Special
PHYSICAL MATHEMATICS SEMINAR

LIFE AT SMALL REYNOLDS NUMBER: GROWING DRAG-MINIMISING SHAPES AND SWIMMING WITH A REVERSIBLE STROKE

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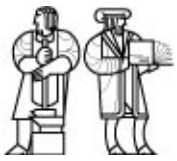
ABSTRACT:

Reproductive success among ascomycete fungi requires that spores germinate far from the parent fungus. To this end, fungi have evolved mechanisms for applying initial accelerations that are unmatched in the plant or animal kingdoms in order to push spores through the thin layer of still air that clings to fruiting body into the vigorous wind currents beyond. Spores are tiny, fast moving objects, so the distance that they can travel in still air is severely limited by fluid drag. I will present evidence that the shapes of unappendaged and individually ejected spores have evolved in order to minimise drag. I will also discuss a curious property of drag-minimising shapes: even up to quite high flow speeds, at which the flow around the body is markedly different in front to the flow behind, the shape of the minimal drag body remains very fore-aft symmetrical. I will show how this surprising but apparently innocuous observation provides a possible mechanism for how a developing spore that has never left the ascus or encountered a moving fluid can be templated to grow in accordance with drag-minimising principles.

Time permitting, I will discuss another challenge of motion in weakly inertial flows. Conventional lift-based swimming gaits, which transmit momentum to the fluid by shedding coherent vortex dipoles from fin edges, fail when the flapping frequency falls below a critical value, and it has been speculated that no reciprocal stroke can continue to produce thrust as flapping frequency tends to zero. I describe a flapping rotor that uses acoustic streaming to generate coherent vortical structures and is able to locomote with a reciprocal stroke at arbitrarily small flapping frequencies.

THURSDAY, JANUARY 18, 2007
2:30 PM
Building 4, Room 370

Reception at 3:30 PM in Building 2, Room 349
(Applied Math Common Room)



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