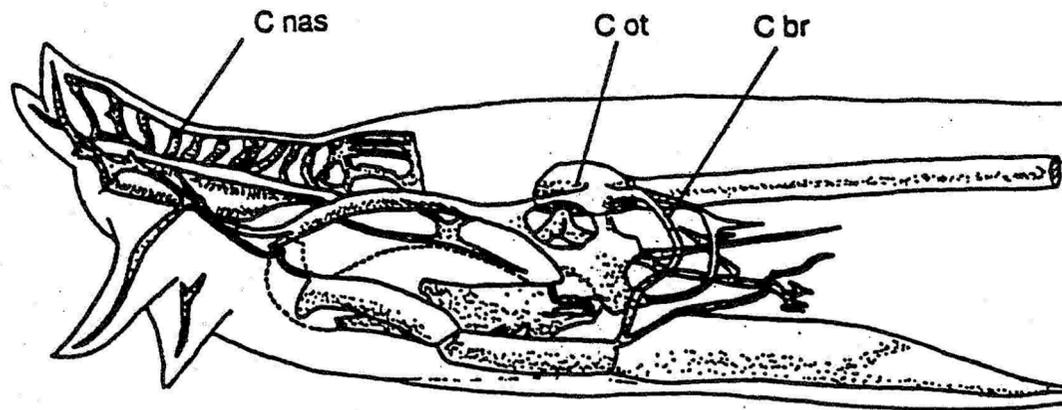
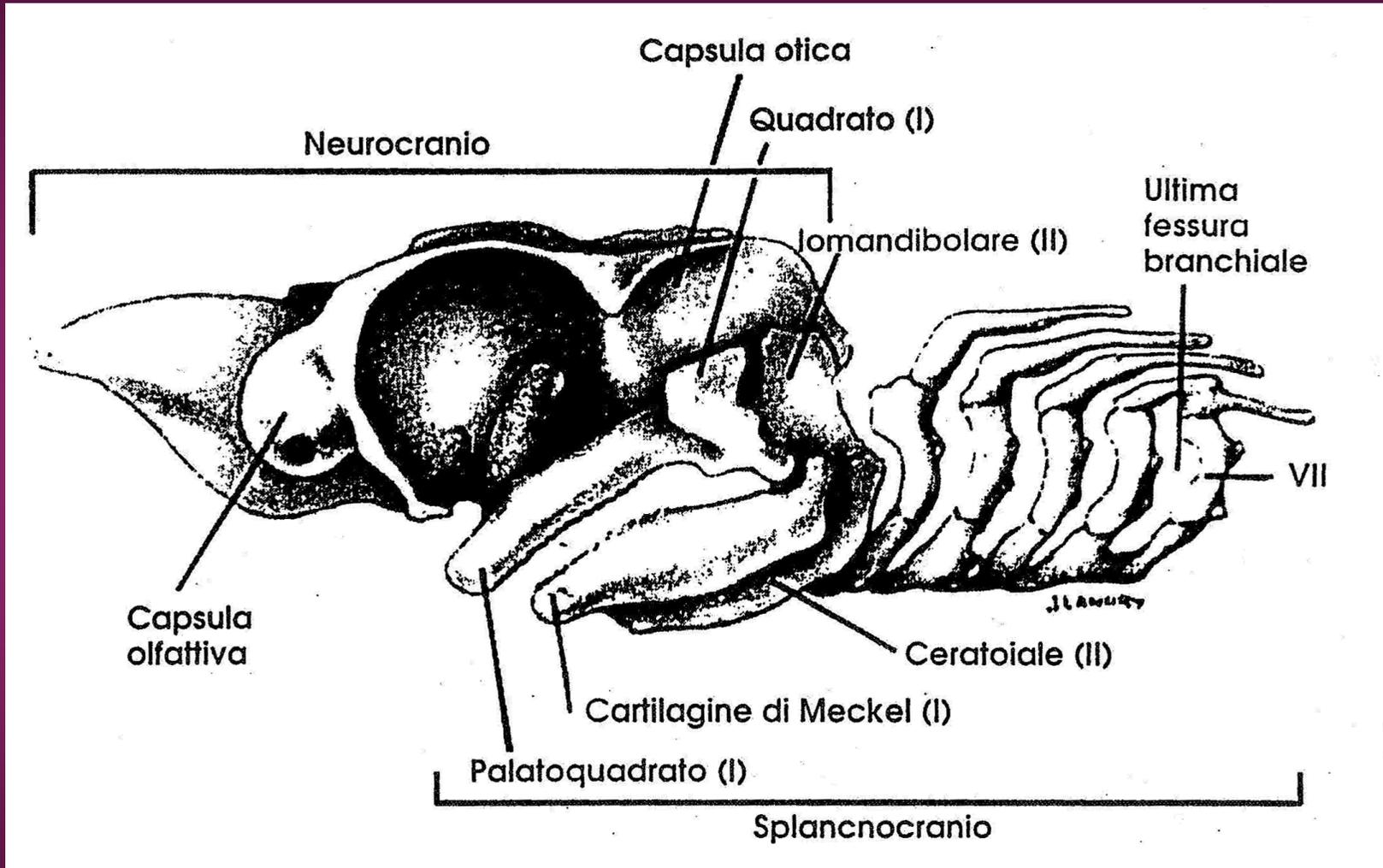
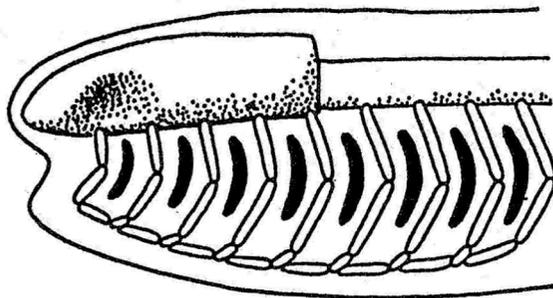


LAMPETRA

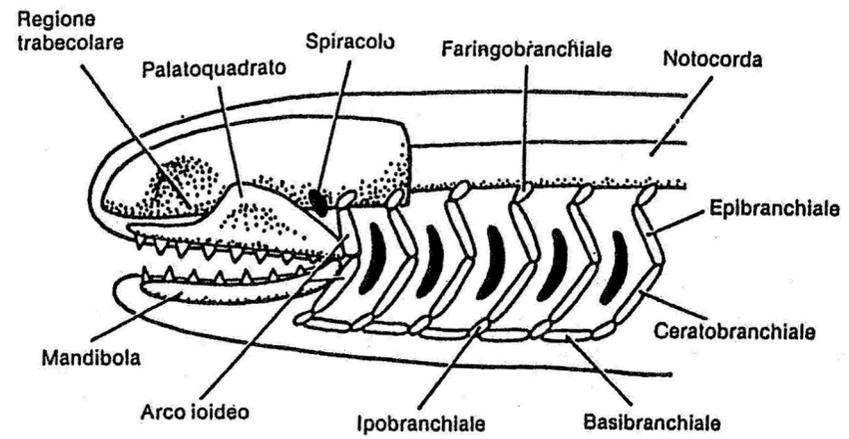


MYXINE





(a)

