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The haemocytes of the cockle *Cerastoderma edule*: types, immune abilities and influence of environment and pathological conditions on the haemocyte counts.

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A study was performed to get knowledge on the cockle *Cerastoderma edule* immune system, with emphasis on the main effector cells, the haemocytes. The shellfish bed of Noia (ria of Muros-Noia, Galicia, NW Spain) was sampled monthly for two years; the haemolymph of the cockles was analysed to estimate the total haemocyte count (THC) and the differential haemocyte count (DHC). Furthermore, health condition of those cockles was analysed with histology and the influence of the most serious pathological conditions on THC and DHC was assessed. The protistan *Marteilia cochillia* is highly pathogenic for cockles; given that marteiliosis outbreaks have never been detected in the ria of Muros-Noia, cockles from Noia were transplanted in Lombos do Ulla (ria of Arousa), a bed heavily affected by marteiliosis, and similar sampling and analyses were performed until all translocated cockles had died, after 8 months.
The THC ranged from 1.9 x 10^5 to 9.7 x 10^6 cells/ml, with the 95% CI from 1.77 to 1.95 x 10^6 cells/ml. It was correlated with seawater temperature, thus it showed a seasonal pattern of variation, with minima in winter–early spring and maxima in summer-early autumn. Six haemocyte types were identified: acidophilic, basophilic and mixed granulocytes, large hyalinocytes, haemocytes with a large vacuole (HLV), and haemoblasts. Their 95% CI of relative abundance was 40.7 – 44.2%, 13.0 – 14.6%, 2.0 – 3.0%, 27.6 – 29.7%, 9.5 – 10.5% and 2.0 – 2.4%, respectively. The dominant type, acidophilic granulocyte, showed relative abundance maxima in autumn and minima in summer. Advanced infection with *M. cochillia* was associated with decrease of the THC, marked decrease of the relative abundance of acidophilic and basophilic granulocytes and marked increase of haemoblasts. Infestation with trematode sporocysts and inflammatory reactions were also associated with changes in DHC. Functional differences among haemocyte types were assessed using flow cytometry. Granulocytes showed the highest ability to phagocytose bacteria, while the hyalinocytes and the haemoblast showed very low ability and the HLV showed intermediate ability. Every type produced reactive oxygen species, without significant differences among types. Lysosomal and non-specific esterase contents were higher in granulocytes and lower in haemoblasts.