

Force measurement model

Figure S1: Worm inside PDMS device

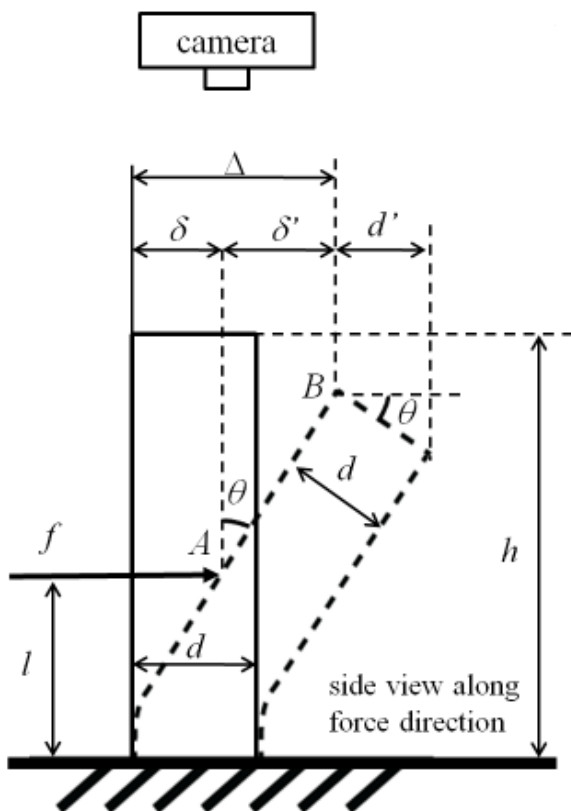
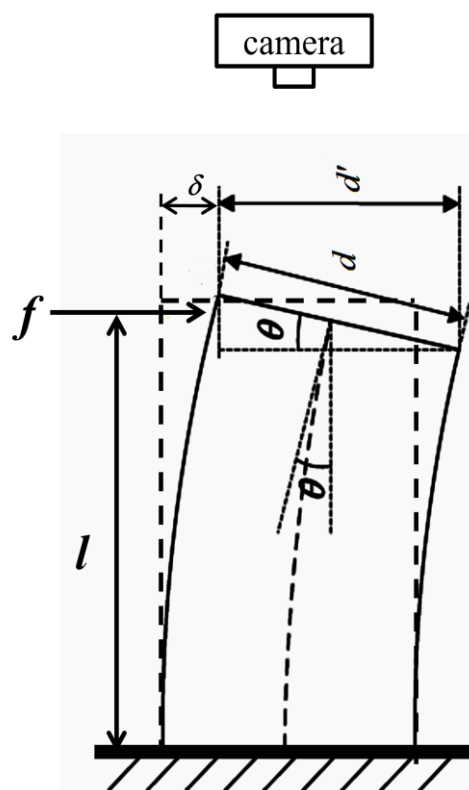


Figure S2: Worm on different substrate



Force, f is calculated from the deflection Δ from the worm contact at the pillar half height and the linear displacement from point A to point B.

$$f = \frac{\Delta}{\left(\frac{l^3}{3EI} + \frac{d^2(1+\gamma)l}{4EI}\right) + \frac{l^2}{2EI}(h-l)}$$

l : pillar height

I : moment of inertia

E : PDMS Young's modulus

γ : Poisson's ratio

d : pillar diameter

Force, f is calculated from the deflection δ caused by the worm's contact approximated as a point force at the pillar tip, corresponding to $h = l$ in the model shown on the left column, thus:

$$f = \frac{\delta}{\left(\frac{l^3}{3EI} + \frac{d^2(1+\gamma)l}{4EI}\right)}$$