

A ectoderme dos vertebrados

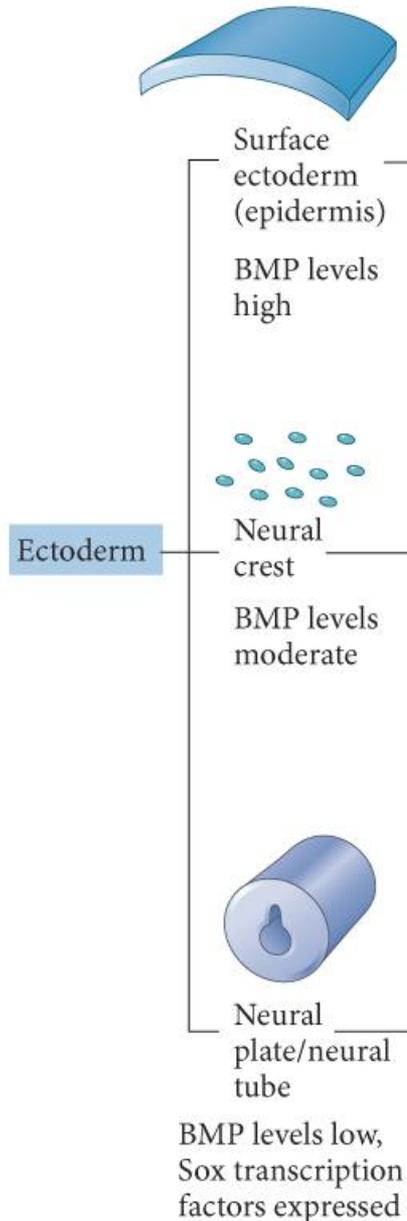
Os três principais desafios da ectoderme:

1- Se diferenciar em **Placa Neural** e posteriormente em um **tubo**, a partir de um epitélio

2- Revestir todo o corpo - **Epiderme** - a pele, um tecido elástico, impermeável e sob constante renovação

3- Dar origem à **Crista neural** - embora derivada da ectoderme, pela sua importância tem sido algumas vezes denominada de 4º folheto embrionário

Derivados da ectoderme



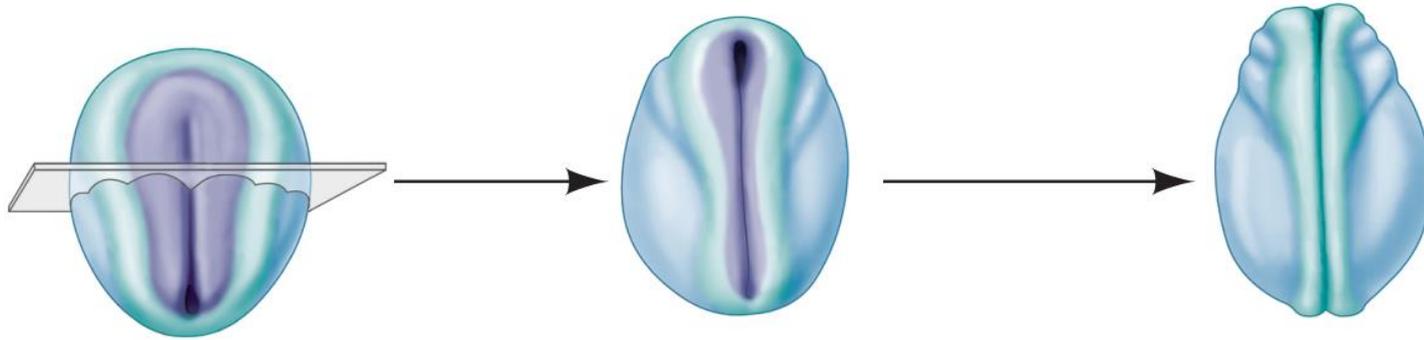
→ Ectoderme superficial

→ Crista neural

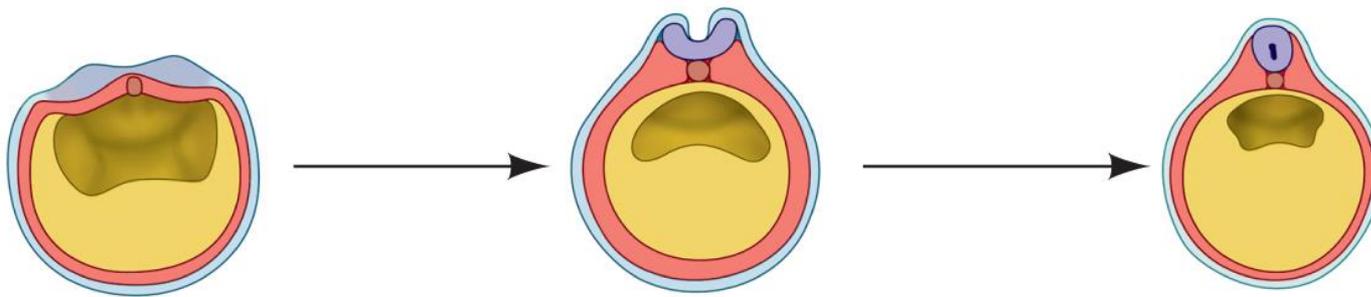
→ Tubo neural

Neurulação em anfíbios...

(A)

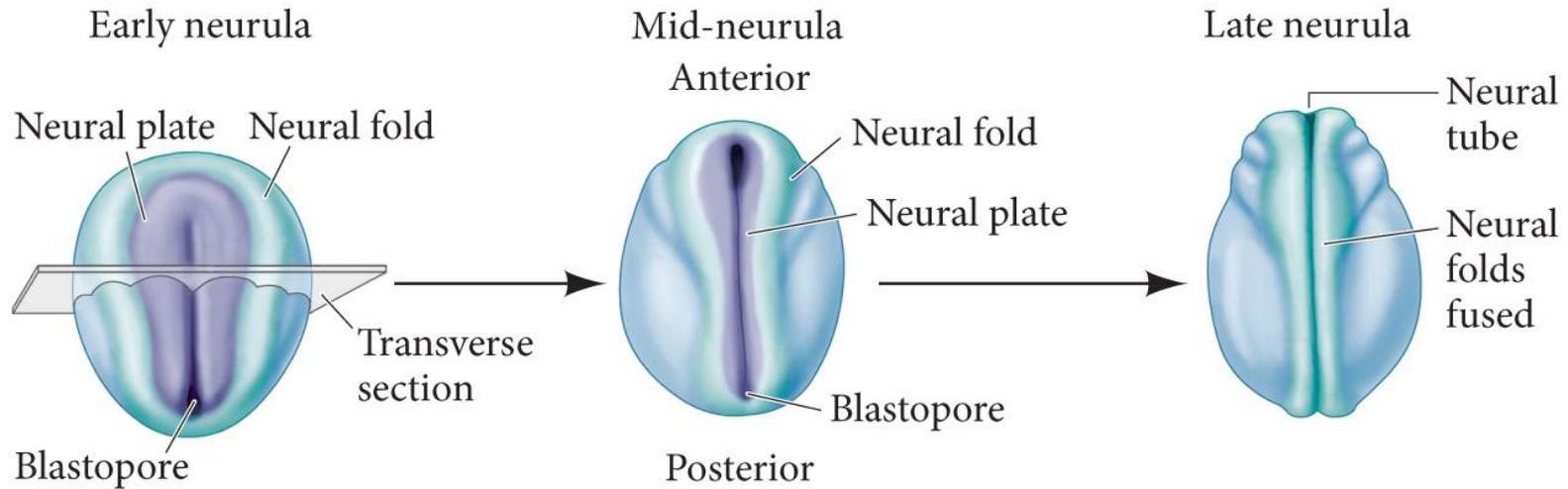


(B)

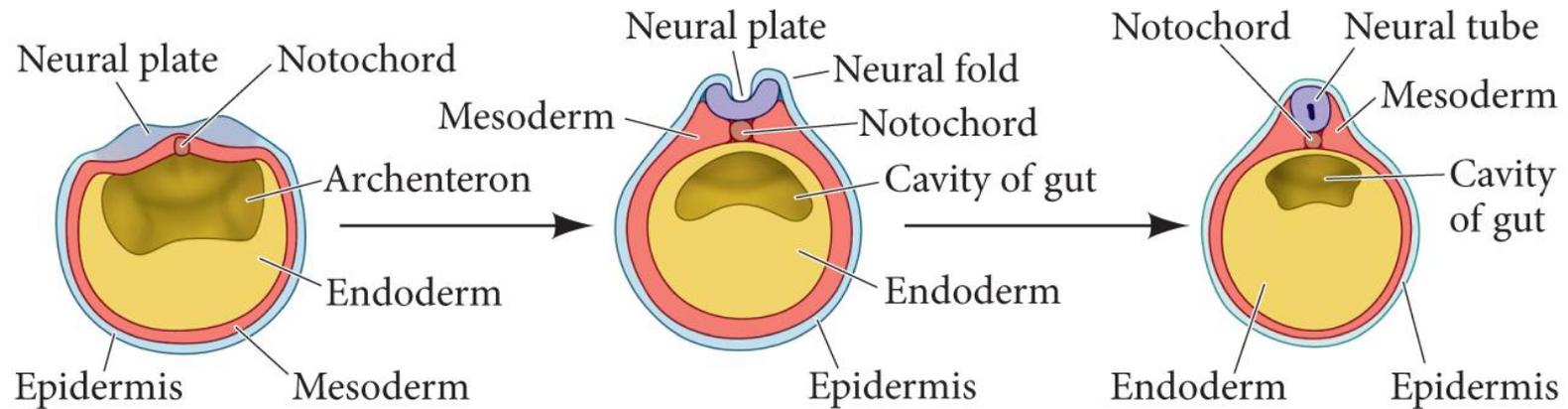


After Balinsky 1975. After B. I. Balinsky. 1981. *Introduction to Embryology*, 5th Ed. Saunders: Philadelphia.

