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Pizza, Popcorn & Perfluorochemicals: Where does that stuff end up?

Heather Bischel

Civil and Environmental Engineering

SUMS Users Meeting - 8/21/08

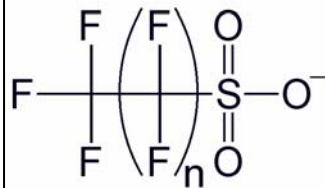
Miracles of Modern Chemistry



Teflon
Scotchguard
Stainmaster
Gore-Tex

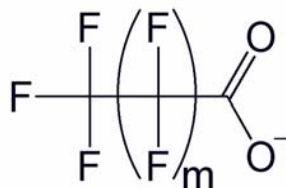


Perfluorosulfonate acids (PFSA)



$n = 7$ Perfluorooctanesulfonate (PFOS)

Perfluorocarboxylic acids (PFCAs)

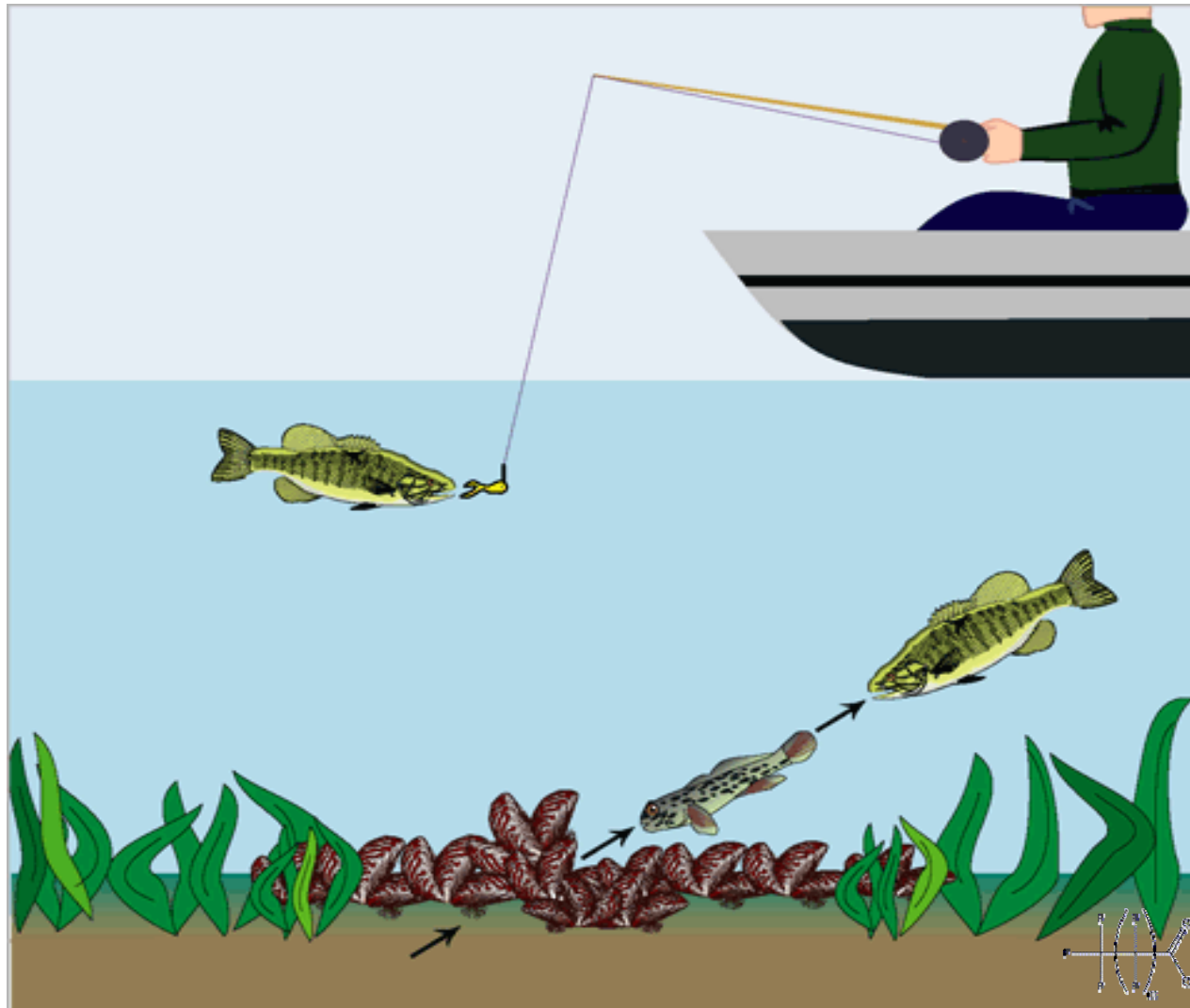


$m = 5$ Perfluorooctanoate (PFOA)

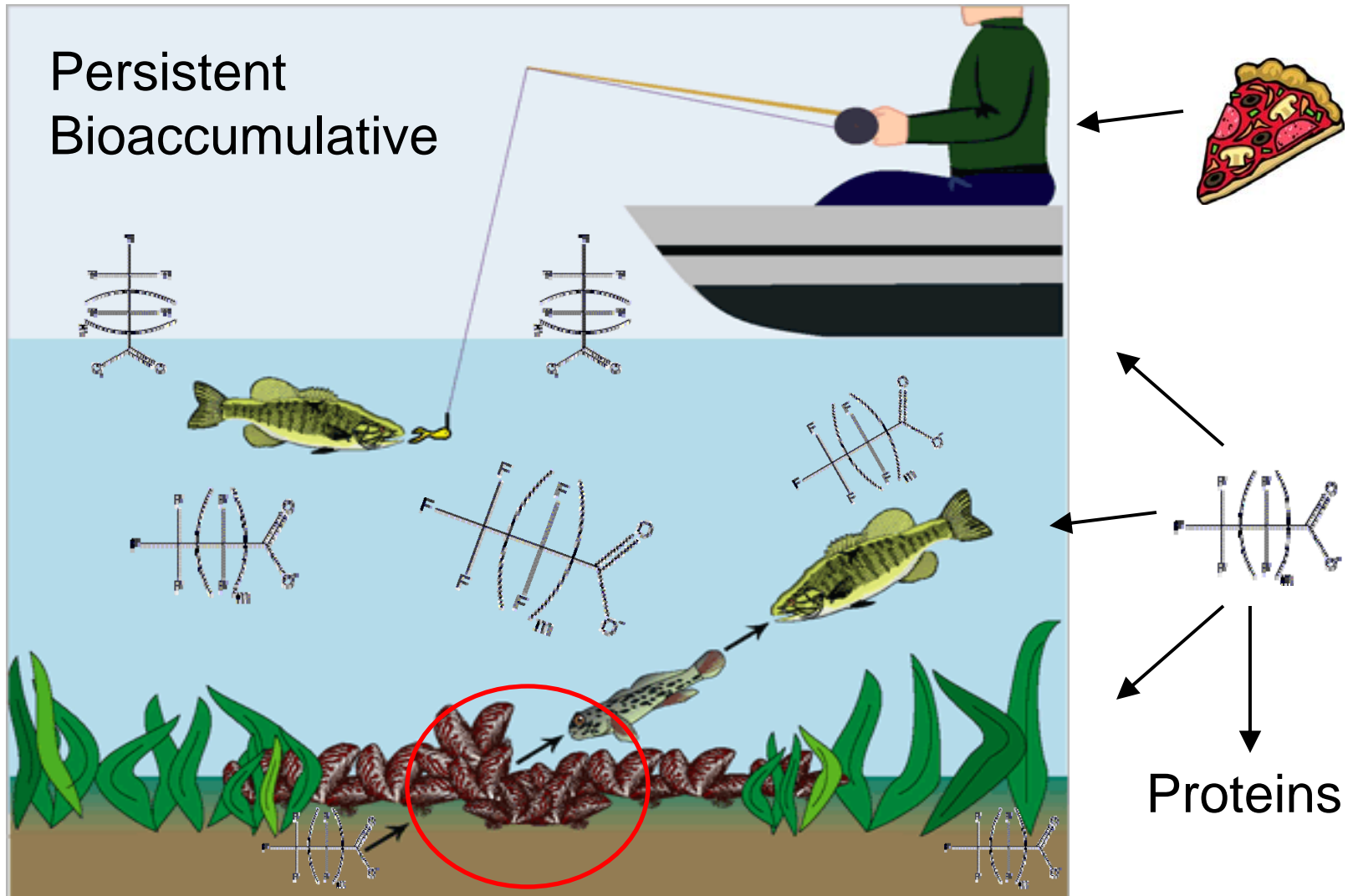
$m = 7$ Perfluorononanoate (PFNA)

$m = 8$ Perfluorodecanoate (PFDA)

Where does that stuff end up?

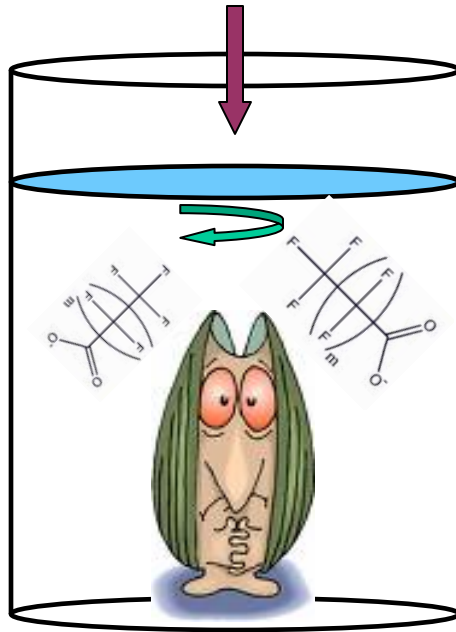


Where does that stuff end up?

