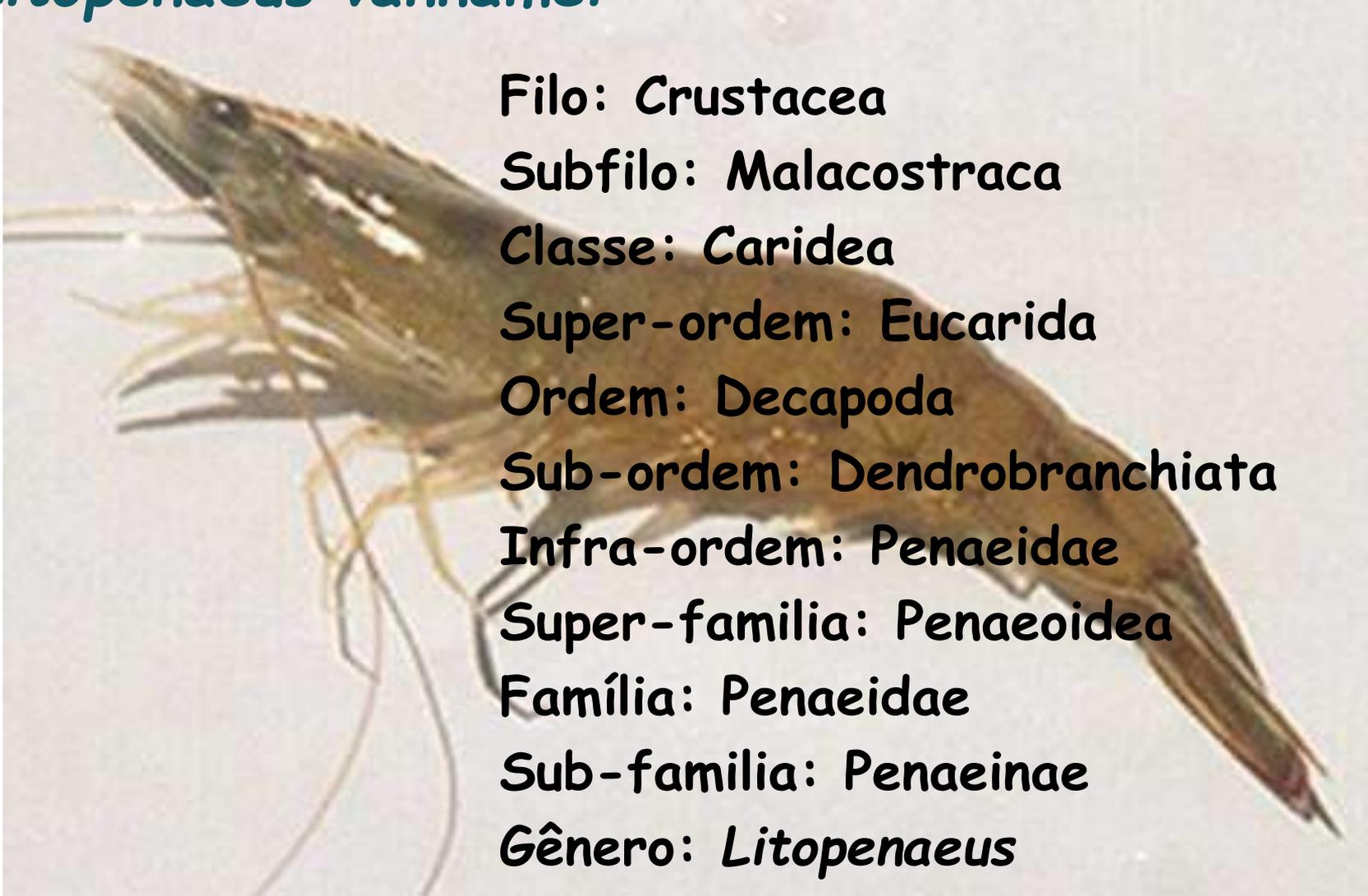


# SEMINÁRIO DE RESPONSABILIDADE TÉCNICA EM ESTABELECIMENTOS DE AQUICULTURA E INDÚSTRIA DE PESCADO

## Anatomia e fisiologia do camarão (sistema imune)

# *Litopenaeus vannamei*



Filo: Crustacea

Subfilo: Malacostraca

Classe: Caridea

Super-ordem: Eucarida

Ordem: Decapoda

Sub-ordem: Dendrobranchiata

Infra-ordem: Penaeidae

Super-familia: Penaeoidea

Família: Penaeidae

Sub-familia: Penaeinae

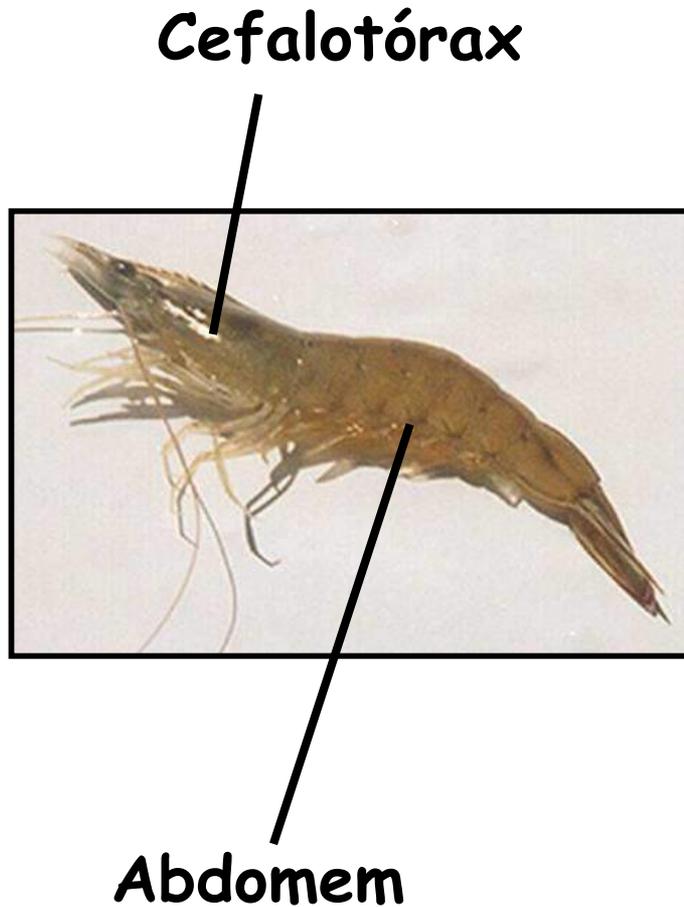
Gênero: *Litopenaeus*

Espécie: *Litopenaeus vannamei*.

# *Litopenaeus vannamei*

## MORFOLOGIA EXTERNA

Latim *crusta*  
Carapaça dura

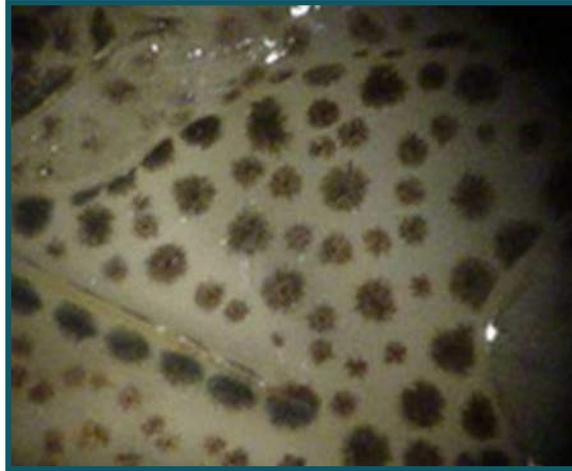


## Crescimento

➡ Desfazem do exosqueleto "apertado" (formar um novo)

