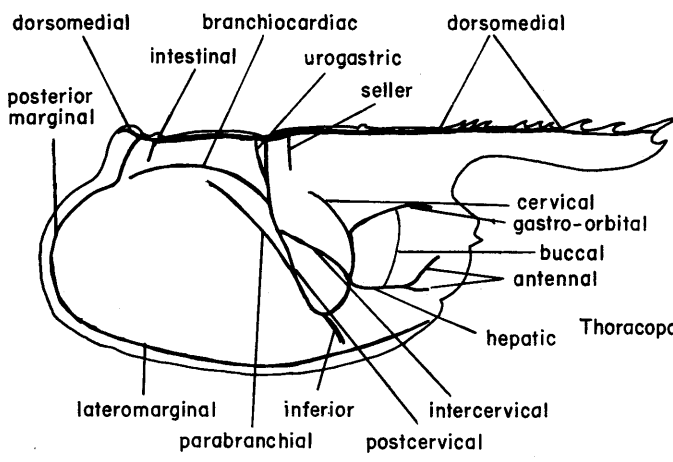
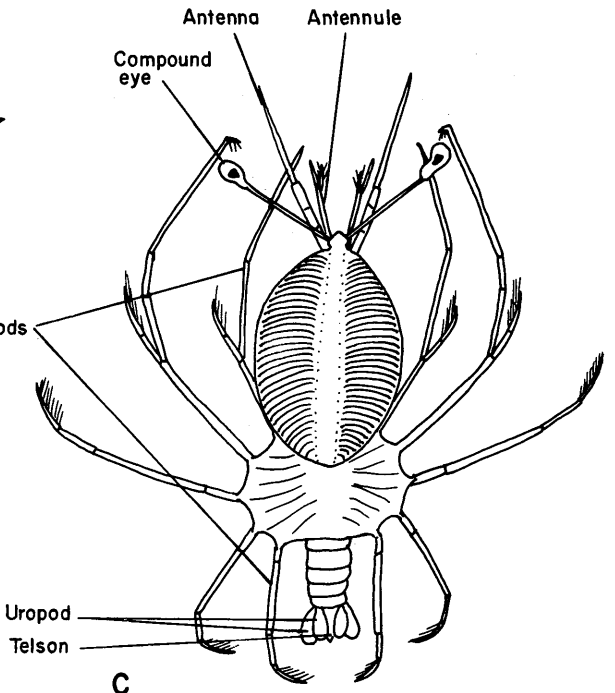


A



B



C

Figure 47 Decapoda: A. Diagrammatic astacidean with gills and musculature removed to show major organ systems; B. Diagrammatic nephropoidean carapace illustrating carapace grooves [after Holthuis, 1974]; C. Phyllosoma larva.

midgut or the other, pierces the ventral nerve cord, and then branches anteriorly and posteriorly. The anterior branch, the ventral thoracic artery, supplies blood to the mouthparts, nerve cord, and 1st 3 pairs of pereopods. The course of this artery cannot be traced until the stomach and hepatic cecum have been removed. The posterior branch, the ventral abdominal artery, which also should be traced later, provides blood to the 4th and 5th pairs of pereopods, nerve cord, and parts of the ventral abdomen. Returning to the heart, follow the dorsal abdominal artery posteriorly through the abdomen. In each somite a pair of segmental arteries are given off that supply blood to the midgut, abdominal musculature, and pleopods. The posterior pair supplies the uropods and telson.

Remove the heart and underlying pericardial membrane to expose the gonad. In females the gonad typically is Y-shaped, with lobes extending anteriorly on either side of the stomach. The male testis is similarly positioned. If possible trace the oviducts or vas deferens from their origins on the gonad ventrally to the gonopores on the coxae of the pereopods (3rd in females, 5th in males).

If the anterior cephalothoracic muscles have not yet been removed, remove them at this time to expose the esophagus and stomach. The esophagus is short and opens into the cardiac portion of the stomach. A constriction marks the boundary between the cardiac and pyloric parts of the stomach. At the junction of the pyloric stomach and midgut, a pair of ducts from the hepatopancreas open into the midgut. In addition to the prominent bilobed hepatopancreas, locate the small cecum that projects anteriorly adjacent to the pyloric stomach. Just posterior to this cecum a slight ridge indicates the junction of the midgut and hindgut; in most crayfish the latter extends nearly the entire length of the abdomen. In the 6th abdominal somite it usually enlarges to form a rectum before terminating at the anus on the ventral surface of the telson. Remove the stomach and examine the structure of the gastric mill in the cardiac portion of the stomach. The pyloric stomach is made up of plates, bars, and channels. How does this stomach compare with that of the penaeid? Excretion in astacideans is via antennal glands. In contrast to the condition found in penaeoideans, the antennal gland of astacideans is distinct. Locate this gland and trace its duct to the excretory pore at the base of the antenna.

The supraesophageal ganglion lies in the midline just ventral to the ocular peduncles. Locate this ganglion and identify the 4 large pairs of nerves radiating from it, the antennular, optic, antennal, and tegumental nerves. Ventrally trace the esophageal connective of one side around the esophagus; it passes beneath the endophragmal shelf before joining the subesophageal ganglion. Portions of this shelf must be removed to expose the ventral thoracic ganglia. The subesophageal ganglion is

indistinct from the fused ganglia of the mandibles, maxillulae, maxillae, and first 2 pairs of maxillipeds. The ganglia of the first 3 pairs of pereopods are segmental; the ganglia of the 4th and 5th pairs lie very close together. Follow the ventral nerve cord into the abdomen and identify the abdominal ganglia.

Larval development is direct (epimorphic) in all freshwater taxa; in marine taxa early developmental stages are passed through in the egg and hatching usually occurs at the mysis stage. Development at this stage corresponds to similar stages in other decapods.

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INFRAORDER AUSTROASTACIDEA Clark, 1936

Recent species	Few in one genus, <i>Austroastacus</i> .
Size range	10 to ~ 80 mm.
Carapace	Strongly vaulted posteriorly.
Eyes	Stalked, compound, well developed.
Antennules	With 2nd flagellum small or absent.
Antennae	Inserted beneath antennules; scaphocerite long or short, slender, sometimes with long slender spine.
Mandibles	(?) With palp.
Maxillulae	(?) With endopodal palp.
Maxillae	(?) Biramous.
Maxillipeds	Epipods of 1st without branchial filaments; 3rd without exopods.
Thoracic appendages	Uniramous; first 3 pairs chelate; 5th pereopods without gills.
Abdominal appendages	Pleopods biramous; 1st pair absent in both sexes. Uropods biramous, without transverse sutures, well calcified.
Telson	Entirely calcareous.
Tagmata	Cephalothorax and abdomen.
Somites	Head with 5 + 3 thoracic (maxillipeds); thorax with 5; abdomen with 6, excluding telson.
Sexual characters	Gonopores on coxae of 3rd pereopods of female; on short, simple papillae on coxae of 5th pereopods of male.
Sexes	Presumably separate.
Larval development	Presumably epimorphic.
Fossil record	Recent.
Feeding types	Presumably herbivores.
Habitat	Burrows in swampy and dry areas.
Distribution	Australia.

The type species, *Austroastacus hemicirratulus* (Smith and Schuster), of this small group of semiterrestrial Australian crayfishes originally was described in the astacid-

ean genus *Engaeus*. Clark (1936) removed *A. hemicirratulus* from its former genus and assigned it to his newly established *Austroastacus*, and at the same time de-

scribed for it the family Austroastacidae. Bowman and Abele (in press) have since elevated the family to infra-order rank.

Several characters distinguish the austroastacideans from other crayfish. The telson and uropods are completely calcified. The first pair of pleopods are absent in both sexes, and the abdomen is relatively small, although larger in females than in males. The carapace is higher than broad and vaulted posteriorly; the cervical and branchiocardiac grooves are strongly impressed and the areola narrow. The inner flagella of the antennules, when present, are much shorter than the outer.

These crayfish live in family groups and dig deep burrows both in swampy patches and on dry hillsides in heavily timbered areas. The entrances to the burrows dug in swampy ground usually have cones a few inches high with an opening at the top. Burrows dug on hill-

sides lack cones; the entrances are indicated only by small round holes, usually beneath fallen logs or stones.

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INFRAORDER PALINURA Latreille, 1803

Recent species	Approximately 130.
Size range	Up to 61 cm.
Carapace	Cylindrical, subovoid, or dorsoventrally compressed.
Eyes	Stalked, compound, generally well developed.
Antennules	Biramous; peduncle with 3 segments.
Antennae	Peduncle with 5 or fewer segments; exopod reduced; flagella sometimes modified.
Mandibles	Usually with palp; molar and incisor processes usually not distinct.
Maxillulae	With endopodal palp.
Maxillae	Biramous; with 2 bilobed endites.
Maxillipeds	Endopod of 1st with 2 or fewer segments; usually with crista dentata.
Thoracic appendages	Uniramous; 1st pair sometimes chelate; other pairs often subchelate.
Abdominal appendages	Pleopods usually biramous; 1st pair frequently absent; male copulatory structures frequently present. Uropods biramous.
Telson	Together with broad uropods forms tailfan.
Tagmata	Cephalothorax and abdomen.
Somites	Head with 5 + 3 thoracic (maxillipeds); thorax with 5; abdomen with 6, excluding telson.
Sexual characters	Gonopores on coxae of 3rd pereopods of female, on 5th of male; male frequently with copulatory structure.
Sexes	Presumably separate.
Larval development	Metamorphic; phyllosoma → puerulus (postlarva) [Palinuroidea].
Fossil record	(?) L. Triassic, M. Triassic to Recent.
Feeding types	Various.
Habitat	Marine.
Distribution	Worldwide.

This infraorder contains three superfamilies; however, specimens from only one, the Palinuroidea, can be obtained relatively easily. It contains, among others, the Palinuridae (spiny lobsters) and the Scyllaridae (slipper or shovel-nosed lobsters). If specimens are available, representatives of these taxa should be compared with the crayfishes and true lobsters (see Figure 46). In scyllarids, the great modification of the antenna is the most striking character. The antennal flagella have been transformed into spinose or tuberculate platelike structures; the first segments of the antennular peduncles are immovable. In the Palinura the rostrum is not prominent, and the carapace is fused to the epistome. In the Palinuroidea, the 5th pereopods of females are the only chelate appendages; however, chelate appendages usually are present in the other superfamilies.

Larval development is typically metamorphic. Early larval stages are passed through in the egg; the first post-embryonic stage in the Palinuroidea is the phyllosoma. This is a very distinctive larval form, with an extremely flattened, disk-shaped body and elongate appendages; it is equivalent to the mysis stage. The postlarval stage in this superfamily is referred to as the puerulus, nisto, or pseudibacus stage, a benthic form more closely resembling the adult.

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INFRAORDER ANOMURA H. Milne Edwards, 1832

Recent species	Approximately 1575.
Size range	Up to 185 cm (leg span).
Carapace	Variable in shape; not fused to epistome.
Eyes	Stalked, compound; generally well developed.
Antennules	Peduncle with 3 segments; flagella usually paired.
Antennae	Peduncles sometimes with 5, possibly 6, or fewer segments; exopod usually reduced to acicle; flagellum variable in length.

Mandibles	With or without palp; molar and incisor processes usually not distinct.
Maxillulae	With endopodal palp.
Maxillae	Biramous; usually with bilobed endites.
Maxillipeds	Flagella usually present; sometimes absent from 1st; often with crista dentata; usually not operculate.
Thoracic appendages	First usually, 2nd occasionally, chelate; 4th and 5th usually chelate or subchelate, one or both frequently reduced.
Abdominal appendages	Pleopods rarely well developed; often reduced or present only on 1 side; both sexes sometimes with copulatory structures. Uropods often reduced or modified, occasionally absent.
Telson	Occasionally reduced or absent; sometimes together with uropods forms tailfan.
Tagmata	Cephalothorax and abdomen.
Somites	Head with 5 + 3 thoracic (maxillipeds); thorax with 5; abdomen with 6, excluding telson, although segmentation frequently obscured.
Sexual characters	Gonopores on coxae of 3rd pereopods of female, on 5th of male; 1st and/or 2nd pleopods often modified as gonopods in both sexes; female sometimes with abdominal brood pouch; male sometimes with sexual tube(s).
Sexes	Presumably separate.
Larval development	Metamorphic; zoea → megalopa (glaucothöe).
Fossil record	L. Jurassic to Recent.
Feeding types	Various.
Habitat	Most frequently marine, but with few semiterrestrial and freshwater species.
Distribution	Worldwide.

Among the decapod crustaceans, the infraorder Anomura presents the greatest diversity in body form; there are five superfamilies. The shrimplike or crayfishlike elongate body is represented by the Thalassinoidea. The abdomen, although often not drastically reduced in length in the Coenobitoidea and Paguroidea, is most frequently membranous or only weakly calcified and an extrinsic protective covering often is adopted. In certain families the familiar crablike body form has been developed (i.e., Lomidae and Lithodidae). In these families, the abdomen is tucked under the cephalothorax; however, in contrast to that of brachyurans, the abdomen remains relatively soft and membranous or is covered by individual calcified plates. The superfamily Galatheoidea has representatives with crayfishlike body forms (Galatheidae) and crablike forms (Porcellanidae), while representatives of the Hippoidea exhibit variations between the two extremes. If a number of anomuran types are available, identify the characters that are possessed in common. As the paguroidean body form is perhaps the most atypical, a pagurid will be used as a basis for discussing anomuran characters (see Figures 48 and 49).

Begin your study with an overall examination of the general morphology of a typical hermit crab. Aside from the membranous abdomen, perhaps the most noticeable character and one that is not common in other crustaceans is the strong tendency toward asymmetry. Depending upon the species under study, the left or the right 1st pereopod (cheliped) usually is noticeably enlarged. A second indication of asymmetry is the presence of pleopods on only the left side of the abdomen; some primitive genera of coenobitoideans have paired pleopods. Usually, unless modified as gonopods, pleopods are absent from the 1st abdominal somite. Sexual modifications of the 1st pair may occur in both male and female; in the male the 2nd also may be modified. In some genera of pagurids the vas deferens is markedly extended from the gonopores to form 1 or a pair of sexual tubes. The asymmetrical uropods common to the majority of paguroideans are another example of the secondary asymmetry characteristic of the group.

