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Zygotic Wnt Activity Is Required for *Brachyury* Expression in the Early *Xenopus laevis* Embryo

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Abstract

The canonical, β-catenin-dependent Wnt pathway is a crucial player in the early events of *Xenopus* development. Dorsal axis formation and mesoderm patterning are accepted effects of this pathway, but the regulation of expression of genes involved in mesoderm specification is not. This conclusion is based largely on the inability of the Wnt pathway to induce mesoderm in animal cap explants. Using injections of inhibitors of canonical Wnt signaling, we demonstrate that expression of the general mesodermal marker *Brachyury* (*Xbra*) requires a zygotic, ligand-dependent Wnt activity throughout the marginal zone. Analysis of the *Xbra* promoter reveals that putative TCF-binding sites mediate Wnt activation, the first sites in this well-studied promoter to which an activation role can be ascribed. However, established mesoderm inducers like *eFGF* and activin can bypass the Wnt requirement for *Xbra* expression. Another mesoderm promoting factor, *VegT*, activates *Xbra* in a *Wnt*-dependent manner. We also show that the activin/nodal signaling is necessary for ectopic *Xbra* induction by the Wnt pathway, but not by *VegT*. Our data significantly change the understanding of *Brachyury* regulation in *Xenopus*, implying the existence of an unknown zygotic Wnt ligand in Spemann's organizer. Since *Brachyury* is considered to have a major role in mesoderm formation, it is possible that Wnts might play a role in mesoderm specification, in addition to patterning.

Keywords

Wnt; Xbra; Tcf; mesoderm; induction; repression; eFGF; activin; zygotic; VegT

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