# JOHNS HOPKINS UNIVERSITY CIRCULARS

*Published with the approbation of the Board of Trustees*

VOL. XI.—No. 97.] BALTIMORE, APRIL, 1892. [PRICE, 10 CENTS.


# MORPHOLOGICAL NOTES.

## FROM THE BIOLOGICAL LABORATORY OF THE JOHNS HOPKINS UNIVERSITY.

EDITED BY WILLIAM K. BROOKS, PH. D.,
PROFESSOR OF ANIMAL MORPHOLOGY AND DIRECTOR OF THE CHESAPEAKE ZOÖLOGICAL LABORATORY.

### THE EMBRYOLOGY AND METAMORPHOSIS OF THE MACROURA.


BY W. K. BROOKS and F. H. HERRICK.


[The introductory chapter of an illustrated memoir by W. K. Brooks and F. H. Herrick, which will appear in the Fourth Memoir of Volume V of the Memoirs of the National Academy of Sciences.]

No great group of animals is more favorable than the Crustacea for the study of the history and significance and origin of larval forms, for these animals possess a number of peculiarities which seem to render the problem of their life-history both unusually interesting and significant, and at the same time unusually intelligible; nor are these peculiar features exhibited, to the same degree, by any other great group of animals.

The body of an Arthropod is completely covered, down to the tip of each microscopic hair, by a continuous shell of excreted matter, and as this chitinous shell is not cellular it cannot grow by the interpolation of new cells, nor can it, like the excreted shell of a mollusc, grow by the deposition of new matter around its edges, for there are no such growing edges, except in a few exceptional cases, such as the barnacles. Once formed and hardened, the cuticle of an Arthropod admits no increase in size, and as soon as it is outgrown it must be discarded and replaced by a new and larger one. The new shell is gradually excreted, in a soft condition, under the old one, and as soon as this is thrown off the new one quickly becomes fully distended and solid. As the result of the very nature of the chitinous shell, and the method of renewal which its structure entails, the growth of an Arthropod, from infancy to the adult condition, takes place by a series of well-marked steps or stages, each one characterized by the formation of a new cuticle and by a sudden increase in size.

In most Arthropods the newly-born young are very different in structure from the adults, and growth is accompanied by metamorphosis. As the changes of structure are necessarily confined to the moulting periods, the stages of growth coincide with the stages of change in organization, and there is none of the indefiniteness which often characterizes the different larval stages of animals with a more continuous metamorphosis. On the contrary, the nature of each change is as sharply defined and as characteristic as the structure of the adult itself. As the moulting period is frequently a time of inactivity, the animal may then undergo profound changes without inconvenience, and the successive steps in the metamorphosis of an Arthropod are not only well marked, but often very profound as well.

In these features all the other Arthropods are like the Crustacea, but another consideration, the fact that, with few exceptions, the higher Crustacea are marine, renders the problem of their life-history much more intelligible than that of any other class of animals.

So far as the ontogenetic history of the metamorphosis of a larva is a recapitulation of ancestral stages in the evolution of the species, its retention at the present day must depend to a great degree upon the persistency of those external conditions to which the larval stages were originally adapted.

This is true at least of all free larvae, which have their own battles to fight and their own living to get, and while a larva inside an egg or within a brood pouch may possibly recapitulate obsolete ancestral stages, the survival of a free larva depends upon its adaptation to its present environment.

As compared with the ocean the inorganic environment of terrestrial or fresh-water animals is extremely variable, and changes in climate, elevation and continental configuration are accompanied by corresponding changes in enemies, competitors and food, so that the conditions which surround a modern terrestrial larva must in nearly every case be very different from those under which the remote ancestors of the species passed their life; but while this is also true to some degree of marine animals, their inorganic environment is comparatively stable, and the persistence of so many ancient marine types shows that the changes in the organic surroundings of marine animals take place much more slowly than corresponding changes on land.