(A) DORSAL SURFACE

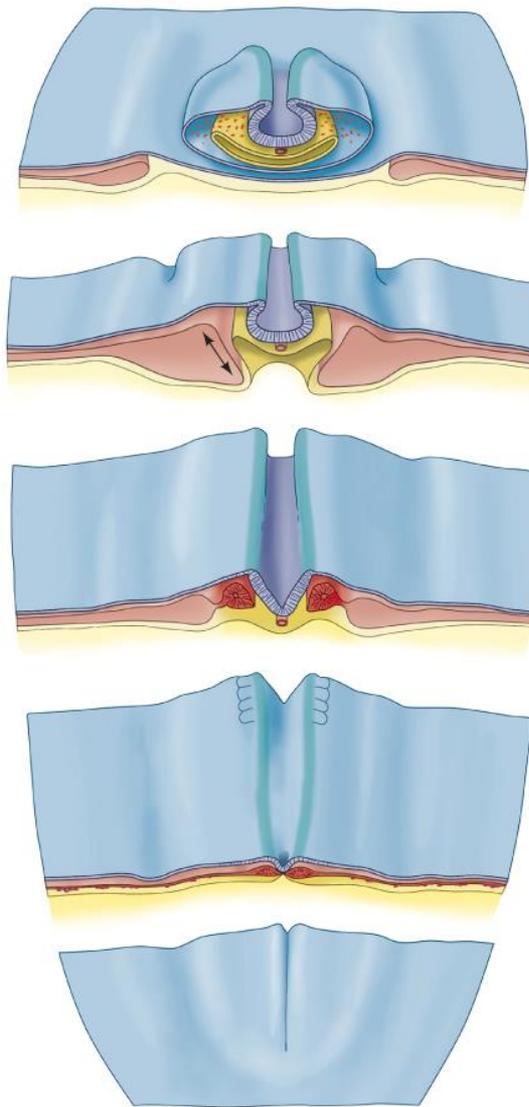


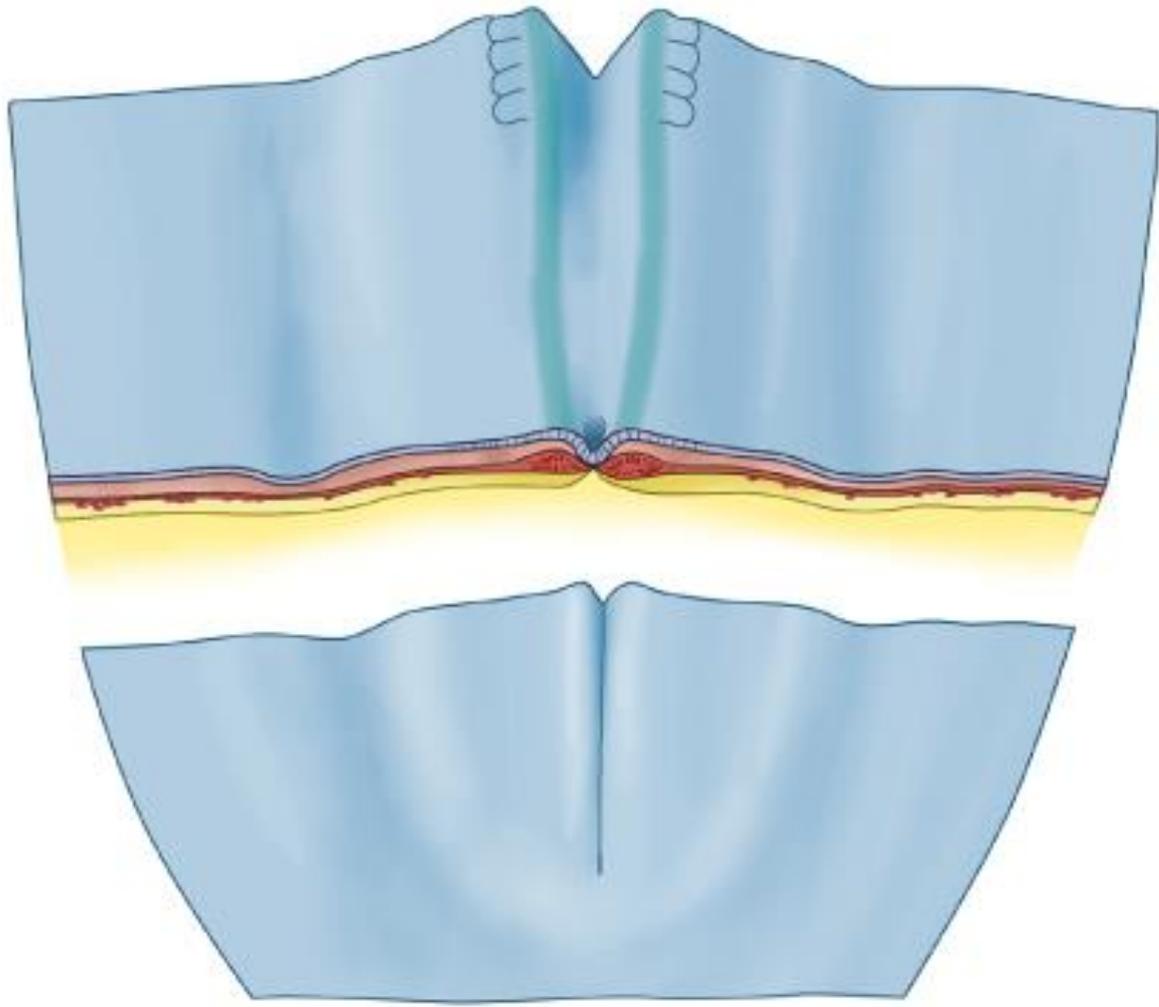
(B) TRANSVERSE SECTION

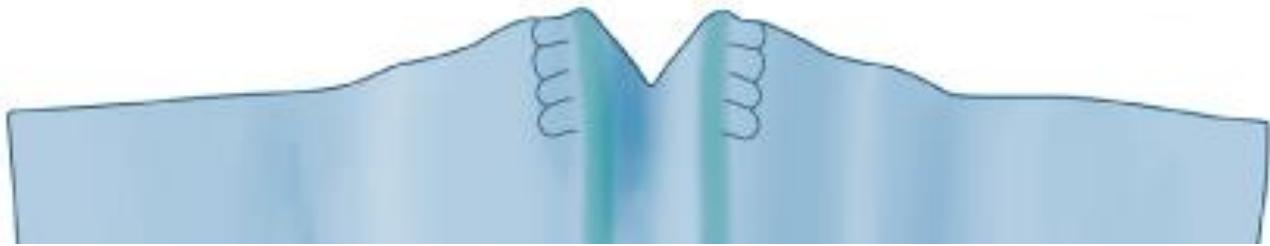
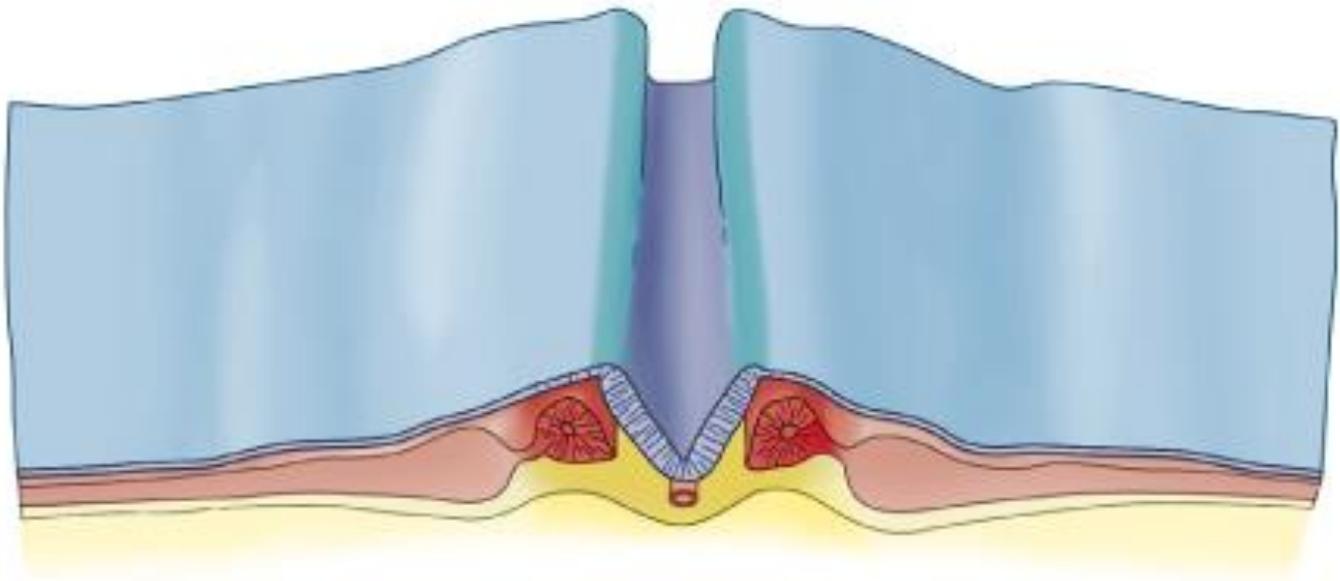


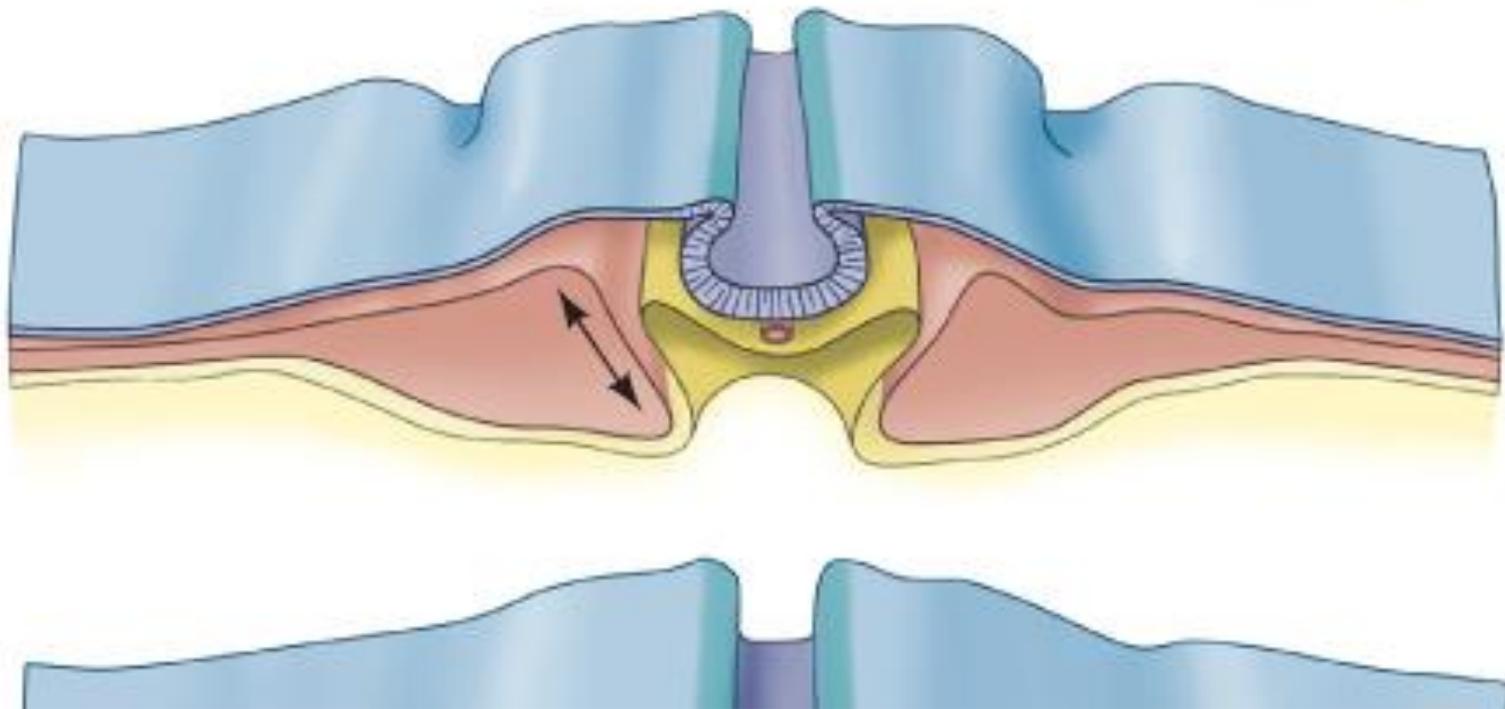
After Balinsky 1975. After B. I. Balinsky. 1981. *Introduction to Embryology*, 5th Ed. Saunders: Philadelphia.

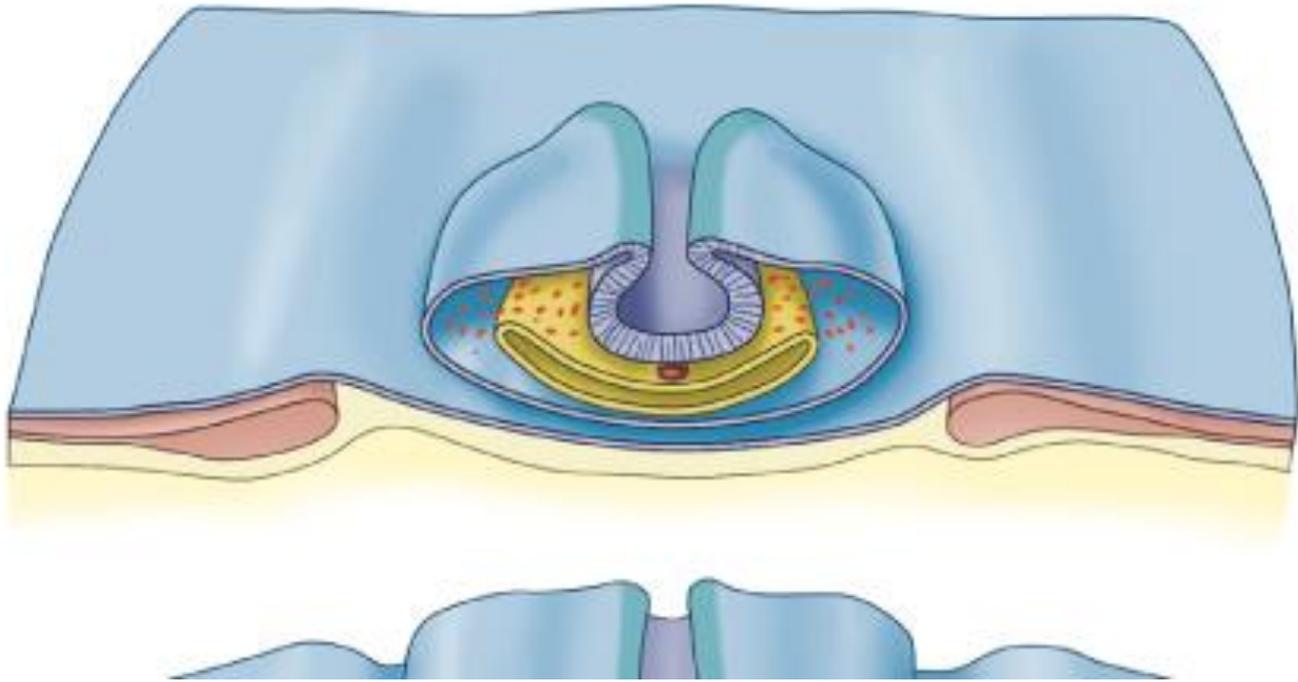
em aves...

