Resumen por el autor, George H. Parker.

## El salto del caracol marino (Strombus gigas Linn.).

Strombus gigas se mueve de un sitio a otro saltando, en vez de deslizarse del modo característico de la mayor parte de los caracoles. El salto tiene lugar mediante la extensión anterior del pié, su fijación al substrato mediante sus extremos anterior y posterior, y una vigorosa contracción muscular, a consecuencia de la cual la concha es arrojada hacia delante, viniendo a situarse a una distancia a veces equivalente a la mitad de la longitud de dicha estructura.

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# THE LEAPING OF THE STROMB (STROMBUS GIGAS LINN.)

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TWO FIGURES

It has long been known that strombs differ from other gastropods in their method of locomotion. These conchs progress over the substrate by sudden leaps and not by the slow gliding movement so characteristic of most snails. Adams ('48, p. 493), in describing the living Strombus, says that "it is, in fact, a most sprightly and energetic animal, and often served to amuse me by its extraordinary leaps and endeavors to escape, planting firmly its powerful narrow operculum against any resisting surface, insinuating it under the edge of its shell, and by a vigorous effort throwing itself forward, carrying its great heavy shell with it, and rolling along in a series of jumps in a most singular and grotesque manner." This description portrays fairly well the movements of this giant conch.

While I was at the Miami Aquarium I had the opportunity of studying the locomotion of Strombus gigas Linn., which, at least in immature specimens, was common in the neighborhood of Miami. I am under obligations to the Miami Aquarium Association for the privilege of carrying out this work at the laboratory of the Aquarium.

Immature but large specimens of Strombus gigas are to be found creeping about on the weed-covered flats in Biscayne Bay, Florida. One large animal whose shell measured 15 cm. long would progress half the length of its shell at a single bound and in doing so it lifted its shell off the substrate at least 4 cm. Ordinarily these snails would progress 4 to 5 cm. at a single leap.

When such specimens were brought into the laboratory and studied closely in a glass aquarium, the details of their locomotion could be readily made out. In this operation the foot and body musculature is the active part. As compared with other mollusks, the foot of Strombus is rather peculiarly shaped. Anteriorly it has the form of a broad, flattened finger which can be applied very closely to the substrate (fig. 1). Behind this comes a second portion which is smooth and rounded from side

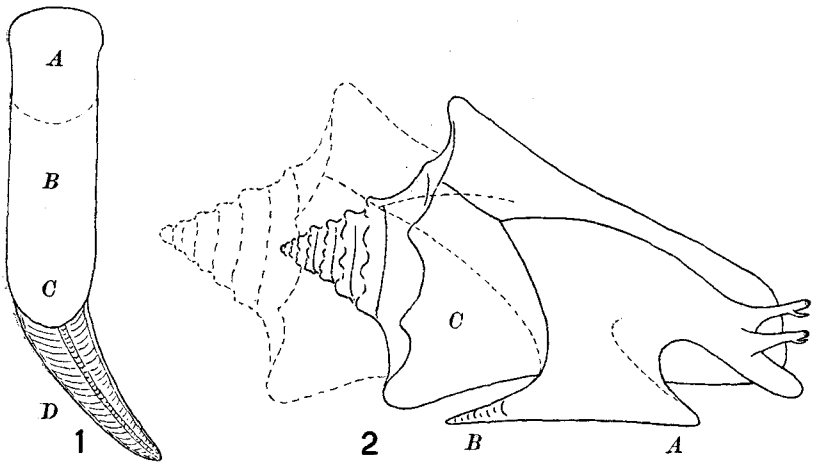


Fig. 1 Ventral view of the foot of Strombus gigas. *A*, anterior flattened end; *B*, middle rounded portion; *C*, posterior or metapodial portion carrying the operculum, *D*.

Fig. 2 Outline of a lateral view of a stromb immediately after a leap. The dotted outline indicates the general position of the parts before the leap, the full outline after the leap. *A*, anterior end of the foot; *B*, operculum; *C*, shell.

to side; this part is seldom in close contact with the surface over which the snail is moving. Finally, in the posterior region the foot tapers off, carrying at its hind end the long, dark-brown, pointed operculum. This metapodial portion is thrust vigorously into the ground at each spring of the animal.

