An enzyme's evolution from changing electric fields and resisting antibiotics

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Enzymes are proteins that speed up or catalyze a reaction in living organisms. Bacteria can produce enzymes that make them resistant to antibiotics. Specifically, the TEM beta-lactamase enzyme enables bacteria to develop a resistance to beta-lactam antibiotics, such as penicillin and cephalosporins. Researchers at Stanford University are studying how an enzyme changes and becomes antibiotic-resistant.

During the Biophysical Society's 62nd Annual Meeting, held Feb. 17-21, 2018, in San Francisco, California, Samuel H. Schneider, a graduate student in Stanford University's Boxer Lab, will present the group's research studying what happens when an enzyme is accelerating reaction and how an enzyme changes over time making it resistant to antibiotics.

Researchers have been trying to figure out exactly what is happening when an enzyme binds to another molecule and ultimately, how that enzyme becomes resistant to antibiotics. The team of researchers at the Boxer Lab is using an existing technique called the vibrational Stark effect (VSE) in a novel way to measure a molecule's electric field when the enzyme and molecule are attached at different times during the enzyme's evolution to becoming resistant to antibiotics.

The team measured the electric fields generated by a TEM beta-lactamase enzyme attached to two different molecules and the vibration of the chemical bonds in these molecules in the hopes that they will find what makes the enzyme develop a resistance to cephalosporins antibiotics.

Going forward, the team hopes to expand the study to thousands of variants of these enzymes "to understand the correlation between the evolution of electric fields in enzymes and the development of [antibiotic] resistances," said Jacek Kozuch, a postdoctoral researcher working in the Boxer Lab.

More information: 1007-Plat - "The physical origins of enzyme evolution: Correlating the active site electric fields of antibiotic resistance along evolutionary trajectories in TEM β-lactamases" is authored by Samuel H. Schneider, Jacek A. Kozuch and Steven G. Boxer. It will be presented on Monday, Feb. 19, 2018. Abstract: plan.core-apps.com/bpsam2018/a … 73141a814abfbdfd1e4d

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