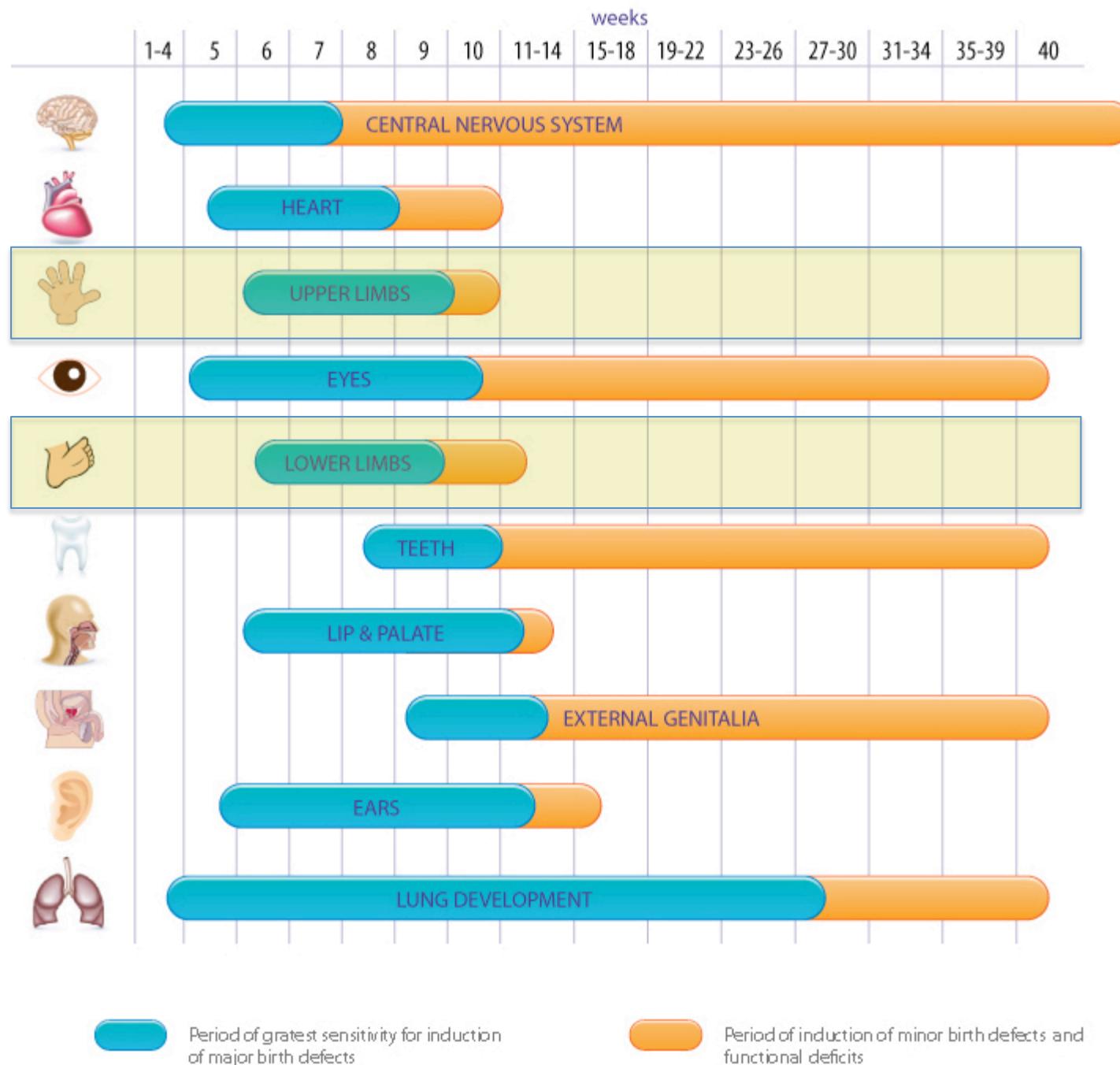
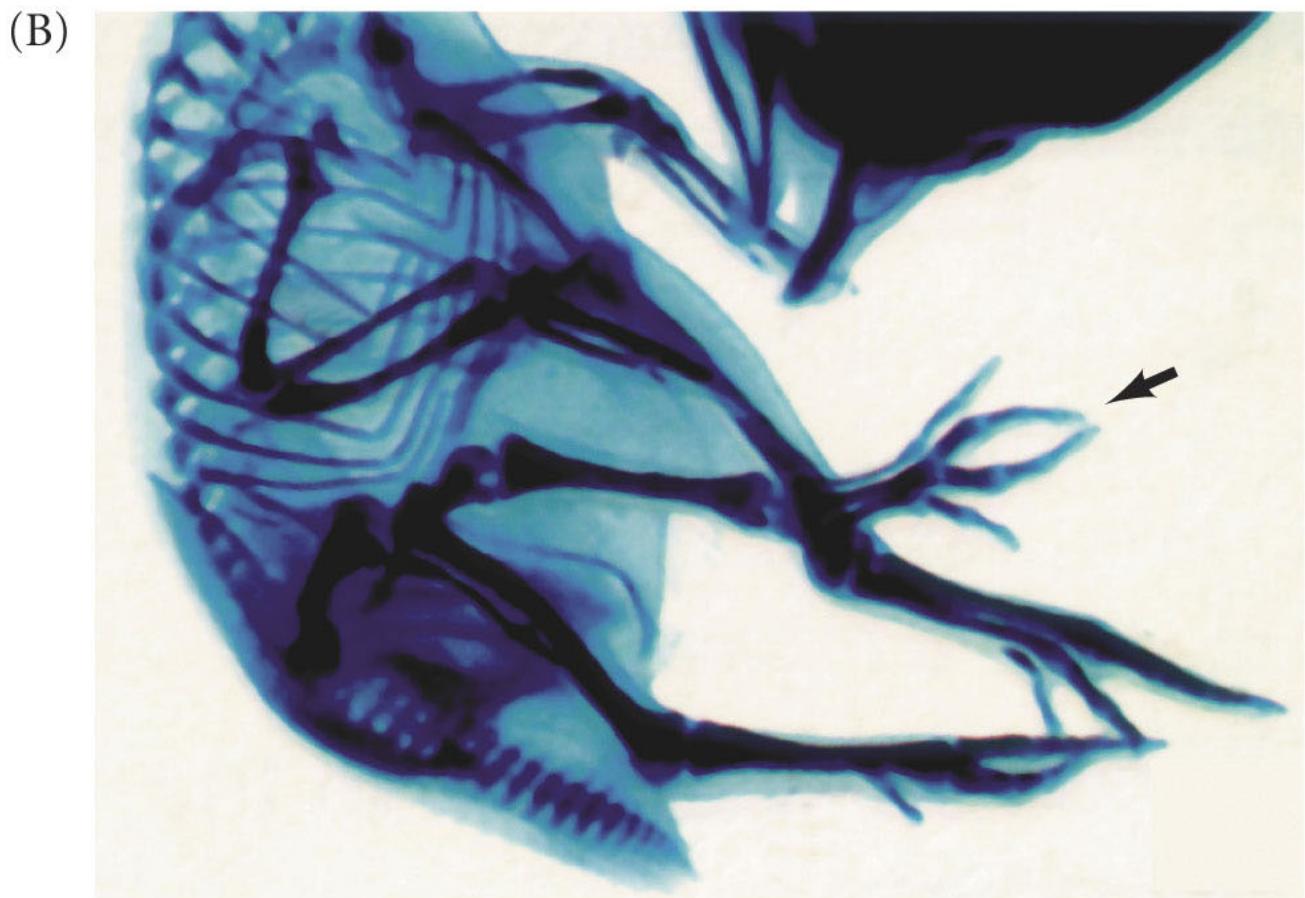
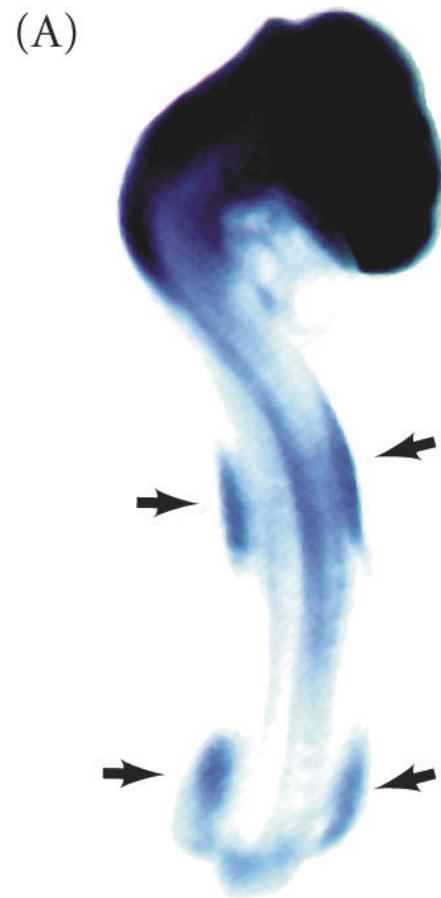


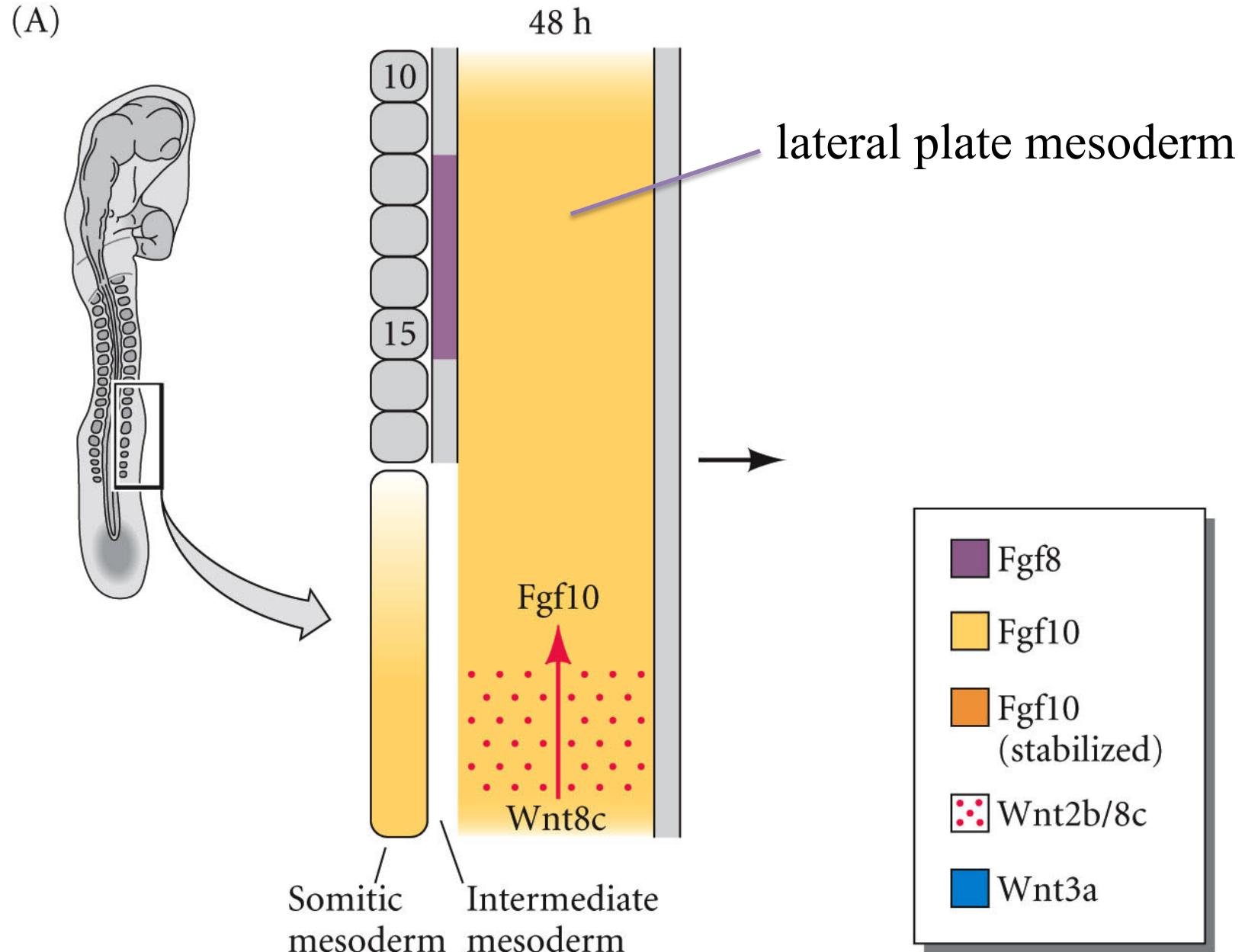
ORGANOGENESE:



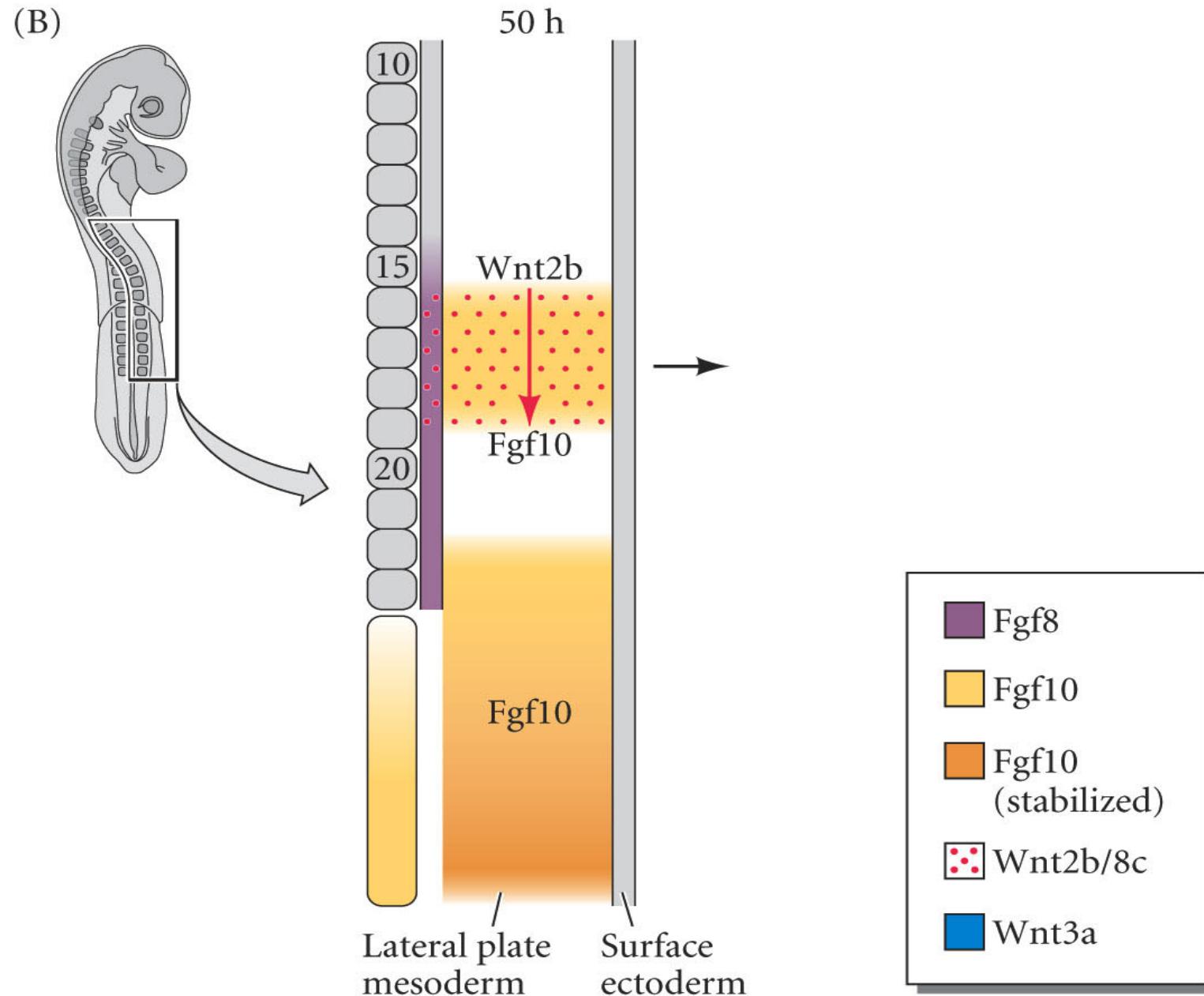
Expressão de Fgf10 e ação sobre os membros em desenvolvimento da galinha



