

**Proceedings of SPIE: Optics and Biophotonics in
Low-Resource Settings XII, San Francisco, California, United States, 17–18
January 2026**

Quantum biosensing illuminates infected cells for timely disease diagnosis

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Photonics has a profound impact on daily life in numerous ways, from communication and entertainment to manufacturing and healthcare. In Africa, photonics applications in point-of-care diagnostics, the diagnosis of substandard drugs, and treatments for cancer, diabetic wounds, and other ailments promise significant improvements in healthcare and the quality of human life. Of particular interest is that quantum technologies can be used for new forms of sensing, imaging, and computing, with potential applications in diagnostics and drug discovery. The amalgamation of biological molecules, such as deoxyribonucleic acid (DNA), proteins, or enzymes, with quantum sensors (QS), which illuminate changes in light emissions during light-matter interactions, introduces a game-changer in rapid, sensitive, and specific disease diagnostics. Here, we theoretically demonstrate how the integration of quantum phenomena into sensing mechanisms could enable the detection of minute variations in intracellular factors, such as refractive index, cell morphology, and pH shifts in infected versus uninfected cells. We propose a conceptually designed quantum biosensing experiment that can be conducted using nitrogen vacancy (NV) centres.