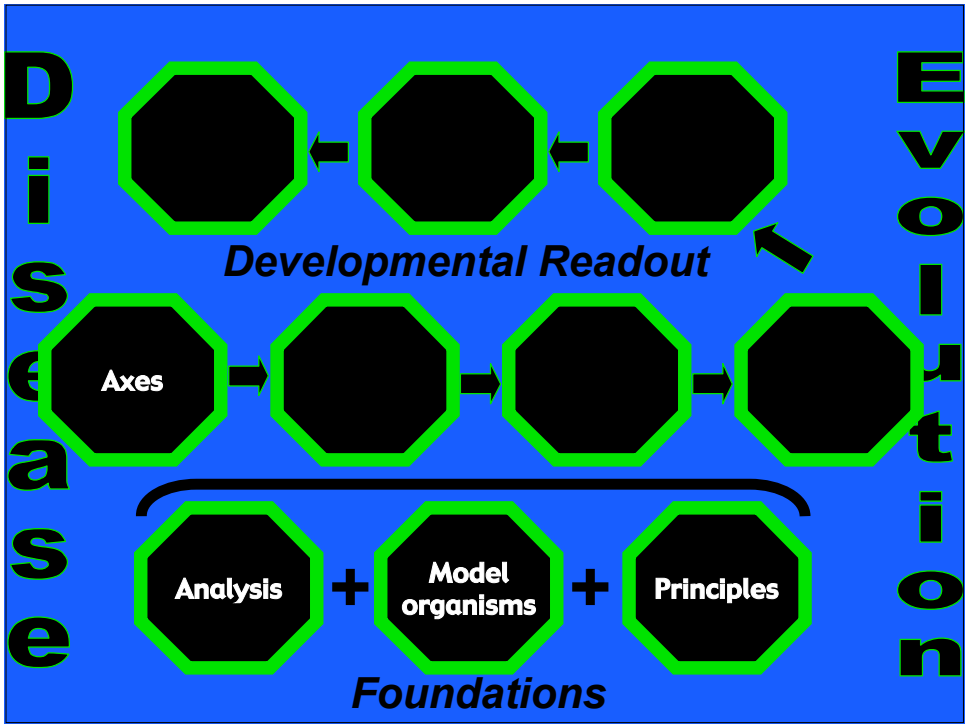
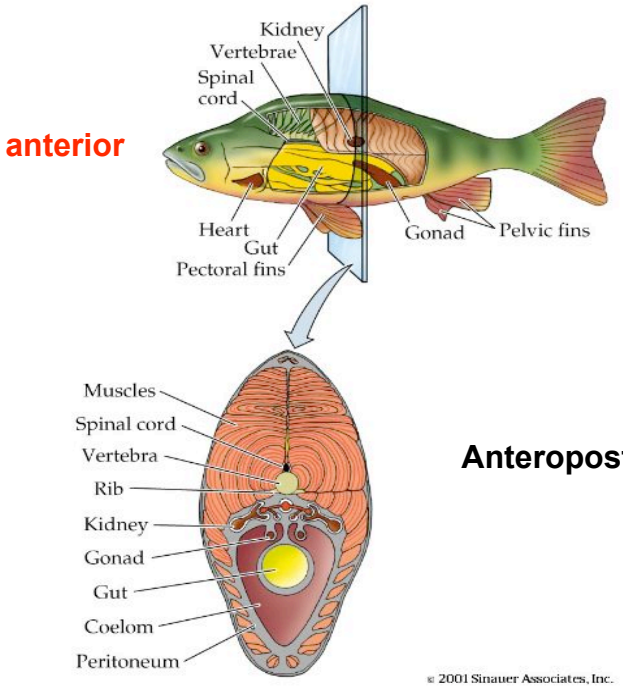
7.72
9.18.06

Anteroposterior axis



What is the A/P axis?

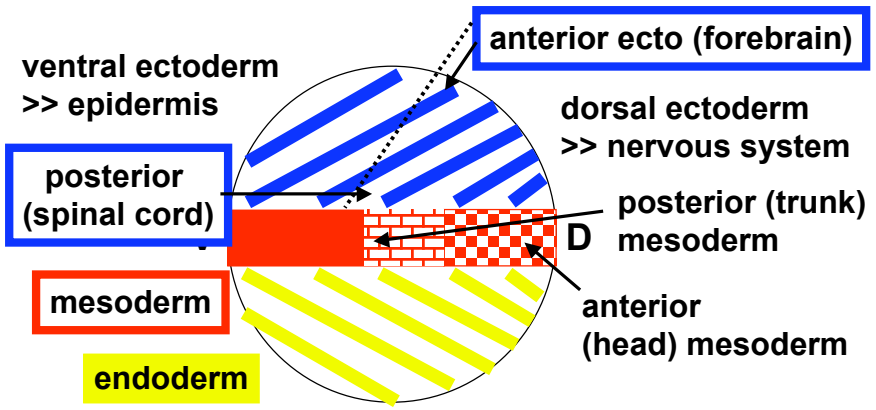
1



Anteroposterior axis

Germ layer rearrangement

2

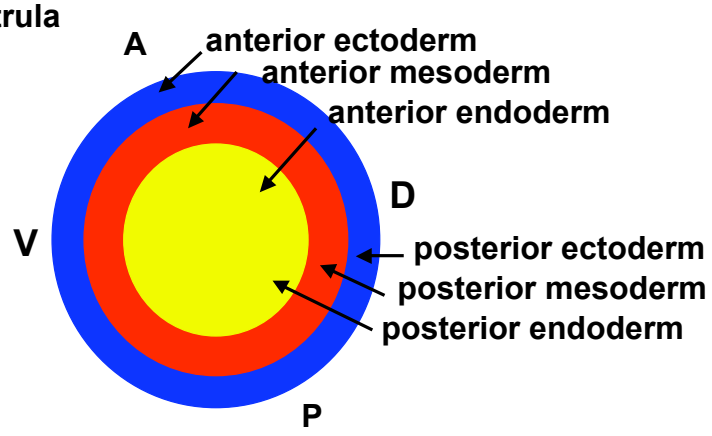


~50,000+ cells/ early gastrula

H. Sive, MIT 2006

3

Late gastrula



Reorganization of germ layers during gastrulation and A/P axis formation: general schematic

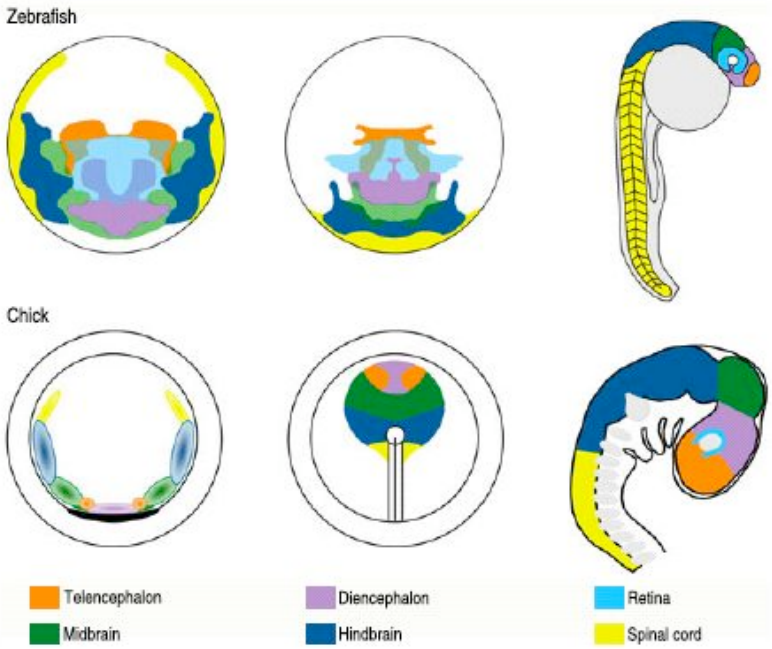
H. Sive, MIT 2006

When does the A/P axis form?

