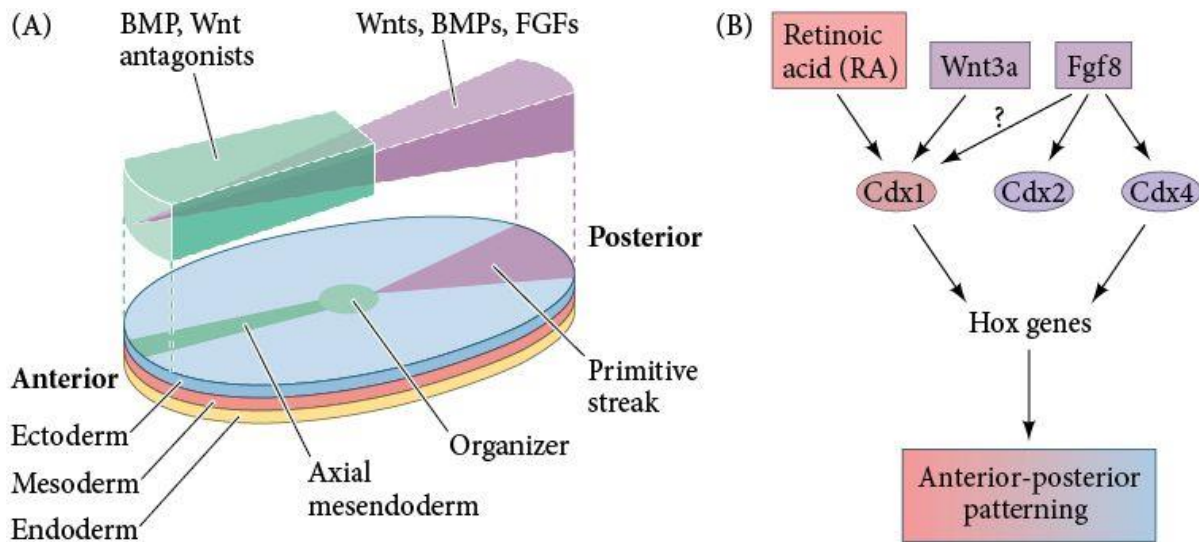


Anterior-Posterior Patterning by FGF and RA Gradients

As the primitive streak does not form in the most anterior locations, neither will the expression of Nodal and thus the head region of the mammalian embryo is largely devoid of Nodal signaling (with the exception of its role in left-right patterning). The posterior region is characterized by Nodal, BMPs, Wnts, FGFs, and retinoic acid. There appears to be a gradient of Wnt, BMP, and FGF proteins that is highest posteriorly and drops off strongly near the anterior region. Moreover, in the anterior half of the embryo, starting at the node, there is a high concentration of antagonists that prevent BMPs and Wnts from acting (Figure 1A). As we will see in Chapter 19, the Fgf8 gradient along with an opposing gradient of retinoic acid in the region of the primitive streak mainly affects the development of the somatic mesoderm (forming muscles and vertebrae), while the gradient of Wnts affect the polarity of neural development (Dubrulle and Pourquié 2004; Sakai et al. 2001; Oosterveen et al. 2004). The FGF gradient patterns the posterior portion of the embryo by working through the Cdx family of caudal-related genes (Figure 1B; Lohnes 2003). The Cdx genes, in turn, integrate the various posteriorization signals and activate particular Hox genes.



A after L. Robb and P. P. L. Tam. 2004. *Sem Cell Dev Biol* 15: 543-554; B after D. Lohnes. 2003. *BioEssays* 25: 971-980.

Figure 1 Anterior-posterior patterning in the mouse embryo. (A) Concentration gradients of BMPs, Wnts, and FGFs in the late-gastrula mouse embryo (depicted as a flattened disc). The primitive streak and other posterior tissues are the sources of Wnt and BMP proteins, whereas the organizer and its derivatives (such as the notochord) produce antagonists. Fgf8 is expressed in the posterior tip of the gastrula and continues to be made in the tailbud. Its mRNA decays, creating a gradient across the posterior portion of the embryo. (B) Retinoic acid, Wnt3a, and Fgf8 each contribute to posterior patterning, but they are integrated by the Cdx family of proteins that regulates the activity of the Hox genes.

Literature Cited

Dubrulle, J. and O. Pourquié. 2004. Fgf8 mRNA decay establishes a gradient that couples axial elongation to patterning in the vertebrate embryo. *Nature* 427: 419–422.

[PubMed Link](#)

Lohnes, D. 2003. The Cdx1 homeodomain protein: An integrator of posterior signaling in the mouse. *Bioessays* 25: 971–980.

[PubMed Link](#)

Oosterveen, T., F. Meijlink and J. Deschamps. 2004. Expression of retinaldehyde dehydrogenase II and sequential activation of 5' Hoxb genes in the mouse caudal hindbrain. *Gene Expr. Patterns* 4: 243–247.

[PubMed Link](#)

Sakai, Y. and 7 others. 2001. The retinoic acid-inactivating enzyme CYP26 is essential for establishing an uneven distribution of retinoic acid along the anterior-posterior axis within the mouse embryo. *Genes Dev.* 15: 213–225.

[PubMed Link](#)

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