**Title**: Caffeine Evolution

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**Abstract**:

This case discusses the evolution of caffeine and investigates why and how coffee plants 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 cacao and tea plants) and compares the structures and functions of all enzymes involved in caffeine biosynthesis. The case begins with reading a newspaper article and a scientific journal article’s abstract. 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. Students learn to identify and access data from various biological databases and integrate information to understand the structure and functions of this protein. By the end of the case, students should develop some basic understanding of biomolecular structure-function relationships. Detailed teaching notes, and discussion prompts are available for download to guide the in-class activity.

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

**Objectives**: Learning objectives span the following fields

*A. Biology*

*B Genetics*

*C. Molecular Biology*

*D. Modeling and Presentation Learning Objectives*

**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**: PDF and Website

**Type/Method**: Flipped, Interrupted

**Language**: English

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