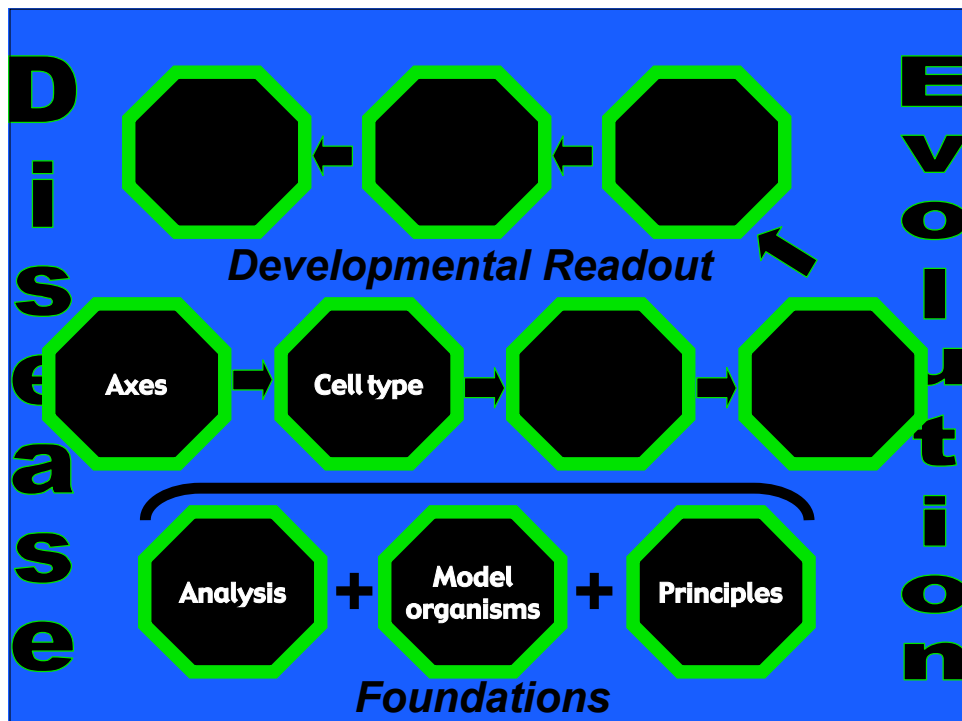
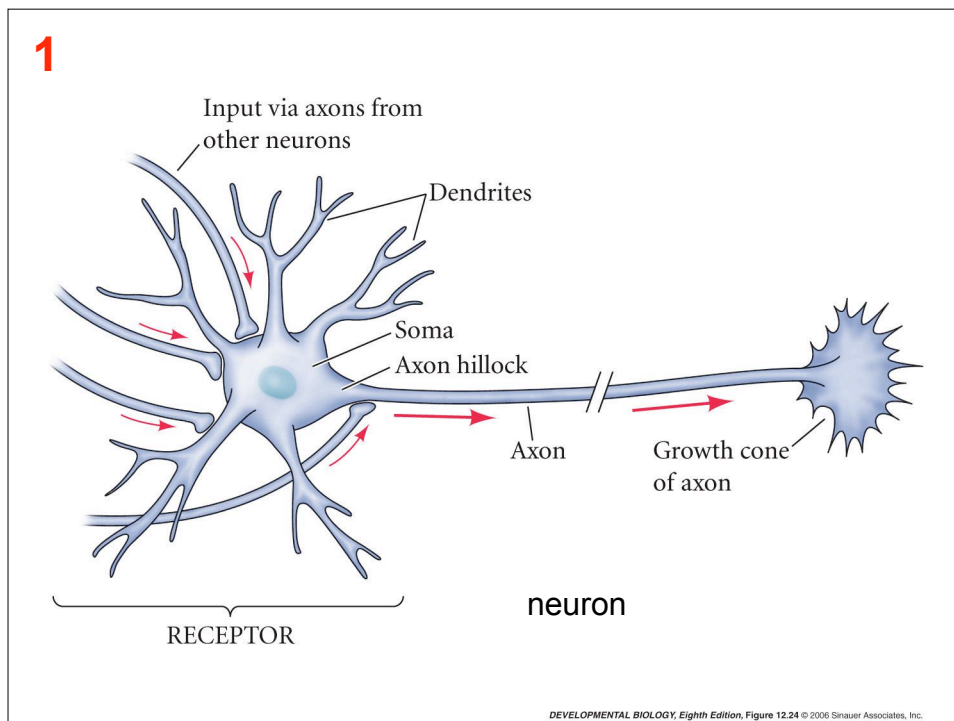


7.72
10.11.06

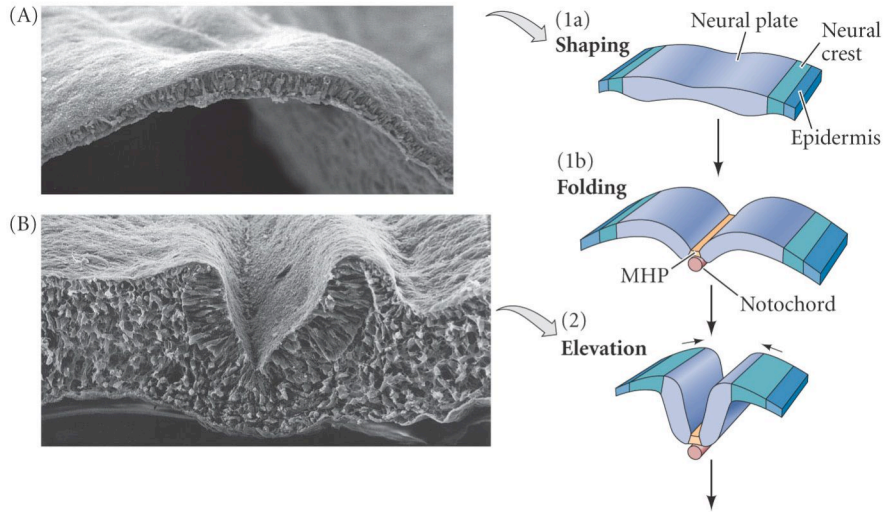
Cell Type
Nervous System I



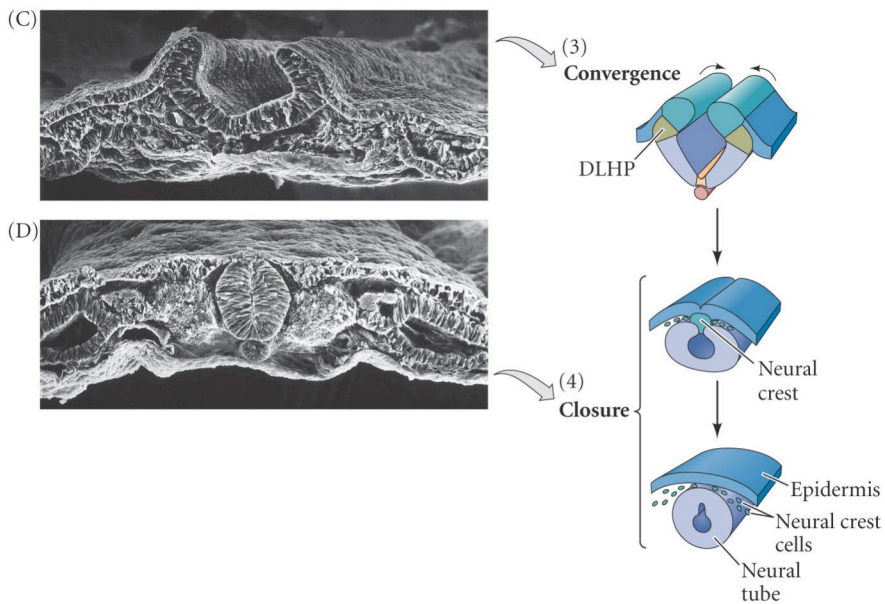
What is the nervous system?