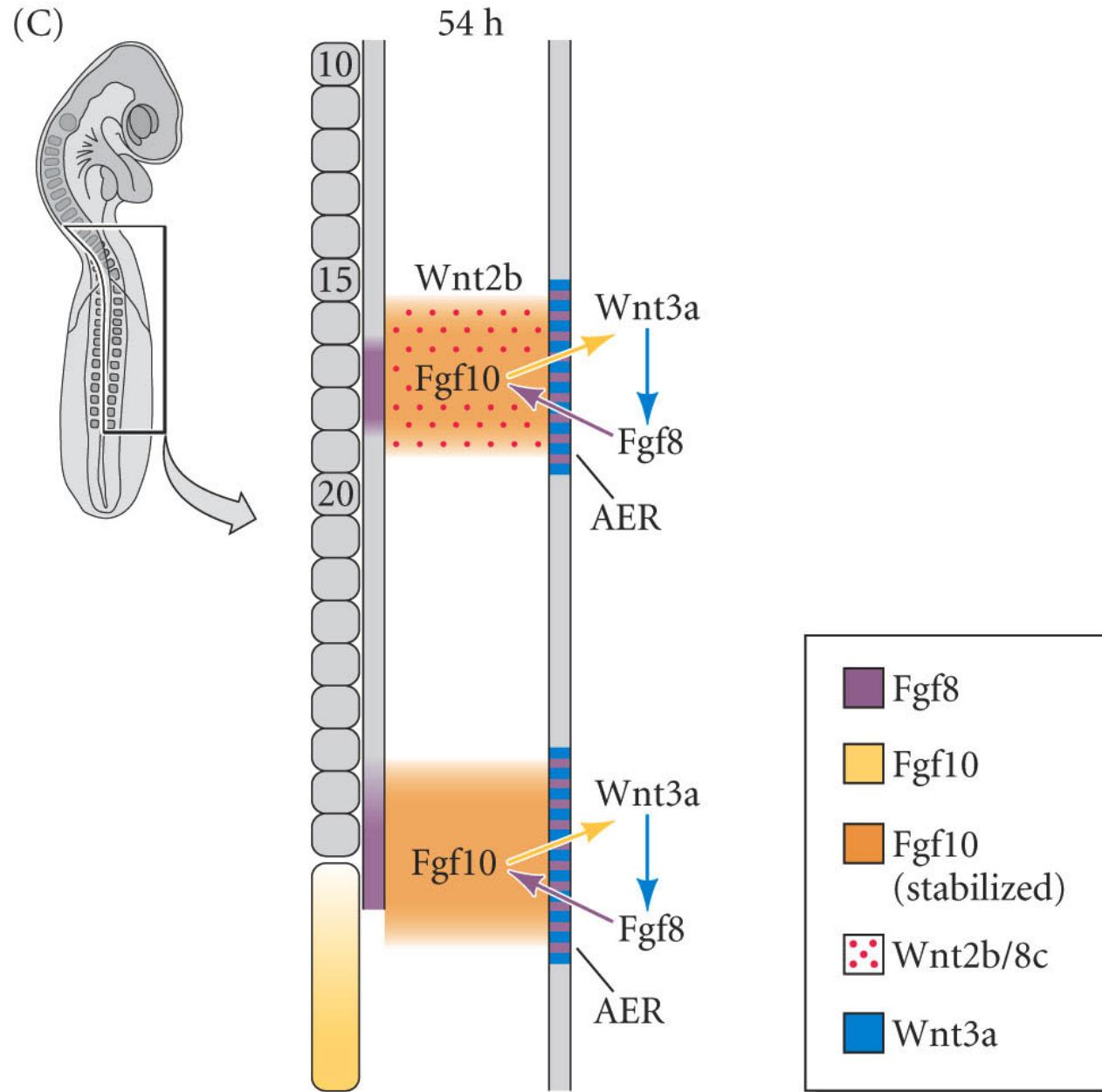
Modelo molecular da iniciação do desenvolvimento do broto de membro na galinha de **48 horas** de incubação (Parte 1)



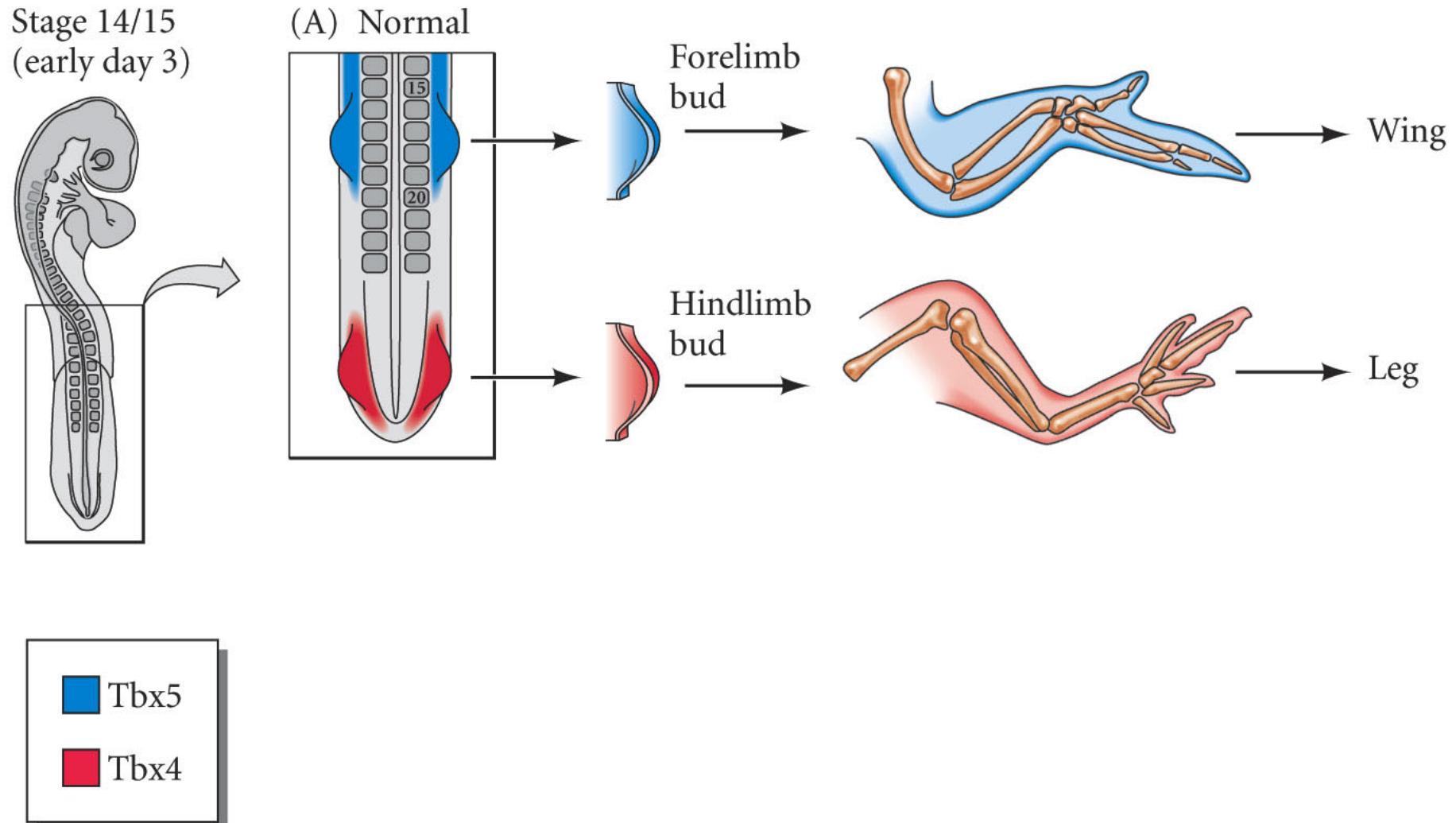
Modelo molecular da iniciação do desenvolvimento do broto de membro na galinha de 50 horas de incubação (Parte 2)



Modelo molecular da iniciação do desenvolvimento do broto de membro na galinha de 54 horas de incubação (Parte 3)

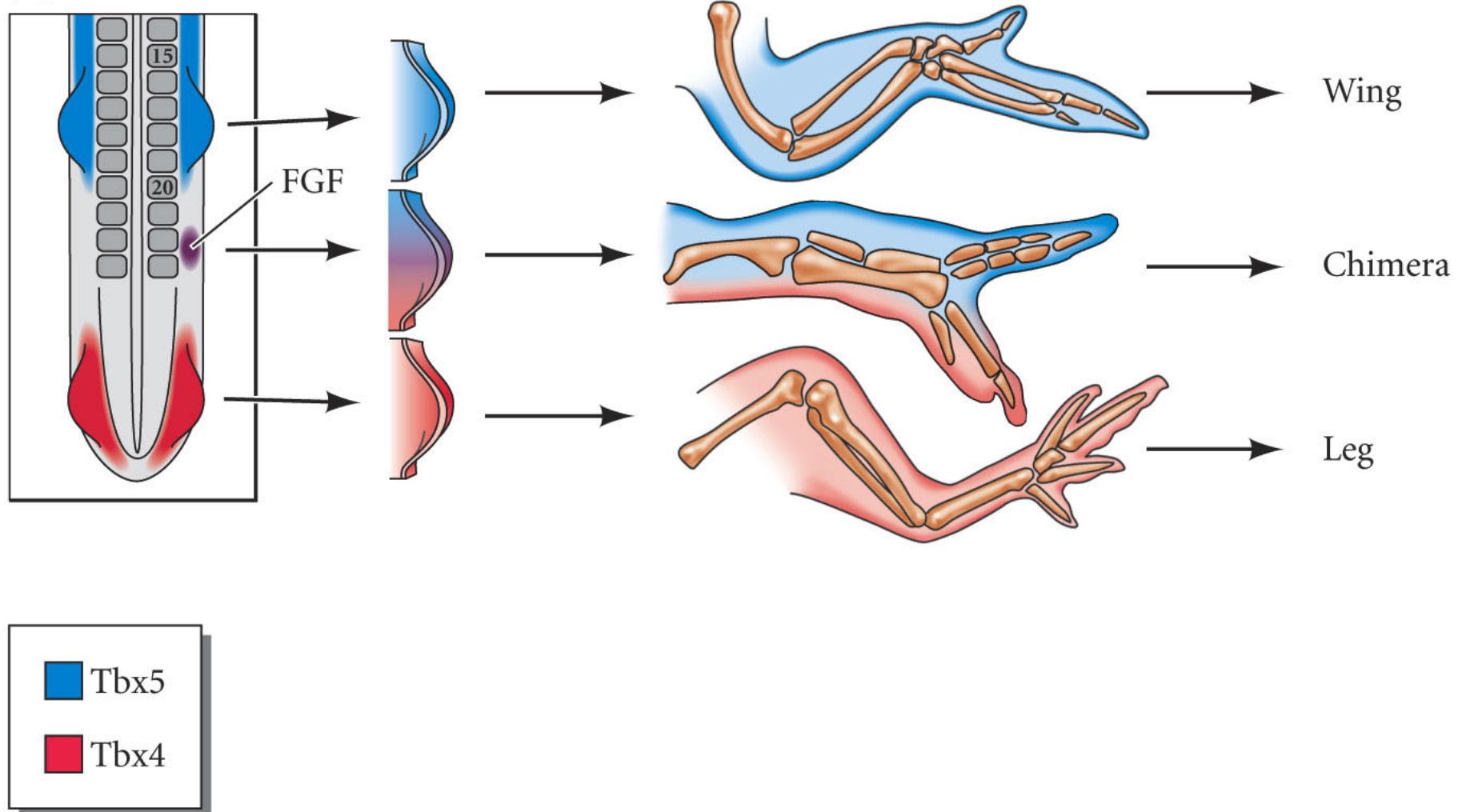


Identidade do membro anterior e posterior: Especificação por Tbx4 and Tbx5 (Parte 1)

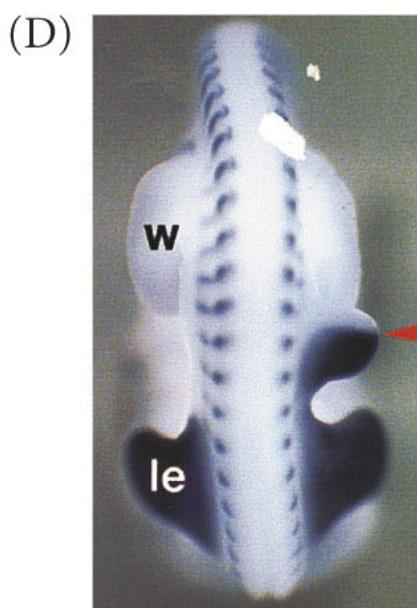
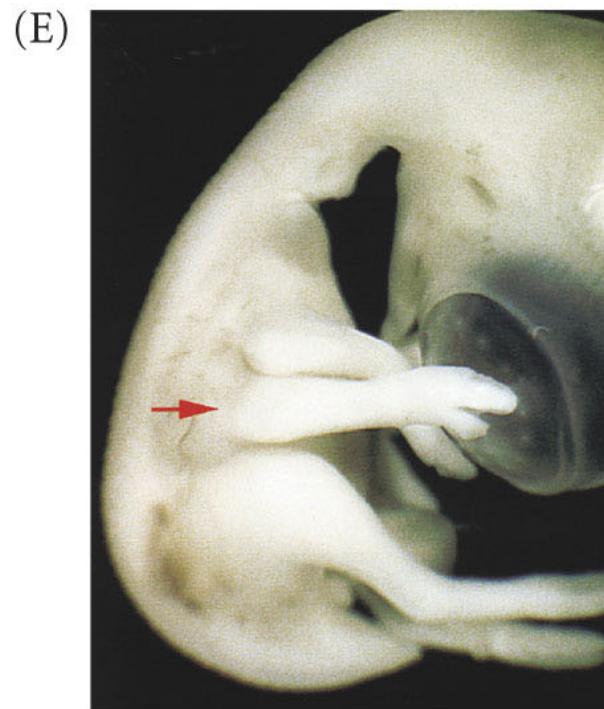
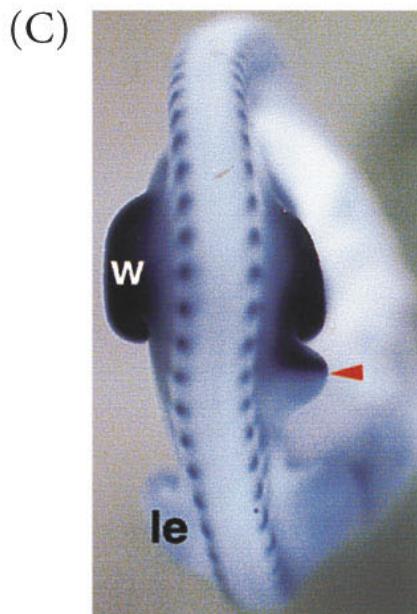


