Submission form for Ocean-Shot Concepts-Round 2

Response ID:46 Data

1. (untitled)

1. Ocean-Shot Contact Information: *Note - This information will be shared with the National Committee for the Ocean Decade in order to receive feedback. It will also be made publicly available if the Ocean-Shot concept is accepted into the Ocean-Shot Directory.

Primary Contact Name (First & Last) : Rachel Harris
Organization : Syntrophia
Email address : syntrophia.microbes@gmail.com

2. Ocean-Shot Title

FISH-TAMB for a healthier ocean: A novel, scalable tool by Syntrophia to sustainably harness microbial power and supercharge bioindustrial processes

3. Author(s): *Please list contributors to the submitted Ocean-Shot concept with first and last names in the order you wish them to be referenced for *potential* use in the Ocean-Shot Directory. Examples can be found here:

Rachel L. Harris, Nicholas Lyons, Hiroko Muraki Gottlieb

4. Ocean-Shot Directory Summary (Please provide a short introduction/description of the Ocean-Shot concept for *potential* use in the Ocean-Shot Directory, 100 word limit. Examples can be found here.):

Harnessing the power of microbial communities will be the cornerstone of future innovations in healthier oceans and climate change monitoring. FISH-TAMB (U.S. patent 63/093,347) monitors microbial metabolism in real time at single cell resolution. Harnessing the full metabolic potential of microbes can sustainably support a growing population – by mitigating hazardous pollutants, and even reclaiming waste as raw materials for new production. These processes will help to reduce industrial pollutants that contaminate the ocean and destabilize our climate and meet the goals of the ocean decade.

5. Abstract (describe hypothesis, scientific and/or technological objective, 200 word limit):

Humankind relies on the ocean for life-nourishing resources and for mitigating climate change impacts. The ocean's propensity to give and receive resources on behalf of humanity is traced back to microscopic single-celled organisms. Indeed, microbes make up > 98% of the ocean's total biomass, serving life on Earth by forming the basis of the marine food web and providing critical custodial services, such as digesting pollutants from human activities.

Biosynthetic manufacturing harnesses microbial labor to generate sustainable alternatives to over-exploited natural resources. However, current biomanufacturing methods are grossly inefficient, leading to wasted raw materials, bioreactor downtime, and inadequate product yields. Syntrophia is developing an easily deployed, proprietary FISH-TAMB assay kit that precisely monitors and gives real-time feedback on the health and evolution of keystone microbial species used in synthetic biology and bioremediation. Coupled with widely accessible laboratory instruments such as flow cytometers and cell sorters, FISH-TAMB can parse through a sample's entire microbial community, enabling direct selection of top-performing "superbugs" and the removal of undesirable contaminating strains and unproductive freeloaders. This innovative technology will enable biomanufacturers and bioremediation services to translate small-scale lab demonstrations into large-scale operations, contributing to the goals of the Ocean Decade.

6. Please select the challenges (no more than 3) that are most relevant to your concept (Expanded reference below):

Challenge 1: Understand and map land and sea-based sources of pollutants and contaminants and their potential impacts on human health and ocean ecosystems, and develop solutions to remove or mitigate them.
Challenge 2: Understand the effects of multiple stressors on ocean ecosystems, and develop solutions to monitor, protect, manage and restore ecosystems and their biodiversity under changing environmental, social and climate conditions.
Challenge 3: Generate knowledge, support innovation, and develop solutions to optimize the role of the ocean in sustainably feeding the world’s population under changing environmental, social and climate conditions.

7. Describe how your Ocean-Shot addresses the selected challenges (150 word limit).

For challenges 1 and 2, FISH-TAMB will be a vital tool for enhancing bioremediation efforts around the world. By identifying and facilitating the isolation of top-performing microbes, remediation can happen more efficiently and sustainably. FISH-TAMB can remove wastewater-based contaminants without the addition of chemical surfactants – resulting in a net reduction of regulated pollutants in industrial effluent. Syntrophia is building partnerships with wastewater treatment plants and synthetic biology companies to incorporate the FISH-TAMB workflow as a central pillar of proprietary strain development and real-time bioreactor optimization. FISH-TAMB can also monitor marine microbes – imaging for targeted metabolisms to identify dangerous algal blooms, eutrophication, and hazardous pollutants. On Challenge 3, FISH-TAMB can support agricultural practices by engineering microbial symbiotes that can provide nitrogen to plant root systems. This practice will maximize crop yields and eliminate eutrophication of rivers and oceans from runoff of traditional chemical fertilizers.

