

Abstract

Rafael Yuste proposes to map the structure and function of the entire neural net and "break the code" of the nervous system of the small freshwater cnidarian *Hydra vulgaris*. Yuste plans to reverse-engineer *Hydra vulgaris* neural control systems, in order to design novel behaviors and recode them into its nervous system by reprogramming it.

With up to 5000 spiking neurons (one of the simplest nervous system), ten distinct behaviors, and a transparent body, the *Hydra* is a perfect choice for this ambitious project. Adding the precise diagnostics that will be used, the technical approach is credible and detailed. In a second phase, the nervous system will be re-engineered, using physical or bio-chemical manipulation and genetic re-programming, to induce new behavior.

This project would represent the first systematic neural code-breaking to date and could revolutionize neuroscience, artificial intelligence and control systems by uncovering novel biological algorithms that could be used for neural-inspired distributed control. His work will also pioneer synthetic neurobiology, enabling the design of novel behaviors.