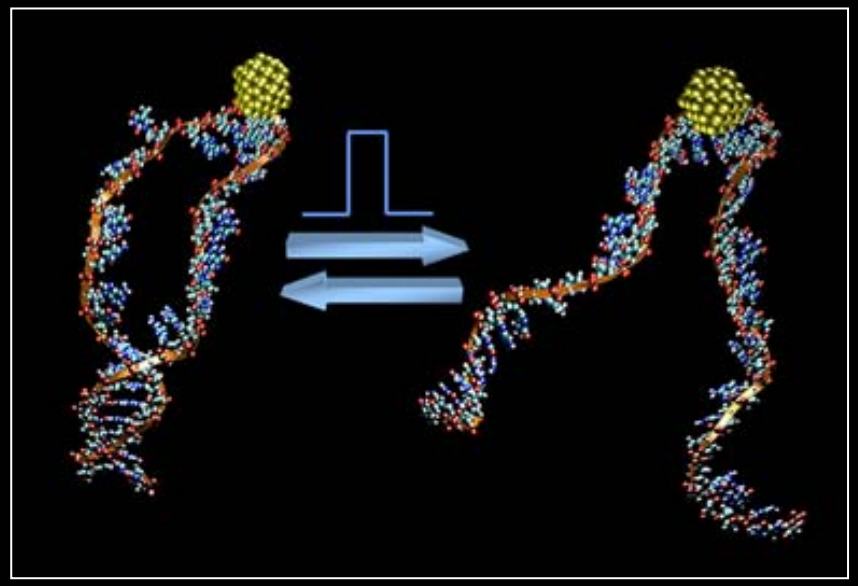
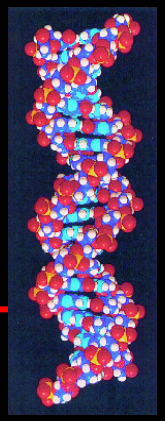
Kimberly Hamad-Schifferli

Departments of Mechanical Engineering and Biological Engineering, MIT



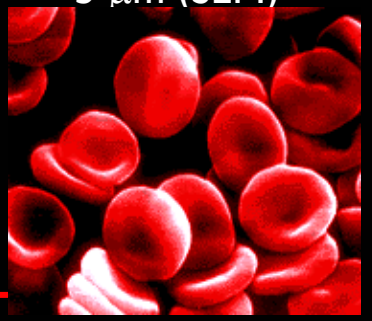
Simple molecules <1nm

DNA proteins nm



bacteria 1 μm

red blood cell ~5 μm (SEM)

