

## High Power Insects: the biomechanics of jumping and striking

Some insects are famous for their ability to generate extremely fast motions. Grasshopper jumps and ant mandible strikes are sometimes so quick that the human eye cannot perceive the motion. Generating this kind of speed requires a mechanical system that generates huge amounts of power relative to the mass of the animal (sometimes as high as tens of thousands of Watts per kilogram of animal). Moreover, the speeds and timescales of these behaviours require cameras that can film at thousands of frames per second in order to visualize them. Moving this quickly, however, is extremely difficult for muscles because the power density of muscle is limited to be no higher than a few hundred Watts per kilogram. In my talk I will do a brief survey of how some insects use biological springs to get around these limits on muscle power, and then I will focus how these springs are specifically used in several powerful examples of these movements, the locust jump, in which the animal generates thousands of W/kg of power, the frog hopper jump, in which the animal generates tens of thousands of W/kg of power, and lastly the ant mandible strike, in which the animal generates hundreds of thousands of W/kg of power. These systems provide biological examples high-speed precision machinery.