

*From independent, mindless robots to flexible,
mobile, and directional structures*

Towards Flexible Robots

H. Kellay

LOMA, U. Bordeaux

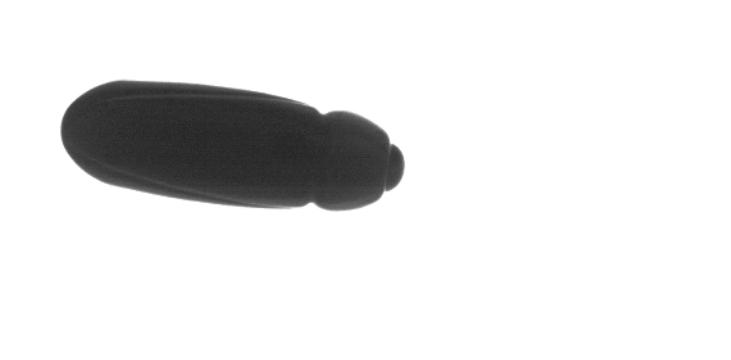
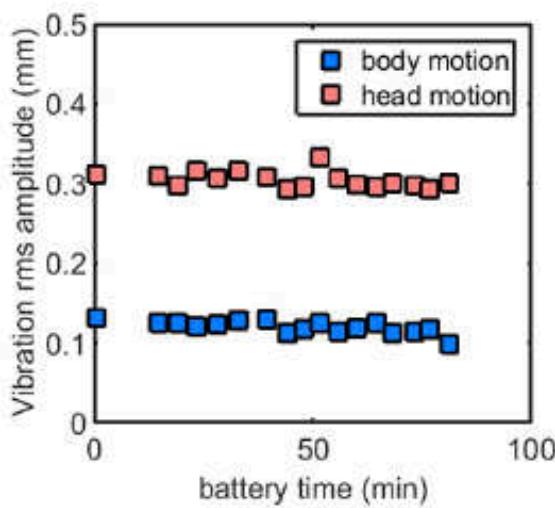
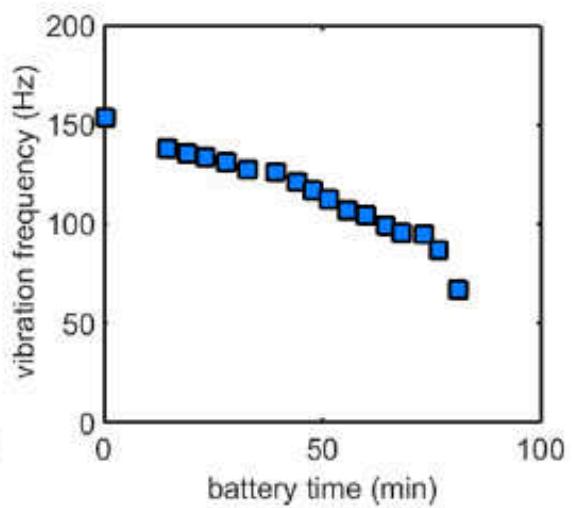
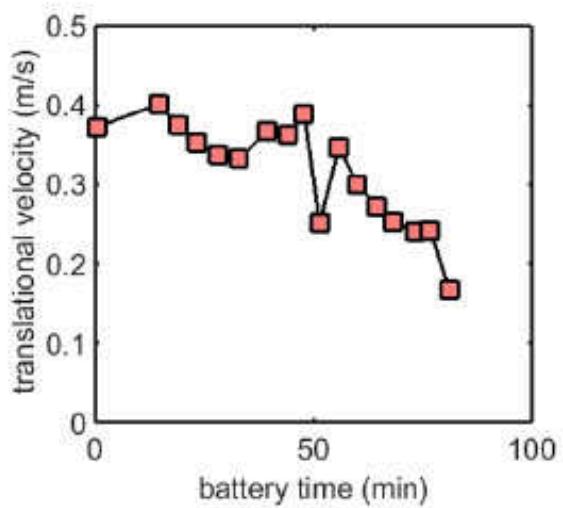
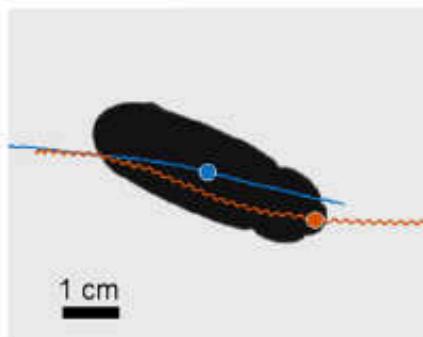
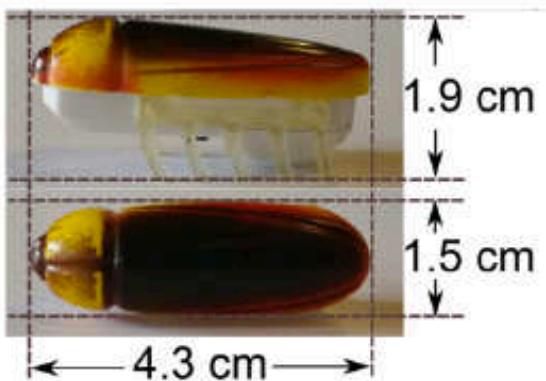
IUF

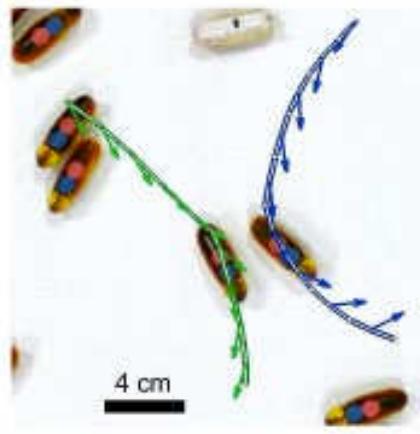
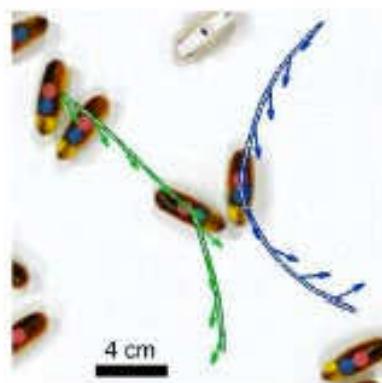
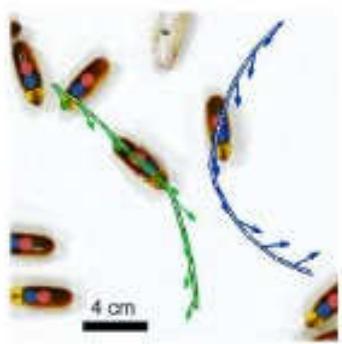
J. F. Boudet, C. Lacouture, T. Barois, T. Guerin, J. Lintuvuori, LOMA, CNRS, U. Bordeaux

A. Deblais, Van der Waals Zeeman, U. Amsterdam

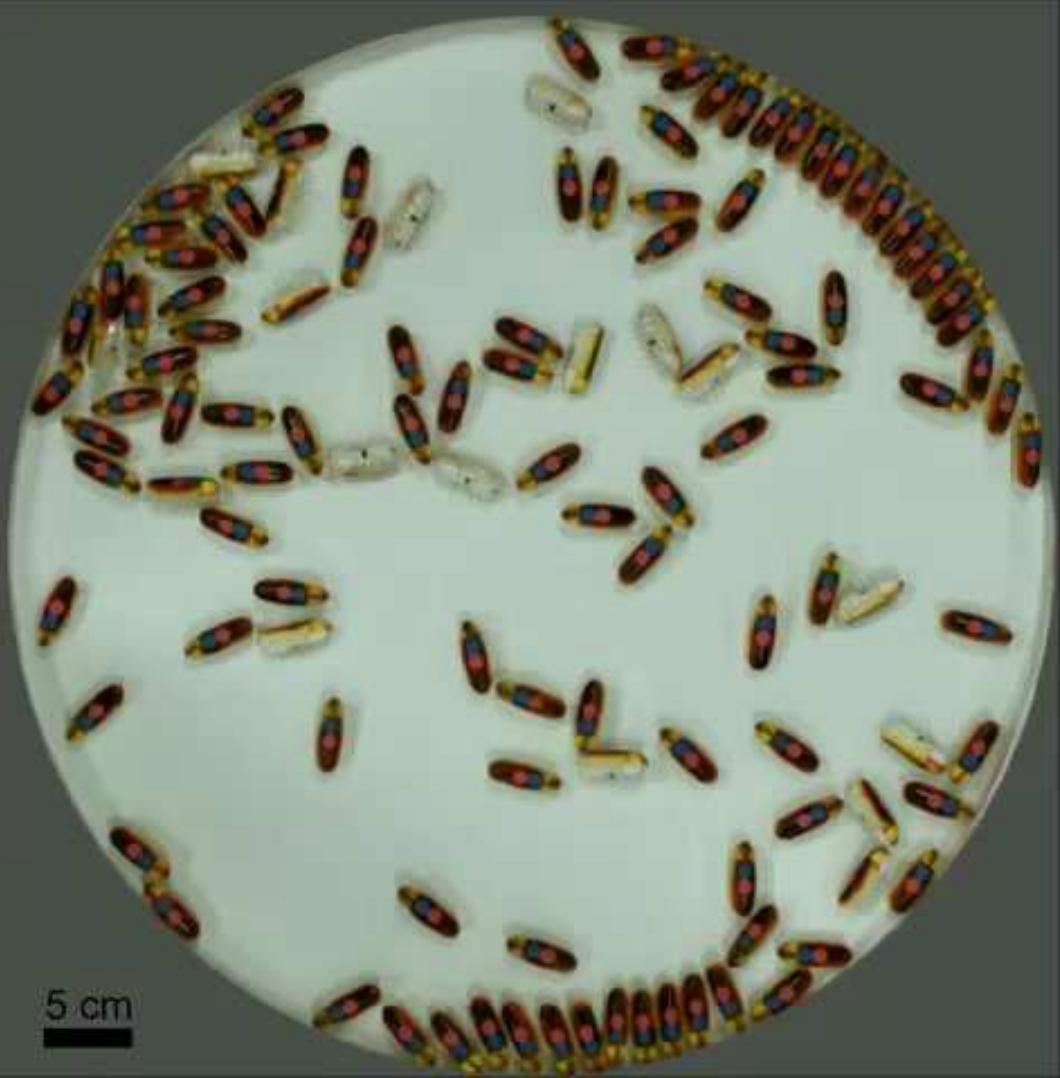
J. C. Baret, CRPP, CNRS, U. Bordeaux

D. Bruckner Arnold Sommerfeld Center, Ludwig-Maximilian-University Munich



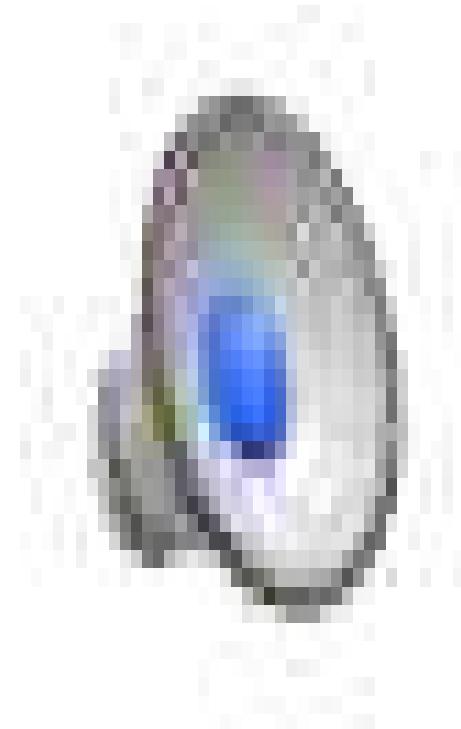


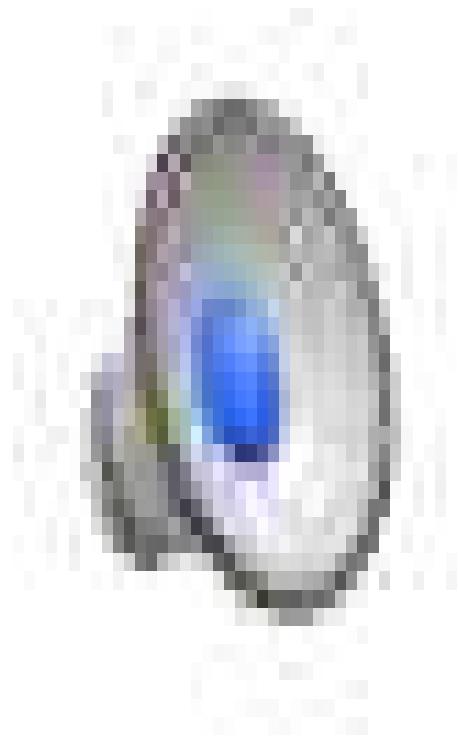


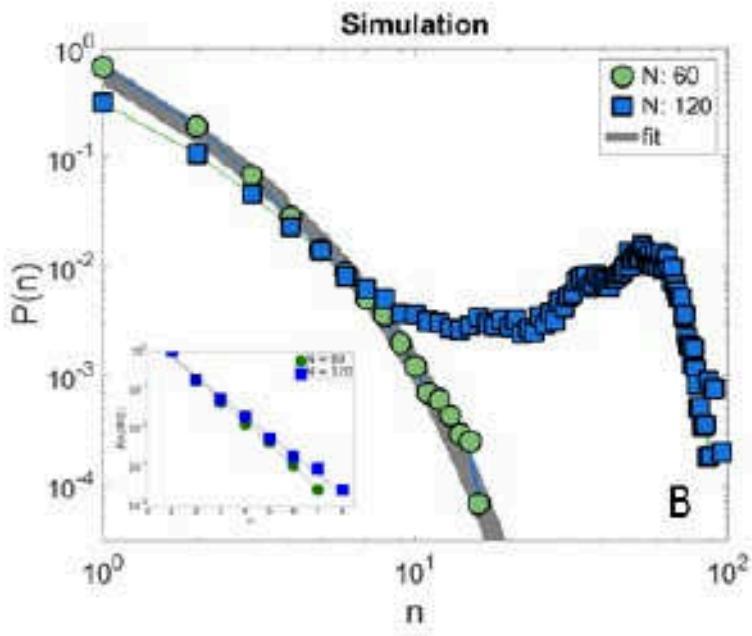
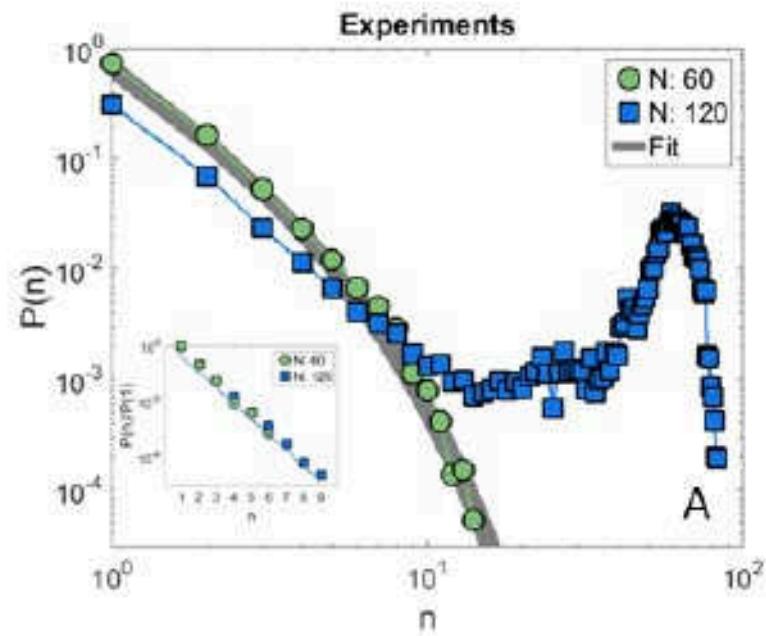
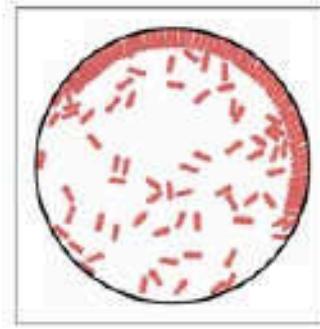
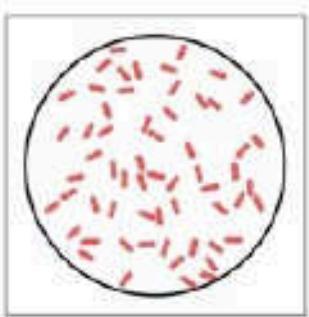


