The Effect of Copper on Apicomplexan Parasites

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Malaria is a disease that kills over one million people per year. It is caused by the parasite Plasmodium falciparum. Both Plasmodium falciparum and Toxoplasma gondii are Apicomplexan parasites which means that a finding in one could lead to a potential discovery in the other. T. gondii is used as a model parasite since it is easier and safer to work with than P. falciparum. The problem addressed in this experiment was that drug resistance is becoming an increasing issue in treatments for malaria. There was also very little known about the nature of the environment that Apicomplexa encounter in their hosts. The goal was to use copper, a vulnerable pathway in Apicomplexa, to learn more about the environment that parasites encounter in their hosts. It was hypothesized that parasites like P. falciparum and T. gondii have to regulate copper homeostasis and use parasite import and export pathways to transport copper. T. gondii parasites were inoculated with various copper chelators to determine the effect that copper has on the parasites' ability to replicate. It was found that one chelator in particular, neocuproine, was able to inhibit parasite replication, showing that copper is in fact necessary for Toxoplasma to replicate. Since copper is a vulnerable pathway in T. gondii parasites, it can be used to determine which genes the parasite turns on and off in the presence of copper. This will lead to further understanding of the parasite's internal environment which can then be used to control diseases like malaria. In the long-run, this could lead to a possible cure for malaria.