2 Gilbert 12.3 Primary neurulation: neural tube formation in the chick embryo (Part 1)

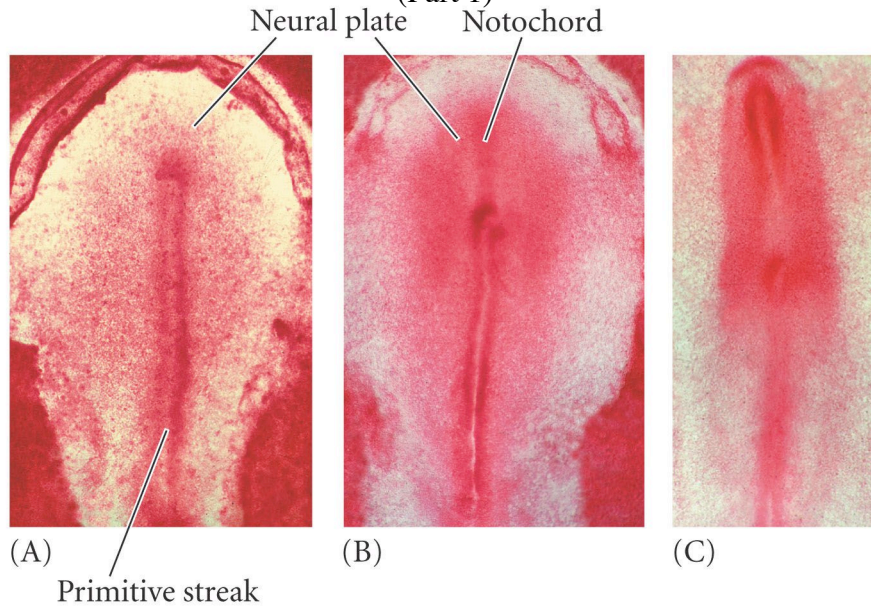


3 Gilbert 12.3 Primary neurulation: neural tube formation in the chick embryo (Part 2)



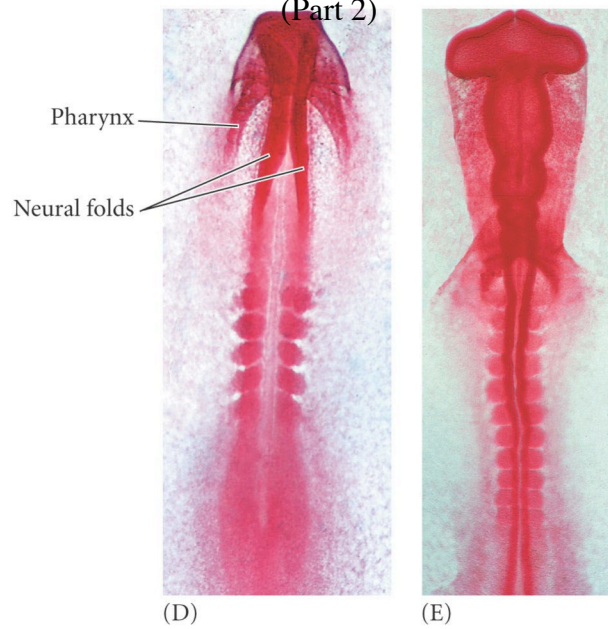
4 Gilbert 12.2 Neurulation in a chick embryo (dorsal view)

(Part 1)



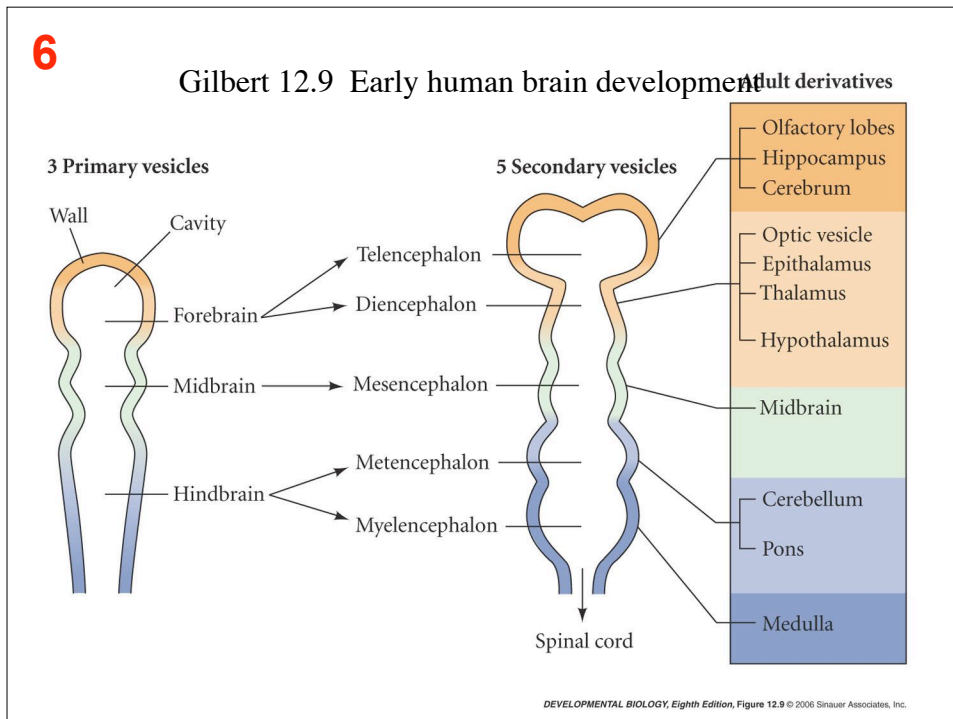
5 Gilbert 12.2 Neurulation in a chick embryo (dorsal view)

(Part 2)

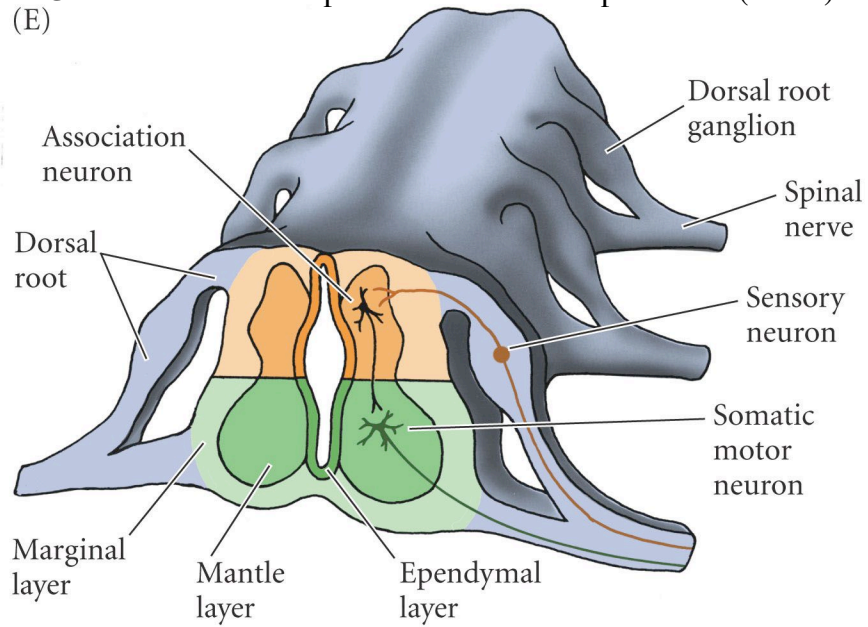


DEVELOPMENTAL BIOLOGY, Eighth Edition, Figure 12.2 (Part 2) © 2006 Sinauer Associates, Inc.

Regionalization versus general neural



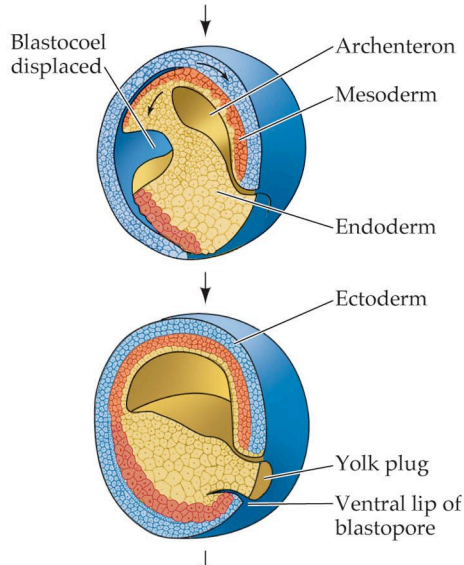
7 Gilbert 12.17 Development of the human spinal cord (Part 2)
(E)



DEVELOPMENTAL BIOLOGY, Eighth Edition, Figure 12.17 (Part 2) © 2006 Sinauer Associates, Inc.

What region of the embryo forms the nervous system?

8



Ectoderm
epidermis
nervous system

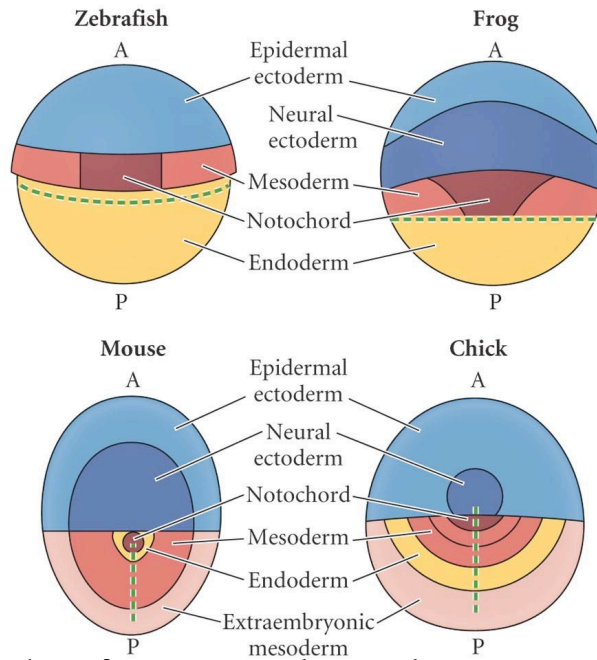
Mesoderm
muscle
blood
kidney
heart

Endoderm
gut
lung

Embryonic "Germ Layers"

17, Seventh Edition, Figure 20.9 Gastrulation in the Frog Embryo (Part 2)
© 2004 Sinauer Associates, Inc. and W. H. Freeman & Co.

