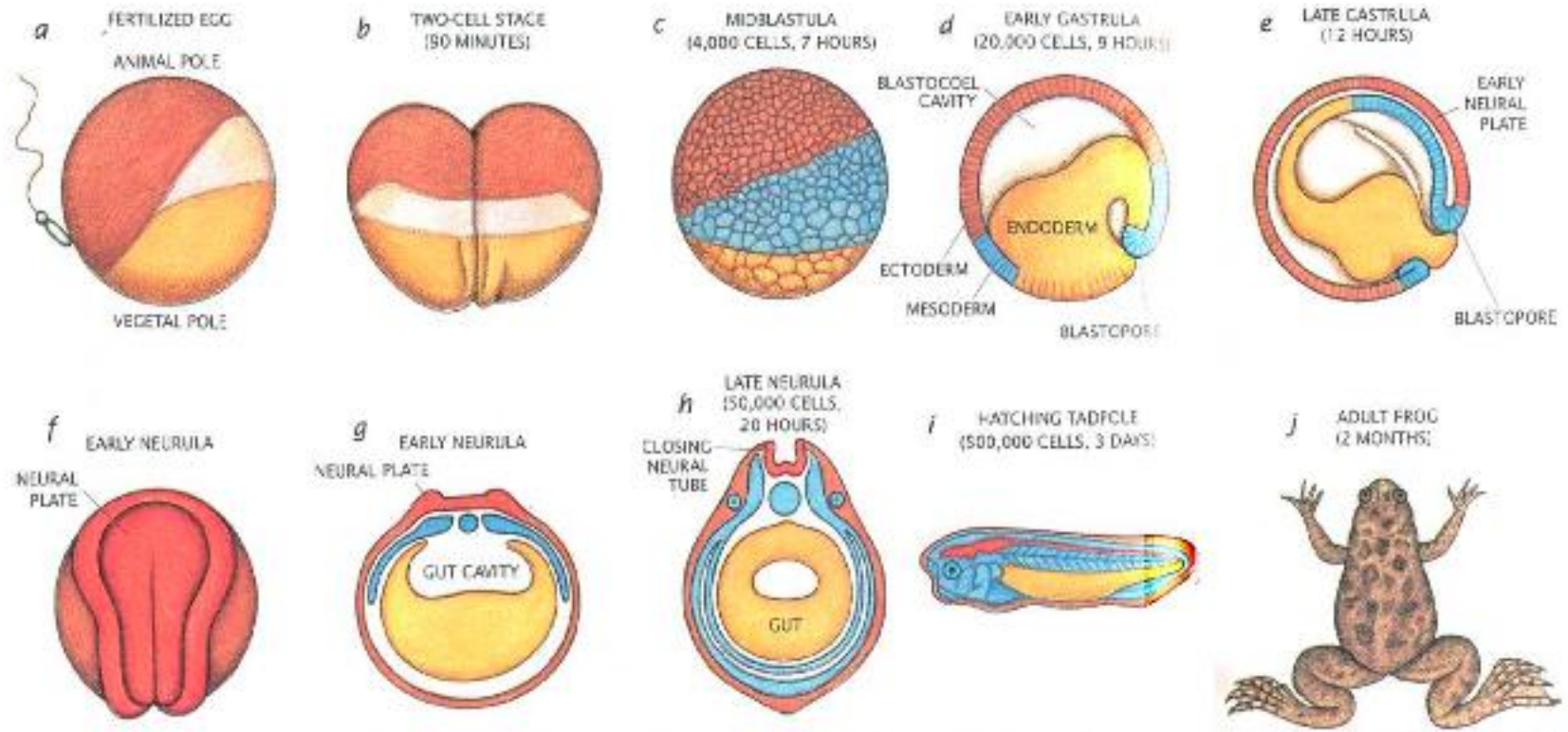
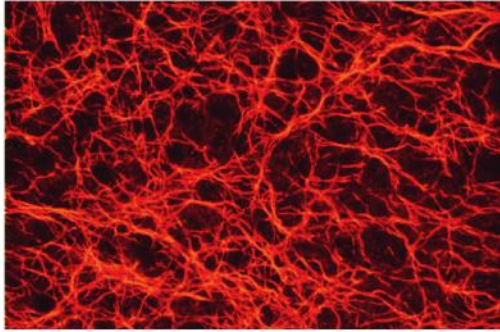


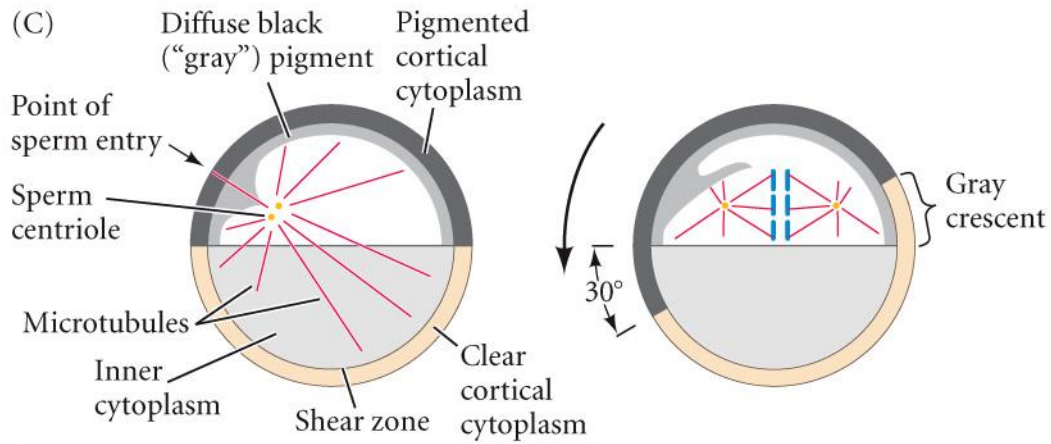
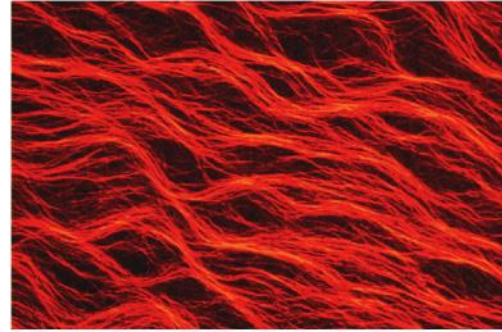
# LO SVILUPPO PRECOCE DI XENOPUS COINVOLGE DETERMINANTI CITOPLASMATICI MATERNI E INTERAZIONI INDUTTIVE



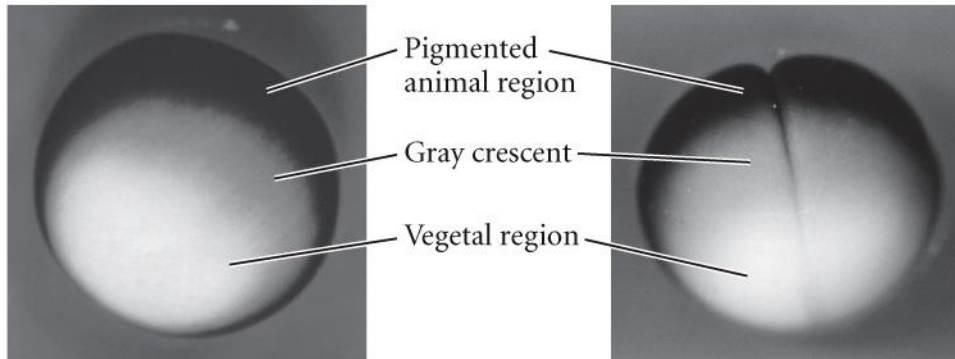
(A) 0.50



(B) 0.70



(D)



