

Paper Electrophoresis Patterns of Sera from Seven Genera of Decapod Crustaceans

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ABSTRACT: The pattern noted for the various families was simple, showing one major protein band and, in most cases, at least one minor one. Serum from crabs from the open coast always showed two bands, while those from the mud flats showed but one. This held even in *Pachygrapsus*, which is found in both habitats.

RECENTLY Woods et al. (1958) reported a very close similarity in the electrophoretic patterns in starch gel of related species of crabs, and stated that, not without exceptions, such electrophoretic relationships seemed to extend to the family level. This work prompted the authors to do a cursory study of representatives of a number of the families of crabs common to the southern California coast.

Paper electrophoresis rather than starch gel was used, employing the Spinco Model R electrophoresis apparatus to separate the serum proteins of specimens from eight genera of decapod crustaceans, representing seven families. The separations were made on individual samples, and, in the case of the smaller species, on pooled samples in a veronal buffer at pH 8.6 with an ionic strength of .075. The liquid sera were separated from the clot and applied to the paper strips and run at 5 milliamperes for 16 hr. Since only the Grapsidae were represented by more than one genus, no generalization can be made as to uniformity within the families.

Differences noted among the families included (a) rapidity of migration of the major band, (b) relative migration of the minor band, (c) strength of the two bands both relative and absolute, and (d) the appearance of a third band in the case of the *Pleuroncodes* (Galatheidæ) (Fig. 1, E.). This latter may be of significance in view of the uncertain taxonomic position of the Galatheidæ, and, if it is found to be a consistent characteristic in large numbers

of specimens, might easily be construed to support a more distant relationship with the main body of the crabs.

However, there appears to be an environmental as well as a genetic relationship in the electrophoretic patterns of the serum proteins of these animals. It will be noted from Figure 1 that those forms which are more commonly associated environmentally tend to have a broad similarity in their electrophoretic patterns. This environmental pattern is shown to exist even within the species in the case of *Pachygrapsus crassipes* Randall which, in Southern California, lives on the margins of the mud flats as well as in the rocky intertidal zone of the open coast.

All the crabs living in the open water (Fig. 1, A-E) and on the well aerated tidal zones, including *P. crassipes* (Grapsidae), show two well-defined protein components, whereas all those (again including *P. crassipes*) taken from the muddy shores (Fig. 1, F-H), where routinely there are wide variations in the tides and high salinity-low oxygen relationships, have but one protein component.

The food supply available to these two environmental groups of crabs also differs widely. The former group has abundant supplies of red, brown, and green algae, as well as various forms of animal life. The second group, living on the mud flats, has a much more limited food supply, consisting of small green algae and saline higher plants, supplemented by more limited amounts of animal and plant material. In addition, the population levels of *P. crassipes* on the beaches studied were much lower than they were on the muddy shores, which may have been a significant influence in the latter group.

