Molecular mechanisms underlying midgut buffering, counter fluxes, and nutrient absorption in *Tenebrio molitor*

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Physiological data showed that *T. molitor* midgut is buffered at pH 5.6 at the two anterior thirds and at 7.9 at the posterior third. Furthermore, water is absorbed and secreted at the anterior and posterior midgut, respectively. To look for the molecular mechanisms underlying these phenomena and nutrient absorption as well, a transcriptome approach was used. For this, 15 types of transporters were chosen from the midgut transcriptome obtained by pyrosequencing (Roche 454). After annotation with the aid of databanks and manual curation, the sequences were analyzed with bioinformatics tools. The relative number of reads indicated the expression level of each gene in the midgut. The sequences expressed only in the midgut and in midgut plus Malpighian tubules, as revealed by RT-PCR, were taken into account. The number of reads, obtained from the transcriptome, corresponding to each sequence was divided by the number of midgut sections expressing the sequence to represent its transcription level there. The data showed that glucose and amino acid uniporters and symporters are expressed along the whole midgut. In the anterior midgut are found transporters for NH_3 and NH_4^+ that with a chloride channel may be responsible for lumen buffering at pH 5.6. At the posterior midgut, a bicarbonate/chloride exchanger, associated with a carbonic anhydrase are arguably responsible for alkalinizing the lumen. Also at the posterior midgut, there is an aquaporin and a K^+/Cl^-/water transporter that with the glucose transporters which co-transport water may drive the midgut counter flux. Transporters that complement the action of those described were also found.

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