In dorsal view, the eyes with their prominent peduncles usually are obvious. At the base of each ocular peduncle observe the ocular acicle; it may have several

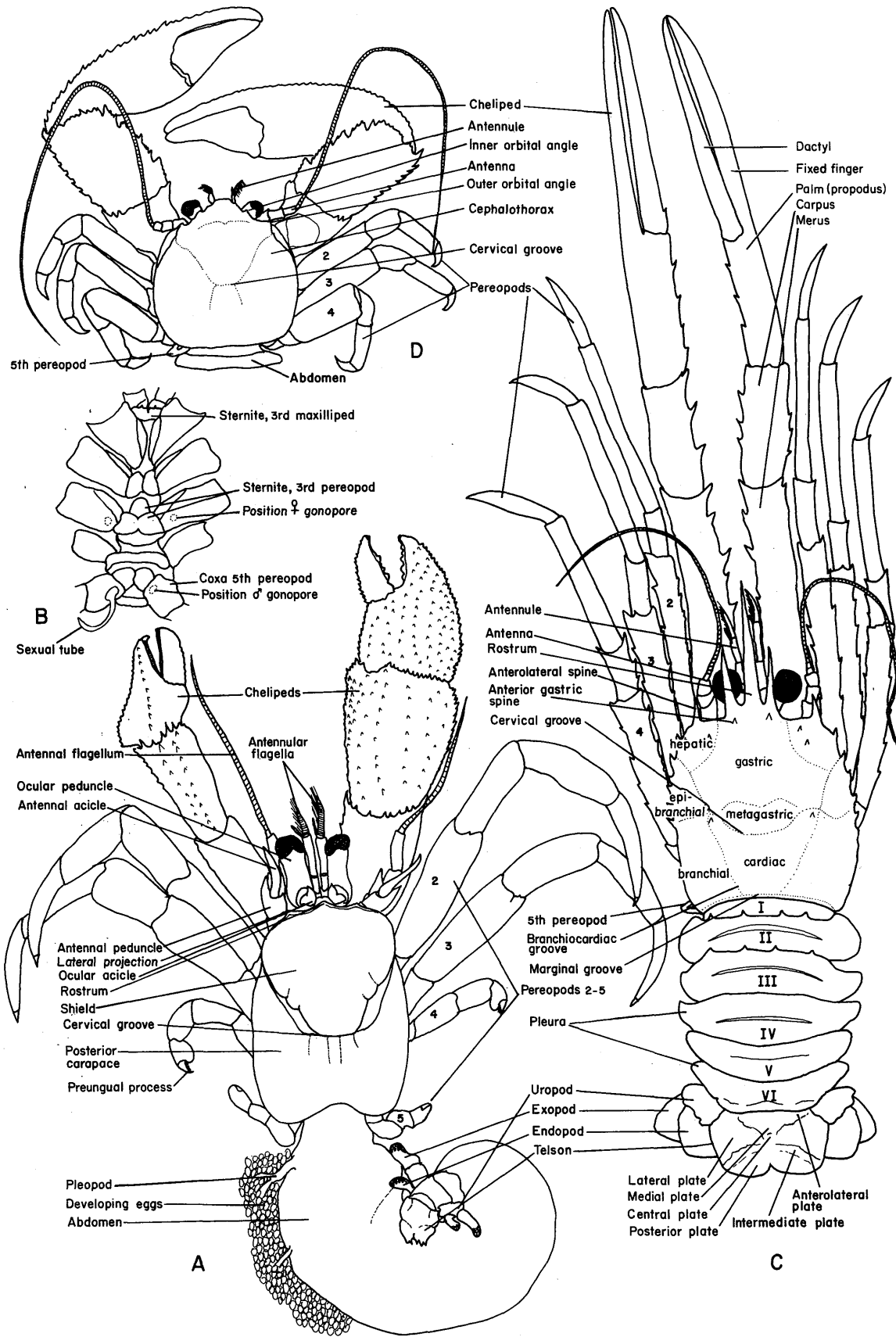


Figure 48 Decapoda, Anomura: A, B, Paguroidea; C, D, Galatheaidea. A. Typical pagurid (dorsal view); B. Pagurid thorax (ventral view); C. Typical galatheaidean (dorsal view), showing regions of carapace; D. Typical porcellanid.

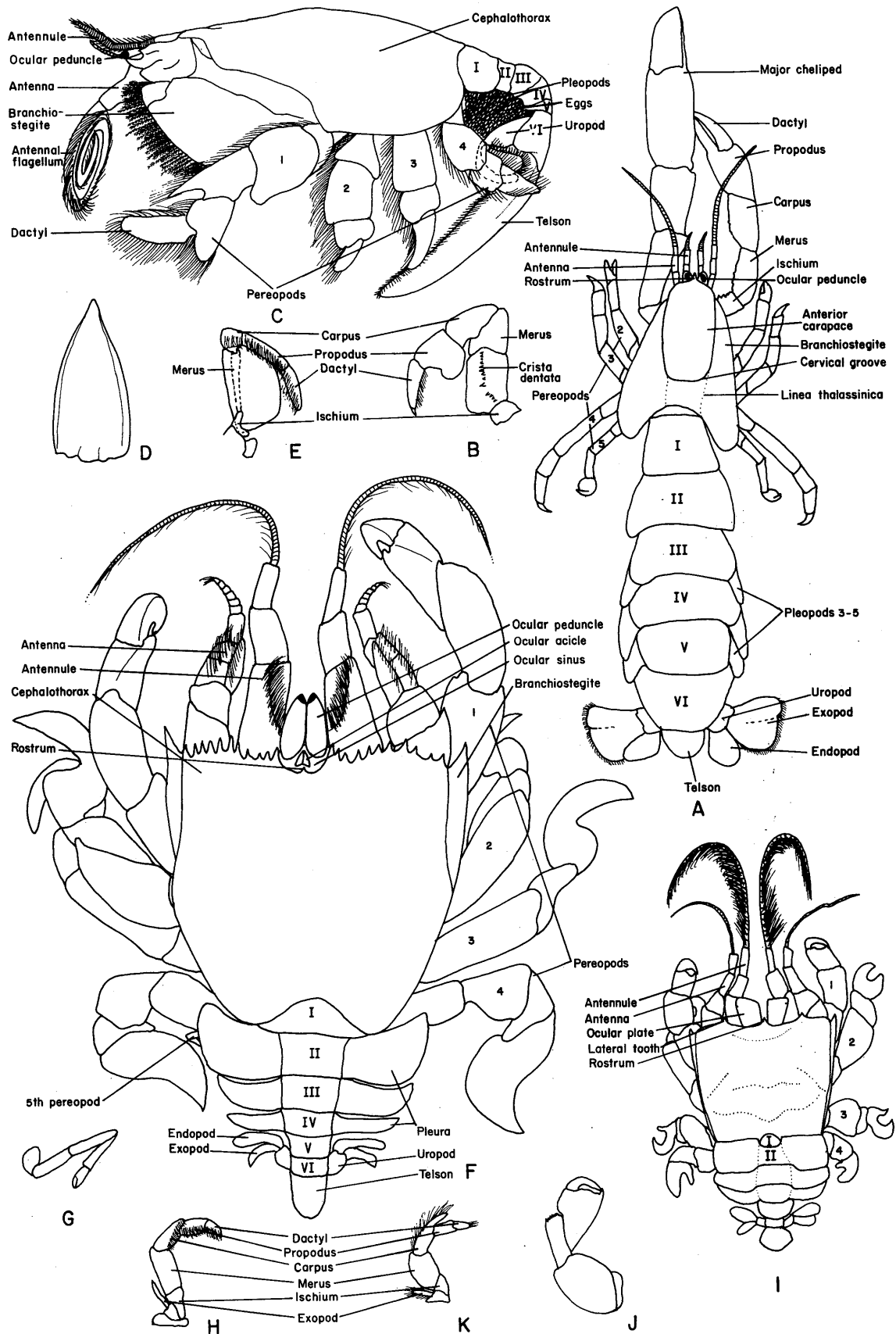


Figure 49 Decapoda, Anomura; A, B, Thalassinoidea; C–K, Hippoidea. A. Typical callianassid (dorsal view); B. 3rd maxilliped; C. Typical hippid (lateral view); D. Hippid telson; E. Hippid 3rd maxilliped; F. Typical albuneid (dorsal view); G. Albuneid 5th pereopod; H. Albuneid 3rd maxilliped; I. Typical *Lepidopa* (Albuneid); J. Left cheliped of *Lepidopa*; K. 3rd maxilliped of *Lepidopa*.

spines, a single spine, or less frequently be unarmed. The antennules are located ventrally between the ocular peduncles; the 1st segment has a prominent statocyst. The antennae are lateral to the ocular peduncles and appear to have, in addition to the typical 5 segments of the peduncle, a small supernumerary segment between the 3rd and 4th segments dorsolaterally. The antennal exopod is reduced to a slender acicle. The pagurid cephalothorax usually is calcified only in the anterior part, referred to as the shield. In some species the branchiostegites are calcified as well. The shield is separated from the posterior part of the carapace by the cervical groove. Usually 3 distinct pairs of lines or grooves can be distinguished on the posterior carapace. In the midline are a pair of elongate sutures, the sulcus cardiobranchialis; 2 short lines or grooves slightly laterad are referred to simply as sulcus "a"; a linea anomurica on each side of the carapace represents the 3rd pair. If the branchiostegite is lifted or removed, the gills are exposed. Typically the gill number in pagurids varies from 10 to 13 pairs, depending upon the taxa. What is the gill formula for your specimen(s)?

In addition to the asymmetrical chelipeds (except in the genera *Paguristes* and *Clibanarius*, and the family Pylochelidae), the 2nd and 3rd pereopods also may be asymmetrical and/or dissimilarly armed from right to left. The 4th pereopods are usually considerably shorter than the preceding pairs and usually are provided with a rasp on the external surface of each propodus; in some taxa they have a preungual process at the base of each dactyl (the function of this structure is unknown). The 5th pereopods also are reduced in size and most frequently are chelate. They too are equipped with rasps.

Although the pagurid abdomen is usually membranous, it often is possible to distinguish the outline of some of the abdominal tergites. The pagurid telson and uropods are distinctive. Notice that the uropods also are provided with rasps. These are used by the animal to help in holding the shell in place.

Before removing the mouthparts, observe the position of the 3rd maxillipeds relative to one another. This is a valuable diagnostic character; the two superfamilies are differentiated on the position of these maxillipeds. In the Coenobitoidea the 3rd maxillipeds are approximate at their bases; in the Paguroidea the bases are widely separated. The approximate position of the 3rd maxillipeds in the Thalassinoidea and the widely separated condition in the Galatheaidea suggest that the Coenobitoidea may be closely related to the former and the Paguroidea to the latter. If such relationships are true, the similarities in body form that exist among representatives of the latter two superfamilies would have to have resulted from convergent evolution.

If specimens of galatheaideans or thalassinoideans are available, list the similarities and differences that you observe between representatives of these taxa and her-

mit crabs. If specimens of lithodids and porcellanids are available, what characters do you find that relate the former closely with the pagurids and the latter with the galatheaids? The superfamily Hippoidea is represented by a relatively few species, many of which are rather specialized. The common "mole crabs" *Emerita* spp. have the antennae extremely setose and adapted for filter feeding. Some of the Albuneidae have the antennules modified for a similar function.

The description of major organ systems also is based on the conditions found in pagurids (see Figure 50), although these are not necessarily always typical of all anomurans. Differences between pagurids and other anomurans will be pointed out. Remove the carapace very carefully to avoid damaging the heart; the pericardium attaches to the membrane underlying the carapace. As the cephalothoracic body cavity of typical pagurids is narrow, remove the gill chamber and inner branchial wall from one side. Locate the heart in the posterodorsal region of the cephalothorax. The pericardium extends from the cervical groove to the 8th thoracic somite, but usually will not be easily distinguished from neighboring tissues. Blood flows from the gills into the pericardium and into the heart via 3 pairs of ostia, 1 anterodorsal pair and 2 lateral pairs. Anteriorly the heart gives off 3 arteries, the unpaired, median ophthalmic artery and the paired lateral arteries. Follow the ophthalmic artery; shortly after leaving the heart a cor frontale is formed. After passing over the dorsal surface of the stomach the ophthalmic artery turns ventrally and divides into 2 branches that provide blood to the anterior cephalic area and supraesophageal ganglion. Returning to the heart trace the path of one of the lateral arteries anterolaterally. Enroute to the cephalic appendages, it gives off branches to the stomach and musculature. Ventrally from the heart locate the small hepatic arteries. In pagurids this pair of arteries no longer supplies blood to the hepatopancreas, which lies almost exclusively in the abdomen, but terminates instead on the stomach or midgut. From the posterior margin of the heart identify the large, posteriorly directed superior abdominal artery and the ventrally directed sternal artery. The path of the latter will be described, but should not be traced until after the stomach and midgut have been removed. Follow the superior abdominal artery posteriorly, cutting open the abdomen if necessary. At the level of the 1st abdominal somite the artery branches. Trace the large segmental artery ventrally; at the level of the 3rd somite it divides into sub- and supramuscular branches. The former passes ventrally along the ventral nerve cord and terminates in the 6th somite. The latter provides numerous branches to the hepatopancreas and gonads and terminates with branches to the telson and uropods. The superior abdominal artery supplies blood to the gonads and to the pleopods. Follow the sternal artery as it passes first ventrally into the 7th thoracic somite and then turns

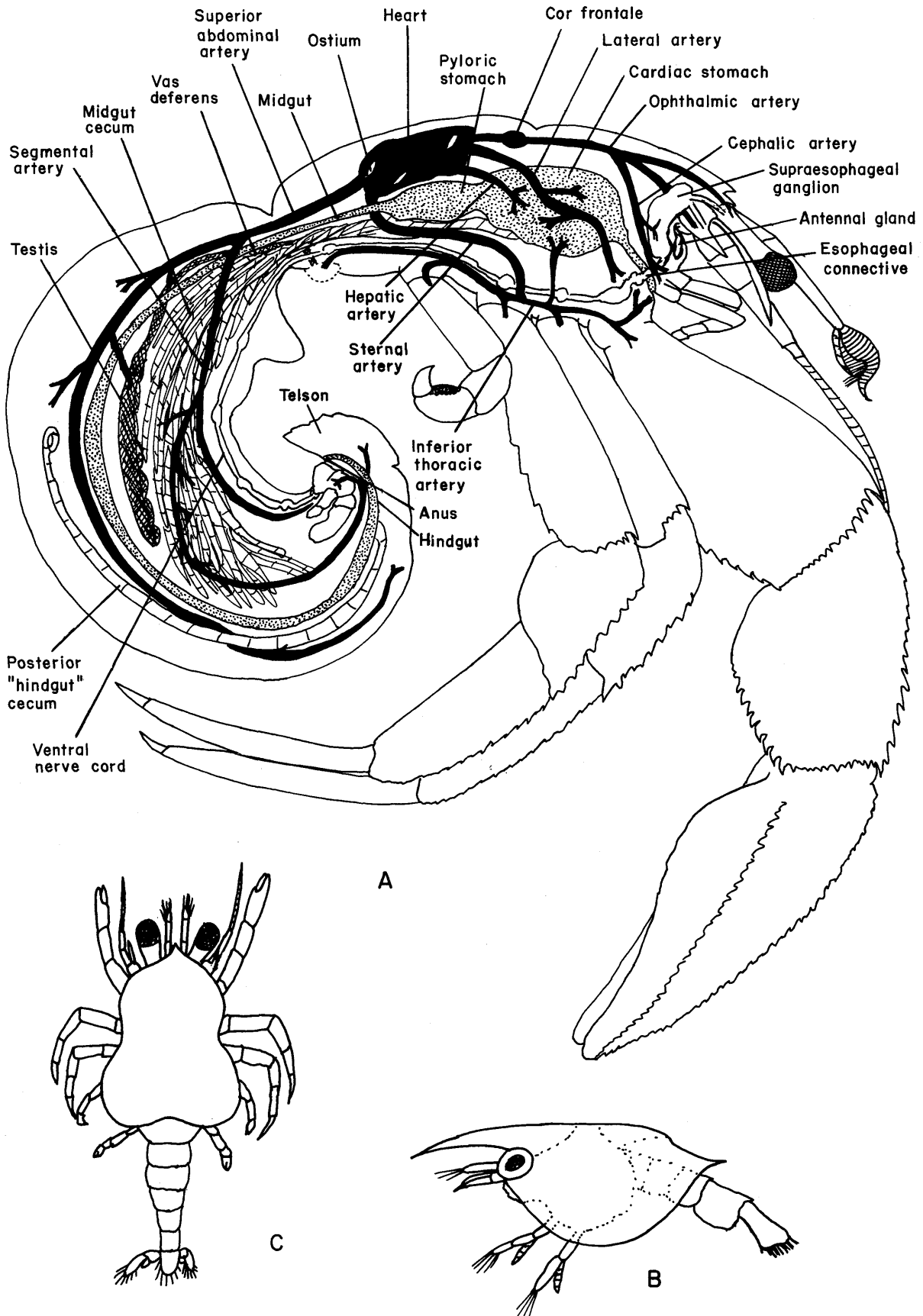


Figure 50 Decapoda, Anomura: A. Diagrammatic pagurid with musculature removed to show major organ systems; B. Zoea; C. Megalopa (*Glaucothoë*.)

horizontally. At the level of the 5th somite it turns ventrally again and pierces the central ganglionic mass between the nerves of the 2nd and 3rd pereopods. Beneath the nerve cord the vessel divides into anterior and posterior branches. The anterior branch, the inferior thoracic artery, provides blood to the chelipeds, mouthparts, renal gland, and ventral region of the stomach. The posterior branch supplies blood to the remaining pereopods, but in contrast to other anomurans, does not enter the abdomen.

