Discerning Signaling Pathways Crucial to the Structure and Function of the Gut

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Developmental Biology - Morphogenesis

[Image of an egg cell] → [Image of a cartoon child] → [Image of a human digestive system]
Malrotation of Gut Causes Midgut Volvulus

Properly Rotated

Improperly Rotated
Conserved Aspects of Gut Morphogenesis
Gut Development in Chicken Embryos

HH17

HH21

Midgut
Left-Right Asymmetry of the DM Causes Gut Tilting

Bmp4

Tsg6 – HA pathway

ECM expansion

Pitx2

Vasculature
Cell-Adhesion
Etc.

Midline

WT, HH22

Bmp4

Bhargav
Pitx2 Reduced with Mis-expression of Bmp4
The Descent of the Gut Tube
Noggin Inhibits the *Bmp4* Signaling Pathway

Noggin inhibits the *Bmp4* signaling pathway by blocking the interaction of Noggin with Bmp4. This leads to the inhibition of Tsg6, HA, HC-HA, stable HA matrix, and ECM expansion, resulting in a leftward tilt and asymmetric vasculogenesis.
The Role of Noggin in the Gut Tube

DAPI
Noggin
Pitx2

Bhargav
The Role of Noggin in the Gut Tube

DAPI

Noggin

Pitx2

Bhargav
Pitx2 Activity Reduced with Presence of Noggin
Why does Noggin Inhibit Pitx2 Activity?

- TGF-β Superfamily protein hypothesized to be upstream of Pitx2
Why does Noggin Follow the Gut Tube?

- Possibly found in the gut tube endoderm:
  - Chordin (Noggin-like antagonist)
  - CYP26A1 enzyme
  - IHH
  - SHH

![Image showing CYP26A1 and Chordin in the gut tube endoderm]
Future Experiments
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