JACS Year in Review: 1978

David Peters

THE YEAR 1978

Science:
- First 'test-tube' baby is born in England
- Insulin is produced by transgenic bacteria via recombiant DNA
- Nobel prize in Chemsitry goes to Peter D. Mitchell for work on chemiosmotic theory and engery transfer in the cell

World:
- the first recorded ascent of Mt. Everest without the aid of oxygen
- First ever transatlantic balloon flight (*Double Eagle II*)
- Famous Camp David Accords are signed by Israeli and Egyptian governments

American Culture:
- the movie *Grease* is released
- the comic strip *Garfield* is released in newspapers
- "Night Fever" and "Staying Alive" by the Bee Gees are still topping the charts
- New York Yankees win the World Series
- Dallas Cowboys win the Super Bowl
- Simon Says becomes the most popular toy in America

Volume: 100
Issues: 26
Articles: 1931

Top Cited Article: 890 citings
"Strong metal-support interactions. Group 8 noble metals supported on titanium dioxide," *JACS* **1978**, 170.)

Least Cited Paper: 0 citings
"Unusual reactivity of trifluoroacetyl peptide chloromethyl ketones with pancreatic elastase," Dimicoli, *JACS* **1978**, 1005.

Total Syntheses In This Year Not Covered:

Seychellene (Jung, 5207)
Giberellic Acid (Corey, 8034)
N-methylmaysenine (Corey, 2916)
Cytochalasin B (Greenlee, 7775)
Vernolepin (Schlessinger, 1938)
Vindoline (Kutney, 4220)
Epidregamine (Kutney, 938)
Meroquinine (Uskokovik, 571)
Quinine/Quinidine (Uskokovik, 576)
Pentalenolactone (Danishefsky, 6536)
Prostoglandins I_1, I_3, $F_{1\alpha}$ (Johnson, 7690)
Para-/Pseudozoanthoxanthin (Buchi, 4208)
Dendrobine (Roush, 3599)
Brefeldin A (Green, 4858)
Longifolene (Oppolzer, 2583)
Pumiliotoxin (Overman, 5179)
Cherylline (Evans, 1548)
Eriolanin, (Grieco, 1616)
Estradiol (Kemetani, 6218)
Biotin (Marquette, 1558)
Lycopodine (Heathcock, 8036)
Nanoamycin A (Li, 6263)
Anthopleurine (Rapoport, 4865)

Some Publications Not Covered:

"Lanthanides in organic chemistry. 1. Selective 1,2 reductions of conjugated ketones," Luche, *JACS* **1978**, 2226. (677 citings)

"Olefin homologation with titanium methylene compounds," Tebbe, *JACS* **1978,** 3611. (511 citings)

"A general, selective, and facile method for ketone synthesis from acid chlorides and organotincompounds catalyzed by palladium," Stille, *JACS* **1978**, 3636. (390 citings)

"Selective carbon-carbon bond formation via transition metal catalysis. 9. Double metal catalysis in the cross coupling reaction and its application to the stereo- and regioselective synthesis of trisubstituted olefins," Negishi, *JACS* **1978** ,2254. (196 citings)

"Selected ion fragmentation with a tandem quadrapole mass spectrometer," Yost, *JACS* **1978**, 2274. (120 citings)

"Allylic alkylation: preparation of π-allylpaladium complexes from olefins," Trost, *JACS* **1978**, 3407. (91 citations)

"An experimental determination of the geometry and electron affinity of methyl radical, Ellison" , *JACS* **1978**, 2556. (78 citings)

"Mechanisms of gas-phase and liquid-phase ozonolysis," Goddard, *JACS* **1978**, 7180. (64 citings)

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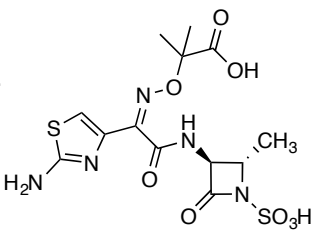
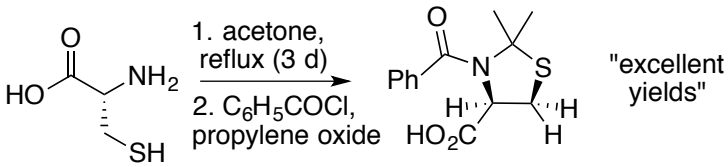
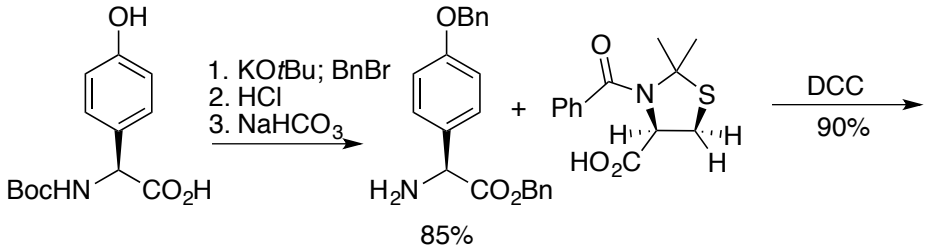
Nocardicins A and D
Koppel (Eli Lilly), *JACS* **1978**, 3933-3935.

