Brackish water forms might be transported in bilge water or ballast tanks of ships. The American blue crab *Callinectes sapidus* was probably transported to Israel in ballast tanks[9]. Because ships passing through the Panama Canal must maintain a minimum draft, empty ships required to take on additional salt water ballast probably transport microscopic marine organisms from ocean to ocean[10]. Several ports in the Chesapeake Bay—for example, Baltimore, Norfolk and Newport News—are either large commercial ports, sites of naval bases or both. West Point, Virginia, adjacent to station *P*–30, is visited by ocean-going freighters loading paper products. The controlling depth of the river channel to this point is less than 6·5 m, so bilges and ballast tanks are pumped to enable more cargo to be loaded. This may be the way in which brackish water organisms from similar regions elsewhere are being introduced.

Three specimens of *M. inexpectata* from the Pamunkey River, Virginia, have been deposited in the National Museum of Natural Sciences, Ottawa, Canada. One of us (D. R. C.) thanks the National Research Council of Canada for support through a postdoctorate fellowship.

DALE R. CALDER

National Museum of Natural Sciences,
Ottawa 4, Ontario, Canada.

VICTOR G. BURRELL, jun.

Virginia Institute of Marine Science,
Gloucester Point, Virginia 23062, USA.

Received March 31, 1969.

1 Ostroumov, A., *Bull. Acad. Sci. St Petersburg*, **5**, 389 (1896).
2 Borcea, I., *Ann. Sci. Univ. Jassy*, **15**, 286 (1928).
3 Calder, D. R., and Burrell, jun., V. G., *Amer. Midland Natur.*, **78**, 540 (1967).
4 Thiel, M. E., *Zool. Anz.*, **111**, 161 (1935).
5 Mayer, A. G., *Carnegie Inst. Washington*, Pub. 109, 231 (1910).
6 Kramp, P. L., *Rec. Indian Mus.*, **53**, 339 (1958).
7 Saraber, J. G. A. M., *Beaufortia*, **9**, 117 (1962).
8 Rees, W. J., *Bull. British Mus. (Nat. Hist.) Zool.*, **4**, 455 (1957).
9 Holthuis, L. B., and Gottlieb, E., *Bull. Res. Coun. Israel*, **5B**, 154 (1955).
10 Chesher, R. H., *Limnol. Oceanog.*, **13**, 387 (1968).

Induced Bactericidal Response in a Sipunculid Worm

THERE is increasing evidence that inducible immunity may be demonstrated in several invertebrate species using appropriate methods. The bactericidal system[1,2] seems to occupy an important position in the phylogenetic emergence of inducible immunity. Such responses and others have been reviewed recently[2,3].

Bang[4] has reported an inducible lysin in the coelomic fluid of a sipunculid worm. This substance caused lysis of a parasitic marine ciliate and could be induced by the injection of foreign substances, including crab blood with or without the ciliate, and by injecting large numbers of bacteria.

The preliminary experiments described here demonstrate an inducible bactericidal system in another sipunculid species, *Dendrostomum zostericolum* Chamberlain, a worm used for other experiments on comparative immunology[5].

Animals were collected, maintained and bled as previously described[5]. The bacterium used for immunization and assay was strain EMB-1, a Gram-negative bacillus isolated from the normal gut flora of a spiny lobster[1]. Antigen preparation and bactericidal assay procedure[6] were identical to those used for lobsters[1]. Animals received a primary intracoelomic injection of $2+10^8$ formalin-killed bacteria (0·1 ml.). Sixty days later the survivors received a secondary injection of 4×10^8 bacteria.

As Table 1 shows, coelomic fluids from fourteen non-immunized worms had no bactericidal activity After a primary injection of antigen, most animals were negative from days 1 to 7 although slight responses were observed in two cases. By the sixtieth day, three of five animals had developed significant titres without further immunization. On days 62 and 67, after an additional challenge with antigen on day 60, bactericidal activity was considerably enhanced. Another group of five non-immunized worms bled at this time were negative. This verified that the increase in coelomic fluid bactericidin was not a consequence of non-specific seasonal variation.

Table 1. BACTERICIDAL TITRES OF CENTRIFUGED COELOMIC FLUID

No. of antigen injections	Day	No. of animals in group	Individual titres
None	0	14	0
One	1	9	0
		Pool*	10
	2	8	0
	4	Pool*	0
	7	4	0
		1	10
	60	5	0, 0, 40, 80, 160
Two	62	5	0, 160, 160, 320, 320
	67	6	10, 80, 640, 640, 640, 640

* Pool of coelomic fluids from five worms.

It is interesting that there was no significant response during the first week after primary immunization; thus the sipunculid seems to differ from other invertebrate systems[1–4] which often increase their activity significantly during the first day or two after immunization.

The accelerated secondary response of this sipunculid is somewhat reminiscent of the antibody response in mammals. Obviously studies of specificity will be required to assess the significance of this bactericidal system in the evolution of immunity. Such studies are in progress and will be reported elsewhere.

We thank Miss Susan Sawyer and Mrs Sheelagh Fuzessery for technical assistance. This work was supported in part by grants from the US Public Health Service and by a contract from the US Office of Naval Research, Biology Branch.

E. EDWARD EVANS
PETER F. WEINHEIMER
RONALD T. ACTON

Department of Microbiology,
University of Alabama Medical Center,
Birmingham, Alabama.

JOHN E. CUSHING

Department of Biological Sciences,
University of California at
Santa Barbara.

Received February 27; revised March 25, 1969.

1 Evans, E. E., Painter, B., Evans, M. L., Weinheimer, P., and Acton, R. T., *Proc. Soc. Exp. Biol.*, **128**, 394 (1968).
2 Bang, F. B., *Fed. Proc.*, **26**, 1680 (1967).
3 Chadwick, J. S., *Fed. Proc.*, **26**, 1675 (1967).
4 Bang, F. B., *J. Immunol.*, **96**, 960 (1966).
5 Cushing, J. E., McNeely, J. L., and Tripp, M. R., *J. Invert. Pathol.* (in the press).
6 Schwab, G. E., and Reeves, P. R., *J. Bact.*, **91**, 106 (1966).

Discrimination of Auditory Sequences by Monkeys

WE have been successful in an attempt to train rhesus monkeys to discriminate among the four permutations of a two element auditory sequence in which each of the elements can be either a burst of tone or a burst of noise. This is an unusually complex task and as such should prove sensitive to manipulations of the central nervous system. Indeed, in experiments now under way, severe deficits have been found in the discrimination performance of monkeys following unilateral ablations of the cortex of the superior temporal gyrus (auditory "association" cortex).