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**Reading 8: Statistical Mechanics of Insect Aggregations**

**Paper 1:** Fire ant aggregation mechanics

***Paragraph or two on any/some of the following points:***
*What do you feel the main contribution of this paper is? What's the essential principle that the paper exploits? What did you find most interesting about this work?*

Again, we revisit the ant world. This paper gives us the perspective of mechanical engineering to look at the behavior of fire ant aggregations, which exhibit the ability to self-heal and adapt to the environment. The authors aim to investigate how the individual ants, which are the building blocks in such aggregations, affect the emerging solid-like aggregations by viewing the ants as materials and building a statistical model for the chain stretch of the aggregations and deriving an evolution equation to describe its distribution.

The ant assemblies are treated partially as solid-like properties and exhibit the ability to sustain normal as well as shear stresses as a result of the transient and dynamic physical connections between individuals. The lifetime of the connections are dependent on the environment of the individuals, resulting in a network that have viscoelastic mechanical behavior that evolve over time and can self-repair. Based on the literature, the fire ant aggregations are likened to a solid at short times and a fluid at longer times.

From the approach of statistical mechanics, the authors treat the behavior of individual ants as discrete elemental mechanics that can affect macroscopic behaviors of the population. The macroscopic aggregation is treated as an elastic network with dynamic intra-connectivities as neighboring ants attach and detach.

***Short answers to the questions below***
*One major strength of the paper*

Most of the figures are very clear and communicative of the methods and results (although the a, b, c, d subfigures for figure 4 seem to be in process of revision). I'm especially intrigued by the experiments in figure 4 and 5 that show the compression of an ant aggregation and the stretching of that aggregation when a ball is dropped into it. It's hard to wrap my head around the fact that the ants don't get squished to death but can quickly adapt to the environment.

*One weakness of this paper*

The paper states that the ant aggregations possess the attributes of a solid at short time and those of a fluid at longer times. It might be due to my ignorance of physics, but I would like to understand this better. What stimulates the ants to switch from one state to another?

***Short discussion of***
*One question or future work direction you think should be followed. Or some insight/connection you think is interesting to pursue.*

What are “creep tests” on the live ant aggregations?

What materials exist that show similar properties of being reconfigurable and can readjust with the environment like these ants?

I’m glad the authors mention how their model may apple to acto-myosin networks in muscle cells, as I also thought of this system while reading this paper. Actin and myosin, much like these ants, also interact to produce mechanical motions. With this statistical framework, exploring a model for this biological system would be interesting and possibly useful for understanding normal vs disease states related to acto-myosin functions.