4

Fate maps

Stern et al



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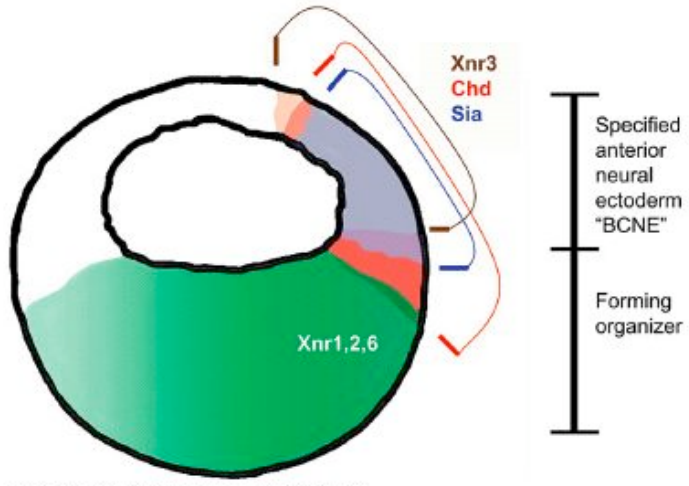
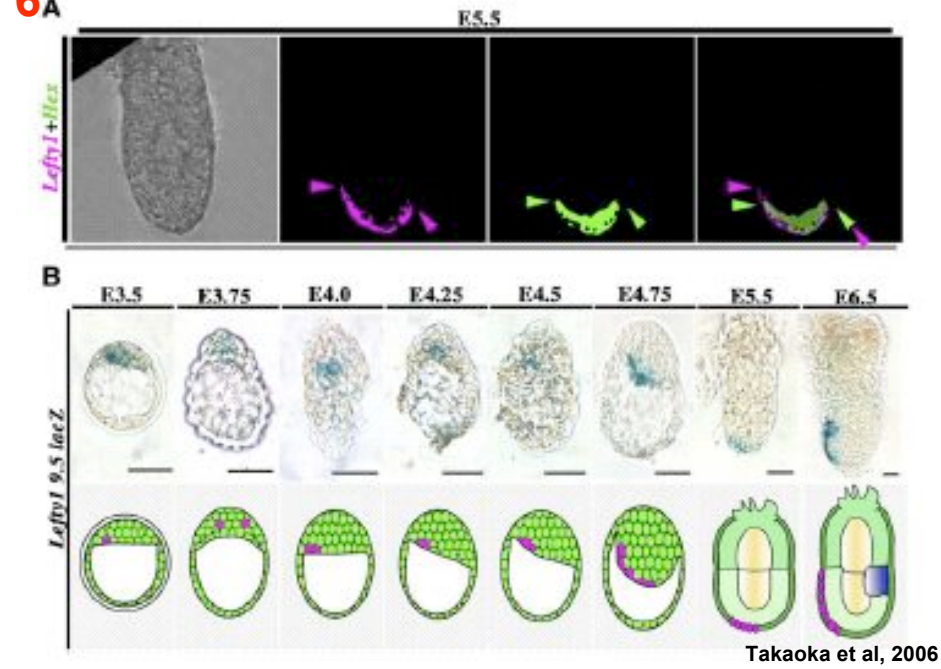


DOI: 10.1371/journal.pbio.0020127.g002

Figure 2. Expression Patterns in Dorsal Ectoderm
Expression patterns of selected genes in the late blastula of *Xenopus*, based on the work of Kuroda et al. (2004). See the text for further explanation.

Dawid, 2004

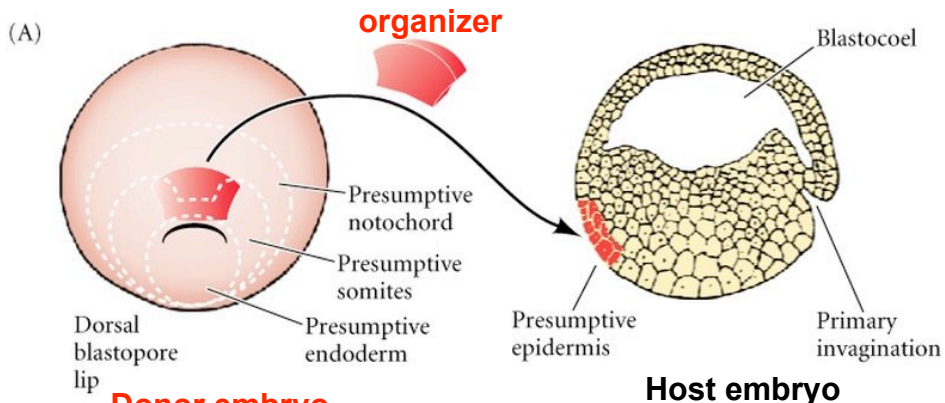
Mouse A/P axis present by implantation



Takaoka et al, 2006

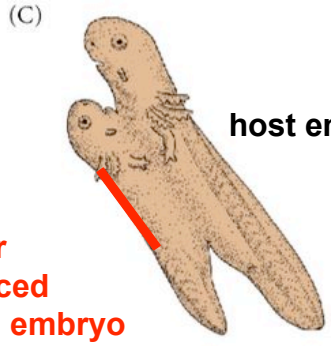
How does A/P axis form?
"The organizer"

7



Organizer transplant

8



donor
organizer
has induced
a second embryo
made mostly from host cells

Conjoined twins after organizer transplant:
organizer is an inducing center

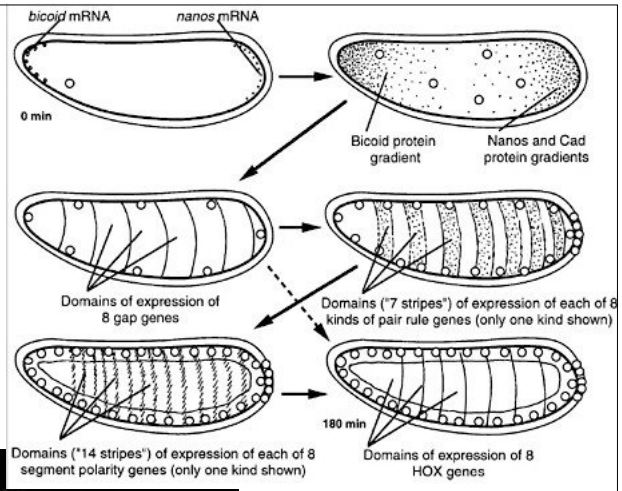
9

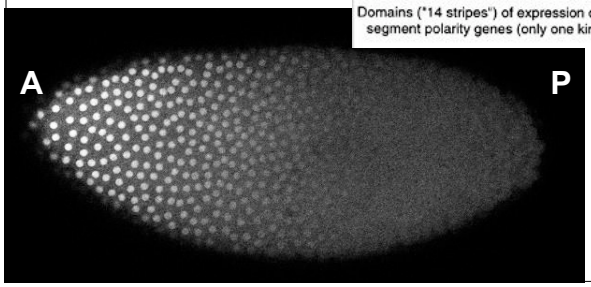
Twinned frog embryos

Relationship to D/V patterning?

10

In Drosophila, A/P axis forms independently of D/V axis.

