ORALS

Advancement to Candidacy Exams

for students in
Organic, Chemical Biology, and Organic Materials

May 18-22, 2015

Advising Session

David L. Van Vranken
Organic Area Advisor

Six Basic Requirements for a Ph.D. in Chemistry

http://www.chem.uci.edu/

1. Completion of a minimum of seven approved courses with maintenance of an average grade of B or better.
2. Completion of a second-year Written Examination.
3. **Completion of an Oral Examination for *Advancement to Candidacy*.**
4. Completion of the teaching requirement (four quarters).
5. Completion of six quarters in residence at UCI.
6. Submission of an acceptable doctoral dissertation.

Year 1
- Fall
- Winter
- Spring

} **Courses**

- Summer

Year 2
- Fall ← **Y2R**
- Winter
- Spring ← **Orals**
- Summer

Year 3 ← **June Progress Reports**
Year 4 ←
Year 5?

Oral Advancement to Ph.D. Candidacy Exam

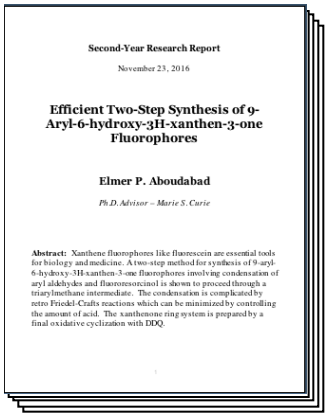
2015 May 18-22 Orals

In <3 months you will take your Ph.D. candidacy exam:

Written:

- 10-page research report, focusing on progress since the second-year report.
- 8-page innovative research proposal.

Get started right now.



Second-Year Research Report

November 23, 2016

Efficient Two-Step Synthesis of 9-Aryl-6-hydroxy-3H-xanthen-3-one Fluorophores

Elmer P. Aboudabad

Ph.D. Advisor – Marie S. Curie

Abstract: Xanthene fluorophores like fluorescein are essential tools for biology and medicine. A two-step method for synthesis of 9-aryl-6-hydroxy-3H-xanthen-3-one fluorophores involving condensation of aryl aldehydes and fluororesorcinol is shown to proceed through a triarylmethane intermediate. The condensation is complicated by retro Friedel-Crafts reactions which can be minimized by controlling the amount of acid. The xanthenone ring system is prepared by a final oxidative cyclization with DDQ.

Oral:

Two-hour presentation with questions and answers.

Attend the many great seminars in our Department.

Emulate the best communicators.

Here are Some Deadlines

Friday, April 17 – Orals Idea Approved and to DVV

Friday, May 11 – Orals documents to committee

Who is on the Orals Committee?

Committee Composition

1. Chair
2. 3 Other Chemistry Faculty are assigned
3. Outside faculty member that YOU INVITE
   - They receive copies of your report and proposal
   - If you are interdisciplinary it will help to get someone knowledgable about your area

Rationale

1. More faculty = more input
2. Outside member = insures fairness

Written Research Report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Just like the 2nd-Year Report

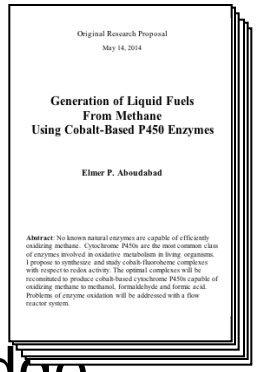
- 10 pages (double spaced)
- Publication quality manuscript (e.g., *J. Org. Chem.*, *J. Biol. Chem*., etc.)
- Explain the problems you faced
- Explain the problems you solved
- Sell your project and your accomplishments

Distinguish your new accomplishments

- … from those of co-workers
- … from results in the 2nd-year report

e.g., “Since my second-year report, my efforts have focused on…”

Original Research Proposal


Original Research Proposal
May 14, 2014

Generation of Liquid Fuels From Methane Using Cobalt-Based P450 Enzymes

Elmer P. Aboudabad

Abstract: No known natural enzymes are capable of efficiently oxidizing methane. Cytochrome P450s are the most common class of enzymes involved in oxidative metabolism in living organisms. I propose to synthesize and study cobalt-fluoroheme complexes with respect to redox activity. The optimal complexes will be reconstituted to produce cobalt-based cytochrome P450s capable of oxidizing methane to methanol, formaldehyde and formic acid. Problems of enzyme oxidation will be addressed with a flow reactor system.

A Test of Scholarship and Innovation

1. Teach the audience about a scientific area
2. Identify a **significant** gap in technology or knowledge

   e.g., synthetic methods, biological tools, human health, hunger, pollution, energy

3. Propose a solution based on fundamental chemical insights (since you want a PhD in chemistry)
4. Defend your proposal
   - based on close literature precedent
   - based on fundamental principles of chemistry

Scholarship

Expect to cite *dozens* of references.

