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Synthetic biology for detection of contaminants and for diagnose of disease: New biotechnology

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Despite the great advances on diagnostic technologies for disease and for detection of environmental contaminants (i.e. pesticides, heavy metals, hydrocarbons, and others), there is still a need for a non-endpoint diagnose in addition to better precision and real-time results. Therefore, herein we are presenting a novel approach based on synthetic biology to diagnose disease and for detection of environmental contaminants/pollutants. Our technology is based on a construct microbial DNA sensor. Thus, we developed three types of DNA sensors for early detection of diabetes (US Patent No.: 9,683,266 B2, June 20, 2017) Alzheimer's disease (patent pending), respectively. Also, we developed a microbial DNA sensor for detection of heavy metals in soil. Although microbial/molecular sensors have been used for detecting different biological molecules, chemicals, as well as contaminants, their sensitivity is limited. Therefore, we present here three types of sensors with higher sensitivity based on assemblage of different genetic parts which are cloned on benign bake yeast, Saccharomyces cerevisiae. The genetic parts were sequences related to proteins for detections of molecules such as glucose or beta-amyloid for diagnosing of diabetes or Alzheimer's disease, respectively. We also assembled a genetic building block for identification of specific heavy metals in soil. The diagnosis was based on the biofluorescence emitted by the mixture of the DNA sensor with patient blood plasma when the respective molecule or proteins have been detected. Hence, the degree of the diagnosed disease is based on the intensity of the fluorescence unit (FSU). Likewise, the microbial DNA metal sensor was able to identify different heavy metals in soil at very low concentrations, also based on the intensity of the fluorescence of the DNA sensor. The denoted technology brings great advantages, since it enables us to accurately classify diabetes patients in different groups (i.e. diabetic, pre-diabetic, normal), thus predicting development of the disease at early stages. In addition to early detection of the disease, the present technology also allows for earlier clinical intervention. Similarly, the technology enables us to identify metal contaminations which are undetectable under conventional methods. The above mentioned synthetic biology approach was effectively supported by a computational modeling. This new biotechnology applied to the medical and environmental fields facilitate the integration of different molecular techniques with physiological mechanisms at the cellular and molecular level on real time, based on the integration of biological sciences, engineering, and computational modeling for a more predictable biological process. This allows biology to become more effective at the industrial level not only for health solutions but also for economic benefit

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