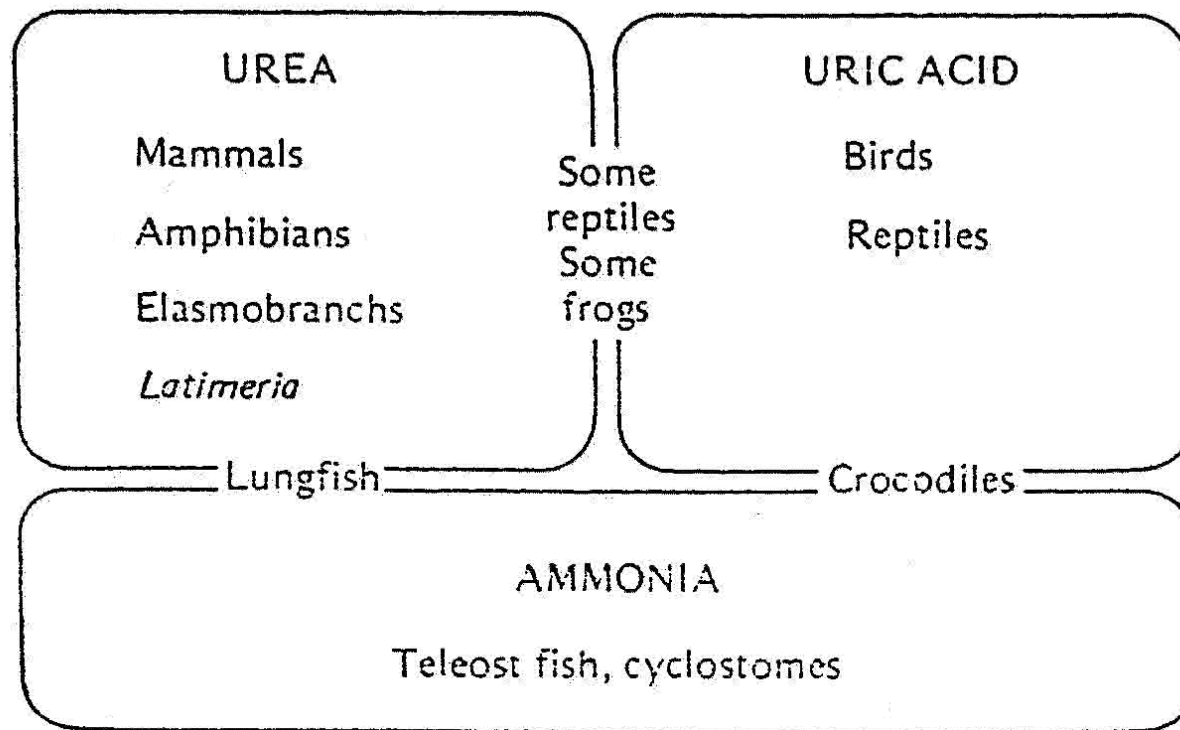
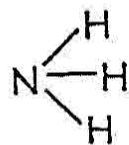


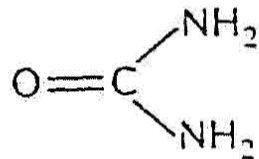
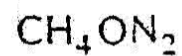
Foodstuff	End product	
Carbohydrate	→	$\text{CO}_2 + \text{H}_2\text{O}$
Fat	→	$\text{CO}_2 + \text{H}_2\text{O}$
Protein	→	NH_3 $\swarrow$ Urea $\searrow$ Uric acid
Nucleic acids	→	Purines ↓ Uric acid ↓ Allantoin ↓ Allantoic acid ↓ Urea ↓ NH_3 + Pyrimidines ↓ β-Amino acids ↓ NH_3



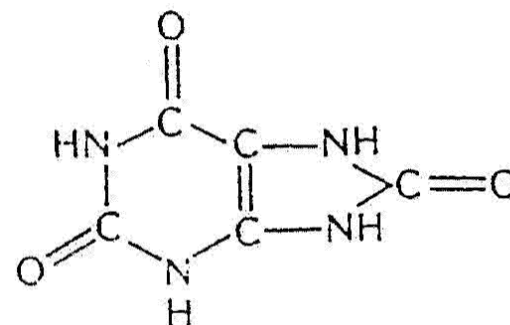
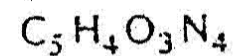
Ammonia

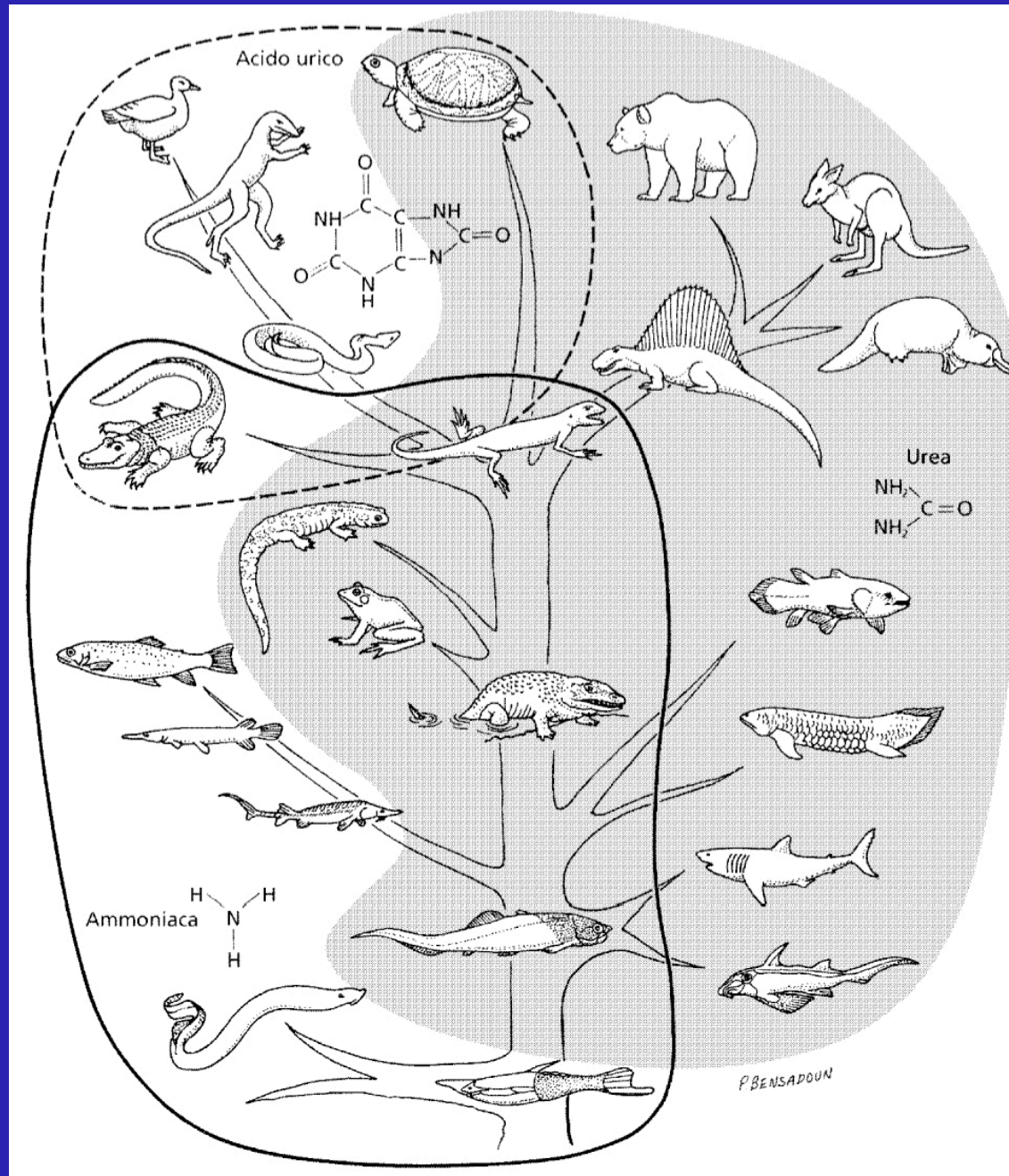


Urea



Uric acid
(keto-form)

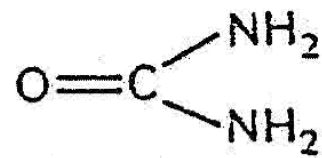




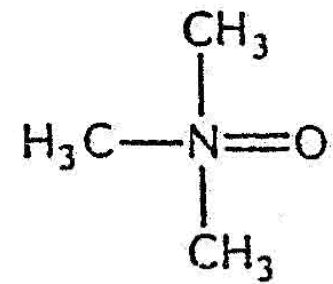
Concentrazioni rappresentative di ioni sodio e cloruro e osmolalità del sangue nei vertebrati e in alcuni invertebrati. Le concentrazioni sono espresse in milliosmoli per kilogrammo di acqua; tutti i valori sono approssimati alle 5 unità più vicine

