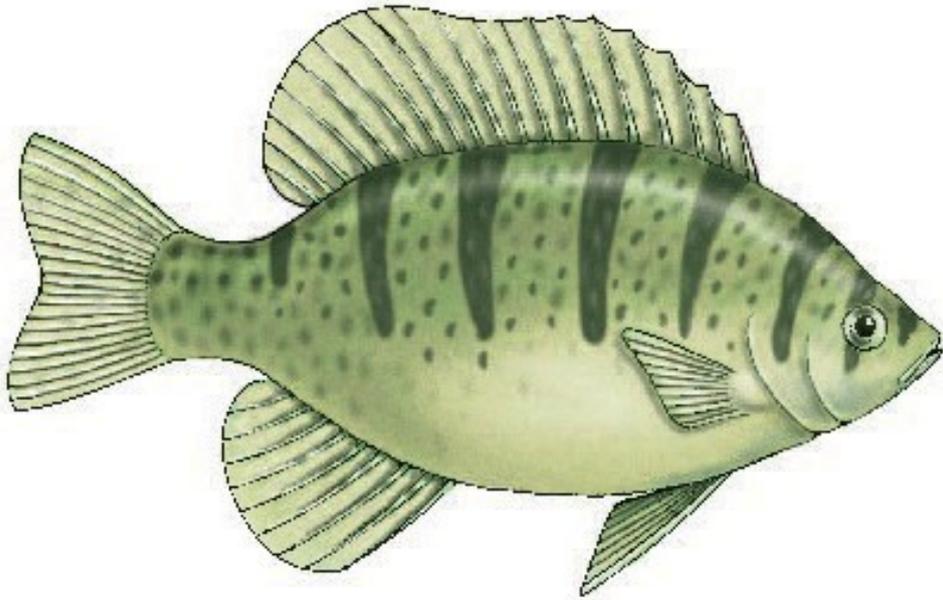


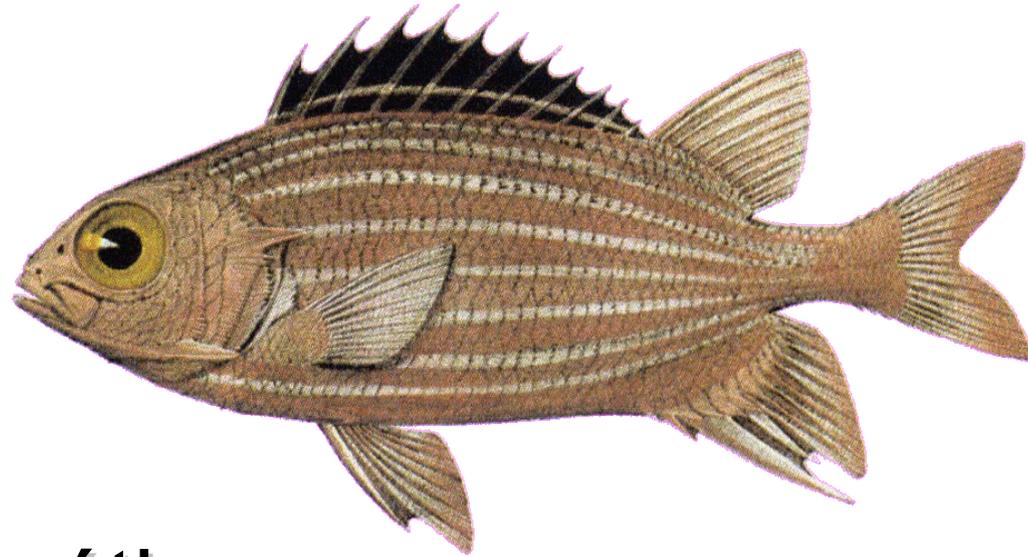
# Los peces

biología y  
anatomía



curso de acuariofilia  
Módulo II: Organismos

# Peces



Vertebrados acuáticos

Ectotérmicos

Cubiertos de escamas

Aletas pares e impares

Branquias

Forma hidrodinámica



# Peces

## Diversidad biológica

- **Comportamiento social**

  - Bancos - territoriales

- **Reproducción**

  - cuidados parentales - depredación crías

- **Alimentación**

  - plantas, zooplancton, corales, peces, etc.

- **Sexo**

  - separado, hermafroditas, cambio de sexo

- **Movilidad**

  - sedentarios - migradores

- **Casi cualquier tipo de hábitat acuático**



# Peces

## Diversidad morfológica

- Tamaño de 8mm a 15m

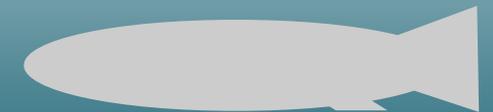


*Paedocypris progenetica*

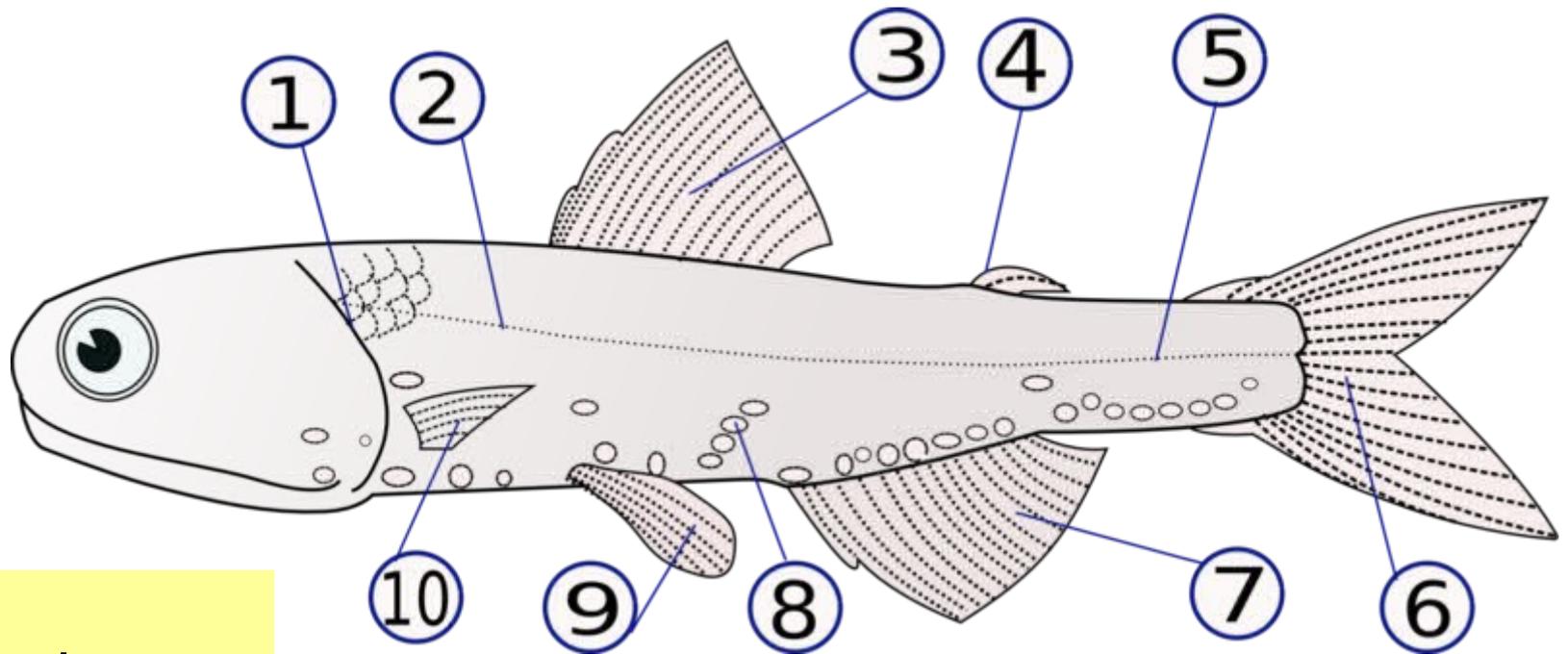


*Rhincodon typus*

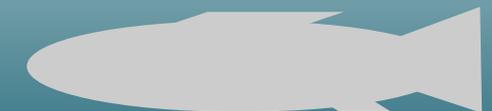
- Forma del cuerpo
- Coloración
- Presencia o ausencia de escamas
- Aletas modificadas



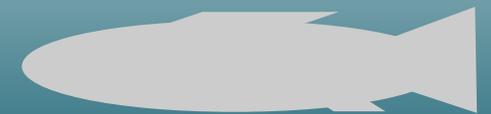
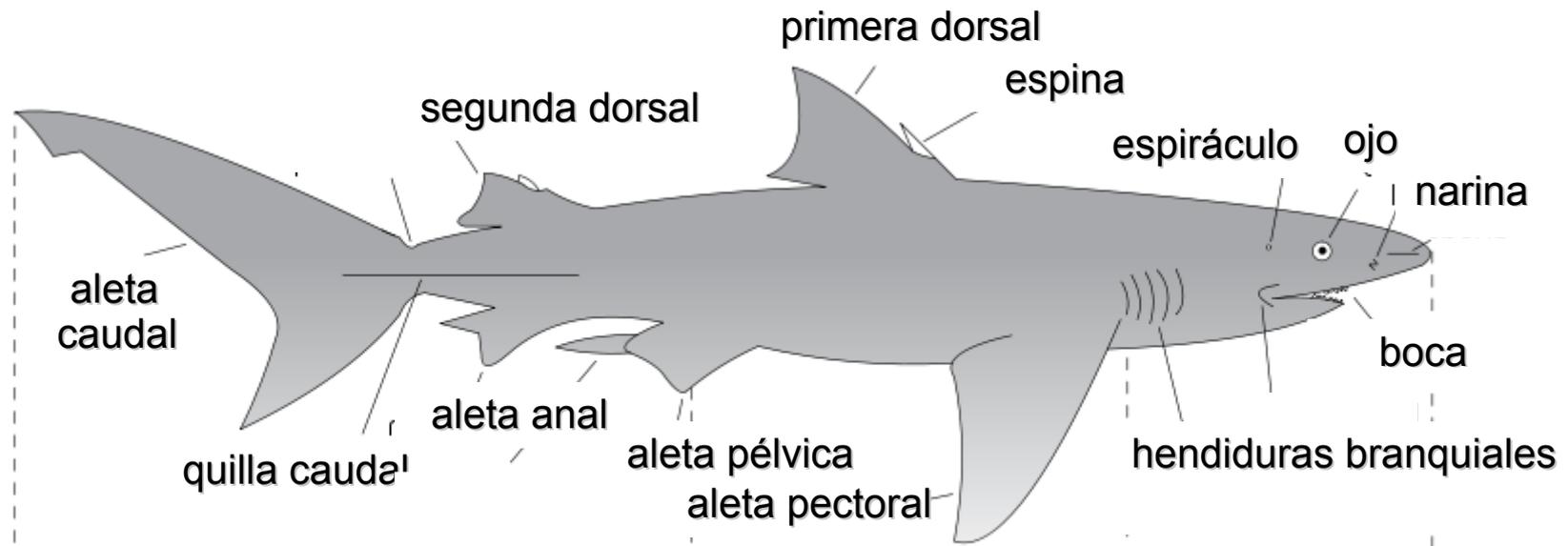
# Anatomía externa



- 1- opérculo
- 2- línea lateral
- 3- aleta dorsal
- 4- aleta adiposa
- 5- pedúnculo caudal
- 6- aleta caudal
- 7- aleta anal
- 8- fotóforos
- 9- aleta pélvica
- 10- aleta pectoral

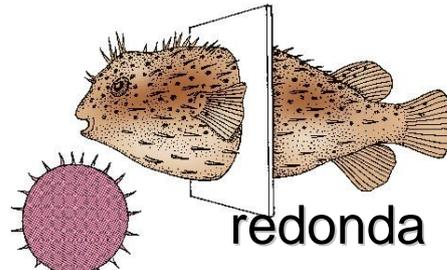
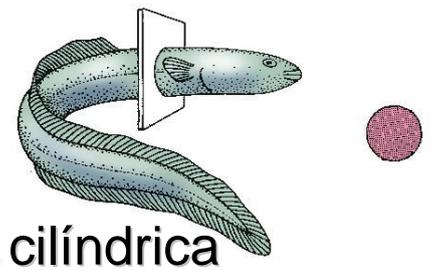
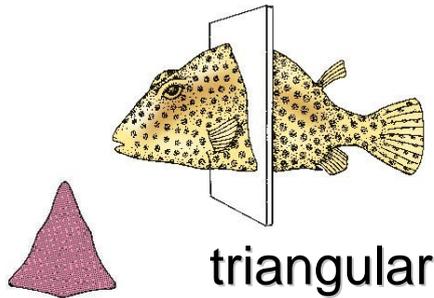
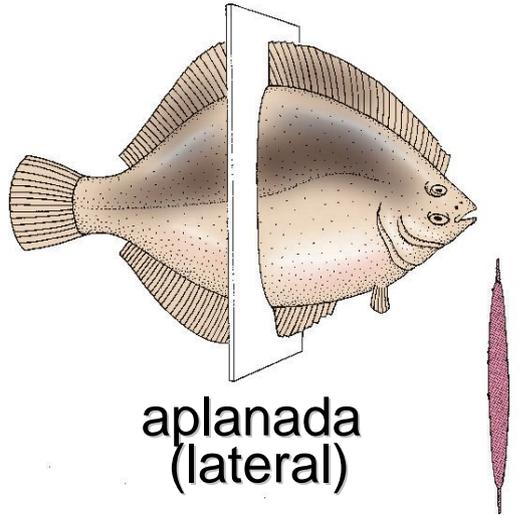
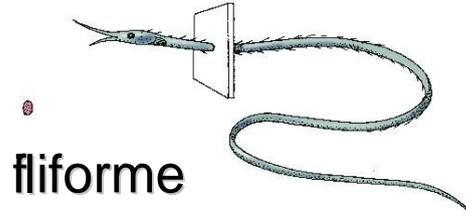
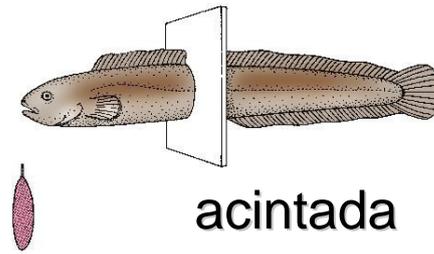
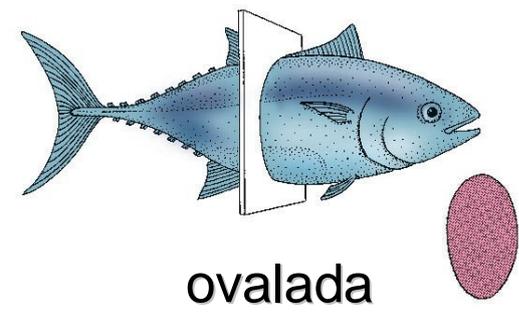


# Anatomía externa



# Forma del cuerpo

sección del cuerpo



# Forma del cuerpo



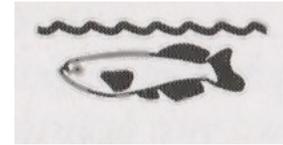
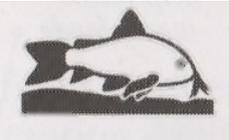
fusiforme



alto y comprimido



vientre plano



dorso plano



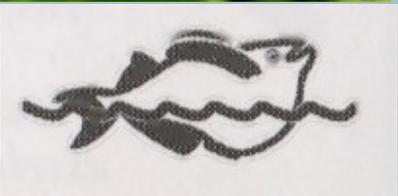
cilíndrico



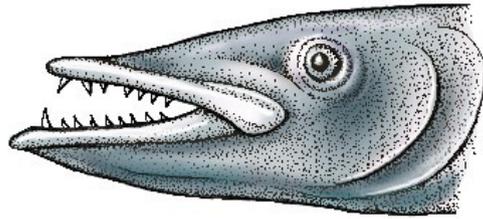
cilíndrico



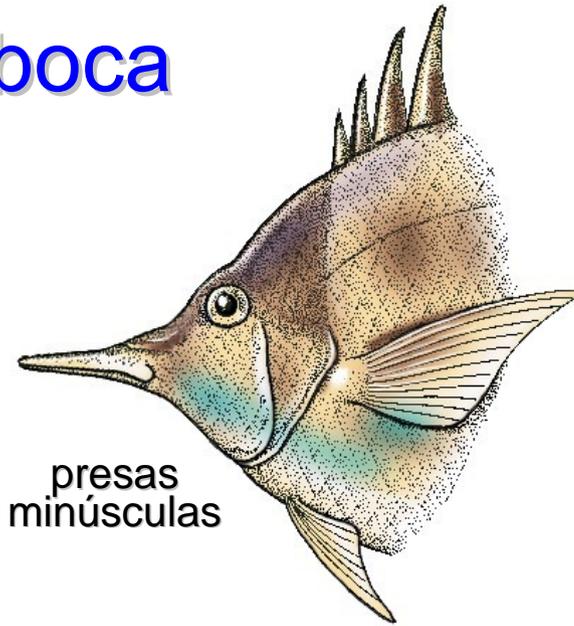
quilla alta



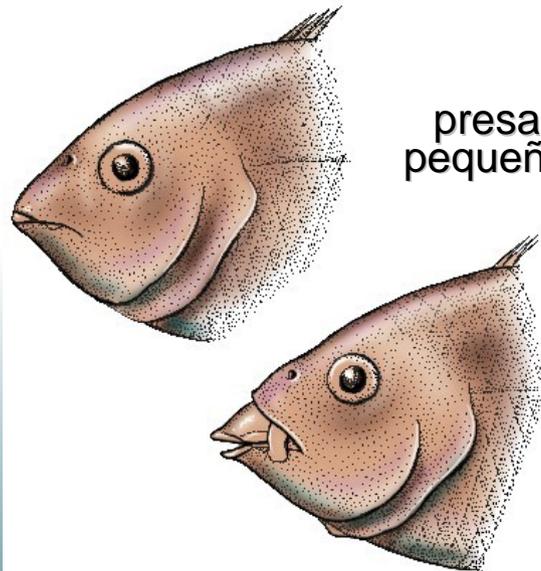
# diferentes tipos de boca



grandes presas

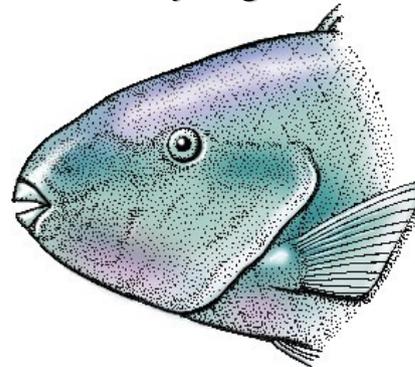


presas minúsculas

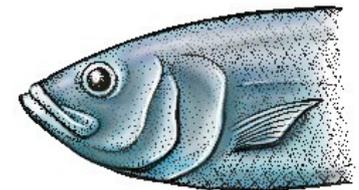


presas pequeñas

corales y algas



plancton



## BOCA TERMINAL



La boca terminal, tal como se aprecia en este pez lápiz dorado y en otras muchas especies de profundidades medias, se encuentra justo en el extremo del hocico, mirando siempre al frente. Las mandíbulas superior e inferior son de igual tamaño.

## BOCA HACIA ABAJO



Los peces que se alimentan en el substrato, como *Misgurnus anguillicaudatus*, presentan una mandíbula inferior más corta que la superior para facilitar la captura del alimento. Suelen disponer, además, de barbillones con papilas gustativas.

## BOCA HACIA ARRIBA



Los peces que se alimentan en la superficie, como el pez arquero, y algunas especies especializadas en plantas (sobre todo *Anostomus* sp.), presentan una mandíbula inferior más larga que la superior para capturar el alimento sin problemas.

## BOCA PROTUBERANTE



La boca protuberante, como la de este *Papiliochromis ramirezi*, es propia de especies predatoras. Gracias a su compleja estructura, el pez puede proyectar hacia delante las mandíbulas y, de ese modo, ofrecer un radio de acción mayor.

## BOCA VENTRAL



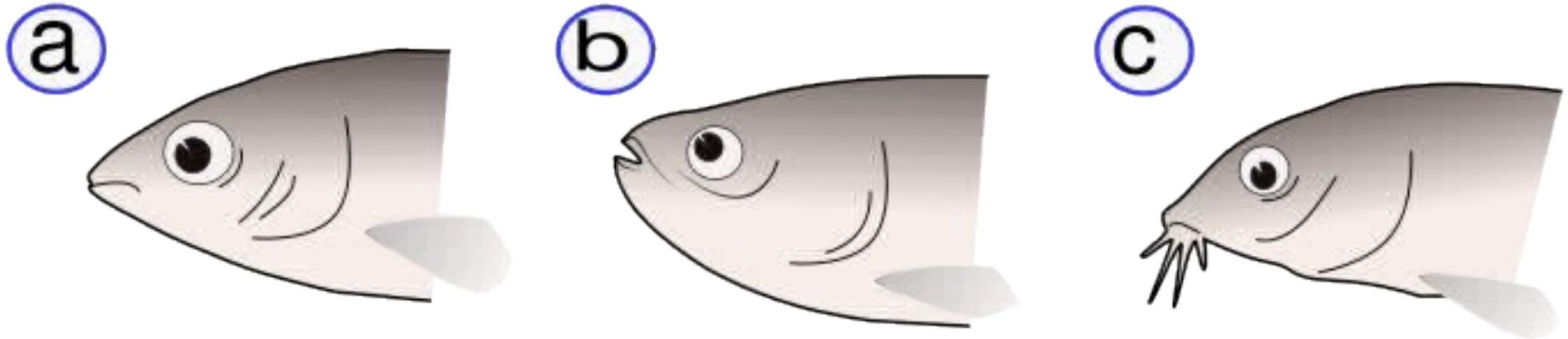
El siluriforme *Ancistrus* se fija firmemente al suelo con los labios para no ser arrastrado por la corriente del agua. La boca ventral cuenta con dientes puntiagudos y diminutos con los que despedazan las algas de que se alimentan.

## BOCA ALARGADA



La boca alargada permite a los lábridos hocico de ave, de agua salada, alimentarse con total soltura por entre los bancos de coral. Los peces de agua dulce que tienen este tipo de boca se valen de ella para escarbar en el substrato en busca de alimento.

# Posición de la boca



- a) terminal
- b) supra
- c) inferior



# órganos accesorios junto a la boca

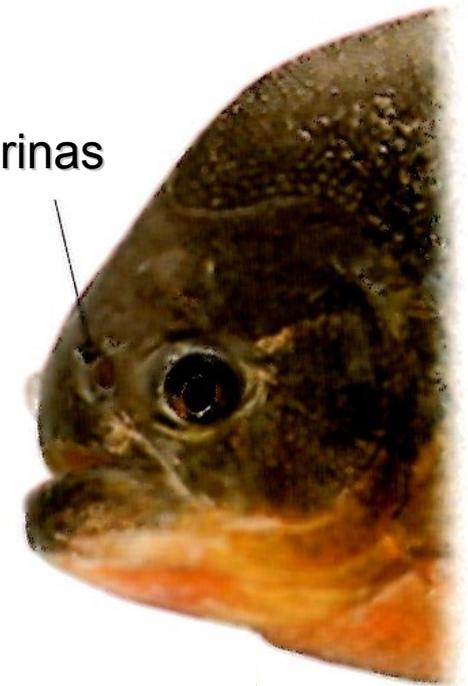
narinas



mandíbula inferior



aletas pélvicas

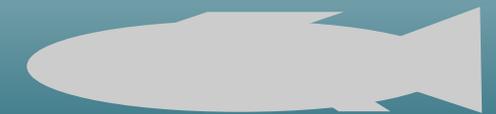
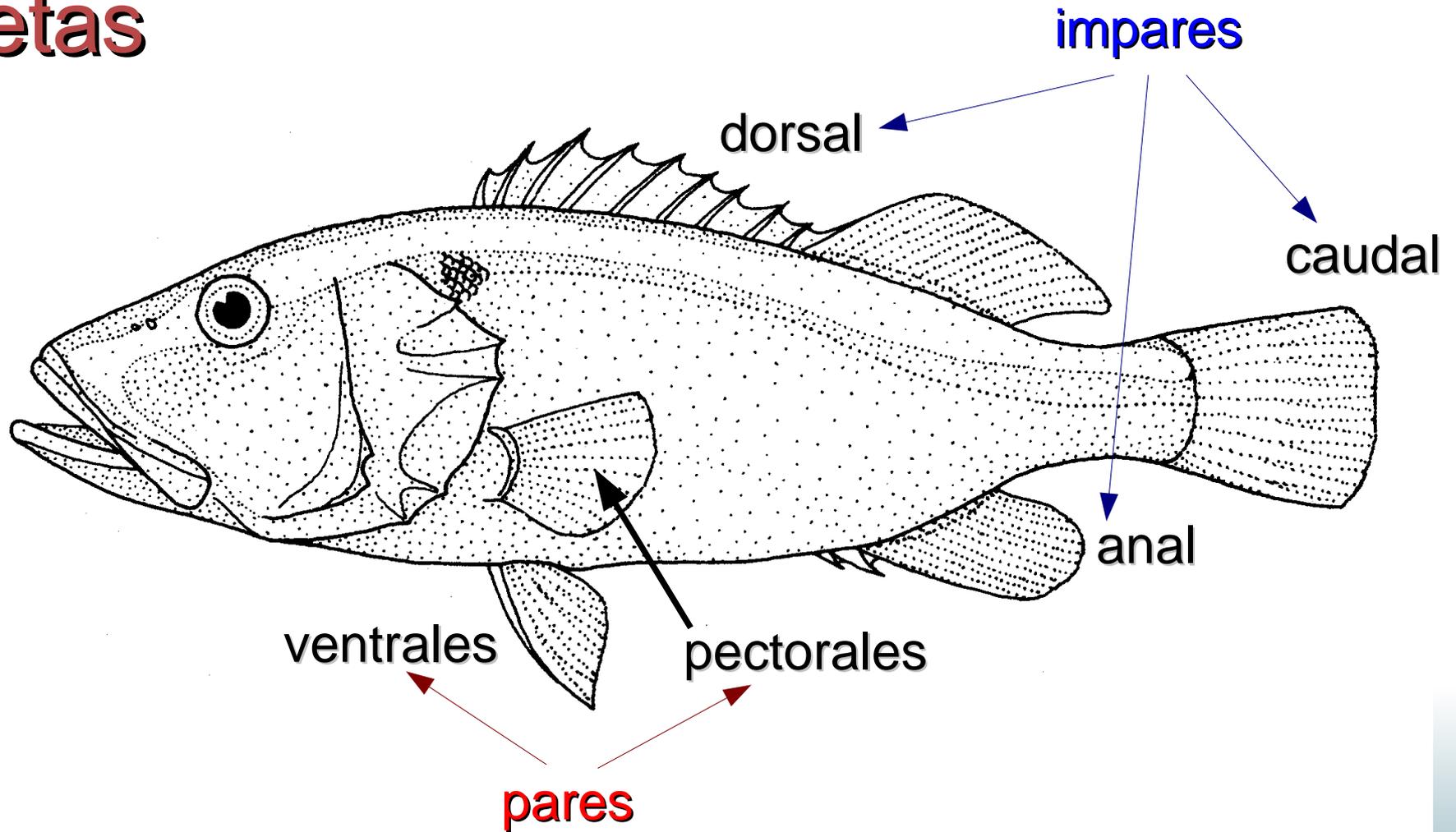


cirros



barbillones

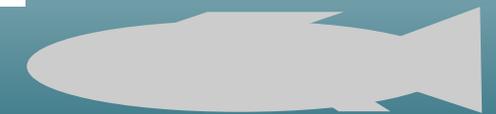
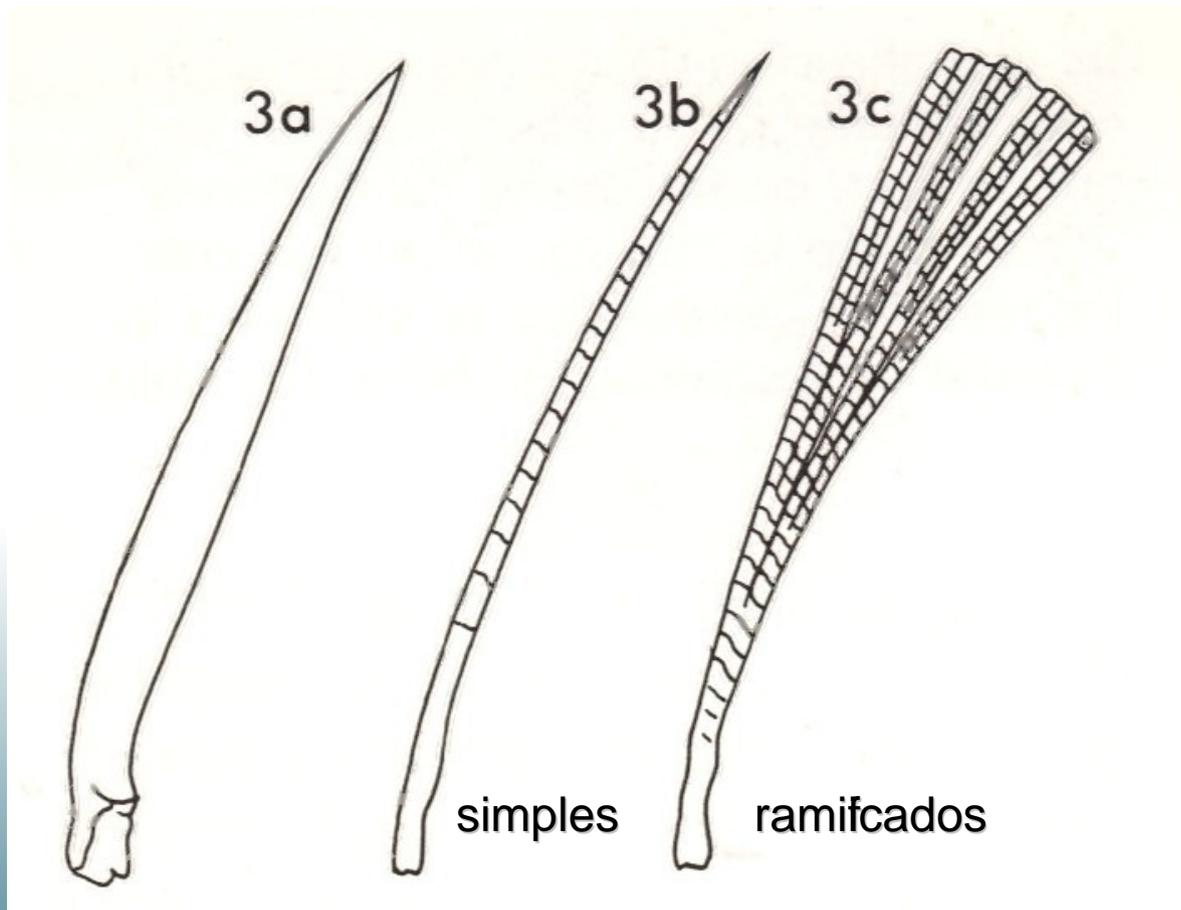
# aletas



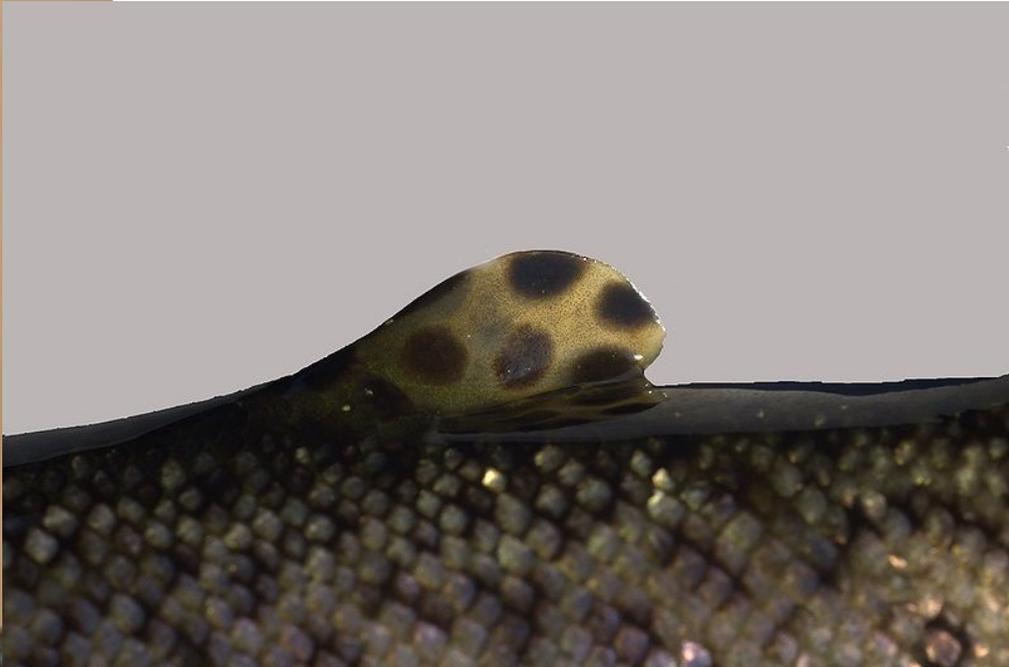
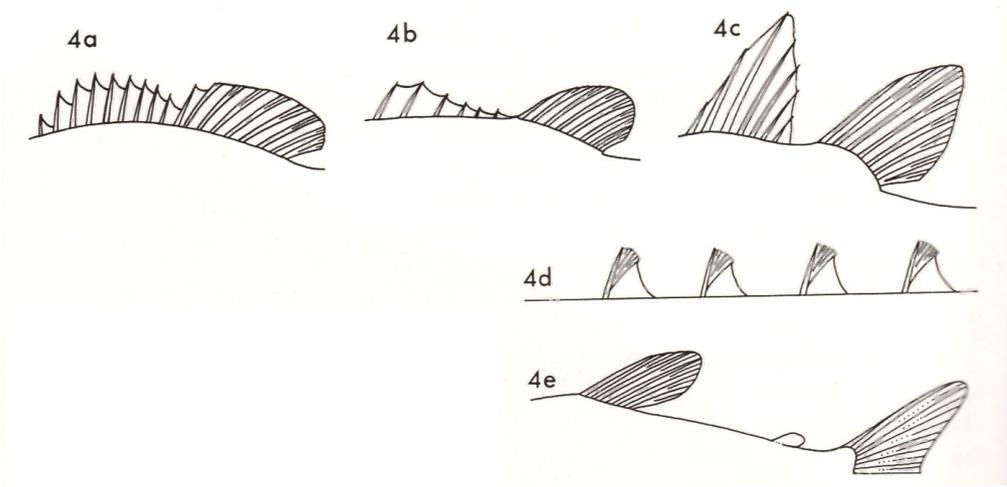
# radios

duros

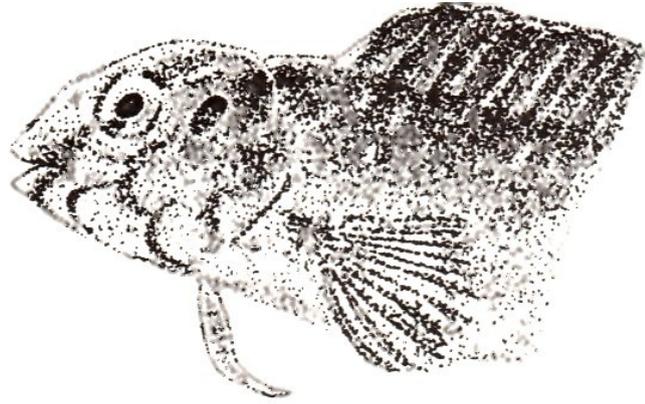
blandos



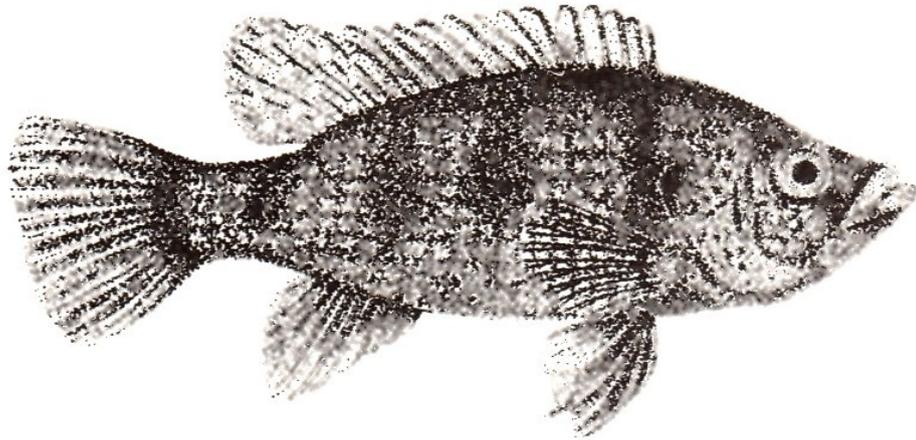
# formas de la aleta dorsal



# posición de las aletas



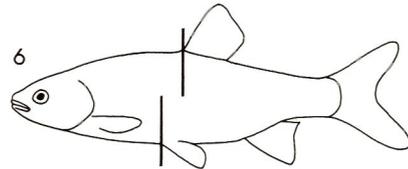
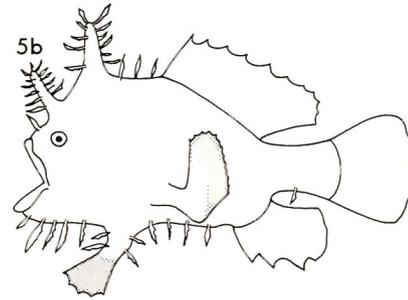
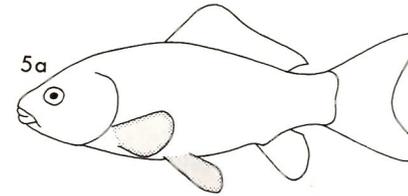
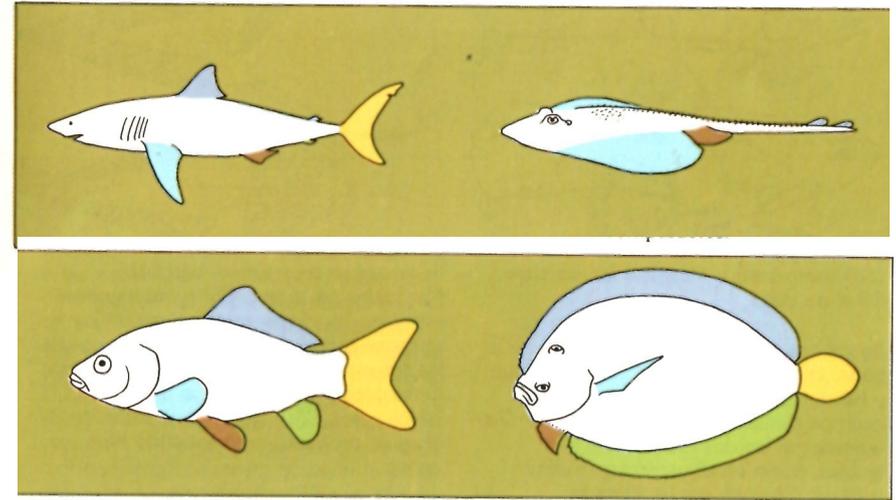
Ventrales yugulares (blénidos)



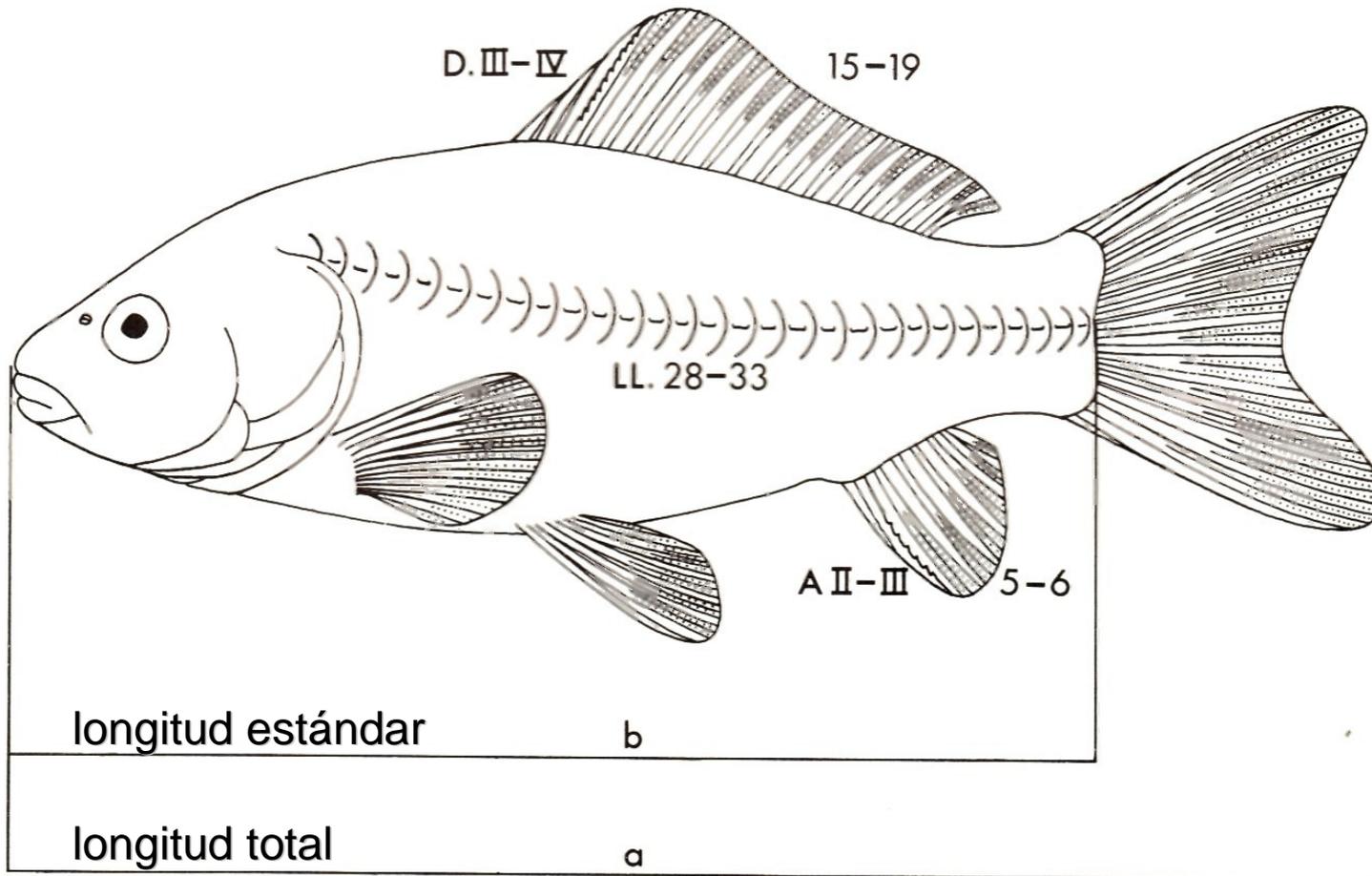
Ventrales torácicas (cíclidos)