The pagurid reproductive system differs not only from other anomurans but from decapods in general in that it is located almost exclusively in the abdomen. In the male the testes are paired, ovoid structures consisting of long convoluted tubules, frequently nearly imbedded in tubules of the hepatopancreas. Anteriorly from the testes, at about the level of the 3rd abdominal somite, trace one of the vas deferens anteriorly to its opening on the coxa of the 5th pereopod. The paired ovaries of the female lie in approximately the same position; the oviducts are distinct and lead from the abdomen, through the thorax, to their openings on the coxae of the 3rd pereopods.

The muscular esophagus leads into the large stomach. The cardiac portion easily is recognized by its baglike appearance and membranous dorsal surface. After examining the remainder of the digestive system, remove the stomach and examine the gastric mill of the cardiac stomach. The considerably smaller pyloric stomach is separated from the former by a cardiopyloric valve. At the junction of the pyloric stomach and midgut a pair of small, anteriorly directed ceca usually arise dorsally; ducts of the hepatopancreas enter the midgut at this level too. The midgut is an elongate thin-walled smooth tube extending almost the full length of the abdomen. Just anterior to its junction with the hindgut or rectum, a prominent, anteriorly directed cecum arises. It has been called the hindgut cecum, but this is a misnomer as it originates from the midgut. The hindgut terminates in a ventrally directed anus at the terminal end of the telson. Excretion in anomurans is via the antennal glands; in pagurids this usually is supplemented by an unpaired abdominal sac or bladder often hidden in the lobes of the hepatopancreas.

The prominent supraesophageal ganglion can be seen in the midline between the ocular peduncles and above the epistome. Trace the major nerves radiating from the ganglion; that is, the optic, antennal, antennular, and tegumental. Follow one of the esophageal connectives around the esophagus; the swelling is the paraesophageal ganglion. The connective terminates in a thoracic ganglionic mass overlaying the inferior thoracic artery. Three masses of fused ganglia, separated by constrictions, comprise this thoracic mass. The 3rd cluster of ganglia, which is pierced by the sternal artery, is composed of the ganglia of the 4th and 5th pereopods and 1st

abdominal somite. In the abdomen the nerve cord is of the ladder type with 5 pairs of fused ganglia. As a result of the flexure of the abdomen, the nerve cord in pagurids is skewed to the left from the 2nd to the 4th somites. The abdominal flexure also has resulted in the atypical development of the abdominal musculature. The flexor muscles have become abnormally enlarged and those of the right side are considerably larger than those of the left.

Larval development is metamorphic; the first postembryonic stage is a zoea, with 2 or 3 pairs of maxillipeds present, and a carapace with the posterior margins produced into 2 lateral spines. The zoeal stage is followed by metamorphosis to a megalopa. In pagurids the zoea is basically symmetrical, but the megalopa (also referred to as a glaucothöe) may exhibit asymmetry in the uropods and chelipeds.

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INFRAORDER BRACHYURA Latreille, 1803

Recent species	Approximately 4500.
Size range	Up to 365 cm (leg span).
Carapace	Progressively shortened and widened; fused to epistome.
Eyes	Stalked, compound; sometimes reduced.
Antennules	Peduncles with 3 segments; flagella often reduced or vestigial.
Antennae	Peduncles usually with 1 or 2 segments; usually without exopod; flagella short, sometimes absent.
Mandibles	With or without palp; molar and incisor processes usually not distinct.
Maxillulae	Usually with endopodal palp.
Maxillae	Biramous; usually with bilobed endites.
Maxillipeds	Flagella often reduced or absent; 3rd often with ischium and merus flattened, operculate.
Thoracic appendages	First chelate; 5th, or 4th and 5th, occasionally subchelate; 5th occasionally paddle-shaped.
Abdominal appendages	In males 1st and 2nd pairs developed as gonopods, 3rd–5th absent; in females 2nd–5th usually developed, rarely 1st pair also developed; uropods in both sexes usually absent; sometimes present in Dromioidea.
Telson	Usually reduced.

Tagmata	Cephalothorax and abdomen.
Somites	Head with 5 + 3 thoracic (maxillipeds); thorax with 5; abdomen with 6 or fewer (some frequently coalesced), excluding telson.
Sexual characters	Gonopores on coxae or sternite of 3rd pereopods in female, on 5th in male; 1st and 2nd pairs of pleopods usually modified as gonopods in male.
Sexes	Presumably separate.
Larval development	Metamorphic; zoea → megalopa.
Fossil record	L. Jurassic to Recent.
Feeding types	Various.
Habitat	Marine, freshwater, and semiterrestrial.
Distribution	Worldwide.

The infraorder Brachyura is divided into five major sections, the Dromiacea, Oxystomata, Oxyrhyncha, Cancridea, and Brachyrhyncha. Although considerable variation occurs, the basic brachyuran characters can be recognized. Examine the external morphology of all the available taxa, paying particular attention to the regions of the carapace, the structure and position of the antennules and antennae, and the ocular peduncles and orbits (see Figures 51 and 52). What differences from the structures in anomurans do you notice? In the oral region, observe the complete closure often obtained by the expanded and operculate segments of the 3rd maxillipeds.

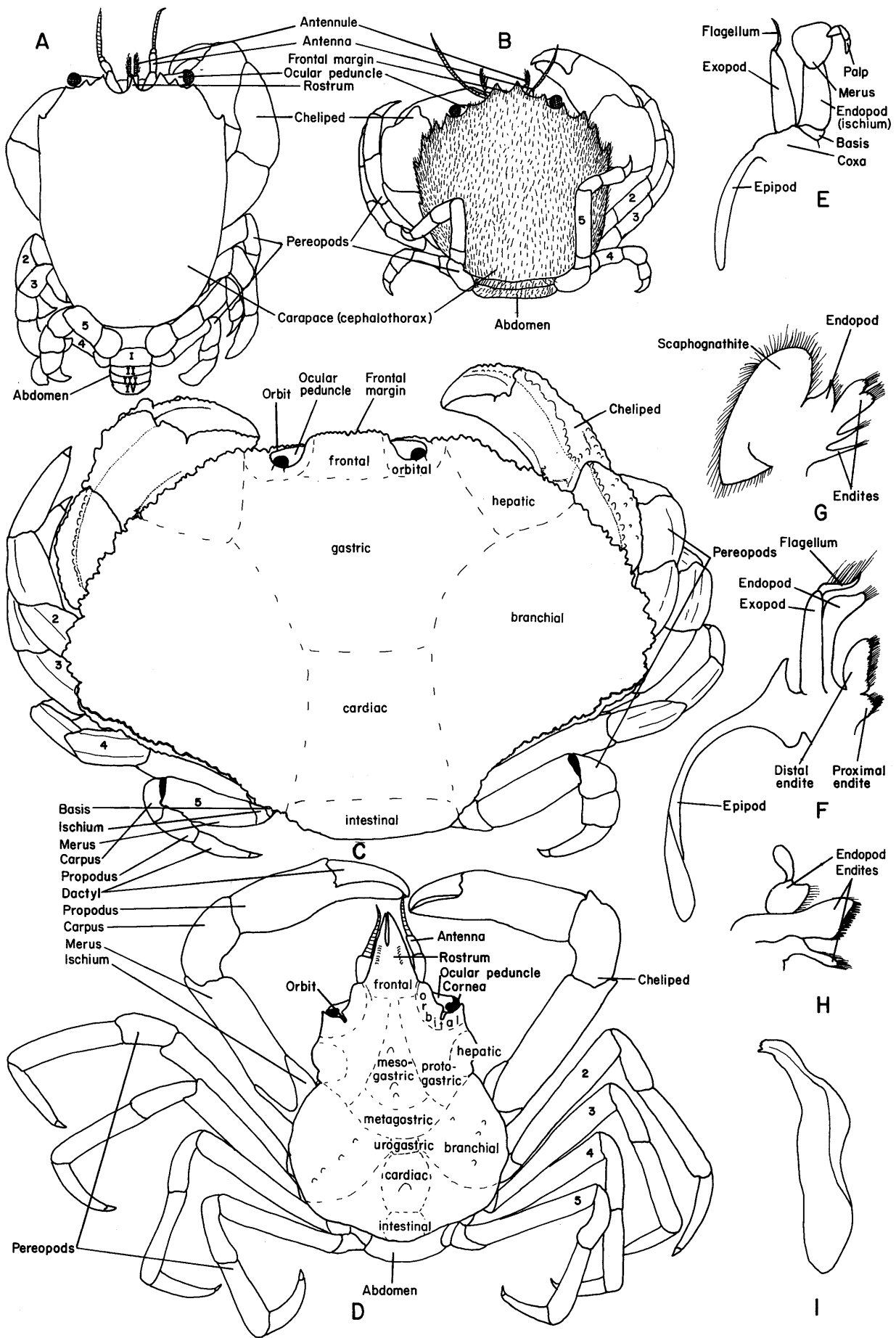
In contrast to the anomurans, the gonopores of brachyurans are not readily discernible, as they are hidden by the tightly folded-under abdomen. The sex of the animal may be determined by the shape of the abdomen. In males the abdomen is acutely triangular; in females it is broadly triangular to semisubcircular. Care must be exercised in attempting to sex juveniles or young adults as the abdomen frequently is not appreciably expanded in immature females. If the abdomen is extended, the pairs of modified pleopods that form the gonopods of the males or the posterior 4 pairs of female pleopods can be observed.

After completing your general examination of the external morphology proceed to an examination of the major organ systems before studying the mouthparts, as the removal of these appendages often will cause serious damage to the cephalic region of the animal (see Figure 53). The description of the internal anatomy is based on specimens of the Portunidae; however, the information is sufficiently general to be applicable to most of the larger, unspecialized taxa. Begin by carefully removing the dorsal carapace. This can best be done by cutting, with a pair of sharp scissors, first the posterior margin and then

about 1 to 5 mm from the dorsolateral margin on each side and on the anterior margin just behind the orbits. Starting at the posterior margin, carefully begin to separate the carapace from the underlying hypodermis. In the region of the cervical groove, a pair of prominent muscles, the anterior dorsal pyloric muscles, attached to the carapace will have to be severed. A few additional muscle strands probably also will have to be cut to remove the carapace. With the removal of the hypodermis, certain muscles, the stomach, heart, and the gills will be apparent. In the dorsal midline anteriorly to either side of the stomach identify the median posterior gastric muscles. Posteriorly in the midline observe the large heart; a pair of prominent ostia is present on the dorsal surface. Two additional pairs can be seen laterally if the heart is gently pushed to one side. Three arteries, the unpaired ophthalmic and paired antennal, leave the heart anteriorly. Follow the ophthalmic artery across the dorsal surface of the stomach; anteriorly it turns ventrally and branches to provide blood to the supraesophageal ganglion, eyes, and antennules. It will be difficult to trace the path of the antennal arteries until components of the digestive system have been examined and removed. Posterolaterally of the heart, behind the branchial chambers, observe the flattened pericardial sacs. From the posterior margin of the heart the unpaired superior abdominal artery turns ventrally and gives off a pair of branches that provides blood to the dorsal proximal muscles of the more posterior pairs of pereopods. It will be difficult to trace these and the ventral hepatic arteries until some of the other organs are removed.

Laterally the gills may be seen to converge to an apex abutting a portion of the endoskeleton. Overlying the gills observe the long epipodite of the 1st maxilliped. What is the gill formula of your specimen? Remove the

Figure 51 Decapoda, Brachyura: A. Typical raninoidean; B. Typical dromioidean; C. Typical caloppoidean; D. Typical majoidean; E–I, General structures from Portunoidea. E. 3rd maxilliped; F. 1st maxilliped; G. Maxilla; H. Maxillule; I. Male gonopod (1st pleopod).



