VOLUME REGULATION AND ACCUMULATION OF COPPER IN
WHOLE AND DECAPITATED Hediste (Nereis) diversicolor UNDER
VARYING SALINITY – COPPER REGIMES

P. T. E. OZOH*

Institute of Estuarine and Coastal Studies, School of Biological Sciences, University of Hull,
HU6 7RX, Great Britain

(Received November 10, 1988; revised September 22, 1989)

Abstract. Volume regulation (weight change) correlates with varying salinity – Cu regimes in whole
worms. Decapitation removed this correlation. Regulation of volume and Cu ion uptake are not coupled.
Whole worms when exposed to Cu levels of 0.15 to 0.45 mg L⁻¹ accumulated Cu which ranged from
48.9 to 145 µg g⁻¹ dry weight within four days. Decapitated worms exposed to similar doses of Cu
accumulated from 77.3 to 405.4 µg g⁻¹ dry weight Cu within three days. Volume regulation appears
to be both passive and active processes mediated by the nervous system.

1. Introduction

Body volume in soft-bodied worms is generally equated with the amount of water
in the animal (Oglesby, 1975). Volume regulation is essential for animals that inhabit
estuarine environments. Hediste diversicolor is euryplastic in that it has to regulate
its osmotic and ionic concentrations. It is an osmoregulator at low salinities and
an osmo-conformer at high salinities (Jorgensen and Dales, 1954; Hohendorf, 1963;
is essentially assessed by the extent of the restoration of the original weight following
a salinity transfer (Oglesby, 1981).

Copper is known to interfere with volume regulation in both plants and animals
(Kregenow, 1971; Riisgard, 1979). The mechanism of volume regulation includes:
- The reduction of permeability of the body wall to water and the consequent
reduction of the rate of water movement. The excess water is expelled through
the urine. Hediste diversicolor secretes hypotonic urine (Smith, 1970). There are
changes in the numbers of extracellular osmolytes and a corresponding reduction
in the osmotic gradient (Oglesby, 1981). The major route is the loss of solutes
to the medium across the body wall through urine (Pierce, 1982).

Decerebration has no effect on volume regulation of the worm (De Leersnyder
and Durchon, 1969). However, decerebration removed extra-cellular volume re-
gulation in the nemertini, Procephalothrix spiralis and the oligochaete Clitellio
arenarius. Decerebration in Clitellio arenarius resulted in reduced capacity to maintain

* Current address: Biology Programme, Abubakar Tafawa Balewa University, P.M.B. 0248, Bauchi,
Nigeria.

TABLE I
Factorial analysis of % weight change in adult *Nereis diversicolor* exposed to 7.6, 15.25, 22.88, and 30.5% seawater singly and in combinations with 0, 150, 300 and 450 ppb Cu for 4 days

<table>
<thead>
<tr>
<th>Salinity (%o)</th>
<th>Cu concentrations</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0</td>
</tr>
<tr>
<td>7.6</td>
<td>+41</td>
</tr>
<tr>
<td></td>
<td>+24</td>
</tr>
<tr>
<td></td>
<td>+11</td>
</tr>
<tr>
<td>15.25</td>
<td>+2</td>
</tr>
<tr>
<td></td>
<td>-2</td>
</tr>
<tr>
<td></td>
<td>-1</td>
</tr>
<tr>
<td>Mean±SD</td>
<td>-1.75±2.17</td>
</tr>
<tr>
<td>22.88</td>
<td>-6</td>
</tr>
<tr>
<td></td>
<td>-15</td>
</tr>
<tr>
<td></td>
<td>-17</td>
</tr>
<tr>
<td>Mean±SD</td>
<td>-14.25±4.97</td>
</tr>
<tr>
<td>30.5</td>
<td>-17</td>
</tr>
<tr>
<td></td>
<td>-18</td>
</tr>
<tr>
<td>Mean±SD</td>
<td>-20±3.08</td>
</tr>
</tbody>
</table>

Total sum      | -16.25             | -16                | -21.25             | -3.75              |
Means           | -4.06              | -4                 | -5.31              | -0.94              |

a hyperosmotic gradient across the body wall (Ferraris, 1984).

*Hediste diversicolor* shows marked resistance to low salinities in the field or under the laboratory conditions or even in fresh water for indefinitely long periods (Bogucki, 1954; Smith, 1955).

The purpose of this research is to determine the relationship between volume regulation and accumulation of Cu in whole and decapitated *Hediste diversicolor* under varying salinities.

### 2. Materials and Methods

**Worm husbandry**

Mature ragworms *Hediste* (*Nereis*) *diversicolor* were collected from the Humber