

Frontiers in Chemical Synthesis I: Towards Sustainable Chemistry

<http://moodle.epfl.ch/>
<http://lcsso.epfl.ch/Teaching>

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Lecture Structure/Plan

- Introduction on February 23
- End of Introduction: choice of general area for each participant
- Max until April 17: 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 15+17: 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 exercises: 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.

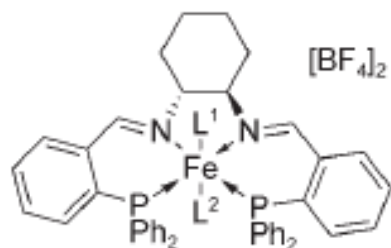
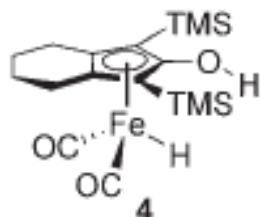
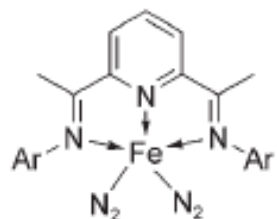
Lecture Structure: Goals of the Lecture

- 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

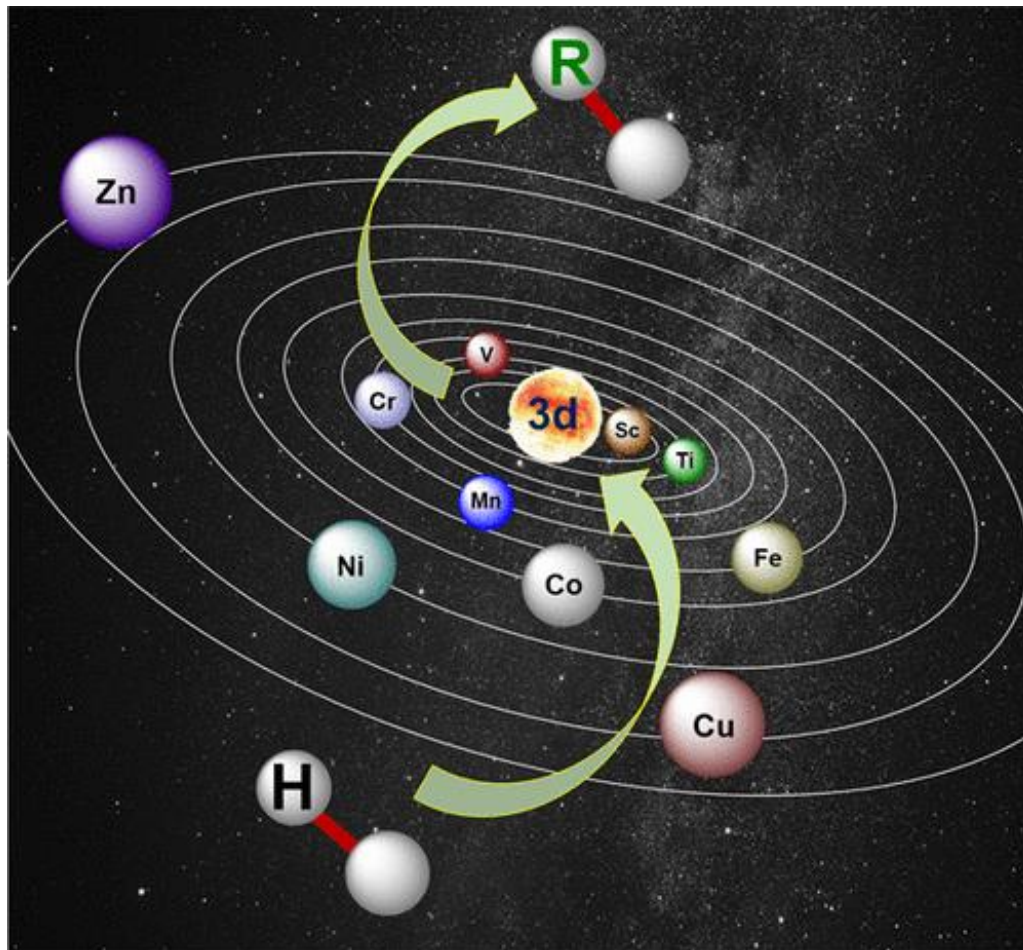
Lecture Structure: Content

- 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

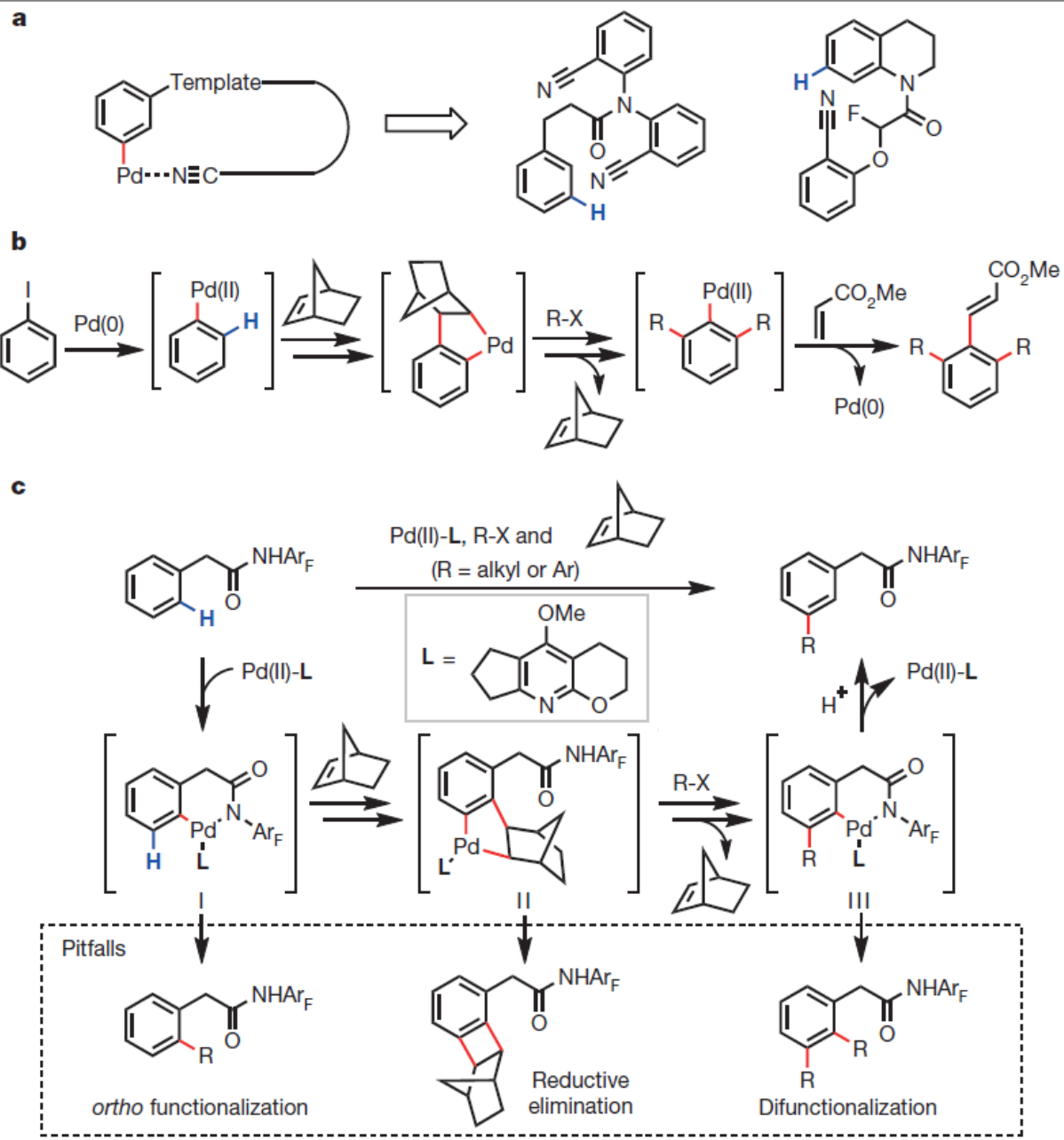


Iron Catalysis



For C-H activation
(Ackermann)

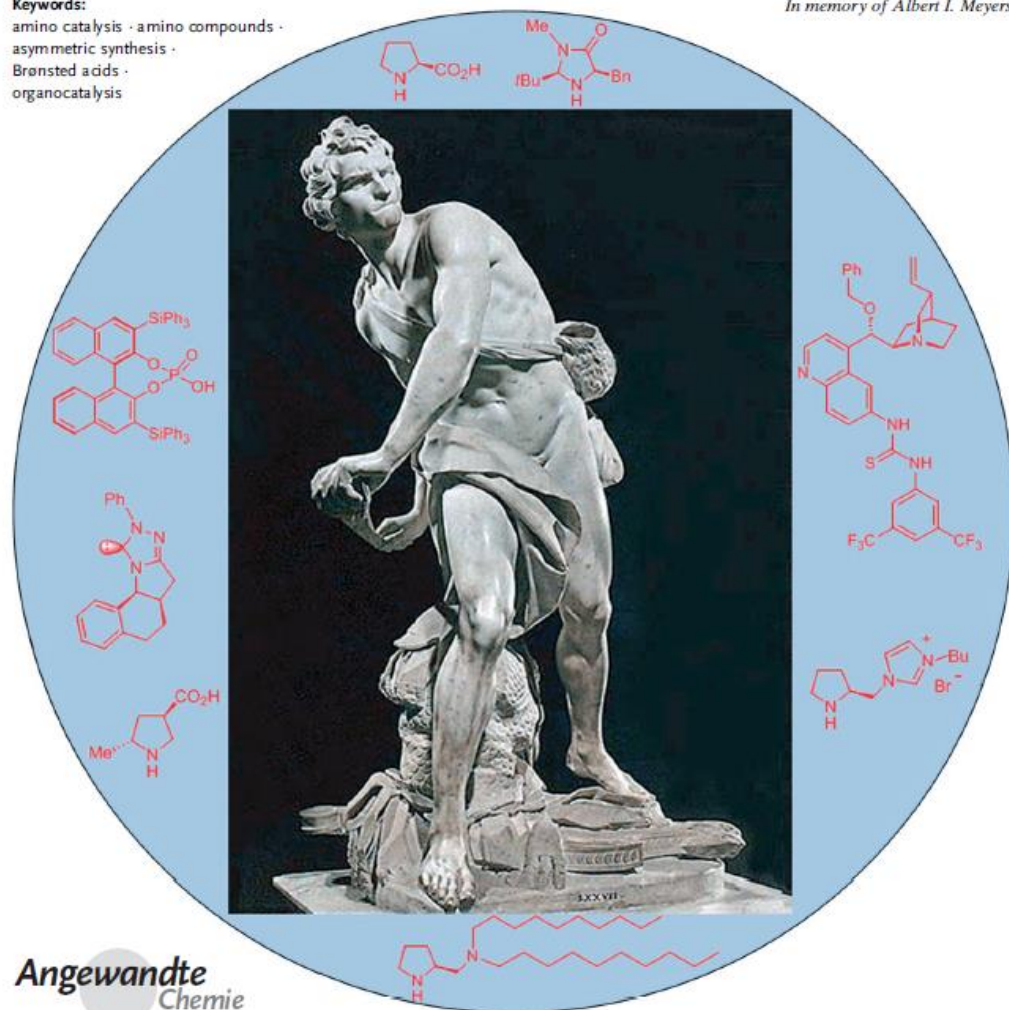
C-H: Beyond Ortho Selectivity



Organocatalysis

Keywords:
amino catalysis · amino compounds ·
asymmetric synthesis ·
Brønsted acids ·
organocatalysis

