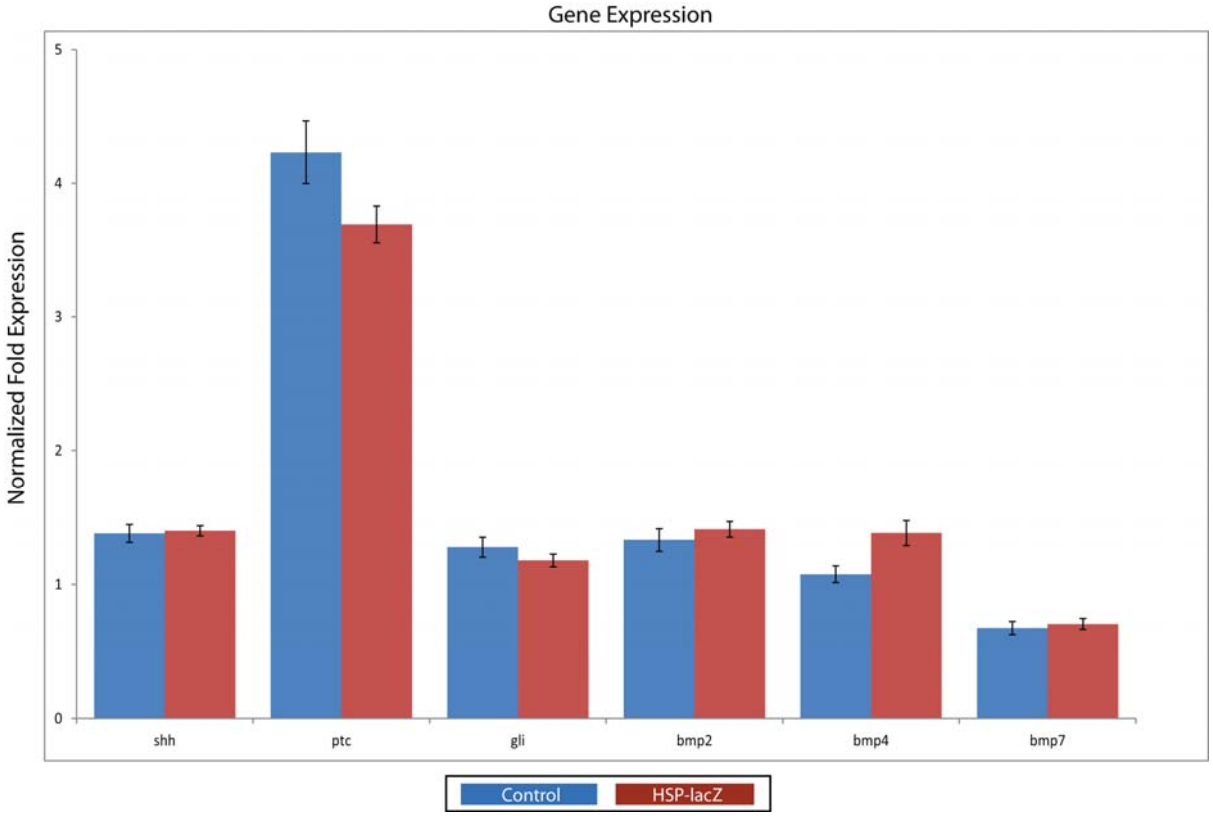


Figure S1. Gene expression is not altered by electroporation.

To control for changes in gene expression that may result from electroporation alone, embryos were electroporated with HSP-LacZ and then gene expression was analyzed 48 hours afterward. No changes in any genes in question were observed.