Identidade do membro anterior e posterior: Especificação por Tbx4 and Tbx5 (Parte 2)

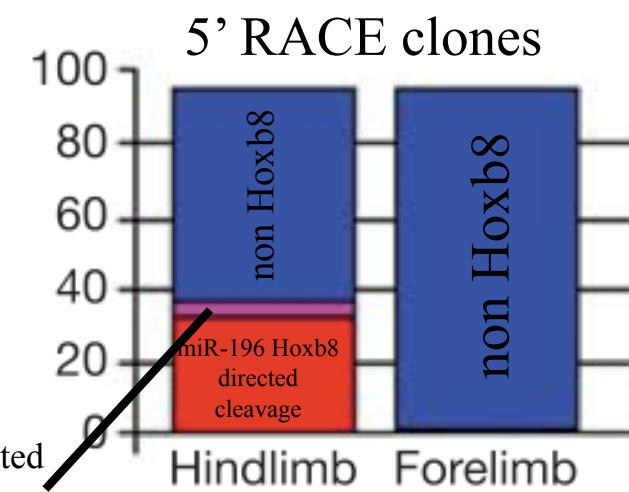
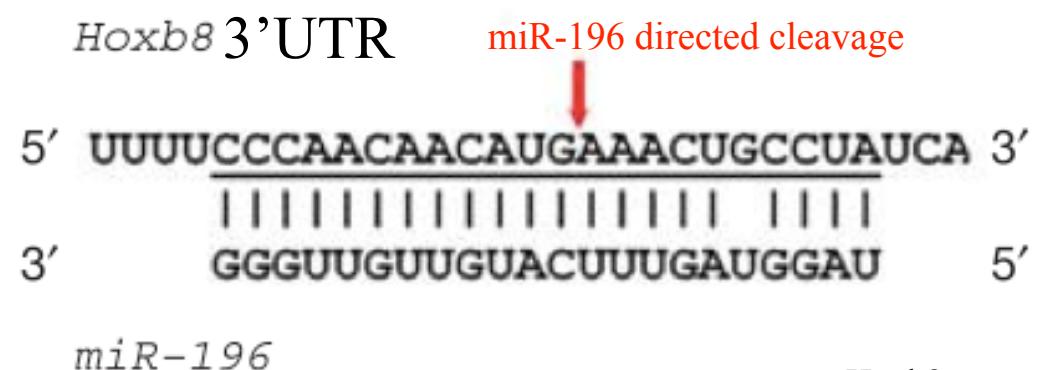
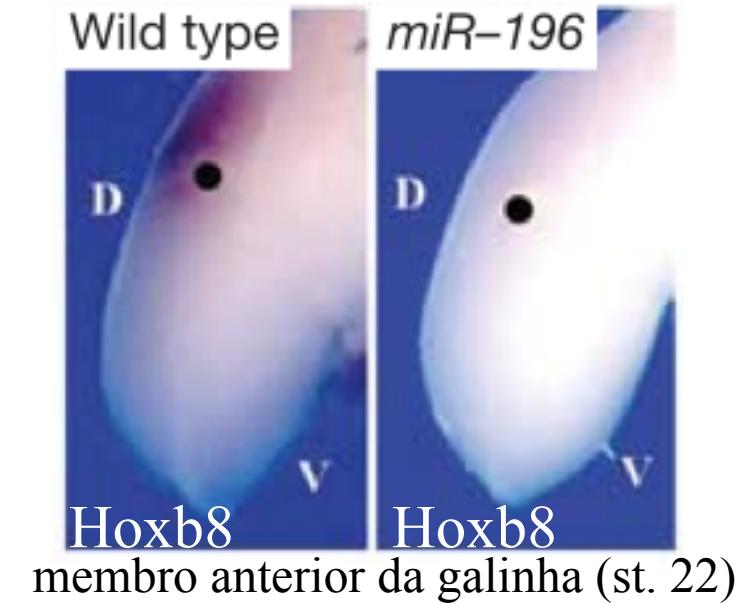
(B) FGF induced



Identidade do membro anterior e posterior: Especificação por Tbx4 and Tbx5 (Parte 3)



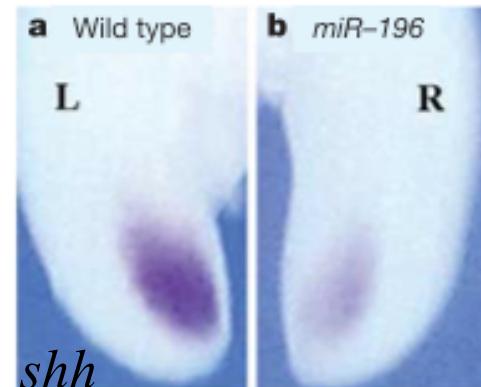
Identidade do membro anterior e posterior: *miR-196* regula Hoxb8 durante o desenvolvimento das extremidades



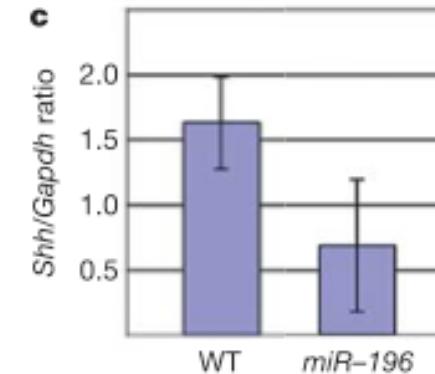
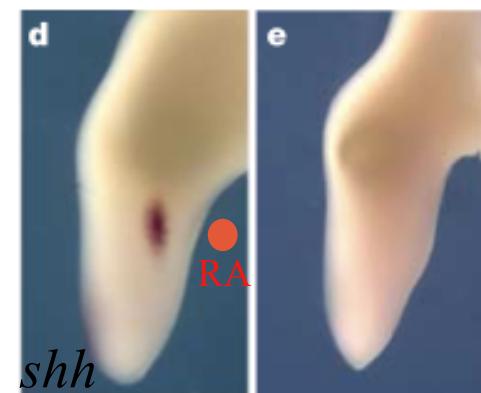
Hornstein et al. 2005

Identidade do membro anterior e posterior: *miR-196* regula *Hoxb8* durante o desenvolvimento das extremidades

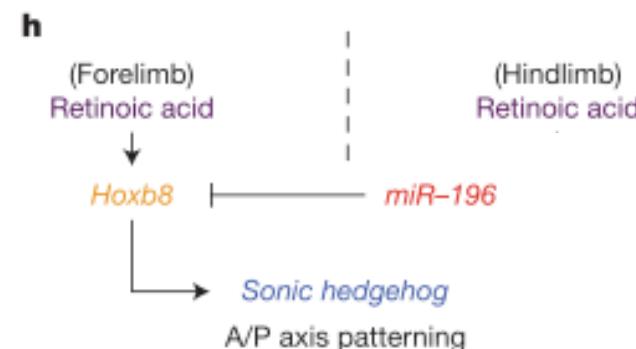
membro anterior



membro anterior



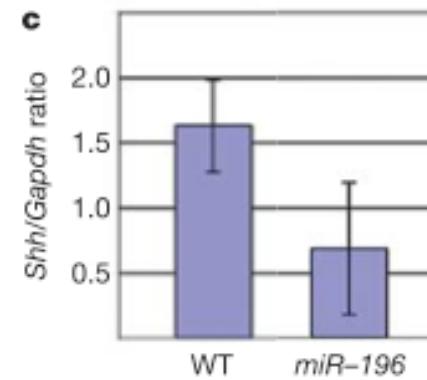
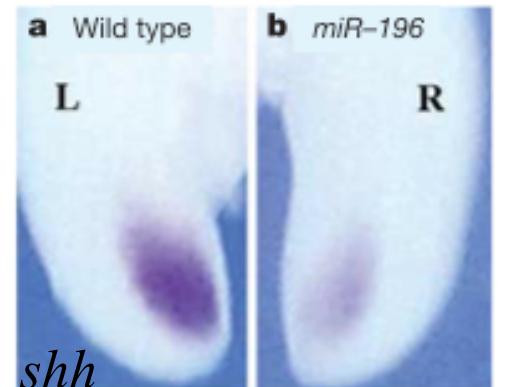
Modelo de regulación:



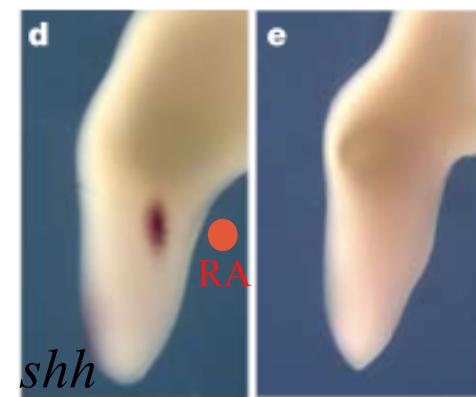
Hornstein et al. 2005

Identidade do membro anterior e posterior: *miR-196* regula *Hoxb8* durante o desenvolvimento das extremidades

