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Active microrheology reveals molecular-level variations in the viscoelastic properties of *Chaetopterus* mucus WILLIAM WEIGAND, Univ of San Diego, ASHLEY MESSMORE, University of California, San Diego, RAE ANDERSON, Univ of San Diego — The sea annelid, *Chaetopterus Variopedatus,* secretes a bioluminescent mucus that also exhibits complex viscoelastic properties. The constituents of the mucus are relatively unknown but it does play an important role in the development of the worms' parchment-like housing tubes. In order to determine how and why this mucus can exhibit material properties ranging from fluidity to rigidity we perform microrheology experiments. We determine the microscale viscoelastic properties by using optical tweezers to produce small oscillations in the mucus which allow us to determine both the linear storage and loss moduli (G',G") along with the viscosity of the fluid. By varying the size of the microspheres (2-10 m) and oscillation amplitude (.5-10 m) we are able to determine the dominant intrinsic length scales of the molecular mesh comprising the mucus. By varying the oscillation frequency (1-15Hz) we determine the crossover frequency at which G' surpasses G", to quantify the longest relaxation time of the mesh network. Initial results show a strong dependence on bead size which indicate that the dominant entanglement lengthscale of the mucus mesh is ˜5 um. Microspheres of this size exhibit a wide variety of stress responses in different regions of the mucus demonstrating the substantial microscale heterogeneity of the mucus. We carry out measurements on a population of worms of varying size and age to determine mucus variability between worms.

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