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Supplementary Material for: Bio-hybrid micro-swimmers propelled by flagella isolated from *C. reinhardtii*[†]

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Supplementary figures

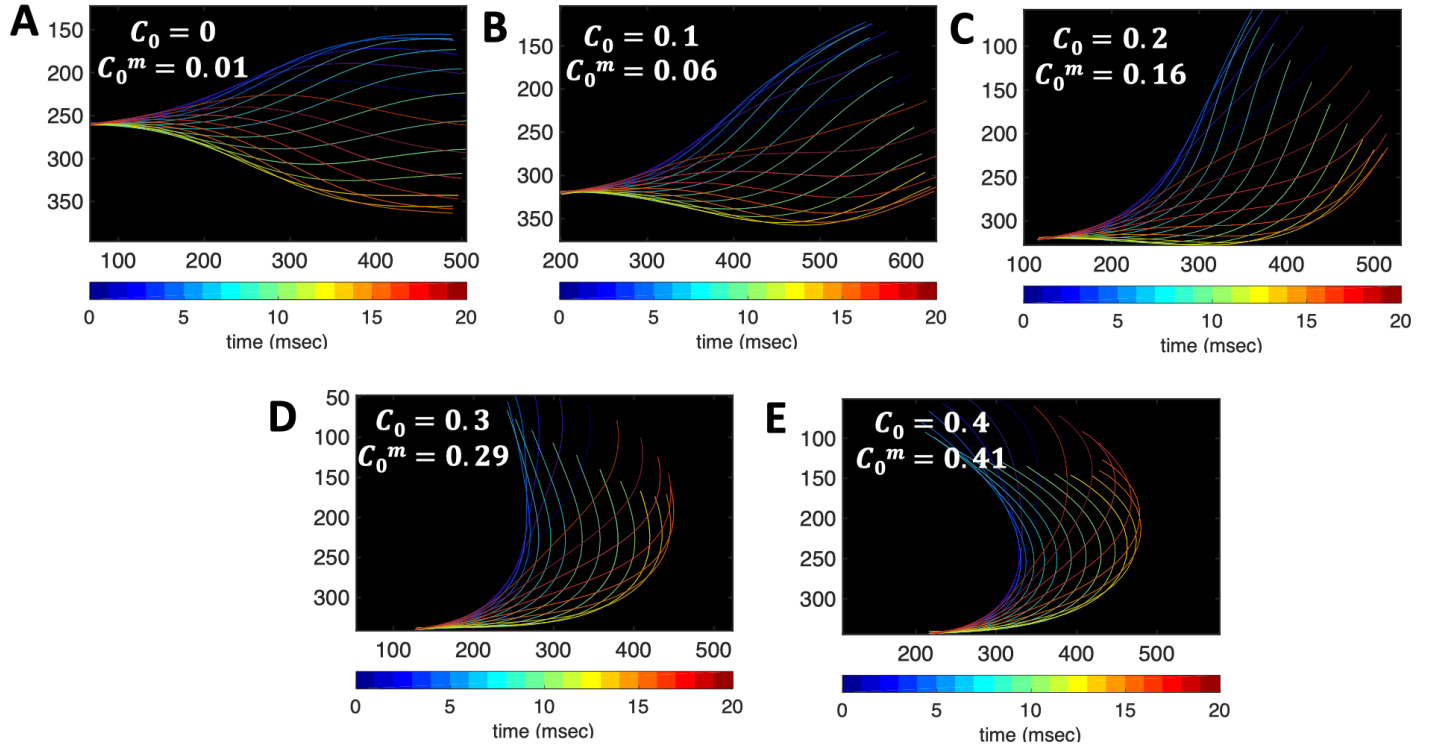


Fig. S1 To measure the systematic error of our tracking GVF algorithm, we generated artificial data with known values of dimensionless mean curvature $C_0 = \kappa_0 L / (2\pi)$, and tracked the filaments using GVF. The measured values of mean curvatures of tracked filaments is given by C_0^m . As it is shown in the panels A-E, the measured values deviate from the real values at small C_0 , but approaches the real values at higher C_0 . In other words, our algorithm has a smaller systematic error (less than 4%) for curved filaments with $C_0 > 0.3$.

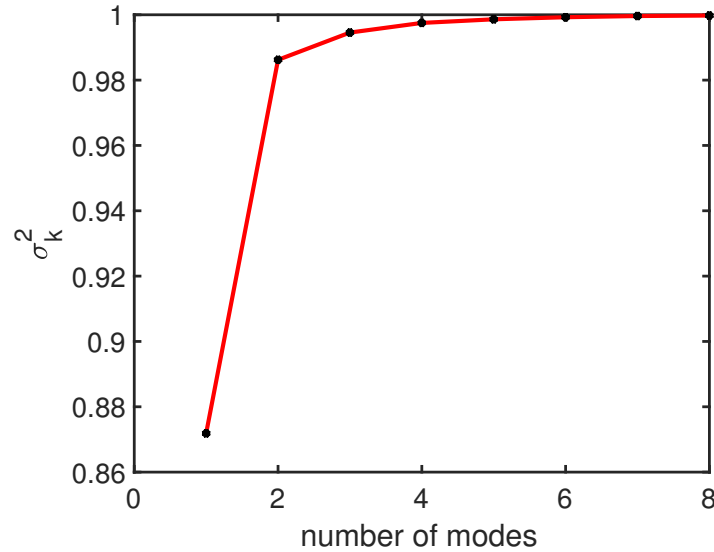


Fig. S2 Fraction of the total variance σ_k^2 , as defined in Sec. 2.3, plotted versus the number of PCA modes n for the axoneme shown in Fig. 3A.