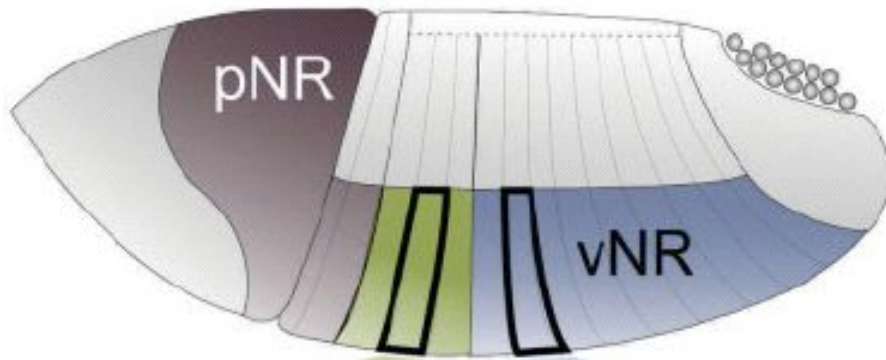
9



Vertebrate fate maps at early gastrula stage

DEVELOPMENTAL BIOLOGY, Seventh Edition, Figure 1.6 Sinauer Associates, Inc.
© 2003 All rights reserved.

10

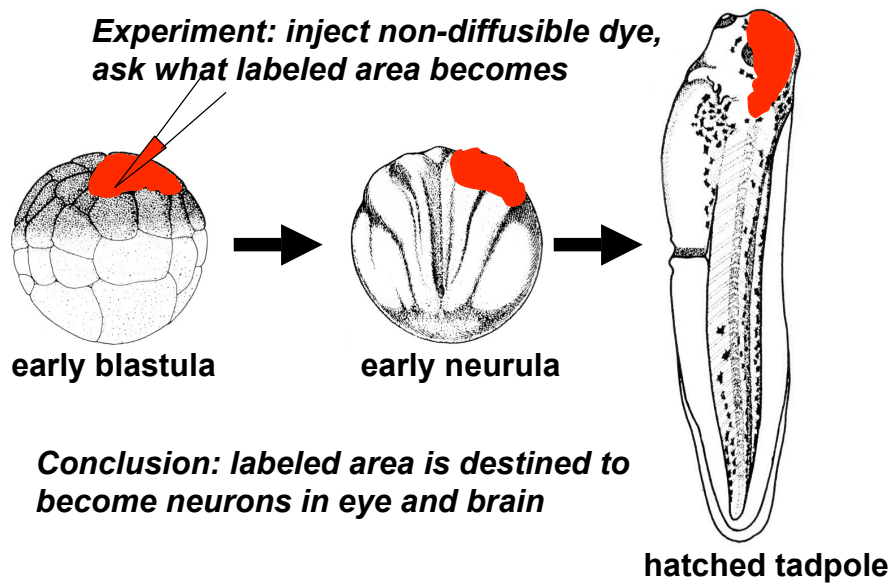


Drosophila neural fate map at early gastrula

Technau 2006

11 Fate mapping shows what cells will become

Experiment: inject non-diffusible dye, ask what labeled area becomes

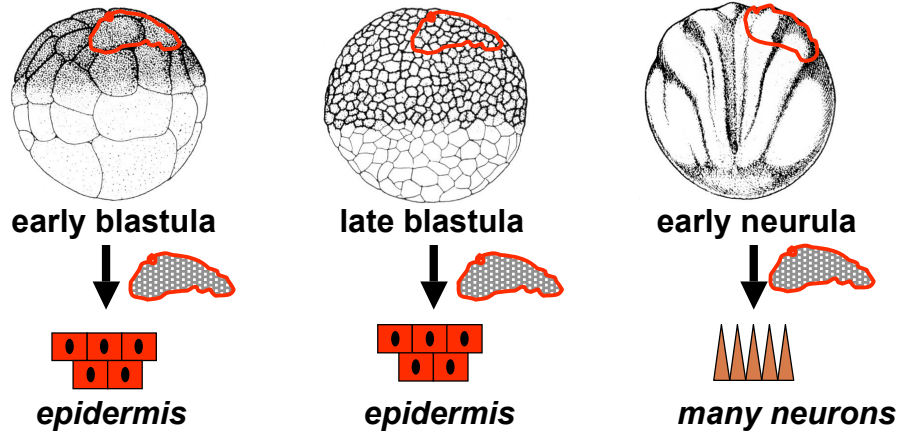


Conclusion: labeled area is destined to become neurons in eye and brain

12

When do cells decide on their fate?

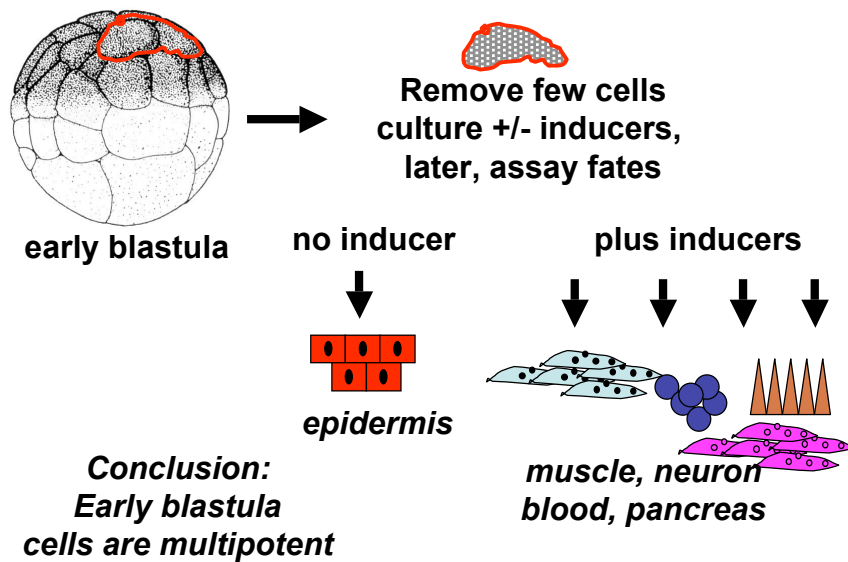
*Explant experiment: remove same relative region
culture in saline, later, assay fates*



*Conclusion: cell fate decision is made by neurula
Also assay via transplant assays, gene expression*

