第185回　臨時生物学セミナー

日時： 4月2日（月）　13:00-15:00

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The currently accepted interpretation of the clock and wavefront model of somitogenesis is that a posteriorly moving molecular gradient sequentially slows the rate of clock oscillations, resulting in a spatial readout of temporal oscillations. However, while molecular components of the clocks and wavefronts have now been identified in the pre-somitic mesoderm (PSM), there is not yet conclusive evidence demonstrating that the observed molecular wavefronts act to slow clock oscillations. Here we present an alternative formulation of the clock and wavefront model in which oscillator coupling, already known to play a key role in oscillator synchronisation, plays a fundamentally important role in the slowing of oscillations along the anterior–posterior (AP) axis. Our model has three parameters that can be determined, in any given species, by the measurement of three quantities: the clock period in the posterior PSM, somite length and the length of the PSM. A travelling wavefront, which slows oscillations along the AP axis, is an emergent feature of the model. Using the model we predict: (a) the distance between moving stripes of gene expression; (b) the number of moving stripes of gene expression and (c) the oscillator period profile along the AP axis. Predictions regarding the stripe data are verified using existing zebrafish data. We simulate a range of experimental perturbations and demonstrate how the model can be used to unambiguously define a reference frame along the AP axis. Comparing data from zebrafish, chick, mouse and snake, we demonstrate that: (a) variation in patterning profiles is accounted for by a single nondimensional parameter; the ratio of coupling strengths; and (b) the period profile along the AP axis is conserved across species. Thus the model is consistent with the idea that, although the genes involved in pattern propagation in the PSM vary, there is a conserved patterning mechanism across species.

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