## MUDA OU ECDISE

# MORFOLOGIA EXTERNA



Melanóforos - grânulos pretos

Leucóforos - grânulos brancos

Eritróforos - grânulos vermelhos

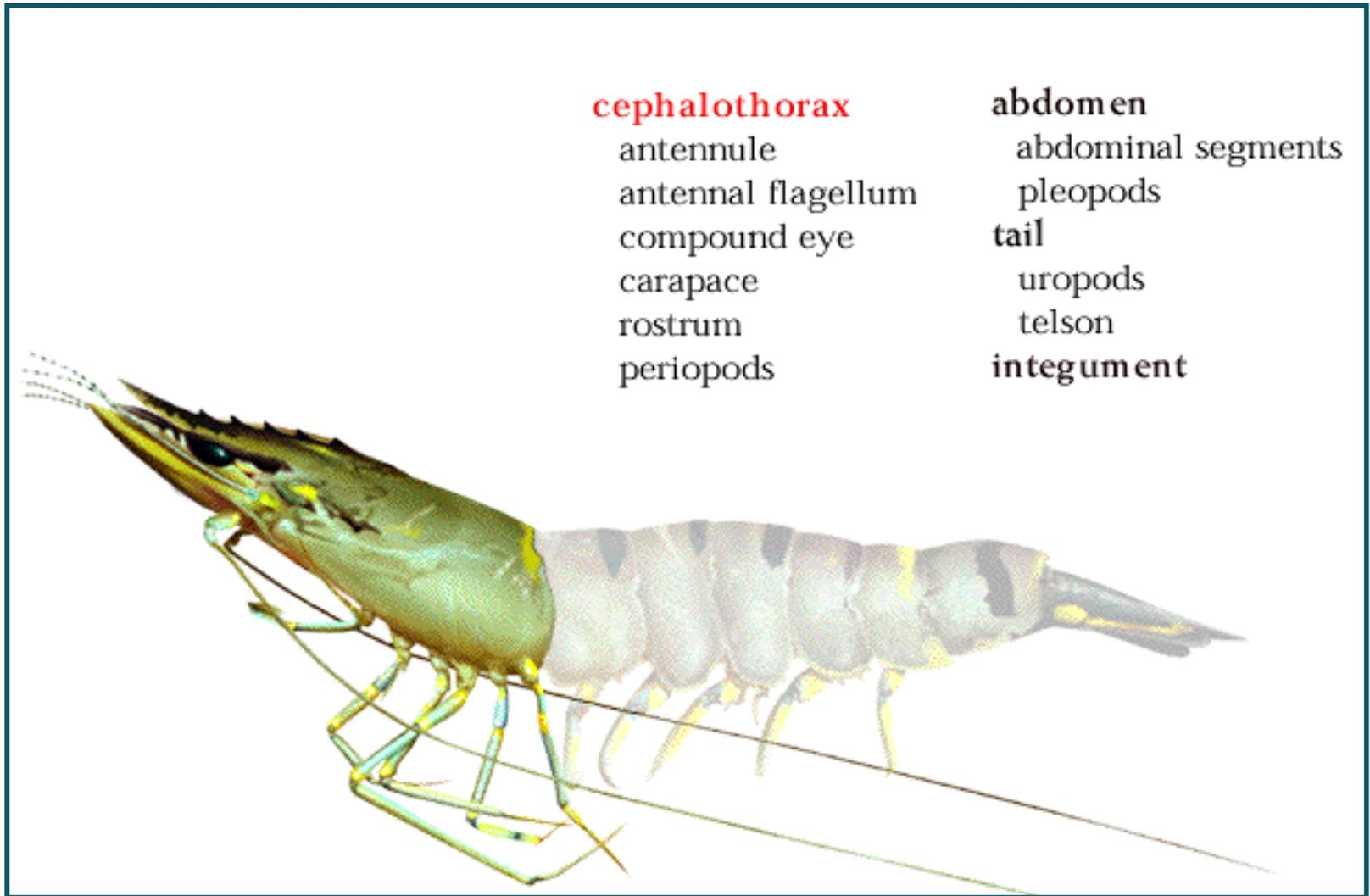
Xantoforos - grânulos amarelos



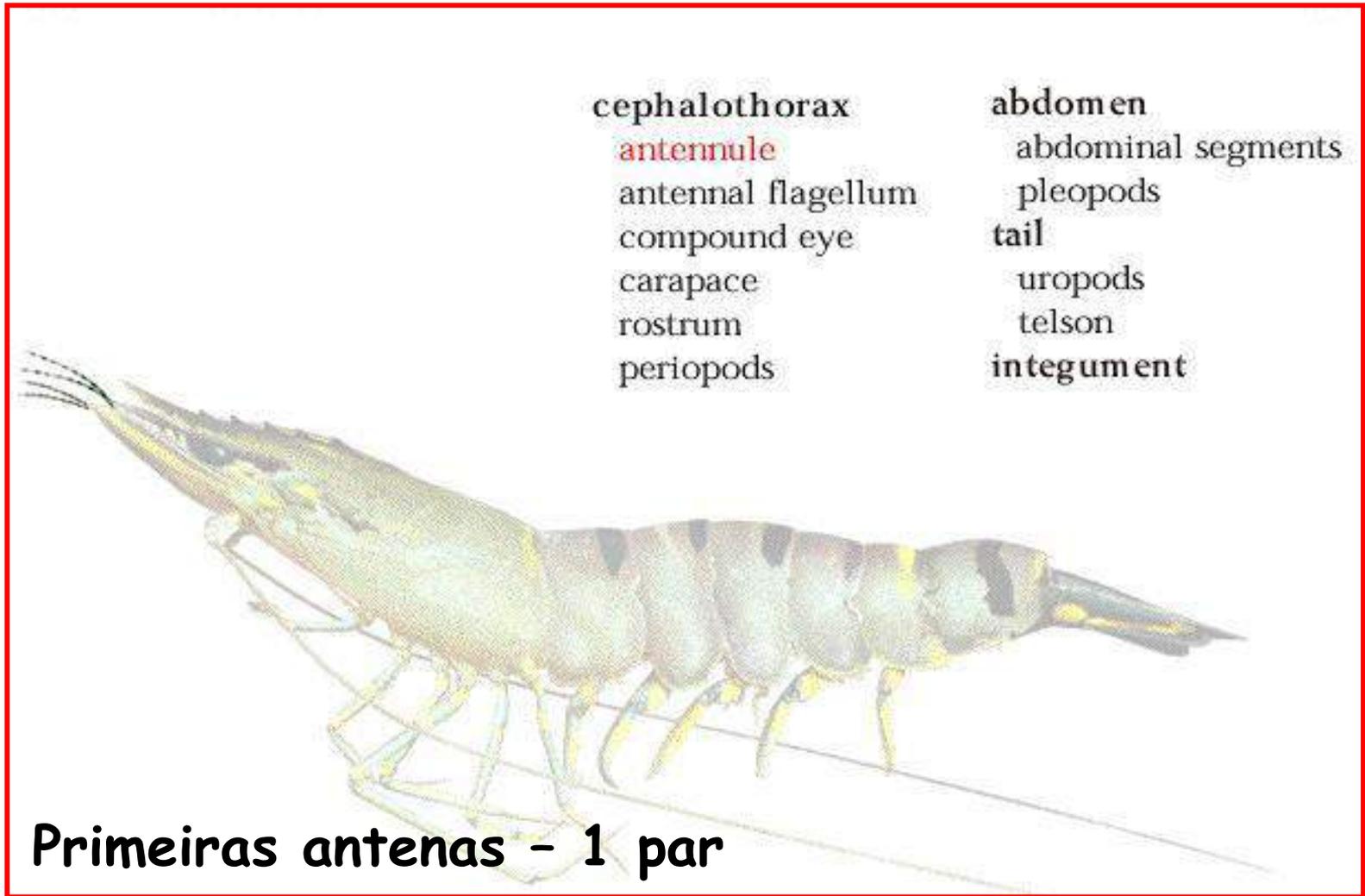
**CROMATÓFOROS**

Controlado por hormônios  
(glândula sinus)  
e pelo sistema nervoso  
central anterior

# MORFOLOGIA EXTERNA



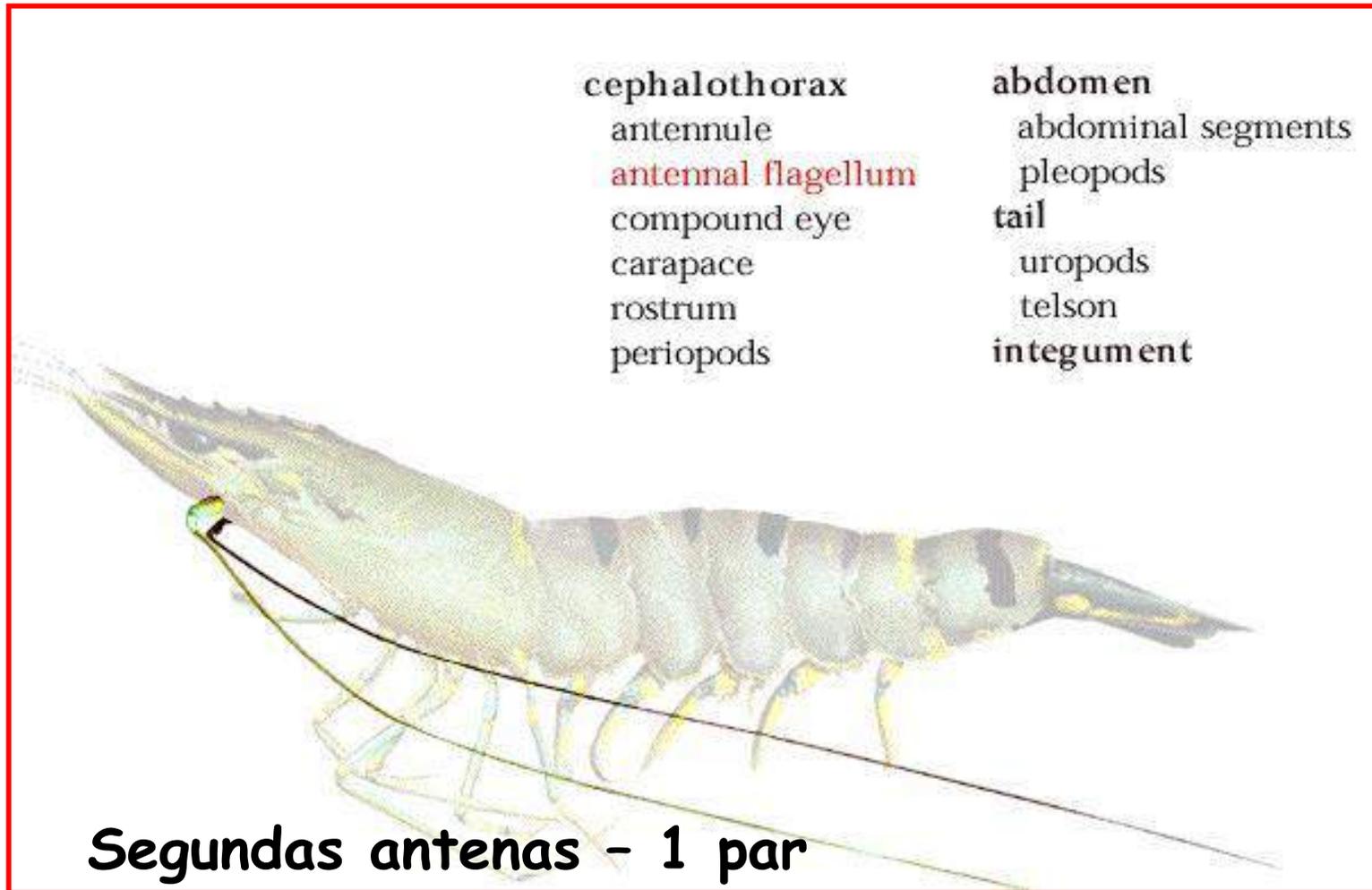
# ANTÊNULAS



Primeiras antenas - 1 par

Função: quimiorreceptores

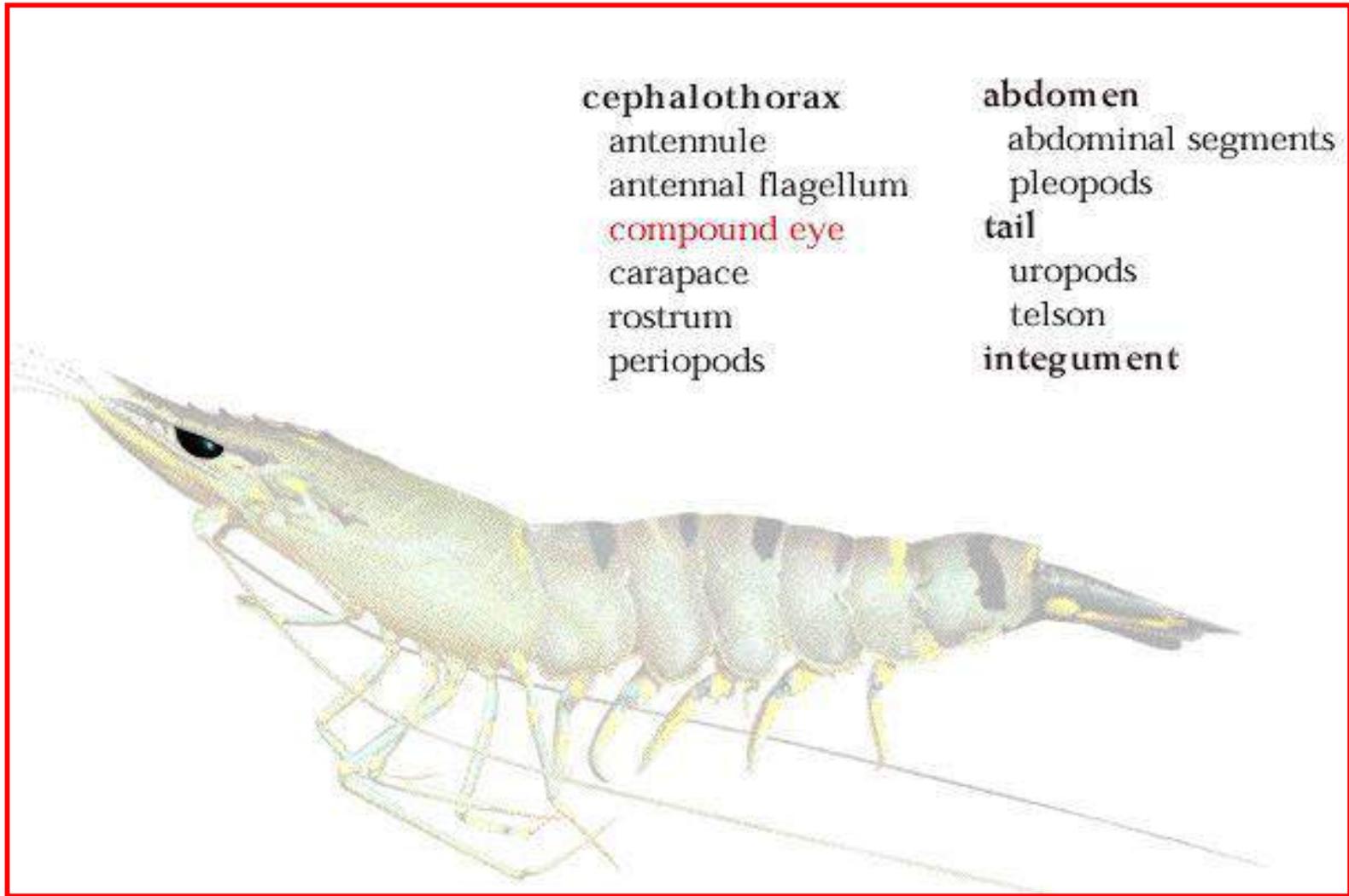
# FLAGELO ANTENAL



Segundas antenas - 1 par

Função: sensores tácteis (detecção de predadores, alimentos)