In memory of Albert I. Meyers



Current Challenges

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

Angewandte
Chemie

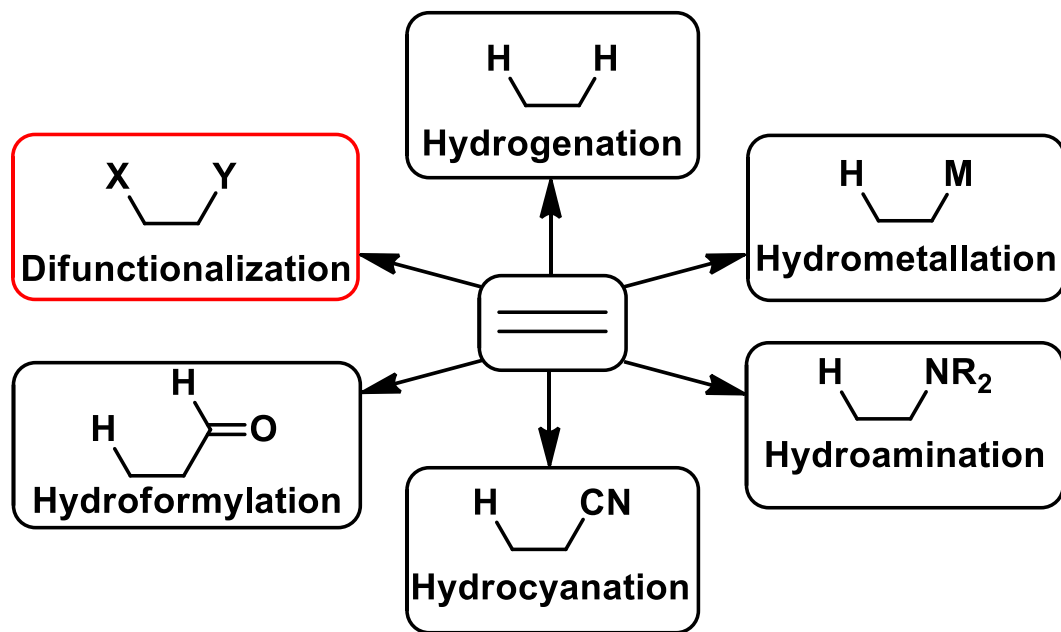
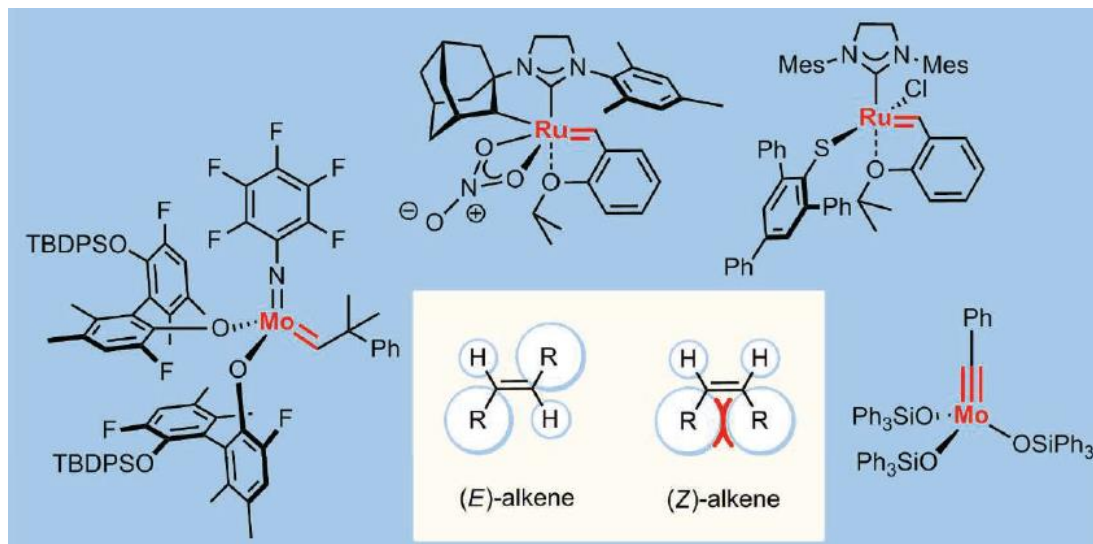
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Olefin Functionalization

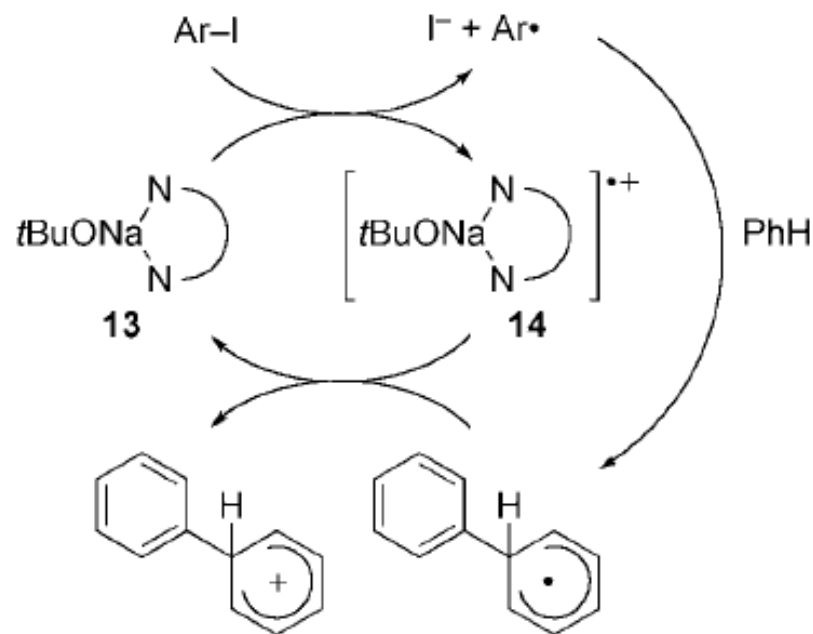
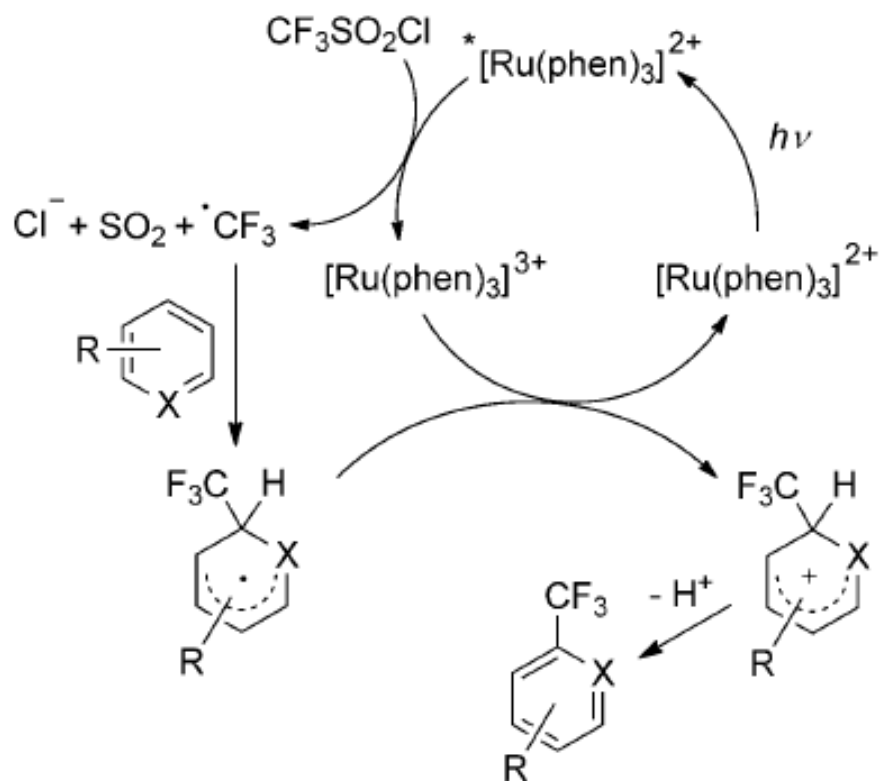
Metathesis



