

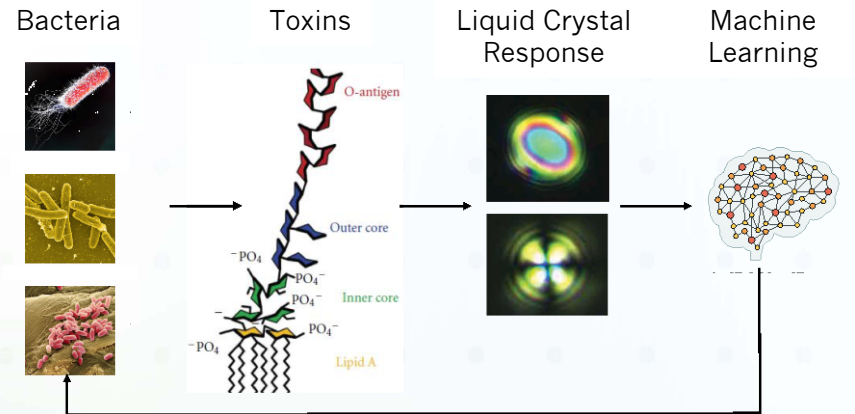
Machine Learning Algorithms for High-Throughput Materials Data

Victor M. Zavala, University of Wisconsin-Madison

Soft materials provide a versatile platform to design low-cost and scalable contaminant sensing technologies.

An example application is detecting bacterial toxins in healthcare. For example, surgical equipment needs to be tested for toxins prior to use. The best available technology to detect bacterial toxins uses the blood of horseshoe crabs. This sensing approach is accurate and reliable, but expensive and not sustainable. Crab blood has a market value of \$60,000 per gallon, and hundreds of thousands of crabs are harvested each year to extract their blood.

The Wisconsin MRSEC has developed machine learning techniques that enable the design of new toxin sensors using liquid crystal droplets that respond to the presence of different bacterial toxins and at extremely low concentrations by changing shape and appearance. Machine learning enables computers to automatically analyze the droplet responses to measure toxin concentration and type automatically at high accuracy. More generally, these results demonstrate that the machine learning approach can quickly extract valuable information from complex datasets.



Bacterial toxins trigger a change in the shape of liquid crystal droplets when they attach to them. Machine learning techniques can automatically analyze such shapes to detect toxins.