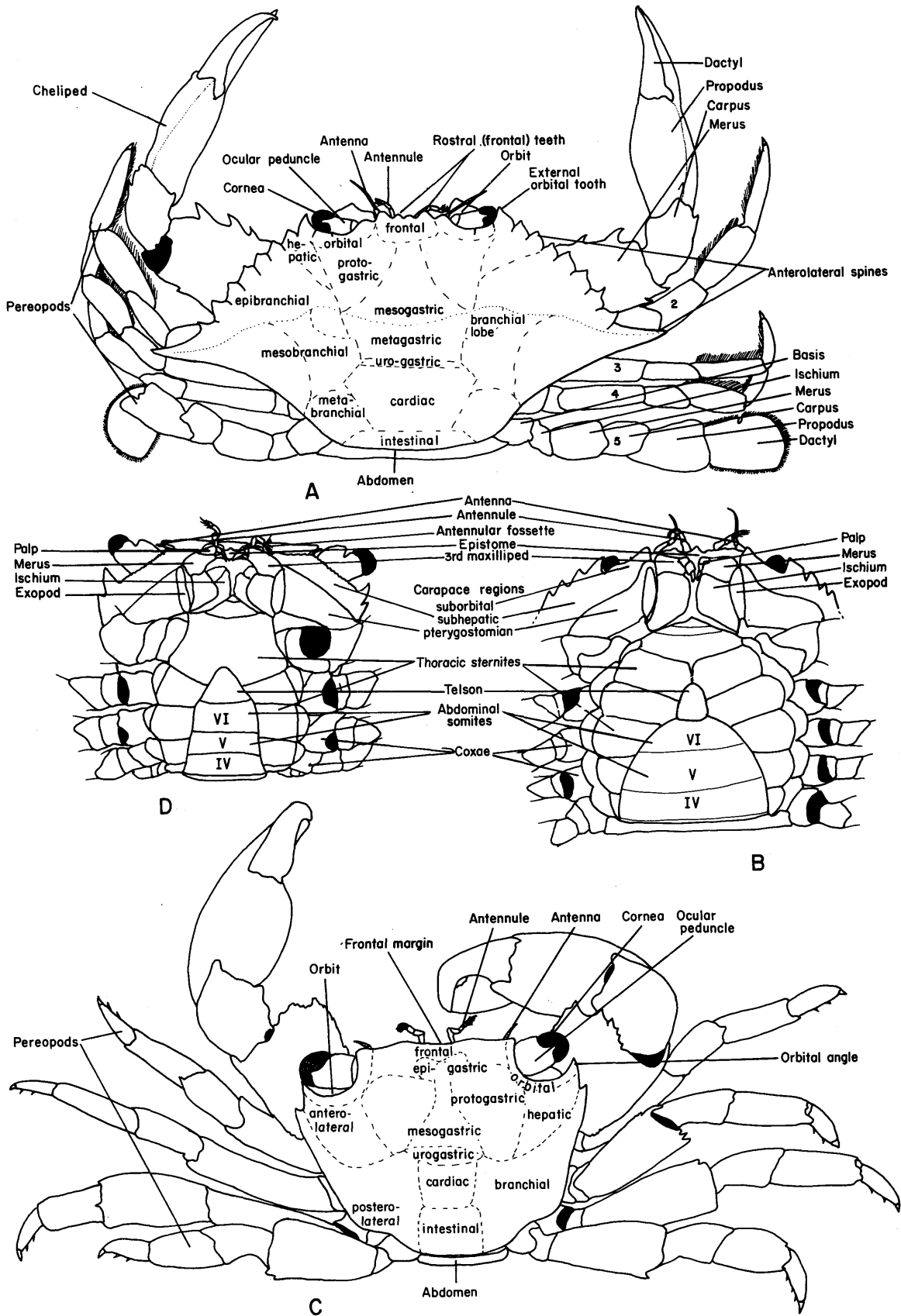


Figure 52 Decapoda, Brachyura: A, B, Portunoidea; C, D, Grapsoidea. A. Typical portunid (dorsal view) showing regions of carapace; B. Female portunid (ventral view, with pereopods removed); C. Typical grapsid (dorsal view) showing regions of carapace; D. Male grapsid (ventral view, with pereopods removed).

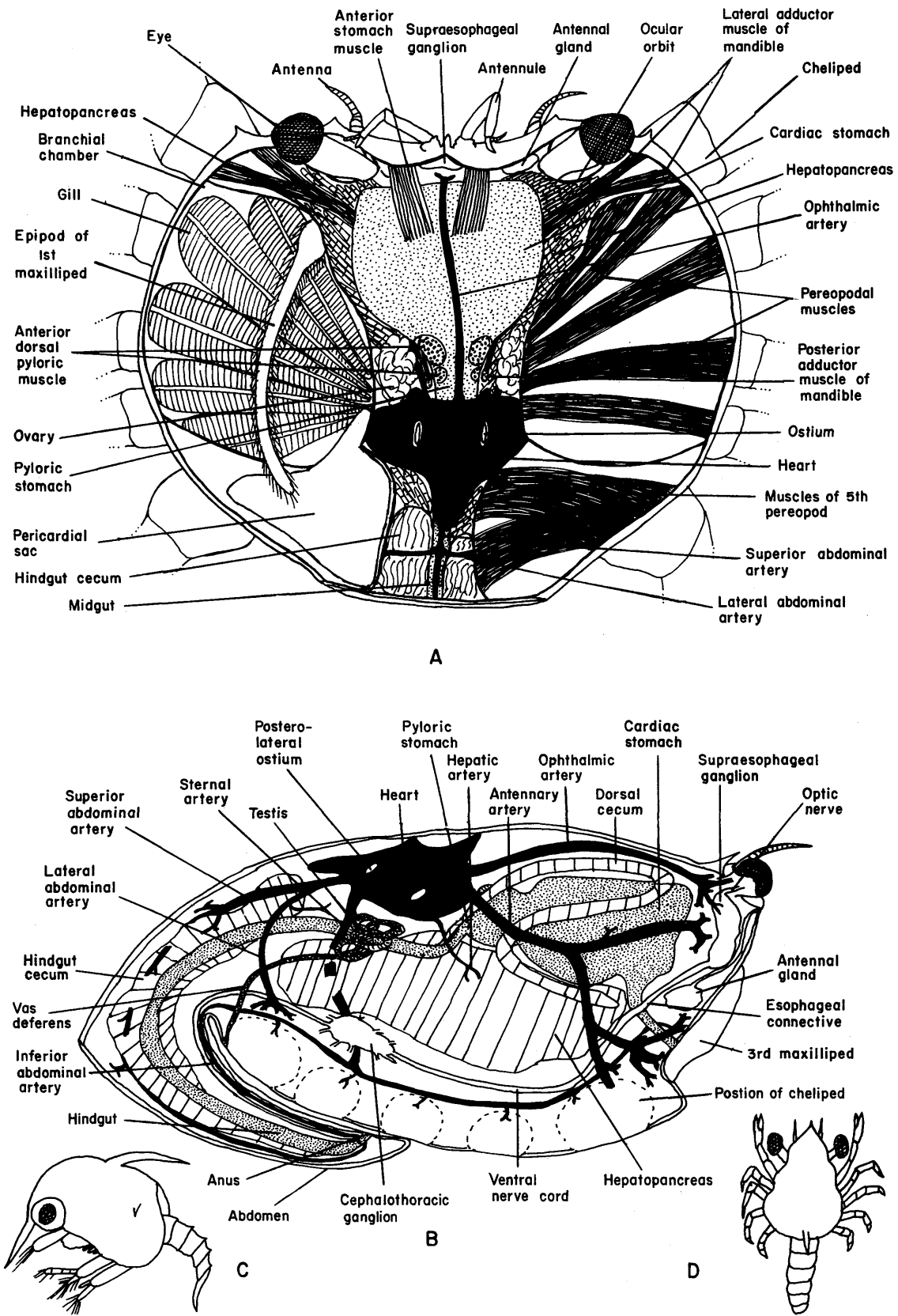


Figure 53 Decapoda, Brachyura: A. Diagrammatic portunid (dorsal view) with carapace removed to show gills and pericardial sac (left) and pereopodal musculature (right); B. Diagrammatic portunid (lateral view) with appendages, gills, and musculature removed to show major organ systems; C. Zoea; D. Megalopa.

gills and locate the smaller but similarly appearing epipodites of the 2nd and 3rd maxillipeds. Remove the stiff membranous floor of the branchial chamber to expose the muscles of the cheliped and first 3 pereopods; removal of the pericardial sac and underlying membrane will expose the muscles of the 5th pereopod.

Lateral to the stomach the mass of tissue filling much of the cephalothorax represents lobes of the hepatopancreas or 1st pair of ceca. If this is removed carefully, 2 mandibular muscles can be distinguished: the large lateral adductor muscle and the smaller external abductor muscle. The latter can be traced from the mandible to a point on the endoskeleton just anterior to the apex of the gills.

Ovaries or testes lie slightly posterior to the pyloric stomach on top of or among the lobes of the hepatopancreas. The difference in texture of the gonadal tissue will aid in distinguishing it from the tissue of the hepatopancreas. The ovaries actually are connected by a cross-bridge just behind the pyloric stomach. A short distance behind the bridge are the paired oviducts, but these usually are concealed in the ovaries. Near the median border of each duct is an oval-shaped seminal receptacle that extends ventrally almost to the sternal floor; ducts lead from the receptacles to the gonopores on the 6th somite. The testes similarly are connected by a bridge behind the pyloric stomach. The vas deferens leaving the testes are coiled, and in mature individuals can be separated into 4 distinct regions related to spermatophore production.

After tracing the midgut from the pyloric stomach to the abdomen, carefully remove the stomach by cutting it at its junctions with the esophagus and midgut. Posterior and lateral of the stomach a 2nd pair of thin, elongate ceca can be observed. A 3rd, unpaired cecum, arising from the hindgut, is located behind or posterior to the heart. Examine the gastric mill of the cardiac stomach. How does this grinding apparatus compare with those of the other decapods studied?

The general plan of the nervous system is similar to that of the crayfish but may not be observed as easily. The major difference between the nervous systems of the two is that in the brachyuran the ventral ganglia are fused into a single mass. The supraesophageal ganglion lies immediately behind the rostrum beneath the transverse apodeme between the eyes. Trace the major nerves radiating from the ganglion; these are the same as have been seen in other decapods. The esophageal connectives are considerably longer than in other decapods because the fused ventral ganglia are situated between the 4th and 5th thoracic somites. Now remove and examine the mouthparts. What structural similarities and differences do you find between the mouthparts of brachyurans and those of other decapods?

Larval development is metamorphic. The first post-embryonic stage is a zoea; however, since rudiments of

the posterior thoracic appendages often are present, it may be considered a later substage than typically seen in anomuran zoeae. The brachyuran megalopal appendages resemble those of the adult; however, the abdomen is large and usually carried in an extended position; the 5 pairs of pleopods are used in swimming. In cases of abbreviated development, the megalopal stage may be suppressed. Metamorphosis apparently is suppressed in most, if not all, freshwater and terrestrial species.

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GLOSSARY OF MORPHOLOGICAL TERMS

- Abdomen.** Trunk somites (tagma) between thorax and telson; somites with or without limbs; syn., *pleon*.
- Abdominal process.** Fingerlike projection(s) on dorsal surface of abdomen (Cladocera).
- Abdominal somite.** Any single division of body between thorax and telson; syn., *pleomere*, *pleonite*.
- Abreptor.** Postabdomen, bent forward from junction with body, terminating in 2 claws (Cladocera).
- Acanthopod.** Appendage (cirrus) with short row of strong sharp spines distally at each articulation of greater curvature and few or no spines along lesser curvature (Cirripedia).
- Acron.** Antermost part of body carrying eyes; not considered true cephalic somite; syn., *ophthalmic somite*, *presegmental region*.
- Adductor muscle.** (1) Muscle attached to carapace for pulling it to body or connecting halves of bivalve carapace (e.g., Conchostraca, Ostracoda, Leptostraca); or (2) Muscle attached to scutum for closing aperture (thoracic Cirripedia).
- Adductor muscle scar.** Impression of adductor muscle on inner surface of each valve (Ostracoda); see *muscle scar*.
- Adductor pit.** Depression on inner surface of scutum between adductor ridge and occludent margin for attachment of adductor muscle (thoracic Cirripedia).
- Adductor ridge.** Linear elevation on inner surface bounding adductor pit on tergal side in sessile barnacles.
- Aesthetasc.** Sensory seta covered by delicate cuticle, often projecting from antenna or antennule; syn., *olfactory hair*, *ethetasc*, *esthete*.
- Afferent channel.** Opening through which water passes to gills.
- Ala (pl. alae).** One of pair of posteriorly directed cephalic-shield extensions (Branchiura and some parasitic Copepoda); triangular lateral part of compartmental plate, with or without radii, overlapped by adjacent compartmental plate (balanomorph Cirripedia).
- Aliform apophyses.** Incurved anterior and posterior extremities of growth lines (Conchostraca).
- Ambulatory leg.** See *pereopod*.
- Anal spines.** Single row of spines on either side of postabdomen (Cladocera) or prominent telsonal spines (Conchostraca).
- Annulus ventralis.** Seminal receptacle of female crayfish.
- Antenna.** One of pair of appendages of second cephalic somite; syn., *2nd antenna*.
- Antennal carina.** See *decapod carapace*, *carina a*.
- Antennal gland.** One of pair of complex excretory glands in many malacostracans with duct opening on antenna; syn., *green gland*.
- Antennal groove.** See *decapod carapace*, *groove a*.
- Antennal muscle scar.** Impression of antennal muscle on inner surface of valve, situated in front of adductor muscle scar, generally above (in some podocopans behind) mandibular muscle scar (Ostracoda).
- Antennal region.** See *decapod carapace*, *region a*.
- Antennal scale.** See *scaphocerite*.
- Antennal spine.** See *decapod carapace*, *spine a*.
- Antennular fossette.** Depression, pit or socket containing basal portion of the antennule.
- Antennular scale.** See *stylocerite*.
- Antennule.** One of pair of appendages of first cephalic somite; syn., *1st antenna*.
- Anterolateral region.** See *decapod carapace*, *region b*.
- Aperture.** Posteroventral opening into mantle cavity (Cirripedia); cf. *orifice*.
- Apex.** Upper angle of scutum or tergum (thoracic Cirripedia).
- Apodeme.** Infold of exoskeleton for attachment of muscles.
- Appendix interna.** Median process of pleopodal endopod uniting members of each pair; syn., *stylamblys*.
- Appendix masculina.** Complex median process of 2nd pleopodal endopod of male Caridea and some other Eucarida used in copulation or spermatophore transfer.
- Areola.** Area between branchiocardiac grooves and posterior to cervical groove on dorsal surface of carapace (Astacidea and Austroastacidea).
- Arthrobranch.** Gill attached to articular membrane between appendage and body (Decapoda); syn., *arthrobranchiata*.
- Arthrobranchiata.** See *arthrobranch*.
- Arthrophragm.** See *endophragm*.
- Article.** Subdivision of antennal or antennular flagella or appendage (cf. *segment*).
- Articular furrow.** Groove near tergal margin of scutum or scutal margin of tergum forming part of articulation between the two valves (balanomorph Cirripedia).
- Articular ridge.** Linear elevation on scutum or tergum bordering articular furrow and with it forming articulation between the two valves (balanomorph Cirripedia).
- Atrium oris.** Preoral cavity, bounded ventrally by posteriorly directed labrum, dorsally by ventral surface of cephalon just behind mouth, and laterally by paragnaths and mandibles.
- Attractor epimeralis muscle.** Prominent muscle in many decapods, inserting along line of branchiocardiac groove.
- Basal margin.** Lower edge of scutum or tergum or other plate (thoracic Cirripedia).
- Basicarinal angle.** Intersection of basal and carinal margins of tergum (thoracic Cirripedia).
- Basicerite.** Second segment of antennal peduncle, bearing scaphocerite (Caridea).

