Frontiers in Chemical Synthesis I: Towards Sustainable Chemistry

http://moodle.epfl.ch/
http://lcso.epfl.ch/Teaching

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Lecture Structure/Plan

- Introduction on February 20
- End of Introduction: choice of general area for each participant
- Max until April 10: choice of topic and title: the topic has to be more focused than the general fields of research in the introduction!
- April-May: preparation of the talk, please come to us if you need to redefine the topic or just need help preparing the presentation
- May 11 (all day) and 13 (morning): presentations (30 min presentation/30 min discussion)
- Presentations will be open access to all interested people!

Lecture Structure: The presentation

- Power point presentation: 30 min (around 30 slides, try not to be too short or too long!). Discussion and exercices: 30 min. 5 min change/break.
- 3 sessions of 3 presentations. One chairman for each.
- Mostly chemdraws, exceptions for complexe models/structures
- Expertise in primary literature expected, not only review
- Each participant has to ask at least one question for each talk
- 2 questions/problems on the talk given to the public
- Open to everybody

Lecture Structure: The presentation

- **Structure of the talk:**
  - Introduction with: position in the field, importance of topic, reason for choice of exact topic, what are related topics
  - Pioneering works in the field
  - Most important works on the topic (try to find the right balance between in-depth and in-breadth insights)
  - Conclusion and future developments

Lecture Structure: The presentation

- **Form of the talk:**
  - Use a simple but clear corporate design for each slide (title, logo…)
  - Do not put too much information on one slide! (No overlong tables, huge synthetic schemes, ….)
  - ChemDraw should be big enough (at least 100%, 125 % is better)
  - Do not use too much text, key words are enough
  - If you use colors, it should be to attract attention to what is important
  - Check your English, eventually ask a friend to help you correct it
  - Check your timing to be at 30 +- 3 min.

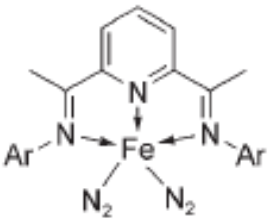
Lecture Structure: Goals of the Lecture

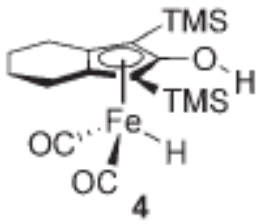
- Become aware of current effort in sustainable organic chemistry
- Learn to enter a new topic and understand it
- Using databases and other tools to find all relevant publications
- Recognizing the most relevant works in a field
- Learn to give well-structured presentations
- Public presentation and handling of questions and discussions
- Individual organisation of work

Lecture Structure: Content

- General Concepts of “Economy”
- Using abundant metals as catalysts
- C-H and C-C activation
- Organocatalysis
- Olefin Functionalization
- Radical chemistry
- Metal-catalyzed carbocyclizations
- Domino/one-pot reaction
- Photocatalysis
- Electrochemistry
- New technologies

Early Metal Catalysis





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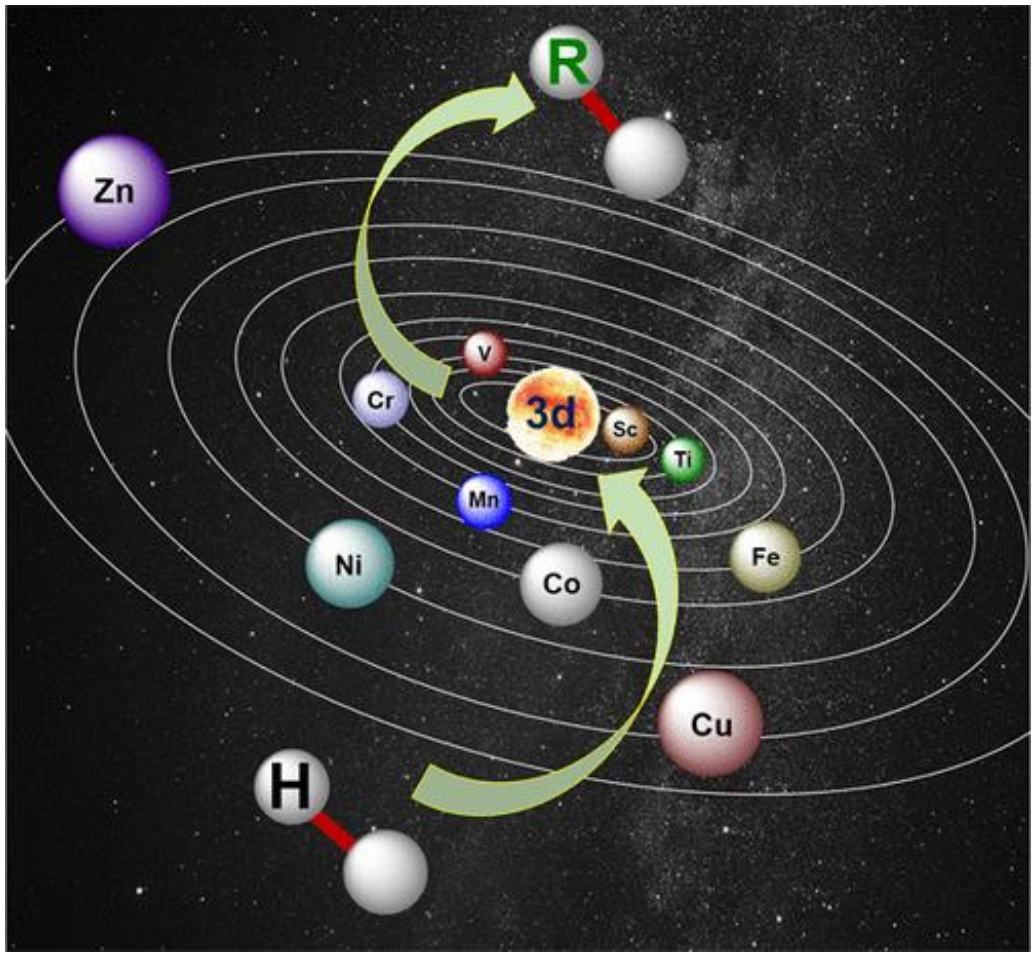
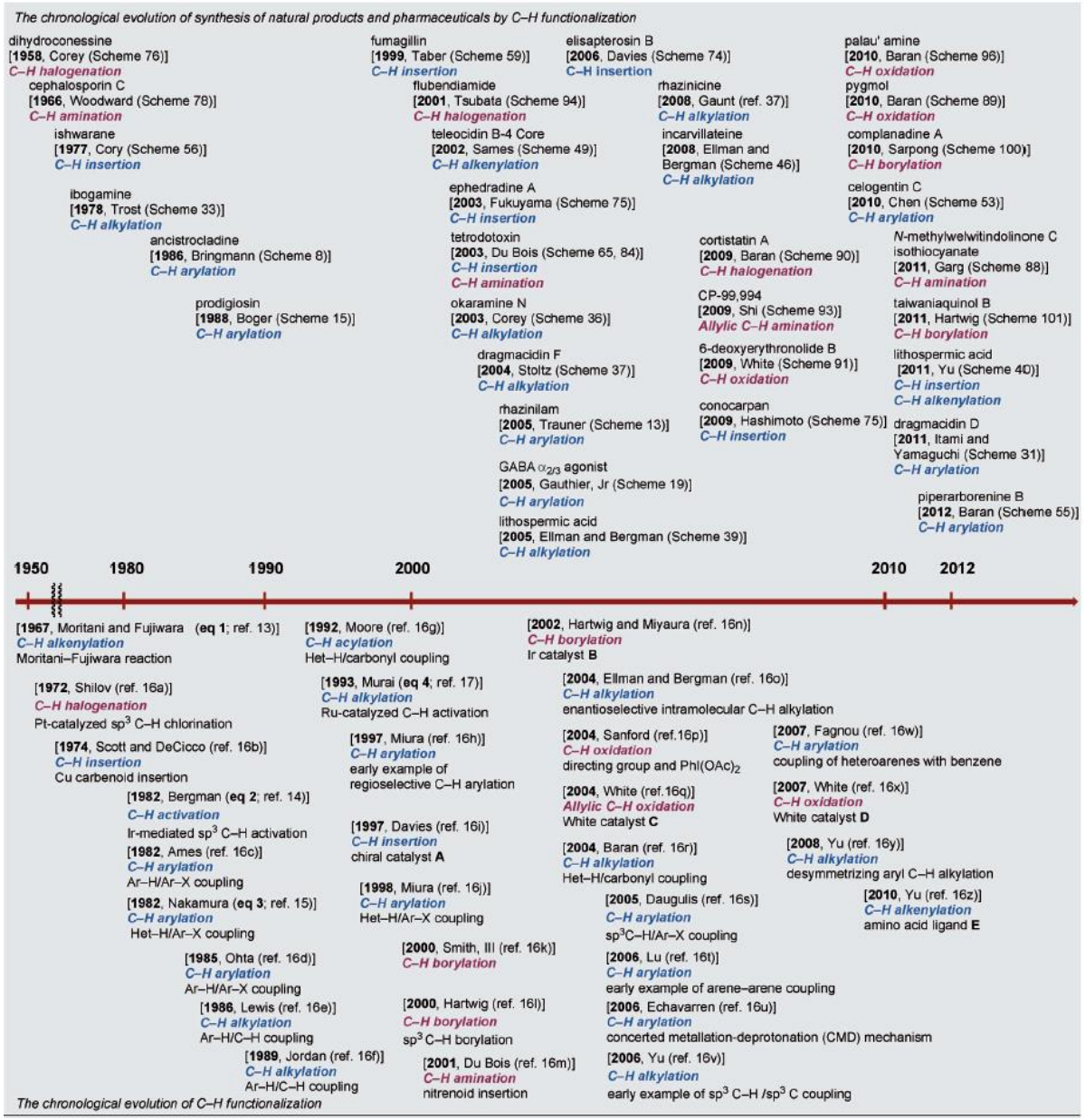
Iron Catalysis