# OLHOS



**Função: reprodução (fêmea) - ablação**

# CARAPAÇA

cephalothorax

antennule

antennal flagellum

compound eye

carapace

rostrum

periopods

abdomen

abdominal segments

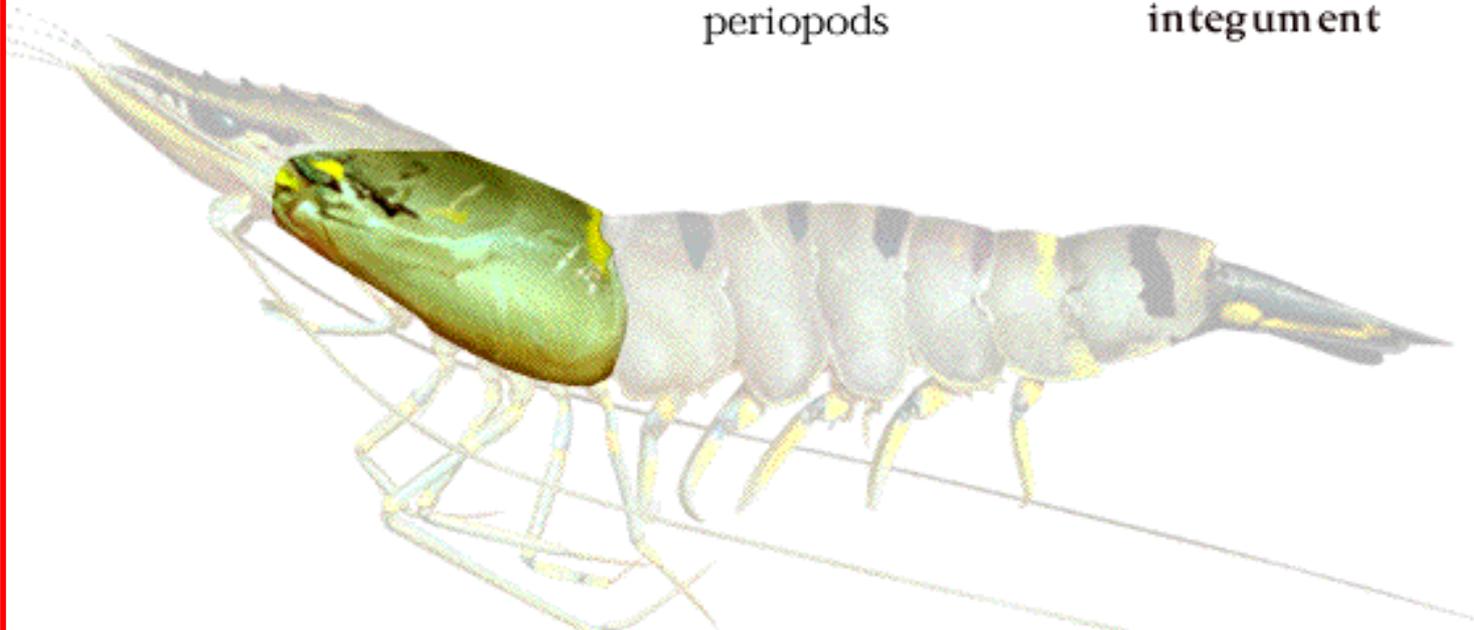
pleopods

tail

uropods

telson

integument



**Função: suporte e barreira protetora**

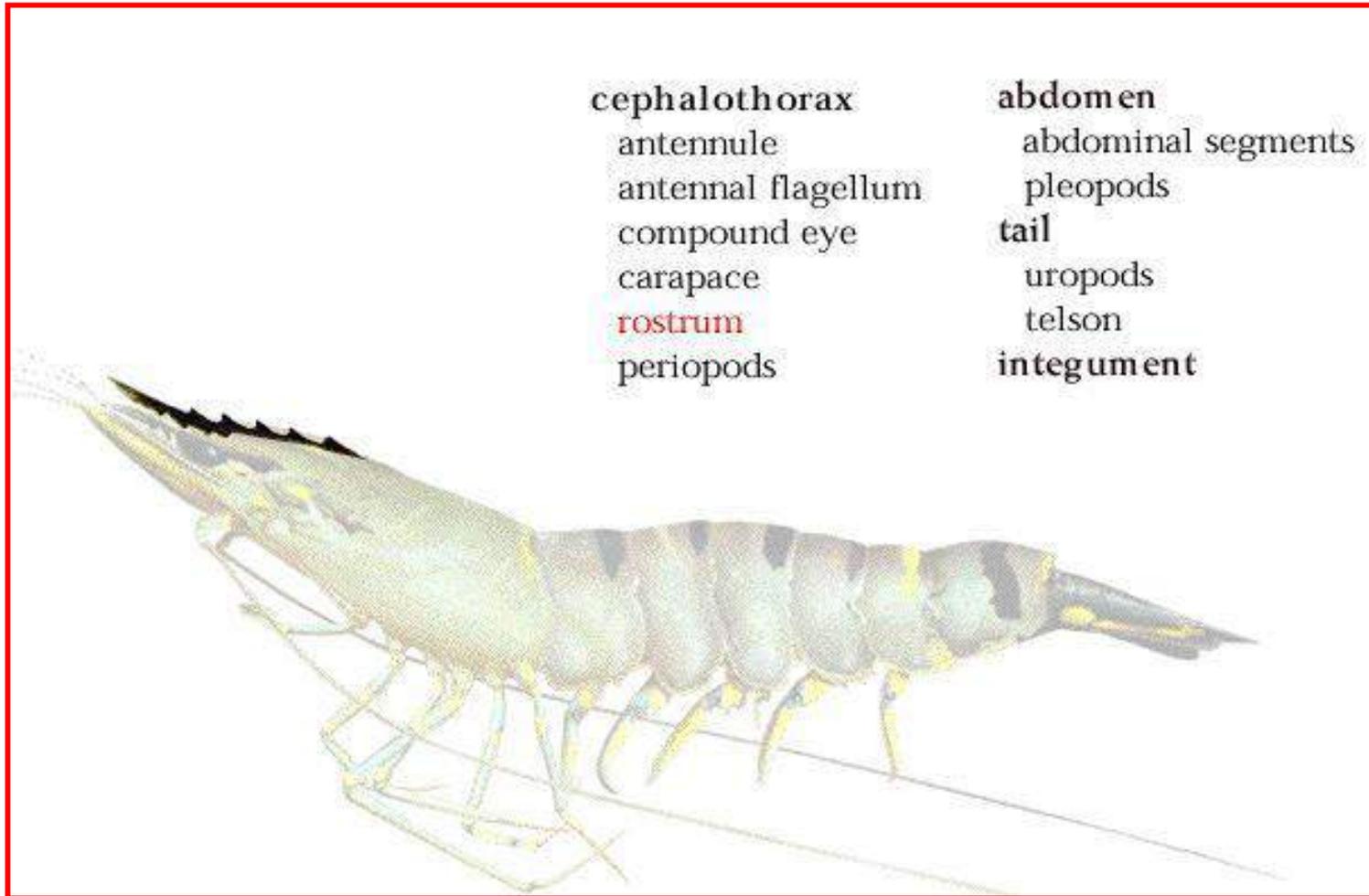
Emiko Shinozaki Mendes

Anatomia e fisiologia

SEMINÁRIO DE RESPONSABILIDADE TÉCNICA

Fonte: Lightner, D.V.

# ROSTRUM

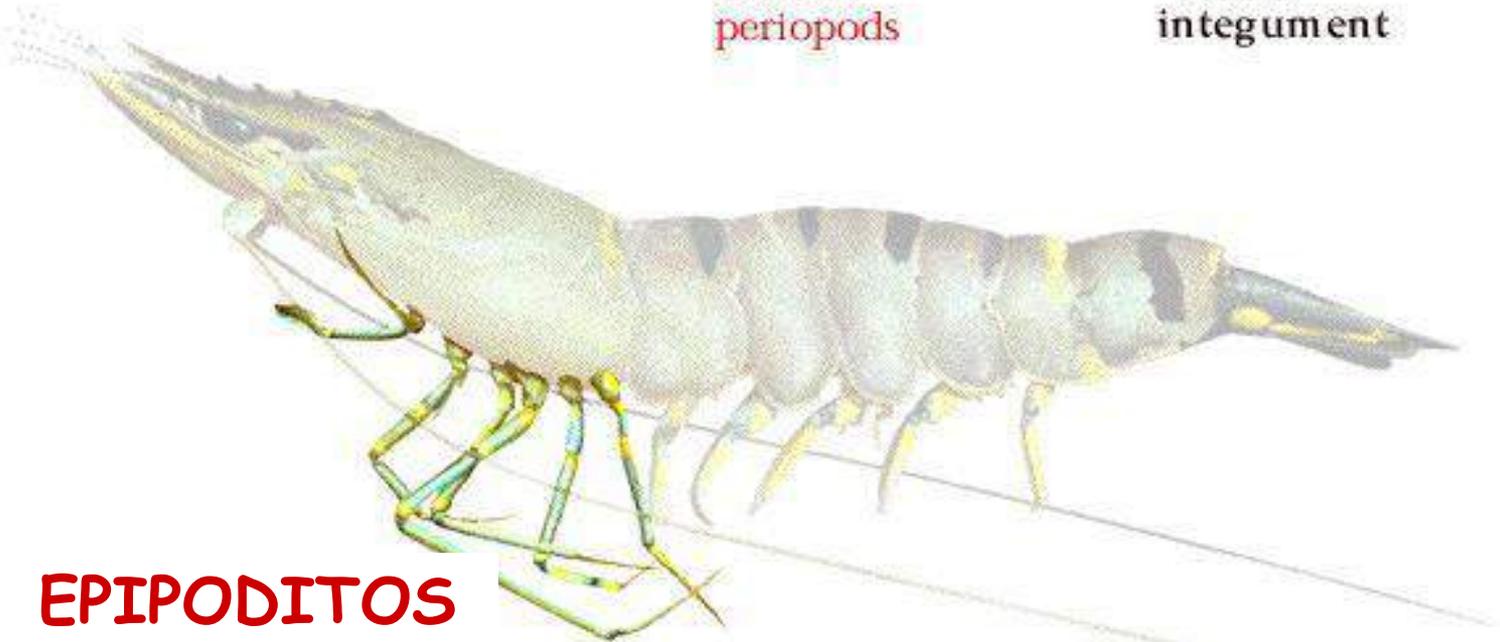


Função: defesa?

# PERIÓPODOS

cephalothorax  
antennule  
antennal flagellum  
compound eye  
carapace  
rostrum  
periopods