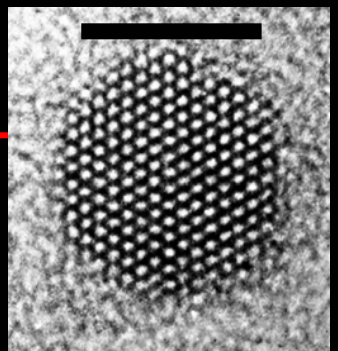


diatom 30 μm

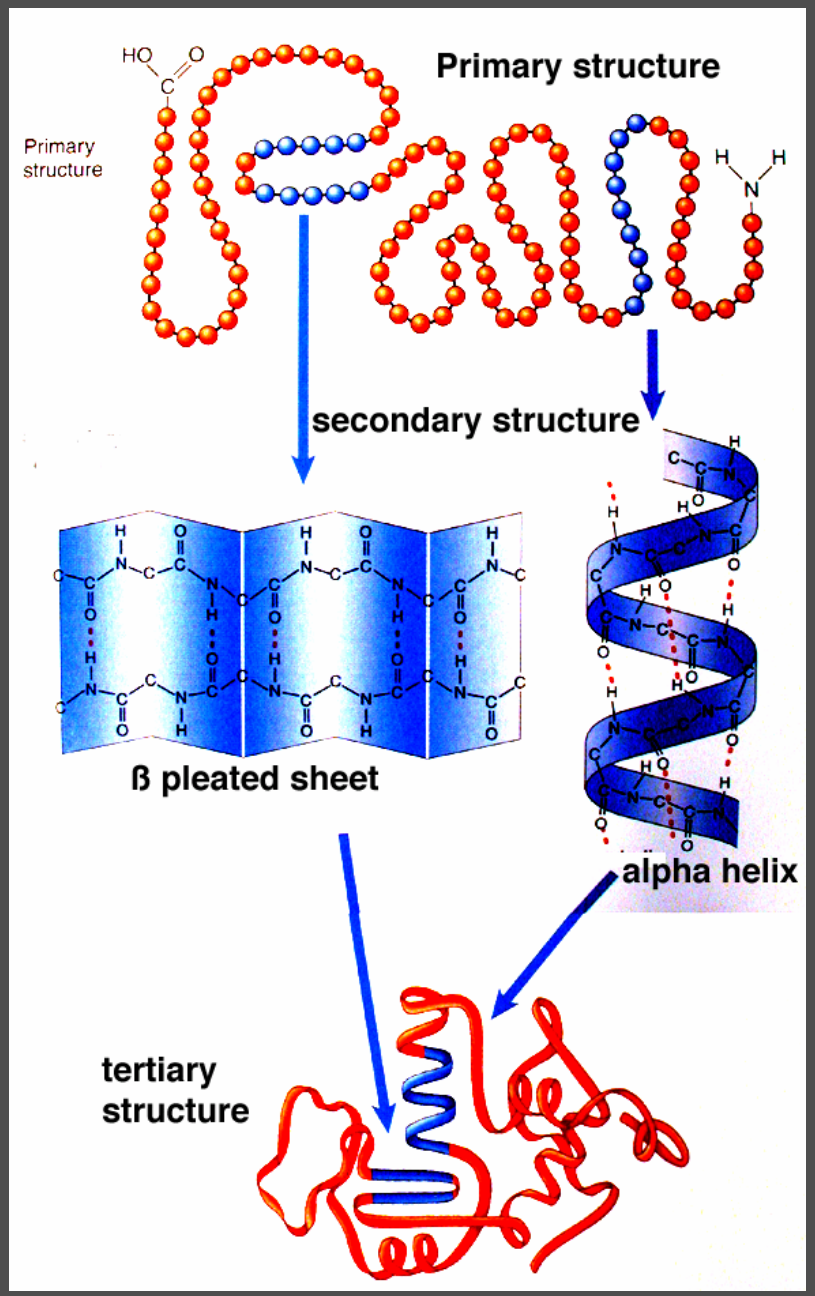
m

10^{-10} 10^{-9} 10^{-8} 10^{-7} 10^{-6} 10^{-5} 10^{-4} 10^{-3} 10^{-2}

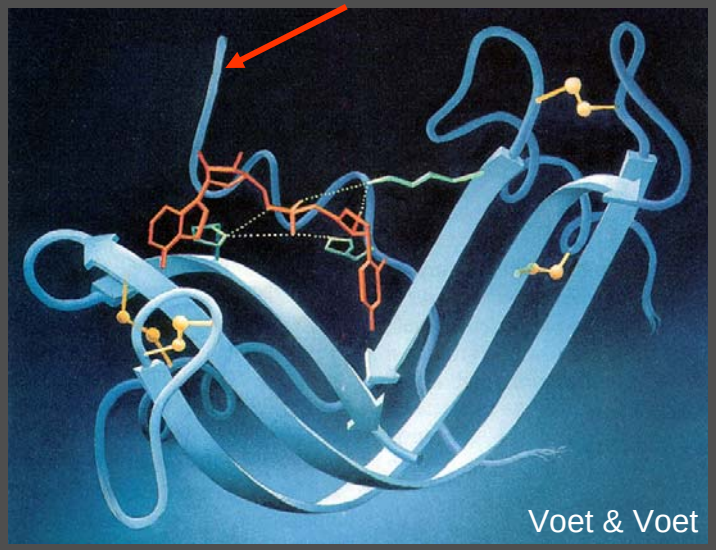
Nanoparticle nm

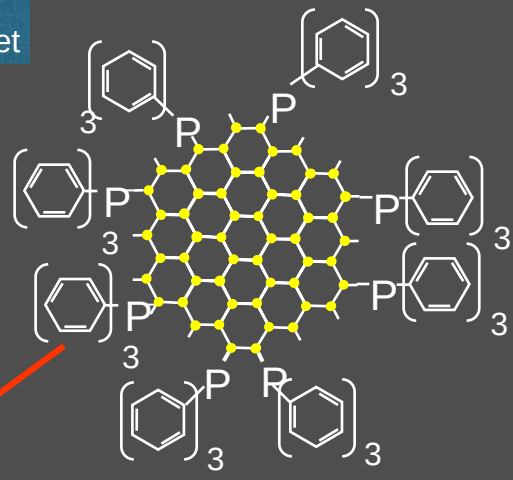


Nanoparticle linkages to proteins