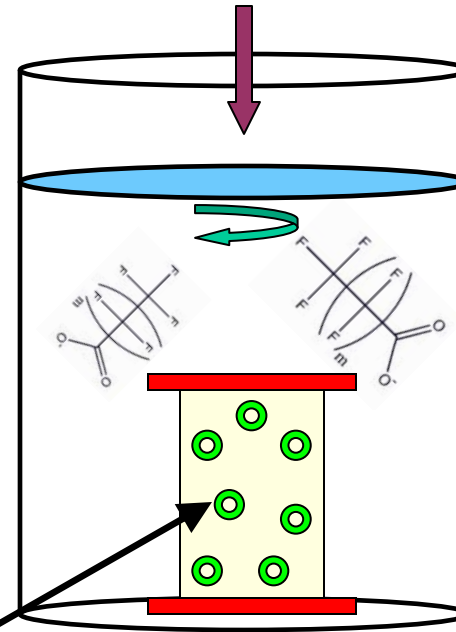


Modeling Bioconcentration

**PFC Organism
Exposure**



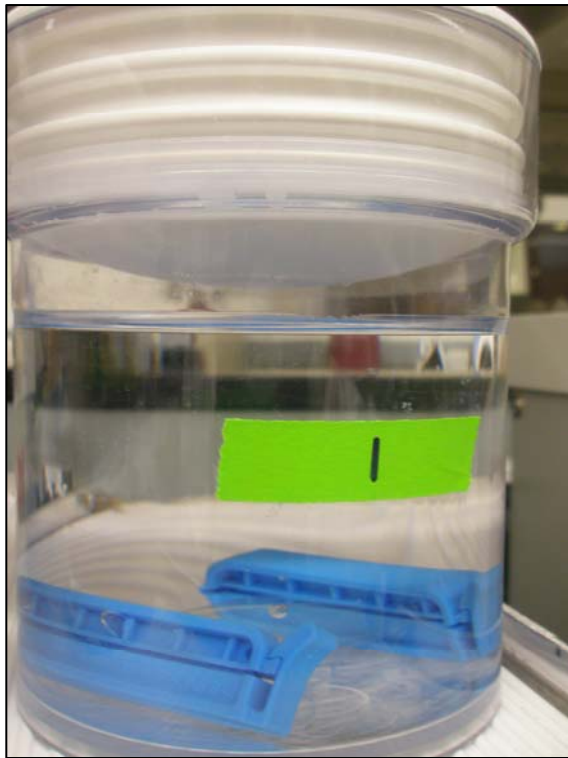
**PFC Protein
Exposure**



Protein: Serum Albumin

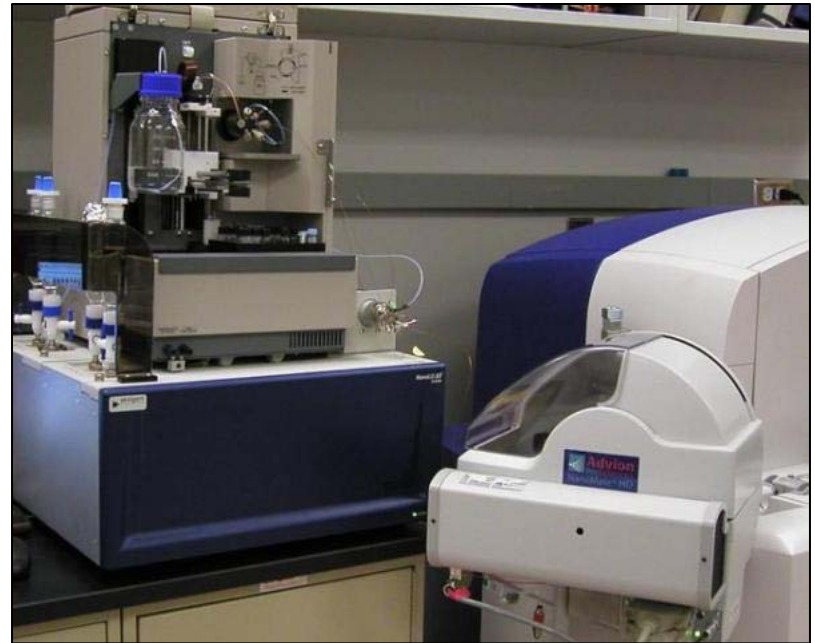
Methods

Equilibrium Dialysis +
Liquid Chromatography
Mass Spectrometry



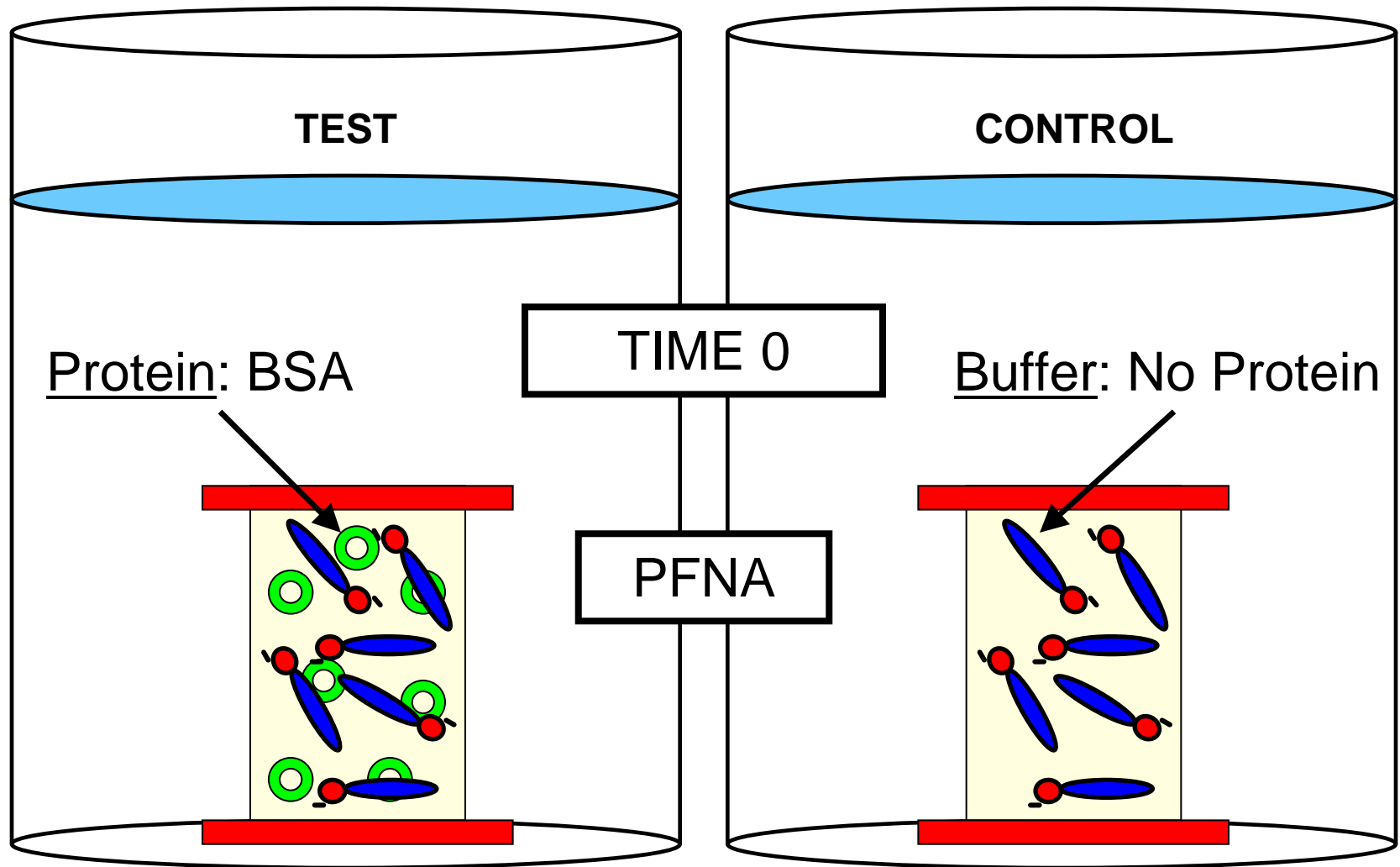
CEE

NanoElectrospray Ionization
Mass Spectrometry
(nanoESI-MS)