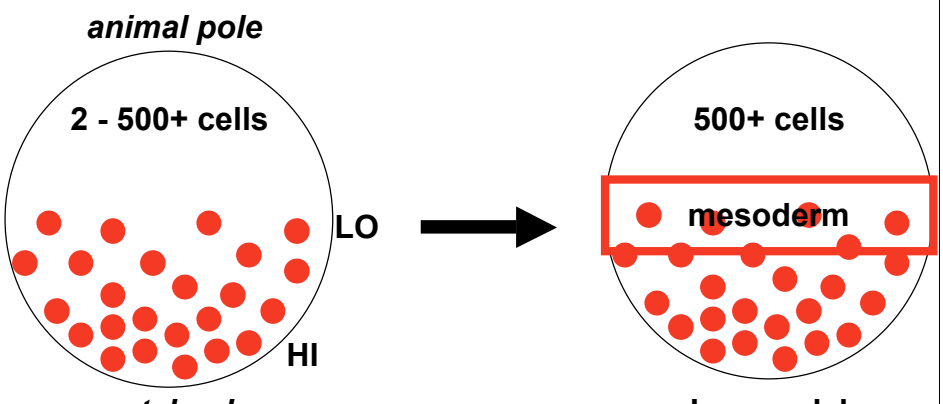




Bicoid protein gradient

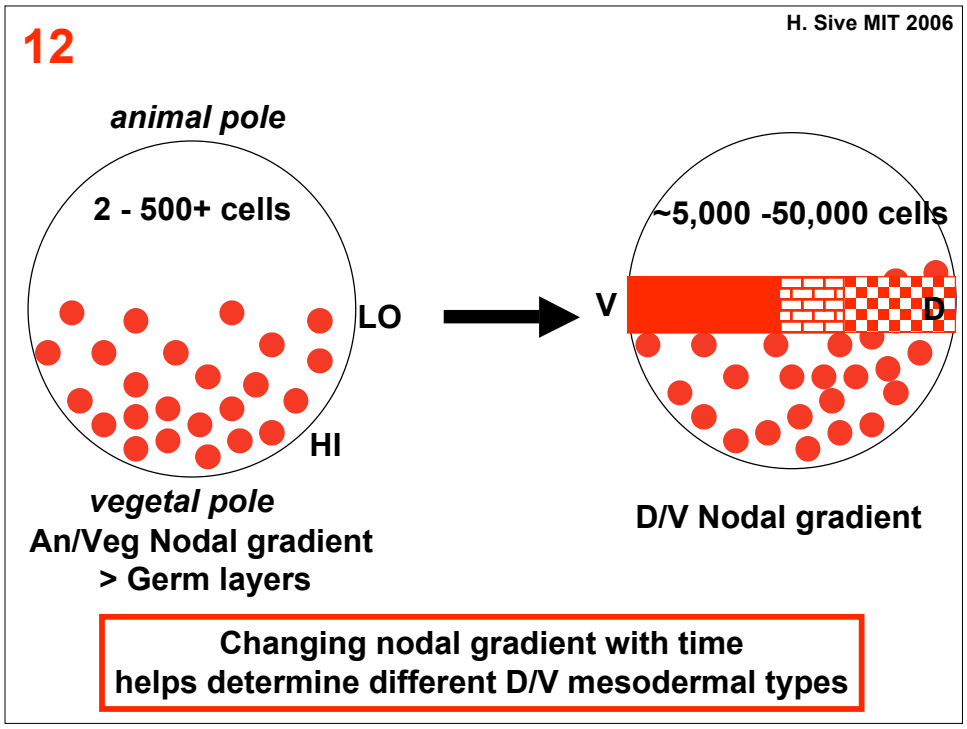
11

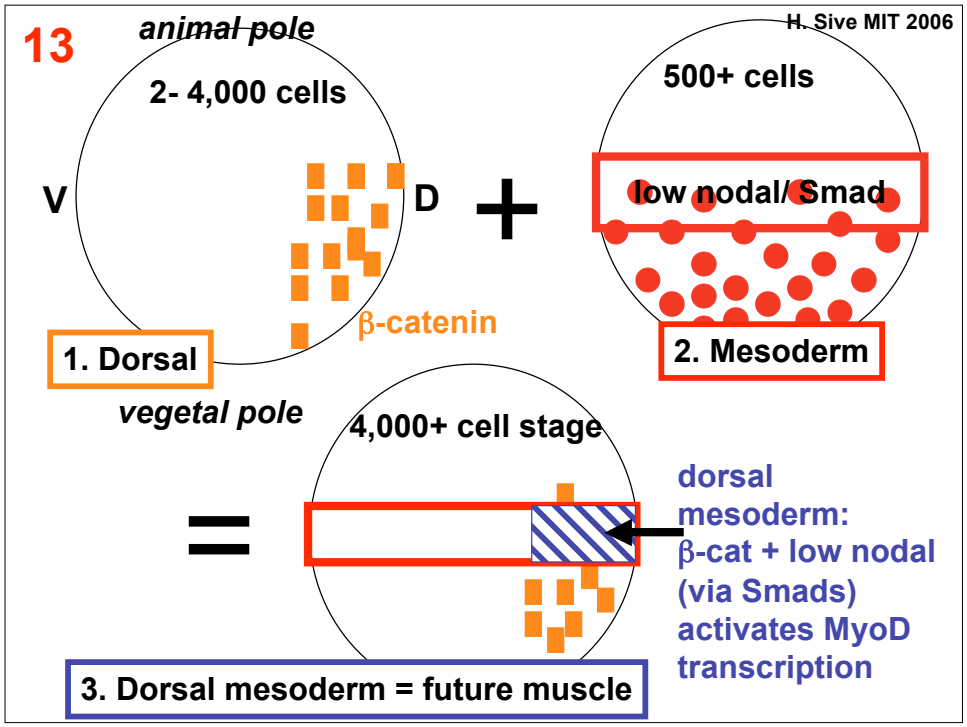
H. Sive MIT 2006



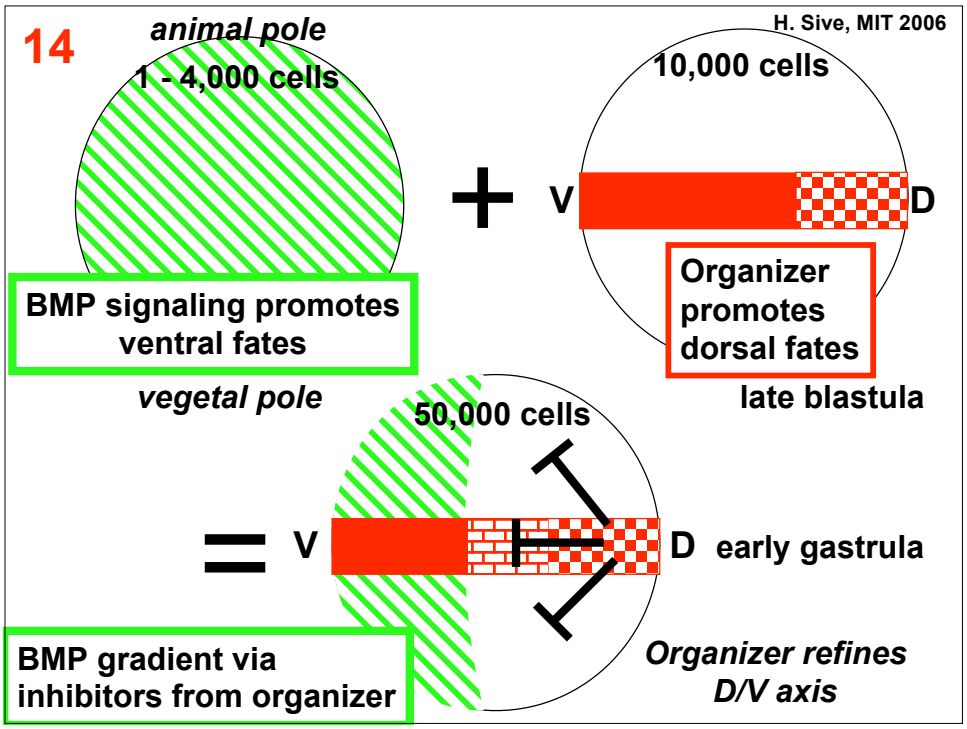
2. Mesoderm determination

(High nodal >> endoderm)


12
H. Sive MIT 2006
animal pole
2 - 500+ cells
LO
HI
vegetal pole
An/Veg Nodal gradient
> Germ layers
~5,000 -50,000 cells
V
D
D/V Nodal gradient
Changing nodal gradient with time
helps determine different D/V mesodermal types

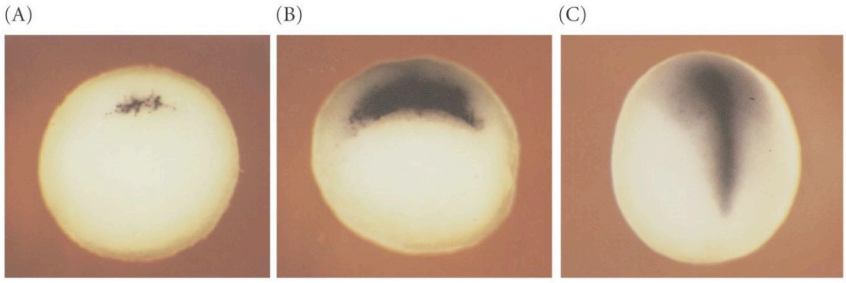

13
H. Sive MIT 2006
animal pole
2- 4,000 cells
V
D
β-catenin
1. Dorsal
vegetal pole
500+ cells
low nodal/ Smad
2. Mesoderm
4,000+ cell stage
dorsal mesoderm: β-cat + low nodal (via Smads) activates MyoD transcription
3. Dorsal mesoderm = future muscle

14



15

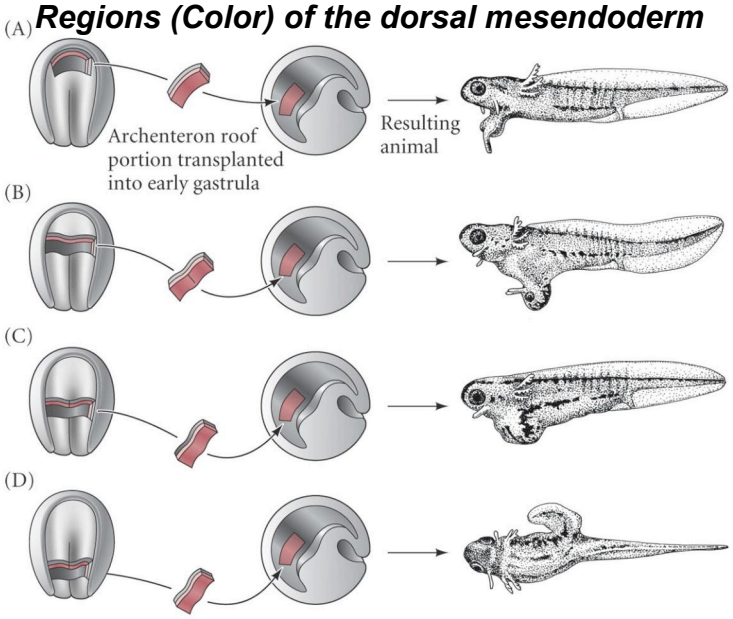
Gilbert Figure 10.32 *Localization of Chordin mRNA in the Xenopus organizer*



Separable head and trunk organizers

16

Gilbert Figure 10.40 ***Regional Specificity of Induction Demonstrated by Implanting Different Regions (Color) of the dorsal mesendoderm***

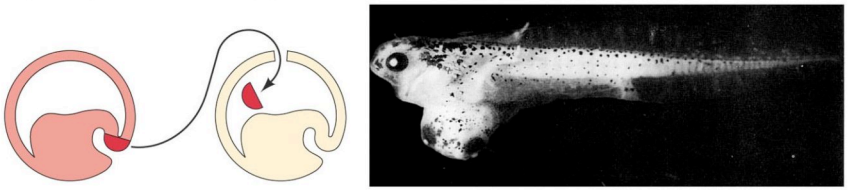


DEVELOPMENTAL BIOLOGY, Seventh Edition, Figure 10.40 Sinauer Associates, Inc.

