

## CHAPTER XXI.

### APPENDAGES IN SECONDARY SYMMETRY—*continued.*

#### THE EVIDENCE AS TO CRUSTACEA<sup>1</sup>.

THE facts as to Secondary Symmetries in Crustacea are so similar to those already detailed in Insects that, were it not for their value as confirmation of the principles indicated, it would be scarcely necessary to describe them at large. Some few of the cases have besides a special interest, as in them may be seen rudimentary or bud-like structures apparently presenting the lowest condition of paired parts in Secondary Symmetry.

Precisely as in Insects there are a number of cases (including those last mentioned) where it would at first sight be supposed that the extra parts are single, but on inspection most of them prove double. Nevertheless there remain some few where this cannot be shewn, and strange as it may seem, these must be admitted to be genuine examples of duplicity of limbs. Of them a special account will be given in another chapter.

There are besides, as in Insects, a considerable number of cases in which the nature of the parts is not clear, though the majority of such cases are not examples of extra parts, but are normal appendages mutilated or deformed.

One specimen (No. 821) is the only case known to me in which *two* pairs of supernumerary parts arise from one appendage.

Another (No. 827) is unique in the fact that according to the description *three* separate appendages are repeated upon a single appendage. It is not clear that this is in any strict sense an instance of Secondary Symmetry, but for convenience it is taken in this chapter.

<sup>1</sup> Useful bibliography given by FAXON, *Harv. Bull.*, 1880—1, VIII. p. 271.

Of the whole number, two affect antennæ, four are in non-chelate ambulatory legs, one is in a chelate ambulatory leg and the rest, being the great majority, are all in chelæ.

With reference to these extra parts several false views have from time to time been held. For example, in some of the commonest cases there is an extra pair of dactylopodites, or of indices, curving towards each other. The extra parts may then greatly resemble the dactylopodite (or "pollex") and index of a normal chela, and many authors have not unnaturally supposed that the extra parts were actually an extra pair of forceps repeating those of the normal chela. This may easily be shewn to be an error, from the fact that it is often possible by some slight structural difference between the pollex and the index to detect that both extra parts are either both pollices or both indices.

But the fullest disproof of this supposition is found in the fact that the great majority of the phenomena will be readily seen to conform to the principles enuniated for Secondary Symmetries in Insects (p. 479).

A good many authors from the time of RÖSEL VON ROSENHOF<sup>1</sup> onwards have said that these cases are a result of injury, or of regeneration after injury. For this belief I know no ground. It should be remembered as an additional difficulty in the way of this belief, that when the limb of a Crab or Lobster is injured it is usually thrown off bodily, while the extra parts most often spring from the periphery of the chela. But since, according to HEINEKEN<sup>2</sup>, such mutilated parts are sometimes retained, this must not be insisted on.

In the case of an ambulatory leg the surfaces may be named as in an insect (without any suggestion that these names denote true homologies between the surfaces so named). In describing chelæ I propose to use the following arbitrary terms. The border upon which the dactylopodite articulates is the *pollex-border*, the opposite border being the *index-border*. It should be noted that in the Crab the pollex-border is *superior*, but in a Lobster<sup>3</sup> it is *internal*.

(1) *Clear cases of Extra Parts in Secondary Symmetry.*

A. *Legs.*

- \*808. **Palinurus vulgaris**: left penultimate ambulatory leg bore two supernumerary legs (Fig. 180). Coxopodite of great width. The basipodite had three articular surfaces as shewn in Figure 180,

<sup>1</sup> RÖSEL VON ROSENHOF, *Insekten-Belustigung*, 1755, III. p. 344.

<sup>2</sup> HEINEKEN, *Zool. Jour.* 1828—29, IV. p. 284.

<sup>3</sup> It is worth noticing that in the chela of a Scorpion though a close copy of that of a Decapod, the arrangement is *reversed*, the articulated pincer being external.

each bearing a complete leg. When seen by me the leg marked *L'* was lost.

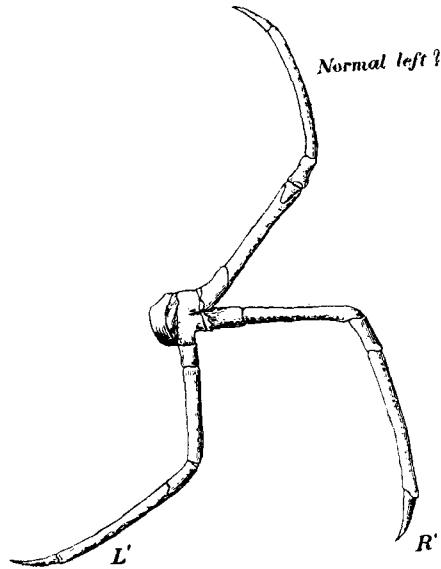


FIG. 180. *Palinurus vulgaris*, No. 808. Left penultimate walking leg. (After Léger.)