<i>Taxon</i>	<i>mOsm · kg⁻¹</i>	<i>Na⁺</i>	<i>Cl⁻</i>	<i>Altri principali fattori osmotici</i>	<i>Fonte</i>
Acqua marina	~1000	475	550		
Acqua dolce	<10	~5	~5		
Invertebrati marini					
Celenterati, molluschi, ecc.	~1000	470	545		1
Crostacei	~1000	460	500		1
Vertebrati marini					
Missine	~1000	535	540		2
Lamprede	~300	120	95		2
Teleostei	<350	180	150		3
Celacantidi (<i>Latimeria chalumnae</i>)	da <1000 a 1180	180	200	Urea 375	4, 10
Elasmobranchi (<i>Carcharhinus leucas</i>)	1050	290	290	Urea 360	5
Olocefali	~1000	340	345	Urea 280	9
Vertebrati d'acqua dolce					
Polipteridi	200	100	90		3
Acipenseridi	250	130	105		3
Neopterigi primitivi	280	150	130		3
Dipnoi	240	110	90		3
Teleostei	<300	140	120		3
Elasmobranchi (<i>Carcharhinus leucas</i>)	680	245	220	Urea 170	5
Elasmobranchi (Potamotrygonidae)	310	150	150		6
Anfibi*	~250	~100	~80		7
Vertebrati terrestri					
Rettili	350	160	130		8
Uccelli	320	150	120		8
Mammiferi	300	145	105		8

* Livelli ionici e osmolalità altamente variabili, ma tendenza verso 200 mOsm · kg⁻¹ in acqua dolce.