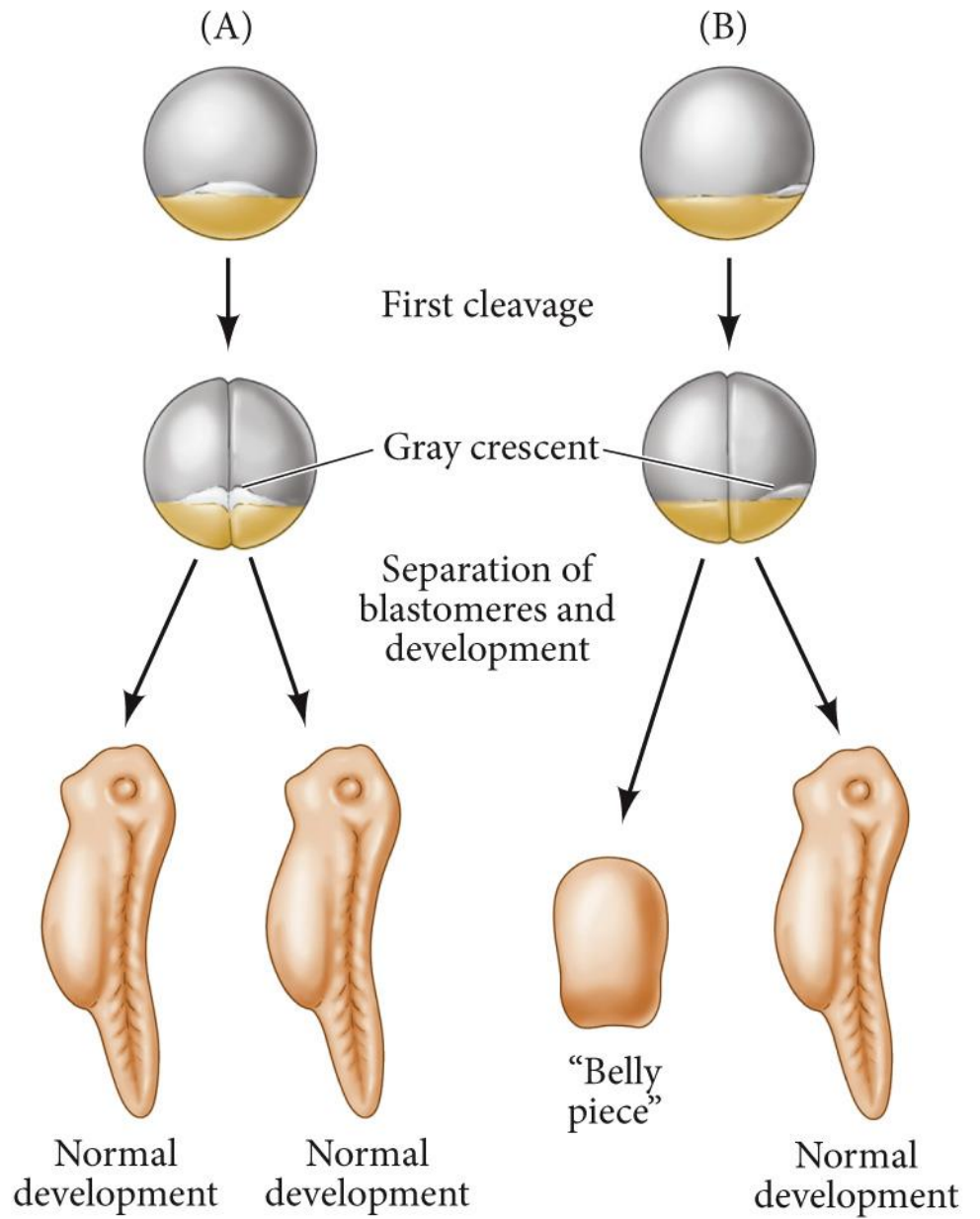


H. Spemann.

1931

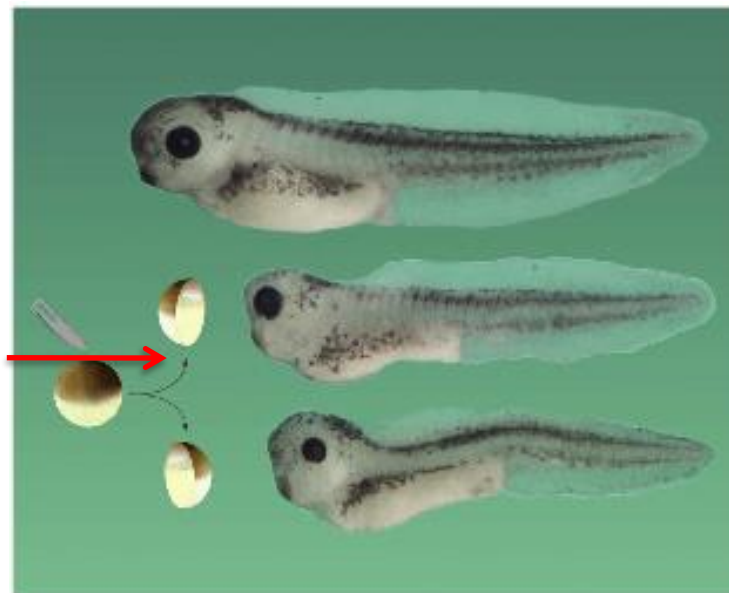
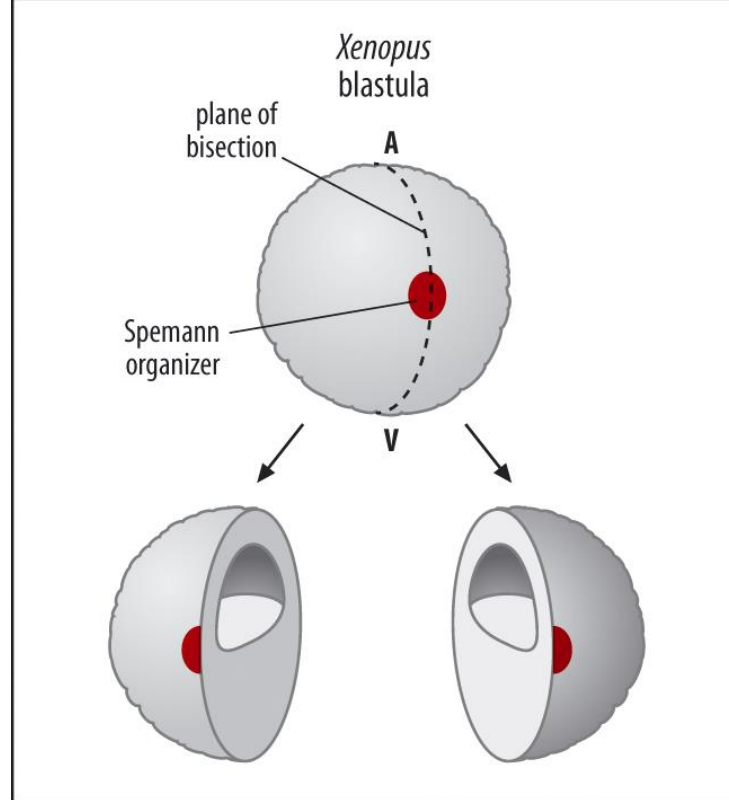
Nobel Prize 1935

H. Spemann

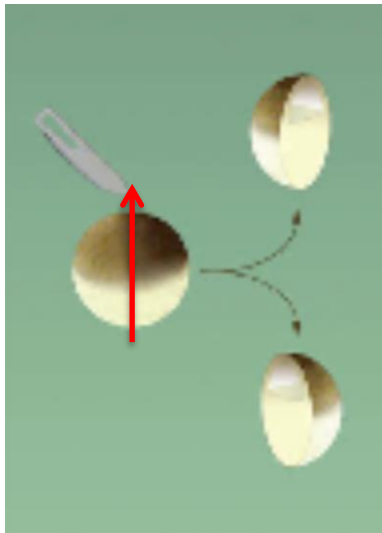


DEVELOPMENTAL BIOLOGY 11e, Figure 11.12  
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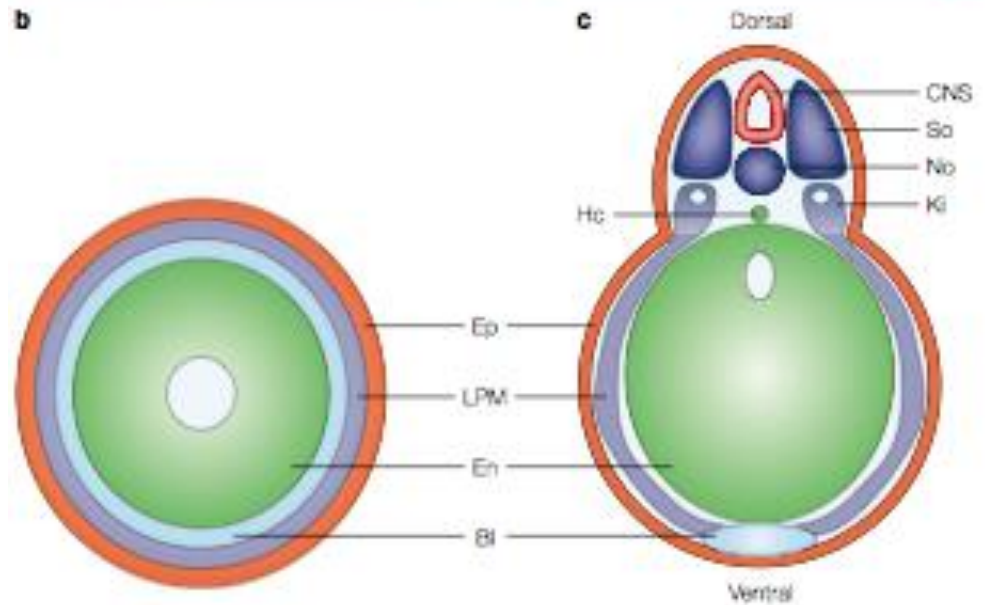
# CAPACITA' REGOLATIVE DELL'EMBRIONE PRECOCE DI XENOPUS



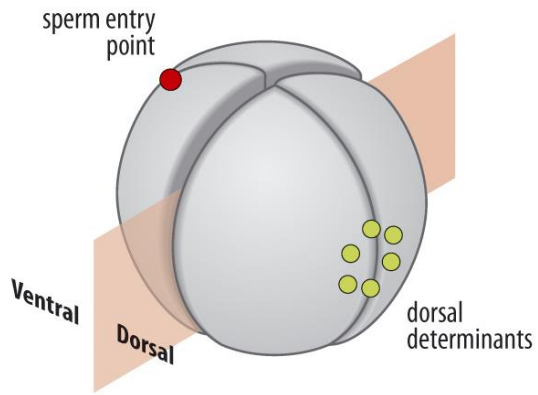
# SPECIFICAZIONE AUTONOMA NELLO SVILUPPO PRECOCE DI XENOPUS: LOCALIZZAZIONE DI DETERMINANTI CITOPLASMATICI NELLA REGIONE DORSALE



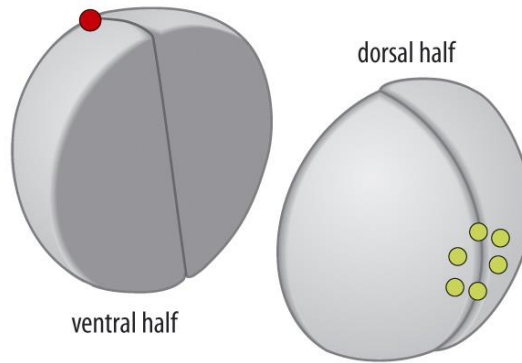
**b**



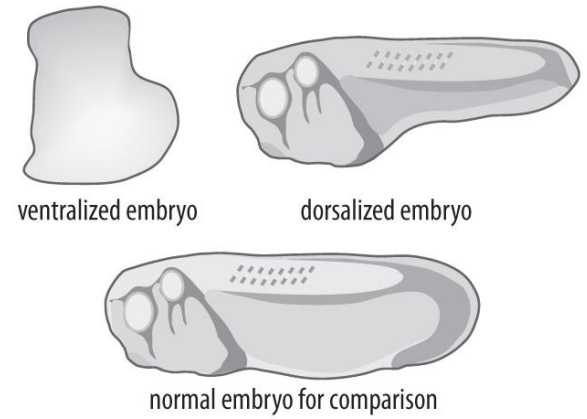
***Xenopus* embryo at the four-cell stage divided into dorsal and ventral halves**



Ventral half lacks dorsal determinants

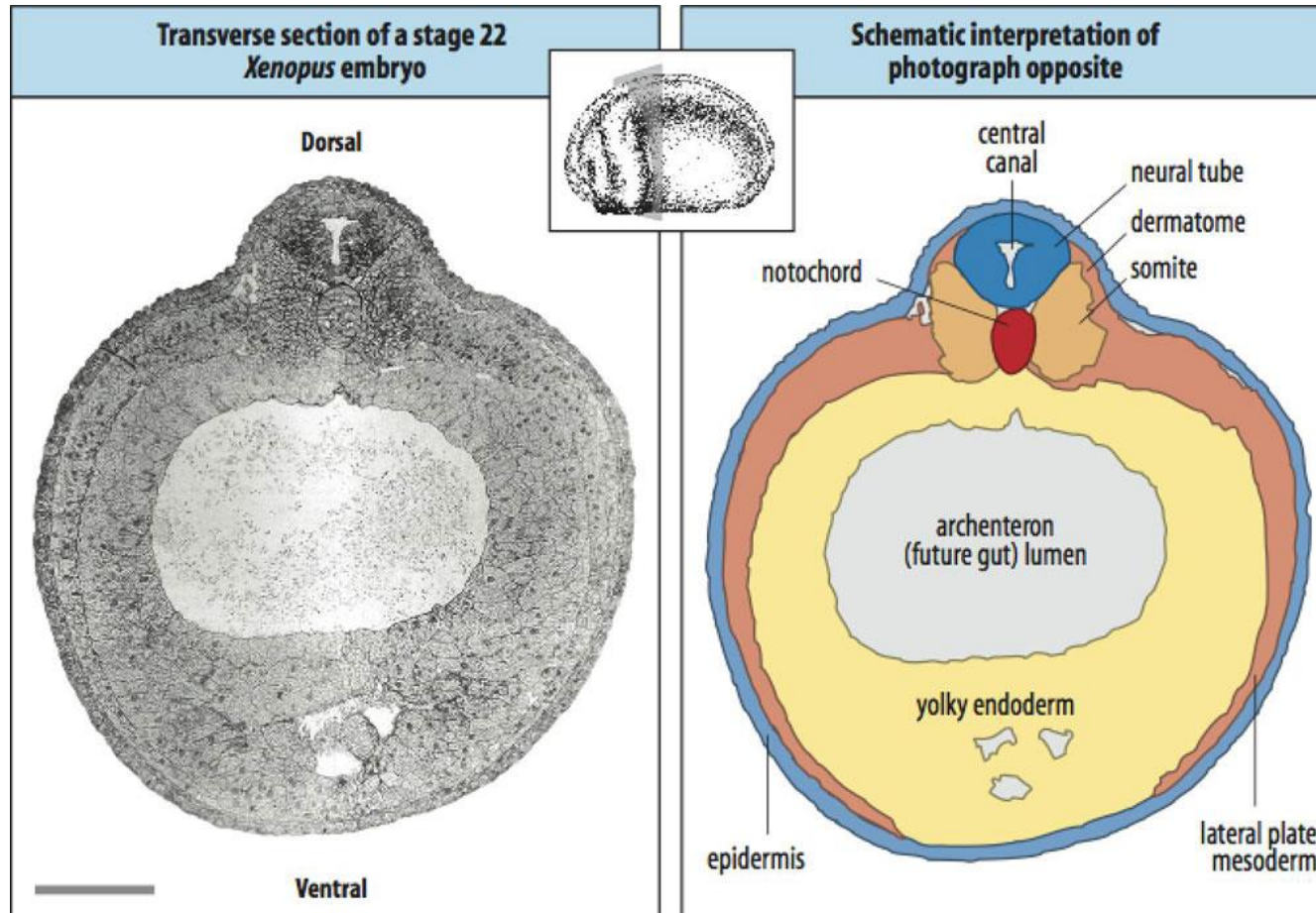


**The ventral half develops into a ventralized embryo. The dorsal half develops into a dorsalized embryo**



# STRUTTURE DORSALI:ECTODERMA DORSALE (TUBO NEURALE) MESODERMA DORSALE (CORDOMESODERMA)

QUANDO VIENE PREFISSATO IL LORO DESTINO?