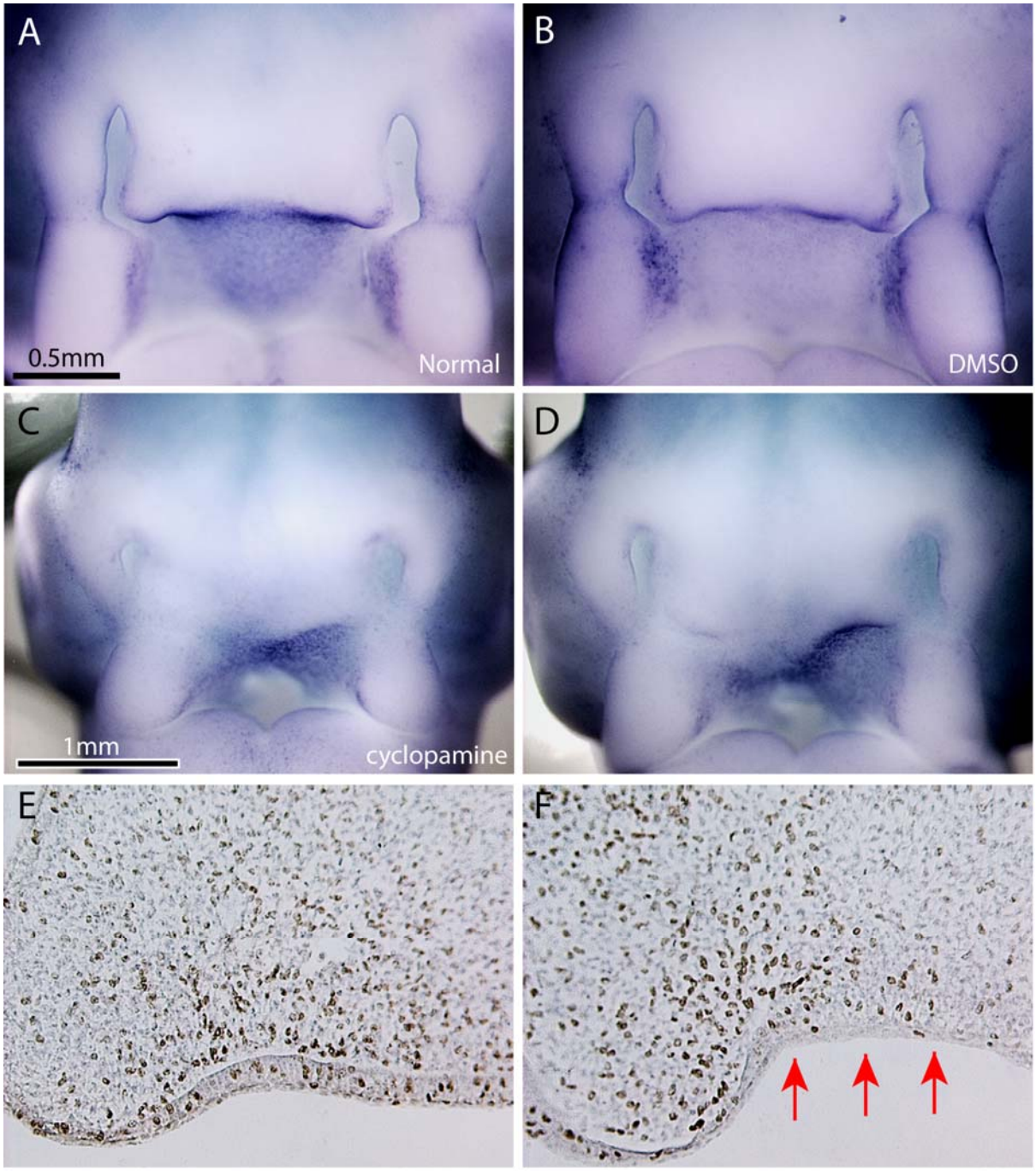


Figure S2. Cyclopamine and *Shh* expression.

(A) Normal and **(B)** control embryo illustrate the normal morphology and *Shh* expression. **(C,D)** After cyclopamine treatment the expansion of *Shh* is not observed on the treated side of the face. **(E)** Proliferation in a normal embryo. **(F)** Decreased proliferation is obvious after cyclopamine treatment (red arrows) similar to Fig. 2.