13

Induction assay for potency

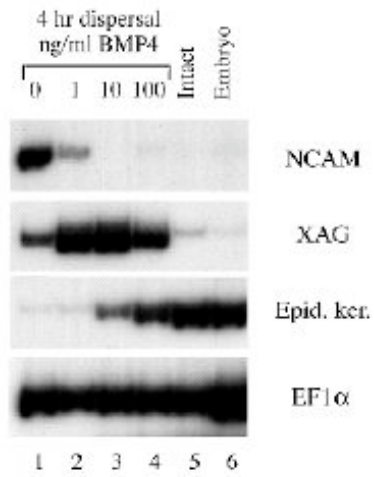


15

DISPERSED ANIMAL CAP

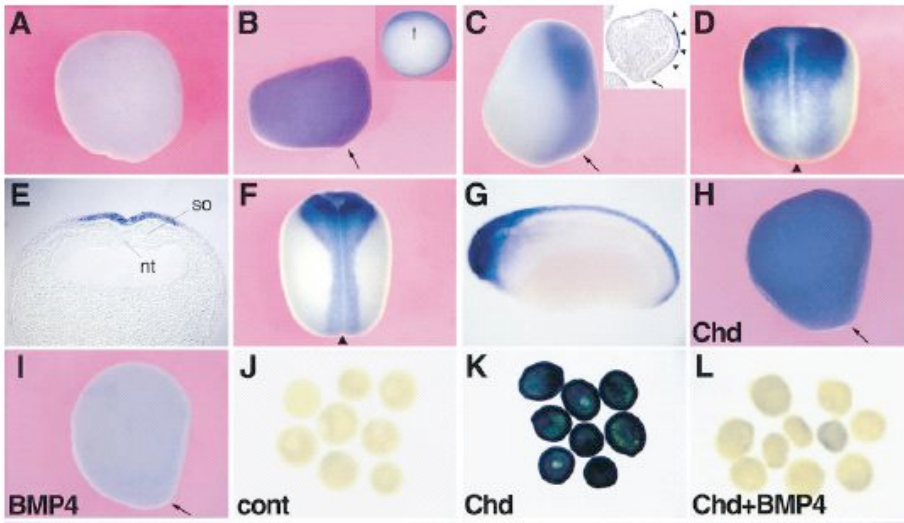


UV-irradiated



Inhibition of BMP signaling activates neural gene expression

Wilson et al, 1997

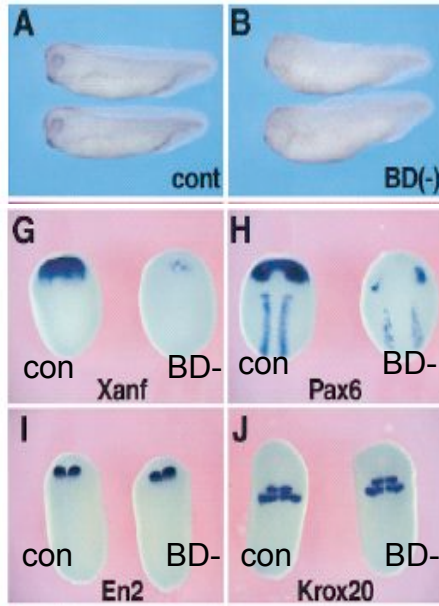


Xenopus SoxD is expressed from early gastrula and in response to BMP inhibition

Mizueki et al, 1998

16

17

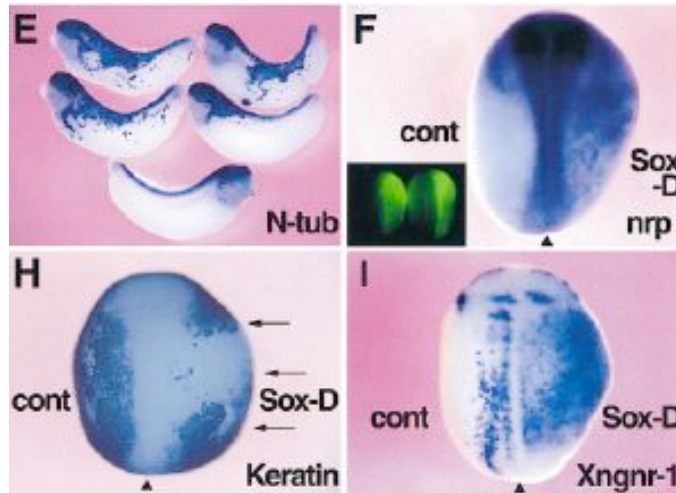


BD- is a dominant negative SoxD

Xenopus SoxD is required for expression of some early neural genes

Mizueki et al, 1998

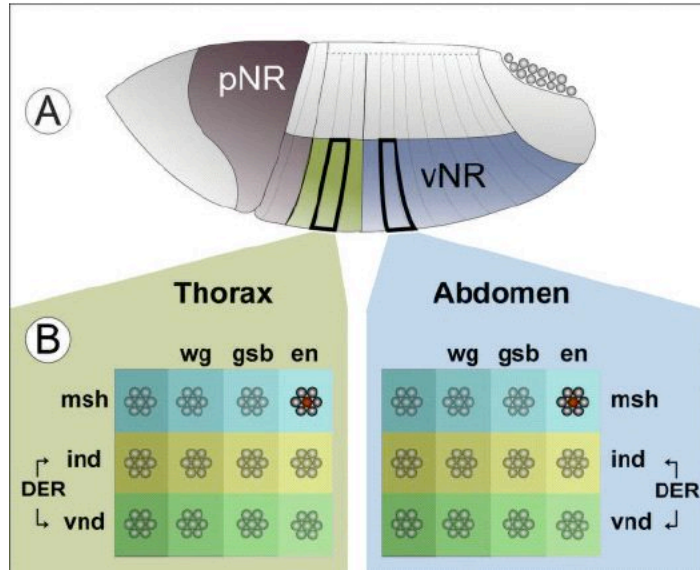
18



Ectopic SoxD induces ectopic expression of neural genes

Mizueki et al, 1998

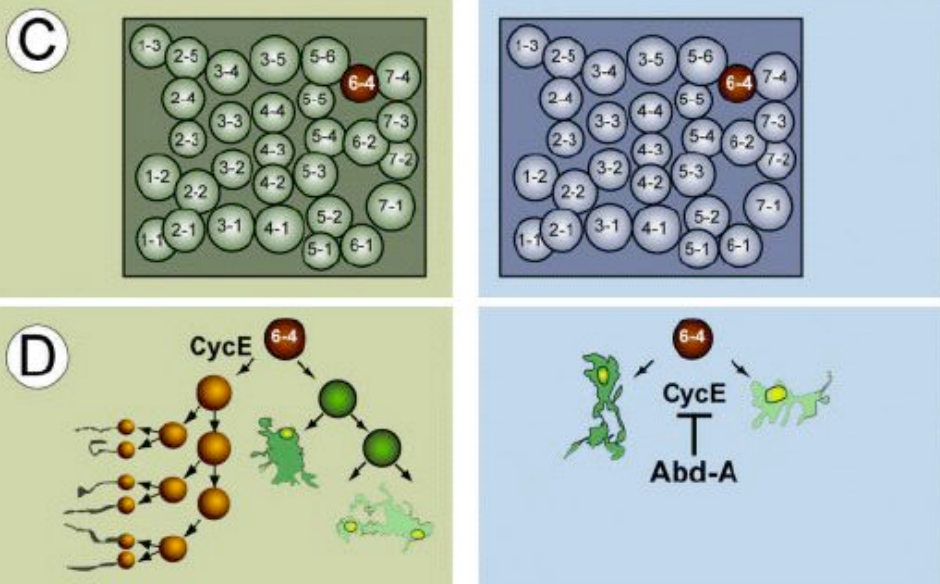
19



Neuroblast clusters

Technau, 2006

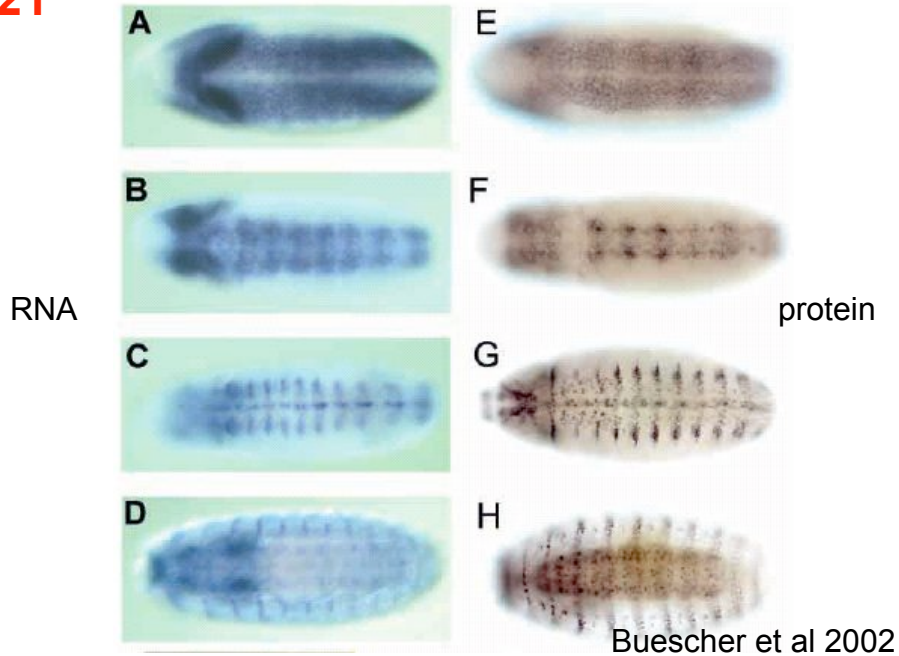
20



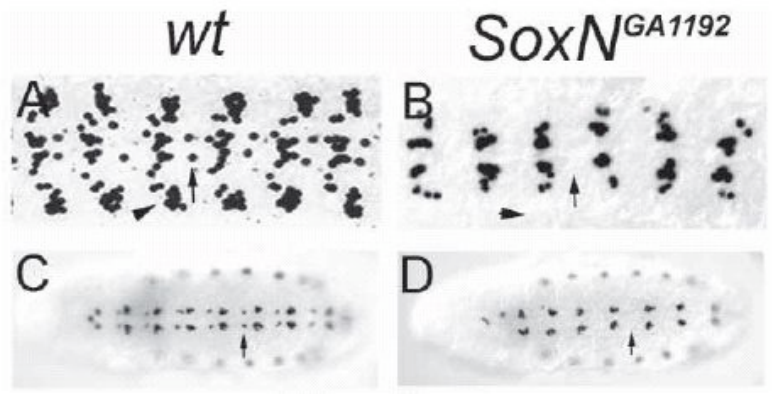
Neuroblast lineages differ in different regions