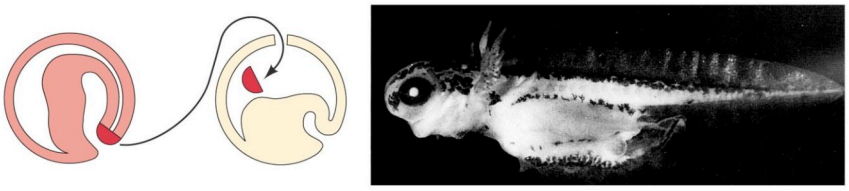
17

Gilbert Figure 10.41 *Regionally Specific Inducing Action of the Dorsal Blastopore Lip*

(A) Transplantation of young gastrula dorsal lip



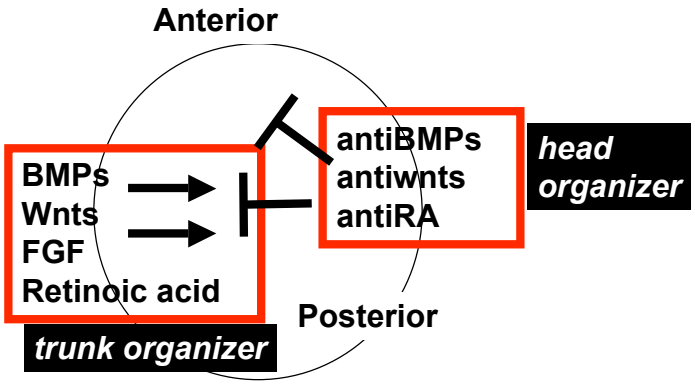
(B) Transplantation of advanced gastrula dorsal lip



DEVELOPMENTAL BIOLOGY, Seventh Edition, Figure 10.41 Sinauer Associates, Inc.

Genes, factors

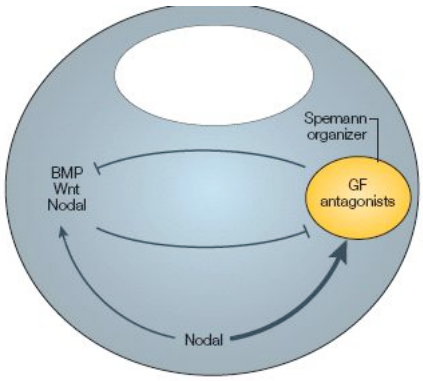
18



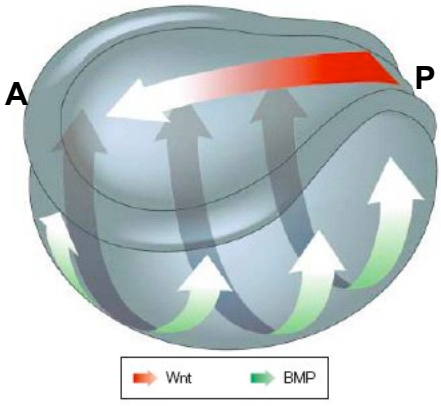
Signaling molecules involved in A/P patterning: mid- to late gastrula: Xenopus schematic

H. Sive, MIT 2006

19



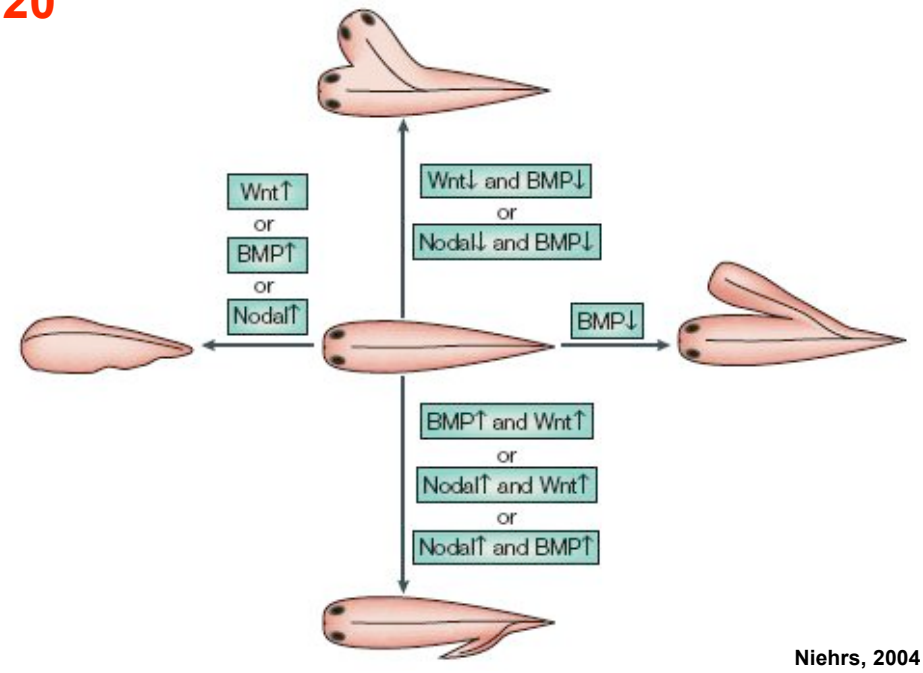
Early gastrula



Mid-neurula

Niehrs, 2004

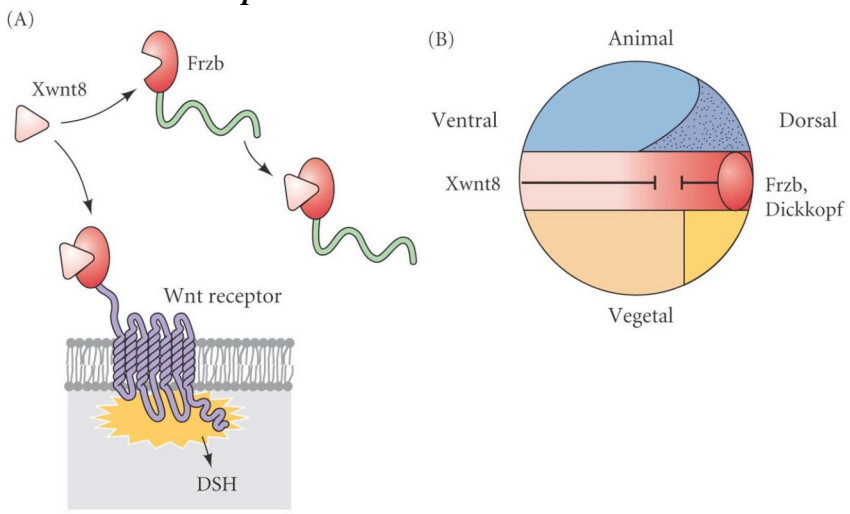
20



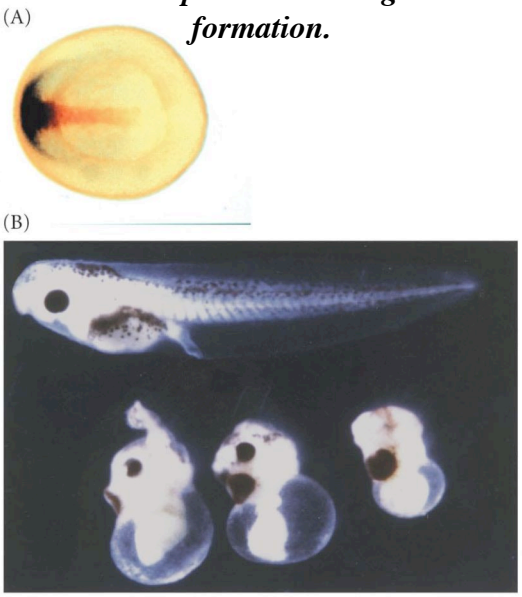
Niehrs, 2004

21

Gilbert Figure 10.36 ***Late expession of Xwnt8 ventralizes mesoderm and prevents Head Formation in the Ectoderm***