- Much more complex than with DNA
- More amino acids to interact with
- Where does nanoparticle link?
- Structure key to function



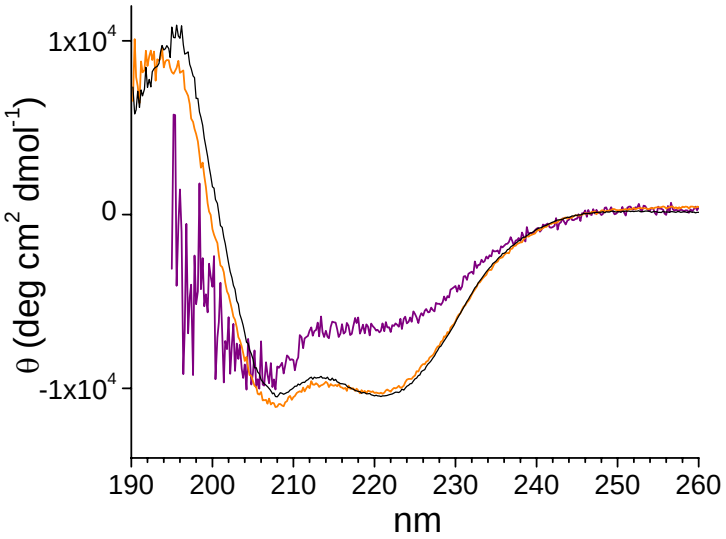


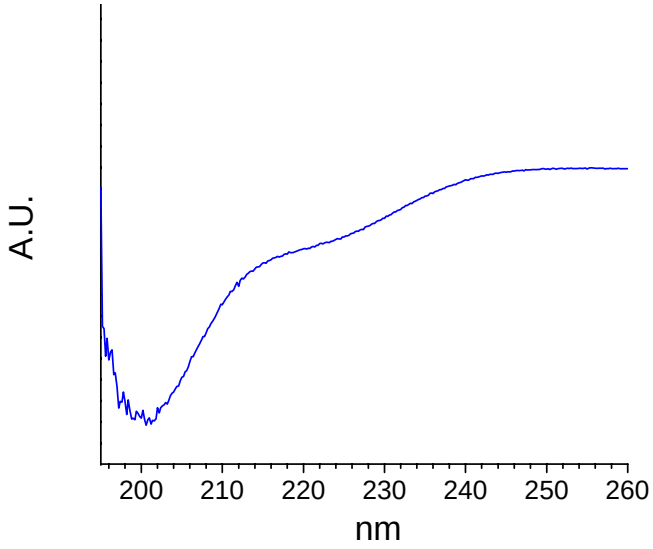
- site specific labeling of protein with NP that preserves protein structure

