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EPPENDORF AWARD FOR YOUNG EUROPEAN INVESTIGATORS

25 Years

Winner 2020
Randall Platt
Switzerland

Randall Platt, Eppendorf Young Investigator 2020

»Receiving the Eppendorf Award is a tremendous honor, one in which I share with my laboratory, collaborators, and family. My research focuses on developing innovative technologies that empower scientists to ask fundamental questions and develop therapeutics and diagnostics. The Award specifically recognizes my laboratory's work on living diagnostics – engineered bacteria that act as biographers of their environment by continuously recording gene expression information – which may in the future provide a non-invasive tool to diagnose and individualize therapies for patients around the world.«

Randall Platt

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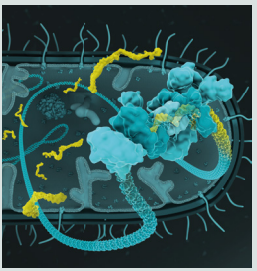
Award-Winning Research

Living Microbial Diagnostics to Enable Individualized Health Interventions

Microorganisms evolved to be experts in adapting and surviving in profoundly diverse environments – water, soil, air, and seemingly all surfaces of the human body – and their gene expression patterns reflect the environments in which they live. For example, in the inflamed human colon, resident *E. coli* adapt to a harsh, free radical-rich environment by coordinating the expression of scavengers like superoxide dismutase. This presents a promising clinical opportunity where microbial gene expression patterns could be used to assess the intestinal environment for diagnostics. Unfortunately, however, microbial gene expression information does not persist throughout time and transit of the gastrointestinal tract and is therefore inaccessible without invasive collection.



A bacterial sentinel cell engineered to express CRISPR-Cas system components for recording gene expression. This record – safely written and stored within the cell's own genome – is preserved throughout time and can be retrieved at any moment and reveal the cell's environmental and biological history. ©Bara Krautz, Science animated*

To overcome this challenge, my laboratory engineered a bacterial sentinel cell capable of sensing, remembering, and reporting on the environment within the intestine of animals. We accomplished this by endowing non-pathogenic *E. coli* with a gene expression recorder – a technology we developed that hijacks the natural function of a CRISPR-Cas immune system process where snippets of RNA inside the cell are converted into DNA and permanently stored within a CRISPR array. This process is also iterative, whereby new RNAs are inserted in front of old RNAs within the CRISPR array – like a fossil record – which upon sequencing provides a timeline of sequential gene expression events. Over the past several years we have shown that these sentinel cells report on complex and multi-faceted environments critical for diagnostics, including pathogenic infections, alterations in diet, and pathological environments such as inflammation. In the future, engineered bacterial sentinel cells could serve as a non-invasive living diagnostic – an alternative to invasive endoscopies – and provide a scalable and sustainable basis for predicting individualized therapeutic interventions in a global context.

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