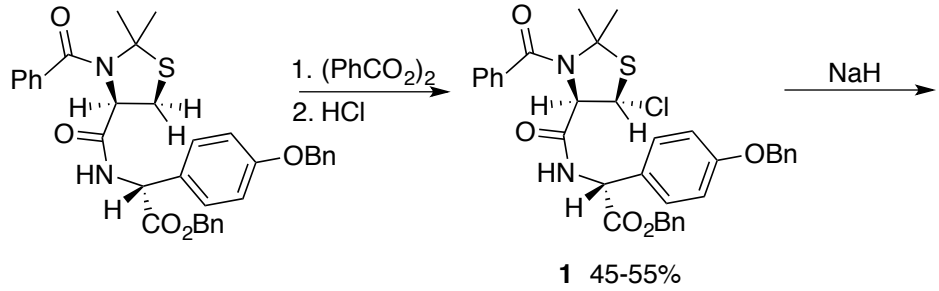
- Nocardicins isolated from *Nocardia uniformis* (*J. Antibiot.* **1977**)
- bacteriocidal - inhibits cell wall synthesis
- Strong Gram-negative activity compared to other β-lactams
- resistant to narrow spectrum β-lactamases
- Currently 1 approved monobactam: Aztreonam (Azactam or Cayston)
- important in treating cystic fibrosis patients (*P. aeruginosa*)

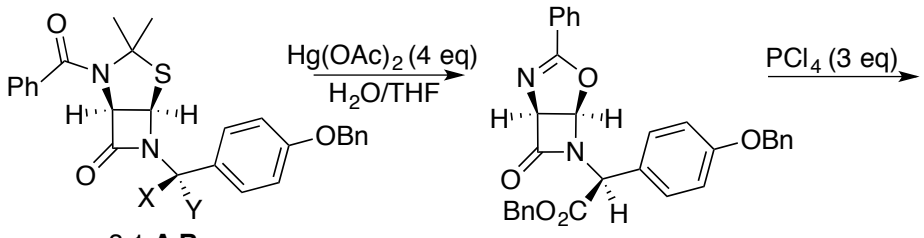


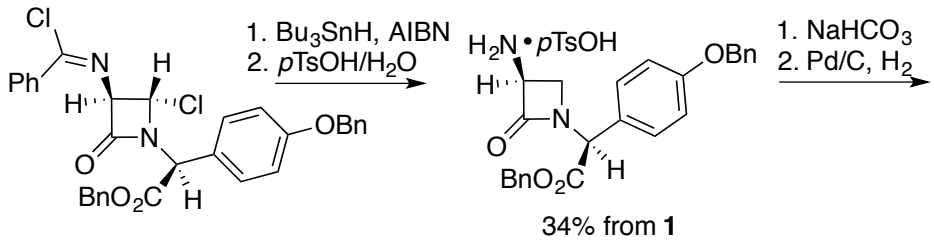
Aztreonam

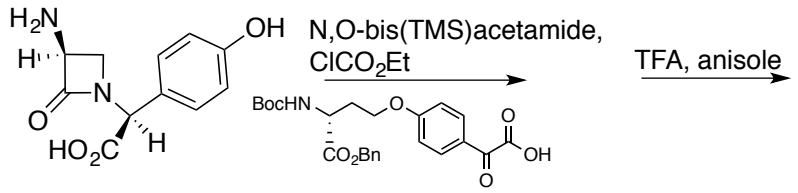


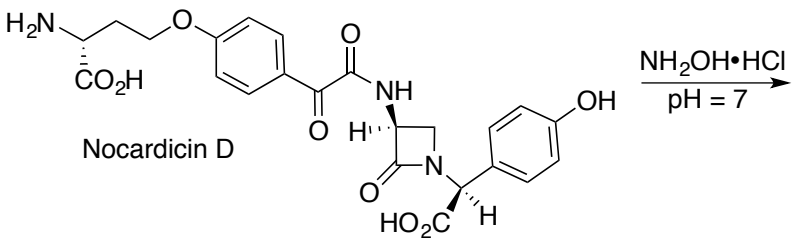


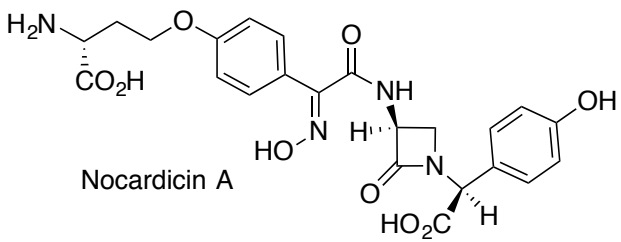












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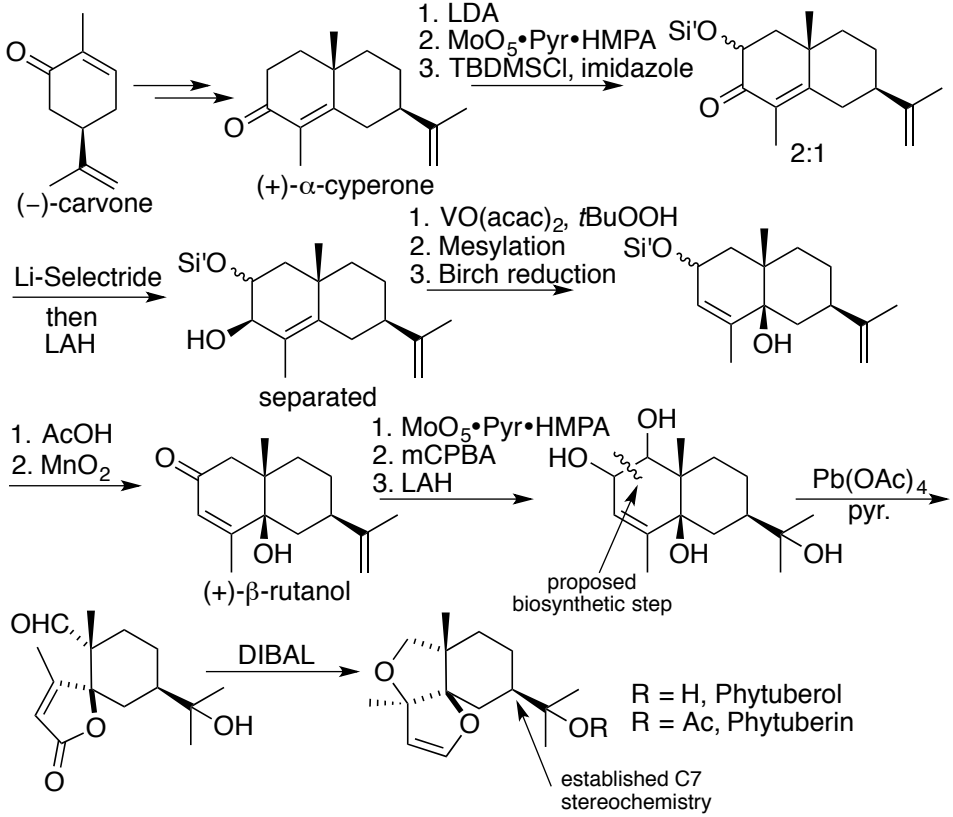
Phytuberol and Phytuberin

Masamune, *JACS*, **1978**, 7751.