abdomen  
abdominal segments  
pleopods  
tail  
uropods  
telson  
integument



**EIPIODITOS**

**Função: locomoção (andar)**

# PATA QUELADA OU PINÇA



**Função: apreensão de alimentos; defesa.**

# SEGMENTOS ABDOMINAIS

cephalothorax

antennule

antennal flagellum

compound eye

carapace

rostrum

periopods

abdomen

abdominal segments

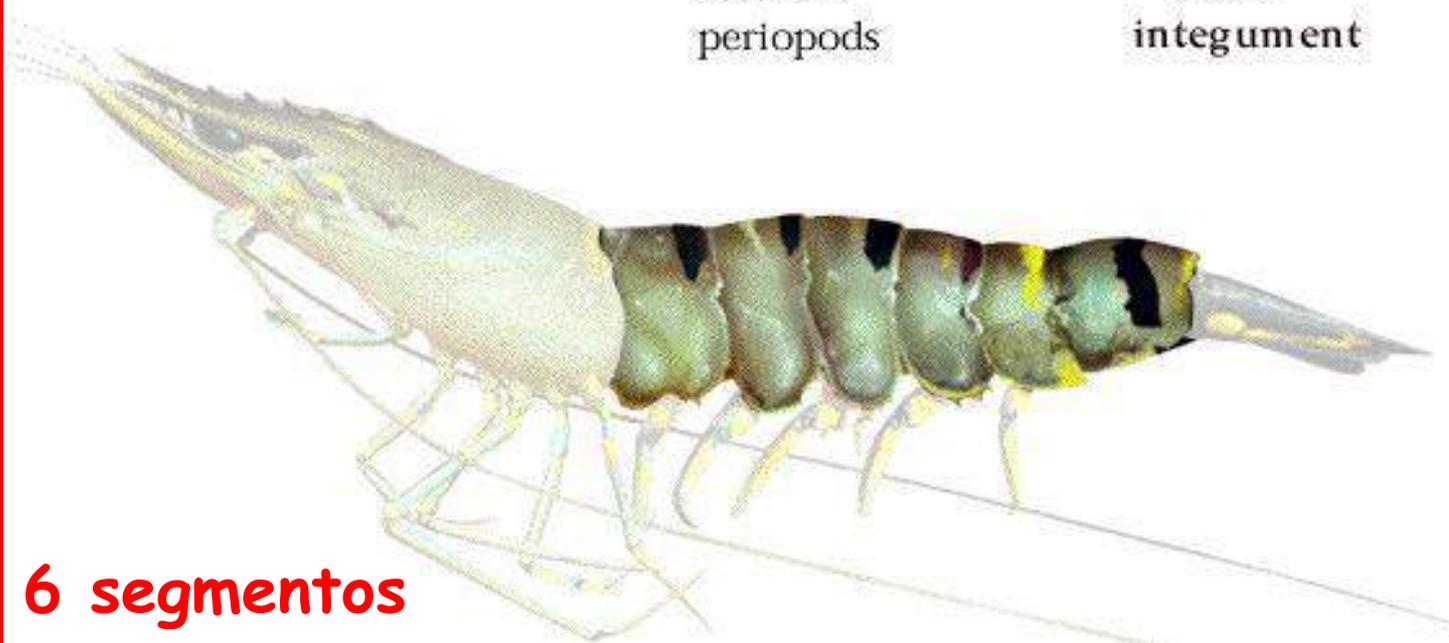
pleopods

tail

uropods

telson

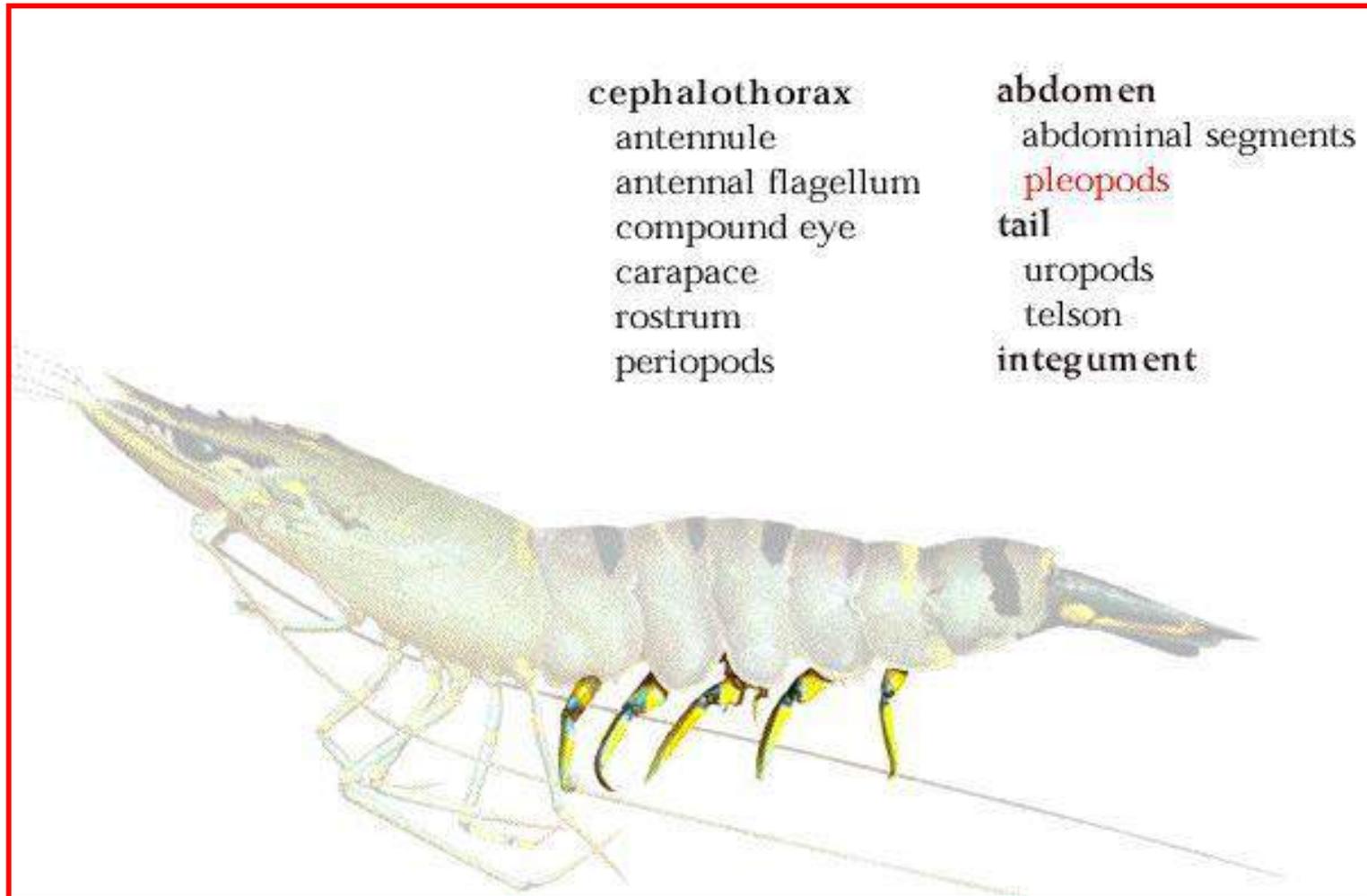
integument



**6 segmentos**

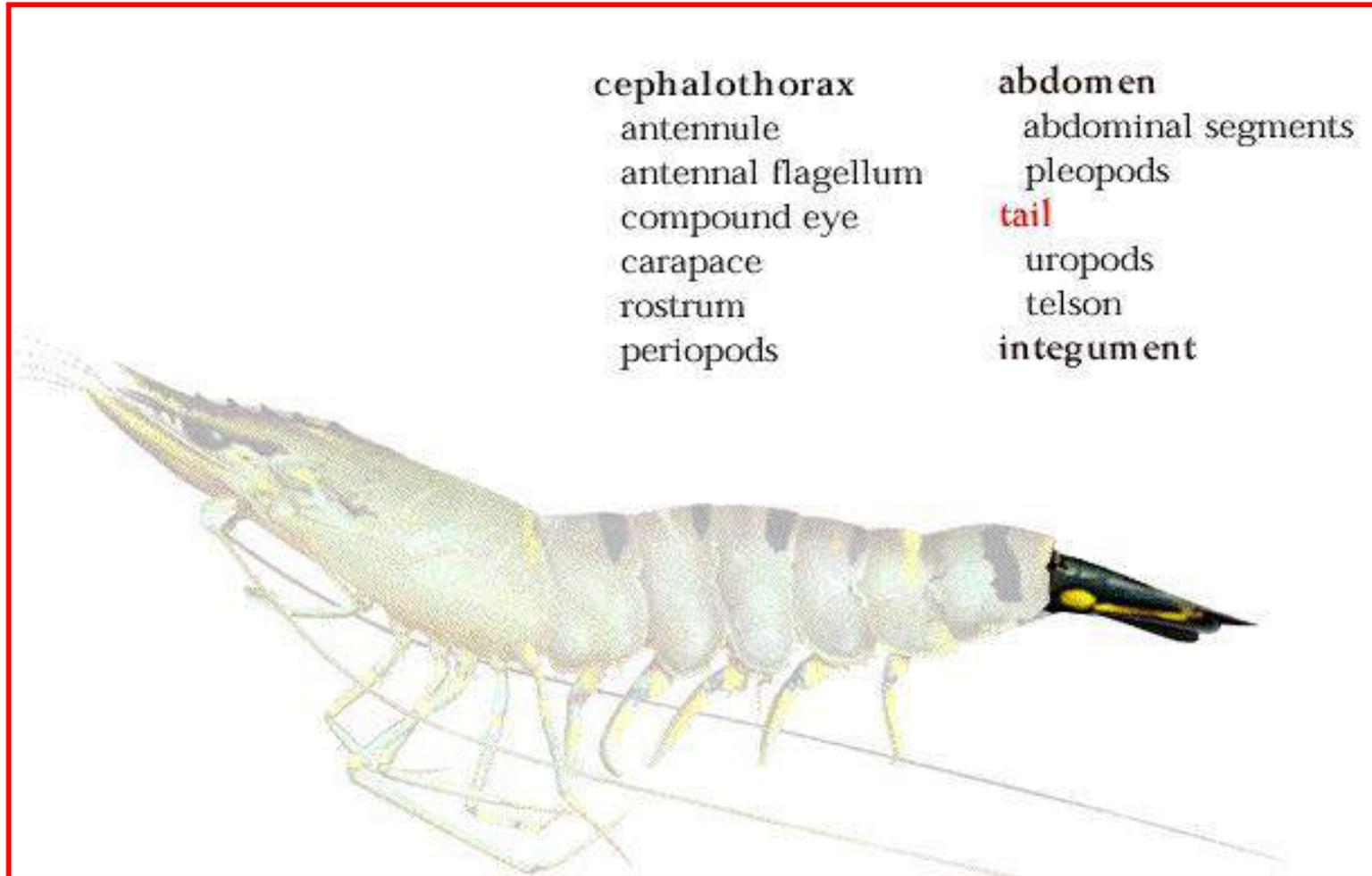
**Função: contrações rápidas para o escape de predadores**