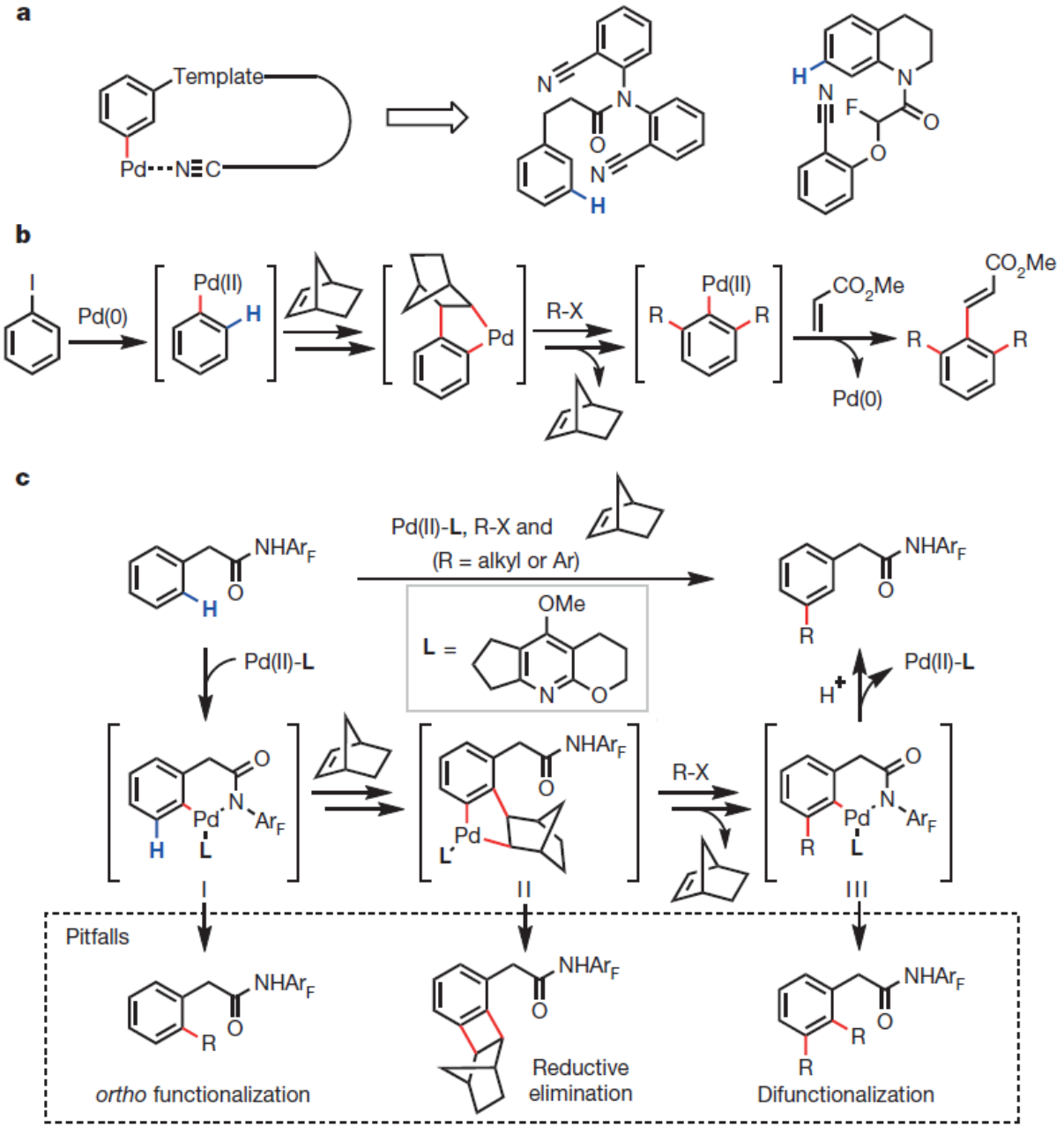
For C-H activation (Ackermann)

C-H and C-C activation



- **Current Challenges**
  - Better or no DG
  - Enantioinduction
  - Cheaper catalysts
  - Applications
  - Generality
  - Low loading and T