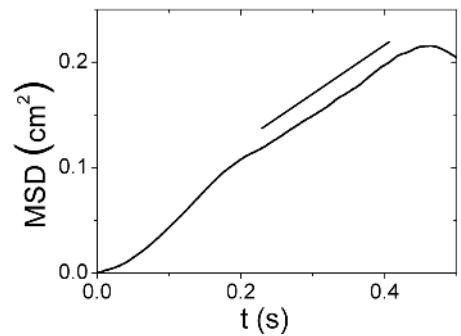
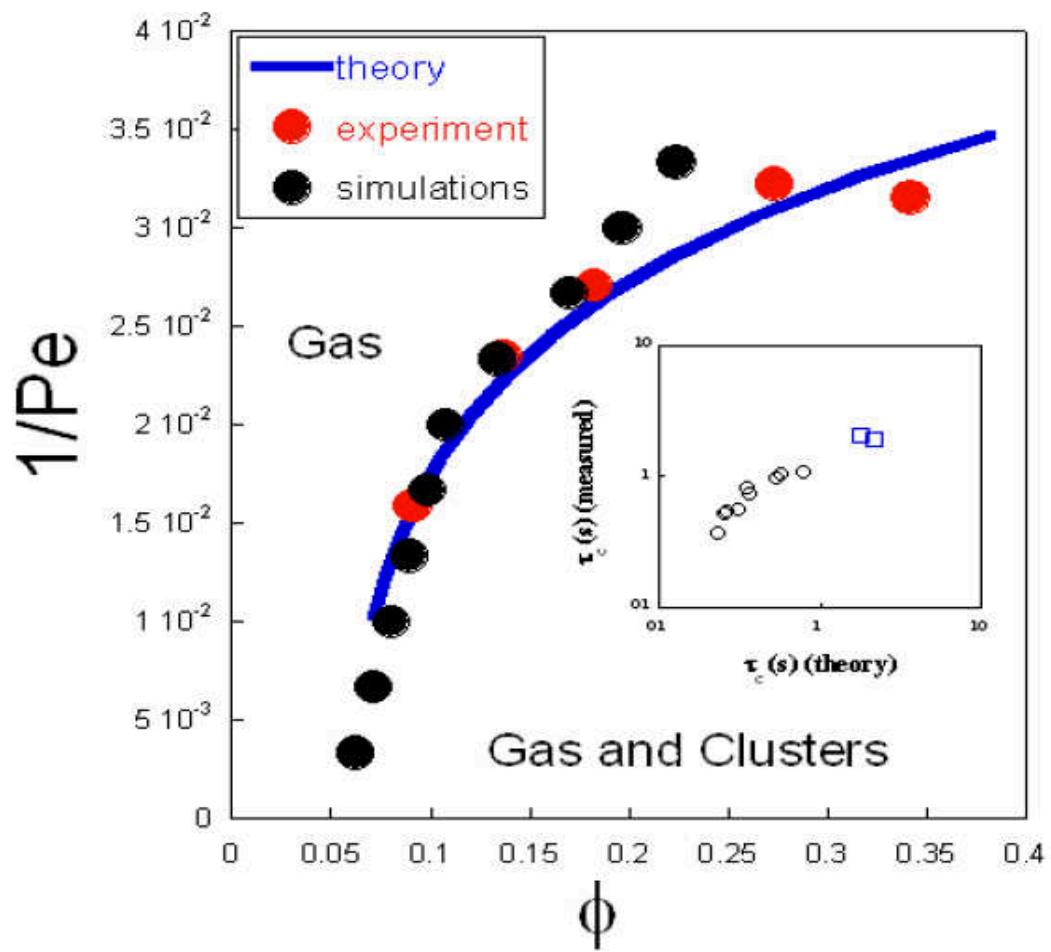
$$m_i \frac{d^2 \mathbf{r}_i}{dt^2} = -\nabla U_i - \gamma_r \frac{d\mathbf{r}_i}{dt} + F \hat{\mathbf{n}} + \eta(t)$$

$$I_i \frac{d^2 \theta_i}{dt^2} = T_i - \gamma_\theta \frac{d\theta_i}{dt} + \Gamma(t)$$

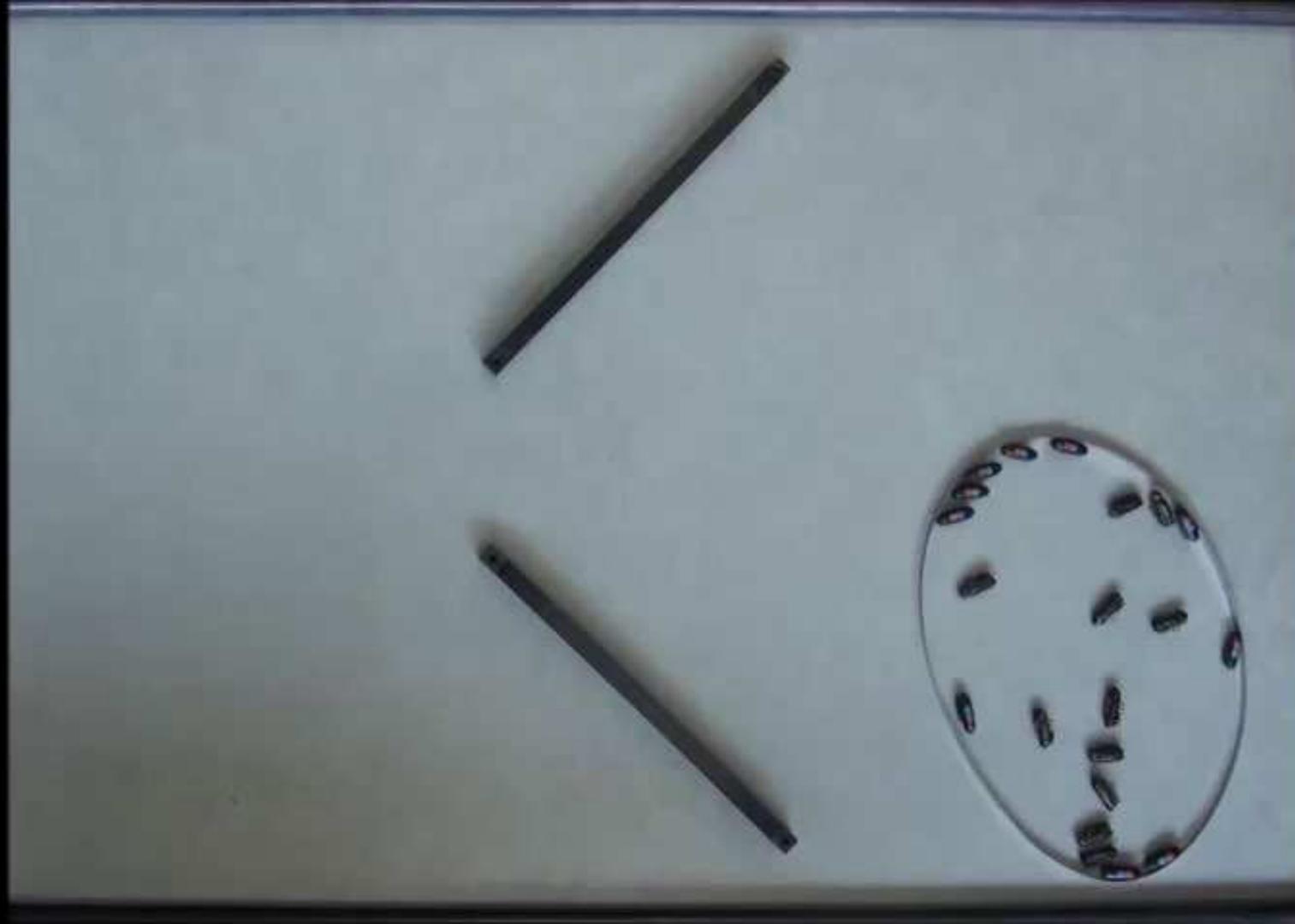




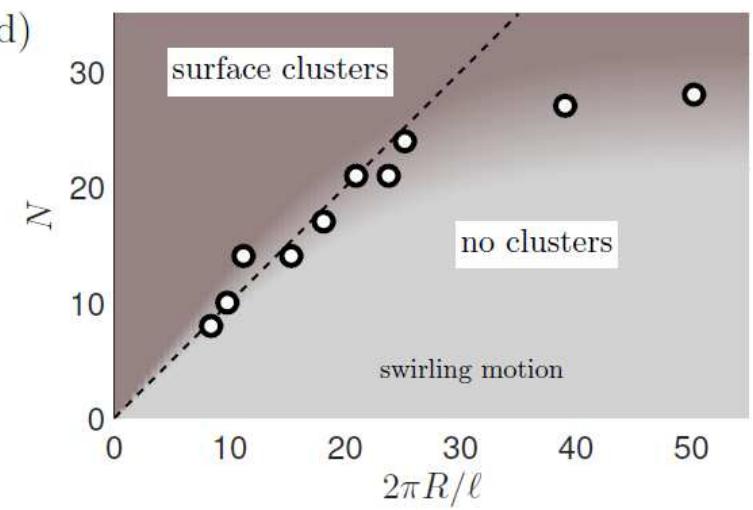
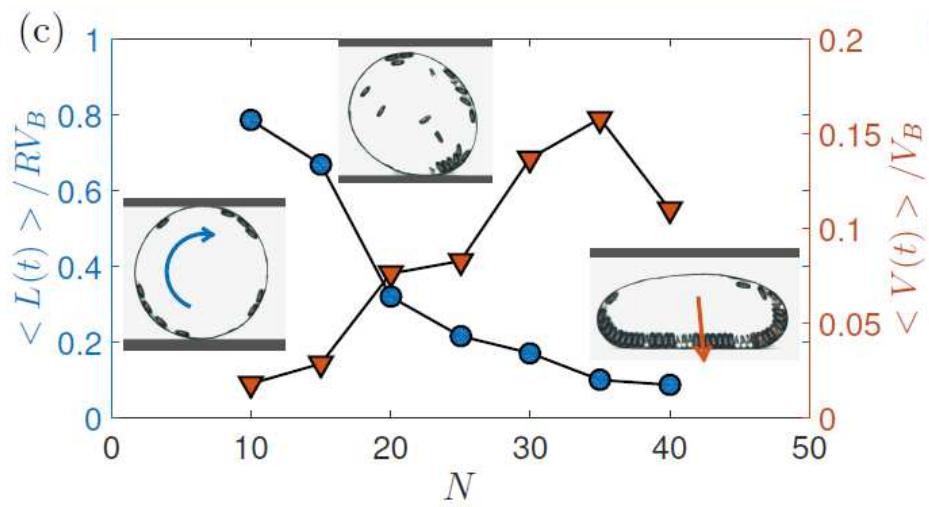
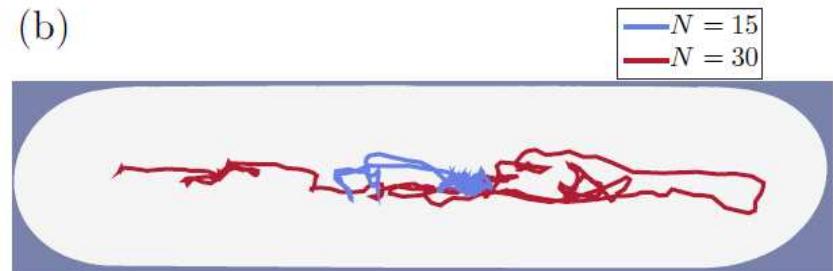
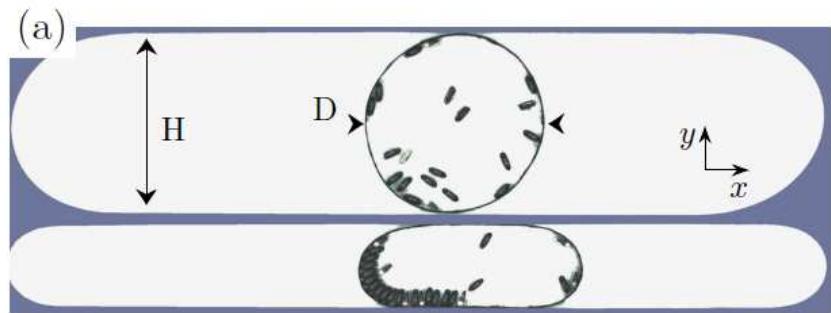