# PLEIÓPODOS



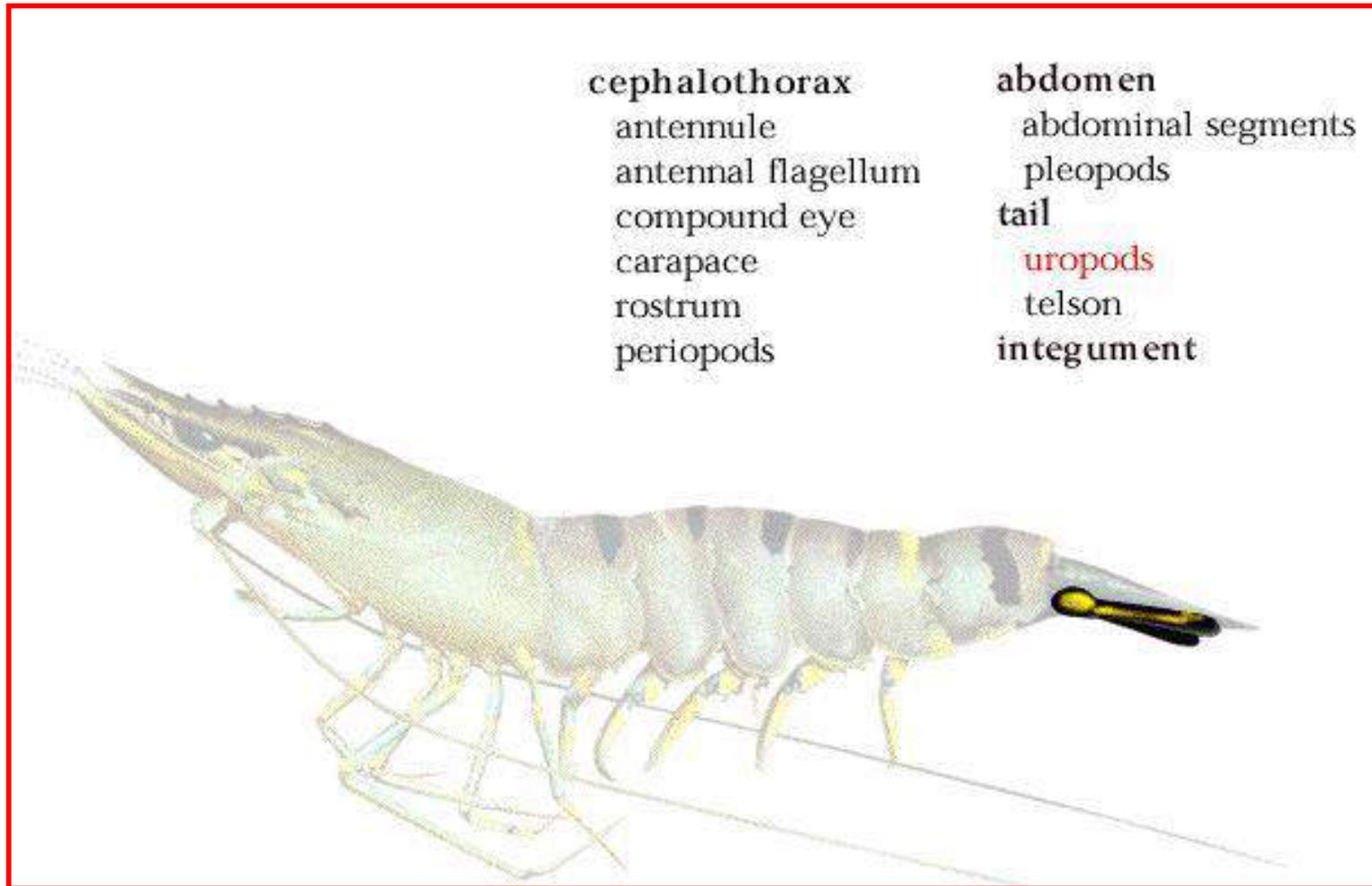
**Função: locomoção (natação)**

# CAUDA



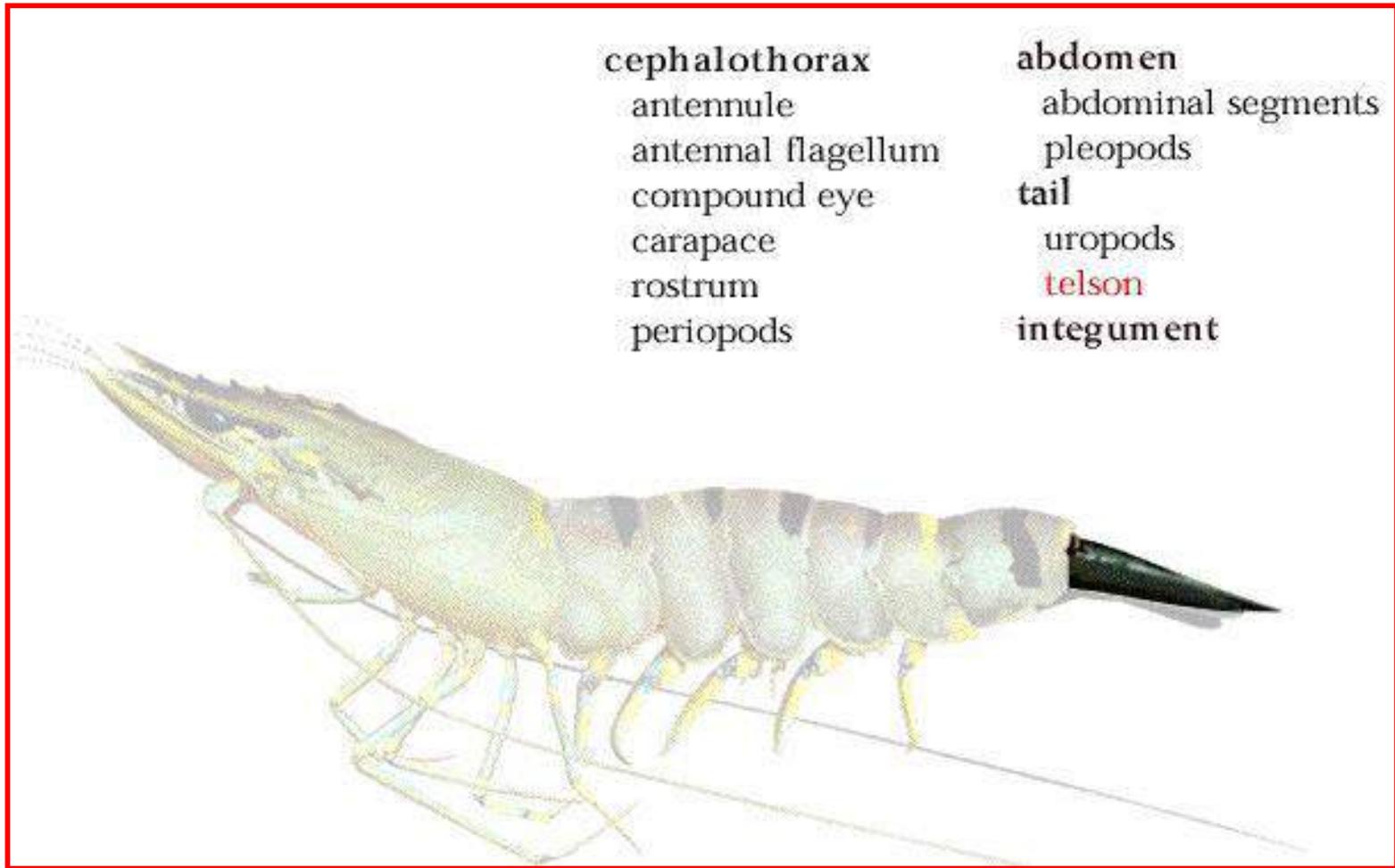
**Função: natação (direção)**

# URÓPODOS



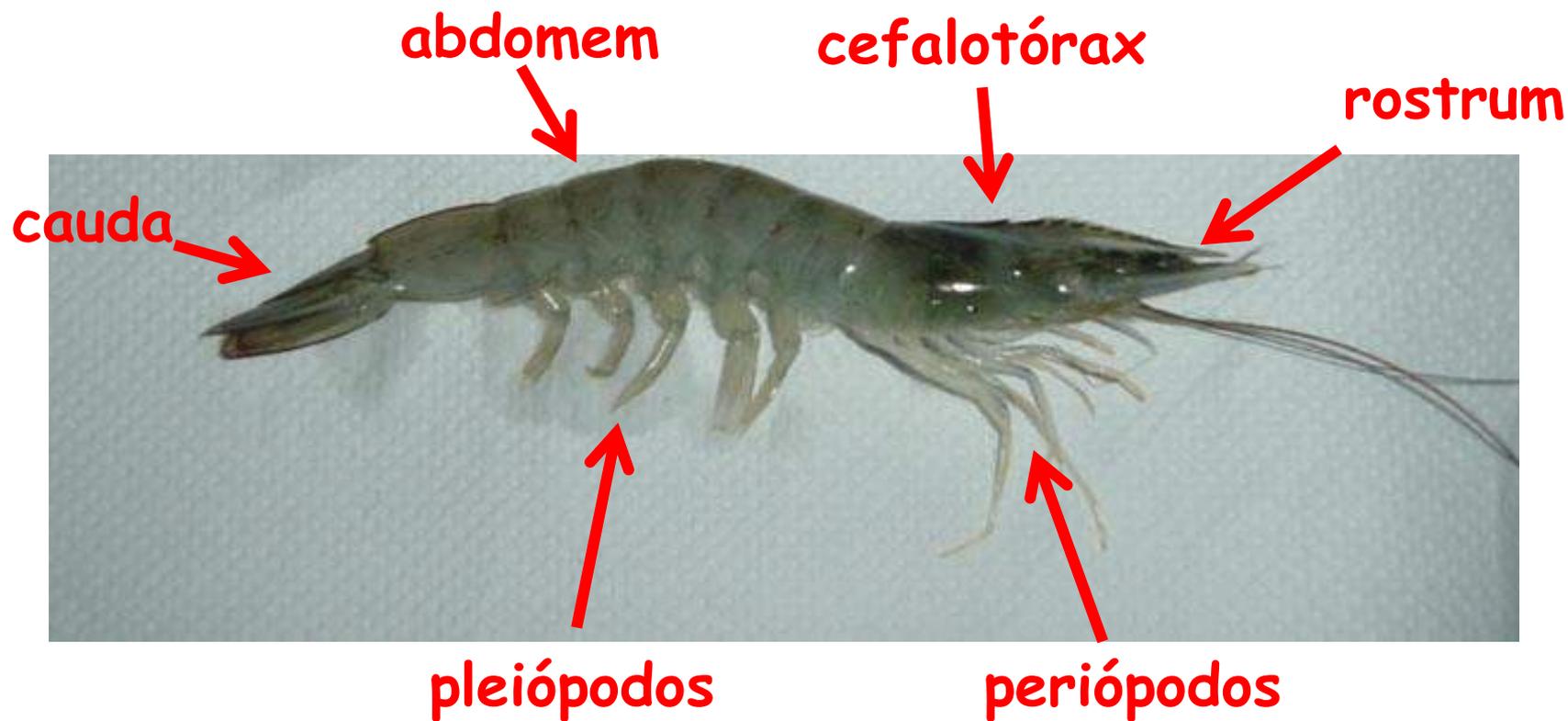
**Função: natação (direção)**

# TELSON

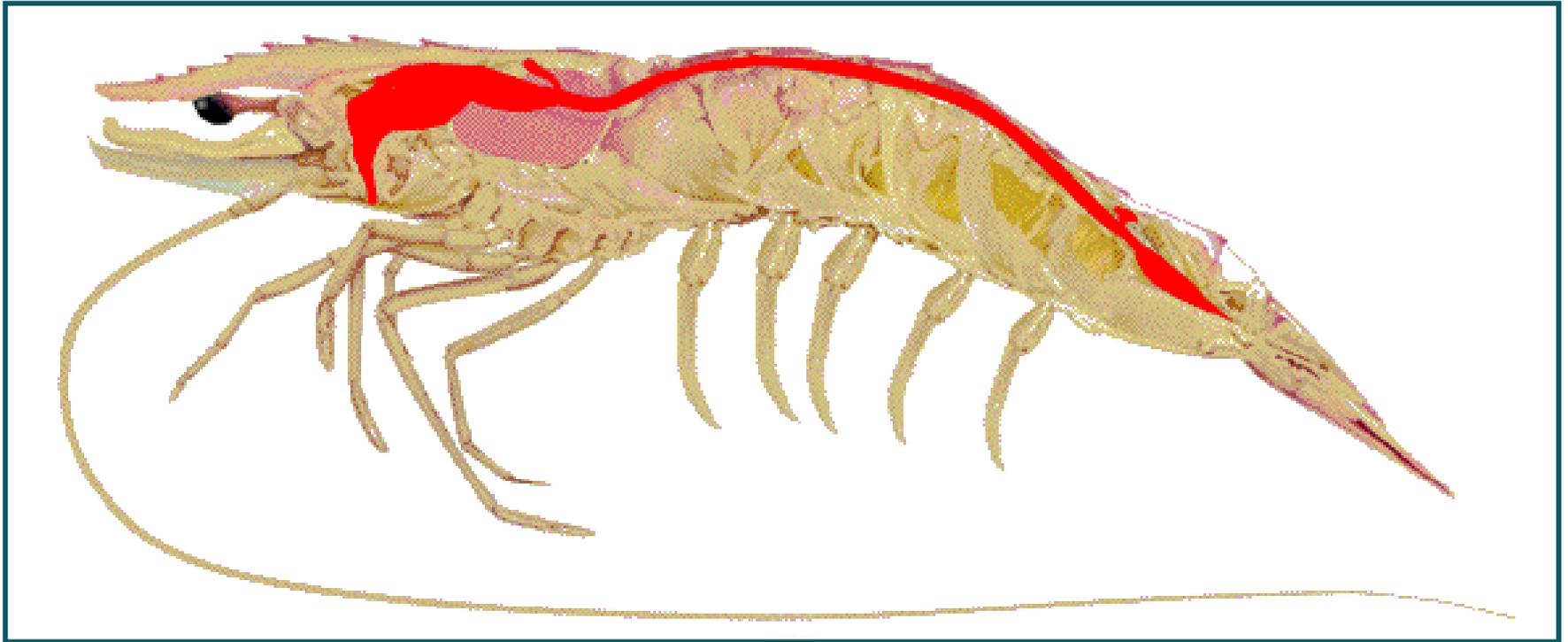


**Função: locomoção (natação)**

# Morfologia externa



# MORFOLOGIA INTERNA



## SISTEMA DIGESTÓRIO

# BOCA

digestive system

oral region

stomach

midgut

hindgut, anus

midgut ceca

hepatopancreas

arteries, veins and sinuses

heart

reproductive organs ovaries

reproductive organs testes

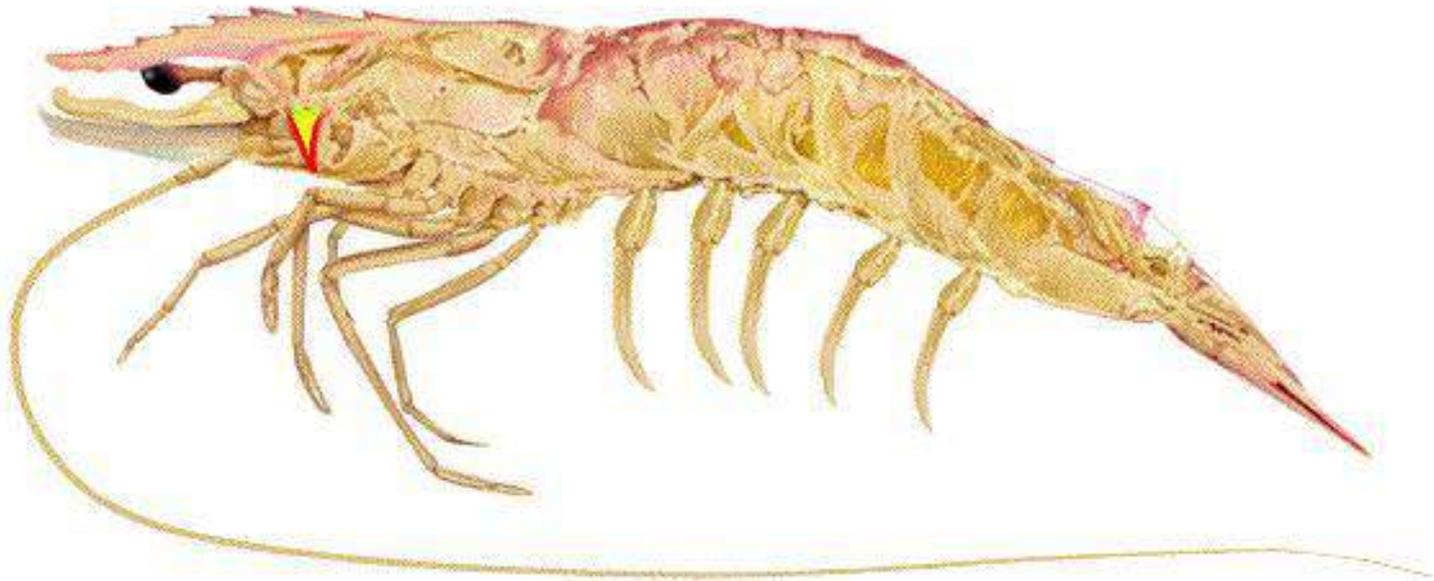
central nervous system

gills

hematopoietic tissue

antennal gland

lymphoid organ



# ESTÔMAGO

digestive system	heart
oral region	reproductive organs ovaries
<b>stomach</b>	reproductive organs testes
midgut	central nervous system
hindgut, anus	gills
midgut ceca	hematopoietic tissue
hepatopancreas	antennal gland
arteries, veins and sinuses	lymphoid organ