membro anterior

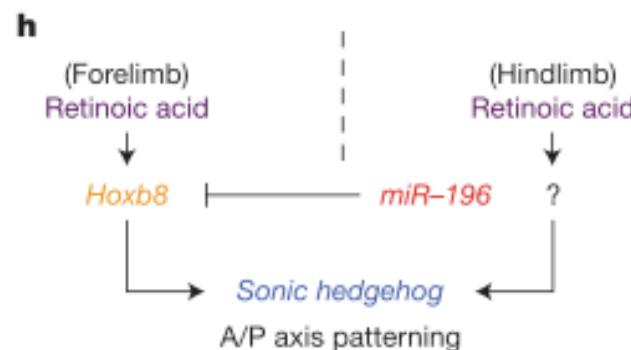


membro anterior

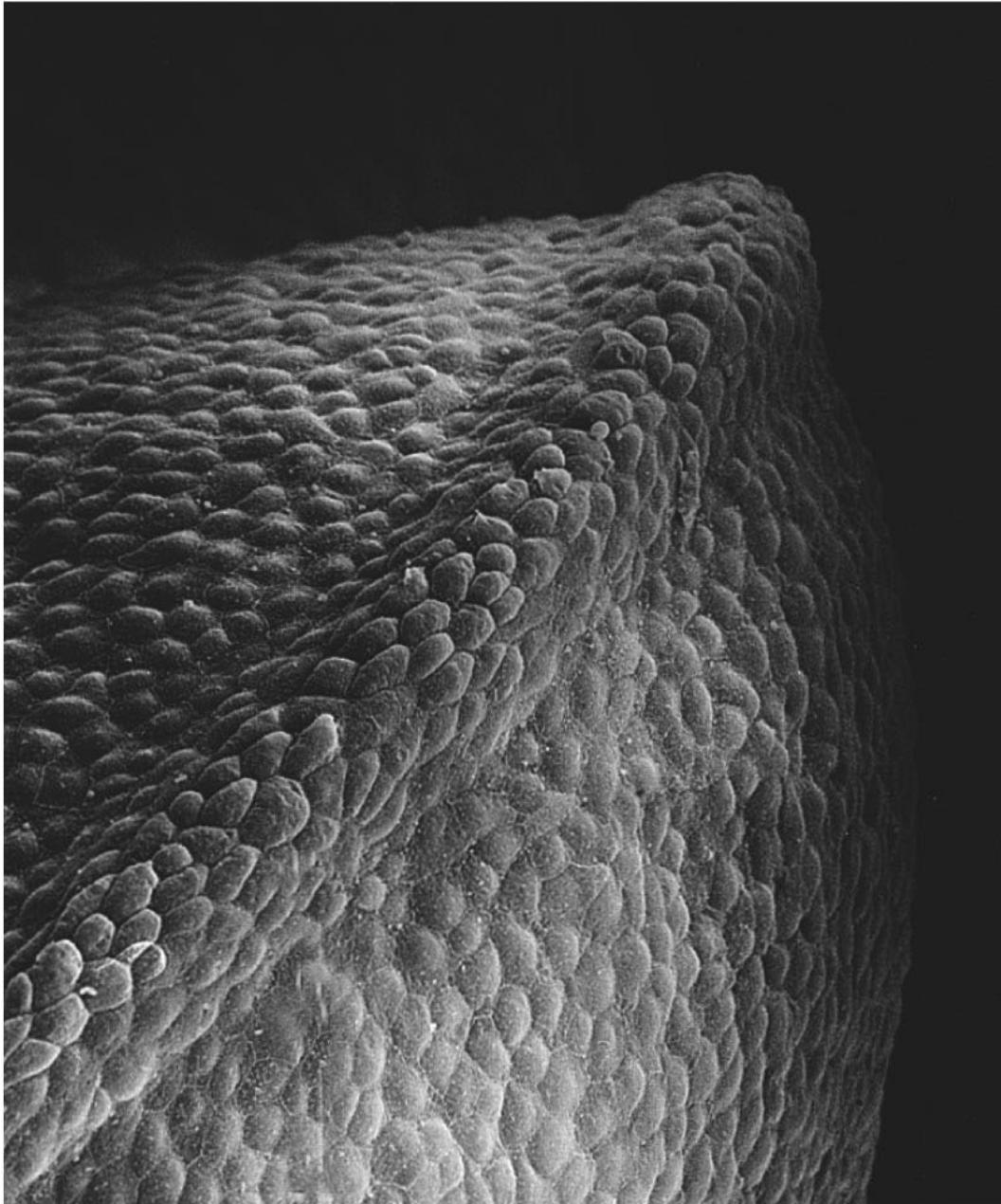


membro posterior

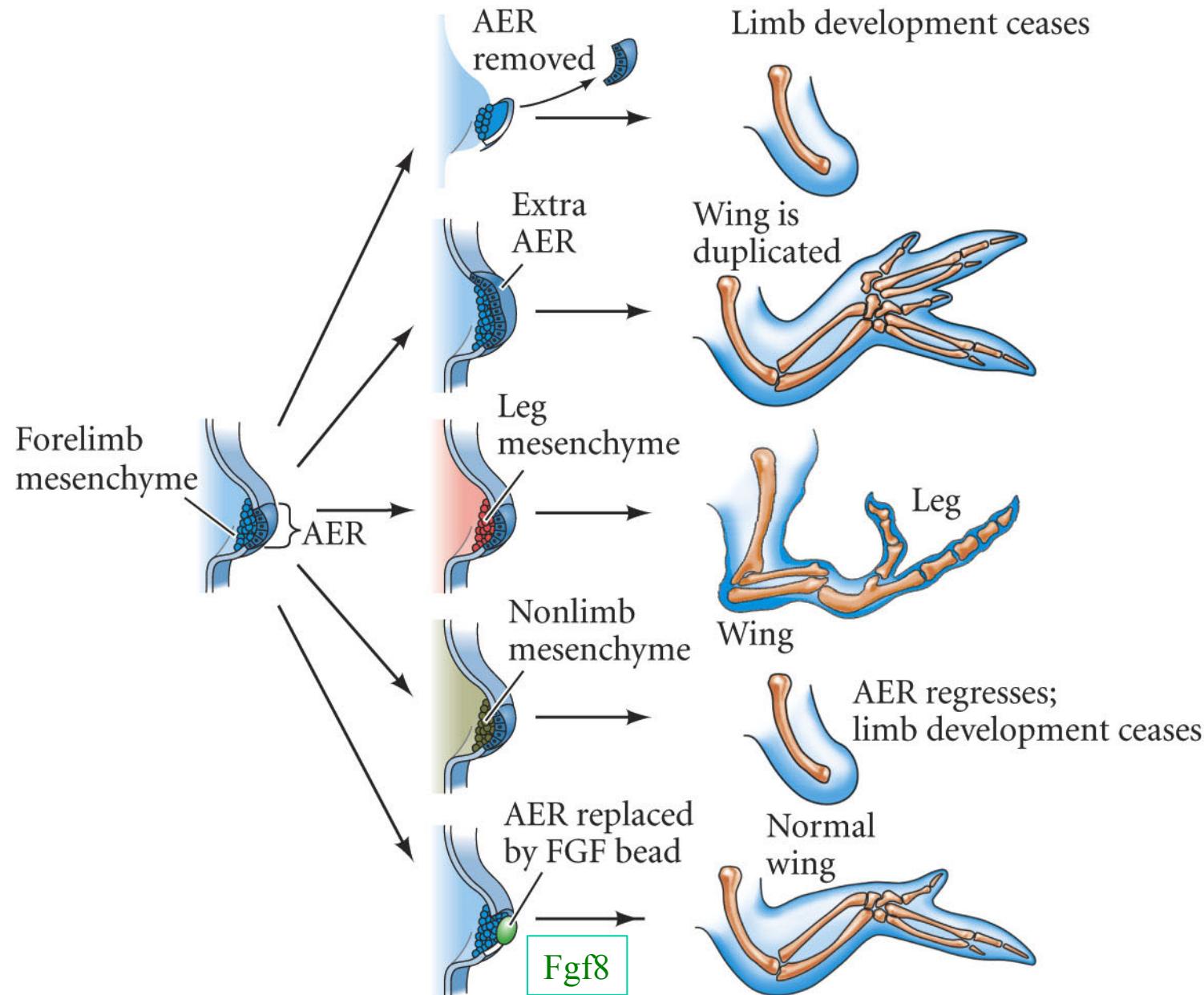
Modelo de regulación:



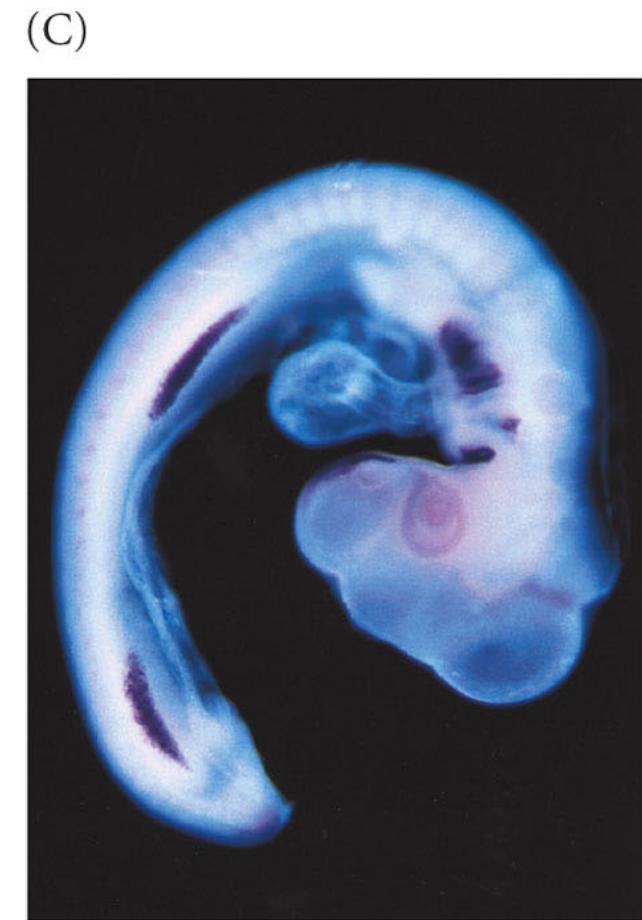
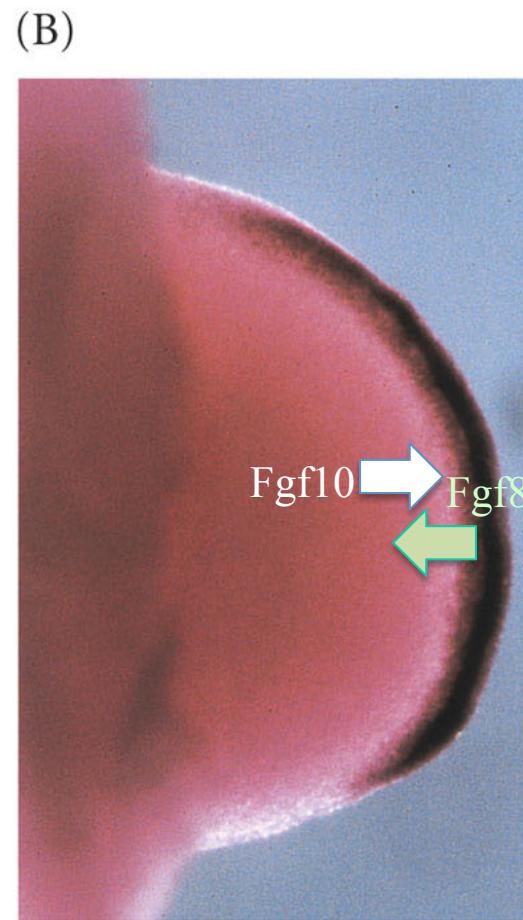
Broto cedo do membro anterior da galinha com o “apical ectodermal ridge (AER)”



Summary of experiments demonstrating the effect of the apical ectodermal ridge on the underlying mesenchyme

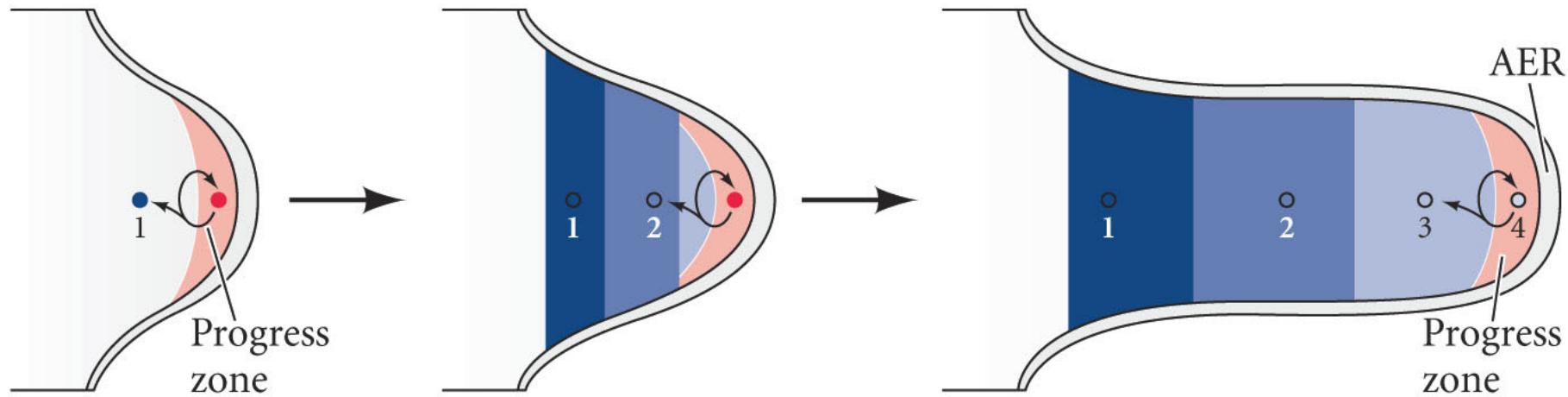


Fgf8 in the apical ectodermal ridge

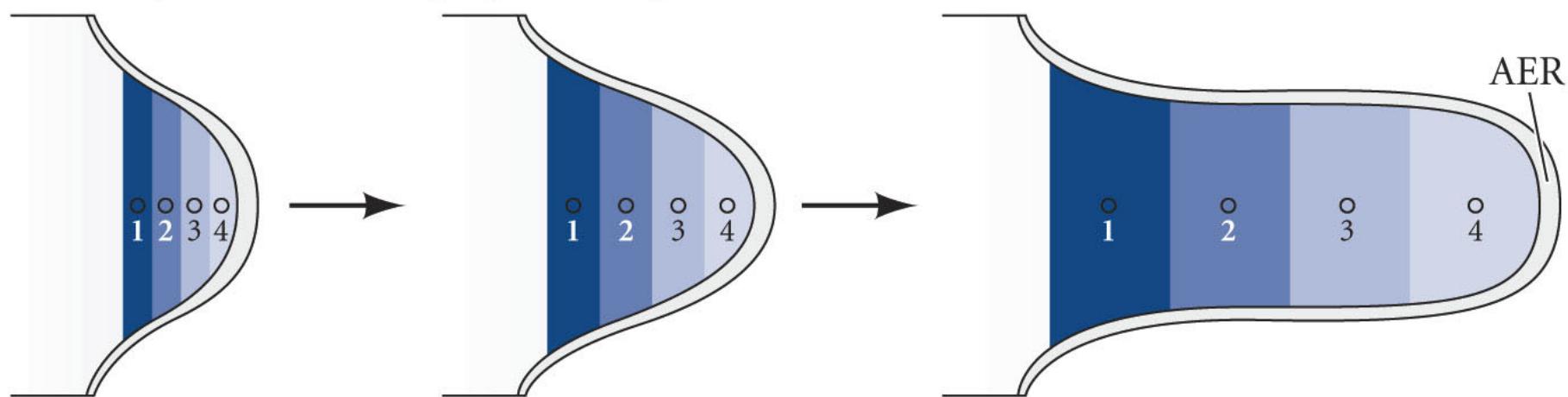


Two models for the mesodermal specification of the proximal-distal axis of the limb

(A) Progress zone model



(B) Early allocation and progenitor expansion model



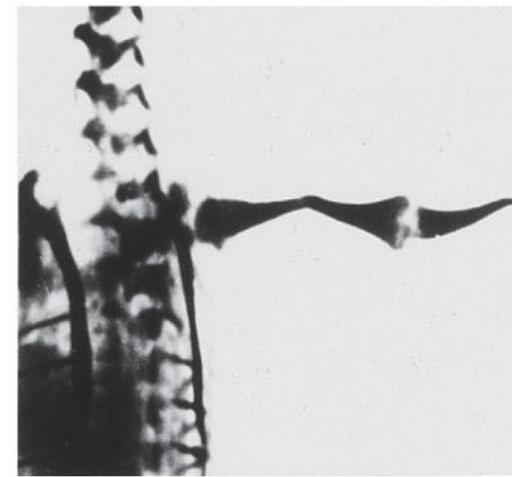
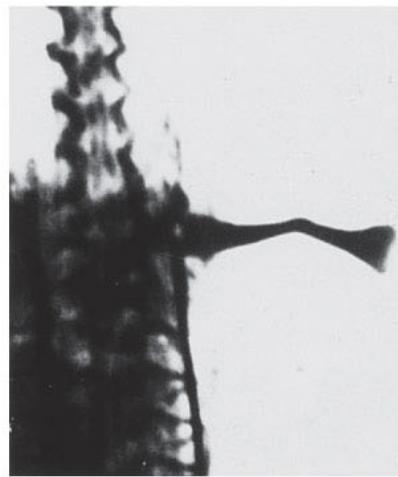
What experiments would you do to test these two models?

The AER is necessary for wing development

(A)



(B)