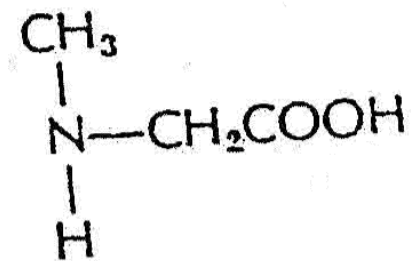
Urea



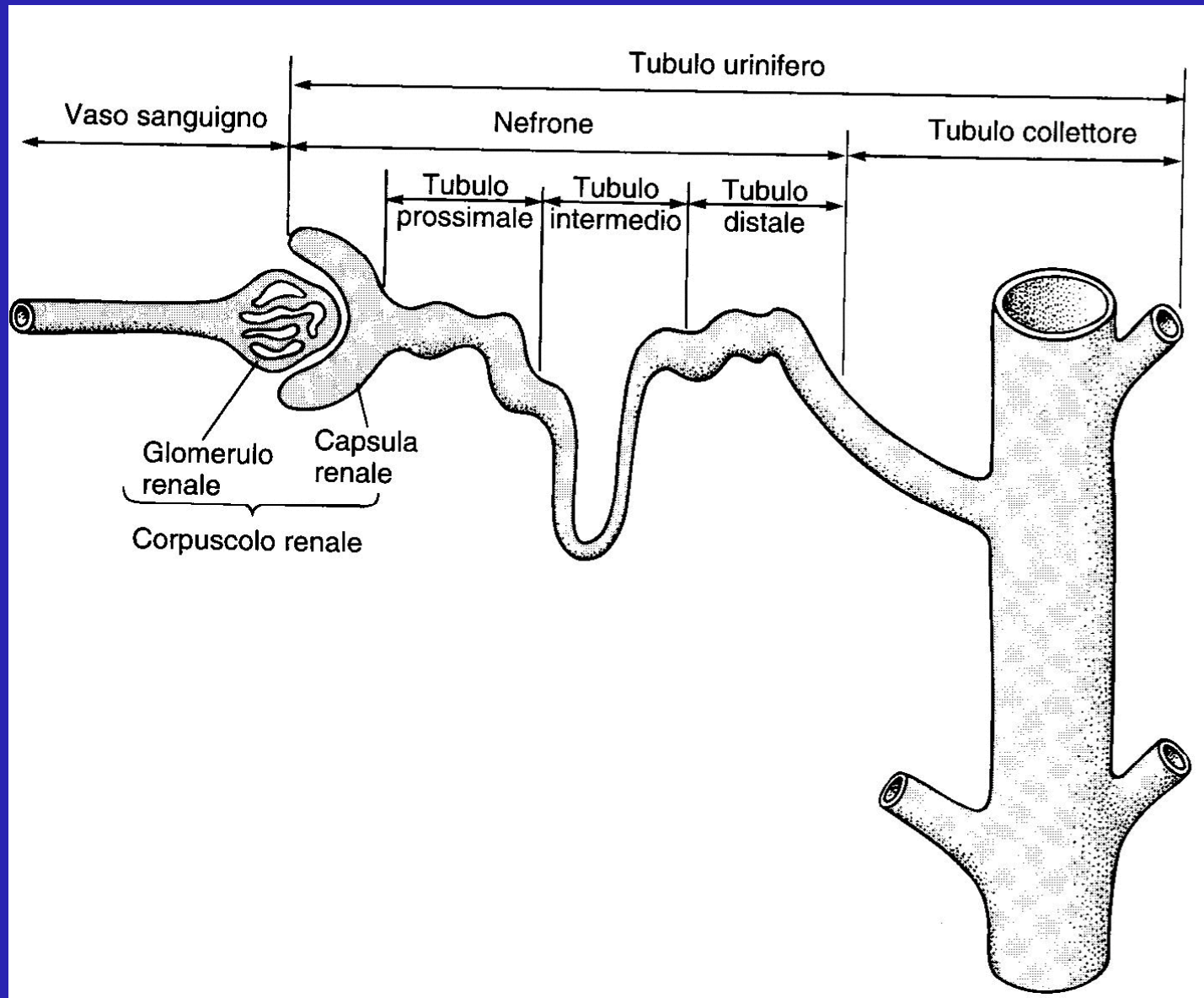
TMAO

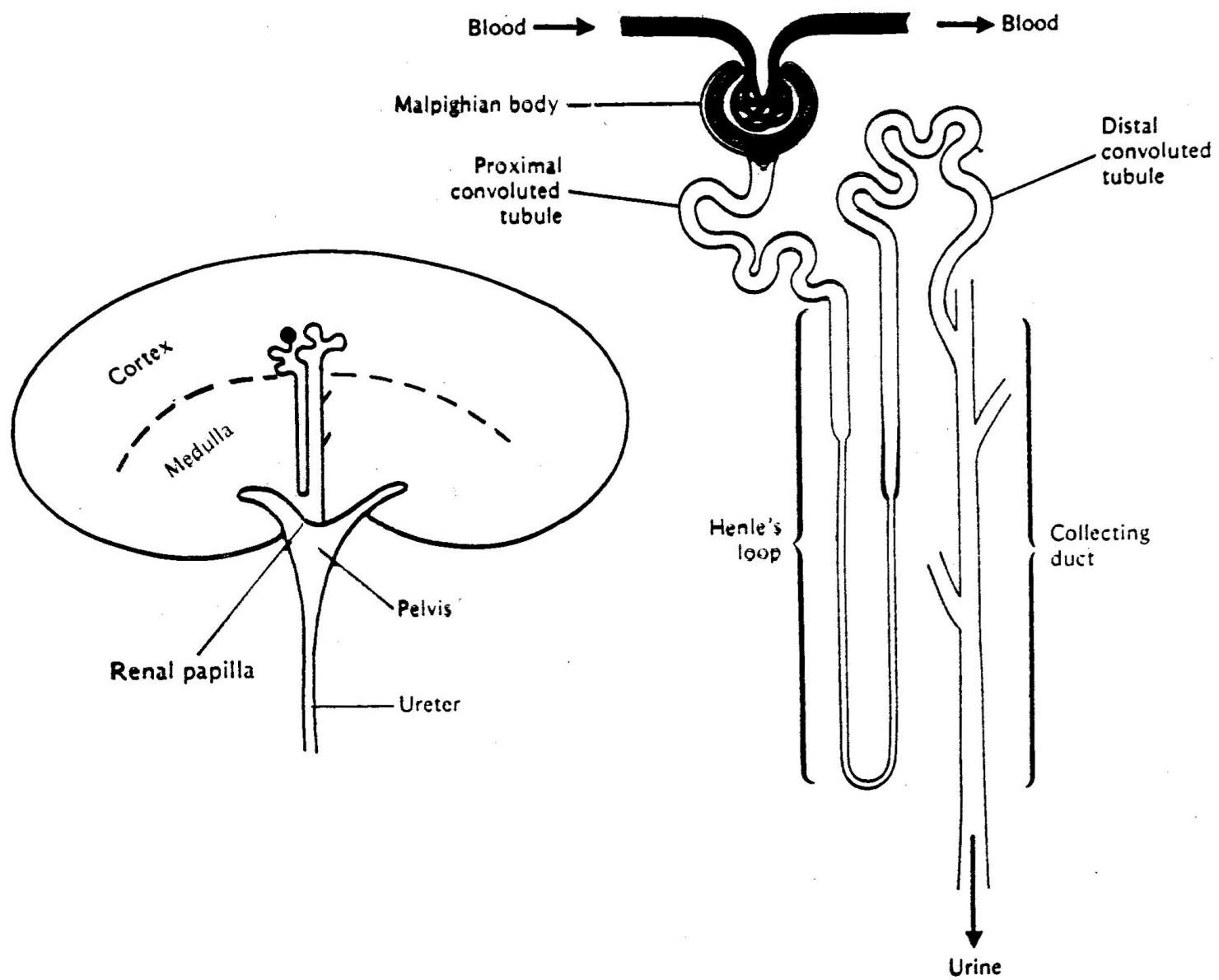


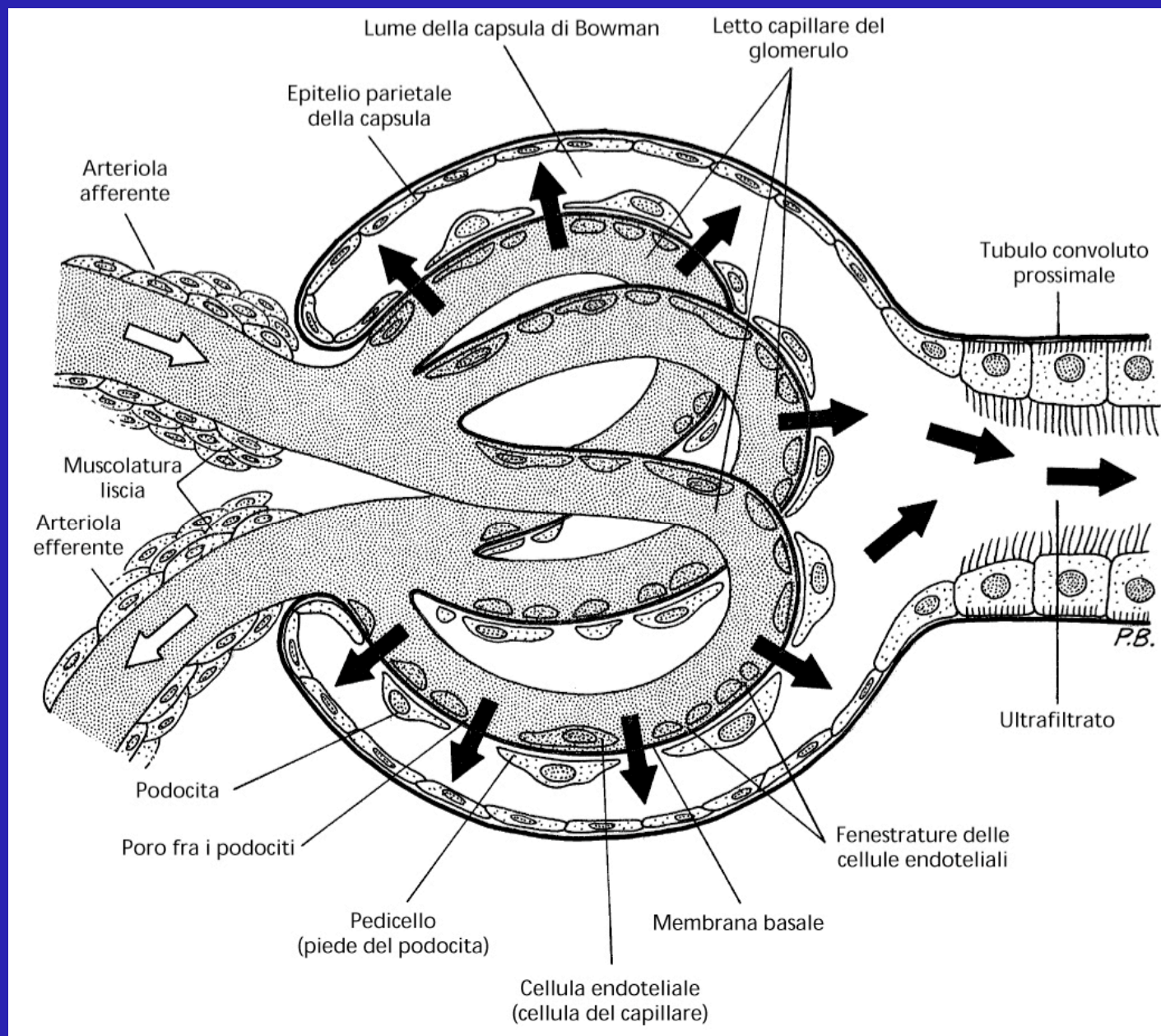
Betaine

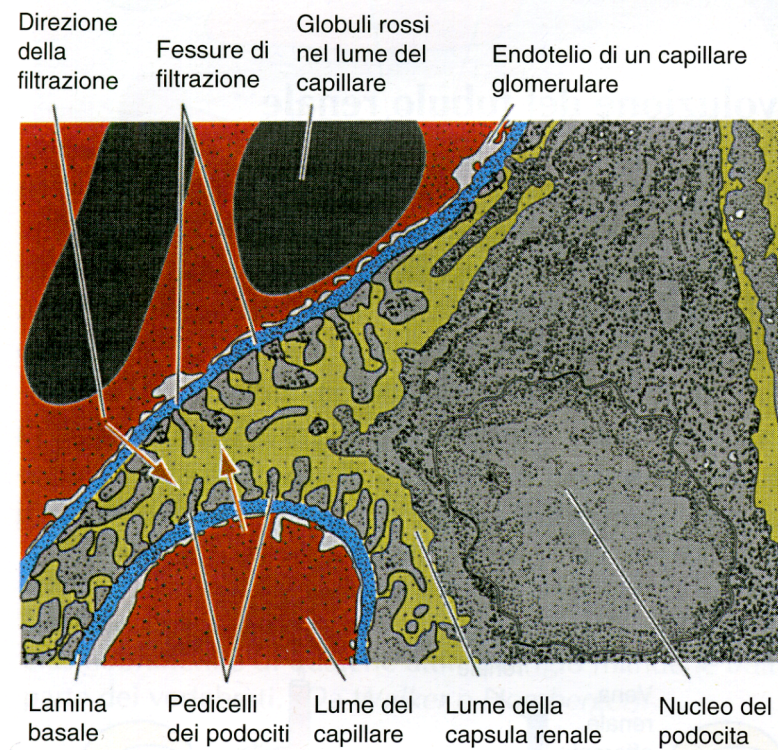


Sarcosine

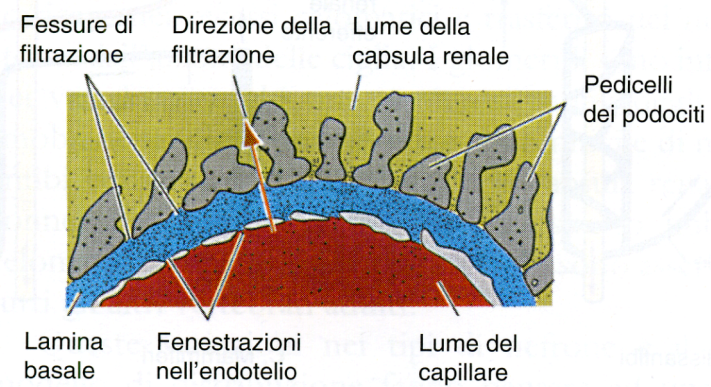






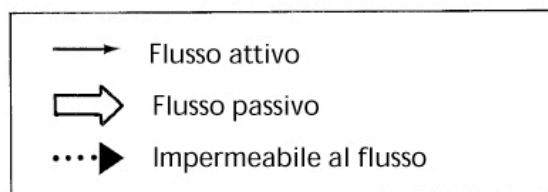
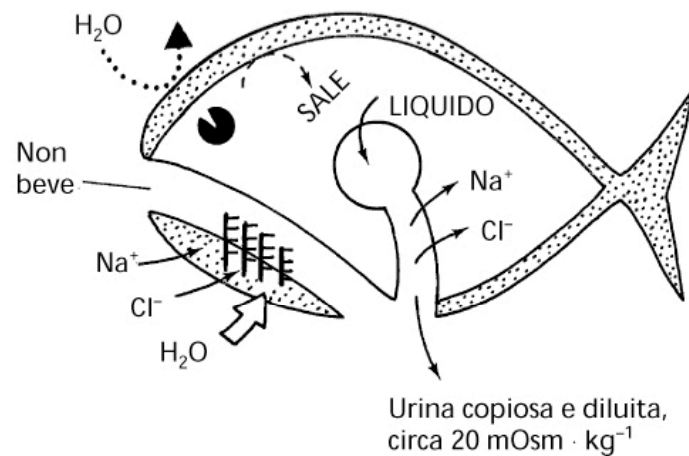


