
Woods Hole Oceanographic Institution
Biology Department Seminar



Thursday, May 11, 2017
Redfield Auditorium – 12:00 Noon

**Collective phenomena in living matter – a
cast study on emperor penguins**

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Emperor penguins are the only vertebrates that breed in Antarctica during the austral winter. From their arrival at the colony until the eggs hatch, the males, who solely incubate the eggs, fast for about 110-120 days during the coldest period of the winter and thereby endure temperatures below -50°C and winds of up to 50 m/s. To ensure successful breeding, emperor penguins form huddles, dense formations of birds, which often consist of more than hundreds of individuals, reaching densities of up to 10 birds/m^2 , where ambient temperatures reach regularly $>20^{\circ}\text{C}$. Such collective behavior can play a fundamental role in colonial systems to face strong environmental pressures, such as harsh winter conditions or regular predation events. Collective processes are often insensitive to microscopic details of the underlying system but instead are emergent properties that arise from the interactions between individuals.

It is revealed that emperor penguins can move collectively in a highly coordinated manner to ensure mobility while at the same time keeping tightly packed. It is found in our work that the dynamics of penguin huddling and group formation is governed by intermittency and approaches to kinetic arrest in striking analogy with inert non-equilibrium systems.