Mathematics, Statistics, and Computer Science **@ UIC**

Analysis and Applied Mathematics Seminar

PNP: Mathematics useful to Molecular Biology

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Abstract: Life is different because it is inherited. All life comes from a blueprint (genes) that can only make proteins. Proteins are studied by more than 10^5 scientists and physicians every day because proteins are so important in health and disease. The structure of proteins is so important that governments have spent billions of dollars measuring them in atomic detail. But the forces that govern the movement and function of proteins are not visible in the structure. Mathematics is needed to compute both function and forces so comparison with experiment can be made. An important class of proteins—ion channels—have been analyzed successfully with mathematics. A consistent mathematical description produces macroscopic features of the atomic detailed structures that fit data in a wide range of conditions surprisingly well, using only a handful of parameters, never changed. I will present the Poisson Nernst Planck approach to the open ionic channel (and its improvements), trying to understand the stochastic meaning of the PNP equations, even trying to 'derive' them. PNP describes the mean field correlation of point charges, but the particles of biology are nothing like points. Extensions of PNP that deal with many of the resulting correlations will be discussed. Systems of crowded charge like those found in biology are so crowded that 'everything interacts with everything else'. The result is a complex fluid. I will present the energetic variational approach to such systems, developed by Chun Liu, more than anyone else.

Monday, October 17 at 4:00 PM in SEO 636