**Proventrículo e esôfago**

# INTESTINO PORÇÃO MÉDIA

digestive system

oral region

stomach

midgut

hindgut, anus

midgut ceca

hepatopancreas

arteries, veins and sinuses

heart

reproductive organs ovaries

reproductive organs testes

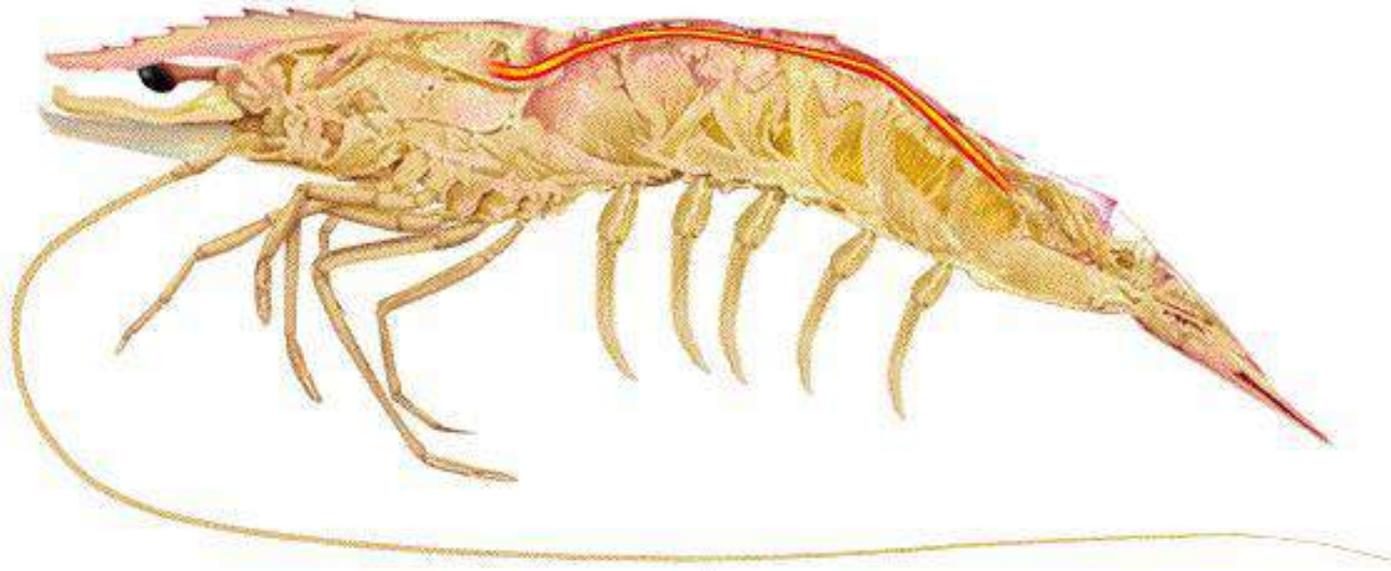
central nervous system

gills

hematopoietic tissue

antennal gland

lymphoid organ



# INTESTINO PORÇÃO FINAL

digestive system

oral region

stomach

midgut

hindgut, anus

midgut ceca

hepatopancreas

arteries, veins and sinuses

heart

reproductive organs ovaries

reproductive organs testes

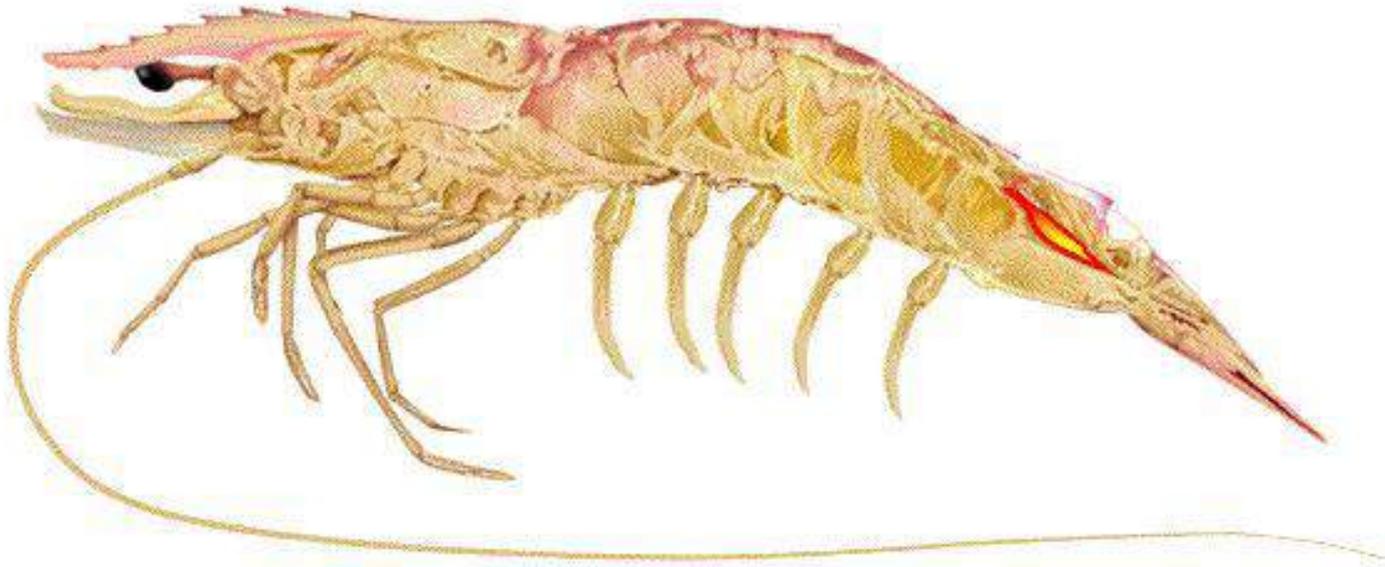
central nervous system

gills

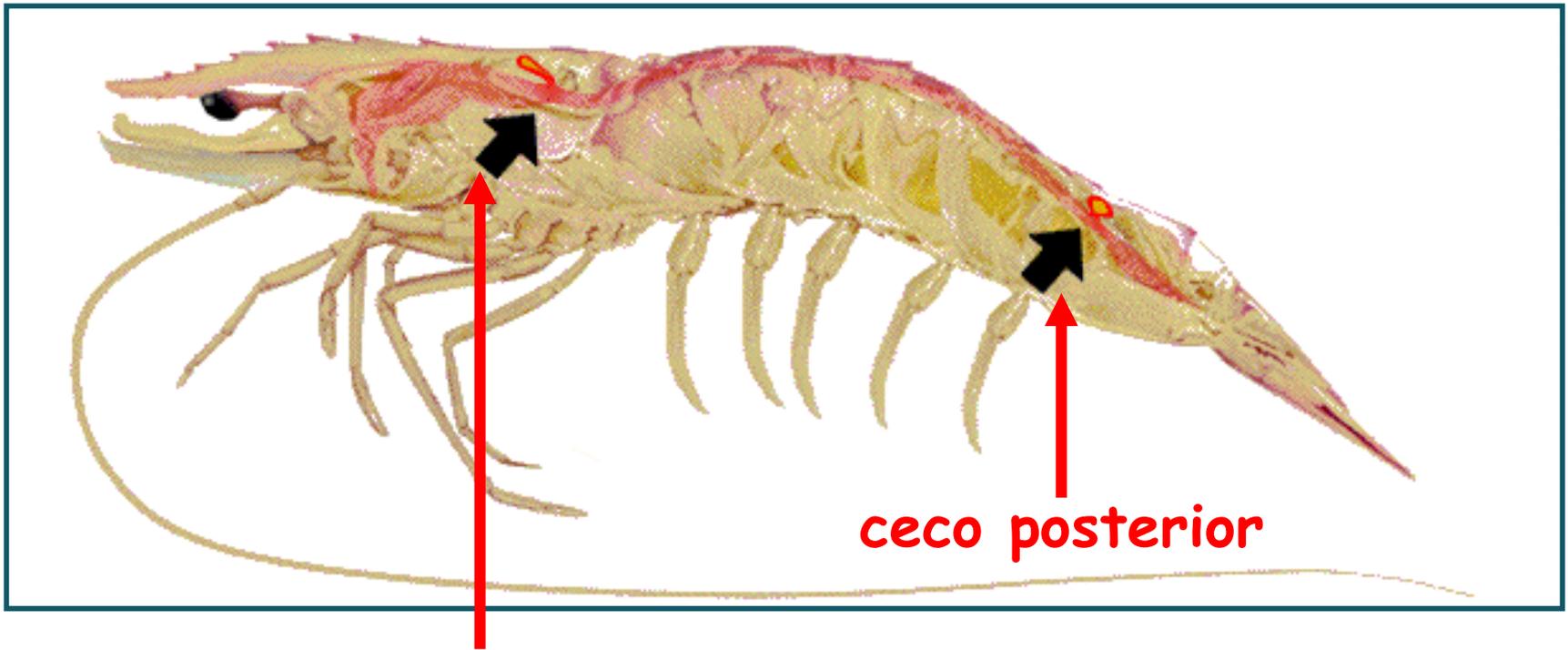
hematopoietic tissue

antennal gland

lymphoid organ



# CECOS



**ceco hepático anterior**

**ceco posterior**

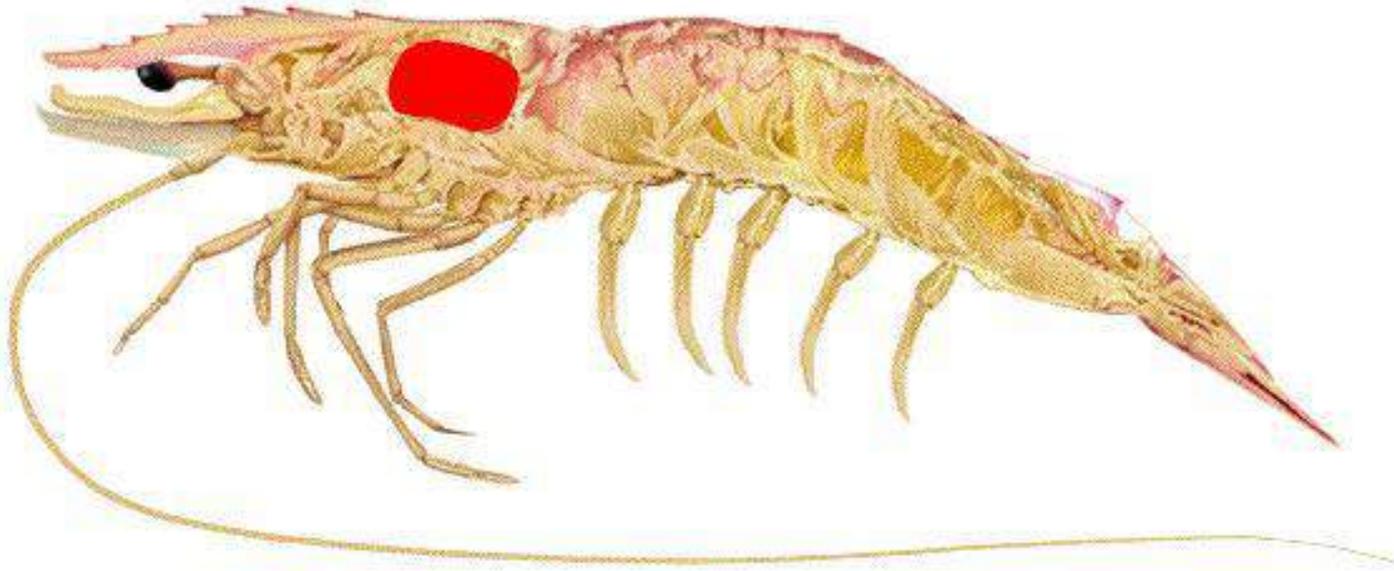
## FUNÇÃO

Receber o conteúdo do intestino delgado e começar a reabsorção de água e nutrientes.

# HEPATOPÂNCREAS

digestive system  
oral region  
stomach  
midgut  
hindgut, anus  
midgut ceca  
**hepatopancreas**  
arteries, veins and sinuses

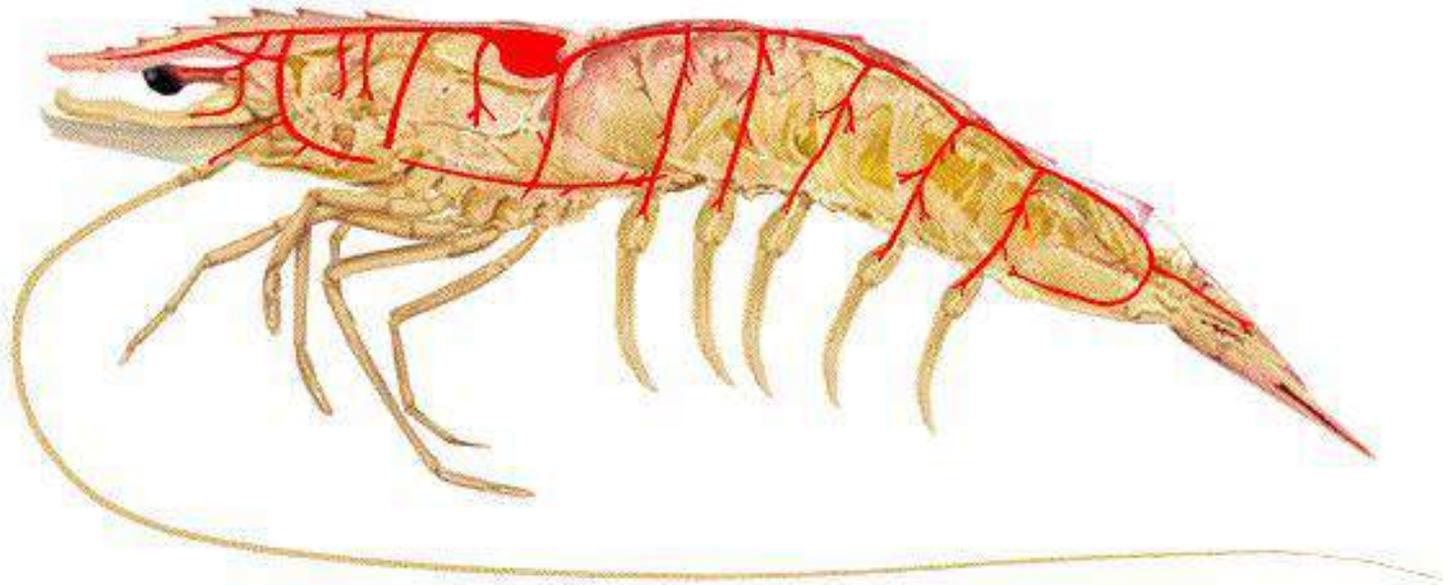
heart  
reproductive organs ovaries  
reproductive organs testes  
central nervous system  
gills  
hematopoietic tissue  
antennal gland  
lymphoid organ



# SISTEMA CIRCULATORIO

digestive system  
oral region  
stomach  
midgut  
hindgut, anus  
midgut ceca  
hepatopancreas  
arteries, veins and sinuses

heart  
reproductive organs ovaries  
reproductive organs testes  
central nervous system  
gills  
hematopoietic tissue  
antennal gland  
lymphoid organ



# HEMOLINFA

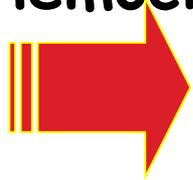
Constituída por uma fração celular (hemócitos)  
uma fração humoral (plasma)

Hialinos (HH);

Grânulos pequenos (HGP);

Grânulos grandes (HGG).

## Hemócitos circulantes



metabolismo de carboidratos, transporte e armazenamento de lipoproteínas e aminoácidos, reparo de lesões e injúrias, coagulação e defesa contra invasão de micro-organismos e parasitos.

## Primeira linha de defesa

- ✓ Exoesqueleto (carapaça externa rígida) - barreira físico-química protetora);
- ✓ Trato digestivo - revestido de uma capa quitinosa, ambiente ácido, enzimas.



### Reações imunológicas

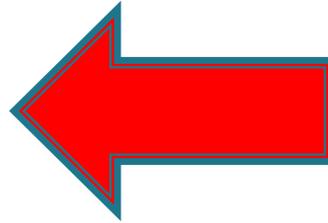
#### Sistema imune inato

(Não tem sistema adaptativo - infinidade de receptores e anticorpos altamente específicos e indução de células de memórias) - inviabiliza vacinas

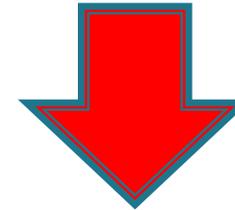
# Sistemas de defesa

- ✓ Coagulação da hemolinfa;
- ✓ Melanização mediada pelo sistema profenoloxidase (proPO);
- ✓ Reconhecimento e aglutinação celular mediados pelas lectinas;
- ✓ Sistemas antibacterianos, antifúngicos e antivirais mediados pelos peptídeos antimicrobianos, RNA de interferência e por proteínas de reconhecimento padrão;
- ✓ Sistema fagocítico e de encapsulamento.