Proposal Approval

The chair of your orals committee must <u>approve</u> your proposal.

- Is it outside your area of research?
- Is it novel?
- Is it feasible for a 3-year project?

  This is the timeline for a federal grant.
  This is the type of proposal submitted for tenure track faculty positions.
  Don't propose a project that would require 20 persons working 20 years.

- Is success easily measured?
- Is there a testable hypothesis?

Try to get input from your committee members early on.

I will email you a form to be signed by your committee chair.

Advancement to Candidacy Examination, 2015

Please submit this form, signed by the chair of your advancement committee, to Professor Van Vranken *via his mailbox in Natural Sciences II* by 5 PM, Friday, 17 April 2015. Please do not personally deliver it to his office.

Student: _____ Research Group: _____

Tentative Title of Proposal:

Brief Description (one to two sentences) of Research Proposal:

What has been done before in this area (a couple of sentences):

Why it is important (one sentence):

I have discussed this proposal idea with the student named above and I believe a passable proposal may be generated on this topic.

Chair of Advancement Committee: _____

I met in person with this student to discuss the development of a research proposal idea on the following dates: _____

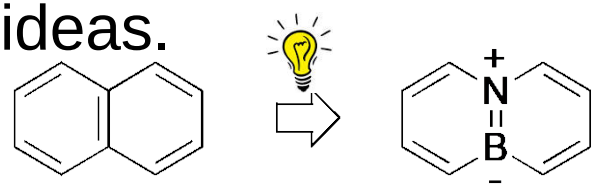
Signature: _____

Date: _____

How Do I Come Up with Great Ideas?

Get others to filter your crappy ideas

You aren't knowledgable enough to distinguish good ideas from bad ideas. Come up with lots of crappy ideas and then run them by other people: grad students, post docs, faculty. Don't become wedded to your crappy ideas.



Expose yourself

The more science you see, the more ideas you'll come up with. Go to seminars; read the literature; talk to people.

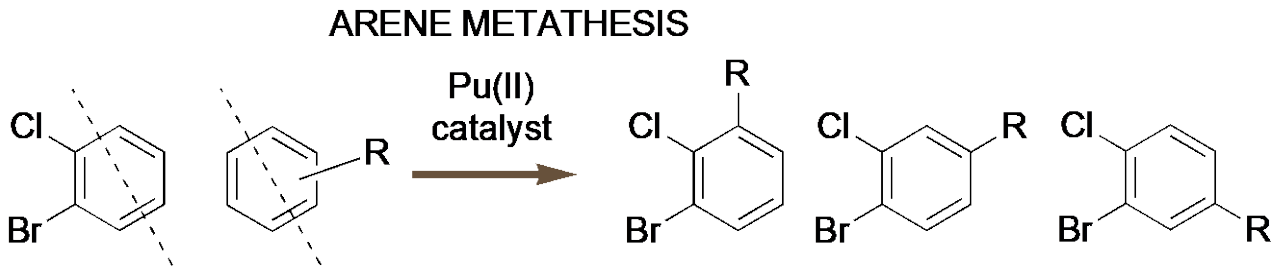
Fail… and move on

The idea has been done. It's uphill in energy. It can't be isolated. There's a known side reaction. Blah, blah, blah.

You're clever. Come up with solutions.

Proposal Pitfalls: Useless Gimmick

Your new gimmick doesn't solve a problem



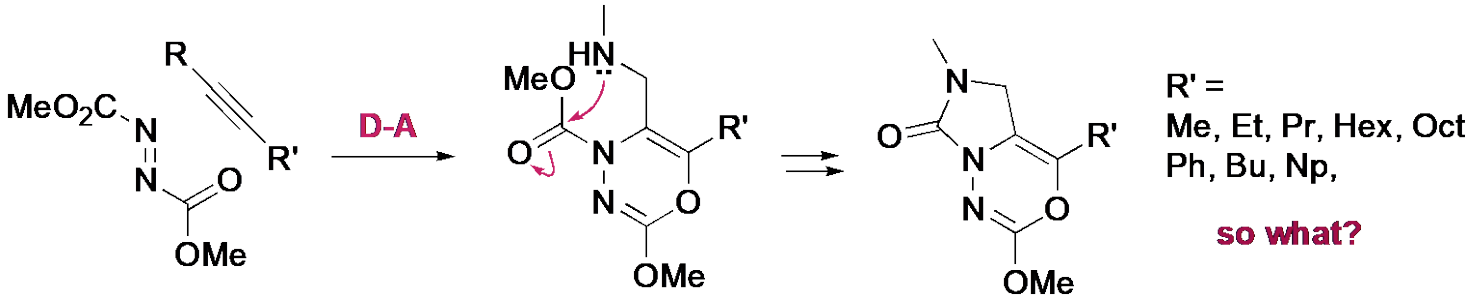
Read the introductions to recent *related* papers to see how others sell the science.

