Central nervous system (CNS) diseases, such as brain cancer, epilepsy, Alzheimer’s and multiple sclerosis, represent one of the largest areas of medical need in the world today as reported in the Journal of the American Medical Association. Treating and managing CNS diseases through therapeutic drug delivery is sometimes invasive and painful. It’s made even more difficult by the blood-brain barrier (BBB), the capillary endothelial cells that line the cerebral microvessels and surrounding perivascular elements that protect the brain from blood-borne chemicals and toxins.

Because nanotechnology plays a significant role in the development of brain-specific drug delivery, including permeating the BBB, its continued development is an important weapon in the arsenal against CNS diseases.

With a major interdisciplinary research interest in the development of nanoparticle-based biomedical applications such as drug delivery, Hu Yang, Ph.D., Qimonda Associate Professor of Biomedical Engineering at Virginia Commonwealth University, is working with his collaborators, graduate students, and postdoctoral scholars to develop an alternative to painful and invasive treatments for CNS diseases.

“The goal is very clear,” Yang said. “To make something useful to treat diseases and to improve the quality of human life.” Pharmaceuticals are coupled to nanoparticles and then delivered into the brain, for example. “Encapsulating as much as possible so that the drug can be slowly released is a means to reduce the number of invasive administrations,” he explains. “Drug delivery takes place over time for the best possible outcome. The initial goal is to deliver higher doses, then minimize dosing frequencies through slow release for chronic disease treatment.”

A National Science Foundation (NSF) Faculty Early Career Development (CAREER) Award recently recognized Yang’s research for developing a transformative hypoxia-targeted delivery system to enhance penetration of anticancer drugs to solid tumors including brain cancer. The CAREER Award is the NSF’s most prestigious award and recognizes and supports outstanding junior faculty members who successfully and consistently integrate research and education.

This new delivery system may eventually complement surgery, chemotherapy or radiotherapy and help to eradicate metastasis, improve survival rate and increase the quality of life for cancer patients.

Magnetic iron oxide nanoparticles coupled to tumor-specific antibody for imaging and targeted therapy of brain tumors. Reproduced with permission.