ACUTE EFFECTS OF CERTAIN HEAVY METALS ON MYTILUS EDULUS

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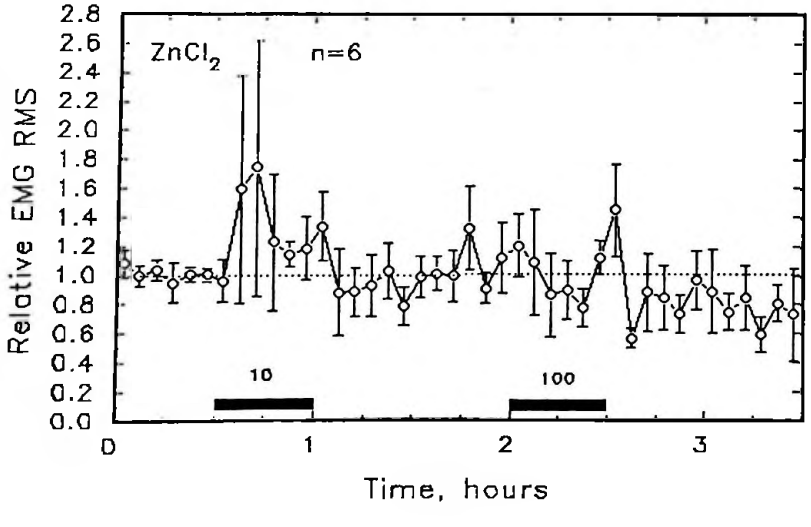
We (Kidder & McCoy, Bull. MDIBL, 34:102, 1995) have shown that the electromyogram (EMG) is a rapid and sensitive indicator of acute mercury toxicity in the blue mussel. The present study extends these observations to additional heavy metal cations Cd^{2+}, Zn^{2+}, Ni^{2+} and Cr^{3+}. The methods were those previously employed. Briefly, two electrodes (Ag|AgCl, 0.3 mm thick) were inserted between the valves of a 1-2 g mussel secured with cyanoacrylate glue in 25 ml of artificial sea water (ASW) at 12°C. The amplified (gain 2000, 3 db bandwidth 0.3 - 30 Hz) EMG is sampled at 50 Hz, recording the absolute maximum value obtained during each second. The chloride of each cation was dissolved as a 10 mM solution in ASW, and added to the bath to obtain a final concentration of 10 or 100 µM. An attempt to investigate Cu^{2+} was abandoned due to the formation of a precipitate in the stock solution, probably $CuCO_3 \cdot Cu(OH)_2$ (malachite).

Each experiment started with a 30 minutes control period in ASW. The test solution was then added at 10 µM for 30 minutes, and removed by washing (2 changes) with ASW. After an hour in ASW, the test solution was added at 100 µM for 30 minutes, followed by an additional hour of washout. When recording was terminated, the mussel was placed in natural sea water and monitored for at least one week for delayed toxic effects. The 12,600 data points for each experiment were averaged into 5 minute periods, normalized to the average value during the first control period, and these averages (± SE) were collected and graphed as shown in the figure. The number of mussels was: Cd^{2+}, 8; Zn^{2+}, 6; Ni^{2+}, 7; and Cr^{3+}, 6.



Inspection of the figure shows that while there is a suggestion of a response to $ZnCl_2$, these responses are not statistically significant. A similar lack of response was noted to each of the other cations tested; in no series was statistical significance (5% probability) reached by more than one point in 20. This is in sharp contrast to the previously reported action of mercury, which was significant at 1 µM. Likewise, the longevity of these mussels was not affected by these brief heavy metal exposures, since there were no deaths observed during the week of post-experimental observation.

We must conclude that whatever the chronic effects of these ions may be, there is no demonstrable effect of short term exposure to these metals on either the EMG or the one-week survival.

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