

LECTURE #2: **REGULATION OF PROTEIN SYNTHESIS**

1. Ribosome structure and function
  - rRNA maturation and modification
  - Large subunit
  - Small subunit
  - Ribosome as ribozyme
  - Antibiotic action
2. Protein synthesis
  - tRNA maturation and charging
  - The translation cycle
  - Initiation and initiation factors
    - Internal ribosome entry sites (IRES's) & how viruses subvert the cell
  - Elongation and elongation factors
  - Termination and termination factors
3. Eukaryotic mRNA structure ("the ends justify the means")
  - eIF4G, a molecular bridge
4. Regulation of translation
  - RNA-binding proteins and regulation of nuclear export of mRNAs
  - eIF4E-BP phosphorylation and regulation of cap-binding protein
  - eIF4E phosphorylation and the stimulation of translation
  - Ribosomal protein S6 phosphorylation and regulation of mRNA selection
  - eIF2 $\alpha$  phosphorylation and regulation of 43S initiation complex formation
    - eIF2B phosphorylation and control of GTP loading of eIF2
  - eEF2 phosphorylation and regulation of elongation
  - Post-transcriptional control of mRNA level (siRNA-mediated destruction)
  - RNA-binding translational repressors (act at 3'-UTR's)
    - protein-dependent translational repression
      - e.g. AU-rich element-binding proteins; Fe<sup>2+</sup> response elements (IRE's)
    - RNA-mediated translational repression (microRNAs)
    - Small molecule-regulated "riboswitches" in 5'-UTR's of bacterial mRNAs
5. Control of mRNA localization
  - Sub-cellular targeting of mRNAs to specific sub-cellular destinations
    - Yeast She proteins and Ash1 mRNA
    - Drosophila Nanos and Pumilio family (Puf) proteins and Hunchback mRNA
  - Control of mRNA polyadenylation, deadenylation, and decay ("P-bodies")
    - Nonsense-mediated decay (NMD)