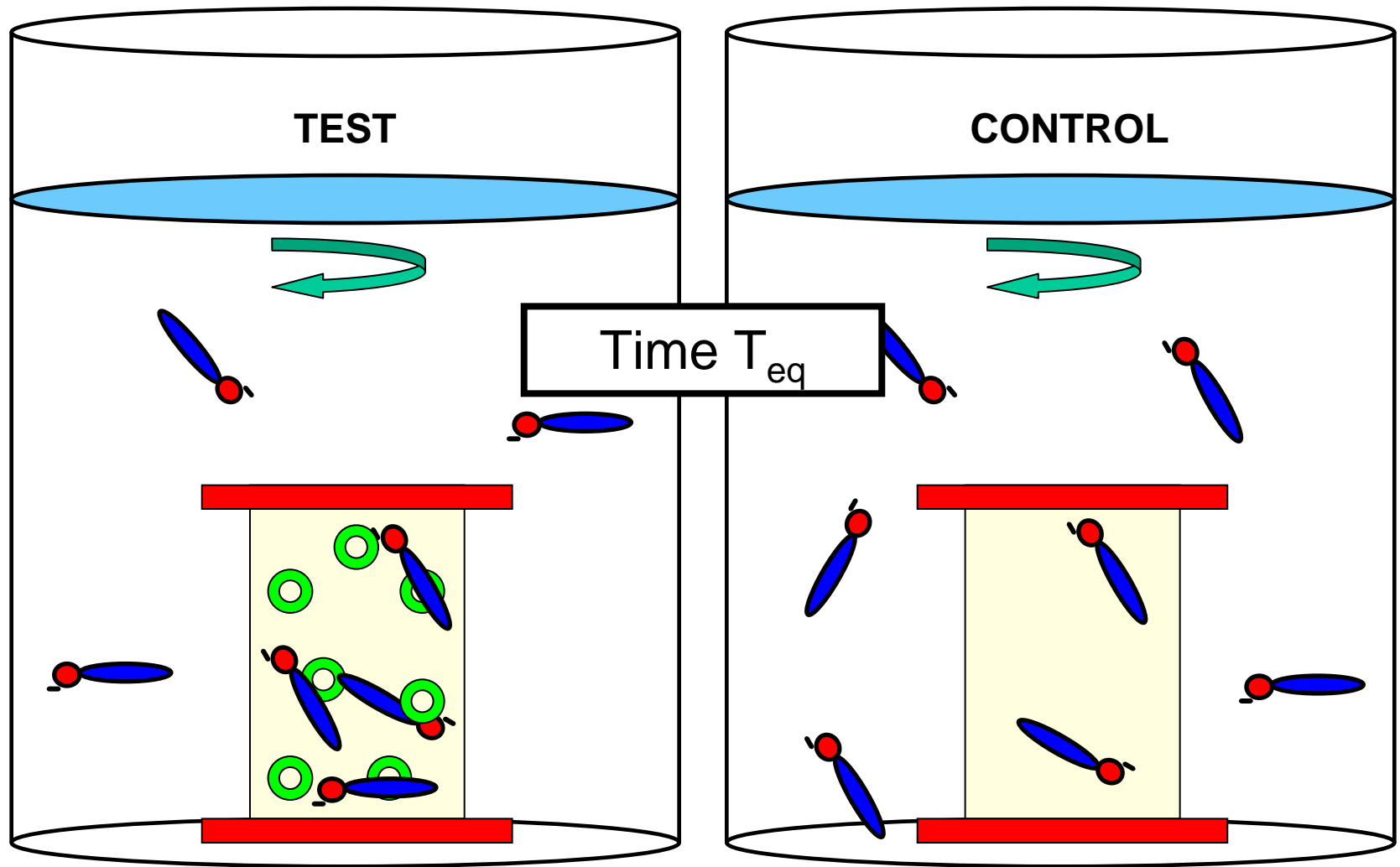


SUMS

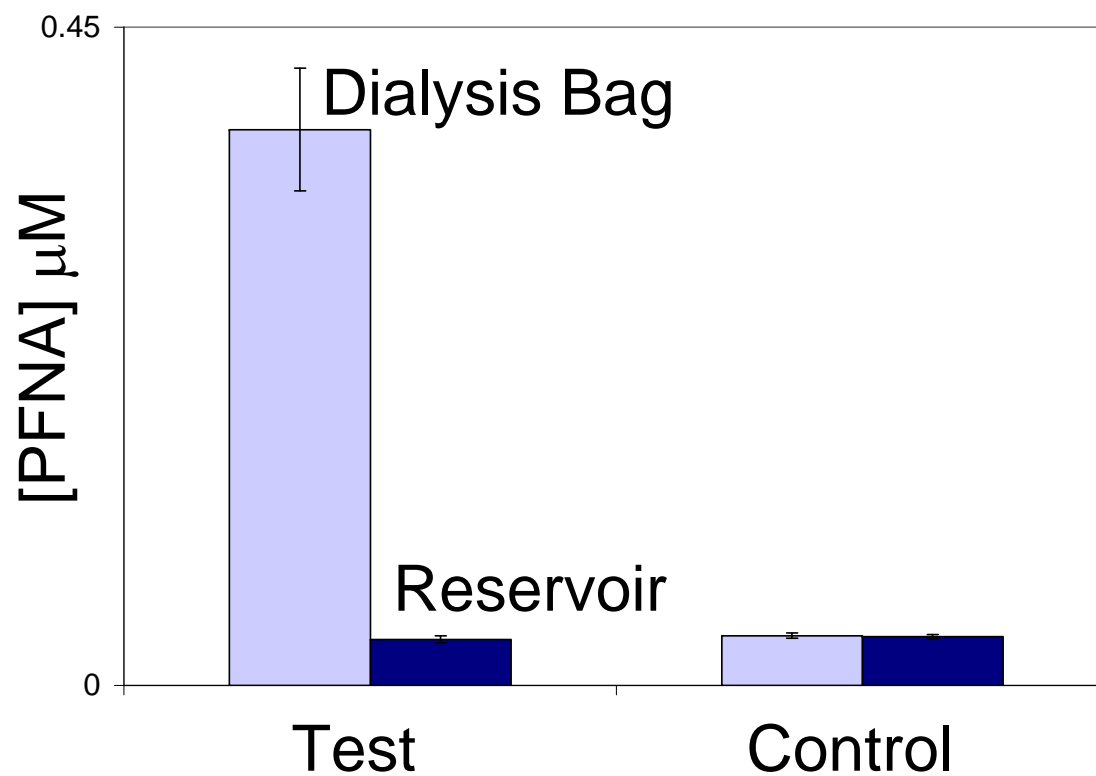
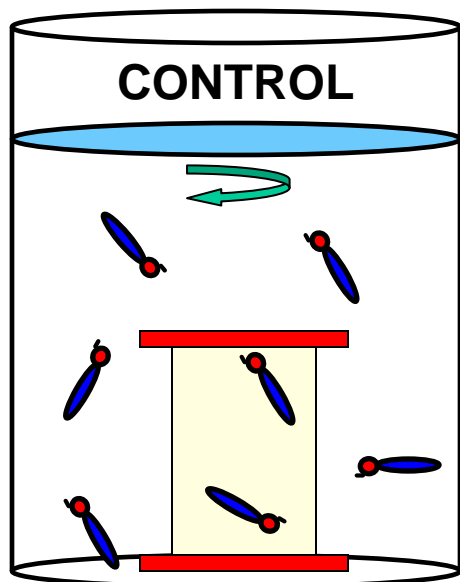
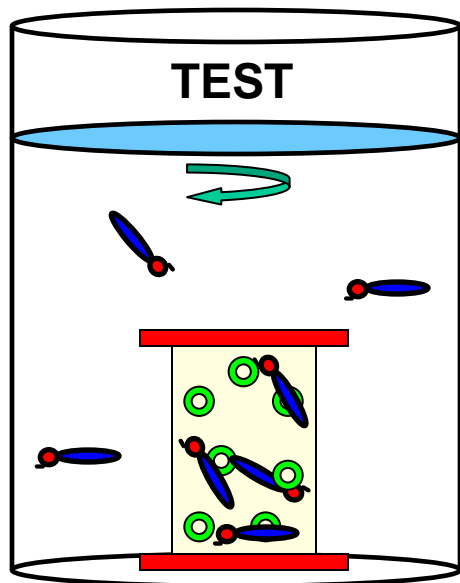
Equilibrium Dialysis



