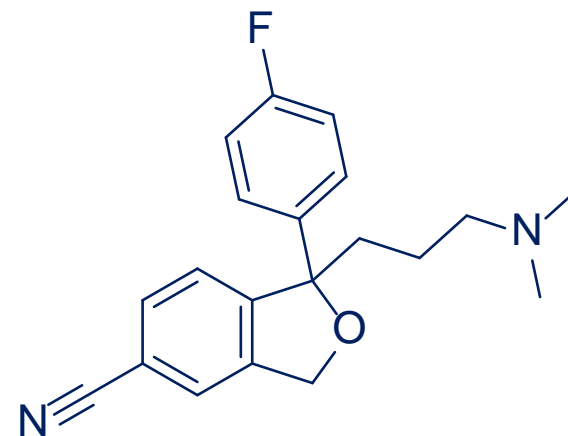
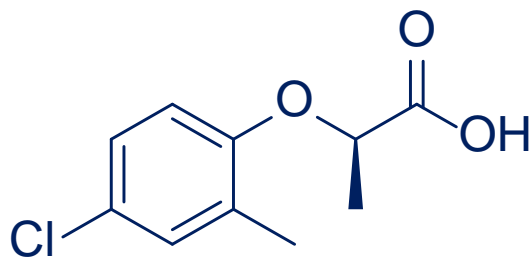
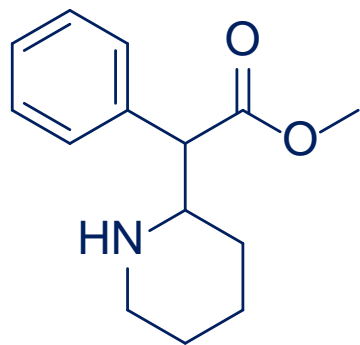


Implementation of organic chemistry in the high school curriculum in central Indiana

Daniel S. Meyers, M.S., M.A.T.

Chemistry Teacher

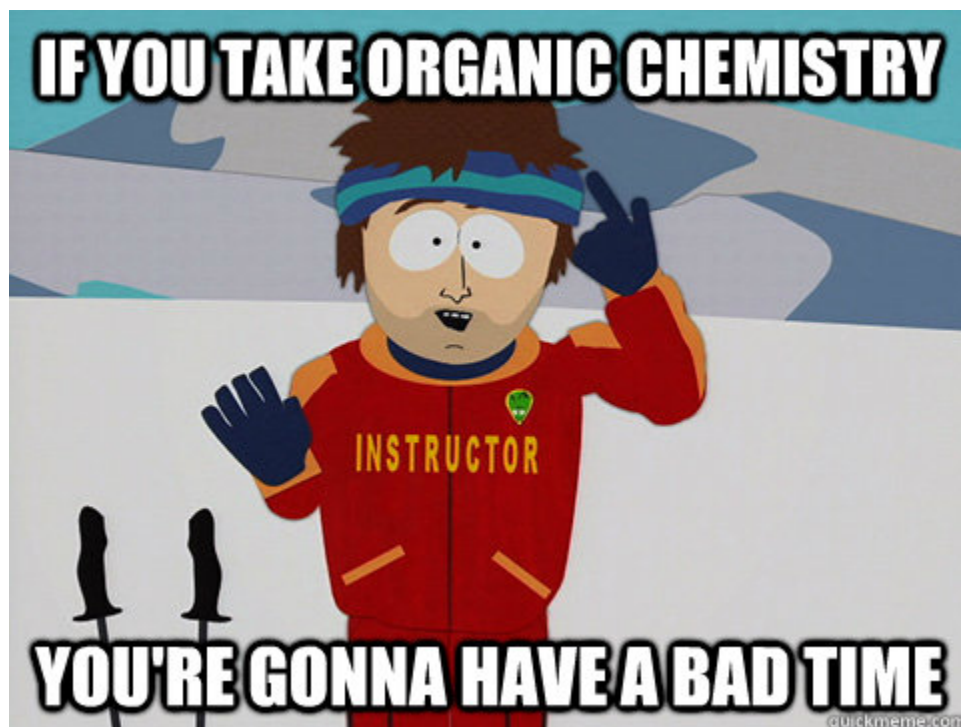
Portage Central High School, Portage, MI