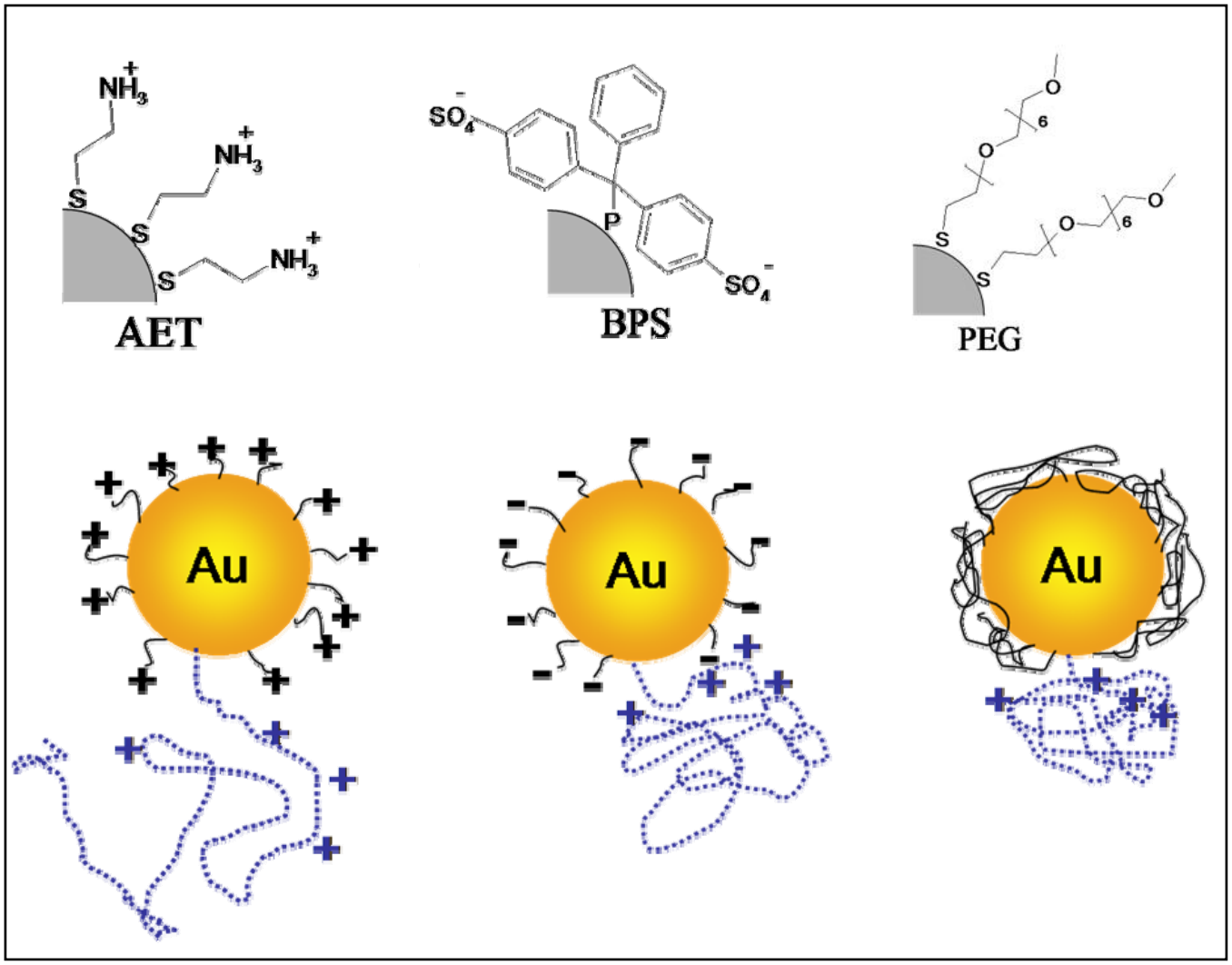
NP-cytochrome *c* interfaces

Site specifically link 1.4nm Au NPs to *Saccharomyces cerevisiae* cytochrome *c*:

TEFKAGSAKKGATLFKTR**C**LQ**C**HTVEKGGPHKVGPNLHGIFGRHSGQAEG
YSYTDANIKKNVLWDENNMSEYLTNPKKYIPGTKMAFGGLKKEKDRNDLI
TYLKKA**C**E





