Wyss Institute Operating Standards for Risk Management of RNA-Guided Gene Drive

In order to evaluate risk of emerging biotechnologies, the Wyss Institute has developed an internal process for risk evaluation of different types of technology. Specifically, the comprehensive risk management plan includes: modifying the design or materials used in research when possible; applying specific or enhanced biosecurity or biosafety measures including regular review of emerging research findings on experiments; determining mode of communication to disclose the results of research responsibly; and, finally, to review annual progress reports from Principal Investigators to determine the applicability of controls administered. When necessary, we engage other professionals for their additional review in order to consider all aspects of risk. This process is unique in that it is an evolving process – built to adapt to changing research - while ensuring safety in the laboratory. The use of RNA-Guided Gene Drive technology was the first technology to be assessed with the Wyss Institute Risk Management Plan.

RNA-Guided Gene Drive technology is a perfect example of a new technology that does not fit the framework of risk assessment currently used in the practice of Biosafety. With RNA-Guided Gene Drives, risk is not defined by the capability to infect and cause disease in a susceptible human or animal host, but instead, the main point of risk management is to consider effects to the natural ecosystem. Depending on the aim of the particular RNA-Guided Gene Drive, there is potential to alter populations of organisms in manners which could have positive effects on human health, but both direct and indirect effects on the environment and the living organisms that inhabit it.

There is no current industry consensus on how to perform research with RNA-Guided Gene Drive technology, and under the framework of NIH Guidelines and existing regulatory oversight, the Institutional Biosafety Committee (IBC) must review “whole organism” recombinant DNA and synthetic nucleic acid work with both nematodes and insects. In the initial stages of risk review and control, the investigator has identified potential security, safety, and potential environmental/ecosystem impacts, and has outlined a series of molecular and ecological containment controls that would make the gene drive unable to spread into a wild population, even if a drive-containing organism were to escape.

These molecular containment and ecological containment controls are intended for work occurring within the lab, and are not intended as controls for work on intentional field releases into the environment. An accidental organism escape would be reported to NIH under the current federal requirements, yet the crucial point is that an accidental escape could have environmental implications. Therefore, the primary concern in risk management is installing biosafety practices, procedures, and facility design that prevent release of the technology to the environment. To enhance that end, controls such as molecular and ecological containment are in place; in the unlikely event an accidental release were to occur, additional layers of control act as added safeguards.

This Wyss Institute Risk Management Plan for RNA-Guided Gene Drive technology is reviewed periodically, as are the experiments covered under the plan. Multiple partners are involved in evaluating the resulting plan and assessing necessary changes to the safety measures. In addition to the proactive management by the investigator and the team working on RNA-Guided Gene Drives, there is a dedicated task force of the parties involved who work collaboratively to address risk. The team includes biosafety professionals, facility managers, the university-based IBC, and Institute and University administration. This risk management team is in charge of adapting the safety procedures to changes in the research, thus adding multiple levels of expertise to the management of risk and ensuring a cohesive approach towards a system of oversight for work with RNA-Guided Gene Drives.

This type of research is a prime example of the need for proactive risk management to review potential concerns that can occur with emerging biotechnology. RNA-Guided Gene Drive technology has vast opportunities to provide global solutions to worldwide public health concerns and environmental issues. Risk identification and proactive risk mitigation in this technology are paramount to the safe conduct of this research.