C-H: Beyond Ortho Selectivity



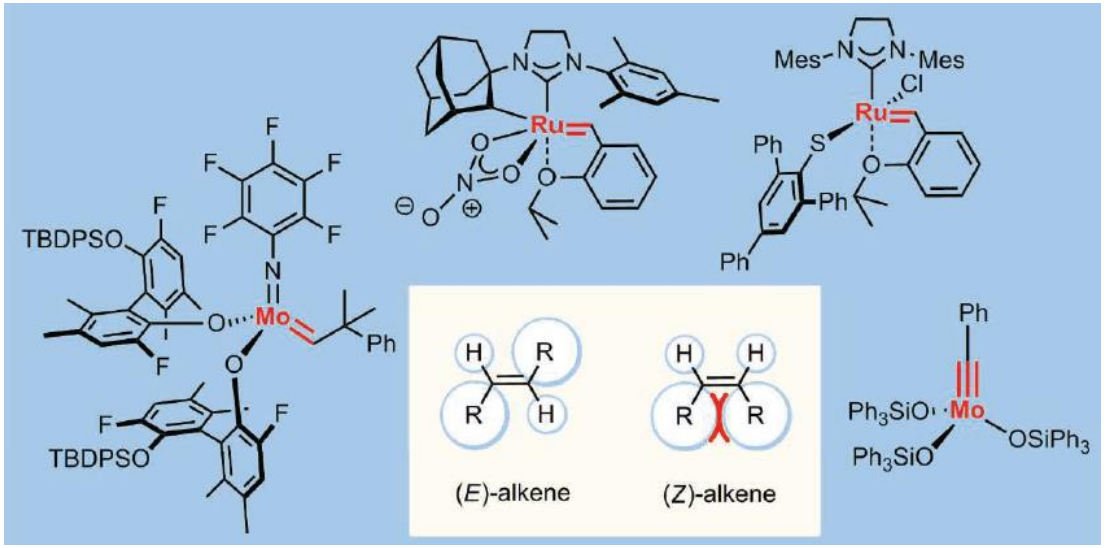
Organocatalysis

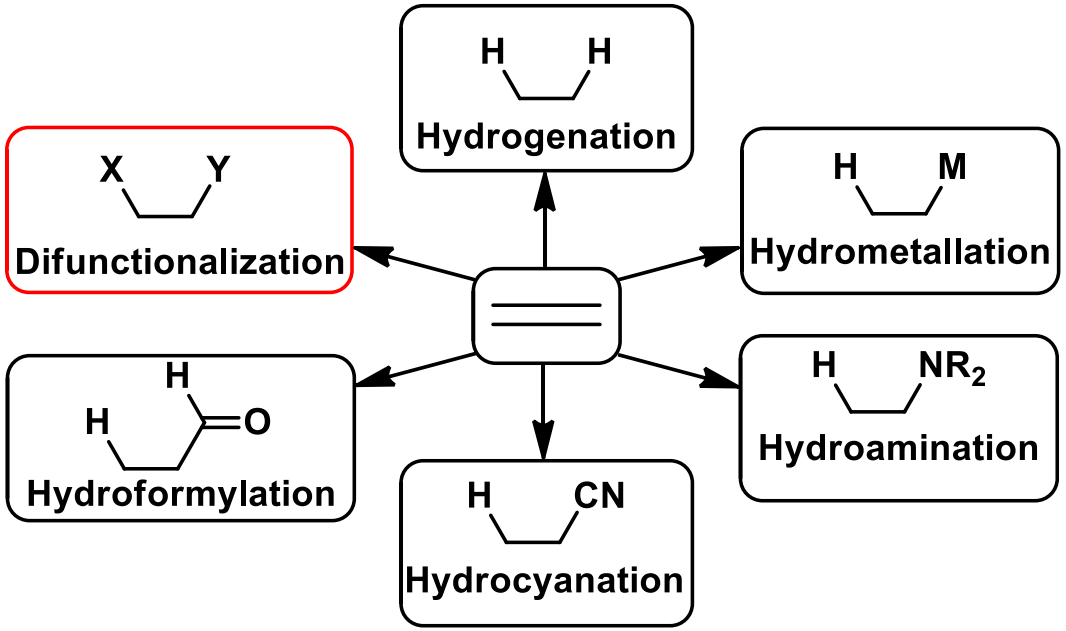
Current Challenges

- Lower loading
- New catalysts
- New concepts (ACDC)
- Cooperation with metals

Olefin Functionalization

Metathesis

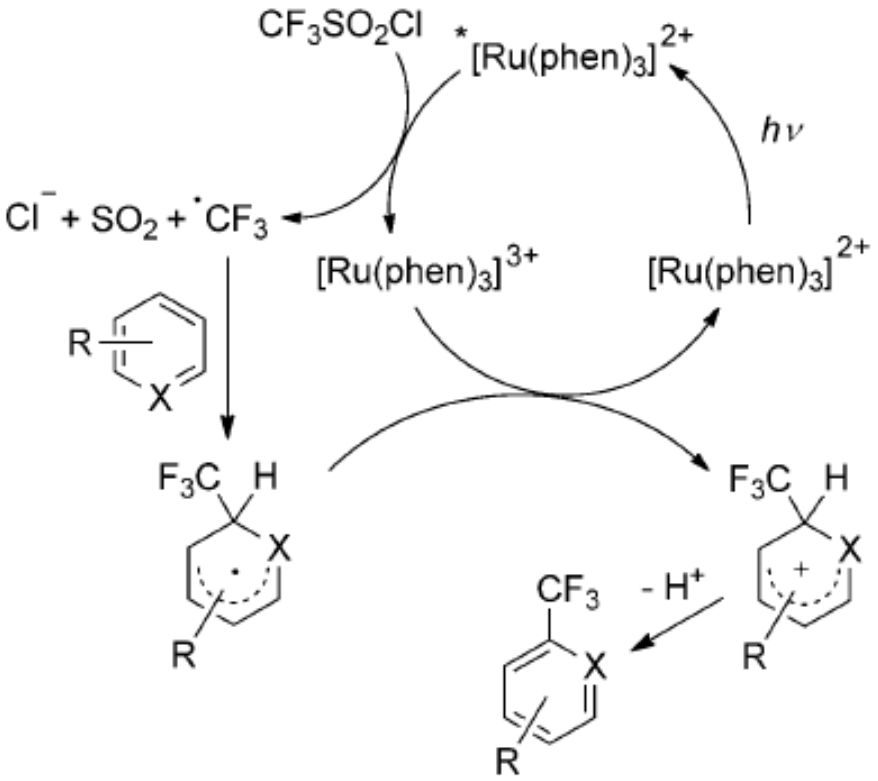