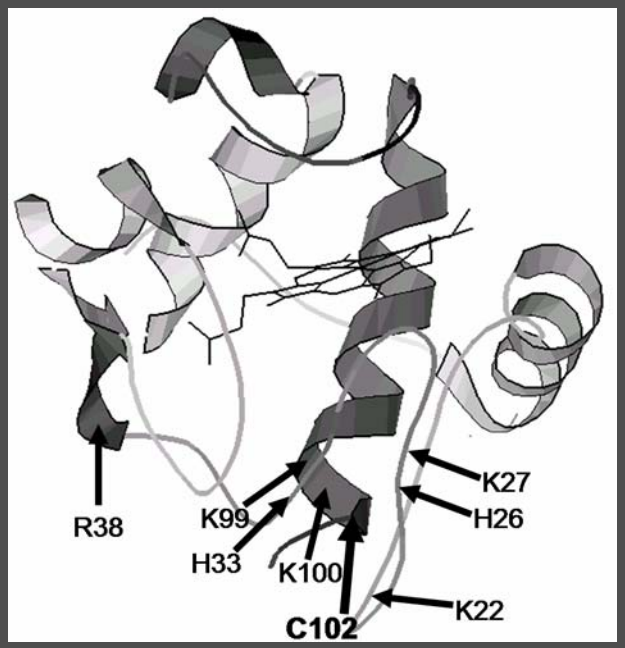


- Charged ligands result in greatest denaturation

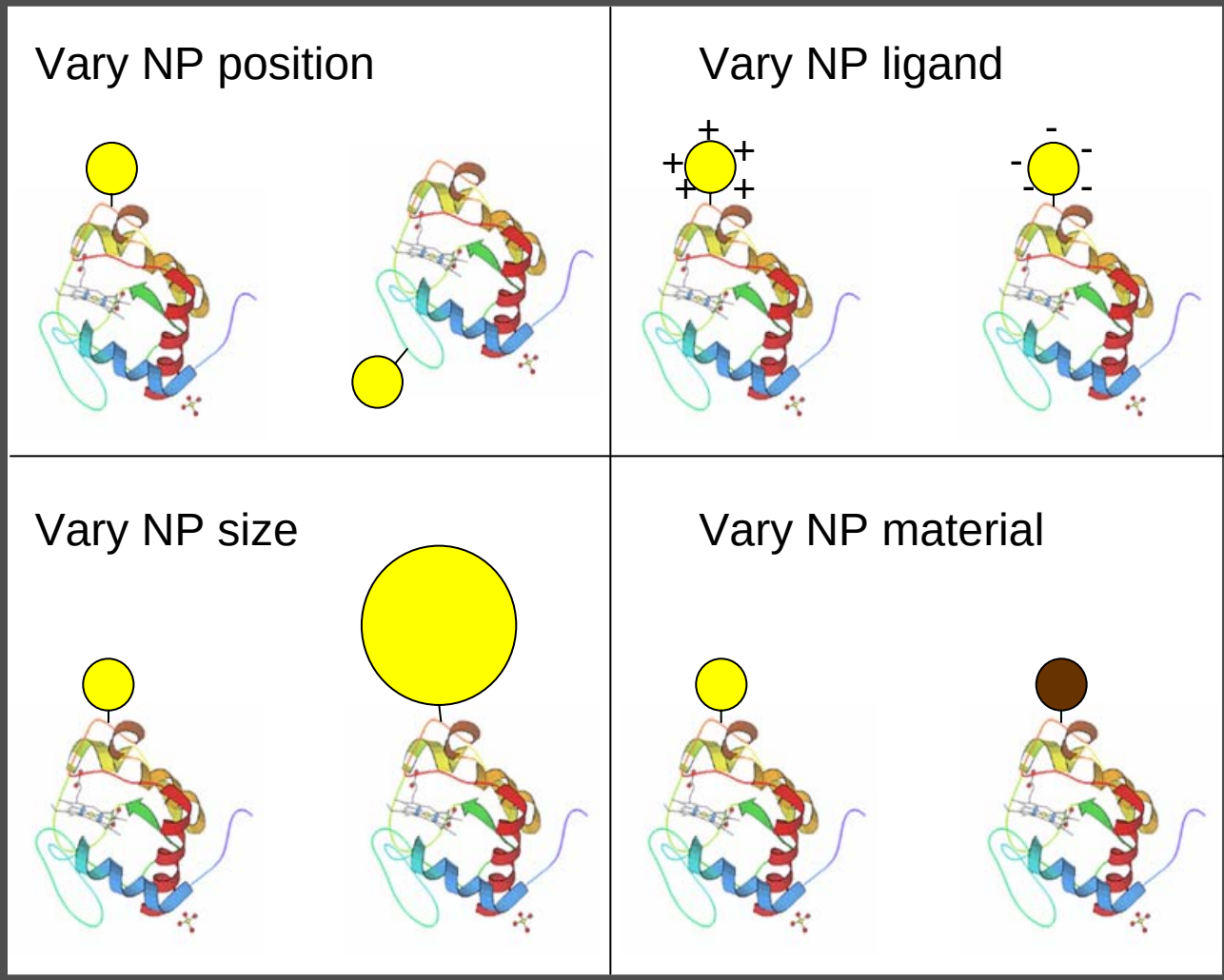
M.-E. Aubin-Tam et al, *Langmuir*, 2005