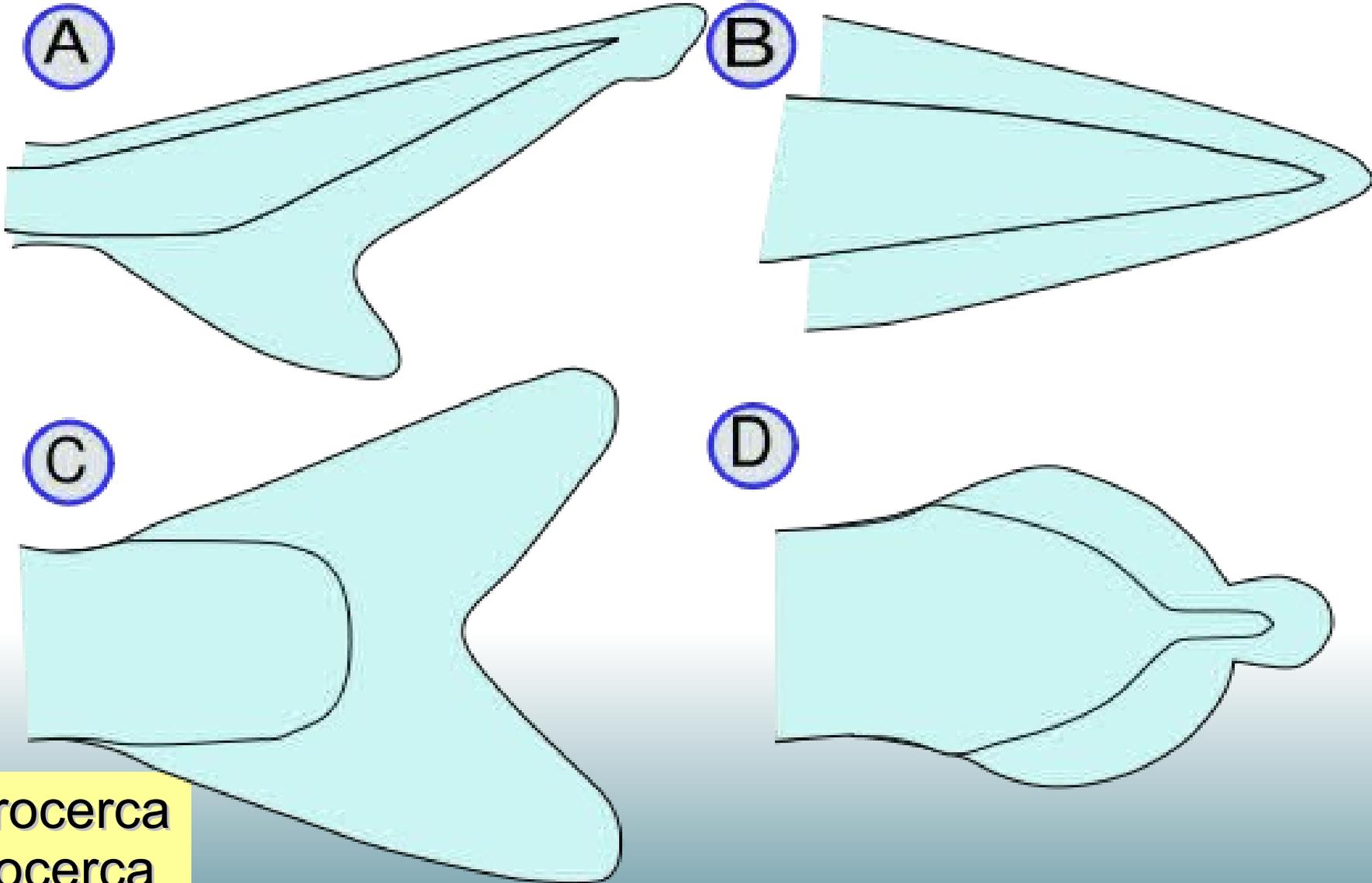
Ventrales abdominales (ciprinodóntidos)



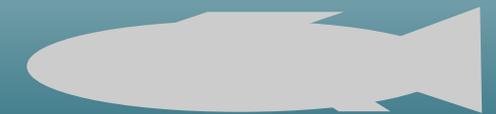
# fórmula de las aletas y línea lateral



# tipos de aleta caudal

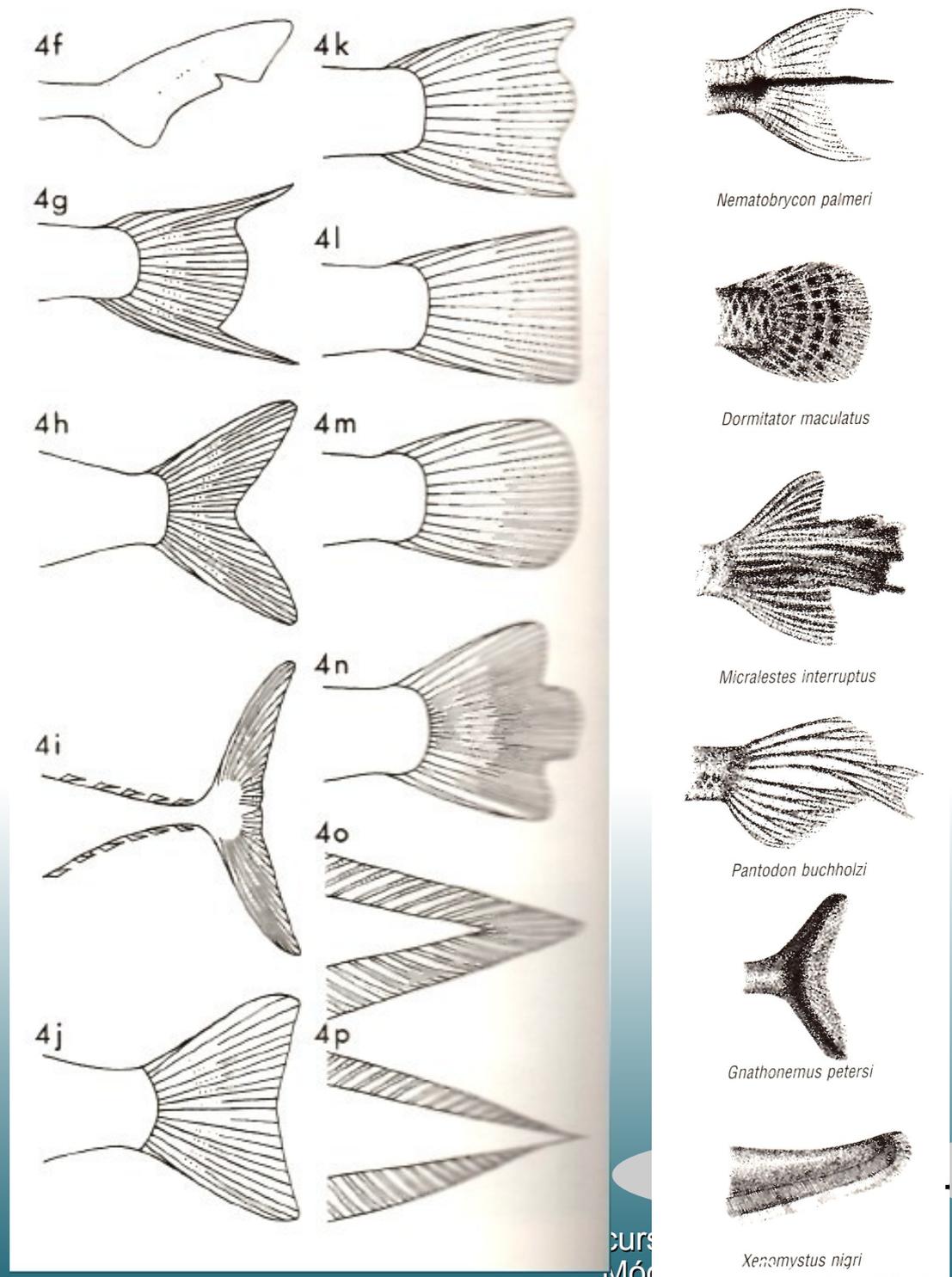


- A – Heterocerca
- B – Homocerca
- C – Proterocerca
- D – Isocerca

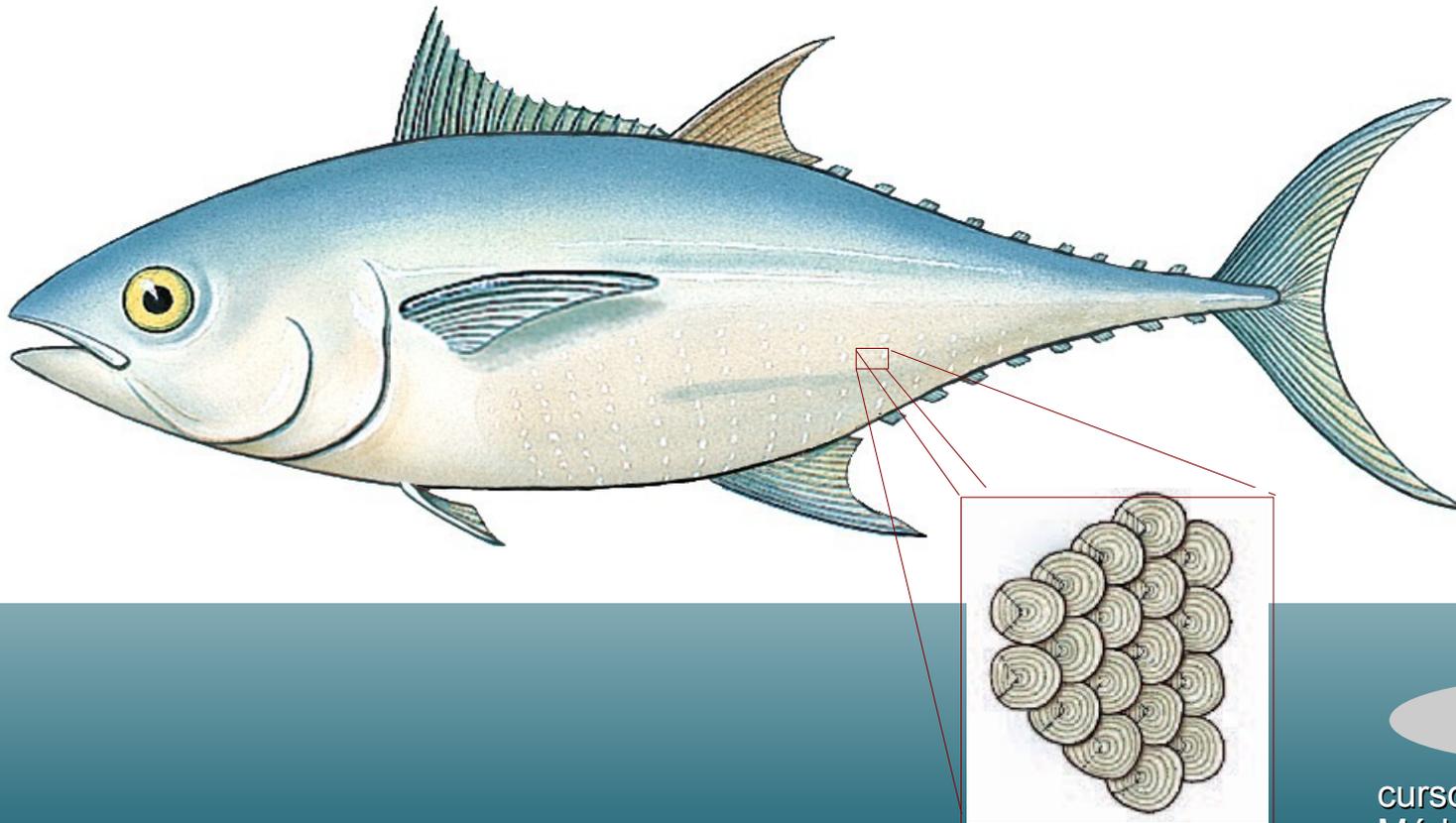
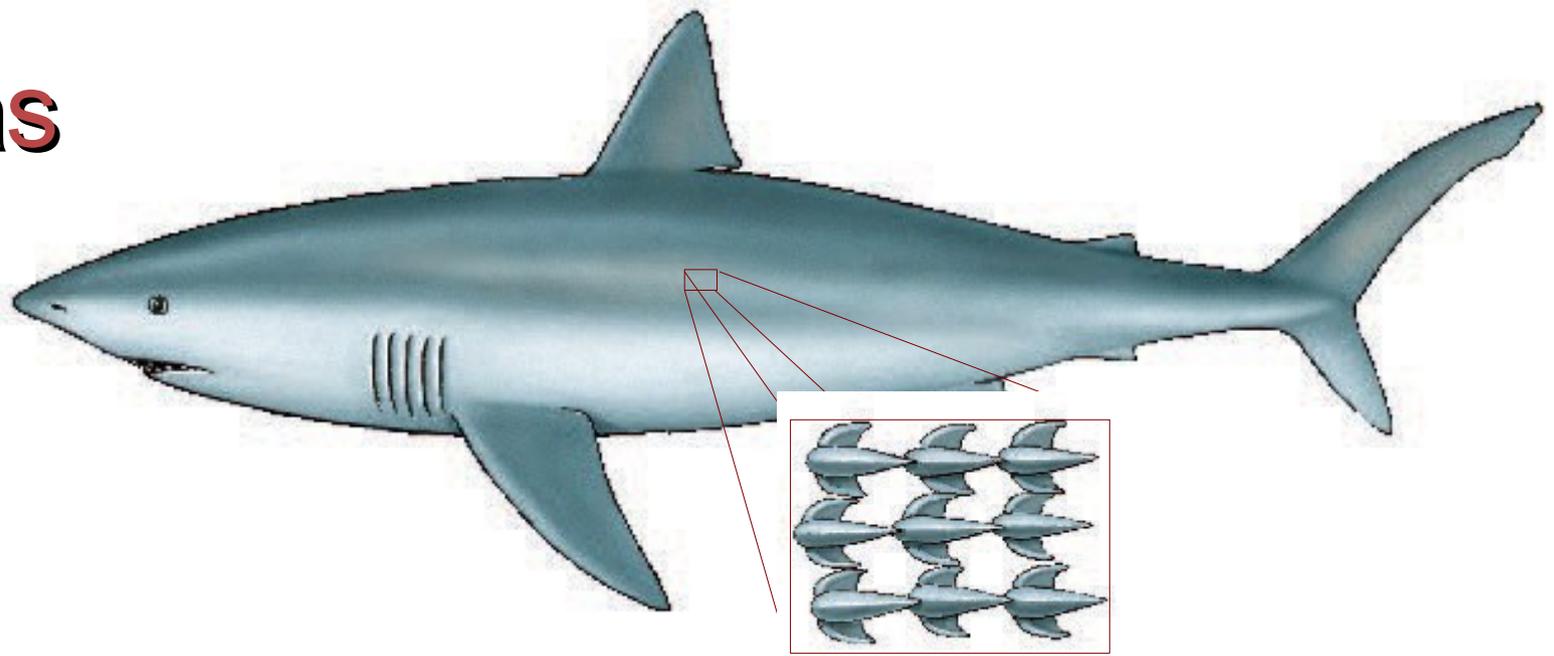


# formas de la aleta caudal

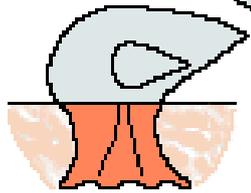
- f) heterocerca
- g) lirada
- h) bifurcada
- i) lunada
- j) indentada
- k) doblemente indentada
- l) truncada
- m) redondeada
- n) radios medios alargados
- o) aguda o confluyente
- p) desnuda



# escamas



## Escamas placoideas



Vista lateral

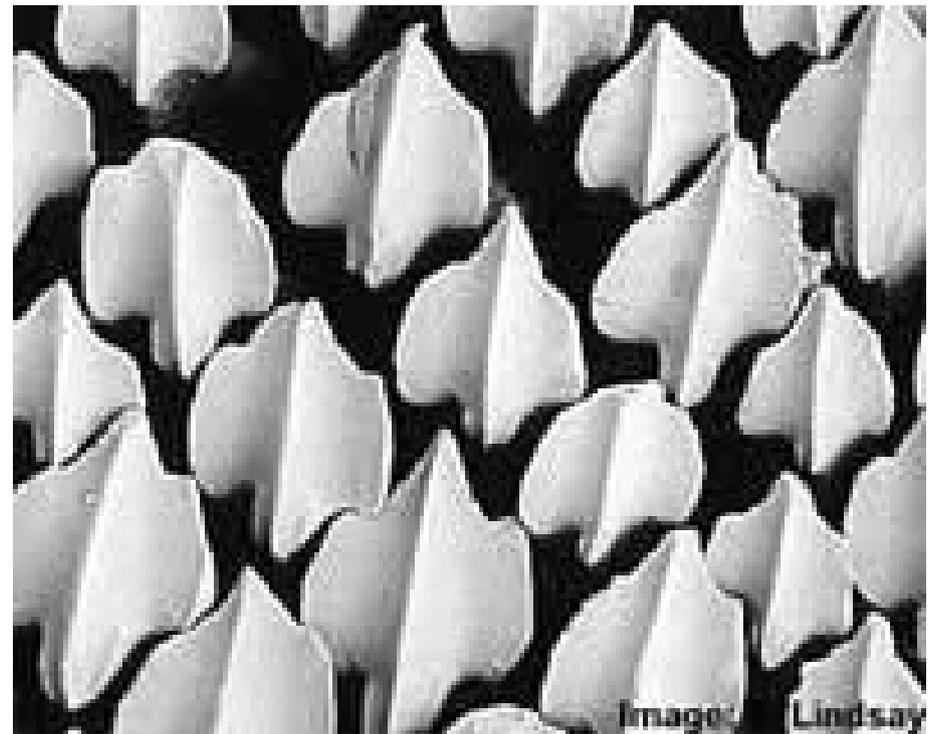
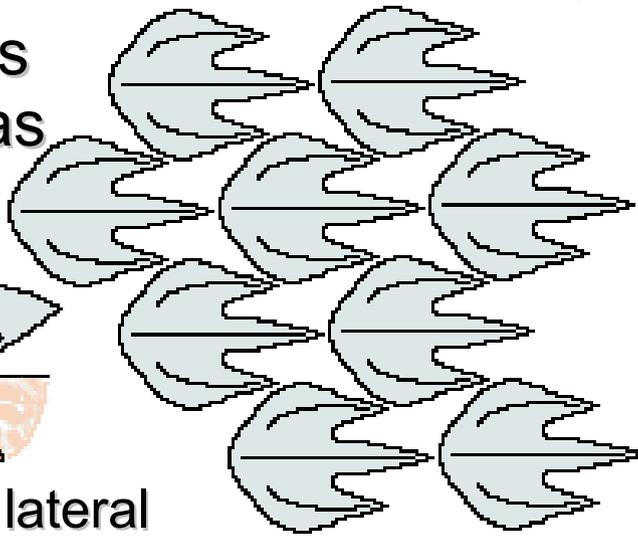
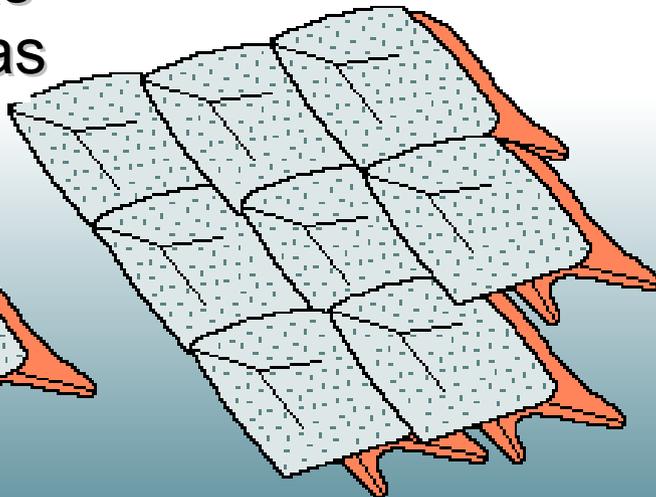
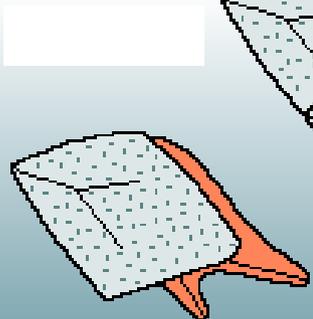


Image: Lindsay

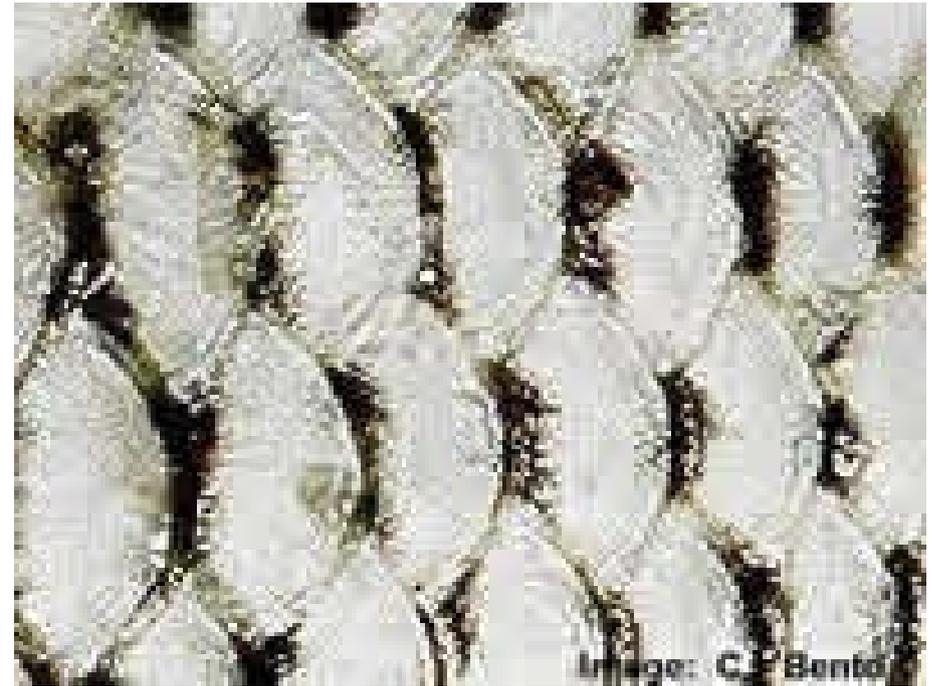
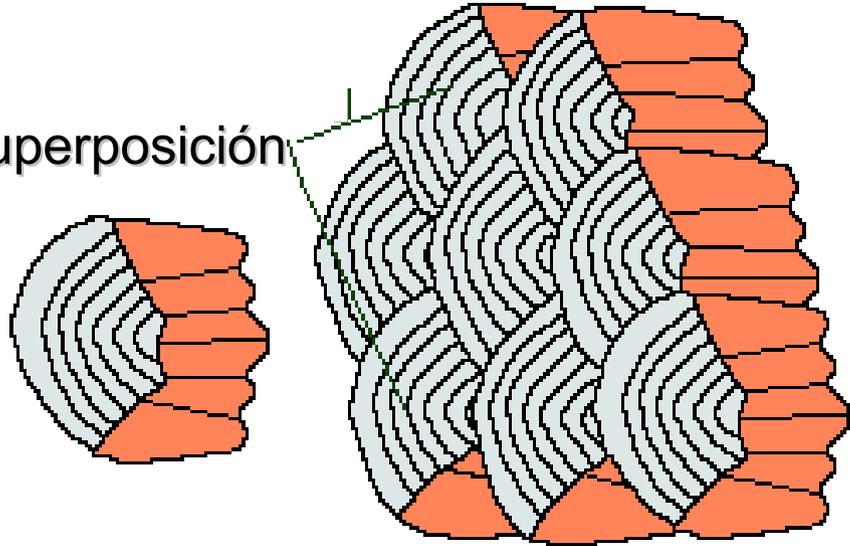
## Escamas ganoideas



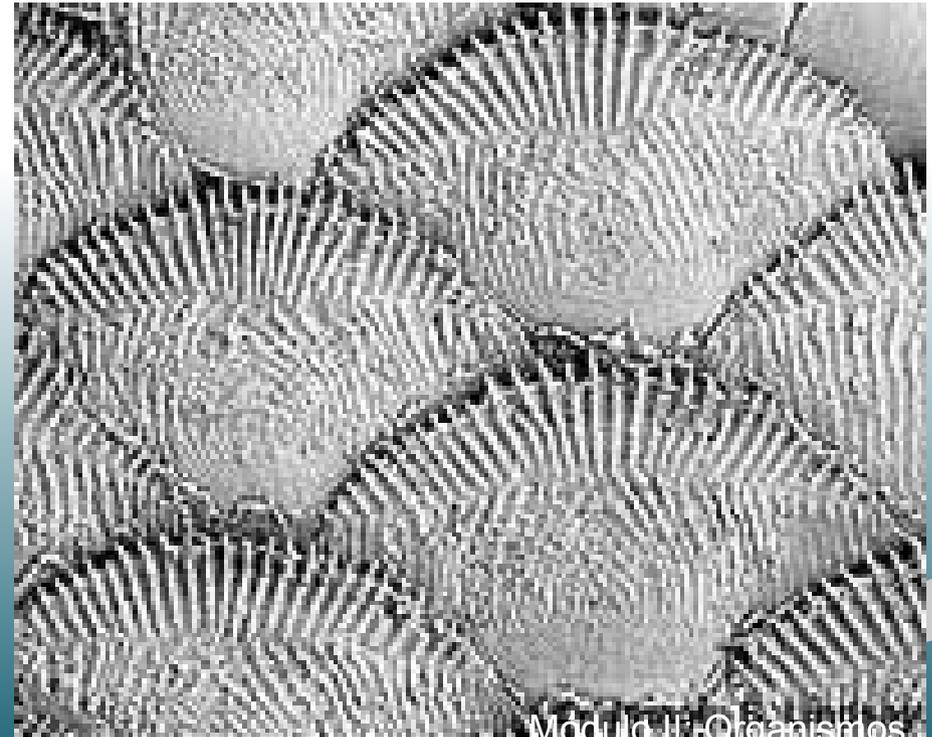
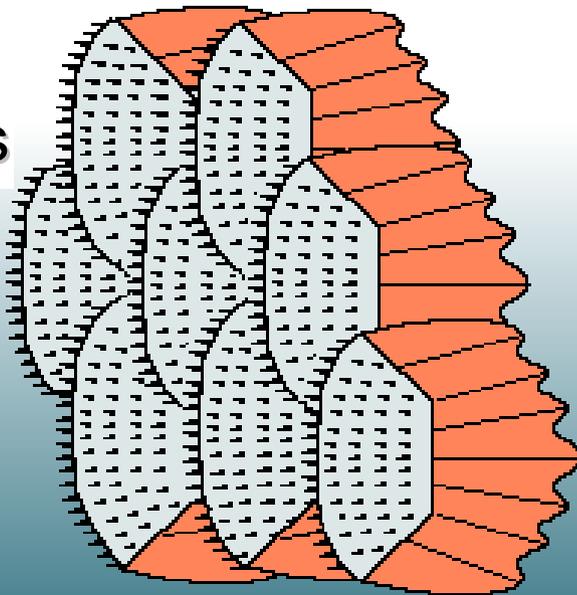
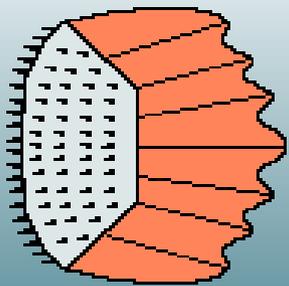
Módulo II: Organismos  
Image: C. Bento

# Escamas cicloideas

superposición



# Escamas ctenoideas



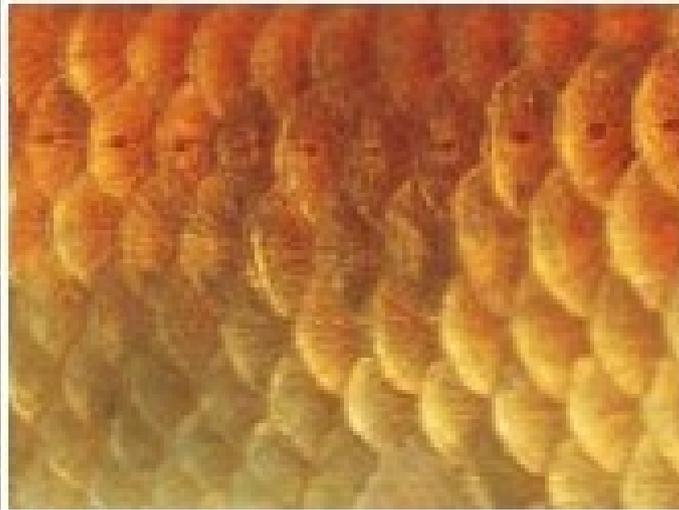
# protección dérmica

cuerpo cubierto de mucus



escamas ctenoideas

*Pomacanthus*



escamas cicloideas

*Carassius*



placas óseas

*Corydoras*

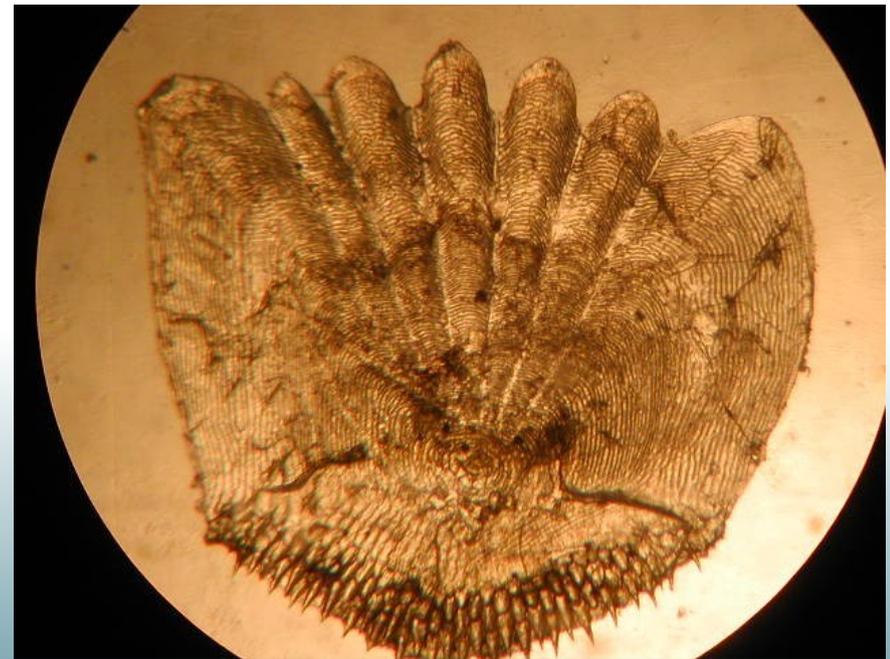


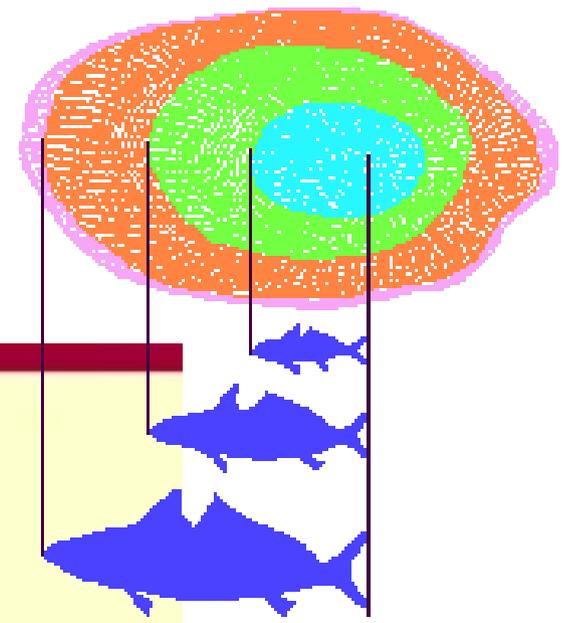
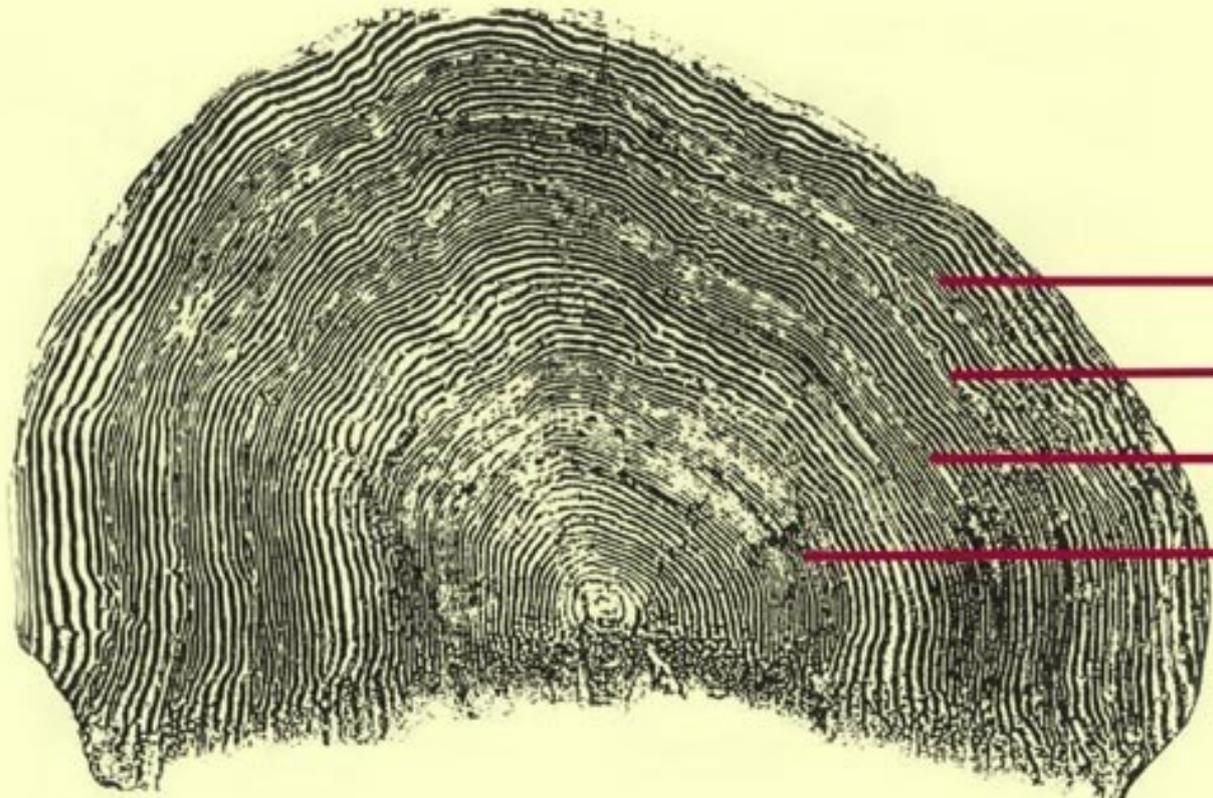
piel descubierta

*Synodontis*



# líneas de crecimiento





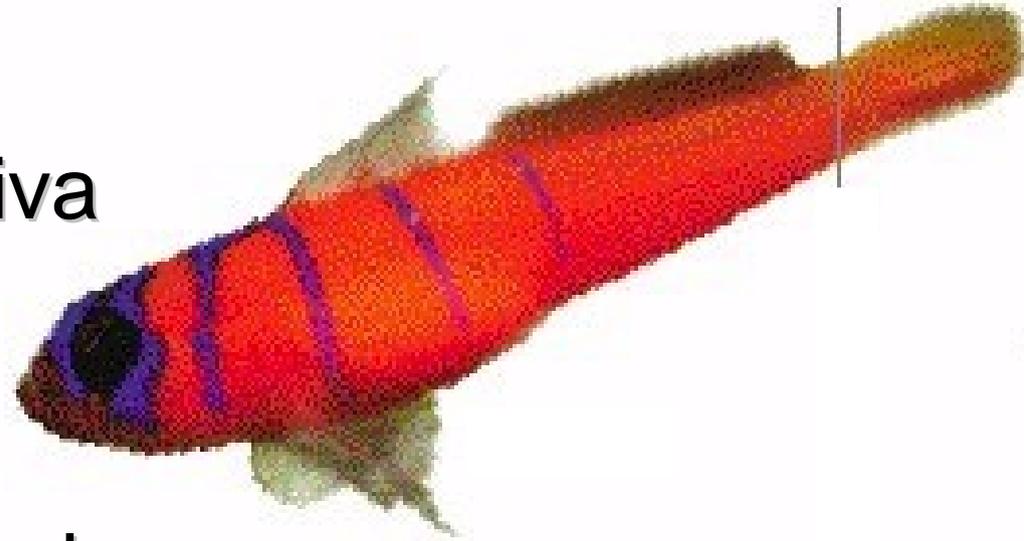
- Fourth Annulus
- Third Annulus
- Second Annulus
- First Annulus



# Color

## Camuflaje

- contrasombreado
- mimetismo
- coloración disruptiva



## Comunicación

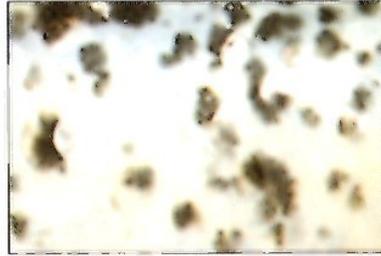
- señalización territorio
- reconocimiento sexual
- advertencia peligrosidad



# Coloración en los peces



**DISIMULAR LA FORMA**  
coloración disruptiva



**PRODUCCIÓN DEL COLOR**  
refejo o pigmento



**MIMETISMO**  
coloración críptica



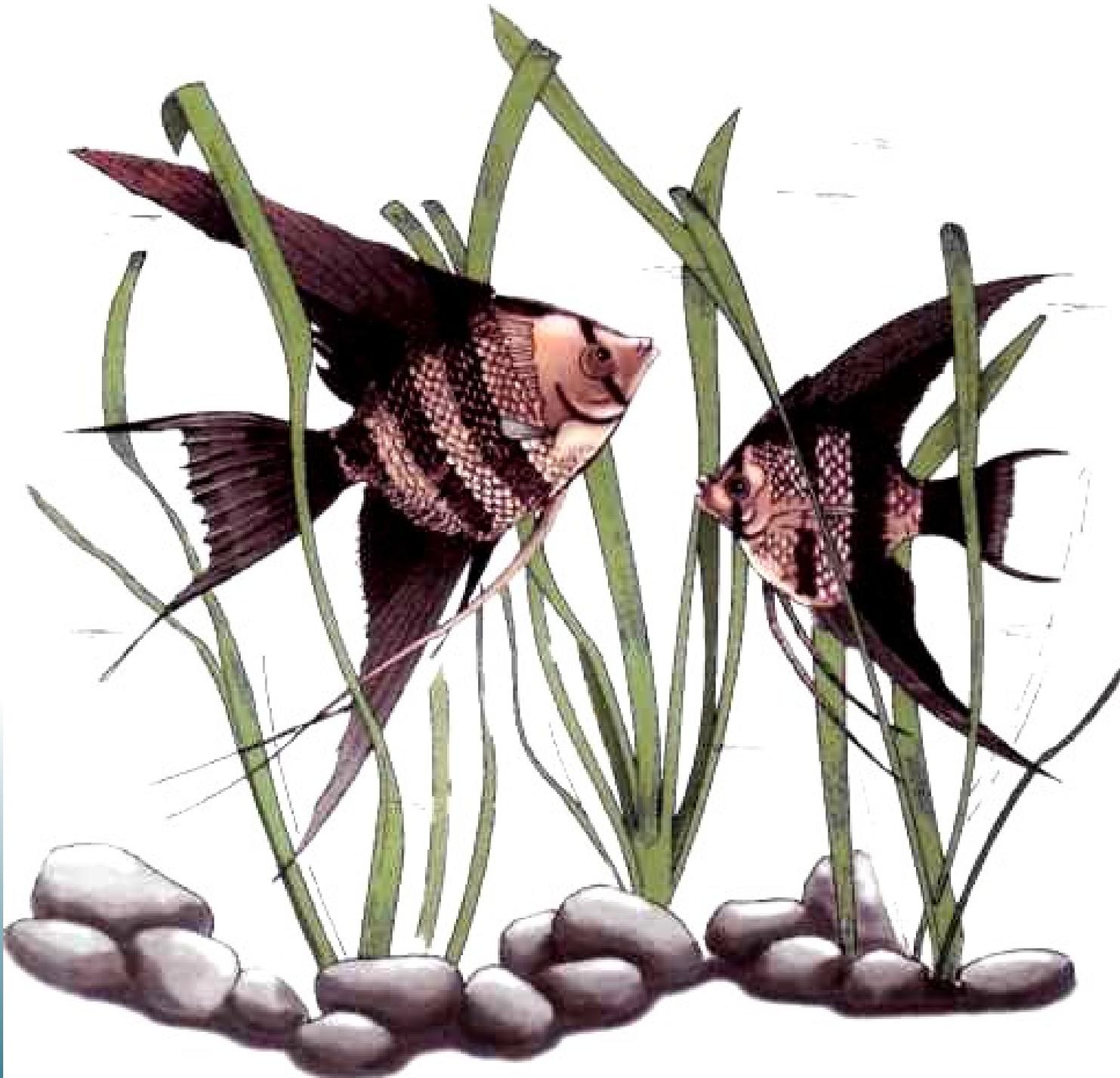
**DIFERENCIA DE EDAD**  
juvenil y adulto