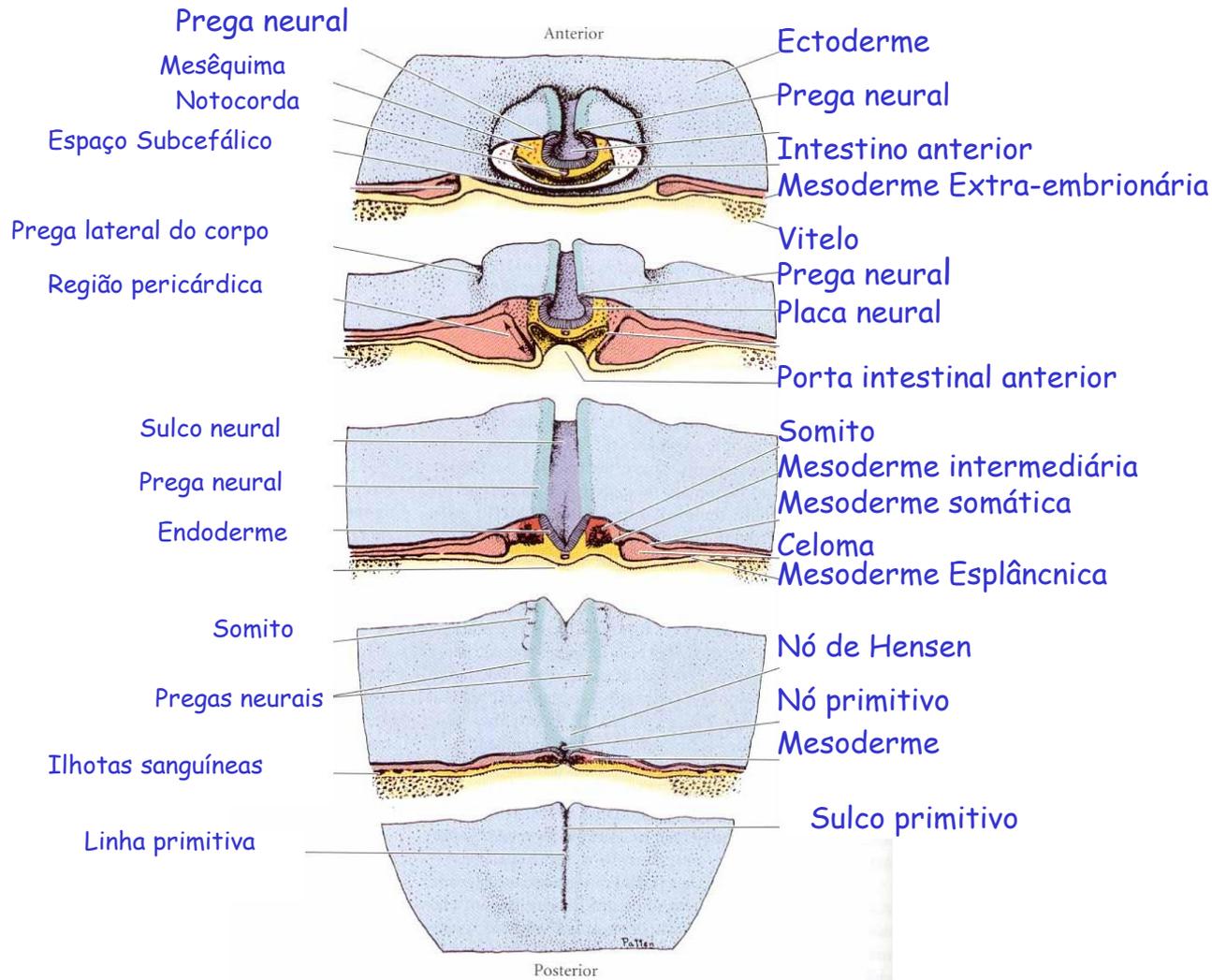






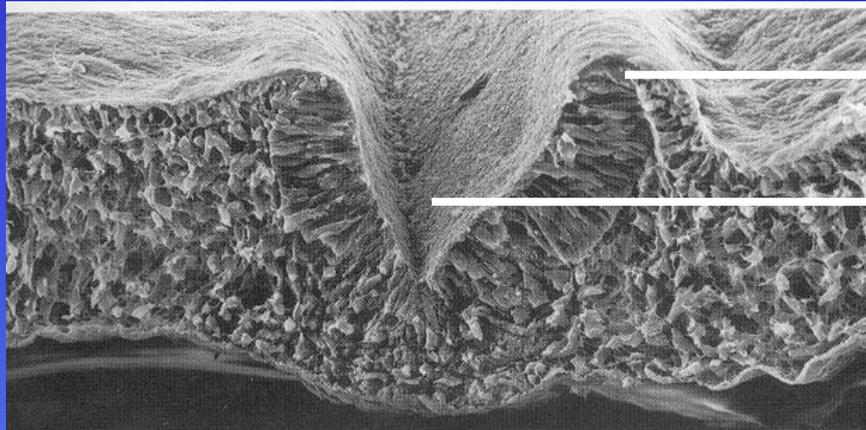






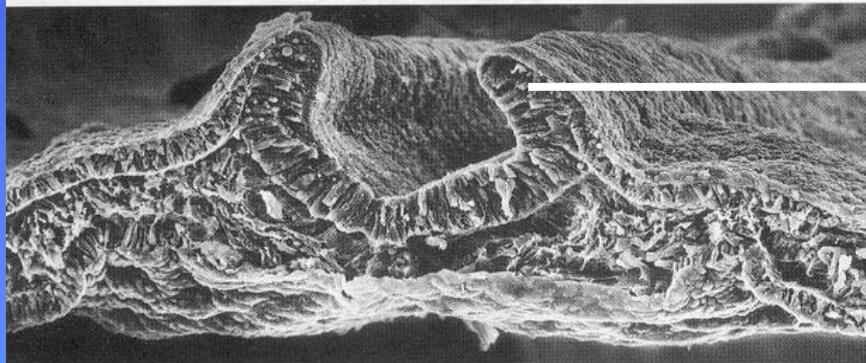
Estereograma de um embrião de ave de 24 horas de desenvolvimento

FORMAÇÃO DO TUBO NEURAL

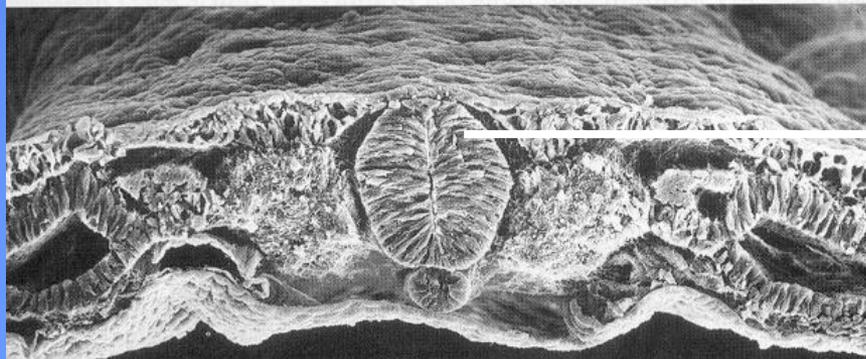


Prega neural

Sulco neural



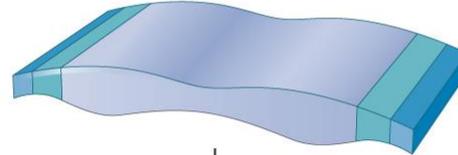
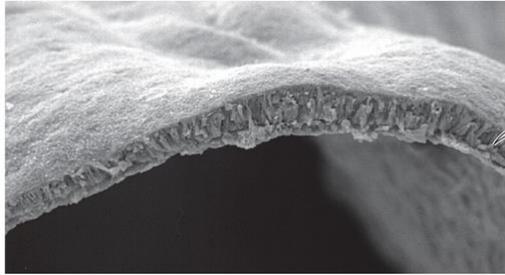
Prega neural



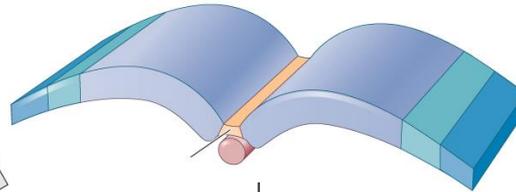
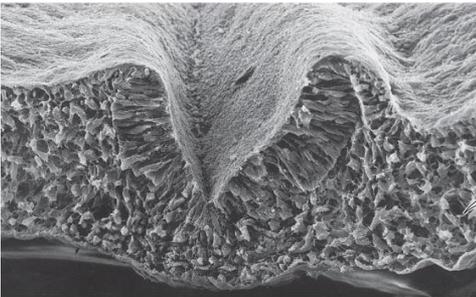
Tubo neural

Cortes transversais de embrião de galinha

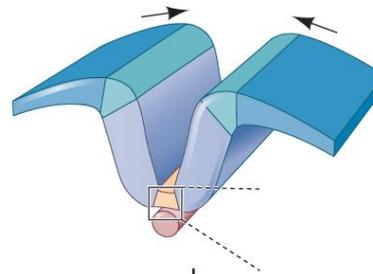
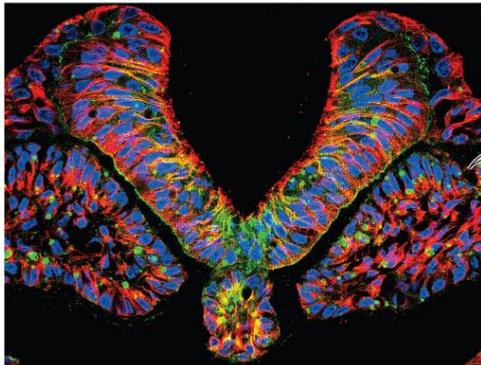
Neurulação primária: formação do tubo neural em embrião de aves



Células da placa neural - alongadas



Pregas neurais - elevação

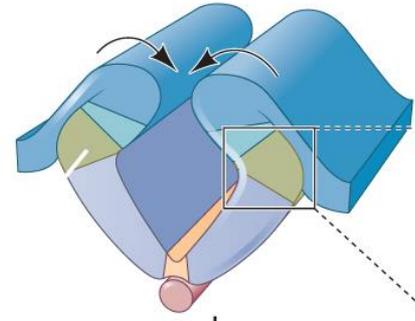
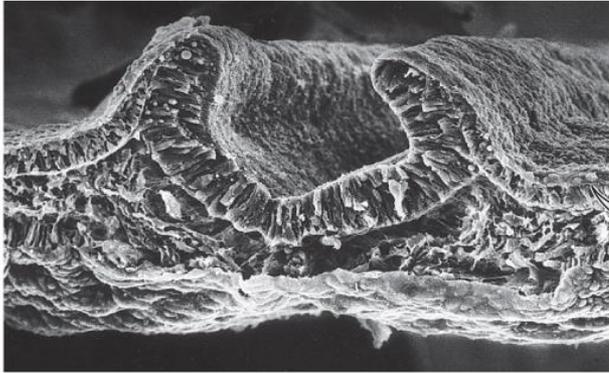


Convergência das pregas neurais

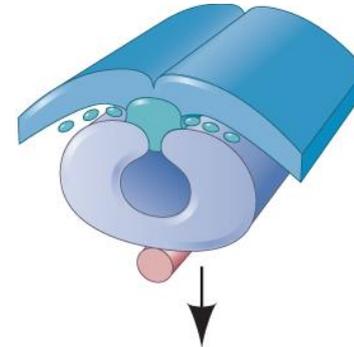
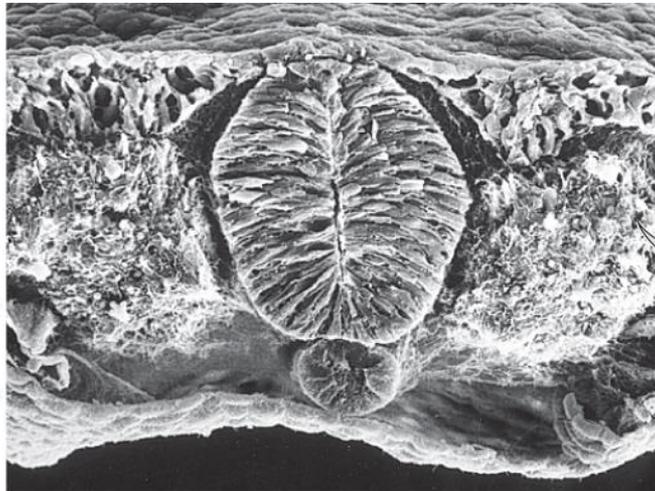


Neurulação primária: formação do tubo neural em embrião de aves

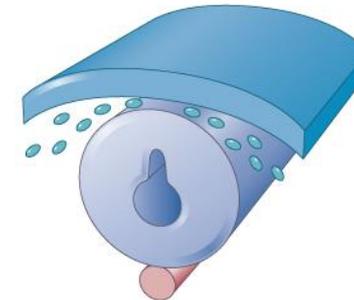
(D)



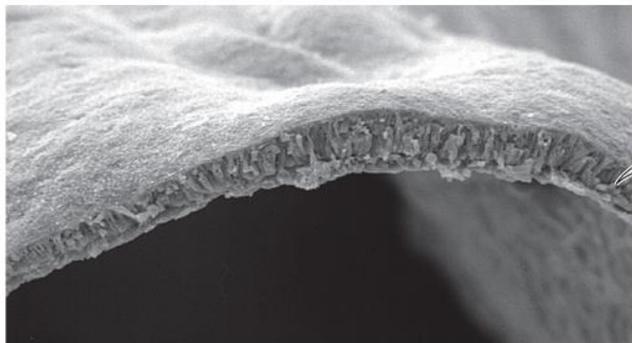
Encontro da pregas neurais



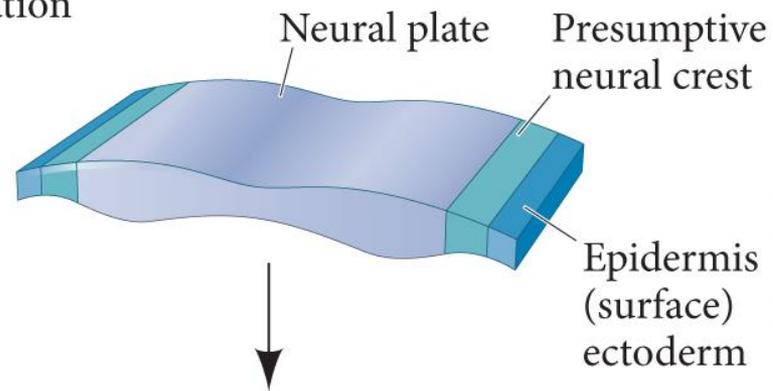
Fechamento do tubo neural



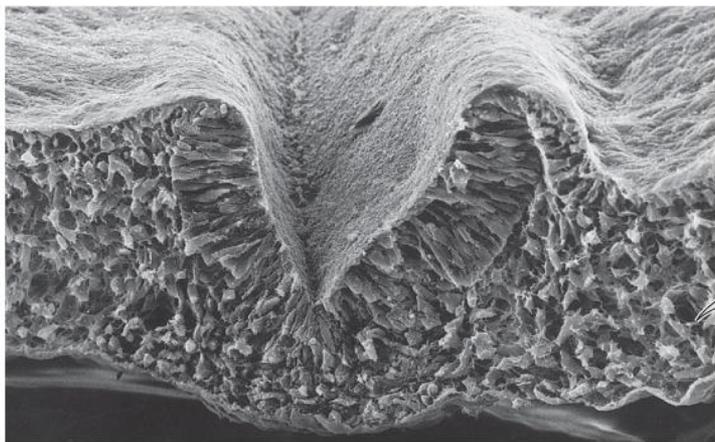
(A)