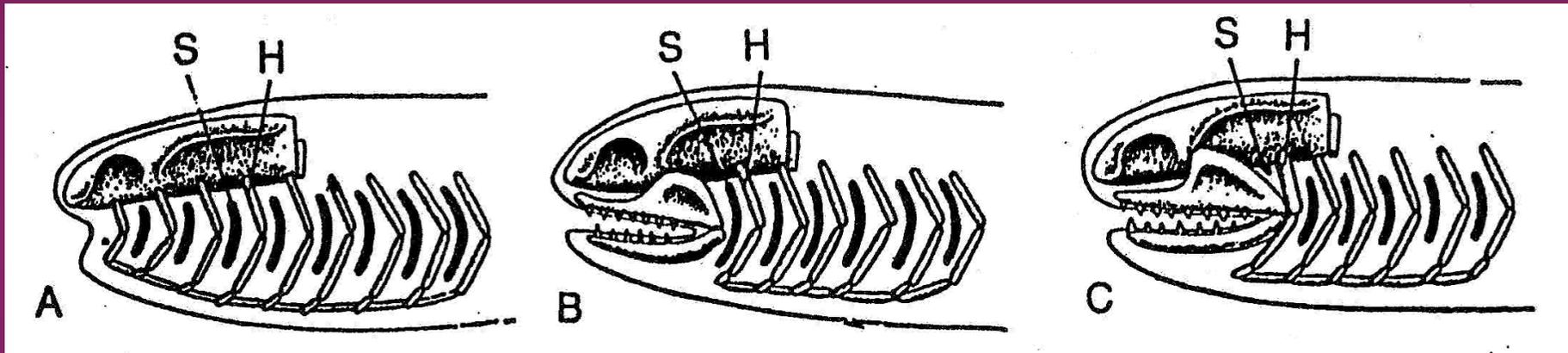


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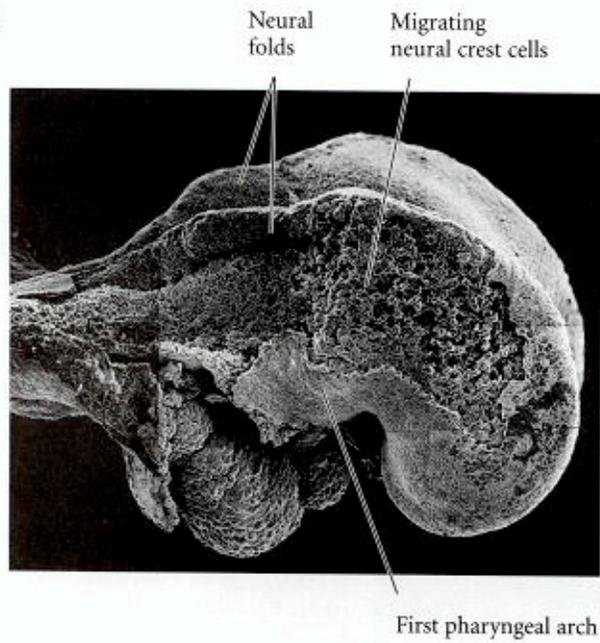
AGNATI

PLACODERMI

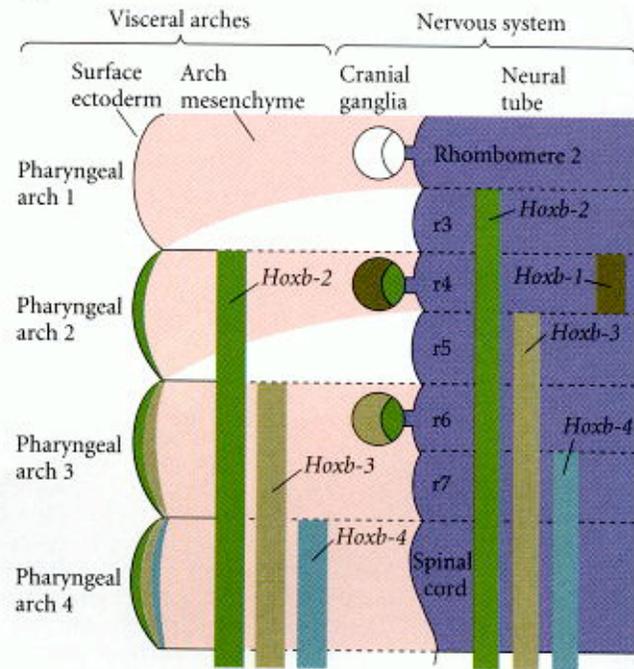
ITTIOPSIDI



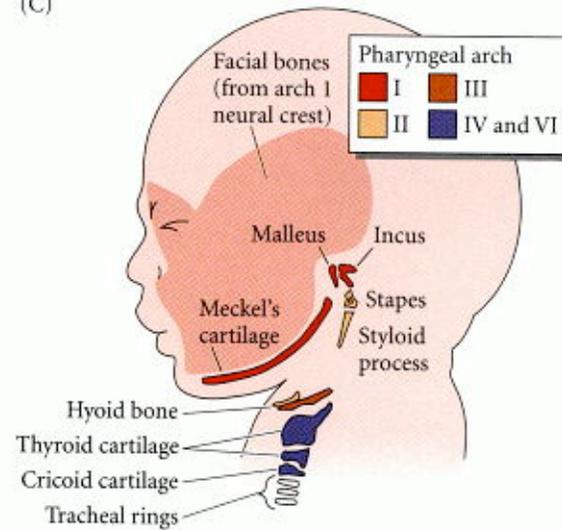
(A)



(B)



(C)

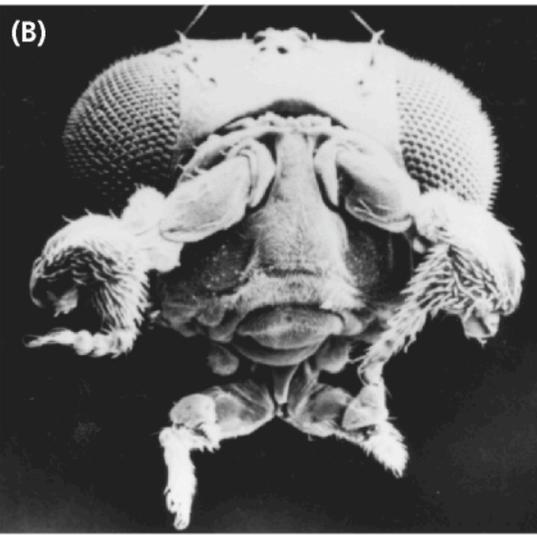


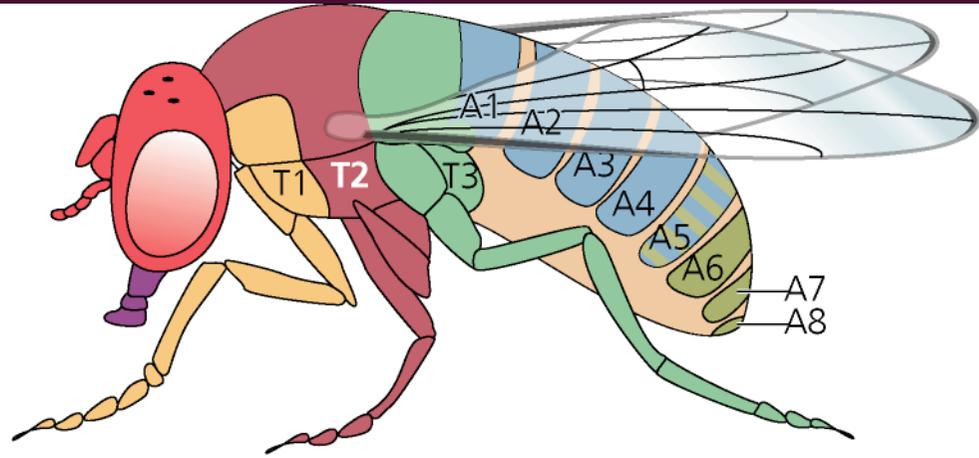


(A)



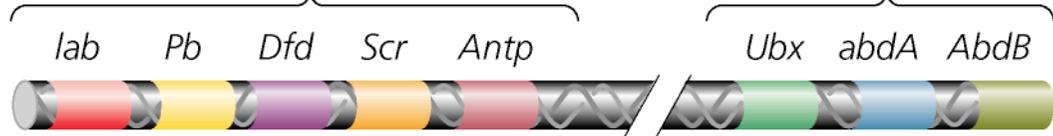
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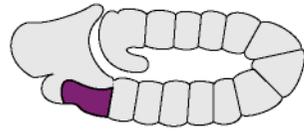


Complesso Antennapedia

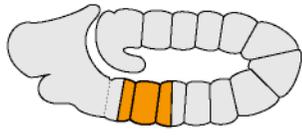
Complesso bithorax



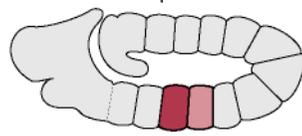
labial (*lab*)



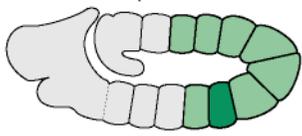
Deformed (*Dfd*)



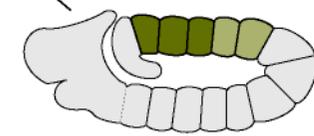
Sex combs reduced (*Scr*)



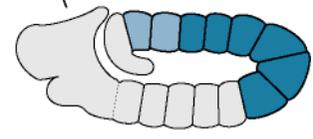
Antennapedia (*Antp*)



Ultrabithorax (*Ubx*)



Abdominal B (*AbdB*)



abdominal A (*abdA*)