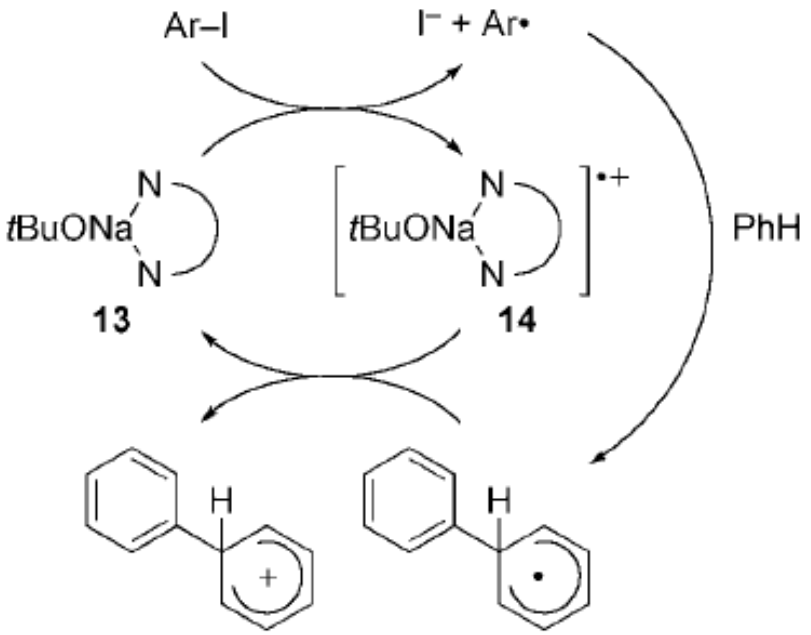


From Bulk to Value Added Compounds

Radical Chemistry: Back to Fashion

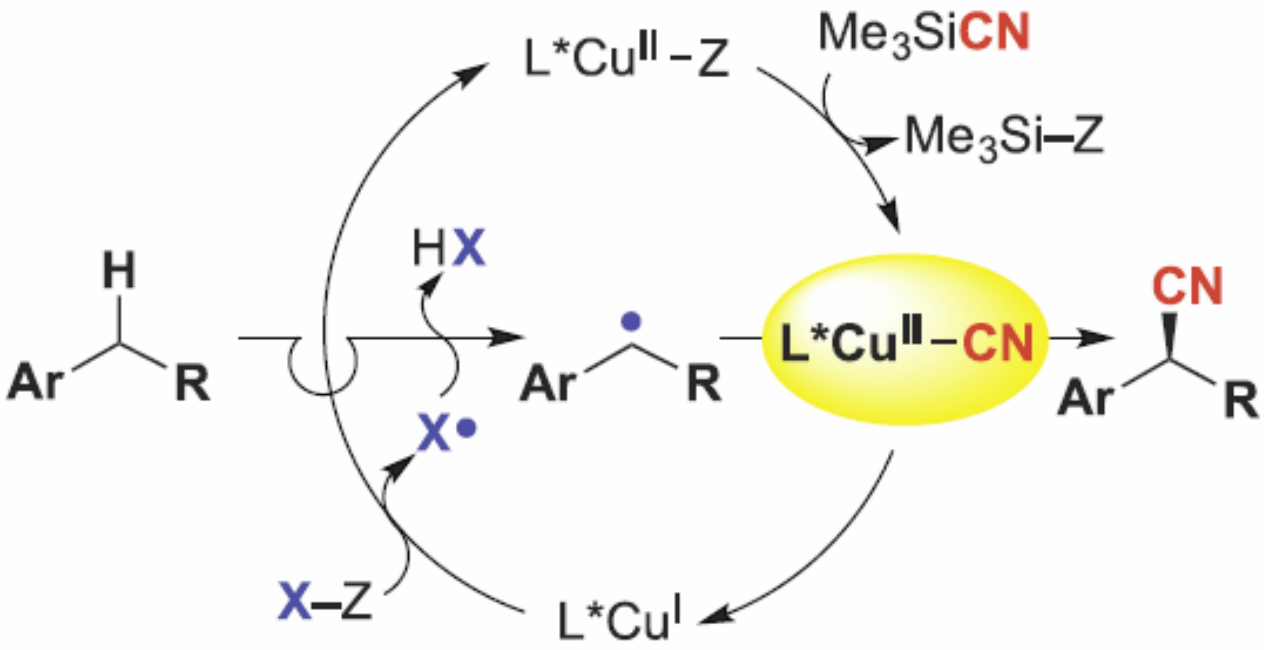
Cross-coupling without transition metals





Trifluoromethylation of arenes

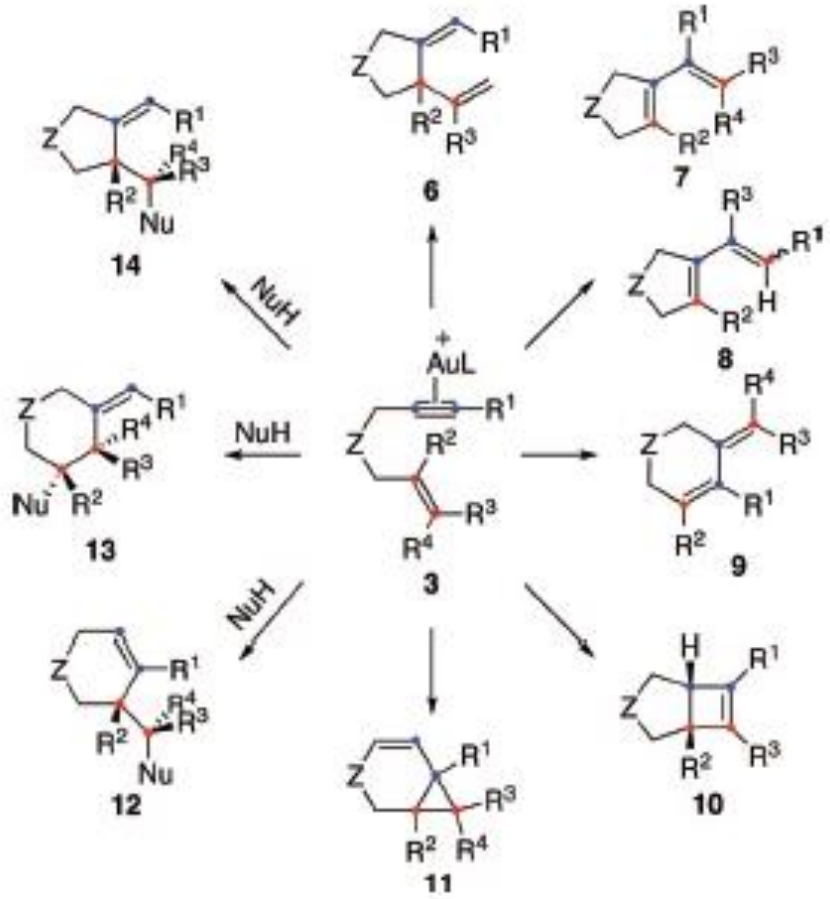
Radical Chemistry: the Hype on Enantioselectivity