I could not quite satisfy myself as to which of the three was the normal, but it was clear that *R'* was in form a *right* leg and that the other two were lefts. If the leg *L'* is the normal, it has been pushed out of place by a pair of extra legs in Position DAA, but if *R'* and *L'* be the extra legs, then the most anterior leg is the normal and has been pushed out of place by a pair in Position VPP. For an opportunity of examining this specimen, I am obliged to the courtesy of Prof. A. MILNE EDWARDS. Originally described and figured by LÉGER, M., *Ann. Sci. Nat., Zool.*, 1886, S. VII. I, p. 111, Pl. 6.

- \*809. **Lithodes arctica**: 2nd leg on right side has terminal joint as shewn in Fig. 181, II. If *R* be the normal then *R'* and *L'* are a pair in Position V, but if *R'* be the normal then *R* and *L'* are a pair in Position D. Attention called to the great diminution in size of all three terminations as compared with the normal (Fig. 181, I). Original description, HERKLOTS, J. A., *Bijdr. tot d. h. Genootsch. Nat. Artis Mag.*, 1852, iv. p. 37, *Pl.*; repeated *Arch. néerl.*, 1870, v. p. 410, Pl. xi.
810. **Cancer pagurus**: last left leg closely like last case [in Position D]. RICHARD, *Arch. Zool. exp.*, 1893, p. 102, *fig.*
811. **Carcinus mænas**: 2nd amb. leg as in Fig. 181, III. A pair of

compounded extra points in Position D. DUNS, *Proc. R. Phys. Soc. Edin.*, ix. p. 75, *Pl.*

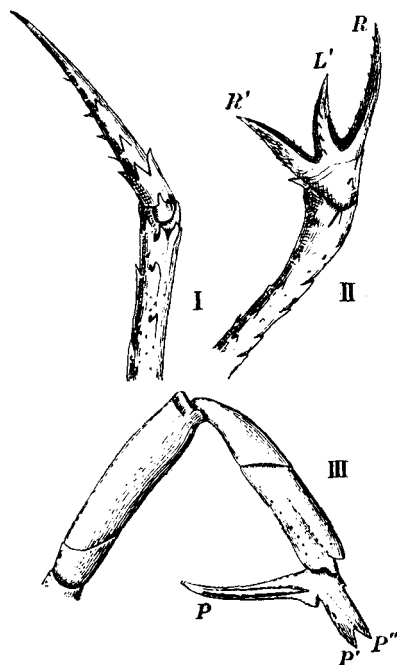


FIG. 181. I. *Lithodes arctica*, normal terminal joint of ambulatory leg. II. Second right leg of No. 809. (Both after Herklots.) III. *Carcinus maenas*, No. 811, second ambulatory leg. (After Duns.) P, normal terminal point. P', P'', extra terminal points in Position D.

### B. Chelate Appendages.

#### (a) Two extra dactylopodites and double extra index.

812. **Eriphia spinifrons** ♀: specimen of unusually large size, normal but for left chela shewn in Fig. 182, I and II<sup>1</sup>. The chela bore normal left dactylopodite, *LD*, and index, *LI*; also, upon pollex-border the structures shewn. These consisted of two dactylopodites, *R'D*, *L'D*, working opposite each other on a compounded double index, *R'I*, *L'I*, which had two toothed borders, one for each of them. This is therefore a pair of chelæ repeated in Position D [if indeed the dactylopodite mark the dorsal surface]. Taken from HERKLOTS, *Arch. néerl.*, 1870., v. p. 412, Pl. XI.

<sup>1</sup> In connexion with this case HERKLOTS states that the rt. chela in the normal is the larger and otherwise differs from the left (1 in 8 being reversed in this respect). It does not seem from the figure that there was such differentiation between the extra pair, but in future cases this point should be looked for.

813. **Astacus fluviatilis**: about 3 years old according to SOUBEIRAN'S (*Comp. Rend.* 1865, LX, p. 1249) account. Right chela apparently deformed by injury or disease. Left chela had all normal

