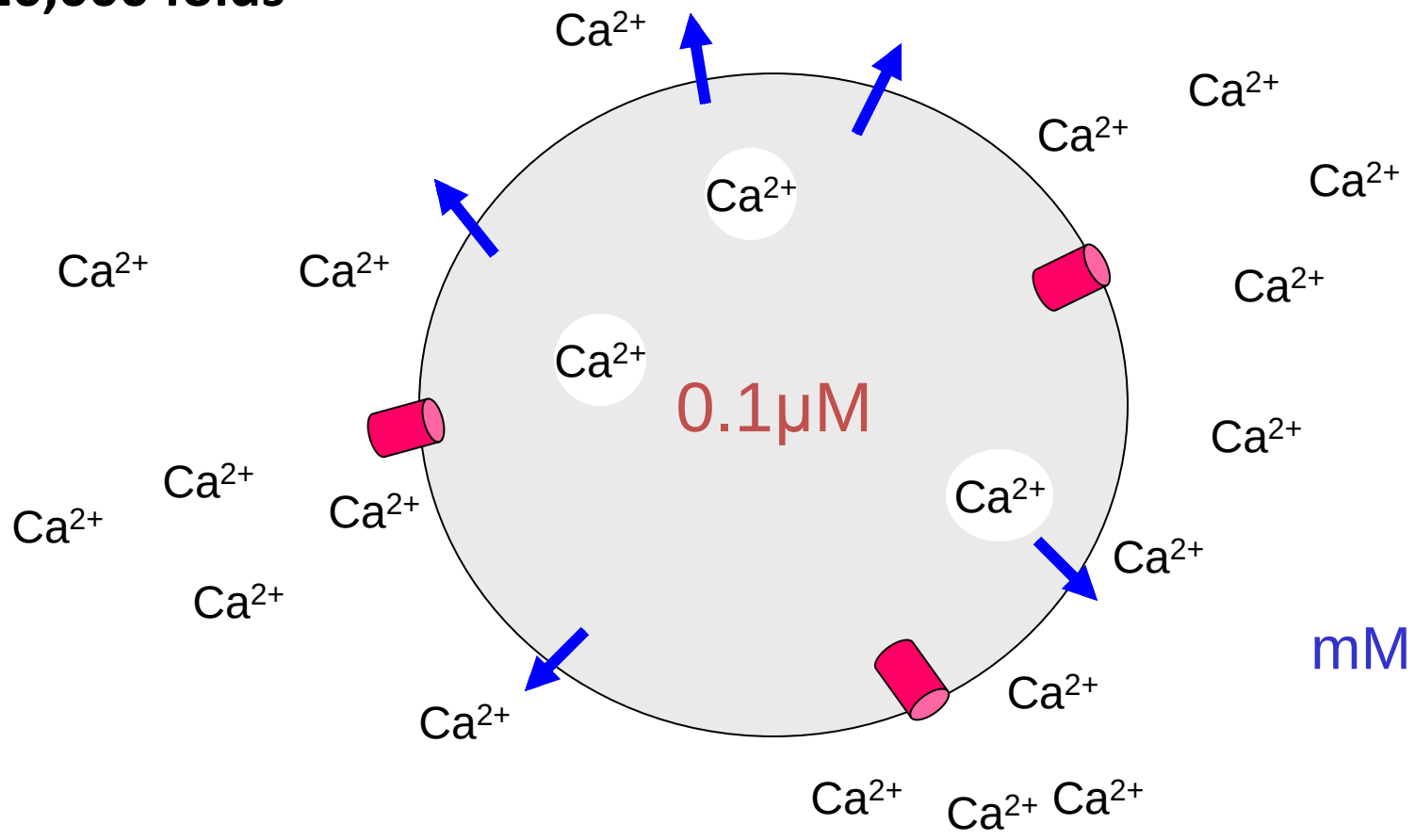
Why Ca^{2+}?

