

# Session 3: Integrating Disciplines

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How can we best bring together the disparate areas of expertise relevant to uncertainty in computation, ranging from uncertainty quantification to decision science, so as to approach the problem in a holistic manner.

- Discussion Leader: Chris Johnson
- Education
- Research
- Funding
- Structure

# Findings

- **Traditional disciplinary boundaries within academia and Federal R&D agencies severely inhibit the development of effective research and education in computational science**
- **The paucity of incentives for longer-term multidisciplinary, multi-agency, or multi-sector efforts stifles structural innovation**



# Recommendations for Academia

- ***Universities must significantly change their organizational structures to promote and reward collaborative research***
- ***Universities must implement new multidisciplinary structures to provide rigorous, multifaceted educational preparation for the growing ranks of computational scientists that the Nation will need to remain at the forefront of scientific discovery***



# Session 3: Education

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- Data Science Education programs are all the rage now. Could we integrate uncertainty education in these programs.
- Expand Data Science beyond AI/Stats to include decision theory, visualization, psychology
- Biomedical Engineering and Information Science at Cornell as an example
- Graduate Minor in Data Science
- Social Computing, Behavioral Modeling and Prediction Conference (NIH, DOE?, DOD, NSF)
  - Tutorials

# Big Data

**Big data is like teenage sex:**  
**everyone talks about it, nobody**  
**really knows how to do it,**  
**everyone thinks everyone else is**  
**doing it, so everyone claims they**  
**are doing it...**

Dan Ariely

# Session 3: Education

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- Multiple courses in multiple departments and programs (like multiple versions of statistics)
- Summer Schools (NSF, NIH)
- Spatial Modeling is another example of a multidisciplinary group that has succeeded
- Educating in the “Future” MOOCs, direct brain implants?
- Simulation Scientists have not yet embraced uncertainty, exception ICES at UT Austin
- Conferences with leaders about Uncertainty

# Session 3: Funding

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- In NIH, for clinical studies, it requires a statistical study as a line item. Could/should we require a discussion of uncertainty (UQ Plan). Discussion of user studies too.
- DOE PSAAP required certificate education programs in CSE
- Funding agencies can help define what is important within educational programs.
- NIH NIGMS Systems Science Education Curriculum
- NSF REUs and RETs
- Expand High School Statistics classes to include uncertainty
- Interdisciplinary advisory boards

# Session 3: Research

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- Lots of disciplinary research in uncertainty needed in Math (UQ), CS (Vis, PL), Decision Science, Psychology, etc.
- Motivating use case problems (Financial markets, Health, Atmospheric events, Security, etc.)
- Best Practices on Interdisciplinary Research (Snir)
- Publishing about uncertainty for a wider group



# Session 3: Structure

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- Multidisciplinary projects require strong leadership and good management plans
- Knowledge management and transfer