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Tether-free endoscopic biopsy with self-assembled micro-surgical tools¹ EVIN GULTEPE, EUN JI SHIN, FLORIN SELARU, ANTHONY KALLOO, DAVID GRACIAS, The Johns Hopkins University — Feynman’s futuristic vision of “swallowing the surgeon” or a truly non-invasive surgery relies on the invention and utilization of tetherless, stimuli-responsive and miniaturized surgical tools. We propose a step in this direction by the use of sub-millimeter scale, untethered, self-assembled endoscopic tools by designing and deploying microgrippers (μ -grippers) for effective mucosal sampling from large surface-area organs and for tissue retrieval from hard to reach places in the body. Due to their small size, tether-free actuation, parallel fabrication and deployment, μ -grippers can be dispersed in large numbers (hundreds or thousands) to collect tissue samples and allow statistical sampling of large mucosal areas. Monte Carlo simulations showed that using large number of biopsy tools increases the sampling coverage for screening procedures and hence the chance of detecting the malignant lesions. To establish the feasibility of using μ -grippers for sampling large organs we used with ex-vivo colon and in-vivo esophagus models. Our results showed that it is possible to retrieve high quality tissue samples which are suitable for either conventional cytologic or genetic analyses by using μ -grippers.

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