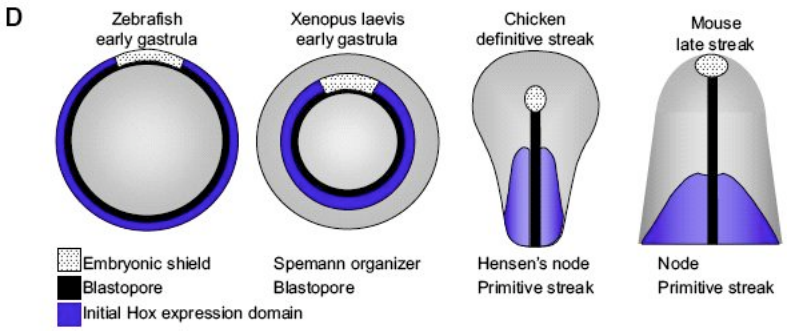


22 **Gilbert Figure 10.37** ***Expression of the Wnt inhibitor Frzb in future head. Overexpression leading to enhanced head formation.***



Organizers in other vertebrates

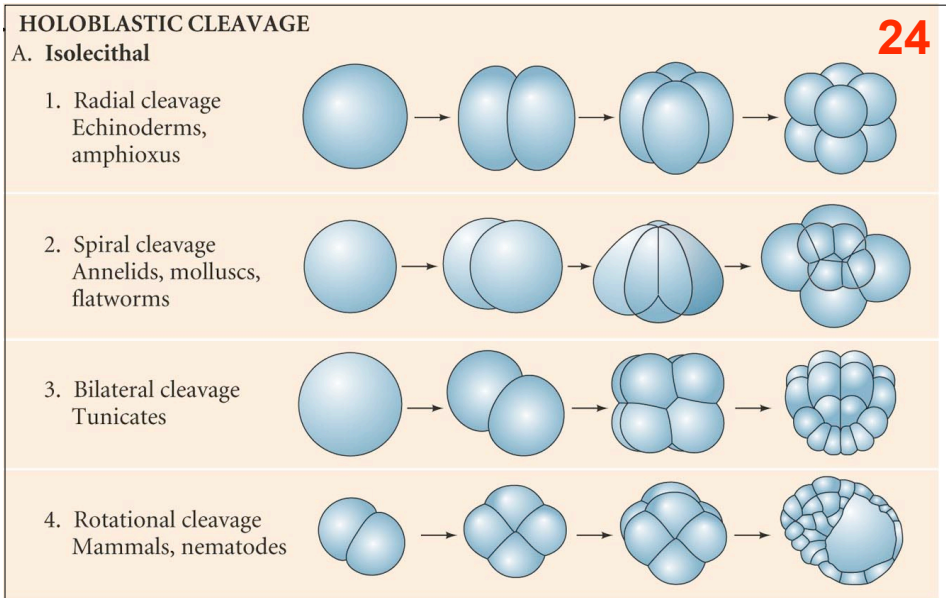
23



Organizer position in various vertebrates

Stern et al, 2006

24



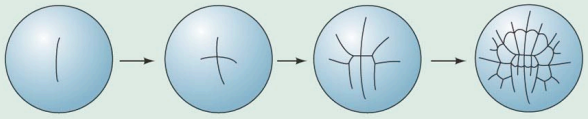
Gilbert Figure 8.4(1) *Cleavage patterns*

25

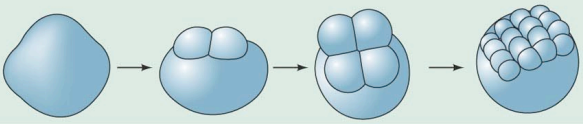
II. MEROBLASTIC CLEAVAGE

A. **Telolecithal**

1. Bilateral cleavage
   Cephalopod molluscs

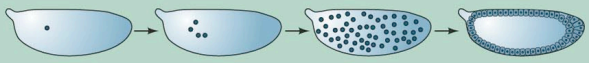


2. Discoidal cleavage
   Fish, reptiles, birds



B. **Centrolecithal**

Superficial cleavage
Most insects

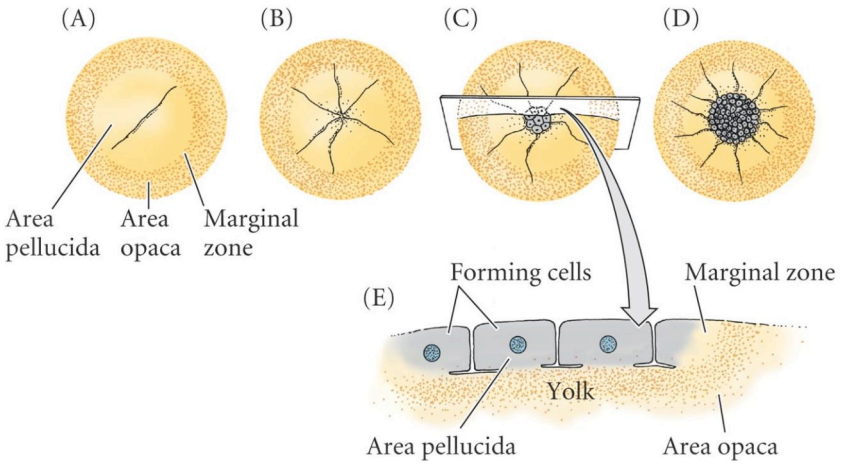


DEVELOPMENTAL BIOLOGY, Seventh Edition, Figure 8.4 (Part 3) Sinauer Associates, Inc.

chicken

26

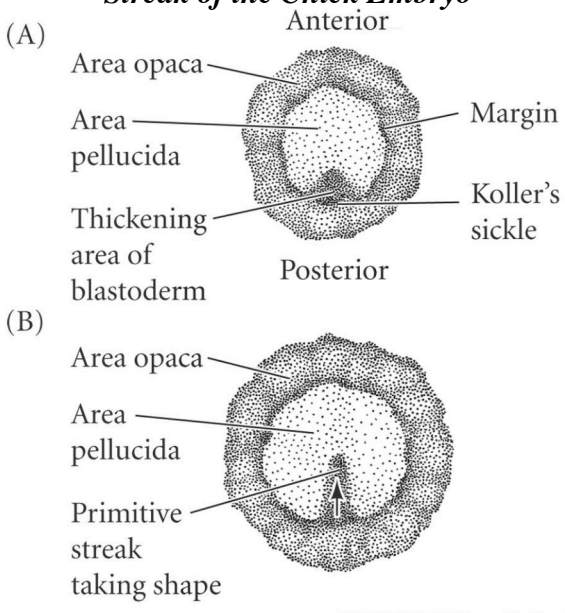
Gilbert Figure 11.12 ***Discoidal Cleavage in a Chick Egg***



DEVELOPMENTAL BIOLOGY, Seventh Edition, Figure 11.12 Sinauer Associates, Inc.

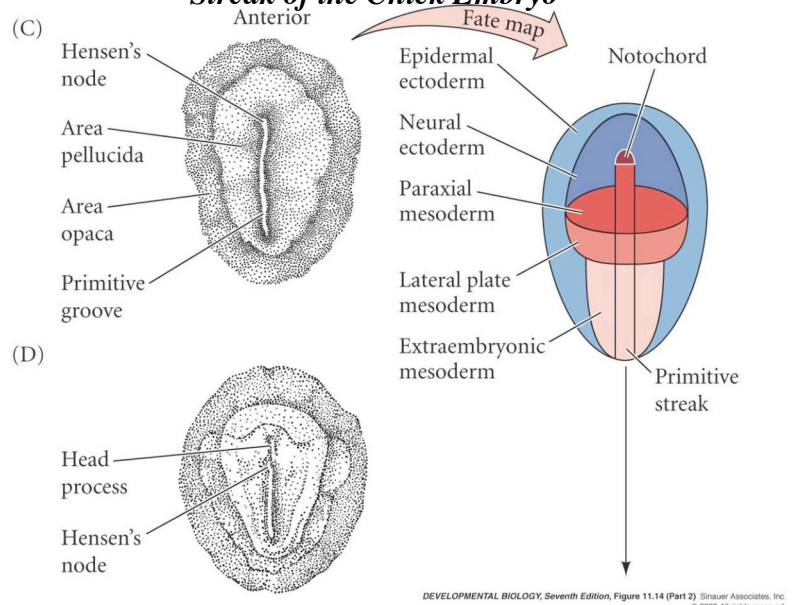
27

Gilbert Figure 11.14(1) ***Cell Movements of the Primitive Streak of the Chick Embryo***



