Letters to the Editor.

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Copepods in the Northern Hemisphere.

It has long been recognised that the distribution of freshwater copepods has been profoundly influenced by the incidence of the glacial period, since the lake-districts which they inhabit are to a large extent postglacial catchment basins. It so happens that there is a general correspondence between the three leading sub-orders and the three principal life-zones of lakes, namely, the creeping Harpacticoida of the littoral zone, the swimming Cyclopoida of the neritic zone, and the pelagic Calanoida of the open water. In the genus *Cyclops* there are upwards of twenty species common to the fauna of Norway (representing northern Europe) and of Germany (representing central Europe). Two significant differences are the absence of *C. capillatus* from Germany and the

the European types, and this relation can be brought out by a tabular list, the knowledge of the items composing it being a secondary matter not necessary for the comprehension of the picture it presents. In two or three instances the differentiating characters are sufficiently intelligible to be mentioned. In *C. hoferi* the antennules are normal and 8-jointed; in its Canadian counterpart, *C. douwei*, they are 7-jointed. On the other hand, in *C. wierzejskii* the antennules are 7-jointed, and in the Canadian equivalent, *C. obatogamensis*, they are 8-jointed. Lastly, in *C. douwei* the fourth seta of the fifth foot is the longest of its set; in *C. hiatus* there is no fourth seta, and a gap, absolutely constant, is left for it (Fig. 1).

EUROPE.	NORTH AMERICA.
<i>Canthocamptus staphylinus</i> Jurine	<i>staphylinoides</i> A. S. Pearse.
" <i>minulus</i> Claus	<i>minnesotensis</i> C. L. Herrick.
" <i>vejdoskyi</i> Mrazek	<i>minuscule</i> Willey.
" <i>arcticus</i> Lilljeborg	<i>subarcticus</i> Willey.
" <i>hoferi</i> Douwe	<i>douwei</i> n.sp.
" <i>fontinalis</i> Rehberg	<i>frigidus</i> Willey.
" <i>northumbicus</i> Brady	<i>northumbicoides</i> Willey.
" <i>hiatus</i> n.sp.	
" <i>wierzejskii</i> Mrazek	<i>obatogamensis</i> n.sp.
<i>Wolterstorffia confluens</i> Schmeil	<i>Marshallia albuquerqueensis</i> Herrick.
<i>Laophonte Mohammed</i> Blanchard and Richard	<i>L. calamorum</i> Willey.

The above table does not exhaust the list of those that can be paired, and there are others which cannot be paired off. For example, *C. cuspidatus* Schmeil is represented here by an undescribed form (the new species named above are succinctly defined in this letter), while *C. illinoisensis* Herrick has no European double, but appears in the ultramontane lakes and springs of Canada in a new form, *C. hyperboreus* Willey (Trans. Roy. Soc. Canada, 1925, in the press).

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July 9.

The Effective Wave-length of γ Rays.

IN his letter to NATURE (January 3, 1925, p. 13), Prof. Gray states: "If the secondary β -rays, produced in light elements by the hard γ -rays of radium-C, are recoil electrons, with energy given by the quantum theory of scattering, . . . the effective wave-length of the γ -rays must be much smaller than that usually accepted. Without going into details . . . no theory, as at present developed, can account for the properties of scattered γ -radiation."

By means of Wilson's cloud expansion method, I have observed the β -rays which are excited in gases by γ -rays hardened by 3 mm. of lead. It has thus been proved quite conclusively that these secondary electrons are recoil electrons, as predicted by Compton's quantum theory of scattering. These results, which Prof. Gray does not mention, permit me to draw some conclusions as to the effective wave-length of γ -rays.

I obtained photographs of β -ray tracks in a homogeneous magnetic field and calculated the velocities of different separate β -particles from the curvature of these tracks. The corresponding results may be found in *Zeitschr. f. Physik*, v. 28, p. 285, October 1924 (see NATURE, Dec. 6, p. 838).

If we assume that the effective wave-length of the γ -rays is equal to 0.02 Å.U. as usually accepted (that means $h\nu$ equal to about 600 kilovolts), then the maximum limiting velocity of the recoil electrons, according to Compton's theory, must be 400 kv. Now, I found that out of 72 electrons for which the velocity was measured, 69 had a velocity smaller than 400 kv. and only 3 electrons showed an energy surpassing this value (the swiftest of the latter had a velocity about 1000 kv.).

FIG. 1.—Fifth foot of female of *C. douwei* and *C. hiatus*.

absence of *C. prasinus* from Norway, both of these species occurring in Canada.

The parallelism between the harpacticoid copepods in Europe and North America is remarkable. The writer has contributed to this subject in recent years, last year making the canoe trip to the great lake Mistassini, which lies beyond the Laurentian watershed and drains into Hudson Bay by the Rupert river. The genus *Canthocamptus* is intimately bound up with the Holarctic region, but the species are local and eclectic and they have to be searched for far and wide in likely places. The uncultivated area that occupies much of the northern portion of Canada offers a profusion of such places, pools, swamps, springs and quaking bogs, which are by no means easy to reach, but the offerings of the more accessible lakes are such as to stimulate one to plunge into the wilderness in quest of these insignificant inhabitants of the primeval sources. The rule is that they differ alike from each other and from their transatlantic relatives by clean-cut unit characters and, incidentally, they are frequently monogamous, thus exhibiting the phenomenon of segregation in all its phases.

The American forms differ, sometimes in the least apparent respect, sometimes in greater degree, from