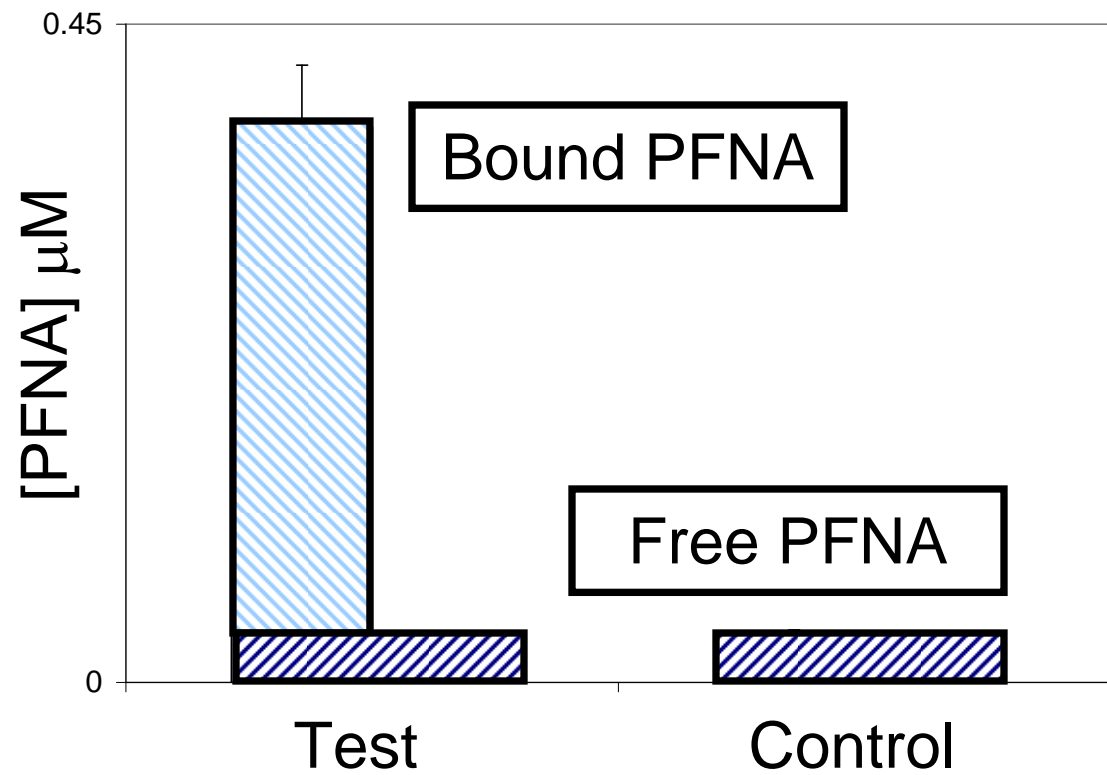
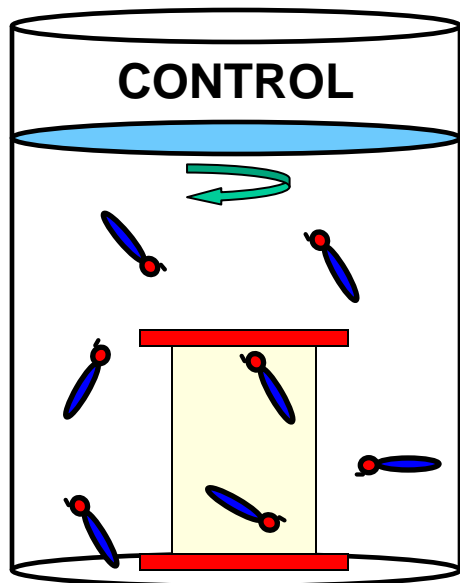
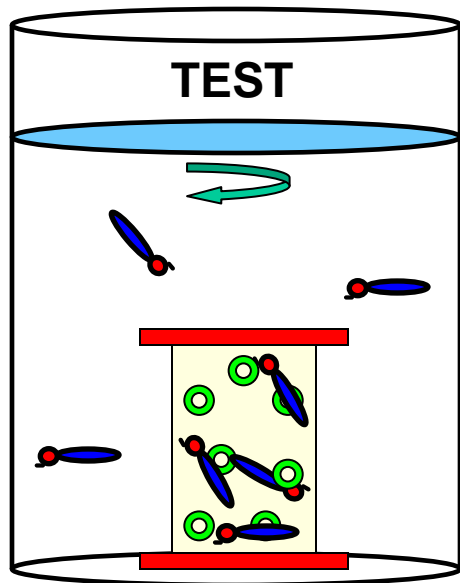
Equilibrium Dialysis