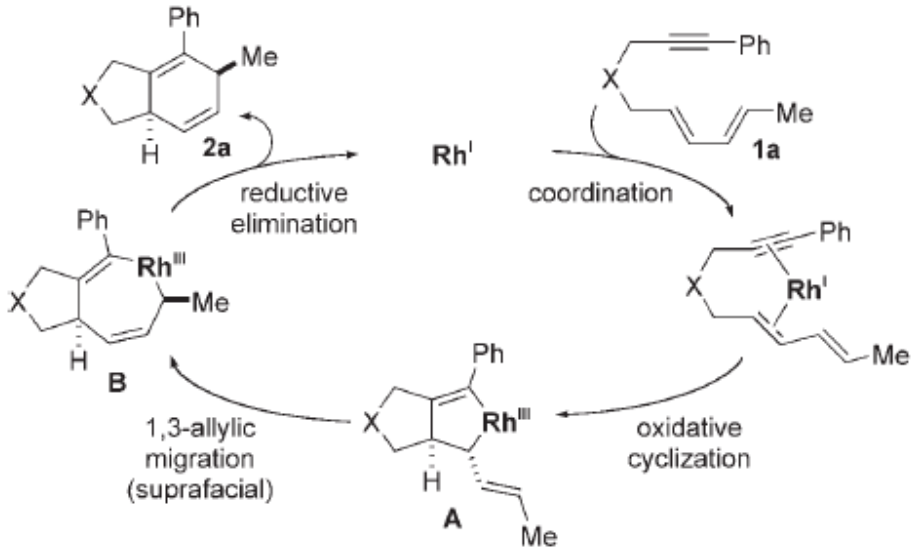


Enantioselective cyanation by Guosheng Liu

Metal-catalyzed carbocyclizations

Gold catalysis

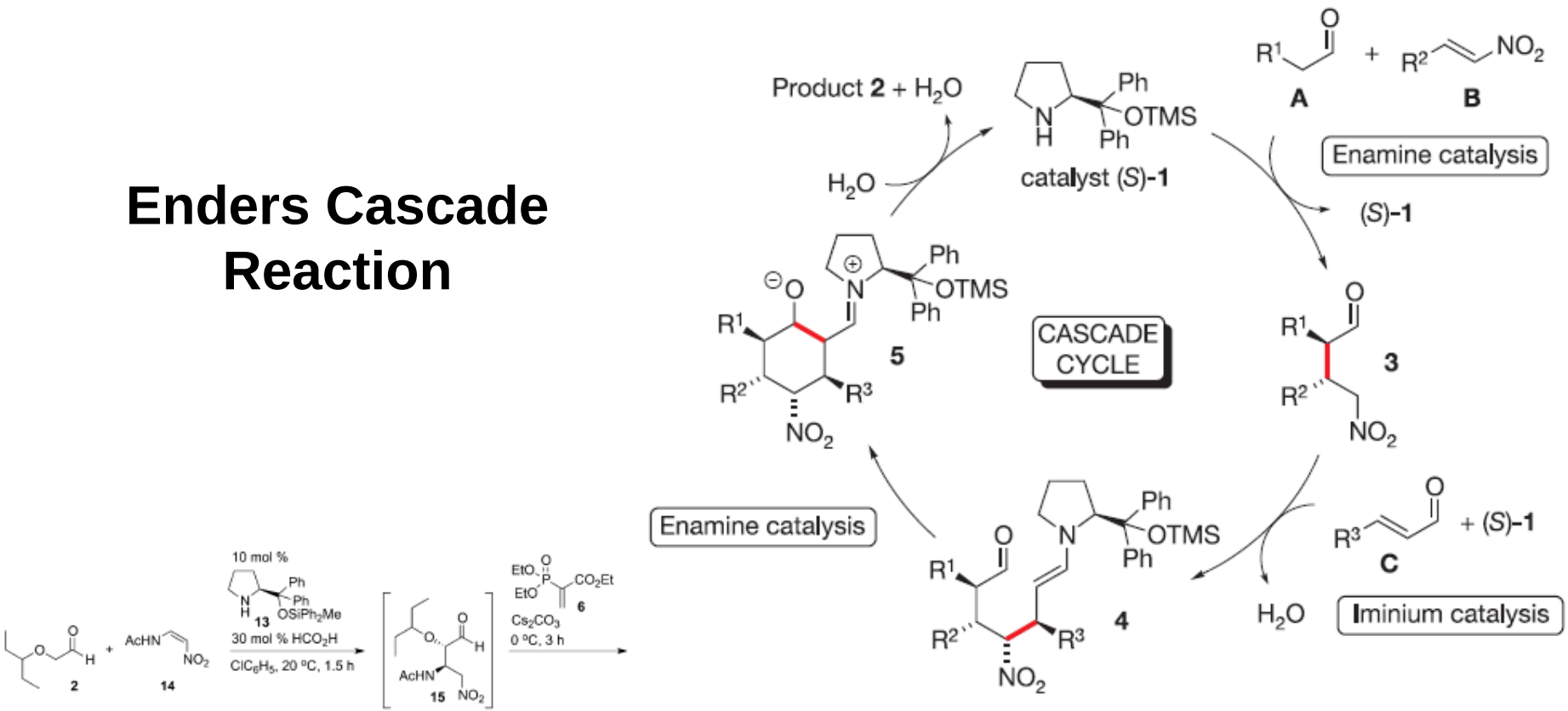


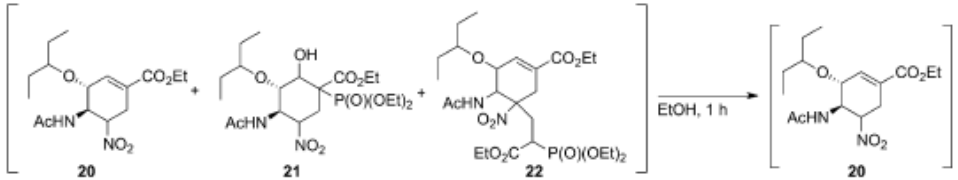


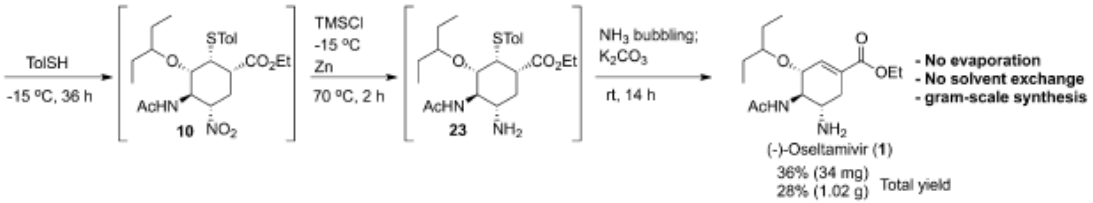