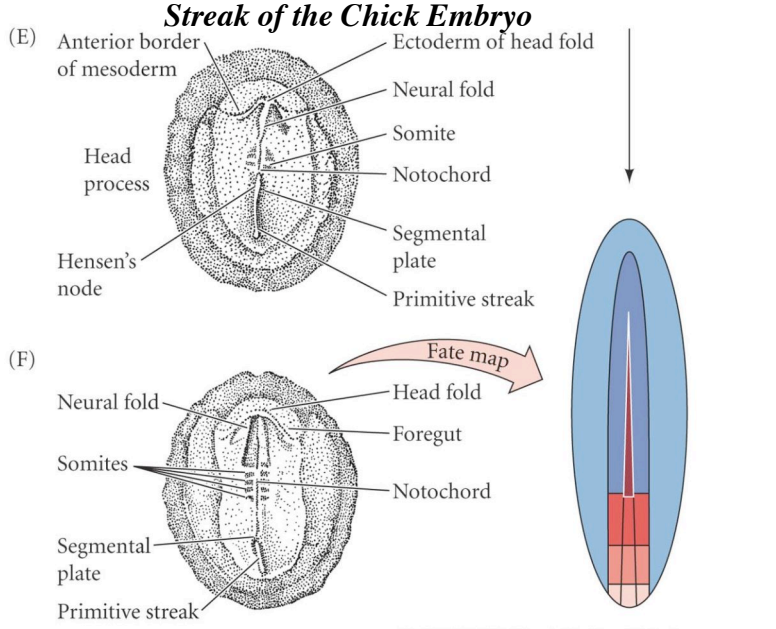
DEVELOPMENTAL BIOLOGY, Seventh Edition, Figure 11.14 (Part 1) Sinauer Associates, Inc.

28 **Gilbert Figure 11.14(2)** ***Cell Movements of the Primitive Streak of the Chick Embryo***



DEVELOPMENTAL BIOLOGY, Seventh Edition, Figure 11.14 (Part 2) Sinauer Associates, Inc. © 2003 All rights reserved.

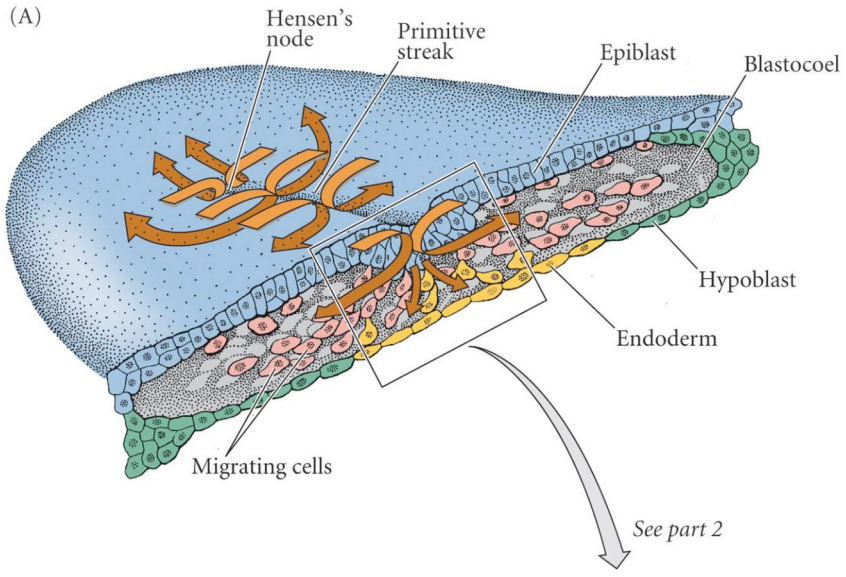
29 **Gilbert Figure 11.14(3)** ***Cell Movements of the Primitive Streak of the Chick Embryo***



DEVELOPMENTAL BIOLOGY, Seventh Edition, Figure 11.14 (Part 3) Sinauer Associates, Inc. © 2003 All rights reserved.

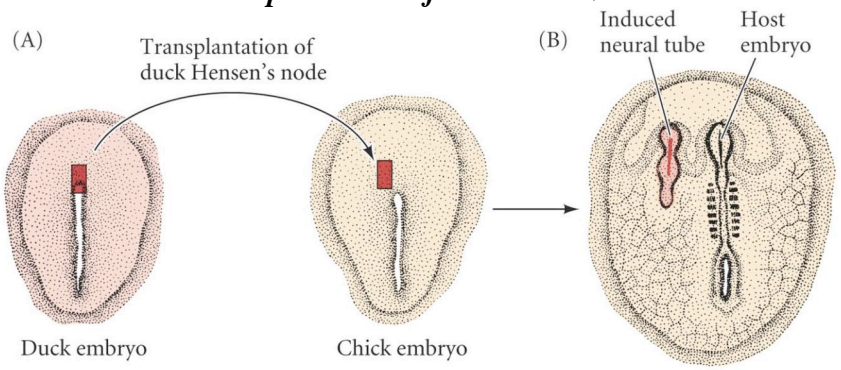
30

Gilbert Figure 11.15(1) ***Migration of Endodermal and Mesodermal Cells Through the Primitive Streak***



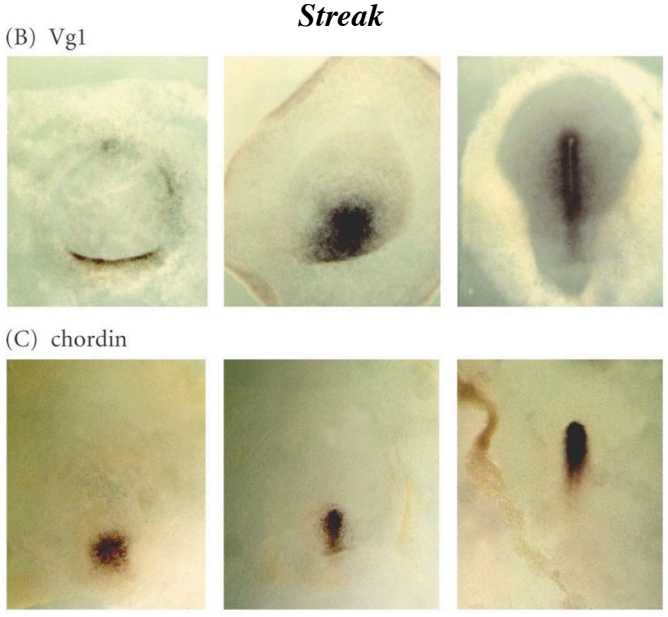
31

Gilbert Figure 11.20(1) ***Induction of a New Embryo by Transplantation of Hensen's Node***



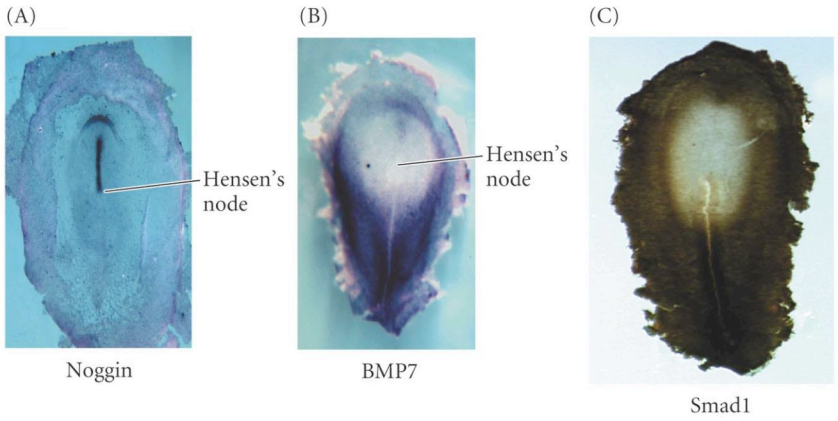
32

Gilbert Figure 11.21(2) ***Gene Expression in the Primitive Streak***



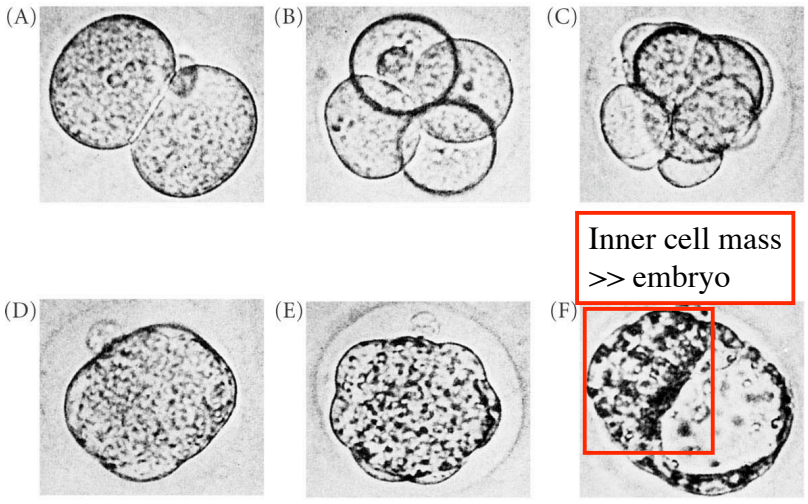
33

Gilbert Figure 11.22 ***Possible Contribution to Chick Neural Induction by the Inhibition of Bmp Signaling***