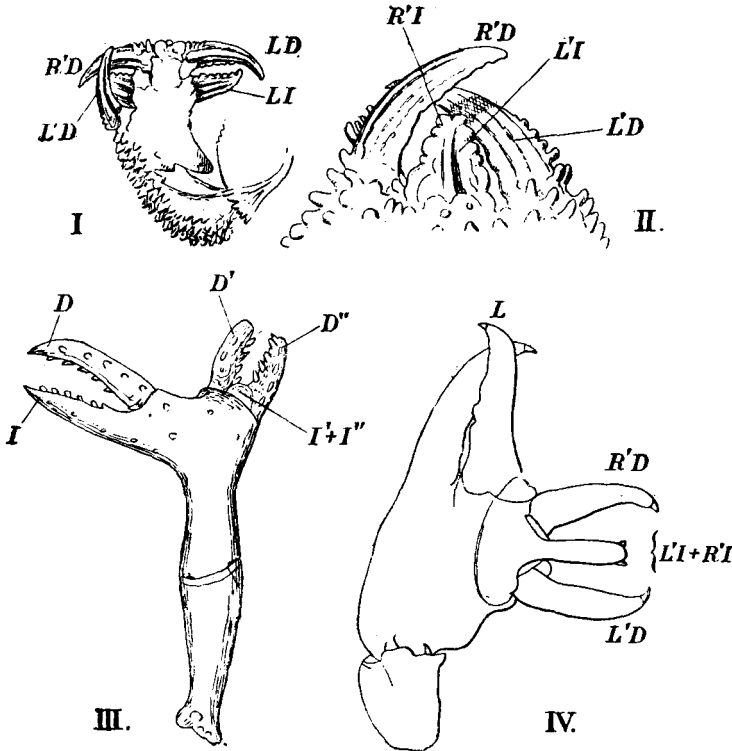


FIG. 182. I and II. *Eriphia spinifrons*, No. 812. I. A view of the left chela. II. An enlarged view of the extra parts from the other side. LD, LI, normal left dactylopodite and index. R'D, L'D, right and left extra dactylopodites. R'I, L'I, right and left extra indices not separated from each other. (After Herklots.)

III. Cheliped of *Homarus americanus*, No. 814. (After Faxon.) D, I, normal dactylopodite and index. D', D'', extra dactylopodites. I', I'', perhaps an indication of double extra indices.

IV. *Astacus fluviatilis*, No. 813, left chela. L, normal left dactylopodite. R'D, L'D, right and left extra dactylopodites. L'I+R'I, left and right extra indices not separated from each other. (After Maggi.)

parts and in addition the structure shewn in Fig. 182, IV upon the pollex-border of propodite. Here was a boss, separated by a groove. It was observed that the structure was that of a rt. and l. dactylopodite working upon a double index [as in last case]. Structure of muscles, fully described, was also in agreement with the view that the extra parts were a complementary

pair [similarly in Position D]. MAGGI, L., *Rend. R. Ist. Lomb.*, 1881, xiv. p. 333, *figs.*

814. **Homarus americanus**: small cheliped as shewn in Fig. 182, III. It bears normal dactylopodite (*D*) and index (*I*), but this part is bent almost at rt. angles. From the outer angle arise the parts shewn. Apparently *D'* and *D''* are a complementary pair of extra dactylopodites in Position D. The piece *I' + I''* is not described; from the figure it seems possible that it may represent parts of the indices proper to *D'* and *D''*. Case given by FAXON, *Harv. Bull.*, 1880—1, VIII. p. 261, Pl. II. fig. 2.
815. **Cancer pagurus**: right chela as shewn in Fig. 183. This is a case of some complexity. The figure will best make it clear. The dactylopodite *D'* is single and so also is the index *P*. *D* is a double dactylopodite, and *P'* having teeth on two sides may be judged to be a double index. But if *D'* and *P* are the normal chela they each stand opposite

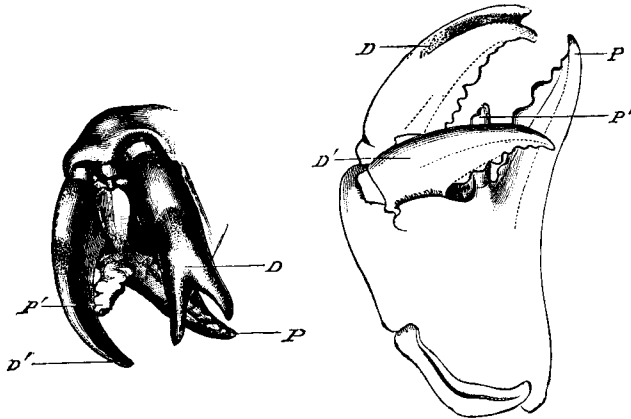


FIG. 183. *Cancer pagurus*, No. 815. Right chela seen from the apex, and from the outside. The lettering is arranged on the hypothesis that *D'* is the normal dactylopodite, *P* the normal index. *D*, the double extra dactylopodite, *P'*, small double extra index. (From *Proc. Zool. Soc.*)

the pincers to which they do not belong. Nevertheless I see no other interpretation possible. (This case is curiously like that of the tarsal claws in *Rhizotrogus* No. 786.) Specimen incorrectly described by myself, *P. Z. S.*, 1890, p. 581, fig. 2. C.

816. **Cancer pagurus**: right chela in a condition not far removed from that of the last case, LE SÉNÉCHAL, *Bull. Soc. Zool. France*, 1888, p. 123, *figs.*
817. **Uca una**: a chela having complex repetition of parts somewhat as in No. 815. JAEGER, G., *Jahresh. d. Ver. vaterl. Naturk.*, 1851, xvii. p. 35, Pl. I. *figs.* 12 and 13.
- Perhaps of this nature is the case in *Astacus fluviatilis*, ROESEL v. ROSENHOF, *Ins.-Belust.*, III. Tab. LX. fig. 28.