- Basioccludent angle.** Intersection of basal and occludent margins of scutum (thoracic Cirripedia).
- Basiophthalmite.** Proximal segment of eyestalk, articulating with distal segment (podophthalmite) bearing corneal surface of eye.
- Basipod(ite).** See *basis*.
- Basis (pl. bases).** Segment of protopod adjoining coxa and carrying exopod and endopod distally; also basal calcareous or membranous plate furnishing anchorage to substrate in sessile cirripeds.
- Basiscutal angle.** Intersection of basal and scutal margins of tergum (thoracic Cirripedia).
- Basitergal angle.** Intersection of basal and tergal margins of scutum (thoracic Cirripedia).
- Biformes.** Carapaces reflecting sexual dimorphism (e.g., Conchostraca), marked by differing valve proportions for each sex of the same species.
- Biramous.** Having two branches. Crustacean appendage with two rami; also antennule or antenna with two flagellar elements.
- Biserial branch.** Primary branch of dendrobranchiate gill subdivided into two rows or series.
- Bopyridum.** Postlarva of epicaridean isopod that is attached to permanent host.
- Brain.** See *supraesophageal ganglion*.
- Branchia (pl. branchiae).** Thin-walled, fingerlike or leaflike structure extending outward from appendage or secondarily from side of body, functioning in respiration; syn., *gill*.
- Branchial carina.** See *decapod carapace, carina b*.
- Branchial chamber.** Area between body and carapace enclosing branchiae; syn. *gill chamber*.
- Branchial glands.** Masses of connective-tissue cells without ducts surrounding venous channels in branchiae.
- Branchial region.** See *decapod carapace, region c*.
- Branchiocardiac carina.** See *decapod carapace, carina c*.
- Branchiocardiac groove.** See *decapod carapace, groove b*.
- Branchiostegal area.** Part of carapace extending laterally and ventrally over branchiae.
- Branchiostegal spine.** See *decapod carapace, spine b*.
- Branchiostegite.** Expanded dorsal and lateral branchial region of carapace.
- Buccal cavity.** Area of cephalon containing mouthparts; bounded by epistome anteriorly and free margins of carapace laterally (Malacostraca).
- Buccal frame.** Structural region of cephalon enclosing mouthparts (Brachyura).
- Buccal groove.** See *decapod carapace, groove c*.
- Bullate.** Inflated, blisterlike.
- Calceolus (pl. calceoli).** Complex sensory filaments on antennules (Amphipoda).
- Calypptosis stage.** Third larval stage, characterized by differentiation of abdomen and appearance of compound eyes (Euphausiacea); see also *zoaea*.
- Capitulum.** Portion of carapace enclosing body, commonly protected by calcareous plates (lepadomorph cirripeds); or anterior prominence in complex tooth and socket hingement (Ostracoda).
- Carapace.** Cuticular, usually calcified, structure arising from posterior margin of cephalon, extending anteriorly and posteriorly, often covering head and thorax (cf. Eucarida); also fold of integument extending from maxillary segment, forming bivalved shell of cyprid larvae and of ascothoracicans and mantle of other Cirripedia; mantle usually with calcified plates in thoracicans.
- Carapace angles.** Intersection of straight dorsal margin by anterior rib (α) and posterior rib (β) (Conchostraca).
- Carapace carina.** Narrow ridge on surface of carapace (cf. *decapod carapace* and *stomatopod integumental ornamentation*).
- Carapace costae.** Closely spaced radial ridges, grading from fine to coarse, not crossing umbo (Conchostraca); syn., *radial lirae*.
- Carapace costellae.** Fine radial ridges extending from ventral margin across umbo (Conchostraca).
- Carapace groove.** Furrow on surface of carapace (cf. *decapod carapace* and *stomatopod integumental ornamentation*).
- Carapace growth line.** Peripheral margin of successive membranes added to shell during each molt (Conchostraca).
- Carapace lirae.** Linear concentric ridges parallel to and between growth lines (Conchostraca).
- Carapace region.** Differentiated portion of carapace surface (cf. *decapod carapace*).
- Carapace spine.** Sharp projection from carapace (cf. *decapod carapace*).
- Carapace tooth.** Generally blunt projection of carapace, often broader than spine (cf. *decapod carapace* and *stomatopod integumental ornamentation*).
- Cardiac notch or incision.** Indentation on posterior margin of carapace.
- Cardiac region.** See *decapod carapace, region d*.
- Cardiac tooth.** See *decapod carapace, teeth a*.
- Cardo.** Basal segment of maxillule articulating with cephalon.
- Caridean lobe.** External rounded projection on basal part of exopod of 1st maxilliped (Caridea).
- Caridoid facies.** Basic group of characters distinguishing eumalacostracan crustaceans: enclosure of thorax by carapace, movable stalked eyes, biramous antennules, antennae with scaphocerites, thoracopods with natatory exopods, ventrally flexed abdomen, and tailfan.
- Carina.** Any keellike structure; any well-defined projecting ridge on outer surface of carapace (podocopan Ostracoda); unpaired posterodorsal plate of thoracic Cirripedia (in lepadomorphs 1 of up to 4 unpaired plates of capitulum; in verrucomorpha compartmental plate between rostrum and fixed tergum; in balanomorpha compartmental plate, with alae on each side, opposite rostrum).
- Carinal latus.** See *latus*.
- Carinal margin.** Edge of any plate adjacent to carina; occluding with carinal margin of opposed tergum (thoracic Cirripedia).
- Carinate.** Valve bearing rib(s) (Conchostraca).

- Carinolateral.** One of pair of compartmental plates typically overlapping carina on each side, with radius on carinal side and ala on lateral side, sometimes absent; homologous with lepadomorph carinal latus (balanomorph Cirripedia).
- Carpocerite.** Distal (5th) segment of antennal peduncle.
- Carpopod(ite).** See *carpus*.
- Carpus.** Antepenultimate segment of thoracopod or pereopod; syn., *carpopod*.
- Caudal appendage.** One of terminal, multiarticulate or simple, uniramous paired appendages homologous with caudal furca (Cirripedia).
- Caudal fan.** Powerful swimming structure formed of laterally expanded uropods and telson; syn. *tailfan*.
- Caudal furca.** Paired caudal rami of terminal abdominal segment or telson; syn., *furca*.
- Caudal process.** Posterior projection of valve border generally above midheight, or posteroventral, directed upward (Ostracoda).
- Caudal ramus.** One of paired appendages constituting caudal furca, usually rodlike or bladelike, sometimes filamentous and multiarticulate; syn., *caudal filament*, *caudal style*, *cercus*, *cercopod*, *furcal ramus*, *stylet*.
- Caudal siphon.** Posteroventral opening in valve border; sometimes produced as tubular structure (Ostracoda).
- Caudal style.** See *caudal ramus*.
- Cement gland.** Special concentration of cells in dermal cover that secretes calcareous substances of valves (Cirripedia).
- Cephalic constriction.** Constriction delimiting anterior antenular part of head from posterior part (Mystacocarida).
- Cephalic flexure.** Forward, or sometimes upward, deflection of anterior sterna (Decapoda).
- Cephalic shield.** Chitinous or more or less calcified covering of the head region, formed of fused tergites of cephalic somites, commonly having pleura.
- Cephalic somite.** One unit of cephalon bearing distinctive pair of appendages; syn., *cephalomere*.
- Cephalomere.** See *cephalic somite*.
- Cephalon.** Anteriormost tagma, bearing eyes, mouth, two pairs of antennae, and three pairs of mouthparts; syn., *head*.
- Cephalosome.** Head region with one or two fused thoracic somites (Copepoda).
- Cephalothorax.** Anterior part of body composed of fused cephalic and thoracic somites; latter with appendages modified as mouthparts, sometimes also with relatively unmodified appendages.
- Cercopod.** See *caudal ramus*.
- Cercus (pl. cerci).** See *caudal ramus*.
- Cervical furrow.** See *decapod carapace*, *groove d*.
- Cervical groove.** See *decapod carapace* or *stomatopod integumental ornamentation*.
- Cervical notch or incision.** Strong indentation of carapace at level of cervical groove.
- Cervical sinus.** Rounded to angular indentation anteriorly along dorsal edge of carapace (Cladocera).
- Cervical suture.** See *cervical groove*.
- Chela (pl. chelae).** Distal part of appendage; pincerlike, with opposed movable and immovable fingers; occasionally both fingers movable.
- Chelate.** Pincerlike.
- Cheliped.** Any thoracopod bearing chela.
- Cincinnulus.** See *retinaculum*.
- Cirrus (pl. cirri).** Thoracic, usually biramous, multiarticulate appendage generally flattened laterally and curled anteriorly, with food-gathering function; anterior and posterior margins designated lesser and greater curvature respectively (Cirripedia, except Ascothoracica).
- Clasper.** Appendage, including antenna, modified for holding female during copulation; or an organ for fixation in parasites.
- Clypeus.** Part of cephalon carrying labrum; plate anteromedially on head formed by fusion of basal segments of antennae (Anostraca).
- Colleteric gland.** Single or paired gland in female or hermaphrodite producing viscid material for binding eggs together (Rhizocephala).
- Comb collar.** Retractable membrane supporting row of uniform setae, at superior angle of aperture (Acrothoracica).
- Compartmental plate.** One of several rigidly articulated plates forming wall in sessile cirripeds.
- Compound eyes.** Paired array of contiguous ommatidia having common optic nerve trunks.
- Compound rostrum.** Compartmental plate formed by fusion of rostrilaterals with rostrum or of rostrilaterals, with rostrum missing (balanomorph Cirripedia).
- Copepodid.** Postnaupliar developmental stage (Copepoda).
- Cor frontale.** Special pulsating structure or accessory heart formed from enlargement of blood vessel; contraction caused by outer tangential muscles or internal muscles derived from muscles having other functions.
- Cormopod(ite).** See *thoracopod*.
- Cornea.** Transparent cuticle covering ommatidia of compound eye.
- Corpus mandibulae.** See *mandible body*.
- Coxa.** Segment of appendage adjoining sternite, except in forms having precoxa; syn., *coxopodite*.
- Coxal endite.** Lobe produced from inner margin of coxa.
- Coxal exite.** Lobe produced from outer margin of coxa; syn., *coxepipod*.
- Coxal plate.** Lateral expansion of coxa broadly joined to lateral margin of tergite.
- Coxepipod(ite).** See *coxal exite*.
- Crista dentata.** Toothed crest on ischium of 3rd maxilliped (Decapoda).
- Cryptoniscus.** Planktonic larval stage of epicaridean isopod with pereopods modified as holdfasts. Stage at which larva seeks permanent host.
- Ctenopod.** Appendage (cirrus) usually with long paired setae on segments of lesser curvature and few setae distally on each articulation of greater curvature.
- Cycladiformes.** Carapace with dorsal margin of valve forming obtuse angle with posterior margin (Conchostraca).

Cyclops stage. Post-metanaupliar stage (Copepoda).

Cyprid. Bivalve larval stage (Cirripedia).

Cyrtopia. Formerly considered 5th larval stage with antennae no longer used in locomotion; currently included in furcilia stage (Euphausiacea).

Dactyl(us). Ultimate segment of thoracopod; syn., *dactylo-*
podite.

Dactylopodite. See *dactyl*.

Decapod carapace. Weakly or strongly calcified integuments covering cephalothorax; variously subdivided marked, and armed; named parts:

Regions:

- (a) antennal. Anterior marginal part bordering orbital region laterally, adjoining hepatic, pterygostomial, and occasionally also frontal regions.
- (b) anterolateral. Lateral part bordering subhepatic or hepatic regions.
- (c) branchial. Lateral part posterior to ptergostomial region, overlying branchiae; epibranchial, mesobranchial, and metabranchial lobes or areas sometimes distinguished.
- (d) cardiac. Median part posterior to cervical groove between urogastric and intestinal regions.
- (e) frontal. Anteromedian part including rostrum and region behind it.
- (f) gastric. Median part anterior to cervical groove and posterior to frontal region; sometimes epigastric, mesogastric, metagastric, protogastric, and urogastric (genital) areas distinguished.
- (g) hepatic. Part adjoining antennal, cardiac, and pterygostomial regions.
- (h) intestinal. Short transverse part posterior to cardiac region; sometimes referred to as posterior cardiac lobe.
- (i) jugal. See pterygostomial region.
- (j) orbital. Part posterior to eyes bordered by frontal and antennal regions.
- (k) pterygostomial. Anterolateral part on ventral surface located on opposite sides of buccal cavity; syn., *jugal region*, *pterygostome*.
- (l) subhepatic. Part on ventral surface below hepatic region, bounded by pterygostomial and suborbital regions.
- (m) suborbital. Part on anteroventral surface beneath orbit.

Carinae:

- (a) antennal. Extending posteriorly from antennal spine.
- (b) branchial. Extending posteriorly from orbit over branchial region.
- (c) branchiocardiac. Dividing branchial from cardiac region.
- (d) gastroorbital. Extending posteriorly from supraorbital spine; syn., *supraorbital*.
- (e) lateral. On lateral margin of carapace.
- (f) orbital. On margin of orbit.
- (g) posterior. Transverse ridge anterior to marginal groove.
- (h) postorbital. Slightly posterior and parallel to orbital margin.
- (i) postrostral. Posterior to rostrum along dorsal midline.

- (j) rostral. Continuous with lateral margin of rostrum.
- (k) subhepatic. Extending posteriorly from branchiostegal spine.
- (l) submedian. On either side of, and parallel to, postrostral carina, sometimes joining rostral carina.
- (m) supraorbital. See *decapod carapace*, *carina d*.

Grooves:

- (a) antennal. Extending posteriorly from vicinity of antennal spine.
- (b) branchiocardiac. Oblique groove approximately in middle of posterior half on each side of carapace, separating branchial and cardiac regions and reaching dorsomedian part well posterior to cervical or postcervical grooves; sometimes longitudinal, connecting cervical and postcervical grooves or extending posteriorly from submedian point on postcervical groove.
- (c) buccal. Transverse groove crossing mandibular elevation behind antennal spine, connecting gastroorbital and antennal grooves (Nephropidae).
- (d) cervical. Transverse groove medially between gastric and cardiac regions, curving toward antennal spine; syn., *cervical suture*, *cervical furrow*.
- (e) dorsomedian. Longitudinal groove extending from tip of rostrum to posterior carapace margin dorsomedially (Nephropidae).
- (f) gastroorbital. Short, longitudinal groove branching from cervical groove at level of orbit and directed toward it.
- (g) hepatic. Short, longitudinal groove connecting cervical with postcervical and branchiocardiac grooves, more or less continuous with antennal groove.
- (h) inferior. Extending from junction of hepatic and cervical grooves toward lateral margin, more or less continuous with cervical groove.
- (i) intercervical. Oblique groove connecting postcervical and cervical grooves (Nephropidae).
- (j) intestinal. Short, transverse groove in median part of posterior carapace, interrupted by intestinal tubercle (Nephropidae).
- (k) marginal. Close to, and parallel with, posterior margin.
- (l) parabranial. Groove below, behind and almost parallel with branchiocardiac and postcervical grooves, joining latter in lower part (Nephropidae).
- (m) postcephalic. One of three transverse furrows on carapace of many fossils.
- (n) postcervical. Posterior to, and parallel with, cervical groove, bisecting cardiac region.
- (o) sellar. Short transverse groove dorsally anterior to cervical groove (Nephropidae).
- (p) submedian. Longitudinal groove in submedian dorsal part, contiguous with postrostral carina.
- (q) urogastric. Short transverse groove in median or submedian region posterior to postcervical groove, sometimes joining upper part of postcervical groove (Nephropidae).

Spines:

- (a) antennal. On anterior margin slightly below orbit.

- (b) branchiostegal. On or close to anterior margin medially between antennal and pterygostomial spines.
- (c) hepatic. Below and posterior to lower branch of cervical groove.
- (d) infraorbital. On lower angle of orbit.
- (e) postorbital. At moderate distance posterior to middle of orbit.
- (f) postrostral. Immediately posterior to rostrum.
- (g) pterygostomial. On anterolateral angle.
- (h) suborbital. Slightly below and posterior to middle of orbit.
- (i) supraorbital. At moderate distance obliquely behind and above orbit; sometimes on postorbital carina.

Teeth:

- (a) cardiac. On midline of carapace just posterior to cervical groove.
- (b) gastric. On midline of carapace immediately anterior to cervical groove.
- (c) lateral. On lateral margin of carapace; anterolateral, mediolateral, and posterolateral teeth distinguished.
- (d) orbital. On orbital margin.
- (e) posterior. On midline of carapace between posterior margin and marginal groove.
- (f) pregastric. On midline of carapace between gastric tooth and rostrum.
- (g) rostral. On rostrum, either single or multiple; upper, lower, and lateral teeth distinguished.