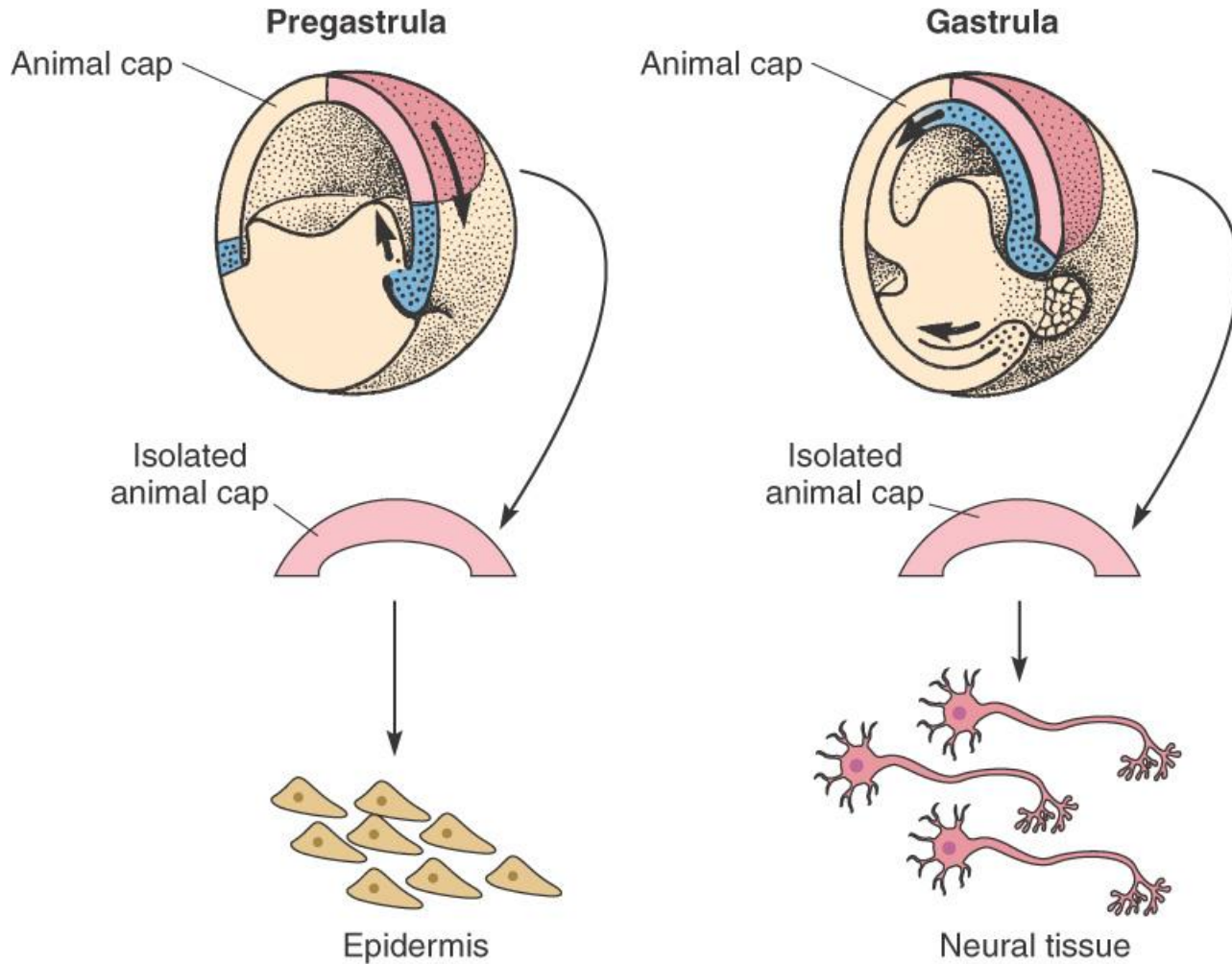


## FASI NEL PROCESSO DI ACQUISIZIONE DEL DESTINO CELLULARE

- **Impegno** (Commitment): fase di indirizzamento della cellula verso un certo fenotipo (restrizione delle potenzialità della cellula)
- **Specificazione**: quando una cellula è posta in un ambiente neutro e separata dal resto dell'embrione, e' in grado di differenziarsi autonomamente, ma se spostata in un'altra regione dell'embrione può ancora modificare il proprio destino maturativo (destino reversibile)
- **Determinazione**: quando una cellula è in grado di differenziare autonomamente indipendentemente dalla sua posizione all'interno dell'embrione (destino irreversibile)

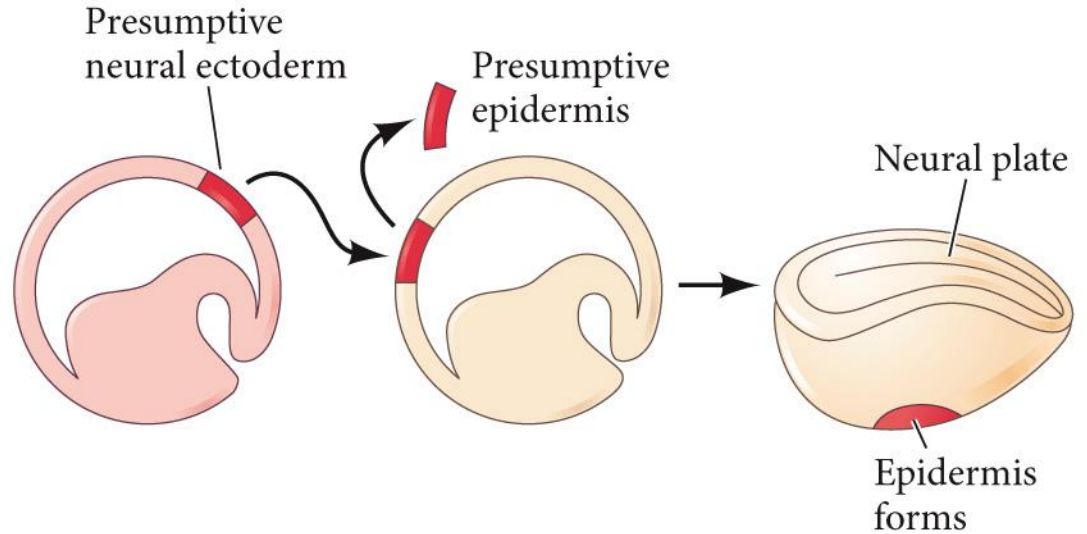


# LA SPECIFICAZIONE DELL'ECTODERMA DORSALE AVVIENE DURANTE LA GASTRULAZIONE

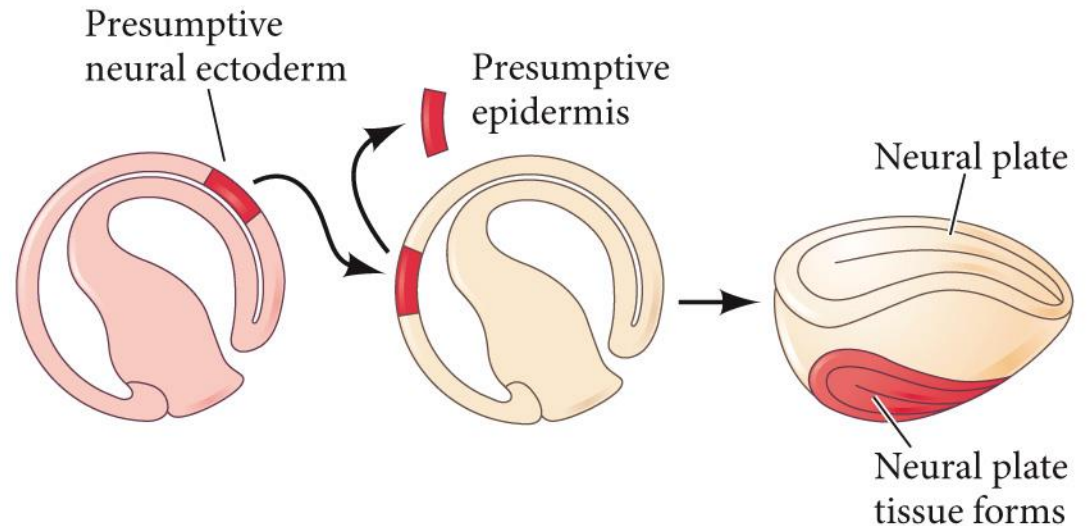


# LA DETERMINAZIONE DELL'ECTODERMA DORSALE AVVIENE DURANTE LA GASTRULAZIONE

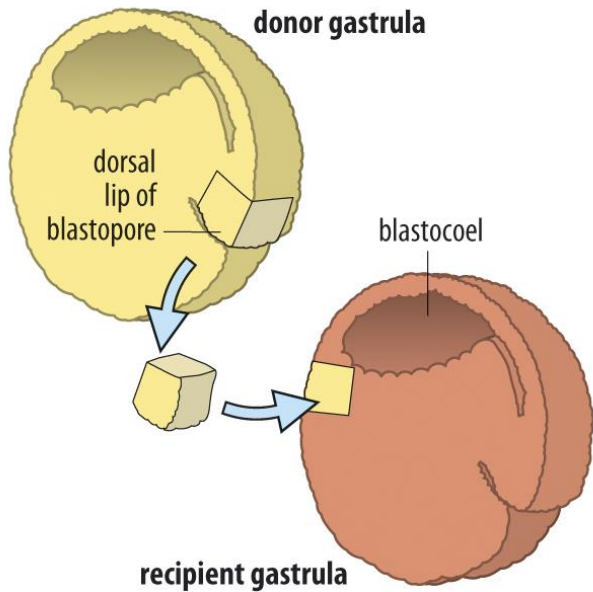
(A) Transplantation in early gastrula



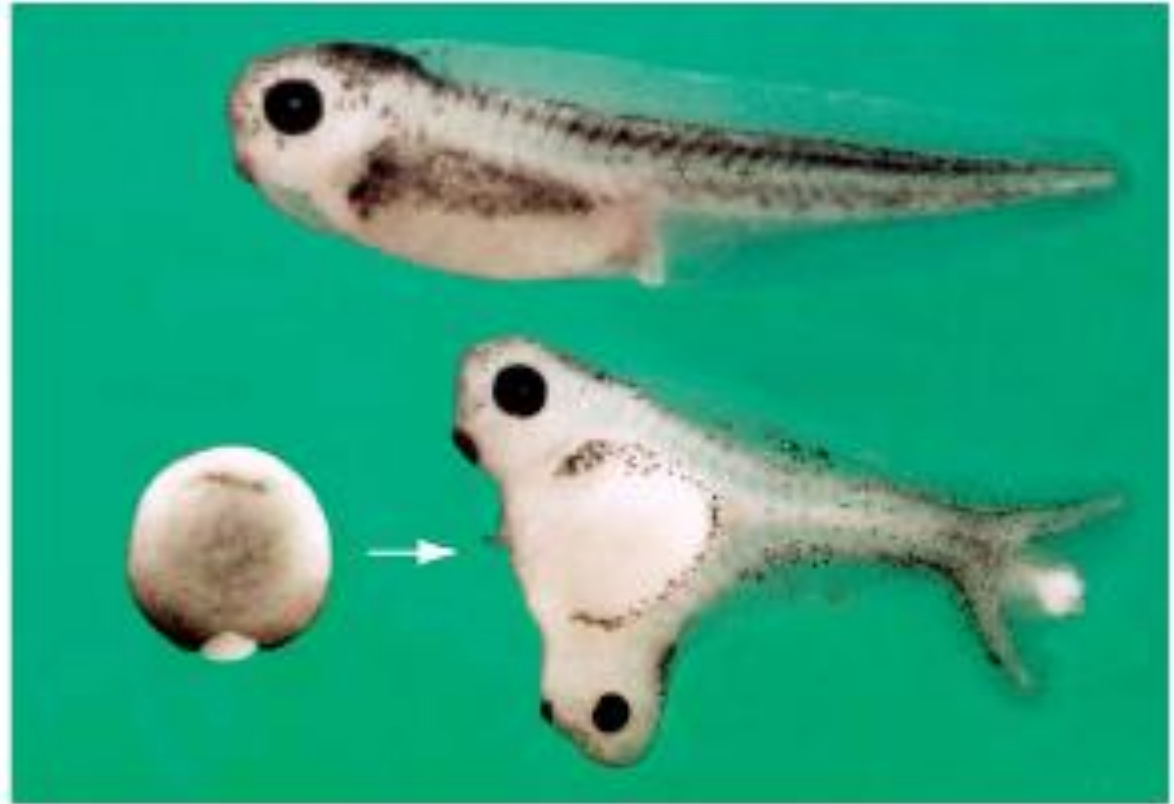
(B) Transplantation in late gastrula



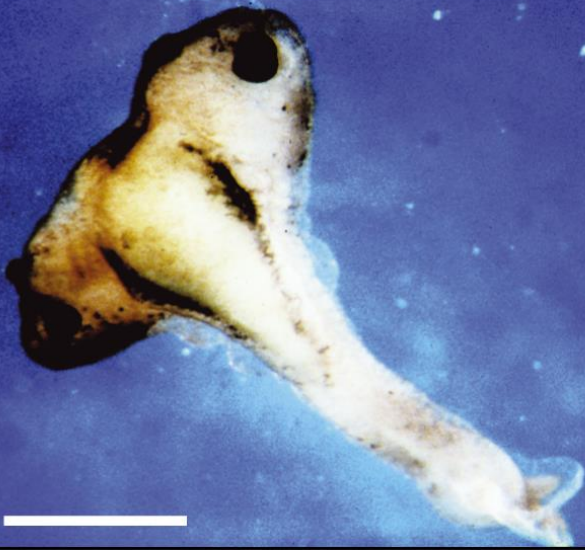
Spemann organizer from *Xenopus* gastrula grafted into ventral region of another gastrula



## L'ESPERIMENTO DI SPEMANN E MANGOLD (1924): TRAPIANTO DEL LABRO DORSALE DEL BLASTOPORO NEL LATO VENTRALE DI UN EMBRIONE ALLO STADIO DI GASTRULA

