Establish a model for modular evolution and lateral (lFNP) fronto-nasal processes. The lower jaw derives from the paired mandibular (mxPA1) prominences with contributions from the medial (mFNP) and lateral (IFNP) fronto-nasal processes.

We are testing a model that predicts that, A) at high levels, small SATB2 levels fail to activate downstream effecters and undergo apoptosis. B) At lower concentrations, small variances in developmental determinants may generate a wide range of phenotypic variation.

Non-linear relationship between genotype and phenotype. D) PCA of 42 landmarks on 3D microCT images of neonatal skulls. E) Fgf8 dosage plotted against PC1 from D. Mean shape and variance are similar in individuals receiving 50% or more of normal jaw size. Specification of the neural plate during gastrulation establishes the basis for a shorter and wider midbrain. This difference, represented by distinct Otx2 expression domains, is evident by HH6 (B,C). The wider midbrain of duck contributes to a larger allocation of NC to the jaw primordia in HH13 embryos (D,E). NC of the duck jaw mesenchyme exhibit an increase in proliferation compared to quail (F,G). Species-specific NC cell biology is maintained in quack chimeras (H) and produces quail-like jaws (I).

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Future Directions

We are testing a model that predicts that, A) at high levels, small variance in developmental determinants cause little phenotypic variance, however, at lower concentrations, small variances in developmental determinants may generate a wide range of phenotypic variance. B) In this model, a 10% variance in SATB2 has a significant effect on cell survival, where all cells with less than 4 molecules of SATB2 exhibit severe apoptosis. In contrast, individuals from the Fgf8/Neomutants. H) Ventral views of E15.5 WT and SATB2−/− neonatal skulls. Note the gap in Meckel’s cartilage in the SATB2−/− lower jaw (red arrows). J) SATB2 heterozygotes exhibit mild to extreme asymmetry.

A) Major developmental events contributing to species-specific jaw size. Specification of the neural plate during gastrulation establishes the basis for a shorter and wider midbrain. This difference, represented by distinct Otx2 expression domains, is evident by HH6 (B,C). The wider midbrain of duck contributes to a large allocation of NC to the jaw primordia in HH13 embryos (D,E). NC of the duck jaw mesenchyme exhibit an increase in proliferation compared to quail (F,G). Species-specific NC cell biology is maintained in quack chimeras (H) and produces quail-like jaws (I).