(b) *Two extra dactylopodites arising from normal dactylopodite.*

- \*818. To this and the next division belong the great majority of

cases of repetition of parts in Crustacea. Including examples recorded by various authors and specimens in different Museums there are nearly fifty cases of this class known to me.

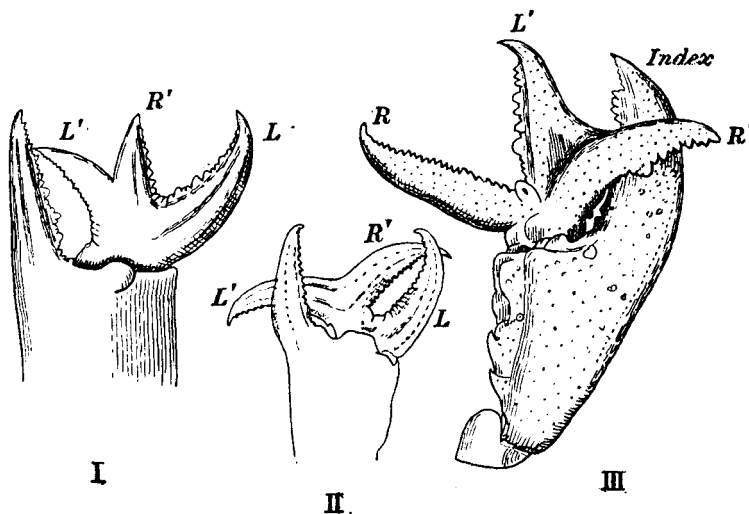


FIG. 184. Three cases of two extra dactylopodites arising from a normal dactylopodite. I. Left chela of *Carcinus menas* in Brit. Mus. II. Left chela of *C. menas* after Lucas, *Ann. Soc. ent. France*, S. 2, II. p. 42, Pl. I. fig. 2. III. Right chela of *Homarus*, after VAN BENEDEEN, *Bull. Ac. Belg.*, S. 2, XVII. p. 371.

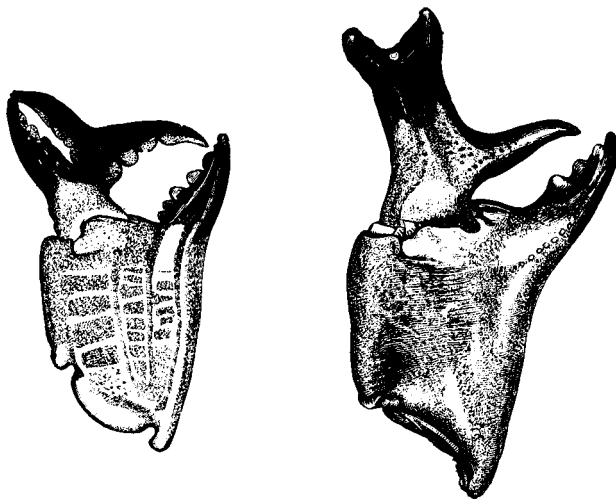


FIG. 185. *Cancer pagurus*. Two chelæ of the kind specified in No. 818, described by myself in *Proc. Zool. Soc.*, 1890, p. 581, whence figs. are taken.

The various simple forms taken are illustrated by the eight cases shewn in Figs. 184, 185 and 186. It will be seen that when such extra processes arise on the toothed border of the dactylopodite they turn their *smooth* borders to each other, but when

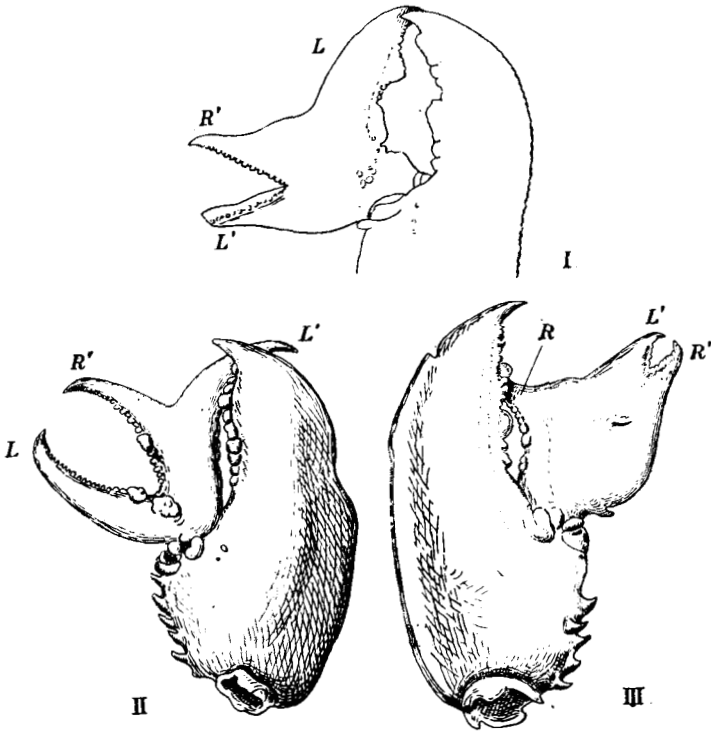


FIG. 186. *Homarus americanus*. Three chela whose dactylopodites bear double extra dactylopodites. I. A left. II. A left. III. A right. *R*, normal right. *L*, normal left. *R'*, extra right. *L'*, extra left. (From Faxon.)