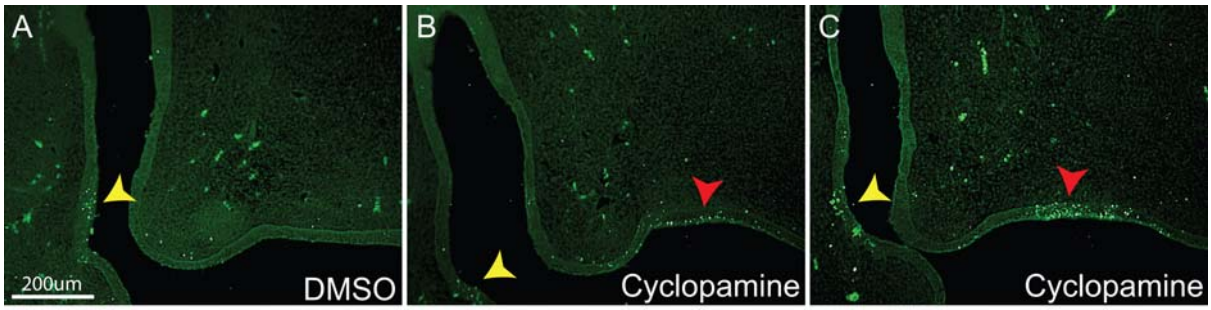


Figure S3. Cyclopamine and apoptosis.

(A) TUNEL staining in a control embryo exposed to DMSO shows few TUNEL positive cells. Programmed cell death in the lateral nasal process is evident (yellow arrow). **(B,C)** After cyclopamine treatment an increase in TUNEL positive cells were observed in the foci within the ectoderm (red arrow), but the epithelium remains intact and does not undergo widespread cell death.