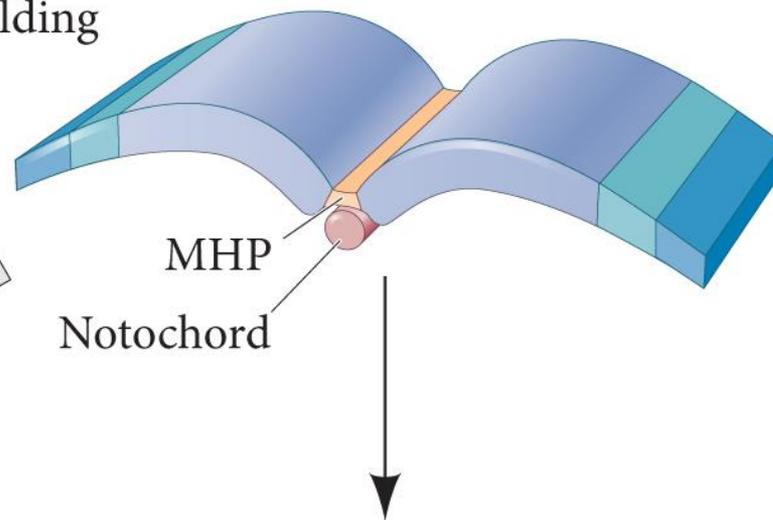
1a Elongation



(B)



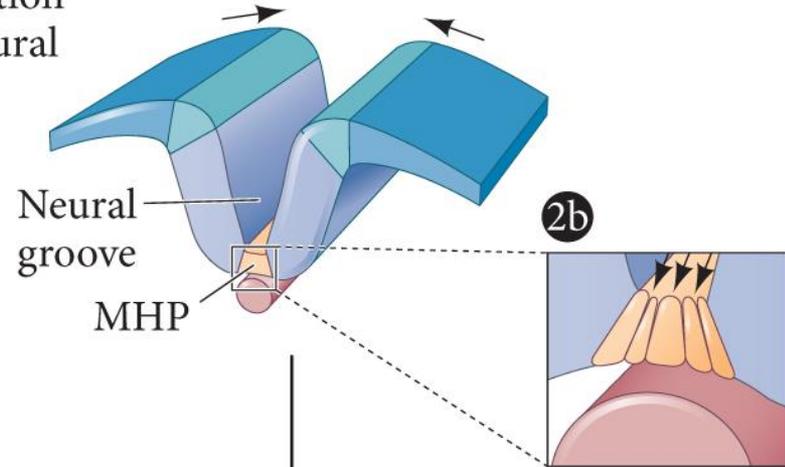
1b Folding



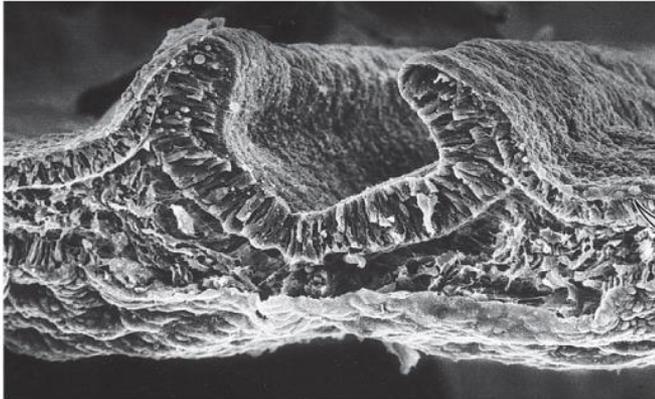
(C)



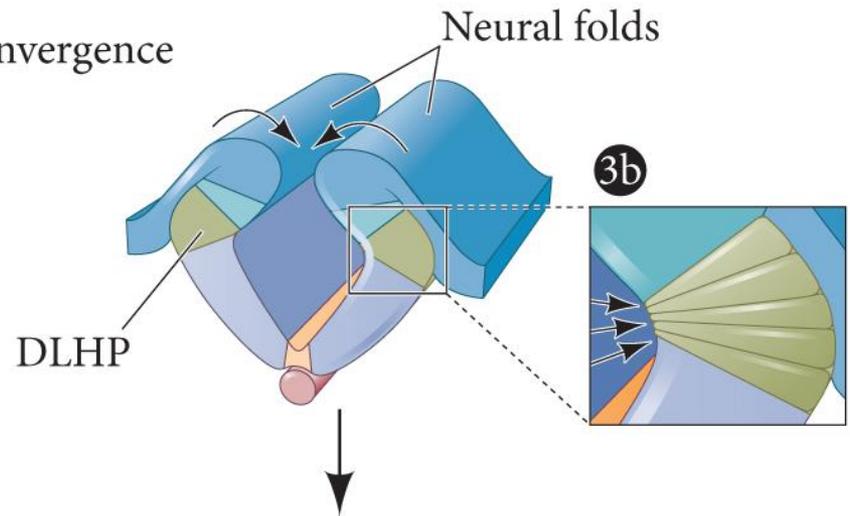
2a Elevation of neural folds



(D)

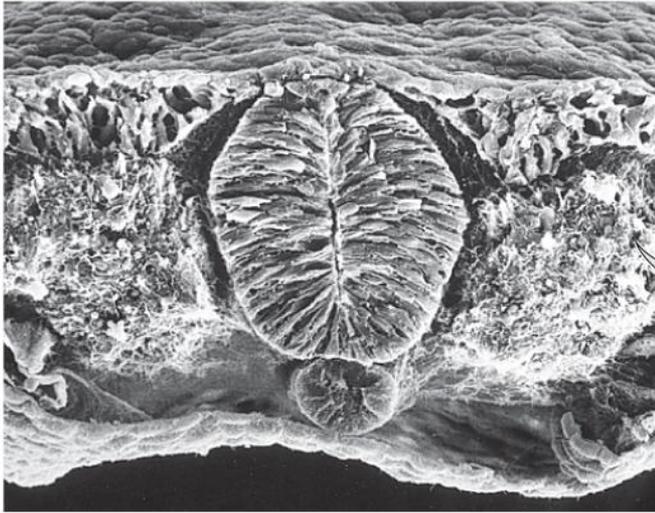


3a Convergence

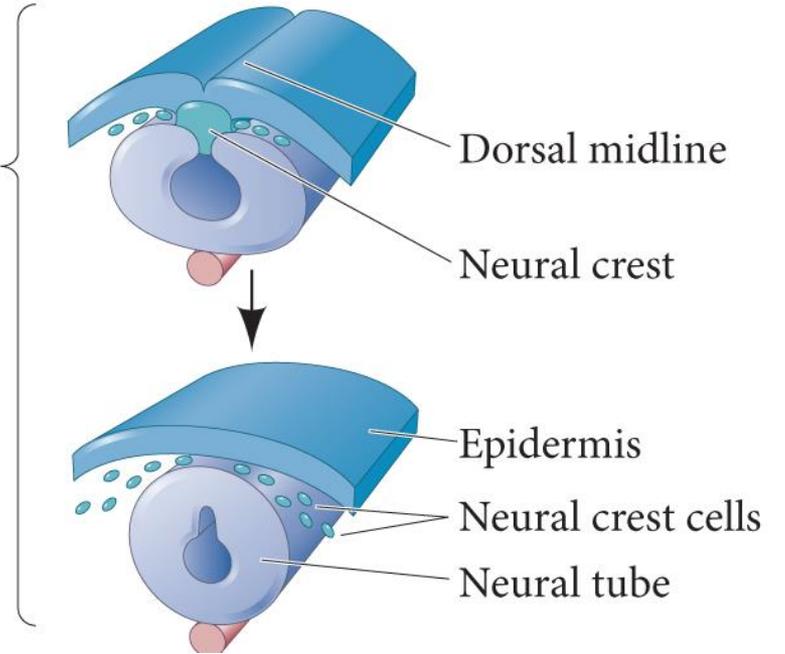


(E)