B. Interfaccia capillare glomerulare/capsula renale

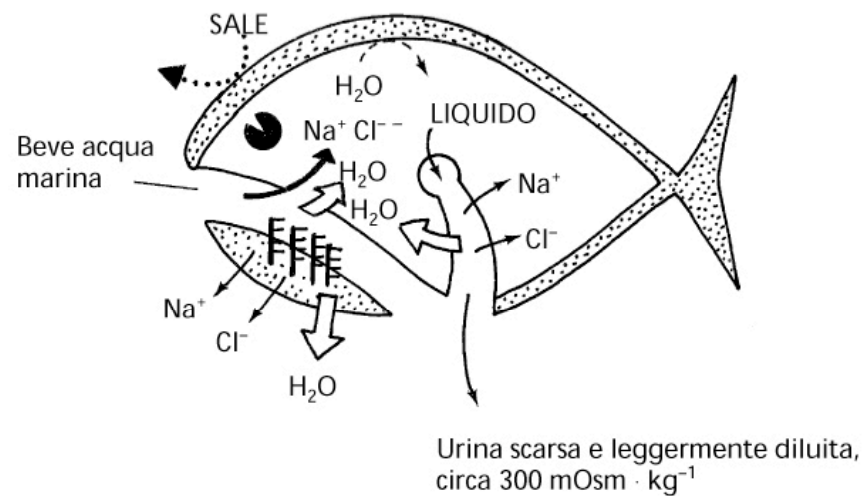


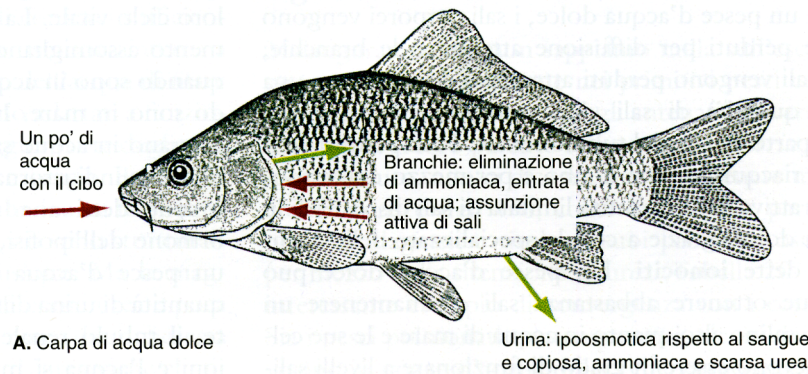
C. Ingrandimento dell'interfaccia

TELEOSTEO D'ACQUA DOLCE
(Liquidi corporei = $300 \text{ mOsm} \cdot \text{kg}^{-1}$; Ambiente $< 20 \text{ mOsm} \cdot \text{kg}^{-1}$)

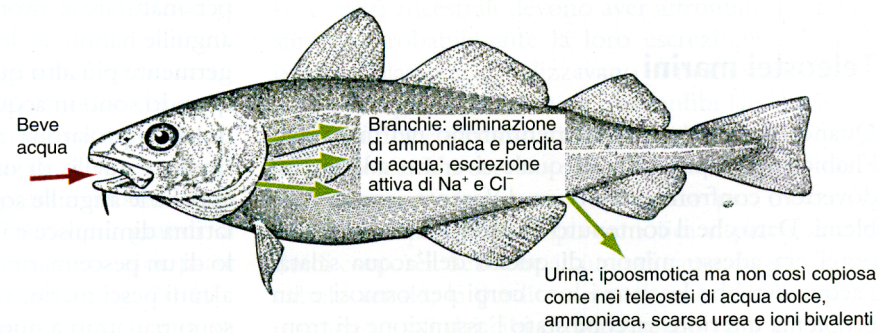


TELEOSTEO MARINO
(Liquidi corporei = $350 \text{ mOsm} \cdot \text{kg}^{-1}$; Ambiente = $1000 \text{ mOsm} \cdot \text{kg}^{-1}$)