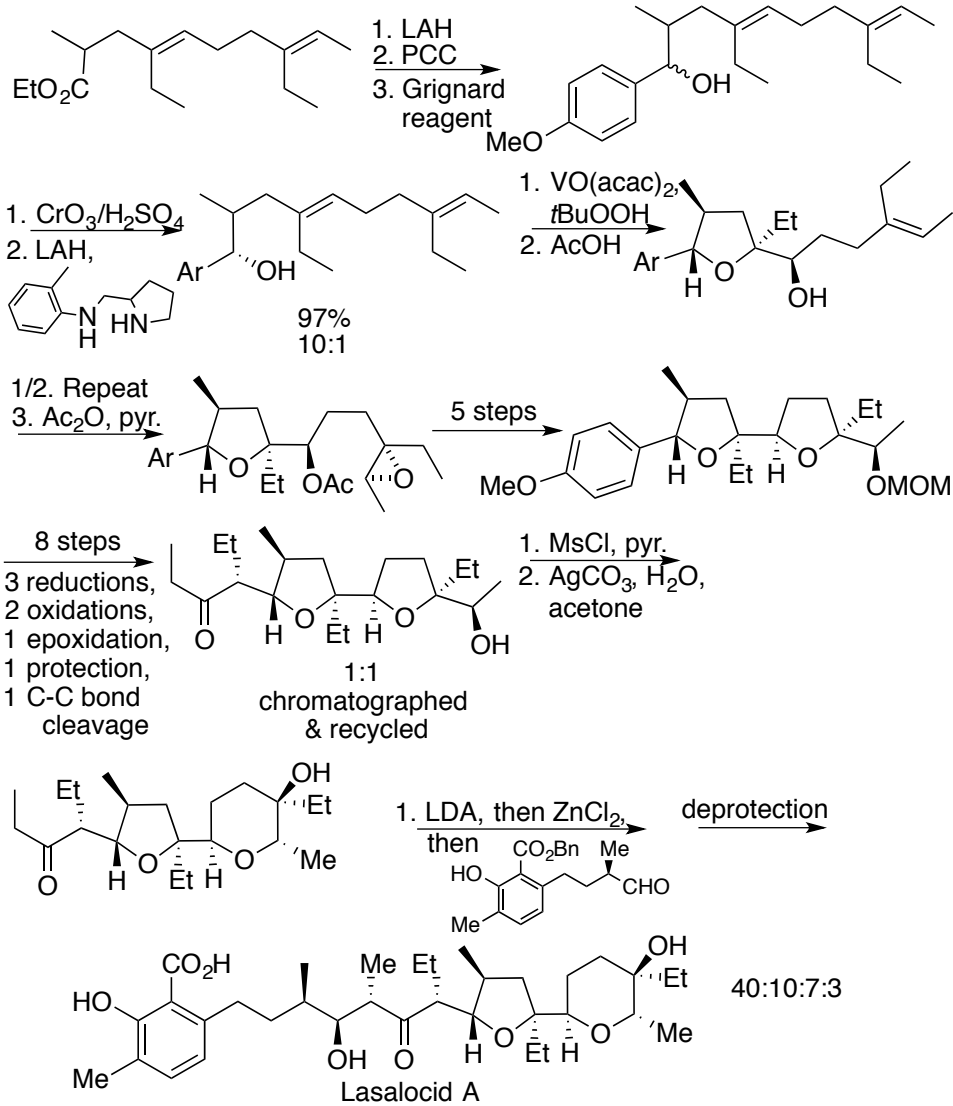
- sesquiterpene isolated from a number of species of *Solanum* (includes potatoes, tomatoes, and tobaco)
- involved in resistance to pathogenic fungi
- implications in arms race against blight and other plant diseases



Lasalocid

Kishi, *JACS*, **1978**, 2933.

- Isolated from fungus - *Streptomyces lasaliensis*
- polyether antibiotic with weak activity - highly studied before1978
- active ingrediet in feed additive Bovatec
- no clinical relevance due to toxicity and activity