SEMs courtesy of K. Tosney and G. Schoenwolf



4 Closure



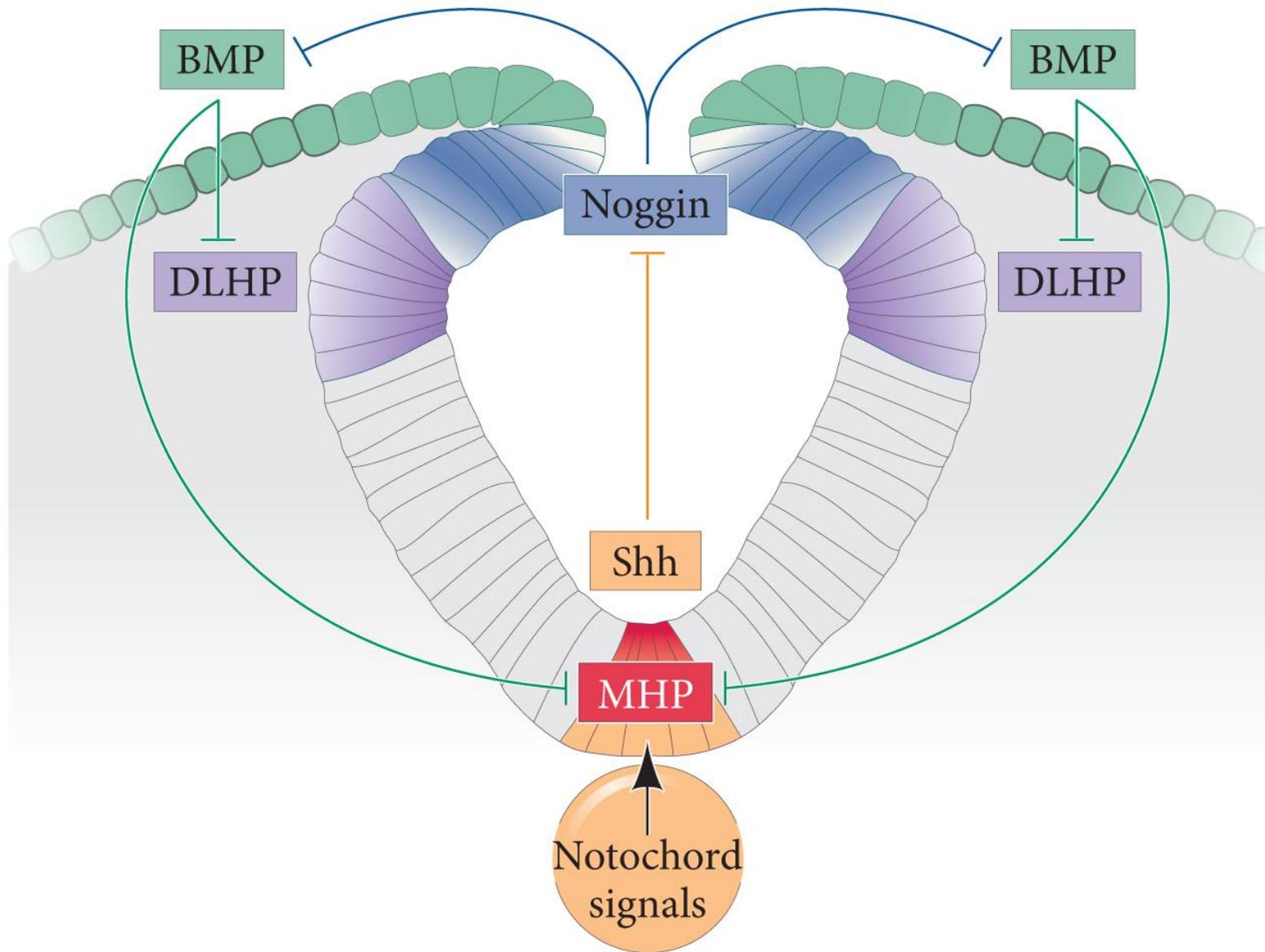
Dorsal midline

Neural crest

Epidermis

Neural crest cells

Neural tube



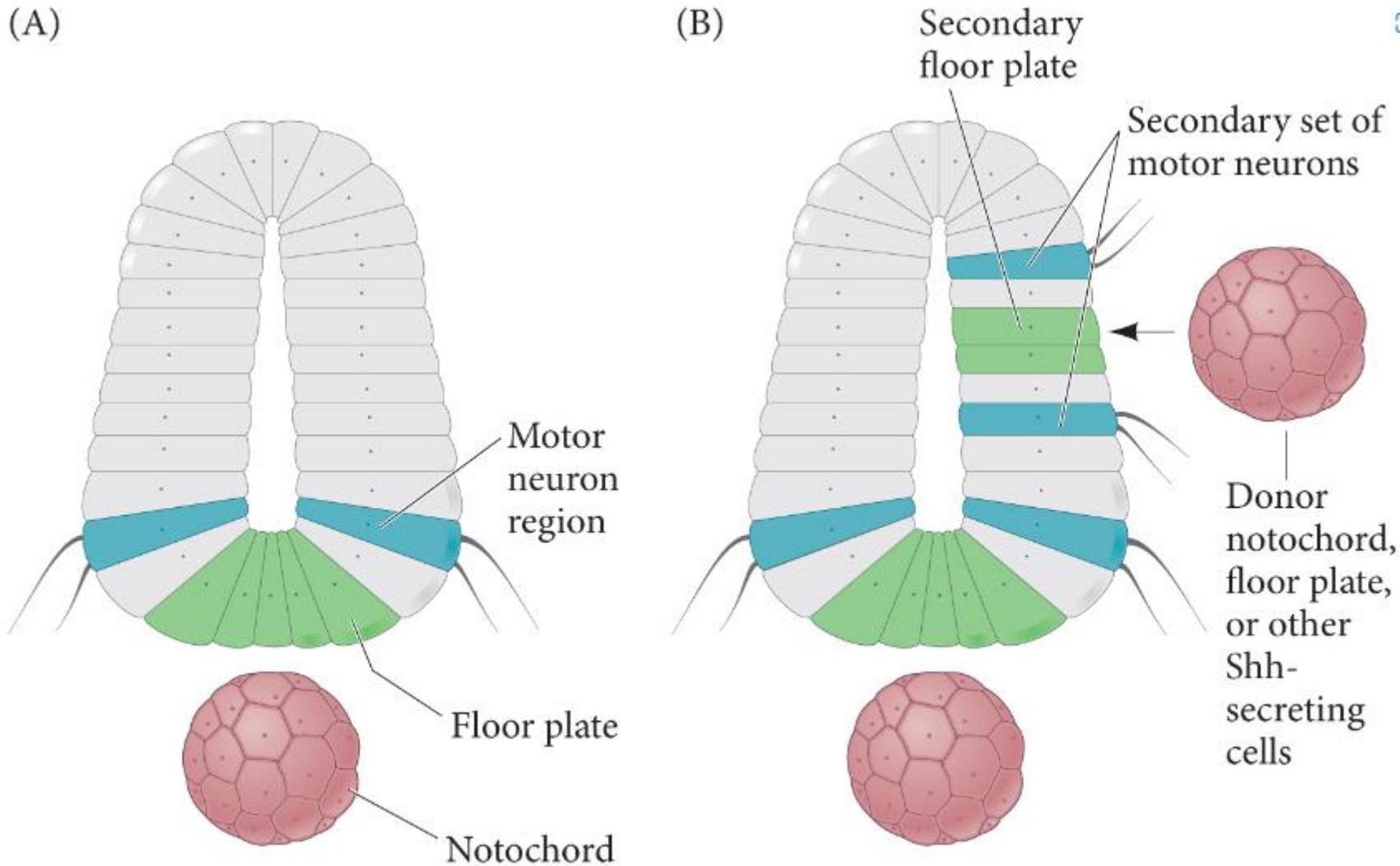
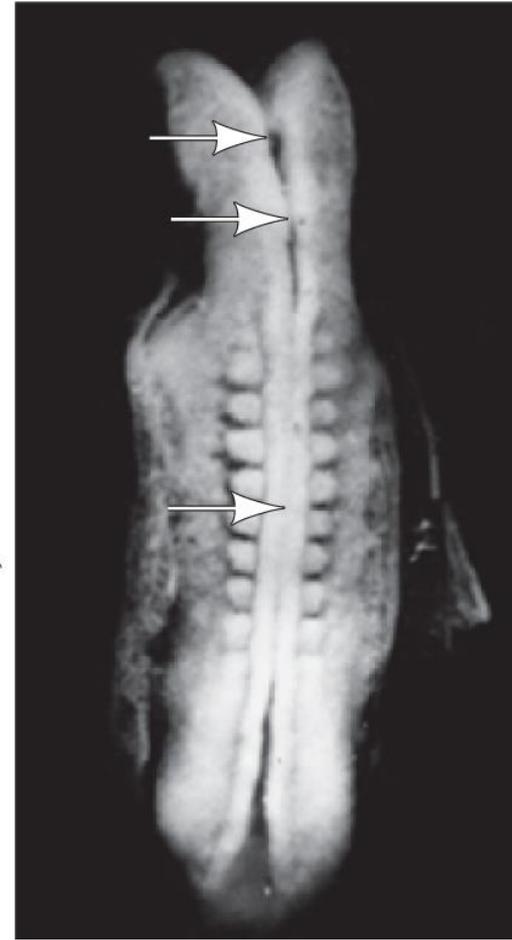
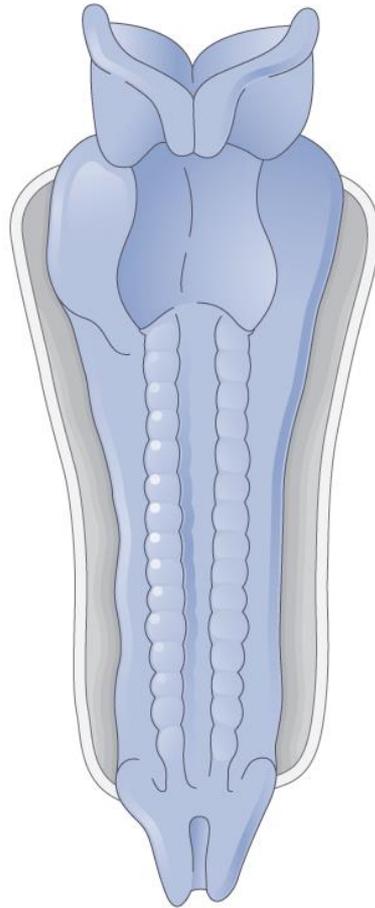
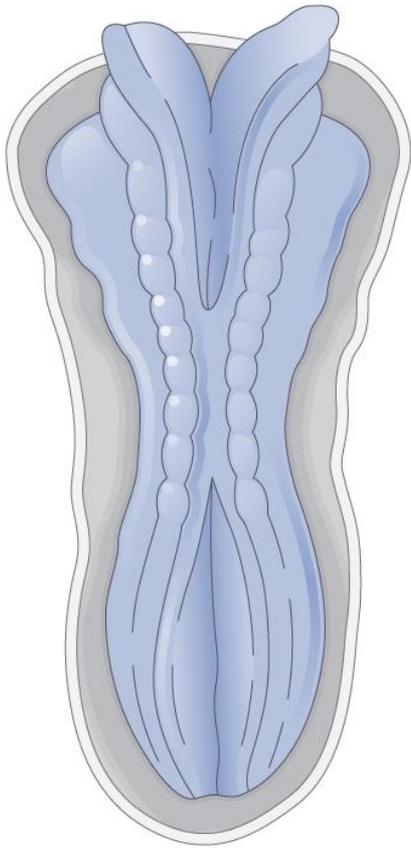
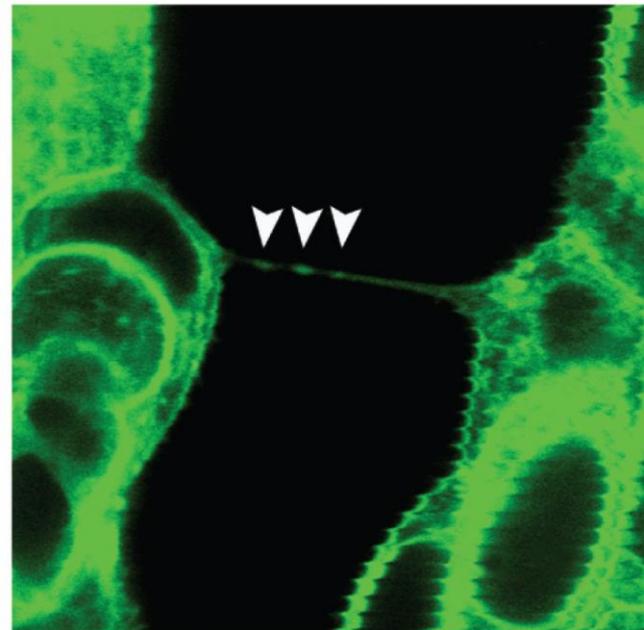
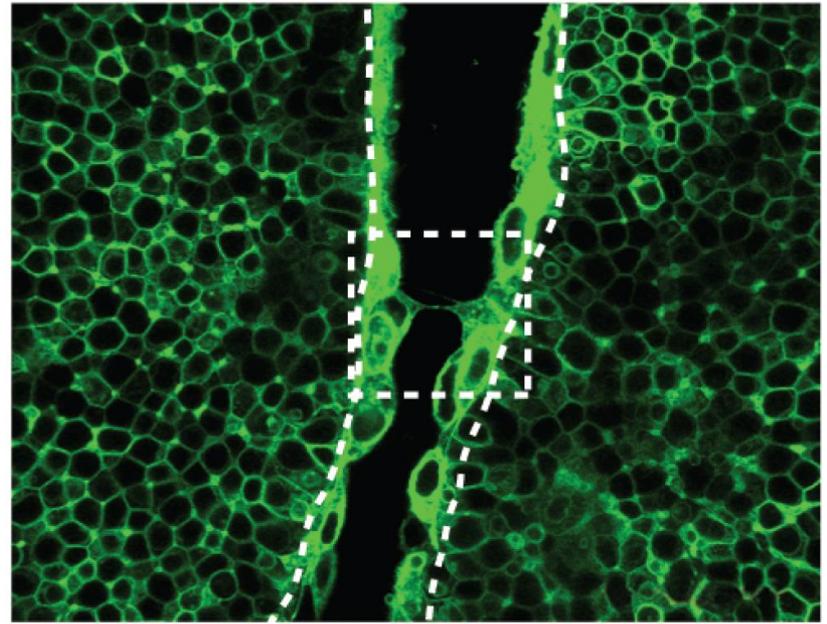
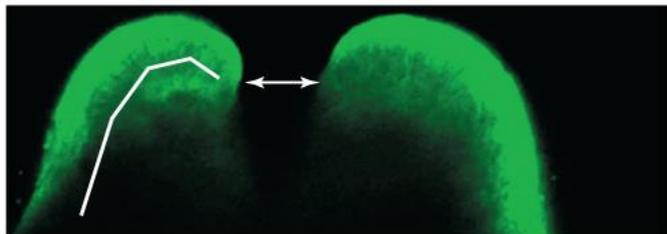
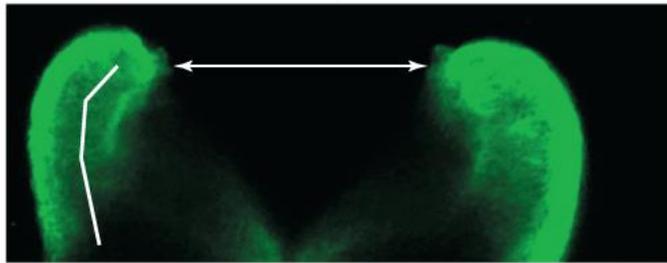
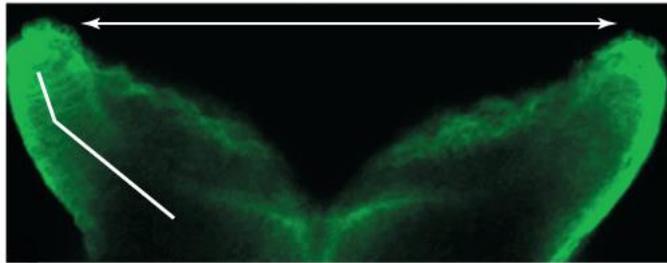
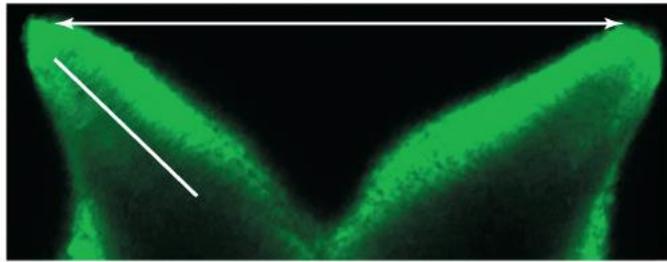


Figure 1 Notochord-derived Shh induces ventral neural tube structures. (A) Cells closest to the notochord become the floor plate neurons; motor neurons emerge on the ventrolateral sides. (B) If a second notochord, floor plate, or any other Sonic hedgehog-secreting cell is placed adjacent to the neural tube, it induces a second set of floor plate neurons as well as two other sets of motor neurons. (After M. Placzek et al. 1998. *Science* 250: 985–988.)