they arise on the smooth border they turn their toothed borders to each other, thus fulfilling the conditions of the Scheme given at p. 481. Though from the close agreement between the three prongs in some of the specimens it is not always possible to tell the normal dactylopodite with certainty, it will be seen that in these the rules hold whichever of the two possible prongs be supposed to be the normal.

819. ***Astacus leptodactylus***: left chela has dactylopodite as shewn in Fig 187, II. Presumably *D* is the normal pushed out of place, and *D'* and *D''* are the two extra dactylopodites. They are so placed that none meets the index. KÁROLI, J., *Term. Füzetek*, 1877, i. p. 53, Pl. II.



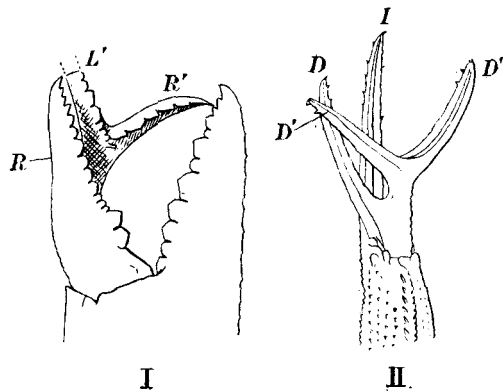


FIG. 187. I. *Cancer pagurus*, No. 820, right chela. Specimen in Coll. Surg. Mus. II. *Astacus leptodactylus*, left chela, after Károli.

820. **Cancer pagurus** : somewhat similar case in rt. chela (Fig. 187, I); but here the normal, *R*, stands in its normal place. In Coll. Surg. Mus.
- \*821. **Homarus americanus** : dactylopodite only of right chela preserved. It is bent sharply downwards, out of the plane of the "hand," and bears upon its upper surface *two pairs* of blunt, toothed processes [probably being rudiments of two pairs of extra dactylopodites]. FAXON, *l.c.*, p. 261, Pl. II. fig. 1.
822. **Homarus americanus** : dactylopodite (*a*) bent upwards and outwards, crossing index without meeting it (Fig. 188). From the smooth border of dactylopodite arise two toothed processes

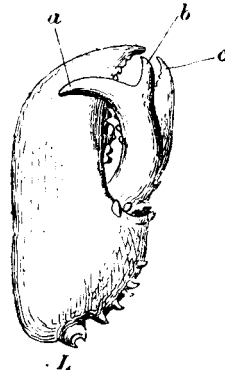


FIG. 188. *Homarus americanus*, No. 822, left chela. *a*, normal point of dactylopodite. *b, c*, extra points. (After Faxon.)

(*b* and *c*) curving towards index. [I take it that this is something like the cases of Position A in Insects (p. 481) but from the original figure the relations cannot be quite decided.] FAXON, *l.c.*, p. 260, Pl. I. fig. 15.

(c) *Two extra indices arising from a normal index.*

\*823. This again is a fairly common form, though much less frequent

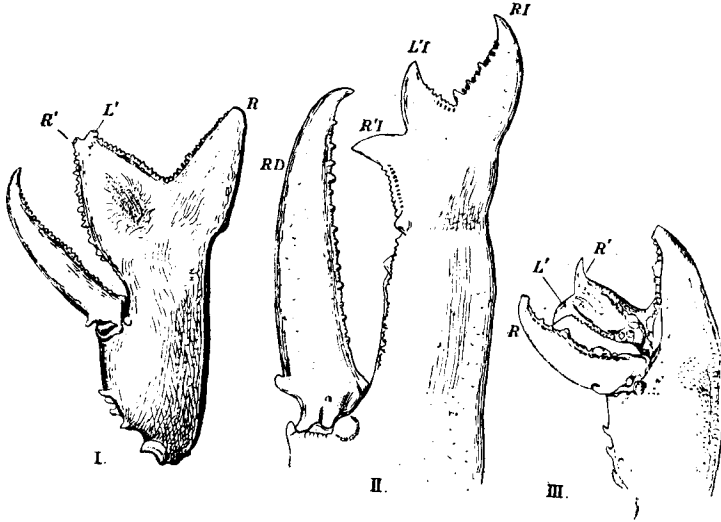


FIG. 189. I. Right chela of *Homarus americanus*. *R'*, *L'*, right and left extra indices not separated from each other. (After Faxon.) II. *Homarus vulgaris*, right chela in Brit. Mus. III. *H. vulgaris*, right chela bearing extra double index. *R'* and *L'*, not separated. (After Lucas, *l.c.*)