Outline

- Background
- Aims and accomplishments at Cardinal Ritter High School, Indianapolis, IN
- Improvements looking ahead
- Current challenge – 1 semester Organic Chemistry at Portage Central High School

Student Perceptions



Student Perceptions

- Organic is difficult, challenging, and competitive
- “Weed out” course for pre-professional programs
- Not easily mastered
- Thinking and learning processes generally unknown to undergraduate chemistry students; requires thinking different from general chemistry



High School Organic Chemistry: Why Not!?

- What purpose does this allow?
 - Start students early, expose to organic sooner, develop unique thinking skills earlier to permit future success.
- An objective of secondary science education
 - Prepare students for collegiate studies, not only in content but with appropriate study skills as well
 - Develop scientifically literate citizens

J. Chem. Educ., 2012, **89**, 850-853

Chem. Educ. Res. Pract., 2008, **9**, 157-162

High School Organic Chemistry: Why Not!?

- “Organic chemistry is a rich, vibrant discipline and given its central importance to science, it is imperative that students develop a sound, conceptual understanding of the subject” (Grove 2012).
- “Modern organic chemistry is a rich, vibrant, and diverse field situated at the heart of the global economy” (Grove 2008).

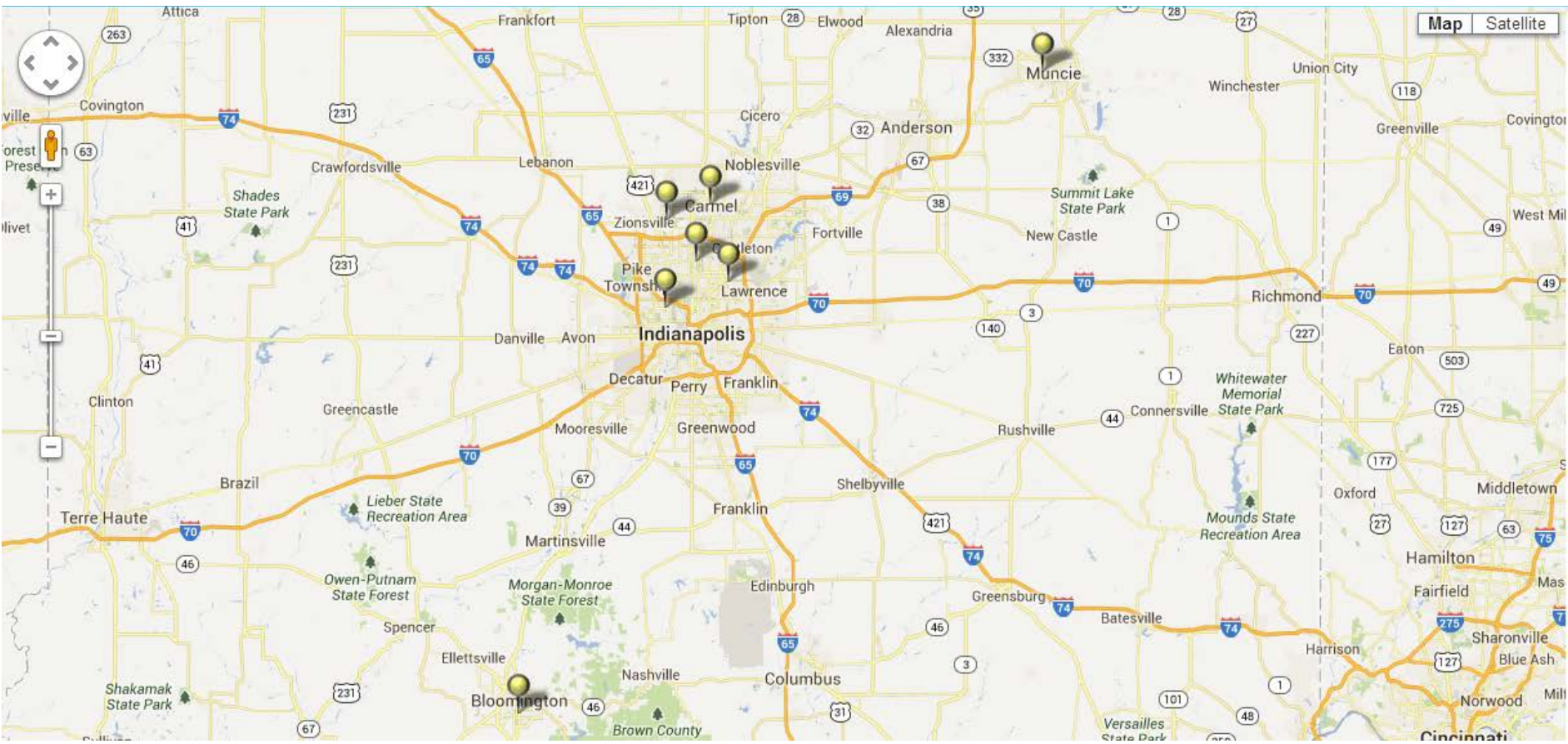
Chem. Educ. Res. Pract., 2012, **13**, 201-208