Deflected front. Broadly downturned front margin of carapace in some decapods.

Dendrobranch(ia). Type of gill with lamellae divided into arborescent bundles.

Depressor muscle. Muscle inserted at basicarinal angle of tergum (balanomorph Cirripedia).

Depressor muscle crests. Elevated denticles or ridges on inner surface of tergum near basicarinal angle for attachment of depressor muscles (balanomorph Cirripedia).

Dermal gland. Cell or concentration of cells in epidermis traversed by canals communicating with surface through fine ducts.

Deuterocerebrum. See *mesocerebrum*.

Diacresis. Transverse groove on posterior part of exopod (also rarely of endopod) of uropod; sometimes dividing exopod into 2 movable parts.

Distal. Part of structure farthest from midline of body or base of attachment; opposed to proximal.

Dorsal organ. Thickened glandular area of hypoderm on dorsal surface, usually in posterior part of cephalon, sometimes in anterior part; not homologous in all taxa.

Dorsal plate. Spindle-shaped division of carapace intercalated with median suture in some decapods.

Dorsomedian groove. See *decapod carapace, groove e*.

Dorsoventralis posterior. Prominent muscle connecting head apodemes with inner surface of carapace posterior to cervical groove in many decapods.

Doubleure. Reflected margin of carapace (Stomatopoda).

Duplicature. That part of border of shell with calcareous

peripheral part of inner lamina in contact with, or separated by vestibule from, outer lamina, generally narrow, sometimes extensive (Ostracoda).

Ecdysis. Act of molting the integument.

Efferent channels. Passageways through which water moves away from gills and out of branchial region.

Endite. Inwardly (medially) directed lobe of precoxa, coxa, basis, or ischium.

Endognath. Endopod of maxilliped.

Endophragm. Septum formed by cephalic and thoracic apodemes; syn., *arthrophragm*.

Endophragmal skeleton. Complex internal structure formed by fusion of apodemes, providing framework for muscle attachment.

Endopleurite. Lateral apodeme of endoskeleton (Decapoda).

Endopod(ite). Inner ramus of biramous appendage.

Endosternite. Mesodermal tendonous plate below anterior part of alimentary canal (Notostraca); also firm calcareous plate between nerve cord and alimentary canal anteriorly in thorax of some decapods.

Endostome. Palatelike part of buccal frame in some brachyuran decapods; syn., *palate*.

Ephippium (pl. ephippia). Semielliptical modification of cuticle in dorsal region of carapace valves forming encasement for eggs, capable of withstanding dessication after being shed (Cladocera).

Epibranchial lobe. See *decapod carapace, region c*.

Epicaridium. First larval stage of epicaridean isopod; syn., *micronicus*.

Epigastric area. See *decapod carapace, region f*.

Epimeral fold. Steep fold of endopleurites connected with branchiostegite to form branchial chamber in some decapods.

Epimere. Each lateral part of integument of somite; syn., *epimeron*, *pleurepimere*, *pleurite*, *pleuron* (pl. *pleura*), *pleura* (pl. *pleurae*), *pleural lobe*, *tergal fold*.

Epimeron. See *epimere*.

Epipod(ite). Laterally directed exite of protopod, usually branchial in function.

Episternum. Posterolateral projection of various sterna (Decapoda).

Epistome. Plate of varying shape between labrum and bases of antennae; also sternum of antennal somite.

Esthetasc. See *aesthetasc*.

Esthete. See *aesthetasc*.

Exhalant passage. Anterior to gill chamber leading to large anterior opening, with scaphognathite for driving water outward.

Exite. Laterally directed lobe arising from external margin of protopodal segment.

Exognath. Exopod of maxilliped.

Exopod(ite). Outer ramus of biramous appendage.

Exoskeleton. Chitinous or calcified outer integument of crustaceans.

Eyestalk. See *ocular peduncle*.

Falcate. Sickle-shaped or hooked.

- Filamentary appendage.** Membranous process developed on body in some cirripeds commonly at base of cirrus (Lepadomorpha, Ascothoracica).
- Filter chamber.** Space beneath thorax enclosed by ventral body wall and moving thoracopods used for food-gathering.
- First antenna.** See *antennule*.
- First maxilla.** See *maxillule*.
- Fixed finger.** Immovable distal part of propodus of chela; syn., *pollex*.
- Flabellum.** Thin distal exite (Branchiopoda); or epipodite of thoracopod.
- Flagellum** (pl. *flagella*). Multiarticulate distal portion of antennule, antenna, or exopod.
- Flange.** Ridge along valve margin formed by projection of outer lamella as narrow brim (Ostracoda).
- Foregut.** See *stomodeum*.
- Fornix.** Ridge in lateral part of cephalon above insertion of antennal muscles (Cladocera).
- Free edge.** Line of contact between closed valves except along hinge line marking distal limit of contact margin, sometimes inside free margin (Ostracoda).
- Free margin.** All parts of margin except hingement (Ostracoda).
- Frena.** Tegumentary folds holding eggs (Cirripedia).
- Frontal appendages.** Paired filaments arising from bases of antennae but independent of them (Anostraca).
- Frontal band.** Glandular organ of adhesion in frontal region of various parasitic copepods used for attachment to host.
- Frontal eye.** See *frontal organ*.
- Frontal organ.** Sensory cells on anterior surface of cephalon; syn., *haft organ* or *frontal eye* in non-malacostracans; not homologous among taxa.
- Frontal plate.** Modified rostrum with downward projecting process united with epistome (brachyuran Decapoda).
- Frontal region.** See *decapod carapace, region e*.
- Frontolateral horn.** One pair of tubular frontolateral extensions of cuticle of cirriped nauplius (except Ascothoracica).
- Furca.** See *caudal furca*.
- Furcal ramus.** See *caudal ramus*.
- Furcilia stage.** Last larval stage marked by movable compound eyes projecting beyond margin of carapace; antenna not used for locomotion in later substages (Euphausiacea).
- Galea.** Outer distal hoodlike lobe of second segment of maxillule.
- Gastric groove.** See *stomatopod integumental ornamentation*.
- Gastric mill.** Apparatus in cardiac stomach (stomodeum) with framework of movably articulated ossicles developed as thickened and calcified parts of stomodeal lining used to break up food, mostly highly specialized in decapods; also chitinous triturating apparatus in foregut of some acrothoracicans (Cirripedia).
- Gastric region.** See *decapod carapace, region f*.
- Gastric tooth.** See *decapod carapace, teeth b*.
- Gastrolith.** Discoid calcareous nodule, common in stomodeum (Decapoda).
- Gastroorbital carina.** See *decapod carapace, carina d*.
- Gastroorbital groove.** See *decapod carapace, groove f*.
- Geniculate.** Bent; having upper part of filament forming more or less obtuse angle with lower, e.g., antennule.
- Genital region.** See *decapod carapace, region f (urogastric)*.
- Gill.** See *branchia*.
- Gill chamber.** See *branchial chamber*.
- Glaucothöe.** Stage in larval development of hermit crabs, equivalent to megalopa.
- Gnathal lobe.** Masticatory endite of mandible; syn., *masticatory process*.
- Gnathobases.** Paired endites used to manipulate or move food.
- Gnathopod.** Prehensile maxilliped; also 1st 2 prehensile pereopods of amphipods, either chelate or subchelate.
- Gnathothorax.** Cephalothorax with all appendages of fused thoracic somites modified as maxillipeds.
- Gonad.** Reproductive organ of either sex, communicating with pair of efferent ducts.
- Gonapophysis.** Median process from base of 1st or 2nd pleopods of male (Syncarida).
- Gonochoristic.** Sexes separate; producing distinct males and females.
- Gonopod.** Pleopod modified for reproductive purposes.
- Gonopore.** Outlet for genital products; syn., *sexual pore*.
- Green gland.** See *antennal gland*.
- Haft organ.** See *frontal organ*.
- Head apodeme.** Fused endopleurite and endosternite forming place for muscle attachment at anterior end of skeleton (As-tacidea).
- Hemocoel.** Lacunar system extending throughout much of body, filled with blood.
- Hemocyanin.** Copper-containing respiratory pigment in blood (Malacostraca).
- Hemoglobin.** Oxygen-carrying protein colored substance of red plasma in blood of some crustaceans.
- Hepatic caecum** (pl. *caeca*). See *hepatic cecum*.
- Hepatic cecum** (pl. *ceca*). Pouchlike diverticulum generally connected with mesenteron, with liver function; also see hepatopancreas.
- Hepatic groove.** See *decapod carapace, groove g*.
- Hepatic region.** See *decapod carapace, region g*.
- Hepatic spine.** See *decapod carapace, spine c*.
- Hepatopancreas.** Digestive gland consisting of tubules ramifying through cephalothorax, with both liver and pancreas functions.
- Hermaphrodite.** Organism with both male and female reproductive organs.
- Heterochelate.** Chelae of left and right chelipeds differing in shape and size.
- Heteromorph.** Adult female, inferred by carapace structure, in dimorphic genera (Ostracoda).
- Hindgut.** See *proctodeum*.
- Hinge line.** Middorsal line of junction of two valves of carapace, permitting movement between them.

- Hingement.** Collective term for structures comprising articulation of valves (Ostracoda).
- Hinge nodes.** Localized thickened parts of right valve hinge (Phyllocarida).
- Hinge selvage.** Structure of hinge area corresponding to, and sometimes continuous with, selvage of contact margin (Ostracoda).
- Hypobranchial space.** Area of gill chamber below gills.
- Hypopharynx.** See *metastoma*.
- Hypostoma.** See *metastoma*.
- Hypostome.** See *metastoma*.
- Incisor process.** Biting portion of gnathal lobe of mandible; syn., *pars incisiva*.
- Inferior groove.** See *decapod carapace, groove h*.
- Inframedian latus.** See *latus*.
- Infraorbital spine.** See *decapod carapace, spine d*.
- Inner lamina.** Inner shell layer of compartmental plates separated from outer lamina by longitudinal tubes (balanomorph Cirripedia).
- Interantennular septum.** Plate separating antennular cavities in some malacostracans; syn., *proepistome*.
- Intercervical groove.** See *decapod carapace, groove i*.
- Interlaminate figure.** Simple or arborescent lines extending between epicuticle of outer lamina through longitudinal septa into inner lamina in sections parallel to base in some balanomorph Cirripedia.
- Intermediate carina.** See *stomatopod integumental ornamentation*.
- Intermediate denticle.** See *stomatopod integumental ornamentation*.
- Intermediate tooth.** See *stomatopod integumental ornamentation*.
- Intestinal groove.** See *decapod carapace, groove j*.
- Intestinal region.** See *decapod carapace, region h*.
- Intraparies (pl. intraparietes).** Secondary lateral margin of carina in some lepadomorph cirripeds.
- Ischiocerite.** Third segment of antennal peduncle.
- Ischiopod(ite).** See *ischium*.
- Ischium.** Third segment of pereopod or 1st segment of endopod articulating with basis; syn., *ischiopod(ite)*.
- Jugal region.** See *decapod carapace, region i*.
- Kentron.** Undifferentiated cells following cyprid (Rhizocephala).
- Labium.** See *metastoma*.
- Labrum.** Unpaired outgrowth arising just in front of mouth and often more or less covering it; syn., *upper lip*.
- Lacinia.** Inner distal spiny lobe of second segment of maxillule.
- Lacinia mobilis.** Small, generally toothed, process articulated with incisor process of mandible (Peracarida).
- Lappet.** Ventrally projecting subdivisions of pleura (Mysidacea).
- Lasiopod.** Appendage (cirrus) with setae in transverse row at each articulation (Cirripedia, limited usage).
- Latera.** See *latus*.
- Lateral.** One of pair of compartmental plates typically located between carino- and rostrolaterals, with radius on carinal side and ala on rostral side, sometimes between carina and rostrolateral or compound rostrum; homologous with lepadomorph median latus (balanomorph Cirripedia).
- Lateral bar.** Pair of external chitinous thickenings extending from apertural thickenings medially down each side of mantle sac (Acrothoracica).
- Lateral carina.** See *decapod carapace, carina e*, or *stomatopod integumental ornamentation*.
- Lateral denticle.** See *stomatopod integumental ornamentation*.
- Lateral depressor pit.** Small depression near basitergal angle of scutum for attachment of lateral depressor muscle (balanomorph Cirripedia).
- Lateral cups.** Paired element of nauplius eye of nonmalacostracan crustaceans.
- Lateral gastrocardiac markings.** Insertions of attractor epimeralis muscle in brachyuran decapods lacking branchio-cardiac groove.
- Lateral tooth.** See *decapod carapace, teeth c*, or *stomatopod integumental ornamentation*.
- Latus (pl. latera).** Any of lepadomorph capitular plates except paired scuta and terga and unpaired rostrum, carina, subrostrum, and subcarina. Smaller plates in basal whorls below paired latera referred to as lower latera; sometimes all or some absent. Types of paired plates:
- carinal. Plate on each side of carina (cf. *carinolateral*).
 - inframedian. Plate below upper latus.
 - median. Plate between rostral and carinal latera in forms with paired latera in one whorl (cf. *lateral*).
 - rostral. Plate on each side of rostrum or below scutum (cf. *rostrolateral*).
 - upper. Plate in upper whorl between scutum and tergum or carina.
- Limadiiformes.** Carapace with recurvature of posterior margin near dorsal line (Conchorstraca).
- Linea (pl. lineae).** Linear marking on carapace.
- Linea anomurica.** Longitudinal groove or uncalcified line on carapace of many anomuran decapods.
- Linea branchiostegalis.** Longitudinal groove or uncalcified line extending posteriorly from anterior margin of carapace, slightly above branchiostegal spine, to or slightly beyond hepatic spine in some caridean decapods.
- Linea dromica.** Longitudinal groove or uncalcified line on dromioidean decapods comparable with *linea thalassinica*; syn., *linea dromiudica*.
- Linea dromiudica.** See *linea dromica*.
- Linea homolica.** Longitudinal groove or uncalcified line on homoloidean decapods comparable with or equivalent to *linea thalassinica*.
- Linea lateralis.** Longitudinal groove or uncalcified line extending posteriorly from frontal margin of carapace below orbit sometimes to posterior extremity of carapace in some penaeoideans.
- Linea thalassinica.** Longitudinal groove or uncalcified line on