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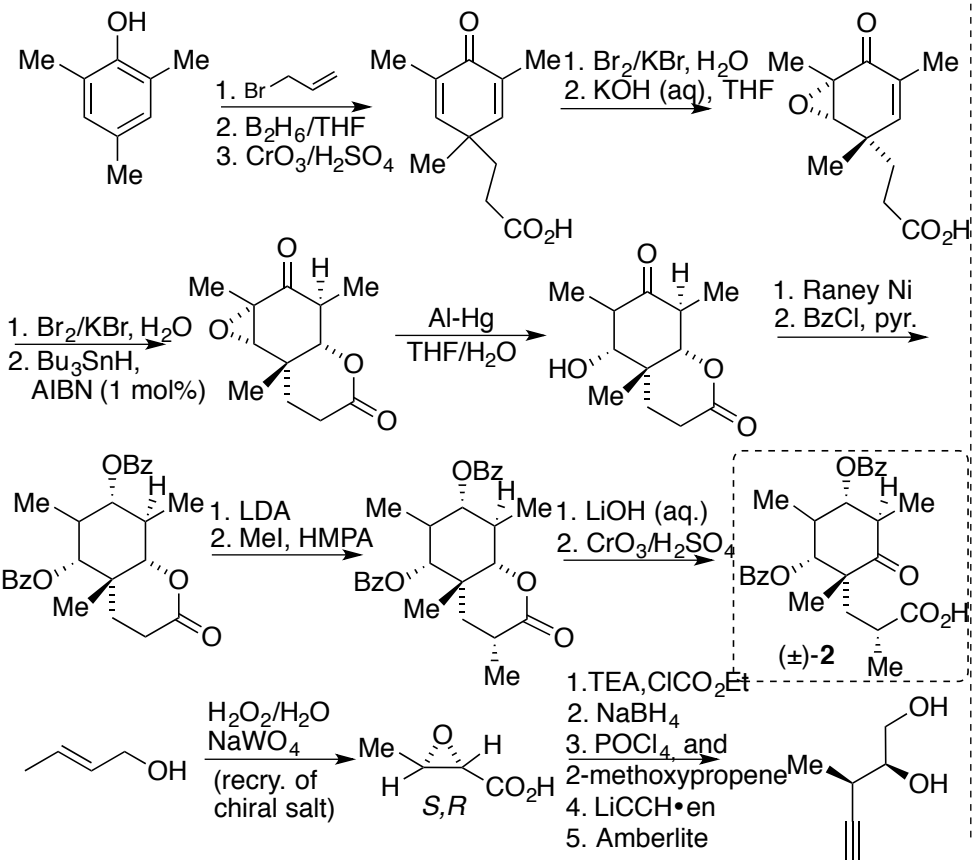
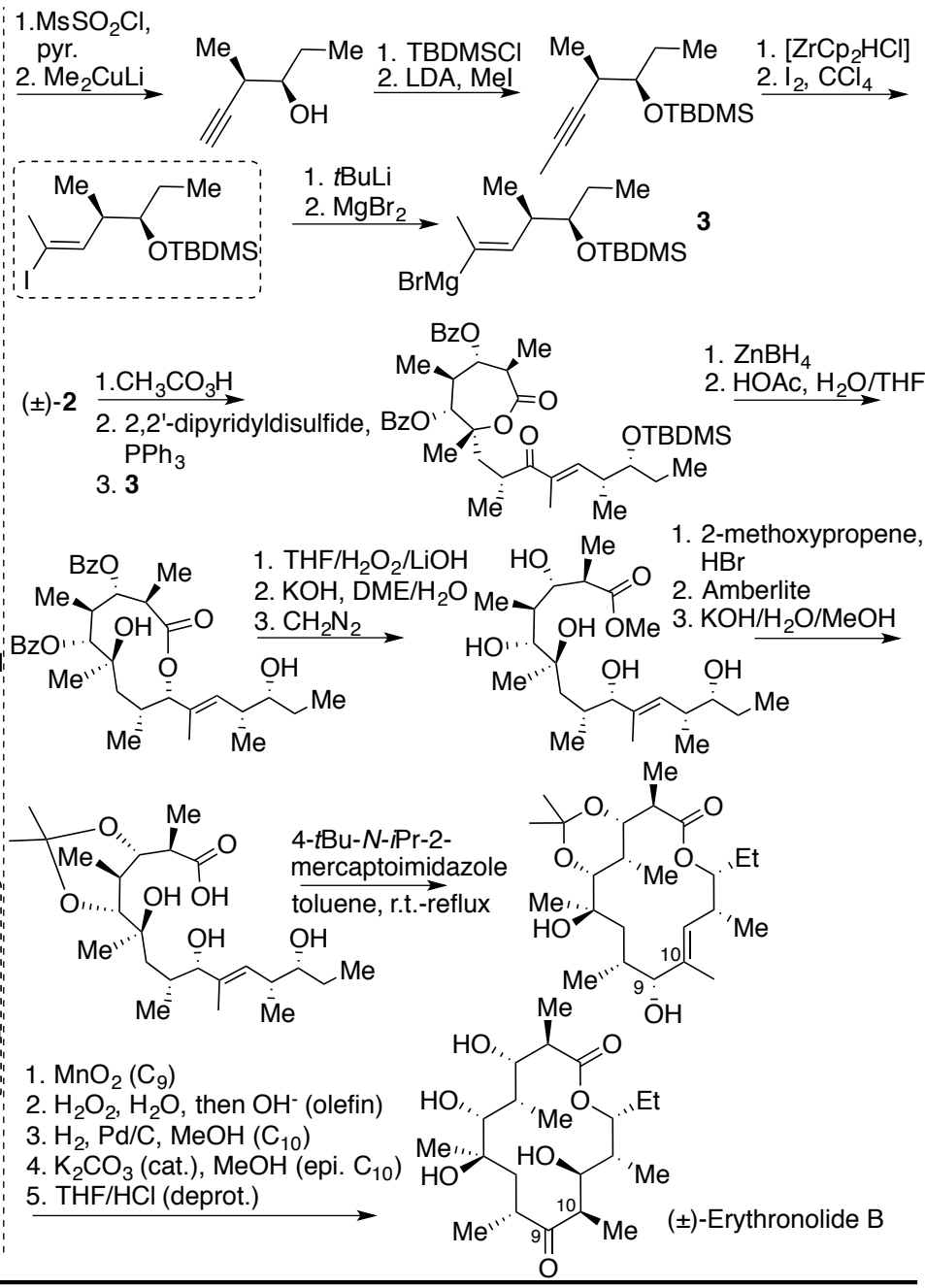
Erythronolide B
Corey, *JACS* **1978,** 4618-4620.
Corey, *JACS* **1978,** 4620-4622.