Fechamento do tubo neural

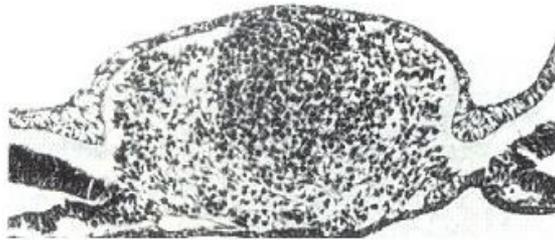




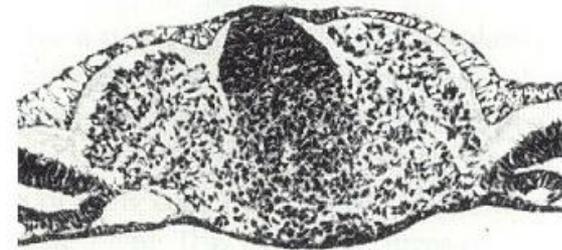
NEURULAÇÃO SECUNDÁRIA

Origem mesodérmica do tubo neural
Células mesenquimais se condensam para formar um cordão medular

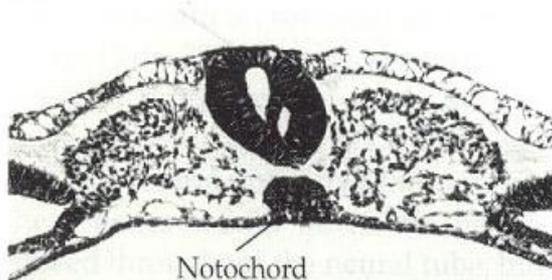
(A)



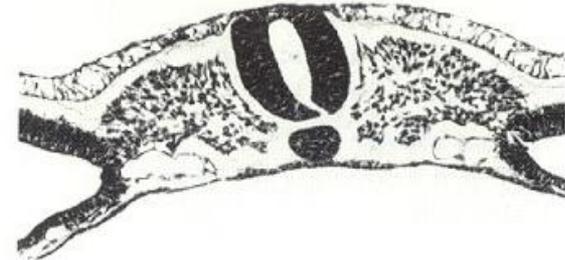
(B)



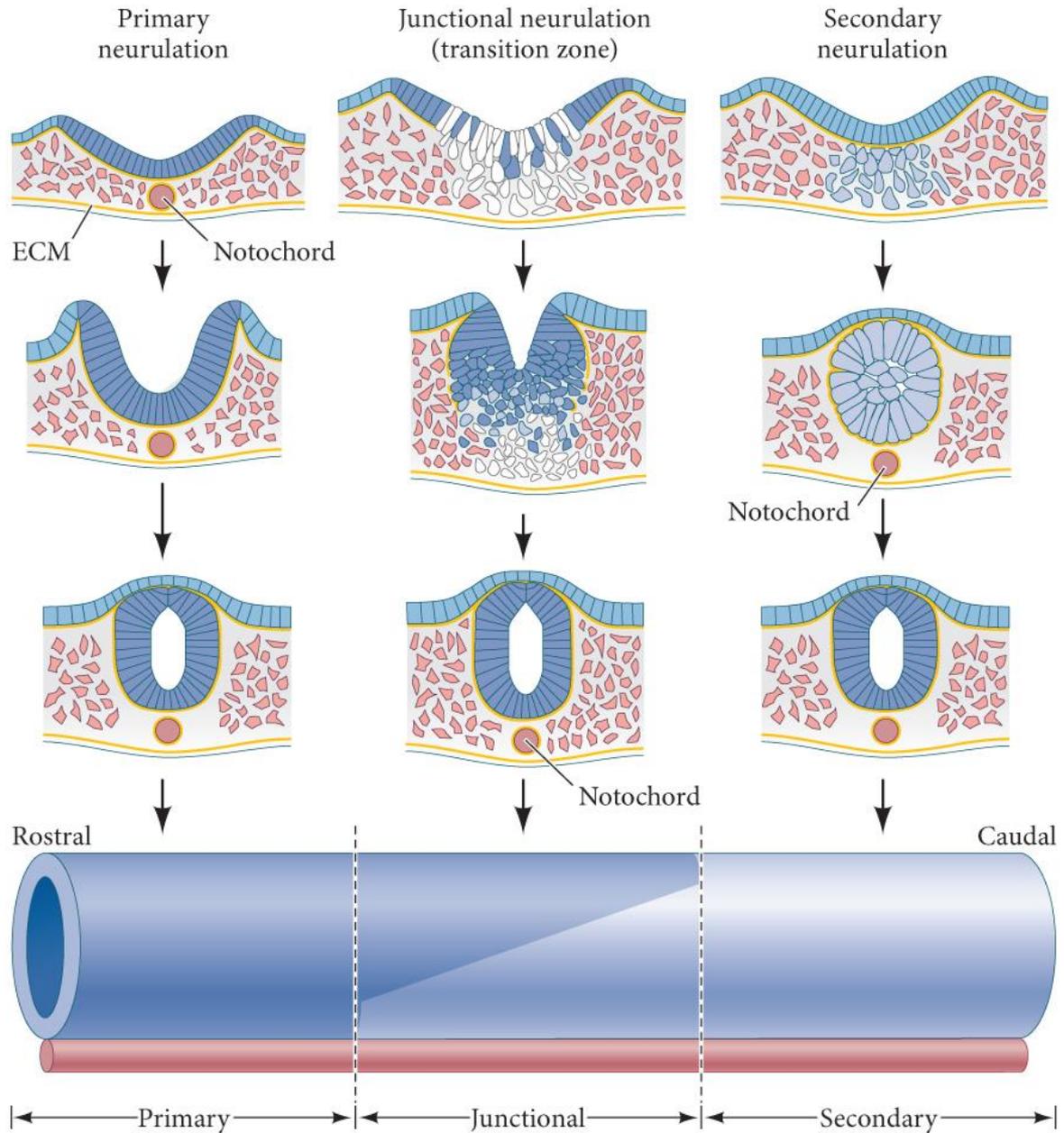
(C)



(D)



Cortes transversais na região caudal de embrião de galinha



After Dady et al. 2014, *J Neurosci*; 34: 13208-13221.

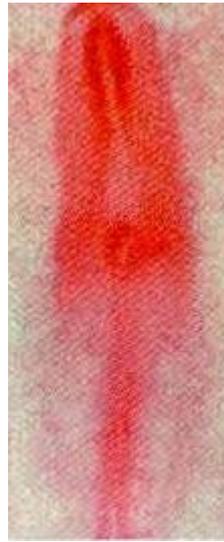
Neurulação em embrião de aves - vista dorsal



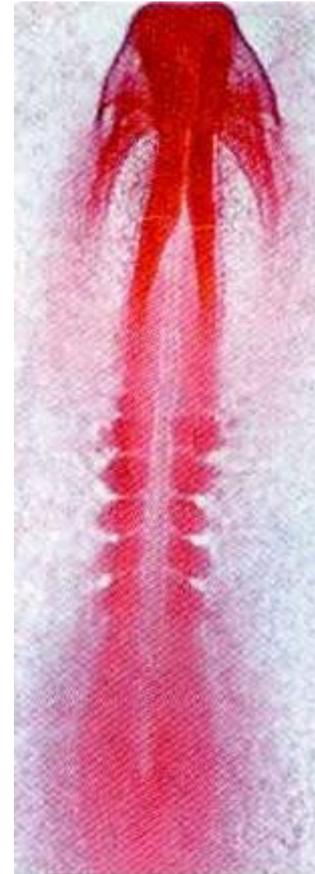
Placa Neural



Placa neural notocorda (sob a PN)



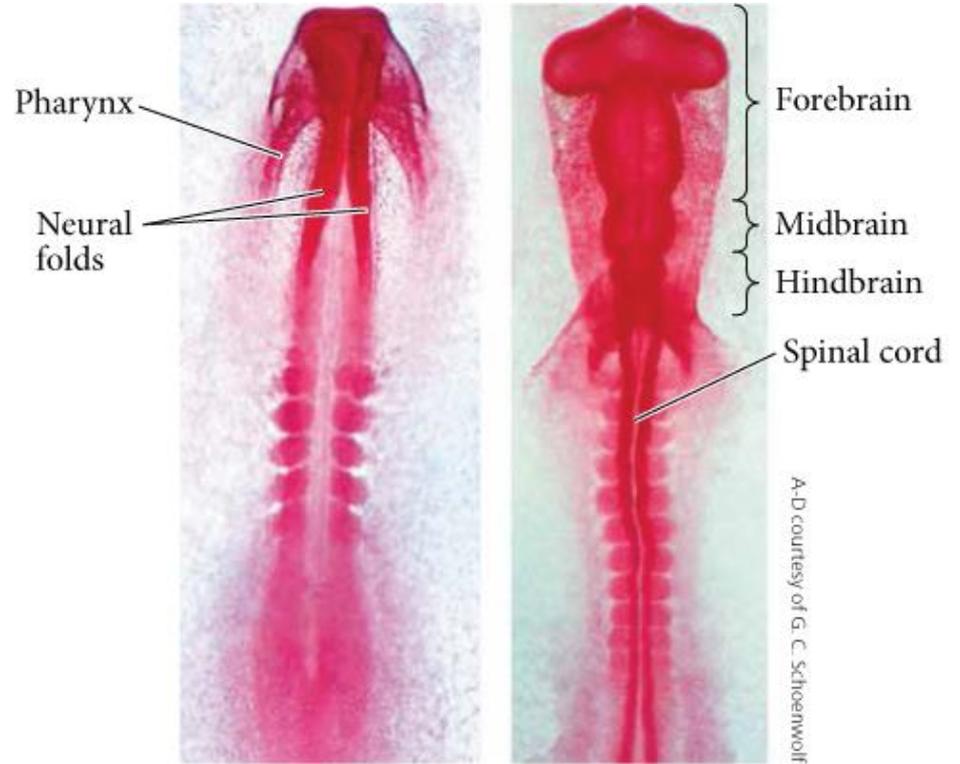
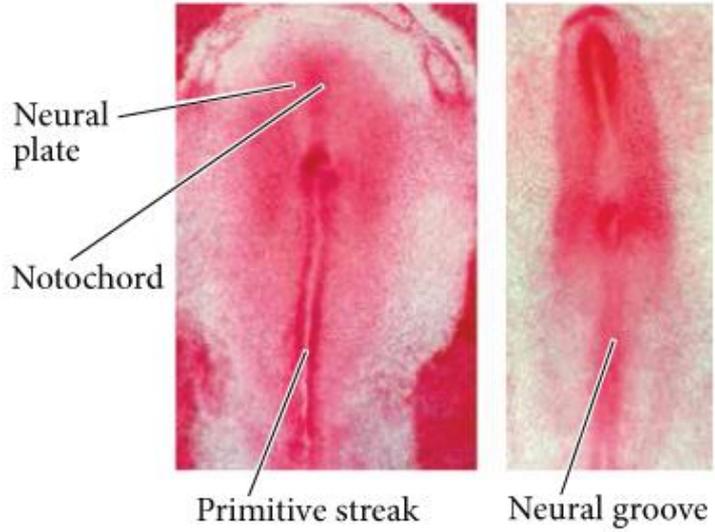
Sulco Neural



Tubo neural (início)