- dorsal part of carapace extending from anterior margin below antennal spine to posterior margin in most thalassinoideans.
- List.** Ridge on proximal side of selvage on contact margin (Ostracoda).
- Longitudinal canal.** See *longitudinal tube*.
- Longitudinal septum** (pl. *septa*). Partition disposed normal to inner and outer laminae of compartmental plate in some balanomorph cirripeds, resulting in longitudinal tubes; syn., *parietal tubes*.
- Longitudinal tube.** Canal formed in compartmental plate of some balanomorph cirripeds between longitudinal septa and inner and outer lamina; syn., *longitudinal canal*; *parietal tube*, *parietal pore*.
- Lower lip.** See *metastoma*.
- Lunule.** Attachment disc at base of antennule in some parasitic copepods.
- Male-cell receptacle.** Pocket or pair of pockets within mantle cavity of female receiving cells of male cyprid, later differentiated into "testes" (rhizocephalan Cirripedia).
- Manca.** Young of some Peracarida lacking last thoracopod at time of release from marsupium.
- Mancoïd stage.** Postlarval stage with rudimentary 4th pleopod (Phyllocarida).
- Mandible.** One of 3rd pair of cephalic appendages, used to masticate food.
- Mandible body.** Inflated base of mandible for attachment of mandibular muscles; syn., *corpus mandibulae*.
- Mandibular foramen.** Relatively large opening in mandibular body for passage of transverse adductor muscle.
- Mandibular palp.** Distal articulated part of mandible used in feeding or cleaning; also nonsegmented part of mandible in Acrothoracica; attached to labrum in thoracic Cirripedia.
- Mantle.** Membranous covering of body, often strengthened by calcareous plates in thoracic Cirripedia (cf. *carapace*).
- Mantle cavity.** Space occupied by body, with aperture (Cirripedia).
- Manus.** Broad proximal part of propodal cheliped; syn., *palm*.
- Marginal carina.** See *stomatopod integumental ornamentation*.
- Marginal groove.** See *decapod carapace, groove k*.
- Marsupium.** Brood pouch.
- Masticatory process.** See *gnathal lobe*.
- Mastigobranch.** Slender respiratory process at base of epipod; syn., *mastigobranchia*.
- Mastigobranchia** (pl. *mastigobranchiae*). See *mastigobranch*.
- Mastigopus stage.** Larval stage in development of some decapods equivalent to adult of *Leucifer*.
- Maxilla** (pl. *maxillae*). Paired appendage of 5th cephalic somite, used in feeding, often also in respiration; syn., *2nd maxilla*.
- Maxillary gland.** Excretory organ in maxillary somite with duct opening on maxilla; syn., *shell gland*.
- Maxillipeds.** Paired appendages modified for feeding on 1st, up to 3rd, thoracic somites, usually fused to cephalon.
- Maxillule.** One of pair of 4th cephalic appendages, usually serving as mouthpart; syn., *1st maxilla*.
- Median carina.** See *stomatopod integumental ornamentation*.
- Median dorsal plate.** Elongate plate separating carapace valves posterodorsally in some phyllocarids.
- Median eye.** See *nauplius eye*.
- Median latus.** See *latus*.
- Megalopa.** First postlarval stage in development of many Eucarida.
- Mereopod(ite).** See *merus*.
- Merus.** Fourth segment (distally from body), articulating proximally with ischium and distally with carpus; syn., *meropod(ite)*.
- Mesenteron.** Midportion of alimentary tract, of endodermal origin, with surface commonly increased by pouchlike extensions serving as digestive glands; syn., *midgut*.
- Mesobranchial lobe or area.** See *decapod carapace, region c*.
- Mesocerebrum.** Ganglion of antennular somite; syn., *deutocerebrum*.
- Mesogastric lobe or area.** See *decapod carapace, region f*.
- Mesosome.** Collective term for all free thoracic somites behind head (not common usage).
- Mesosternum.** Median plate of sternum in some brachyuran decapods.
- Metabranhial lobe or area.** See *decapod carapace, region c*.
- Metacerebrum.** Ganglion of antennal somite; syn., *tritocerebrum*.
- Metagastric lobe or area.** See *decapod carapace, region f*.
- Metanauplius.** Postnaupliar larva with generally same body and body shape as nauplius, but with additional appendages.
- Metasoma.** See *metasome*.
- Metasome.** Part of prosome, consisting of free thoracic somites anterior to major articulation (Copepoda); or first three abdominal somites (Amphipoda, not general usage); syn., *metasoma*.
- Metastoma.** Lower lip posterior to mandibles, usually cleft into pair of lobes (paragnaths); syn., *hypostoma*, *hypostome*, *hypopharynx*, *labium*.
- Metazoea.** Last zoeal substage of larval brachyurans.
- Metapon.** Entire preoral area, including part of mandibular somite (Decapoda).
- Micronicus.** See *epicaridum*.
- Midgut.** See *mesenteron*.
- Molar process.** Grinding portion of gnathal lobe of mandible; syn., *pars molaris*.
- Mouth cirri.** First pair of cirri considerably modified (acrothoracican Cirripedia).
- Movable finger.** Dactyl of chela.
- Mucro** (pl. *mucrones*). Spine on inferoposteal angle of carapace in some Cladocera.
- Muscle scar.** Mark on interior of valve or carapace indicating position of muscle attachment, generally distinguishable by localized difference in surface texture, elevation, depression, or delimiting narrow groove.
- Mysis stage.** Larval stage in penaeoidean development equivalent to zoeal stage of Nephropoidea; cf. *zoea*; syn., *schizopod larva*.

- Nauplius** (pl. *nauplii*). Early larval stage with only 3 pairs of appendages, antennules, antennae, and mandibles.
- Nauplius eye**. Unpaired median eye, common in nauplii and many adult crustaceans; structure simple, consisting of 1 to few light-sensitive cells; syn., *median eye*.
- Neck organ**. See *nuchal organ*.
- Nephropore**. Elevated opening of antennal gland on ventral surface of coxa of antenna.
- Nisto**. Postlarval stage of some palinurans; syn., *pseudibacus*, *puerulus*.
- Notum**. Posterior part of dorsal carapace in shrimplike decapods (limited usage).
- Nuchal organ**. Sense organ on upper side of cephalon (Branchiopoda); syn., *neck organ*.
- Occipital notch**. Angulated indentation at rear of cephalon (Conchostraca).
- Occludent margin**. Margin of scutum and tergum bordering orifice (thoracic Cirripedia).
- Occludent teeth**. Small projections on occludent scutal margin, formed by extensions of external growth ridges, interdigitating with teeth on margin of opposed scutum (balanomorph Cirripedia).
- Ocellus**. Simple single eye or eye spot; common in some branchiopods and copepods (cf. *nauplius eye*).
- Ocular bulla**. Knob on inner surface of carapace connecting lower and upper orbital margins with basal segment of antenna, serving to protect eye.
- Ocular papilla**. Anterior projection on eyestalk (Mysidacea and one Anaspidacea).
- Ocular peduncle**. Peduncle movably articulated with cephalon, with compound eye at distal end, sometimes with two or three segments, sometimes retractable; syn., *eyestalk*.
- Olfactory hair**. See *aesthetasc*.
- Ommatidium** (pl. *ommatidia*). Cylindrical or prismoidal visual constituent of compound eye covered by transparent cuticle (cornea).
- Oostegite**. Inner, medially directed lamella arising from coxa of pereopod in female, part of midventral marsupium (Pera-carida).
- Opercular membrane**. Thin, flexible membrane attaching opercular valves to sheath, periodically shed during ecdysis, in balanomorph Cirripedia; represented by membranous hinge in verrucomorph Cirripedia.
- Opercular valve**. One of 2 or 4 movable plates occluding aperture in sessile barnacles.
- Operculum**. Scuta and terga (balanomorph) or movable scutum and tergum (verrucomorph) and associated membrane, forming apparatus occluding aperture.
- Ophthalmic somite**. See *acron*.
- Optic lobe**. Ganglion of brain or nervous system for innervation of eye.
- Orbit**. Circular to rectangular opening in anterior face of carapace supporting ocular peduncle in some decapods.
- Orbital carina**. See *decapod carapace*, *carina f*.
- Orbital hiatus**. Gap or slit in orbital margin of carapace.
- Orbital region**. See *decapod carapace*, *region j*.
- Orbital tooth**. See *decapod carapace*, *teeth d*.
- Orifice**. Opening in sessile barnacle wall occupied by operculum (cf. *aperture*).
- Ostium** (pl. *ostia*). Valved opening in heart for return of blood.
- Oviduct**. Passageway from ovary to genital aperture.
- Ovigerous frena** (pl. *frenae*). Fleshy ridge or flap on inner surface of mantle adhering to and holding egg masses in place in some lepadomorph Cirripedia.
- Ovigerous lamella**. Adherent egg masses forming one or more lamellae within mantle cavity, in some lepadomorph Cirripedia, held in place by ovigerous frena.
- Palate**. See *endostome*.
- Palm**. See *manus*.
- Palp**. Usually one ramus (endopod), sometimes both, and basis, reduced distally to 1 to 3 segments, associated with mouthparts; also nonsegmented setose structure attached to mandible (Acrothoracica) and to lateral margin of labrum in thoracic Cirripedia.
- Palp foramen**. Small opening in mandibular body communicating with mandibular palp.
- Parabranchial groove**. See *decapod carapace*, *groove l*.
- Paracopulatory organ**. Specialized endopod of pleopod in some isopods; used in copulation.
- Paragnath(s)**. See *metastoma*.
- Paries** (pl. *parietes*). Median triangular part of each compartmental plate in sessile barnacles.
- Parietal pore**. See *longitudinal tube*.
- Parietal septum**. See *longitudinal septum*.
- Parietal tube**. See *longitudinal tube*.
- Pars ampullaris**. Bottle-shaped diverticulum at entrance of ceca into pyloric chamber of stomach (Hoplocarida, Anaspidacea).
- Pars incisiva**. See *incisor process*.
- Pars molaris**. See *molar process*.
- Parva stage**. First postlarval stage in development of caridean decapods.
- Pedigerous**. Bearing footlike appendages.
- Peduncle**. Stalk in lepadomorph cirripeds, supporting capitulum, attached to substrate by opposite end, commonly armed with calcareous scales.
- Penicilla** (pl. *penicillae*). Dentate setae on mandible (Stygocaridacea).
- Penicillus** (pl. *penicilli*). Tufts of fine hair resembling small brush.
- Penis** (pl. *penes*). Male copulatory organ; probosciform in hermaphroditic thoracic Cirripedia and greatly distensible.
- Peraeon**. See *pereon*.
- Peraeonite**. See *pereonite*.
- Peraeopod**. See *pereopod*.
- Pereion**. See *pereon*.
- Pereionite**. See *pereonite*.
- Pereiopod**. See *pereopod*.
- Pereon**. Anterior portion of trunk with thoracopods, exclu-

- sive of maxillipedal somites and appendages; syn., *peraeon*, *pereion*.
- Pereonite.** Somite of pereon; syn., *peraeonite*, *pereionite*.
- Pereopod.** Thoracic appendage used in locomotion; syn., *peraeopod*, *pereiopod*, *ambulatory leg*, *walking leg*.
- Pericardium.** Blood sinus surrounding heart and communicating with it by paired ostia.
- Peritrophic membrane.** Chitinous sheath secreted around feces.
- Petasma.** Abdominal structure developed from male pleopods, used in copulation.
- P-4 structure (type A).** Structure on lateral face of propodus of 4th pereopod in some pagurids; presumably sensory in function.
- Photophore.** Luminous organ.
- Phyllobranch.** Gill with leaflike filaments; syn., *phyllobranchia*.
- Phyllobranchia.** See *phyllobranch*.
- Phyllopodium (pl. phyllopodia).** Leaflike thoracic appendages.
- Phyllosoma.** Larval stage in development of palinuroidean decapods.
- Pleomere.** See *abdominal somite*.
- Pleon.** See *abdomen*; also first 3 abdominal somites of amphipods.
- Pleonite.** See *abdominal somite*.
- Pleopod.** Paired appendage of any of first 5 abdominal somites (rarely 6) in Malacostraca, adapted for swimming; syn., *swimmeret*.
- Pletelson.** Structure formed by fusion of one or more abdominal somites with telson.
- Pleura (pl. pleurae).** See *epimere*.
- Pleural lobe.** See *epimere*.
- Pleural suture.** Line of separation of carapace in molting.
- Pleurepimere.** See *epimere*.
- Pleurite.** See *epimere*.
- Pleurobranch.** Gill attached directly to body wall (Decapoda); syn., *pleurobranchia*.
- Pleurobranchia.** See *pleurobranch*.
- Pleuron (pl. pleura).** See *epimere*.
- Pleuropod.** See *precoxa*.
- Podobranch.** Gill arising from coxa of thoracopod; syn., *podobranchia*.
- Podobranchia.** See *podobranch*.
- Podomere.** See *segment*.
- Podophthalmite.** One of 2 segments of eyestalk (when segmented), bearing cornea.
- Pollex.** See *fixed finger*.
- Pore canal.** Minute tubular passageway extending through shell (Ostracoda).
- Postabdomen.** Terminal part of body (Cladocera).
- Postcephalic groove.** See *decapod carapace, groove m*.
- Postcervical groove.** See *decapod carapace groove n*.
- Postcervical notch or incision.** Strong indentation of carapace at level of postcervical groove.
- Posterior cardiac lobe.** See *decapod carapace, region h*.
- Posterior carina.** See *decapod carapace, region h*.
- Posterior gastric pit.** One of two small depressions dorsally near midline on exterior of carapace marking point of insertion of stomach muscle (Decapoda).
- Posterior tooth.** See *decapod carapace, teeth e*.
- Postlarval stage.** Developmental stage reached after completion of megalopal or equivalent metamorphosis; marked by initial appearance of adult characters.
- Postorbital carina.** See *decapod carapace, carina h*.
- Postorbital spine.** See *decapod carapace, spine e*.
- Postrostral carina.** See *decapod carapace, carina i*.
- Postrostral spine.** See *decapod carapace, spine f*.
- Postsegmental region.** See *telson*.
- Precoxa.** Segment of protopod proximal to coxa, rarely present; syn., *pleuropod*.
- Pre-epipod(ite).** Laterally directed lobe of coxa or from coxal position.
- Pregastric tooth.** See *decapod carapace, teeth f*.
- Preischium.** Segment of endopod between protopod and ischium, rarely present.
- Prelateral lobe.** Proximalmost lateromarginal lobe of telson (Stomatopoda).
- Preoral sting.** Retractable piercing mechanism with poison gland (Branchiura).
- Presegmental region.** See *acron*.
- Preungal process.** Structure at base of dactyl of 4th pereopod in many pagurids; function unknown but presumed sensory.
- Prezoea.** Just-hatched postnaupliar larva still covered by embryonic cuticle.
- Primordial valve.** One of 5 chitinous plates (scuta, terga, and carina) in cyprid larvae of lepadomorphs and verrucosomorphs, site of calcification during metamorphosis, sometimes visible at umbones of these plates in adults.
- Proctodaeum.** See *proctodeum*.
- Proctodeum.** Posterior part of alimentary canal lined with cuticle of ectodermal origin; syn., *hindgut, proctodaeum*.
- Proepistome.** See *interantennular septum*.
- Propodus.** Penultimate segment of pereopod (thoracopod).
- Prosartema.** Scale implanted on inner margin of basal segment of antennular peduncle (Penaeoidea).
- Prosoma.** See *prosome*.
- Prosome.** Anterior region of body, commonly limited posteriorly by major articulation. In cirripeds, large saclike body in position of "head" in front of, and rostral to, thoracic appendages, supporting trophi and usually 1st cirri; syn., *prosoma*.
- Protandry.** Hermaphroditic condition with male elements maturing and being released before maturation of female elements.
- Protocephalon.** See *acron*.
- Protocerebrum.** Ganglion of preantennular region.
- Protogastric lobe or area.** See *decapod carapace, region f*.
- Protogyny.** Hermaphroditic condition with female elements maturing and being released before maturation of male elements.

