# PHYSICAL MATHEMATICS SEMINAR

## THE BIOPHYSICS OF CONJOINED ELASTIC FILAMENTS

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**ABSTRACT:**

Biology has engineered numerous objects that are much longer in one dimension than in the other two; i.e., they are filamentary structures. Examples of these from the molecular/cellular level are DNA, actin, microtubules, sperm tails, cilia, and cylindrical bacteria. Much of the theoretical research that has been done on these structures has treated these filaments as single elastic filaments; however, many of these structures are composed of multiple filaments that are coupled together. In this talk, I will discuss the mechanics and dynamics of three such conjoined, biological elastic filaments. To begin, I will describe recent research on the flagella of the spirochete Brachyspira hyodysenteriae, the bacterium responsible for swine dysentery. The flagellum of this bacterium is composed of a core and a sheath. Bacteria lacking the sheath produce flagella that are more flexible than those with a sheath. Interestingly, these bacteria also swim more slowly than wild-type. Different mutations allow us to show that the swimming speed of these bacteria is affected strongly by the stiffness of the flagellum. Next, I will discuss the structure and elastic of the flagellum. Next, I will discuss the structure and elastic properties of coiled-coil proteins. The coiled-coil is a ubiquitous structural motif formed by wrapping two alpha-helices into a supercoil. Finally, I will return to spirochetes to discuss the deformations of the cell body that are due to the unique location of the flagella and how the body deforms when the flagella rotate, which causes propulsion.

**TUESDAY, OCTOBER 17, 2006**
**2:30 PM**
**Building 4, Room 270**

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

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