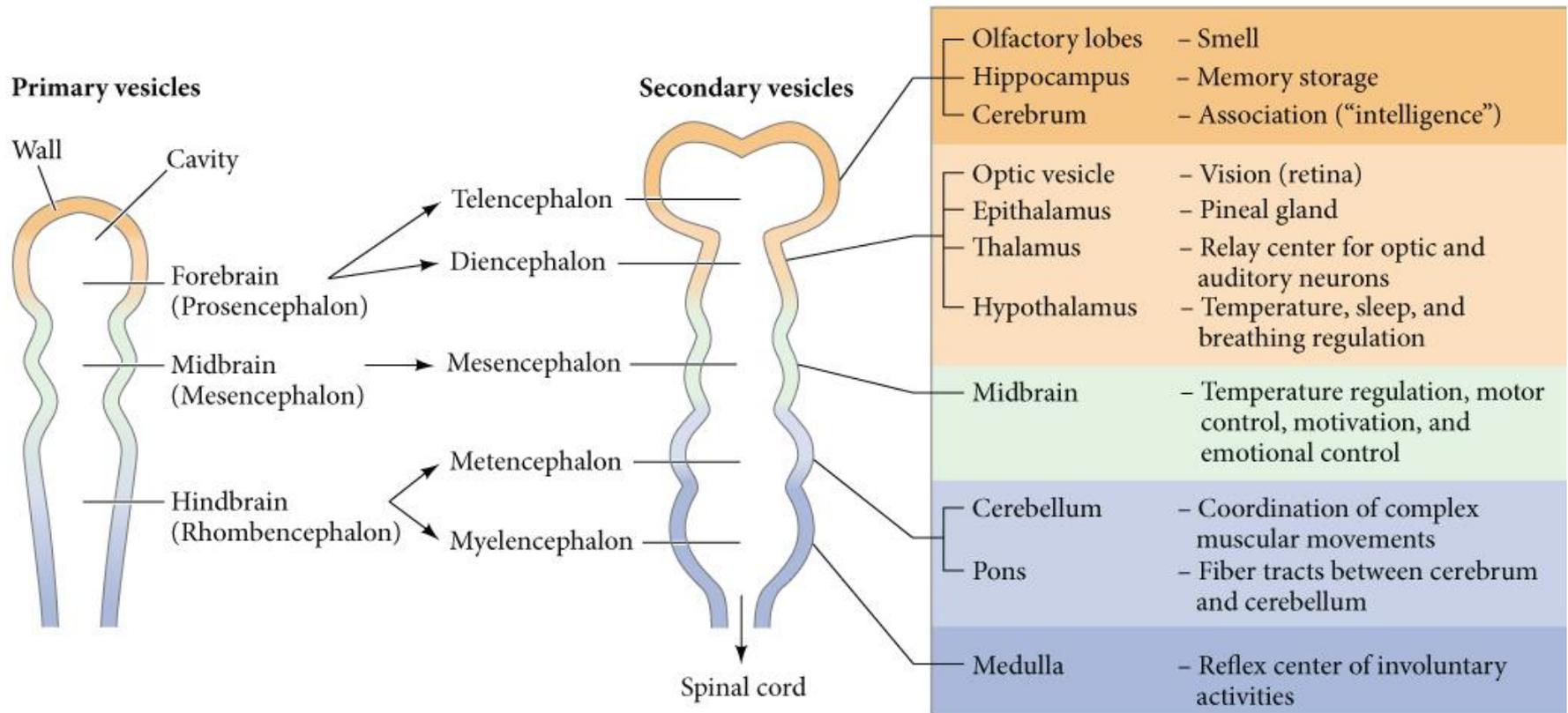


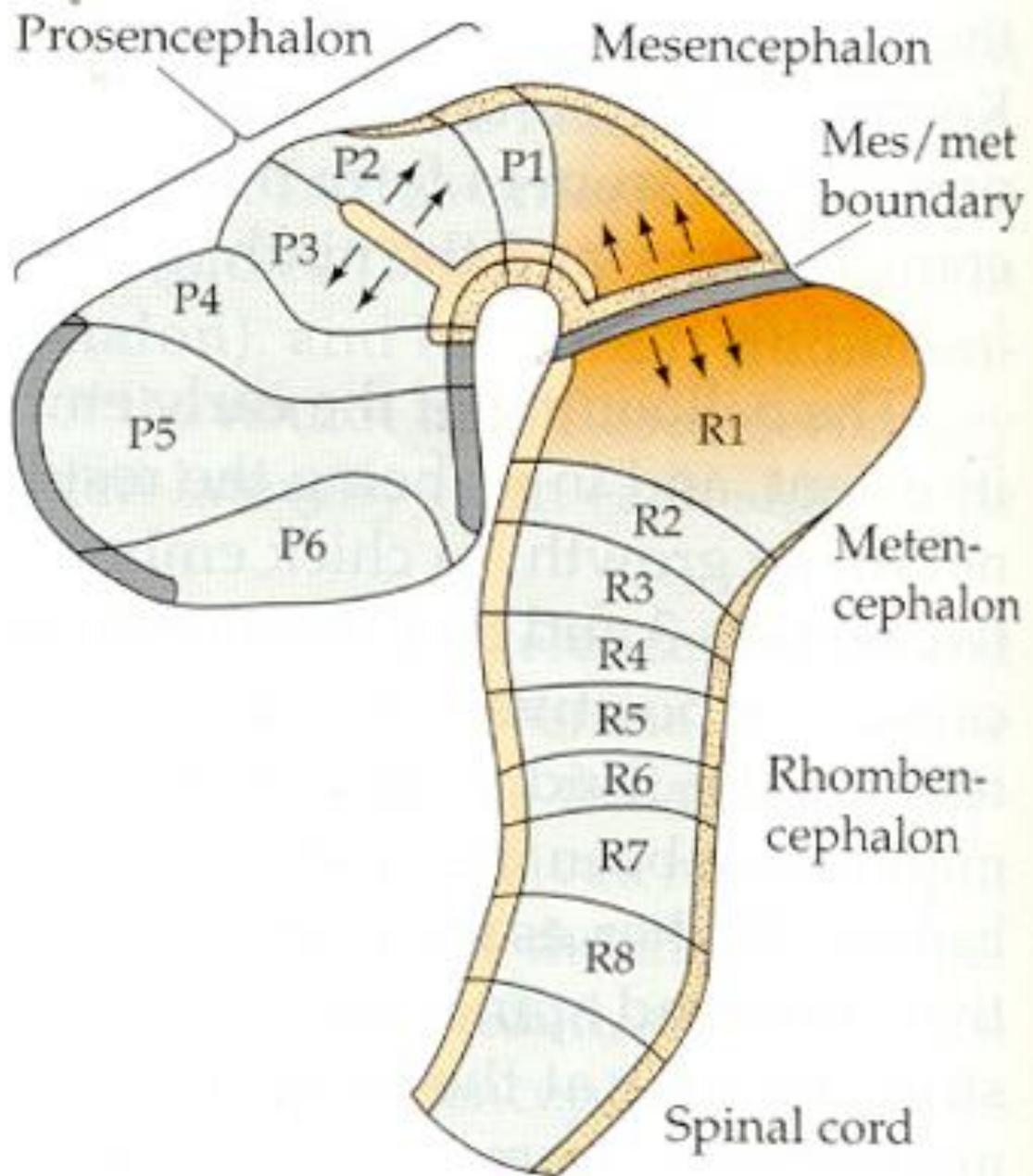
Tubo neural com as vesículas encefálicas



Derivados das vesículas encefálicas

Vida Adulta

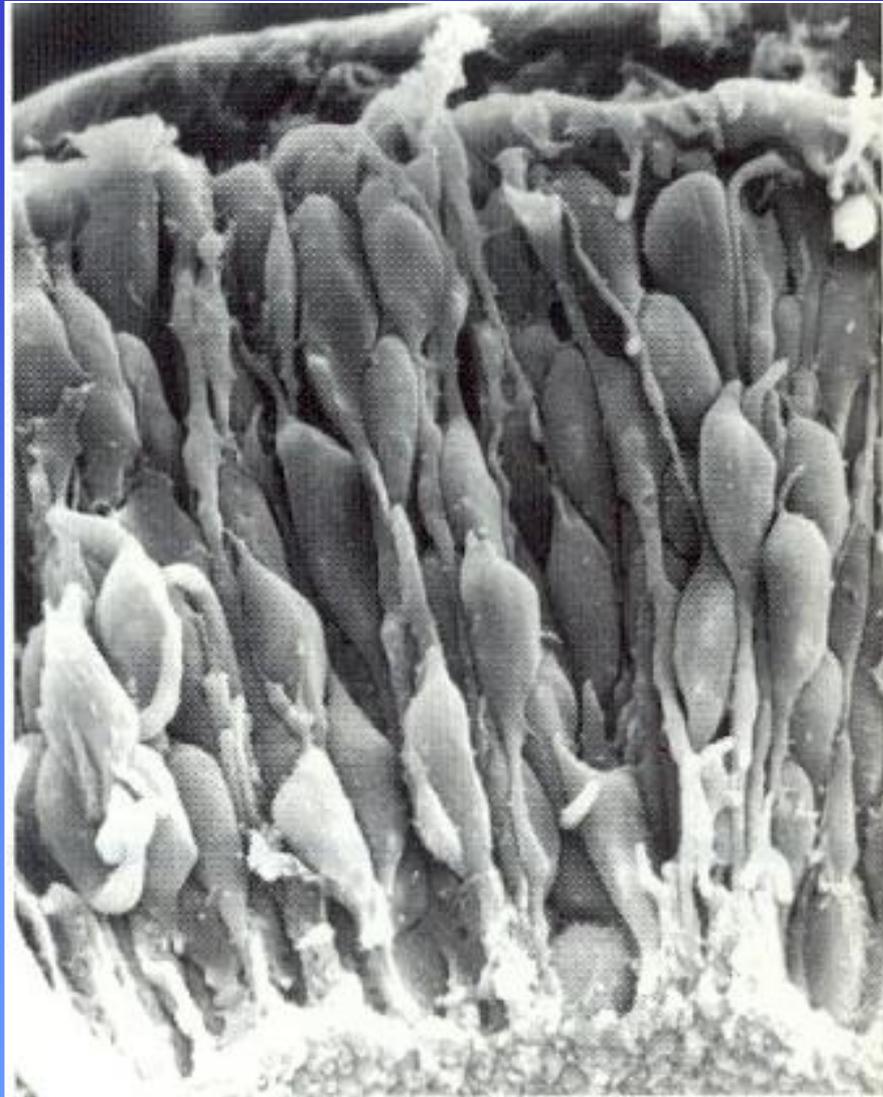




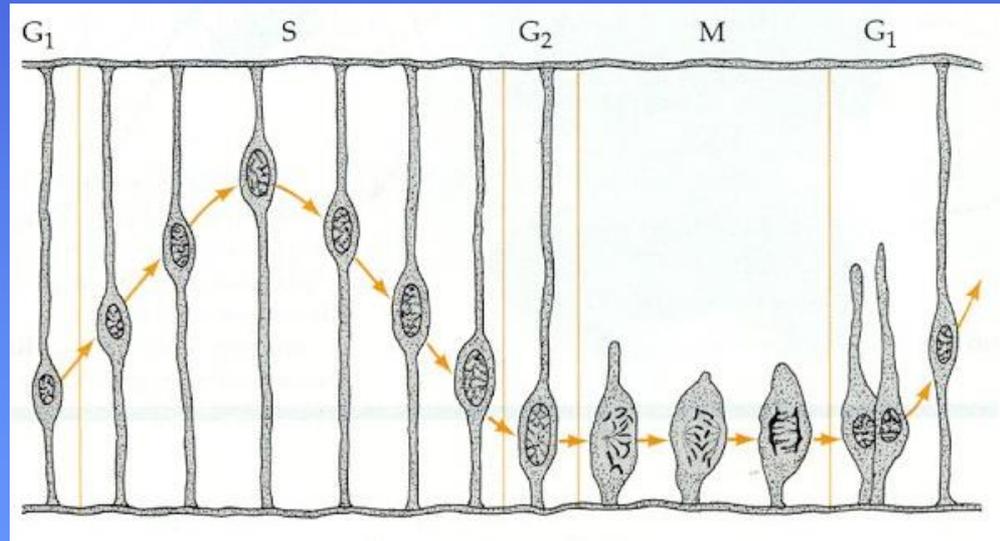
Curvatura do TUBO NEURAL

P = prosômeros
R = rombômeros

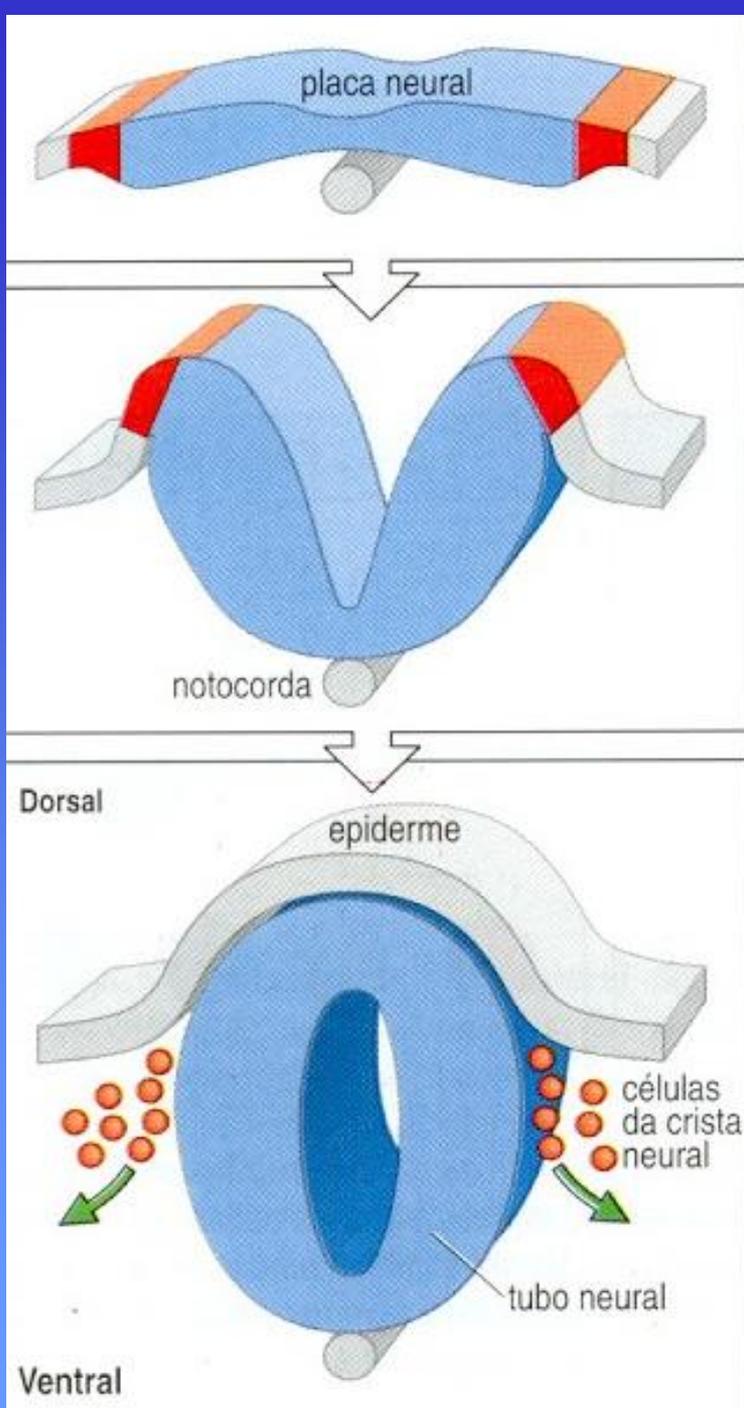
CÉLULAS NEUROEPITELIAIS DO TUBO NEURAL: posição do núcleo dependente da fase do ciclo celular