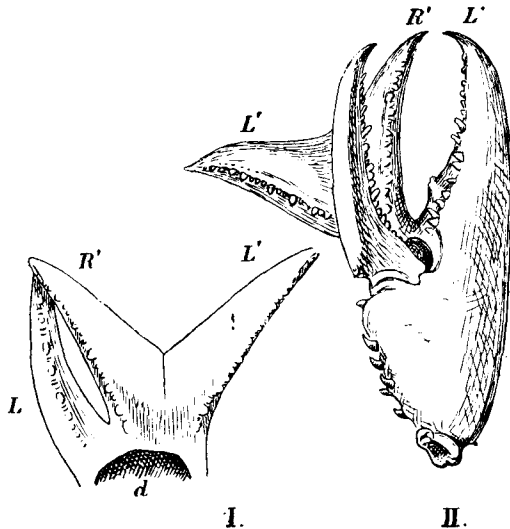


FIG. 190. I. Left chela of *Carcinus menas*, indices only shewn. *d*, place of articulation of dactylopodite. In Coll. Surg. Mus. II. A similar case in *Homarus americanus*, after Faxon. *L*, normal left index. *R'*, *L'*, extra right and left indices.

than the last. The cases known to me amount to about ten or fifteen. Seven cases are illustrated in Figs. 189, 190, and 191.

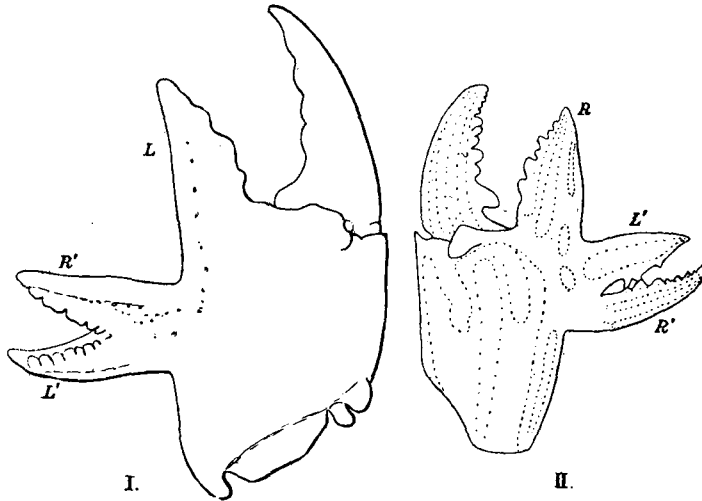


FIG. 191. Two cases of extra indices in *Cancer pagurus*. I. In Coll. Surg. Mus. II. After le Sénéchal. R, normal right index. L, normal left. R', L', extra rights and lefts.

(d) *Simple processes, probably being rudimentary extra pairs of indices or of dactylopodites.*

\*824. Many such are described, but of few can anything be said with confidence. A comparatively simple case is shewn in Fig. 192, where there is a decided suggestion that the process  $L' + R'$  is morphologically a pair of indices that have not separated from each other but stand compounded by their toothed borders. On comparing this case with for instance, Fig. 191, II, it will be seen that the two conditions might readily pass into each other in the way so often seen in Insects.

Other cases of a more doubtful character are shewn in Fig. 193. Though in each the nature of the extra part is obscure, it is probable that they are all rudimentary states of the repetitions described. The alternative view that they are *single* repetitions certainly cannot be applied to all, for in many the extra process, though in the plane of the index and dactylopodite, is similar on

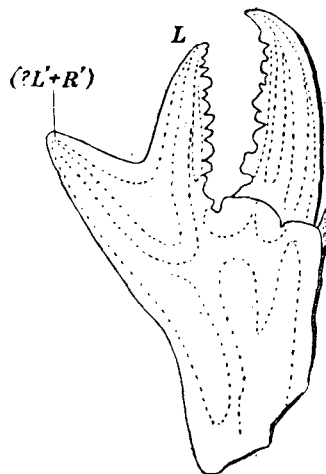


FIG. 192. Left chela of *Portunus puber* from le Sénéchal, Bull. Soc. Zool. France, 1888, XIII. p. 125. L, normal index.  $L' + R'$ , ? pair of extra indices in Position V.

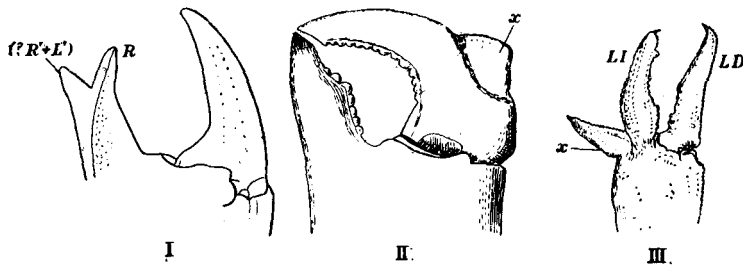


FIG. 193. I. Right chela of *C. pagurus* in Coll. Surg. Mus. *R*, right index. II. Similar specimen whose dactylopodite bears *x*, a supernumerary process. In Coll. Surg. Mus. III. *Astacus fluviatilis*, left chela bearing *x*, a supernumerary process. *RI*, *RD*, right index and dactylopodite. (After Lucas.)

both its faces in this plane. There is however no doubt that the distinction between these cases and true duplicity is hard to trace and possibly enough it is not really absolute.

