

*Grands Séminaires du Collège de France*  
Centre Interdisciplinaire de Recherche en Biologie du Collège de France

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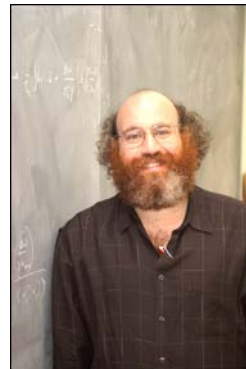
à 16h00

Salle 2

(accès public)

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More than the sum of their parts: Collective behavior in flocks of birds  
and networks of neurons

**Abstract :** As we learn more about the microscopic ingredients of life's mechanisms, the more we urgently we confront the fact that biological systems are not the sum of their parts. In the inanimate world, some of the most familiar phenomena are also collective - being "solid" is not a property of individual atoms, but only emerges from interactions among many microscopic degrees of freedom. The difference is that we understand solidity, but we don't understand the kinds of order that emerge in living systems. In this talk I will explore two examples of collective behavior in biological systems, and show how the ideas of statistical physics can help us to build very accurate models of these systems. We can describe thousands of birds and more than one hundred neurons, and make predictions that agree quantitatively with the data in great detail. This success encourages us to look inside the models and ask what they are telling us about the nature of order in these systems. Surprisingly, both flocks of starlings and the network of ganglion cells in the vertebrate retina seem to be poised very near a critical point. I'll discuss why this is surprising, and its implications for the function of these systems.