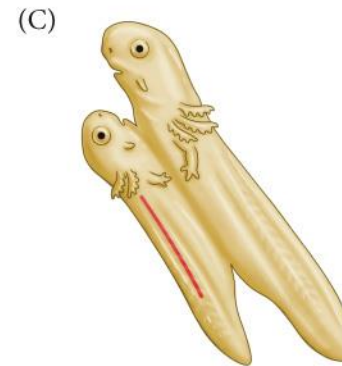
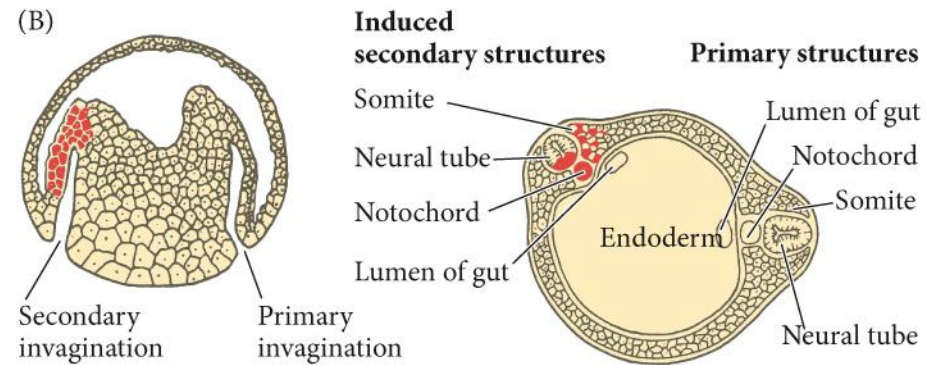
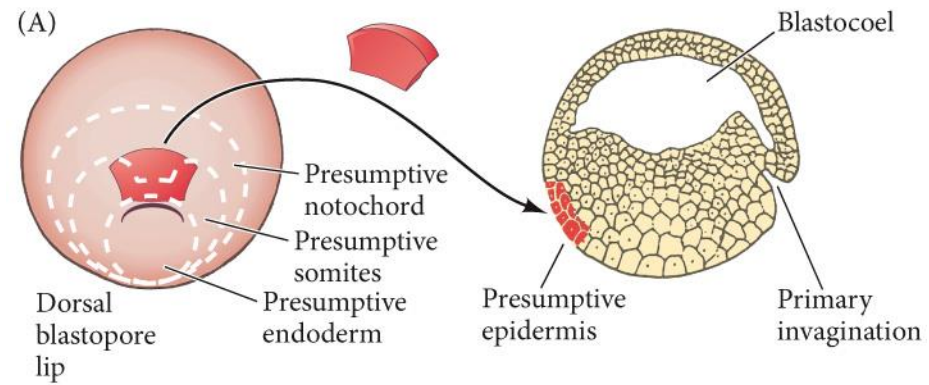
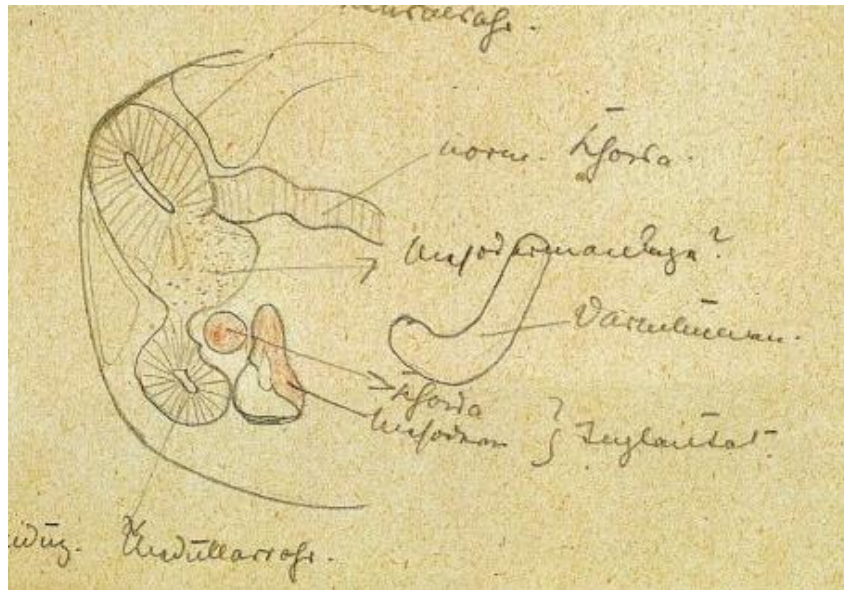
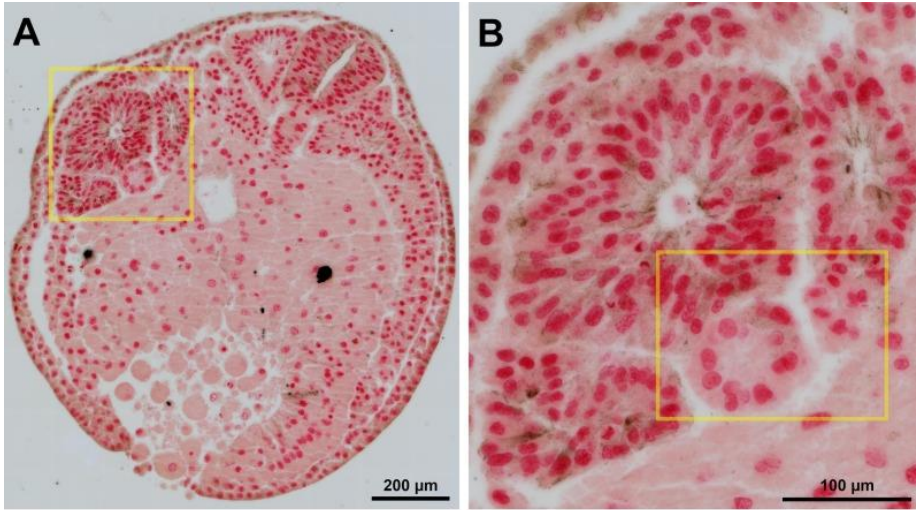


Twinned embryo with second axis induced with head and complete dorso-ventral axis





# L'AZIONE DELL'ORGANIZZATORE COINVOLGE INTERAZIONI INDUTTIVE EXTRA-CELLULARI

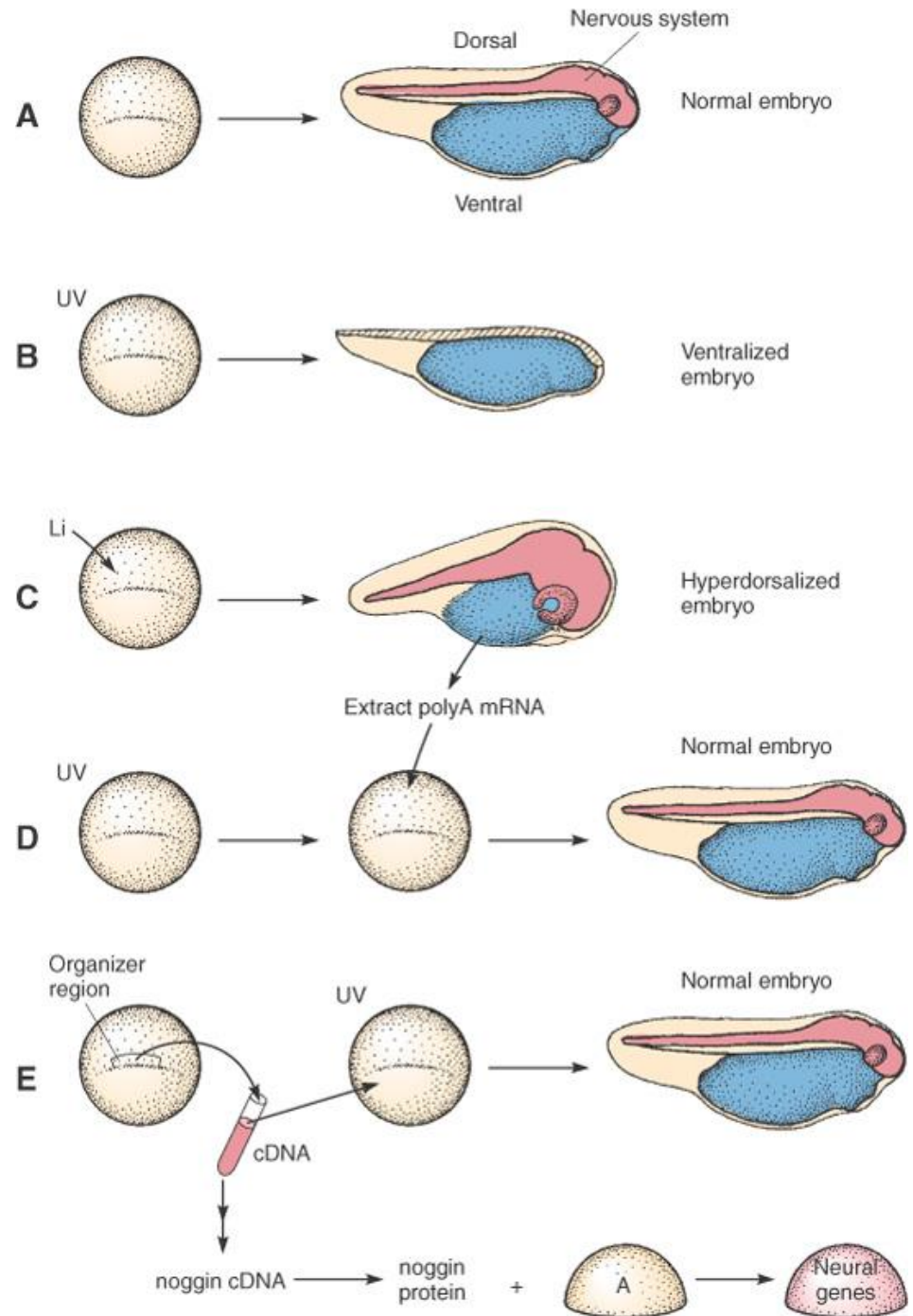


DEVELOPMENTAL BIOLOGY 11e, Figure 11.14  
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# ISOLAMENTO DEI FATTORI PRODOTTI DALL'ORGANIZZATORE: LA PROTEINA DI SEGREZIONE NOGGIN



**Richard Harland**  
**University of California, Berkeley**

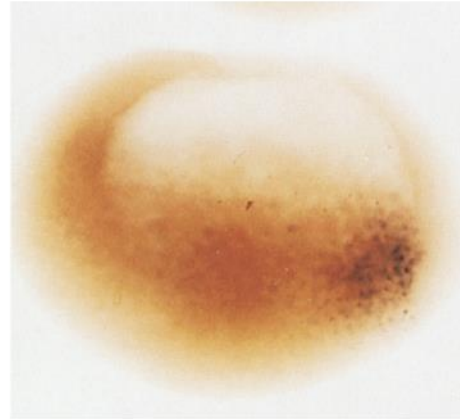


**NOGGIN E' ESPRESSO NELL'ORGANIZZATORE E NEL CORDOMESODERMA  
DA ESSO DERIVATO E PUO' RECUPERARE LA FORMAZIONE DI STRUTTURE  
DORSALI IN EMBRIONI VENTRALIZZATI**

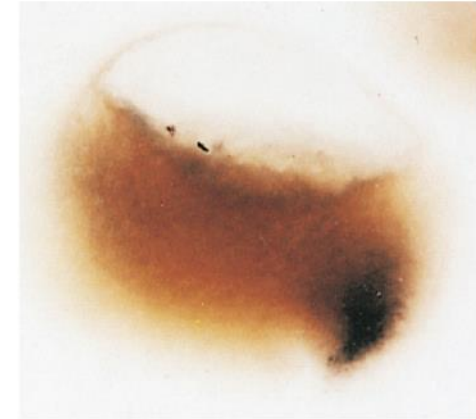
(A)



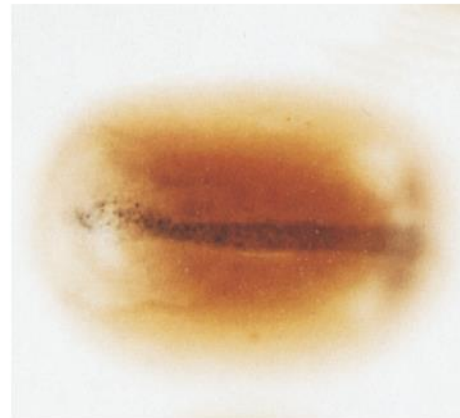
(B)



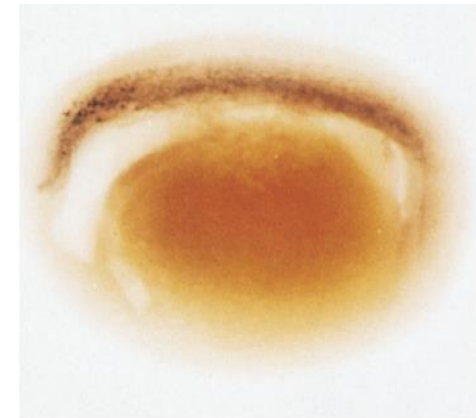
(I)



(II)