**RECONOCIMIENTO**  
coloración distintiva



mimetismo



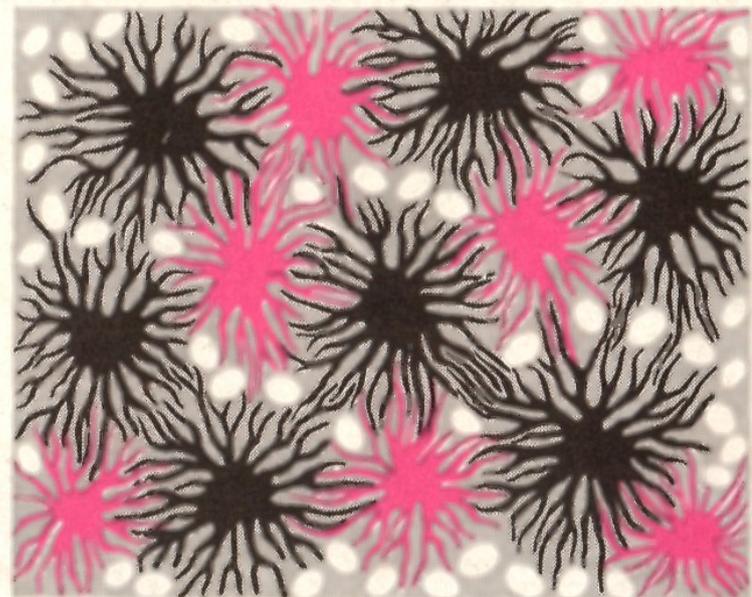
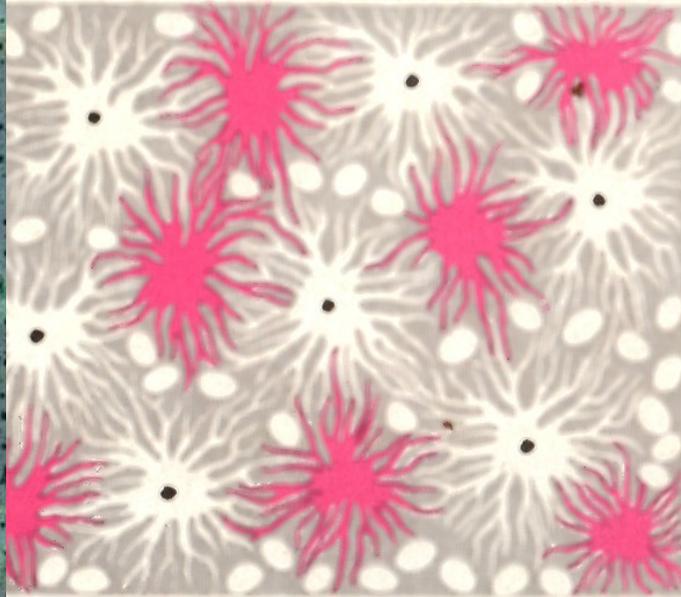
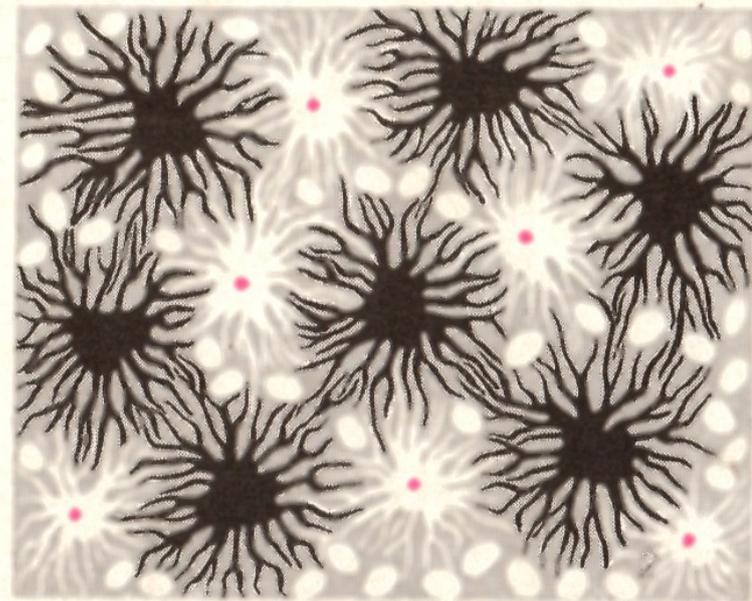
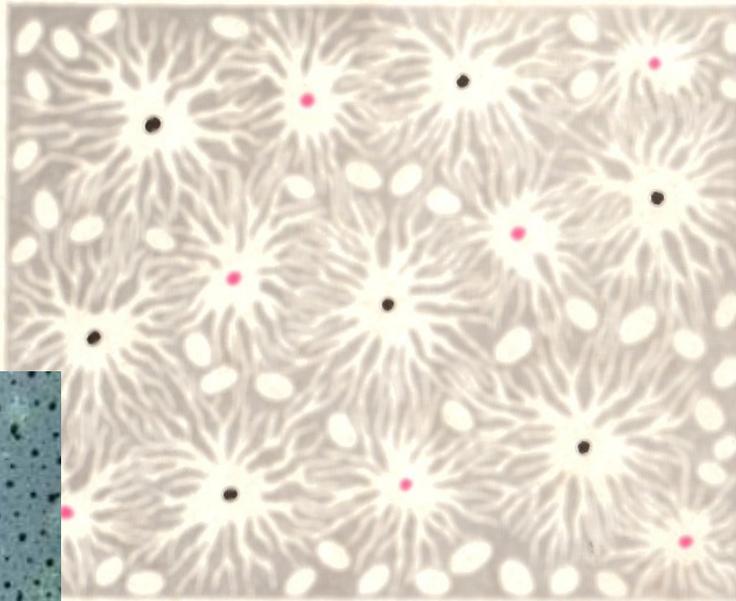


coloración  
disruptiva

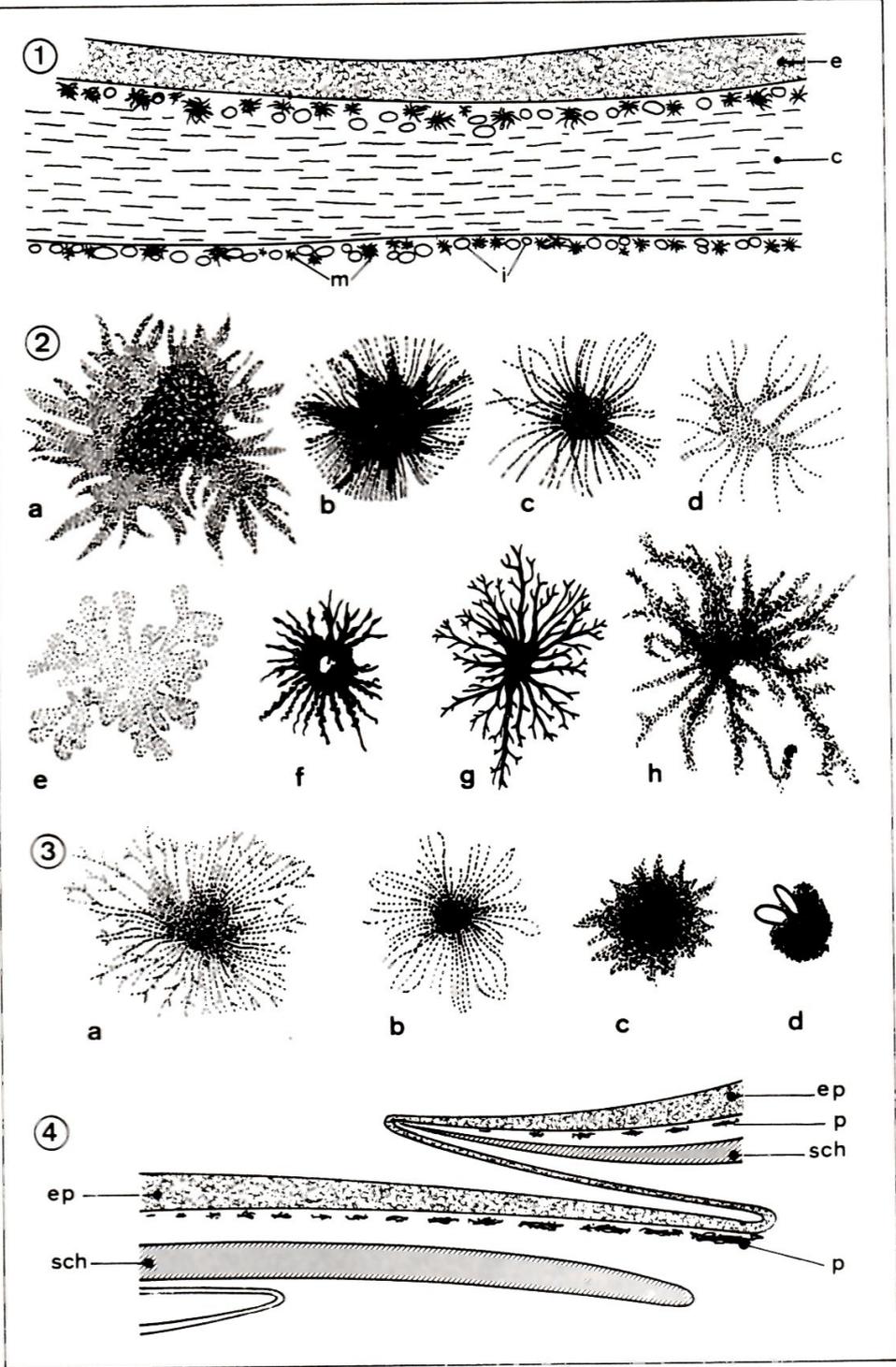




# Cromatóforos



# Posición y formas de los cromatóforos

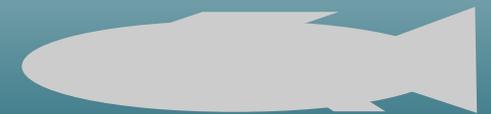
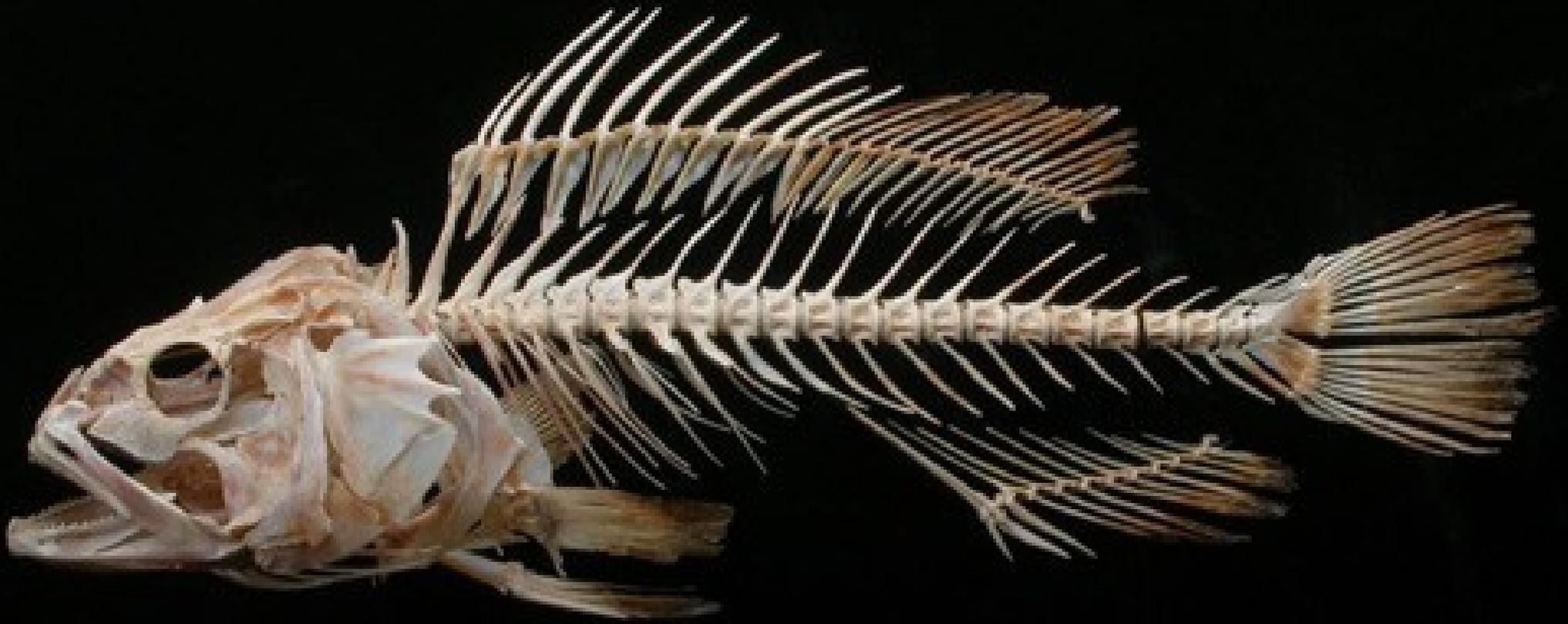


# Tipos de cromatóforos

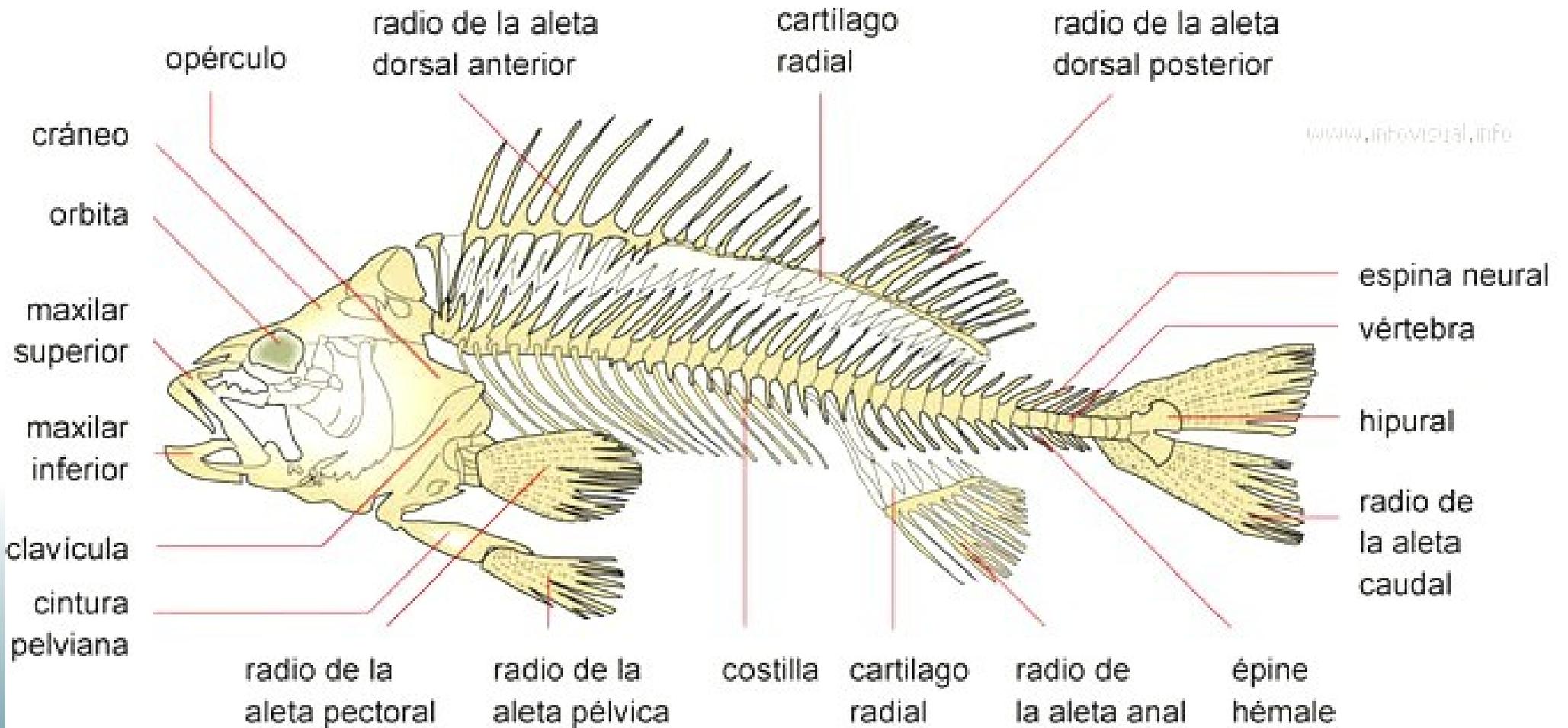
<b>Cromatóforo</b>	<b>Pigmento</b>	<b>Tipo</b>	<b>Colores</b>
Melanóforo	Melaninas	Color	Negro, Pardo
Xantóforo	Carotenoides	Color	Rojo, Naranja, Amarillo
Iridóforo	Guanina	Ref ectante	Blanco, Plateado, Azul, Violeta



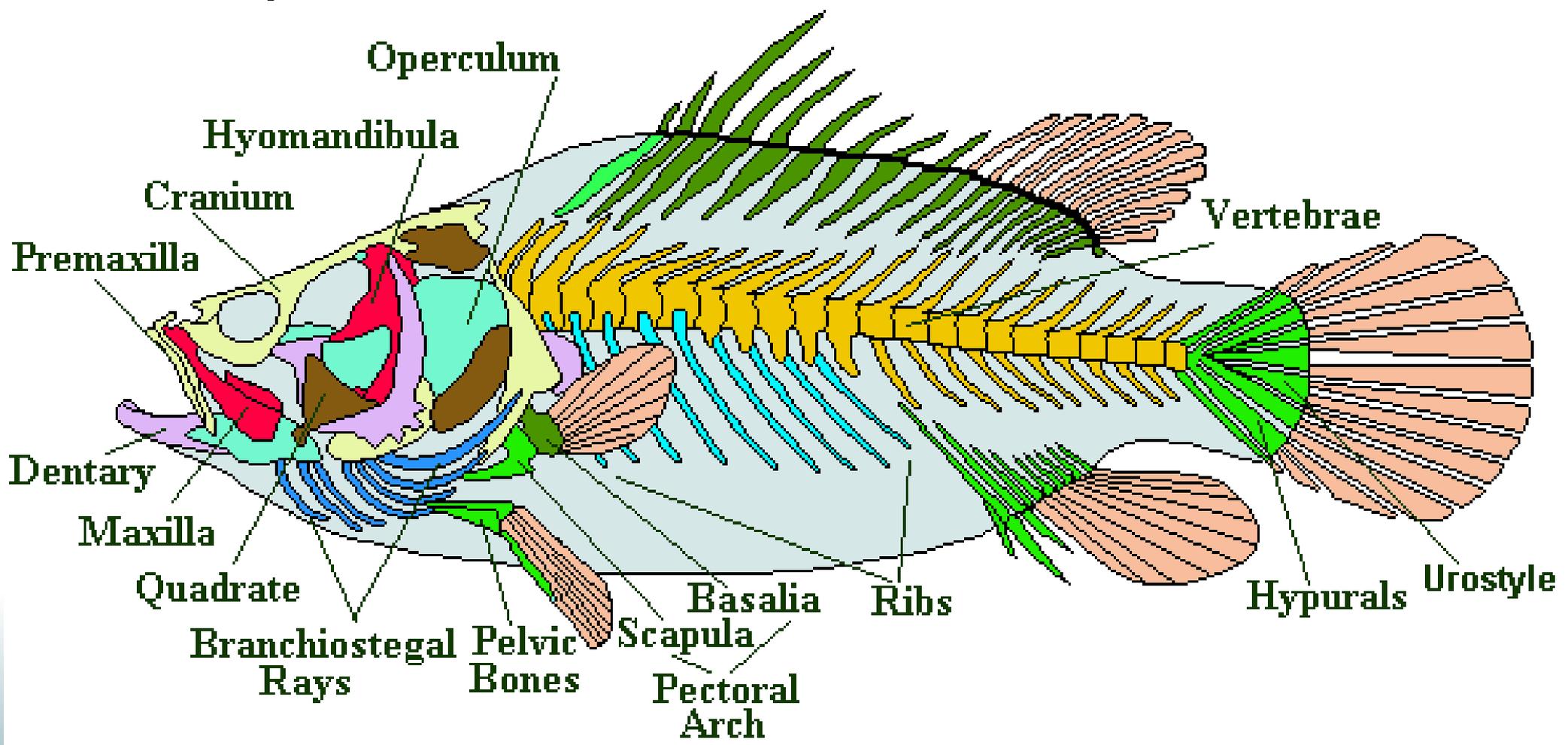
# Esqueleto



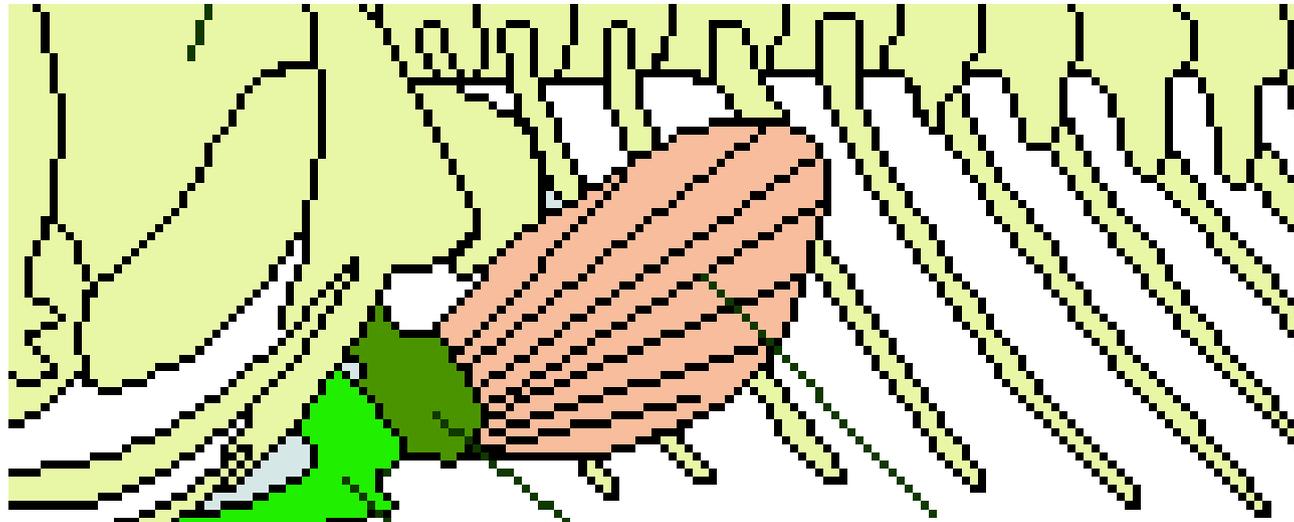
# Esqueleto



# Esqueleto



# Aletas pares



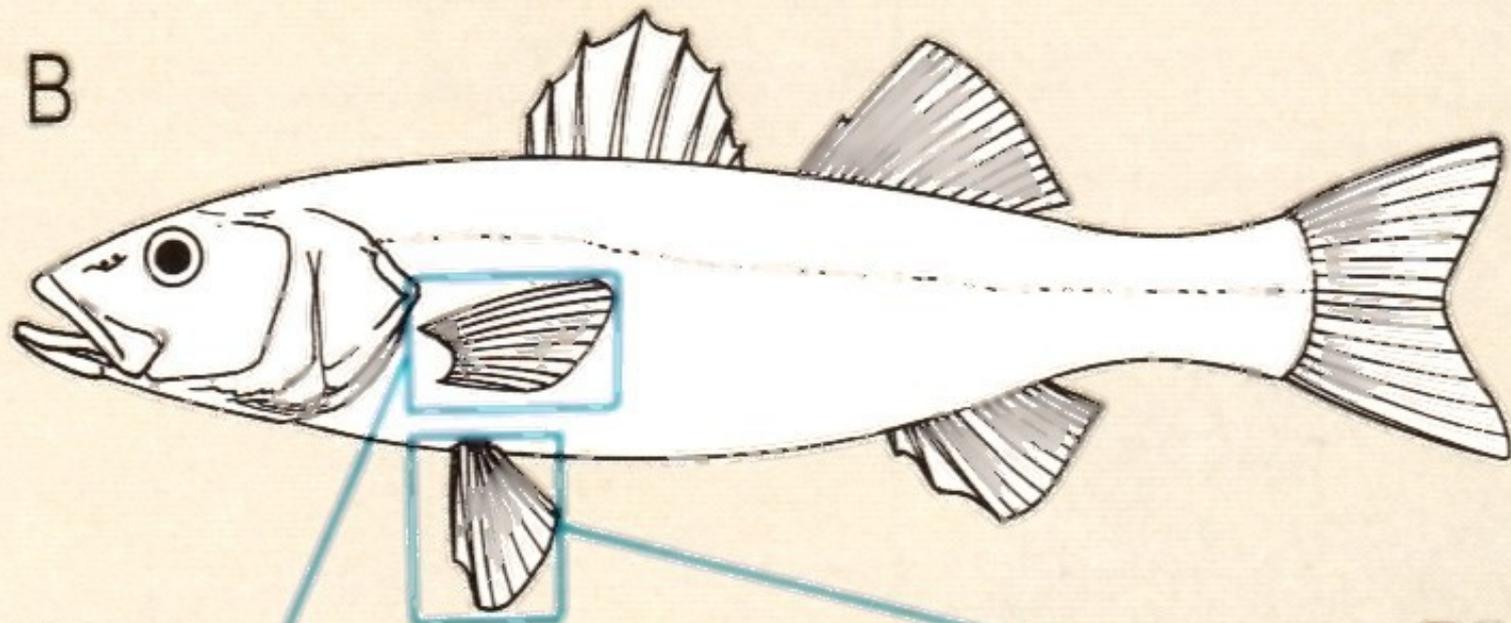
radios de la aleta pectoral

cintura  
pélvica

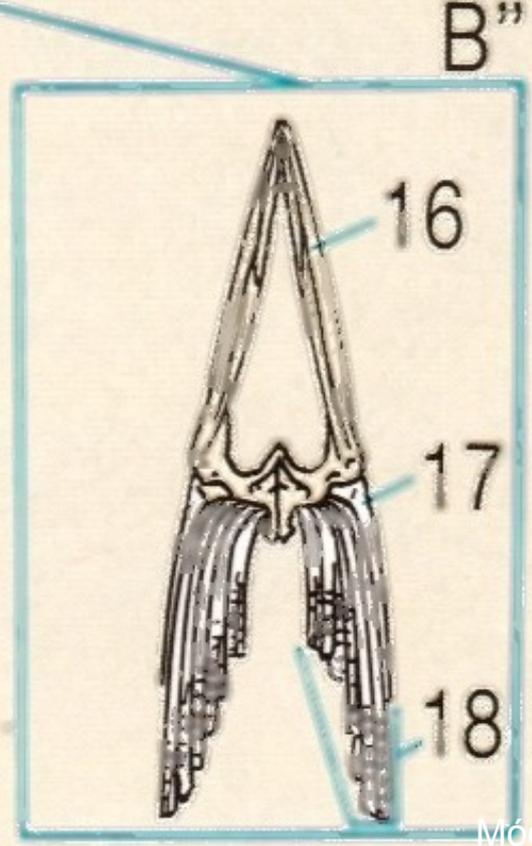
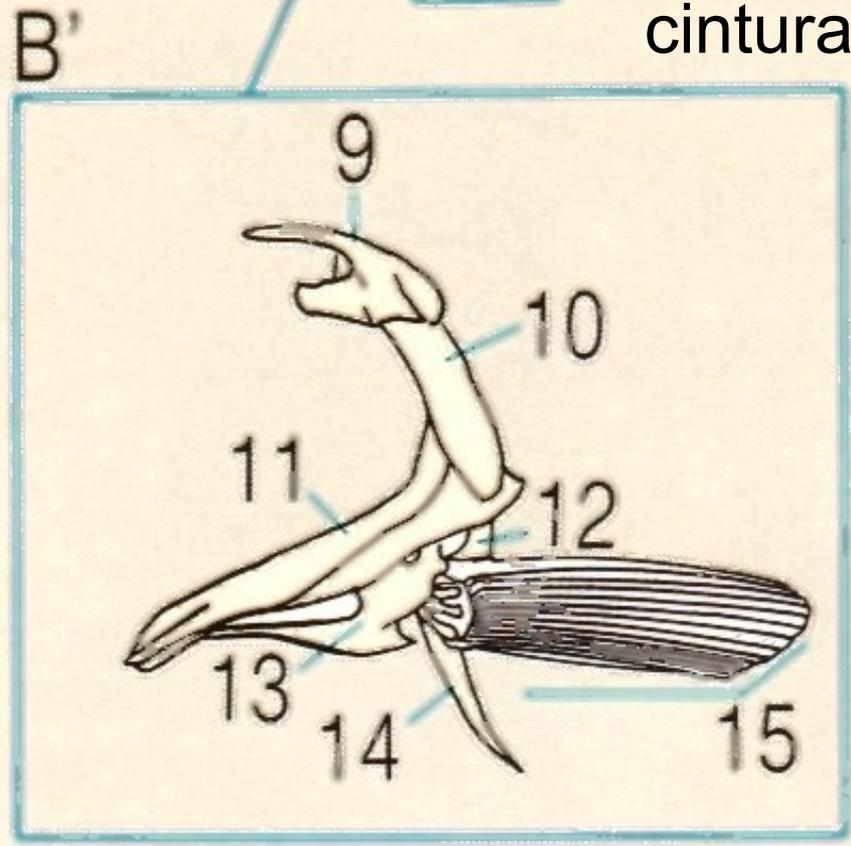
cintura pectoral

radios de la  
aleta pélvica





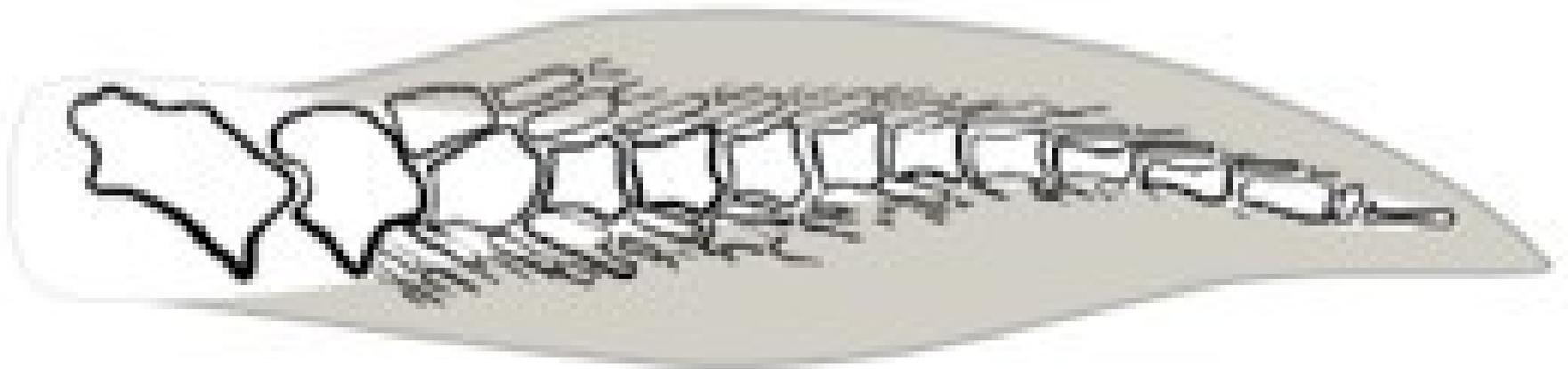
cinturas





**aletas radiadas**

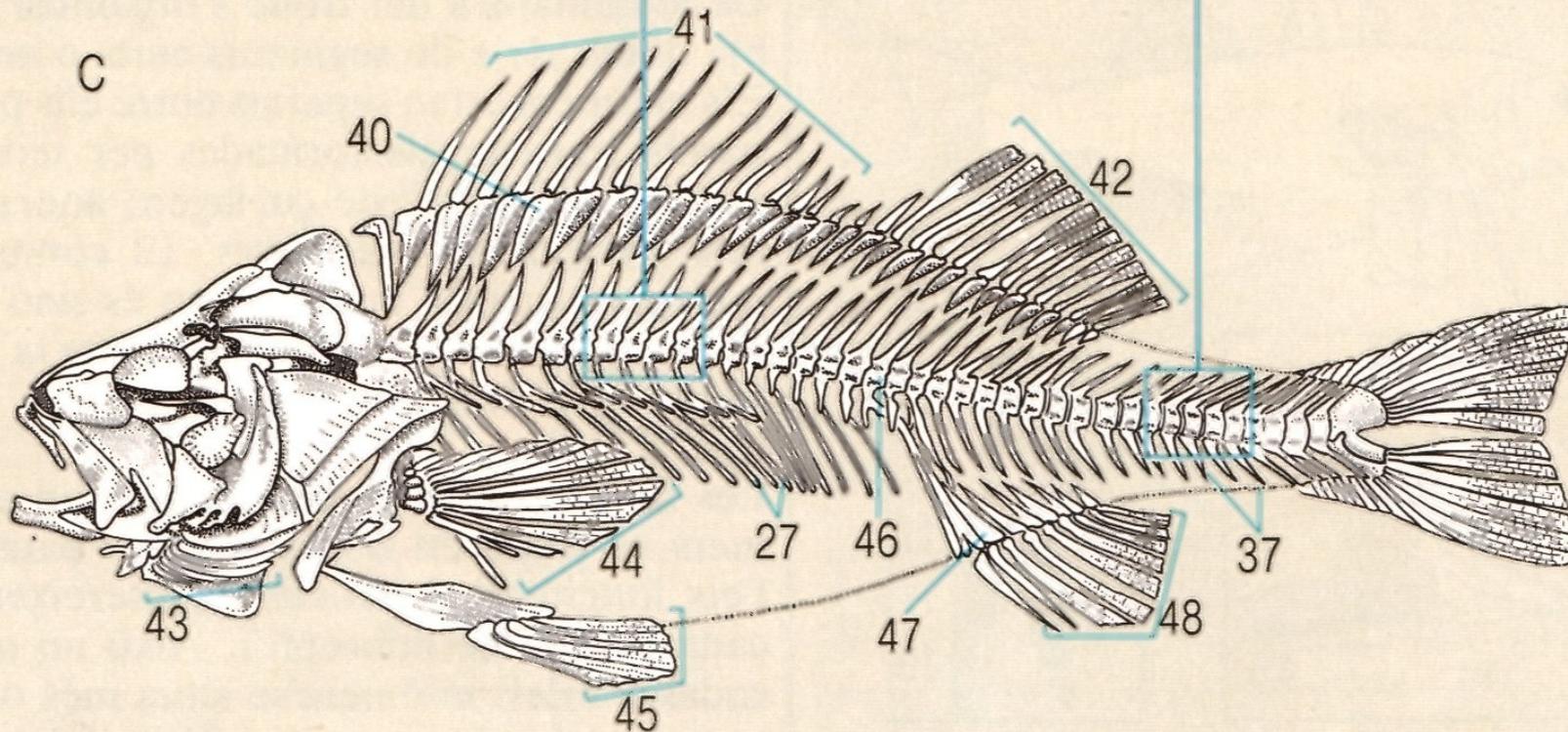
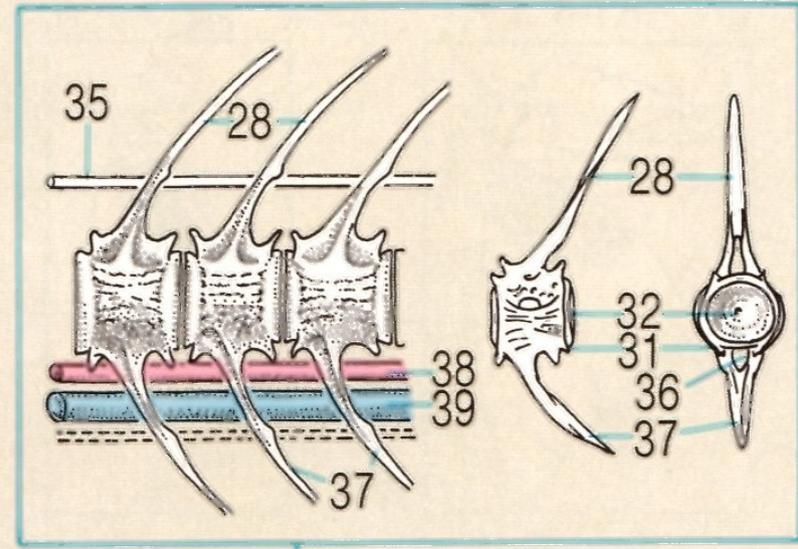
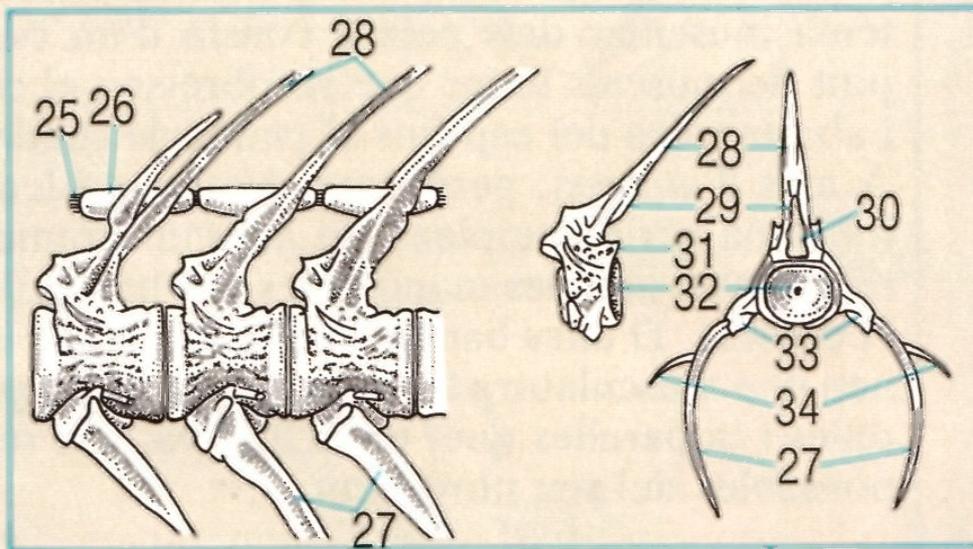
**ciprínido**



**aletas lobuladas**

**pez pulmonado**

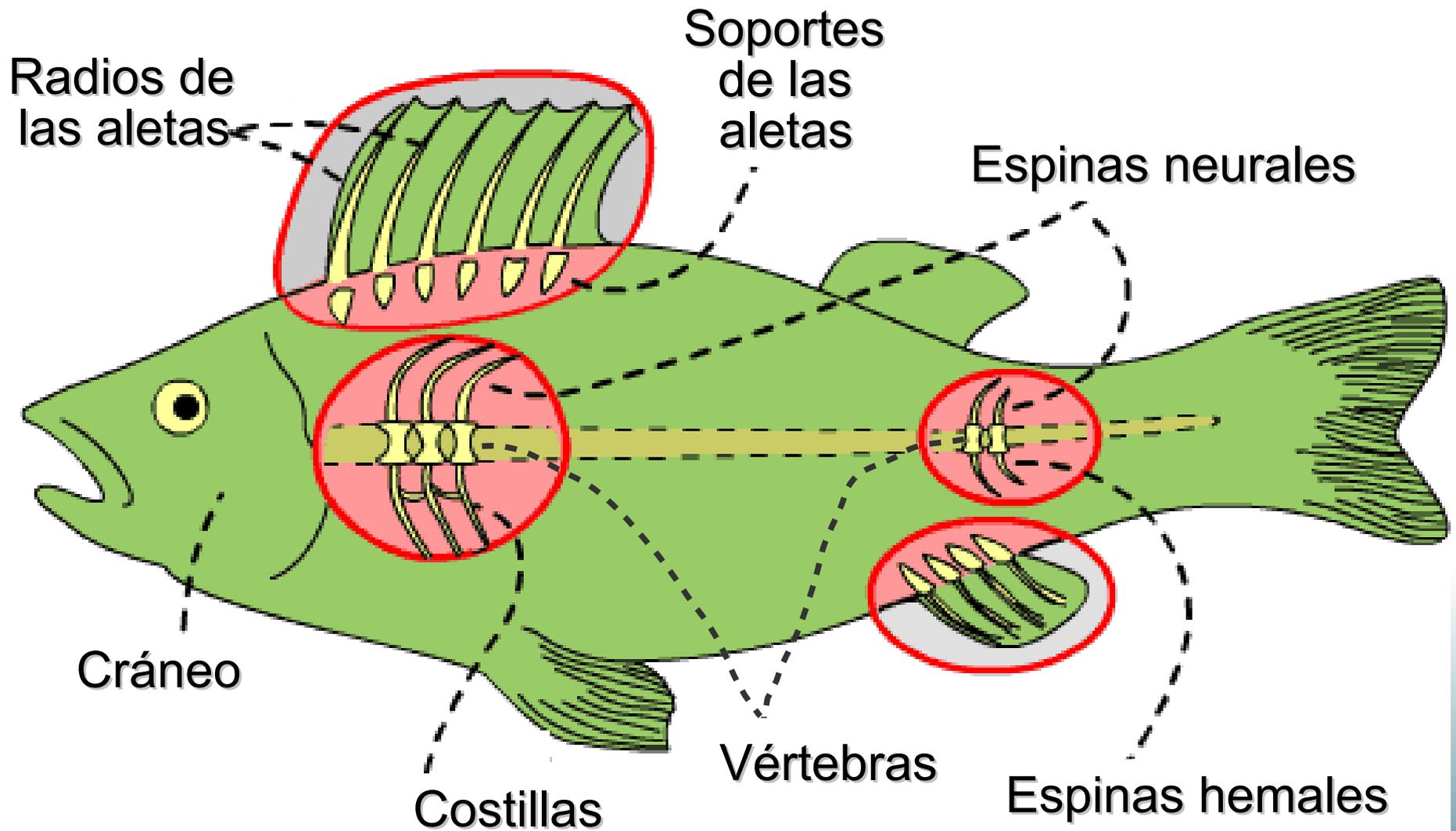
# Vértebras



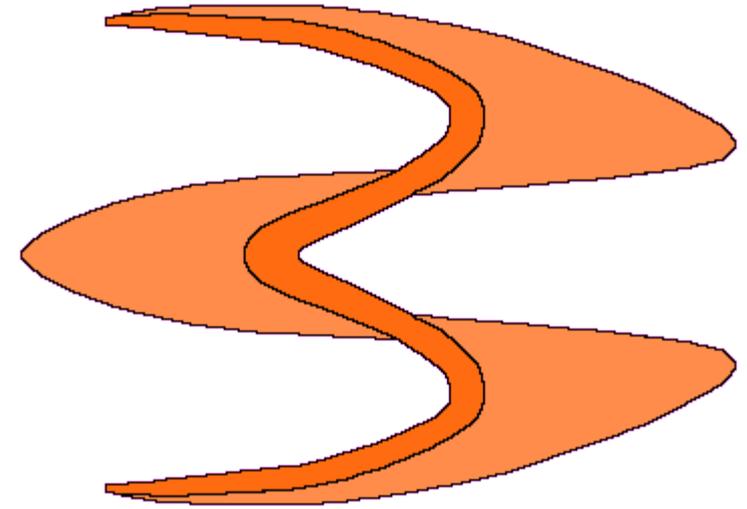
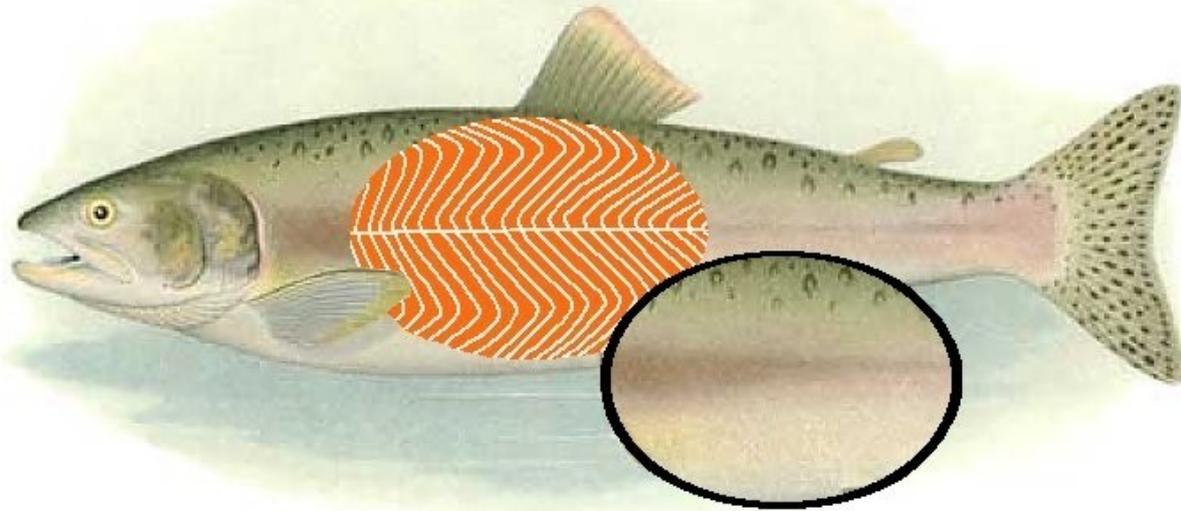
# Vértebras



