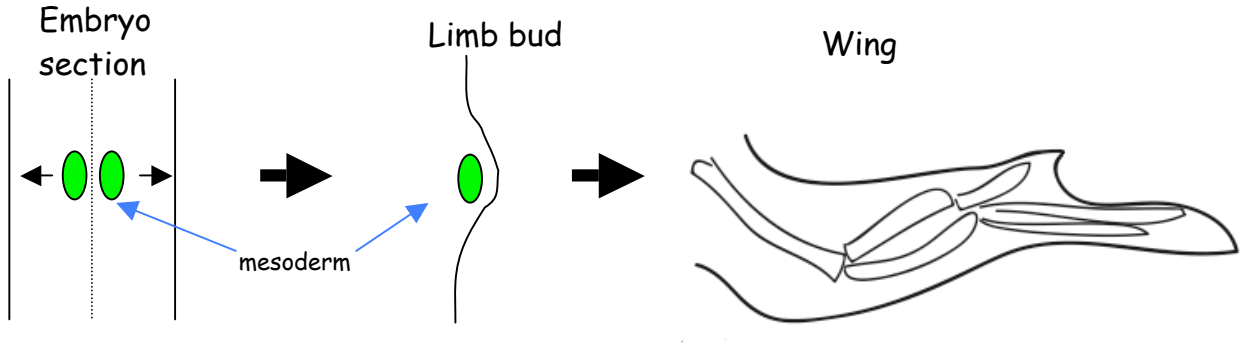
7.013 Cell Type and Position Section

The chicken wing (forelimb) develops primarily from a population of mesodermal cells that migrate from near the midline of the embryo laterally to the position of the future forelimb. After migration, they form the "limb bud" which later differentiates into the forelimb.



a) You find out which population of cells gives rise to the limb by... (Circle one.)

activation carcinogenesis epistasis analysis fate mapping

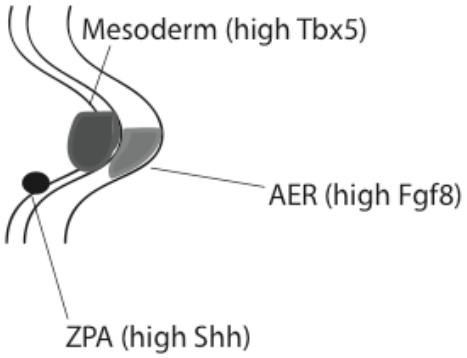
b) Migrating cells are always...(Circle one.)

epidermal epithelial organizers mesenchymal

The limb is organized by a region called the ZPA, which is required for formation of another region called the AER. In turn, the AER organizes the mesoderm to form a limb.

ZPA → AER → Mesoderm

Three pivotal proteins for fore limb development are Fgf8. secreted by a region called the AER, sonic hedgehog (Shh), secreted by a region called the ZPA and the transcription factor, Tbx5, expressed in the forelimb mesoderm.



c) Fill in the table below. Choose from options in parentheses. **9 points**

Region	**ZPA**	**AER**	**Mesoderm**
Factor	Sonic Hedgehog (Shh)	Fgf8	Tbx5
Class of Protein	Secreted	Secreted	Transcription Factor
(Determinant/ Inducer)	*Inducer*	*Inducer*	*Determinant*
Factor binds to **what?** (DNA, RNA, ER, Golgi, receptor, ligand)	*Receptor*	*Receptor*	*DNA*
Factor binds **where?** (ZPA, AER, Mesoderm)	*AER*	*Mesoderm*	*Mesoderm*

Forelimbs and hindlimbs are clearly different from one another in the shape of the bones and digits (fingers or toes). You perform a series of transplants between early fore and hindlimb buds to determine what tissues are pivotal in deciding whether a forelimb (FL) versus hindlimb (HL) forms.

	Donor	**Substitute for**	**Result**
i.	HL ZPA	FL ZPA	FL
ii.	HL AER	FL AER	FL
iii.	HL mesoderm after migration	FL mesoderm	HL
iv.	HL mesoderm before migration	FL mesoderm	no limb
v.	FL ZPA	HL ZPA	HL
vi.	FL AER	HL AER	HL
vii.	FL mesoderm after migration	HL mesoderm	FL
viii.	FL mesoderm before migration	HL mesoderm	no limb

d) The tissue(s) defining limb identity (forelimb vs hindlimb) is/are …(circle one or more)

AER ZPA mesoderm

e) When has the forelimb versus hindlimb difference been determined?

before migration after differentiation after migration