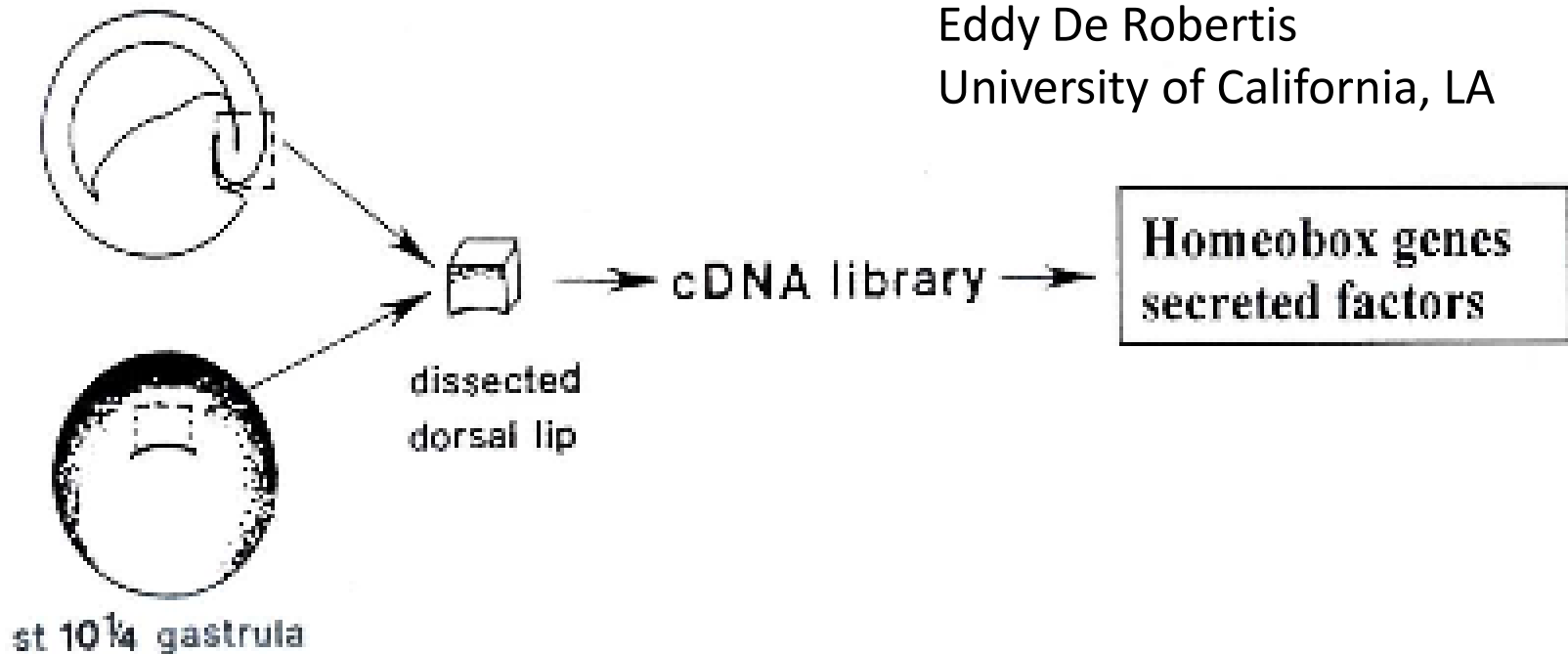
(III)



(IV)



Eddy De Robertis  
University of California, LA



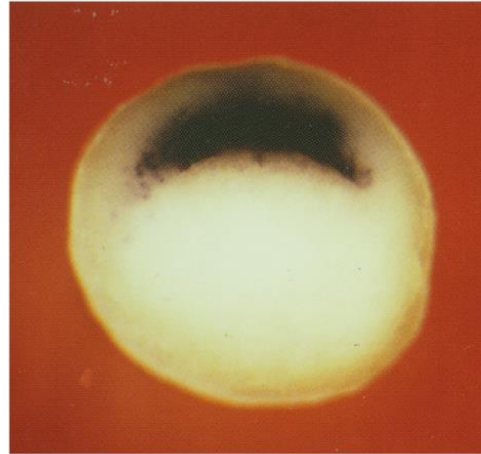


# Isolamento dei fattori molecolari dell'organizzatore: la proteina secreta chordin e' espressa nel mesoderma dorsale e puo' indurre assi secondari se espressa ectopicamente nei tessuti ventrali

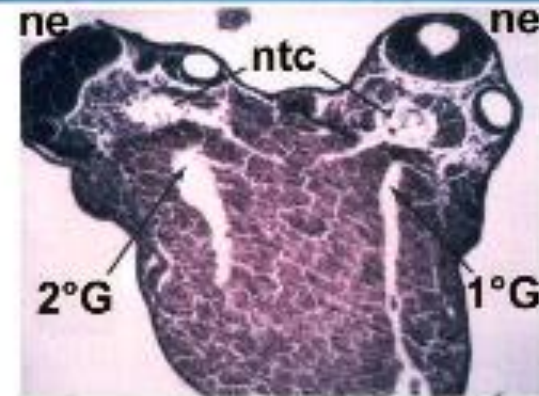
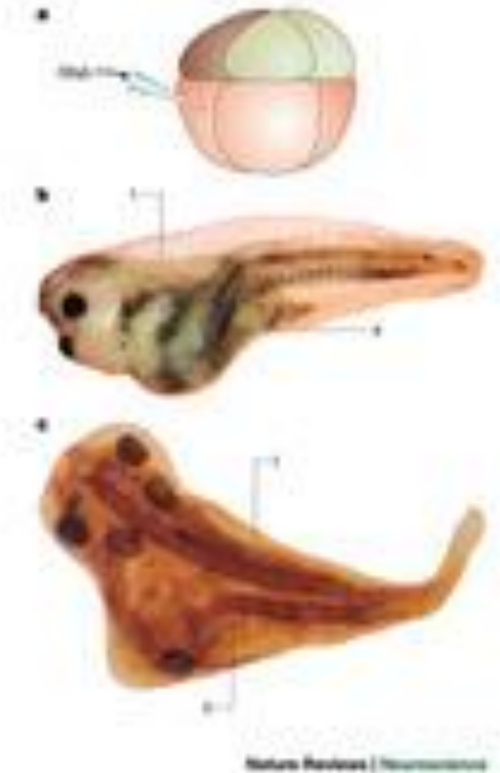
(A)



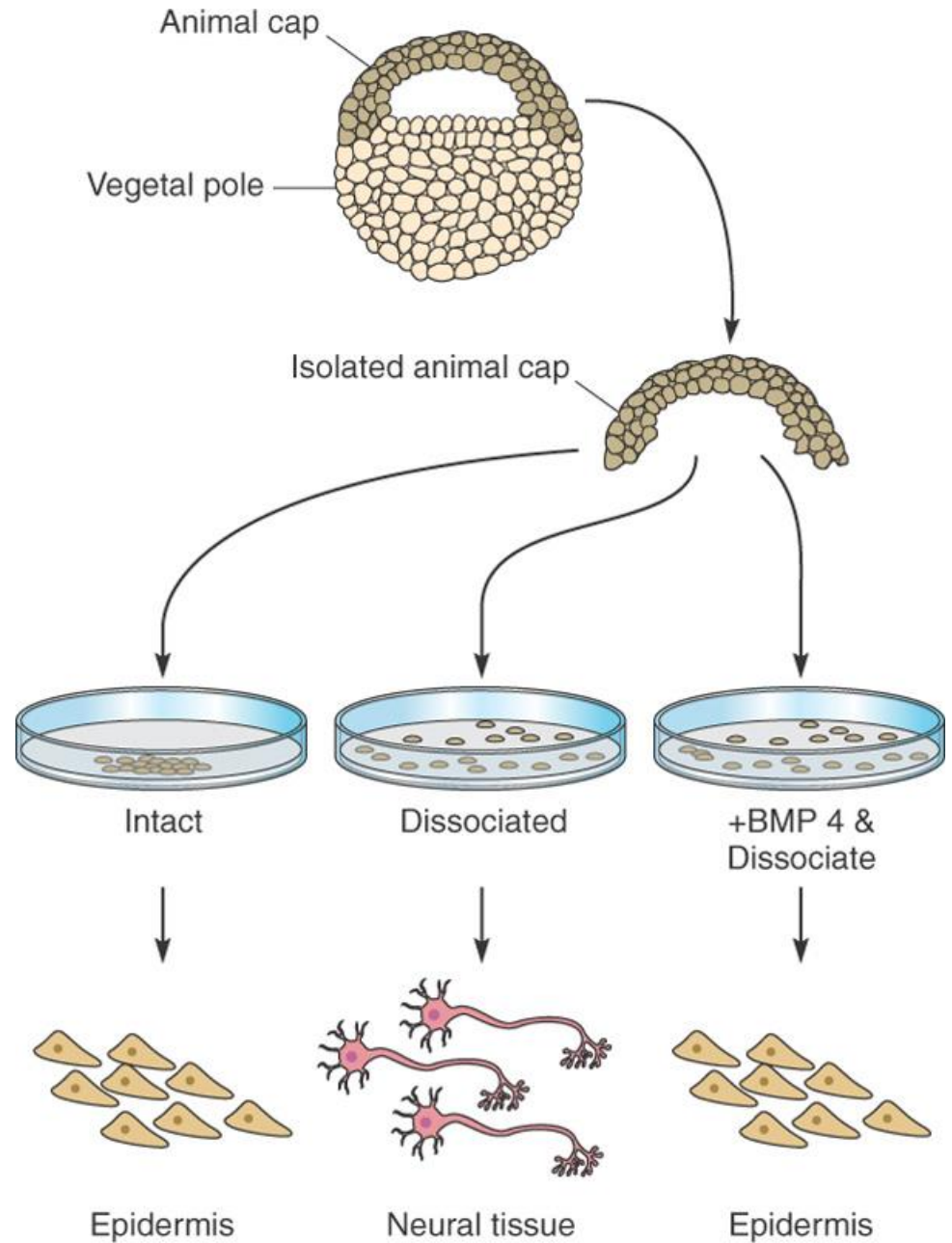
(B)



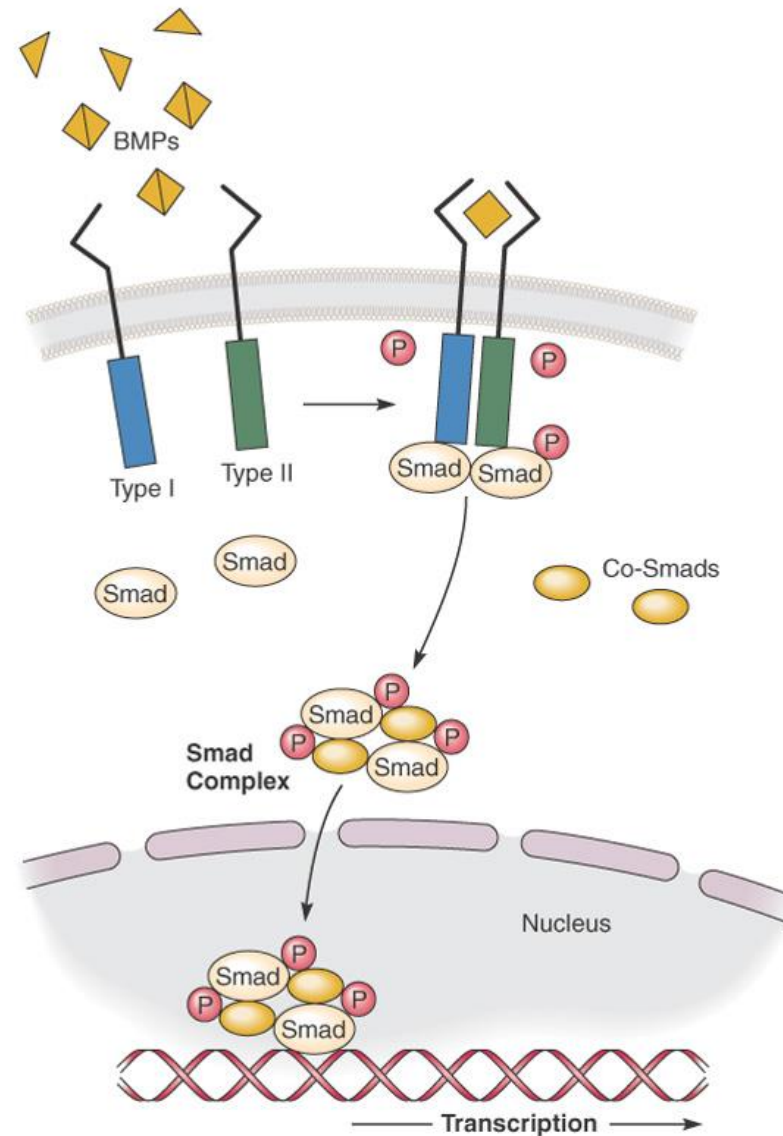
(C)



