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Polymer-induced compression of biological hydrogels SUJIT DATTA, ASHER PRESKA STEINBERG, RUSTEM ISMAGILOV, California Institute of Technology — Hydrogels – such as mucus, blood clots, and the extracellular matrix – provide critical functions in biological systems. However, little is known about how their structure is influenced by many of the polymeric materials they come into contact with regularly. Here, we focus on one critically important biological hydrogel: colonic mucus. While several biological processes are thought to potentially regulate the mucus hydrogel structure, the polymeric composition of the gut environment has been ignored. We use Flory-Huggins solution theory to characterize polymer-mucus interactions. We find that gut polymers, including those small enough to penetrate the mucus hydrogel, can in fact alter mucus structure, changing its equilibrium degree of swelling and forcing it to compress. The extent of compression increases with increasing polymer concentration and size. We use experiments on mice to verify these predictions with common dietary and therapeutic gut polymers. Our results provide a foundation for investigating similar, previously overlooked, polymer-induced effects in other biological hydrogels.

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