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Complex situation comes to Nashua

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You would think it would take something big and gnarly to draw Nashua's highest annual concentration of (let's see, how can I put this?) wicked smart people – but in fact it's something small and clean.

"Simple rules can lead to complex behavior. That's the new fact of this whole field," said applied mathematician Gregory Buck, who heads the math department at Saint Anselm College.

In a word, it's "complexity." This term – or its buzzword predecessor, "chaos" – is the heart of a small revolution, or perhaps a not-so-small one, in the physical and social sciences.

"We once thought that if you just found the right simple rules and wrote them down, you would know everything, how everything would work. That's clearly no longer the world view," Buck said. "In an enormous number of fields, (scientists) are trying to distinguish which phenomena are the ones that are chaotic – and if so, how closely or for how long you can describe them – and which phenomena are linear ones, predictable ones."

Here's how the New England Complex Systems Institute, which is bringing the collection of what the British call "boffins" to Nashua, puts it:

"The study of complex systems is about understanding indirect effects. Problems that are difficult to solve are often hard to understand because the causes and effects are not obviously related. . . . The field of complex systems provides a number of sophisticated tools, some of them concepts that help us think about these systems."

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This complexity revolution has cut across almost all boundaries over the past decade or more, affecting biology, physics, artificial intelligence, psychology, even economics.

And Nashua has had an unusual ring-side seat, thanks to the small but well-regarded Complex Systems Institute, whose president and guiding light, Harvard Professor Yaneer Bar-Yam, has brought the institute's annual conference to Nashua since 1998.

Admittedly, he has done that mostly because it's cheaper to hold it here than in Boston, but who's complaining? Not me.

Next week, from Sunday to Friday, the International Conference on Complex Systems will return to the Sheraton Nashua, filling it with talks both arcane and obvious, plus workshops, poster sessions and polysyllabic chatter that deal with complexity in a wide range of areas.

And I do mean wide. Program topics include everything from computer-data mining and understanding terrorism, to evolutionary theory and air traffic control, to a talk titled "No-Free-Lunch theorem and computer security funding."

Some people known to the public will be present, including James Watson of DNA fame and artificial-intelligence guru Marvin Minsky of MIT, but mostly it will be a forum for academics and researchers whose names resonate only with those in the field.

"The point of a conference is the people who are there, and if you look at the list of names, they're wonderful people and an interesting mix. In that sense, you'd have to call it first-rate," Buck said.

Buck will attend as a spectator – "I like to do that sometimes," he said – although his research in topology, the mathematics of shapes, crops up all over the place in complexity discussions.

His work has applications in everything from genetics to magnetic flux in the solar corona: anything that behaves like a string. "The number of different kind of knotting and tangling patterns grows exponentially with length . . . as anyone who has Christmas lights knows," which means that predicting tangles is a complex process that requires new approaches.

Buck is particularly interested these days in evolution, which seems like a topic unrelated to topology – unless you diagram the process as an energy flow on a surface, in which case Buck's mathematical tools suddenly become useful.

"It's a generic problem, to minimize and maximize something, like motions on complex energy surfaces. That's a theme of many of the (conference presentations)," he said.

If this connection escapes you, don't be alarmed. Complexity theory is full of not-so-obvious connections – which, Buck said, is part of its appeal, and its power.

"Usually when you go to workshops, there are 50 people who all work on

the same thing. You can get right to the point, it's very focused, but you went in already knowing what the questions are," he said. "Something like this, it's much broader, and you can't necessarily ask for the same kind of guaranteed progress that you'd get out of a workshop – but on the other hand, it can broaden your views considerably, and maybe, if you get lucky, you'll make real jumps . . . more than you would if you were with people who are already looking at things the same way.

"The hope is, with a conference like this, you might make some cross-connections and see the problems you're interested in, in some kind of new light," he said.

Seeing in a new kind of light: You can't ask for more than that. No matter how smart you are.

Science From the Sidelines appears Wednesdays in The Telegraph. David Brooks can be reached at 249-3336.

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Neat! I love this type of article. Grins, Marge

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