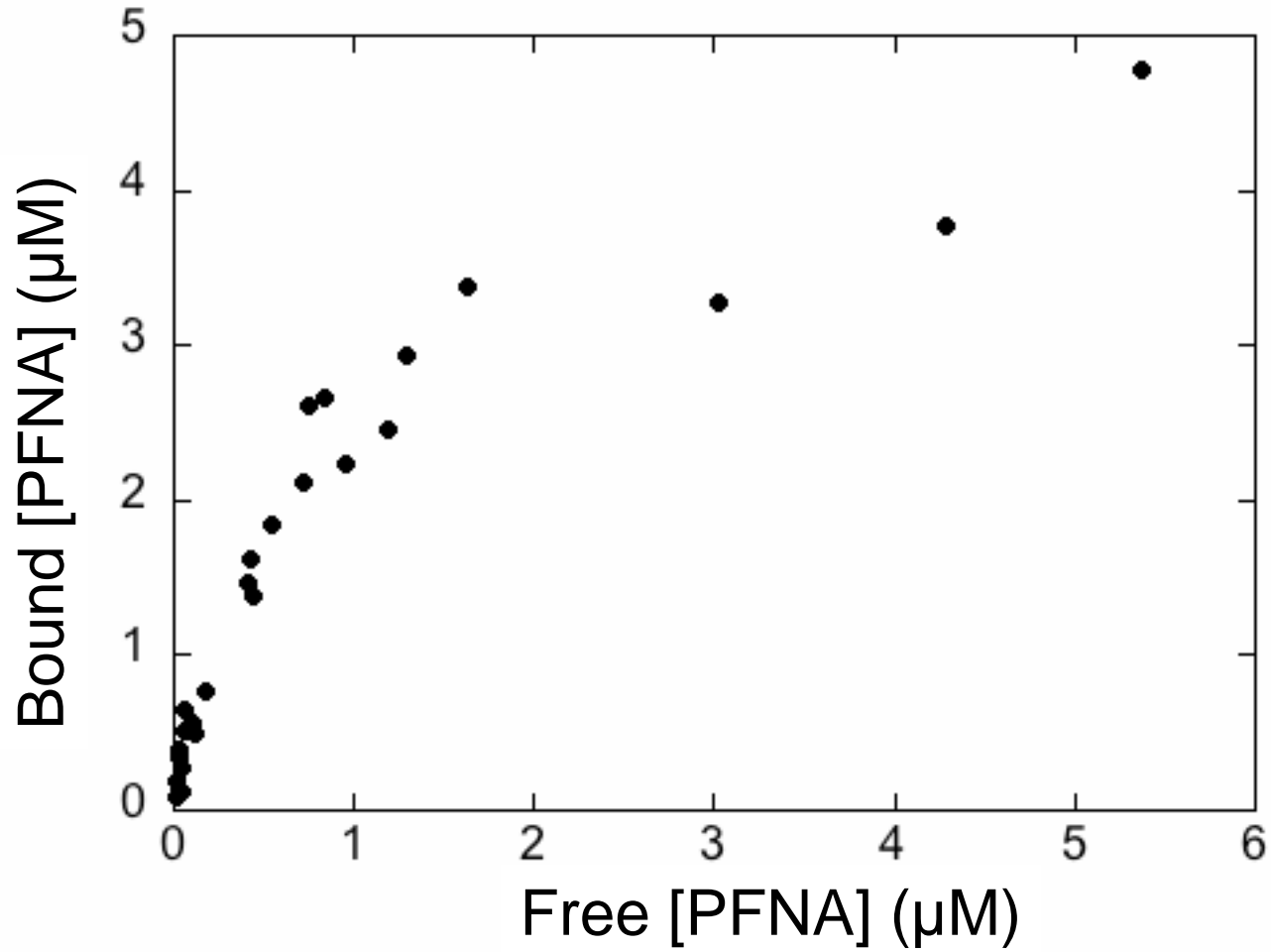
Equilibrium



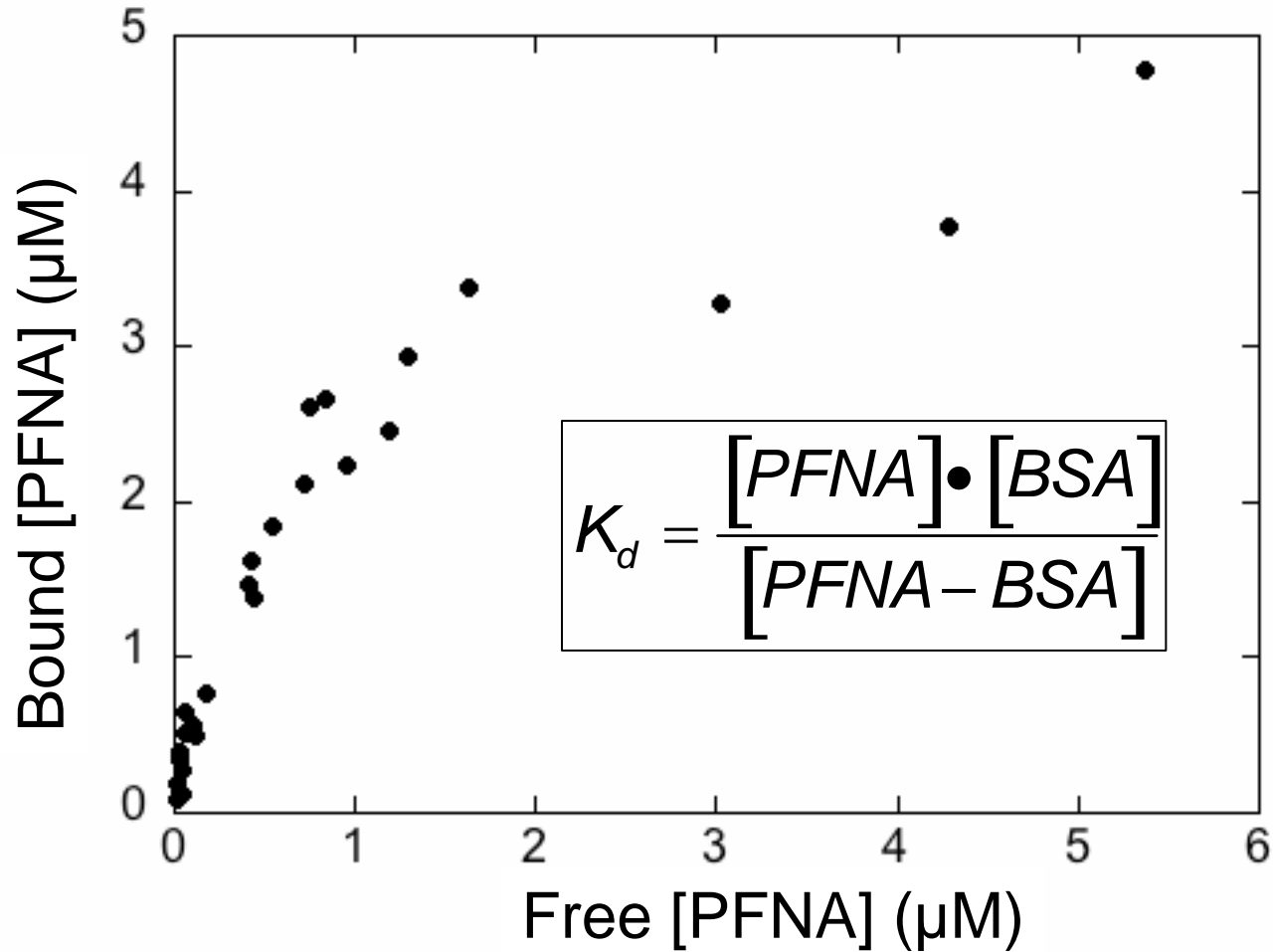
Quantification



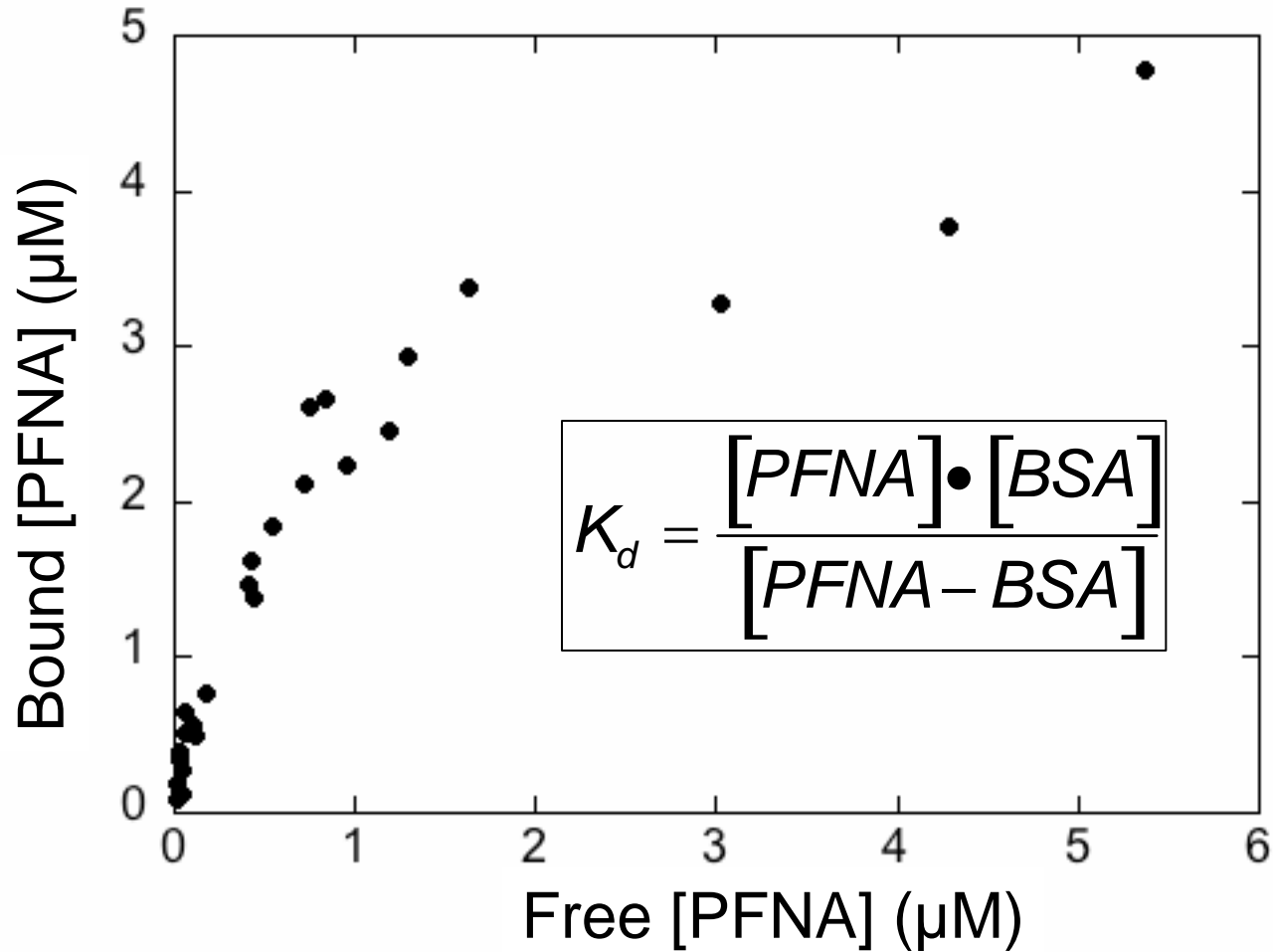
Dialysis Results



Dialysis Results

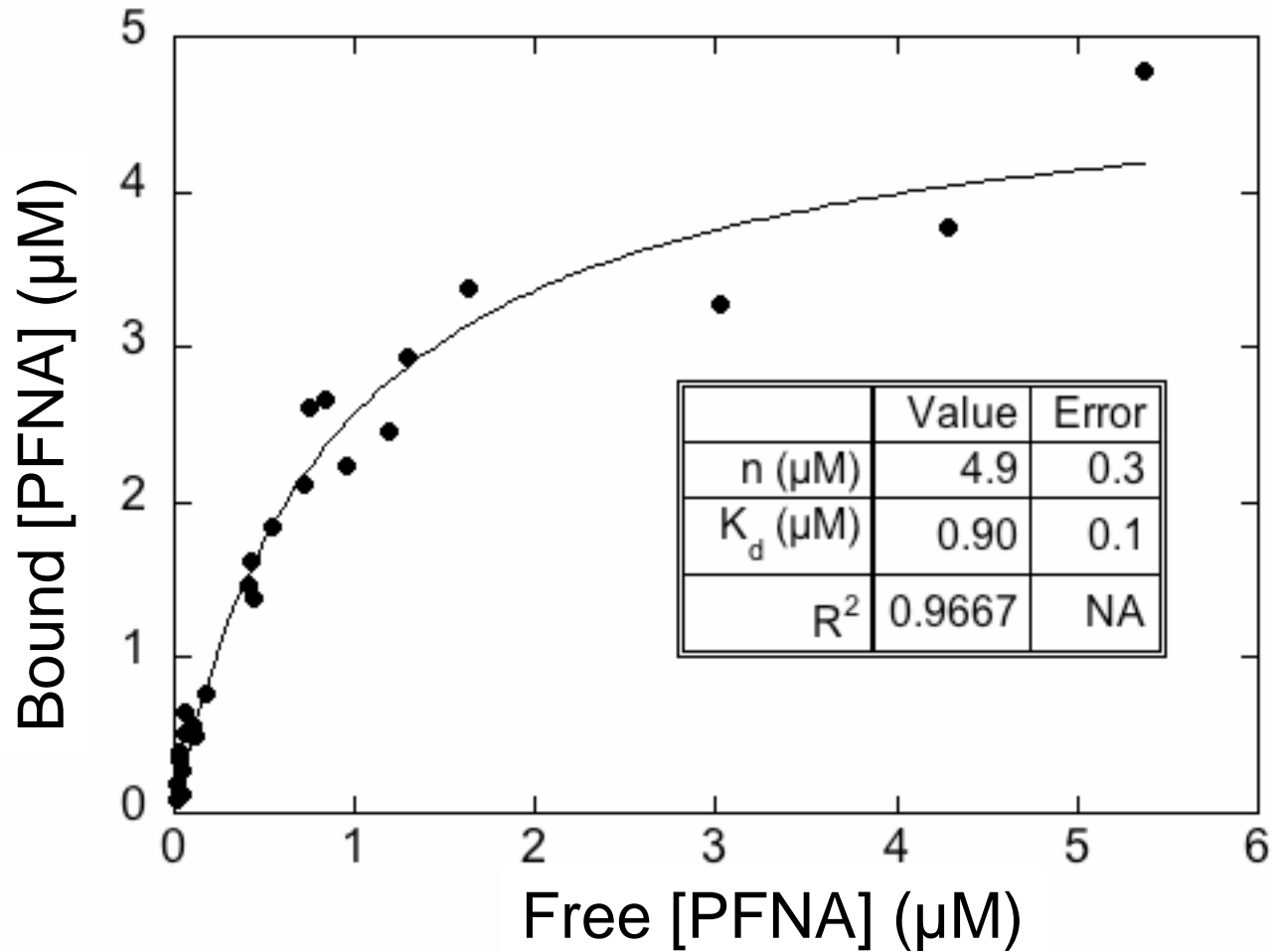


Dialysis Results