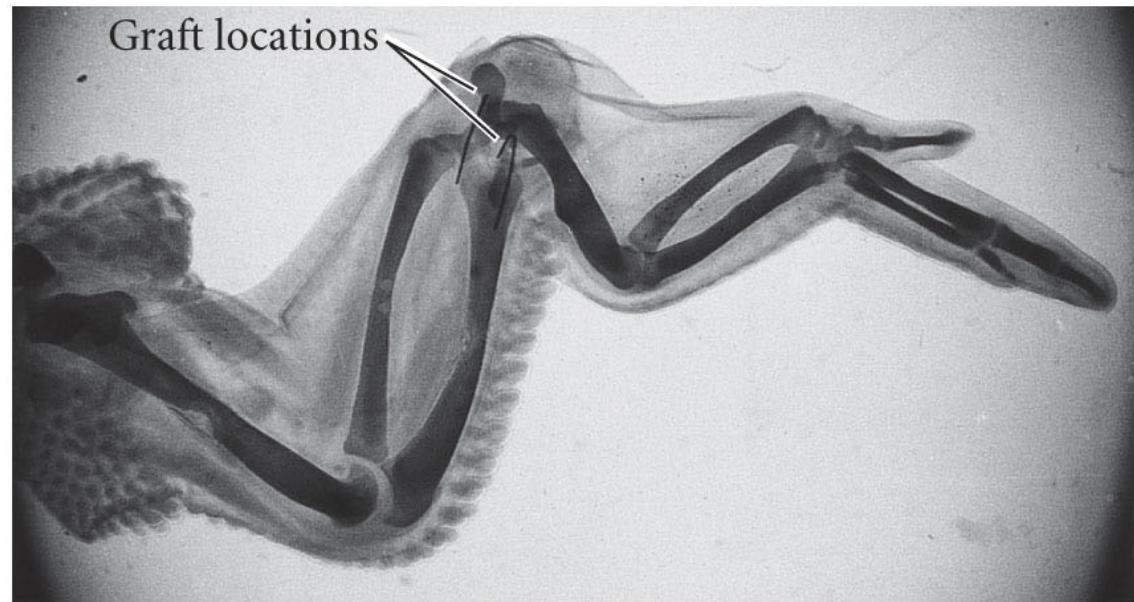


AER Vade mecum

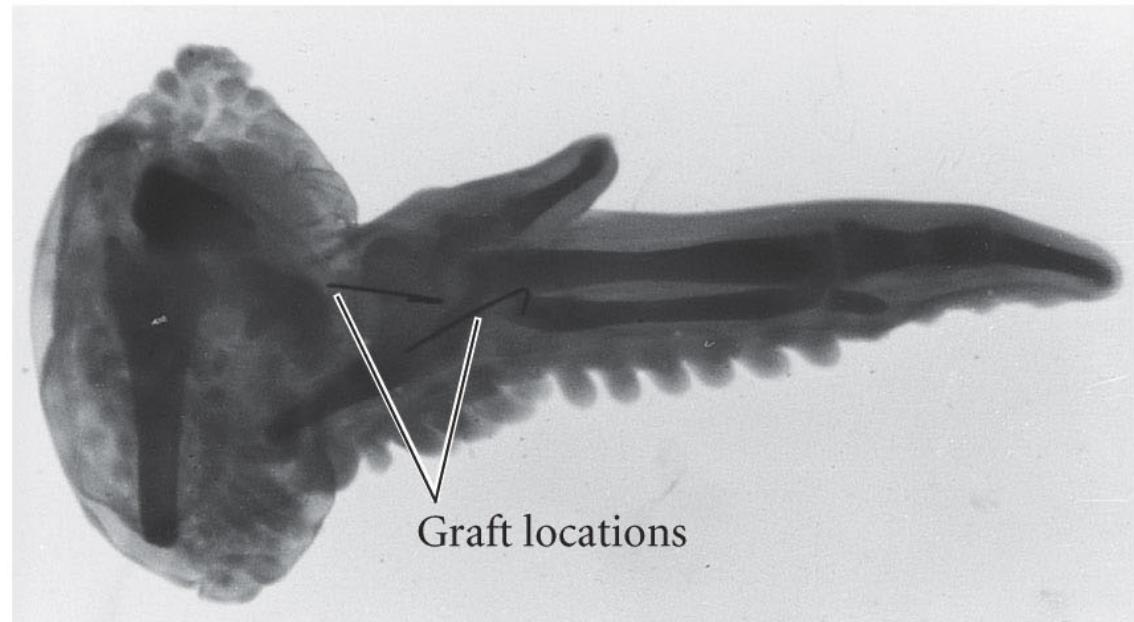
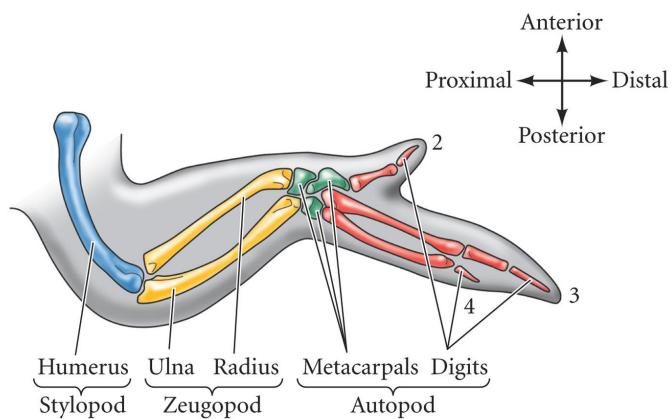
DEVELOPMENTAL BIOLOGY, Eighth Edition, Figure 16.11 © 2006 Sinauer Associates, Inc.

Control of proximal-distal specification by the progress zone mesenchyme

(A)

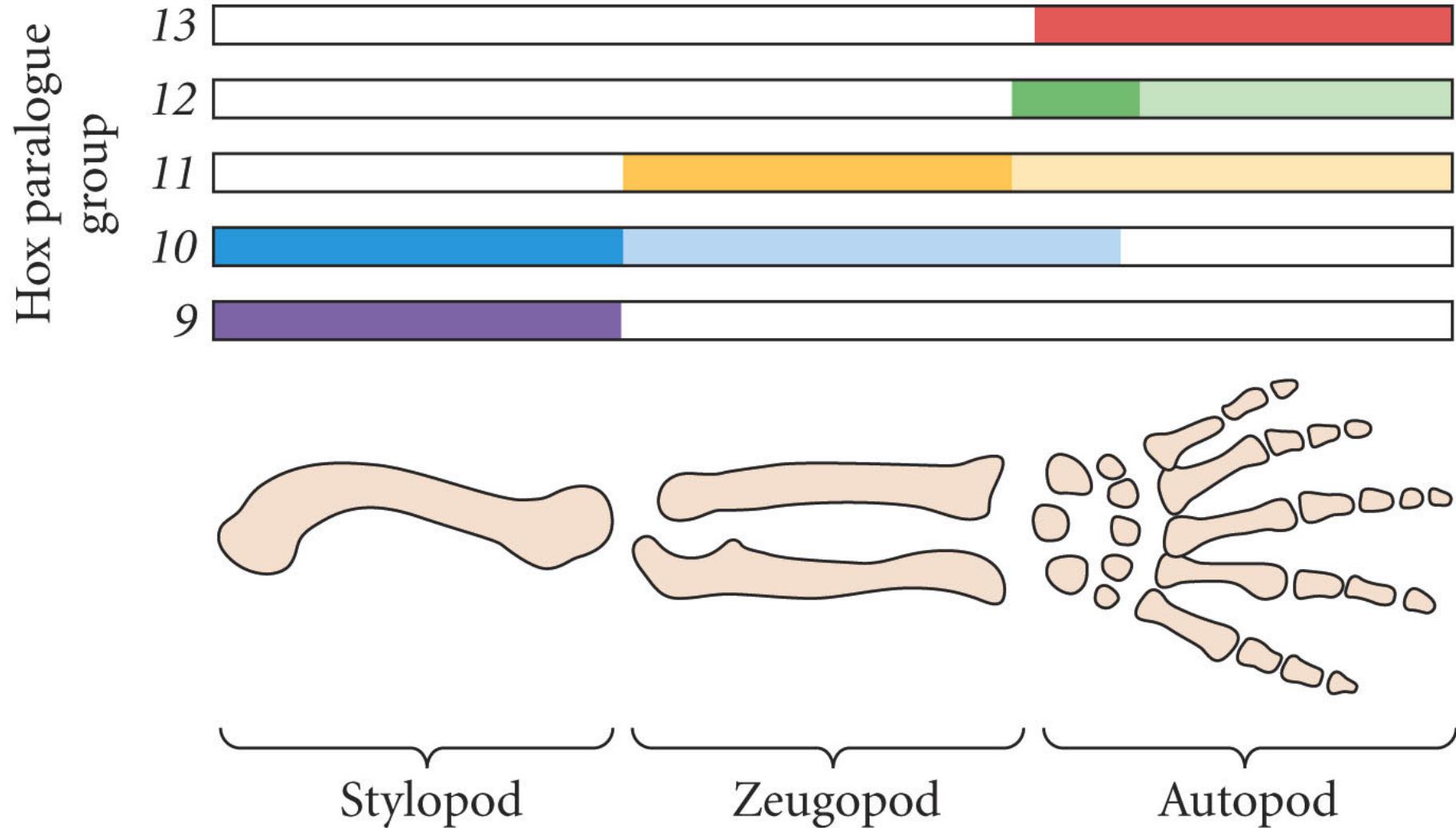


(B)

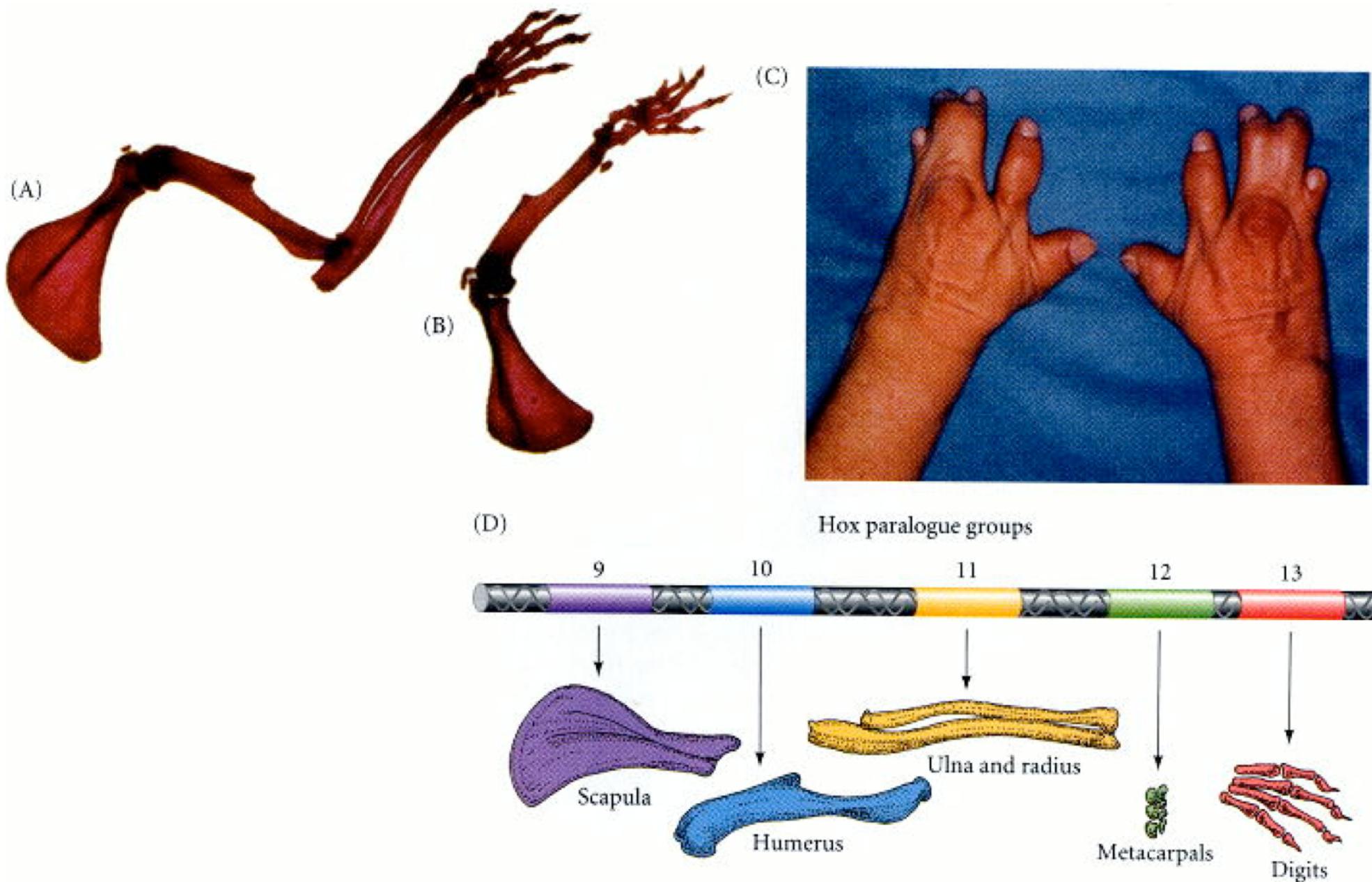


(A)

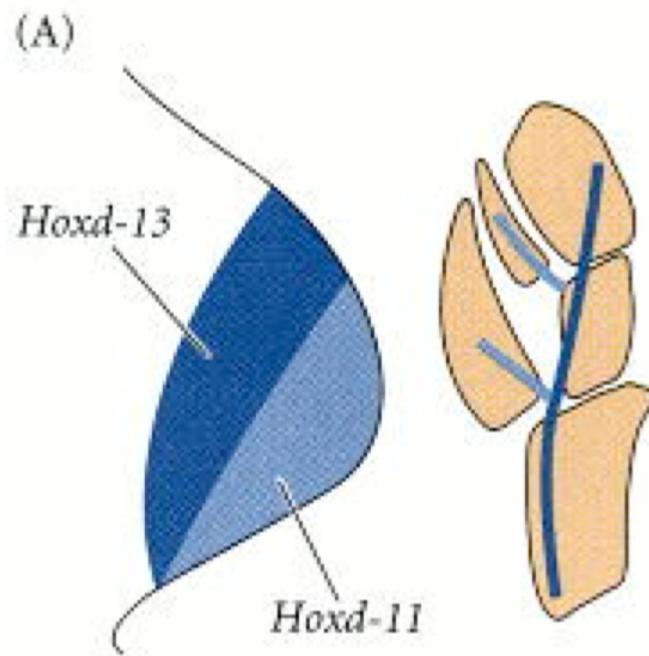
Forelimb



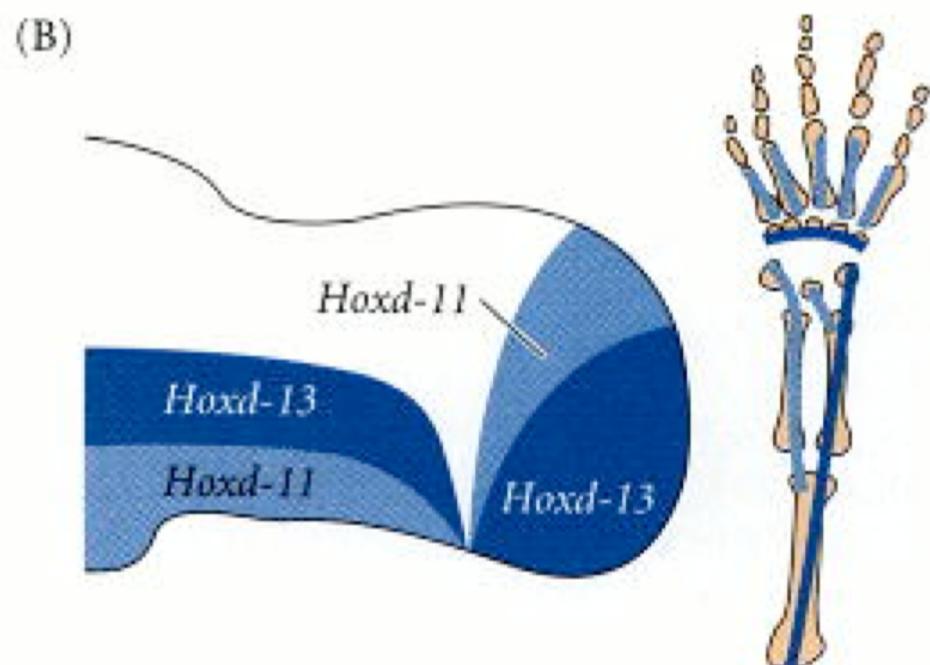
PD patterning: Deletion of limb bone elements by the deletion of paralogous Hox genes (Part 1)