Talk to more people.

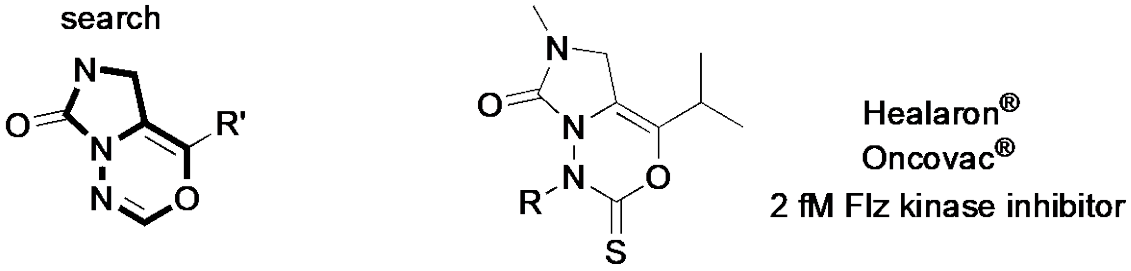
Proposal Pitfalls: Insignificance

So what?

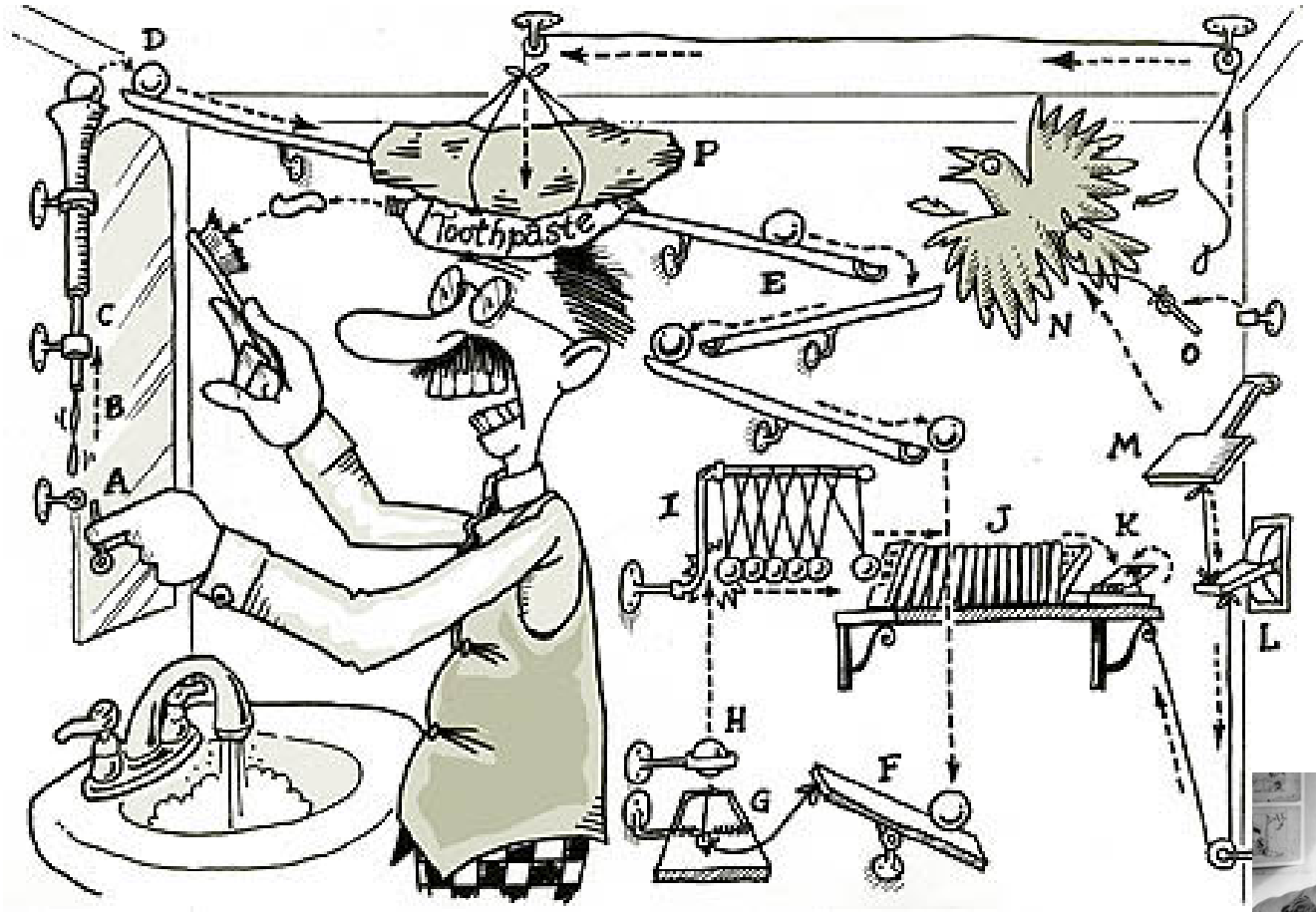
Don't pursue overworked areas of chemistry. If the first step is boring, adding more gimmicks won't make it interesting.