Technau, 2006

21 SoxN is expressed in the developing nervous system



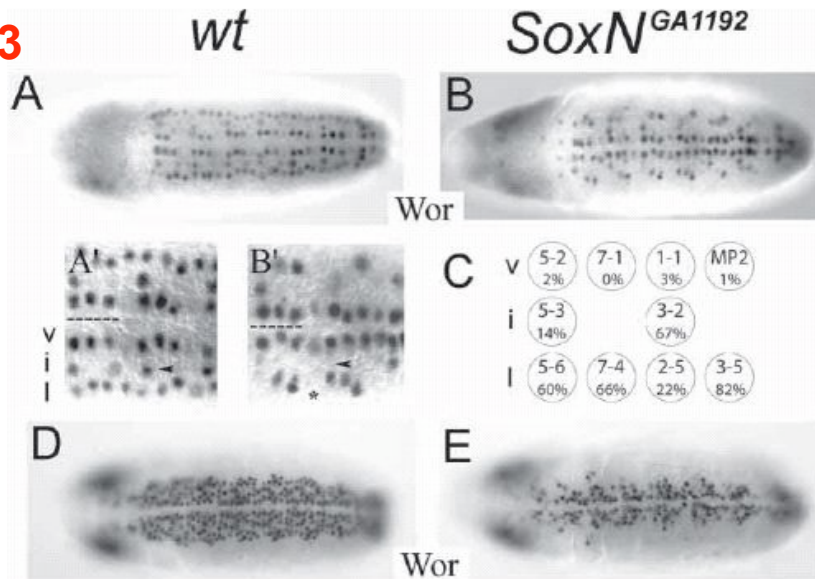
22



SoxN required for normal neuroblast development

Buescher et al 2002

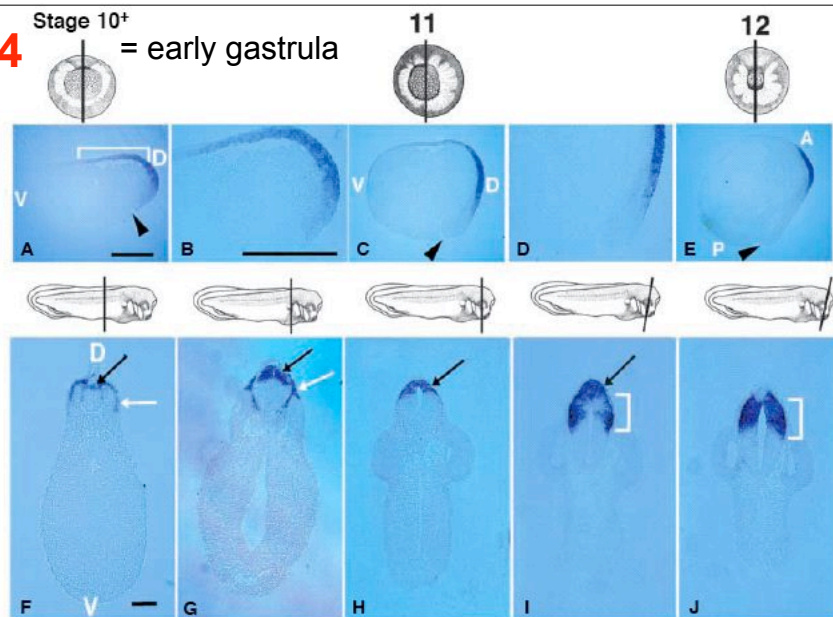
23



SoxN is required for lateral and intermediate neuroblasts

Buescher et al 2002

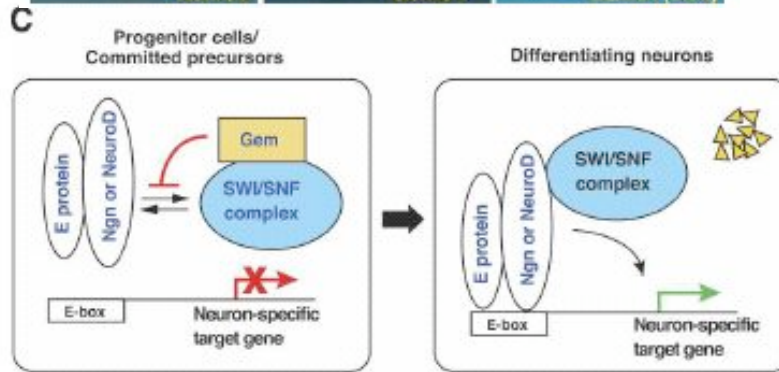
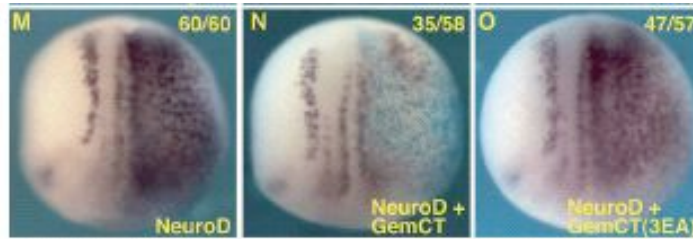
24



Zic1 is a very early neural marker gene

Kuo et al, 1998

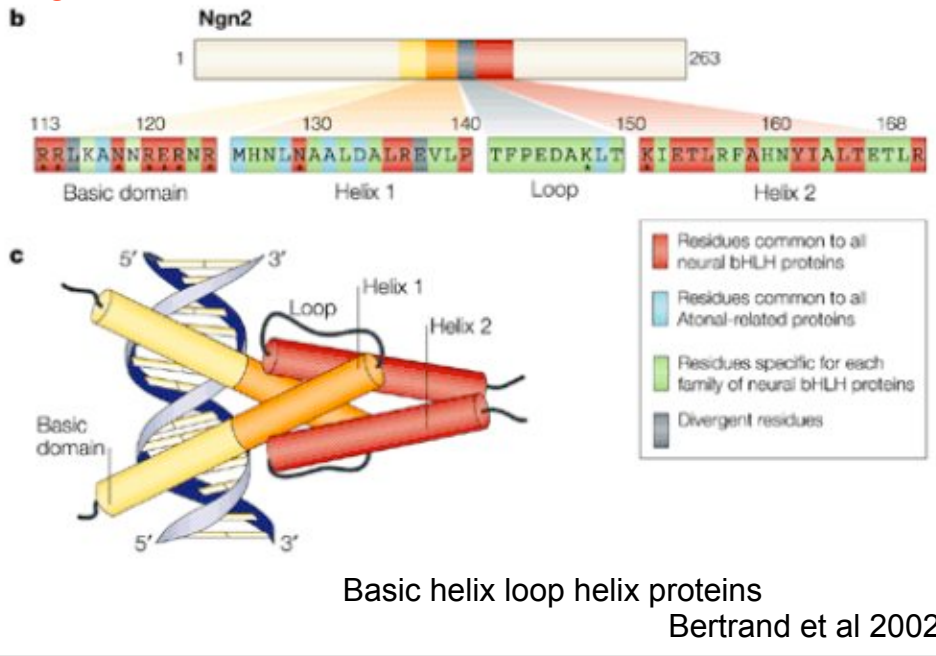
25



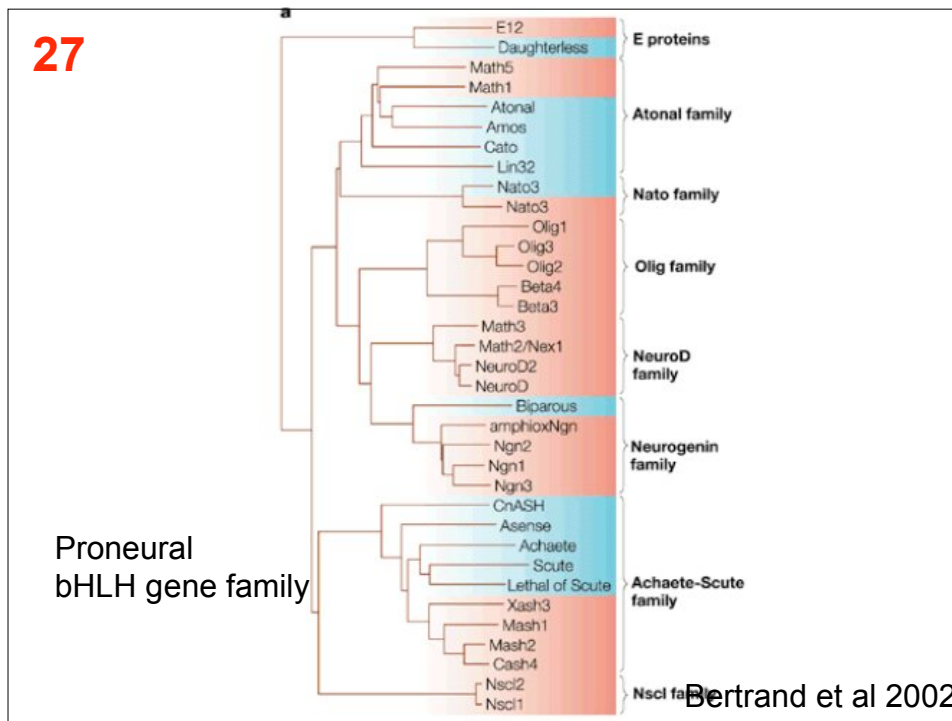
Geminin is an early neural gene that inhibits differentiation and promotes cell cycle withdrawal Seo et al, 2006