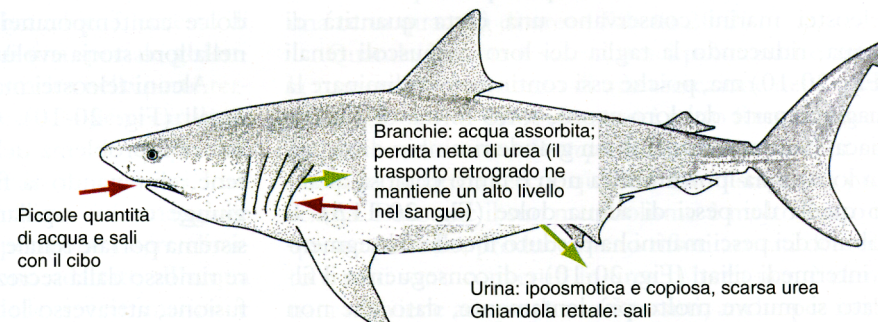




A. Carpa di acqua dolce

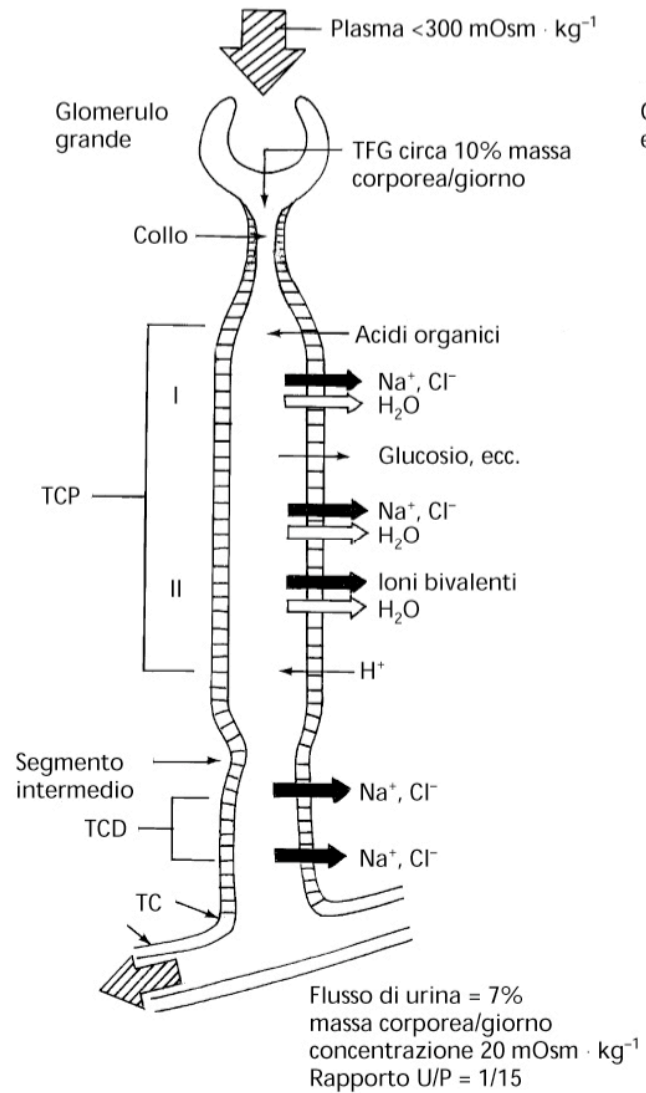


B. Merluzzo marino

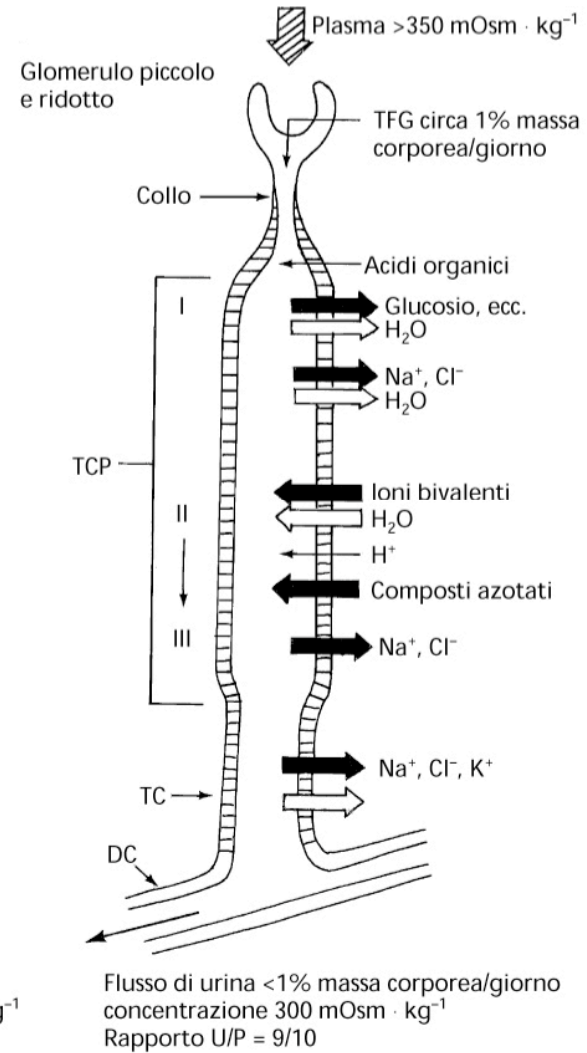


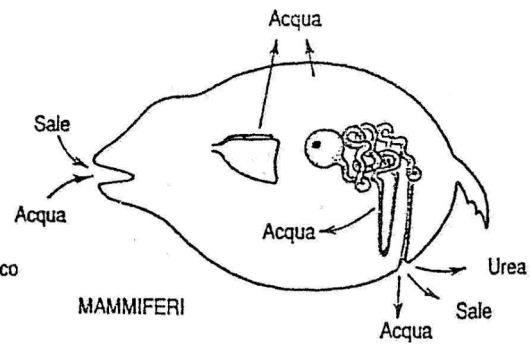
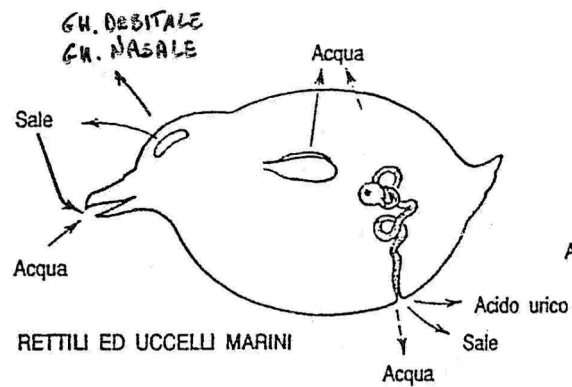
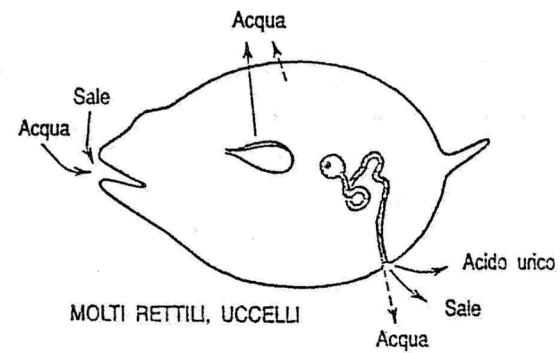
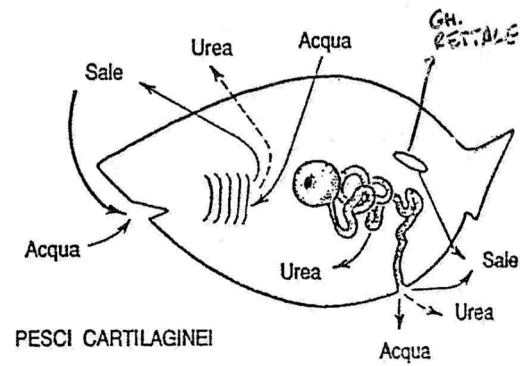
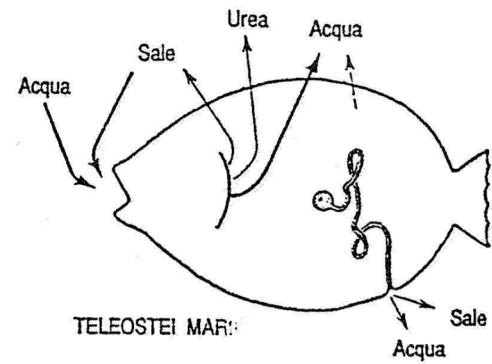
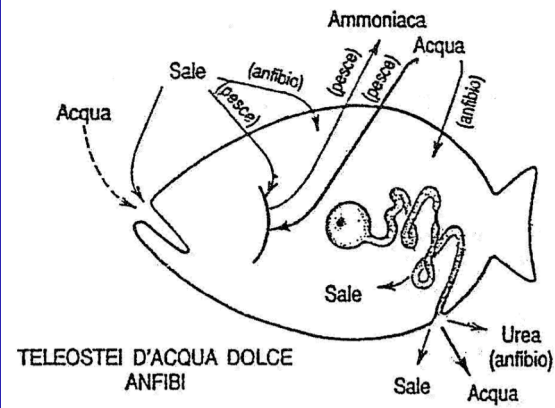
C. Squalo marino

