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A simplified model of aquatic locomotion

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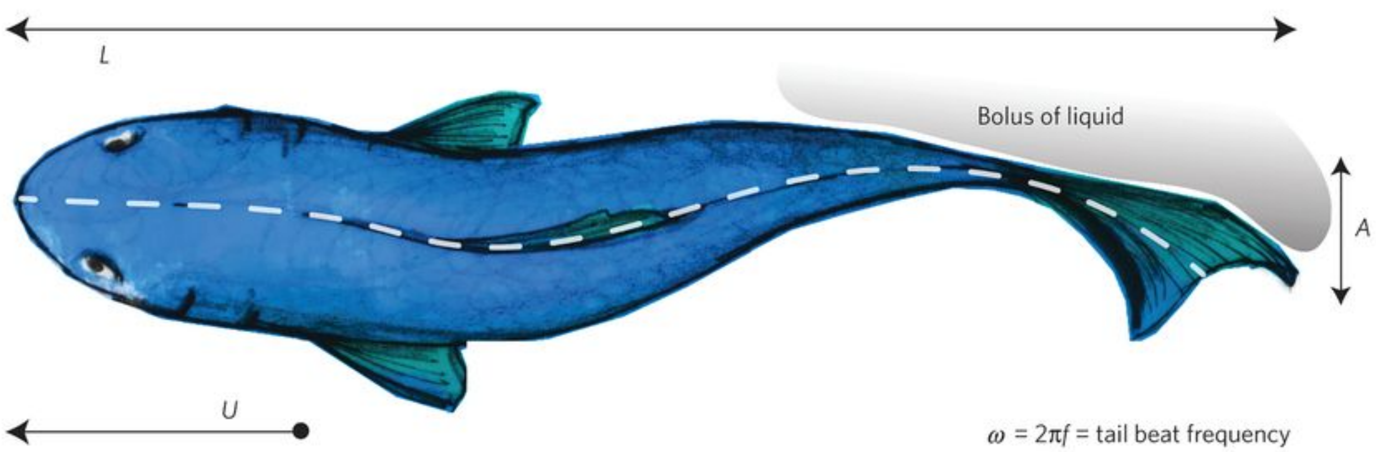
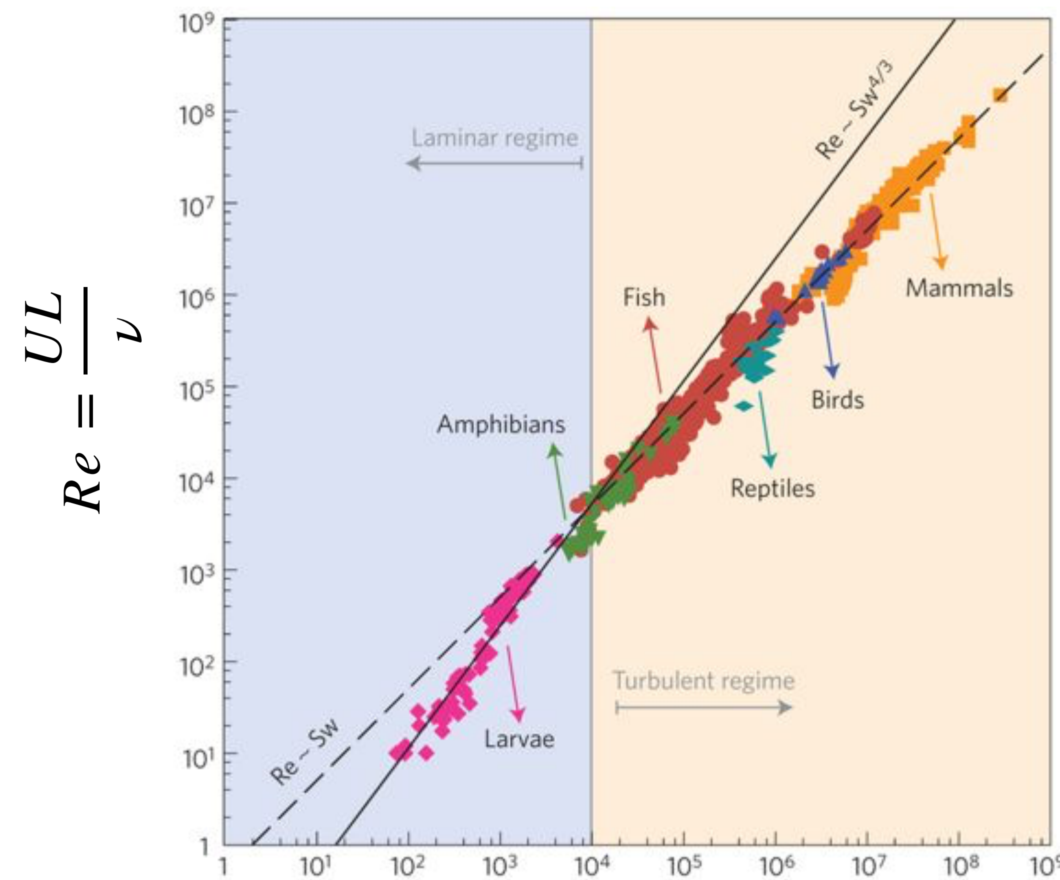