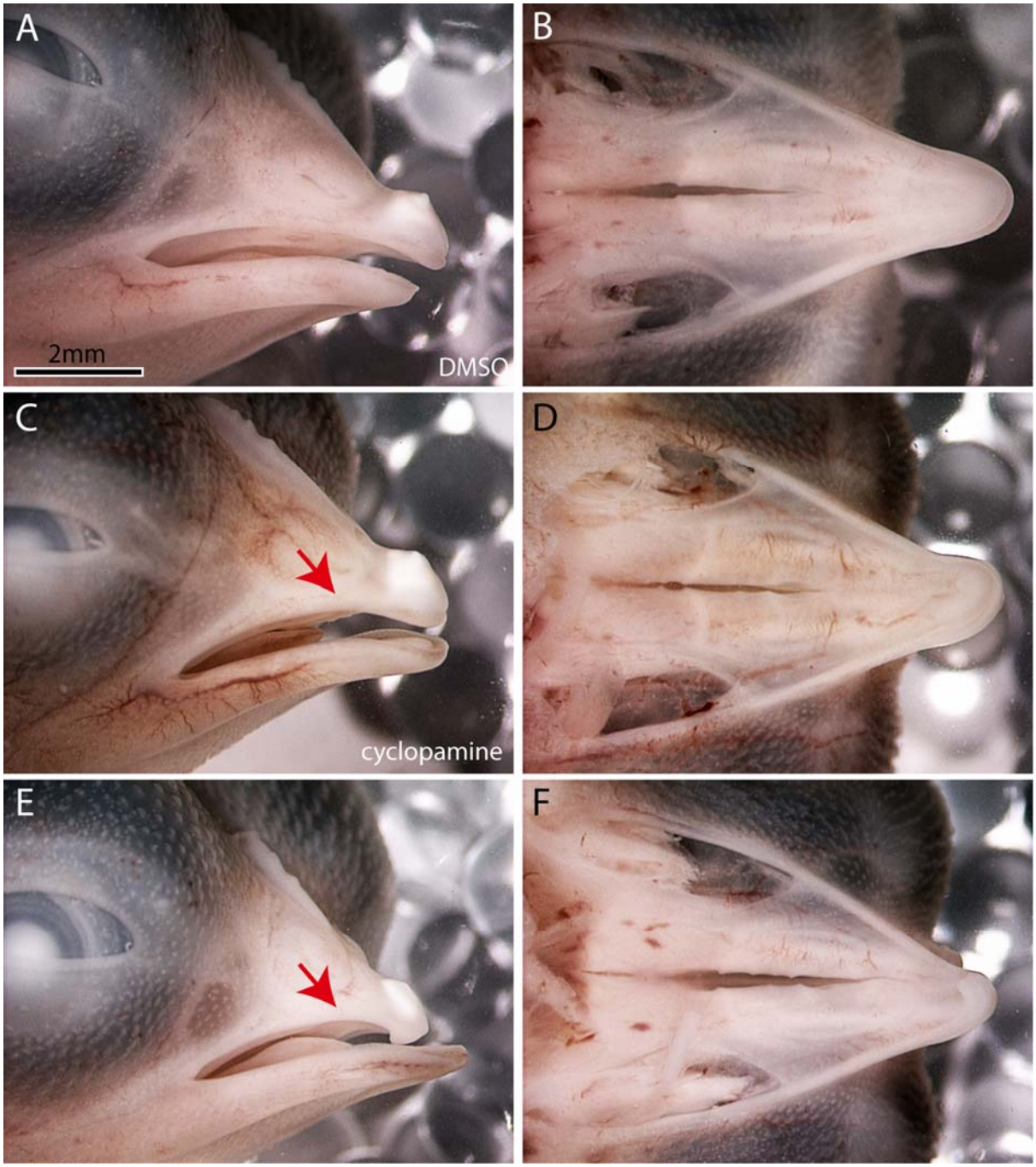


Figure S4. Cyclopamine and shape.

(A) Lateral and **(B)** dorsal view of a control embryo showing normal morphology of the upper jaw. **(C-F)** After cyclopamine treatment, a cleft in the upper jaw is evident (red arrows in C,E).