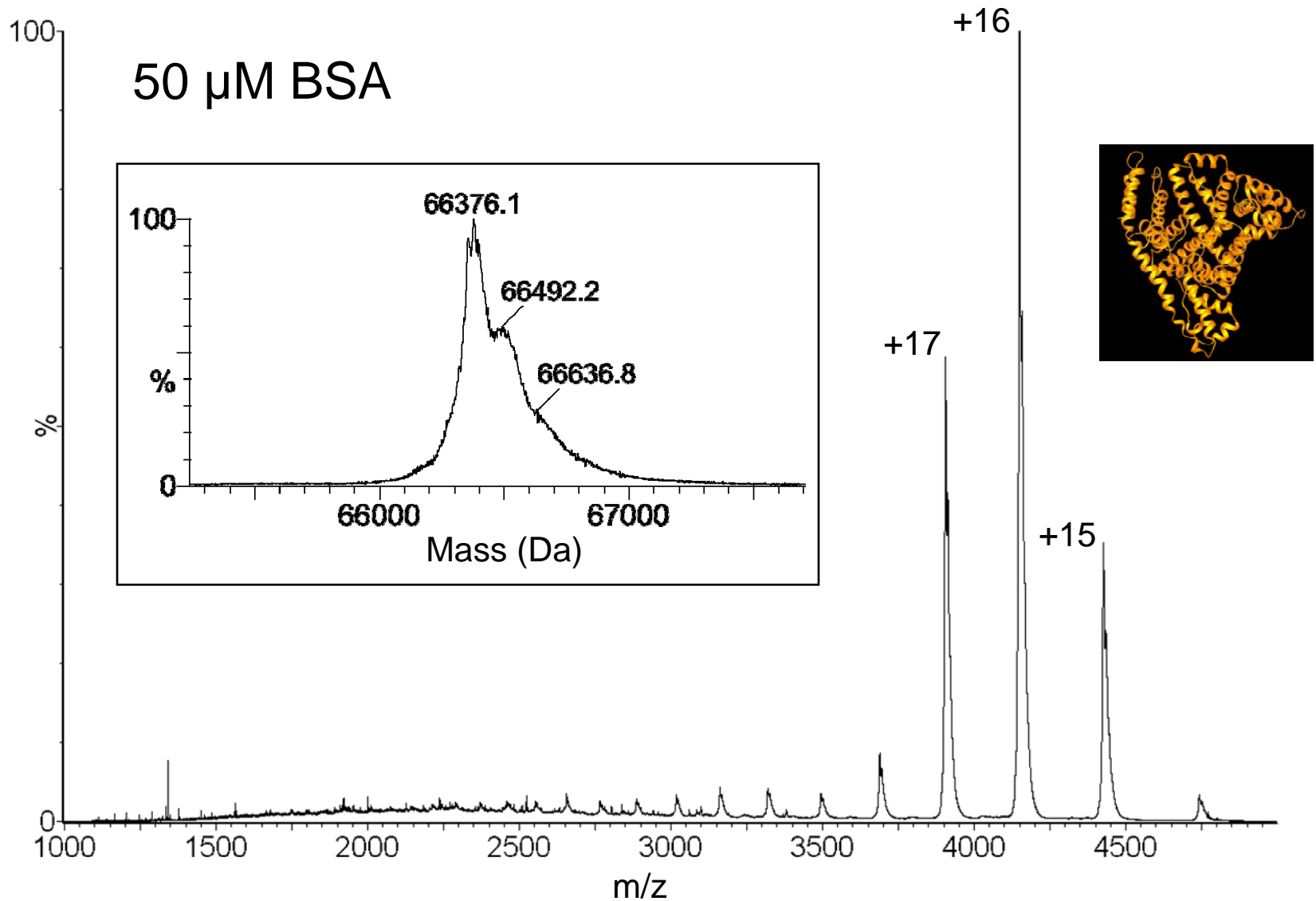
$$[PFNA - BSA] = \frac{n \cdot [PFNA]}{K_d + [PFNA]}$$

Dialysis Results

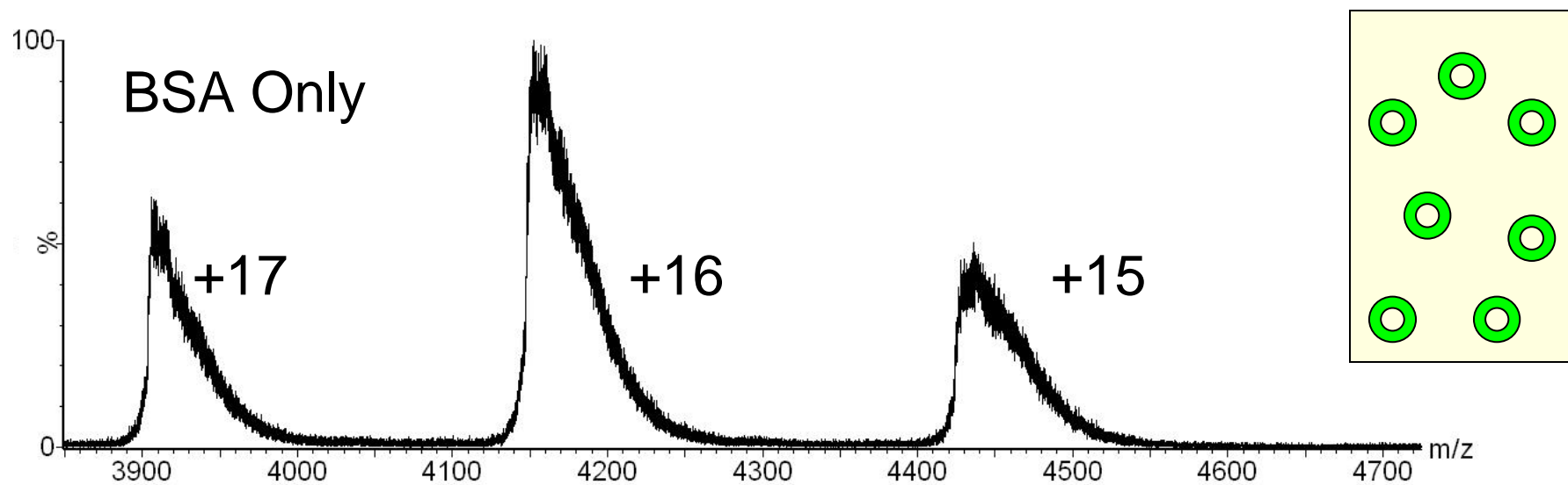


$$[PFNA - BSA] = \frac{n \bullet [PFNA]}{K_d + [PFNA]}$$

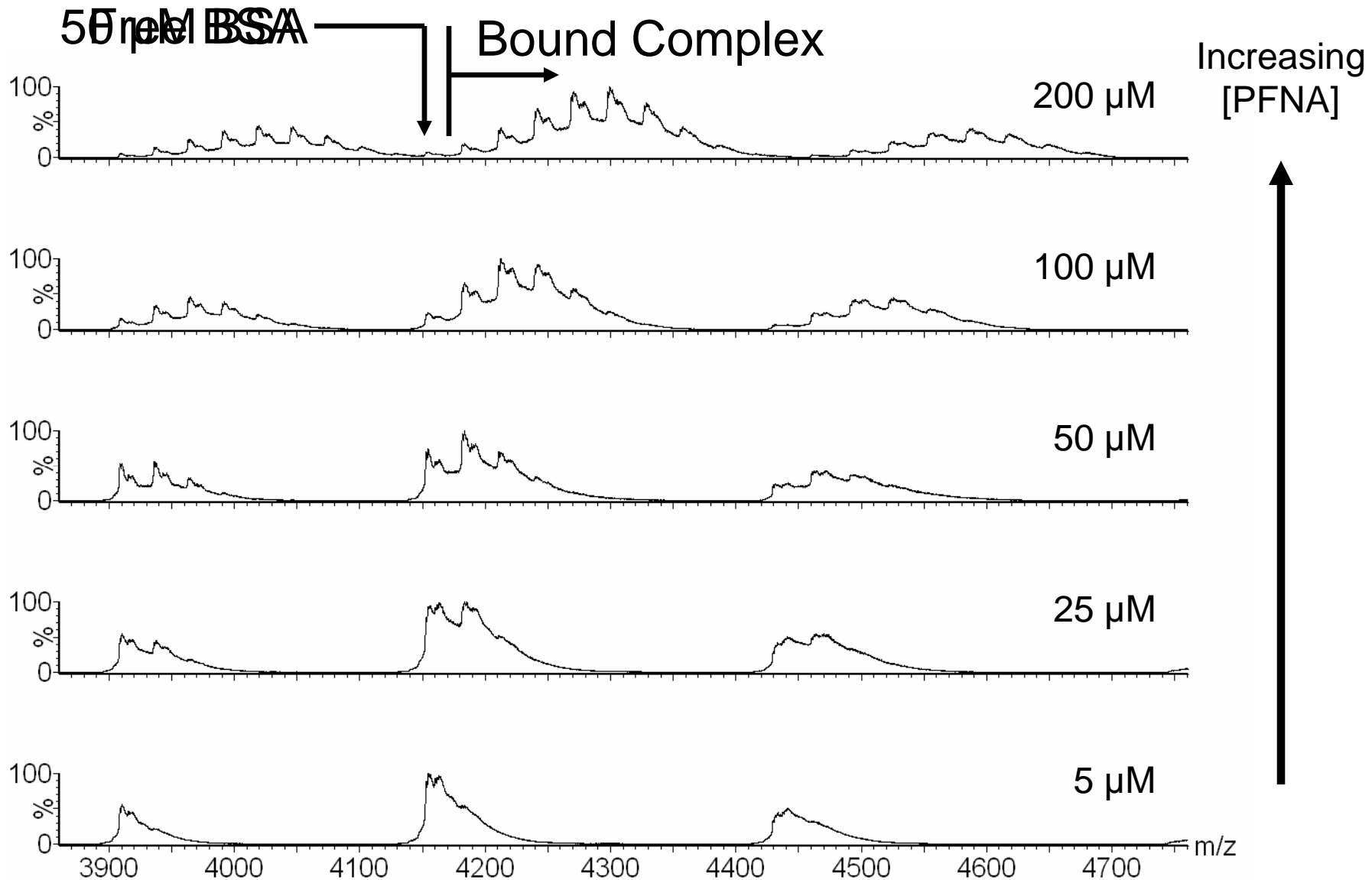
NanoESI-MS (Q-TOF)