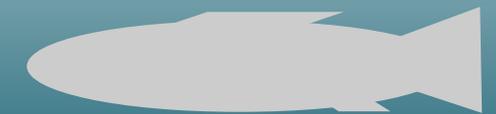
# Espinas



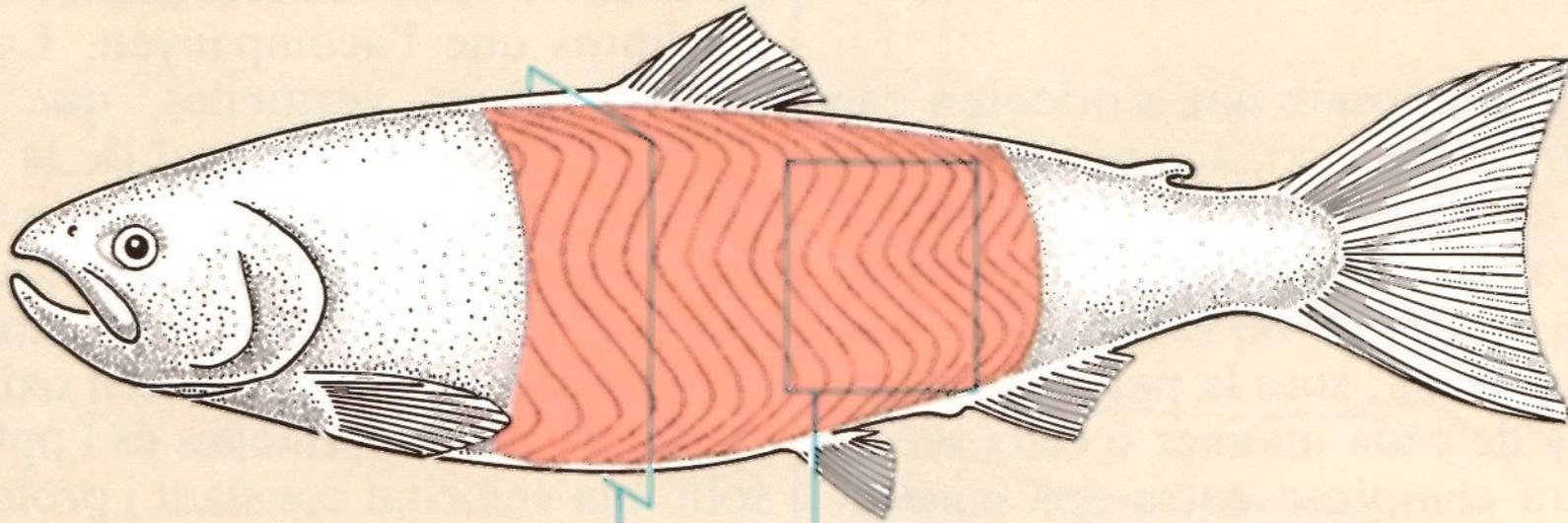
# Musculatura



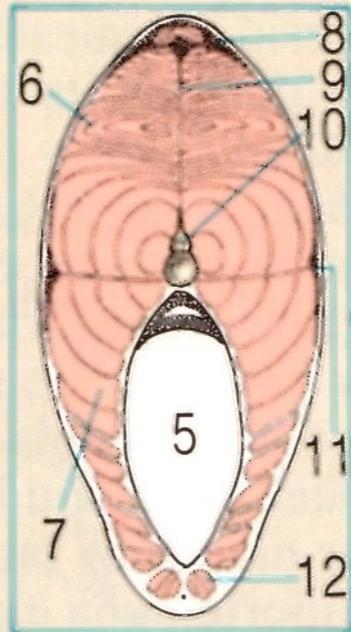
Miotomo con su plegamiento



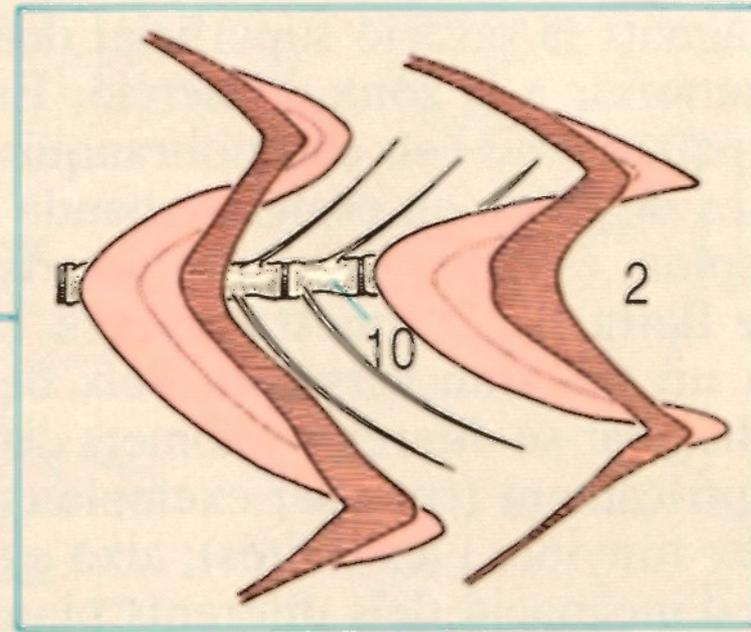
C

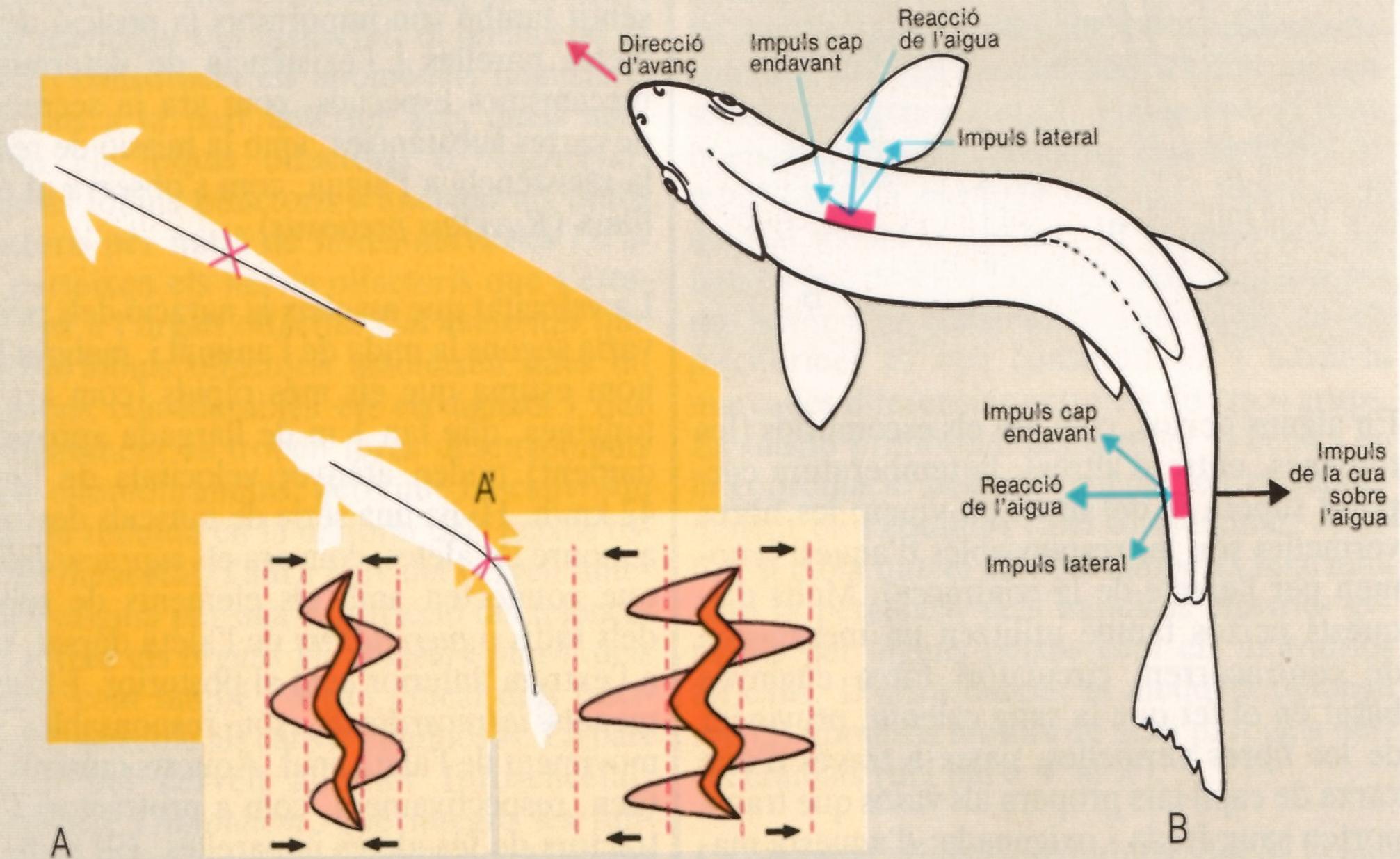


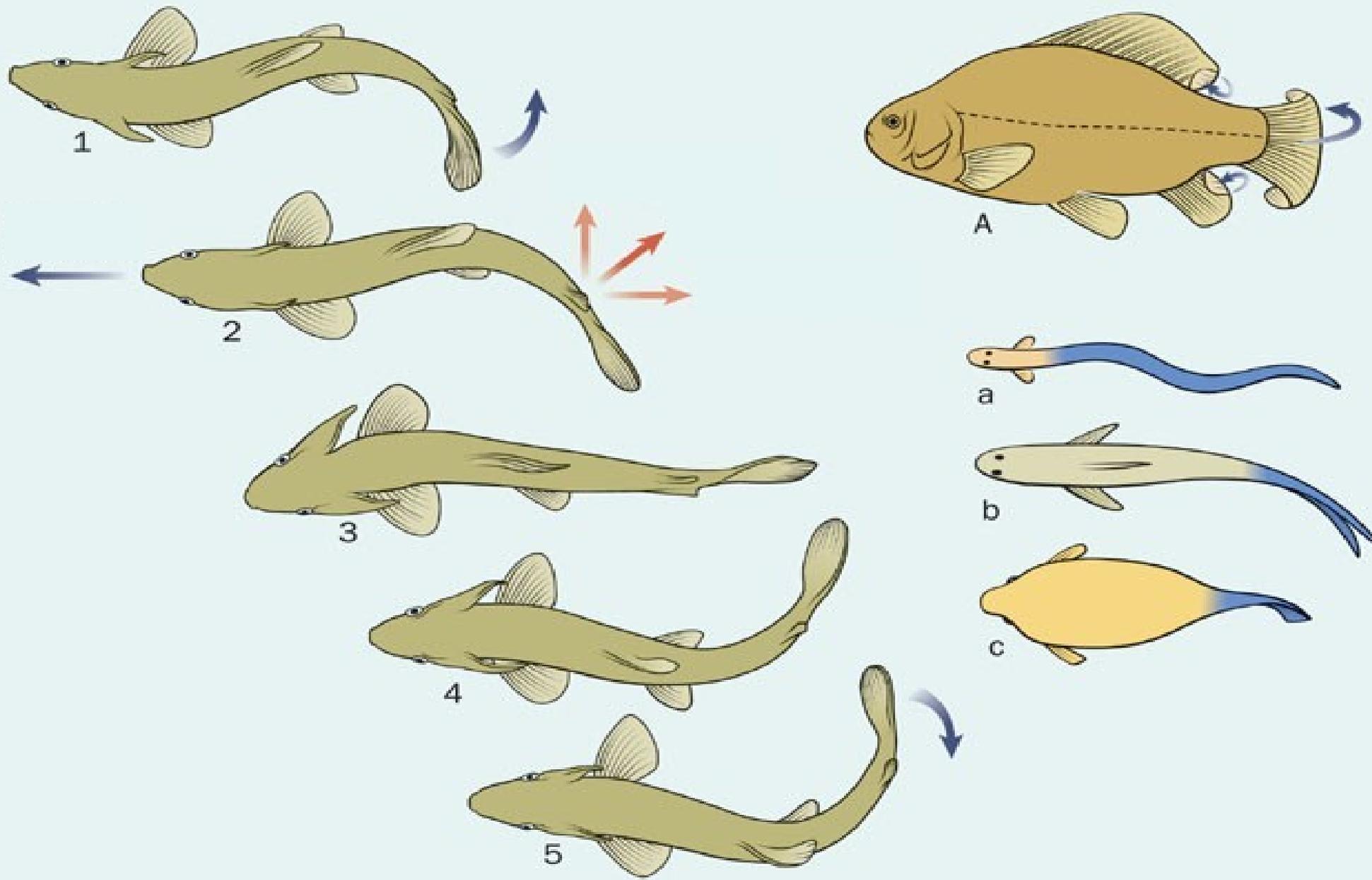
C'

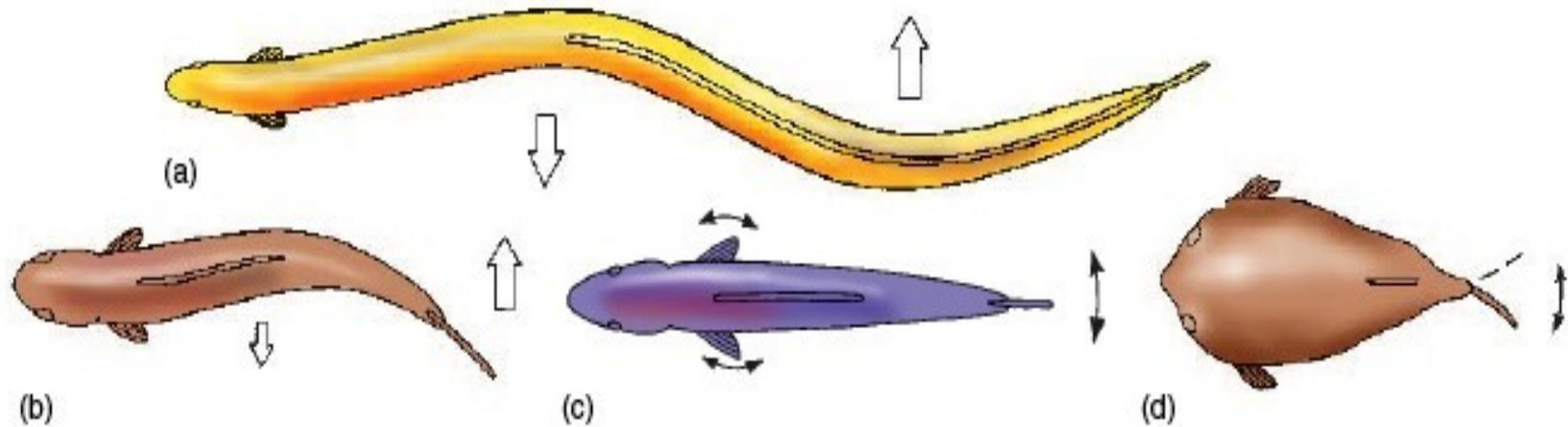


C''









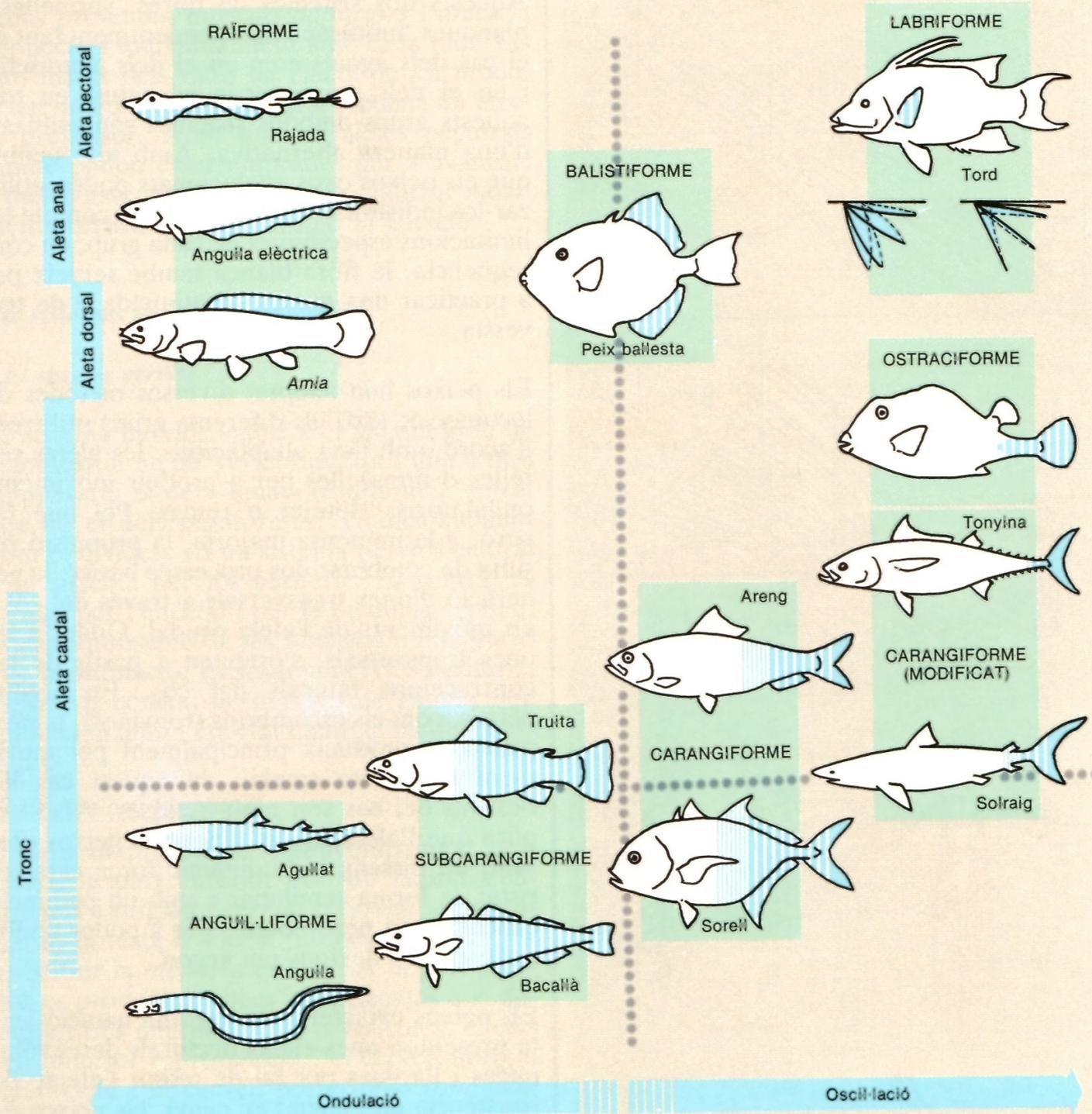
a) ondulación lateral de todo el cuerpo de la cabeza hasta la cola

b) oscilación lateral de la parte posterior del cuerpo (cola)

c) movimiento de las aletas

d) movimiento de la aleta caudal

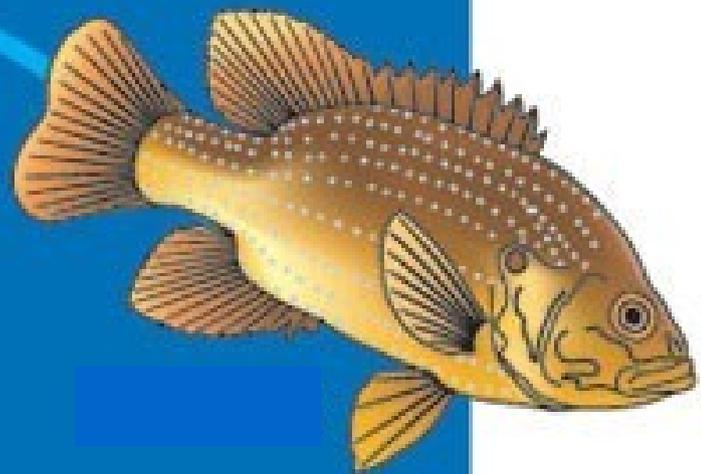




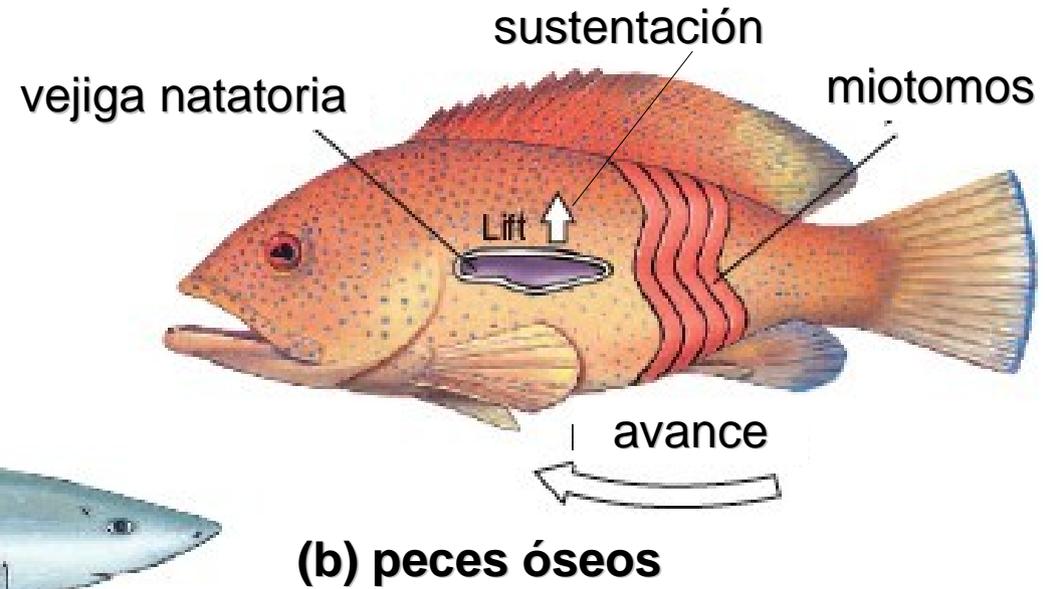


cadena de remolinos  
en sentidos opuestos

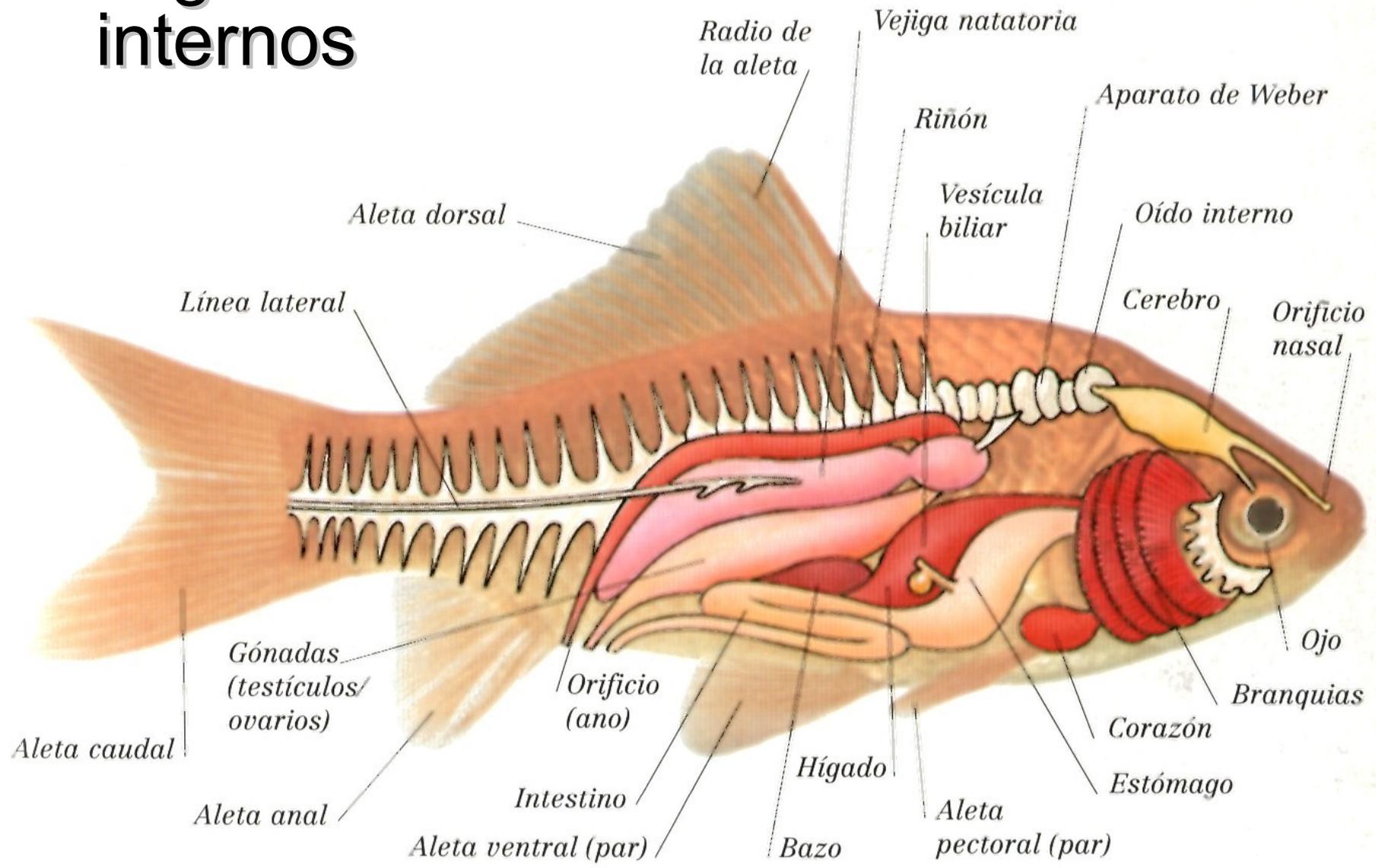
The diagram illustrates a chain of vortices. It features a series of overlapping, elongated loops. The top half of each loop is formed by a light blue arrow pointing to the right, while the bottom half is formed by a white arrow pointing to the left. This configuration represents a chain of vortices with opposite rotational directions. A thin blue line connects the rightmost vortex to the tail of a fish.

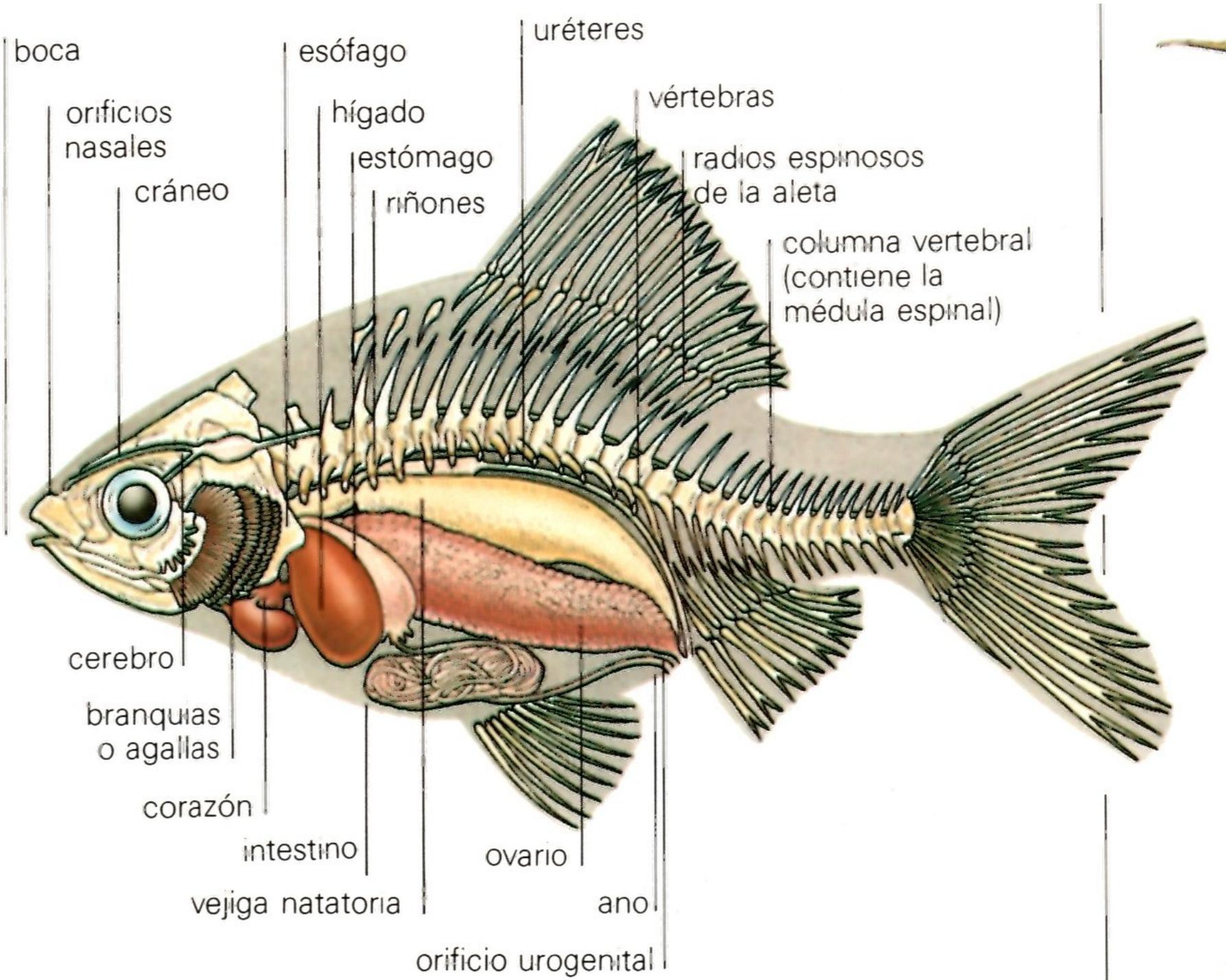


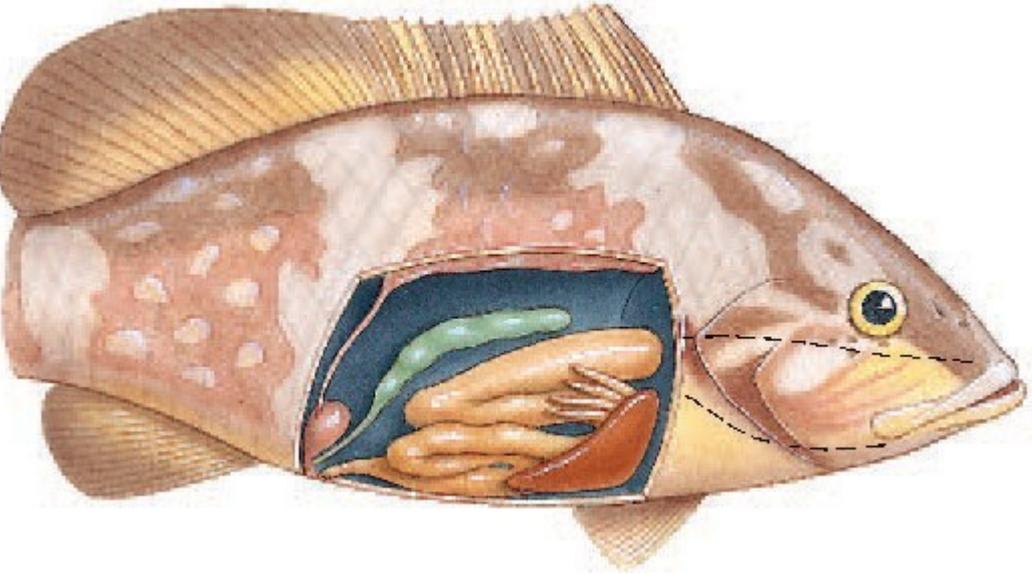
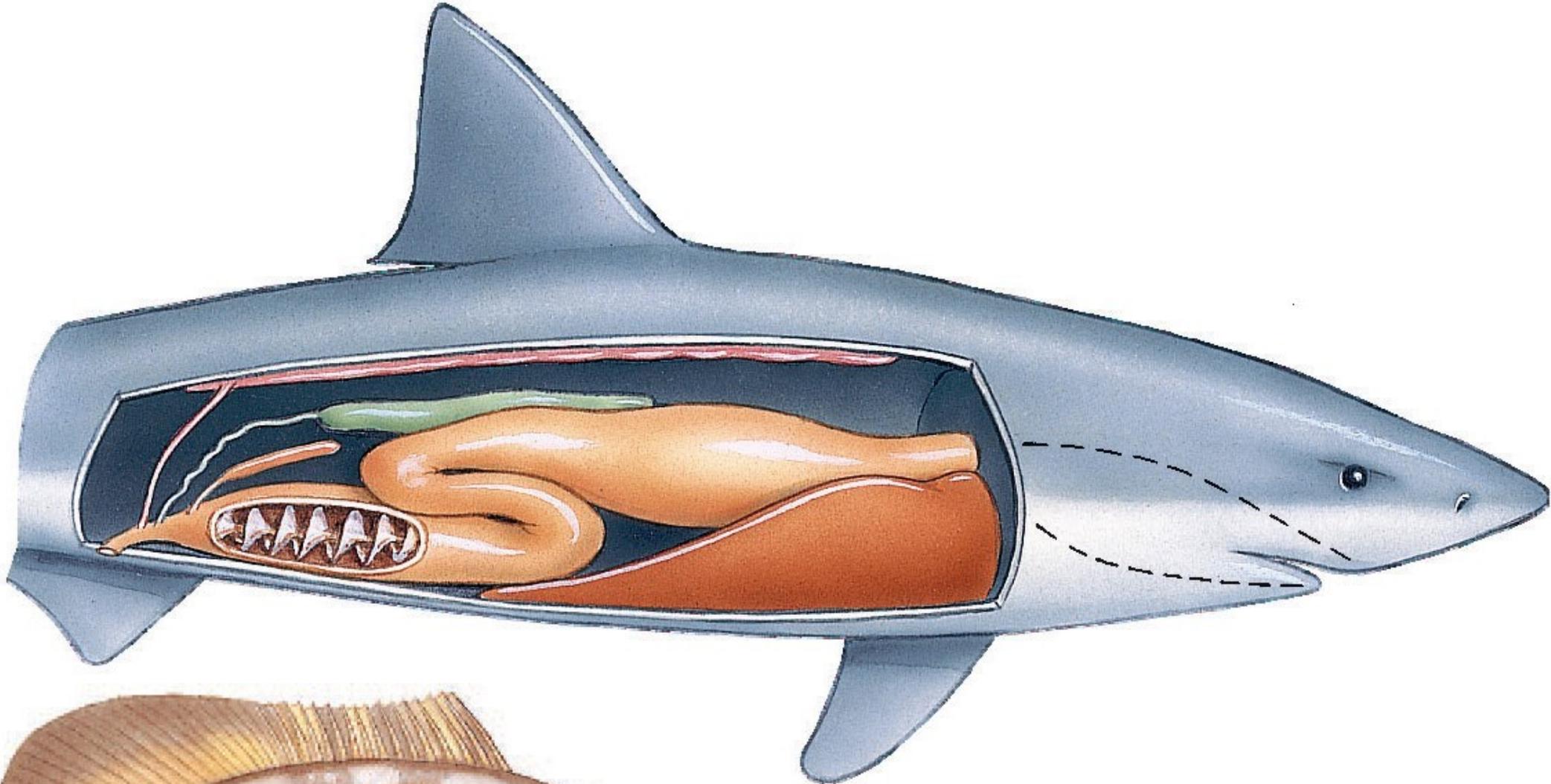
# sustentación



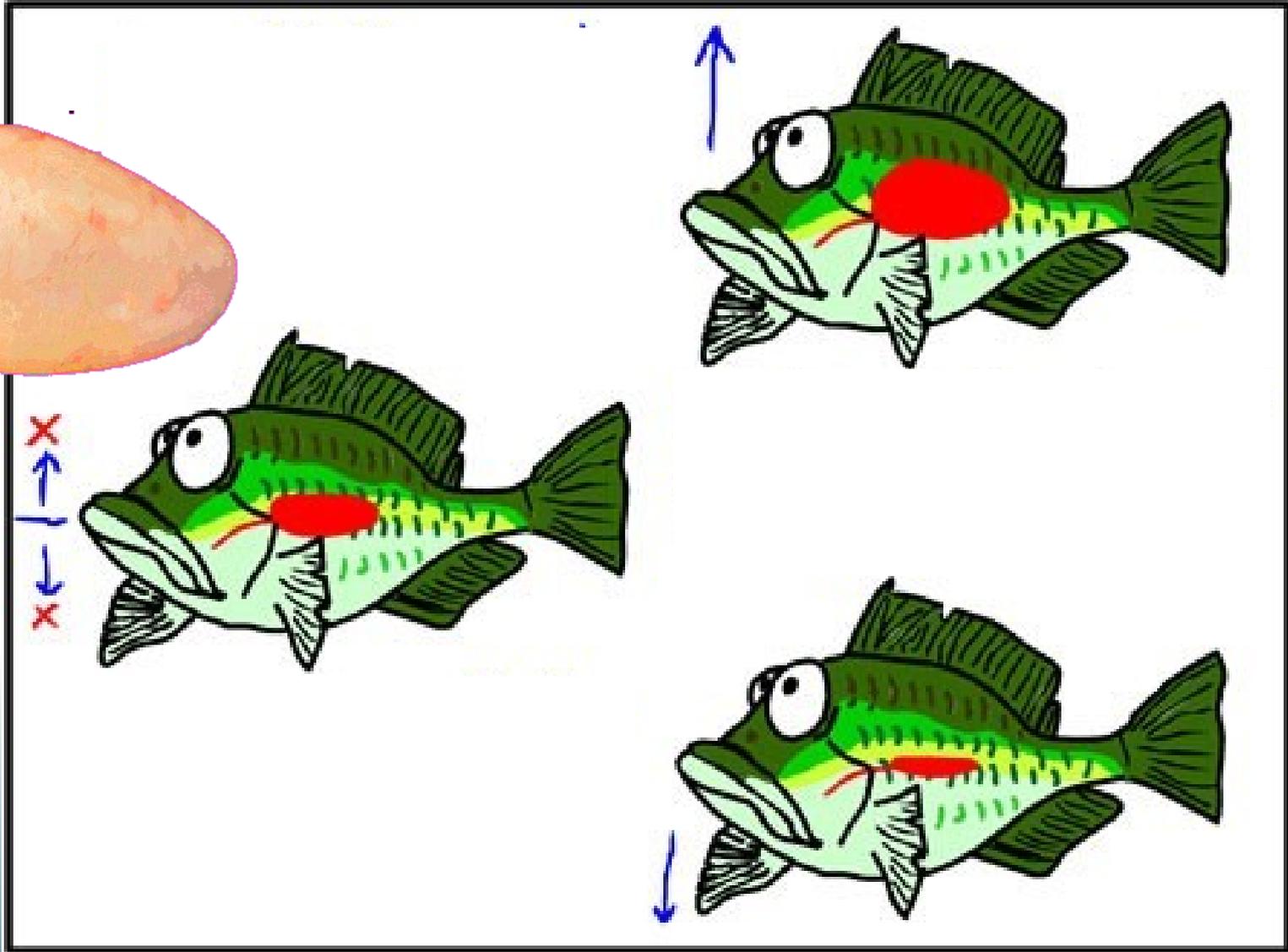
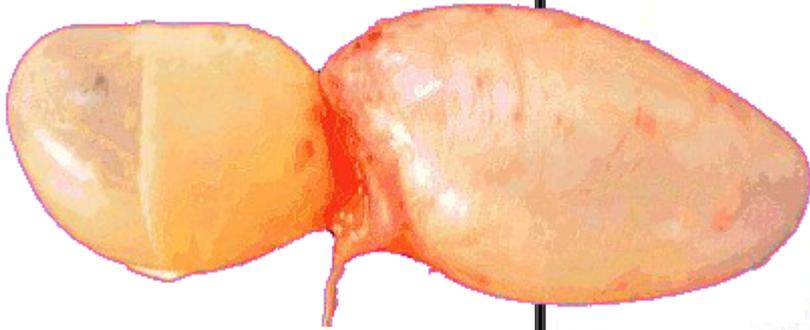
# Órganos internos



