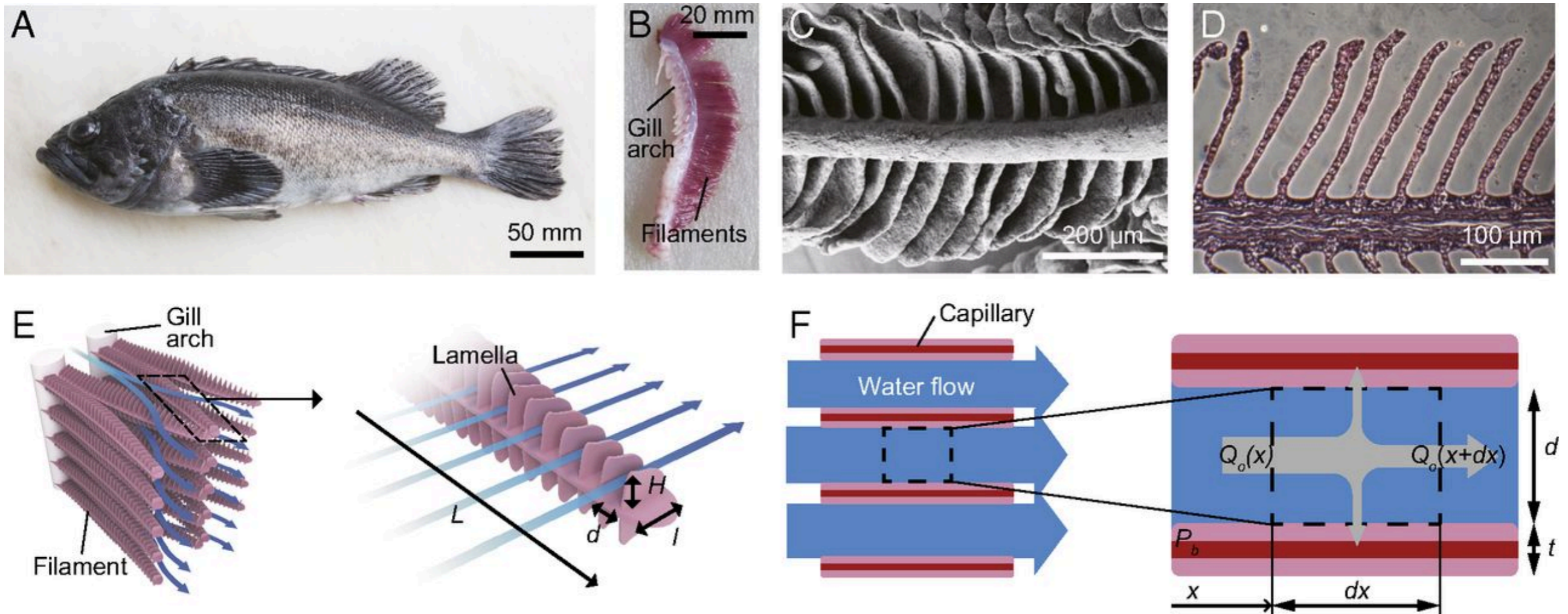
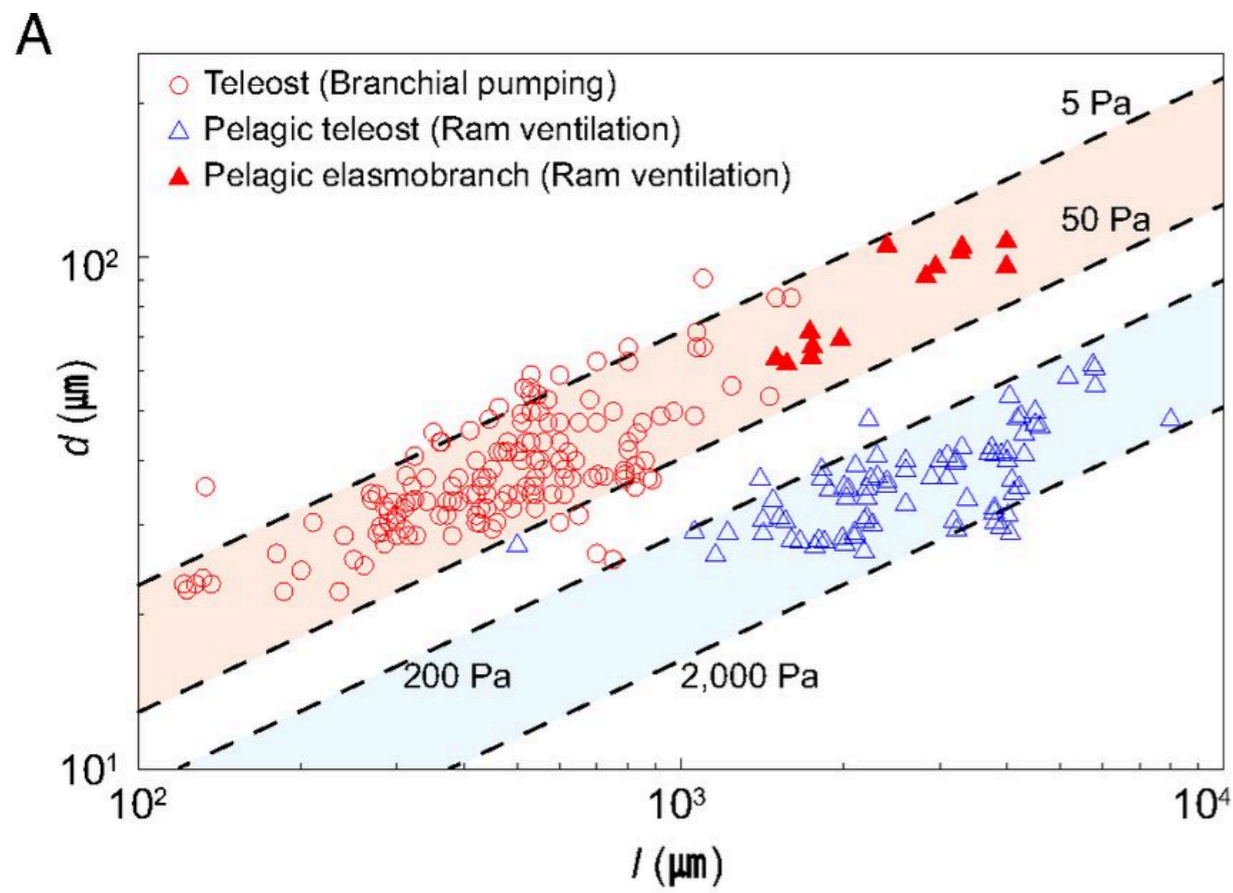