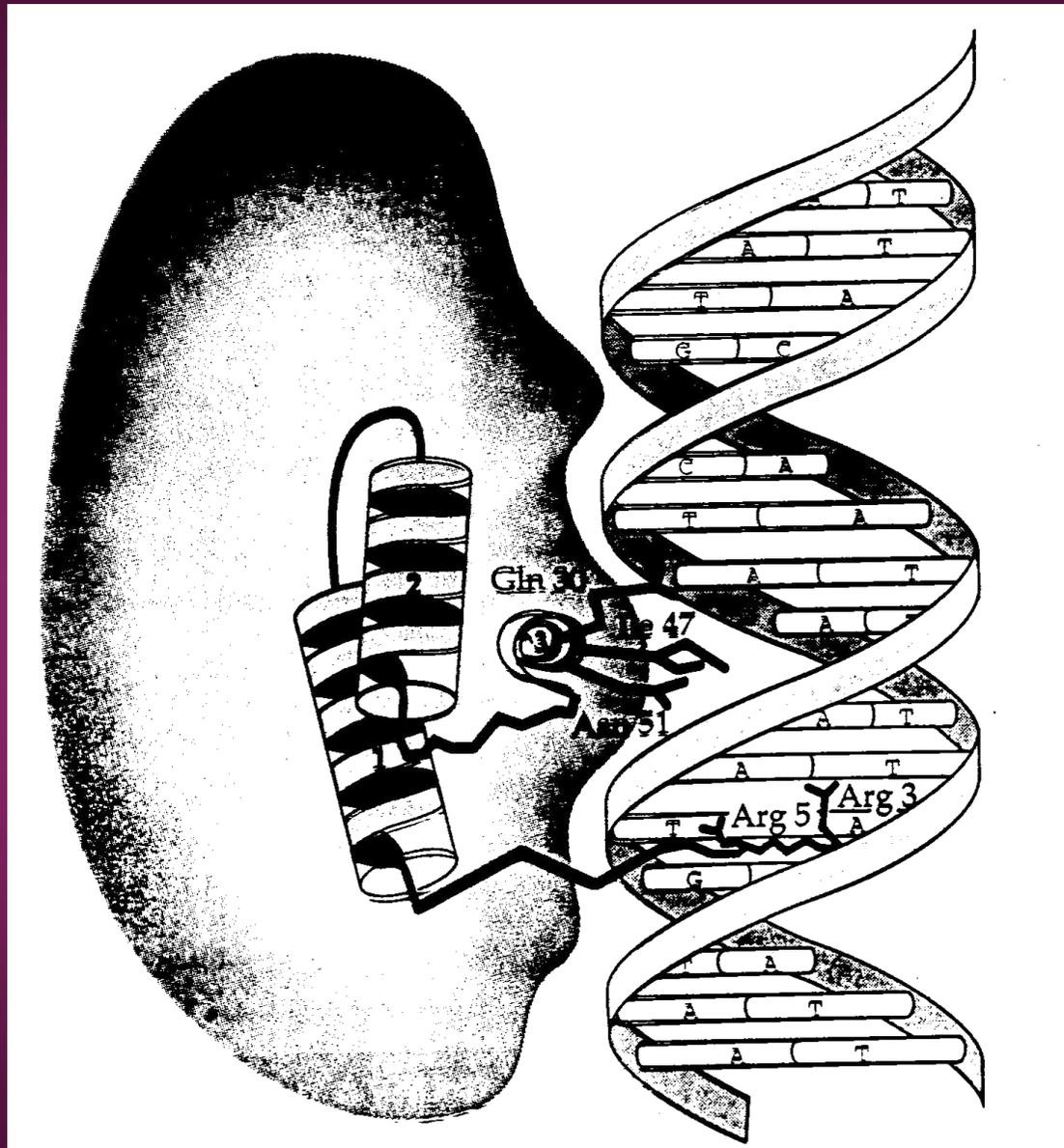
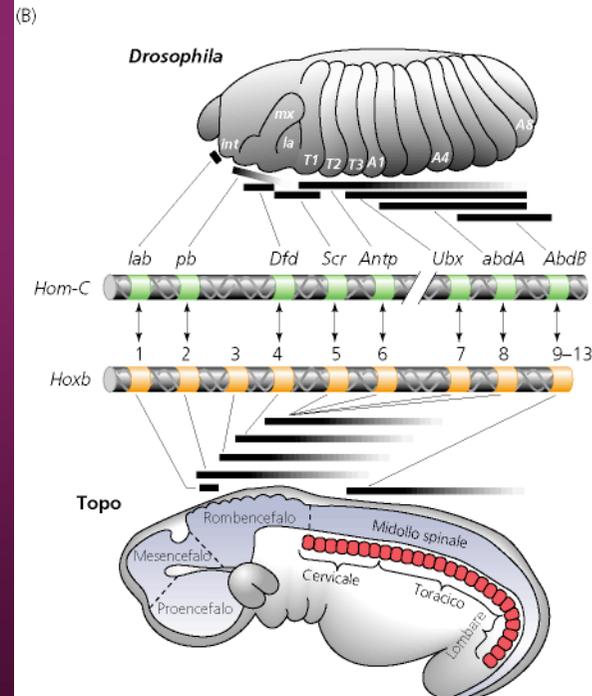
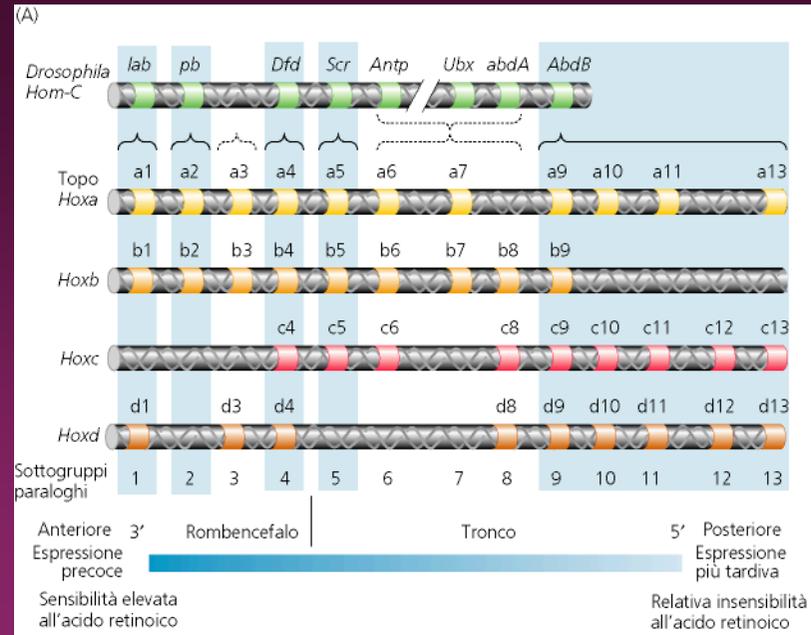
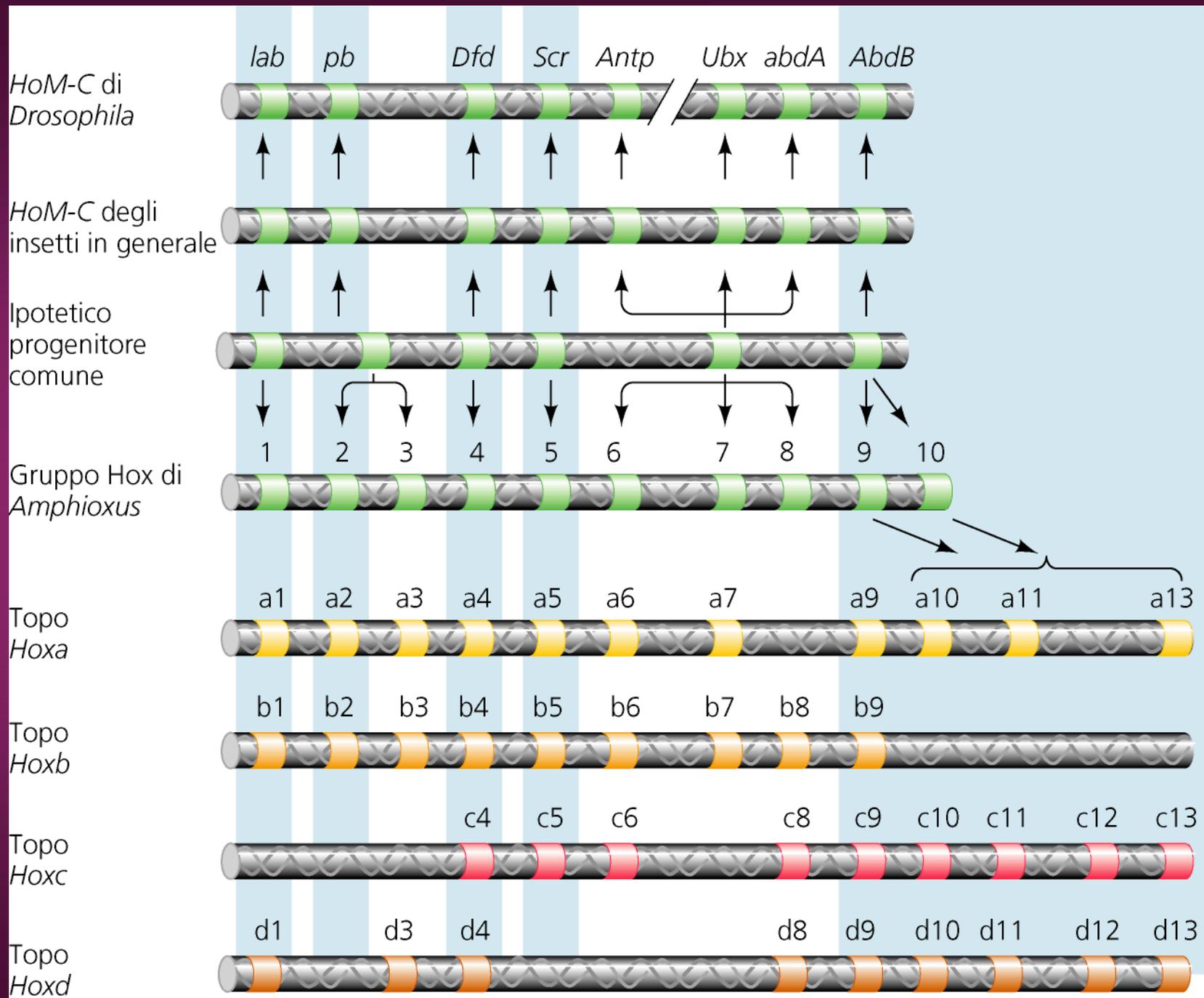