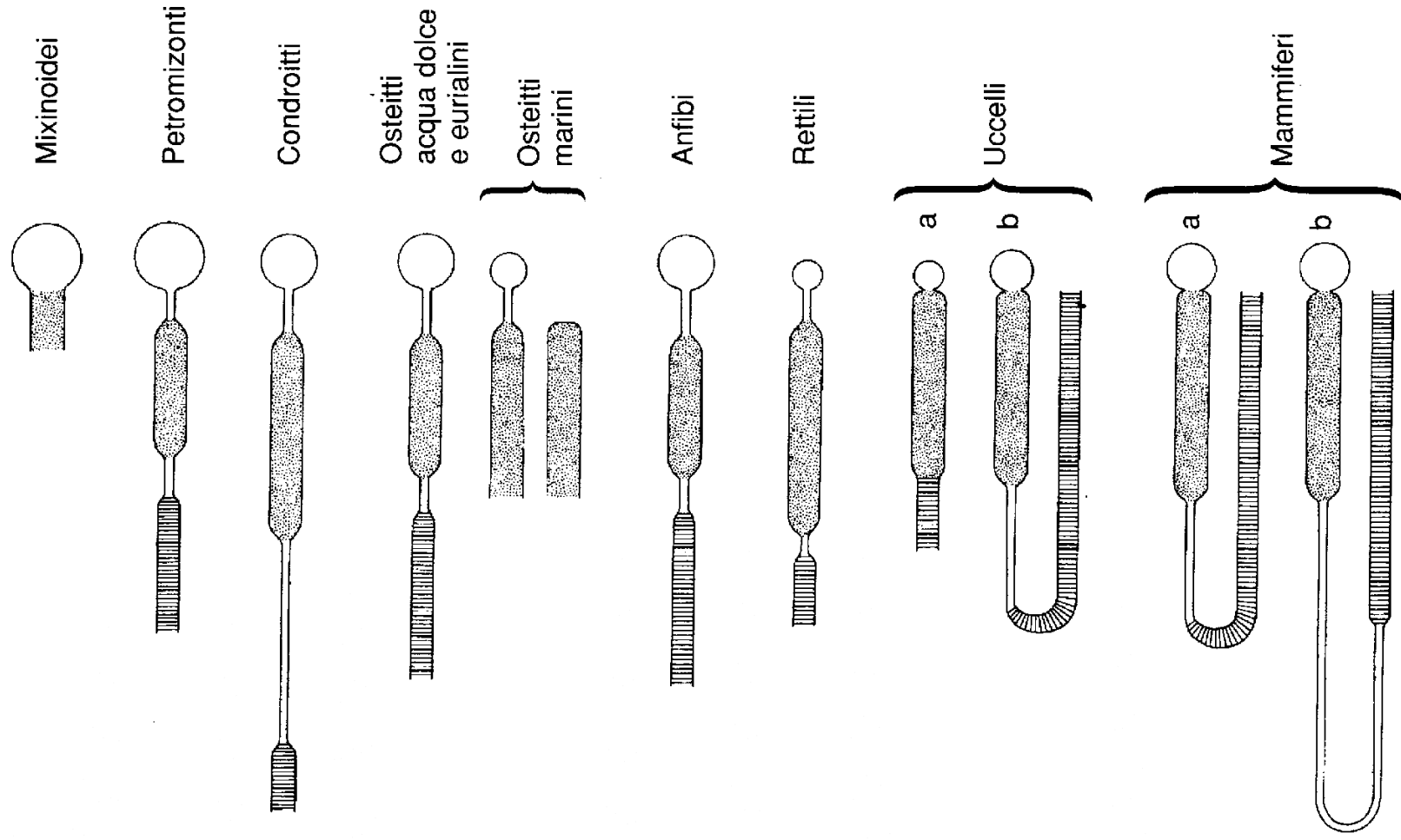
TELEOSTEO D'ACQUA DOLCE

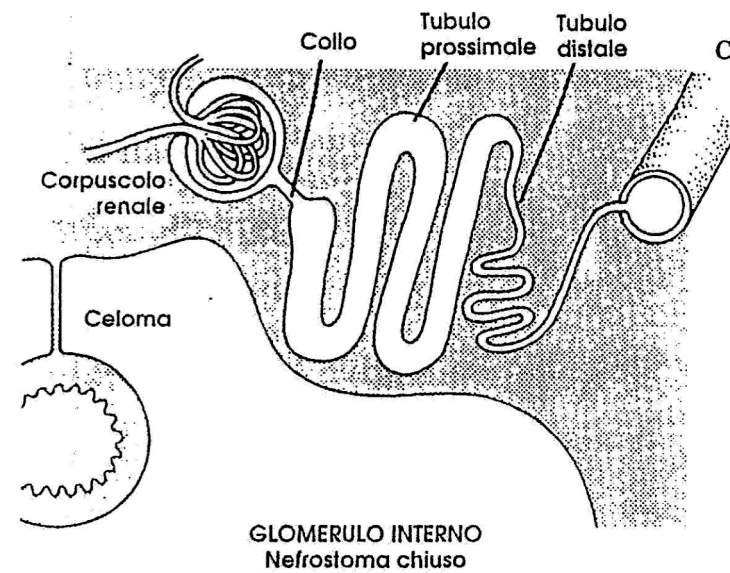
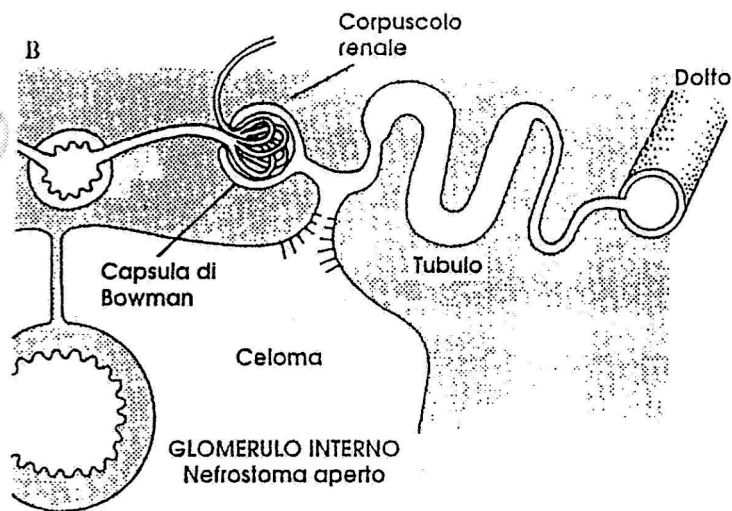
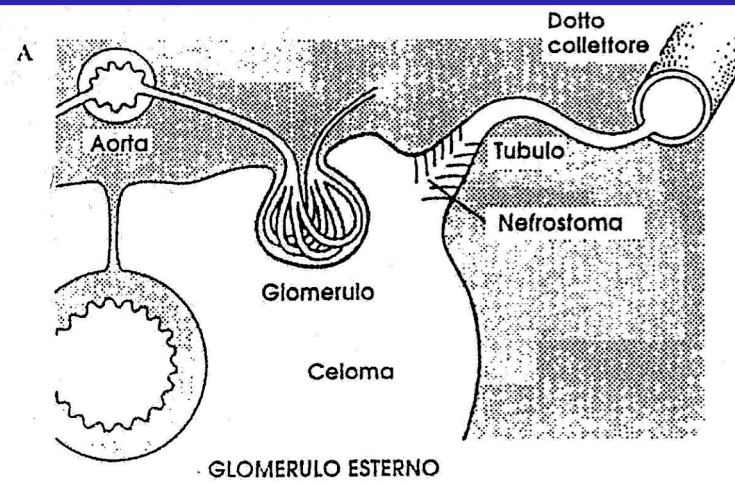


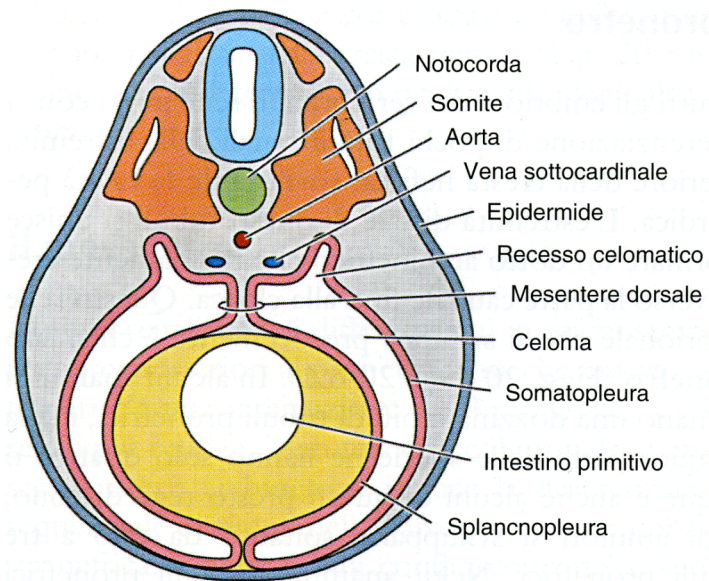
TELEOSTEO MARINO



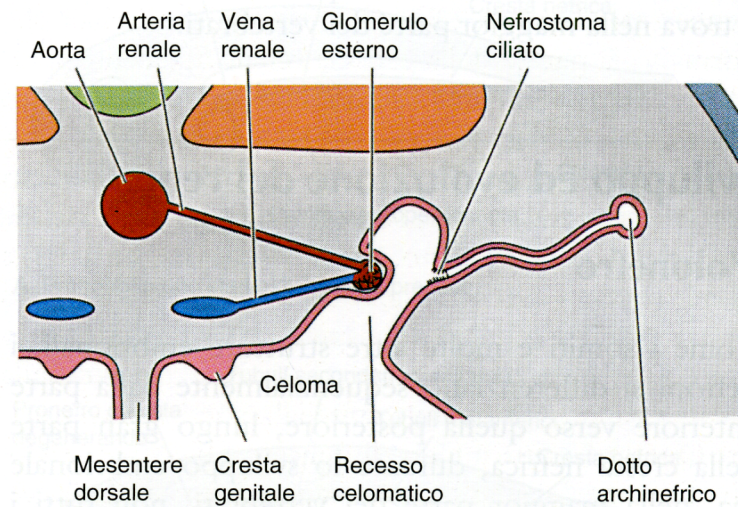




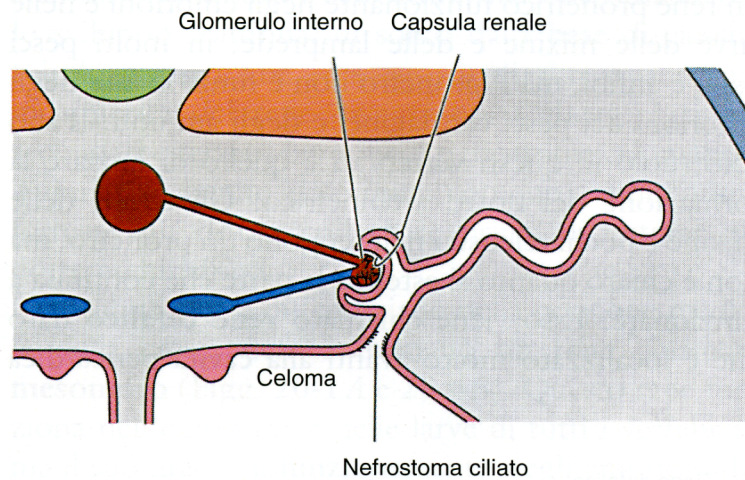




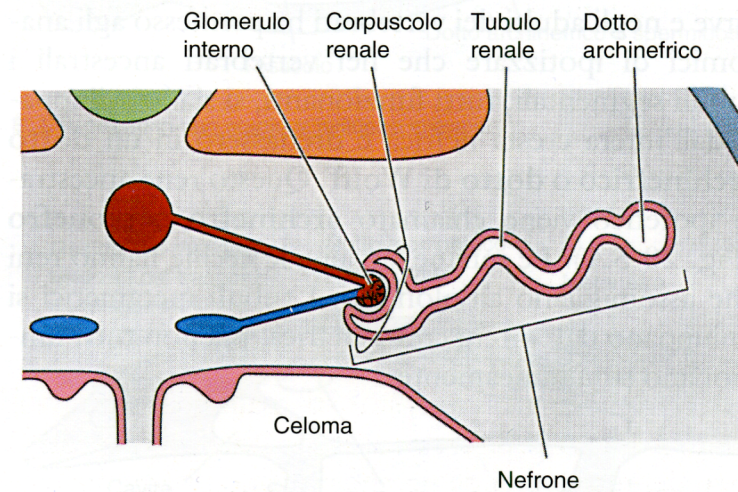
A. Sezione trasversale dell'embrione di un vertebrato



B. Ammocete e lissanfi larvati

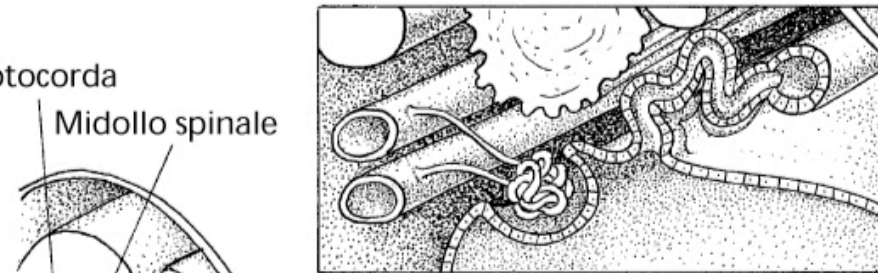


C. Elasmobranchi e alcuni attinopteri

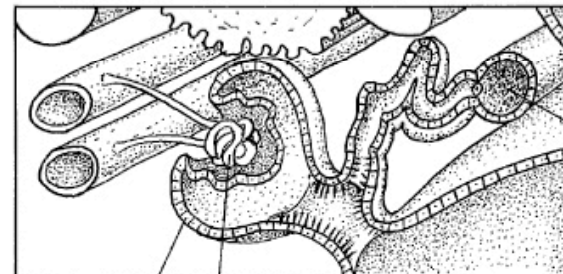
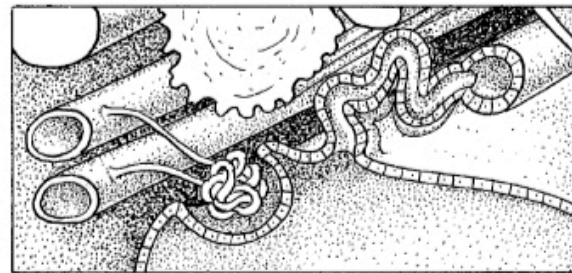