Proneural genes

26



27



28

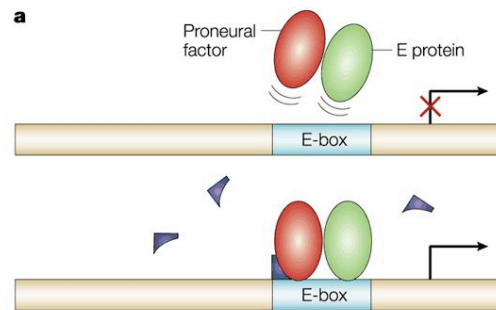
d

Origin of E-boxes	Binding of Asc proteins	Binding of Ngn proteins	Binding of Math proteins	Binding of NeuroD	Ref.
<i>Bearded</i>	GCAGGTGT				155
<i>scabrous</i>	GCAGGTGG				155
<i>Espl m7</i>	GCAGGTGG				155
<i>Espl m8</i>	GCAGGTGG				155
<i>Espl m8</i>	GCAGCTGT				155
<i>NeuroD</i> promoter		CCATATGG ACAGATGG			104
<i>Math1</i> promoter			TCAGCTGG		89
β 3 nAChR promoter			ACAGCTGA		156
POMC promoter				GCAGATGG	157
Insulin promoter				CCATCTGC	158
Consensus	GCAGGTGG/T	CA-ATGG	CAGCTG	CA--TG	

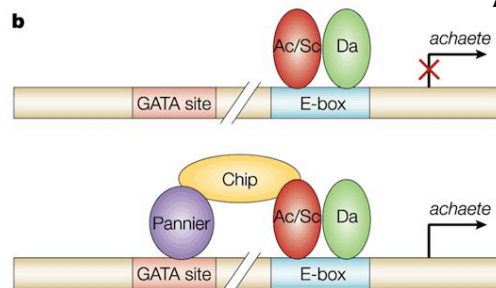
Proneural genes bind E boxes

Bertrand et al 2002

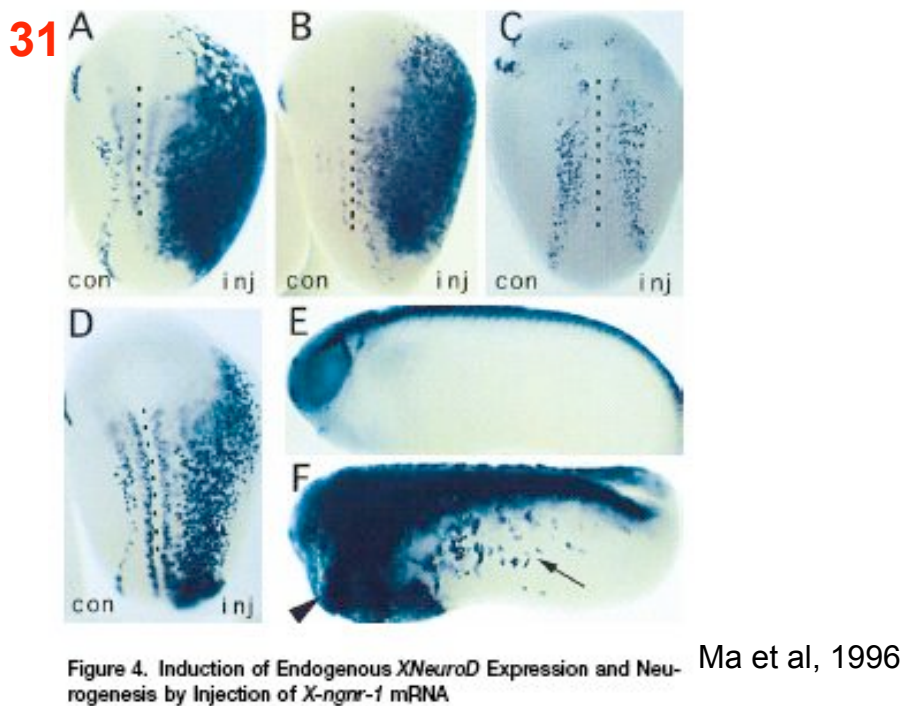
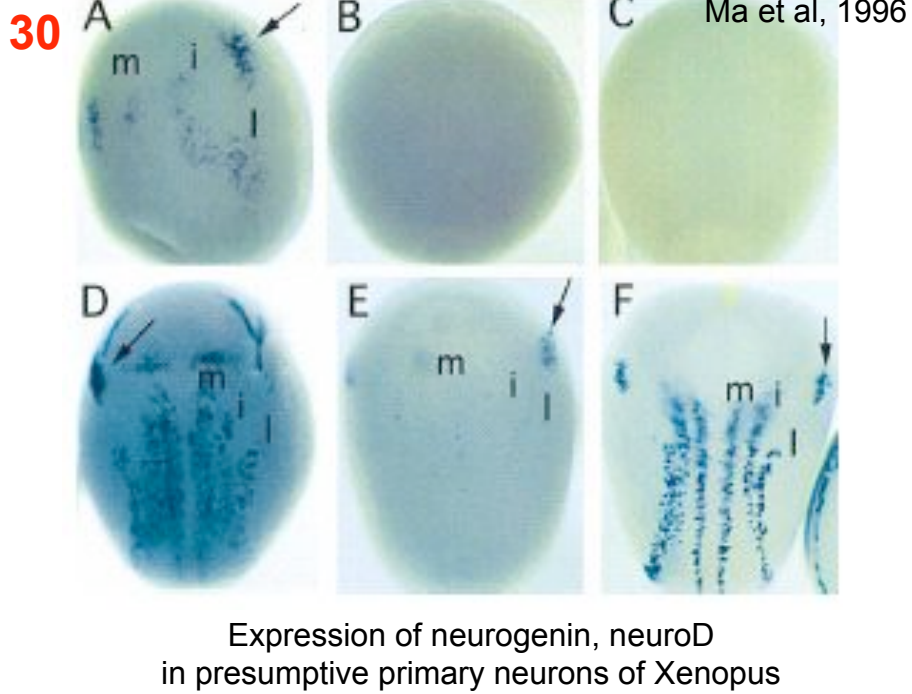
29