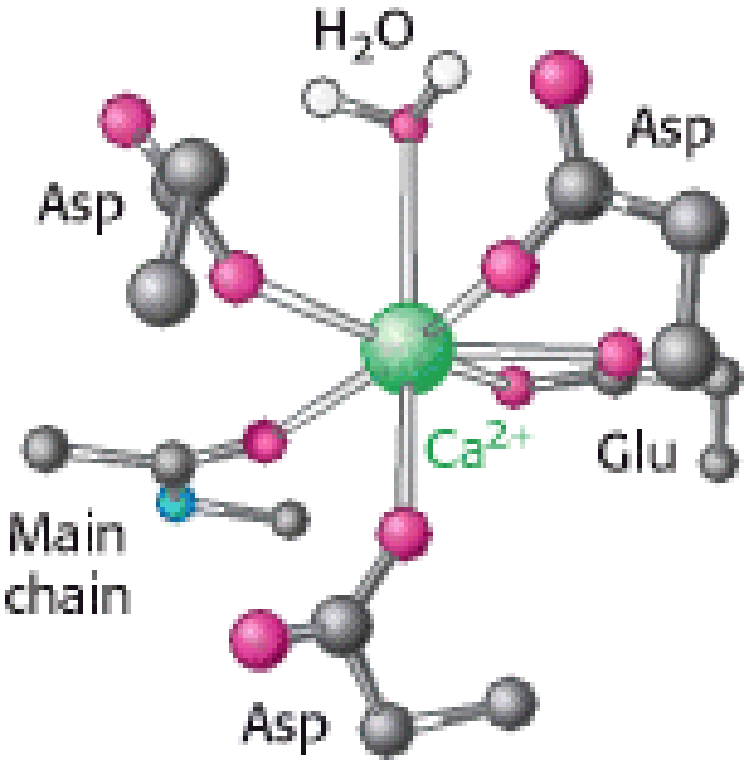
A large difference in concentration

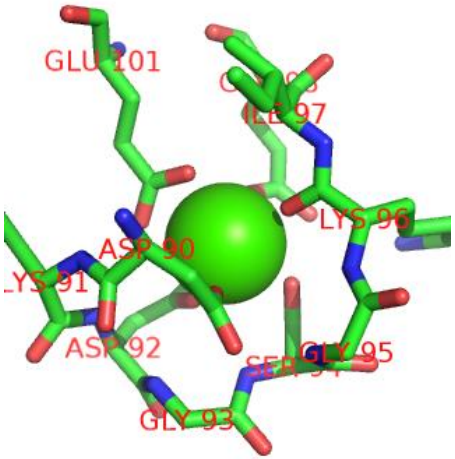
10,000 folds

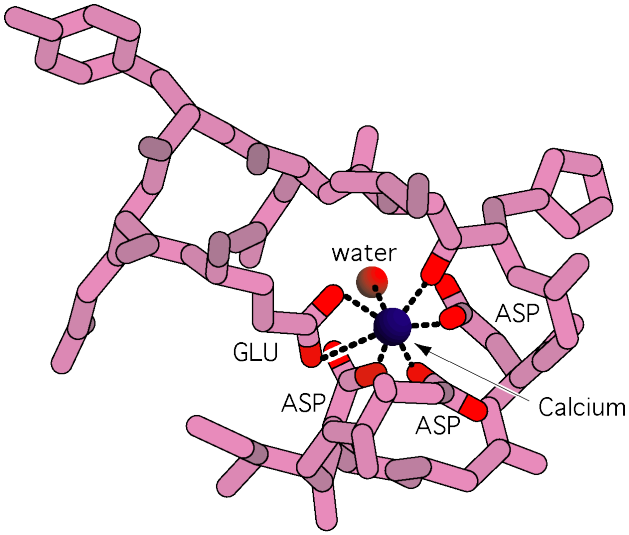


Why Ca^{2+}?