From Bulk to Value Added Compounds

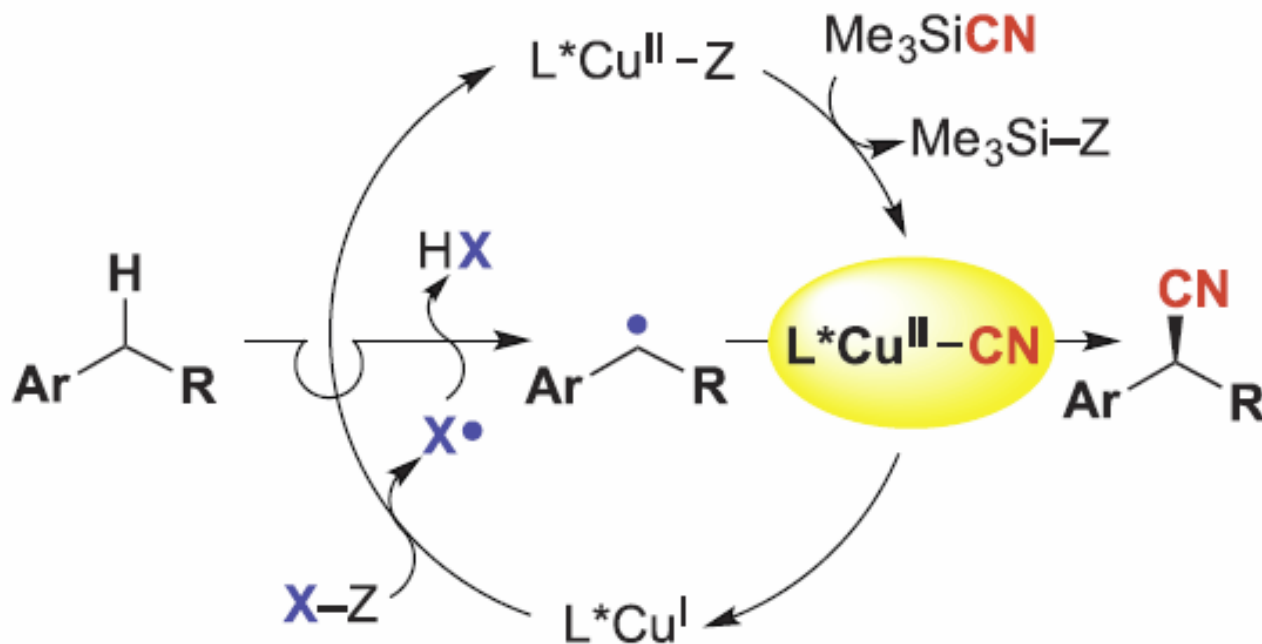
Radical Chemistry: Back to Fashion

Cross-coupling without transition metals



Trifluoromethylation of arenes

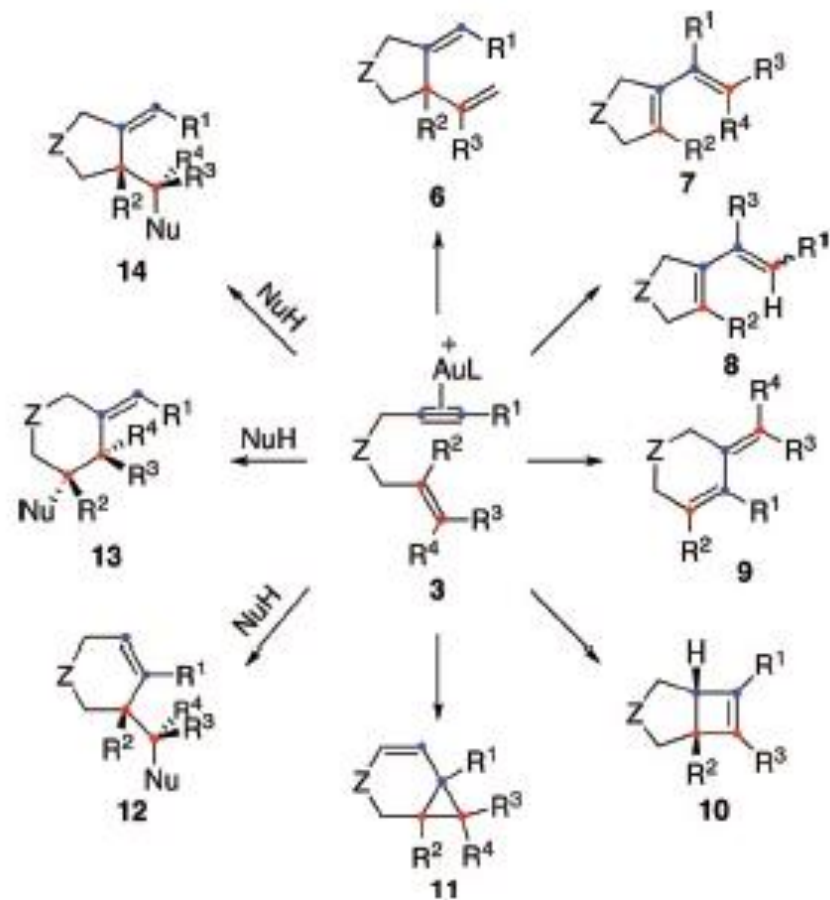
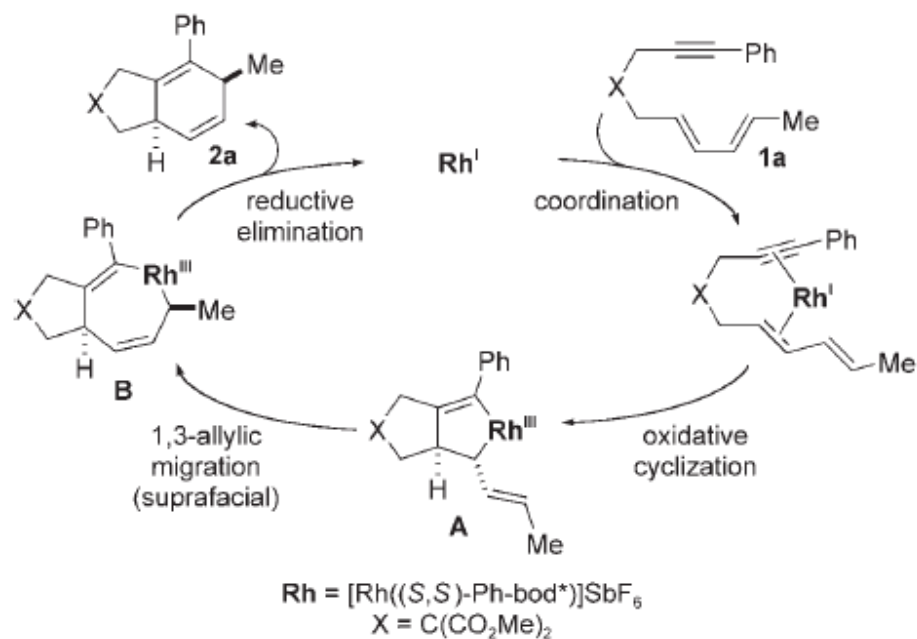
Radical Chemistry: the Hype on Enantioselectivity