D. La maggior parte degli altri vertebrati

Notocorda
Midollo spinale



Vena cava dorsale
Aorta dorsale
Tubulo renale
Glomerulo esterno



Glomerulo interno
Capsula renale
Corpuscolo renale

Dotto archinefrico
(dotto di Wolff)

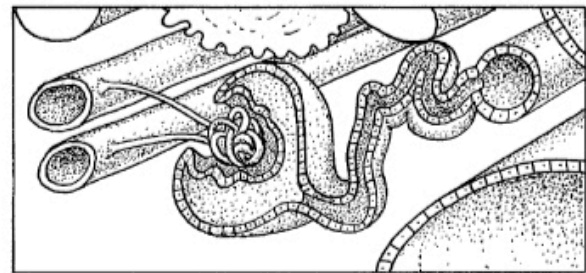
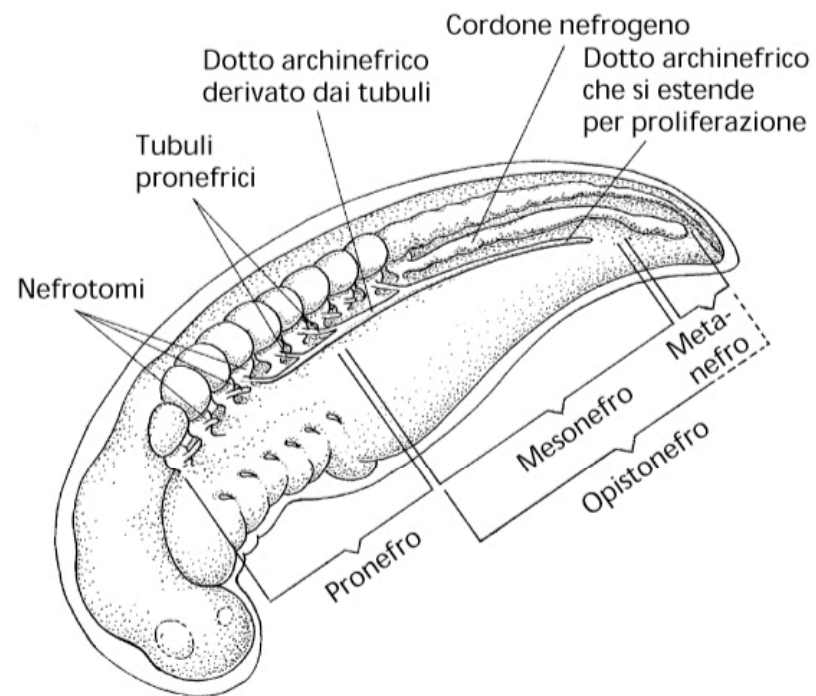
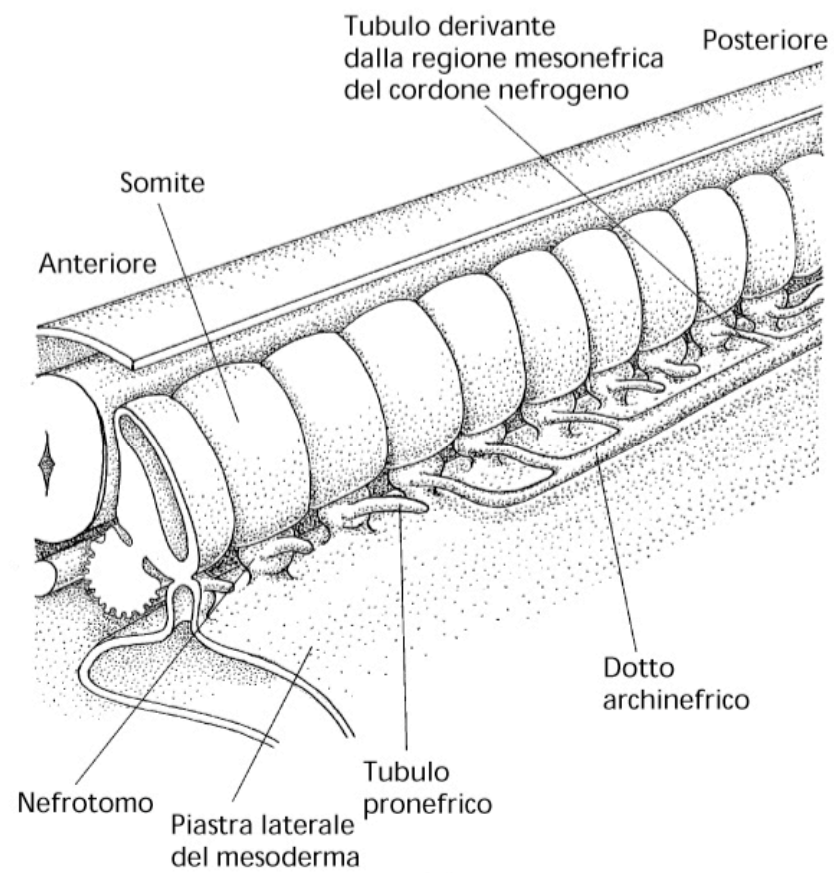


Tabella 3-2. Tipi di rene dei vertebrati.

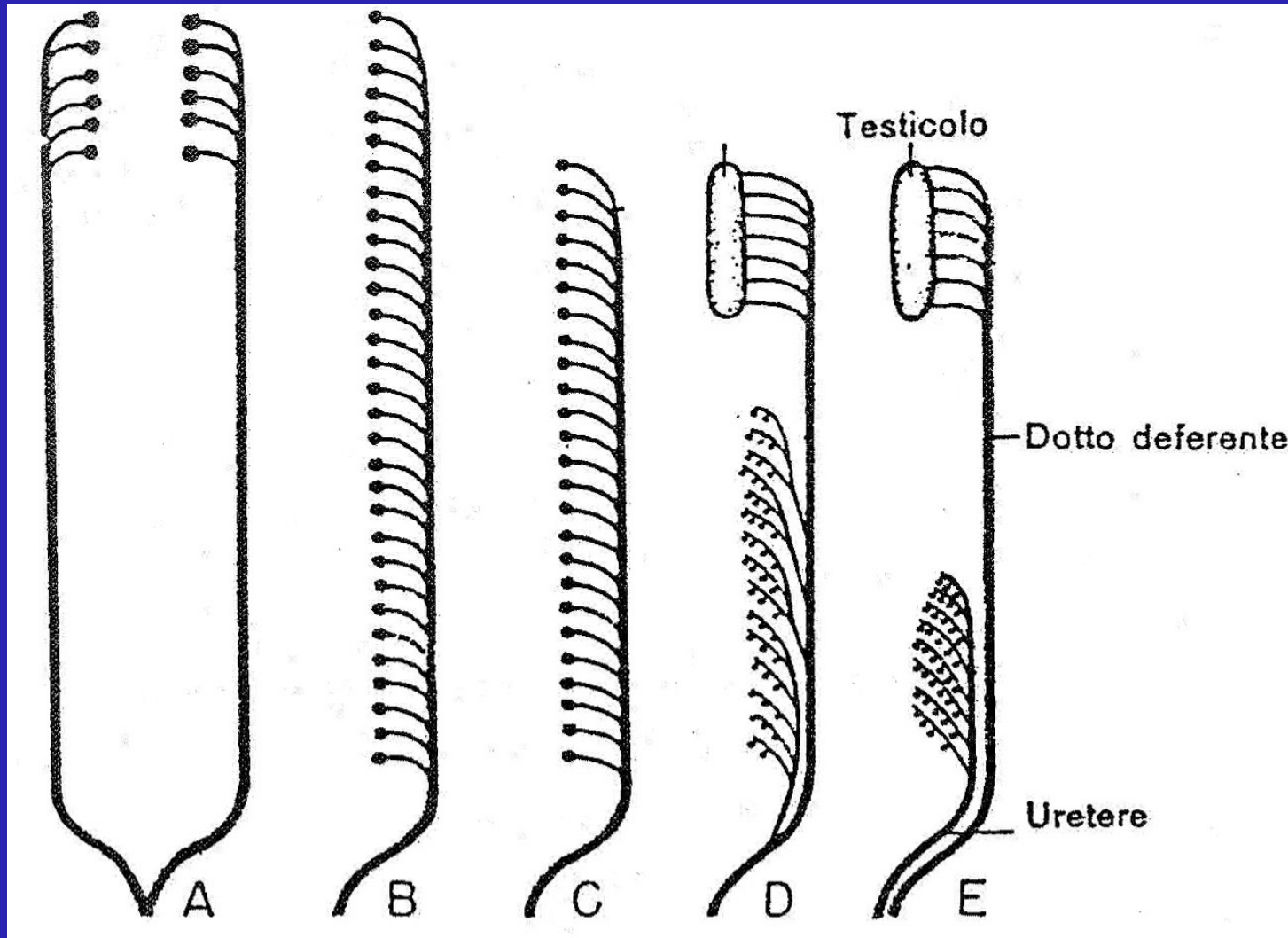
<i>Classificazione ontogenetica</i>	<i>Classificazione filogenetica</i>
Pronefro In tutti i vertebrati si sviluppa nella porzione più anteriore del tessuto nefrogeno, ad organizzazione segmentale, drenato dal dotto archinefrico, attivo negli embrioni di pesci e anfibi, presente, ma non attivo, negli embrioni precoci degli amnioti.	Olonefro Una struttura ipotetica, assente nei vertebrati adulti attuali. Un singolo tubulo per segmento corporeo per l'intera lunghezza del tessuto nefrogeno, drenato dal dotto archinefrico.
Mesonefro In tutti i vertebrati si sviluppa nella porzione mediana del tessuto nefrogeno, drenato dal dotto archinefrico, sprovvisto di segmentazione evidente; i tubuli sono più numerosi dei segmenti; è attivo negli embrioni di tutti gli gnatostomi, ma solo per un breve periodo di tempo negli embrioni degli amnioti.	Opistonefro Si sviluppa nella porzione mediana e successivamente in quella posteriore del tessuto nefrogeno, è drenato dal dotto archinefrico e da dotti posteriori accessori di origine nefrogena; nessuna segmentazione; numerosi tubuli; attivo negli adulti di tutti gli anamni.
Metanefro Si sviluppa nella porzione posteriore del tessuto nefrogeno degli amnioti, drenato da una estroflessione della cloaca (uretere); numero molto grande di tubuli con nessuna evidenza di segmentazione, attivo nelle ultime fasi dello sviluppo embrionale e negli adulti di tutti gli amnioti.	

