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Editorial

# Environment and synthetic biology

Industrial expansion and population growth stimulates the utilization of natural resources and energy. It inevitably leads to environmental pollution with various pollutants like heavy metals, pesticide and xenobiotics. Synthetic biology is an interdisciplinary field involving designation, construction, and manipulation of biological parts or devices in chassis and organisms for diverse purposes. It's a promising alternative for synthetic biotechnology to overcome the global environmental issues by engineering microorganisms.

Despite the significant amount of work that has been done on the application of synthetic biology for energy recovery, waste treatment, and environmental remediation, there is still a pressing need for further research in this field.

A total of seven articles made contributions to the Research Topic, consisting of four Orignial Research Papers and three Review articles. These articles cover a wide range of topics, from the development of novel synthetic bio-techniques and tools, to the engineering of microbial strains and consortia.

The review articles highlight the potential of synthetic biology to create novel and efficient biocatalysts and biosensors, and demonstrates the efficiency of the integration of synthetic biology with other disciplines. Somayaji et al. reviewed the synthetic biology techniques to tackle heavy metal pollution and poisoning, and discussed the strategies to engineer microorganisms for biosorption, biotransformation, and biomineralization of heavy metals. In parallel, Bi et al. reviewed the degradation strategies of pesticide residue, from chemicals to synthetic biology, and compared the advantages and disadvantages of different methods for pesticide degradation. Apart from these, Tao et al. explored the enhanced depolluting capabilities of microbial bioelectrochemical systems by synthetic biology, and reviewed the recent progress in engineering microbial bioelectrochemical systems for the removal of various pollutants, such as organic compounds, nitrogen, phosphorus, and metals, and propose future directions for the integration of synthetic biology and bioelectrochemistry.

Researchers redesigned the biological systems to prompt tolerance, improve toxic sensitivity, enhance biodegradation, and convert xenobiotics into high-value products. Liu et al. probed the growth and mechanical properties of *Bacillus subtilis* biofilms through genetic mutation strategies, and reveal the roles of different genes and pathways in rational design of biofilm-based bioprocesses. Yang et al. reported the engineering of *Shewanella* spp., to enhance methyl orange degradation and bioelectricity harvest, which demonstrated the feasibility of using synthetic biology to improve the performance of microbial fuel cells for simultaneous wastewater treatment and energy production. Hu et al. described the improvement of a highly sensitive and specific whole-cell biosensor by adding a positive feedback amplifier, and enhanced the signal-to-noise ratio and the dynamic range of the biosensor for tracing target molecules. He et al. presented an efficient biosynthetic strategy based on "biology funneling" to produce a valuable precursor – *cis,cis*-muconic acid from aromatic pollutants in engineered *Pseudomonas*, and optimized the production by consortia construction and fermentation.

We thank all the authors for their high-quality and timely contributions and the manuscript-handling editors, reviewers, and editorial staff of *Synthetic and Systems Biotechnology*. We hope that this issue will provide a comprehensive overview of the current state-of-the-art and the future prospects of synthetic biology for addressing environmental contaminants. We also hope that researchers across different disciplines will enjoy reading the articles in the collection and this collection will inspire and stimulate further research and innovation.

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