**Title**: Caffeine Evolution

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**Abstract**: This case investigates why and how coffee plants make caffeine and discusses the evolution of enzymes that make caffeine. The case begins with students reading a newspaper article announcing the sequencing of the coffee genome. The case explores the structures and functions of coffee enzymes involved in caffeine biosynthesis. It also explores the biosynthesis of caffeine by other plants (such as cocoa and tea plants) and compares the structures and functions of all enzymes involved in caffeine biosynthesis.

**Learning Objectives**: This case was designed for undergraduate students in introductory botany courses to help them understand the concepts of allelopathy and convergent evolution. Mini-lessons included in the case introduce these concepts, while students explore the application of these concepts in caffeine biosynthesis. By the end of the case, students should develop some basic understanding of biomolecular structure-function relationships.

**Molecules explored**: In this case, coffee enzymes that play key roles in caffeine biosynthesis will be explored. The structures of these enzymes will also be compared to that of other plant methyl transferases.

**Implementation**: The case can be implemented using either a flipped approach and/or in-class discussions.

**Subject Headings**: Biology (Introductory), Chemistry (Introductory), Biochemistry, Genetics, and Molecular Biology

**Keywords**: Caffeine; N-methyltransferase; SAM; SAH; xanthosine, cofactor; substrate; conserved, convergent evolution, allelopathy.

**Topical Area**: Scientific method; Molecular structure representation; Visualization

**Educational Level**: Undergraduate lower division

**Formats**: Word document and Website

**Type/Method**: Flipped, Interrupted

**Language**: English

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