

Electrotaxis of the Brittle Star

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Brittle stars exhibit a very remarkable taxis in electric field. All the arms become oriented to the cathode and the animal physically approaches to this electrode.

It has been wellknown for some time that certain fish orient themselves in a specific manner while subjected to an electric field. The behaviour of invertebrates in this respect has not been well documented. Recent interest¹ in electrophysiological problems in the invertebrate kingdom also strongly demands a thorough study.

We report here an interesting finding with brittle stars which may lead to a deeper analysis of the problems of taxis in electric field, the invertebrate nervous system and receptors.

The experiments were performed at Port Blair, Andaman Islands under field conditions. A portable, battery-operated gadget with two metal plates (size 10×2 cm) as electrodes was used. Freshly caught brittle stars as well as animals kept for a day or two in a bucket of sea water were used for the experiments. The living specimen were put in a dish of sea water and the electrodes placed at the two ends. On passing the current (57–90 mA) at a voltage of 7–8 the animal would try to reach the cathode by turning a somersault and clutch at the cathode with the arms. The turning (bending) of the five arms towards the cathode is unmistakable.

21 experiments were carried out with 10 different animals. Positive result *i.e.* orientation and taxis, was observed in all cases.

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No. of animals	No. of tests with each animal
1	3
1	2
1	2
1	3
1	2
1	5
1	1
1	1
1	1
1	1
Total 10	Total 21

An individual arm, *i.e.* broken from the body of a brittle star is stimulated to make wriggling movements in the same type of electric field but there is no taxis towards either of the electrodes.

Other invertebrate species we studied, namely starfish, Nudibranch, File shell, holothurian, octopus and hermit crab did not show significant orientation or taxis effects in the corresponding experimental paradigm.

The results clearly indicate that while the individual arm can be stimulated by the electric field, it is impelled to reach the cathode under the governing influence of the nervous system in the basal disc. Ward² has recently shown that nematodes respond to a gradient of anions like Cl^- , cations like Na^+ , Mg^{2+} and basic pH, OH^- . In the present case the sea-water, under electric current, might have produced such gradients of Na^+ , Cl^- , Mg^{2+} . These can be excluded by performing further experiments in samples of water containing lesser and lesser amounts of such ions as is indeed proposed in the next expedition. After this it might be possible to obtain a system for studying how the nervous system in the brittle star transforms the sensory input from the disc into its electrophysiological or chemotoxic behaviour.

¹ Report, Nature New Biology **243**, 33 [1973].

² S. Ward, Proc. Nat. Acad. Sci. U.S. **70**, 817 [1973].