Rhodium catalysis

Dominos, Cascades and One-Pot

Enders Cascade Reaction

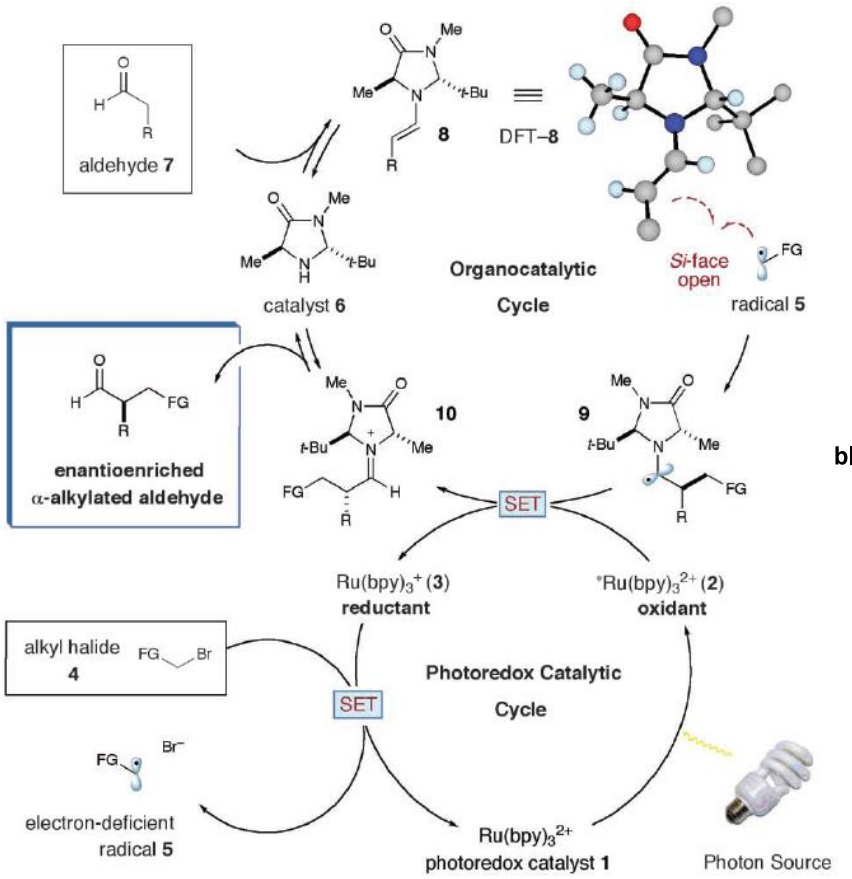




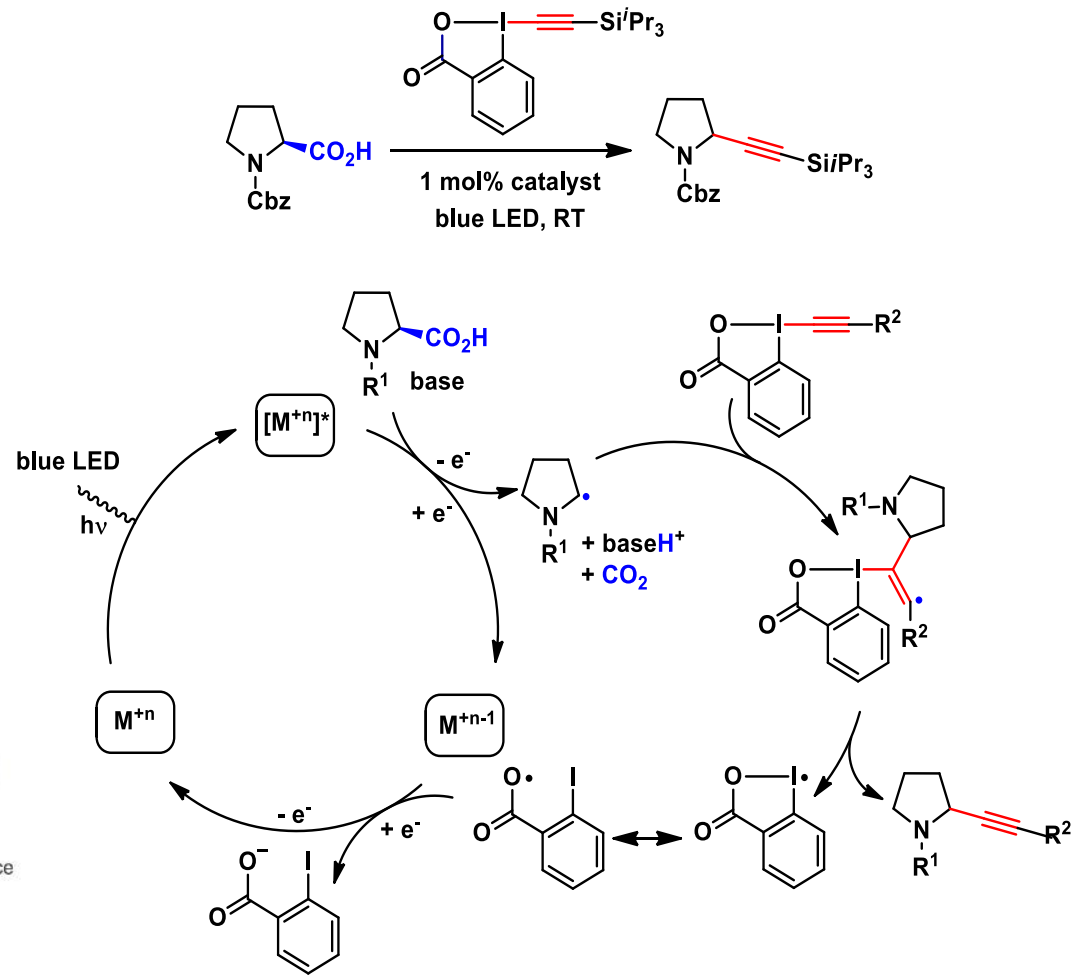


Hayashi: one-pot synthesis of Tamiflu

Photo(redox)catalysis