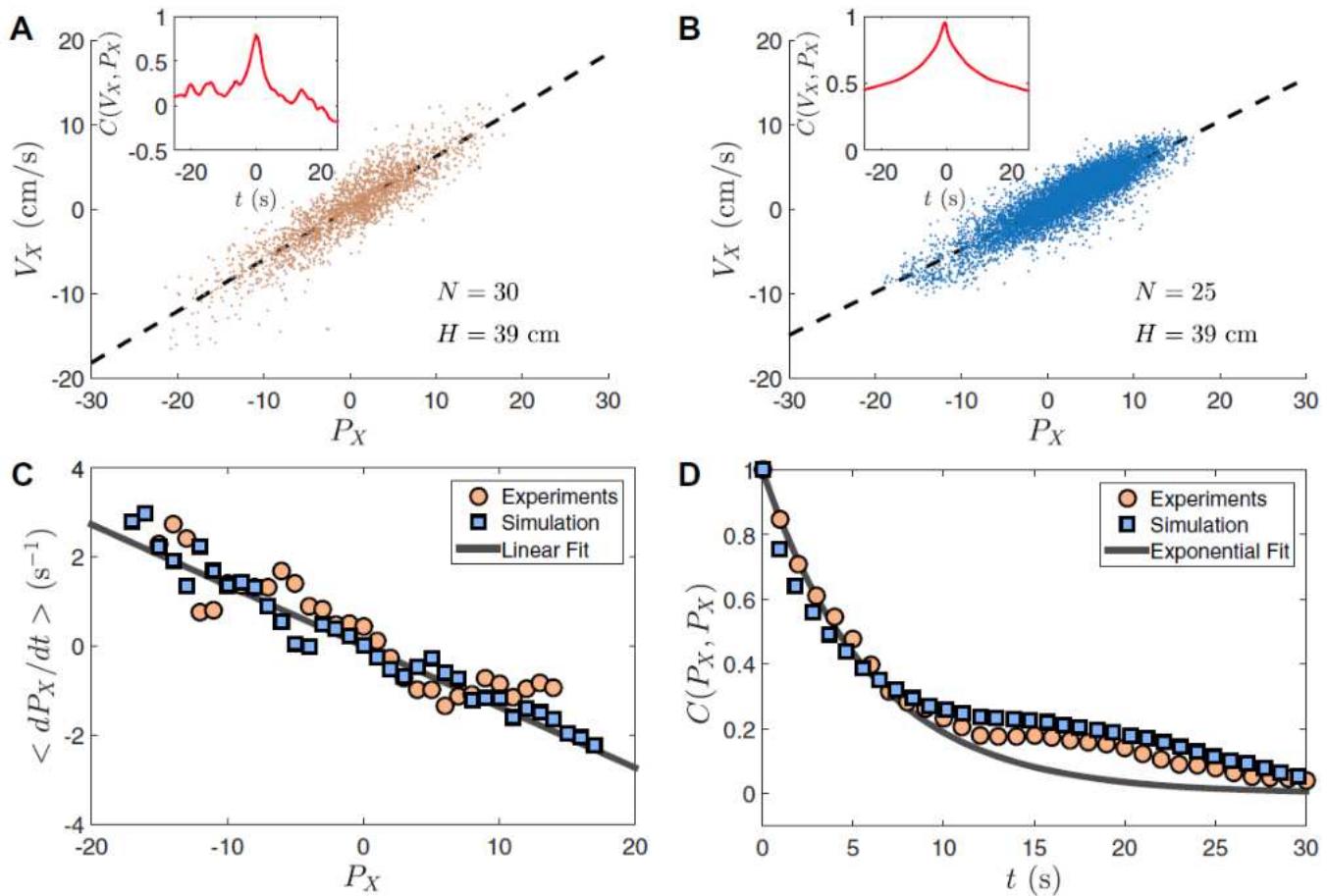
$$\text{Pe} = Vl/D_s$$





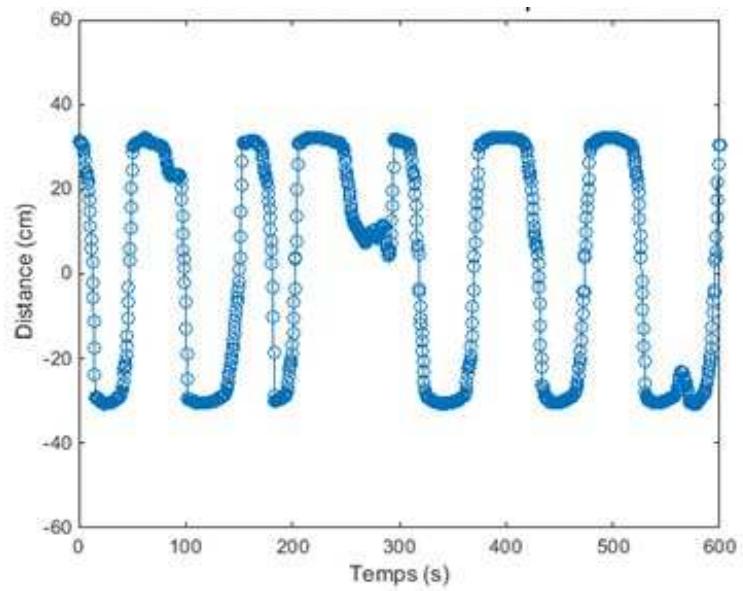
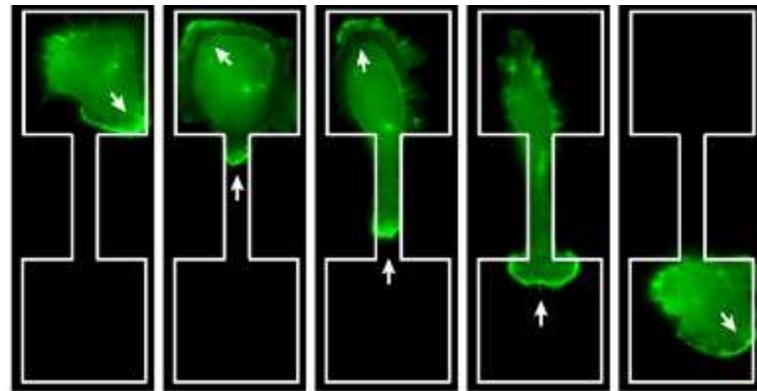
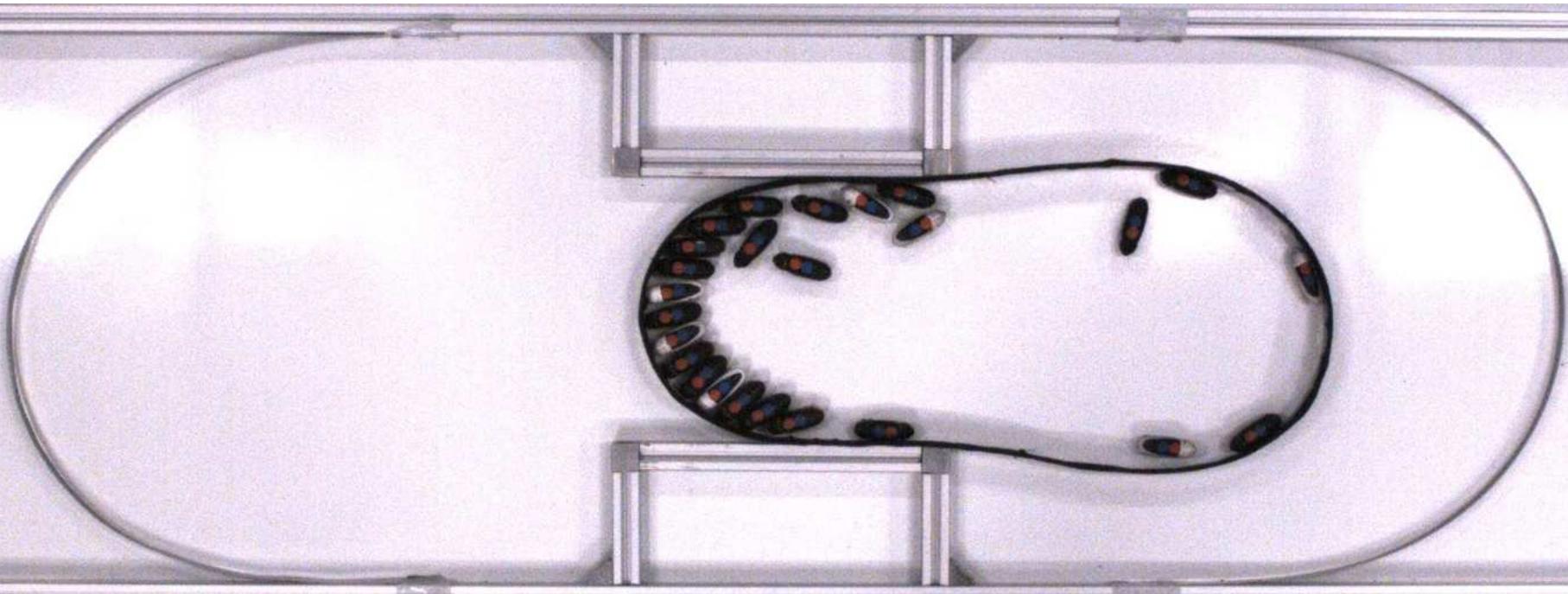


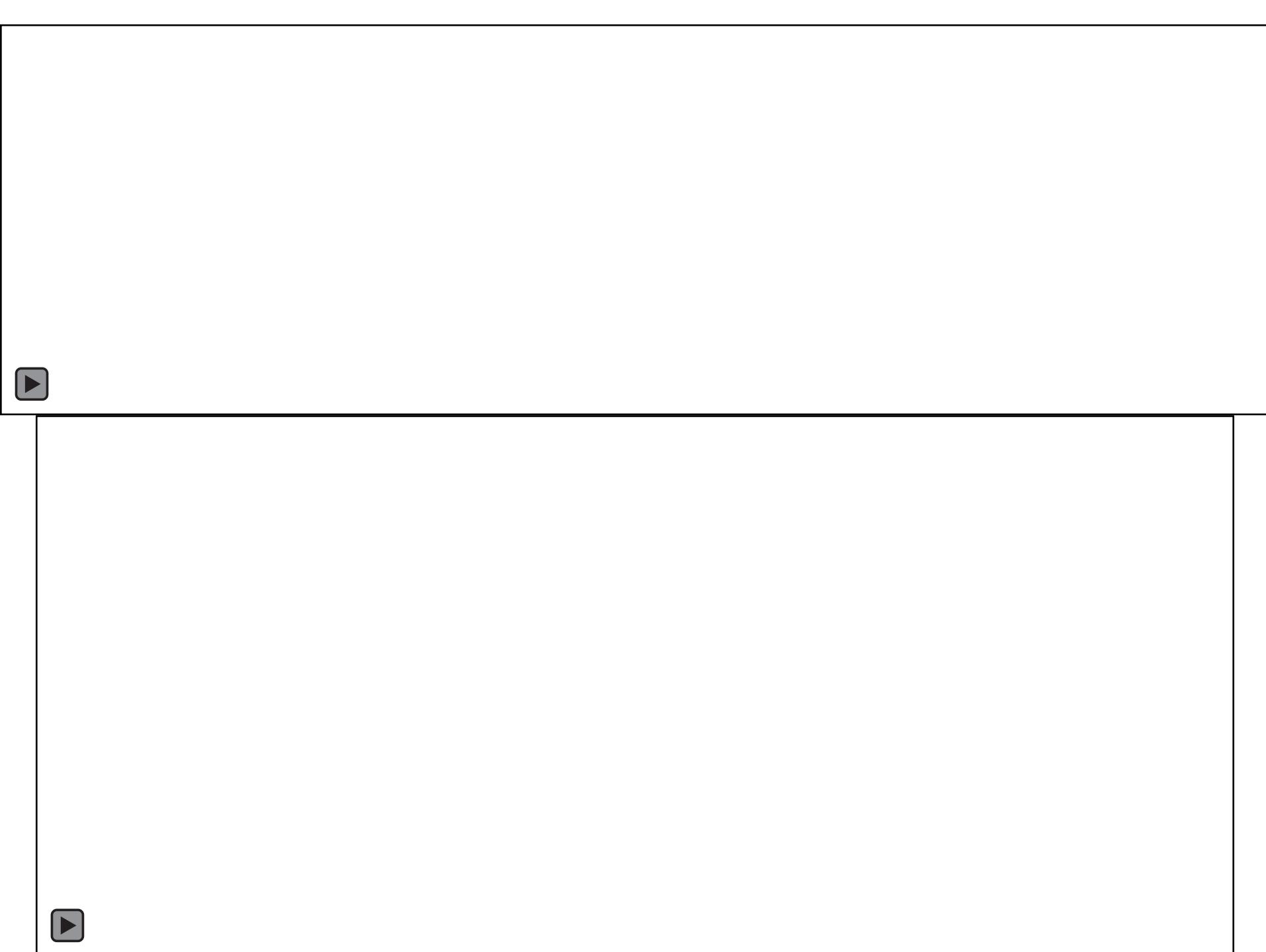
$$\langle \mathbf{L}(t) \rangle = \langle \mathbf{r}(t) \times \mathbf{v}(t) \rangle_{t,N}$$

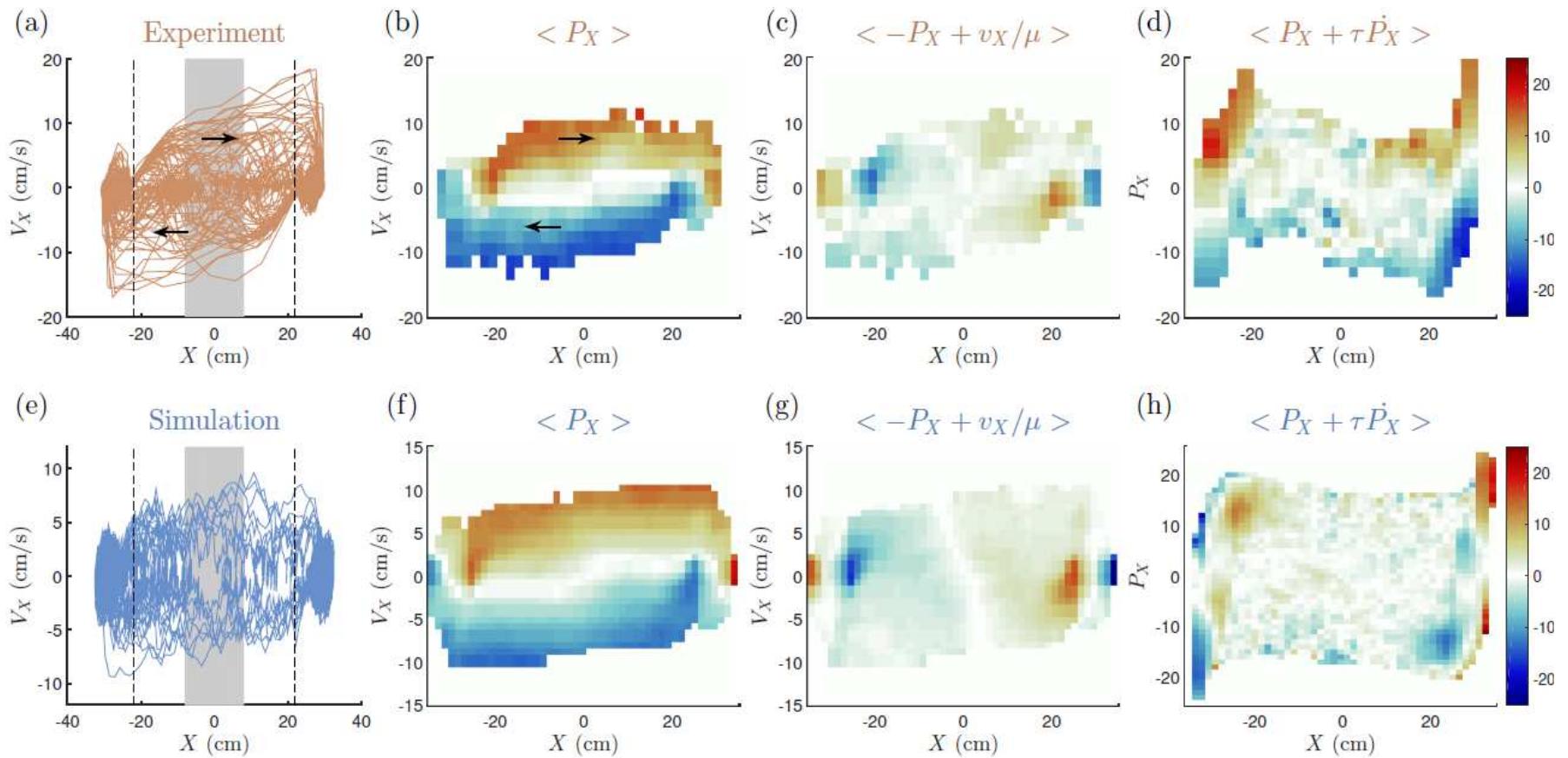


$$V_X = \mu P_X \quad (1)$$

$$P_X = \sum_N \mathbf{n} \cdot \mathbf{e}_x \quad \frac{dP_X}{dt} = -\frac{P_X}{\tau_c} + \delta(t) \quad (2)$$