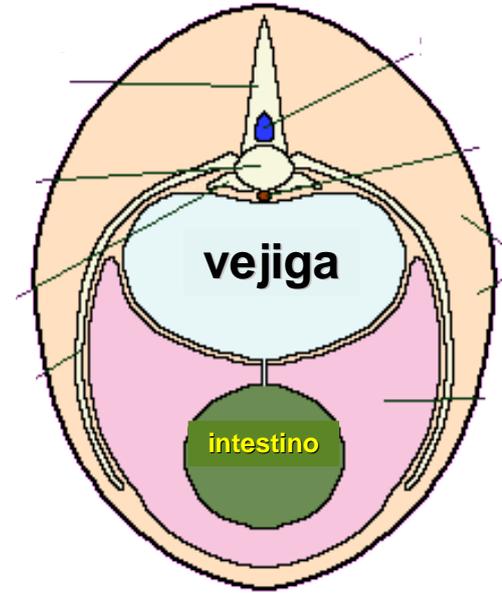




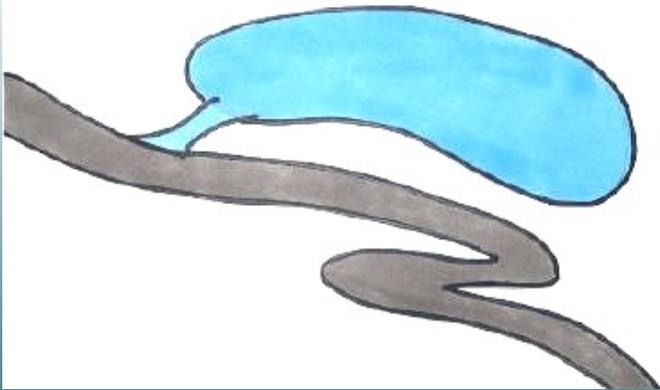
# vejiga natatoria



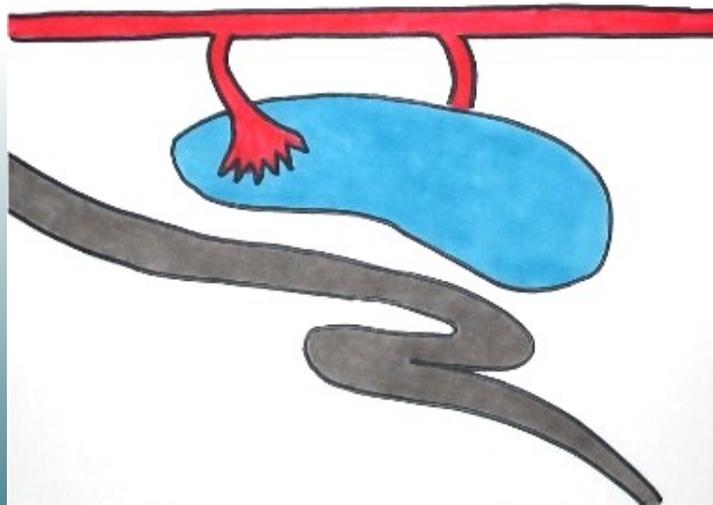
# vejiga natatoria



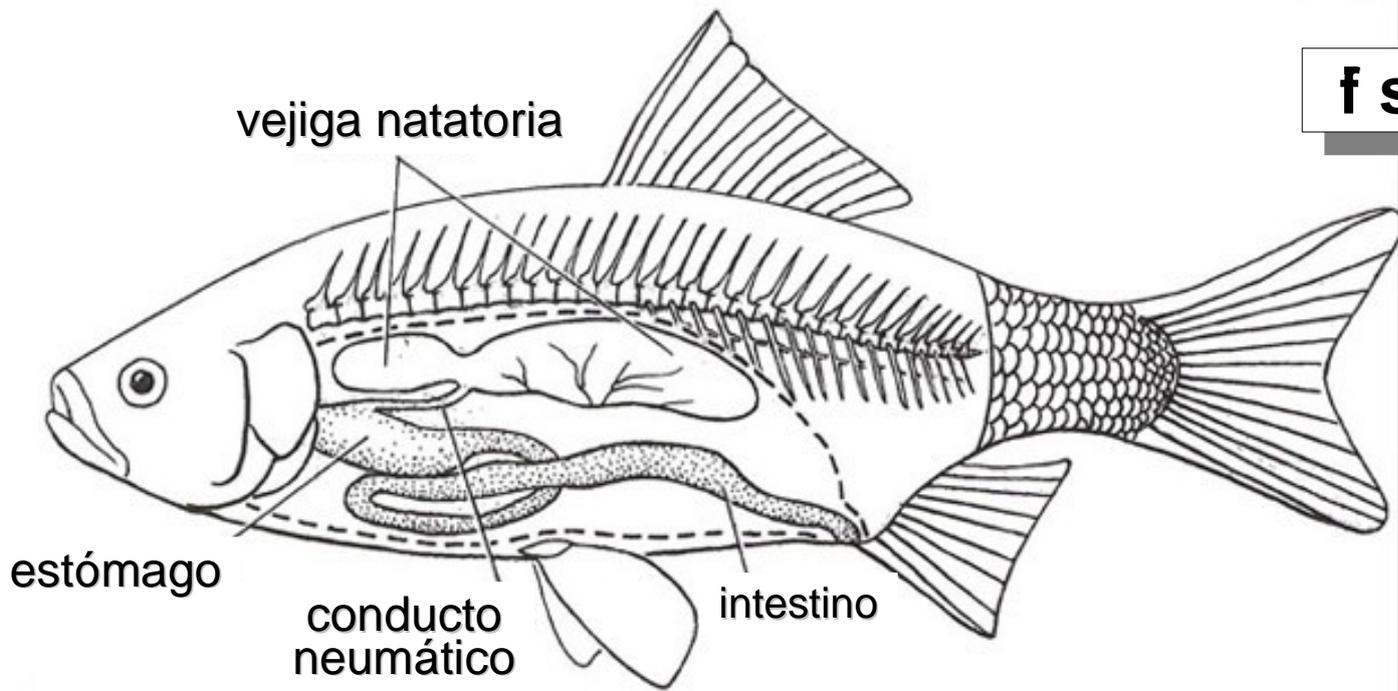
fisóstomos



fisoclistos



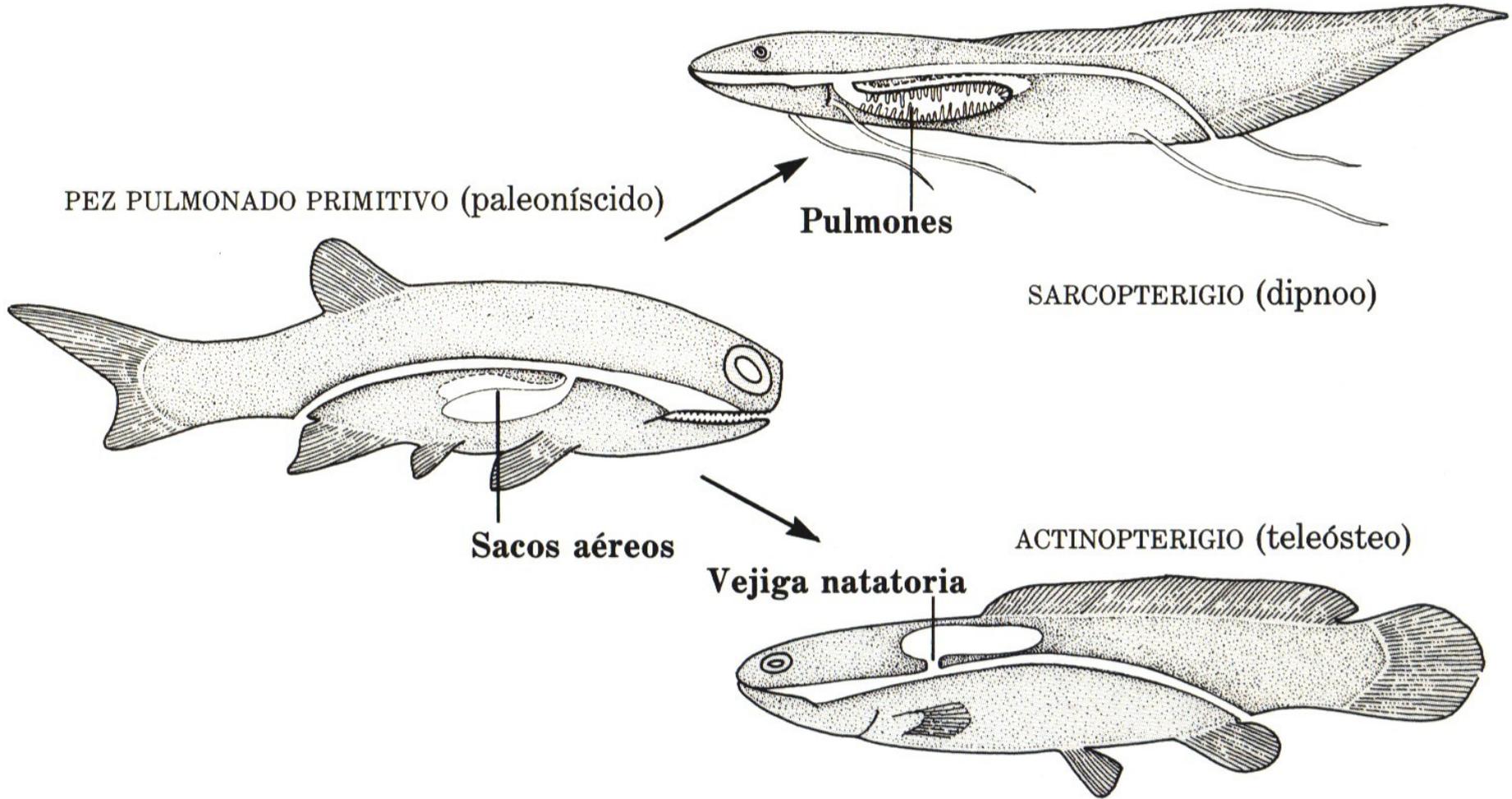
**f sóstomo**



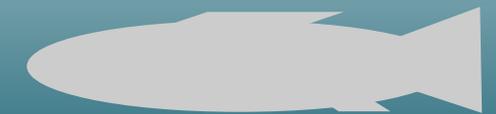
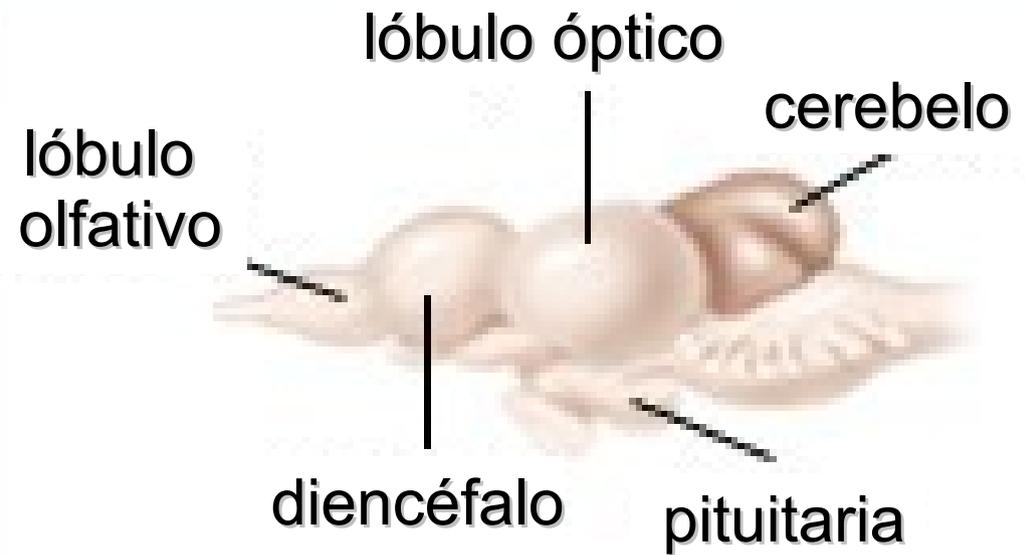
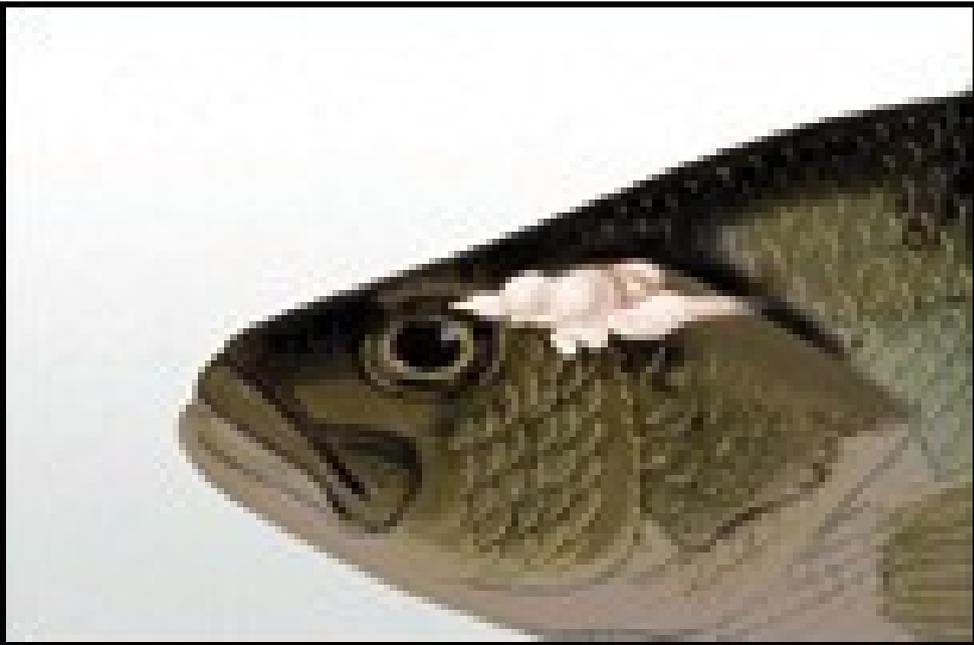
**f soplito**



# EVOLUCIÓN DE LOS PULMONES Y LA VEJIGA NATATORIA



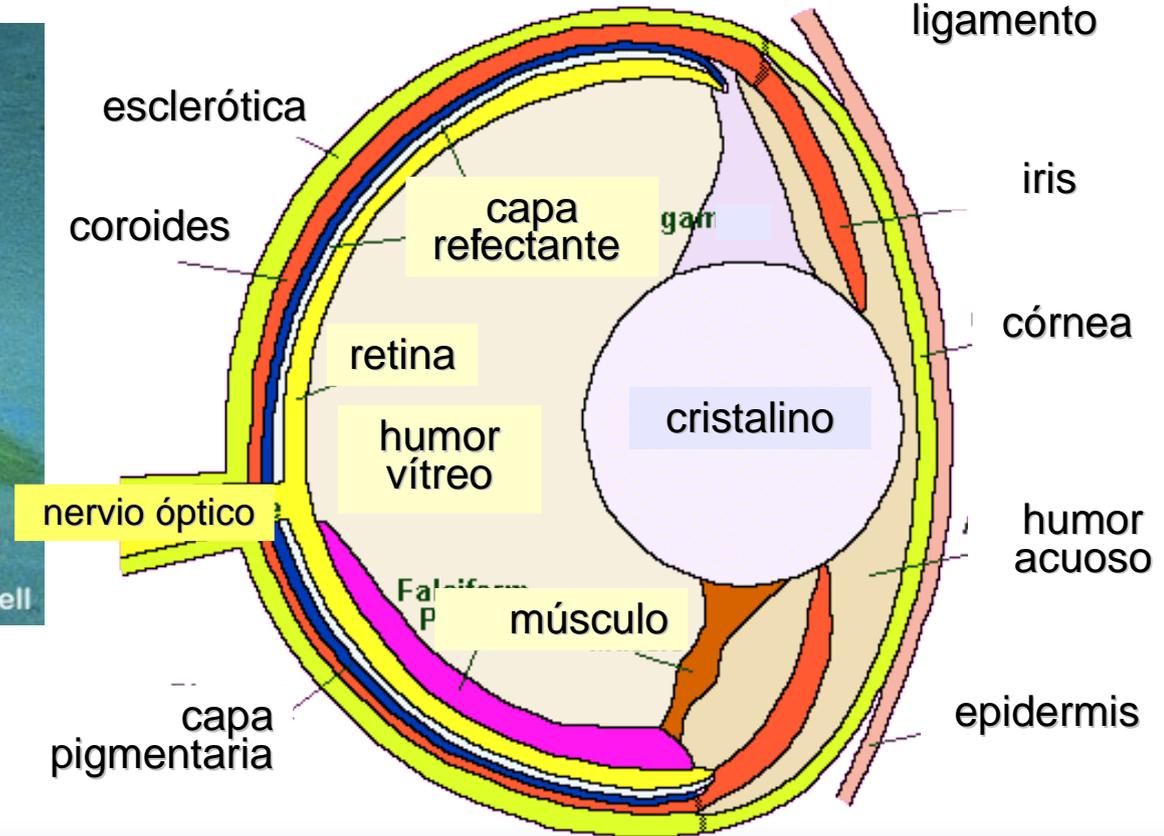
# cerebro



# vista



## A Diagrammatic Representation of a Teleost Eye

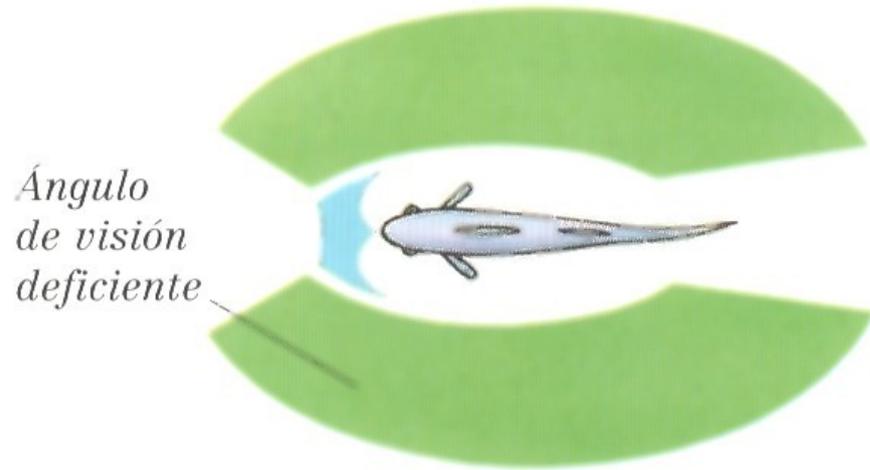


zona de vision binocular o estereoscópica

visión monocular

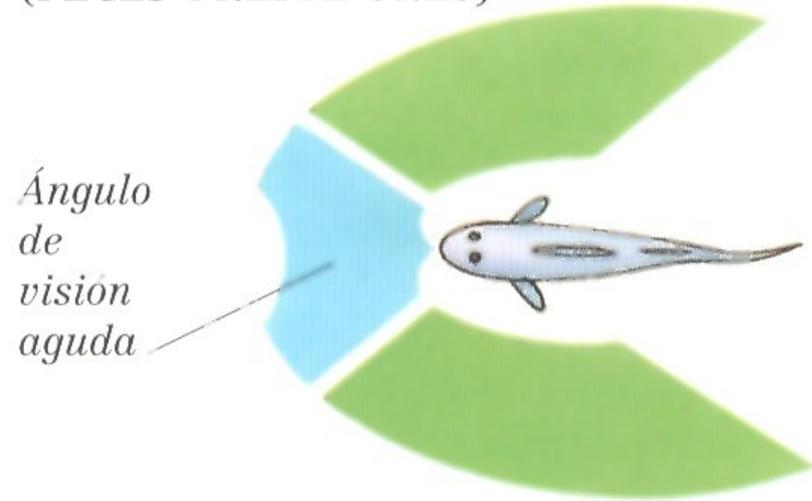
visión monocular

## VISIÓN MONOCULAR (PECES NO PREDADORES)

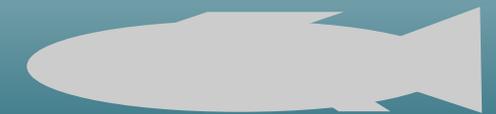


Los ojos de los peces no predadores suelen encontrarse a ambos lados de la cabeza, lo que les permite disponer de un ángulo de visión de casi 360 grados (arriba, abajo y a los lados). Este campo de visión tan amplio les permite detectar rápidamente la presencia de peligro desde cualquier ángulo.

## VISIÓN BINOCULAR (PECES PREDADORES)



Los ojos de los predadores se encuentran situados uno junto al otro, como en los humanos, de modo que pueden fijar la vista en un mismo punto. Esta visión estereoscópica les permite tener un agudo sentido de las distancias, así como un amplio campo de visión a la hora de capturar las presas.



# gusto



BARBILLONES SIMPLES



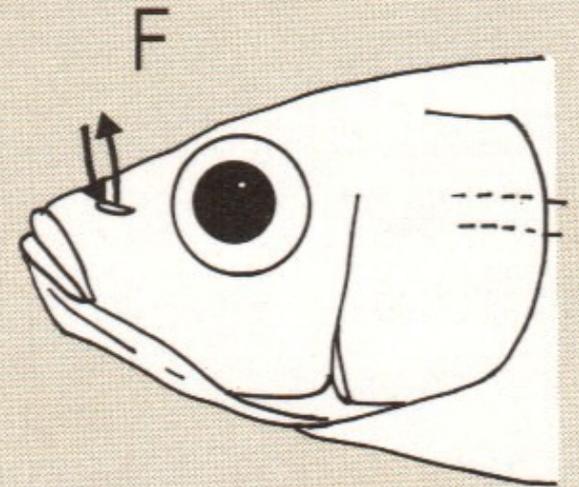
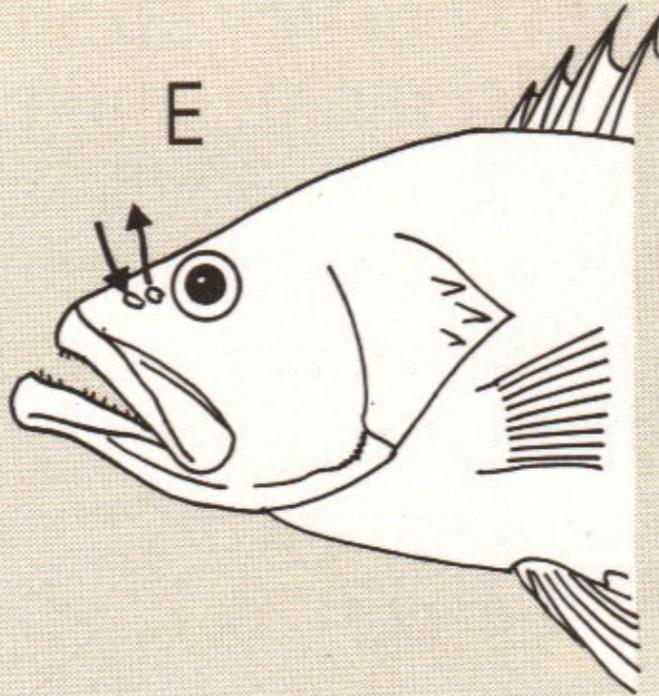
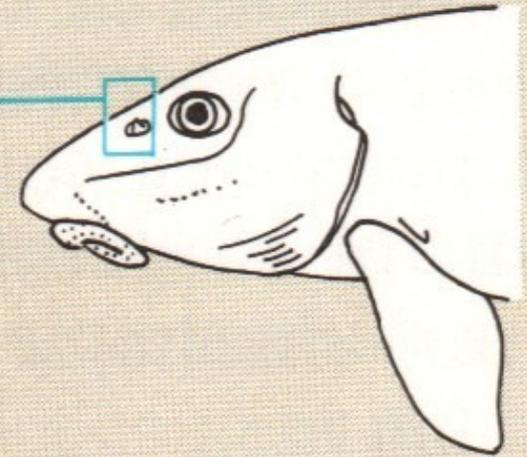
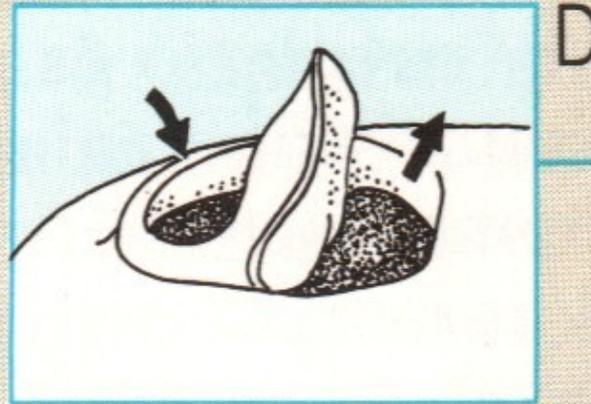
BARBILLONES COMPUESTOS

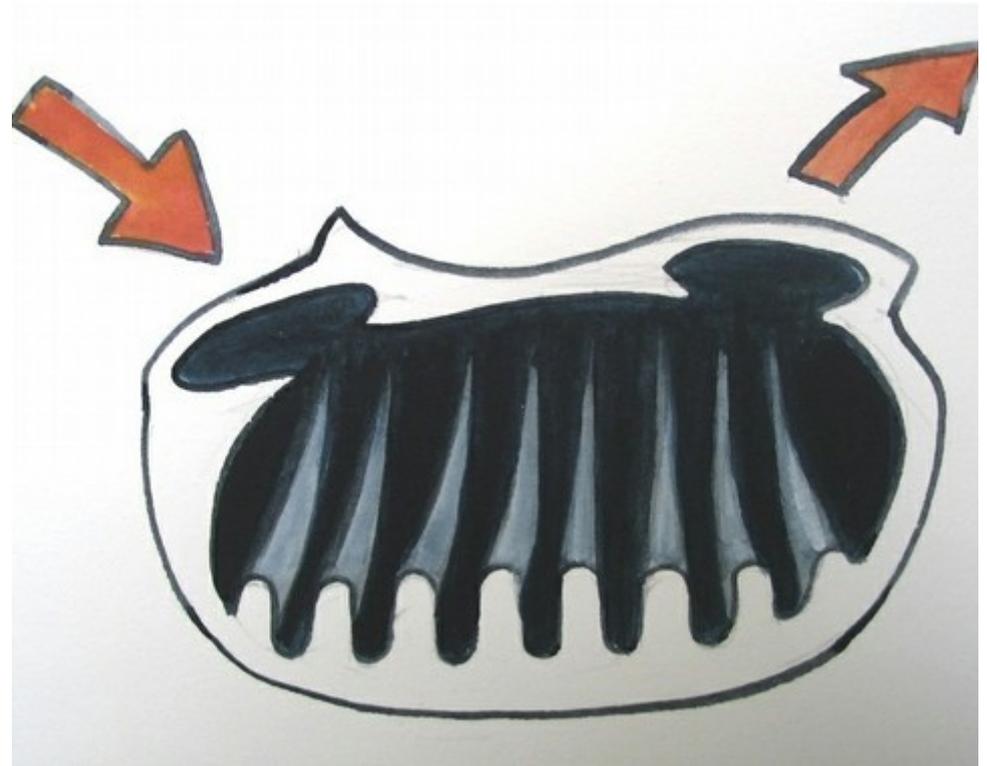


PROLONGACIONES DE LAS ALETAS



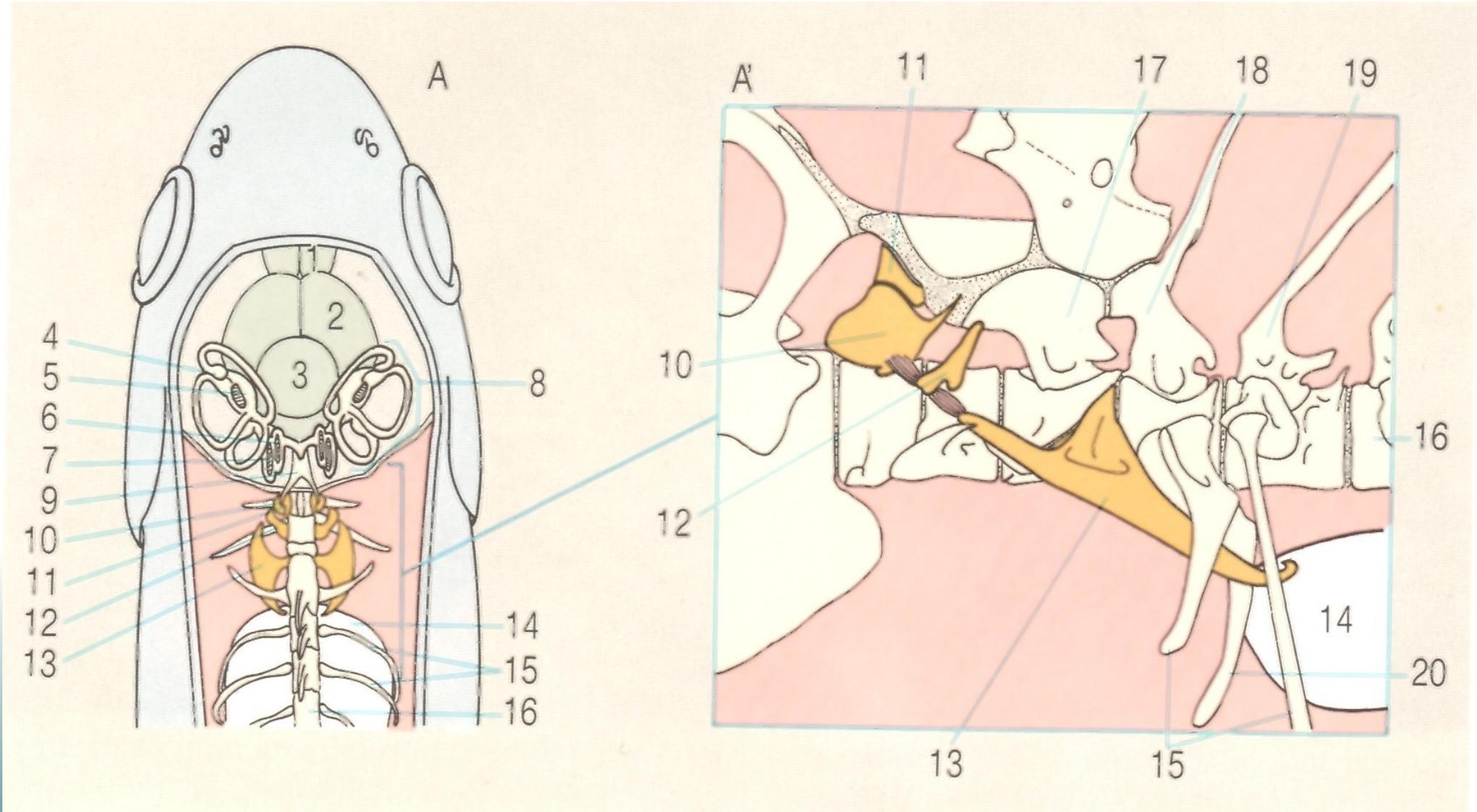
# olfato



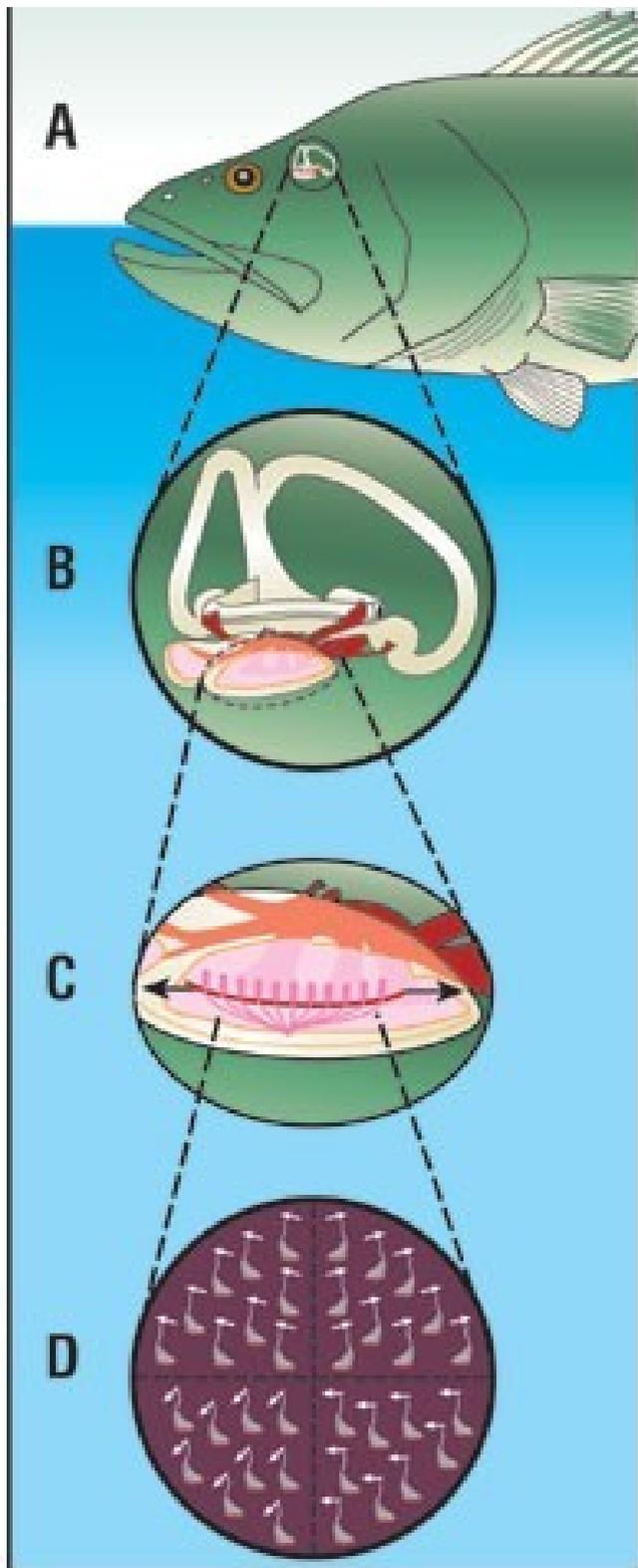


# oído

## aparato de Weber

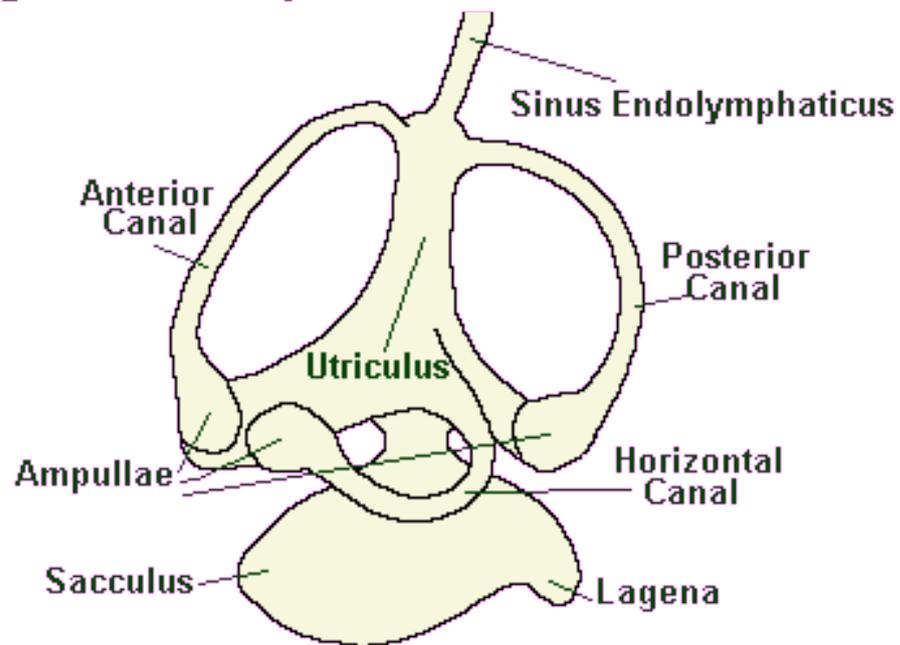


oído



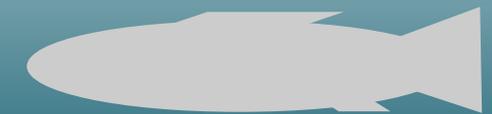
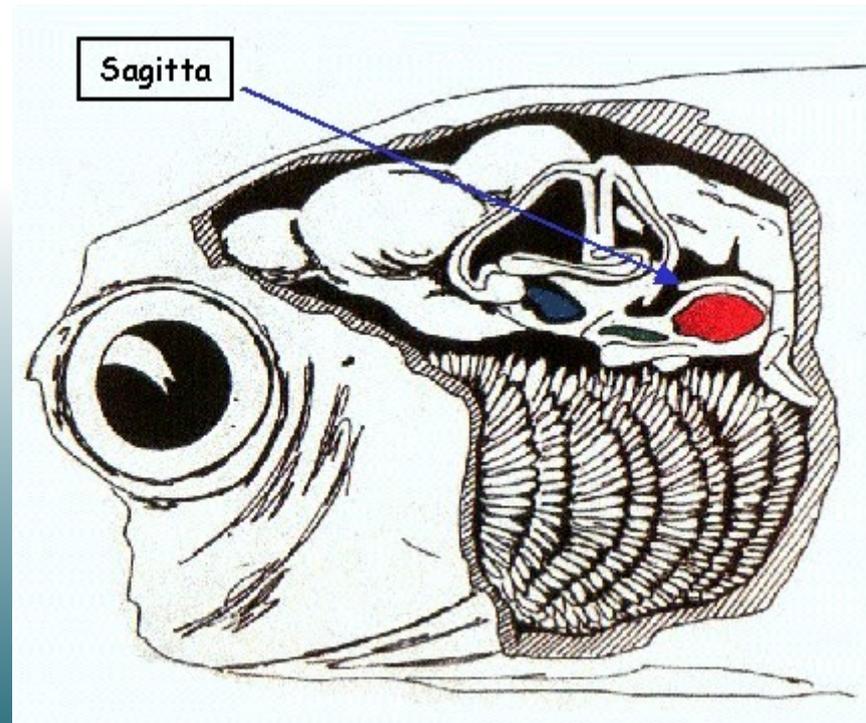
## órgano del equilibrio

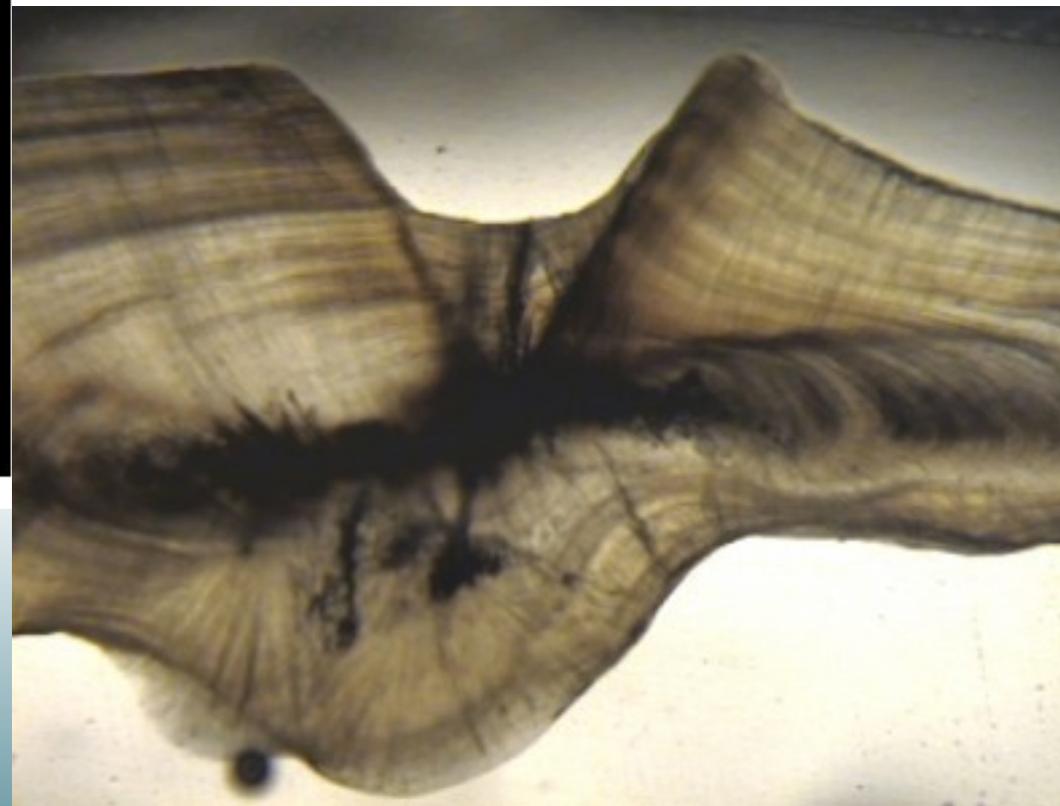
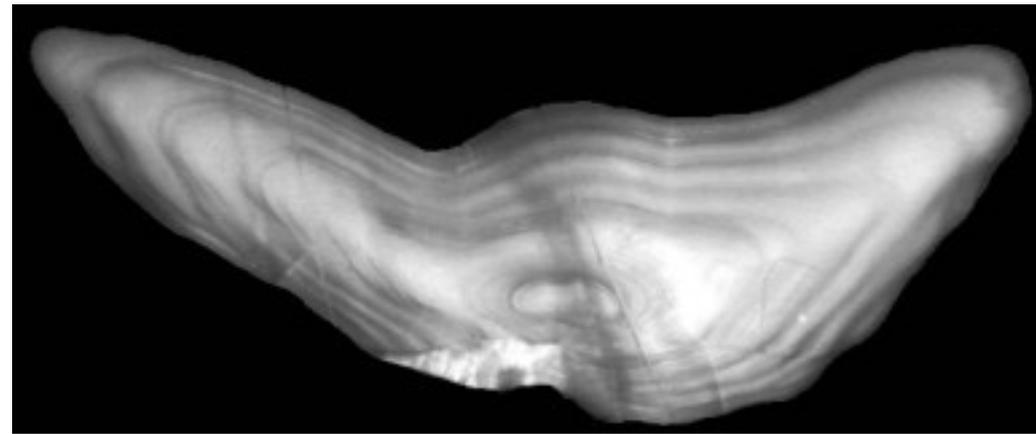
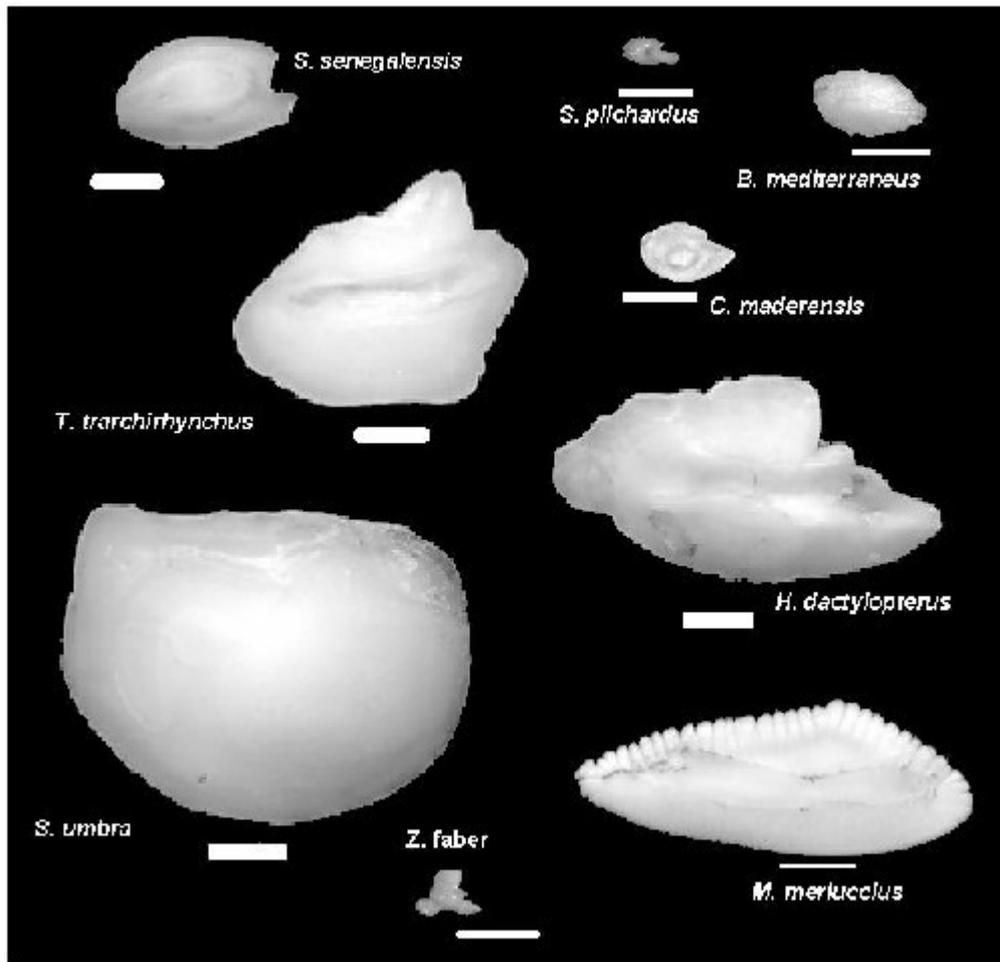
### Diagrammatic Representation of a Teleost Ear



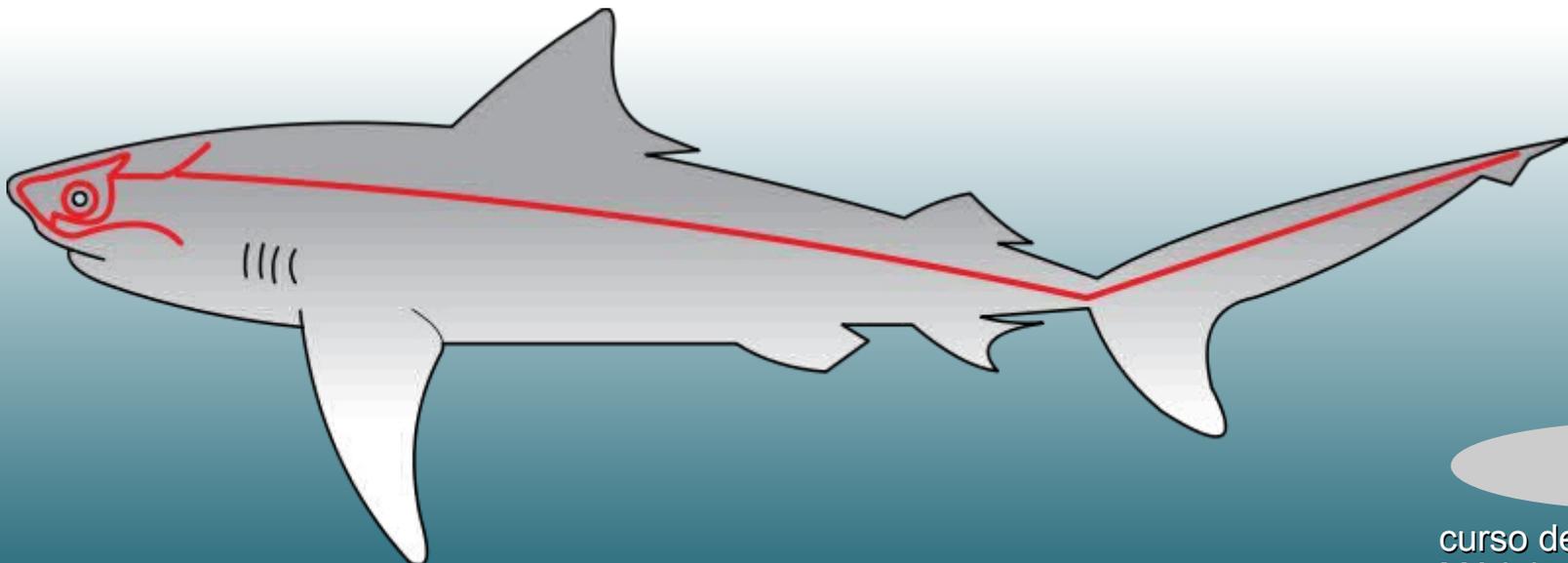
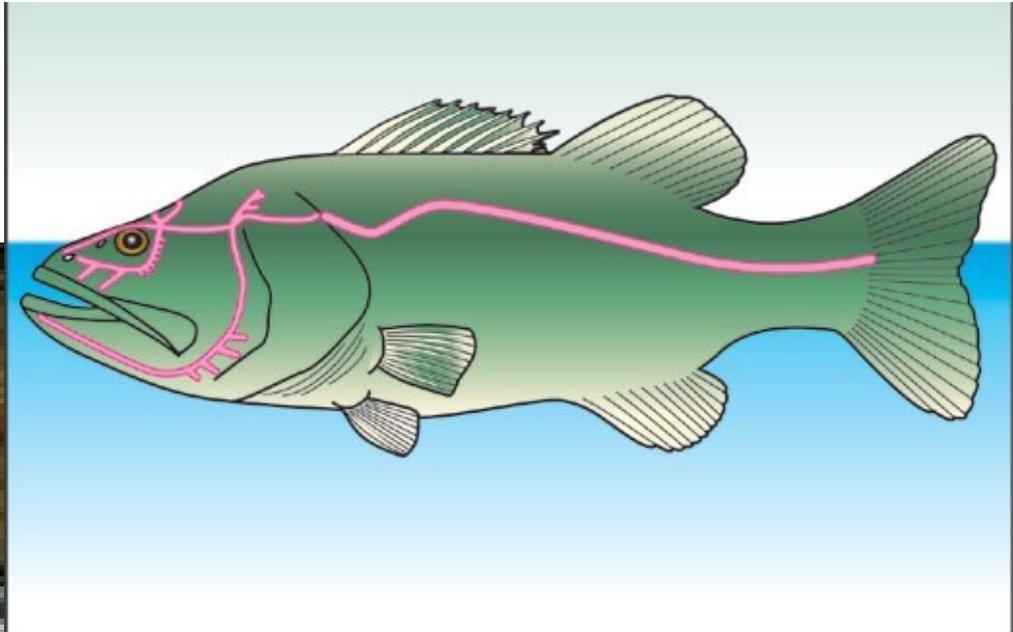


