Saturday, April 24 "Computational and Theoretical Biology".

Title: Outline of the Research Statistics Component

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Research statisticians will be crucial to the goals of the "Center for Theoretical and Computational Science at MSU." They are central to modern research activities in Biology and Medicine where statistical models, studies, and trials are increasingly a principal mode of discovery. The role envisioned would be *collaborative* and far more demanding of research excellence than statistical consulting, which focuses more on off the shelf solutions to standard problems.

Statisticians are needed in both these collaborative and consultive capacities and should be persons having a strong presence in statistical research who can be relied upon to understand the relative merits of all of the newer methods being proposed in this exploding area.

For a modest Center the level of statistical support could be one full time senior statistician and two full time statistics graduate students with consulting experience. Perhaps the Center could have an arrangement of cost sharing with Departments.

Statistical Problems of Computational and Theoretical Biology:

Problem	Example
1. very small (sparse) data	expensive preliminary trials
2. very large (dense) data	genetics/breeding studies

3. censored data	subjects lost from clinical trials
4. missing or incomplete data	experimental settings unobserved
5. mega parameters	mega pixel medical imaging genome searches
6. complicated estimations	partially understood biological models statistics for patterns/structures

Momentum in Modern Statistical Research:

Problem	Momentum
1. very small (sparse) data	Bayes using Markov Chain Monte Carlo
2. very large (dense) data	Bayes using Markov Chain Monte Carlo Inverse Problems Methods Wavelet Statistical Methods
3. censored data	Kaplan-Meier Statistics Meta Prior Bayes Methods
4. missing/incomplete data	Bayes using Markov Chain Monte Carlo data imputation inverse problems approaches
5. mega parameters	Meta Prior Bayes models inverse problems approaches quantile regression (nonlinear method)
6. complicated estimations	Bayes methods bootstrap methods

Most of the momentum cited above is in the areas of Computation Intensive Statistical Methods, Bayesian methods, Non parametric methods. There are five or six faculty in the Department of Statistics who are active in the research areas cited and who would be able to rotate through the Center through epochs of perhaps one or two years.