mouse

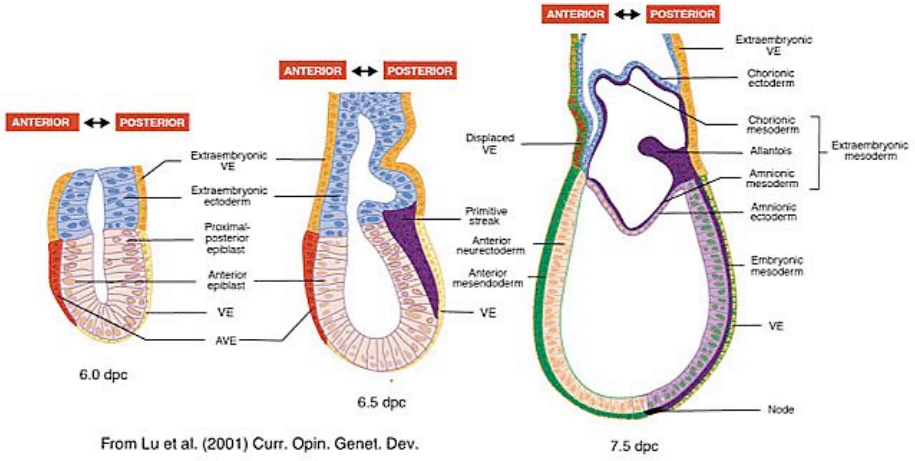
34



Inner cell mass
>> embryo

Gilbert Figure 11.28 ***Mouse cleavage***

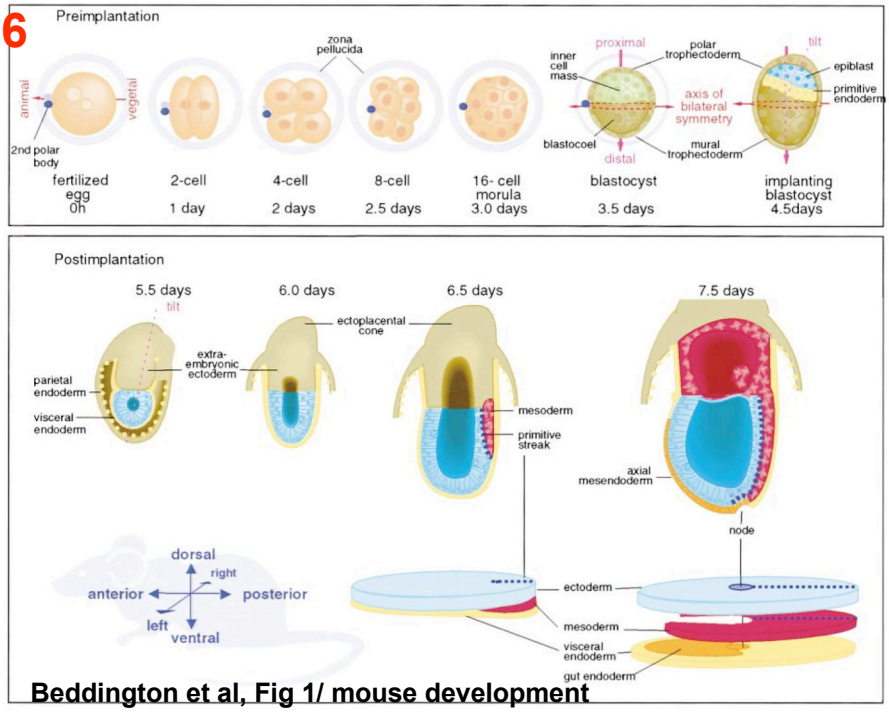
35



From Lu et al. (2001) Curr. Opin. Genet. Dev.