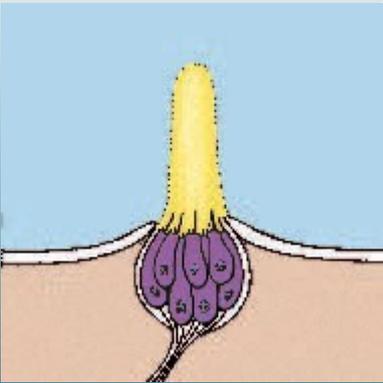
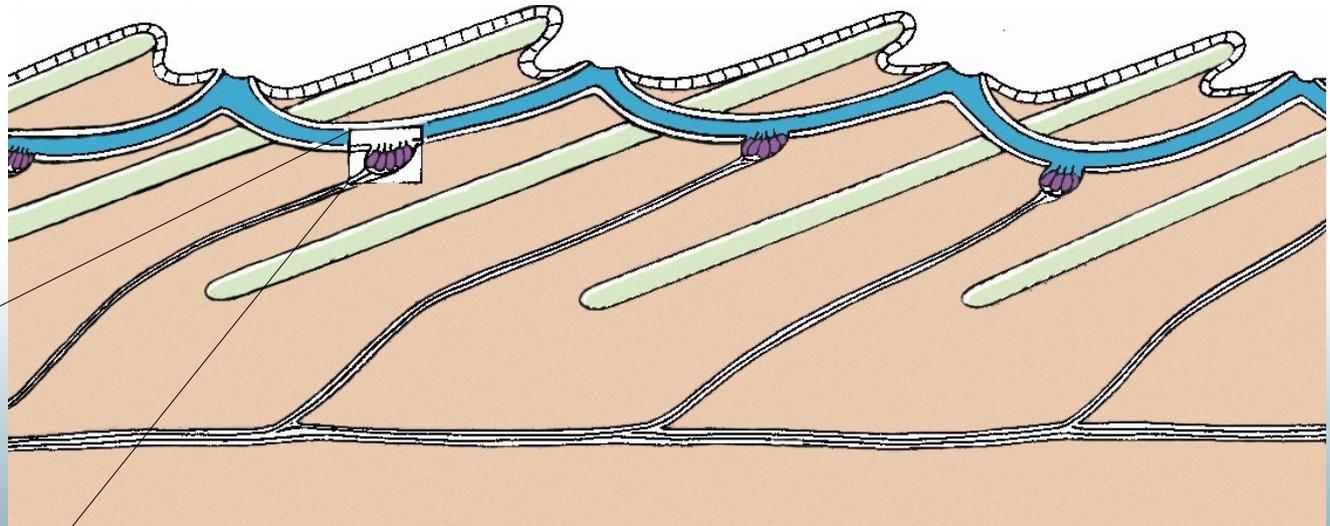
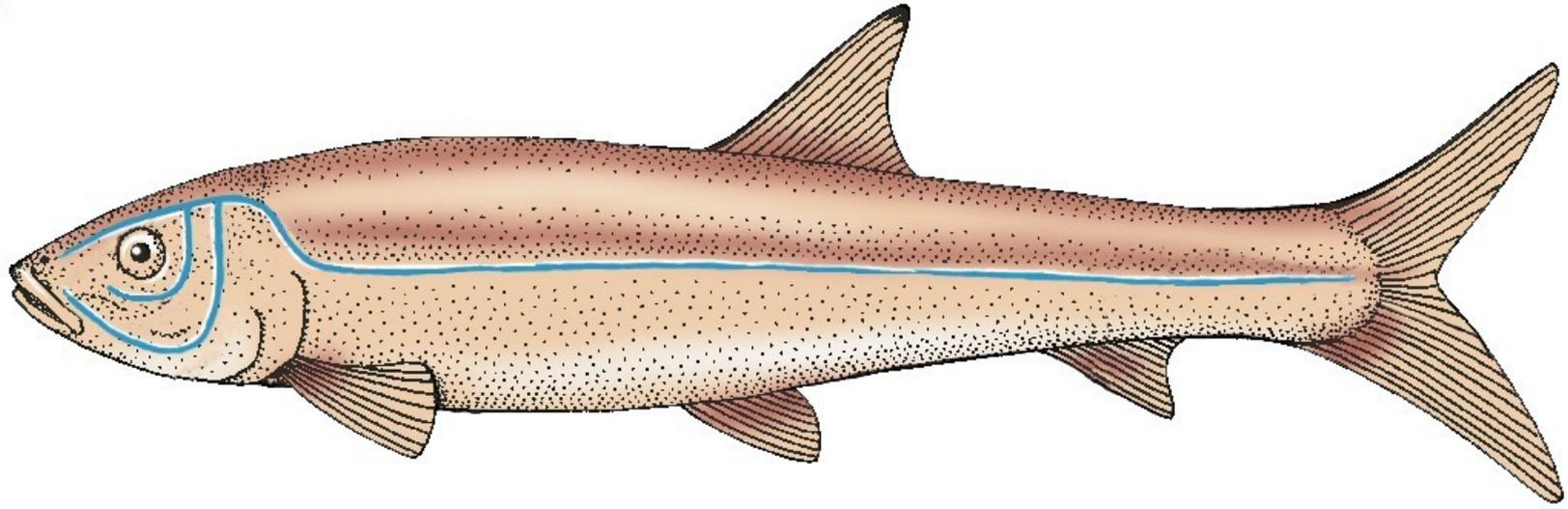
# otolitos

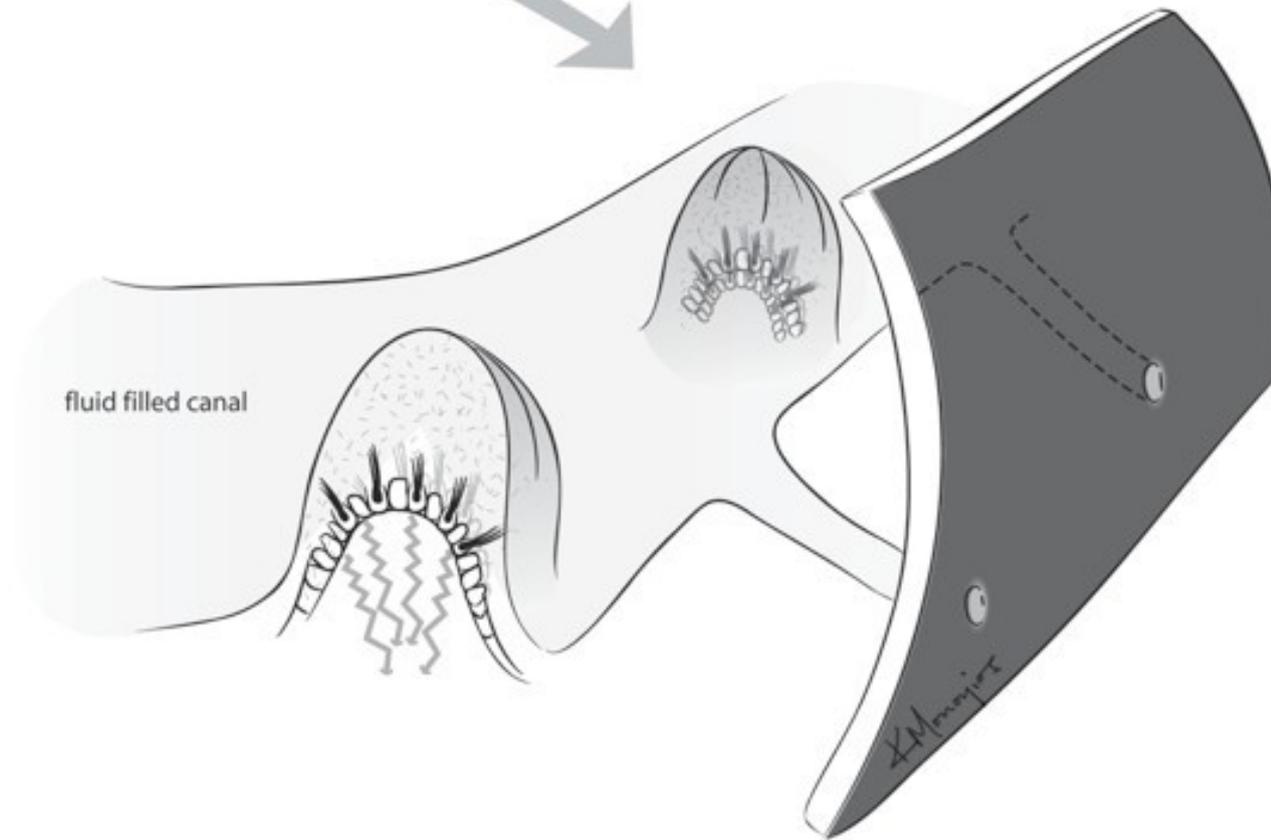
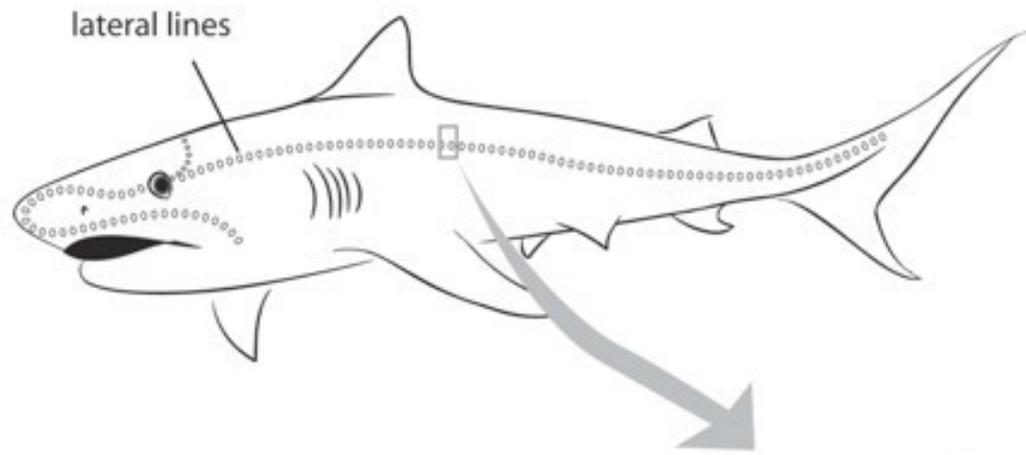




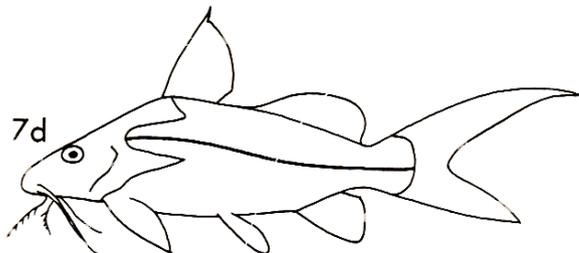
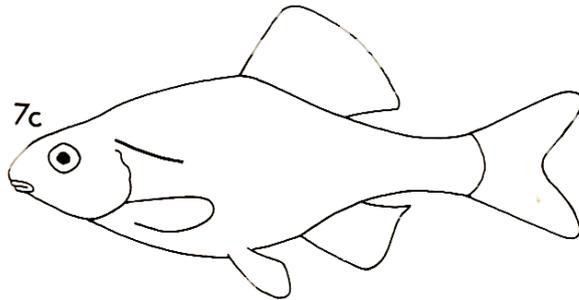
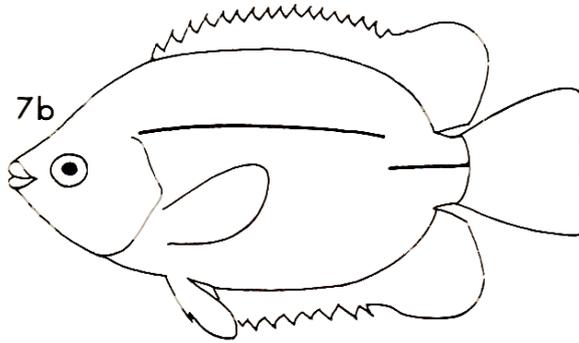
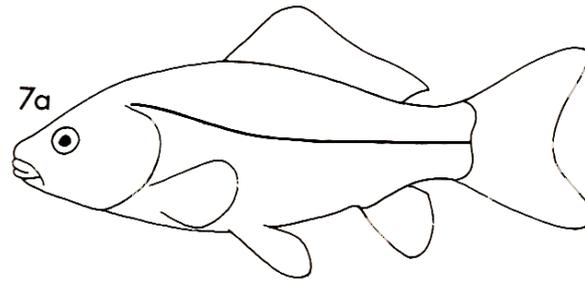
# línea lateral



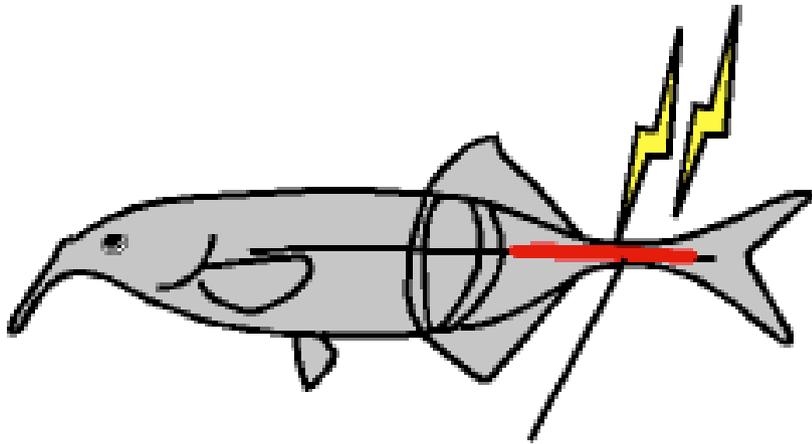




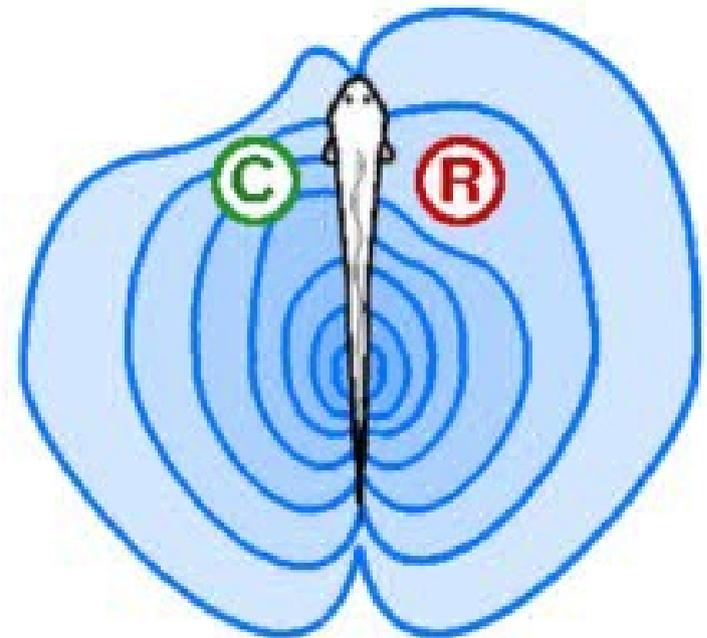
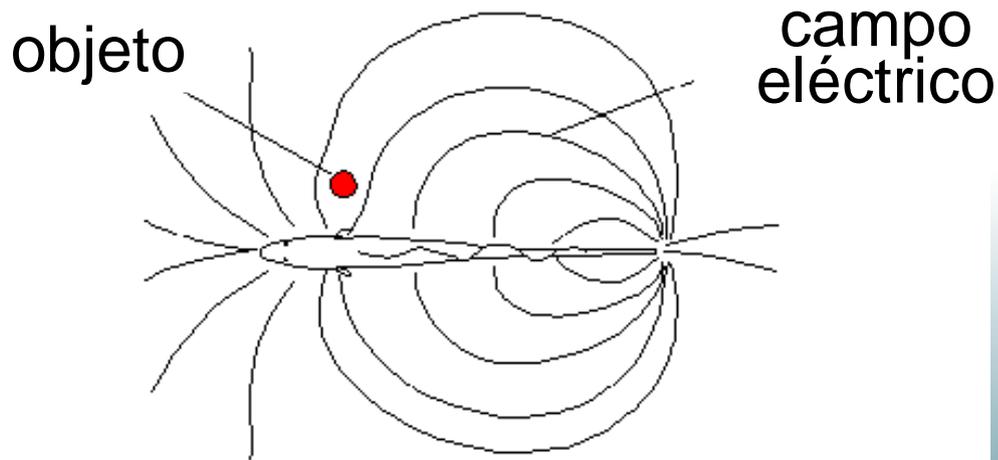
# diferentes tipos de línea lateral



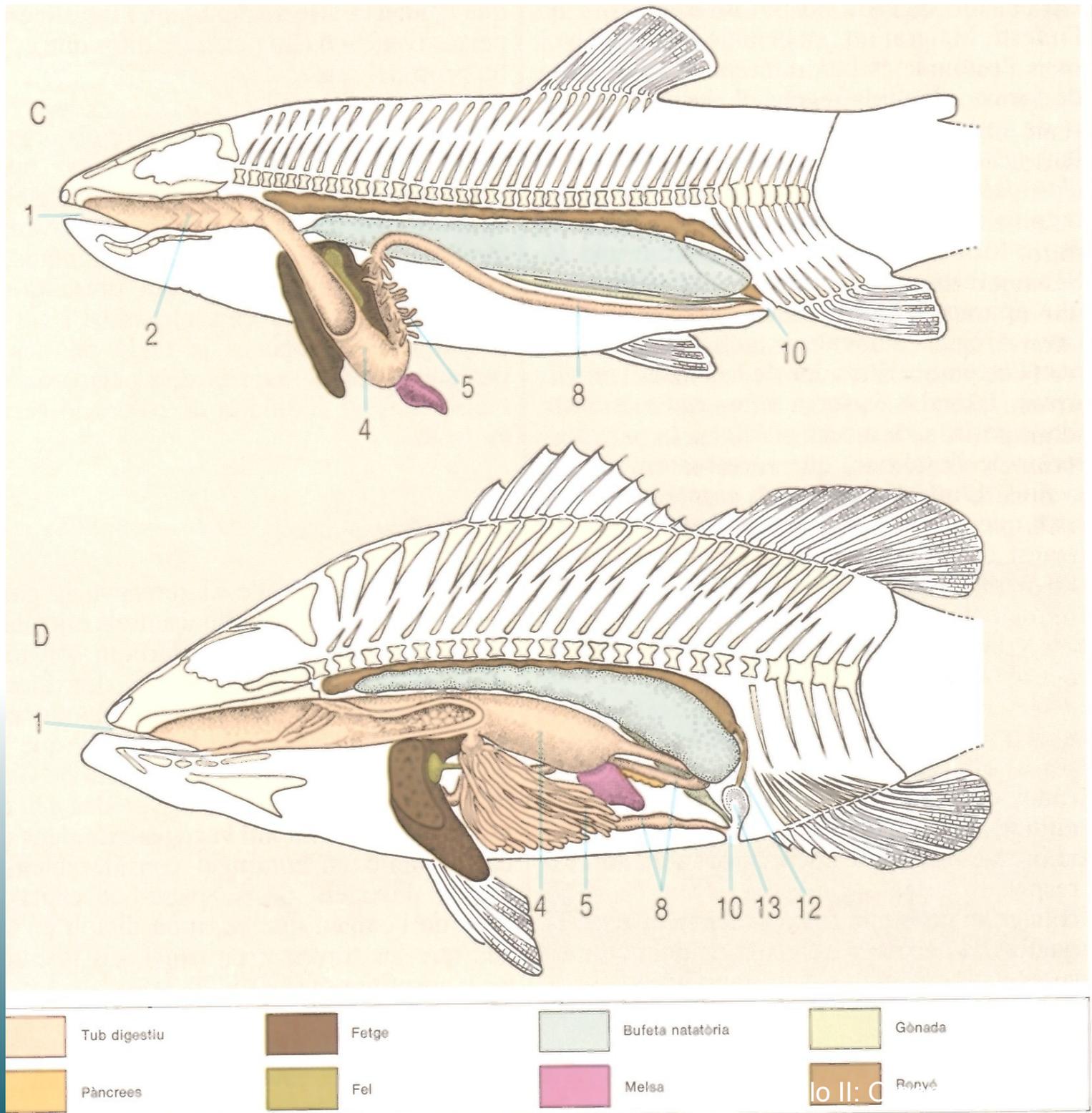
# órganos eléctricos

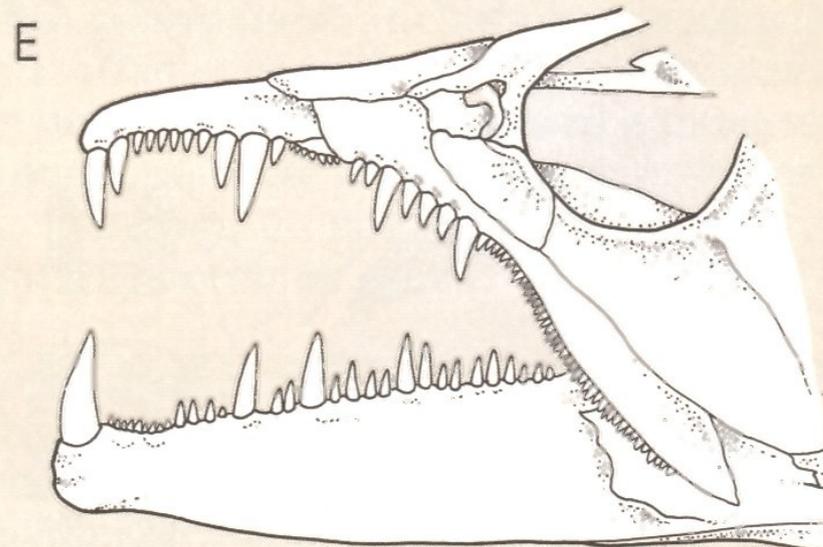
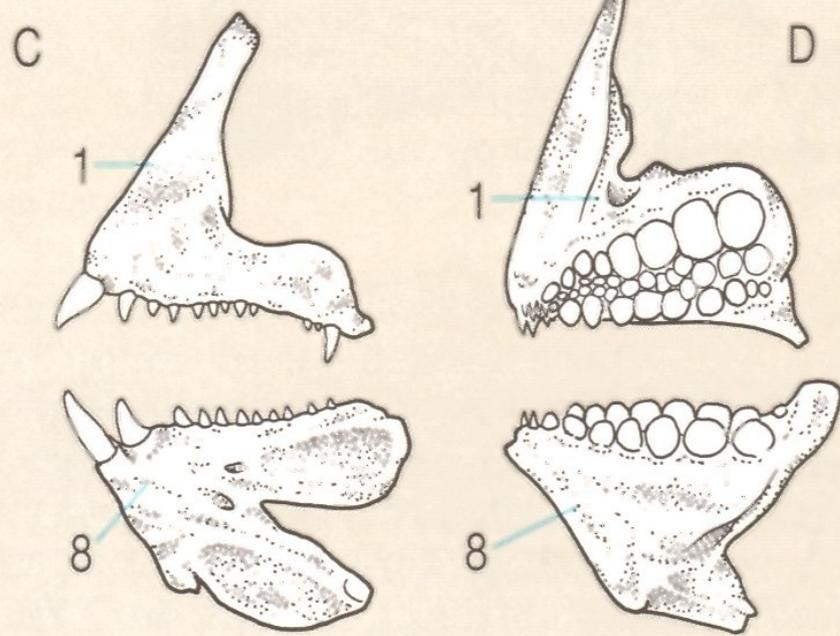
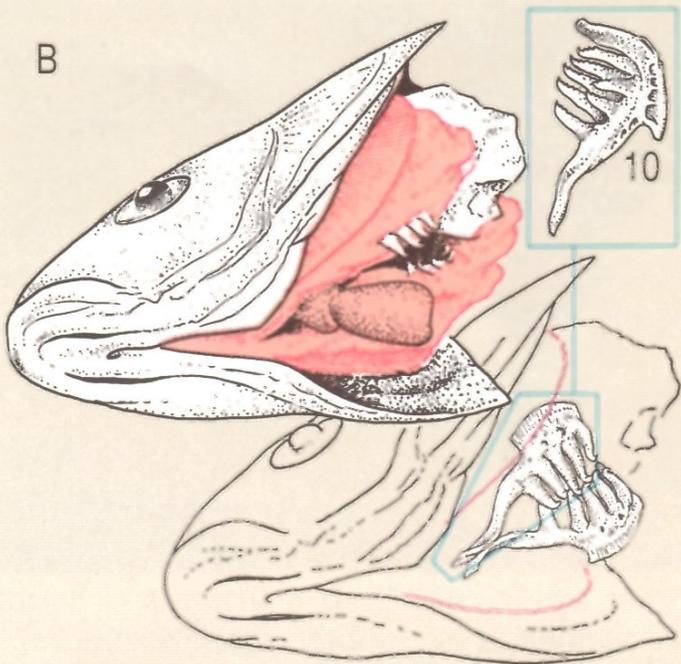
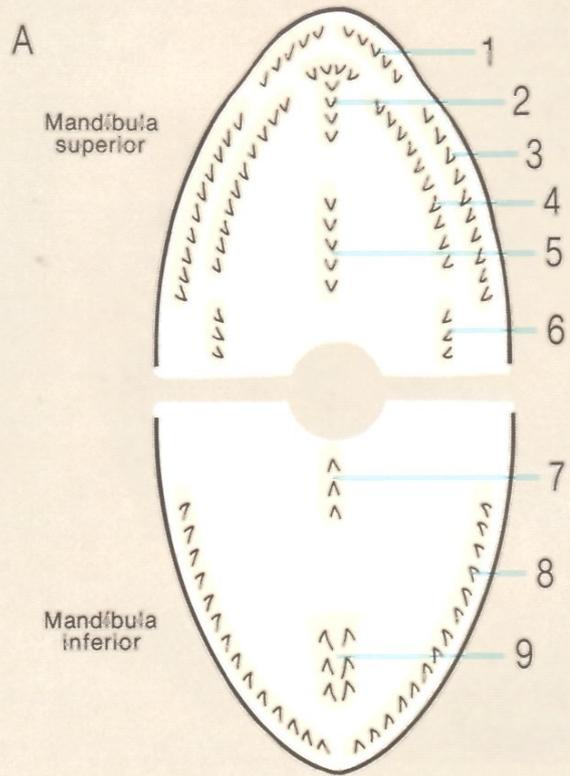


órgano eléctrico

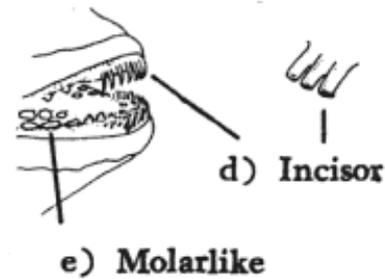
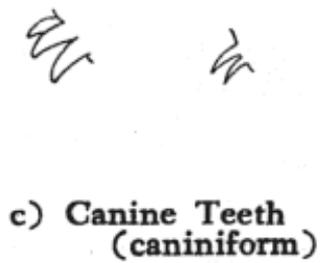
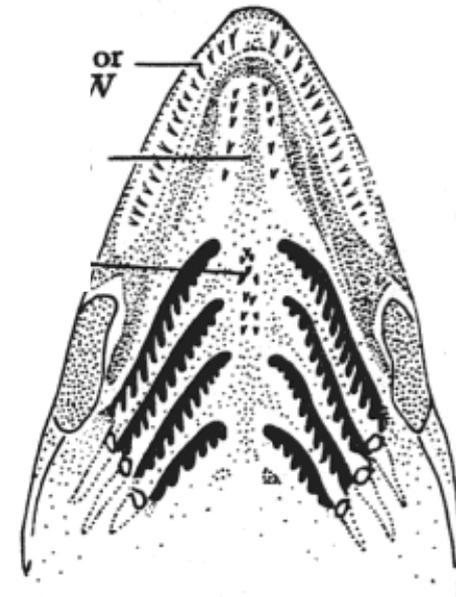
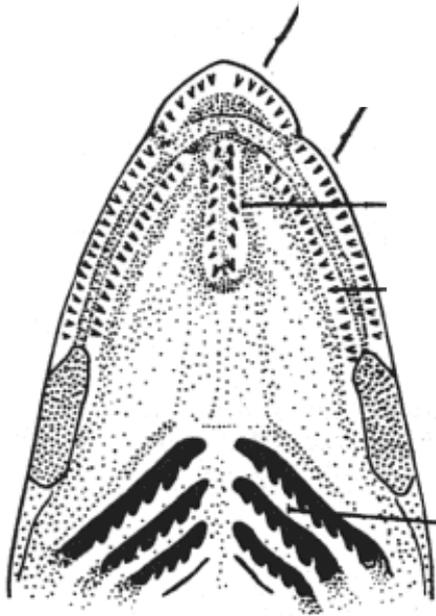


# aparato digestivo

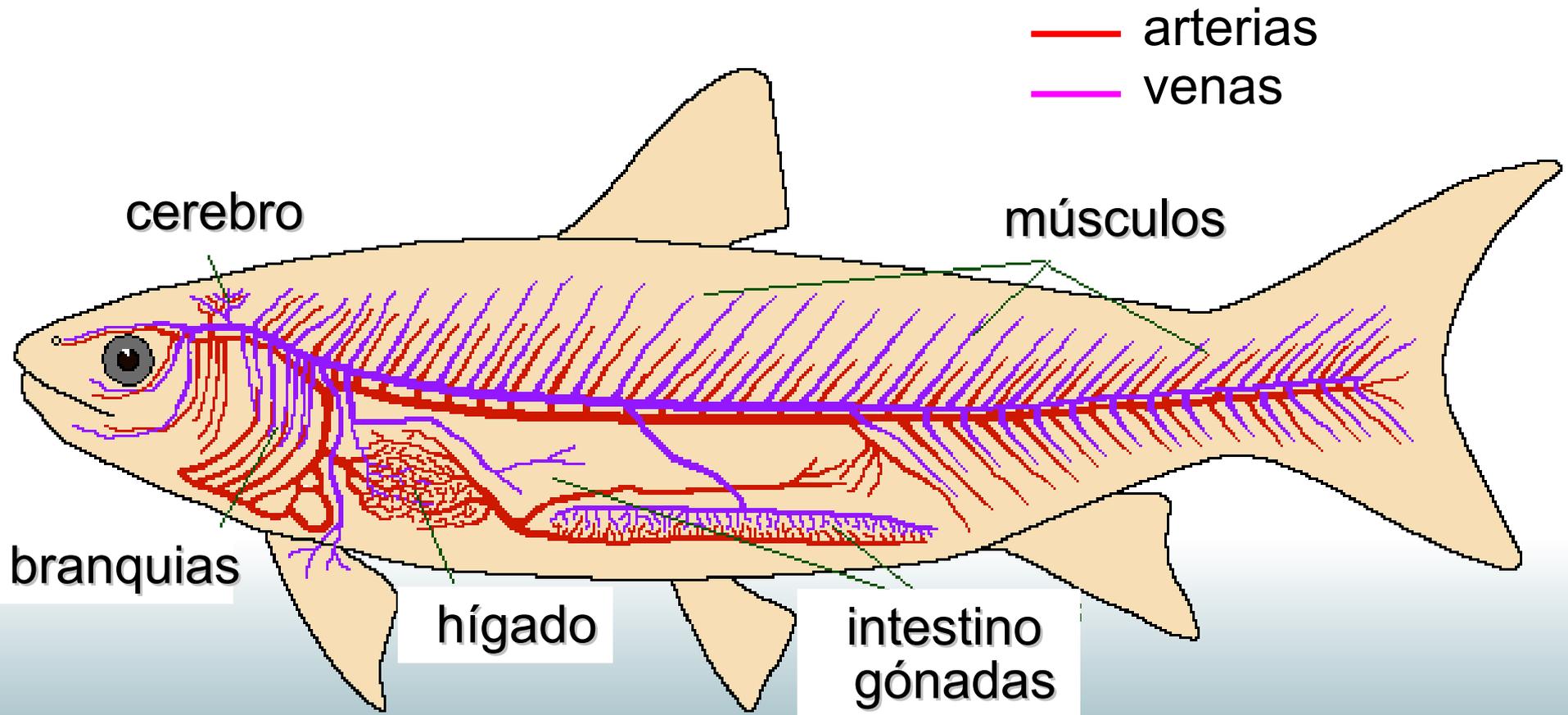




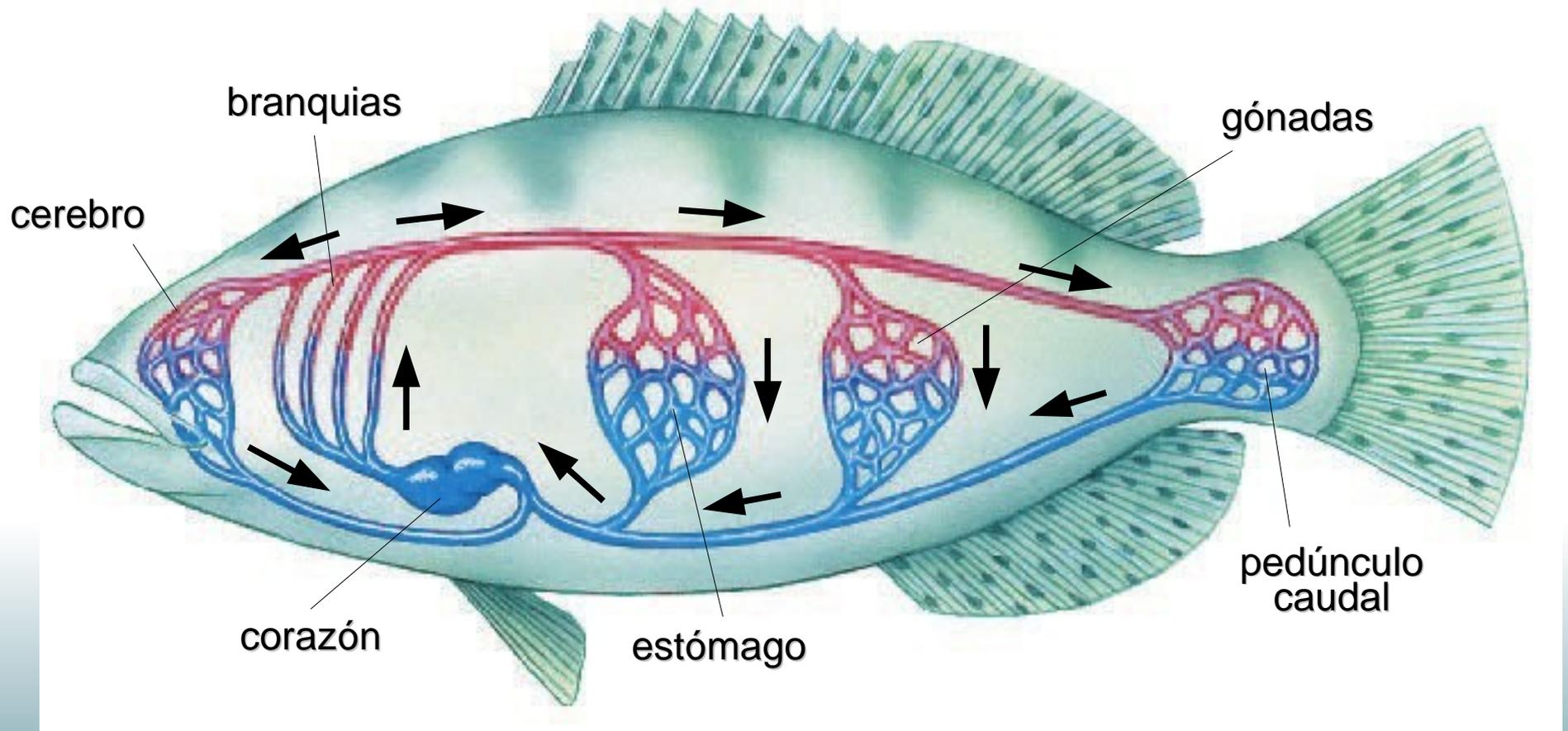
# dientes



# sistema circulatorio

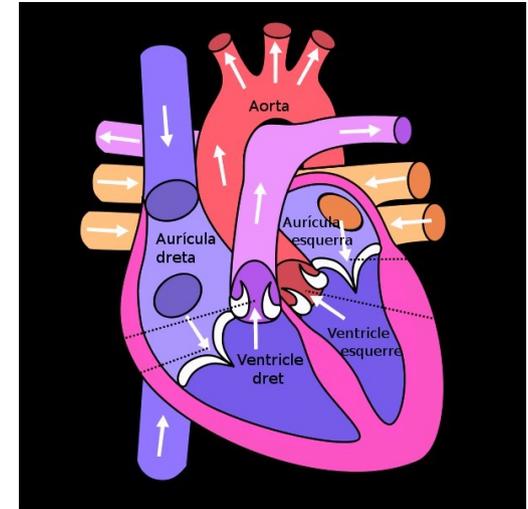
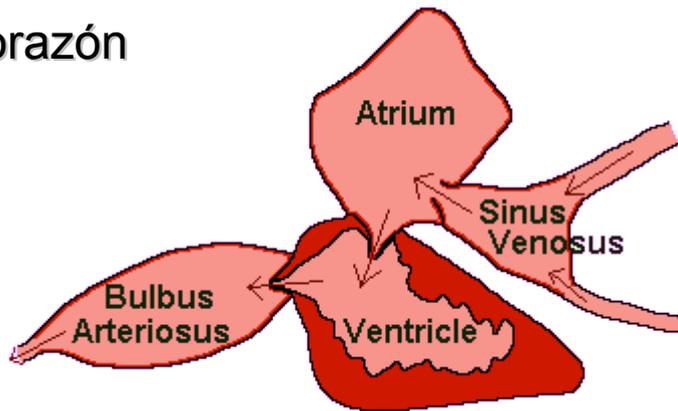