Regulation of
Ac/Sc gene targets

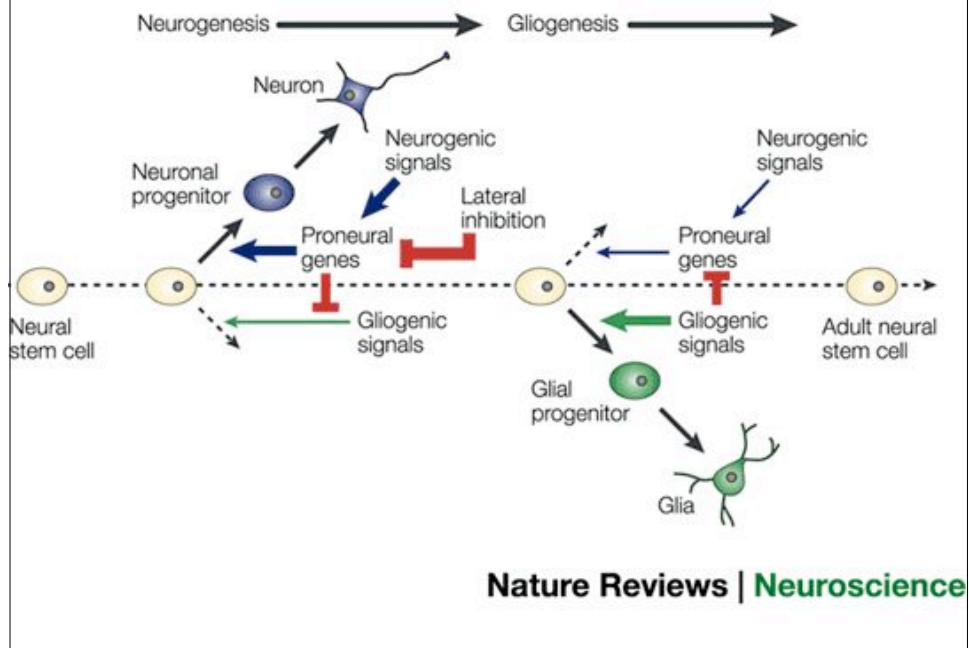


Bertrand et al 2002



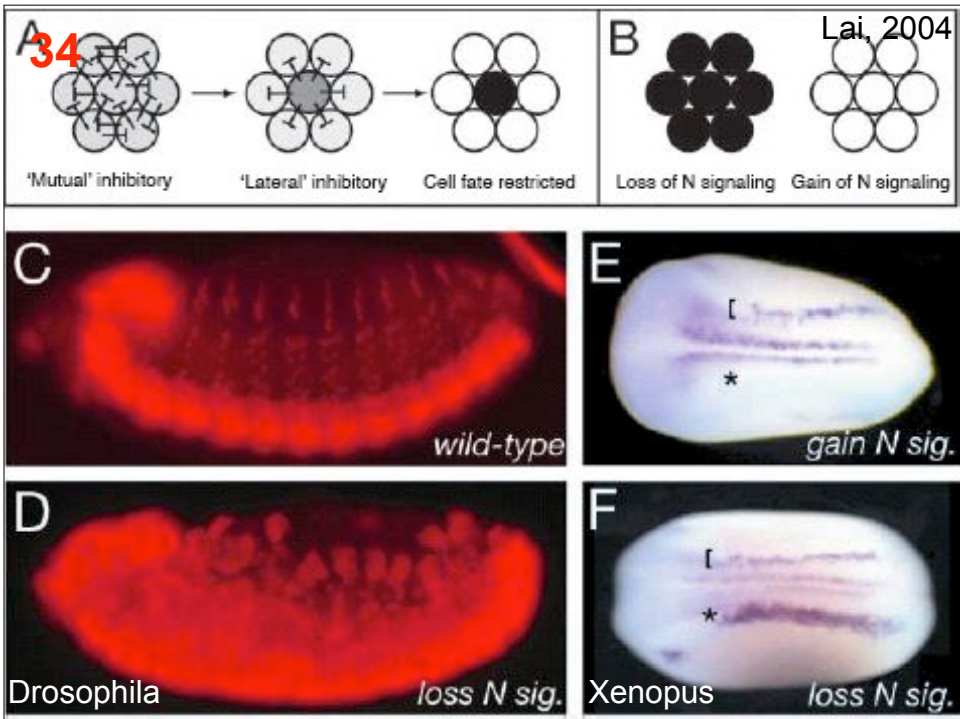
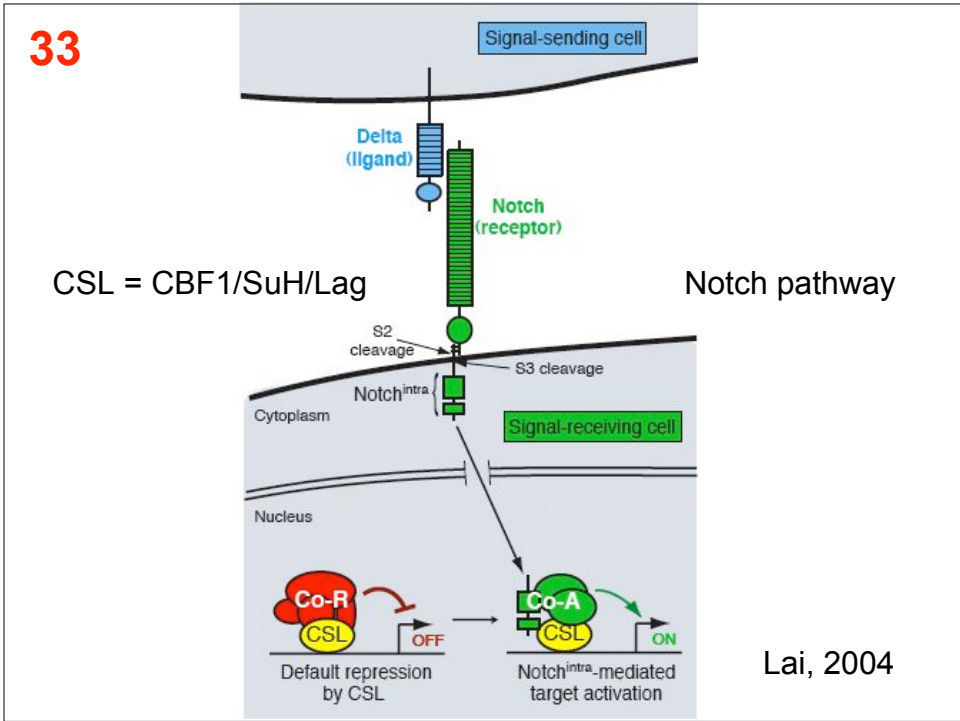
32

Bertrand et al 2002

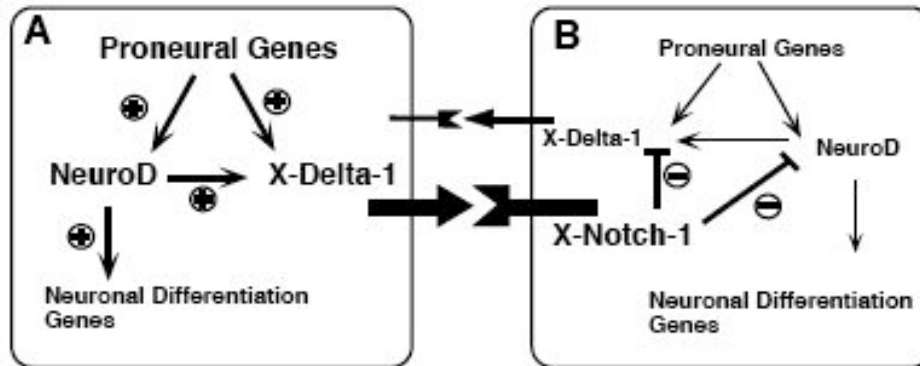


Role of Notch

33



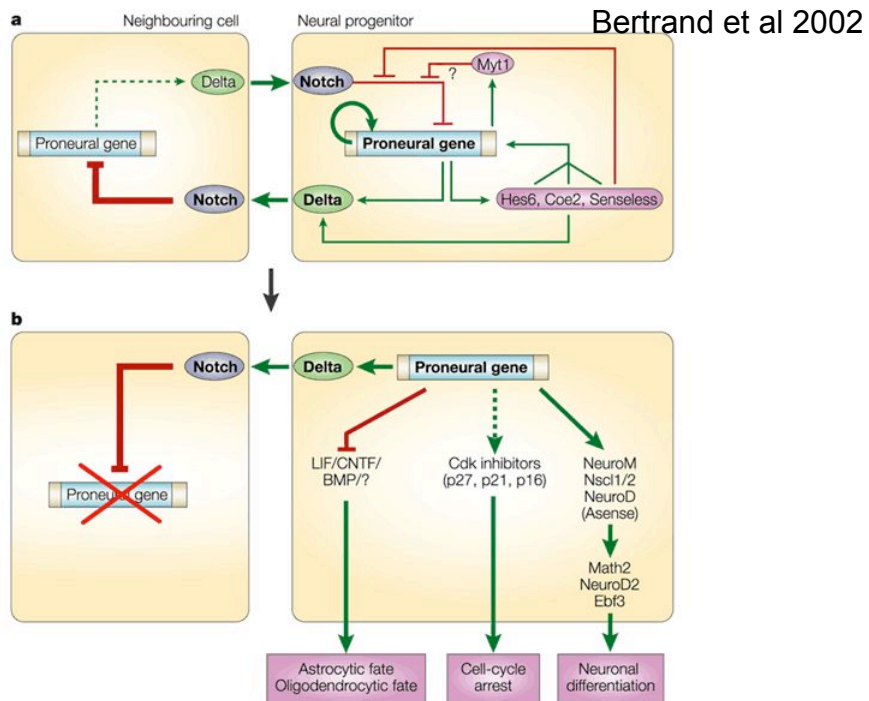
35



Relationship of proneural gene expression and Notch signaling

Chitnis and Kintner, 1996

36



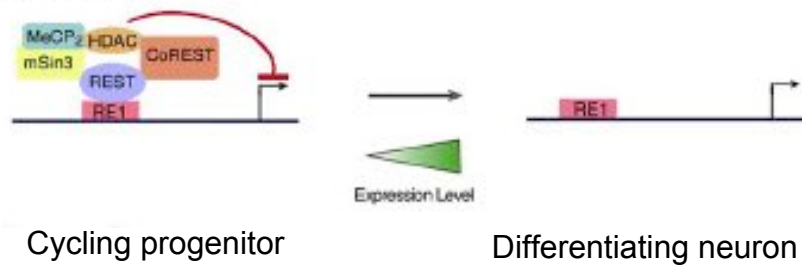
Role of inhibitors

See the “comment_on_mandel” pdf posted with this section.