Before giving up, search for natural products or bioactive compounds in REAXYS.



Proposal Pitfalls: The Rube Goldberg Device

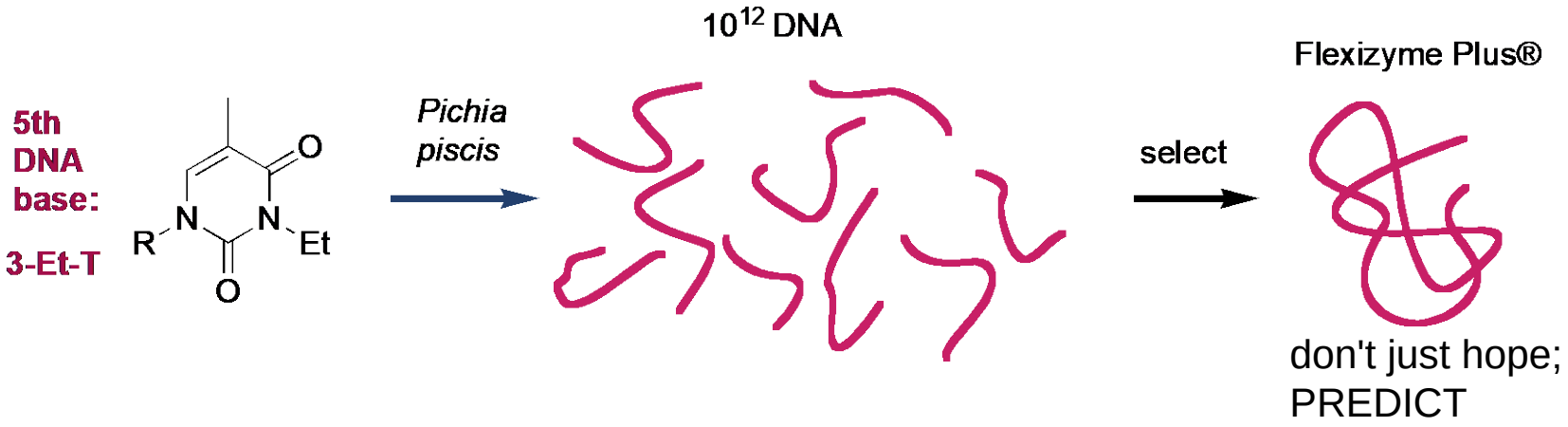


Enough said.

Proposal Pitfalls: A Fishing Expedition

I might get lucky

Don't use screens, selections, and random variations as a replacement for critical ***predictive*** thinking. We expect you to justify why your idea will work using fundamental chemical principles: reactivity, bonding, MO, stereoelectronics, etc.