- Erythromycin B isolated from *Streptomyces erythreus* in 1949 (Eli Lilly)
- 16 membered macrolide; most famous
- Inhibits protien synthesis at the ribosome; bacteriostatic
- take it how you like! - IV, IM, orally, topically, eye drops
- mostly active against Gram-positive bacteria (respritory tract, muccous membrane, and skin infections)
- resistance arises via ribosomal mutation, eflux, and xenobiotic modification
- currently 12 erythromycin-based antibiotics on the market
- respritory tract, muccous membrane, and skin infections





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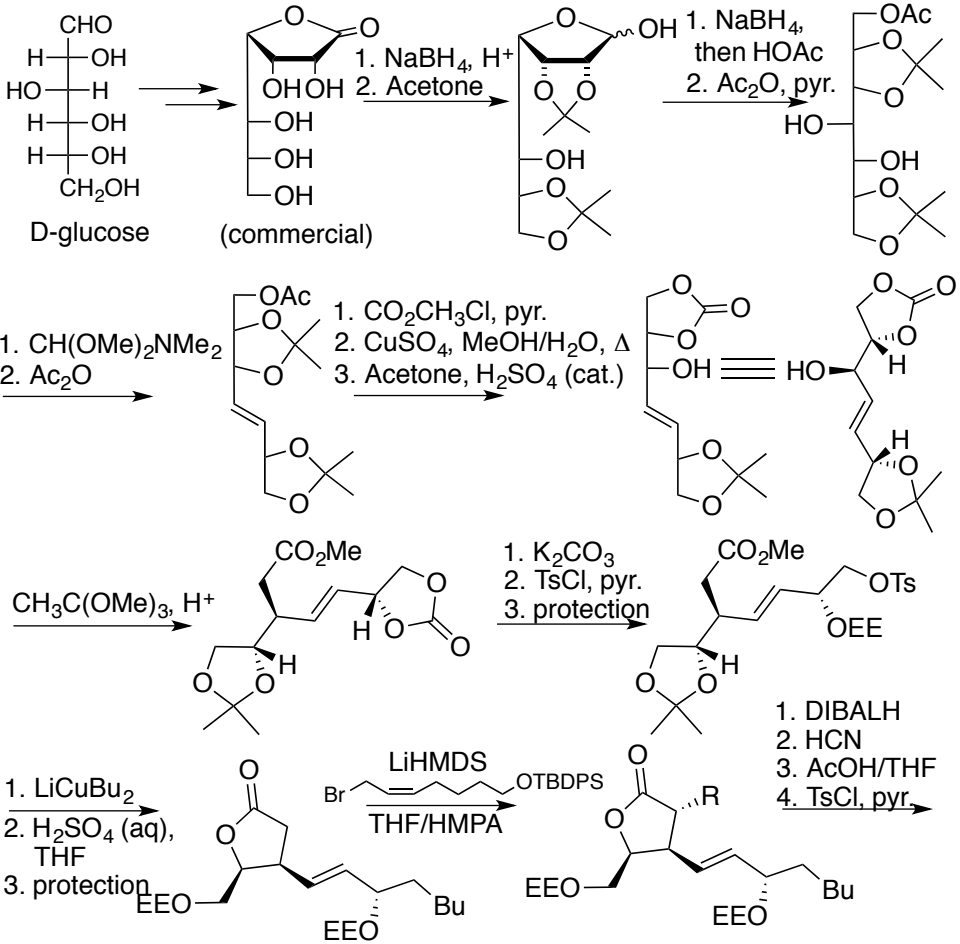
Prostaglandin $F_{2\alpha}$

Stork, *JACS* **1978**, 8272-8273.

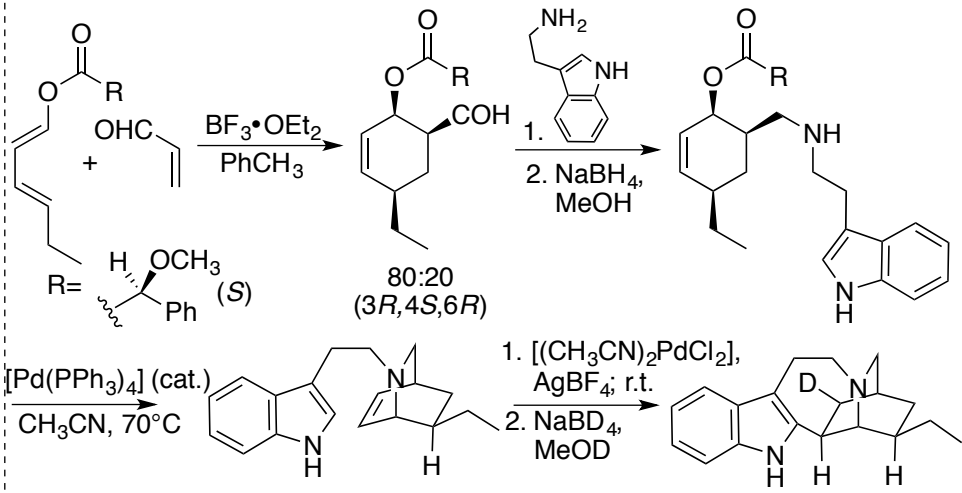
- large class of fatty acid derived molecules; found in every human tissue
- discovered in 1935 by Ulf von Euler
- act as autocrine effectors for a diverse range of functions
- Letter designates ring structure; number indicates degree of unsaturation
- most are synthesized from one precursor - arachidonic acid
- inhibition of synthesis lead to discovery of aspirin
- medicinal uses are as wide as the functions of natural prostaglandins
- this synthesis done at the height of prostaglandin research



Ibogamine

Trost, *JACS,* **1978**, 3930.

- iboga alkaloids from *Taberanthe iboga*
- most have psychoactive properties
- synthetically related compound: vinblastine
- ibogaine: (5-OMe) is Schedule 1 in the U.S.



