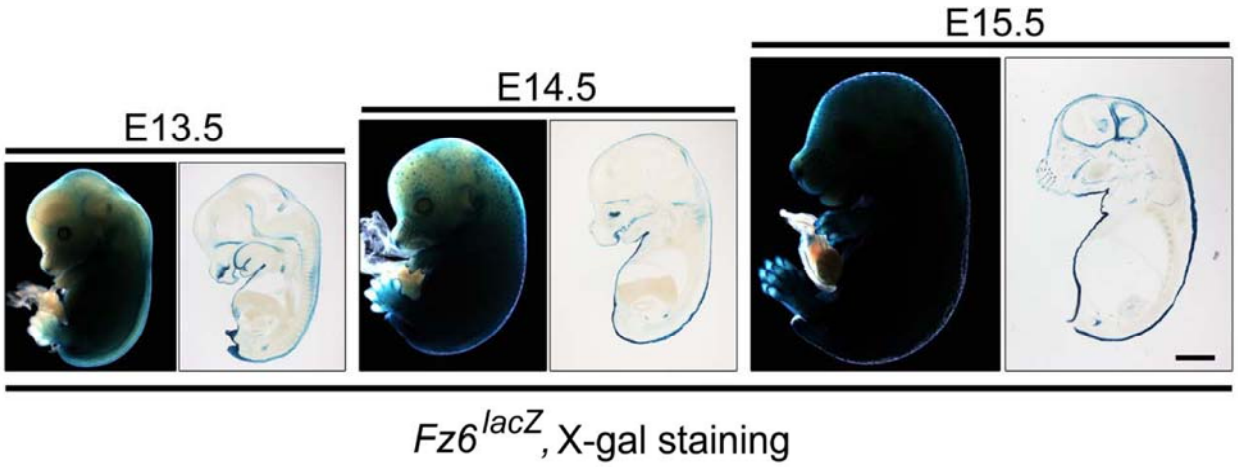


**Figure S1. Expression of *Fz6*$^{lacZ}$ in E13.5, E14.5, and E15.5 embryos.**

X-gal staining on whole-mount *Fz6*$^{lacZ}$ embryos and vibratome sections from E13.5 to E15.5 show *Fz6* expression in developing skin, tongue and blood vessels. Within the skin, *Fz6*$^{lacZ}$ expression is detected over the entire body surface.