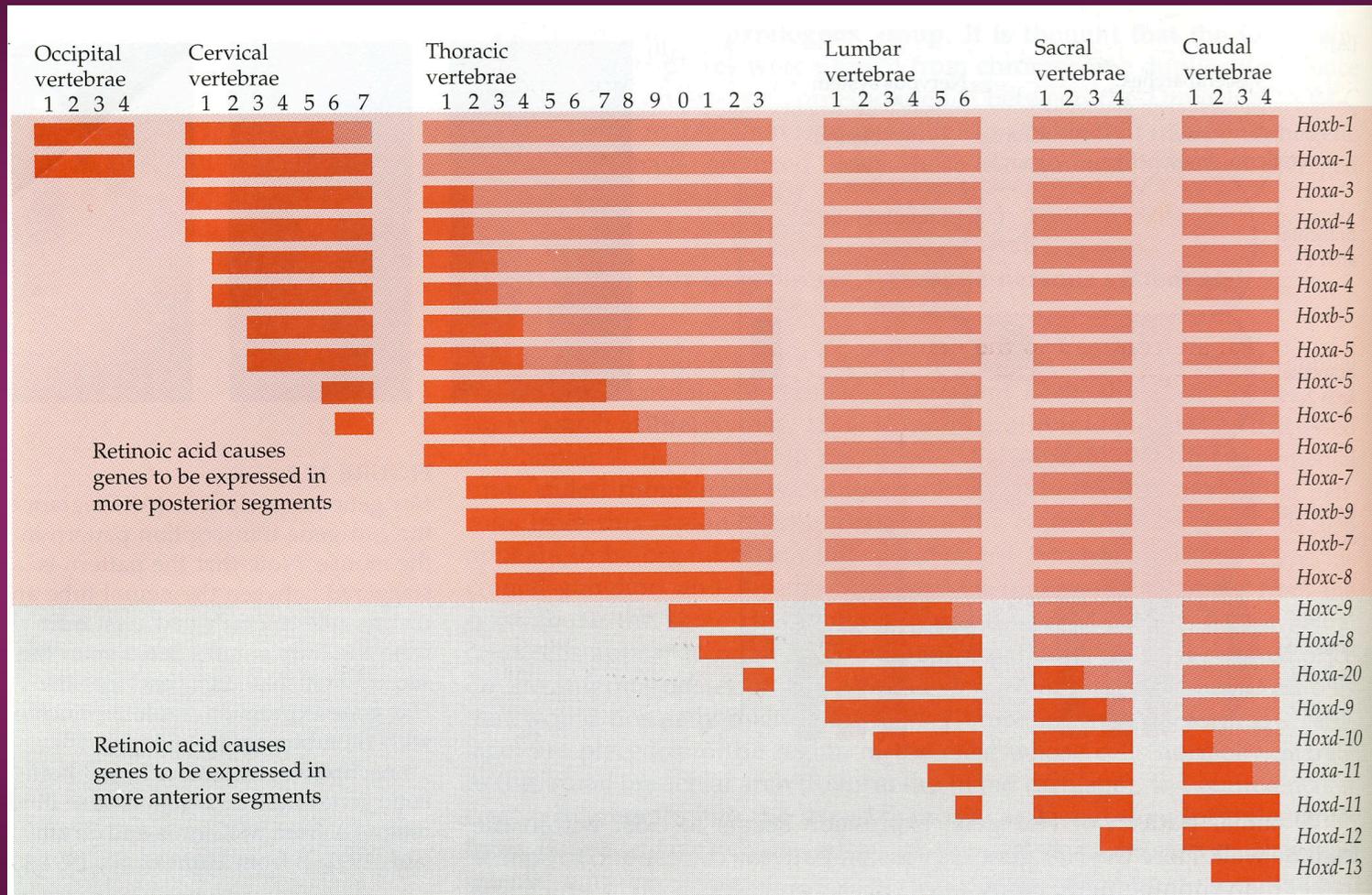
Table 1. The known genes under HOM/Hox control