The almost identical patterns of *Hemigrap-*

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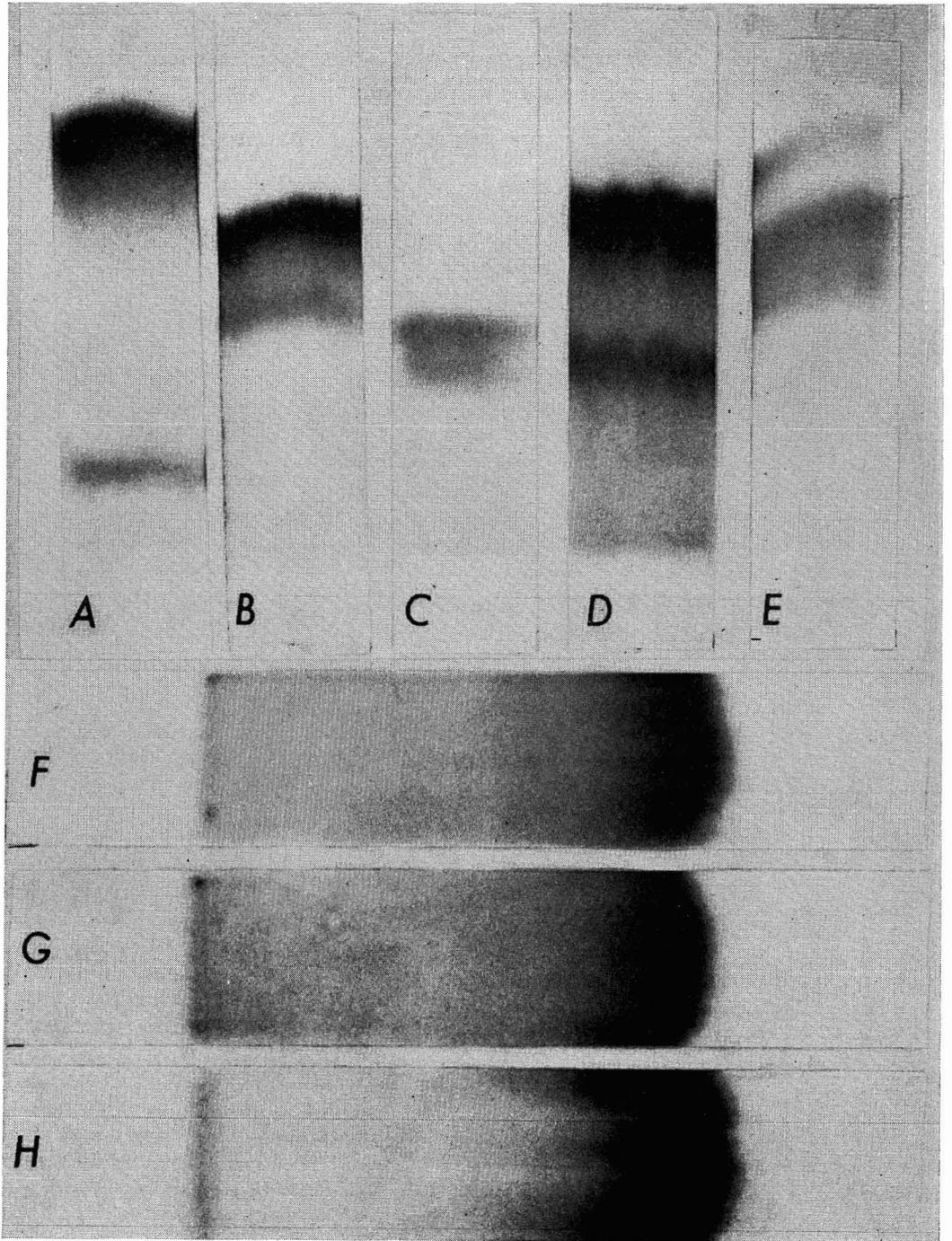


FIG. 1. A-E, Electrophoretic patterns of sera from crabs from tidal zone and open water. F-H, Electrophoresis patterns of sera from crabs from mud flats. A, *Portunus* (Portunidae); B, *Pachygrapsus* (Grapsidae); C, *Cancer* (Cancridae); D, *Loxorhynchus* (Majidae); E, *Pleuroncodes* (Galatheidae); F, *Hemigrapsus* (Grapsidae); G, *Pachygrapsus* (Grapsidae); H, *Uca* (Ocypodidae).

sus, *Uca*, and *Pachygrapsus* from the mud flats would seem to indicate a strong environmental or nutritional influence on the electrophoretic pattern of the blood proteins synthesized, superimposed on the species-controlled genetic factor. This hypothesis is strengthened by the obvious difference, within the species *P. crassipes*, between specimens living in the two different environments mentioned (Fig. 1, A-E and 1, F-H).

Work in progress toward experimental elucidation of this blood pattern difference in

Pachygrapsus, using the more sensitive agar gel electrophoresis, seems to indicate that the nutritional factor may be the predominant influence in the environment. The results of these studies will be reported upon completion.

REFERENCE

- WOODS, K. R., ELIZABETH C. PAULSEN, RALPH L. ENGLE, SR., and JAMES H. PERT, 1958. Starch gel electrophoresis of some invertebrate sera. *Science* 127 (3297):519-520.