Chem. Educ. Res. Pract., 2008, **9**, 157-162

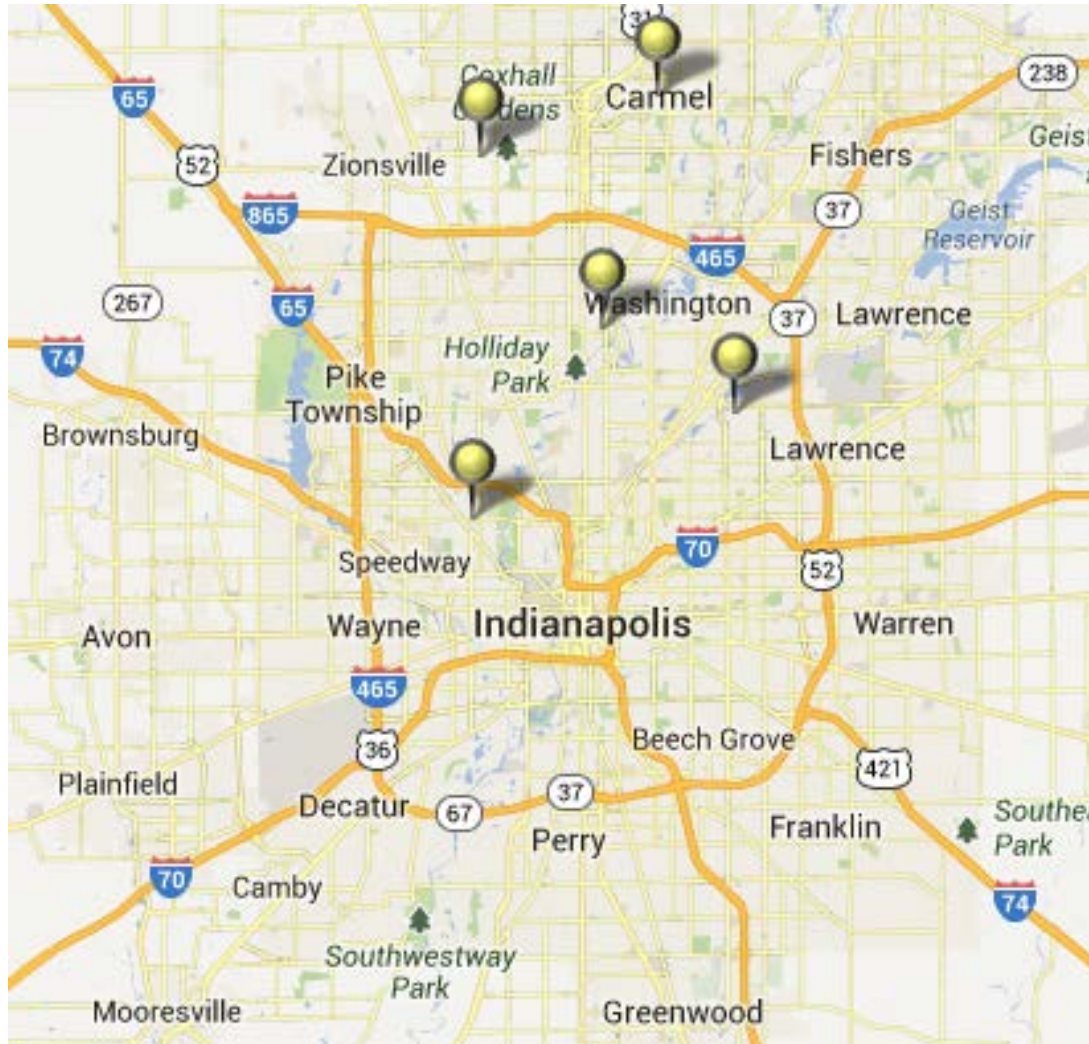
High School Organic Chemistry

- Small but growing number of high schools in Indianapolis that have offered and/or are beginning an organic chemistry course this fall.
- Generally a 1-semester course focusing on fundamentals, i.e. bond-line drawings, nomenclature, functional groups, reactions.

Central Indiana High Schools



Focus on Indy



Aims at Cardinal Ritter High School

- Develop a year-long organic chemistry course listed as an advanced science elective for 11th and 12th grade students.
- Prerequisites: B average in Honors Chemistry or B- average in AP Chemistry only.
- Mimic CHEM-C341 course at Indiana University throughout year.
- Use networking from IU and Grand Valley State University (author's alma mater) in designing course, assembling homework and test questions; later use connections at IUPUI.

Aims at Cardinal Ritter High School

- Promote rigorous course requiring students to write, draw, and think.
- Assess with short-answer based problems rather than multiple choice questions.
- Build a culture that requires students to learn and think rather than regurgitate information.
- Deviate from the culture found in many high school science classes.

Aims at Cardinal Ritter High School

- Course emphasis placed on
 - Structure
 - Functional groups
 - Nomenclature
 - Acids and bases
 - Conformational analysis and stereochemistry
 - Important classes of organic reactions
 - Alkenes, alkynes, alcohols, substitution, elimination
 - Synthesis
 - Spectroscopy*