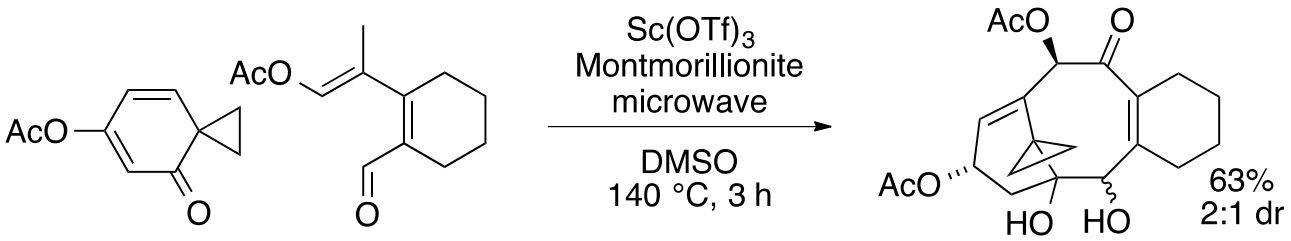


Proposal Pitfalls: They're Obviously Going to Do It

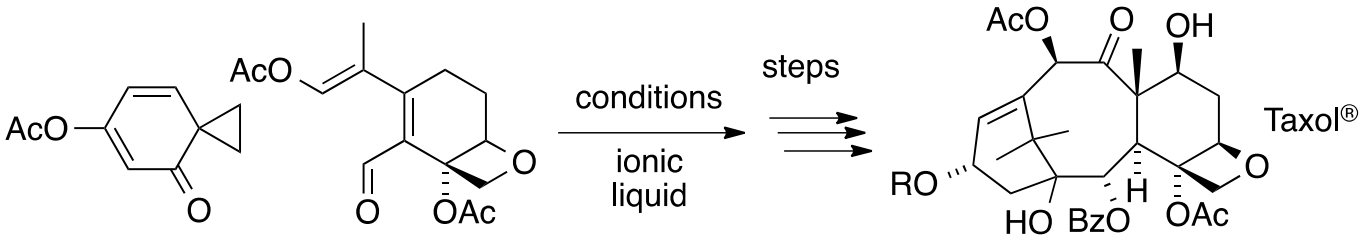
Microwave Synthesis of 6-8-6 Tricyclic Ring Systems

Shin, Q.-H.; Fahriq, M.; Stillson, T. M.

Articles ASAP (As Soon As Publishable)
Publication Date (Web): May 18, 2016 (Featured Article)
DOI: 10.1021/acs.joc.5b00742



They mention "application to terpene synthesis" but not taxol.
My Idea: make taxol.



The Research and Proposal Presentations

Powerpoint - about 15 slides each, w/ low info content

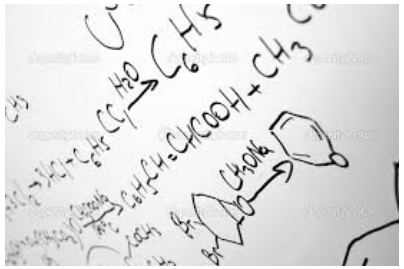
1. Explain the scientific background. If your committee is outside your area (polymers, biology) teach them. Be prepared to sell your project to your outside member who doesn't understand ANY chemistry.

2. Shill, Hustle, and Sell
   - sell your science
   - sell your accomplishments (research)

Step up and hear about my GREAT SCIENCE.

The Research and Proposal Presentations, contd.

3. Be ready to go to the white board
   - anticipate the questions
   - know every reaction mechanism
   - expect questions about fundamental principles from your classes



4. Anticipate the quick wrap up
   - "Oops, we ran out of time. Try to summarize your last twelve slides in the remaining five minutes."

We expect independent thinking. It's *your* Ph.D. project.

Types of Questions During the Exam, contd.

Acronyms: You should know the principles and structures behind any acronyms you use.
Mechanisms: Draw arrow-pushing mechanisms for your reactions.
Thermodynamics and Kinetics: Kcal/mol vs ratios; effects of intrinsic reactivity, concentrations, temperature.
Fundamental Biology: The central dogma, dose-response curves, enzyme function, assays, gels, cell types, microbiology. Know your molecules.
Synthesis: If you propose to use a particular compound as either a starting material or substrate, if you cannot buy it, you should be prepared to describe its synthesis.
Analytical Techniques: You should be prepared to describe the analytical tools you used or would use to evaluate a reaction.

Elements of a Good Research Talk

Organic - approx 15 slides on your research

- Tell us an engaging story. The lead-in is critical:
  Why is this problem interesting?
  How do you think you can solve it?
  How have you begun to address it?

- Clearly and simply describe your accomplishments. We expect significant progress since the 2nd-year report.

- Enumerate the problems you have faced: e.g., insolubility, instability, side reactions

- Explain the problems you have solved.

You've been going to *great* seminars every week.
Emulate the best speakers.

Outcomes of the Advancement to Candidacy Exam

1. Pass
2. Fail on research
3. Fail on proposal

You can take the exam again the following year.

Final Points

Preparation:

- Start early: particularly with characterization of compounds. You should be doing that as you go along
- Leave lots of time for proofreading your reports, and go though SEVERAL rounds of proofreading. Line up trustworthy, critical people to proofread your reports one week in advance.
- Practice giving your talks in front of others — with people from inside and outside of your group

During the exam:

- Ask for clarification if you are confused about the question.
- No notes are allowed. It's OK to say "I don't know." You can impress us with your knowledge on something else.
- We *want* you to do well; we're on your side; we're just trying to see how much you know