The Problem:
- Kinetics is essential to understand enzymes.
- Students are intimidated by the math.
- Students do not easily connect abstract analyses to real experiments.
- Building kinetic models is not easily learned as a spectator.

Our Solution: webZyme
- Instructors create “virtual enzymes” on a web-server.
- Students perform virtual experiments using their browser.
- Data are downloaded and analyzed independently of webZyme.
- Mechanism is a “black-box” to the student.
- Quality of the results depends on a student’s experimental design; fosters the development of good judgement.
- Reactions defined with an intuitive syntax.
- Many types of experiments are possible.
- Allows model-building & hypothesis-testing.

Current Capabilities
- Absorbance Stopped-Flow
- Steady-State Velocities
- Fluorescence Stopped-Flow

Coming Very Soon
- Quenching

Unique Capabilities
- Calculates reactions between the contents of syringes in the virtual stopped-flow prior to a shot.
- All data have experimental noise at a level controlled by the instructor.
- Nothing to install.
- Independent of platform & location.
- Works on my iPhone.
- Possible to create unique enzymes for each student.

webZyme is not (yet)...
- ...a data-analysis (curve-fitting) program.
- ...a substitute for standard simulation programs (e.g., KINSIM, Berkeley Madonna, Gepasi).
- ...expensive. Use webZyme on our server for free – just send Bruce an e-mail (brupalf@umich.edu).
- ...finished. Features are still being added, and bugs are still being found (and fixed).

Example: Simple Michaelis–Menten
- 10^8 M^-1s^-1
- E + S -> Complex (1 s^-1) E + P

Instructor enters reactions & rate constants.

Instructor creates absorbance spectra (for assay traces) and adds other parameters.

Students could collect assay traces...

...or students could get velocities directly.

Example: Dihydroorotate Dehydrogenase

Based on data from:

Unpublished results

Students explore transient kinetics...

Reductive Half-Reaction

Oxidative Half-Reaction

Reaction with O2

Inhibitor Binding & Competition

Ei

Ei + O2

Ei + H2O2

Ei + PCA

Ei + OA

Ei + Succinate

Ei + Fumarate

Ei + DHO

Ei + DHO

Ei + DHO

Ei + DHO

Ei + DHO

Ei + DHO

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