Invasão de  
micro-organismo

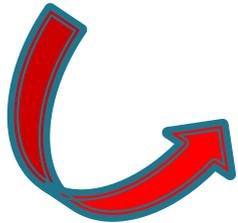


Migração dos  
hemócitos

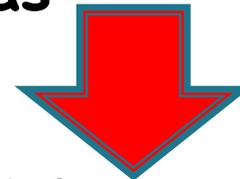


**INFLAMAÇÃO**

Sítios de infecção

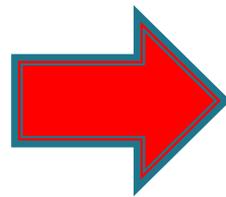


fagocitose - formação de agregados celulares densos em torno das partículas invasoras



Pode ocorrer liberação de diferentes moléculas capazes de neutralizar e degradar os agentes patógenos.

Linha de defesa



fagocitose

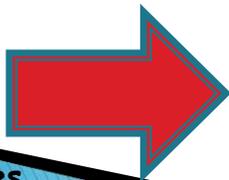
Quando há invasão massiva de micro-organismos ou partículas/patógenos de grande tamanho, não sendo possível a fagocitose, desencadeia-se a formação de cápsulas celulares e nódulos.

**Cápsulas  
celulares**

Rodeiam a grande quantidade de micro-organismos e são capturados para dentro das células agregadas, semelhantes a cápsulas.

**Formação  
de  
nódulos**

Agregação de várias capas de hemócitos ao redor do patógeno de grande tamanho (hifas, nematóides, algumas formas de protozoários).



Disseminação e produção de septicemia.

# CORAÇÃO

digestive system

oral region

stomach

midgut

hindgut, anus

midgut ceca

hepatopancreas

arteries, veins and sinuses

heart

reproductive organs ovaries

reproductive organs testes

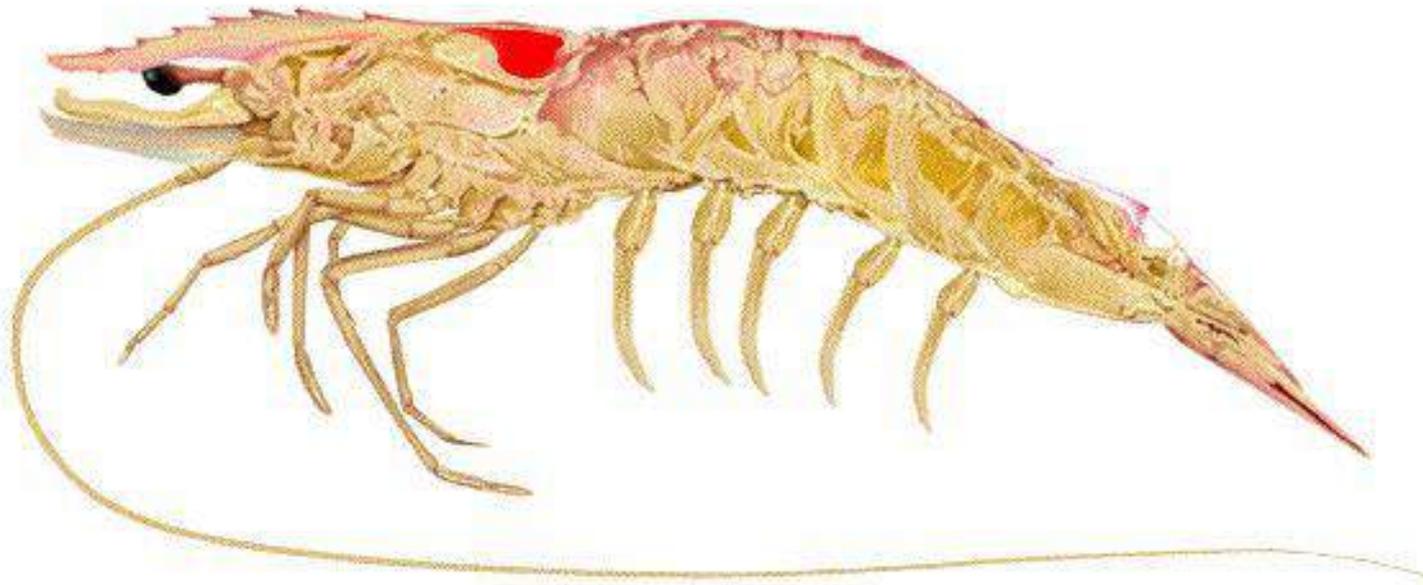
central nervous system

gills

hematopoietic tissue

antennal gland

lymphoid organ



# SISTEMA REPRODUTIVO FÊMEA

digestive system

oral region

stomach

midgut

hindgut, anus

midgut ceca

hepatopancreas

arteries, veins and sinuses

heart

reproductive organs ovaries

reproductive organs testes

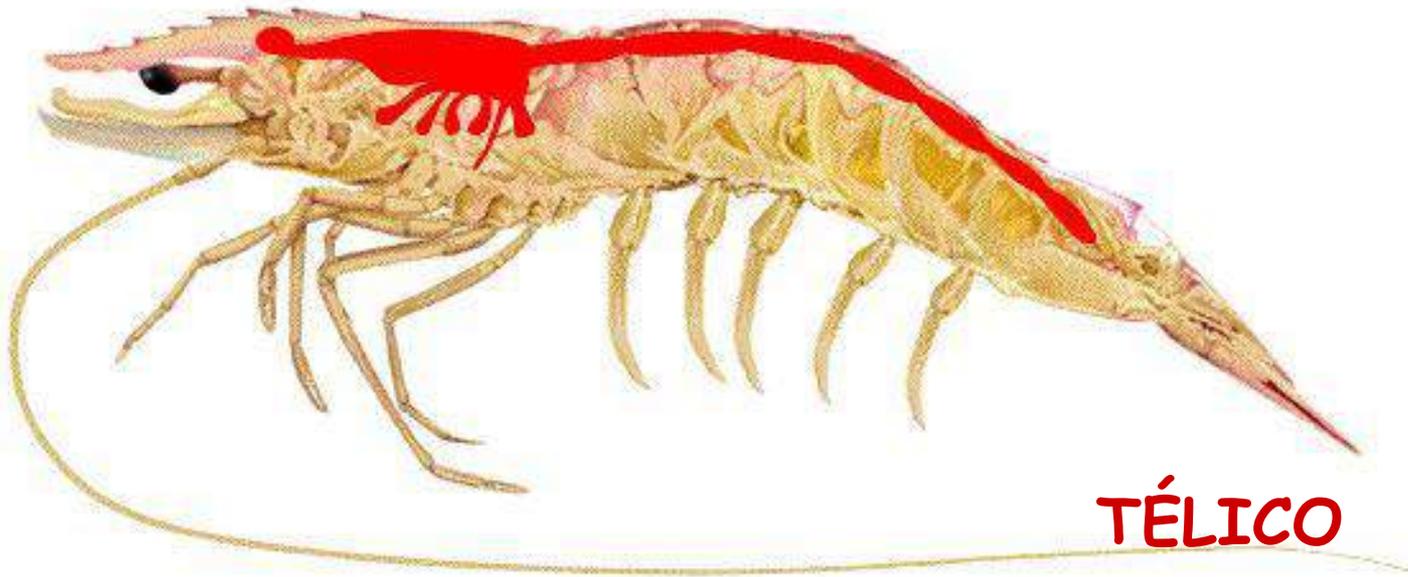
central nervous system

gills

hematopoietic tissue

antennal gland

lymphoid organ



**TÉLICO**

# SISTEMA REPRODUTIVO MACHO

digestive system

oral region

stomach

midgut

hindgut, anus

midgut ceca

hepatopancreas

arteries, veins and sinuses

heart

reproductive organs ovaries

reproductive organs testes

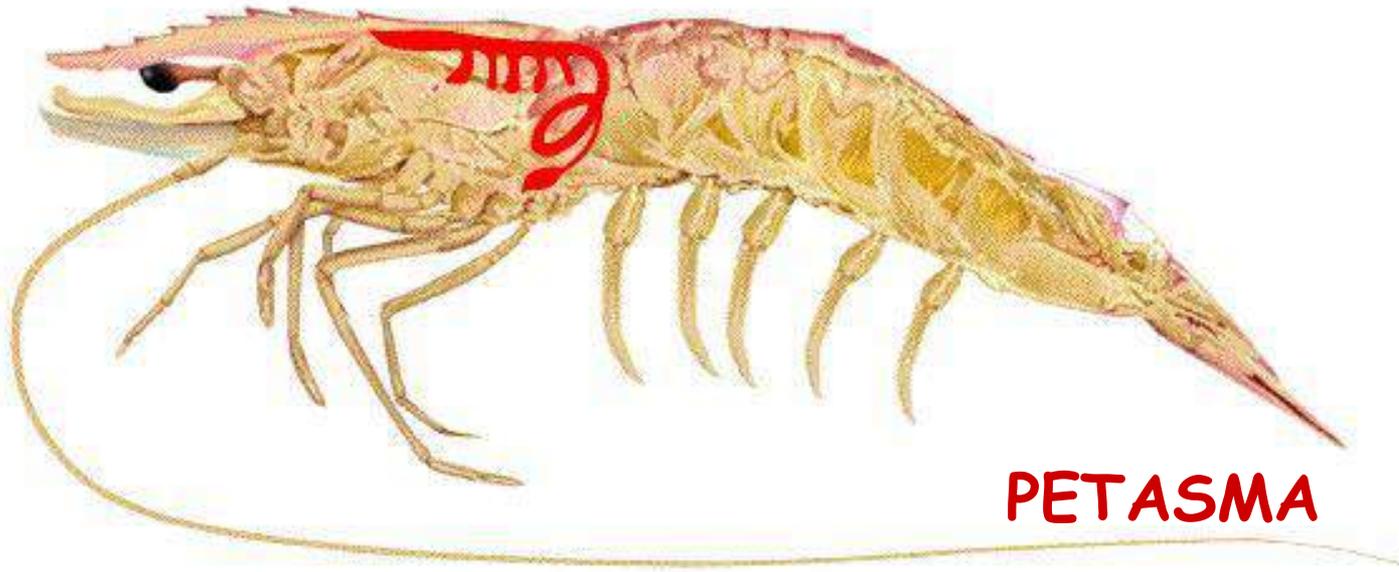
central nervous system

gills

hematopoietic tissue

antennal gland

lymphoid organ

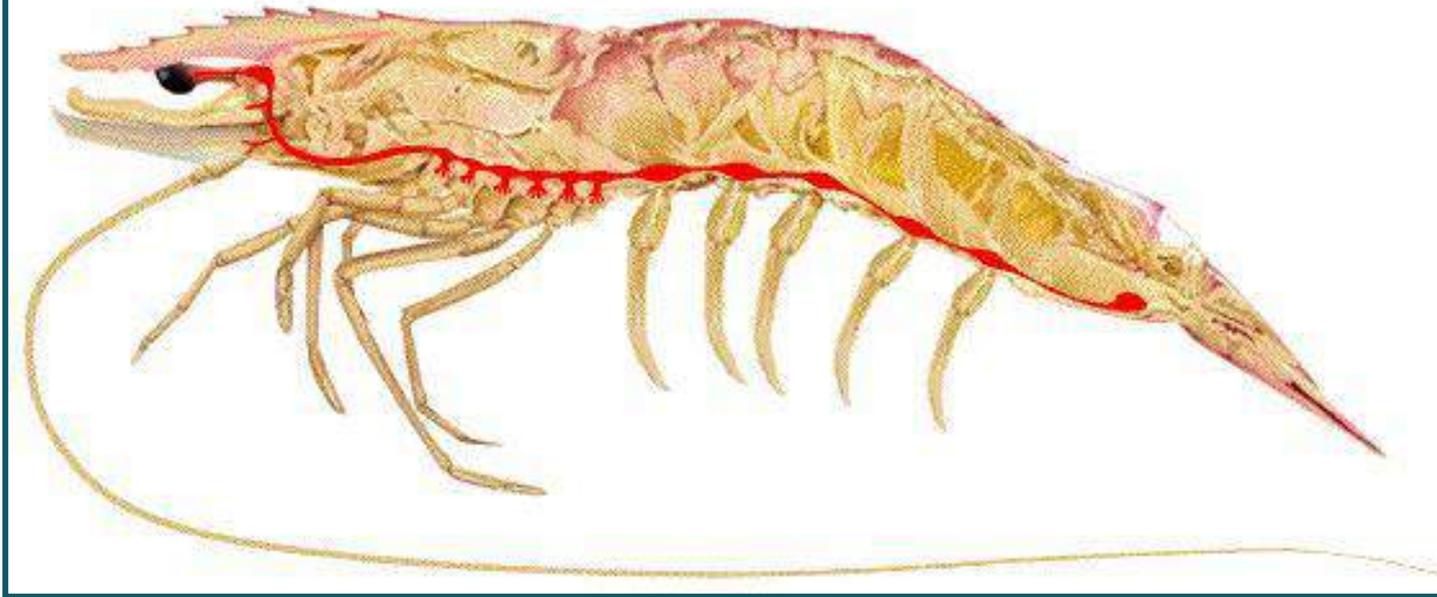


**PETASMA**

# SISTEMA NERVOSO CENTRAL

digestive system  
oral region  
stomach  
midgut  
hindgut, anus  
midgut ceca  
hepatopancreas  
arteries, veins and sinuses

heart  
reproductive organs ovaries  
reproductive organs testes  
**central nervous system**  
gills  
hematopoietic tissue  
antennal gland  
lymphoid organ