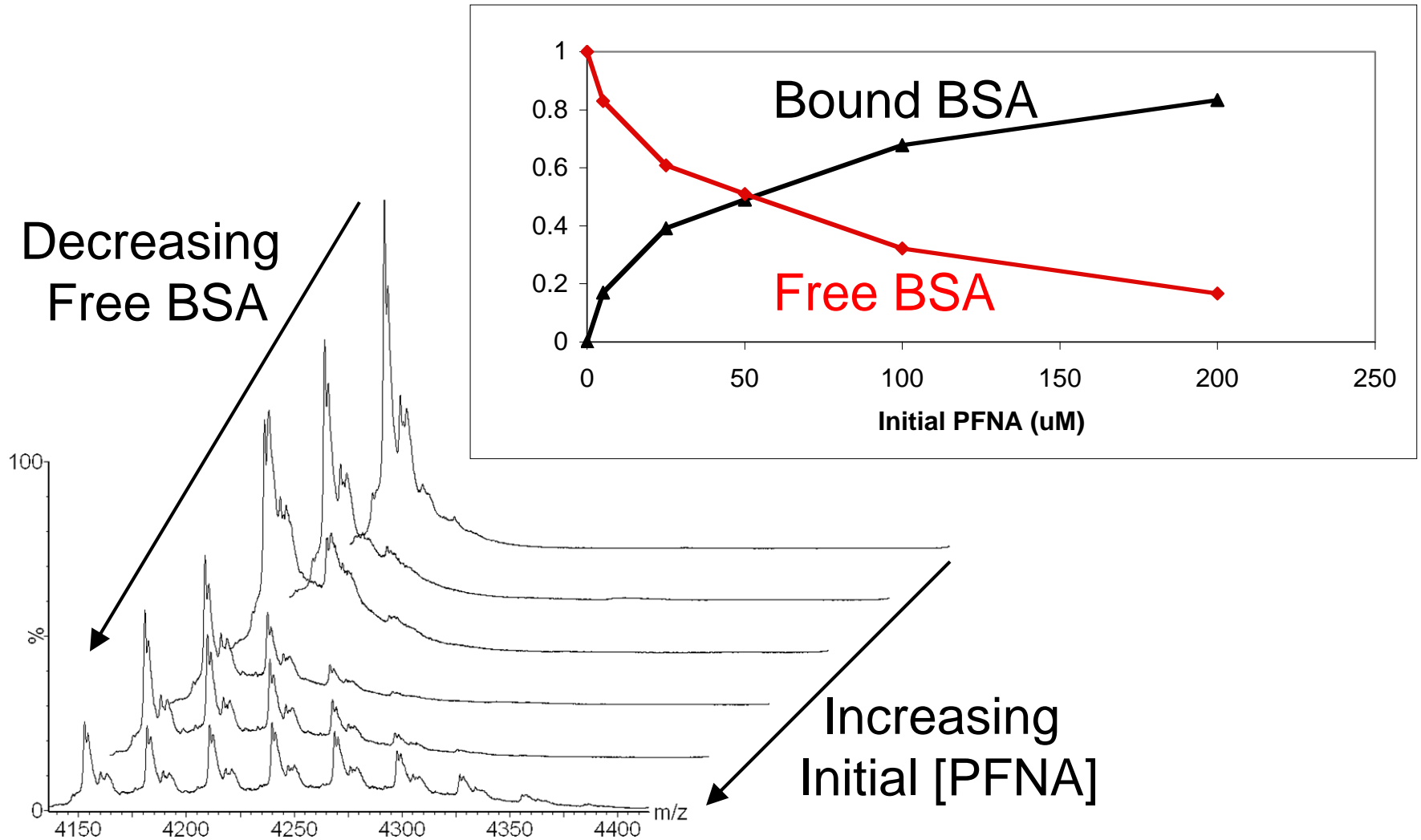
Observing Protein Binding



Observing Protein Binding

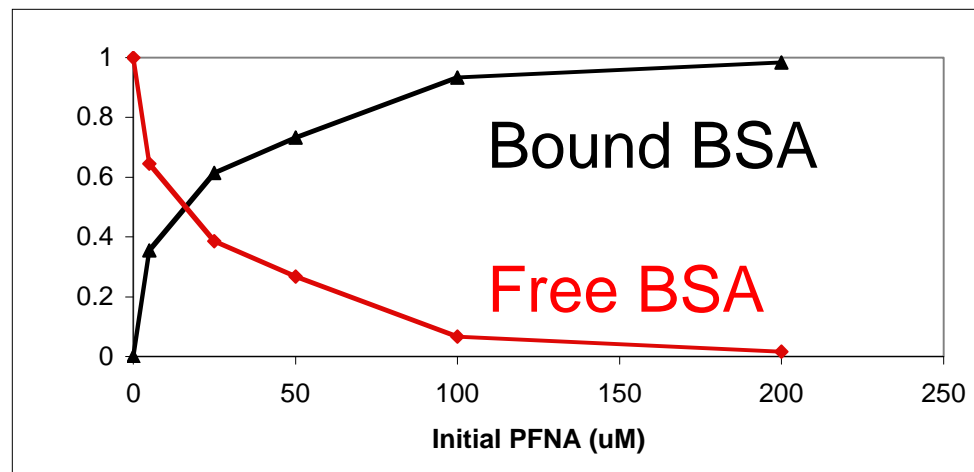
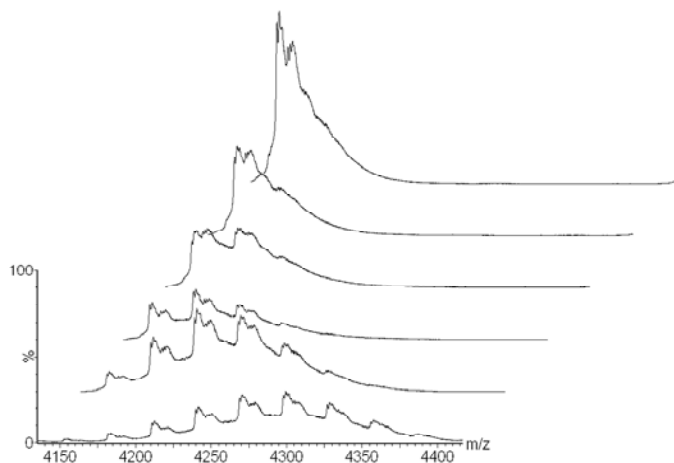


Nano-ESI Results

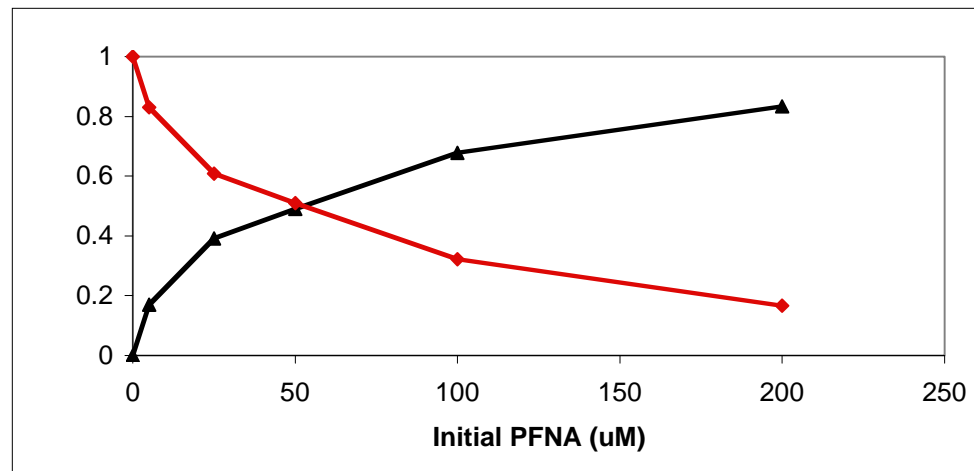
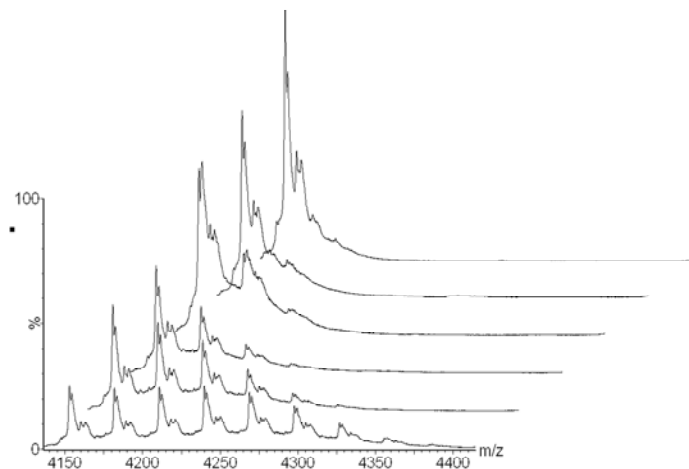