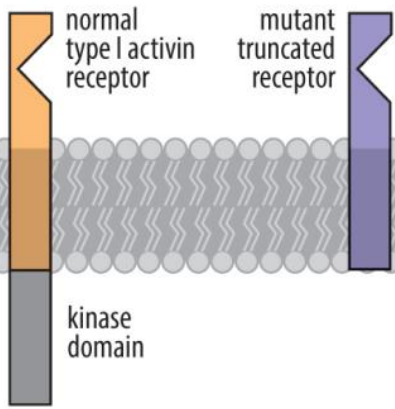
**IL SEGNALE DELLE BONE  
MORPHOGENETIC PROTEINS  
(BMP)  
SPECIFICA IL DESTINO  
EPIDERMICO**



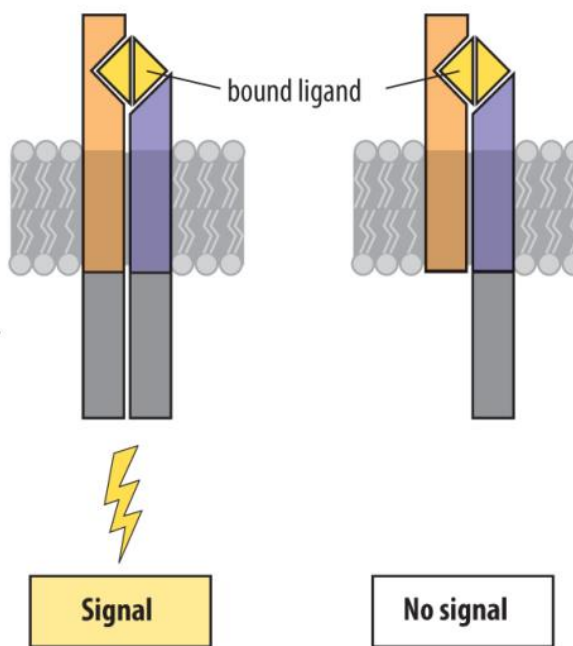
# VIA DI TRASDUZIONE DEL SEGNALE BMP (SOTTOFAMIGLIA DELLE MOLECOLE DI SEGNALE TGF- $\beta$ )



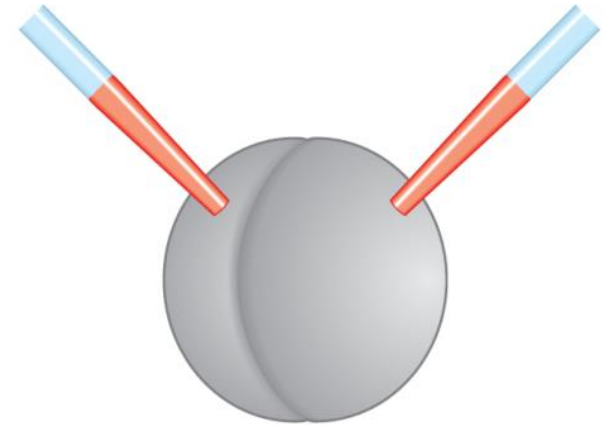
**Normal and defective type I receptor proteins**



**No signal from mutant receptor even when dimerized with a normal type II receptor subunit**

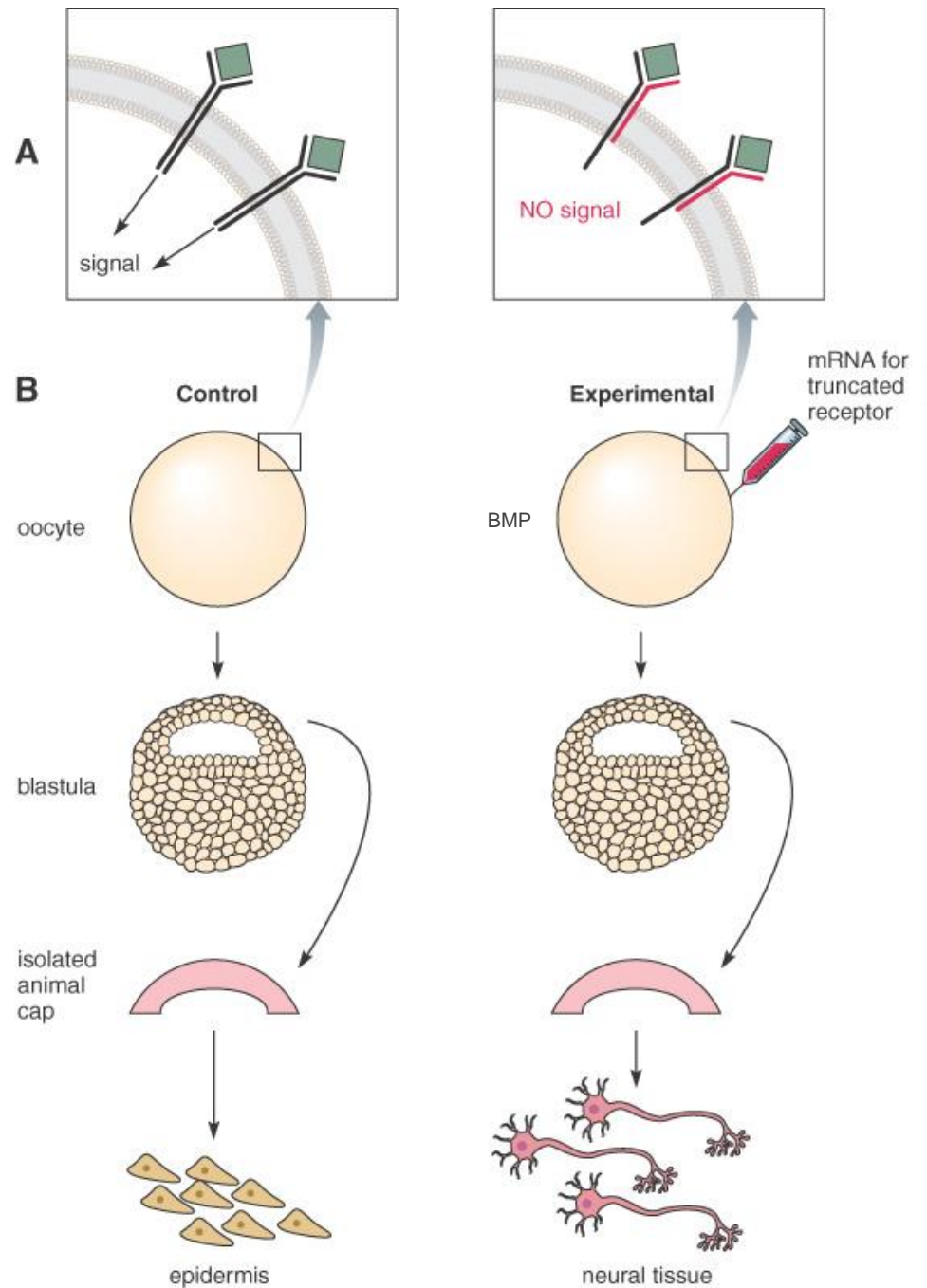


**mRNA encoding mutant receptor injected into both cells of a two-cell embryo**

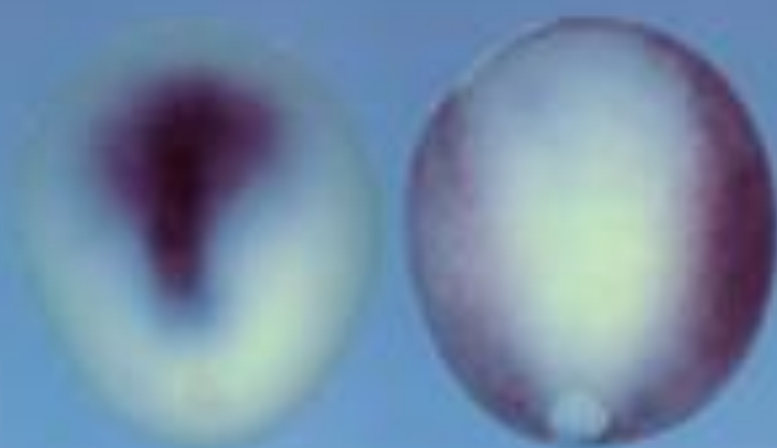


No mesoderm or axial structures

# L'INIBIZIONE DEL SEGNALE BMP SPECIFICA IL DESTINO NEURALE

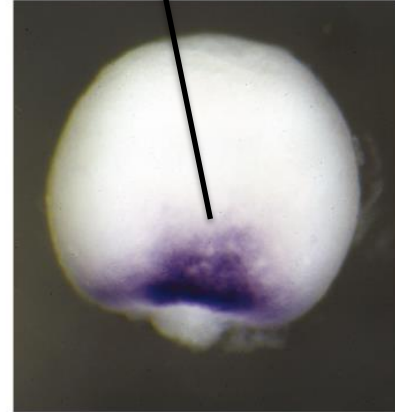


# Cell

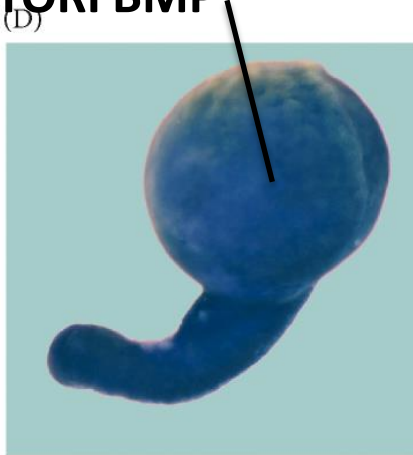
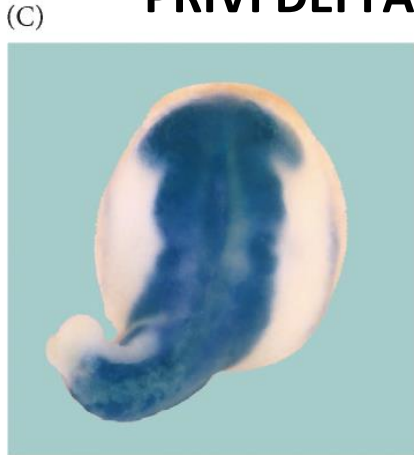


