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Bioinformatic Analysis of the Sodium Hydrogen Exchanger Protein in Plasmodium yoelii

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Abstract

Since its discovery over 100 years ago, malaria has been the most important parasitic disease in the world. Malaria affects about 300 to 500 million people every year; killing 5 million people every year. The most virulent causative agent in humans is *Plasmodium falciparum*; it is an important member of the phylum Apicomplexa, which also includes *Toxoplasma gondii*. These organisms contain specialized, unique structures, including rhoptry organelles. In *Plasmodium* and *Toxoplasma gondii*, they assist invasion into the host cell. Analyses have been performed on proteins located in rhoptries in *Toxoplasma* and *Plasmodium*. Among the proteins that have been analyzed, the sodium hydrogen exchanger protein has been found in these parasites, but not much is known about its characterization and function in *Plasmodium*. This protein was found to be localized in the rhoptries in *Toxoplasma gondii* in an experiment performed by Karasov et. al. The protein homologue in *T. gondii*, TgNHE2, has become the first intracellular sodium hydrogen exchanger (NHE) characterized in a protozoan parasite. Proteome analysis show that there are four NHE2 in *T. gondii*, but only two are known in the parasite. Comparative analyses including protein sequence alignments were performed showing the relationship of this protein across several species. This protein is found across several species of Apicomplexa and vary widely in size and weight. The four proteins that were analyzed were two strains in *P. falciparum* (PFIT_1302700 and PF3D7_1303500), *P. yoelii* (PY02931), and *T. gondii* (TGME49_105180). The analysis shows regions of similarity in the location of the transmembrane domains amongst PFIT, PF3D7, and PY02931. These species also contain regions of asparagine-, aspartic acid-, and lysine-rich regions that overlap. This protein is also present in mammals, in the mitochondria. It is primarily characterized as an intracellular protein in mammals although it is found in the plasma membrane of certain cells. The characterization of this protein in *T. gondii* will provide a groundwork in better understanding its function in *Plasmodium*, specifically *P. falciparum*.

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