- **Ability to bind protein tightly**
- **6-8 bonds with oxygen**
- **Conformational changes (bulky molecule)**



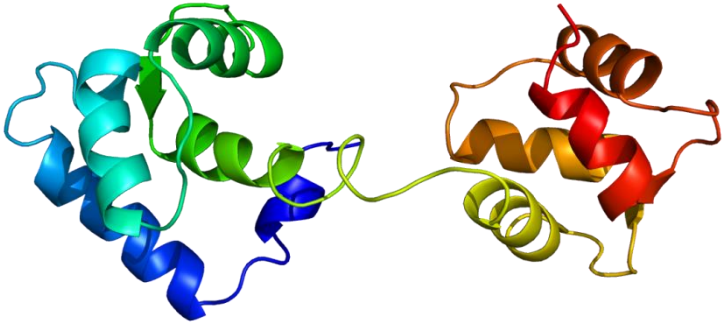




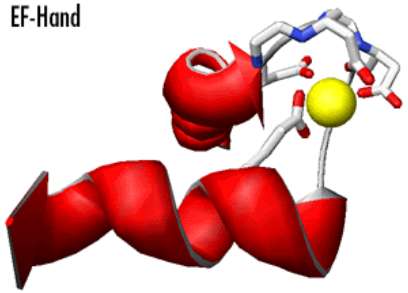
Calcium Binding Proteins

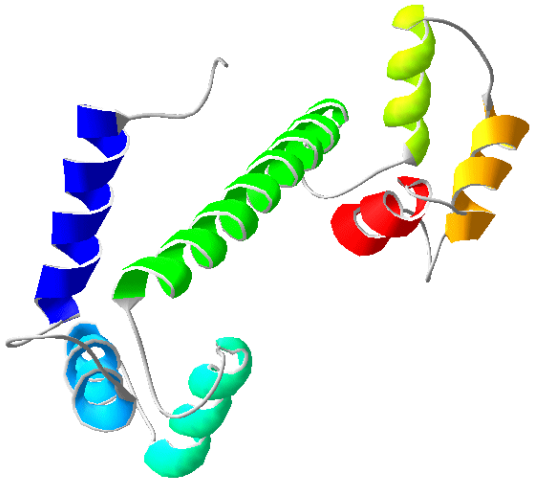
- Mediate the effects of Calcium (Ca^{+2})
- Many proteins