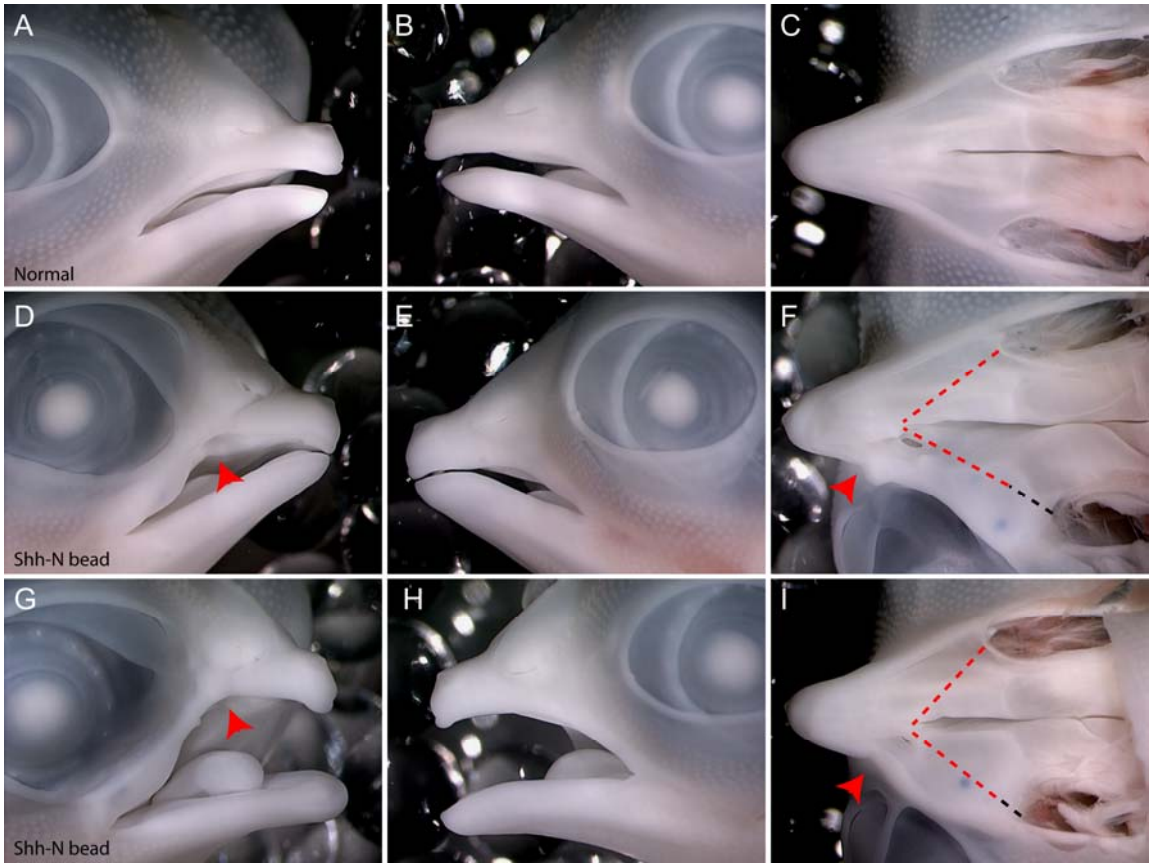


Figure S5. Activating SHH signaling leads to cleft palate.

(A) View of right and **(B)** left sides of a normal chick embryo at day 10. (**C**) Ventral view of the upper jaw in a normal embryo at day 10. (**D**) The right (treated) side of an embryo treated with a bead soaked in SHH-N illustrates a cleft (red arrowhead) of the primary palate. **(E)** The left (untreated) side appears unaffected. (**F**) Ventral view of the jaw of this treated embryo shows a cleft of the primary palate (arrowhead) as well as an increase in the gap of the palatal shelves. The red dotted line is the normal length of the upper jaw. The increase in size is shown by the red and black dotted line. (**G**) View of the right (treated) side of an embryo at day 10 shows a severe cleft (arrowhead), (**H**) while the left (untreated) side appears unaffected. **(I)** Ventral view of the upper jaw shows a cleft primary palate (arrowhead) and a widening of the space between the palatal shelves. The red dotted line is the normal length of the upper jaw. The increase in size is shown by the red and black dotted line.

Table S1. qPCR primers

GAPDH FW: CTGGTATGACAATGAGTTTGG
RV: ATCAGTTTCTATCAGCCTCTC

Shh FW: GCTGACAGACTGATGACTCA
RV: TCGTAGTGCAGCGATTCCTC

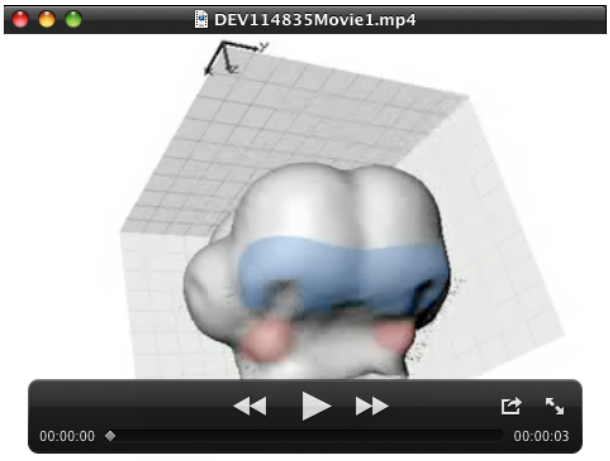
GLI1 FW: TGAAACAAACTGCTACTGGG
RV: ACACAAACTCCTTCTTCTCC

PTC FW: GCTTTCCTTTACTACAACTACCC
RV: GCAAGCATTAGTAAGTAGCCA

BMP2 FW: TTAACTTCCATCCCTAATGAGGAG
RV: ATGGTTAGGTTGTCCGTGT

Bmp4 FW: CCCAGTTACATGCTGGATC
RV: CTTCGTAAATGTTTATCCG

Bmp7 FW: AAAGCATAGATGGGCAAAGC
RV: GTCCCTGAAGCTGACATAGAG



Movie 1. Growth of the upper jaw anlagen. A surface rendering is warped along PC1 (Fig. 1) to illustrate the growth pattern of the upper jaw anlagen from 90-160 h of development. The FNP is colored blue and the MxP is colored pink. During this time the FNP grows posteriorly and the MxP grows rostrally.