

原虫病に対する治療法を開発するための
プラズマ技術の可能性について

Plasma as a potential tool for the development of therapeutic regimens against
protozoan diseases

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Protozoa are single-cell eukaryotic organisms, some of which can infect humans and animals, causing intractable protozoan diseases. The most common protozoan diseases, such as malaria, trypanosomiasis, leishmaniasis, and cryptosporidiosis, are widespread throughout the world. However, to date, no effective and safe drug has been developed for any of these protozoan diseases.

The National Research Center for Protozoan Diseases (NRCPD) of the Obihiro University of Agriculture and Veterinary Medicine conducts research and academic activities related to protozoan diseases. The World Organization for Animal Health (OIE) has accredited the NRCPD as a collaborating center that specializes in animal protozoan diseases. Scientists affiliated with NRCPD, including the speaker, carry out research to develop novel methods to control protozoan diseases. The speaker has been participating in the project "Plasma Medicine" led by Professor Hori since 2013 and researching the development of innovative treatment methods using plasma technology. In this presentation, we will discuss "The inhibitory effect of plasma irradiation on the growth of *Trypanosoma*", which was investigated under this collaborative project.

Trypanosoma brucei (Tb) is a protozoan parasitizing human blood, which causes a lethal disease called sleeping sickness. Previous studies have suggested that Tb is highly sensitive to oxidative stress. In the present study, to investigate whether plasma-induced oxidative stress has any effect on the growth of protozoa, we irradiated the culture medium using a low-temperature plasma (LTP) apparatus under atmospheric pressure and used that to cultivate Tb *in vitro*. We found that the LTP-treated medium significantly inhibited Tb growth. In particular, the parasites lost their morphological homeostasis and had swollen

mitochondria and endoplasmic reticulum. These findings show that LTP-induced oxidative stress can kill Tb. We have published an article summarizing our results in a scientific journal (*Japanese Journal of Applied Physics*, vol. 60, 2021).

Plasma has the potential to be used as topical therapy, as the oxidative stress induced by this technology may kill protozoa in external lesions. Plasma may also be a useful tool for sterilizing blood products and surfaces contaminated with protozoa. Furthermore, the elucidation of the mechanism by which oxidative stress kills protozoa may lead to the discovery of previously unknown therapeutic targets. The classical approach, which relies on existing knowledge and technology, has limitations. To generate breakthroughs, collaborative interdisciplinary research is vital. Thus, I look forward to continuing this collaborative research focusing on the development of plasma therapy.

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