Gazzola et al. (2014)



- **Basic principles** to derive the locomotion of aquatic swimmers $Sw = \frac{AL\omega}{\nu}$

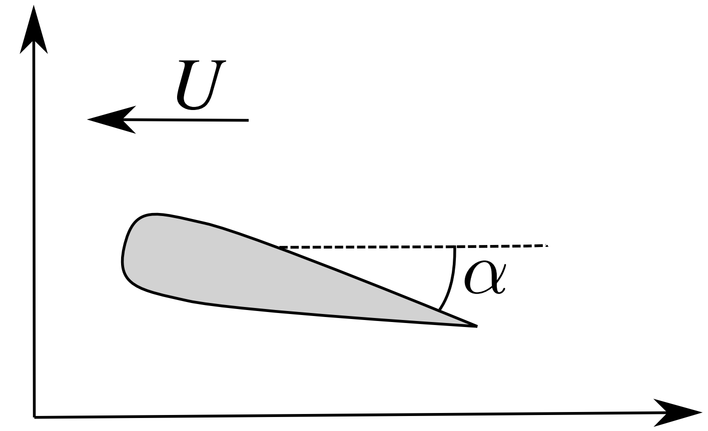
- Equilibrium of **drag force** and **added mass** effects

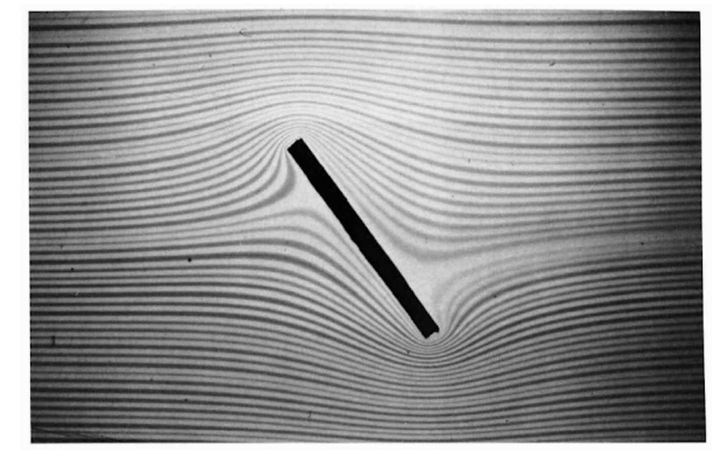
- This leads us to a **scaling relation** $U \sim A\,\omega$

Modelling the swimming

- **Incompressible**, **irrotational** and **inviscid** flow
- **Two dimensional** geometry and a swimmer in the shape of a **segment**
- We impose a **sinusoidal** tail motion

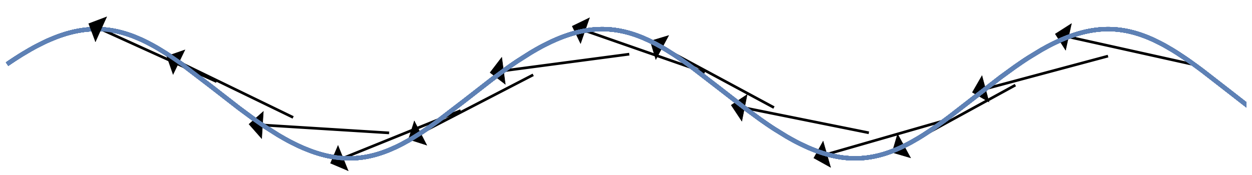
$$\alpha = \alpha_0 \sin \omega t$$





- Pressure and hydrodynamical forces are calculated by **Bernoulli relation**

$$\frac{\partial \phi}{\partial t} + \frac{1}{2}U^2 + \frac{p}{\rho} = 0$$



Trajectory of the swimmer

- Our model predictions are **in accordance** with the scaling relation
- Within a **perturbative expansion** we compute analytically the swimming velocity.