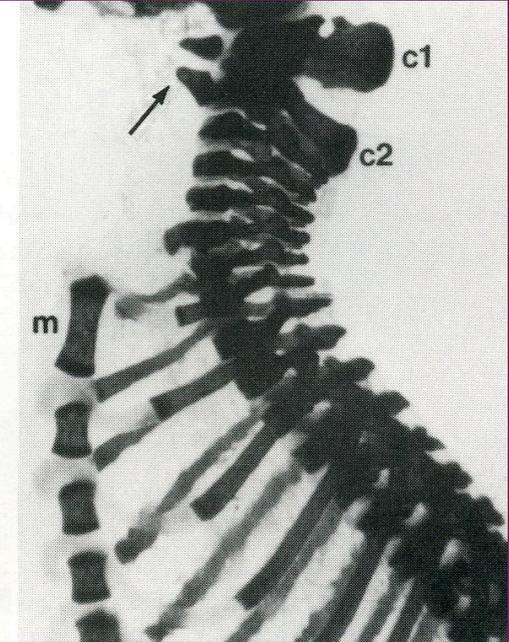
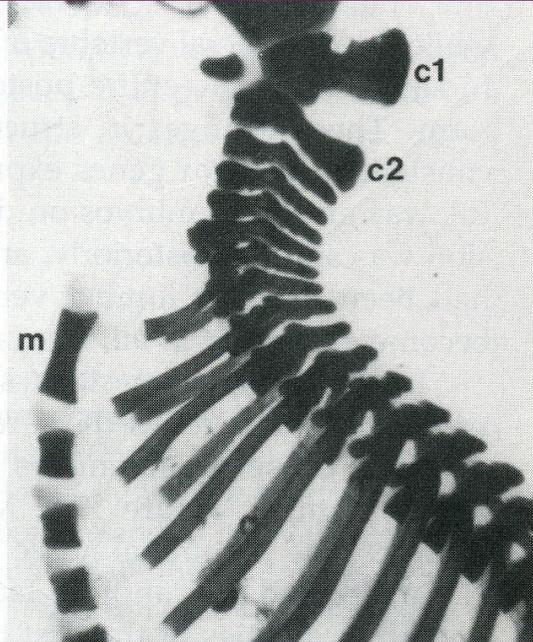
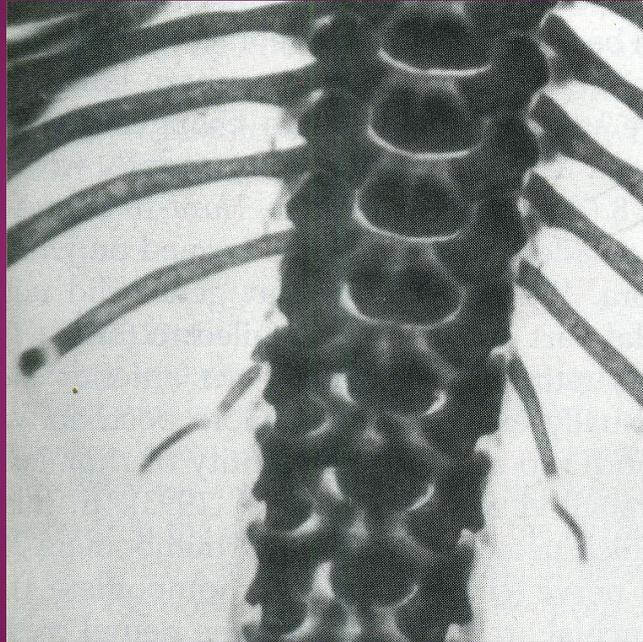
Gene	Product	Mutant phenotype (1)	Regulated by	Reference
<i>1.28</i>	no similarity	lethal	<i>Did</i>	[67*]
<i>48</i>	?	?	<i>Ubx, abd-A, Abd-B</i>	[68]
<i>412</i> retrotransposon	transposable element	none obvious	<i>Ubx, abd-A, Abd-B</i>	[69]
<i>aldehyde oxidase</i>	enzyme	no enzyme activity, viable	<i>Ubx</i>	[70]
<i>apterous</i>	LIM domain, homeodomain	musculature, wing, haltere	<i>Antp, Ubx, abd-A</i>	P Lawinger and J Botas, unpublished data
<i>connectin</i>	cell surface, LRR	none obvious	<i>Antp, Ubx, abd-A</i>	[68,71*]
<i>decapentaplegic</i>	secreted, TGF- β family	gut morphogenesis	<i>Ubx, abd-A</i>	[72-74,75*] M Capovilla <i>et al.</i> , unpublished data
<i>Distal-less</i>	homeodomain	limb development	<i>Did, Ubx, abd-A, Abd-B</i>	[76**,84*]
<i>empty spiracles</i>	homeodomain	filzkörper	<i>Abd-B</i>	[77**]
<i>isocitrate dehydrogenase</i>	enzyme	no enzyme activity, viable	<i>Ubx</i>	[78]
<i>N-CAM</i>	cell adhesion molecule	?	<i>Hox-88, 89</i> in culture cells	[79]
<i>scabrous</i>	fibrinogen family	none obvious	<i>Ubx, abd-A, Abd-B</i>	[80*]
<i>spalt major</i>	zinc finger	head identity	<i>Antp</i>	[81]
<i>teashirt</i>	zinc finger	trunk identity	<i>Antp, Ubx, abd-A</i>	[82*]
β -3 <i>tubulin</i>	structural protein	lethal	<i>Ubx</i>	[83*]
<i>wingless</i>	secreted, wnt family	gut morphogenesis	<i>abd-A</i>	[72,73]

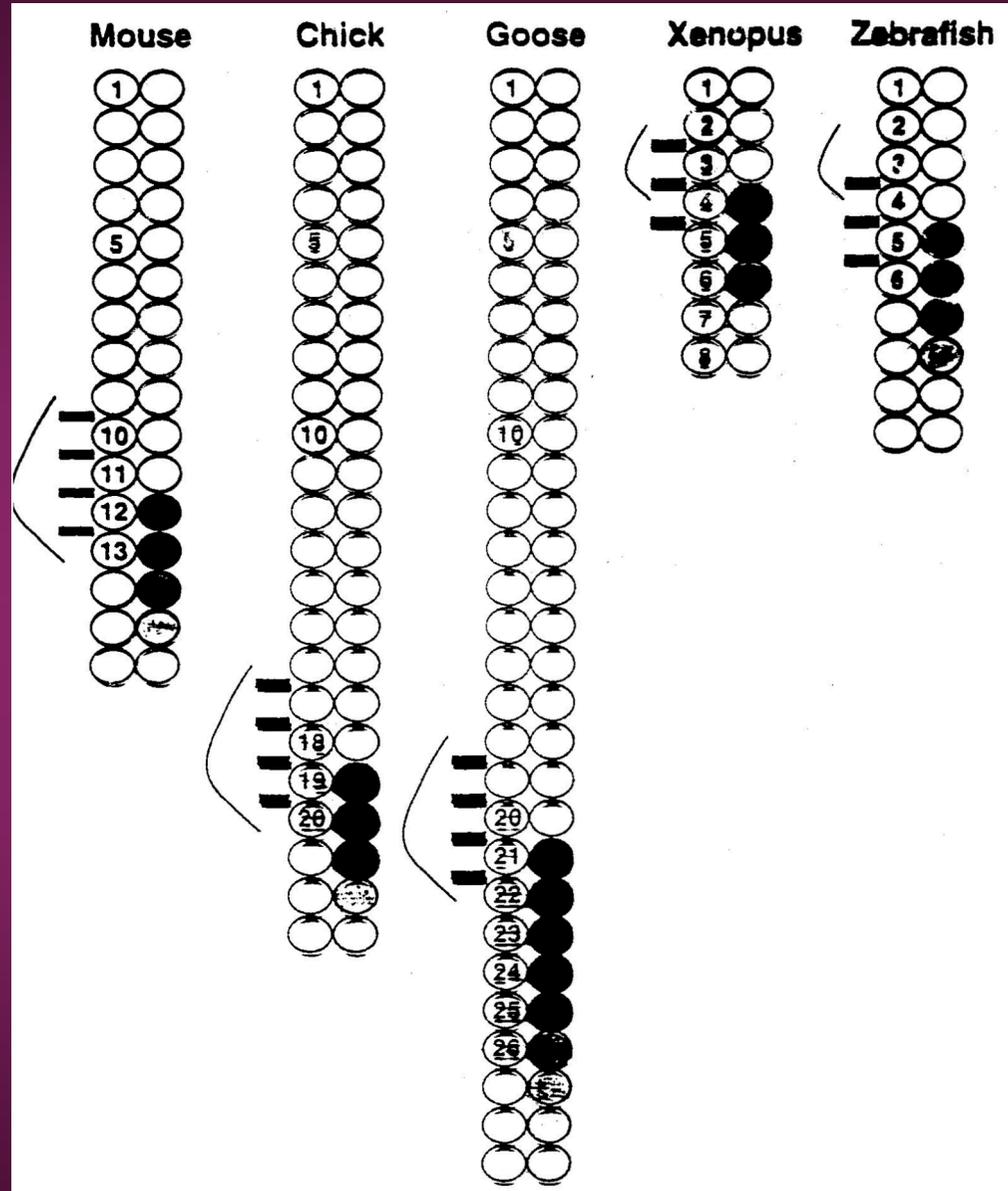
(1) Only the phenotype relevant to HOM/Hox control is described.