8. Vision and potential transformative impact (200 word limit):

Improving the productivity and efficiency of biomanufacturing and bioremediation technologies are crucial milestones in meeting the Sustainable Development Goals (SDGs) in a world with a growing population that is contributing to unprecedented degradation of biodiversity. To ensure a transformative and lasting paradigm shift, we must improve the tools of the trade, making real-time decisions to increase the efficiency and rate at which industrial microbes process and generate materials. FISH-TAMB is the only method available which allows for rapid (< 15 min) nanoscale resolution of real time metabolic activities without the use of toxic fixatives and washing buffers that traditionally kill cells in comparable assays. This transformative innovation enables the study of both industrial strains and environmental microbes as it allows, for the first time, the ability to identify desirable cells whose metabolic capacities can be perpetuated and improved upon through selective cultivation – simply because the assay assessing their metabolic activities does not kill them. If widely adopted, we anticipate FISH-TAMB will rapidly accelerate the rate at which we can identify and cultivate "supercharged" microorganisms capable of working harder and more efficiently to meet the SDGs.

9. Realizable, with connections to existing U.S. scientific infrastructure, technology development, and public-private partnerships (150 word limit):

The Syntrophia team is well-poised to enter the private scientific industry given the co-founder's expertise and experience. Within the Boston area, where Syntrophia is based, there are several startup incubators for independent laboratory space, as well as venture capital competition programs to accrue both financial support and the attention of innovative leaders. We are presently writing proposals for non-dilutive funding from the National Science Foundation (SBIR grant) and the Department of Energy (ARPA-E grant). We have established working relationships in wastewater treatment (MA Water Authority) and the synthetic biology industry (Lanzatech, Modern Meadow, Ginkgo Bioworks). The potential application of the technology to a wide range of uses and in various conditions will allow the Syntrophia team to connect with a wide range of existing U.S. infrastructure, technology development, and public-private partnerships to contribute to SDGs.

10. Scientific/technological sectors engaged outside of traditional ocean sciences (100 word limit):

FISH-TAMB is broadly applicable across a number of industries and public sector infrastructure. Any manufacturing, agricultural, and remediation activities that rely on microbial labor could improve their process by deploying our platform. These applications could include biomanufacturing, synthetic biology, wastewater processing and bioremediation. The breadth of applications the technology could transform is huge, and in the case of synthetic bio, growing rapidly.

11. Opportunities for international participation and collaboration (100 word limit):

Syntrophia envisions scaling FISH-TAMB to make it broadly accessible around the world. FISH-TAMB is especially useful not only for academic and non-profit scientists researching ocean microbes, but also industry partners in biomanufacturing and bioremediation. Additionally, there is great potential to partner with governments and stakeholders globally, particularly as it relates to wastewater treatment, access to potable water, sustainable agricultural practices, and increase in food production in resource scarce countries.

12. Develops global capacity and encourages the development of the next generation of ocean scientists (100 word limit):

Syntrophia is an early start-up headed by early career leaders in science and technology development in one of the world's best biotech hubs. Cambridge, Massachusetts is home to world-class research institutions, cradling leaders of tomorrow who

hail from across the globe. Syntrophia can create internships, training programs, and workshops for other researchers interested in our platform. The founding members and Syntrophia's advisors have rich experience in international relations (including work at the United Nations), educating, mentoring, training, and technology transfer. Syntrophia's goal is for FISH-TAMB to change the world so that we can secure the future we want.

2. Thank You!

Thank You Email

Jul 01, 2021 19:03:16 Success: Email Sent to: syntrophia.microbes@gmail.com