# sistema circulatorio y respiración

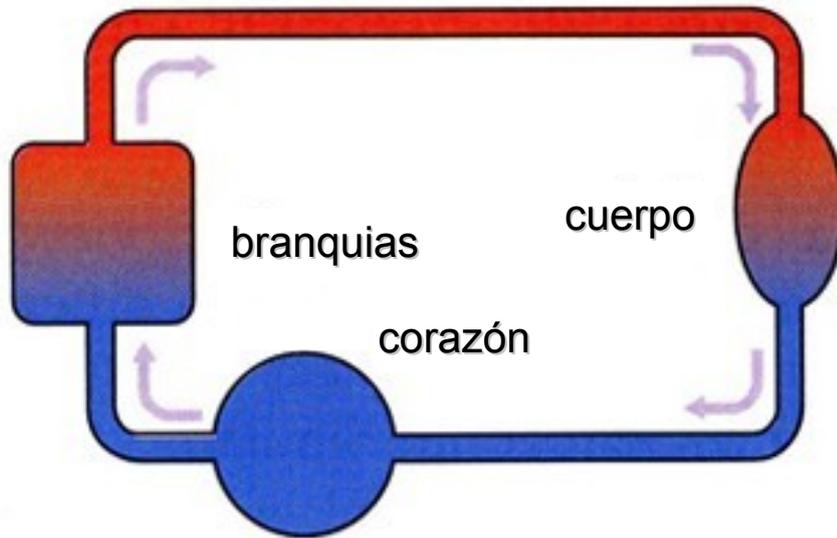


# sistema circulatorio

corazón

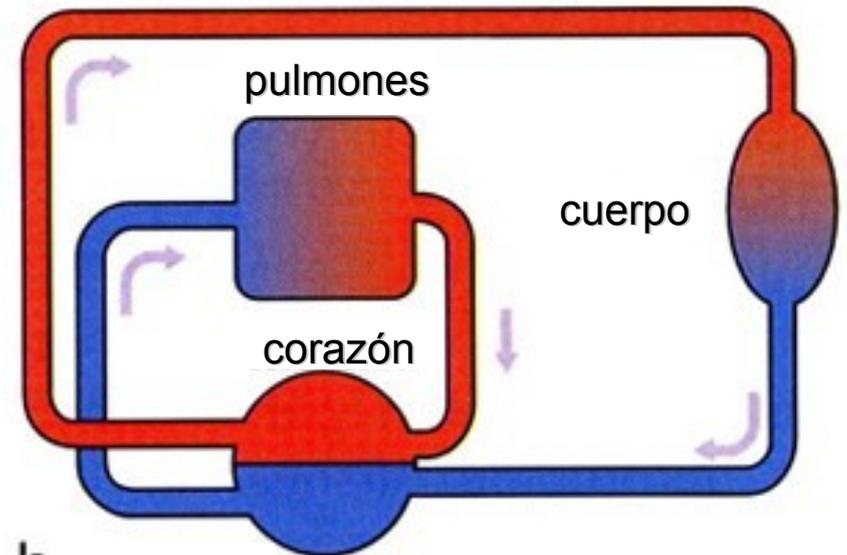


circulación simple



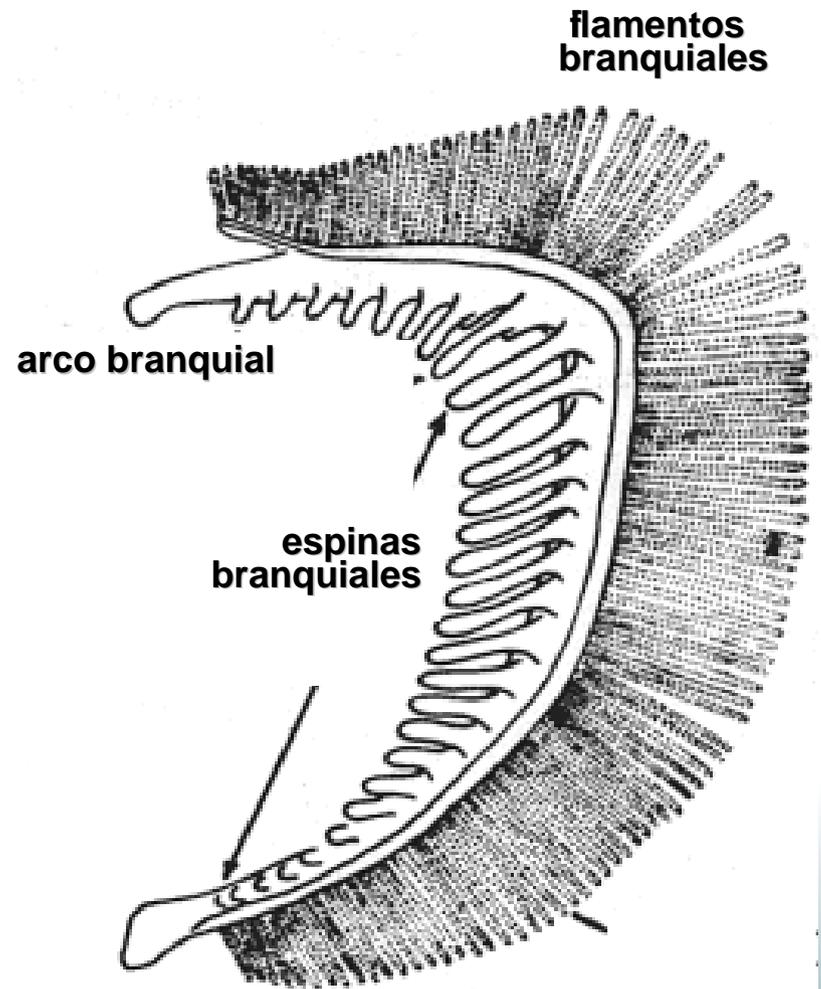
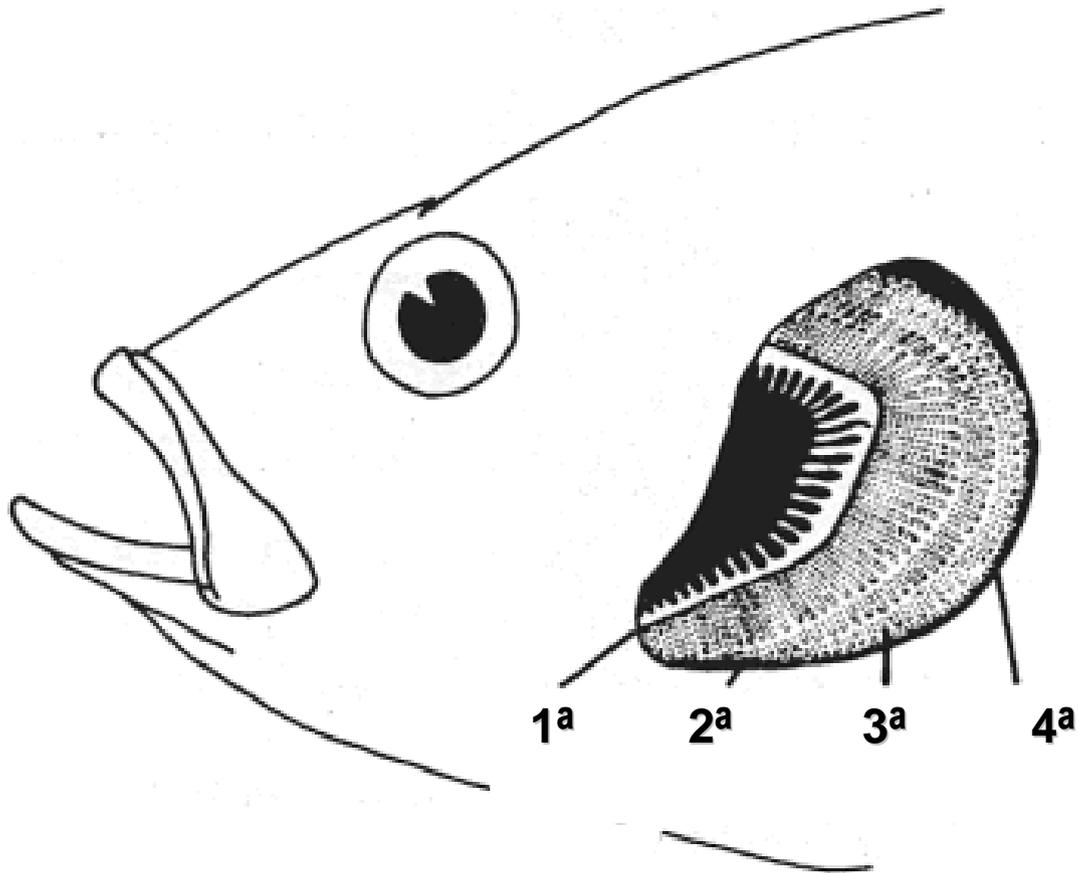
a peces

circulación doble

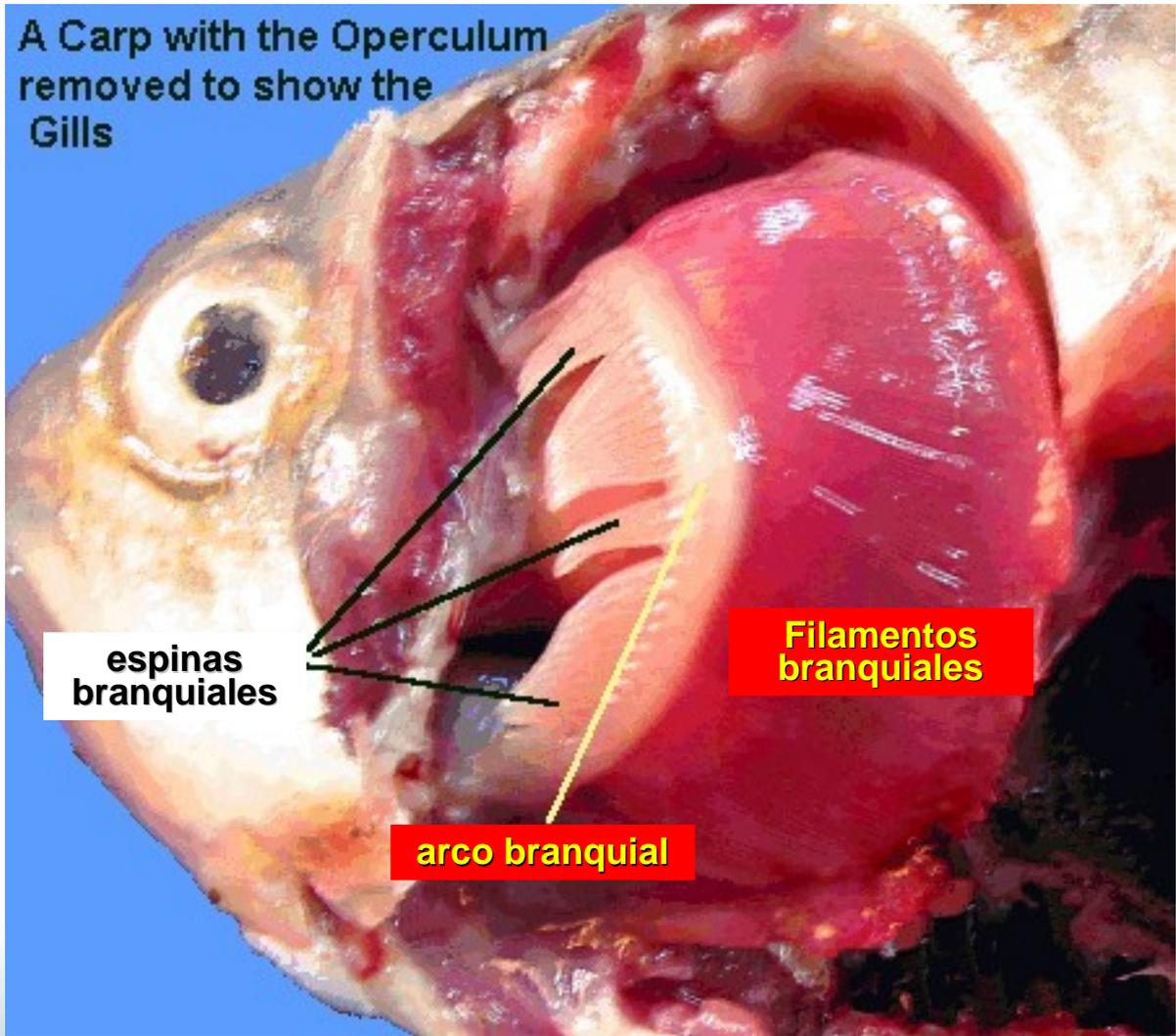


b mamíferos

# branquias



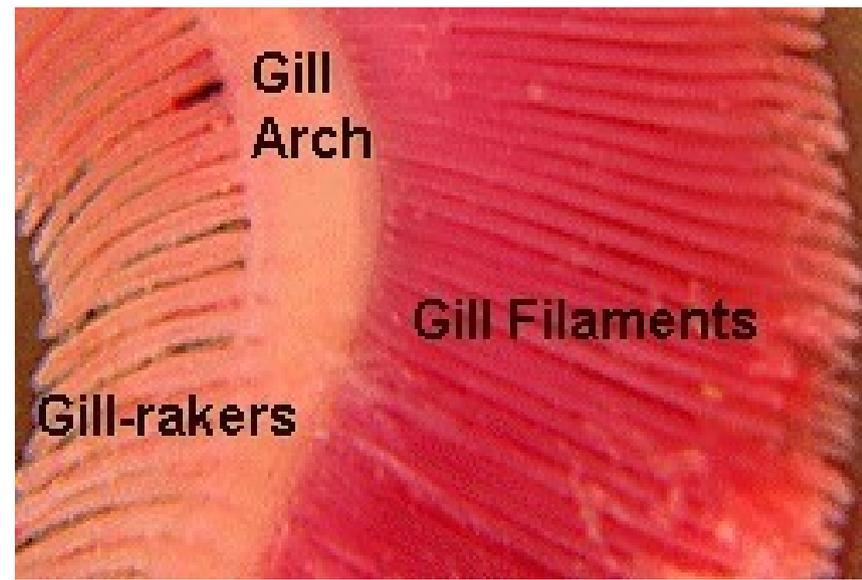
A Carp with the Operculum removed to show the Gills



espinas  
branquiales

Filamentos  
branquiales

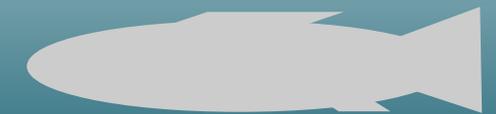
arco branquial



Gill  
Arch

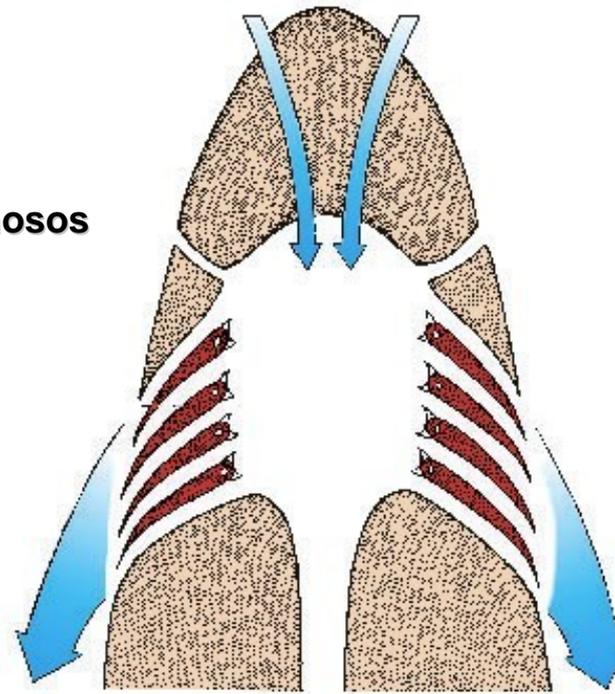
Gill Filaments

Gill-rakers

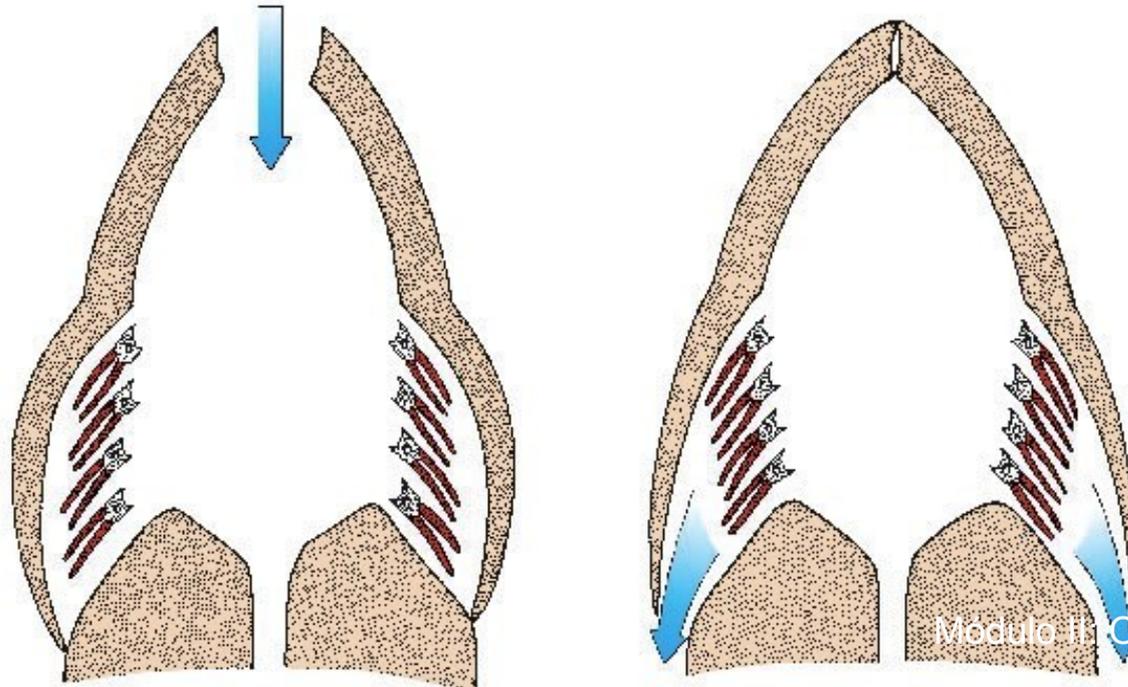


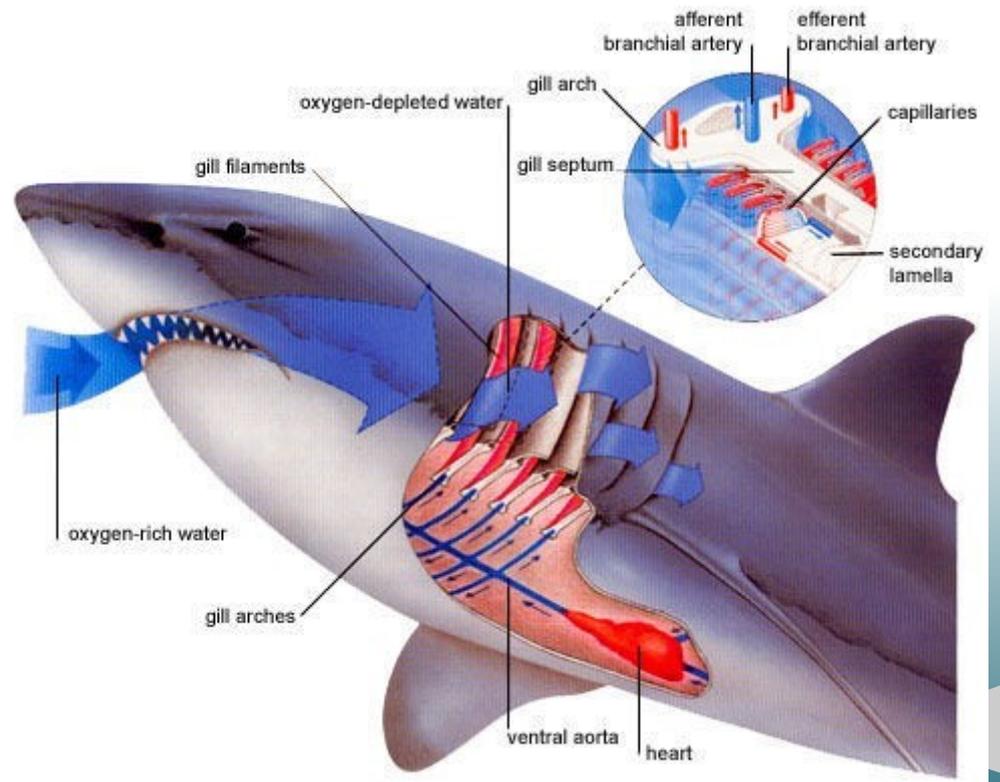
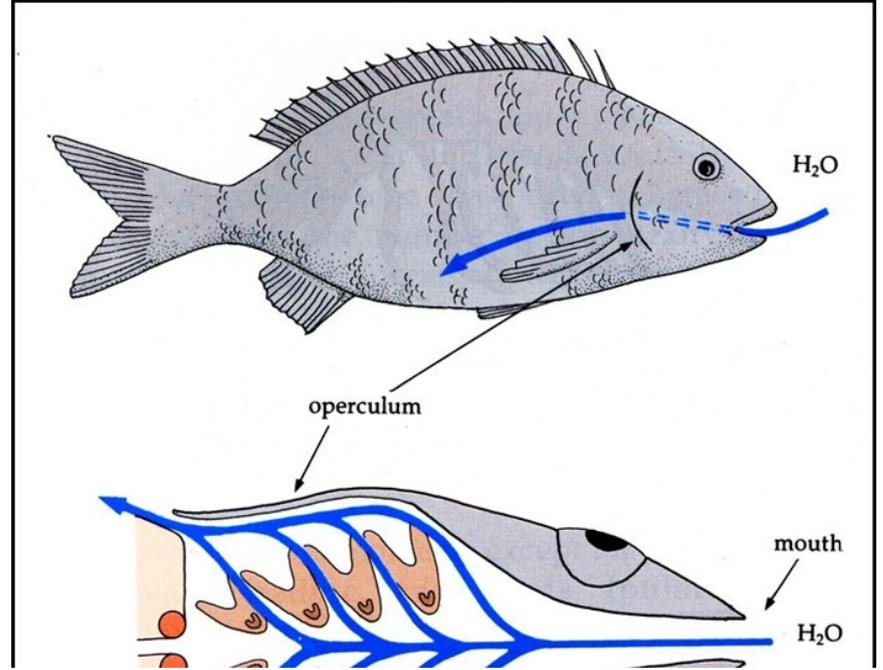
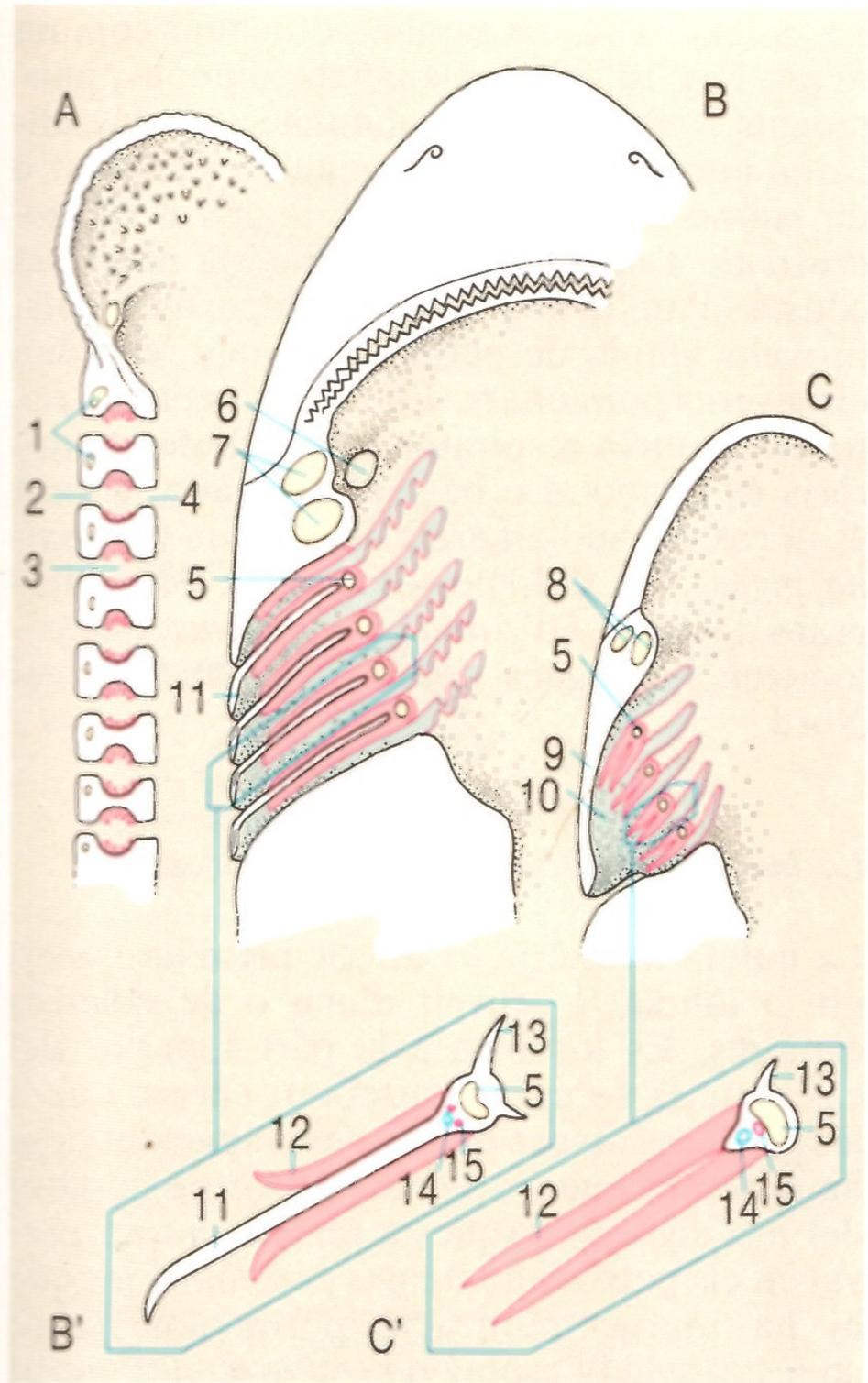
# respiración

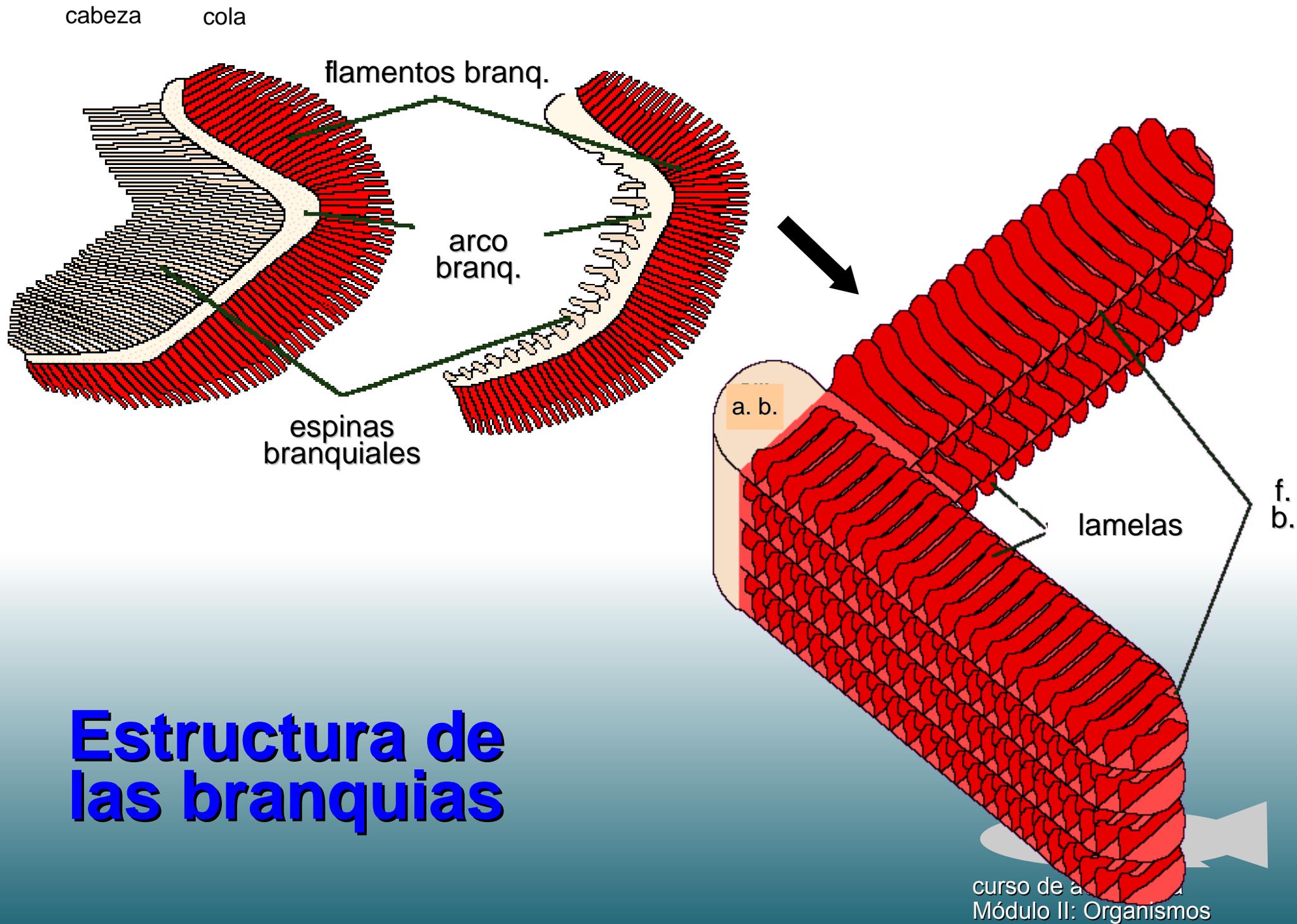
Peces cartilagosos



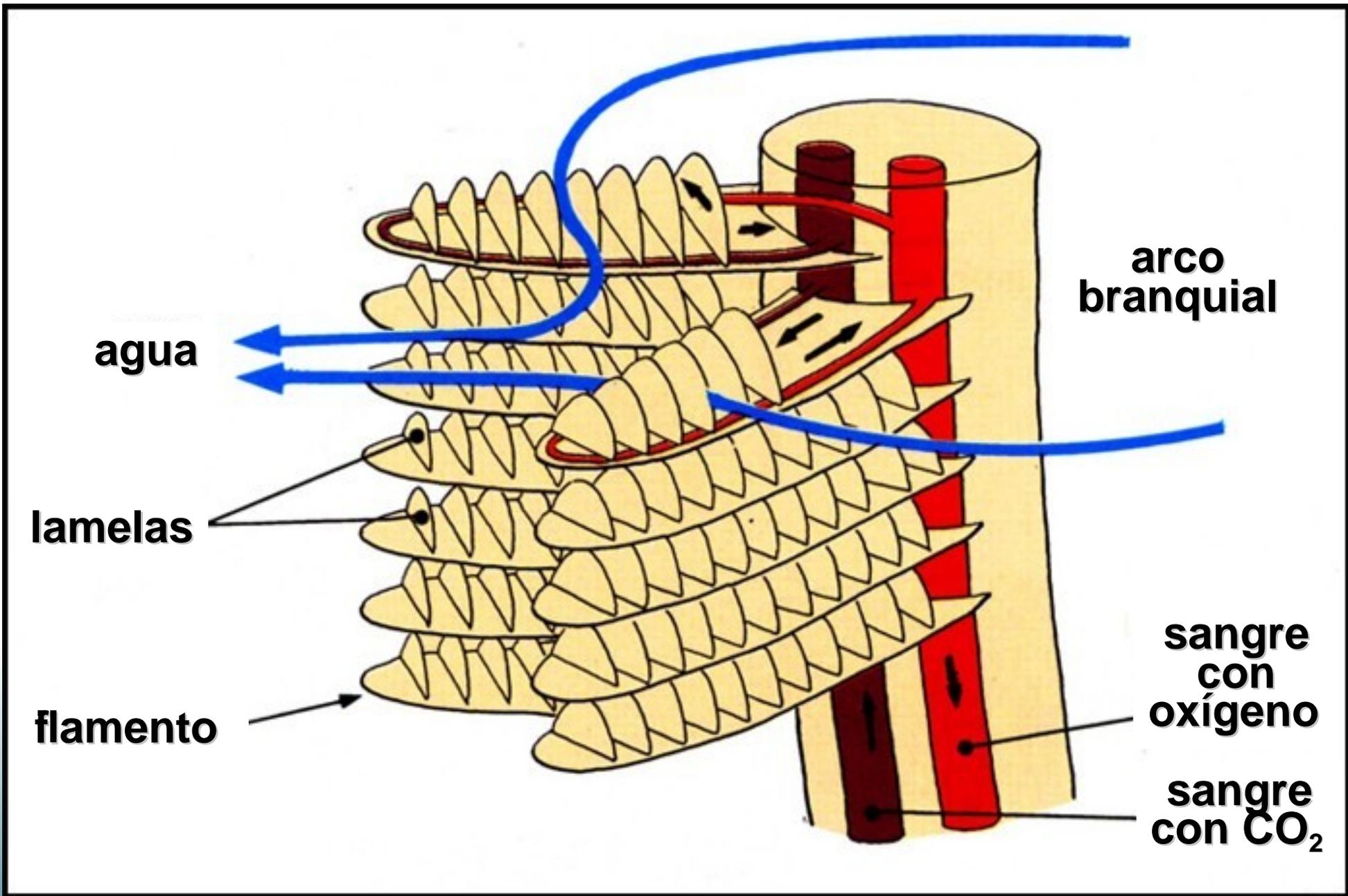
Peces óseos







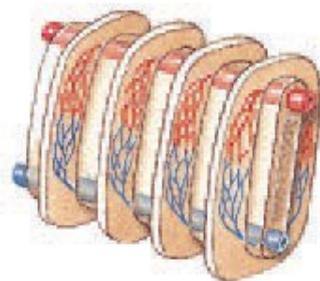
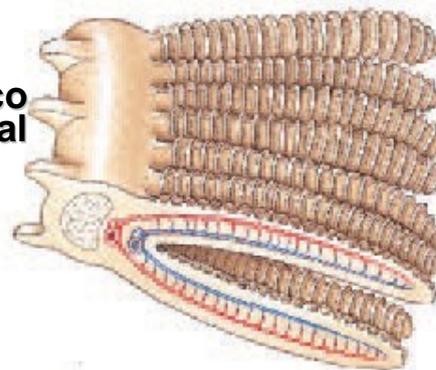
# Estructura de las branquias



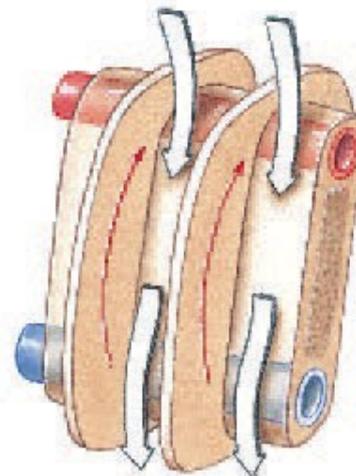


arco  
branquial

flamentos

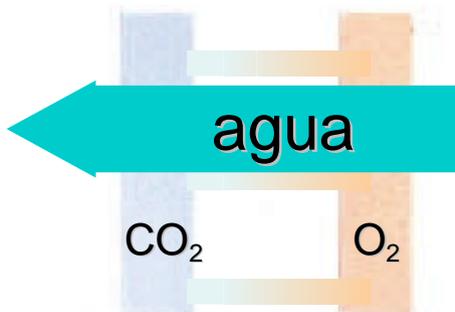


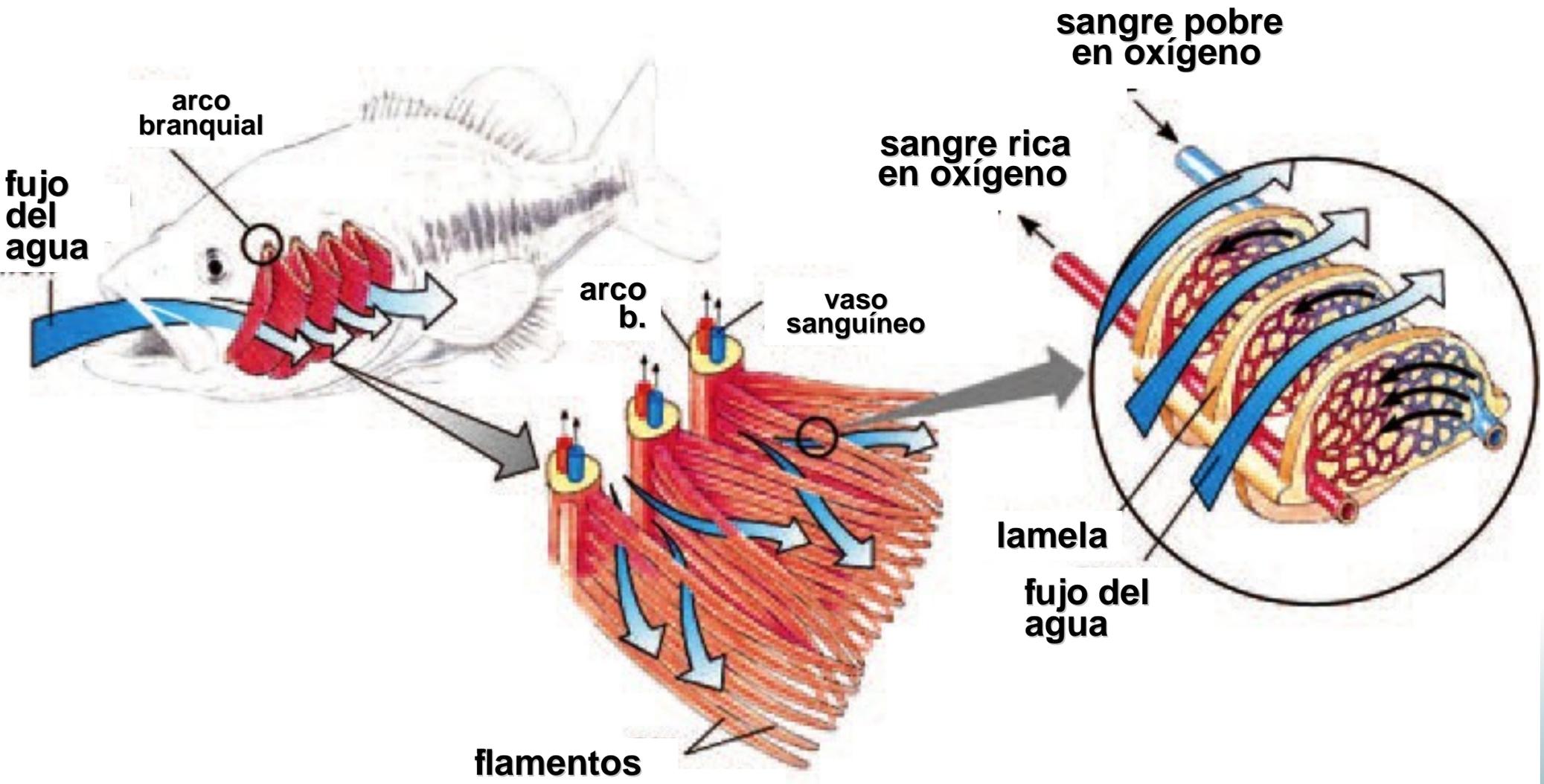
lamelas



sangre  
con oxígeno

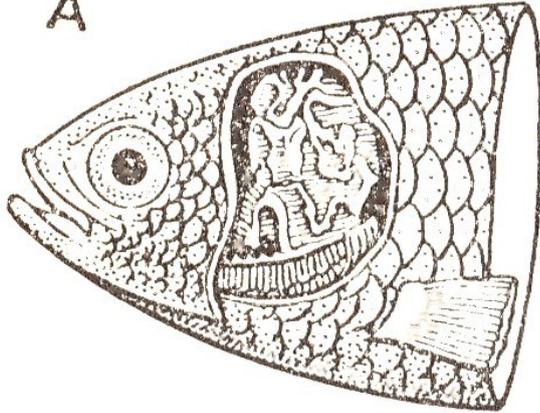
sangre  
con  $\text{CO}_2$



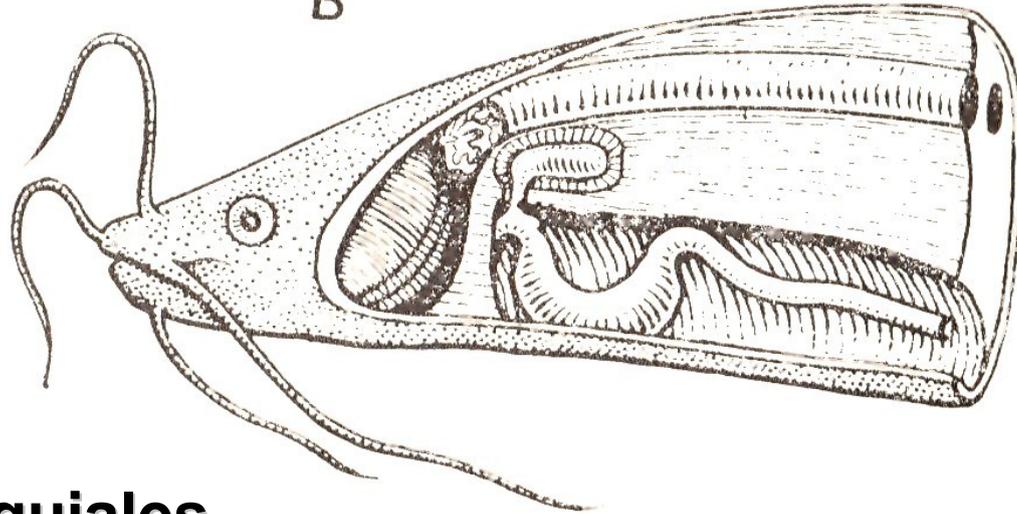


# Respiración aérea

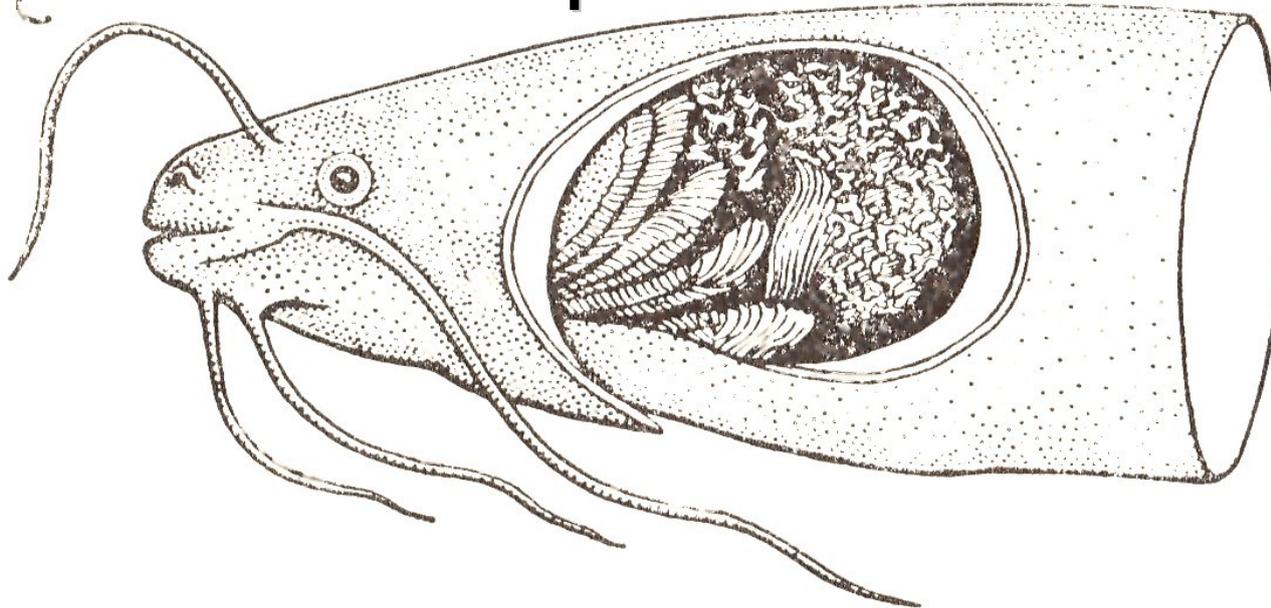
**A** laberinto



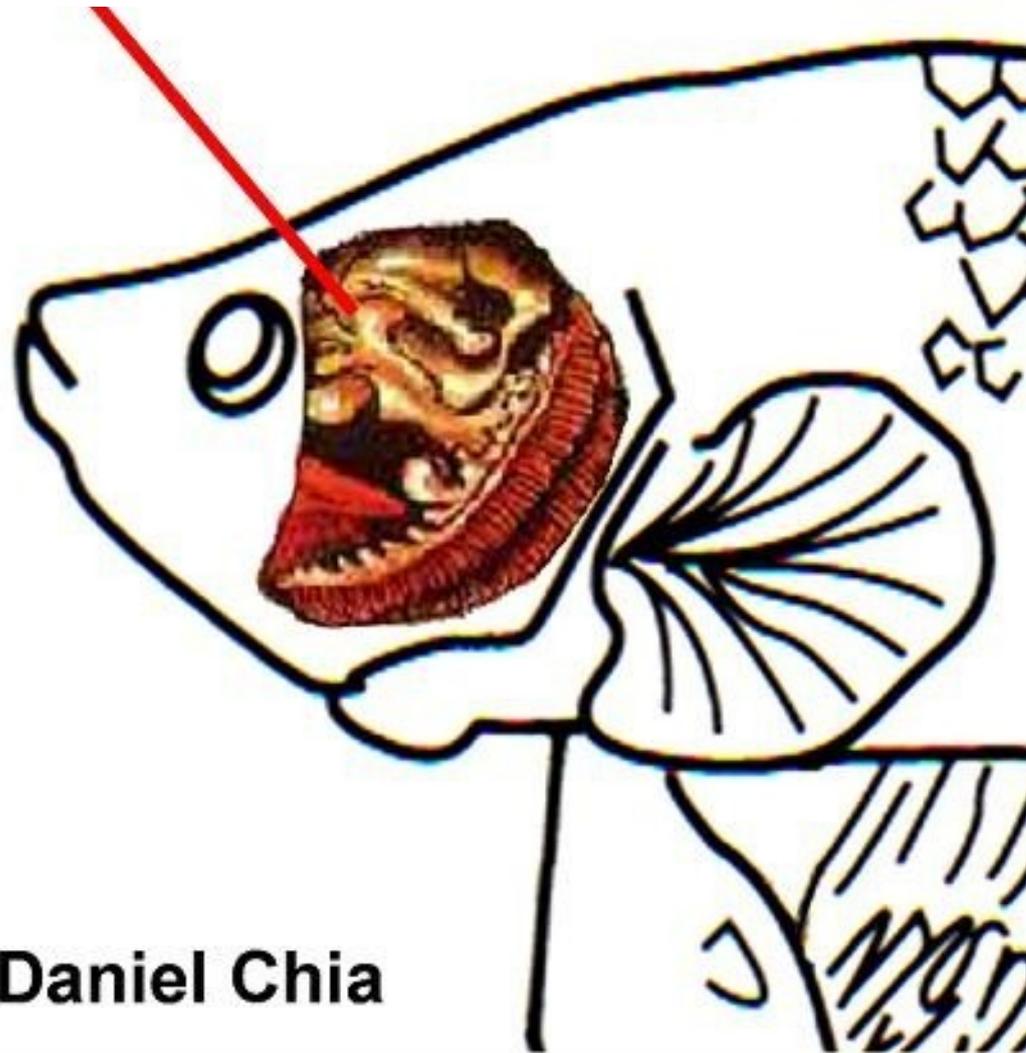
**B** sacos aéreos



**C** cámaras branquiales



**Laberinto**



**© 2007 Daniel Chia**

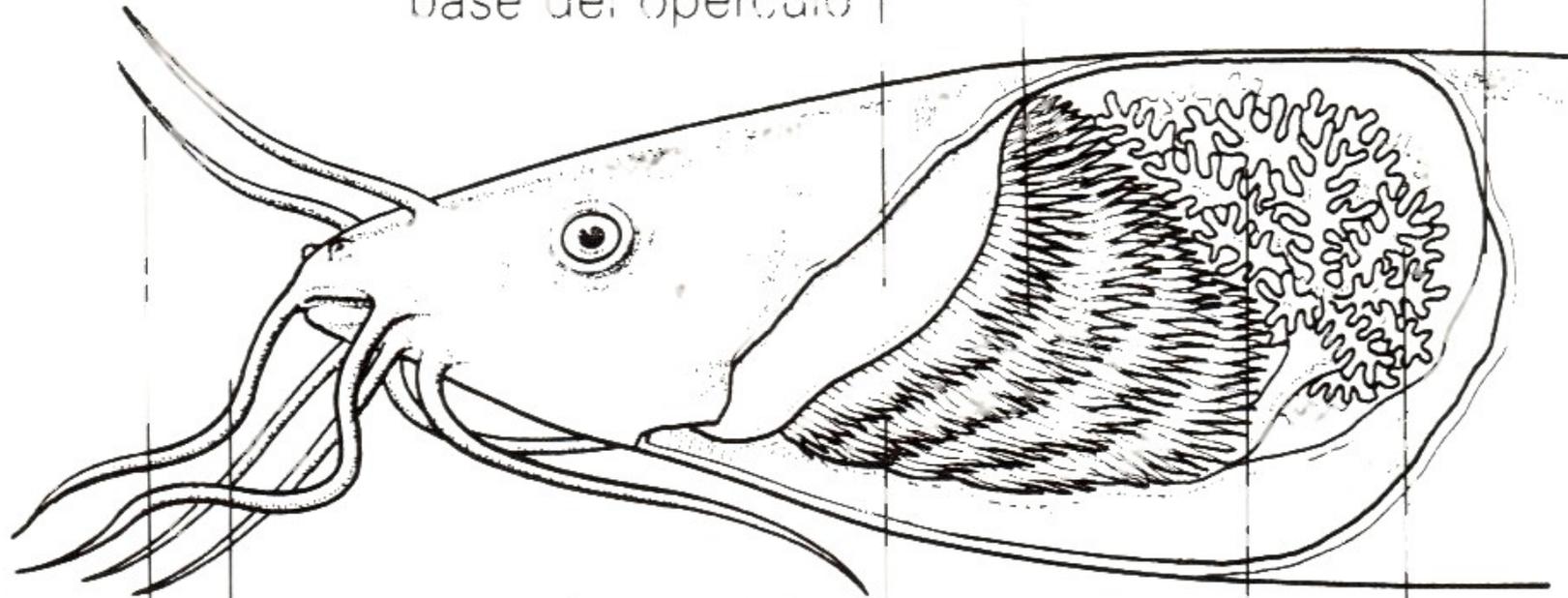


# cámaras branquiales

conexión cartilaginosa con la prolongación branquial

filamentos

base del opérculo



barbillas

arcos branquiales

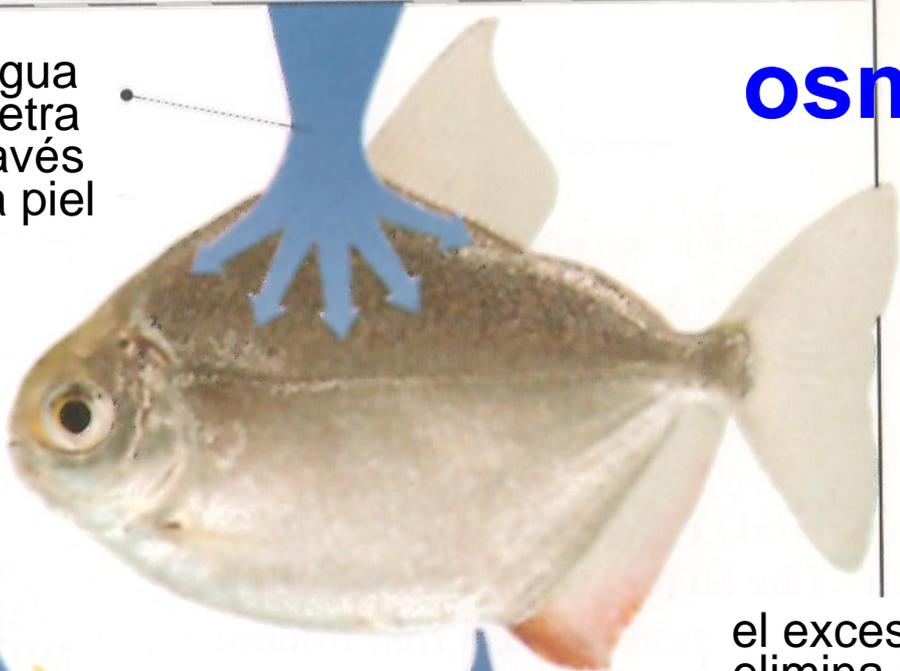
prolongaciones branquiales

prolongación de la cámara branquial

# osmorregulación

**agua dulce**

el agua penetra a través de la piel



el agua se pierde a través de la piel



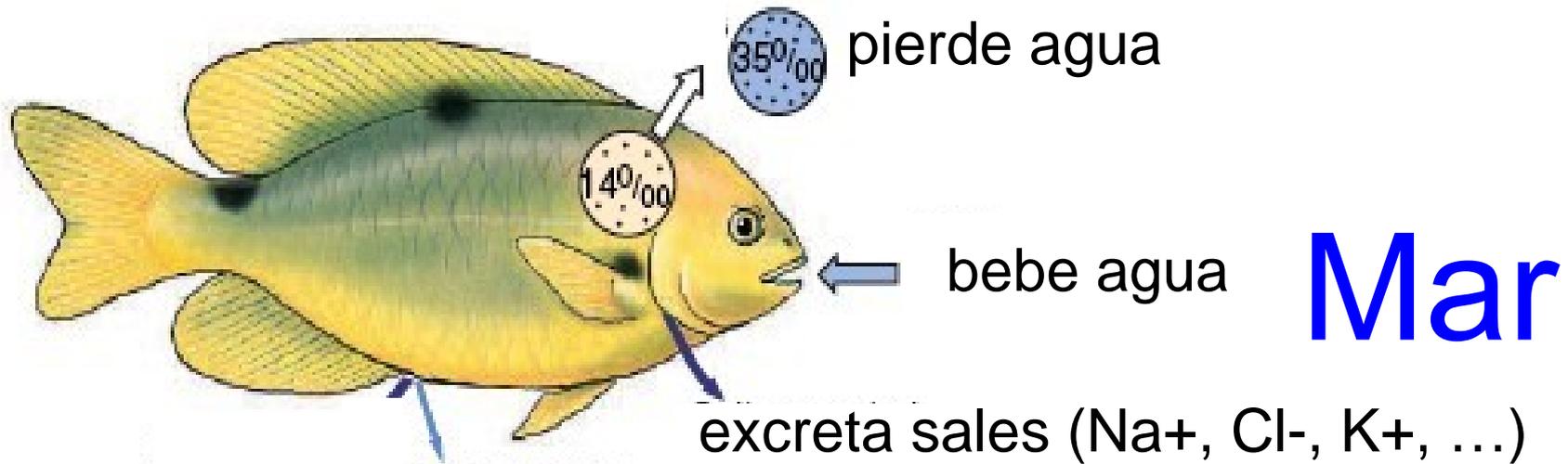
el exceso de agua se elimina a través de la orina