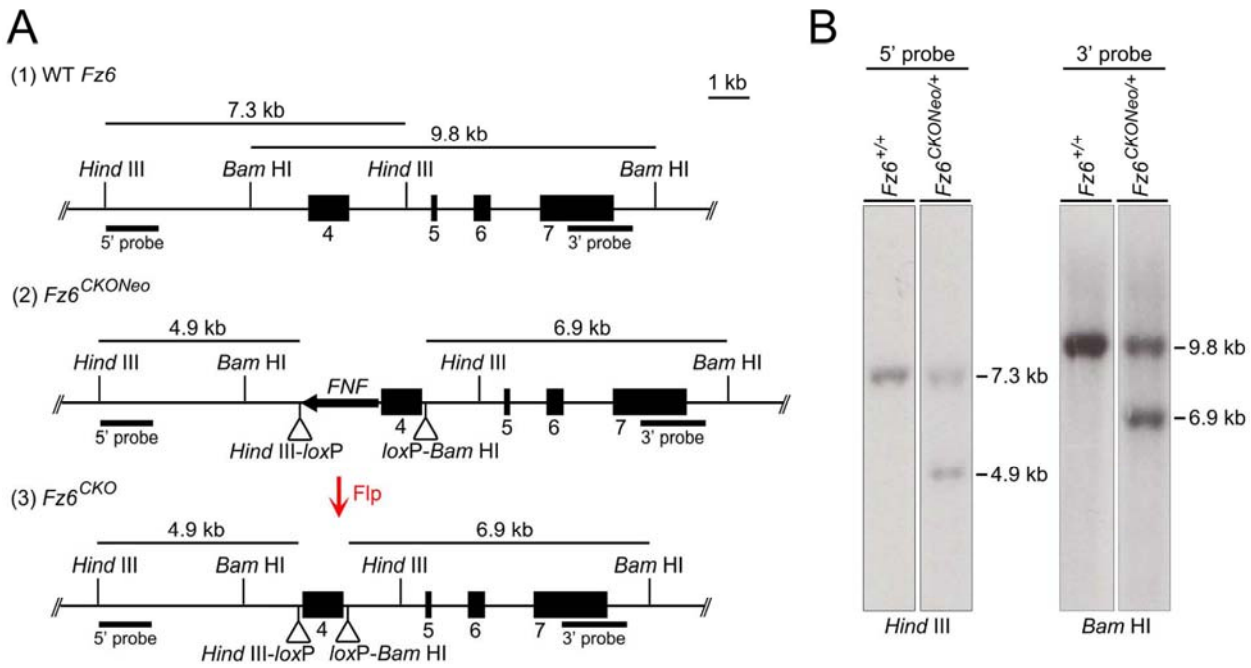


**Figure S2. Strategy for constructing the *Fz6$^{CKO}$* allele.**

(A) Restriction maps, exons (solid black bars, with exons numbered), Southern blot probes flanking the 5' and 3' homology arms of the gene targeting construct, and Southern blot fragment sizes (horizontal bars) are shown for the *WT Fz6* locus (top), the *Fz6* locus after targeting with the *Neo* resistance marker present (middle), and the *Fz6$^{CKO}$* allele (bottom). Germline Flp-recombinase was use to excise the *Neo* marker from a *Frt-Neo-Frt* (*FNF*) cassette.

(B) Southern blots of parental (*WT*) and heterozygous gene targeted (*Fz6$^{CKO\text{-}Neo/+}$*) ES cells.

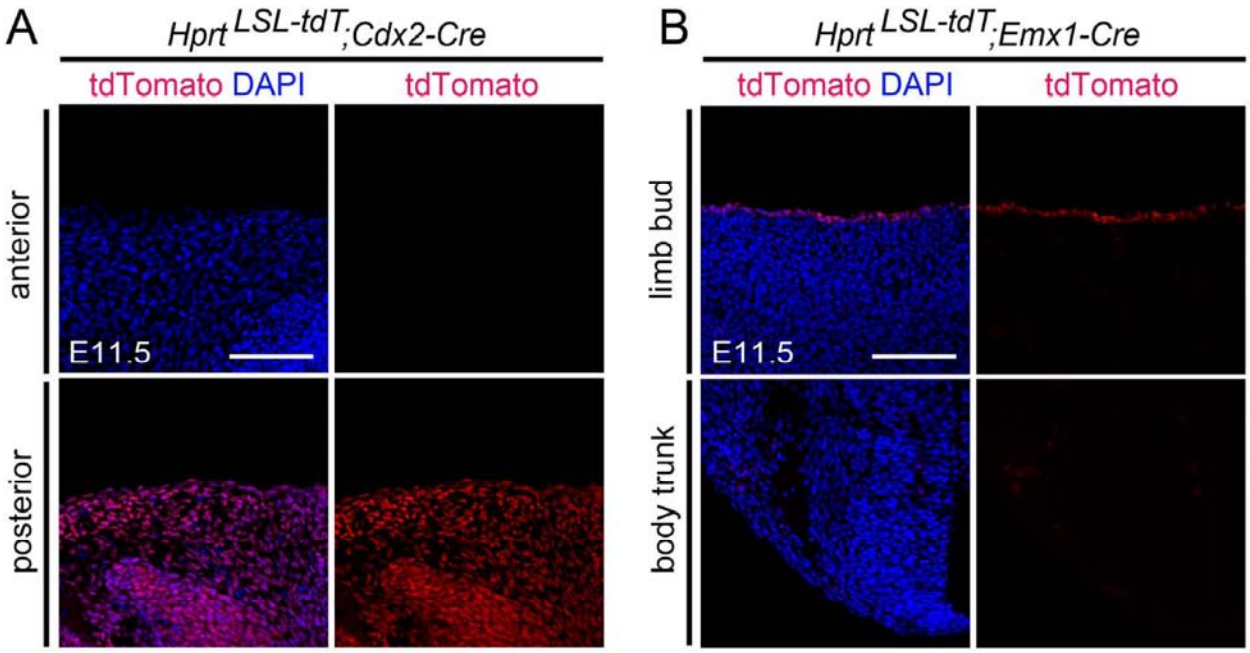


**Figure S3. Expression of *Cdx2-Cre* and *Emx1-Cre* at E11.5.**

(A) Sagittal sections of an E11.5 embryo show that *Cdx2-Cre* recombines the *Hprt-LSL-tdT* reporter in the posterior but not in the anterior of the body.