# BRÂNQUIAS

digestive system

oral region

stomach

midgut

hindgut, anus

midgut ceca

hepatopancreas

arteries, veins and sinuses

heart

reproductive organs ovaries

reproductive organs testes

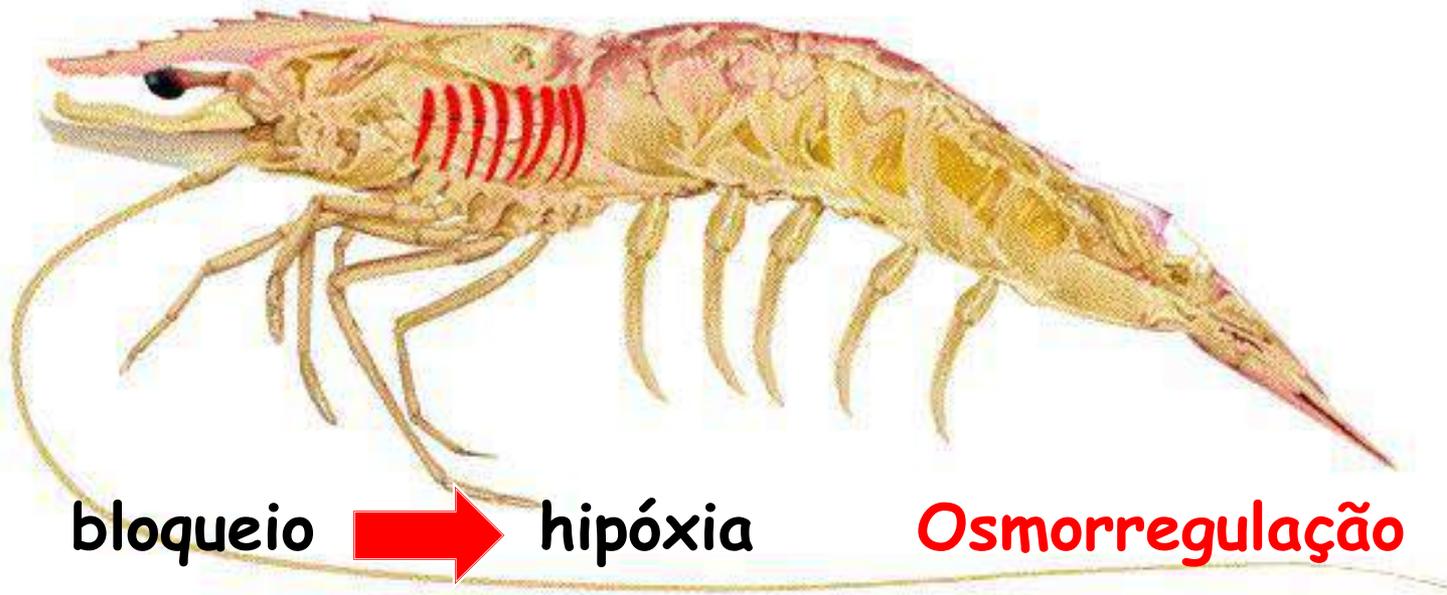
central nervous system

**gills**

hematopoietic tissue

antennal gland

lymphoid organ



# ÓRGÃO HEMATOPOIÉTICO

digestive system

oral region

stomach

midgut

hindgut, anus

midgut ceca

hepatopancreas

arteries, veins and sinuses

heart

reproductive organs ovaries

reproductive organs testes

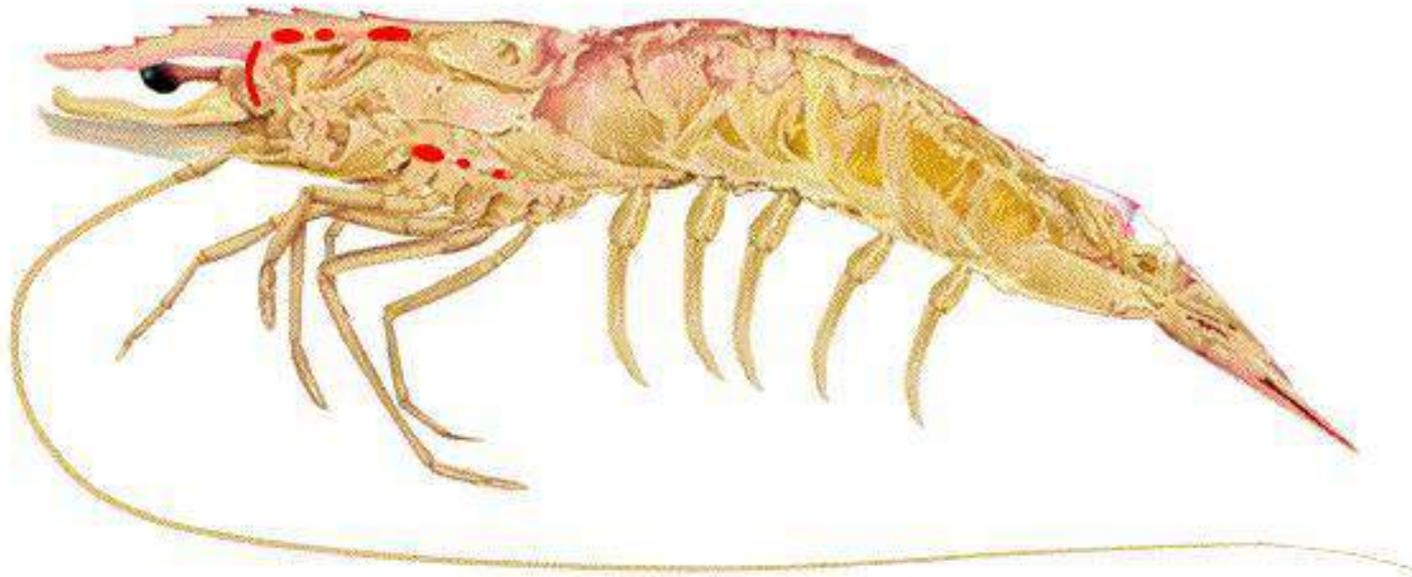
central nervous system

gills

hematopoietic tissue

antennal gland

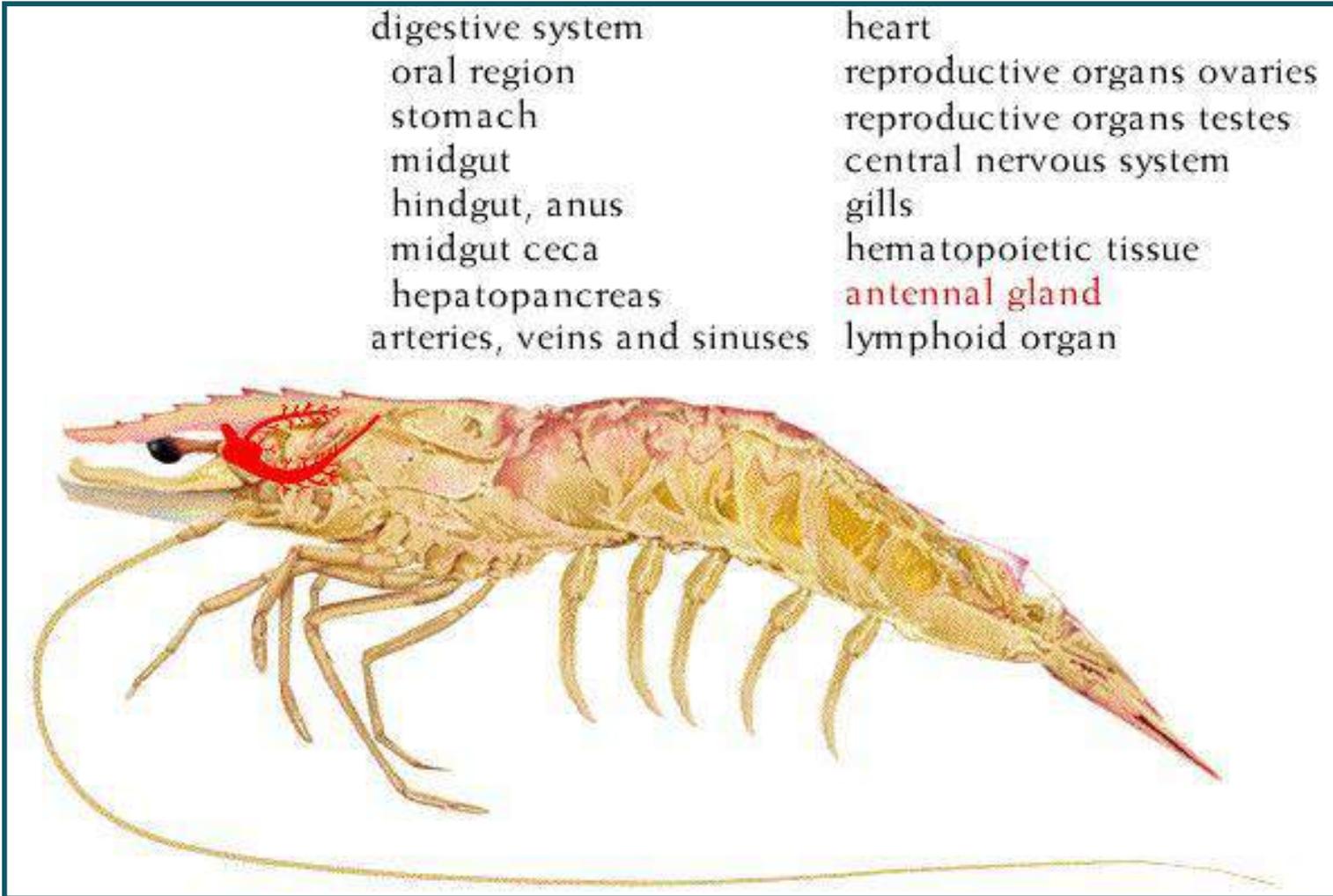
lymphoid organ



# GLÂNDULA ANTENAL

digestive system  
oral region  
stomach  
midgut  
hindgut, anus  
midgut ceca  
hepatopancreas  
arteries, veins and sinuses

heart  
reproductive organs ovaries  
reproductive organs testes  
central nervous system  
gills  
hematopoietic tissue  
**antennal gland**  
lymphoid organ



# ÓRGÃO LINFÓIDE

digestive system

oral region

stomach

midgut

hindgut, anus

midgut ceca

hepatopancreas

arteries, veins and sinuses

heart

reproductive organs ovaries

reproductive organs testes

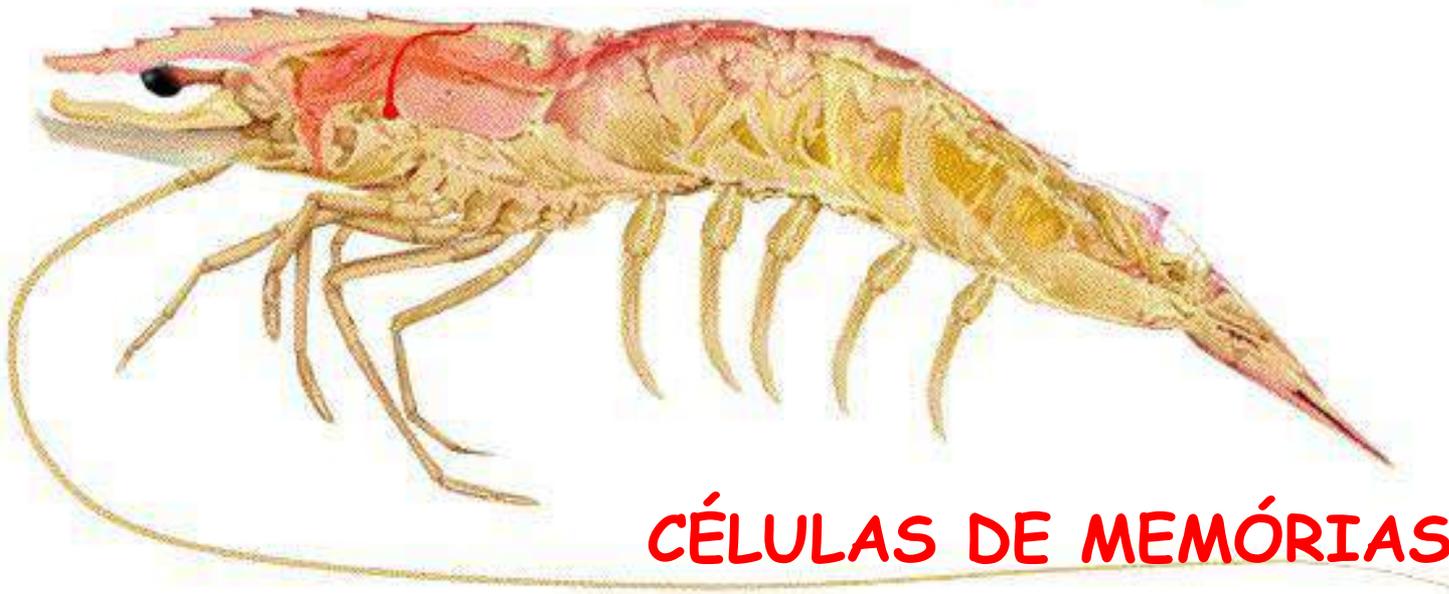
central nervous system

gills

hematopoietic tissue

antennal gland

lymphoid organ



**CÉLULAS DE MEMÓRIAS**