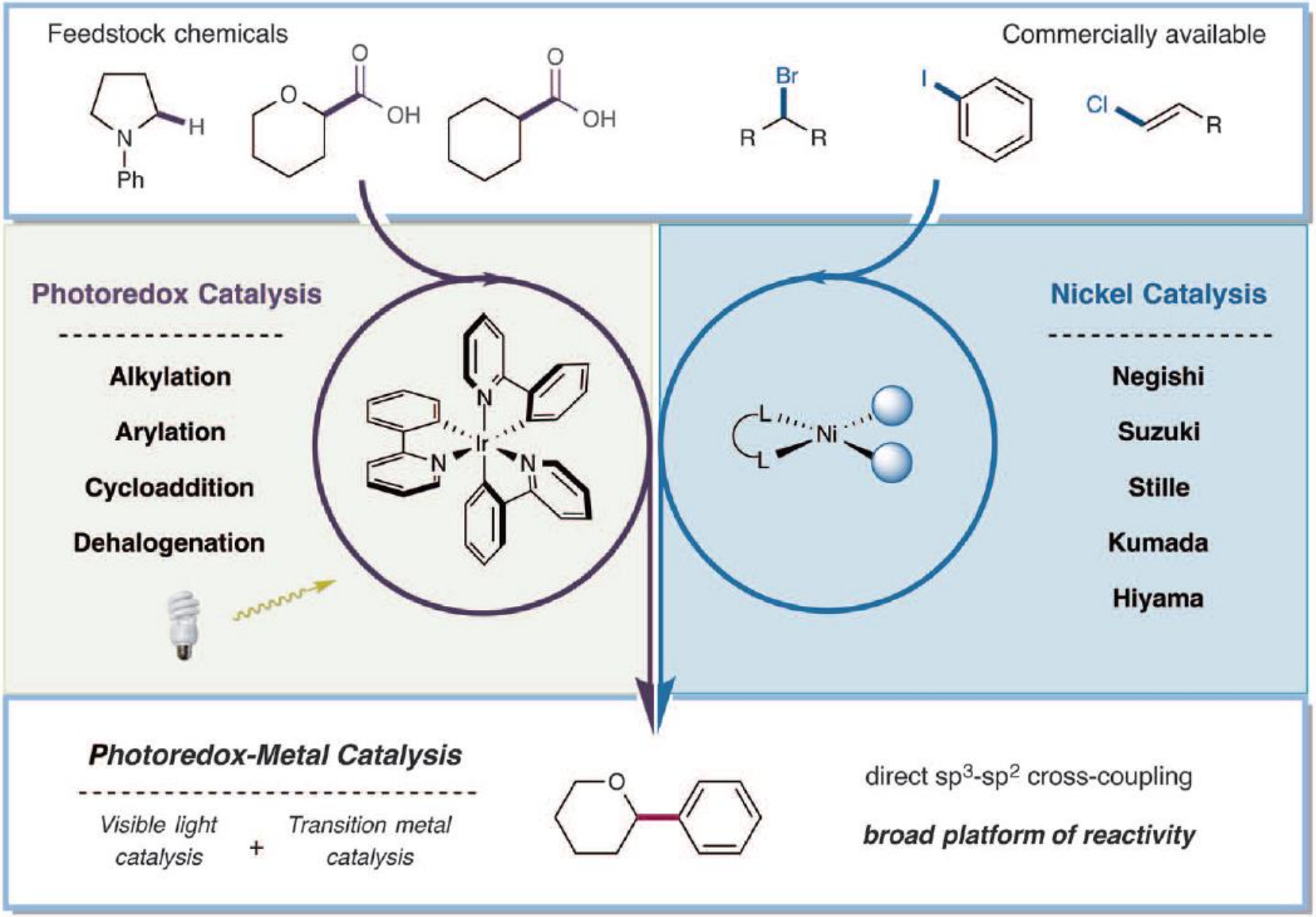


Photoredox and Somo Catalysis

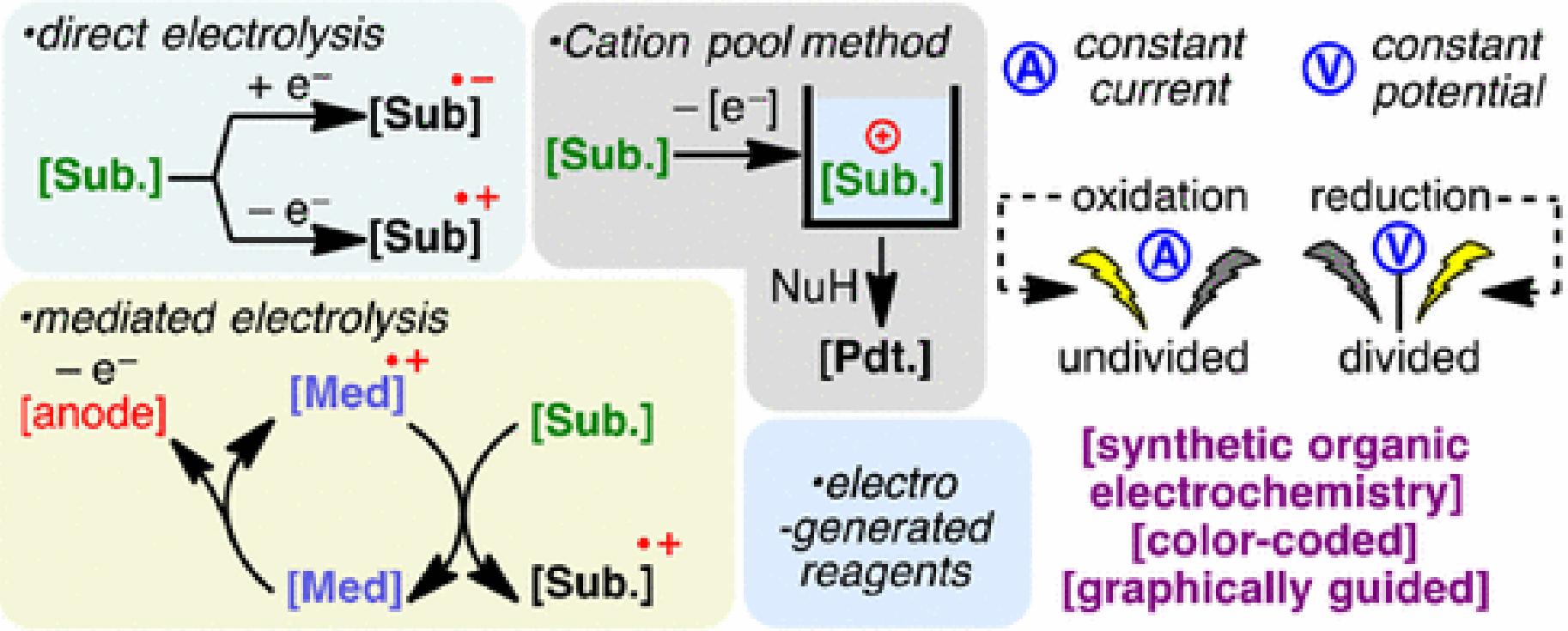


Photoredox and Hypervalent Iodine

Joining Photoredox and Transition Metal Catalysis

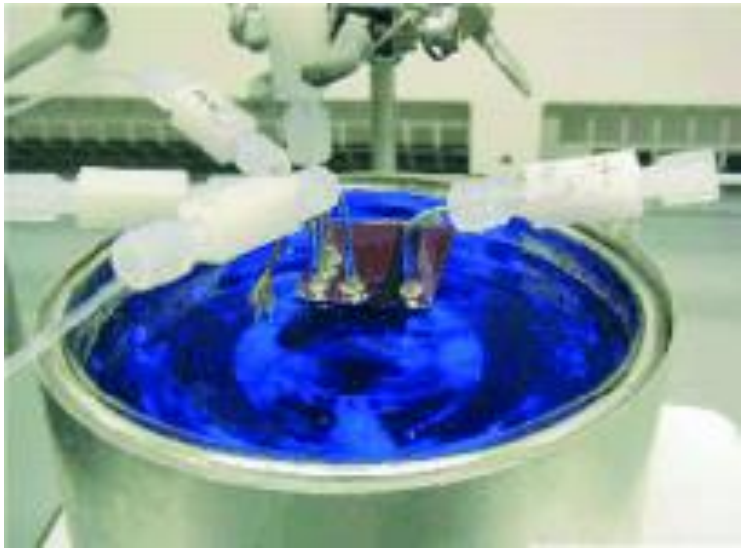