37

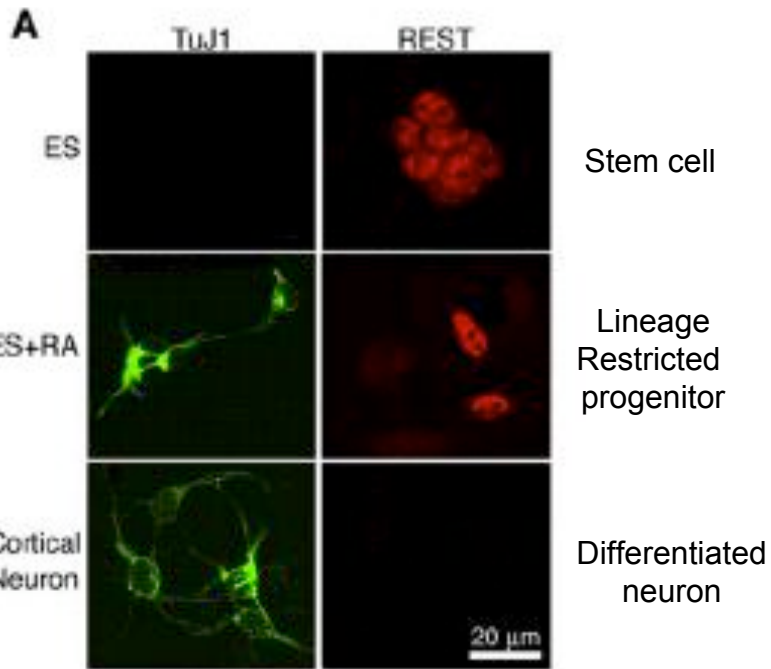
B

CLASS I NEURONAL GENES



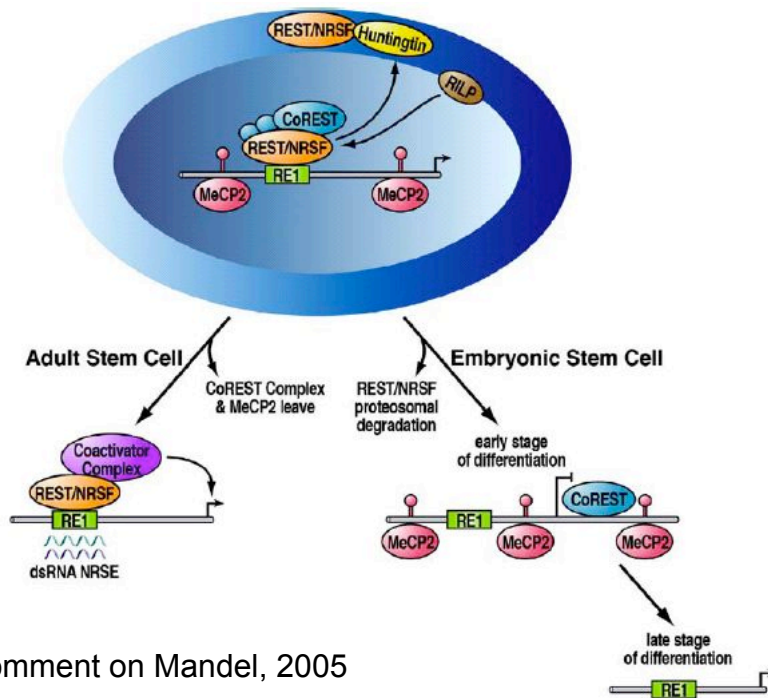
RE-1 Silencing Factor (REST)
(neural cell restrictive factor (NCRF))
mechanism

38



REST downregulation during neurogenesis Ballas et al, 2006

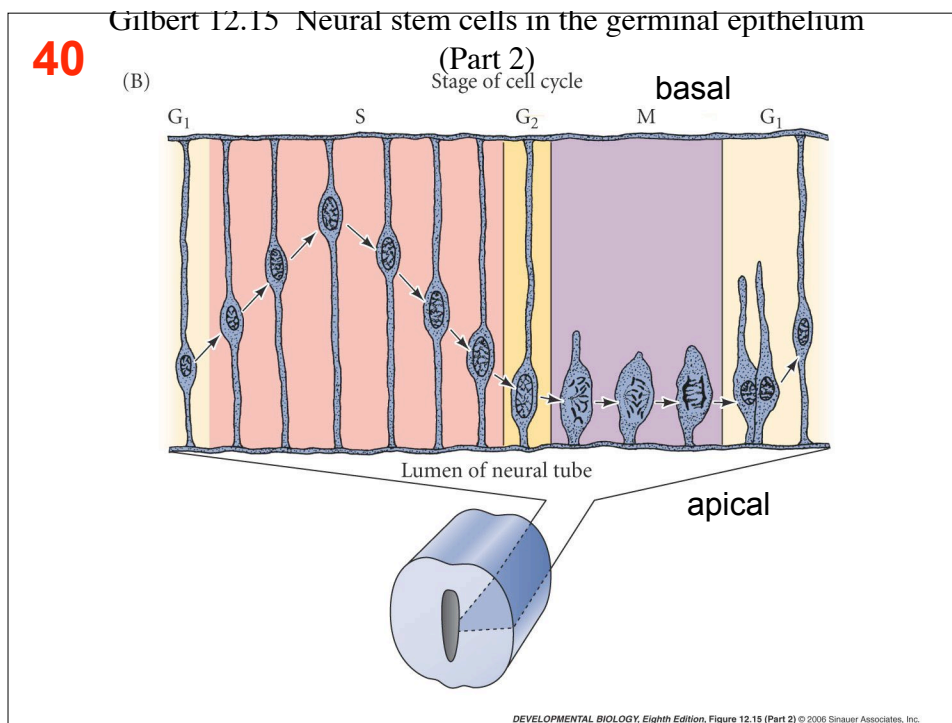
39



Comment on Mandel, 2005

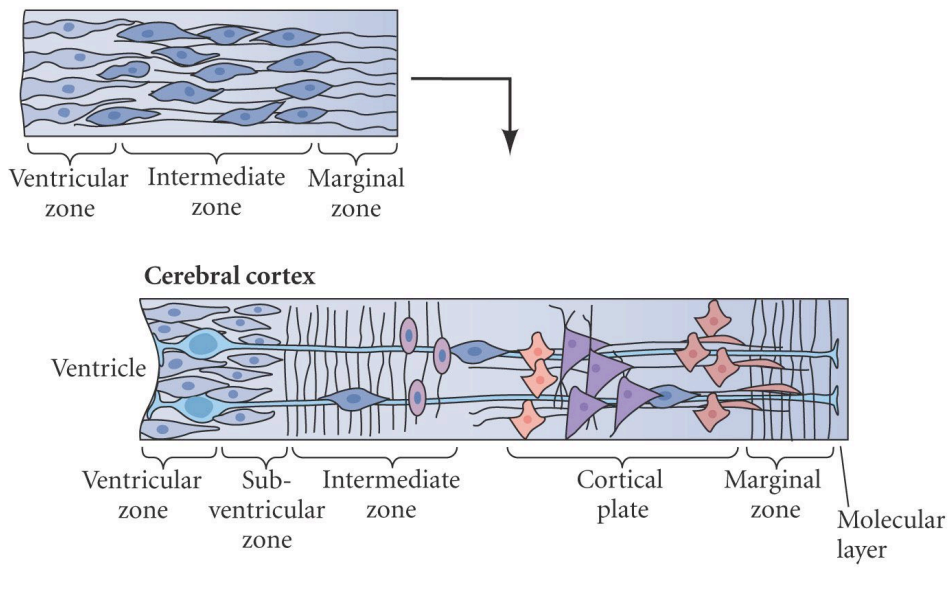
Role of asymmetric cell division

This will be covered further in the papers you read. I am posting a review from Wodarz that covers some of this material. See also Gilbert, chapter 12.

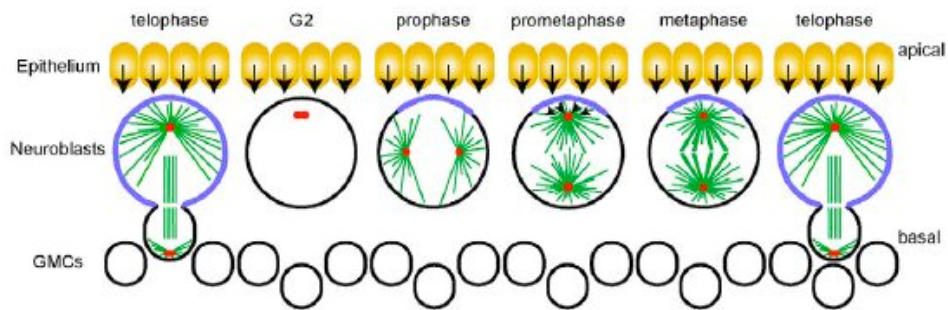


41 12.16 Differentiation of the walls of the neural tube (Part 3)

Neural tube



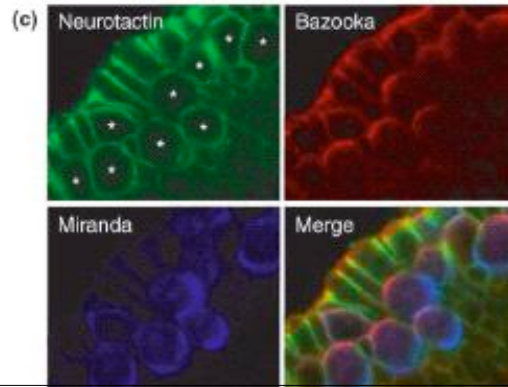
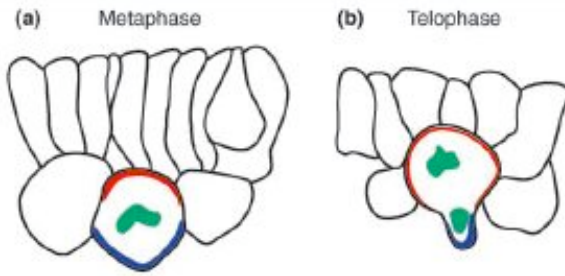
42



Asymmetric neuroblast cell division/ role of epithelium

Siegrist and Doe, 2006

43



Asymmetric gene
expression
during neuroblast
division polarize
spindle orientation

Wodarz, 2005