* Not achieved

Aims at Cardinal Ritter High School

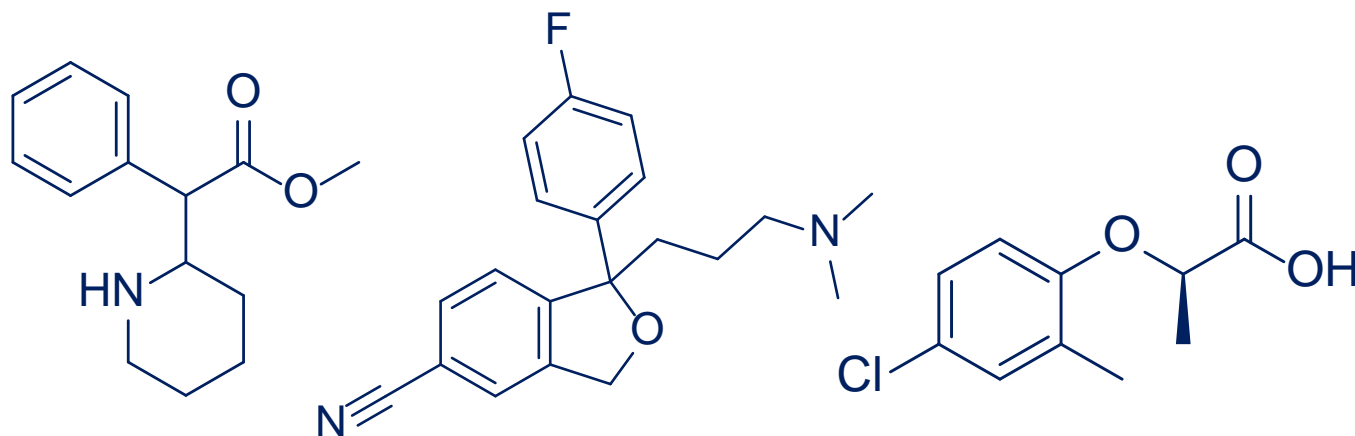
- Course objectives met through lectures, laboratory experiments, use of technology, presentations, and science literacy activities.
- Assessments included announced and unannounced quizzes, unit tests, problem sets, and a mid-year research presentation.

Mid-Year Project: Enantiopure Drugs

- Began 2nd semester with stereochemistry-focused research project.