Enantioselective cyanation by Guosheng Liu

Metal-catalyzed carbocyclizations

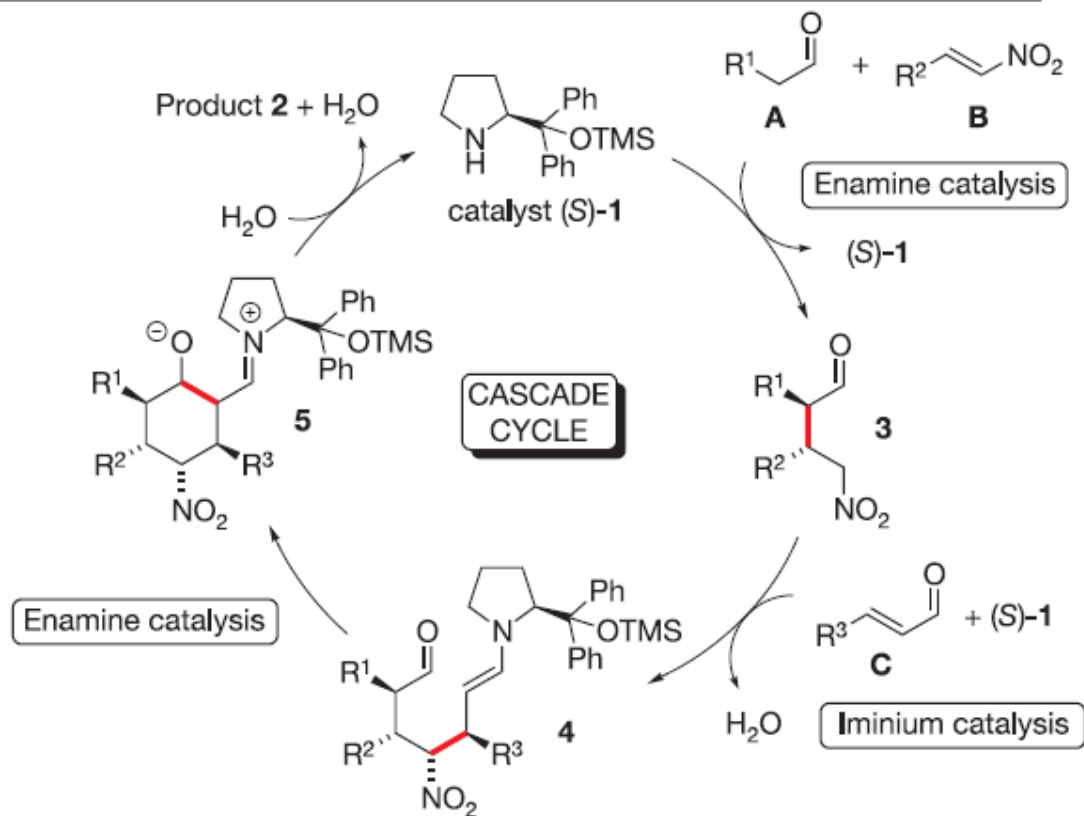
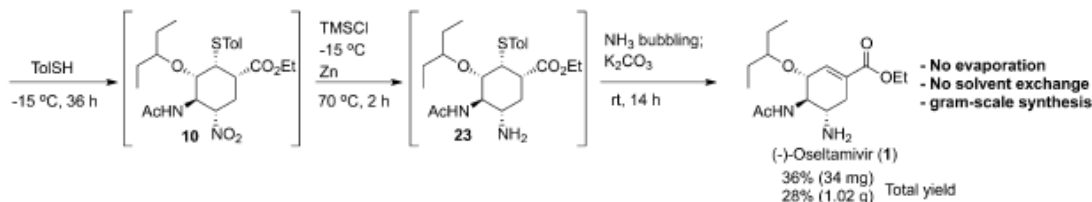
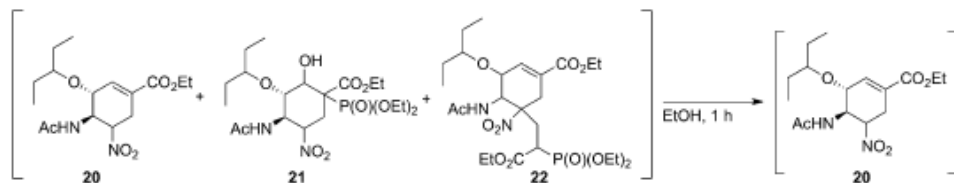
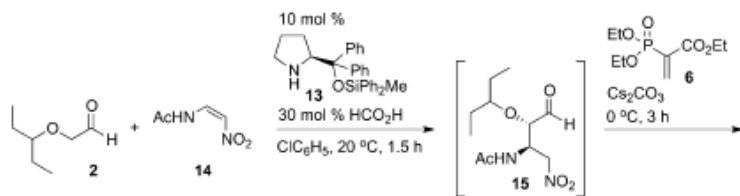
Gold catalysis