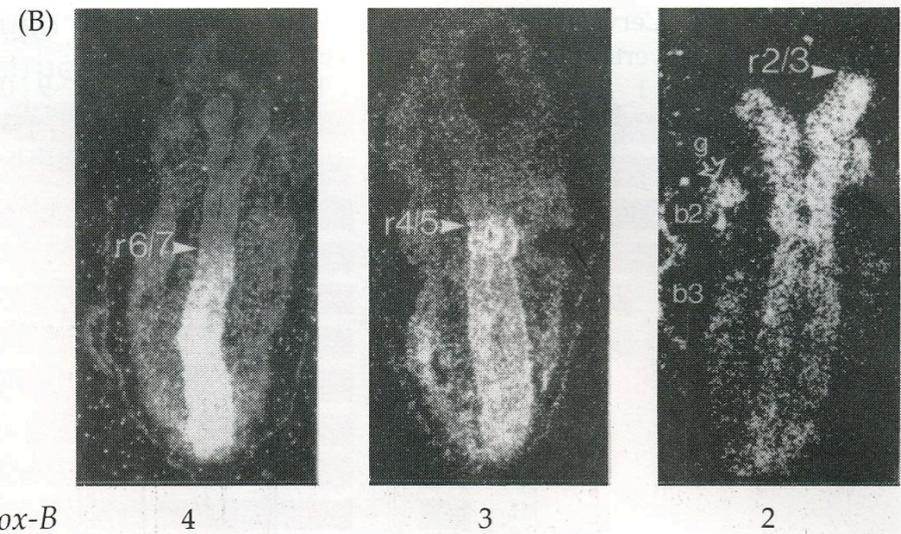
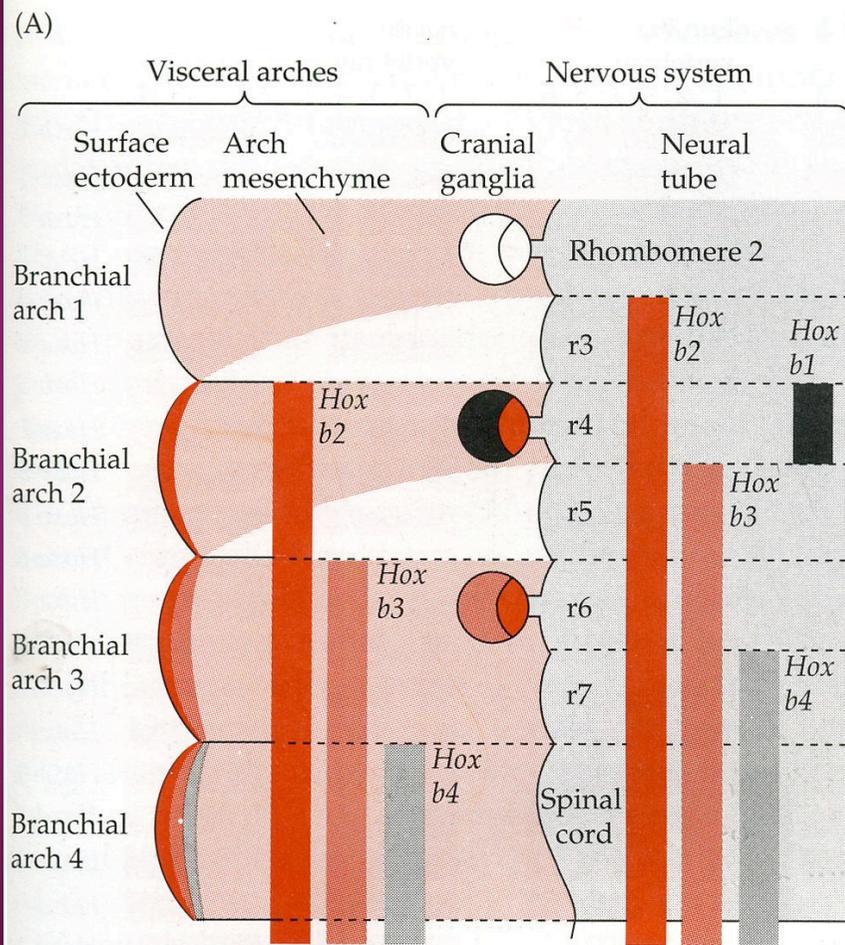




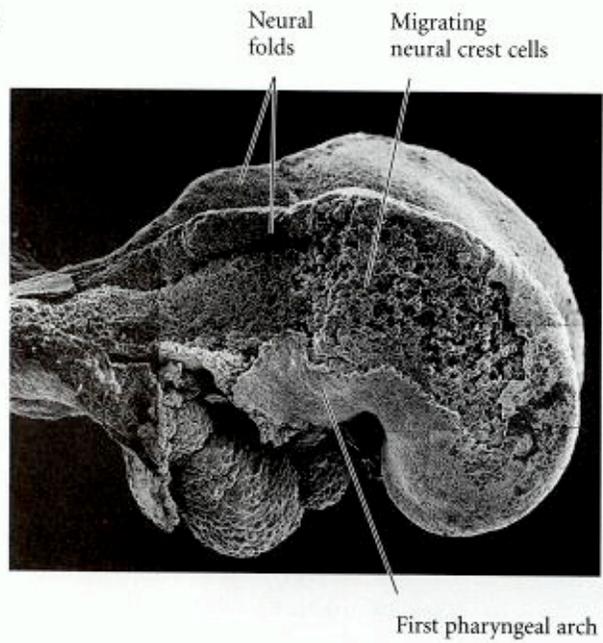




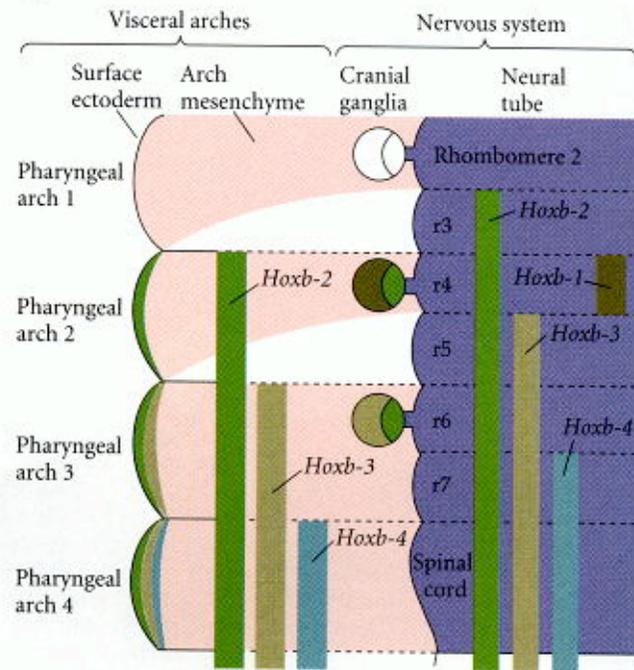




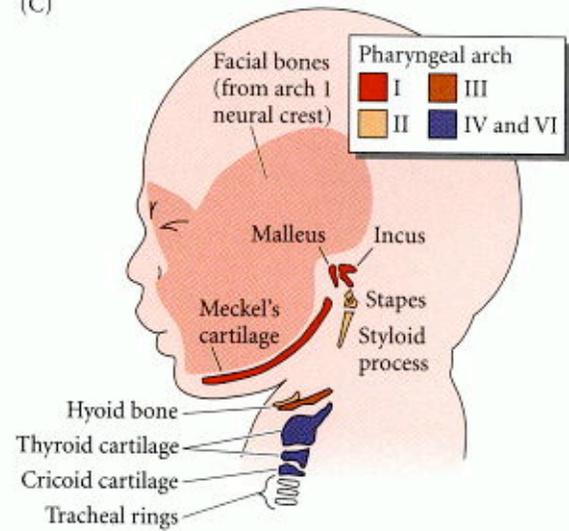
(A)

