The application of whole-cell biosensors for the detection of metals and dopamine

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A quantitative method for the detection of analytes is important for the medical and environmental applications. The use of engineered microorganisms in the detection of environmental pollutants has attracted considerable attention, due to the low-cost, high specificity and robustness of this approach. We developed various whole-cell biosensors for the detection of heavy metals, dopamine, tyrosine, and phenylalanine.[1-4] Using synthetic biology technique, we developed a dual signal sensor for simultaneous quantification of phenylacetic acid and phenylethylamine via bacterial catabolic regulons.[5] To facilitate simple, inexpensive, and portable setup with minimal or no instrumentation, we developed a smartphone-based diagnostic system using the built-in camera of a smartphone in conjunction with a green laser pointer and optical filters.[6] In addition, a protein-based sensor was developed to further characterize the structural details of molecular interactions. An intramolecular fluorescence resonance energy transfer (FRET)-based biosensor presents a ratiometric change in the fluorescence of two proteins (donor and acceptor).[7] CupR of Cupriavidus metallidurans was used to design a silver sensor based on the strong affinity of metal ions for metal binding residues (ser77, cys112, and cys120). Our work highlights the potential of employing engineered microbial strains as robust analytical tools.

References

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Biography

Dr. Yi-Chun Yeh received her Ph.D. degree in chemistry from Stanford University in 2012. After graduation, she worked as a postdoctoral research scientist at the Lawrence Berkeley National Lab. She joined as an Assistant Professor in the chemistry department at National Taiwan Normal University in 2014, and currently is working as a Full Professor. Her research interests focus on the development of enzyme-based, whole-cell, and nanomaterial biosensors.