Rhodium catalysis

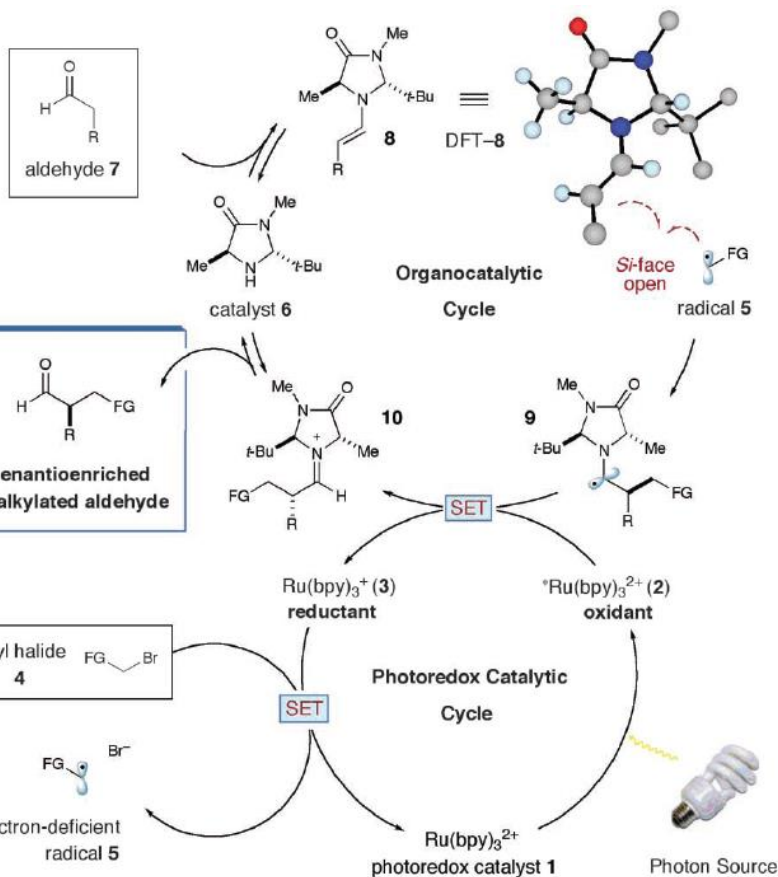
Dominos, Cascades and One-Pot

Enders Cascade Reaction

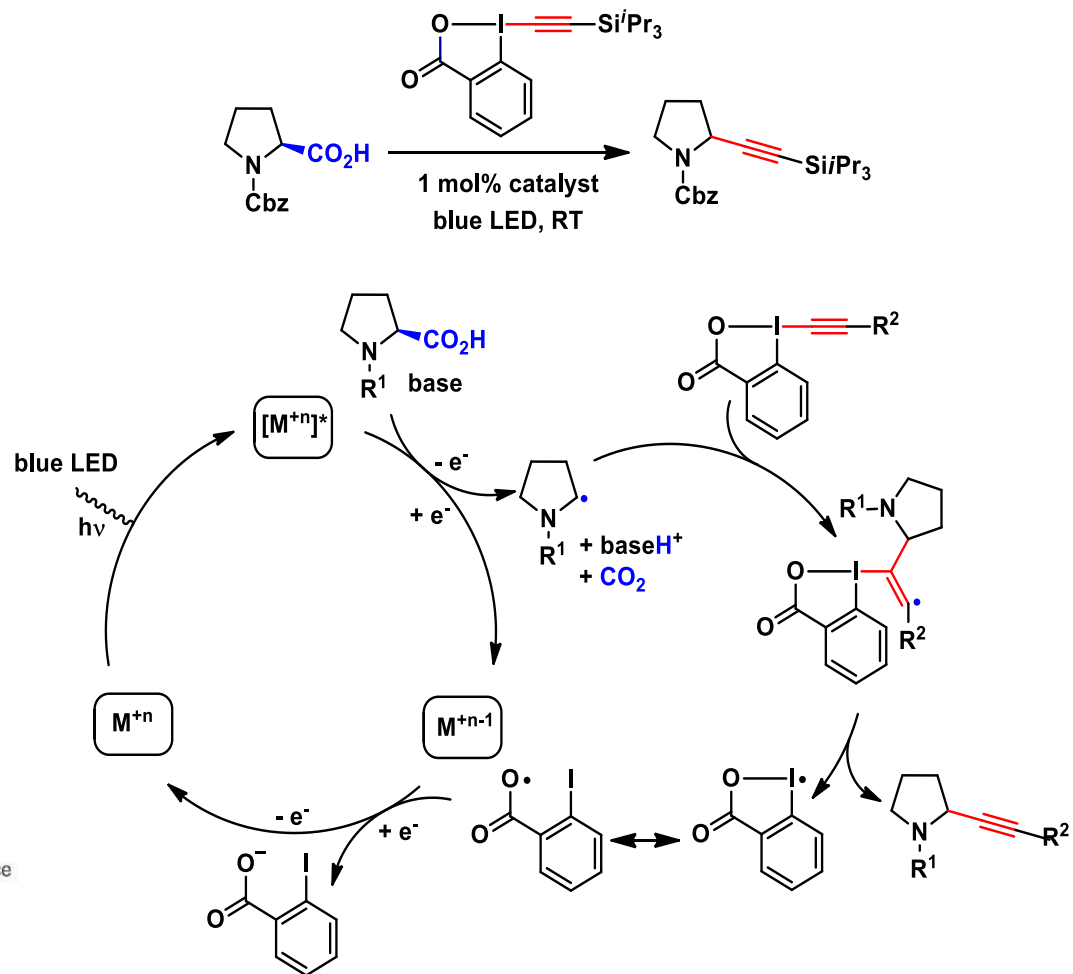


Hayashi: one-pot synthesis of Tamiflu

Photo(redox)catalysis

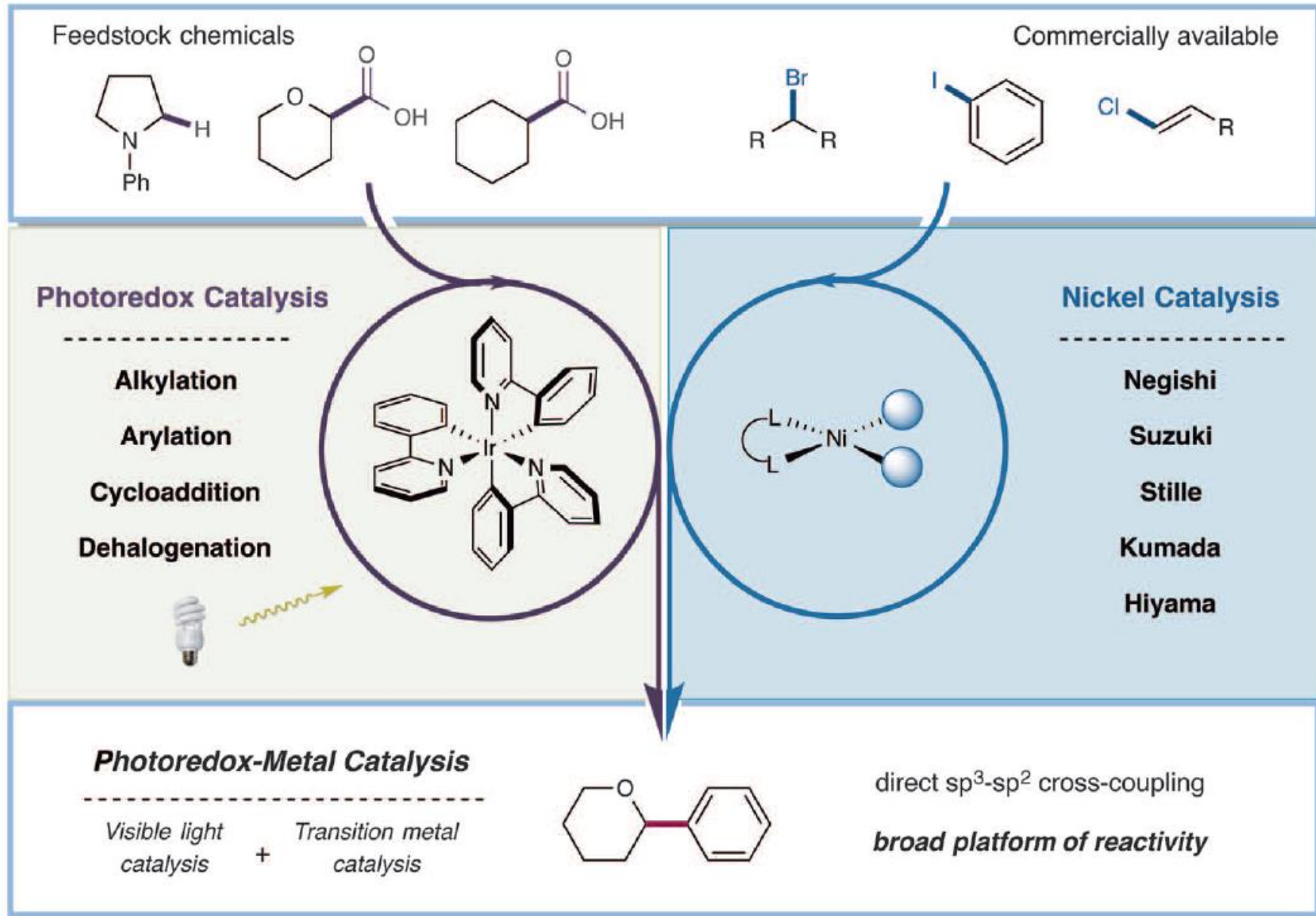


Photoredox and Somo Catalysis



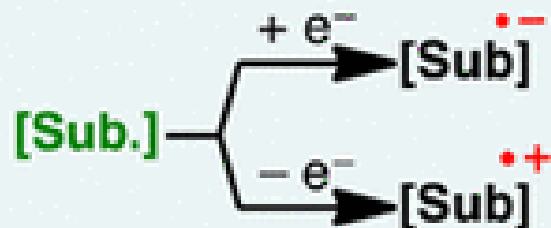
Photoredox and Hypervalent Iodine