- done first with R=CH_3 to yield racemic ibogamine
- 17% from diene, "without yield optimization"
- most natural igobamine is (–); propose using (*R*) auxiliary
- deuteration suggest Pd is in association with indole at initiation of cyclization

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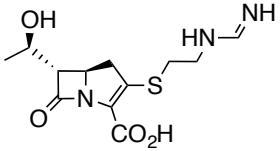
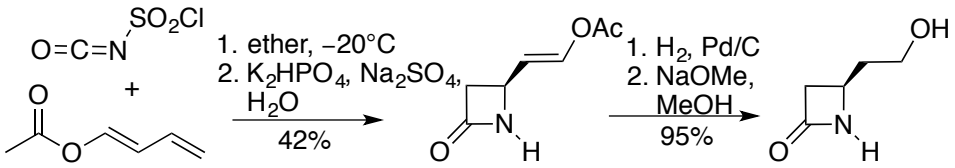
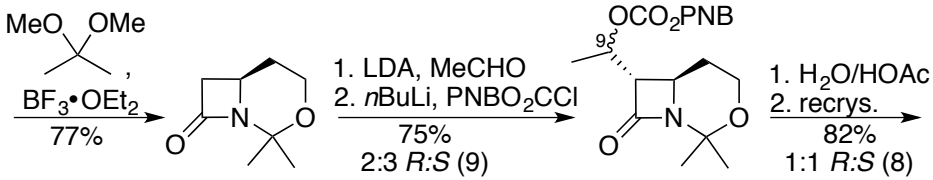
(±)–thienamycin
Johnston, D.B.R. (Merck), *JACS* **1978**, 313-315.

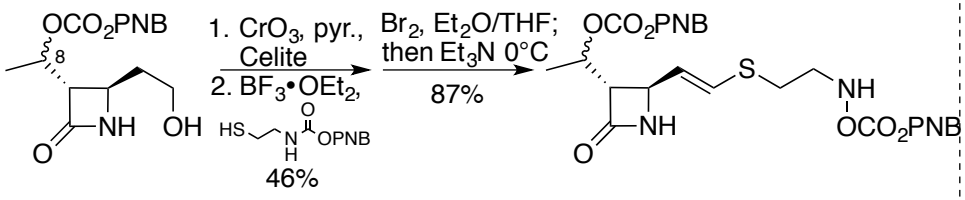
- first isolated carbapenem; from *Streptomyces cattleya* (*J. Antibiot.* **1979**, 1, 1-12.)
- unstable in water (pH > 8); derivitization needed
- imipenem closest related derivative and first to get use
- 4 carbapenems approved in U.S.
- resistant to most β-lactamases
- does not bind PBP-2a (no MRSA activity)
- A class of reserved antibiotics. Some resistance scares (New Delhi, Greece)

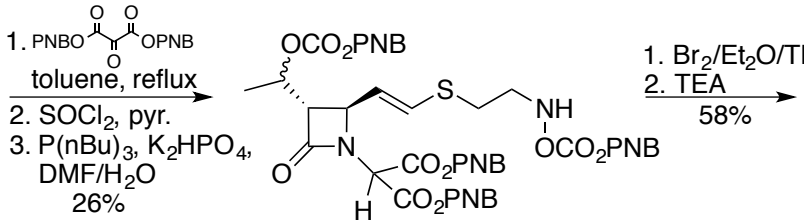


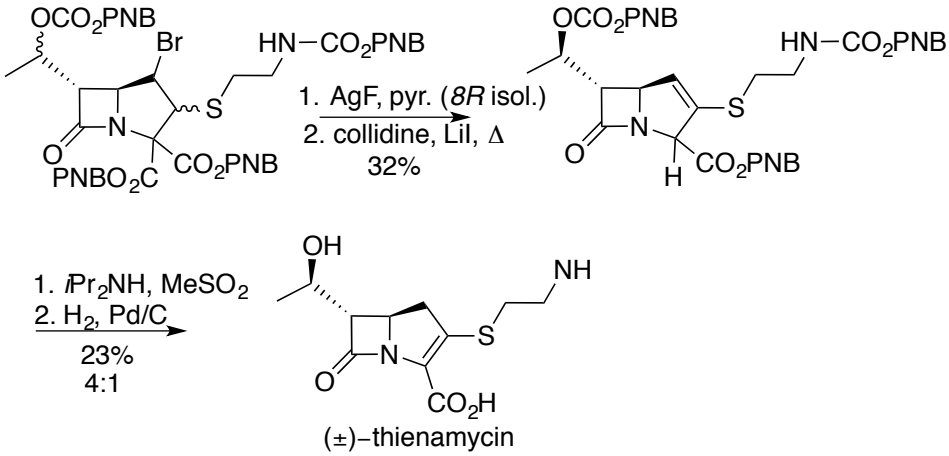
imipenem











(±)–thienamycin

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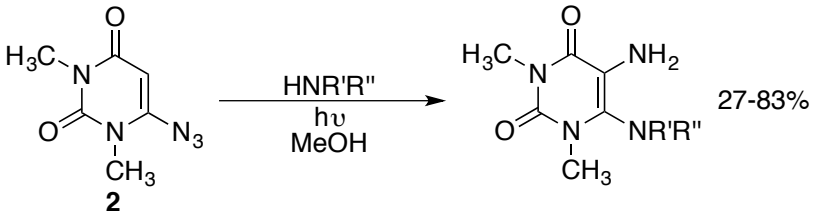
"A new photochemical transformation of 6-azido-1,3-dimethyluracil to 6-alkylamino-5-amino-1,3-dimethyluracils and its application to one-step synthesis of lumazines and fervenulins," Senda, *JACS* **1978**, 7661-7664.



