TIFR Centre for Interdisciplinary Sciences
21, Brundavan Colony, Narsingi, Hyderabad 500 075

Seminar

Spherical Squirmers: models for swimming micro-organisms

Timothy J Pedley

DAMTP, University of Cambridge, UK

In 1952, Lighthill introduced the simplest possible model of a swimming micro-organism of finite size, intended as a model of a single-celled protozoan covered in beating cilia. The model consisted of a sphere, on the surface of which material points undergo small-amplitude oscillations. In 1971, Lighthill's student, John Blake, completed the calculations and in particular showed how to model the metachronal wave patterns exhibited by beating cilia. Subsequently we have used the even simpler (though less realistic) model of a steady squirmer, a sphere whose surface moves tangentially with time-independent velocity.

In this talk we survey:

- low Reynolds number locomotion, nutrient uptake and optimisation of individual squirmers;
- hydrodynamic interactions between pairs of steady squirmers and their influence on self-diffusion in suspensions.
- measurements and modelling of metachronal waves in *Volvox*, the only truly spherical multi-celled 'organism', culminating in the prediction of the mean swimming speed and angular velocity of free-swimming *Volvox*. The predictions are compared with experimental observations.

We conclude with observations of small numbers of 'dancing' *Volvox* in time-dependent bound states.

Monday, Feb 22nd 2016

4:00 PM (Tea/Coffee at 3:45 PM)

Seminar Hall, TCIS