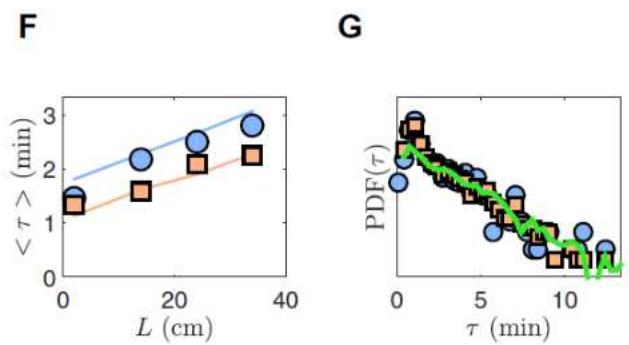
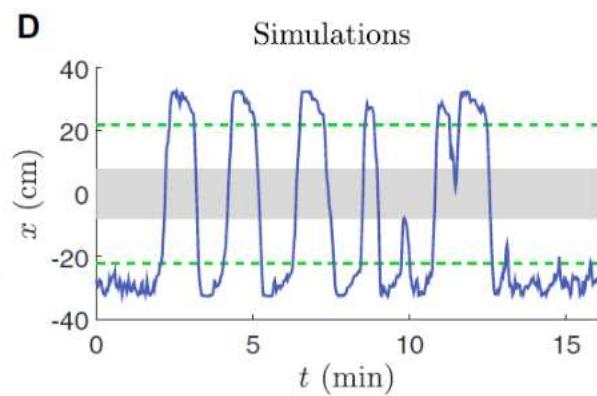
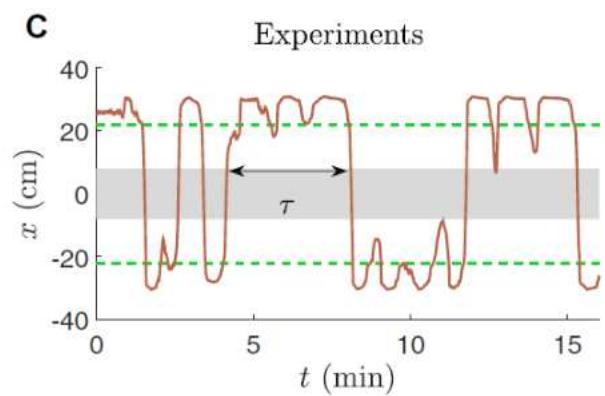
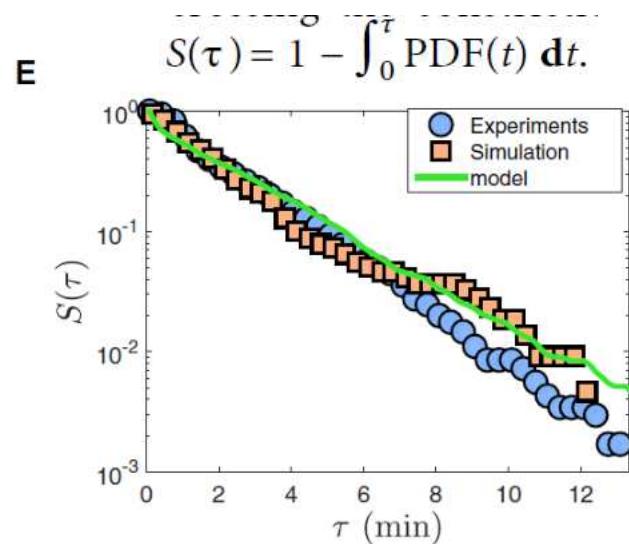
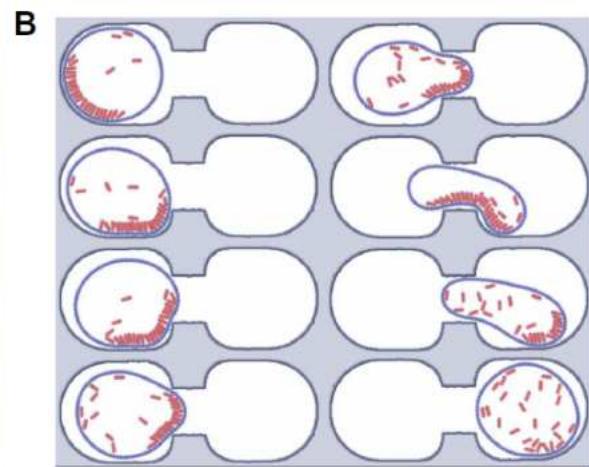
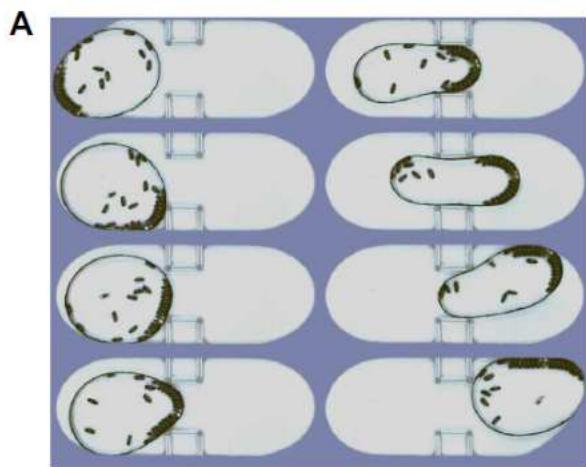






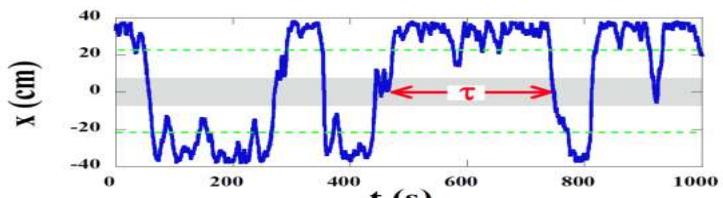
$$V_X = \mu P_X + \frac{1}{\alpha} F(x, V_X)$$

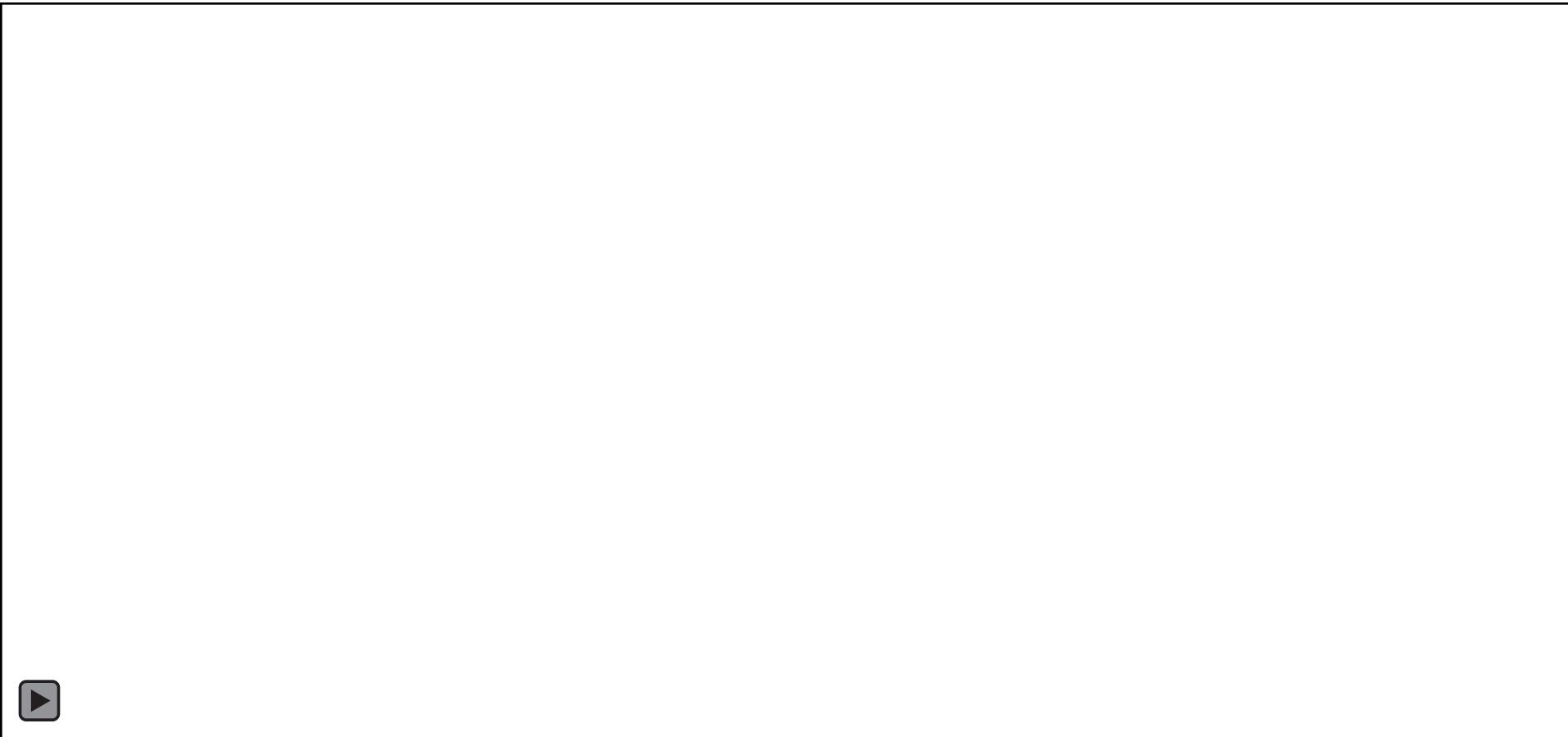
$$\frac{dP_X}{dt} = -\frac{P_X}{\tau_c} + \delta(t) + G(x, V_X)$$

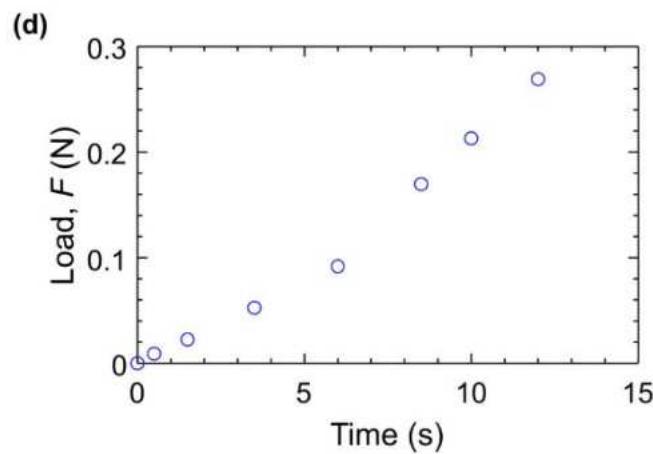
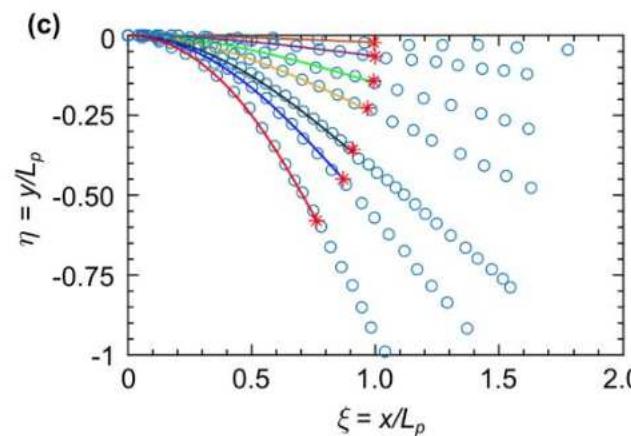
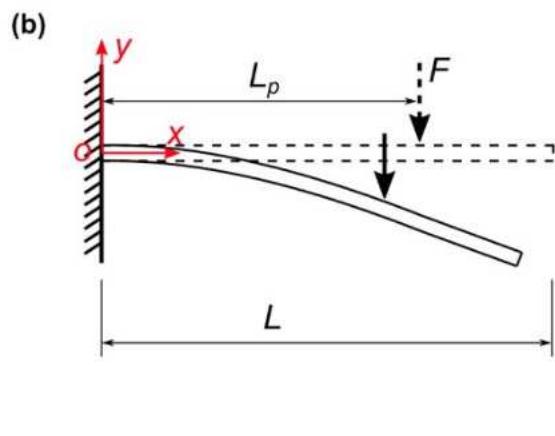
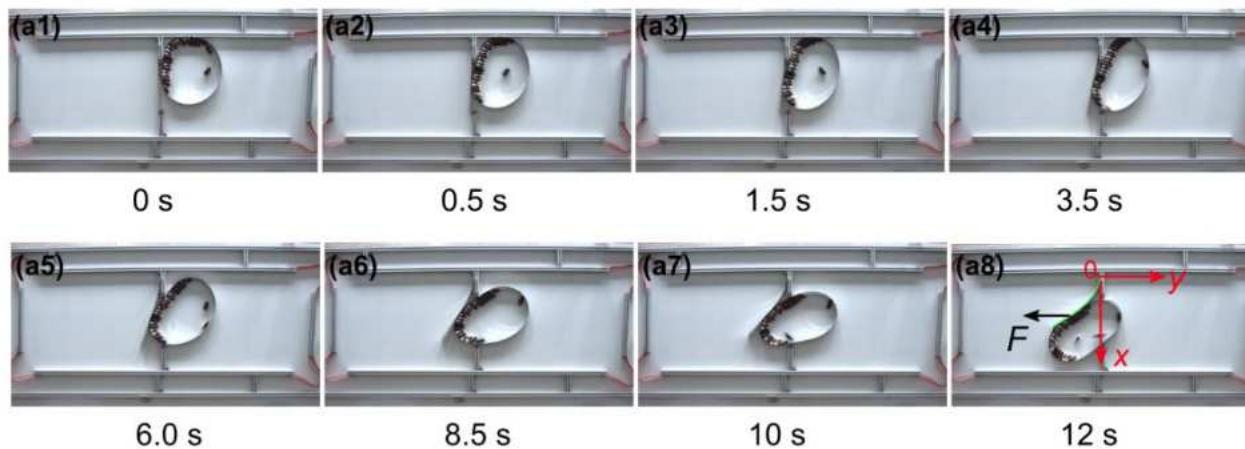