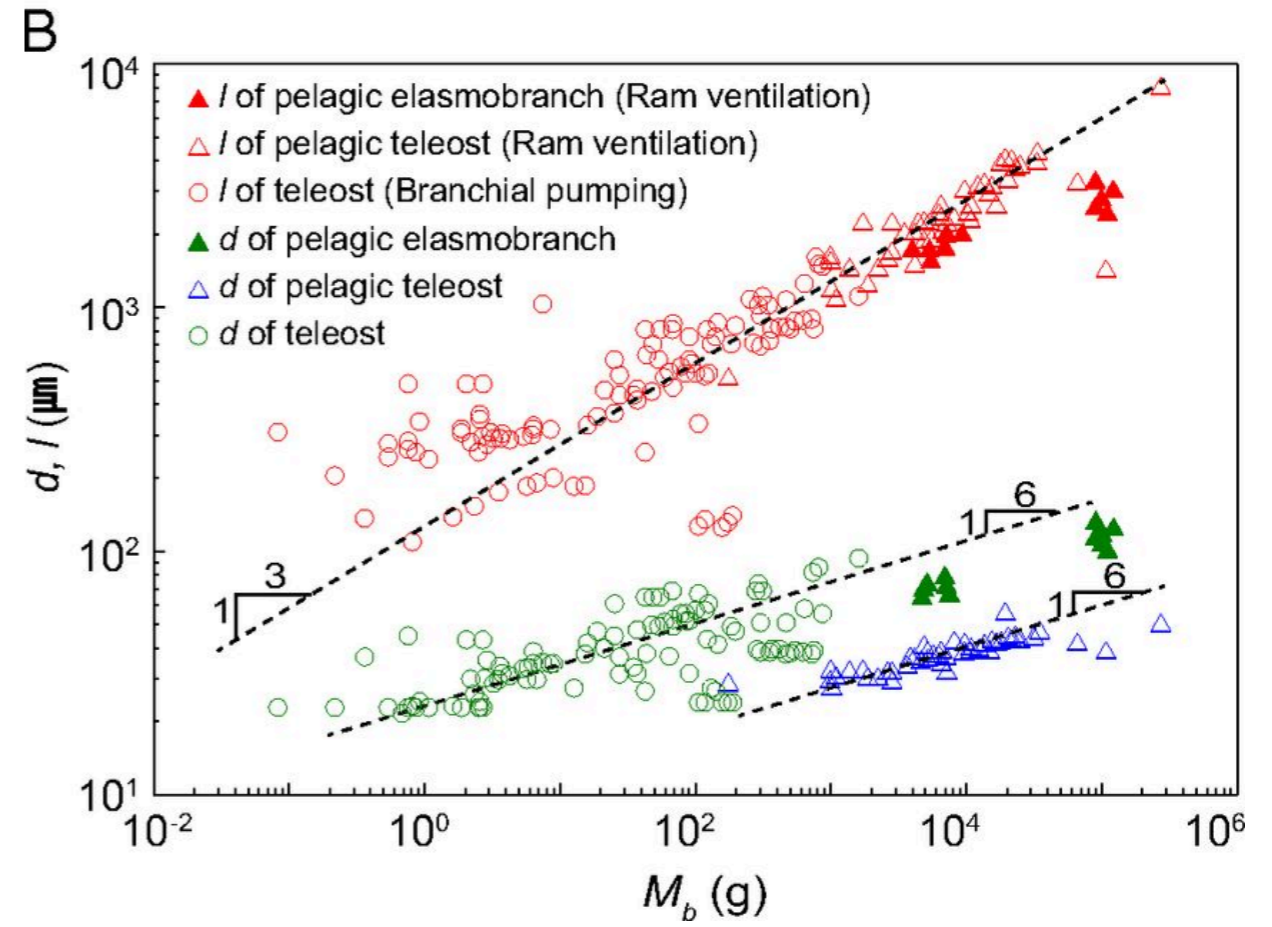