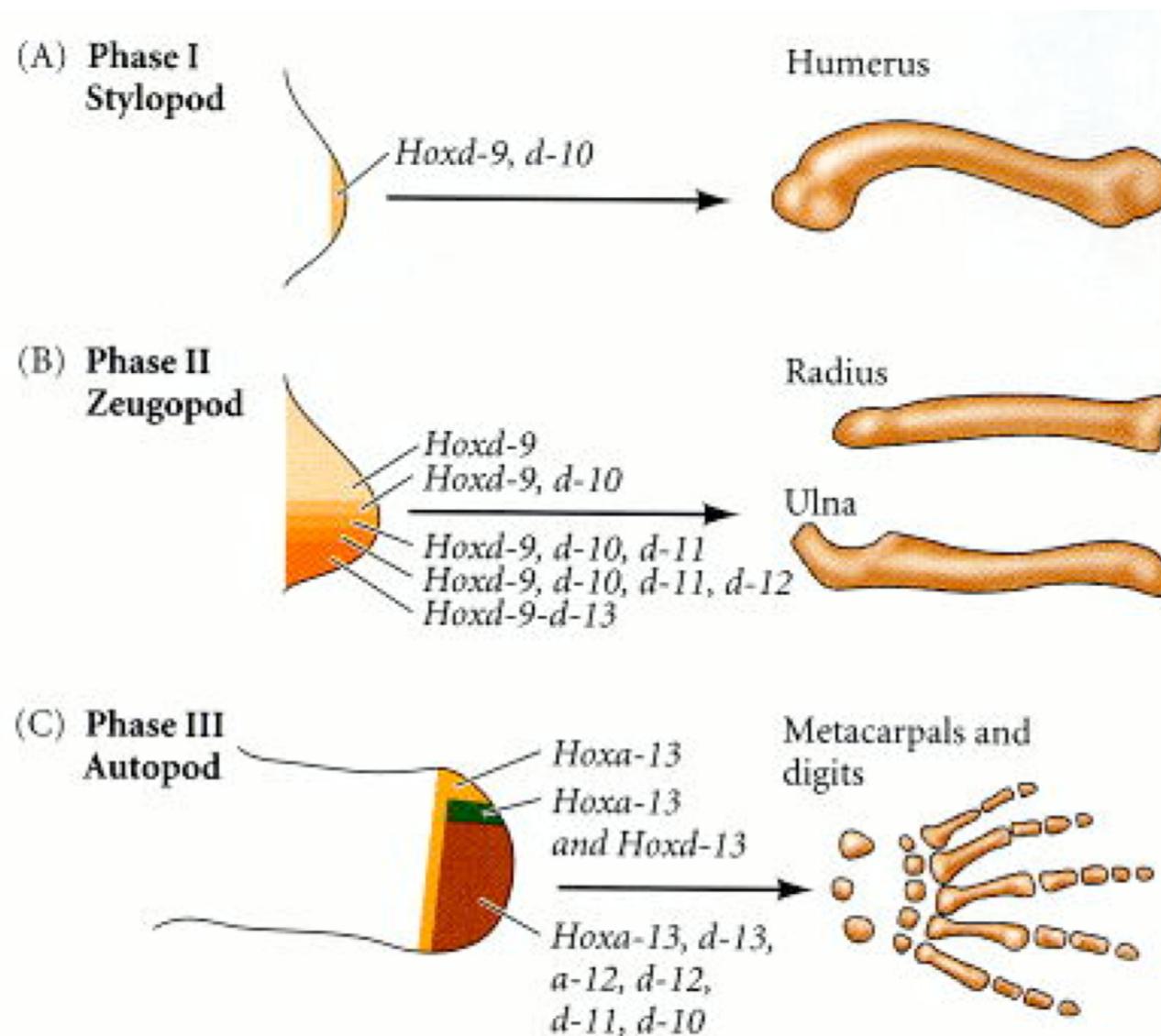
Peixe:



Tetrapodo:

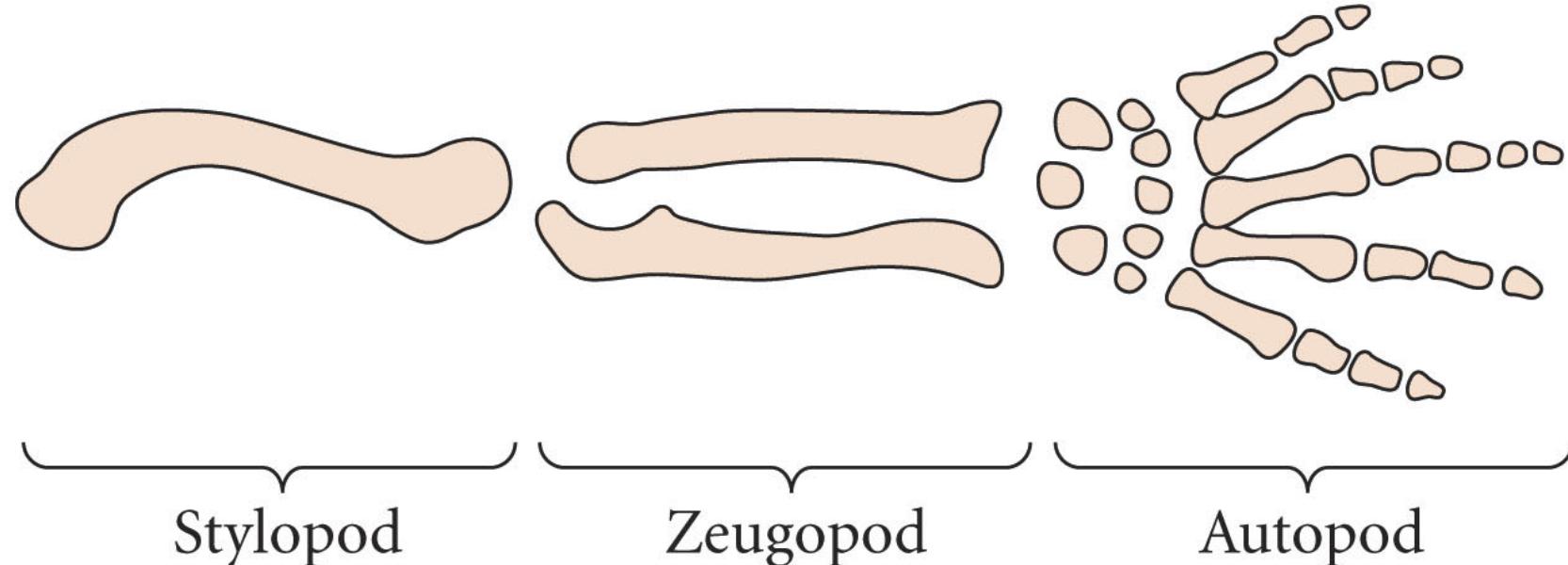
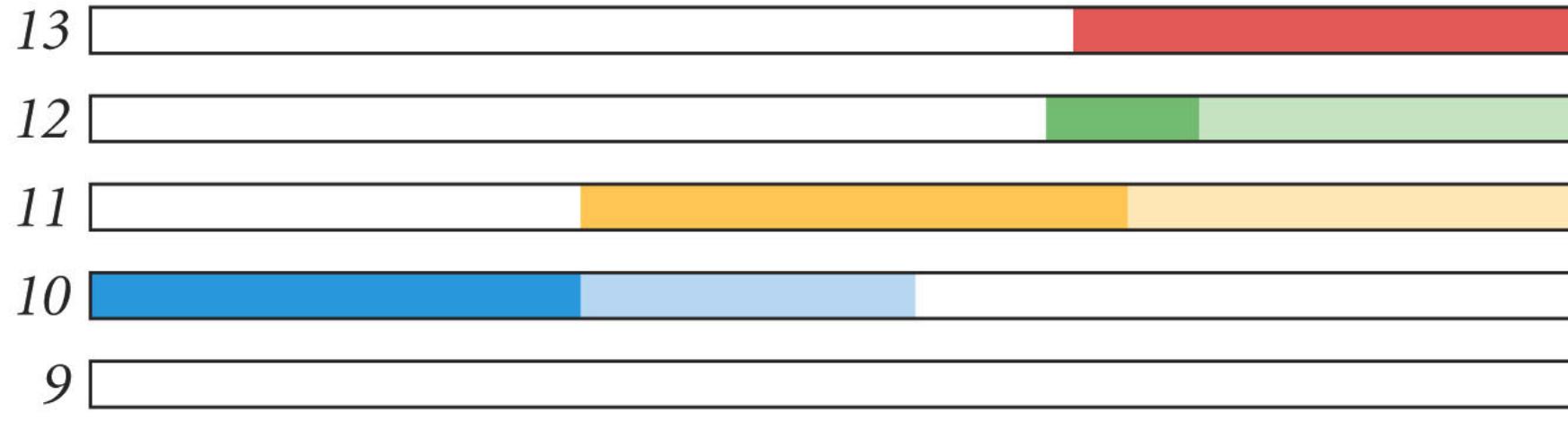


AP patterning: Hox e desenvolvimento dos membros



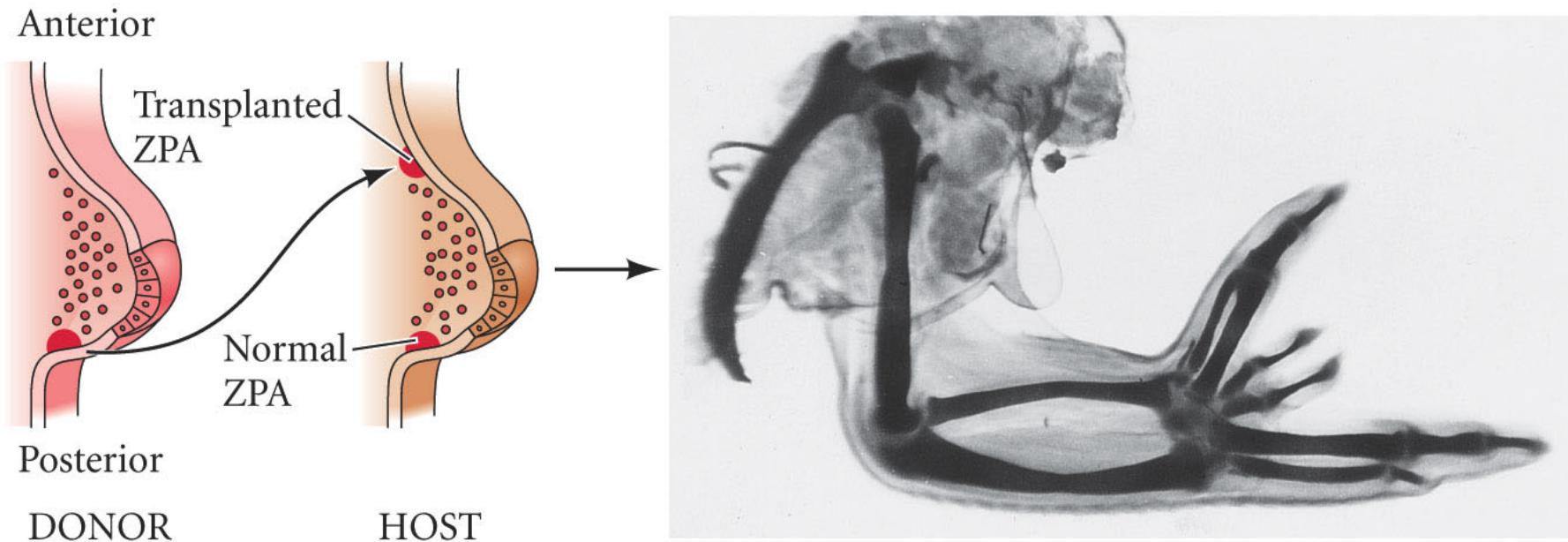
(B)

Hindlimb



AP patterning: When a ZPA is grafted to anterior limb bud mesoderm, duplicated digits emerge as a mirror image of the normal digits

Discovering the ZPA: Vade mecum



ZPA = zone of polarizing activity

AP patterning: Sonic hedgehog protein is expressed in the ZPA (Part 1)

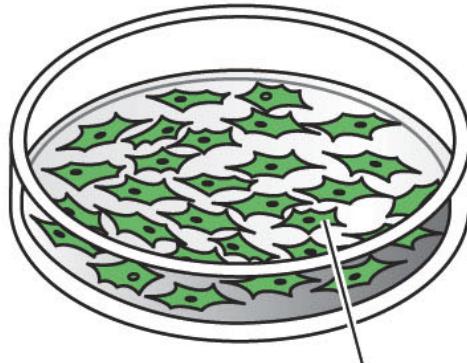
(A)



Is it sufficient?

AP patterning: Sonic hedgehog protein is expressed in the ZPA (Part 2)