Fases do ciclo celular

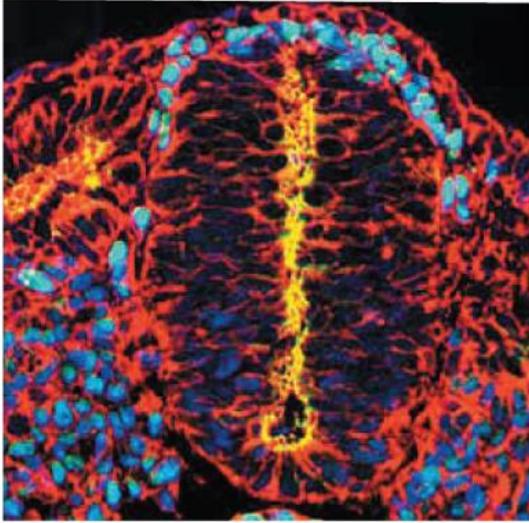


Lúmen do tubo neural



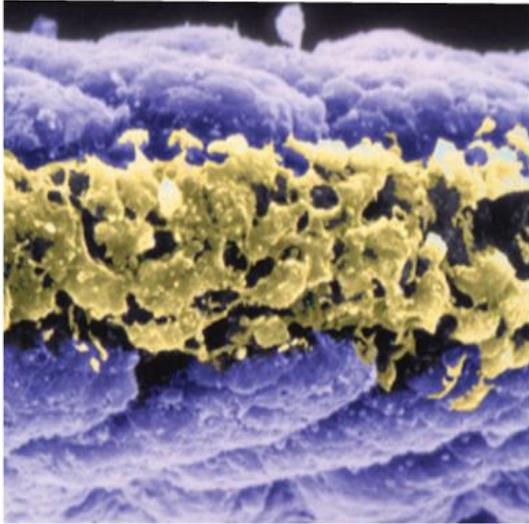
ORIGEM E INÍCIO DA MIGRAÇÃO DAS CÉLULAS DA CRISTA NEURAL

(A)



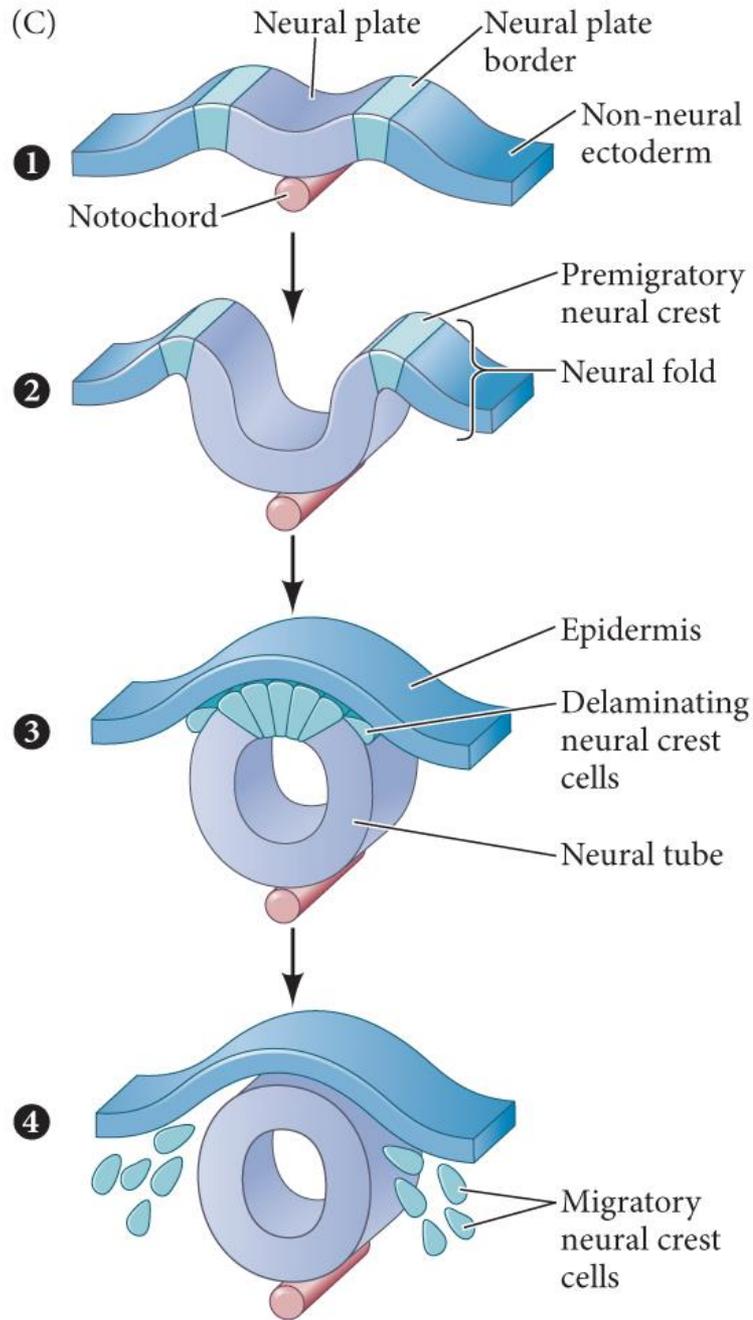
Courtesy of J. Briscoe

(B)



Courtesy of D. Raible

(C)



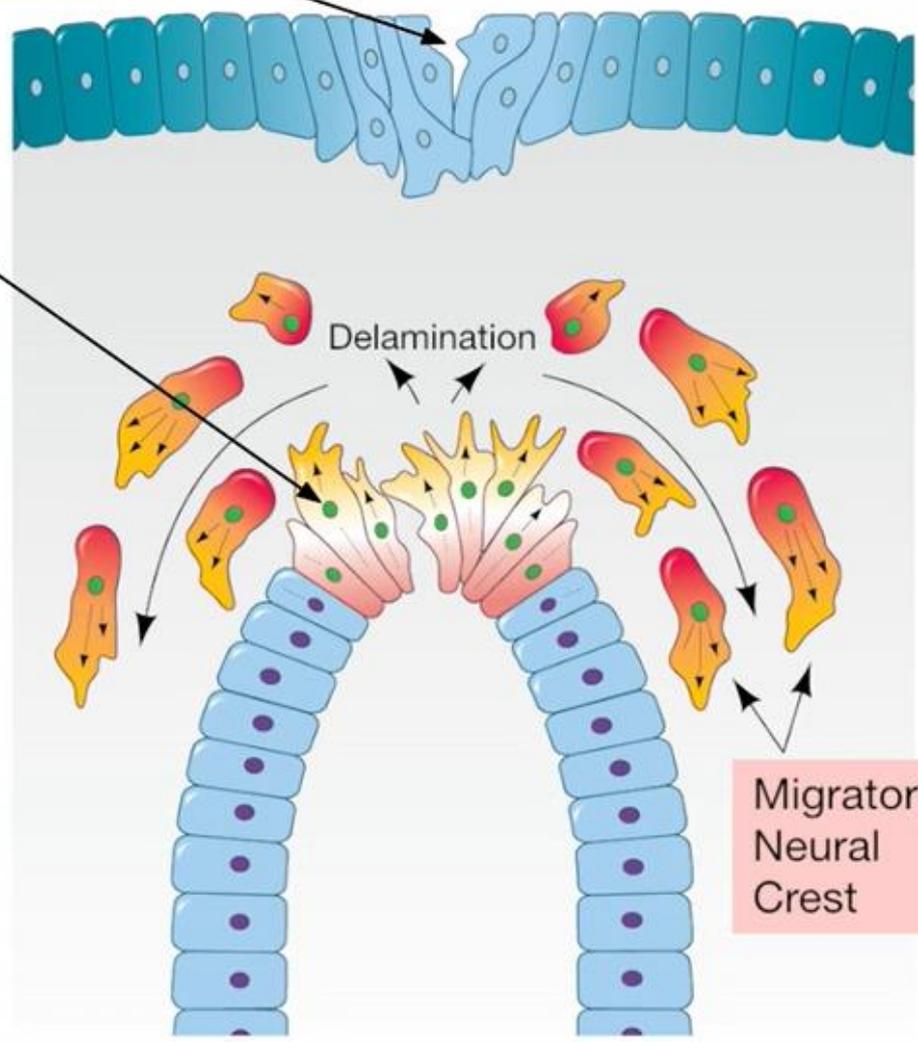
C after M. Simões-Costa and M. E. Bronner. 2015. *Development* 142: 242–27.

Surface Ectoderm Cells Fuse into One Layer

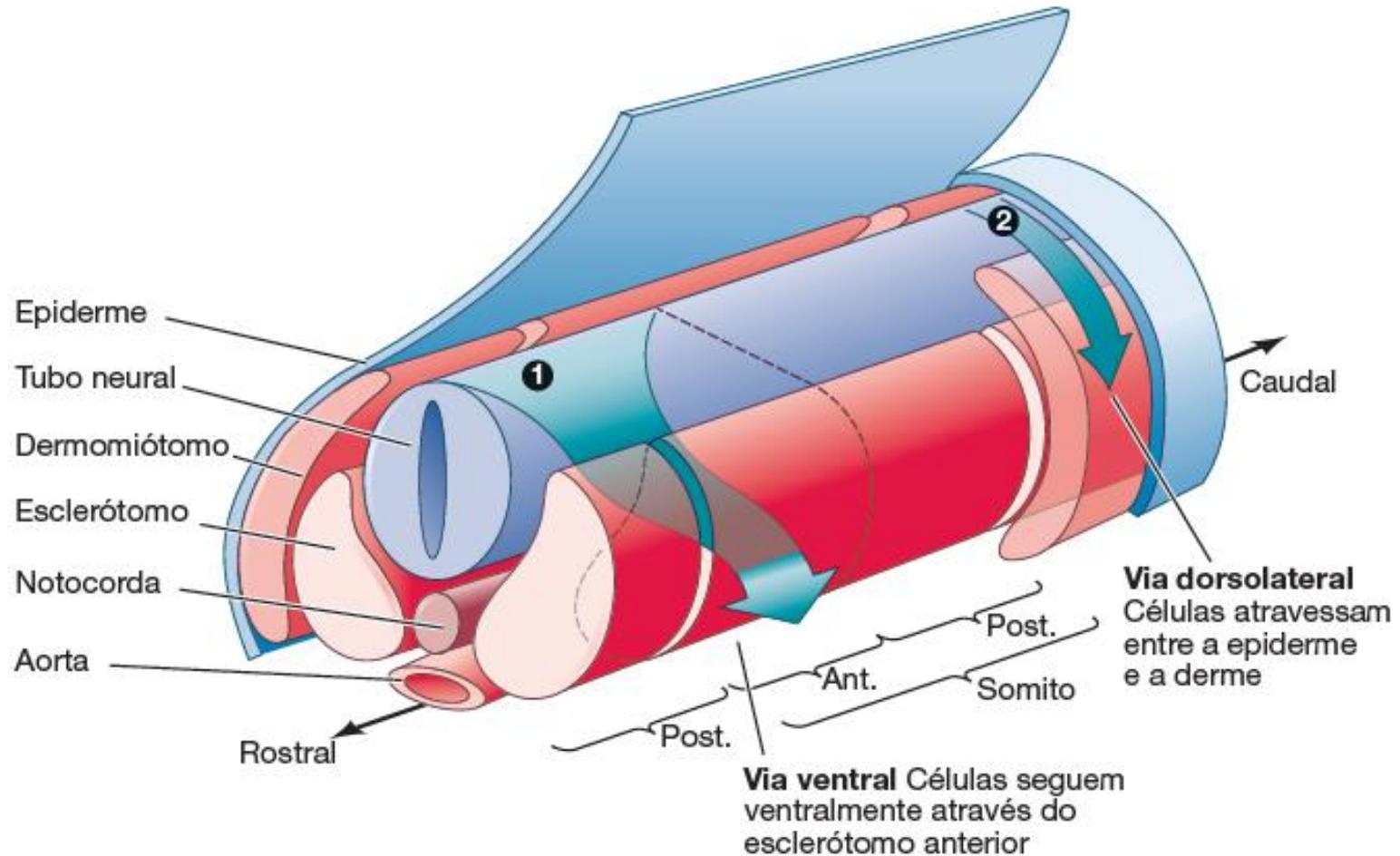
Premigratory Neural Crest

Delamination

Migratory Neural Crest



ROTAS DE MIGRAÇÃO DAS CÉLULAS DA CRISTA NEURAL



ALGUNS DERIVADOS DAS CÉLULAS DA CRISTA NEURAL

SISTEMA NERVOSO PERIFÉRICO	Neurônios, incluindo gânglios sensitivos e do sistema nervoso simpático e parassimpático, células da neuroglia e células de Schwann
DERIVADOS ENDÓCRINOS	Medula da glândula adrenal, células secretoras de calcitonina
CÉLULAS PRODUTORAS DE MELANINA	Células pigmentares da epiderme
ESTRUTURAS FACIAIS	Cartilagens e ossos faciais
TECIDO CONJUNTIVO	Endotélio e estroma da córnea
	Papila dentária
	Derme, musculatura lisa e tecido adiposo da pele da cabeça e pescoço
	Tecido conjuntivo das glândulas salivares, lacrimais, timo, tireóide e hipófise
	Tecido conjuntivo e músculo liso das artérias que originam-se de arcos aórticos