This fact, joined to the definite character of the changes which make up the life history of a marine crustacean, renders these animals of exceptional value for the study of the laws of larval development, and for the analysis of the effect of secondary adaptations, as distinguished from the influence of ancestry; for while Claus has clearly proved that adaptive larval forms are much more common among the Decapods than had been supposed, his writings and those of Fritz Müller show that no other group of the animal kingdom presents an equal diversity of orders, families, genera and species, in which the relation between ontogeny and phylogeny is so well displayed, but while proving this so clearly, Claus' well known monograph also shows with equal clearness, that this ancestral history is by no means unmodified, and that the true significance of the larval history of the higher crustacea can be understood only after careful and minute and exhaustive comparison and analysis.

Greatly impressed by this fact, I begun nearly ten years ago to improve the opportunities that were afforded by the marine laboratory of the

On the northwest coast Lucea, with a well protected harbor, furnished very fair surface-collecting in the middle of August and about the same shore-collecting as at Port Henderson. Owing, however, to the abruptness of the coast no coral is accessible at the surface and mangrove swamps do not furnish the wealth of life found at Port Royal.

Montego Bay from its situation is completely protected from the prevailing winds and offers unusual advantages for surface-collecting, the calm water being of remarkable clearness yet swarming in peculiar marine forms. The extensive sand beaches, rocks and sunken coral reefs yield abundance of echinoderm, crustacea and coelenterates and molluscs more numerous than elsewhere in Jamaica. Here also the mangrove fauna approaches that of Port Royal in its character and diversity. The conditions are nearer those of the Bahamas than at any other part of Jamaica.

Falmouth, with its exposed harbor and fresh water, yields algæ not observed elsewhere but is not rich in its marine fauna. The same is true of the remaining ports in the north as far as Port Antonio, excepting perhaps Port Maria where the occurrence of crystalline rocks along with the limestone in prominent bluffs affords somewhat unusual conditions seized upon by algæ, and perhaps to be recognized in the character of the fauna.

At Port Antonio the fauna seems identical with that at Port Henderson as far as seen in a week or so of exploration. Yet the reefs are less varied and not as rich in animal forms nor are there any of the peculiar mangrove "Zoological Gardens" so remarkable at Port Royal. On the other hand the land and fresh water fauna is rich and accessible while the nature of the coast allows of most easy access to the pelagic fauna, which seems richer than that of the south coast. In fact so small is the harbor and so steep the coast that a few minutes' row brings one out beyond the headlands into 40 to 100 fathoms of "blue water." Richer surface collecting was, however, found in water less deep just outside the reef off Navy Island.

The marine zoölogy was not examined at the east end of Jamaica, but the ports there do not present favorable conditions for its study.

---

## DECAPOD CRUSTACEA OF KINGSTON HARBOR.

By JAMES E. BENEDICT.

The following list of Crustacea collected for the most part near the Laboratory at Port Henderson by Dr. T. H. MORGAN, but in some cases obtained from Port Antonio, has been prepared by JAMES E. BENEDICT, of the United States National Museum.

*Brachyura.*

1. Pericera cornuta (Herbst).
2. Macrocœloma trispinosa (Latreille).
3. Microphrys bicornutus (Latreille).
4. Othonia lherminieri Schramm.
5. Othonia, sp. One small female. The species cannot be accurately determined.
6. Mithrax aculeatus (Herbst).
7. Mithrax hispidus (Herbst).
8. Mithrax cinctimanus (Stimpson).
9. Mithrax sculptus (Lamarck).
10. Mithrax coronatus (Herbst).
11. Thoe puella Stimpson.
12. Platylambrus serratus (Milne Edwards).
13. Menippe rumphii (Fabricius).
14. Pilumnus aculeatus Say. One young specimen.
15. Panopeus areolatus Benedict and Rathbun.
16. Panopeus wurdemannii Gibbes.
17. Lupa forceps (Fabricius).
18. Achelous spinimanus (Latreille).
19. Eucratoplax spinidentata sp. nov.