$$V_X = \mu P_X + \frac{1}{\alpha} F(x, V_X)$$

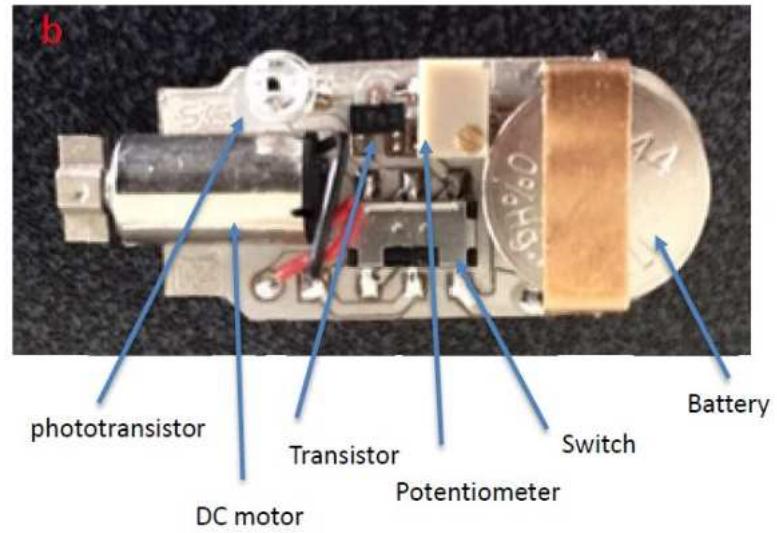
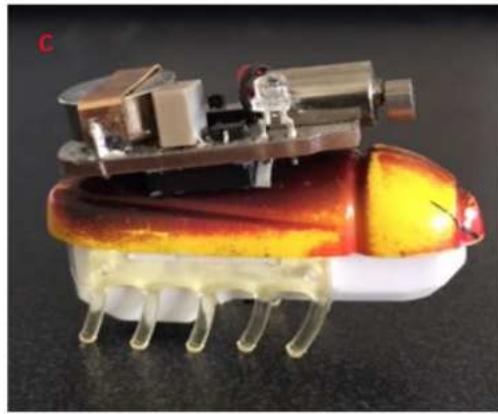
$$\frac{dP_X}{dt} = -\frac{P_X}{\tau_c} + \delta(t) + G(x, V_X)$$

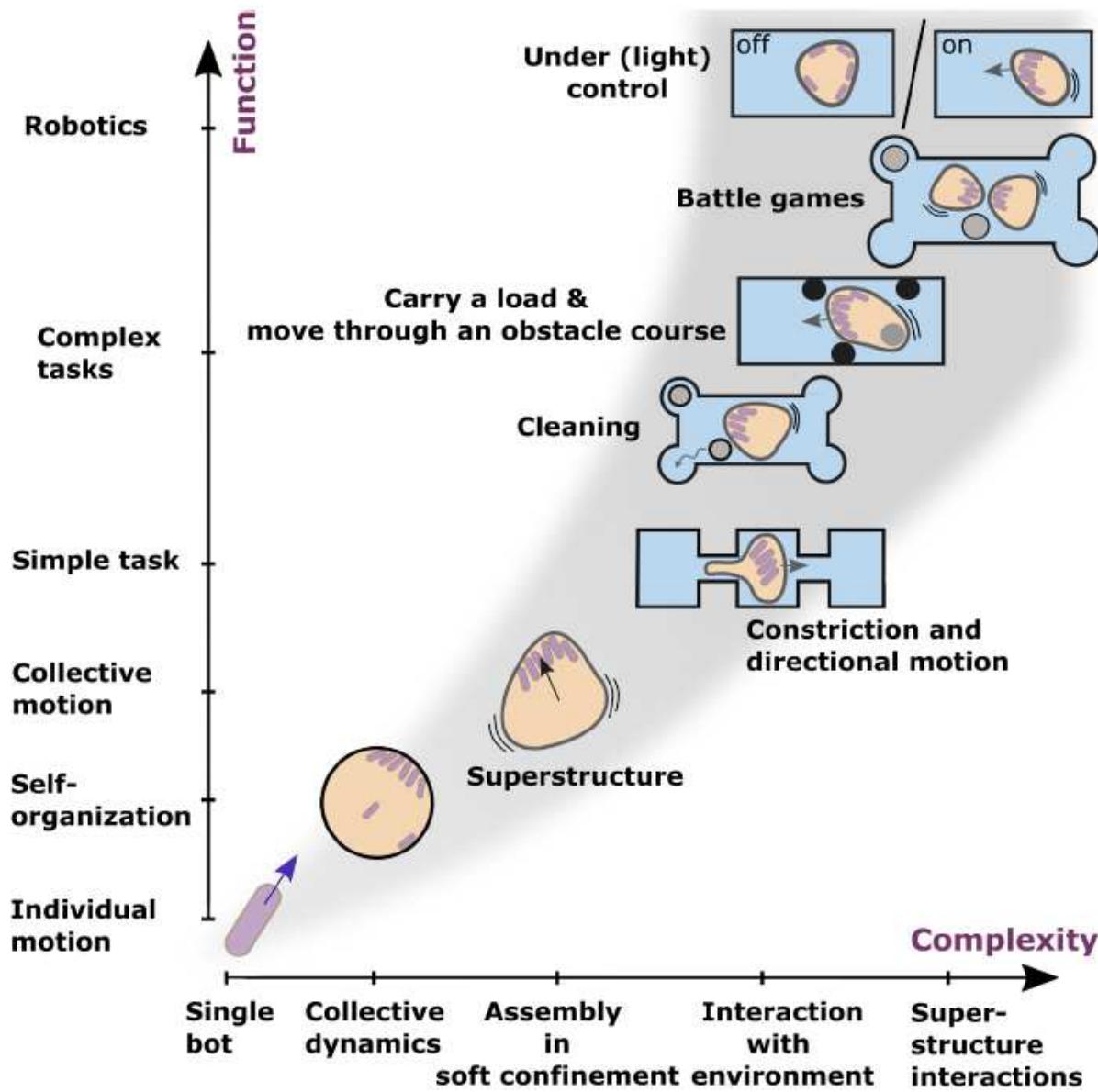


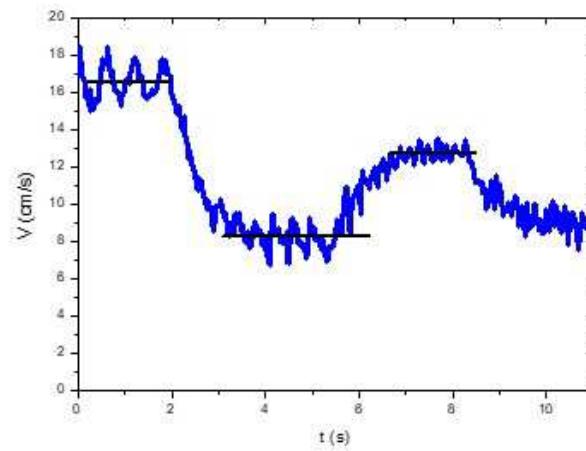
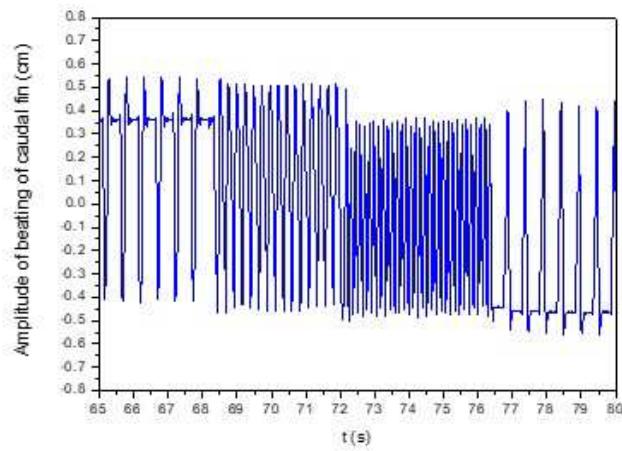
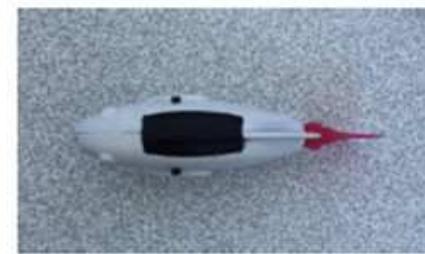












