Employing Electromagnetics to Treat Malaria

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HEALTH

Malaria kills one million victims each year in tropical countries, most of them children. While drugs exist to combat the disease, the malaria parasite develops resistance to these drugs. An effort is now underway to harness a noninvasive electromagnetic-based treatment in the fight against this disease.

The electromagnetic field used in this innovative treatment is the same that is produced in lightning, is responsible for the Northern Lights, and also causes compasses to point in a north-south orientation. It is also found in high-frequency radio waves that bounce from one part of the world to another via antennas to phone networks, TV pictures, and the Internet.

Understanding electromagnetic fields allows scientists to develop smaller and more powerful antennas useful in emergency communication devices and portable radar, or those made flexible with new alloy materials and applied to implantable medical devices. Electromagnetics also has a direct application at the biological level—as in the treatment of parasitic diseases like malaria.

Malaria is caused by a parasite that is transmitted from one human to another by the bite of mosquitoes. In humans, the malaria parasite travels to the liver, where it invades a red blood cell. There, it consumes the cell's hemoglobin and produces hemozoin, an iron crystal, as a waste product. It then divides into many more daughter parasites that invade other red blood cells. Researchers now understand that the iron crystal remains with the parasite within the host cell. By applying a suitably designed magnetic field, the iron crystals can be made to agitate, rotate, and churn, destroying the parasite before it can multiply further.

Paul Diament is the lead inventor of the magnetic resonance method of treating the malaria parasite, and is working with biologists at the Columbia Medical Center in pursuing this application. He is an eminent researcher in electromagnetics and wave propagation. His teaching and research focus includes microwaves, antennas, optics, radiation statistics, plasmas, wave interactions, relativistic electron beams, and transient electromagnetic phenomena. Along with biomedical applications, his research interests include attempts to make mutual coupling among antennas beneficial rather than detrimental, potentially achieving smaller antenna size.

Diament is a member of the Institute of Electrical and Electronics Engineers, the American Physical Society, the Optical Society of America, Tau Beta Pi, Eta Kappa Nu, and Sigma Xi.

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