Complex Sensitivity: Cone Voltage

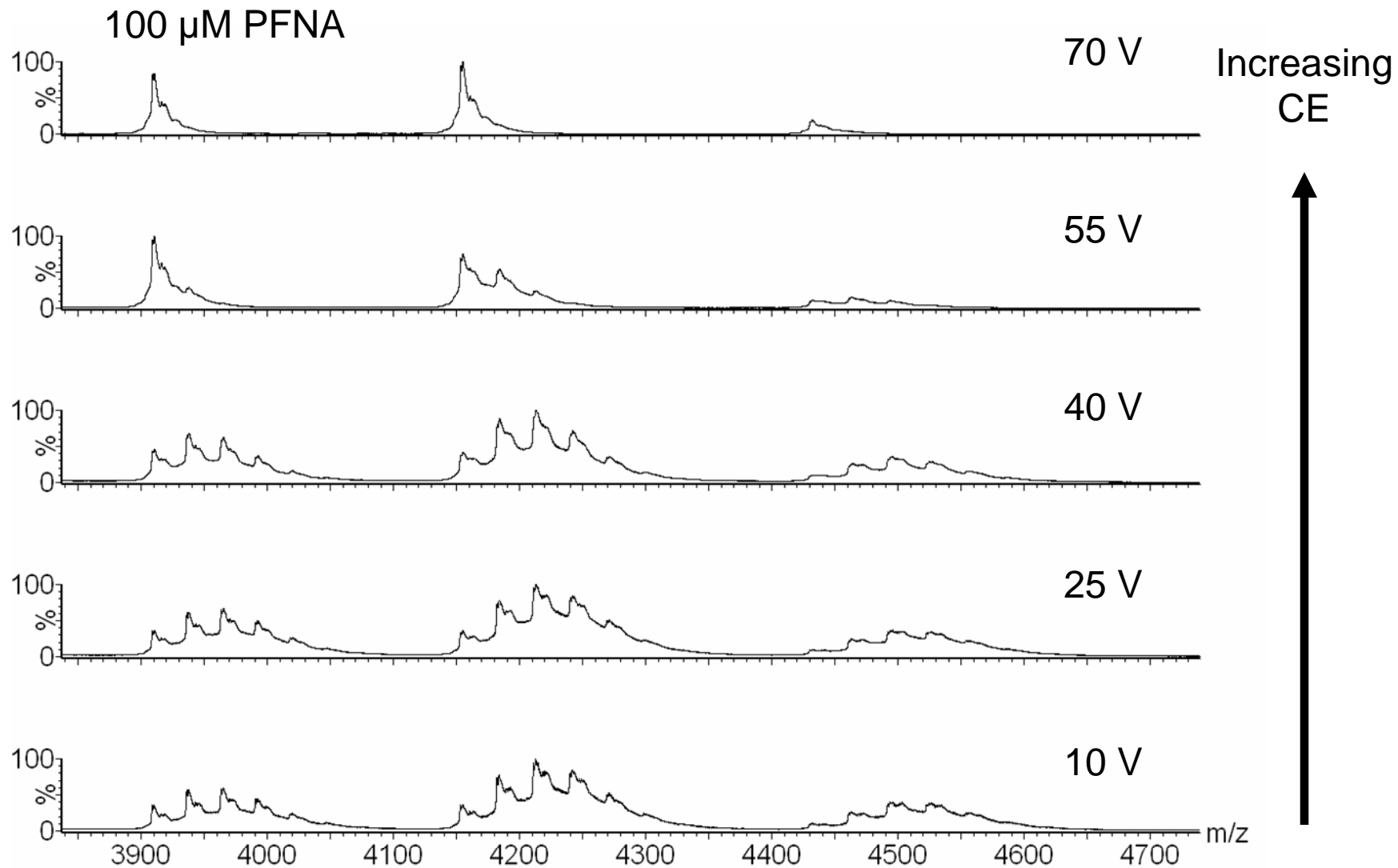
Cone = 100V



Cone = 130V

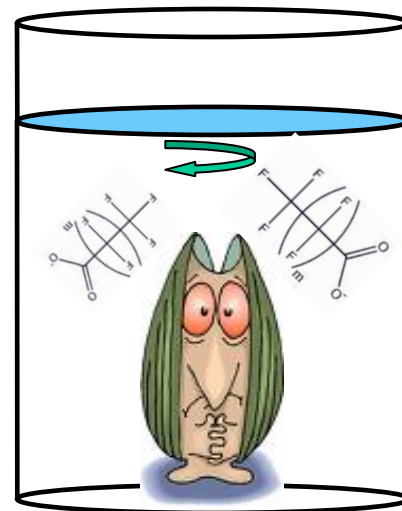
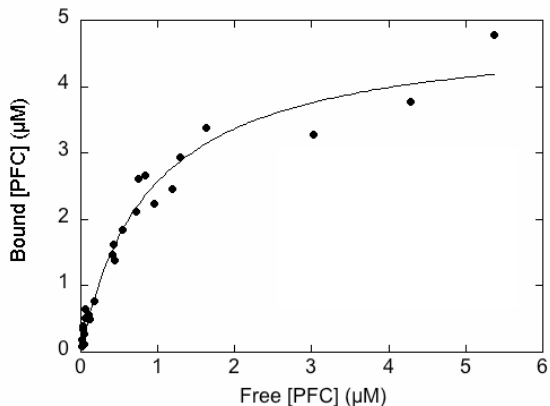
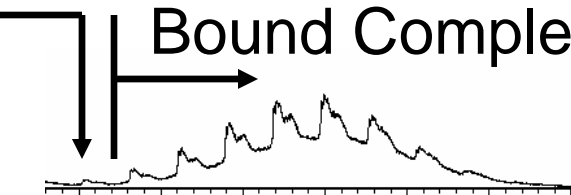


Complex Sensitivity: CE

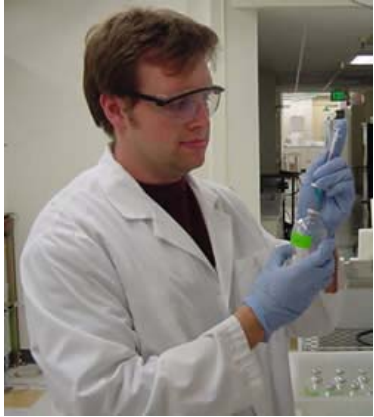


Bioaccumulation and Environmental Fate

Free BSA Bound Complex



Environmental Engineering



Kurt Rhoads: Biodegradation of precursors in Wastewater

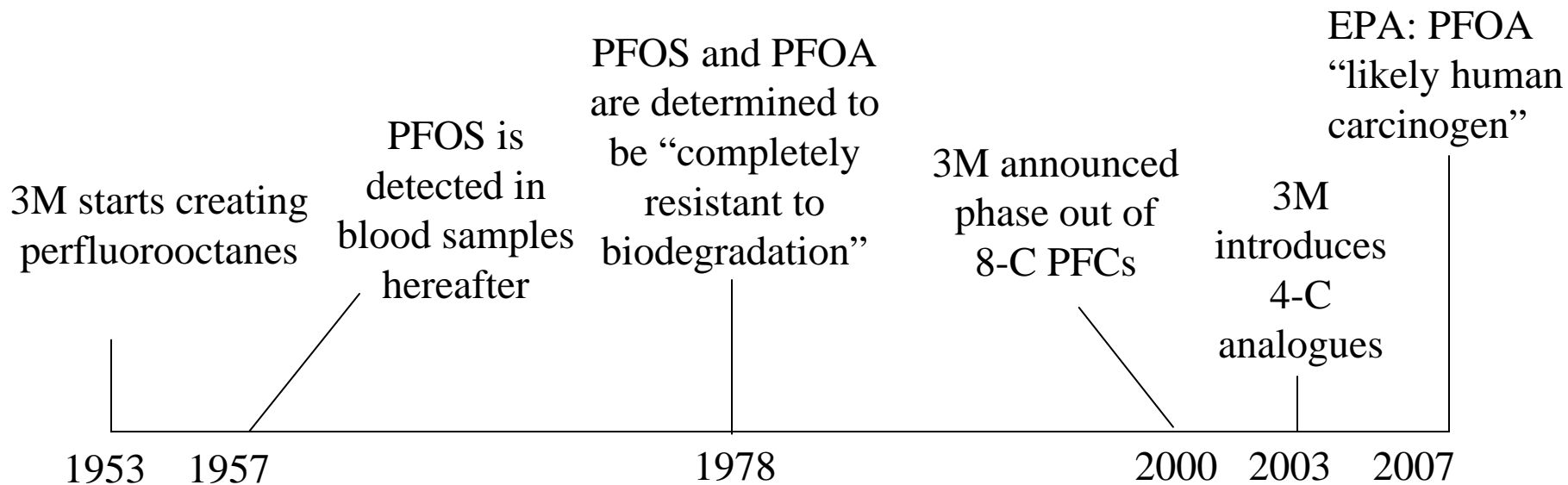
Megan Plumlee: Photochemical Degradation of Precursors; Natural Attenuation



Eva Steinle-Darling: Membrane Rejection; Wastewater treatment



Perfluorchemical (PFC) Timeline



US EPA and DuPont agree to eliminate PFOA from products by 2015