- Modeled after group meetings
- Students required to draw structures using ACD ChemSketch
- Research scientific literature (PubMed – free full text)

Mid-Year Project: Enantiopure Drugs

- Drugs/agricultural products researched included: fluoxetine, methylphenidate, citalopram, mecoprop.



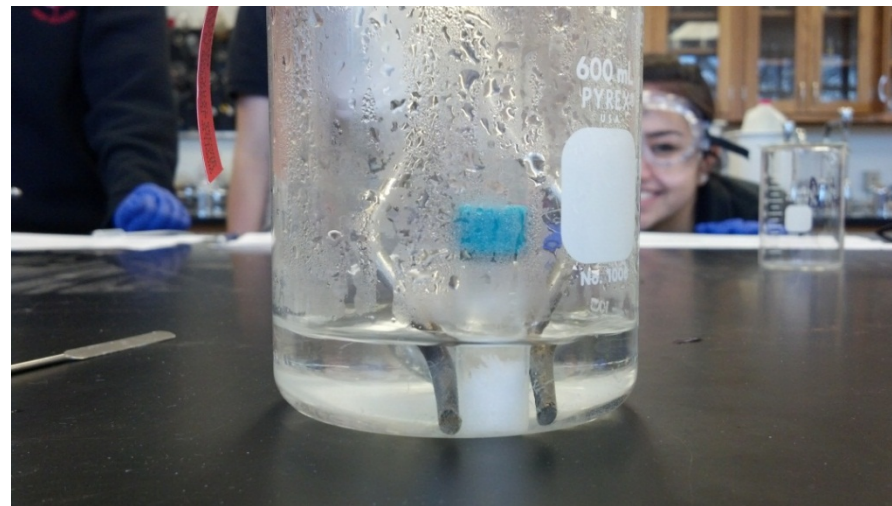
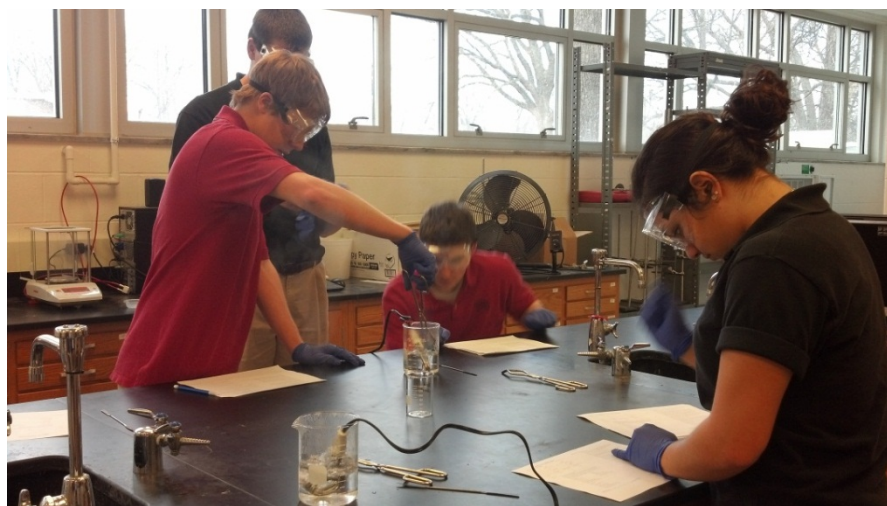
- Random teacher evaluation by principal