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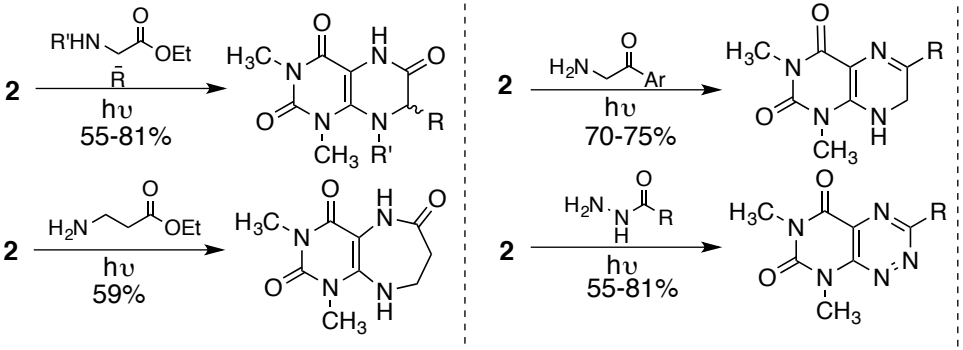
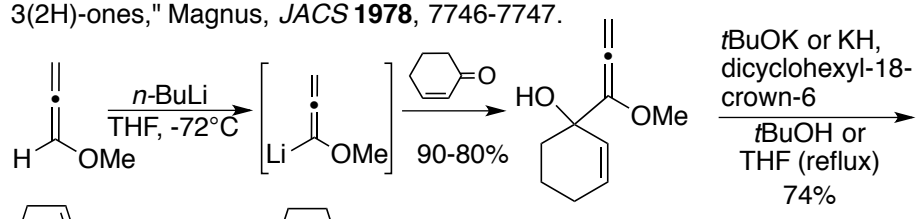
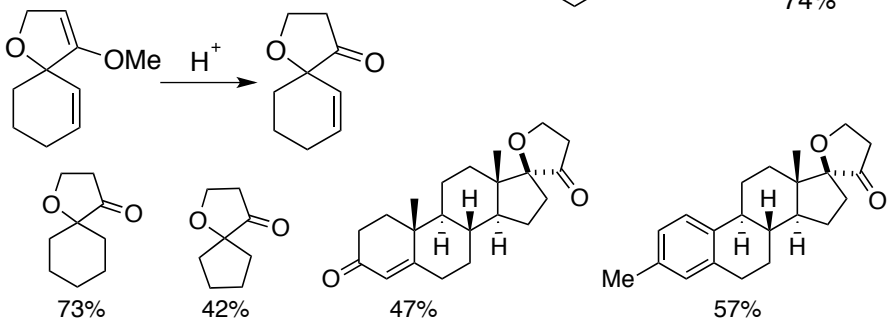
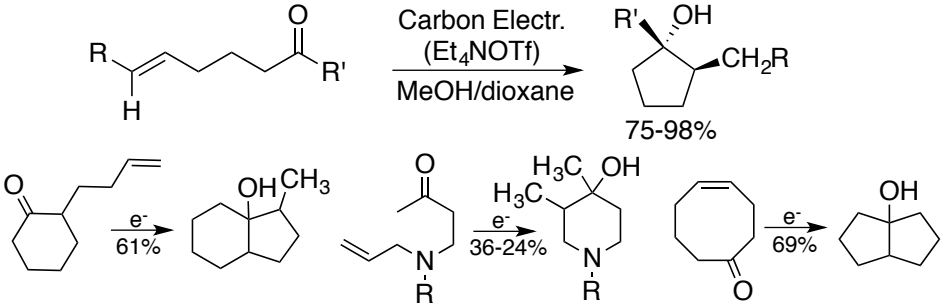


"An unusual New Allene Cyclization Reaction. Synthesis of Dihydrofuran-3(2H)-ones," Magnus, *JACS* **1978**, 7746-7747.



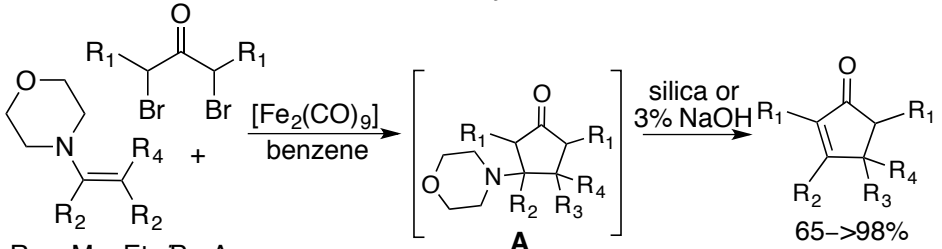


"Electroorganic Chemistry. Reductive cyclization of Nonconjugated Olefinic Ketones to Cyclic Tertiary Alcohols," Shono, *JACS*, **1978**, 545-550.



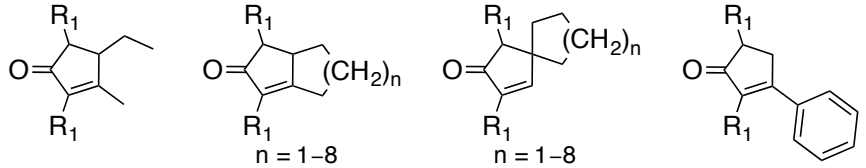
- R and R' substituents show little affect on ring formation
- regio- and stereoselective; only 5 and 6 membered rings oserved
- substitution at the proximal olefinic carbon precludes cyclization
- done in diaphragm split cell as well; some 1,2-reduction of carbonyl

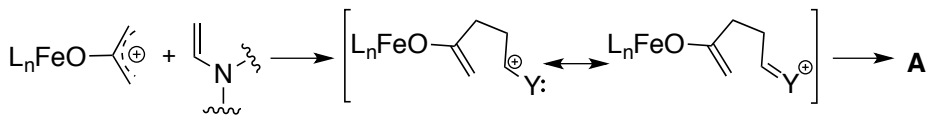
"Novel cyclopentenone synthesis via the iron carbonyl aided coupling between α,α'-dibromo ketones and enamines," Noyori, *JACS* **1978**, 1799.



