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Forward Looking Session
        SIAM-DM 2012
          Halifax
Notes of Joel Spencer and Amanda Redlich
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Panelists

MC Maria Chudnovsky, Columbia, Graph Theory

AB Anders Björner, KTH (Stockholm), Algebraic Combinatorics

LC Lenore Cowen, Tufts, Computational Biology

CB Christian Borgs, Microsoft Research, Mathematical Physics

Moderator

JS Joel Spencer, Courant Institute, Probabilisitic Combinatorics

Some highlights:

MC Open questions: Given a perfect graph find the chromatic number. Hadwigger's Conjecture. Erdős-Hajnal Conjecture. "Traditionally there is a divide between those who use structural graph theory and those who use the regularity lemma but there are problems that can use both."

LC Computational biology at SIAM-DM goes back at least two meetings. There is a synergy between traditional Discrete Math and Computational Biology. This meeting there are several sessions.

CB Applications have given us beautiful problems. A general question: do discrete structures have continuum limits? The dense case is mostly understood but the sparse case is open. Also, in phase transitions, difference equations become differential equations and the discrete turns to the continuous. For results from physics we can say "OK, perhaps that is not exactly right, but what do the physicists mean and how can we prove it?"

AB Deeply hesitant about being "forward looking" as this kind of thing is notoriously ill-advised. Algebraic and topological combinatorics has links to other areas including biology. For example, the space of phylo-genetic trees can be given an interesting topology. "I think that as a mathematician one should be aware of a spectrum of problems." Goldilocks principle: Look at but don't perseverate on problems that are too hard, and stay away from problems that are too soft.

JS (to panel) Do you feel you have moved away from where you started?

LC Yes, in some ways. Two thirds of my current work has no math theorems, it is empirical. Part of me is in mourning for proofs. There is lots of math but no proofs in protein folding.

CB I was originally in experimental physics, just working on something new, and moved to statistical physics and then probability theory and limit theorems. "Probably all of us do this."

`AB` I find it interesting, retooling is such a common experience.

`LC` A problem in other areas with retooling is equipment costs, which we don't face.

Karen Collins (audience question): Are math tools worth learning even when they are hard?

`MC` I don't think I use many tools.

`AB` Thinking about examples rather than structure is important. "The essence of combinatorial mathematics is the absence of tools." When confronted with a problem one doesn't know what to use, anything might come in handy.

`CB` "I think tools are important because that is how you get out of your stuck little corner." Our field has profited from tools in other areas.

`AB` Yes, and it is impossible to know which tools are important.

`JS` (to panel) What about the influence of the computer on mathematics? For example, the distinction between existential and algorithmic arguments.

`MC` Much of my work deals with polynomial algorithms but is not related to real computers. The computer as a tool, e.g., generating examples, is very useful.

`LC` The computer is good because is gives lots of data and it is bad because it gives lots of data. Bonnie Berger gave a talk saying we need better math and better algorithms to cope with the gold mine of data.

`CB` Math in the real world certainly uses computers

`AB` Computers have influenced us more deeply than understood. For example, there are computer program to examine manifolds. There is a distinction in the style and quantity of research in different dimensions as some dimensions have many computer tools with which to study them while others do not.

Bobby Kleinberg (audience question) plus `JS`: What about arXiv, math blogs and the like? The traditional view of a mathematician working alone, is that changing?

`LC` Absolutely. Tools like Google Scholar are now essential for her.

`MC` Ten years ago she worked on the Perfect Graph Conjecture in a group using the at-the-time-current computer tools of email, LaTeX. Working with others remotely using email, etc., is very positive.

`CB` The only pitfall is that maybe we are too fast in writing papers, pushing to make deadlines.