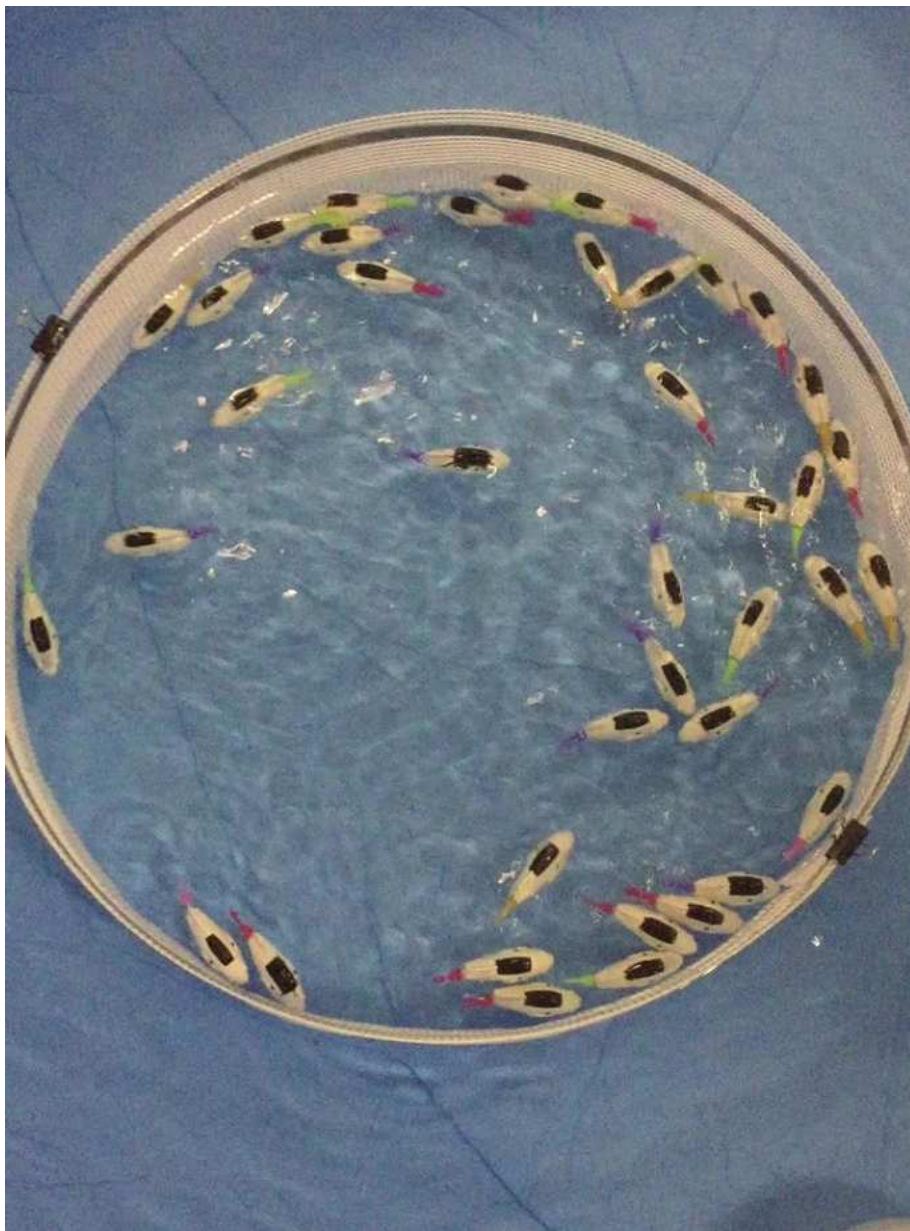
J.F. Boudet and H. Kellay

A. Deblais, H. Chartier, P.H. Delville, A. Hirsch

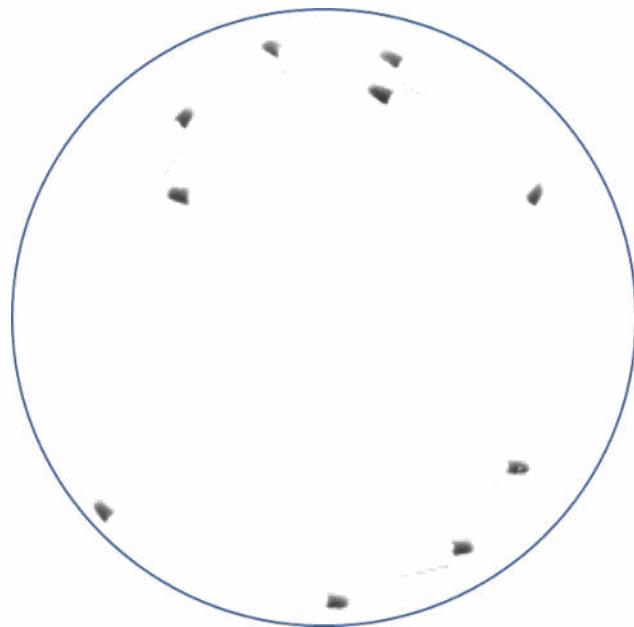
LOMA, U. Bordeaux

M. Bergmann, A. Iollo

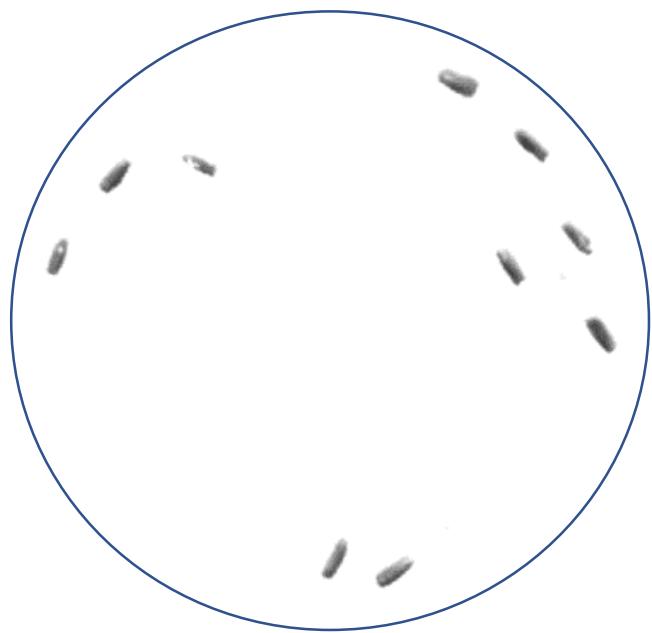
IMB, U. Bordeaux et Inria

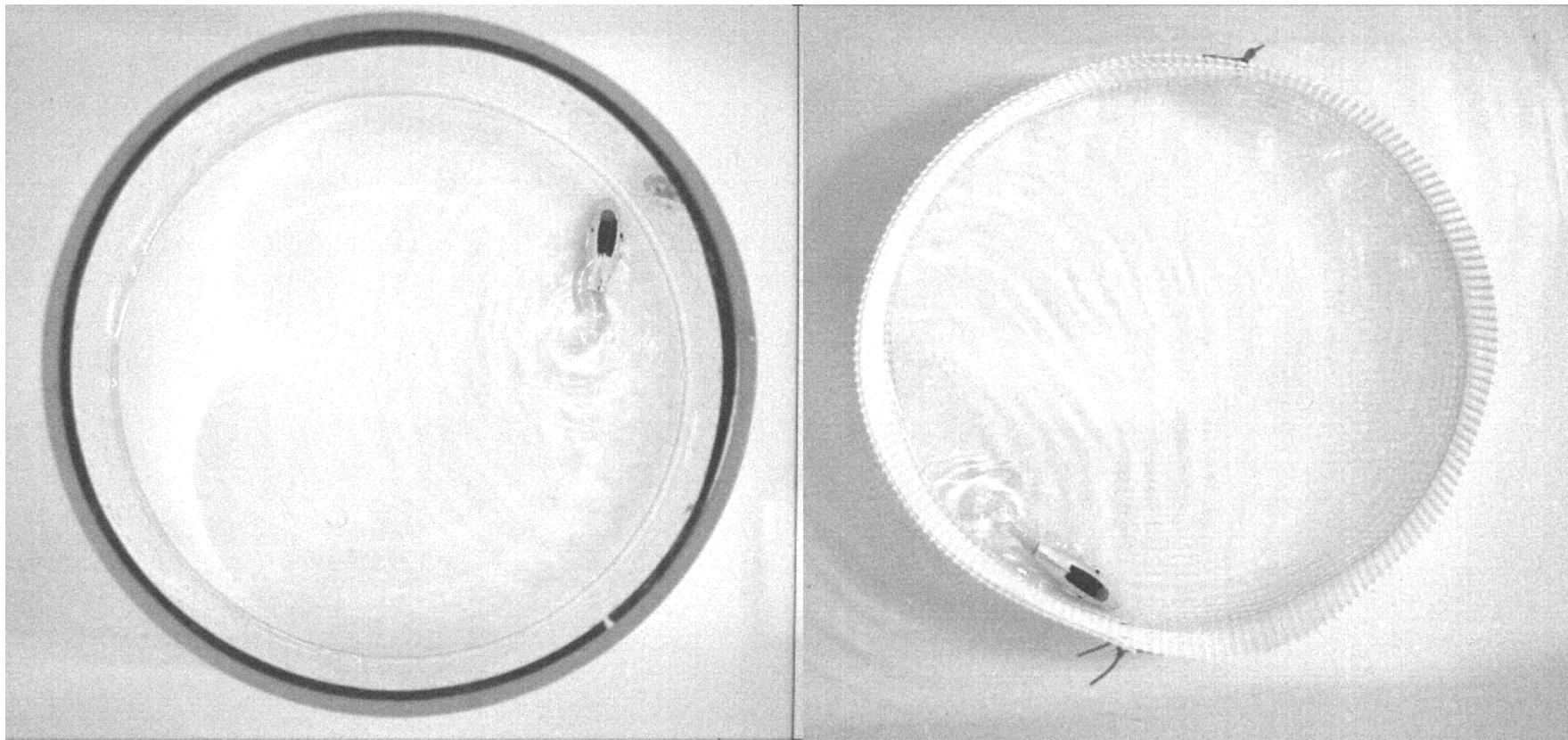


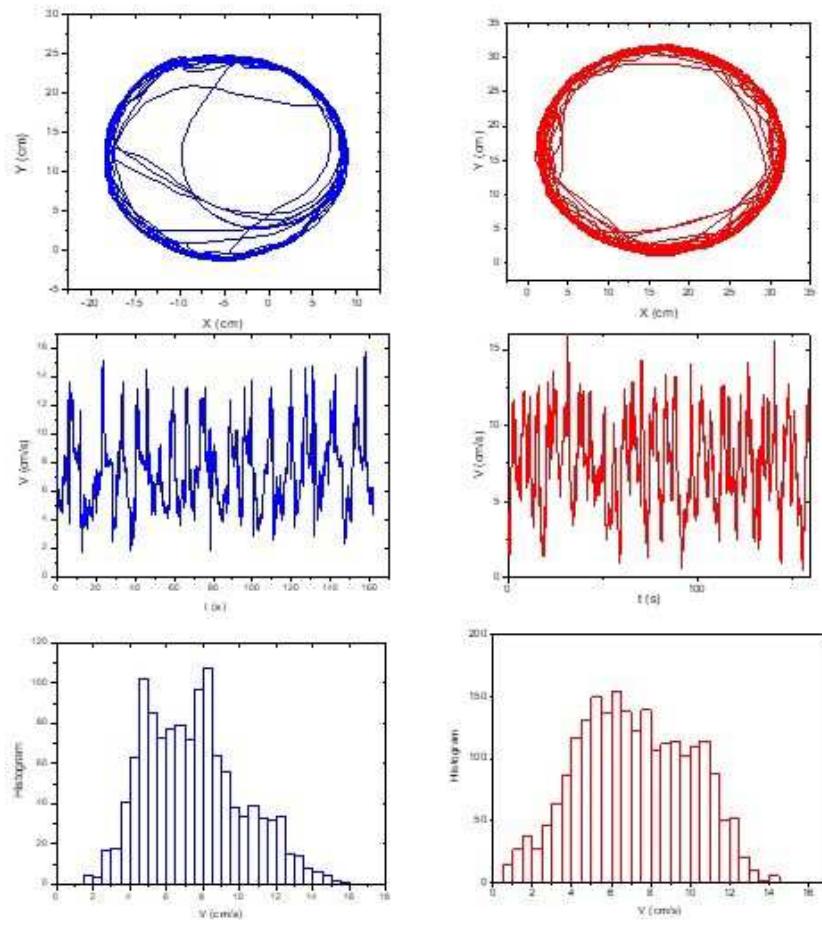
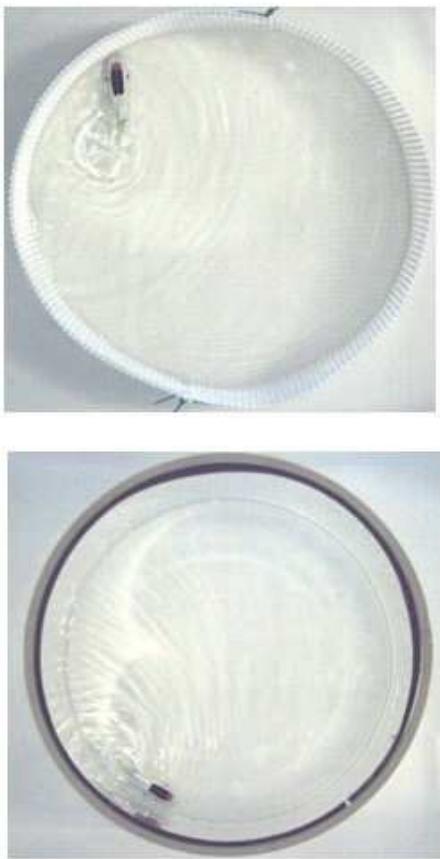
10 fish impermeable

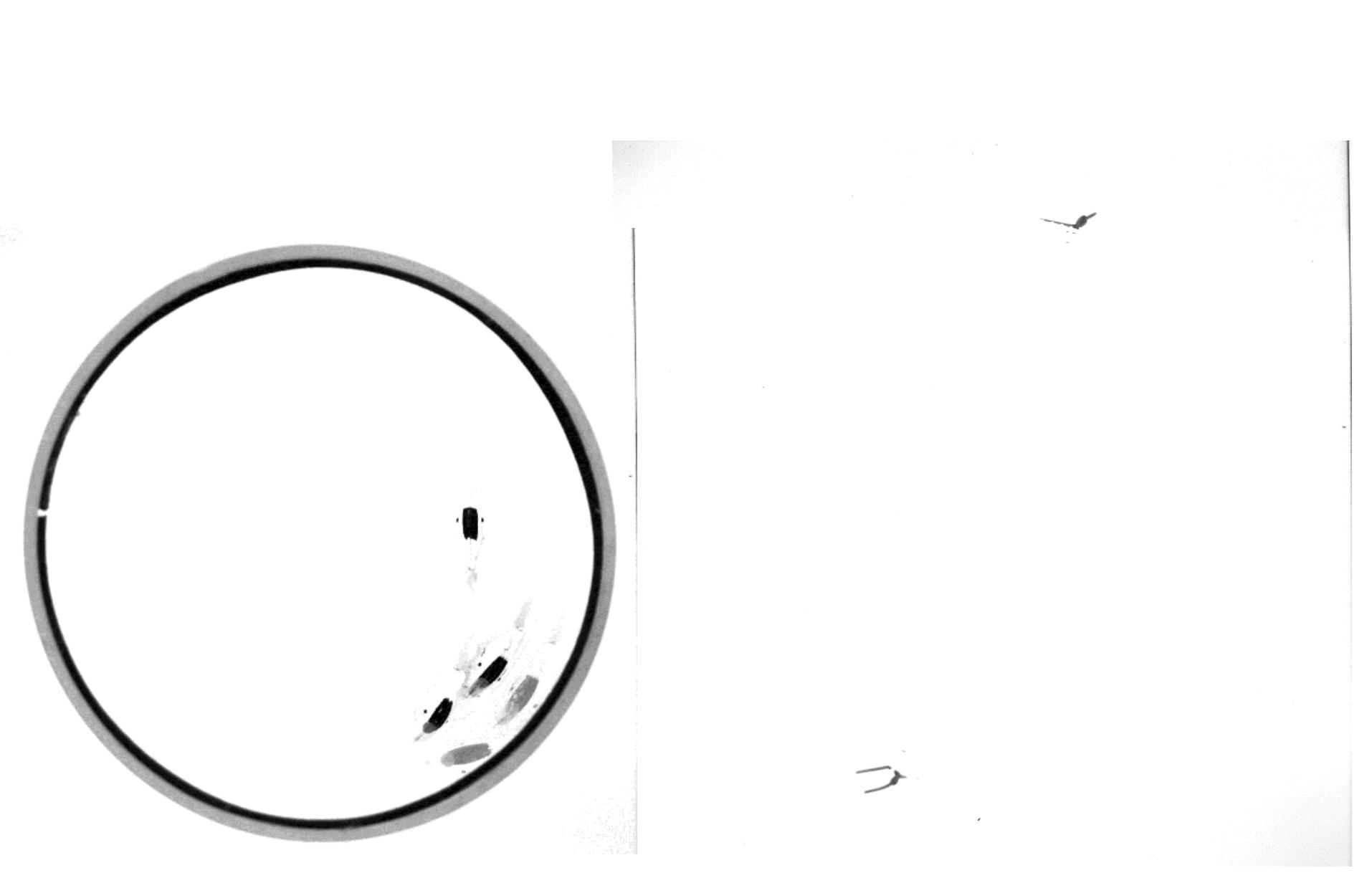


10 fish porous

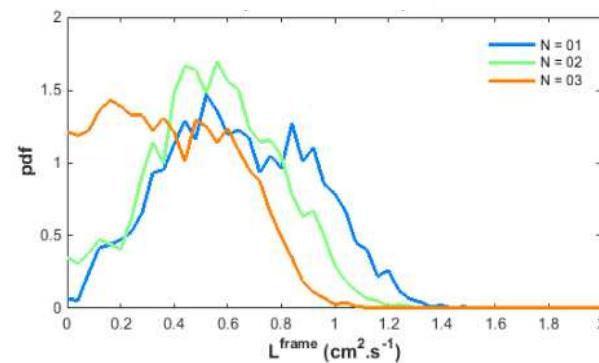
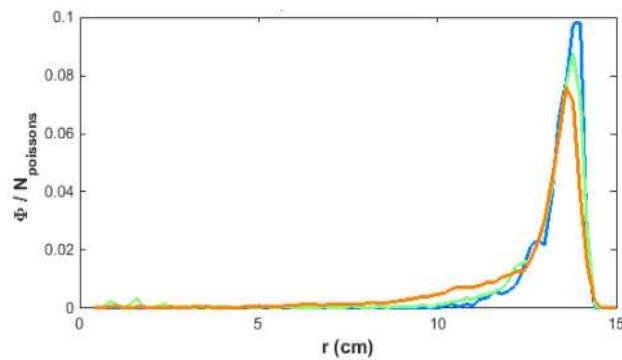
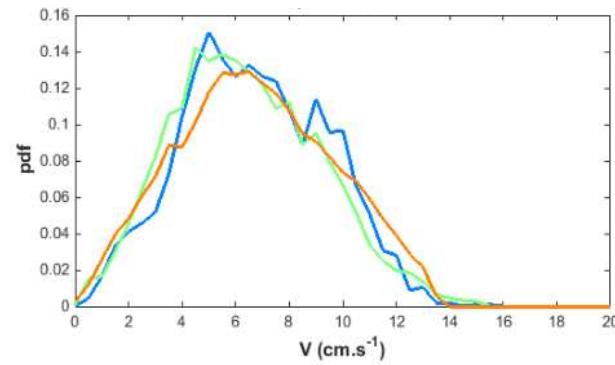
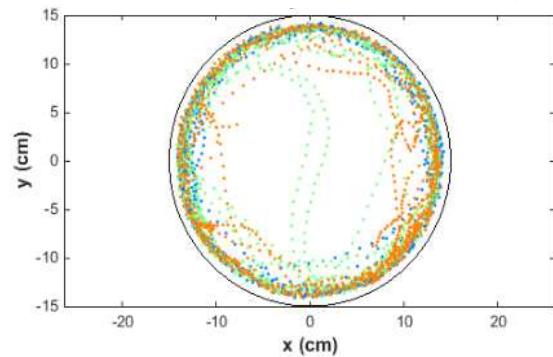