R_1 = Me, Et, *i*Pr, Ar

A





- $Fe(CO)_5$, Zn-Cu couple give low yields, no reaction NaI
- Trans isomer predominant, except in fused rings
- No reductant = no reaction; in furan yields [3+4]

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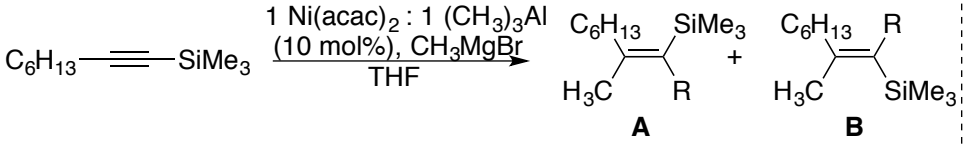
"Nickel-catalyzed addition of Grignard reagents to silylacetylenes. Synthesis of tetrasubstituted alkenes," Snider, *JACS*, **1978**, 4624.

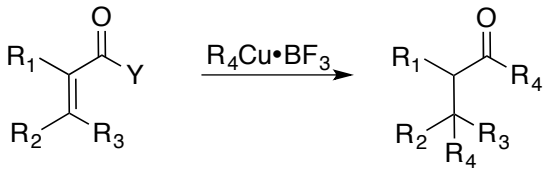


A **B**

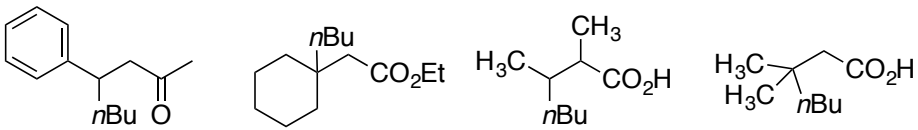
Quench	R	Yield	**A** : **B**
H_2O	H	80%	9:1
CHO	CH_2OH	66%	9:1
CO_2	CO_2H	61%	4:1
I_2	I	71%	9:1

- reaction time/conditions sensitive due to isomerization of **A**→**B**
- crude vinyl organometallic also coupled with allyl and vinyl halides
- EtMgBr only yields trisubstituted alkenes

"$RCu•BF_3$. 3. Conjugate addition to previously unreactive substituted enoate esters and enoic acids," Yamamoto, *JACS*, **1978**, 3240.

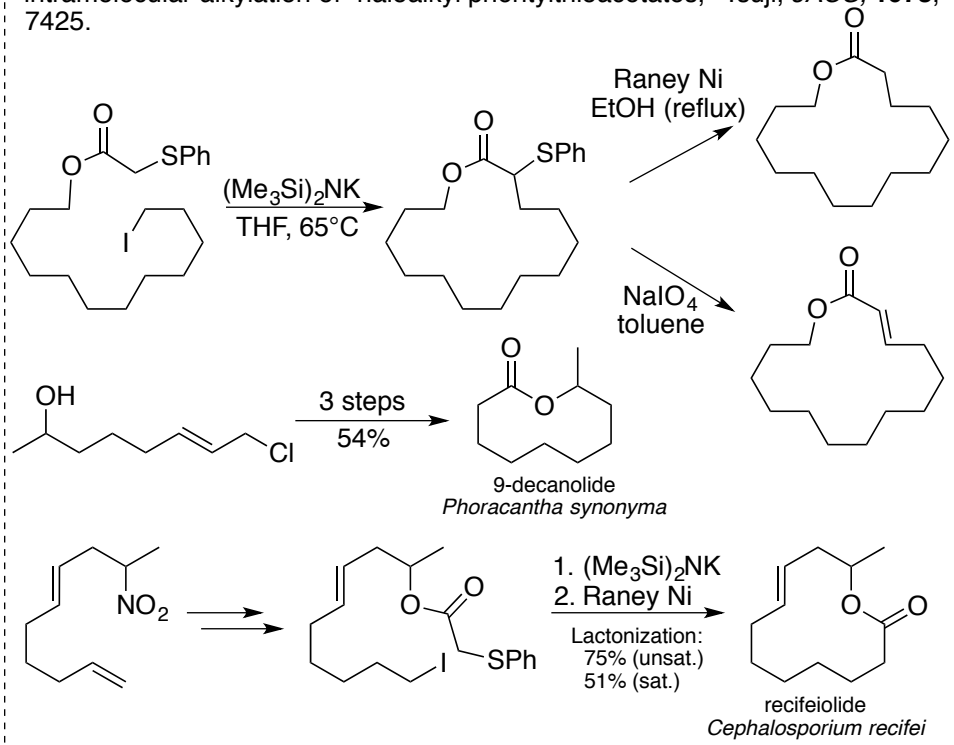


R_1-R_3 = H, alkyl, and/or aryl
Y = H, CH_3 OR, OH

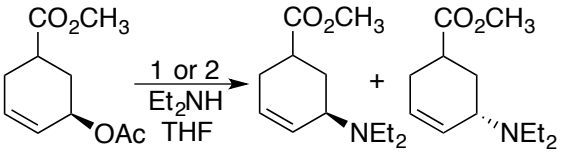


- $RCu•BF_3$ prepared from alkyl lithium reagent, CuI, and $BF_3•OEt$; overall one pot
- yields generally decrease with substitution; β,β-disub. enoic acids
-1,4-addition to enoate ester conjugated diene, and 1,6-addition to enoic acid conjugated diene

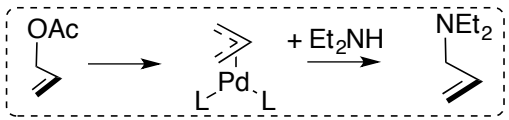
"A New synthetic method for medium- and large-membered lactones by intramolecular alkylation of -haloalkyl phentylthioacetates," Tsuji, *JACS*, **1978**, 7425.



Steric steering with supported palladium catalysts, Trost, *JACS*, **1978**, 7779.



	Pd	Yield	**A** : **B**
1	$(Ph_3P)_4Pd$	85%	67:33
2	Pd on posph. silica	72%	100:0



- $(Ph_3P)_4Pd$ treatment of posphenylated silica and polystyrene: active & air stable
- comparable results with PS and with opposite stereochemistry
- nucleophile precluded from face Pd initially binds
- flow reactor developed