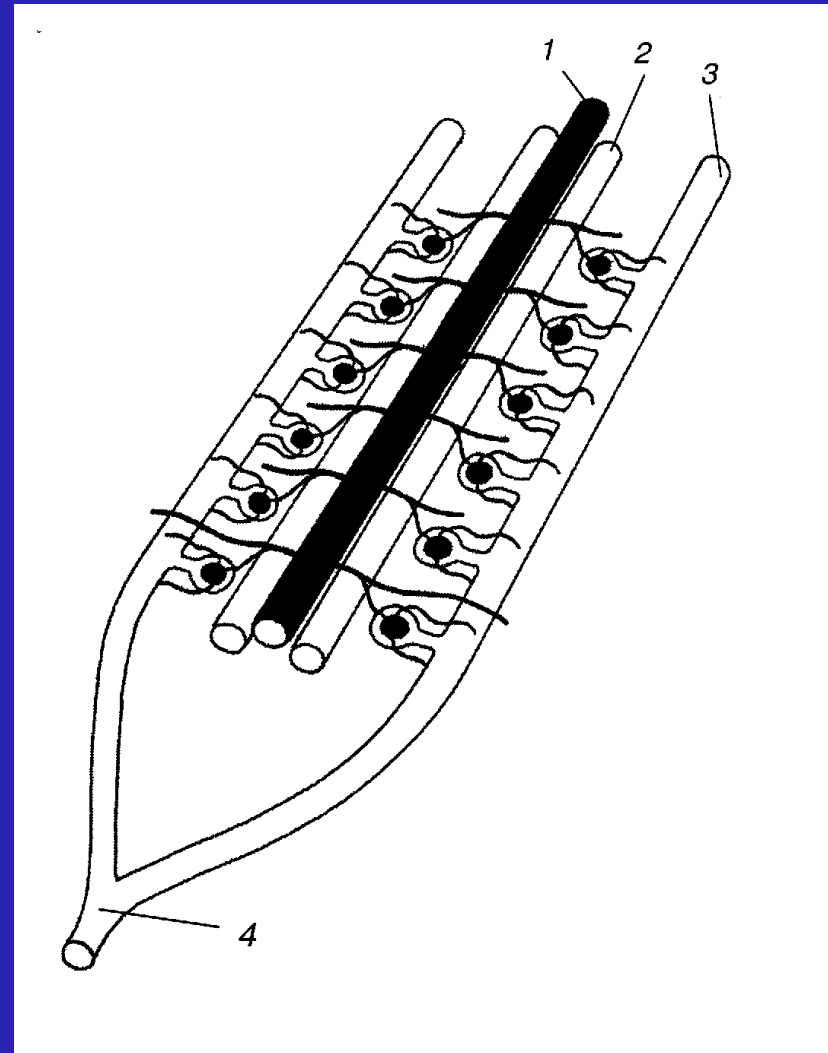


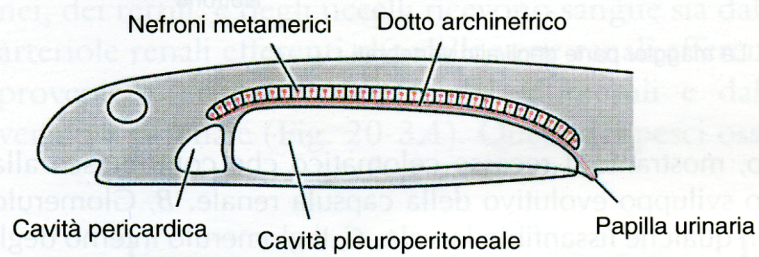
(a)



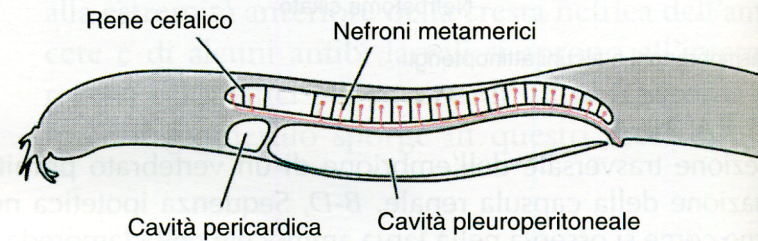
(b)



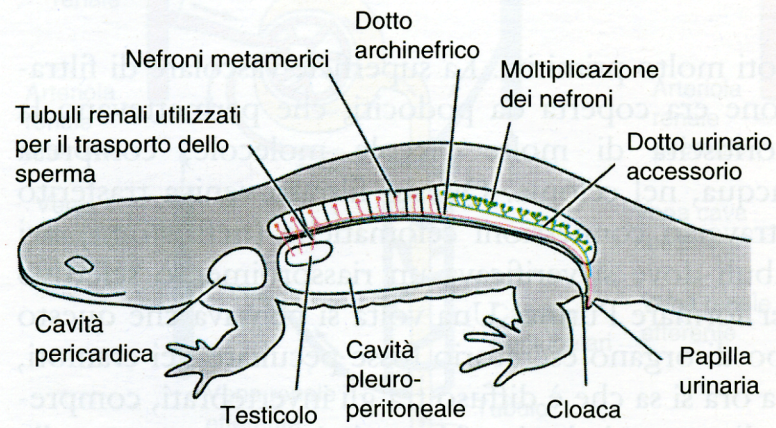




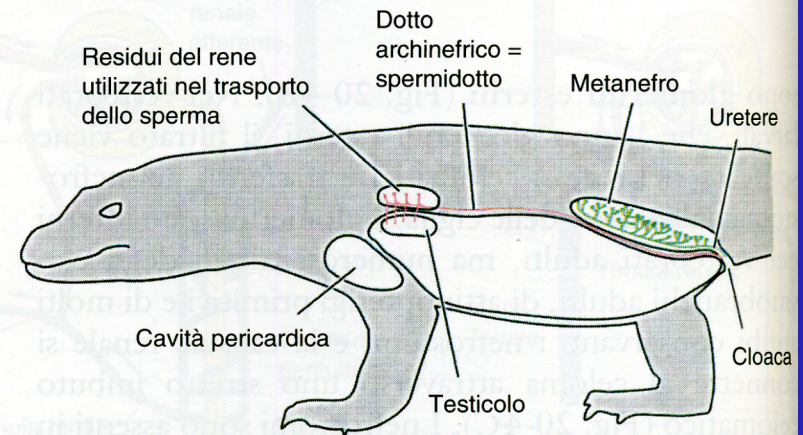
A. Olonefro ipotetico



B. Opistonefro primitivo



C. Opistonefro evoluto



D. Metanefro