Control of BMP4 and dpp Signaling

**DRASTICA RIDUZIONE DEL TESSUTO NEURALE IN EMBRIONI PRIVI DI NOGGIN, CHORDIN, FOLLISTATIN**

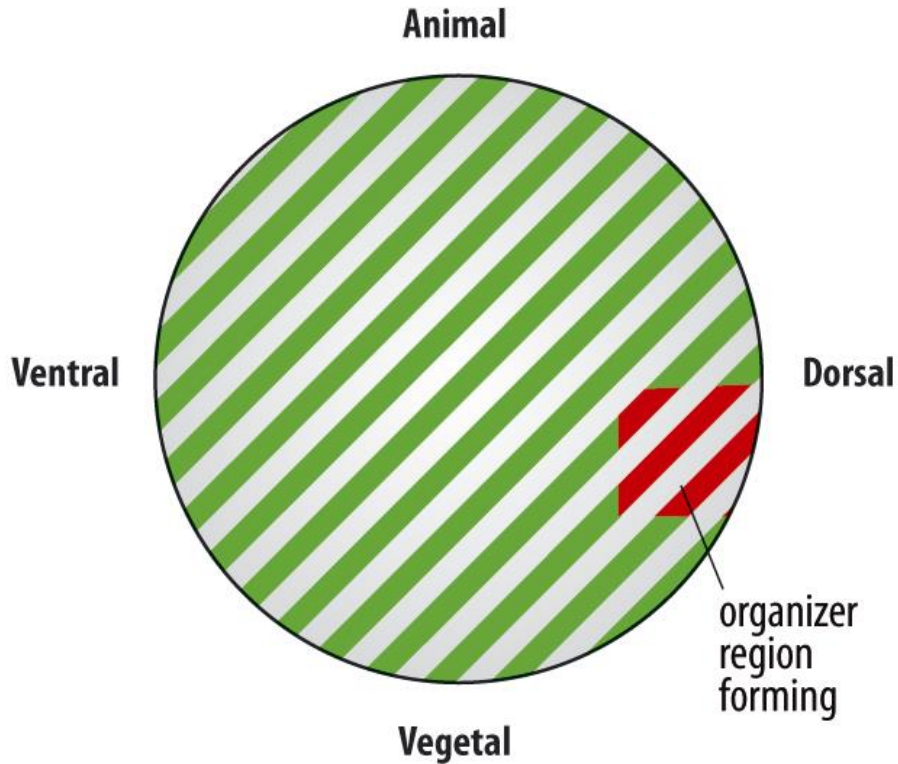


**CONVERSIONE DI EPIDERMIDE IN TESSUTO NEURALE IN EMBRIONI PRIVI DEI FATTORI BMP**

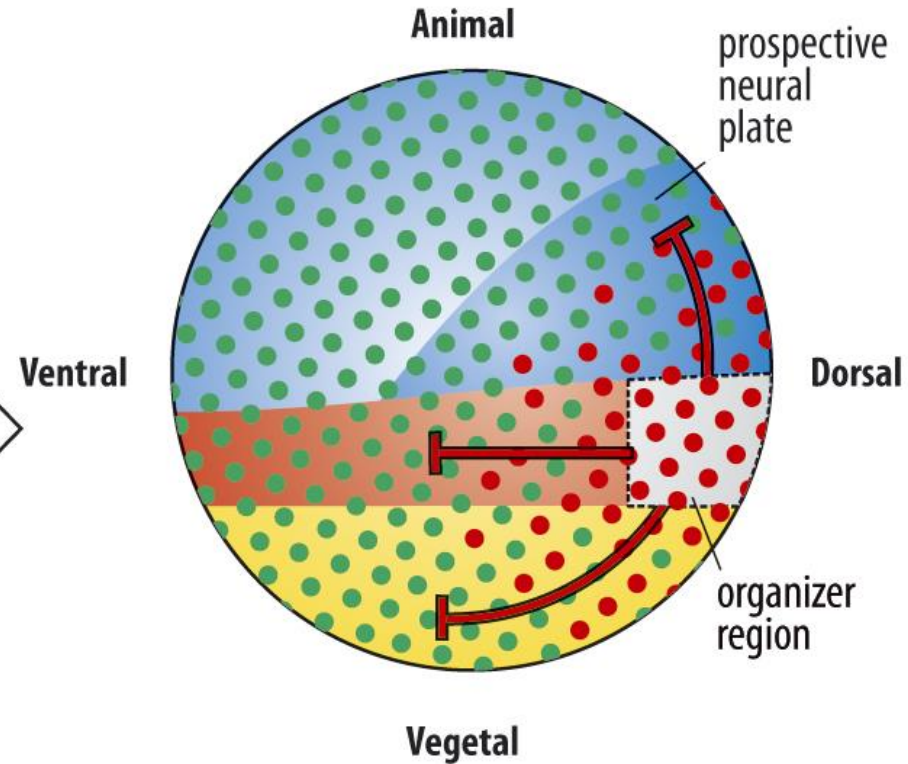


	Normal	BMP depleted
Sox2		
Cytokeratin		

BMP is expressed throughout the *Xenopus* blastula



In the gastrula, neural plate forms from prospective ectoderm where BMP signaling is inhibited by antagonists from the organizer



BMP-4



BMP antagonists



BMP-4



ectoderm



BMP antagonists



neural plate



inhibition of BMP signaling



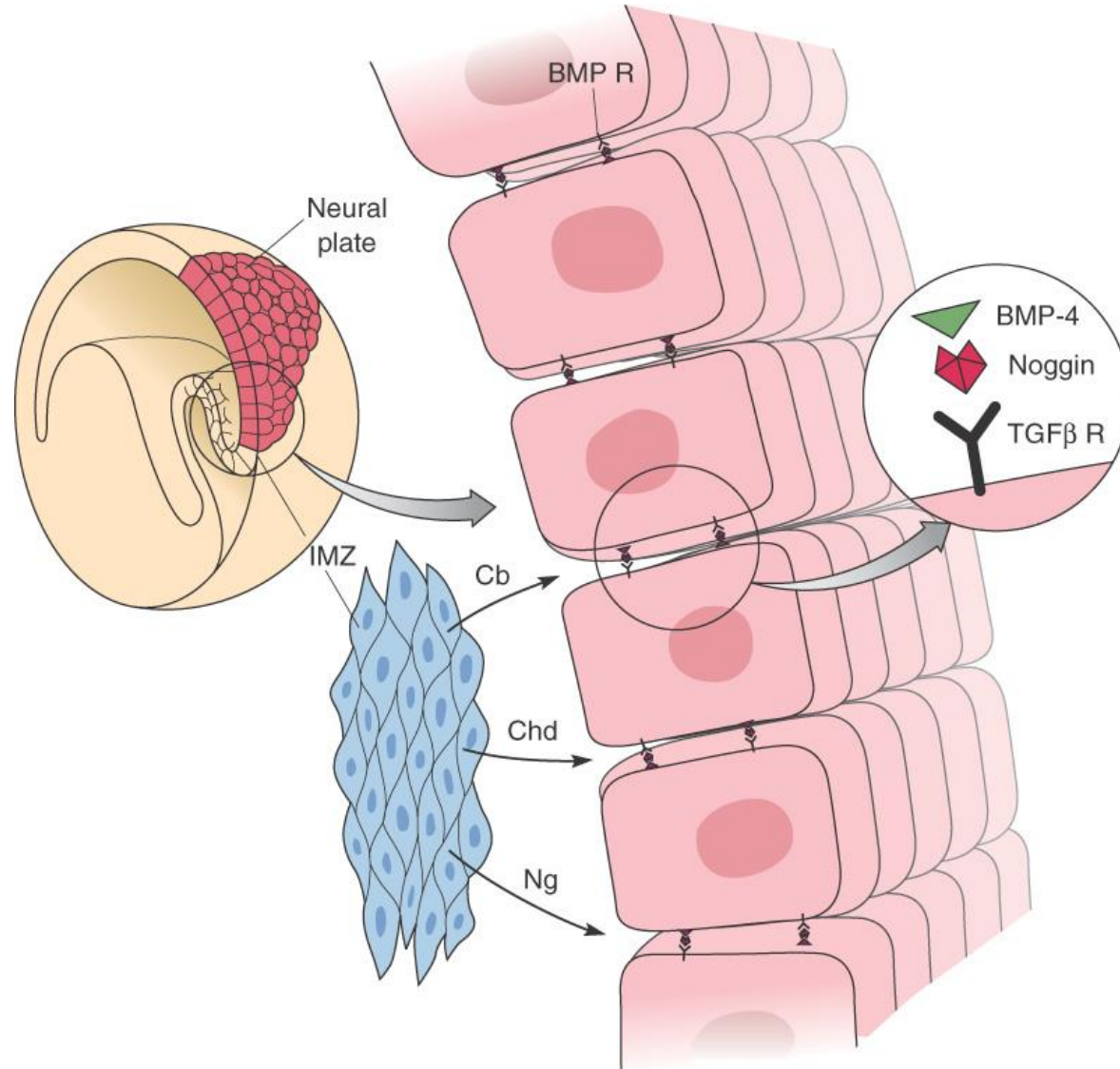
mesoderm



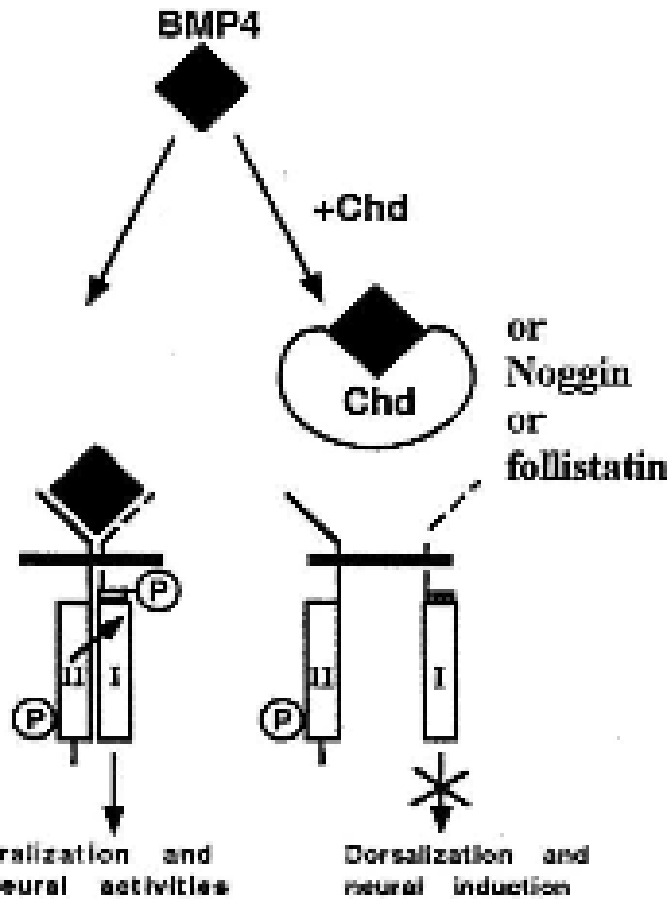
endoderm



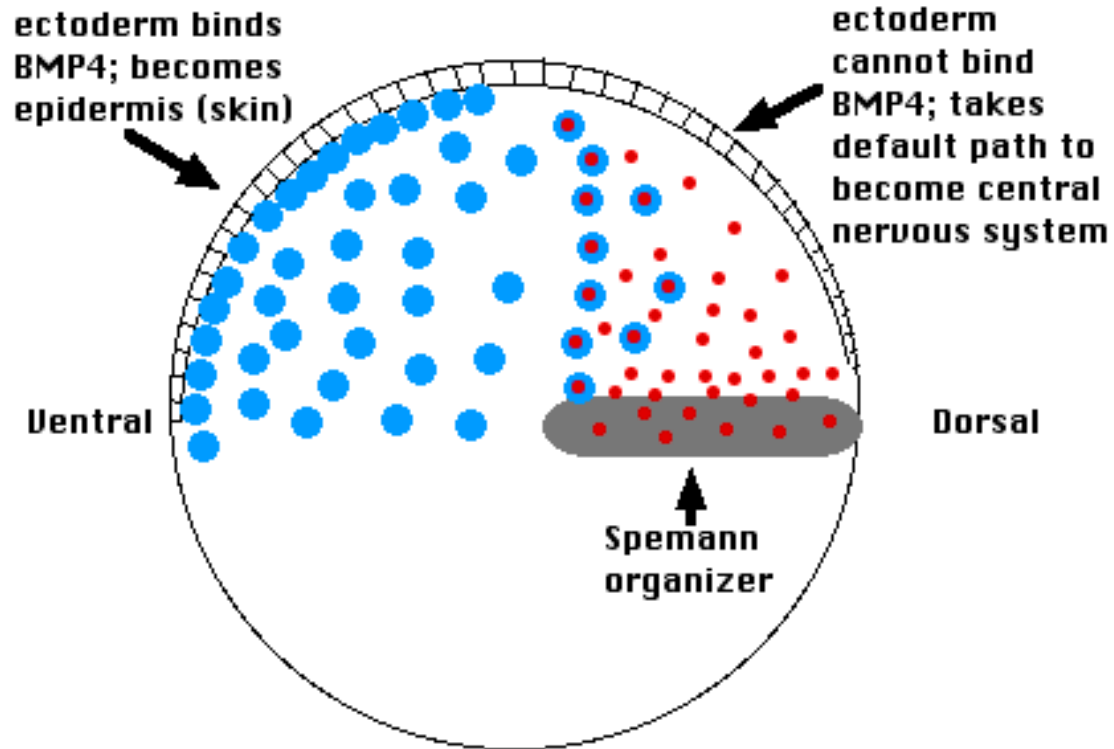
# CHORDIN E NOGGIN AGISCONO COME ANTAGONISTI EXTRA-CELLULARI DEI FATTORI BMP



# L'ORGANIZZATORE E' UNA SORGENTE DI ANTAGONISTI DI FATTORI BMP



Model of the Molecular Mechanism by Which Chordin Antagonizes BMP4 Signaling



- = BMP4
- = chordin, noggin, others
- ● = inactive complexes

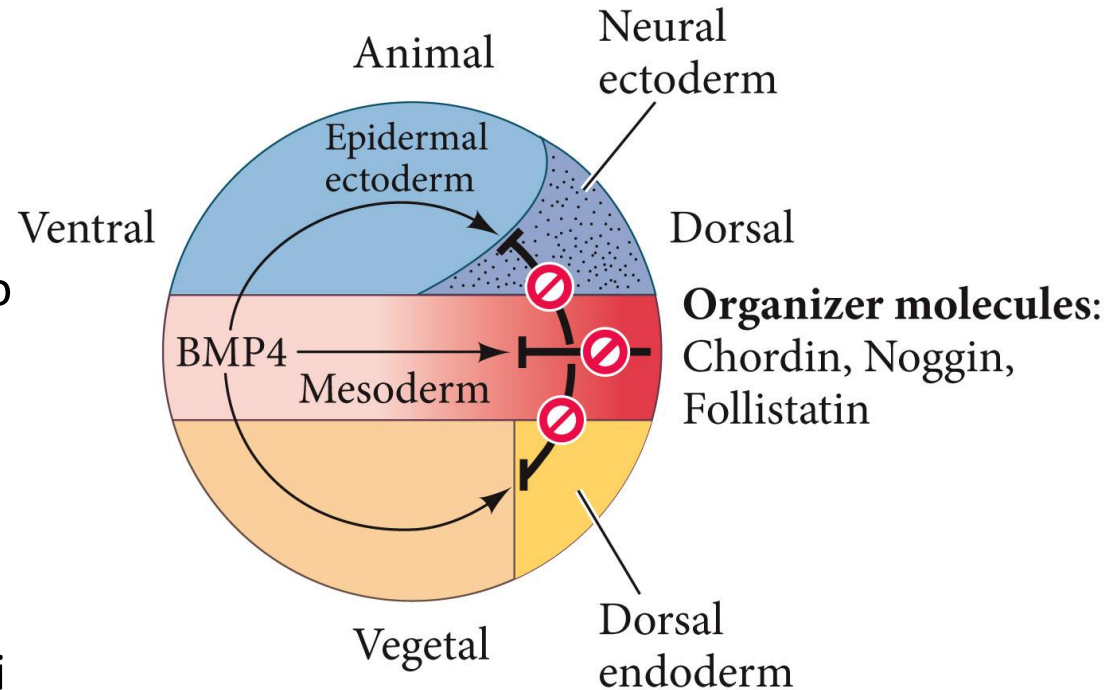
## Funzioni dell'organizzatore:

-Capacita' di autodifferenziarsi in mesoderma dorsale (mesoderma precordale, notocorda)

-Induzione neurale (indirizzamento dell'ectoderma dorsale a neuroectoderma invece che epidermide)

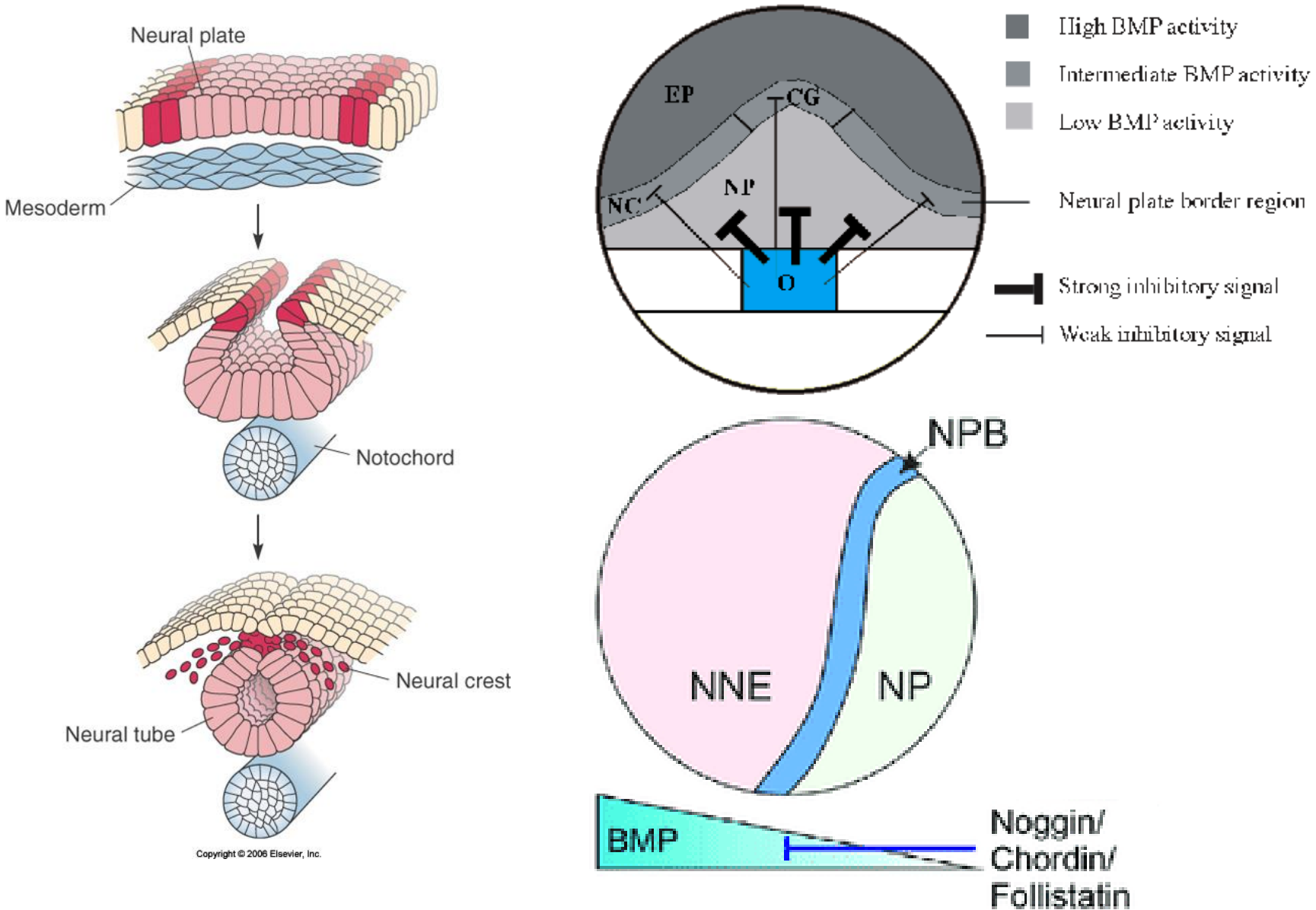
-Dorsalizzazione del mesoderma parassiale (indirizzamento a somiti invece che mesoderma ventrale)

- Attivazione dei movimenti di gastrulazione

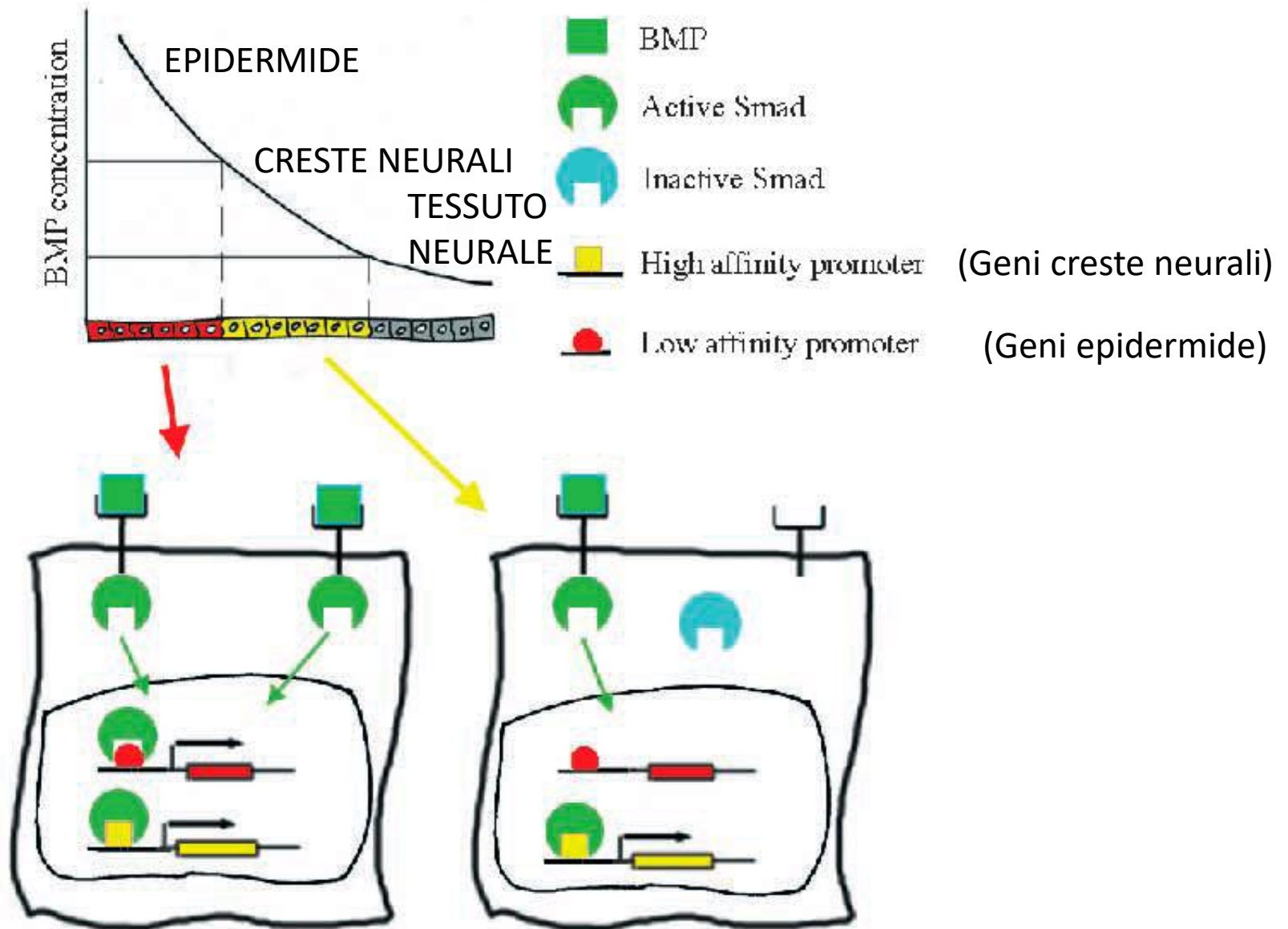


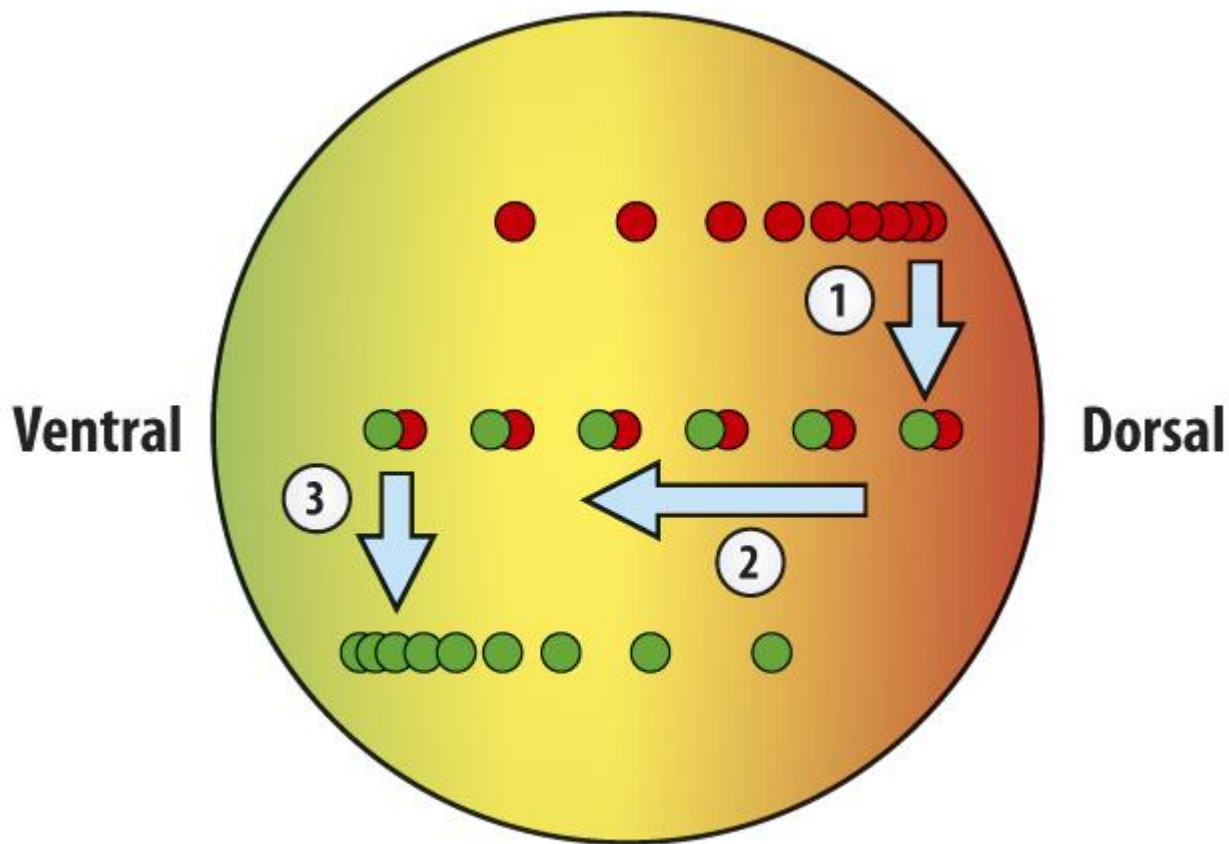
DEVELOPMENTAL BIOLOGY 11e, Figure 11.21  
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# PATTERNING DELL'ECTODERMA MEDIANTE UN GRADIENTE DI SEGNALE BMP



# REGIONALIZZAZIONE DELL'ECTODERMA MEDIANTE UN GRADIENTE MORFOGENETICO DI SEGNALE BMP





● BMP      ● Chordin      ● BMP/chordin complex

Le proteine Chordin e BMP formano un complesso nella regione dorsale e diffondono nella regione ventrale.

Una metalloproteasi presente nella regione ventrale degrada Chordin e libera i fattori BMP. Questo meccanismo contribuisce a rifinire il gradiente dorso-ventrale di segnalazione BMP.