Joining Photoredox and Transition Metal Catalysis

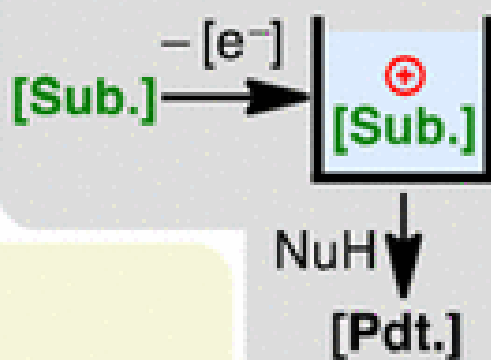


Electrochemistry for Organic Synthesis

•direct electrolysis

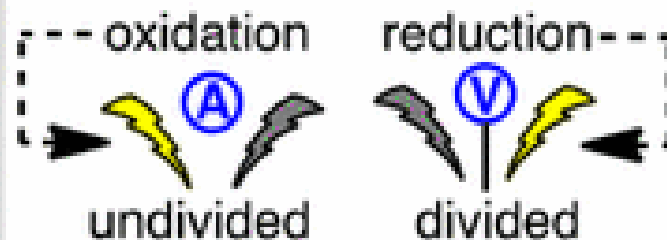


•Cation pool method

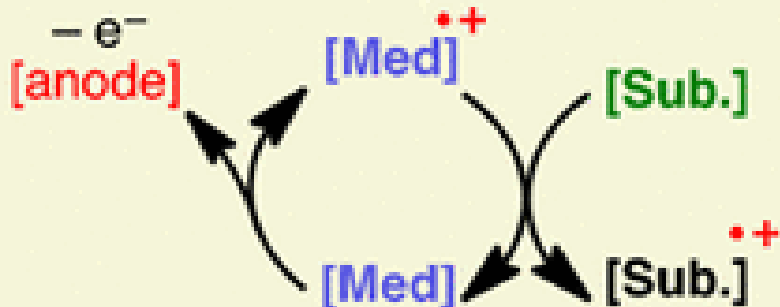


(A) constant current

(V) constant potential



•mediated electrolysis

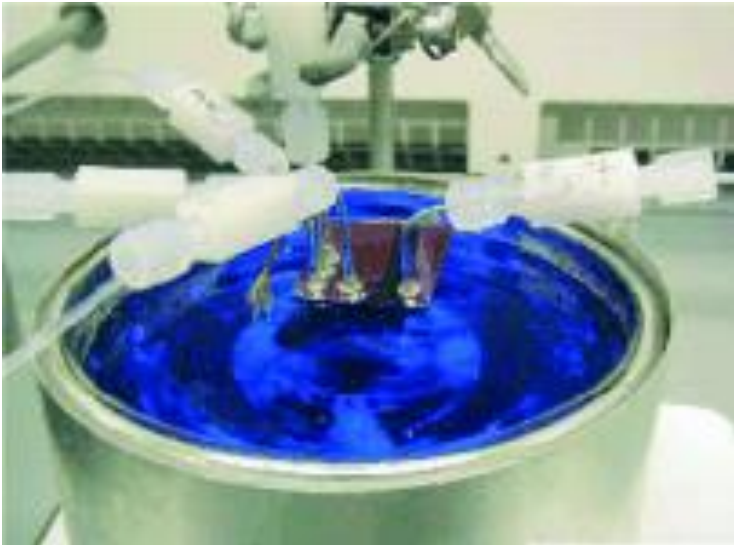