825. As each case differs from the others I give a list of those not in private collections<sup>1</sup>. The ? indicates that the case perhaps approaches the condition of true duplicity.

*R*, right. *L*, left. *D*, dactylopodite. *I*, index.

<b><i>Astacus fluviatilis</i></b>	<i>RI</i>	TIEDEMANN, <i>Meckel's Arch.</i> , 1819, v. p. 127, Pl. II. fig. 2.
? <b><i>A. fluviatilis</i></b>	<i>RI</i>	JAEGER, G., <i>Jahresh. Ver. vaterl. Naturk.</i> , 1851, xvii. p. 35, Pl. I. fig. 7.
<b><i>A. fluviatilis</i></b>	<i>LD</i>	<i>id.</i> , <i>Meckel's Arch.</i> , 1826, p. 95, Pl. II. fig. 3.
<b><i>A. fluviatilis</i></b>	<i>RI</i>	RÖSEL v. ROSENHOF, <i>Ins.-Belust.</i> , III. p. 344, fig. 31.
? <b><i>A. fluviatilis</i></b>	<i>LI</i>	<i>ibid.</i> , fig. 30.
<b><i>A. fluviatilis</i></b> (Fig. 193, III.)	<i>LI</i>	LUCAS, <i>Ann. soc. ent. Fr.</i> , 1844, Sér. 2, II. p. 45, Pl. I. fig. 6.
<b><i>Homarus americanus</i></b>	<i>LI</i>	FAXON, <i>Harv. Bull.</i> , VIII. p. 259, Pl. I. fig. 11.
<b><i>H. americanus</i></b>	<i>RD</i>	<i>ibid.</i> , Pl. I. fig. 6.
? <b><i>Cancer pagurus</i></b>	<i>LD</i>	RICHARD, <i>Ann. sci. nat.</i> , 1893, p. 106.
<b><i>C. pagurus</i></b> (Fig. 193, I.)	<i>LI</i>	<i>Coll. Surg. Mus.</i>
<b><i>C. pagurus</i></b> (Fig. 193, II.)	<i>LD</i>	<i>Coll. Surg. Mus.</i>

(e) *Exceptional Cases.*

- \*826. ***Homarus americanus***: Right chela. Meropodite sub-cylindrical instead of flattened; peripherally divides into two parts each bearing an articulated appendage as shewn in Fig. 194. [The appendage *R* is a normal chela. What is *R' + L'*? FAXON, carefully describing the case, thinks that *R' + L'* is a rudimentary and reversed copy of *R*, and that the case is one of duplicity. But from the particulars given, and especially from the circumstance that the carpopodite was "much more spiny" than the normal, I think it likely that *R' + L'* is morphologically a double structure formed of a pair of carpopodites compounded together.

<sup>1</sup> With these may perhaps be mentioned the following: ***Apus cancriformis***, having upon the 40th foot a second small flabellum shaped like the normal flabellum. The bract was greatly reduced in size. LANKESTER, E. R., *Q.J.M.S.*, 1881, XXI. p. 350, Pl. xx. fig. 12. [In explanation of Plate the abnormal foot is called the 30th.]

Without having seen the specimen it is impossible to say much, but the parts should be examined with a view to this possibility. I conceive that the large spine marked by Faxon *sp'* stands on

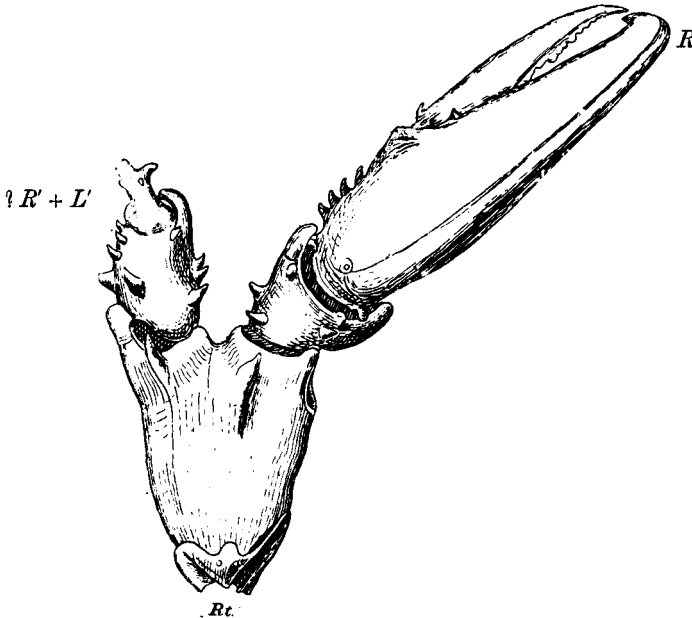


FIG. 194. *Homarus americanus*, No. 826. A right chela. (After Faxon.)

the morphologically middle line between the two extra half-meropodites.] FAXON, *Harv. Bull.* VIII. p. 262, Pl. II. fig. 6.