Carapace longitudinally very convex, transversely slightly so. Front very narrow, divided into two evenly rounded lobes. Orbit with two fissures above. Postocular and first marginal tooth coalesced and slightly emarginate as in *Panopeus;* second tooth rounded; third and fourth teeth slender, spiniform. Chelipeds large; fingers slender, strongly bent downward. No large tooth at the base of the pollex in either cheliped. Ambulatory legs long, very slender, hairy above and below. Abdomen of male and its appendages much as in *Panopeus.* Length of carapace, 15 mm.; width, 21 mm.

20. Gelasimus pugnax? Smith.

The specimens appear to be intermediate between *pugnax* and *mordax* Smith.

21. Ocypoda arenaria Say.
22. Goniopsis cruentatus (Latreille).
23. Geograpsus lividus (Milne Edwards).
24. Pachygrapsus transversus Gibbes.
25. Pachygrapsus gracilis (Saussure).
26. Areograpsus jamaicensis, gen. et sp. nov.

*Areograpsus,* gen. nov. Carapace convex in both directions; deeply areolated, broader than long; posterior half much broader than the anterior; broadest and deepest at the second pair of ambulatory legs. Antero-lateral margin slightly arcuate; cut into teeth; much longer than the postero-lateral. Front conspicuously four-lobed. Merus of maxillipeds broader than long, shorter than the ischium and not dilated at the distal outer angle; exognath slender; no rhomboidal gape.

*Areograpsus jamaicensis* sp. nov. The protogastric, mesogastric, cardiac and intestinal regions swollen. Carapace covered with coarse granules, especially on the branchial and protogastric regions. The surface is coarsely and deeply punctate. Antero-lateral border slightly arcuate, running backward to a point directly over the second pair of ambulatory legs, then diagonally backward. Front four-lobed; median lobes separated by a deep rounded sinus; lateral lobes by a shallow sinus. Margin of the front and also of the entire carapace tuberculate. Antero-lateral margin divided by slight cuts into four teeth including the postocular. Postocular tooth sharp; margin of second tooth in line with that of the first; third tooth rounded; fourth pointed. Chelipeds covered with small tubercles. Right cheliped short and stout; margin of carpus elevated, with no internal spine. Left cheliped much smaller than the right, slender. Ambulatory legs very coarsely granulate; propodal joints compressed, with a cushion of thick, short hair below; dactyls compressed, flattened above and below, with small cushions of thick hair beneath.

Color of alcoholic specimen dark reddish brown.

Length of carapace, 32 mm.; width, 38 mm.; length of right hand, 24 mm.; length of first pair of ambulatory legs, 47 mm.

27. Sesarma angustipes Dana.
28. Sesarma bidentata sp. nov.

Carapace convex in both directions; broader than long; broadest posteriorly. Lateral margins straight; a single tooth behind the angle of the orbit; a faint indication of a second tooth. Front nearly vertical, slightly sinuous; the fine point of the mesogastric region runs forward and divides the superfrontal crest into two parts, each of which is divided by shallow impressed lines into two unequal parts. The surface of the carapace is prominently punctate, and coarsely granulate on the anterior and branchial regions. Chelipeds small; carpus and manus coarsely granulate above. Ambulatory legs long; meral joints rather wide.

Length of carapace, 16 mm.; width behind, 19.5 mm.; width just behind the eyes, 18 mm.

29. Aratus pisoni Milne Edwards.
30. Cyclograpsus integer Milne Edwards.
31. Leiolophus planissimus (Herbst).

*Anomura.*

32. Dromidia antillensis Stimpson.
33. Petrolisthes sexspinosus (Gibbes).
34. Petrolisthes armatus (Gibbes).
35. Petrolisthes, sp.

Near *sexspinosus.* The outer margin of the hand is more arcuate; the ridges of the hand and carpus are not so conspicuous and rough as in *sexspinosus.* The little flattened tuberculate crests are bright purple interspersed with lines of light-colored hair.

36. Megalobrachium granuliferum Stimpson.
37. Porcellana ocellata Gibbes.

*Macrura.*

38. Palæmon faustinus Saussure.

---