  Calmodulin, Troponin C, Parvalbumin

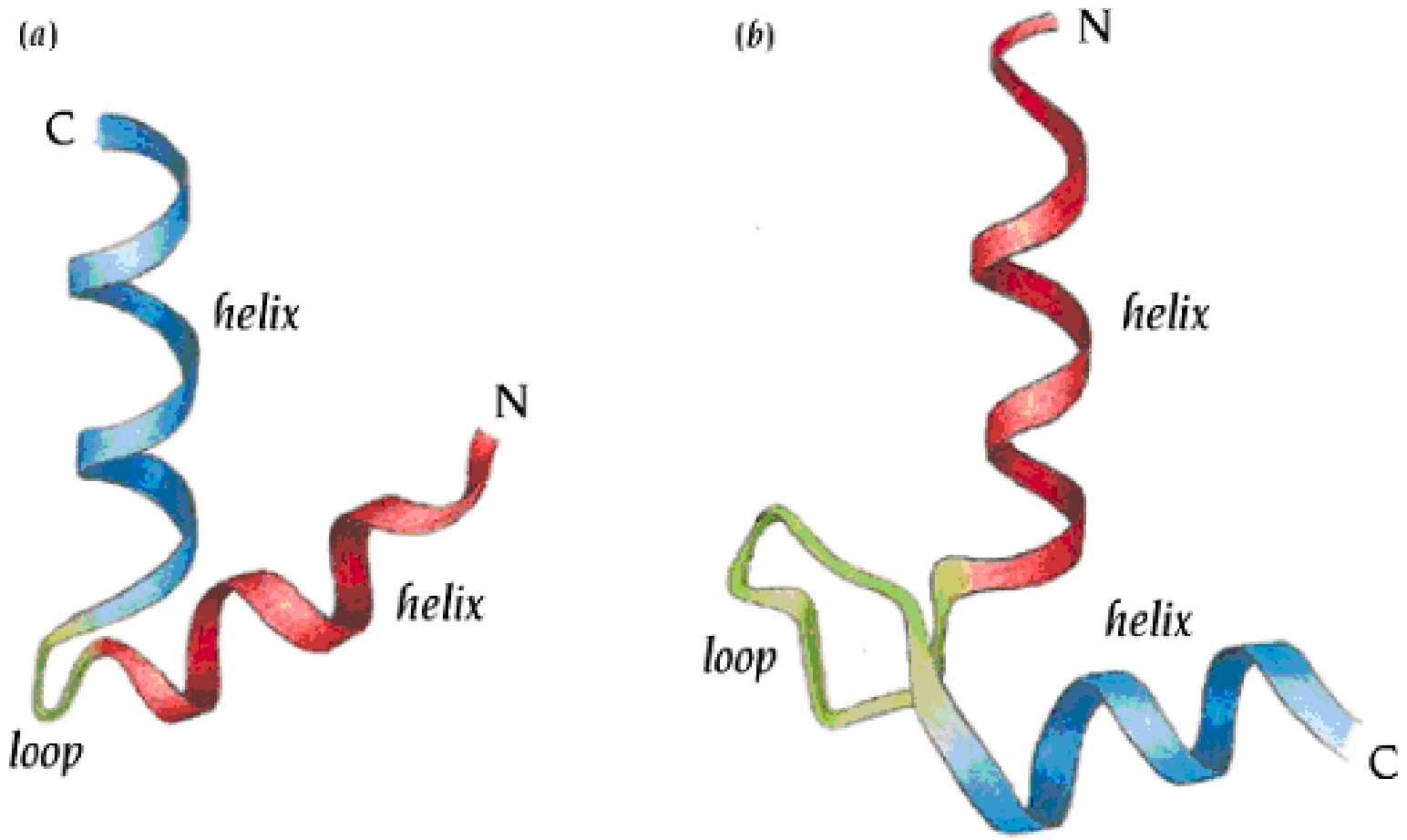


- Similar structures
  - Rich in Asp and Glu
    - Gln, Asn, Ser
  - Several α helical segments
  - Binding site is formed by
    - Helix Loop Helix
      - Super-secondary structure



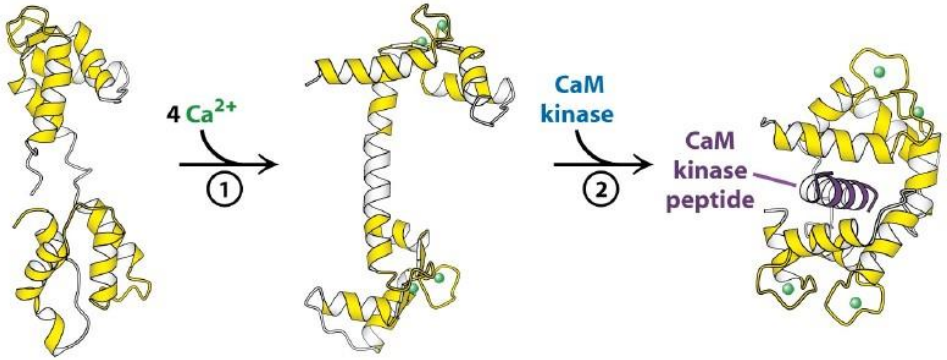


Calcium Binding Proteins



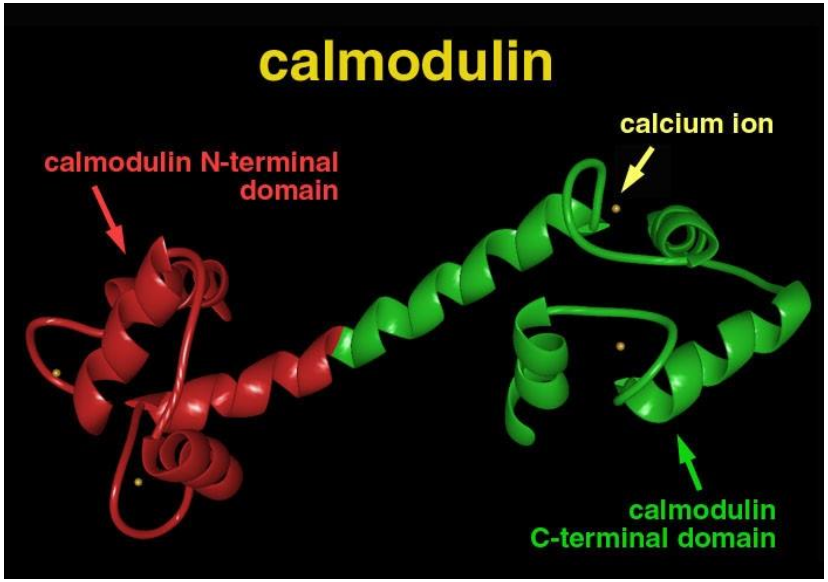
Calmodulin (≈17 kD)