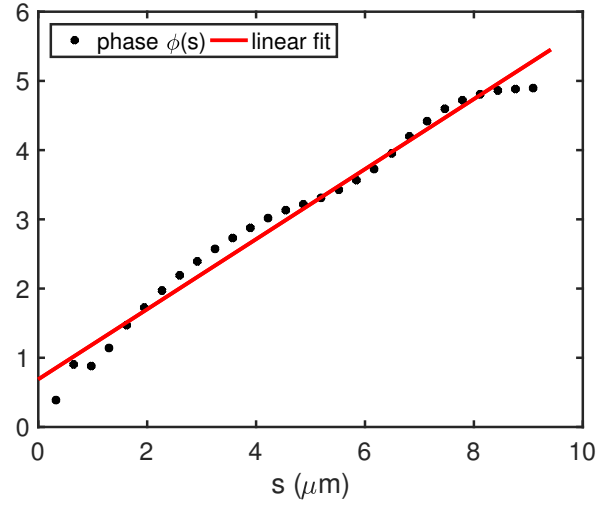


Fig. S3 The phase $\phi(s)$ of traveling curvature waves of the axoneme presented in Fig. 3A, obtained by performing Fourier transform in time at each position s along the axonemal length. The wavelength is then calculated as $\lambda = 2\pi L/(\phi(L) - \phi(0)) = 13.19 \mu\text{m}$. The red line represents a linear fit, which we extrapolate to obtain $\phi(0)$.

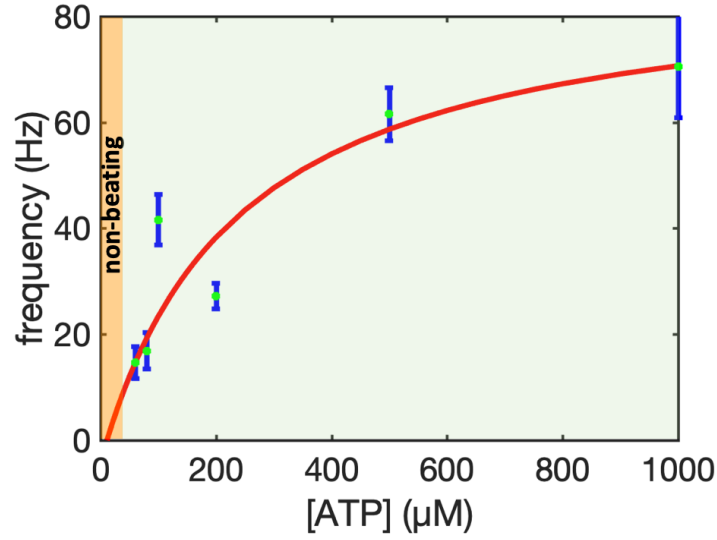


Fig. S4 The frequency of reactivated axonemes depends on the $[\text{ATP}]$ and follows a Michaelis-Menten type kinetics with a linear trend at small $[\text{ATP}]$ and saturation at higher $[\text{ATP}]$. A minimum critical concentration of $[\text{ATP}]_{\text{critical}} = 60 \mu\text{M}$ is needed to reactivate the axonemes. In all the experiments $[\text{Ca}^{2+}] = 0 \text{ mM}$.

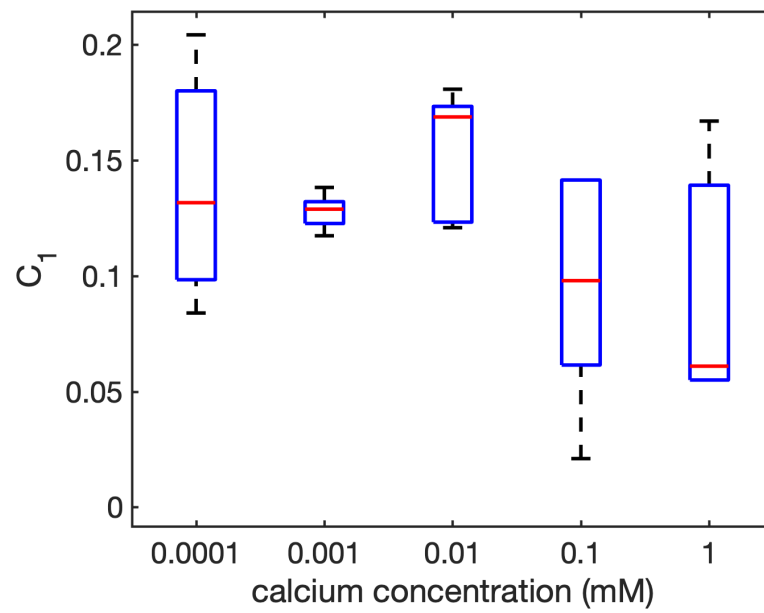


Fig. S5 The amplitude of traveling wave component C_1 is less sensitive to the calcium concentration and shows a reduction at high $[Ca^{2+}]$ around 1 mM.