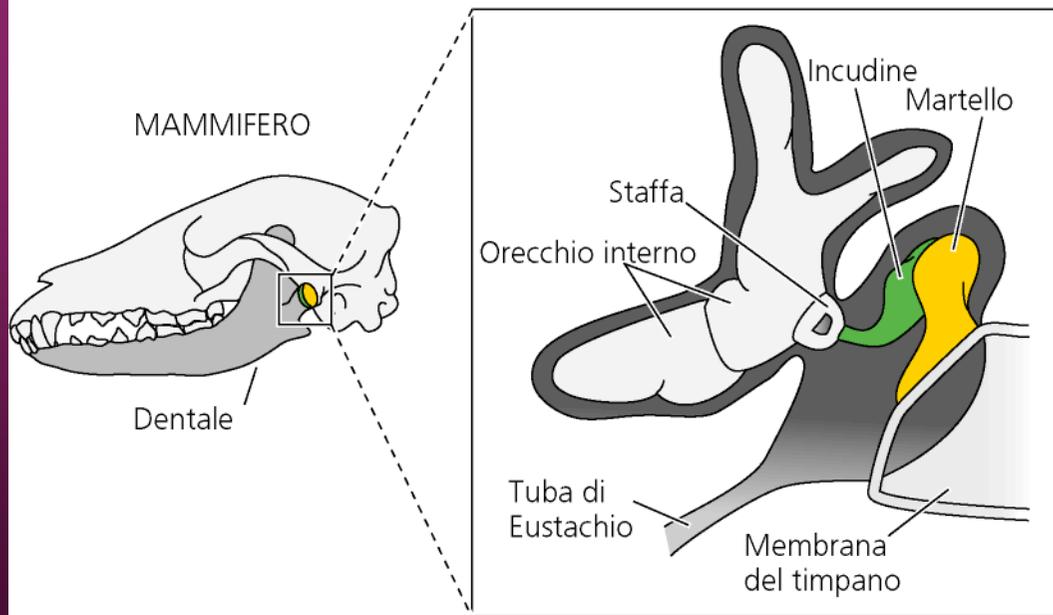
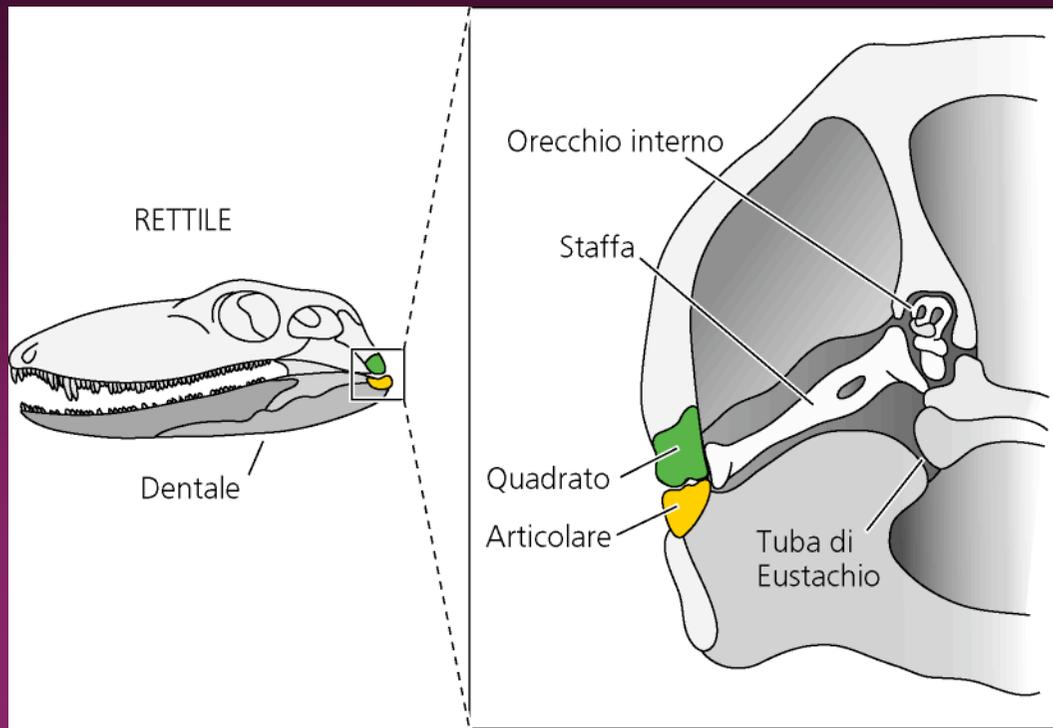


(B)



(C)





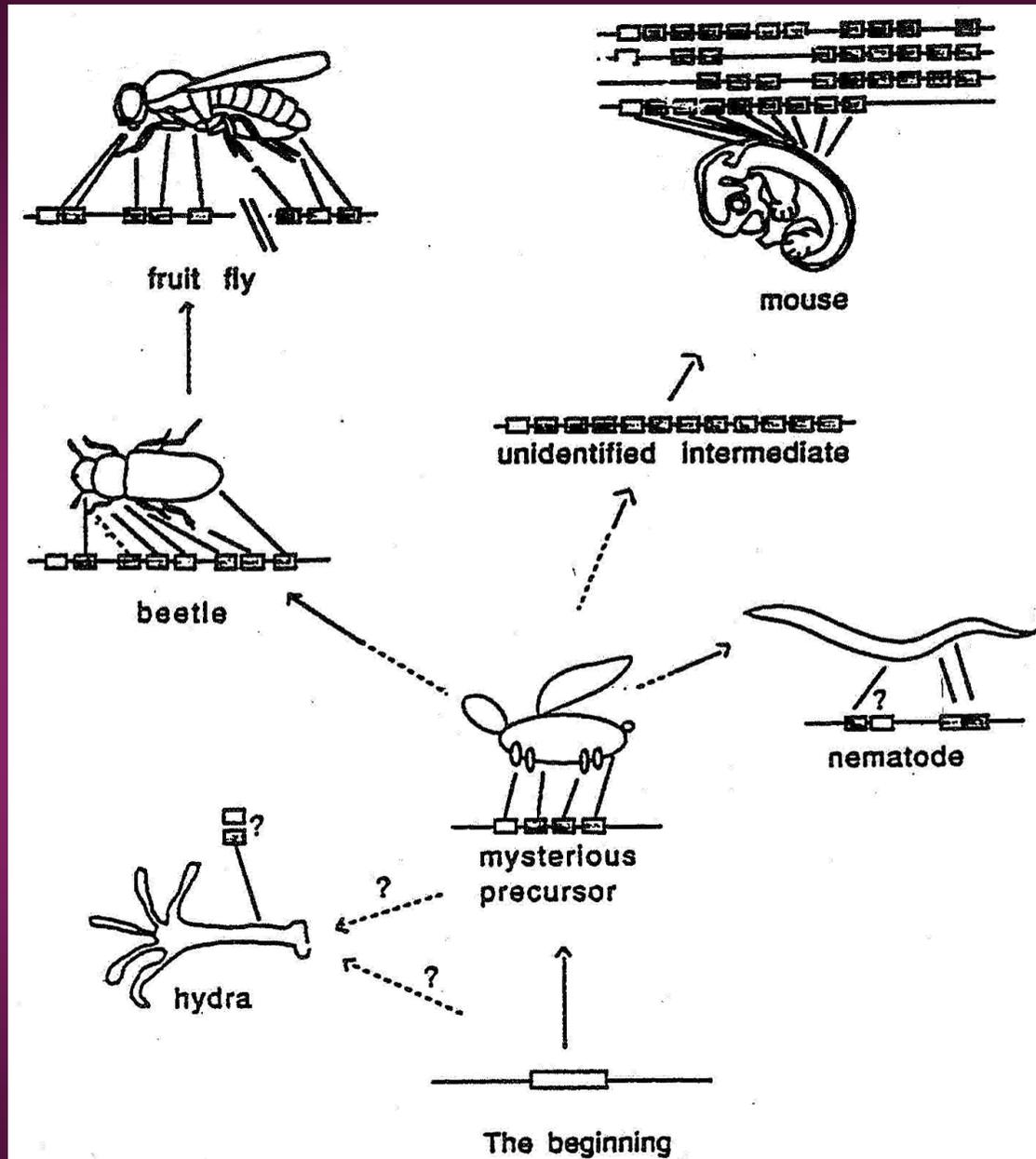


Figure 1. Evolution of the *Hox* Clusters

Table 2. Estimated *Hox* cluster structure in lamprey, amphioxus, and acorn worm

Species	Cluster estimate	No. of genes in cognate group										Total
		1	2	3	4	5	6	7	8	9	10	
Mouse	4	3	2	3	4	3	3	2	3	4	3	30
Lamprey	3	2	1	0	3	2	4		2	3	2	19
Amphioxus	2	2	2	2	0	0	2		2	0	1	11
Acorn worm	1	1	1	1	1	1	2		1	1	0	9
<i>Drosophila</i>	1	<i>lab</i>	<i>pb</i>	—	<i>Dfd</i>	<i>Scr</i>	<i>Antp</i>	<i>Ubx</i>	<i>abd-A</i>	<i>Abd-B</i>	—	8

Our estimates of the number of genes in each cognate group for the lamprey, amphioxus, and acorn worm are listed for each group, as are our estimates of cluster number. The known *Hox* structure for the mouse and *Drosophila* are also indicated (see ref. 15 and references therein).

Table 1. Gene number within gene families in amphioxus and selected vertebrates

	Msx genes	Hox clusters	Cdx genes	Mn SOD	Insulin/IGF
Amphioxus	1	1	1	1	1
Agnatha	n/t	≥2	n/t	1	2
Mammal	3	4	≥4	1	3

Results from hagfish and lampreys are amalgamated under agnatha, although we do not suggest this is a monophyletic group. Not shown are the En, XIHbox8, IF and Wnt gene families, for which insufficient data are available. n/t, not tested. See text for further details and references.