# Is there an optimum size of fish gills lamella ?



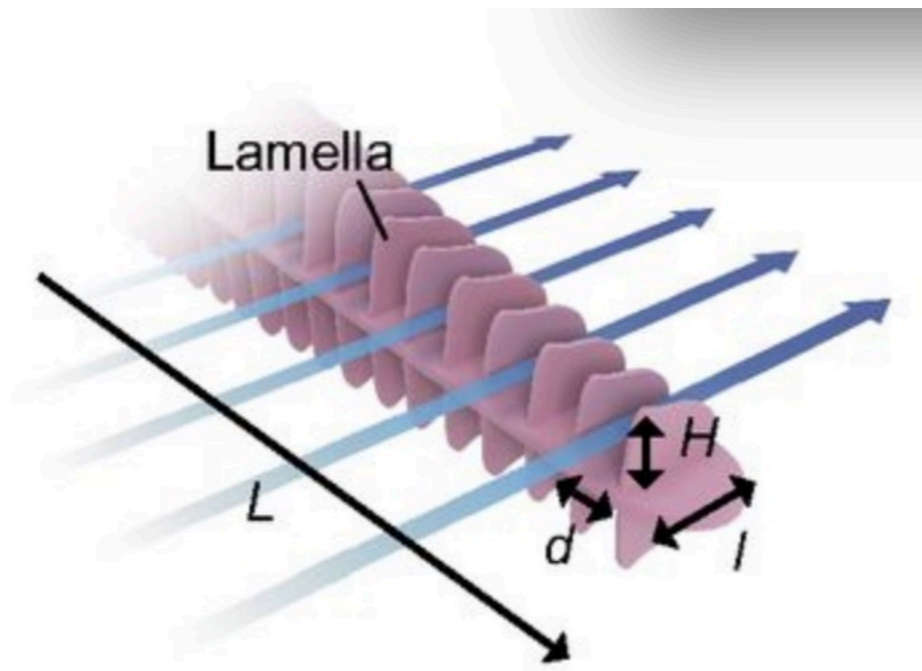


$$d \sim l^{1/2}$$



$$d \sim M_b^{1/6}$$

Scaling laws for lamella spacing and length



Typical sizes  
 $d \sim 50 \mu\text{m}$   
 $H \sim 400 \mu\text{m}$   
 $l \sim 1 \text{ mm}$

What is the order of magnitude of the Reynolds and Peclet number ?  
 Flow field within the channels ?  
 Write the transport equation for  $\text{O}_2$   
 Boundary conditions on  $\text{O}_2$  concentration ?

$D_{\text{O}_2} \sim 10^{-9} \text{ m}^2/\text{s}$

$v_{\text{O}_2} \sim 10^{-6} \text{ m}^2/\text{s}$

$U \sim 1 \text{ cm/s}$

$Re \sim 0.5$

$Pe \sim 500$

Laminar Poiseuille Flow (parabolic velocity profile)

# Model experiment

Channel length  $L = 70$  mm

Channel width  $W = 2$  mm

Central channel height  $d$  70 to 190  $\mu\text{m}$

Top and bottom channels height 200  $\mu\text{m}$

$$U = (d^2 / 12 \eta) \Delta p / L$$