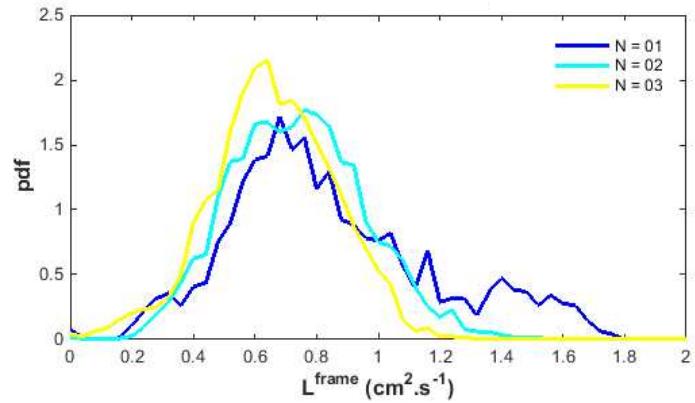
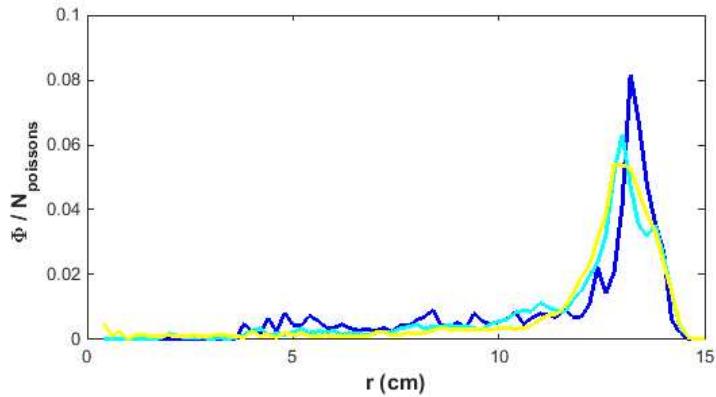
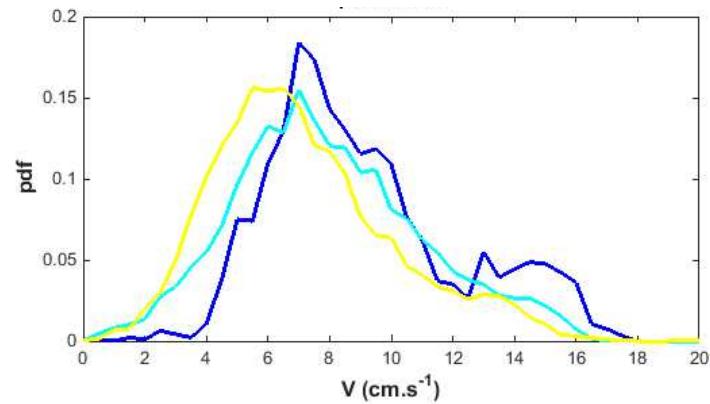
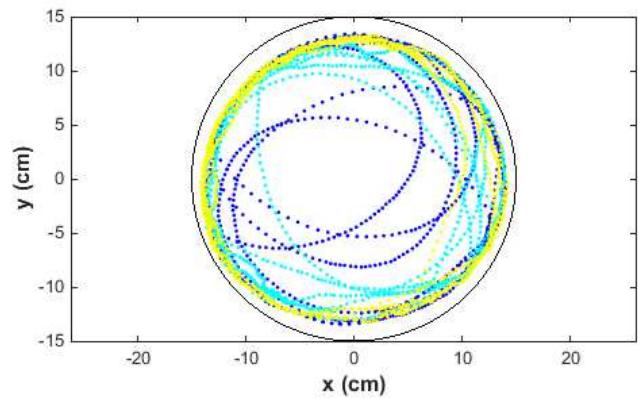


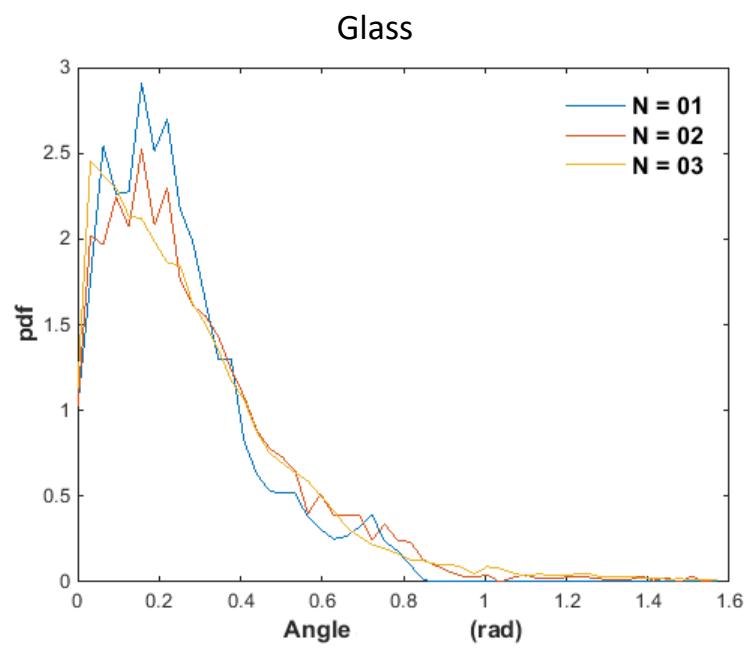
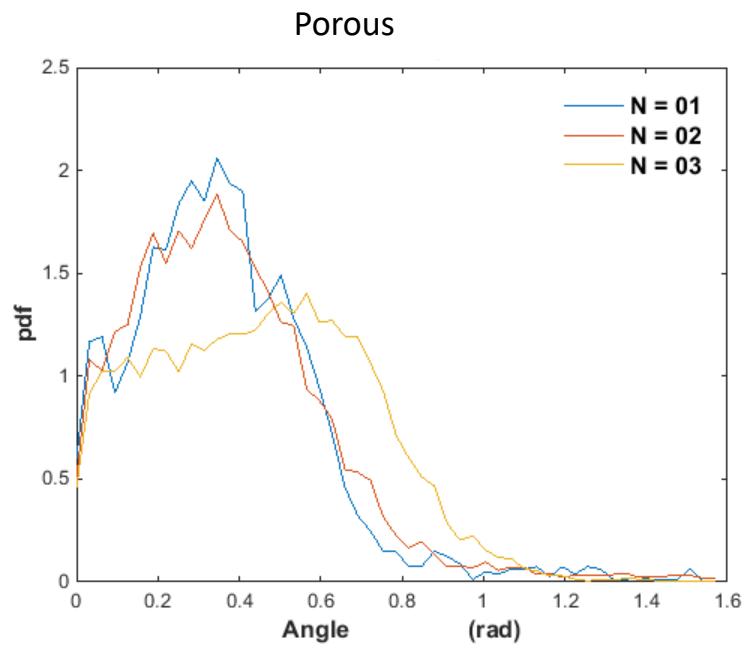
Glass container 1,2,3 Fish



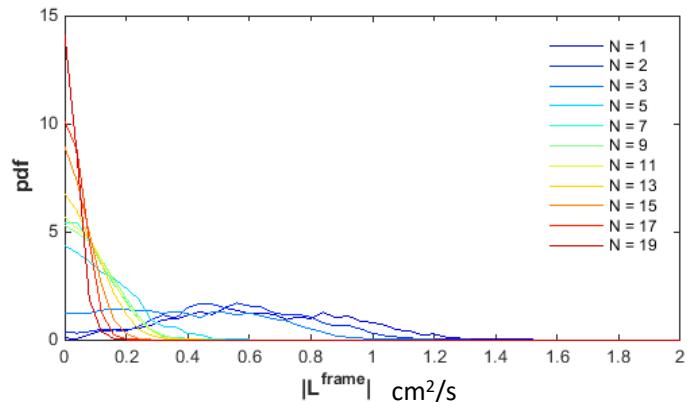
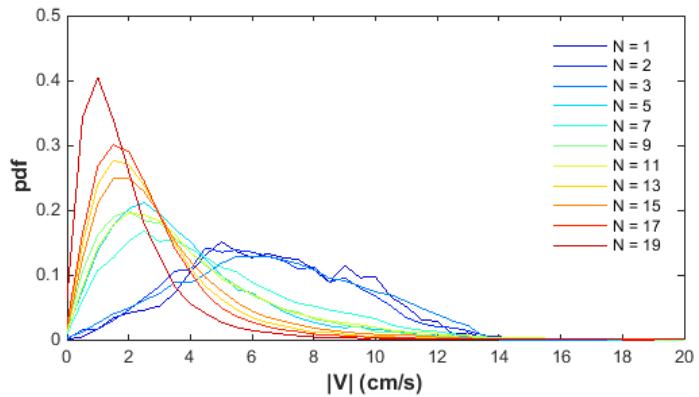
$$L^{\text{frame}}(t) = \frac{1}{N_{\text{fish}}} \sum_{\text{fish}} \overrightarrow{r(t)} \wedge \overrightarrow{V(t)}$$

Porous container 1,2,3 Fish

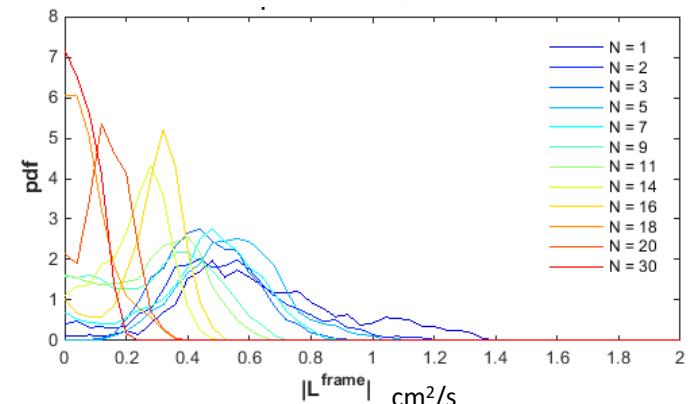
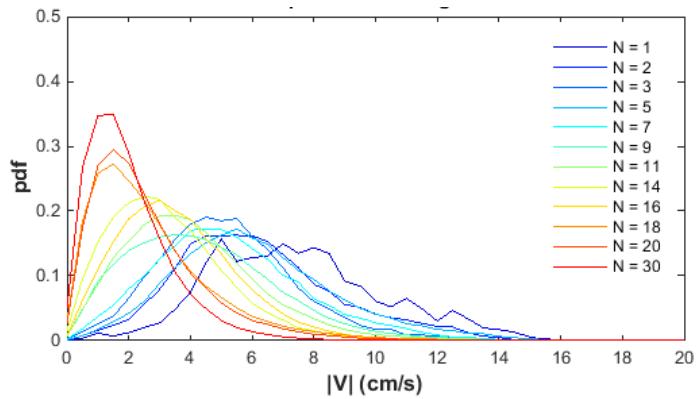


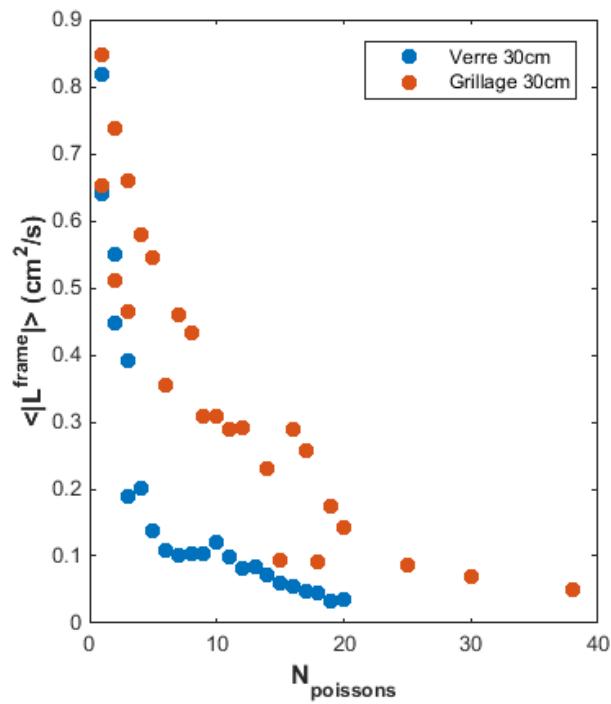
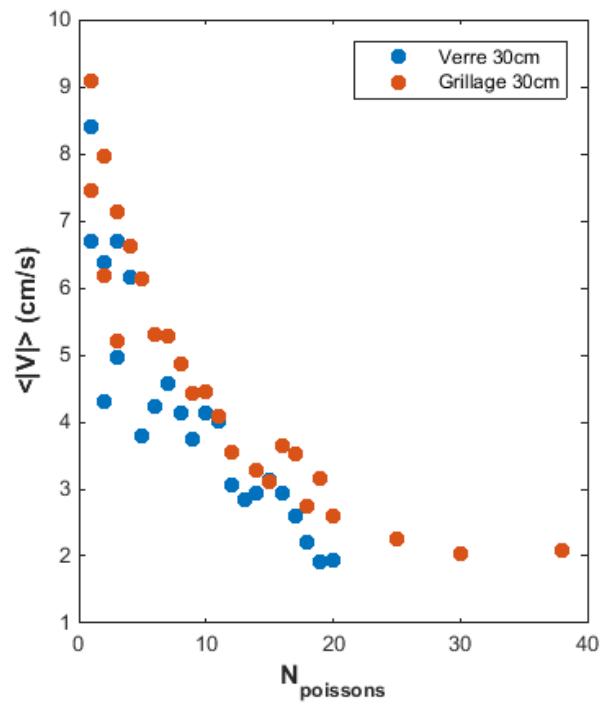