•electro-generated reagents

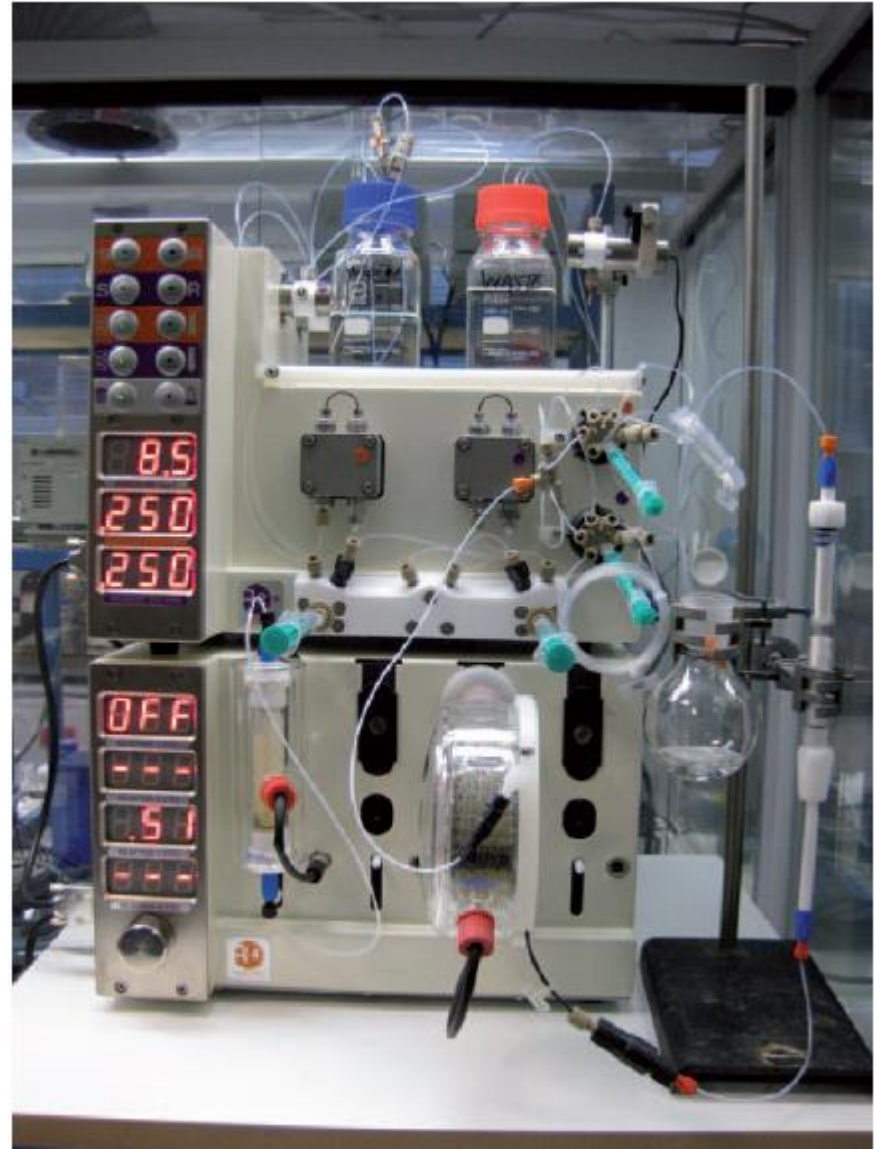
[synthetic organic electrochemistry]
[color-coded]
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Old, but re-popularized by
Baran

New Technologies

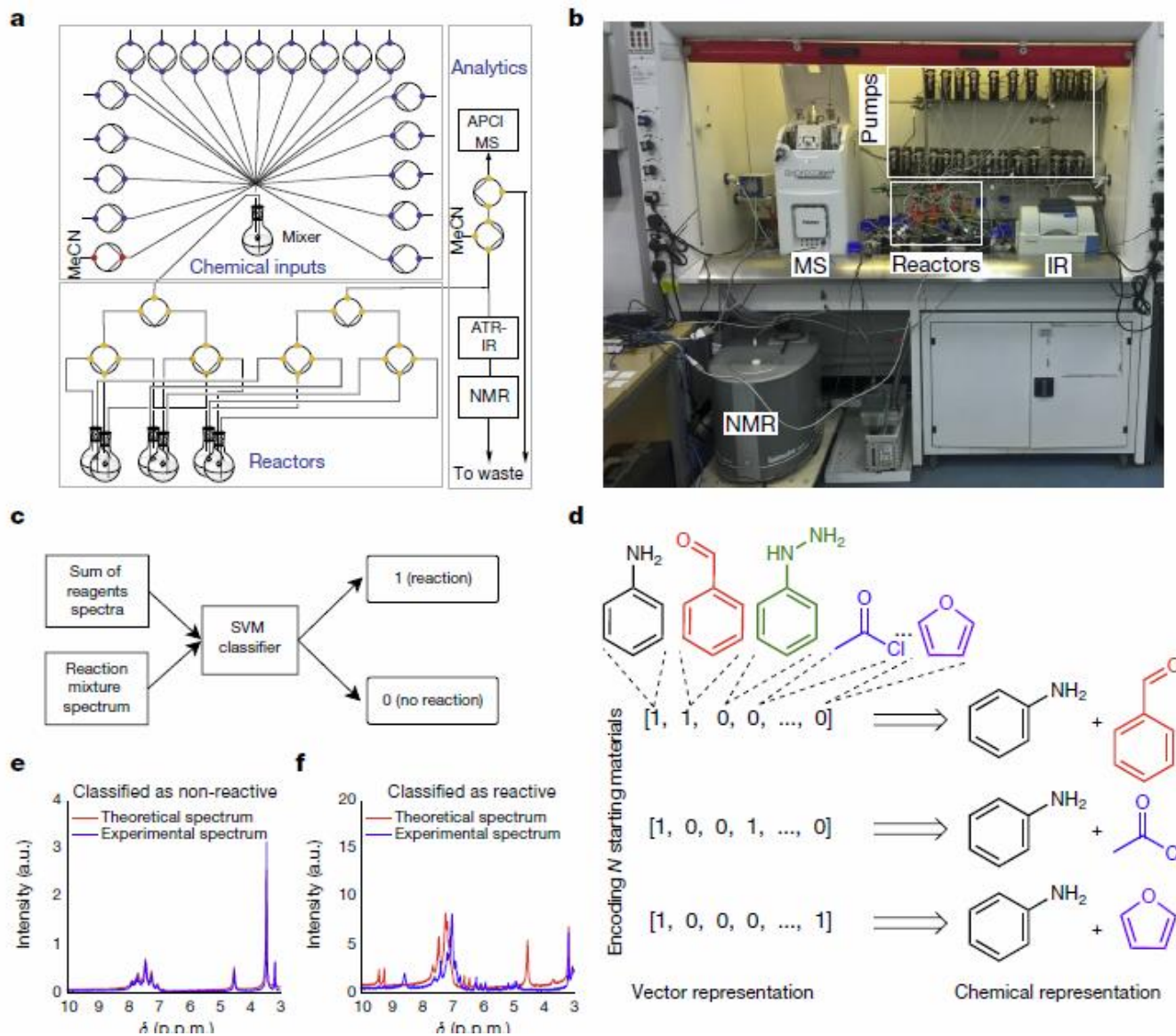


Microreactors



Flow Reactor

New Technologies



Cronin: will the robots take over?