Electrochemistry for Organic Synthesis

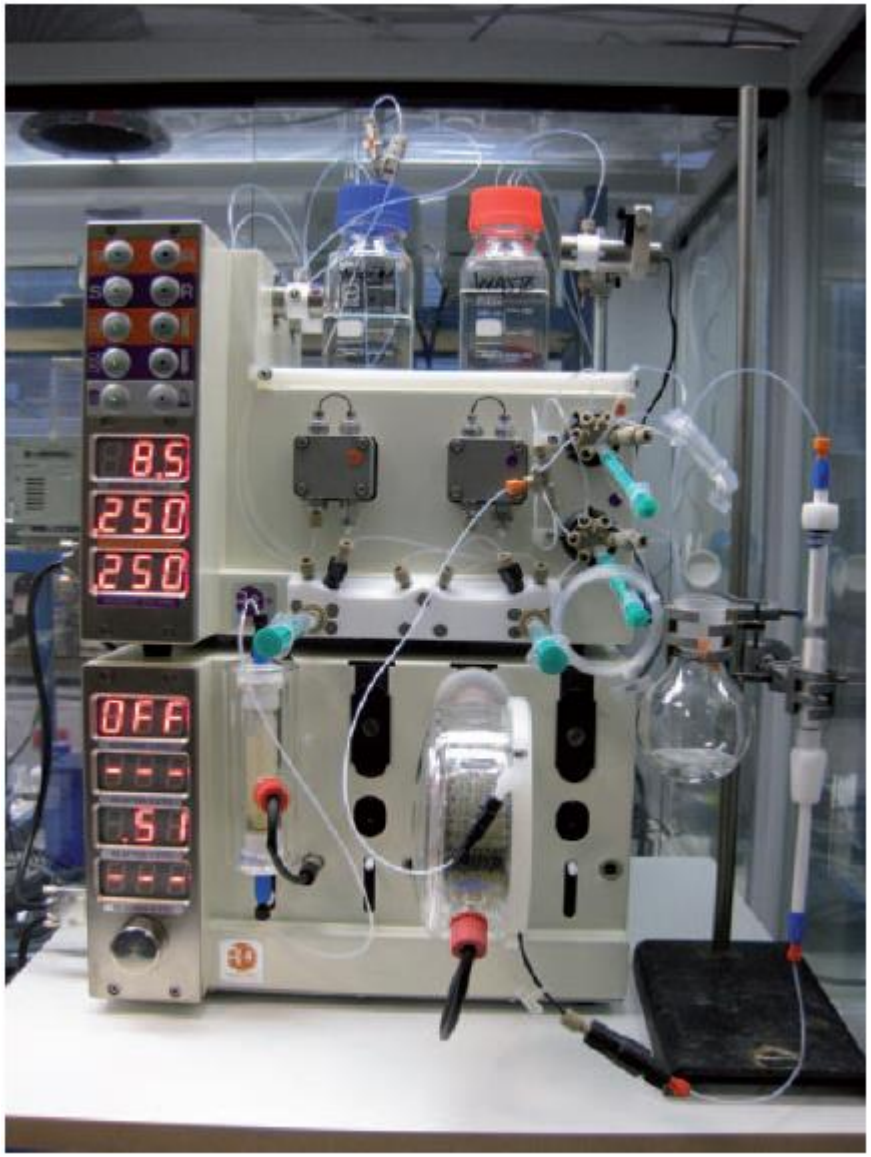


Old, but re-popularized by Baran

New Technologies

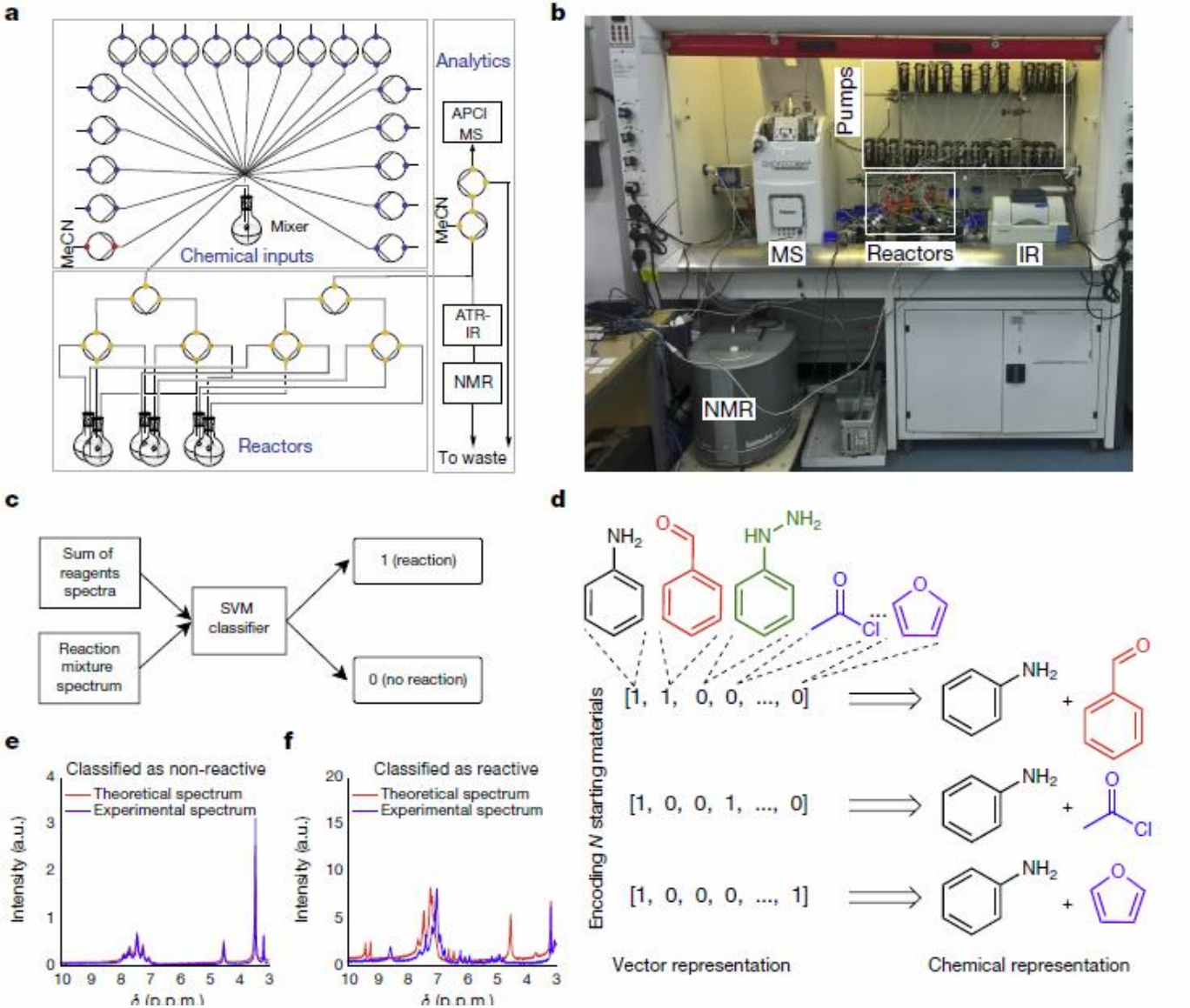


Microreactors



Flow Reactor

New Technologies



Cronin: will the robots take over?