- Protopod(ite).** Proximal part of appendage, consisting of coxa and basis or less frequently of precoxa, coxa, and basis, sometimes fused; syn., *sympod*.
- Protozoa.** First two or three postnaupliar substages in development of Penaeiidea and Euphausiacea (cf. *calyptopis* in latter).
- Proventriculus.** Elaborated anterior part of alimentary canal in some crustaceans.
- Proximal.** Part of structure nearest midline of body or base of attachment; opposed to distal.
- Pseudopod(ite).** Lateral lobe arising from distal part of basis or proximal part of exopod.
- Pseudibacus.** Postlarval stage of some palinurans; syn., *nisto*, *puerulus*.
- Pseudorostrum.** Anterior part of carapace formed by pair of forward projecting plates (Cumacea).
- Pseudotrachea.** Respiratory structure developed in pleopods of some terrestrial isopods for air-breathing.
- Pterygostome.** See *pterygostomial region*.
- Pterygostomial region.** See *decapod carapace, region k*.
- Pterygostomial spine.** See *decapod carapace, spine g*.
- Puerulus.** See *pseudibacus*.
- Punctum (pl. puncta).** Small pitlike depression(s) in valve surface (Ostracoda).
- Pustula (pl. pustulae).** Small protuberance(s) on valve surface with pore at summit (Ostracoda).
- Radial lirae.** See *carapace costae*.
- Radius (pl. radii).** Lateral part of compartmental plate when marked off from paries by change in direction of growth lines; overlaps ala of adjoining compartmental plate.
- Ramus.** Branch of appendage or other structure (e.g., flagellum).
- Raptorial claw.** Toothed dactyl, generally strong, curved backward on propodus, modified for quick motion in catching prey.
- Rasp.** One or several rows of chitinous plates or scales on surface of pereopodal or uropodal segments.
- Receptaculum seminalis.** See *seminal receptacle*.
- Retinaculum (pl. retinacula).** Small hook at tip of appendix interna, one of many serving to interlock right and left pleopods; syn., *cincinnulus*.
- Rostral angle.** Intersection of basal and occludent margins of scutum in lepadomorph Cirripedia.
- Rostral carina.** See *decapod carapace, carina j*.
- Rostral incisure.** Gap below rostrum in anterior margin of valve for protrusion of antenna (Ostracoda); syn., *rostral notch*.
- Rostral latus.** See *latus*.
- Rostral notch.** See *rostral incisure*.
- Rostral plate.** Anteriorly projecting, unpaired, movably articulated, median extension of carapace (Phyllocarida); antennular portion of cephalon (Mystacocarida).
- Rostral tooth.** See *decapod carapace, teeth g*.
- Rostrolateral.** One of pair of compartmental plates typically overlapping rostrum on each side, with radii on both sides, sometimes fused with rostrum, laterally or to each other; homologous with lepadomorph rostral latus (balanomorph Cirripedia).
- Rostrum.** (1) Anteriorly projecting, unpaired, usually rigid median extension of carapace between eyes or ocular peduncles; (2) anterior beaklike projection of valve margins overhanging incisure or notch (Ostracoda); (3) unpaired anteroventral plate of thoracic Cirripedia; in lepadomorphs, 1 of up to 4 unpaired plates of capitulum; in verrucomorphs, compartmental plate between carina and fixed scutum; in balanomorphs, compartmental plate overlapping adjacent plates, sometimes compound, either fused with rostromerals or missing and formed of fused rostromerals; simple or compound with or without radii on each side.
- Saw bristles.** Heavy setae in row on gnathal lobe of mandible between molar and incisor processes.
- Scale.** Small calcareous plates on peduncle of lepadomorph Cirripedia; see also *scaphocerite*.
- Scaphocerite.** Exopod of antenna; syn., *scale, squama*.
- Scaphognathite.** Exopod of maxilla, often used to produce respiratory current in gill chamber.
- Schizopod larva.** See *mysis stage*.
- Scutal margin.** Edge of tergum articulating with scutum or edge of any other adjacent to scutum (thoracic Cirripedia).
- Scutum (pl. scuta).** Paired plate or valve of thoracic Cirripedia; in lepadomorphs, 1 on each side of occludent margin of capitulum. In verrucomorphs, of two types: fixed scutum, 1 of 4 compartmental plates; movable scutum, 1 of 2 opercular plates. In balanomorphs, 1 of 4 opercular plates.
- Second antenna.** See *antenna*.
- Second maxilla.** See *maxilla*.
- Segment.** Individual component of crustacean appendage connected by movable articulation with adjoining segments; syn., *podomere* (cf. *article*).
- Seller groove.** See *decapod carapace, groove o*.
- Selvage.** Middle (principal) ridge of contact margin sealing valves closed (Ostracoda).
- Seminal receptacle.** Diverticulum of oviduct or external pouch for storing spermatozoa delivered by male; syn., *receptaculum seminalis, spermatheca*.
- Seminal vesicle.** Sac in male, independent of testes, for storage of spermatozoa; syn., *vesicula seminalis*.
- Serration.** Irregular saw-toothed outline, e.g., on conchostracan valves.
- Seta (pl. setae).** Hairlike process of cuticle with which it articulates or through which it protrudes.
- Sexual pore.** See *gonopore*.
- Sheath.** Cylindrical structure inside shell, consisting of alae and thickened upper part of parietes, greatly strengthening orifice and providing for attachment of opercular membrane (balanomorph Cirripedia).
- Shell fold.** Part of carapace behind cephalon.
- Shell gland.** See *maxillary gland*.
- Shield.** Anterior part of cephalothorax in hermit crabs.
- Simple velum.** Velate structure having simple flangelike form or forming ridge (Ostracoda).

Sinus gland. Storage release site for molt-inhibiting and other hormones produced by x-organ and other sites of central nervous system.

Skeletal duplicature. Outer chitinous body cover shed during ecdysis (Conchotraca, Notostraca, Cladocera).

Somite. Division of body, including exoskeleton, usually with pair of appendages.

Spermatheca. See *seminal receptacle*.

Spermatophore. Packet or capsule of spermatozoa.

Spur. Pendent projection from basal margin of tergum (sessile Cirripedia); also velate structure modified as flattened spinelike projection in some dimorphic genera (Ostracoda).

Spur fasciole. Nearly level, slightly depression on outer surface of tergum extending to apex in line with spur; usually delimited on 1 or both sides by narrow groove (balanomorph Cirripedia).

Spur furrow. Groove on outer surface of tergum extending to apex in line with spur, with sides sometimes folded in (sessile Cirripedia).

Squama. See *scaphocerite*.

Statocyst. Diminutive organ providing sense of balance.

Stenopodium. Slender, elongate appendage, composed of rod-like segments.

Sternum canal. Internal skeletal structure of some crabs formed by meeting of sternal apodemes of opposite sides above nerve cord.

Sternal plastron. See *sternum*.

Sternal process. Projection from midsection of sternite (Mysidacea).

Sternite. Sclerotized ventral surface of body somite.

Sternum (pl. *sterna*). Structure comprised of ventral portions of somites taken together; syn., *sternal plastron*.

Stipe. Stemlike basal part of appendage with exopod sometimes squamate.

Stomatopod integumental ornamentation. Armature and ornamentation of carapace, thoracic somites, abdomen, and telson; named types include:

Carinae:

- (a) intermediate. Between submedian and lateral carinae on each side of carapace.
- (b) lateral. Between intermediate and marginal carinae on each side of carapace and abdomen; extending posteriorly from near anterolateral angle nearly to margin on carapace.
- (c) marginal. Carinae of lateral margins on abdomen; extending along each lateral margin of carapace, often curving upward posteriorly to loop around lateral carinae.
- (d) median. Middorsal carina, sometimes bifurcate anteriorly on either side of cervical groove.
- (e) submedian. Slightly laterad of midline and median carina in abdominal region, not present on carapace.

Denticles:

- (a) intermediate. Row of small projections between intermediate and submedian teeth on lateroterminal margin of telson.

- (b) lateral. Small projection(s) at medial base of each lateral tooth on telson.

- (c) submedian. Small projection(s) just laterad of midline on terminal margin of telson (medial to submedian teeth).

Grooves:

- (a) cervical. Distinct transverse depression or groove in posterior half of carapace.

- (b) gastric. Longitudinal pair of grooves, extending from base of rostrum to posterior margin of carapace.

Teeth:

- (a) intermediate. Strong spinelike or blunt projection at distolateral angle of telson, between submedian and lateral teeth.

- (b) lateral. Strong spinelike or blunt projection on lateral margin of telson distally, between intermediate tooth and prelateral lobe.

- (c) submedian. Strong spinelike or blunt projection just laterad of midline on terminal margin of telson.

Stomodaeum. See *stomodeum*.

Stomodeum. Anterior part of alimentary tract, ectodermal in origin and lined with cuticle; cast with molt; syn., *foregut*.

Stridulating organ. Structure producing sound by 2 parts of exoskeleton being rubbed together; surface with ridge or tubercles or cross-ridges surface and opposing surface with single transverse ridge or tubercle.

Stylamblys. See *appendix interna*.

Style. See *telson*.

Stylet. See *caudal ramus*.

Stylocerite. Rounded or spiniform process on outer part of proximal segment of antennular peduncle; syn., *antennular scale*.

Subcarina. Unpaired plate below carina (lepadomorph Cirripedia).

Subchela. Distal end of appendage developed as prehensile structure by folding back of dactyl against propodus or some broadened part of it; also may result from propodus folded back against carpus; e.g., gnathopod.

Subchelate. Provided with subchela.

Subesophageal ganglion. Nerve plexus below esophagus.

Subhepatic carina. See *decapod carapace, carina k*.

Subhepatic region. See *decapod carapace, region l*.

Submedian carina. See *decapod carapace, carina l* or *stomatopod integumental ornamentation*.

Submedian denticle. See *stomatopod integumental ornamentation*.

Submedian groove. See *decapod carapace, groove p*.

Submedian tooth. See *stomatopod integumental ornamentation*.

Suborbital region. Narrow region bordering lower margin of orbit, sometimes defined, sometimes indistinguishable (Brachyura); see *decapod carapace, region m*.

Suborbital spine. See *decapod carapace, spine h*.

Subrostrum. Unpaired plate below rostrum (lepadomorph Cirripedia).

- Suctorial structures.** Mouthparts of ectoparasites modified for piercing bodywall of host and for sucking out body fluids.
- Sulcus.** Groove or furrow.
- Supra-anal plate.** Tongue-shaped, spatulate, or rounded plate produced posteriorly on dorsal side of telson (Notostraca).
- Supraesophageal ganglion.** Nerve plexus above esophagus, equivalent to brain.
- Supraorbital carina.** See *decapod carapace, carina m.*
- Sutural edge.** Margin of compartmental plate along suture (Cirripedia).
- Suture.** Line or seam at juncture of 2 compartmental plates (Cirripedia); also weakly calcified areas of integument separating at ecdysis.
- Swimmeret.** See *pleopod.*
- Symphod(ite).** See *protopod.*
- Tagma (pl. tagmata).** Major division of body (e.g., head, thorax, abdomen), each composed of varying number of somites.
- Tailfan.** See *caudal fan.*
- Telopod.** Part of appendage distal to coxa (limited usage).
- Telson.** Terminal portion of body (not considered to be true somite), usually bearing anus, sometimes with caudal furca; syn., *postsegmental region, style.*
- Tergal fold.** See *epimere.*
- Tergal margin.** Edge of scutum adjacent to tergum, or edge of any plate bordering tergum (Cirripedia).
- Tergite.** Sclerotized dorsal surface of single body somite.
- Tergum (pl. terga).** Paired plate or valve of thoracic Cirripedia; in lepadomorphs, 1 on each side of occludent margin at apex of capitulum. In verrucomorphs, of two types: fixed tergum, 1 of 4 compartment plates, movable tergum, 1 of 2 opercular plates. In balanomorphs, 1 of 4 opercular plates.
- Terminal cirri.** Cirri, except first pair, located at posterior end of thorax (Ascothoracica).
- Terminal claw spines.** Toothlike projections of varying size at concave end of postabdomen (Cladocera).
- Thelycum.** External pocket on ventral side of thorax in penaeid female serving as seminal receptacle.
- Thoracic appendage.** Any appendage attached to somite of thorax (cf. *thoracopod*).
- Thoracomere.** Somite of thorax.
- Thoracopod(ite).** Appendage of any thoracic somite; see thoracic appendage, phyllopod, maxilliped, pereopod, syn., *cormopod.*
- Thorax.** Tagma between cephalon and abdomen, i.e., anterior part of trunk.
- Transverse septum.** Thin wall normal to longitudinal septum and parallel to basis, dividing longitudinal tubes into series of cells (balanomorph Cirripedia).
- Trichobranch(ia).** Gill with filamentous structure of hairlike projections from axis.
- Tritocerebrum.** See *metacerebrum.*
- Trophi.** All mouthparts of cirripeds.
- Trunk.** Postcephalic portion of body.
- Umbo.** Apical portion of either valve of bivalved crustaceans; also location on plate from which successive growth increments extend in lepadomorph Cirripedia.
- Umbonal spine.** Hollow, minute to large, curved, looped, or nodular spinose projection, sometimes involving entire umbo (Conchostraca).
- Upcurved growth lines.** Upwardly bent growth lines covering tear in shell margin at site of injury (Conchostraca).
- Upper latus.** See *latus.*
- Upper lip.** See *labrum.*
- Urogastric groove.** See *decapod carapace, groove q.*
- Urogastric lobe or area.** See *decapod carapace, region f.*
- Uropod(ite).** Appendage of 6th abdominal somite of Malacostraca, generally fanlike, sometimes reduced or modified; also last 3 pairs of abdominal appendages in amphipods.
- Urosoma.** See *urosome.*
- Urosome.** Part of body behind major articulation (Copepoda); also last 3 abdominal somites bearing modified appendages (Amphipoda).
- Valve.** Lateral part of divided carapace, commonly joined to opposite part by hingement along dorsal midline; also any one of opercular elements in sessile Cirripedia.
- Vas deferens.** Duct in male for passage of sperm from testis to penis.
- Ventral comb.** Row of setae or bristles on posteroventral margin of last abdominal somite or telson (Cephalocarida).
- Ventral cup.** Element of nauplius eye in nonmalacostracans.
- Ventral frontal organ.** Paired sensory structure associated with the nauplius eye of nonmalacostracan crustaceans.
- Ventral nerve chain.** See *ventral nerve cord.*
- Ventral nerve cord.** Ganglia or connectives in somites joined by single or double tract of nerve fibers running longitudinally beneath alimentary canal.
- Vertex.** Top part of head or cephalon (Cladocera).
- Vesicula seminalis.** See *seminal vesicle.*
- Vestibule.** Space between duplicature and outer lamella (Ostracoda).
- Walking leg.** See *pereopod.*
- X-organ.** Site of secretion of molt-inhibiting and other hormones. Located in eyestalks of most decapods or cephalon of sessile-eyed crustaceans. Also referred to as paired frontal organ in Anostraca.
- Y-organ.** Site of secretion of molting hormone in decapods.
- Zoea.** Larval stage characterized by natatory exopods on some or all thoracic appendages, pleopods absent or rudimentary; syn., *mysis, phyllosome, protozoea, schizopod larva.*

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