\*827. ***Astacus fluviatilis*** ♀: large adult.

Abdomen wide in comparison with slender chelæ: otherwise normal except left chela. This was formed as in Fig. 195. All normal except carpopodite, from which arose a fixed piece seeming to be an extra misshapen carpopodite, bearing three extra chelæ, *L'*, *R'* and *x*. [*R'* and *L'* are a clear pair of images being right and left respectively. But between *R'* and the normal *L* there is the third extra chela *x*. As to the nature of this nothing can be said. Whether it is a left or a right cannot be told from fig. So far as I know, this case is unique. Full description and measurements given in original, *q. v.*] CANTONI, *Rend. R. Ist. Lomb.*, 1883, XVI. p. 771, fig.

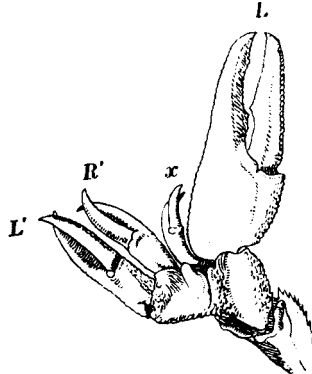


FIG. 195. *Astacus fluviatilis*, No. 827, left chela. *L*, the normal. *R'*, *L'*, presumably extra right and left chelæ. *x*, extra chela of uncertain nature. (After Cantoni.)

C. *Antennæ.*

- \*828. **Palinurus vulgaris**: right antenna bore three complete filaments. So far as last spiny joint (merocerite) normal. Of this joint the peripheral portion much enlarged, presenting two articulations. The most posterior bore a normal carpo-cerite and filament (Fig. 196, I). The anterior articulation bore a double carpo-cerite with two filaments (II and III). As author points out, II is structurally a *left* antenna. [By the kindness of M. Alphonse Milne Edwards I have been allowed to examine this specimen. I am not sure that I succeeded in correctly determining the surfaces of the extra antennæ, for the basal parts were not very fully formed; but according to my determination their relations differed markedly from those of any of the Schematic positions, for while the position of origin is VVA the two extra antennæ stand very nearly in the Position DA.] LÉGER, *Ann. sci. nat., Zool.*, 1886, S. 7, I. p. 109, Pl. 6.

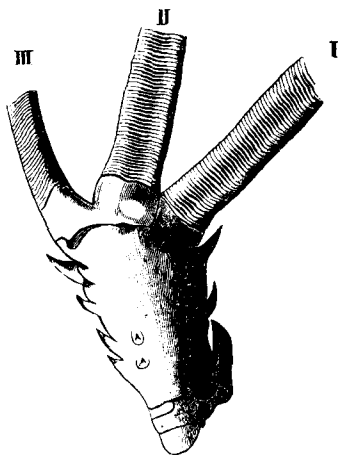


FIG. 196. Proximal parts of the right antenna of *Palinurus vulgaris*, No. 828. I, the normal. II, extra left. III, extra right. (After Léger.)

- \*829. **Astacus fluviatilis**: exopodite of left antenna (Fig. 197) bears two supernumerary points, *R'* and *L'*, which seem to have been inserted upon the internal border of the normal exopodite. STAMATI, G., *Bull. Soc. Zool. France*, 1888, XIII. p. 199, fig.

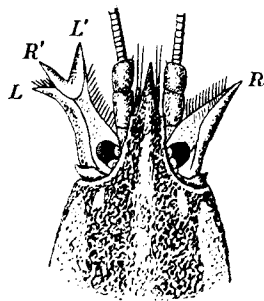


FIG. 197. *Astacus fluviatilis* having extra points to exopodite of left antenna. *R*, normal right. *L*, normal left. *R'*, *L'*, extra right and left. (After Stamatii.)

## AMORPHOUS CASES.

As has been stated, there are many cases, recorded or preserved, in which the nature of the parts cannot be made out. The majority of these are, I believe, injured or deformed limbs, and not cases of repetition of parts. Nevertheless of the latter class there are undoubtedly some amorphous cases, though they are far less common than regular ones, even as normal structures are more common in their regular shapes than in a deformed state. I mention the following as being, I think, the earliest record of abnormalities of this class.

830. **Homarus**: left chela having irregular process on inner border of dactylopodite, and two irregular processes on inner border of index. [No description.] BERNHARDUS & BERNIZ, *Miscell. Curios.*, Jena, II. 1671, p. 175, Obs. cl. *Pl.*