(B) Cross sections of an E11.5 embryo show that *Emx1-Cre* recombines the *Hprt-LSL-tdT* reporter in the limb bud but not in the body trunk.

Scale bars, 100 um.

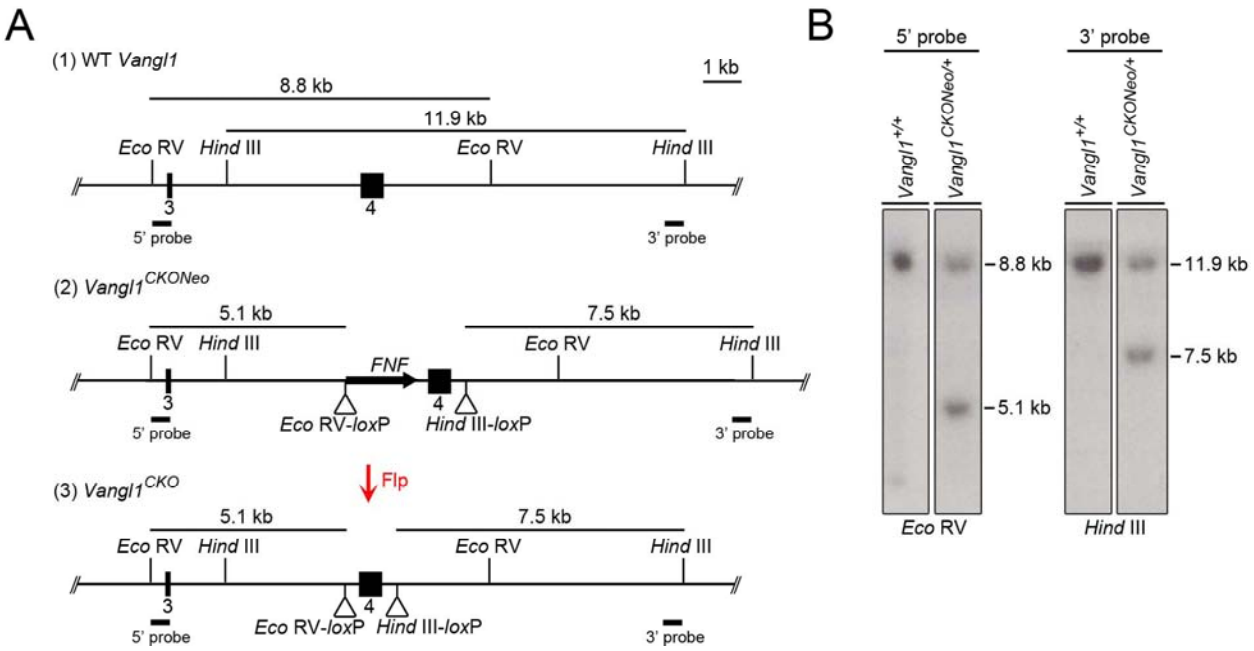


**Figure S4. Strategy for constructing the *Vangl1*$^{CKO}$ allele.**

(A) Restriction maps, exons (solid black bars, with exons numbered), Southern blot probes flanking the 5' and 3' homology arms of the gene targeting construct, and Southern blot fragment sizes (horizontal bars) are shown for the *WT Vangl1* locus (top), the *Vangl1* locus after targeting with the *Neo* resistance marker present (middle), and the *Vangl1*$^{CKO}$ allele (bottom). Germline Flp-recombinase was use to excise the *Neo* marker from an *Frt-Neo-Frt* (*FNF*) cassette.

(B) Southern blots of parental (*WT*) and heterozygous gene targeted (*Vangl1*$^{CKO\text{-}Neo/+}$) ES cells.