Calcium-modulated protein



- Found in almost all eukaryotes
- Consists of two globular regions
  - Connected by flexible region
  - Each contains 2 EF hands
  - Four Ca^{2+} binding sites
- Calcium-Calmodulin Complex can Bind to a large Number of Target proteins including:

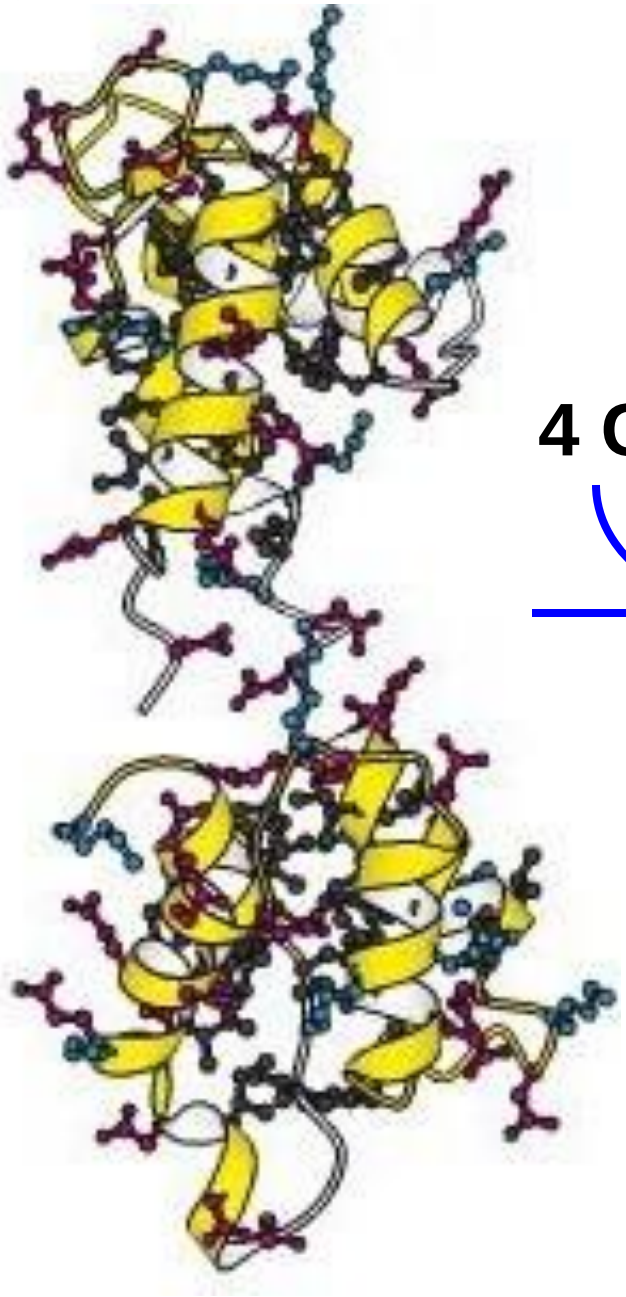
149 amino acids



Calmodulin-dependant Protein Kinase

Ca^{2+} ATP'ase Pump

Sort of memory



4 Ca^{2+}

Calmodulin binds to Ca^{2+} which results in change in conformation

(Moving some hydrophobic residues from the inside to the outside of the domains)

Ca^{2+} Transporter

- In sarcoplasmic reticulum
  - 80% of the membrane proteins
  - 10 membrane spanning helices
  - Ca^{2+} move against a large concentration gradient
  - 2 Ca^{2+} / ATP (high)
    - Depletion of ATP leads to tetany, Rigor mortis