chromaffin cells. This is not surprising, since these cells have a common embryological origin. The fact that hexamethonium blocks CA release by DMPP, but not by K^+, suggests that the ganglion cells are involved in a release mechanism, but it does not necessarily imply that a sympathetic reflex pathway for initiating CA release from chromaffin cells exists in the dogfish. This research was supported by a grant from the American Heart Association–New Jersey Affiliate, Central New Jersey Chapter.

15 THE FEEDING AND BURROWING MECHANISM IN THE SAND DOLLAR ECHINARACHNIUS PARMA

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Microarchitectural and experimental studies of the echinoid *Echinarachnius parma* show the importance of spines and podia in the feeding and burrowing process. Scanning electron photographs reveal five structurally distinct spines. These include club, miliary, marginal, locomotive and geniculate spines. Aboral spines (club and miliary) form a two-tiered canopy which acts like a sieve to sort and dismember particles. Potential food matter that is passed posteriorly by these spines (and ambulacral podia) can fall between the spine canopy where they are swept away by ciliary currents flowing continuously past the spine bases towards the test martins. Pores at the distal ends of miliary spines and from small domes on the animal's epidermis are the sites of mucus secretion. Food is loosely aggregated by the mucus secretions to facilitate handling of microscopic particles in the ciliary currents. At the food grooves, aggregated food particles are passed towards the mouth by geniculate spines and podia on and within the groove. Aboral ambulacral tube-feet form five complicated radial bands extending from the petalloid region to the marginal fringe. They actively gather and draw particles to the test edge and then bring them aborally. They assist the aboral spines in moving particles posteriorly over the test.

Sand dollars are found mostly in 2–3 ϕ sand grains. When placed in artifically sorted sand fractions, the sand dollars tolerated a wider range of substrata than that reported for other sand dollar species. It is the podia that are chiefly responsible for the wider geographic distribution of this echinoid. When marginal spines are surgically removed the animals continue to burrow in all sediment grades suggesting that the podia are chiefly involved in the burrowing process.

E. parma occurs intertidally and to depths of about 1600 meters. Distribution and sediment type in the intertidal and in the shallow subtidal range was studied at 3 sites in Frenchmen's Bay, Maine. Within these two zones distribution was influenced by sand grain size; lower densities of *E. parma* were found in the silty–mud bottom of the subtidal zone while greater numbers were reported for the medium–fine sand regions (intertidally).

E. parma could right itself in artificial and control sediments using a combination of spine and podia movements. The righting reaction is completed in anywhere from 10 minutes to 3 hours. A thick layer of sediment is required under the animal to falicitate righting. Sand dollars can burrow in 8 – 15 minutes in the host sediment. Burrowing is achieved by the action of the ventral locomotive spines and the movement of particles over the test by the aboral spines and podia.

Burrowing and feeding are accomplished by the echinoid simultaneously through spine and podia manipulation. This works was funded by the Sonderforschungsbereich 53 ("Paläkologie"), Tübingen, whose financial support by the Deutsche Forschungsgemeinschaft is acknowledged. I thank Ms. Maria Durig for assistance in the field and in the laboratory.