When an active stromb is put on its side in a glass aquarium, it soon begins to protrude its foot and eye-stalks. At the least movement on the part of the observer it is likely to withdraw into its shell and with a suddenness quite surprising for a snail.

As compared with other gastropods, Strombus is remarkably alert and active, and in the quickness of its movements it reminds one more of a vertebrate than of a mollusk. Its eyes, too, are highly developed and are moved and directed in such a way as to give it the appearance of no small degree of intelligence.

After the stromb has protruded its foot a few times in a tentative way, it will gradually extend this organ till it reaches the substrate. The anterior finger-like end of the foot is then pressed vigorously against the ground, the middle section of the foot arching over to the metapodium, which together with the operculum is moved in under the shell and thrust vigorously backward. At the same moment the general musculature of the foot and of the body contracts in such a way as to raise the shell over the support given by the foot and throw the shell vigorously forward, as though the animal as a whole made a spring (fig. 2). After such a leap, which, as already stated, may be half the length of the shell, the animal usually withdraws a little, then thrusts out the foot far forward, regains a hold on the substrate, and leaps again. Thus step by step it progresses at a rate quite surprising for a mollusk.

The principle upon which the locomotion of Strombus rests appears to be the forward extension of the body and especially the foot, the attachment of the latter by its two ends to the substrate, and the lifting and throwing of the shell forward to the advanced location occupied by the foot. In preparing for a leap the anterior finger-like end of the foot is closely applied to the substrate and appears to attach itself by suction. Such, however, is not the case. When a stromb is about to spring, its shell may be laid hold of by the experimenter without interrupting the action of the animal, and under such circumstances the anterior end of the foot may be freely lifted from the substrate, showing that it is not exerting suction, for this end leaves a mud, wood, or glass surface at once and without the least sign of being especially attached. The posterior end of the foot, which at the moment of the spring is drawn well under the shell, is fixed by having the point of the operculum energetically driven into the substrate. So vigorous is this backward thrust of the operculum

that divers who are collecting strombs are said often to be cut on the breast by these conchs when, with an armful held tightly to the body, the diver is swimming to the surface. Strombus, then, attaches its foot by pressing the two ends of that organ vigorously against the substrate and by relying more or less upon the weight of the shell to hold the foot in place while the shell itself is being thrown forward.

The weight of the shell is considerable and no one can watch the locomotion of Strombus without being impressed by its strength. In an immature specimen whose living body weighed 49 grams the shell weighed 173 grams, making a total of 222 grams, yet the relatively small amount of musculature in this animal was sufficient to enable it to make considerable leaps even in the air. In the sea-water the shell is, of course, relatively lighter, and in consequence the animal can leap rather farther than in air. The shell that weighed 173 grams in the air, weighed only 105 grams in sea-water, the whole animal, shell and soft parts, weighing 110 grams in water as against 222 grams in air. Thus in its more usual habitat, in sea-water, the stromb has less work to do in moving its shell than it has in air, but such work even when the animal is in the water is by no means inconsiderable.

Thus the locomotion of Strombus is accomplished by means radically different from those used by other gastropods, for the muscular action involved in the leap of this snail is in no obvious way related to the muscular waves that pass over the foot of most moving gastropods and is absolutely distinct from ciliary activity which, contrary to my former view (Parker, '11, p. 157), has been recently shown by Copeland ('19) to be the means of locomotion in several gastropods.

## SUMMARY

Pedal locomotion in gastropods is accomplished either by gliding (an operation dependent upon muscular waves passing over the foot or by ciliary action) or, in Strombus, by leaping, an act that involves the forward extension of the foot, its fixation in the substrate by its anterior and posterior ends, and a

vigorous muscular contraction whereby the animal's shell is thrown well forward, to the extent even of half the length of that structure.

## LITERATURE CITED

ADAMS, A. 1848 Notes from a journal of research into the natural history of the countries visited during the voyage of H. M. S. Samarang. In E. Belcher: Narrative of the Voyage of H. M. S. Samarang during the years 1843–46, vol. 2, pp. 223–532.

COPELAND, M. 1919 Locomotion in two species of the gastropod genus Alectrion with observations on the behavior of pedal cilia. Biol. Bull., vol. 37, pp. 126–138.

PARKER, G. H. 1911 The mechanism of locomotion in gastropods. Jour. Morph., vol. 22, pp. 155–170.