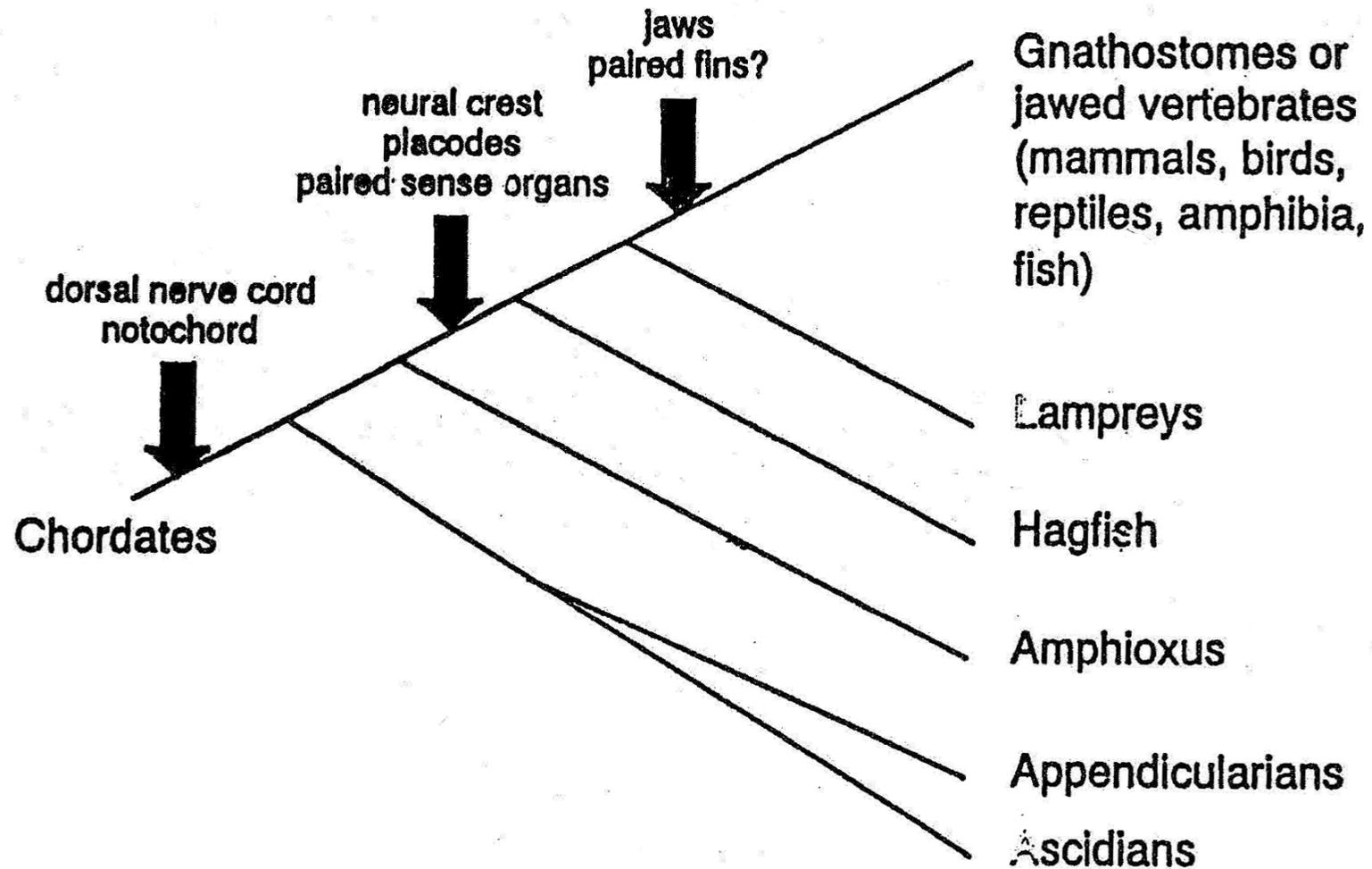
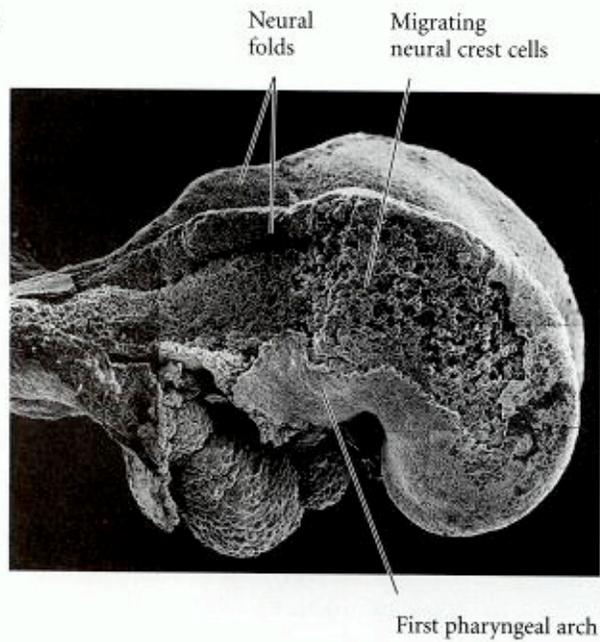
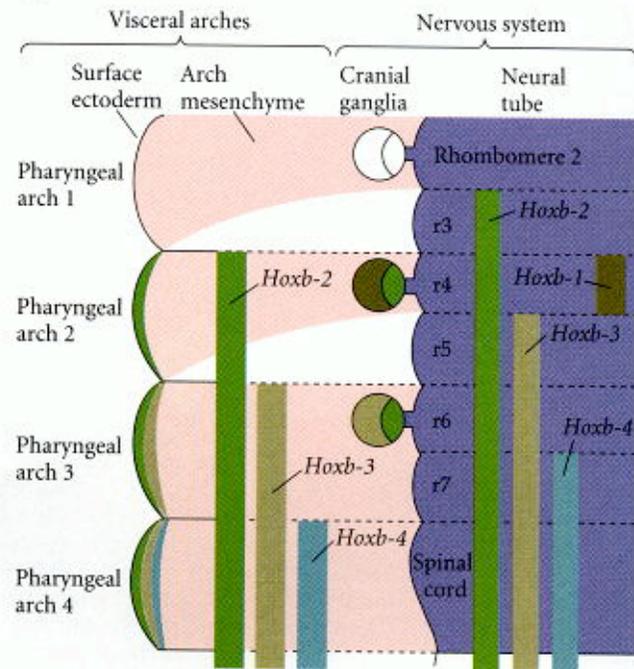


Fig. 1. Possible phylogenetic relationships between chordates showing origin of developmental and anatomical innovations.

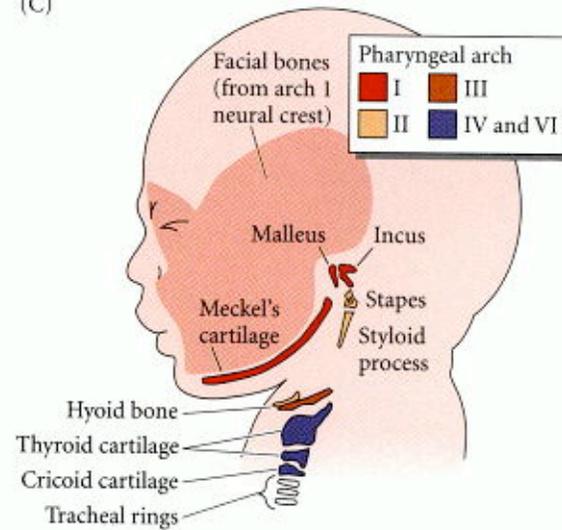
(A)



(B)



(C)



EVENTI NELL'ORIGINE E NELL'EVOLUZIONE DEI VERTEBRATI

- PRESSIONI SELETTIVE (MOBILITA'=DISPERSIONE, AUMENTO DELLE DIMENSIONI, PREDAZIONE)
- ETEROCRONIA-PROGENESI (?)
- COMPARSA ED EVOLUZIONE FUNZIONALE DI STRUTTURE EMBRIONALI (CCN, PLACODI, SOMITI)
- DUPLICAZIONE DEI GENI CONTROLLANTI QUESTE STRUTTURE (HOMEBOX)