



Figure S1: We imagine two scenarios: if the representative cell is moving to the right at  $(x, t)$ , it may have swum along the path  $(x-l_+, t-\delta t_+) \rightarrow (x, t)$  with the initial activity  $a(x-l_+, t-\delta t_+) = \bar{a}(x, t)$ ; if the cell is moving to the left at  $(x, t)$ , it may have come from the path  $(x+l_-, t-\delta t_-) \rightarrow (x, t)$  with  $a(x+l_-, t-\delta t_-) = \bar{a}(x, t)$ .