Amino acids in vicinity

- Many charged amino acids closest to linking site



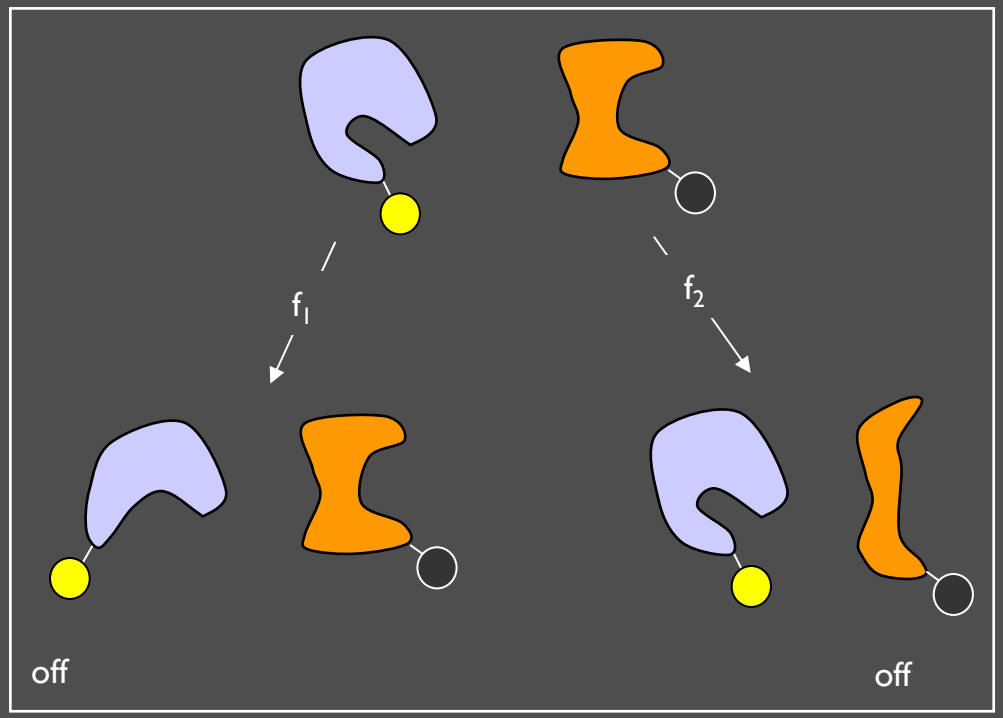
- Systematic study:



▸ electrostatic interactions with amino acids in local vicinity

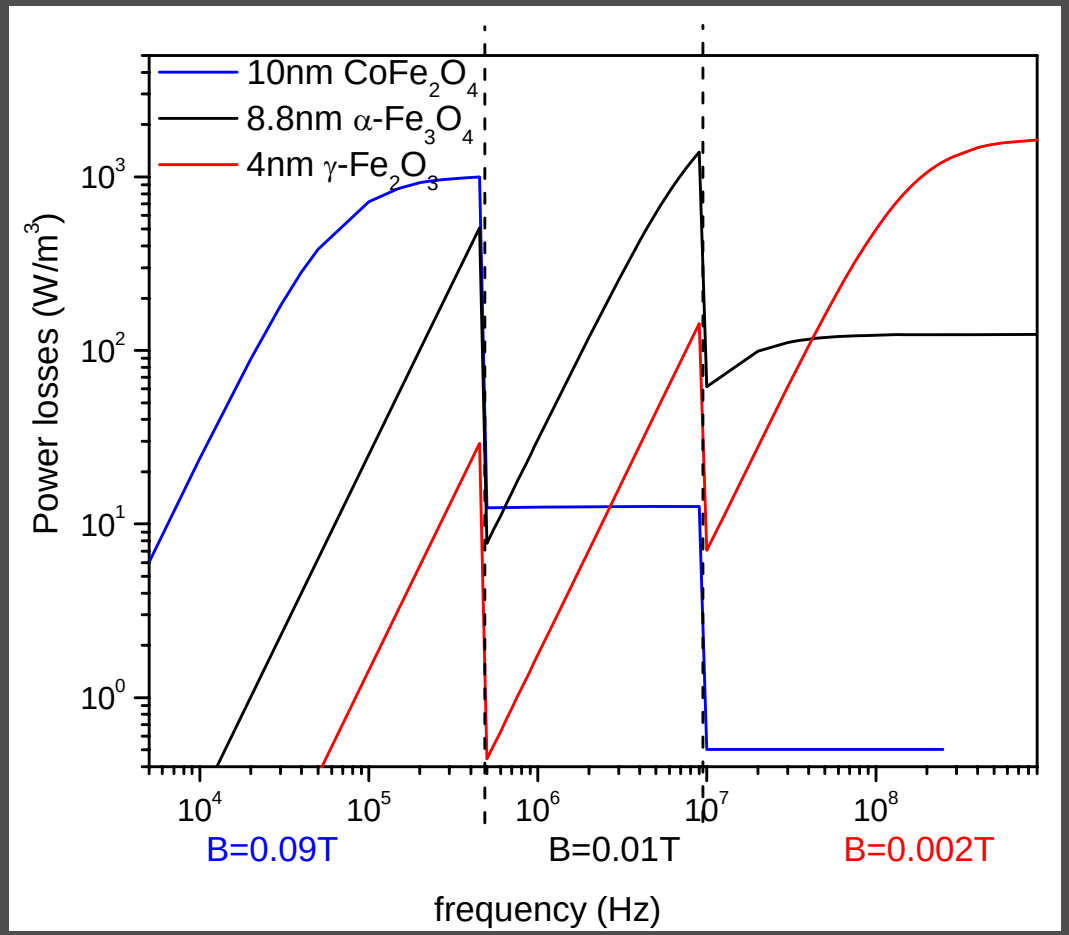
M.-E. Aubin-Tam et al, *Langmuir*, 2005

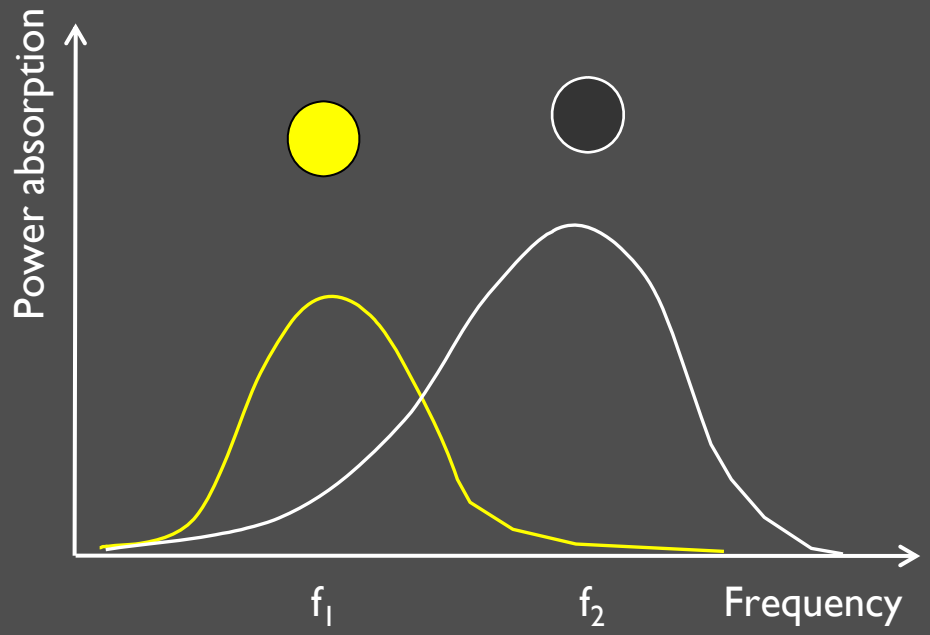
Orthogonal heating of NPs



P = f (material properties, R, H, ω)

3-Variable Tuning = Multiple Control





A. Wijaya et al., 2006

- independent heating possible