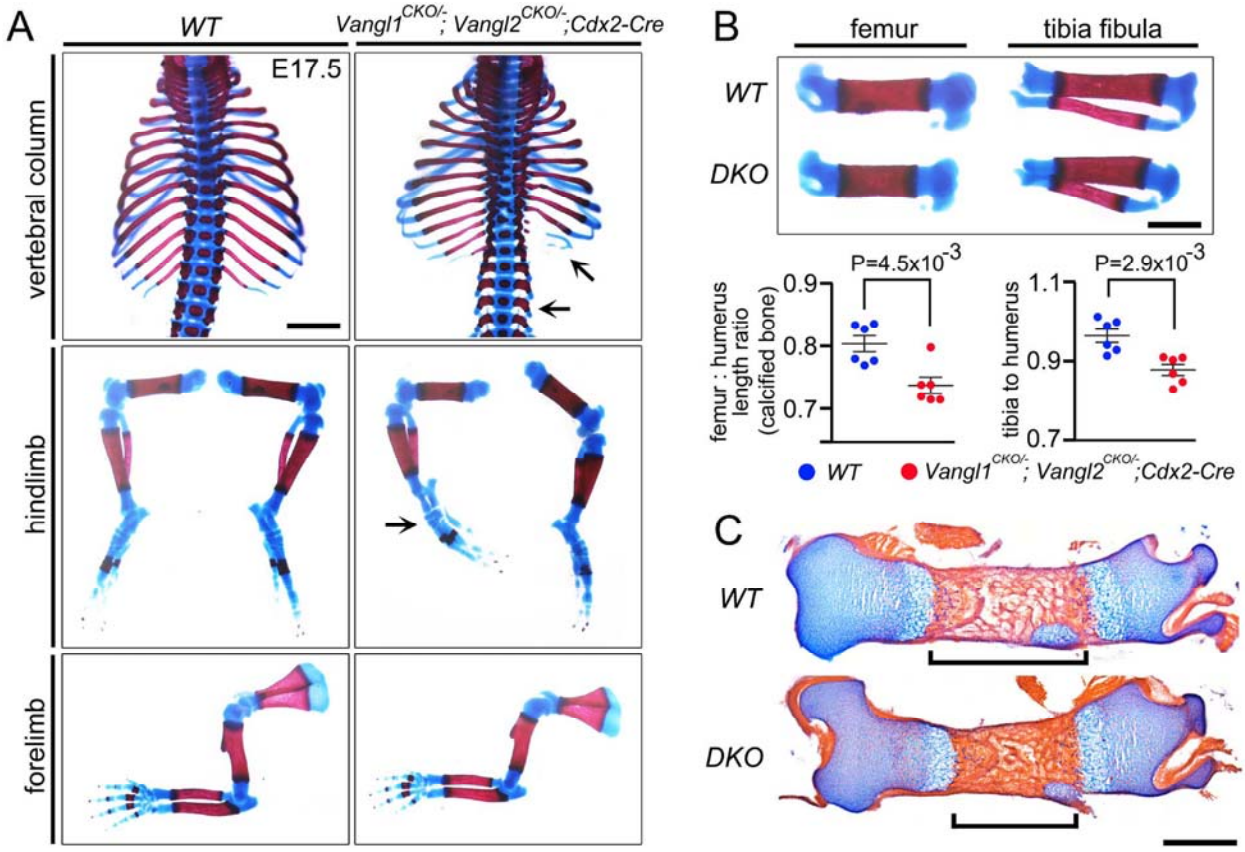


**Figure S5. Roles of Vangl1 and Vangl2 in skeletal patterning.**

(A) Skeletal phenotypes caused by posterior deletion of *Vangl1* and *Vangl2*. E17.5 *Vangl1*$^{CKO/-}$*;Vangl2*$^{CKO/-}$*;Cdx2-Cre* embryos, stained with alizarin red (calcified bone) and alcian blue (cartilage), show multiple defects in the posterior of the body: fusion and ossification defects in lower ribs, caudal vertebral column malformation and tail truncation, retarded growth of the hind limbs, and clubfoot (arrows). The torso, skull, and forelimbs are normal. Scale bar, 2 mm.

(B) Calcified bone length of femur and tibia are measured and normalized by the length of humerus. *Vangl1*$^{CKO/-}$*;Vangl2*$^{CKO/-}$*;Cdx2-Cre* embryos show significant reduced length in both femur and tibia. Scale bar, 1 mm.

(C) Alizarin red and alcian blue staining on section show overall normal but shortened femoral morphology in *Vangl1*$^{CKO/-}$*;Vangl2*$^{CKO/-}$*;Cdx2-Cre* embryos. Brackets indicate the calcified portion of the femur. Scale bar, 0.5 mm.