el pez bebe agua para compensar

**agua de mar**

la orina es muy concentrada





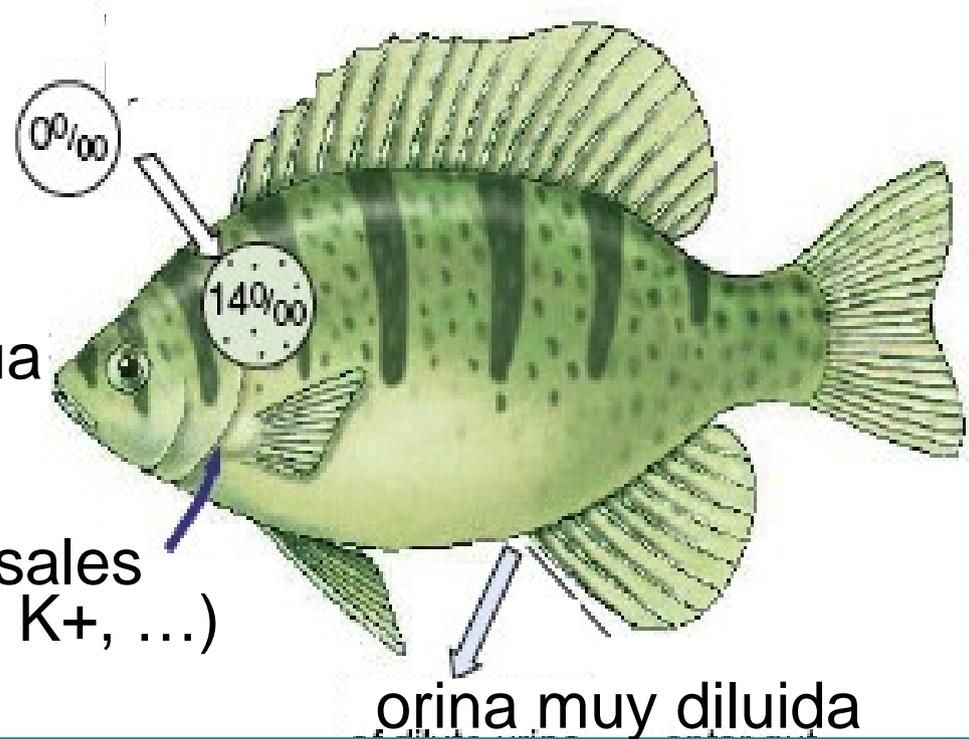
orina muy concentrada

incorpora agua

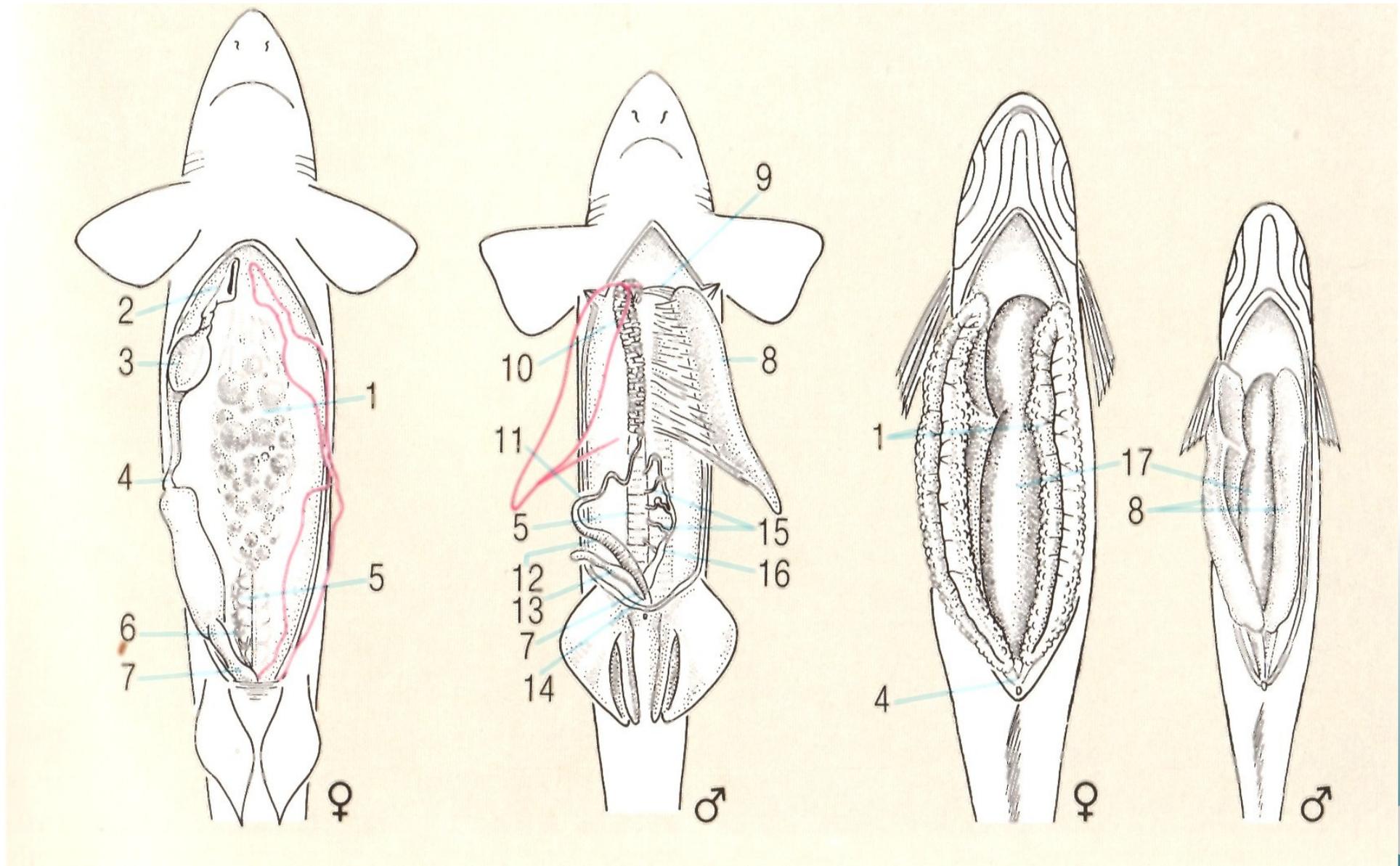
**Agua dulce**

no bebe agua

capta sales ( $\text{Na}^+$ ,  $\text{Cl}^-$ ,  $\text{K}^+$ , ...)



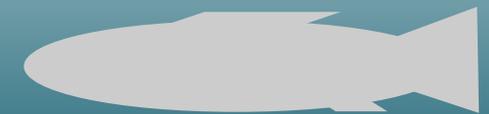
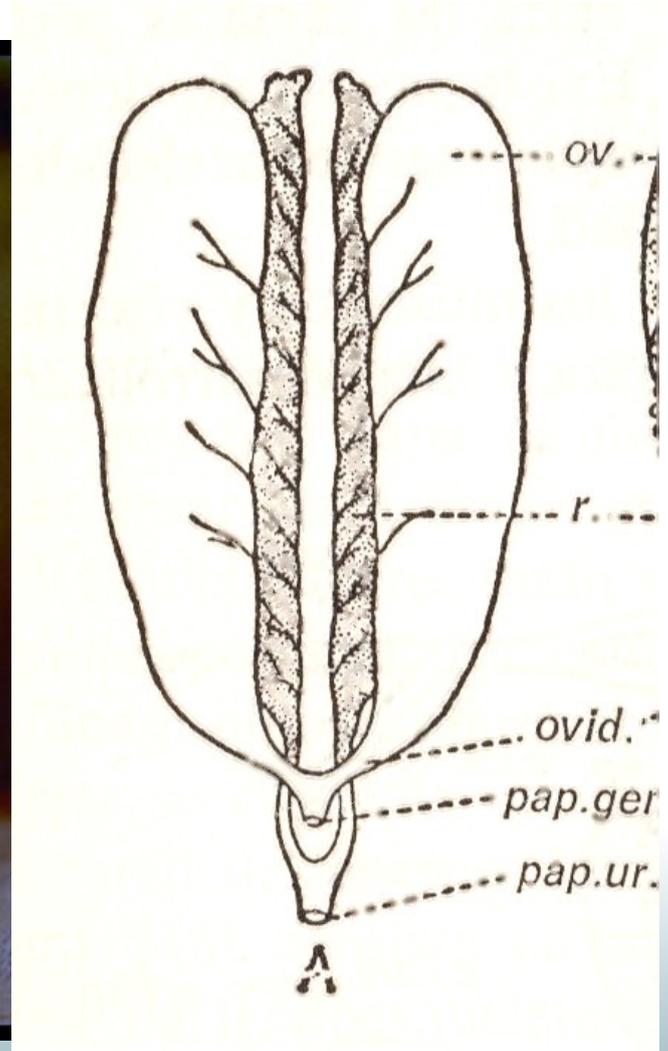
# sistema reproductor



**testículos**



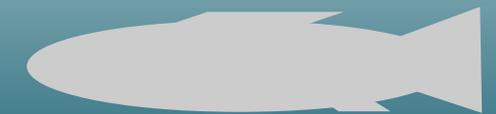
# ovarios



## ovarios



## testículos





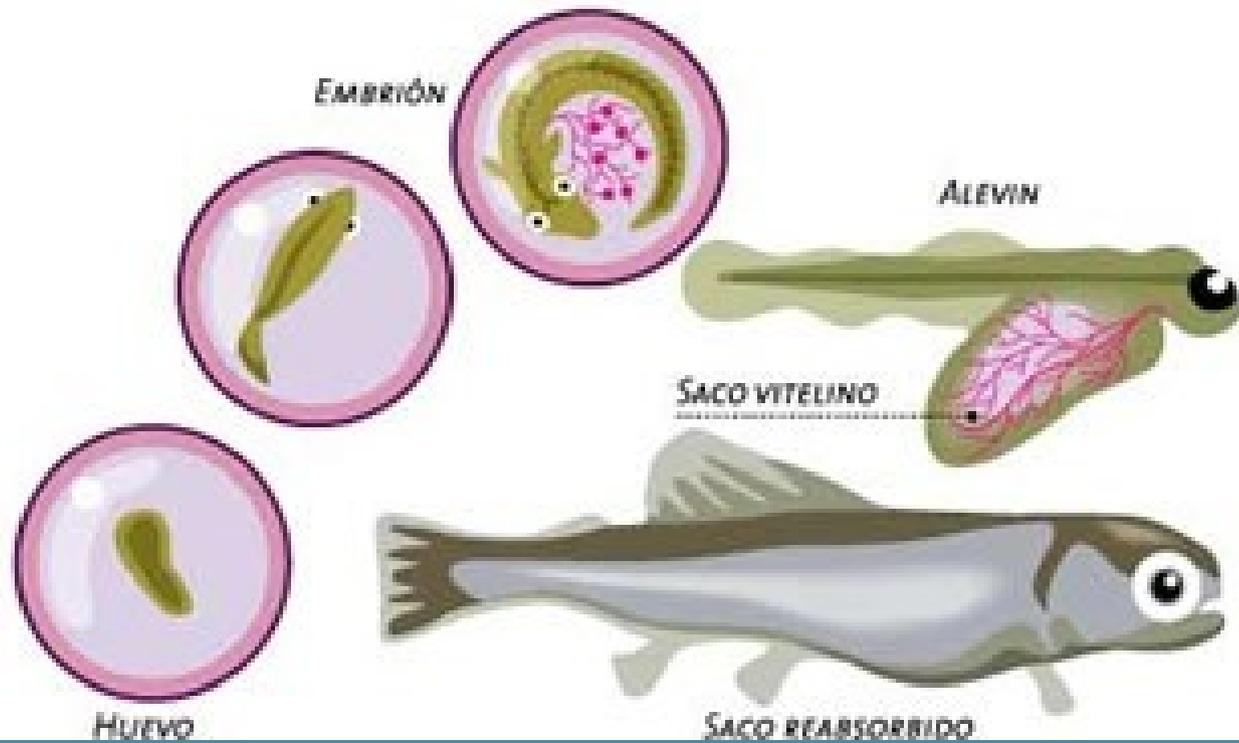
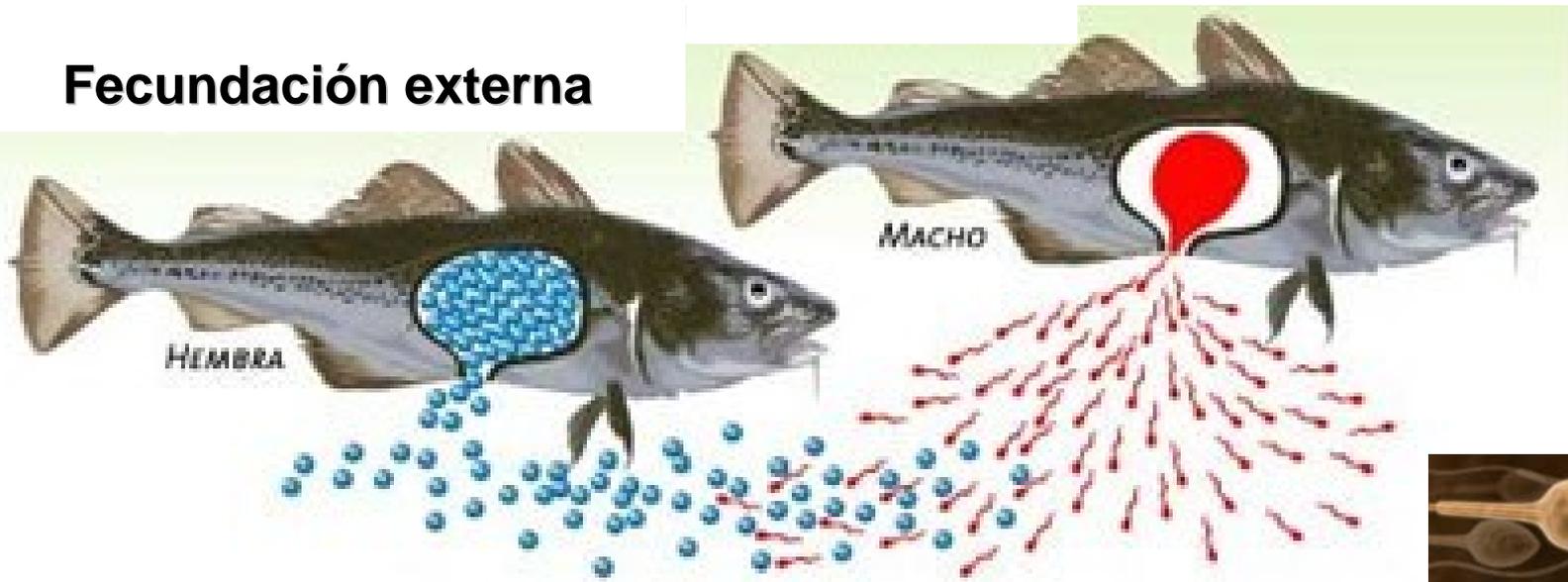
**ovarios**

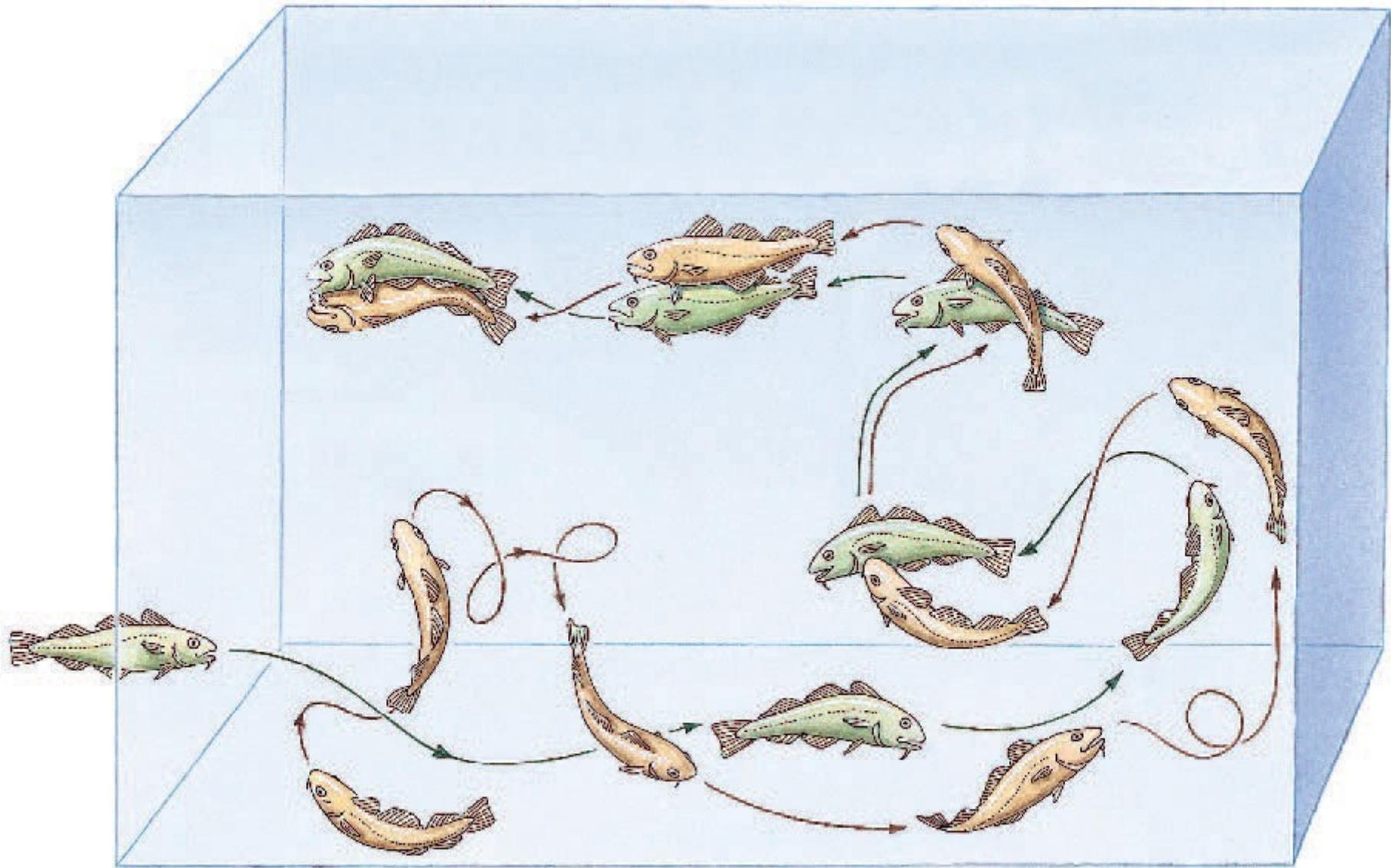


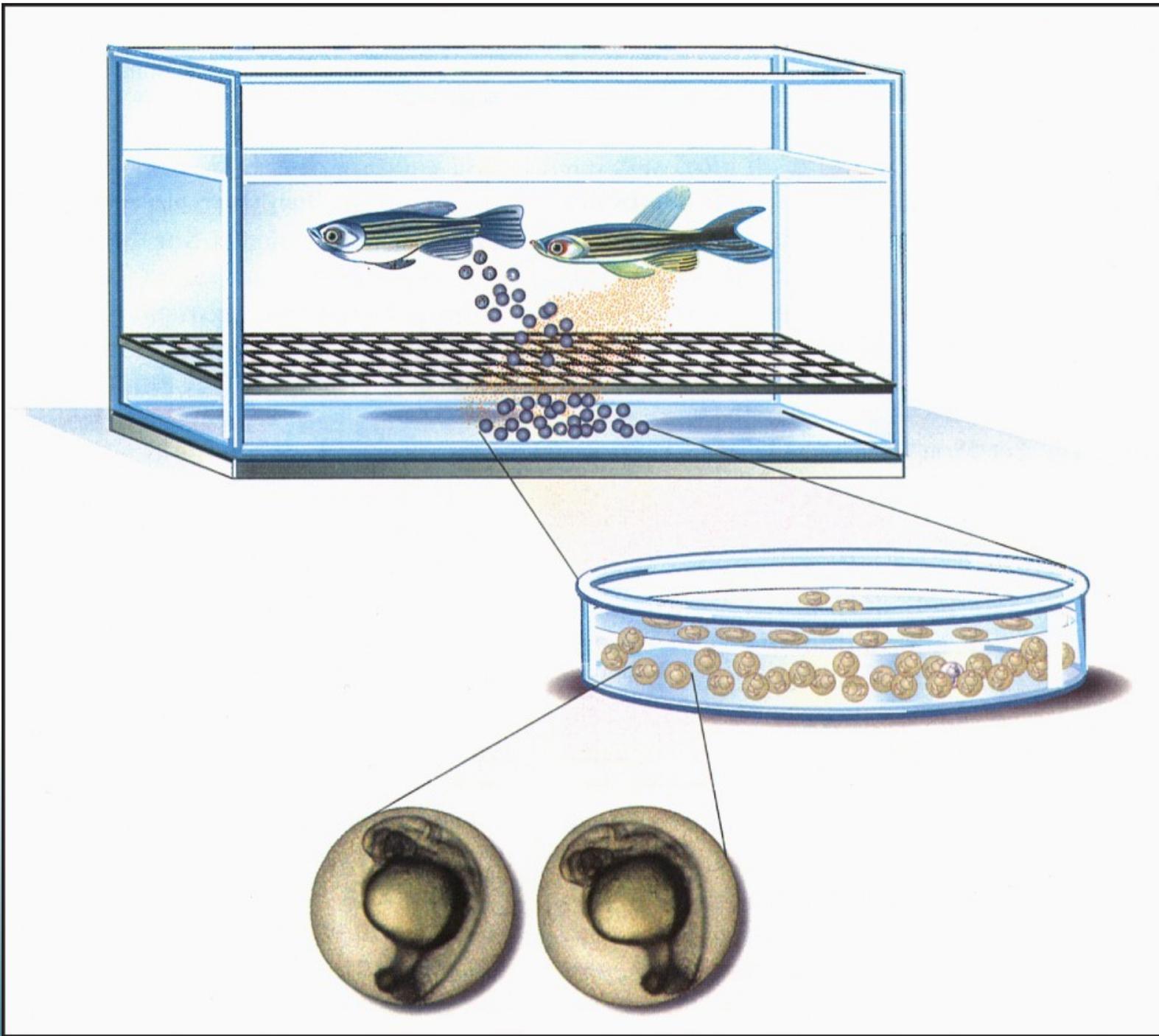
**testículos**



# Fecundación externa





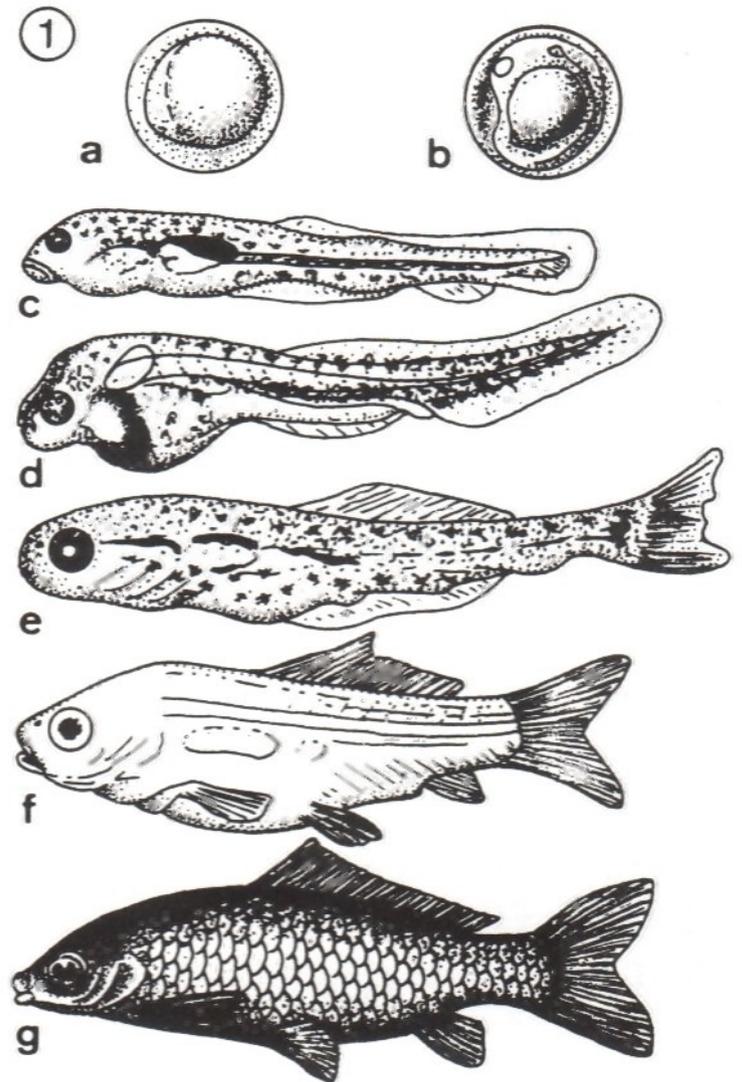




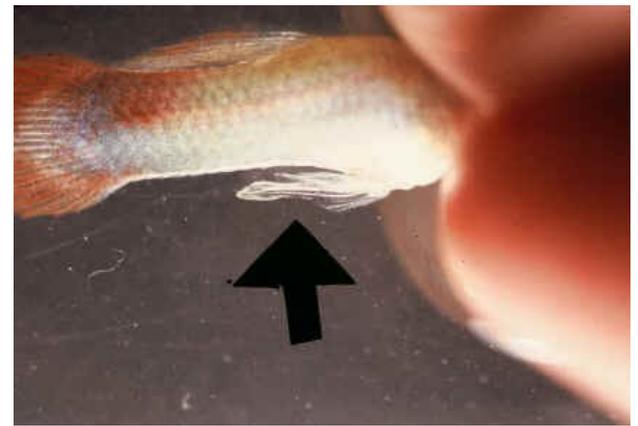
A.Slotwinski/TAFI/UTAS



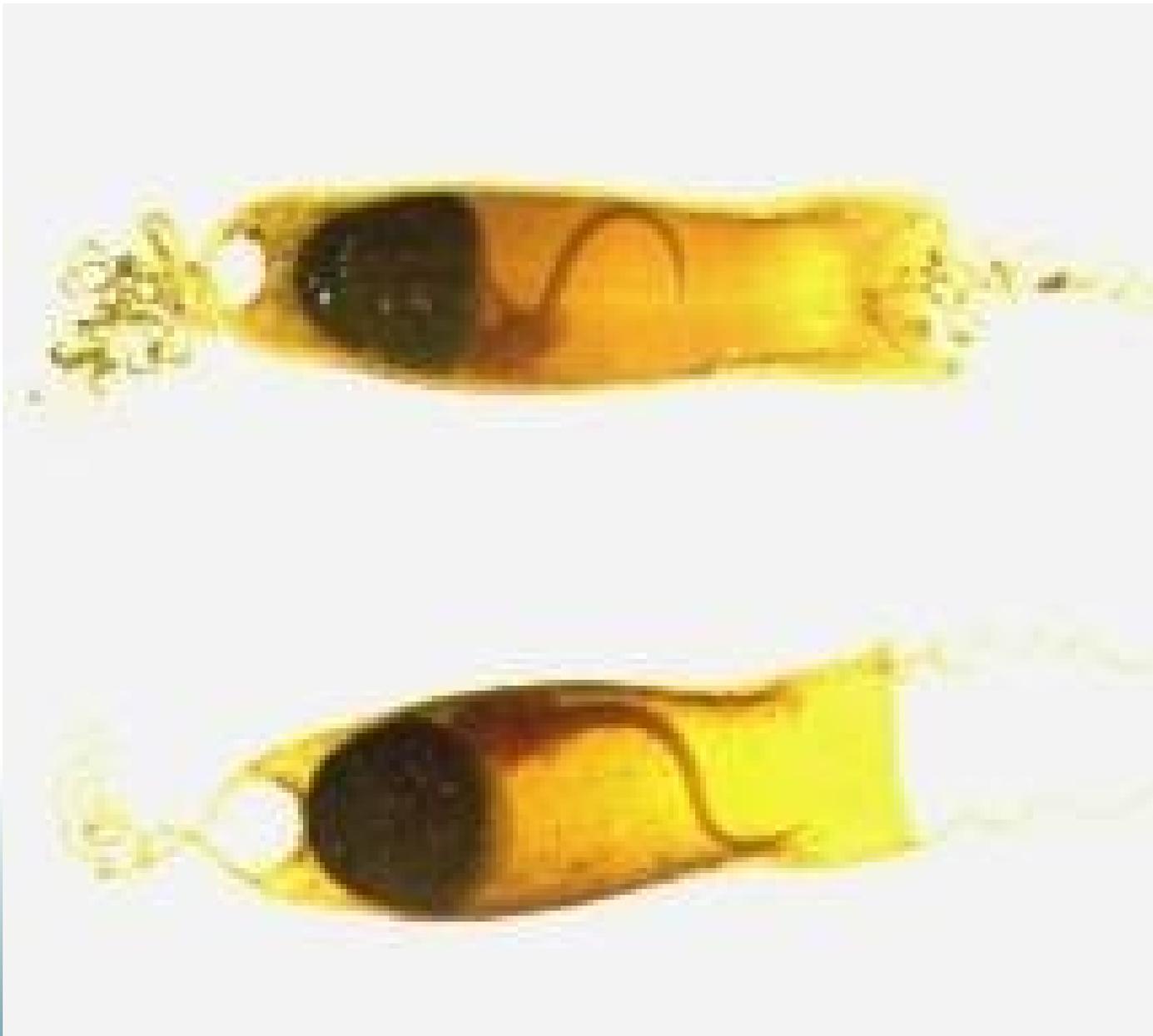
Nacimiento

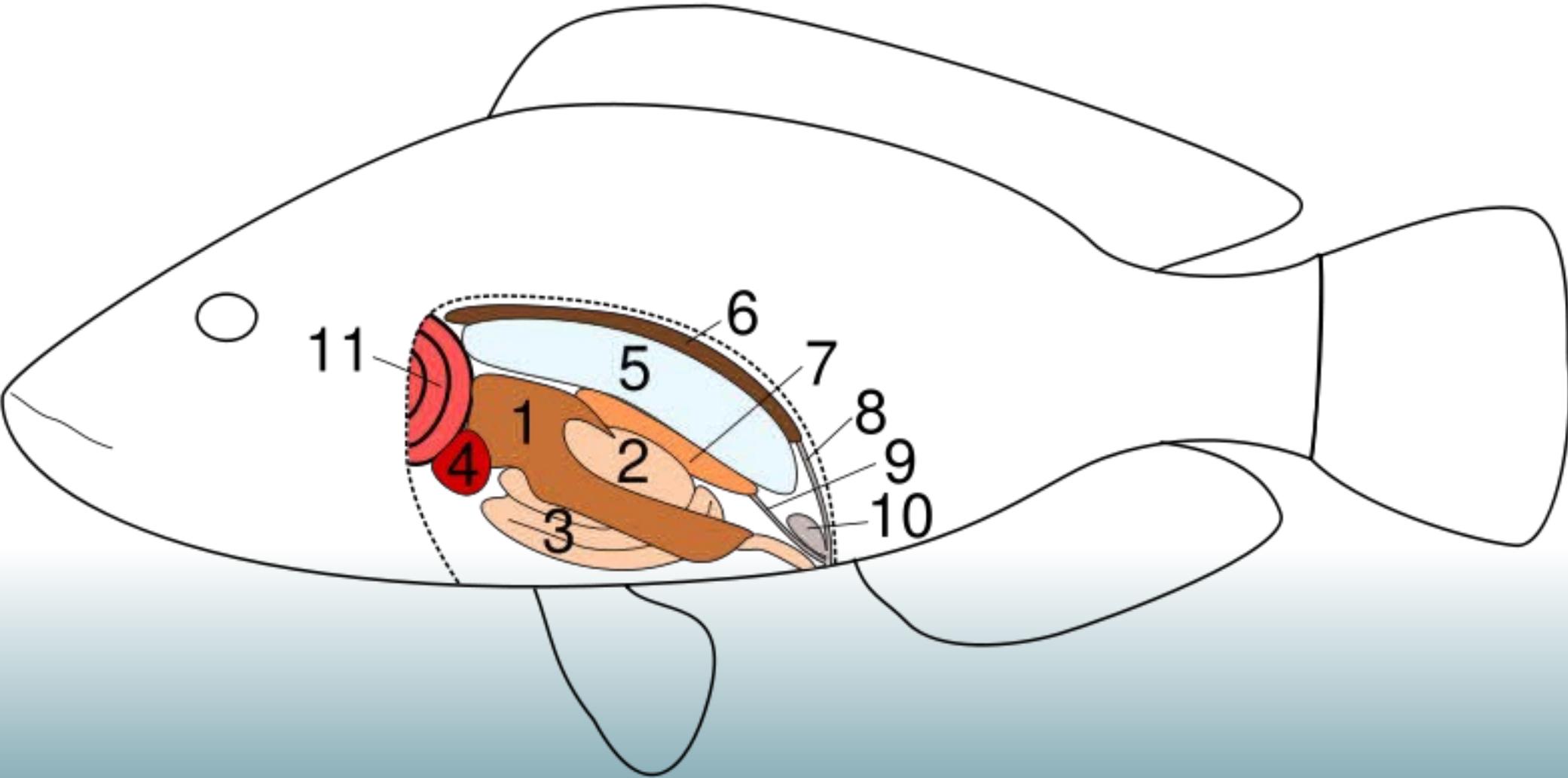


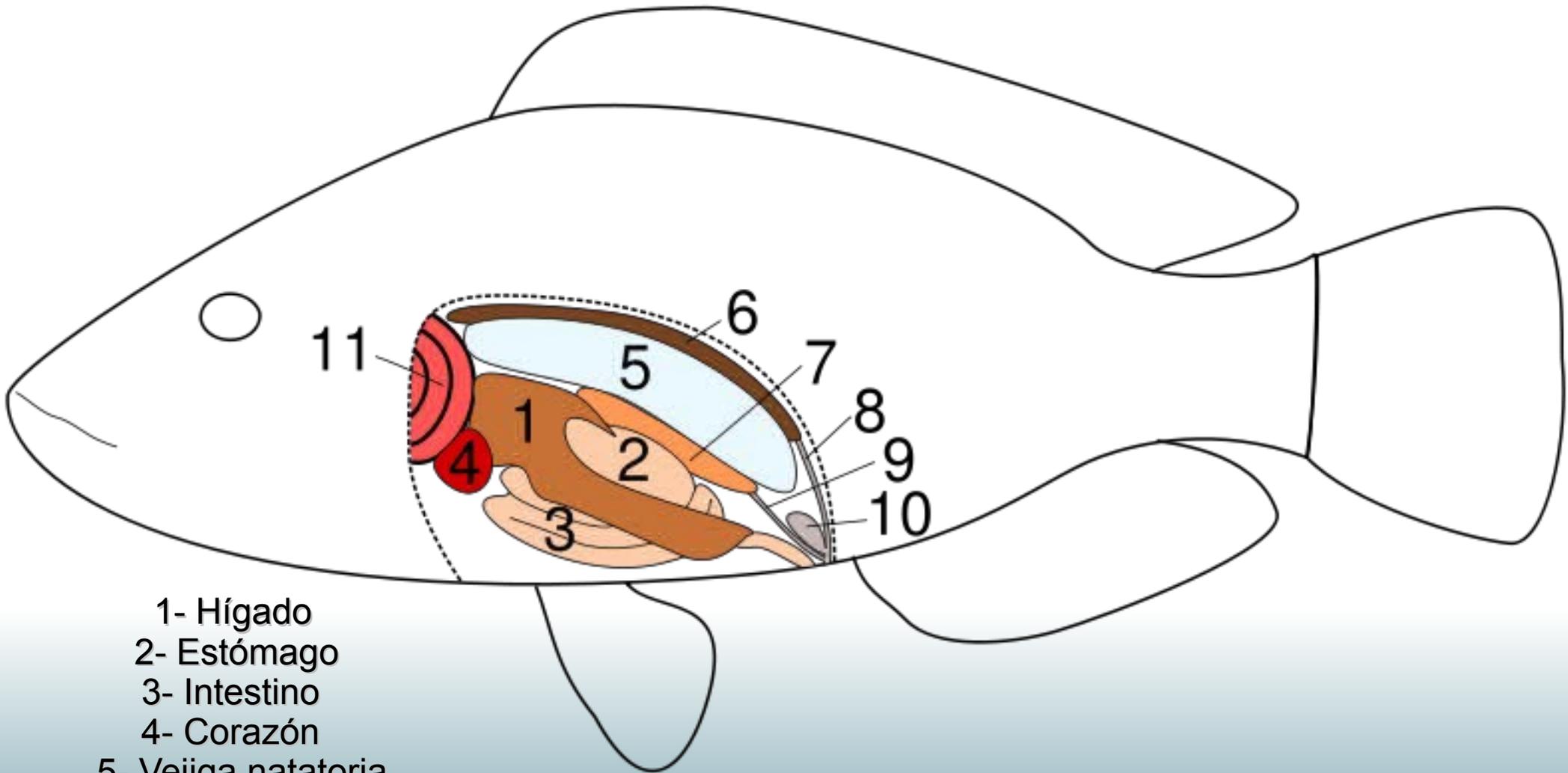
# Fecundación interna











- 1- Hígado
- 2- Estómago
- 3- Intestino
- 4- Corazón
- 5- Vejiga natatoria
- 6- Riñón
- 7- Gónada
- 8- Uretra
- 9- Conducto deferente
- 10- Vejiga urinaria
- 11- Branquias