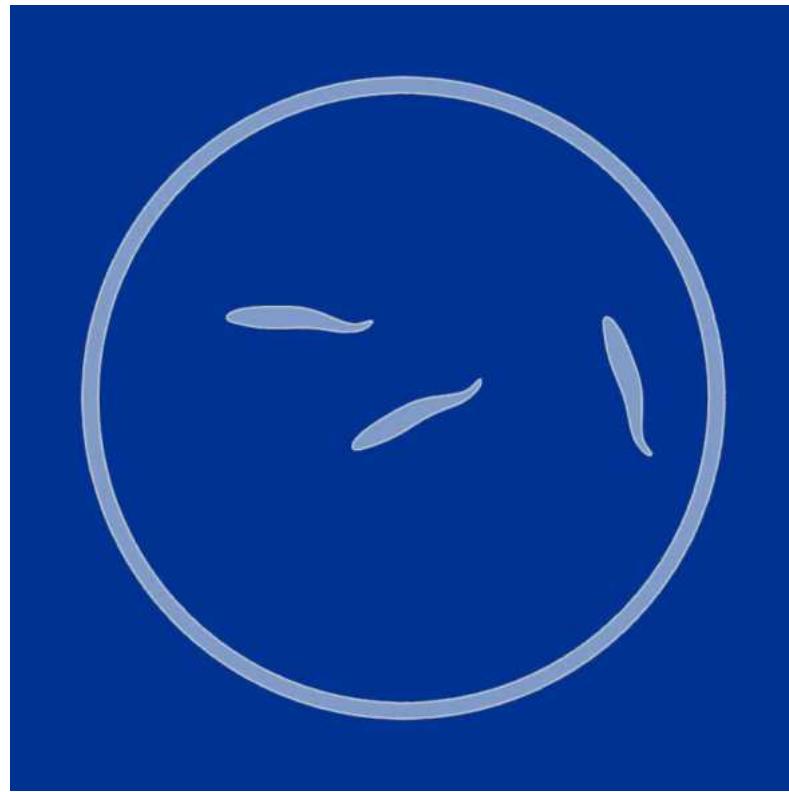
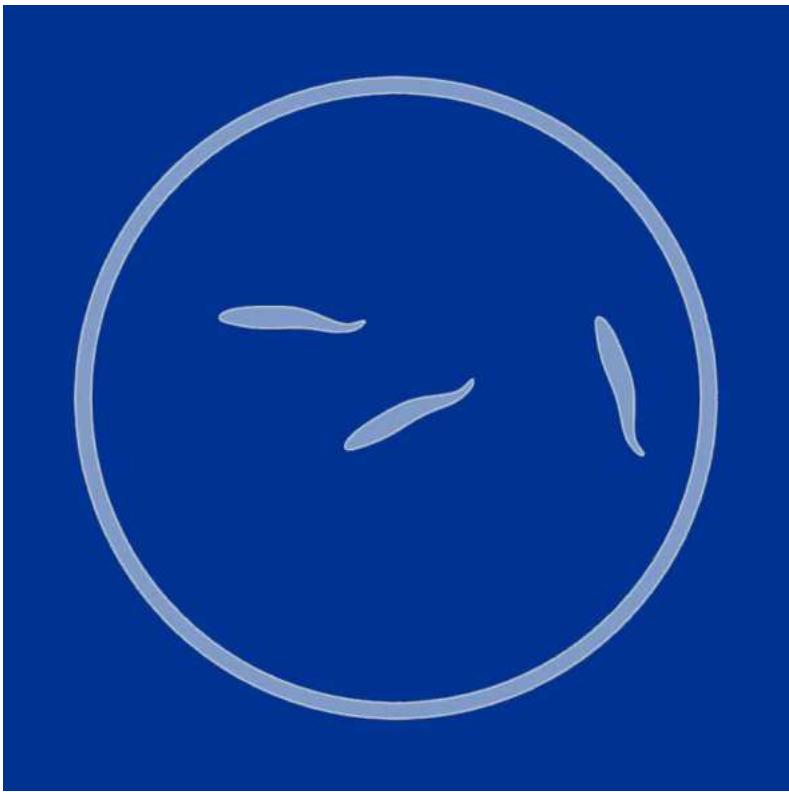
Glass

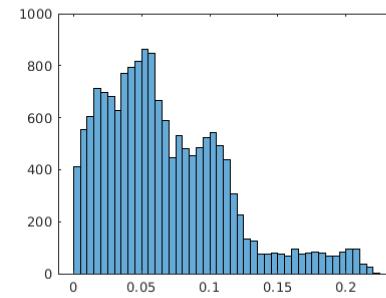
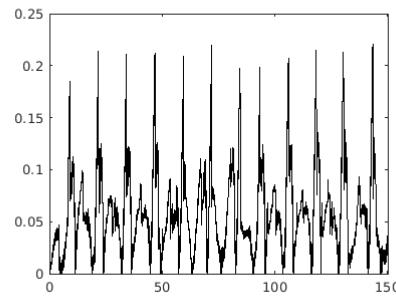
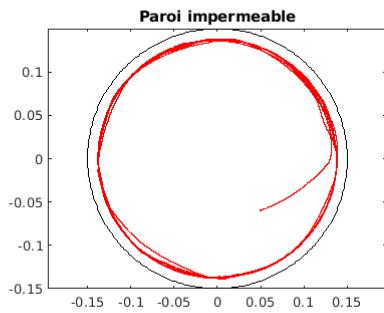
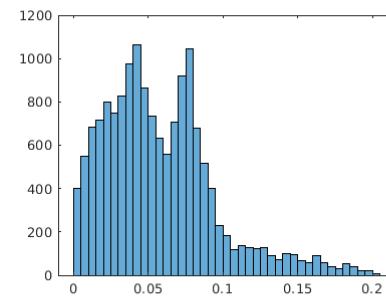
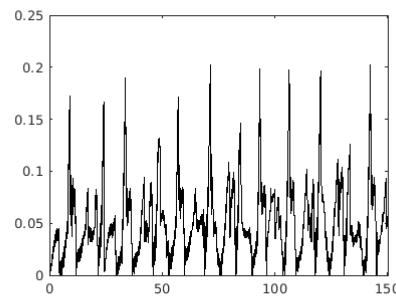
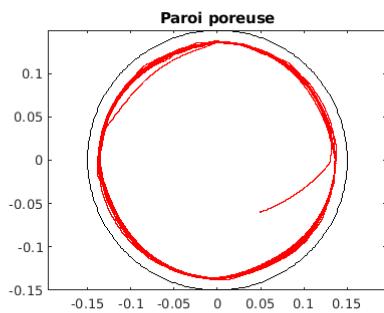
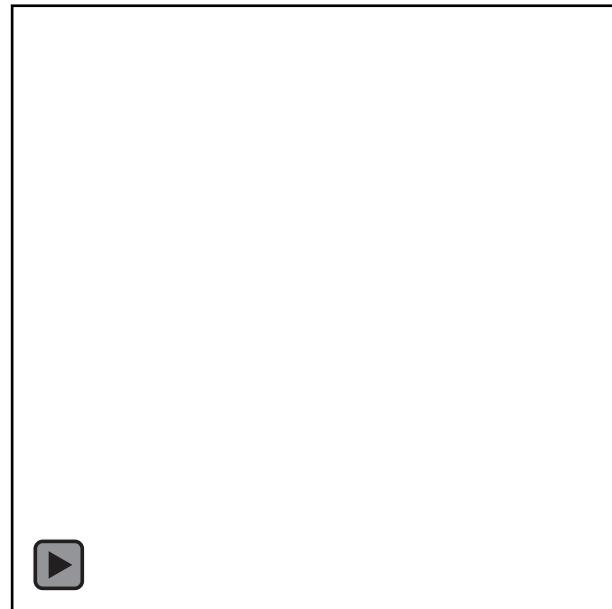
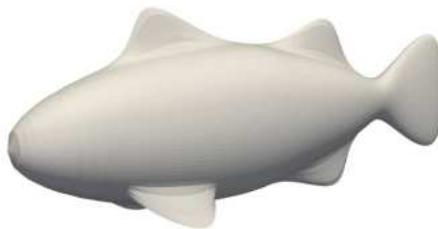


Porous



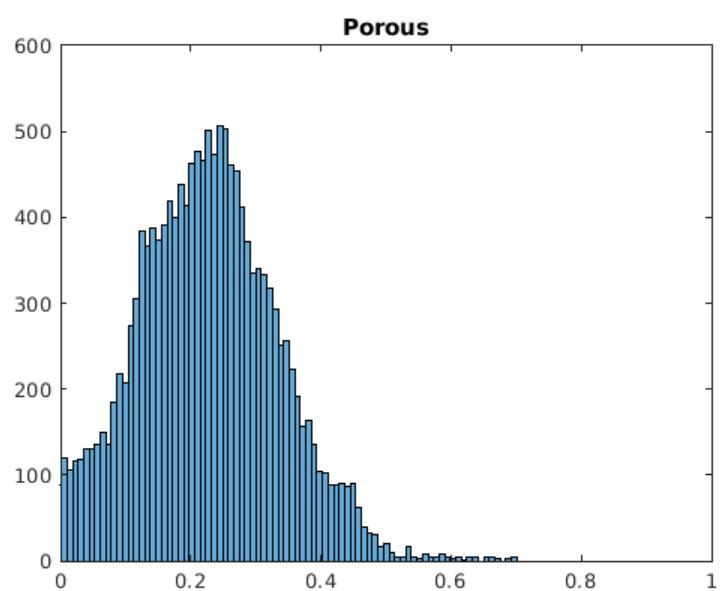
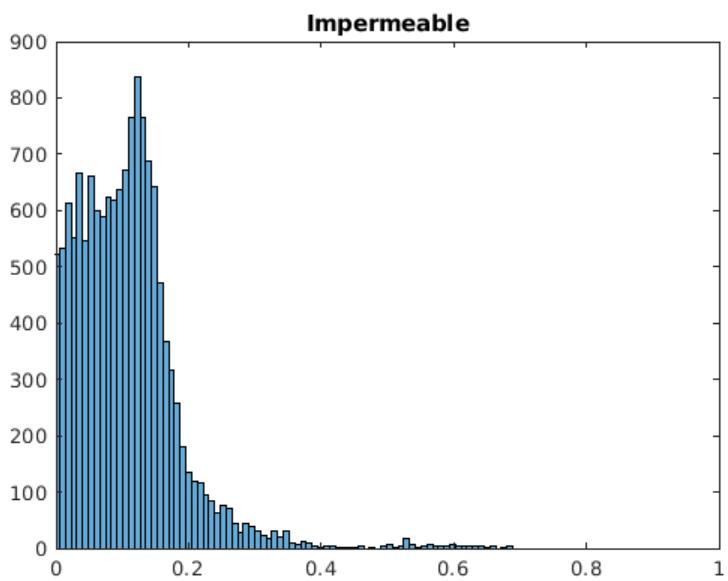


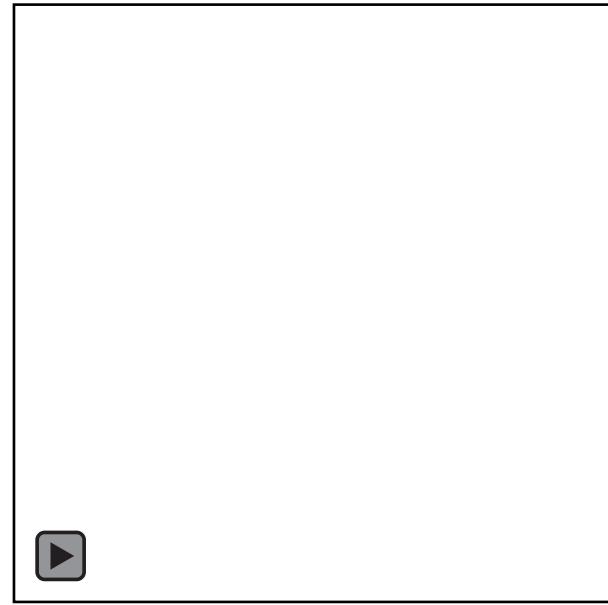
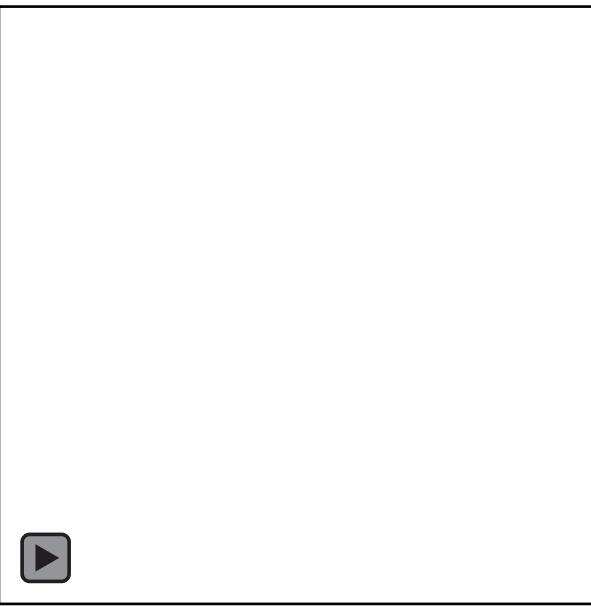


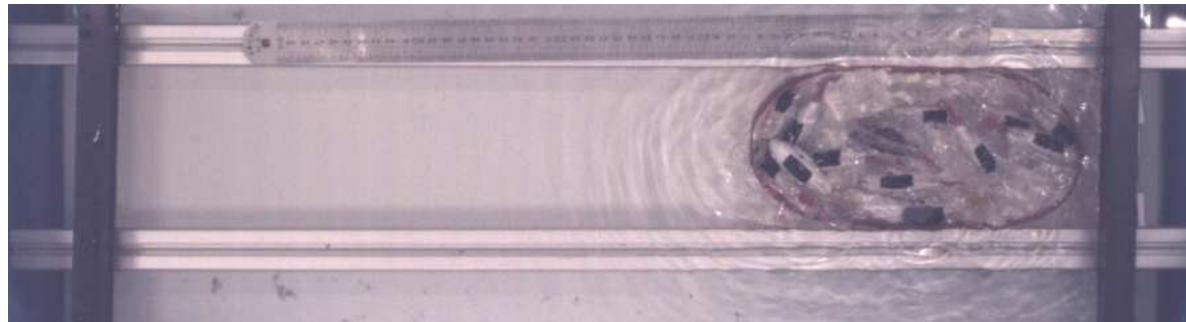
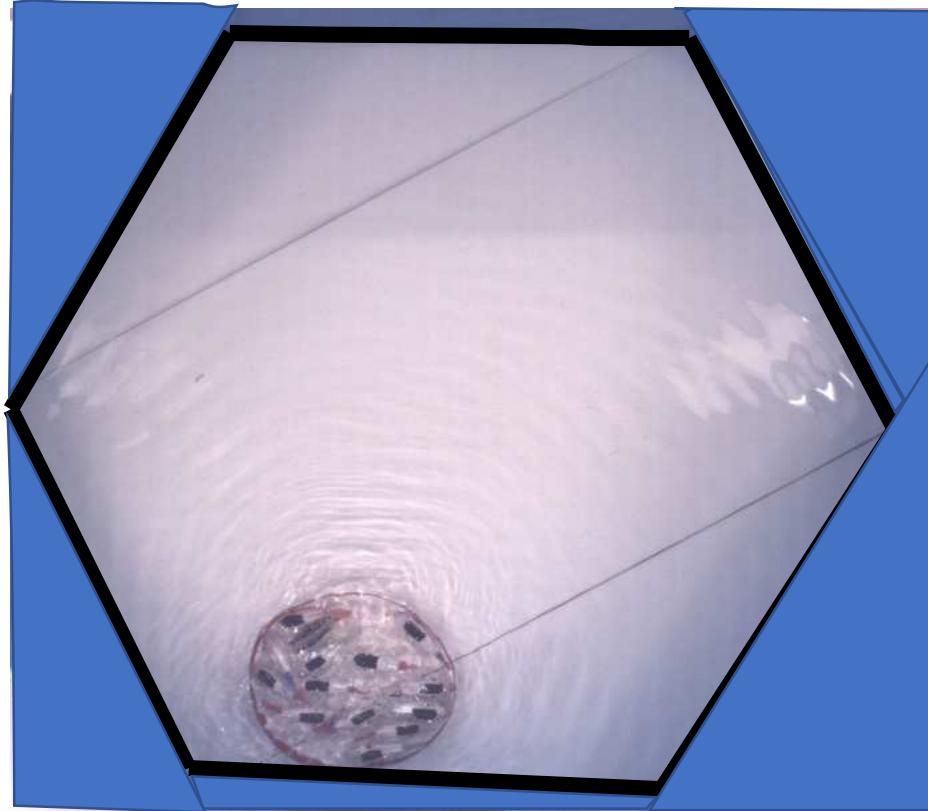




Angle at the wall







Thanks for your attention

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