Improvements Going Forward

- LABS!!! – more of them, more often
 - Become accustomed to block schedule and slow pace
 - 1st semester content covered – very few undergraduate labs that correspond to content
 - Unable to order lab materials through private donor until 2nd semester

Improvements Going Forward

- LABS!!! – more of them, more often



Improvements Going Forward

- LABS!!! – more of them, more often
 - Used Flinn's Vial Organic Lab series (cis-trans isomerization, oxidation of benzaldehyde, tie-dye, esterification)
 - Incorporate more high school appropriate labs
 - Examples includes column chromatography (separation techniques), pigment separation (Erin Carlson JCE article), A/B reactions
 - 1st semester labs to focus on technique, 2nd semester labs to highlight organic reactions

Current Challenge...

- High school organic chemistry in **Michigan!**
- Teaching Honors Chemistry 1 & 2, Chemistry 1 & 2, and Chemistry 3 (Organic) at Portage Central High School.
- Teaching a semester-long organic chemistry course.
- Model organic chemistry in the traditional sense vs spiral curriculum (Grove 2008).

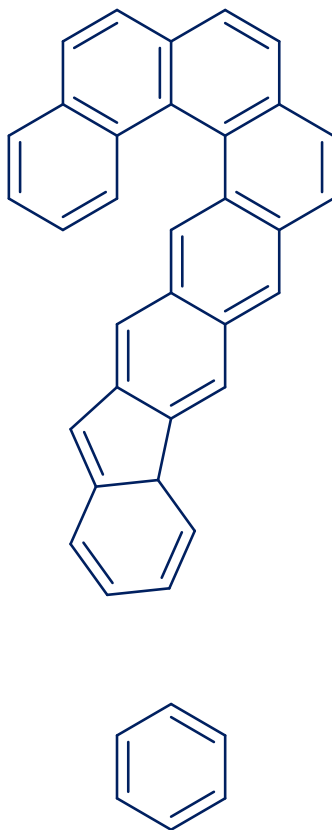
Organic Chemistry in Michigan



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- *Chem. Educ. Res. Pract.*, 2008, **9**, 93-101
- *Chem. Educ. Res. Pract.*, 2008, **9**, 157-162
- *Chem. Educ. Res. Pract.*, 2012, **13**, 201-208
- <http://lennoxtutoring.com/2013/07/13/deductive-reasoning-skills-organic-chemistry/>
- *J. Chem. Educ.*, 2012, **89**, 850-853

Questions



Contact Information

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Things to Consider...

- Impact of Common Core standards, Next Generation Science Standards
- Not seen too much in rural areas, concentrated more so around universities and industries
 - Indianapolis – IUPUI, Uindy, Butler, Marian Lilly, Dow Agro, Roche, IU Health
 - Bloomington – IU, Cook Pharmica/Cook Medical, Baxter, IU Health
 - Portage/Kalamazoo – WMich, Kalamazoo College, Pfizer, MPI
 - Haslett – Michigan State
 - Metro Detroit – Oakland University, Wayne State, UD Mercy, automotive sector, health sciences)