(B) Transfect *shh*-expressing virus
and allow viral spread



↓
Infectable strain of chick
embryo fibroblast cells

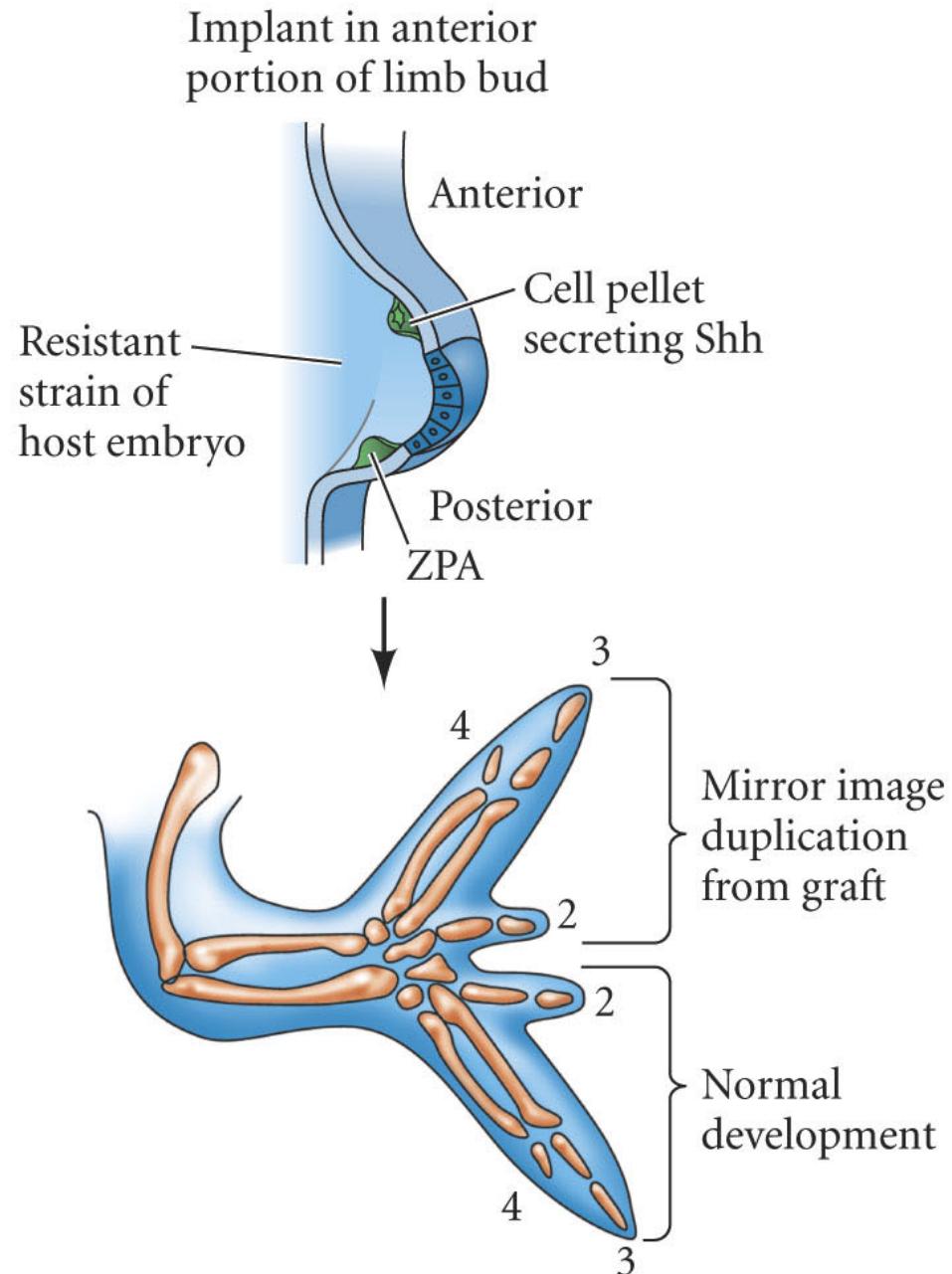
Centrifuge cells



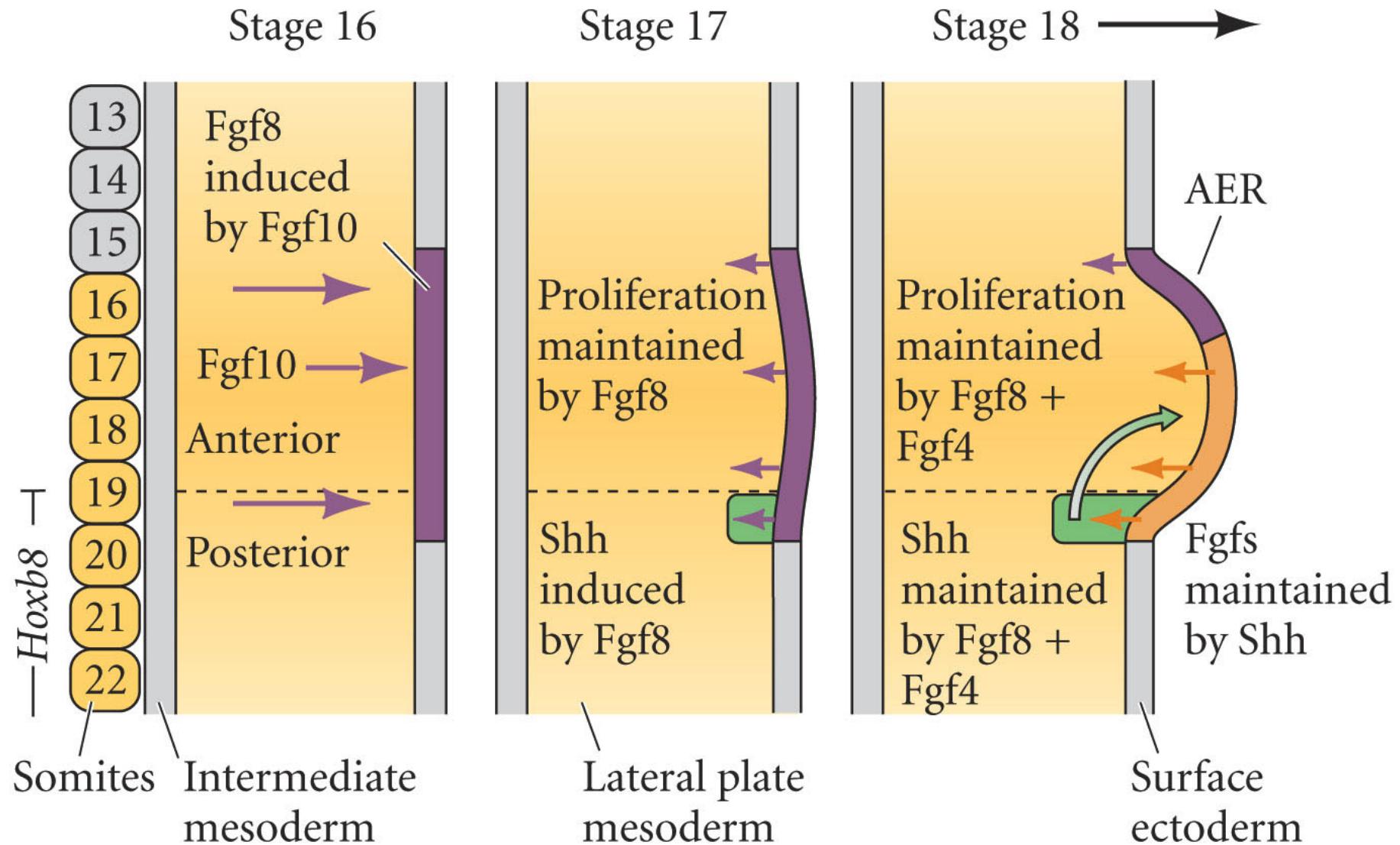
Cells containing
the *shh* gene



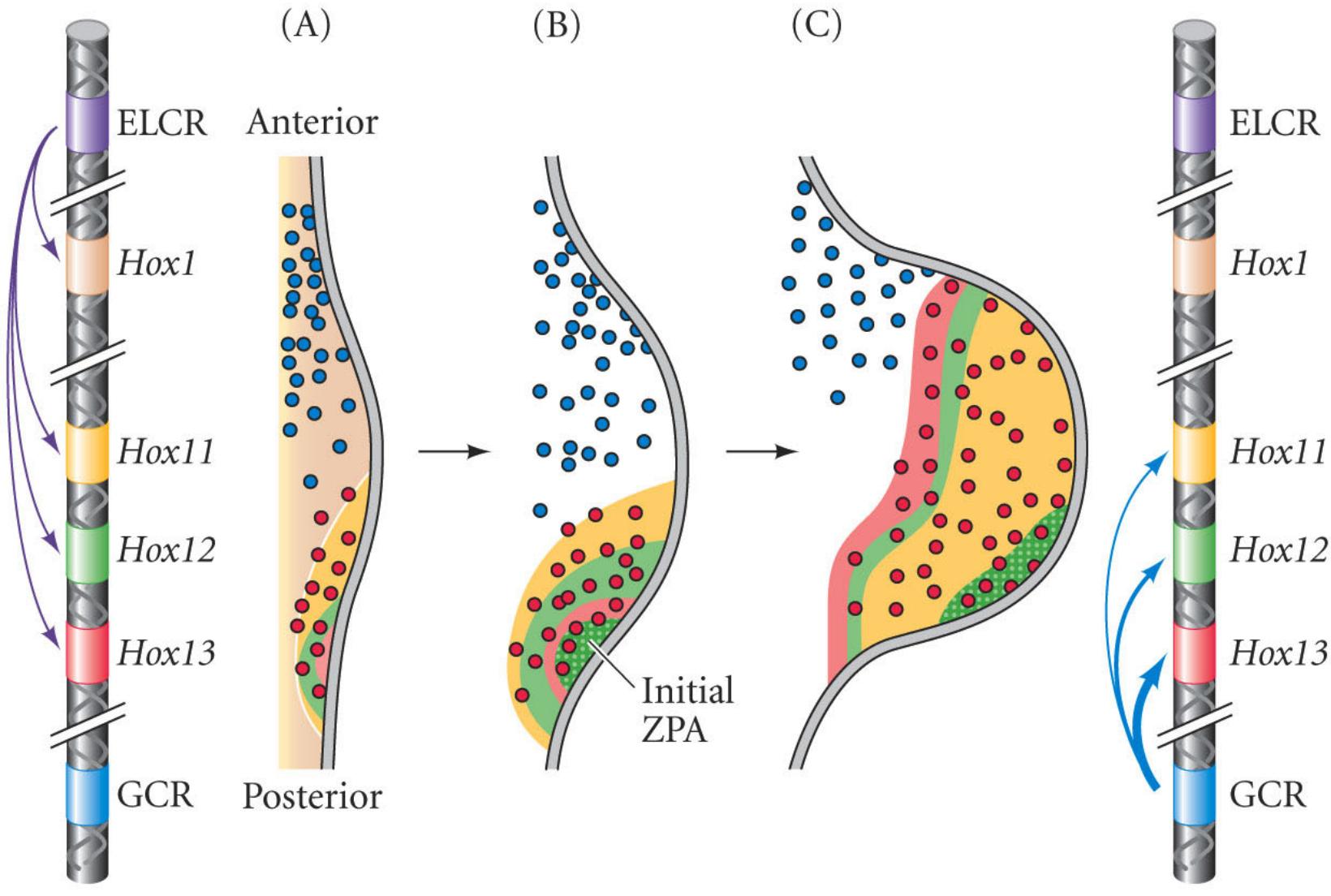
AP patterning: Sonic hedgehog protein is expressed in the ZPA (Part 3)



Patterning and growth of the bud: Feedback between the AER and the ZPA in the forelimb bud

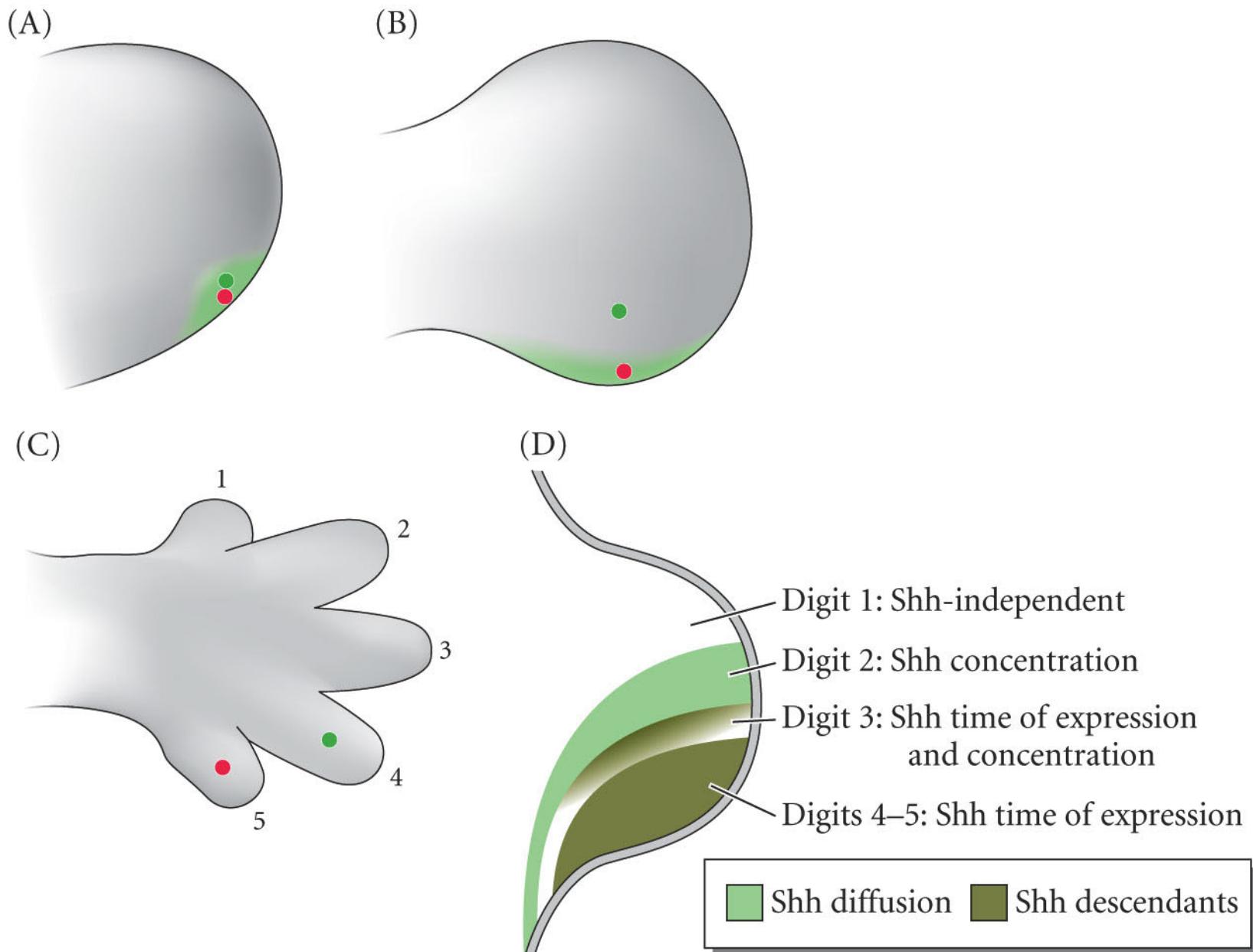


AP patterning: Hox gene expression changes during the formation of the tetrapod limb

