Arginine and lysine transporters are essential for Trypanosoma brucei

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For Trypanosoma brucei arginine and lysine are essential amino acids and therefore have to be imported from the host. Heterologous expression in Saccharomyces cerevisiae mutants identified cationic amino acid transporters among members of the T. brucei AAAP (amino acid/auxin permease) family. TbAAT5-3 showed high affinity arginine uptake (Km 3.6 ś 0.4 μM) and high selectivity for L-arginine. L-arginine transport was reduced by a 10-times excess of L-arginine, homo-arginine, canavanine or arginine-β-naphthylamide, while lysine was inhibitory only at 100-times excess, and histidine or ornithine did not reduce arginine uptake rates significantly. TbAAT16-1 is a high affinity (Km 4.3 ś 0.5 μM) and highly selective L-lysine transporter and of the compounds tested, only L-lysine and thialysine were competing for L-lysine uptake. TbAAT5-3 and TbAAT16-1 are expressed in both procyclic and bloodstream form T. brucei and cMyc-tagged proteins indicate localization at the plasma membrane. RNAi-mediated down-regulation of TbAAT5 and TbAAT16 in bloodstream form trypanosomes resulted in growth arrest, demonstrating that TbAAT5-mediated arginine and TbAAT16-mediated lysine transport are essential for T. brucei. Growth of induced RNAi lines could partially be rescued by supplementing a surplus of arginine or lysine, respectively, while addition of both amino acids was less efficient. Single and double RNAi lines indicate that additional low affinity uptake systems for arginine and lysine are present in T. brucei.
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