRNA and its amino acid)
   After this, EF-Tu leaves as GDP.
3. EF-G–GTP binds and hydrolyzes GTP, using that energy to shift the ribosome forward one codon.
   Now the old tRNA moves to the E site and pops off, the new peptidyl-tRNA is in the P site, and the A site is free for the next aminoacyl-tRNA.

Termination:

When a stop codon reaches the A site, no tRNA fits it. Instead, a release factor (RF1 or RF2) jumps in and triggers the release of the finished polypeptide chain.
Then RF3–GTP helps knock RF1/2 out.
RRF (ribosome recycling factor) and EF-G then break apart the ribosome into subunits, and IF3 binds the 30S again to keep it single.
Done.