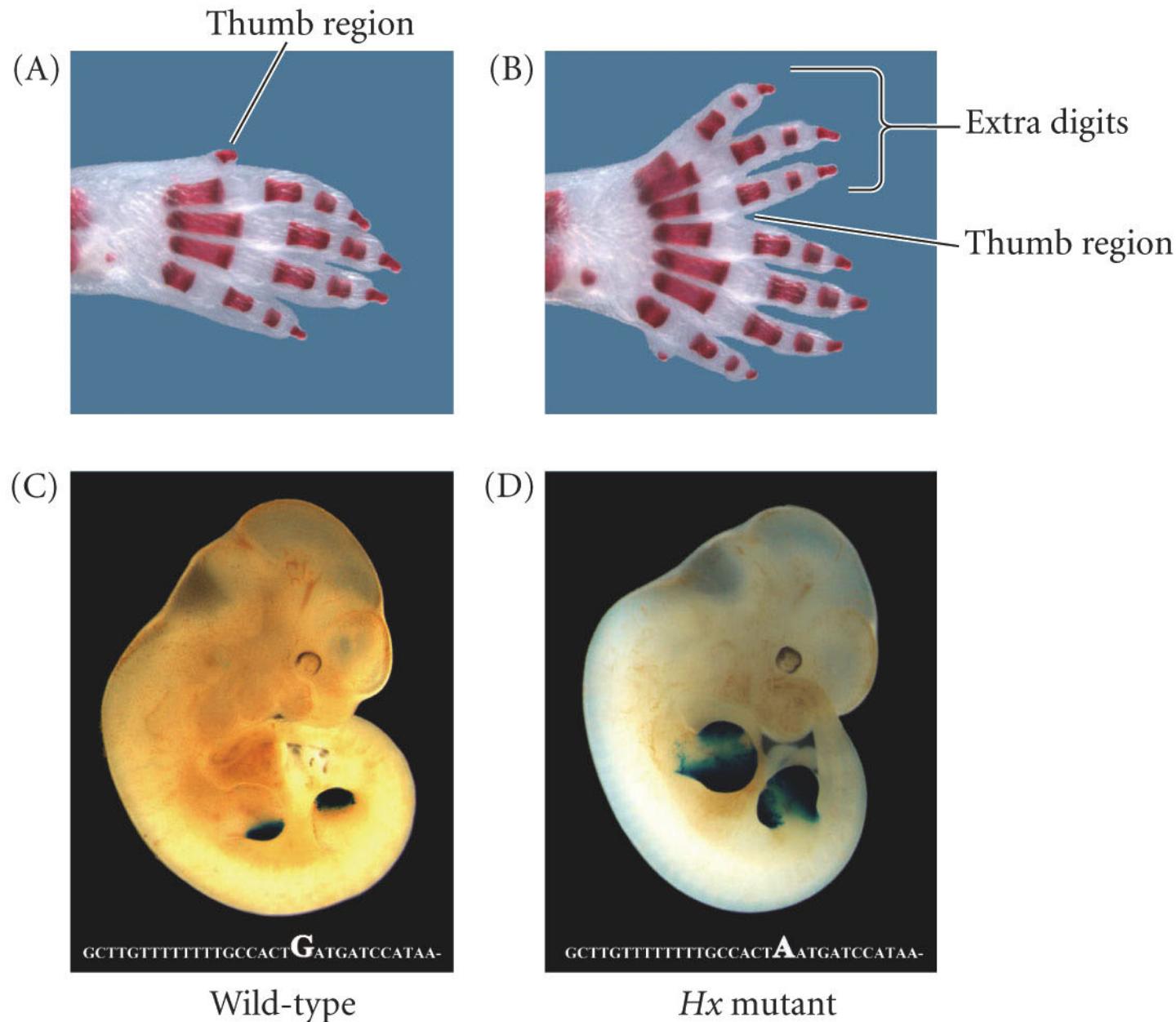


● Gli3 ● dHand ■ Shh

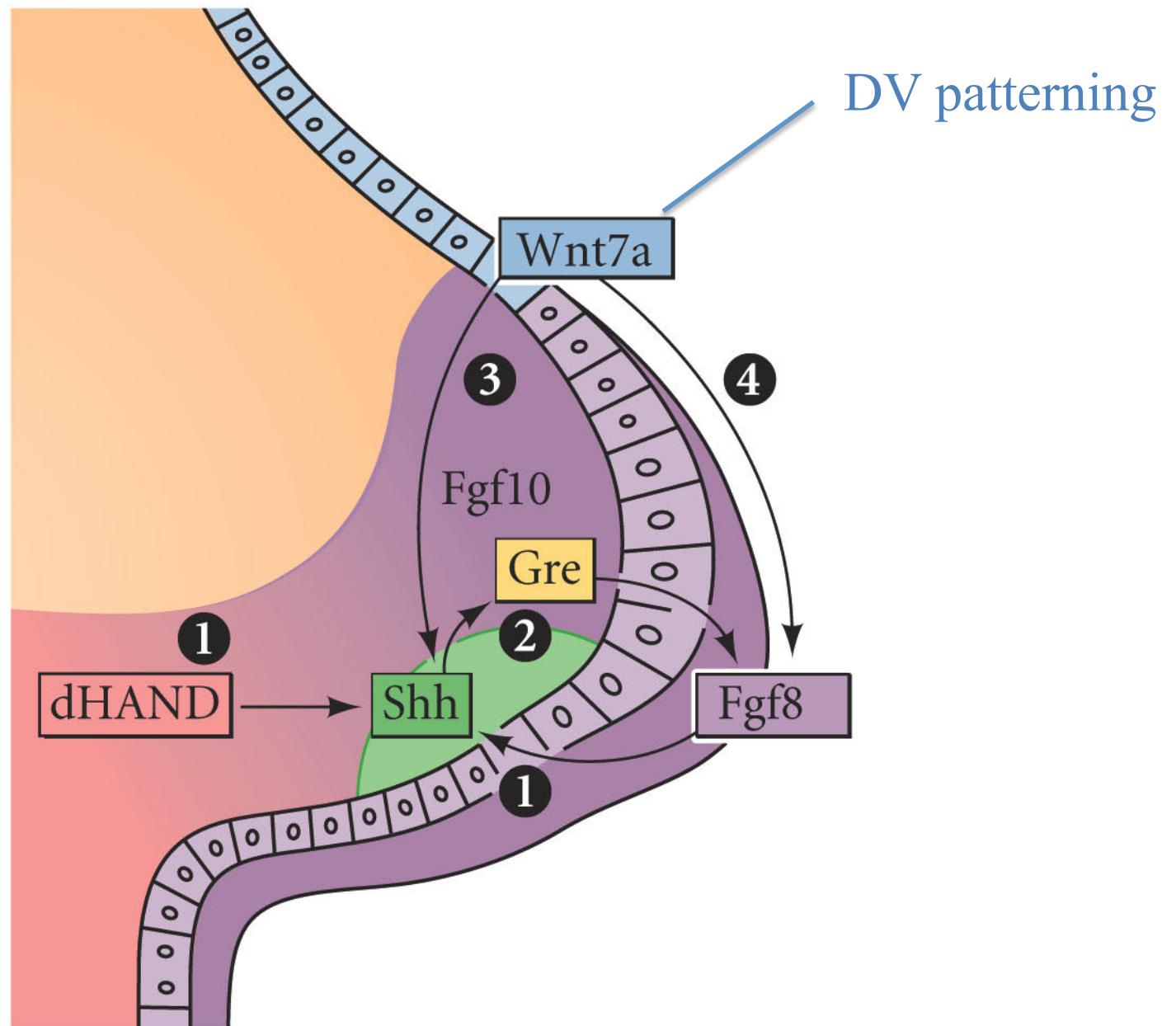
AP patterning and digit identity: The Shh-secreting cells form digits 4 and 5, and contribute to the specification of digits 2 and 3 in the mouse limb



AP patterning: Ectopic expression of mouse *sonic hedgehog* by a mutation in *Hx* in the anterior limb causes extra digit formation



Patterning and growth of the bud: Some of the molecular interactions by which limb bud formation and growth are initiated and maintained



DV Patterning: Vade mecum

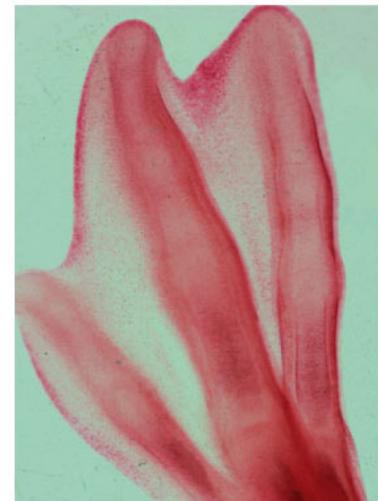
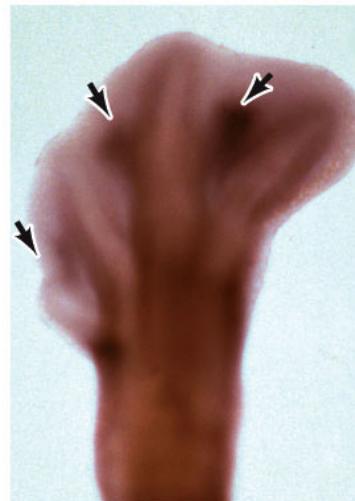
Apoptosis in late digit formation: Inhibition of cell death by inhibiting BMPs by Gremlin

Patterning through cell death: Vade mecum

Chick
hindlimb



Duck
hindlimb



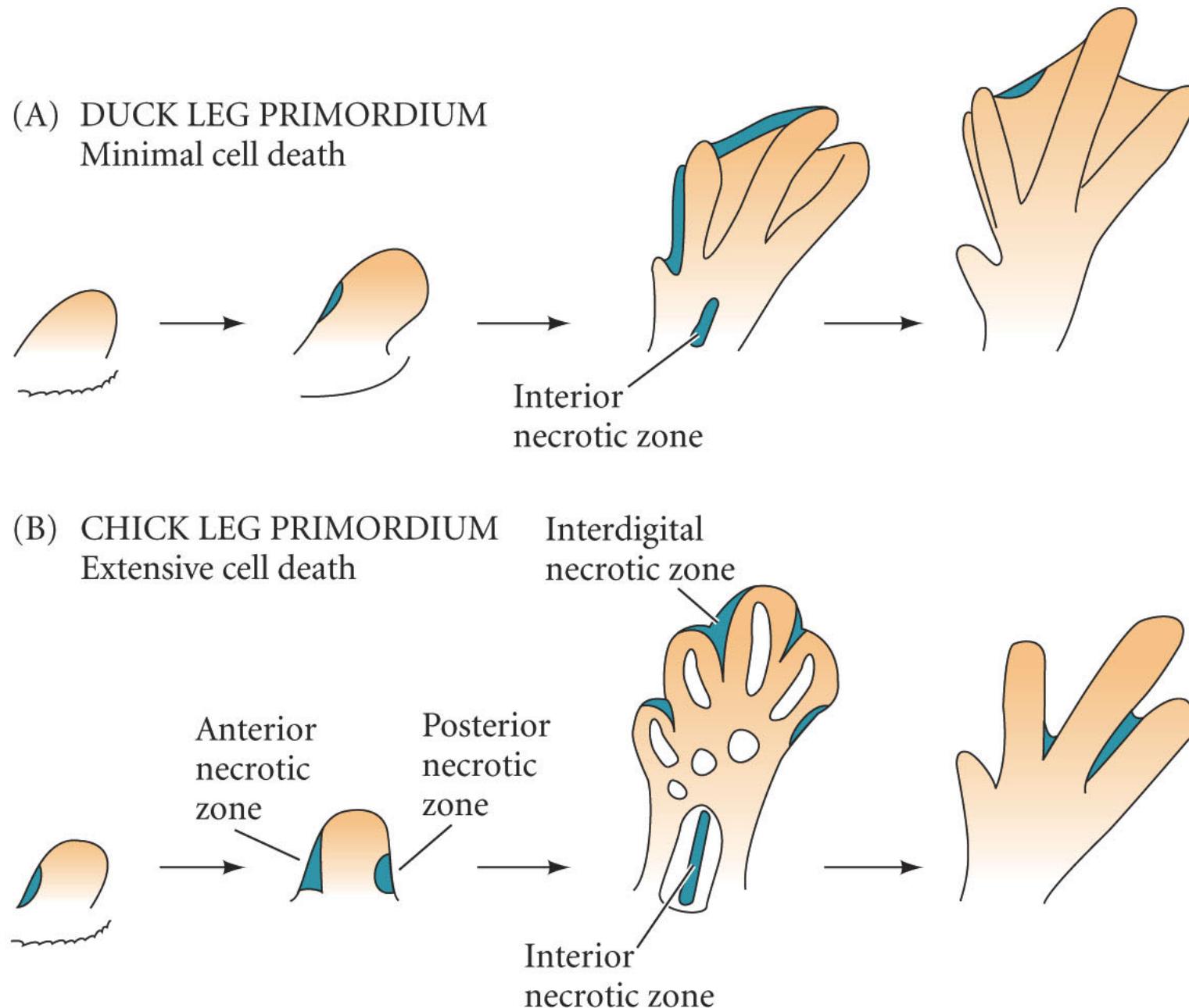
BMP

Gremlin

Apoptosis

Newborn

Late digit formation: Patterns of cell death in leg primordia of (A) duck and (B) chick embryos



Apoptosis in late digit formation: Inhibition of cell death by inhibiting BMPs in chick leg

(A)

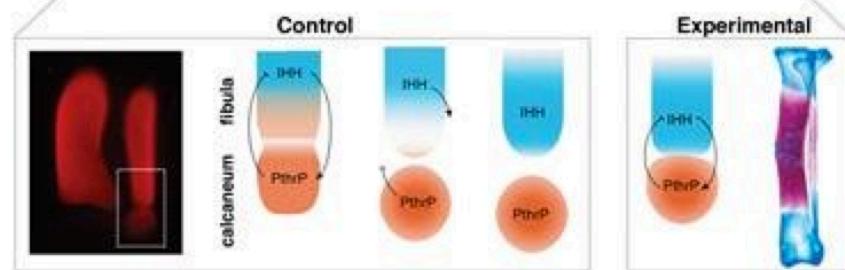
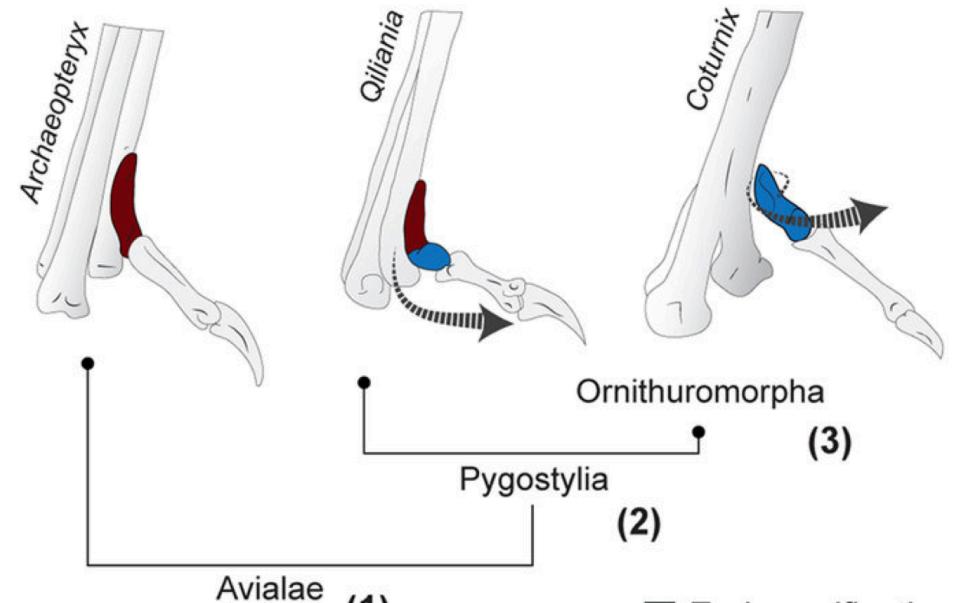
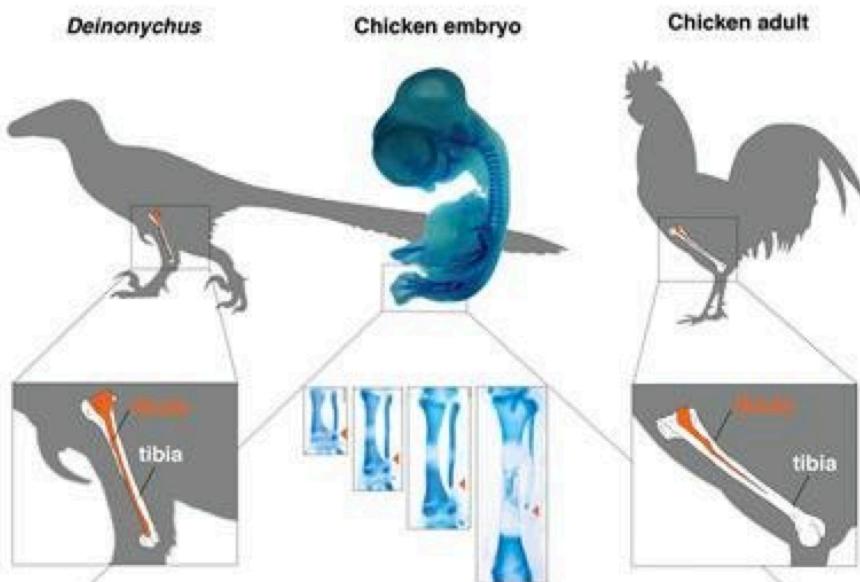


(B)



J  o  o Botelho (Brazilian researcher) et al. at the Vargas Lab (Universidad de Chile)

<https://www.sciencedaily.com/releases/2016/03/160307153051.htm>



■ Early ossification
■ Late ossification