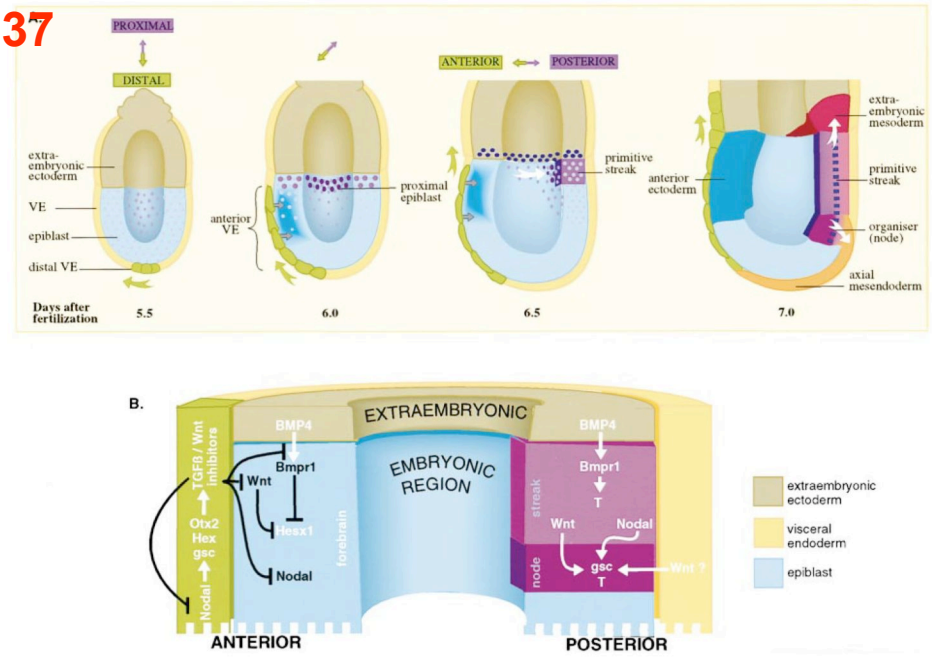
Mouse gastrulation

36



Beddington et al, Fig 1/ mouse development

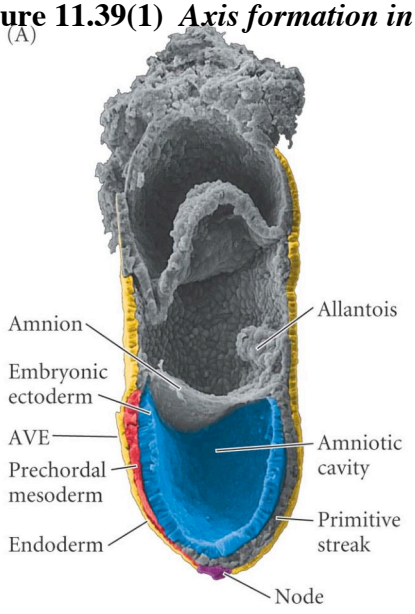
37



Beddington et al, Fig 2/ mouse development

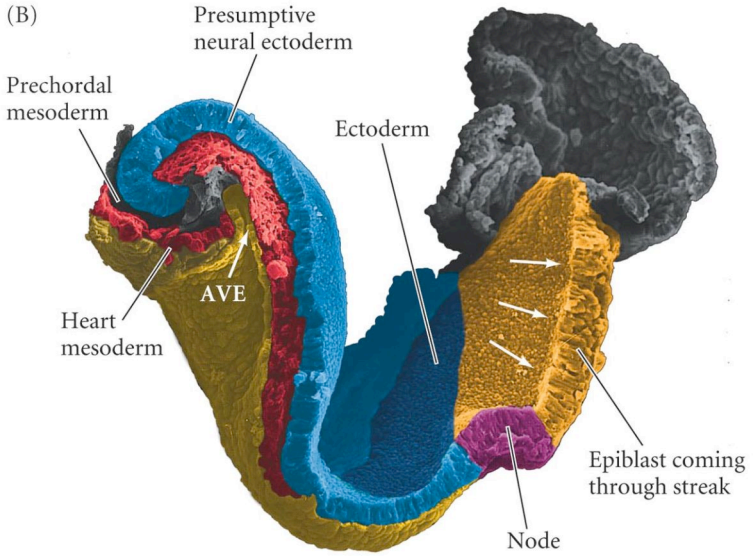
38

Gilbert Figure 11.39(1) ***Axis formation in the Mouse***



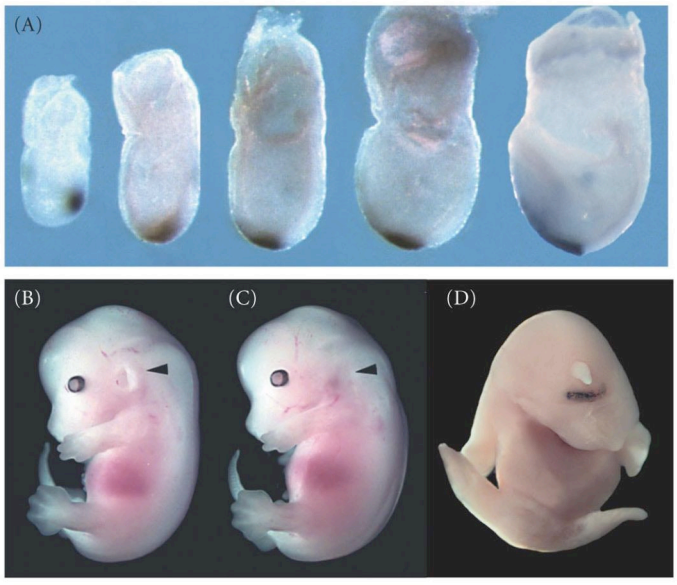
39

Gilbert Figure 11.39(2) ***Axis formation in the Mouse***



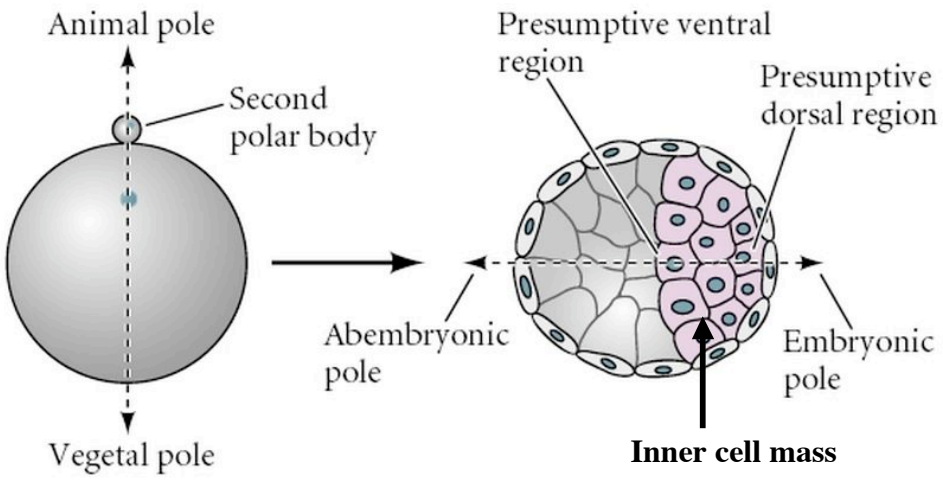
40

Gilbert Figure 11.40 ***Expression of BMP Antagonists in the Mammalian Node***



human/ primate

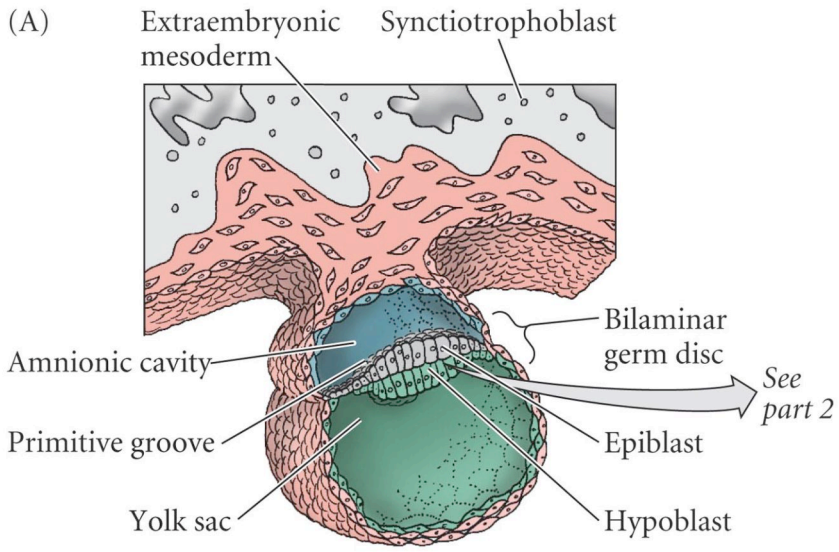
41



Gilbert Figure 11.41
Human embryo

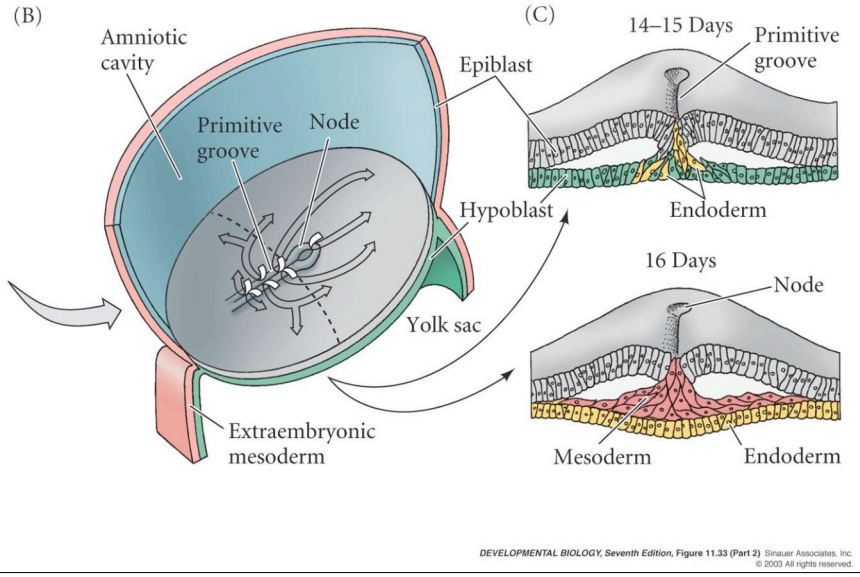
42

Gilbert Figure 11.33(1) ***Amnion Structure and Cell Movements During Human Gastrulation***



43

Gilbert Figure 11.33(2) ***Amnion Structure and Cell Movements During Human Gastrulation***



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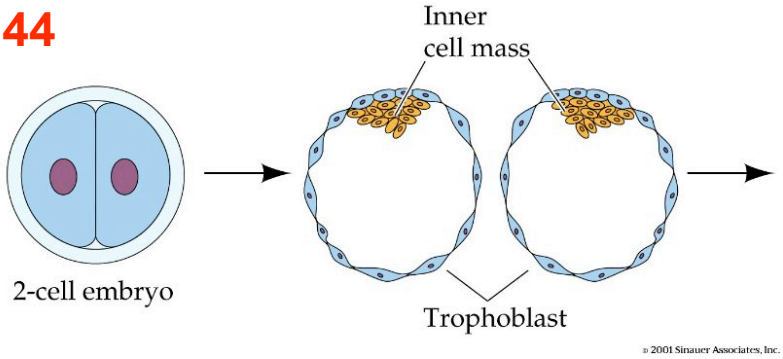
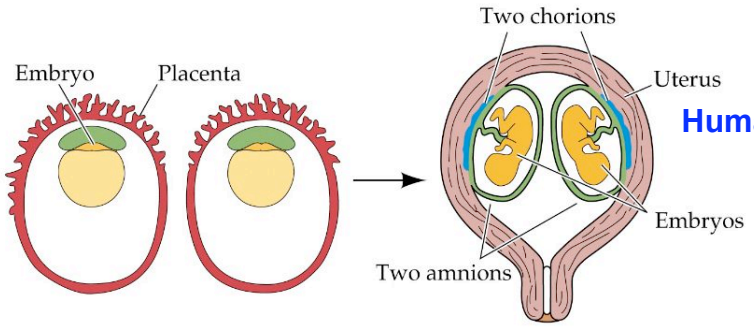
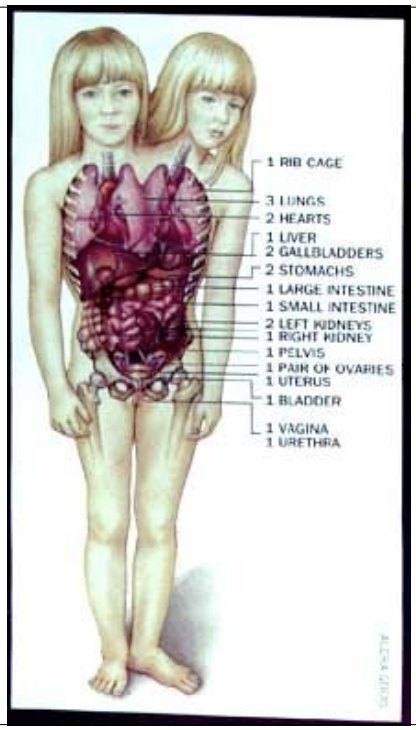
44





Human twinning

45



Conjoined twins